Contents of Sidelifter Operator, Service & Parts Manual

Section Description

- **A** Overview
- **B** STEELBRO Operator & Service Manual
- **C** STEELBRO Spare Parts
- D Remote Control
- **E** Kubota Motor
- F Suspension / Axles
- **G** Hydraulics
- **H** Electrics
- I Braking
- **J** Certificates

A

Overview

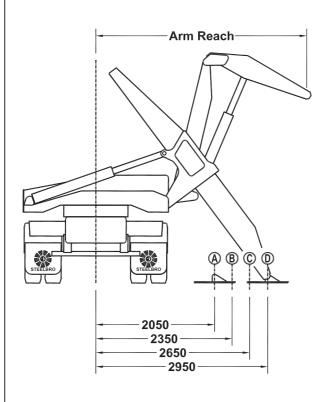
This section contains:	
Product Description	
SWL Charts	
Design Regulation Certificate (Australia)	
SARN numbers (Australia)	

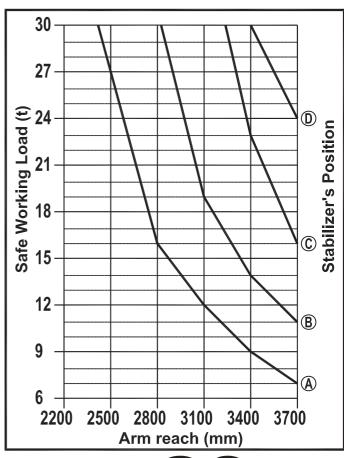


Product Description



SAFE WORKING LOAD CHART





STEELBRO **30**

DE-22459

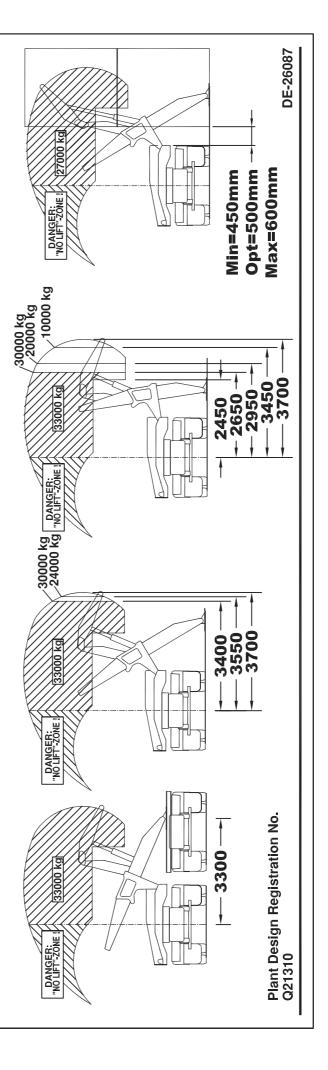
STEELBRO 33

WARNING

This machine must only be operated by authorised personnel in accordance with the instructions in the Operator's Manual.

A tractor unit must always be coupled to the sidelifter when lifting.

Stabilizer legs must always be deployed before lifting.



STEELBRO SB360



SWL Chart

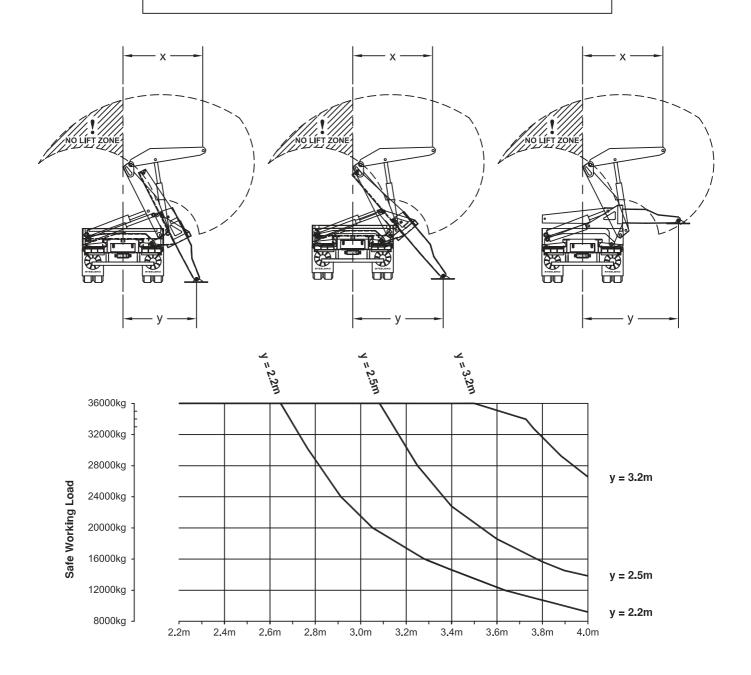


WARNING

This machine must only be operated by authorised personnel in accordance with the instructions in the Operator's Manual.

If the unit is trailer mounted a tractor unit must always be coupled to the sidelifter when lifting.

Stabiliser legs must always be deployed before lifting.



Arms Outreach (x)

STEELBRO SB361



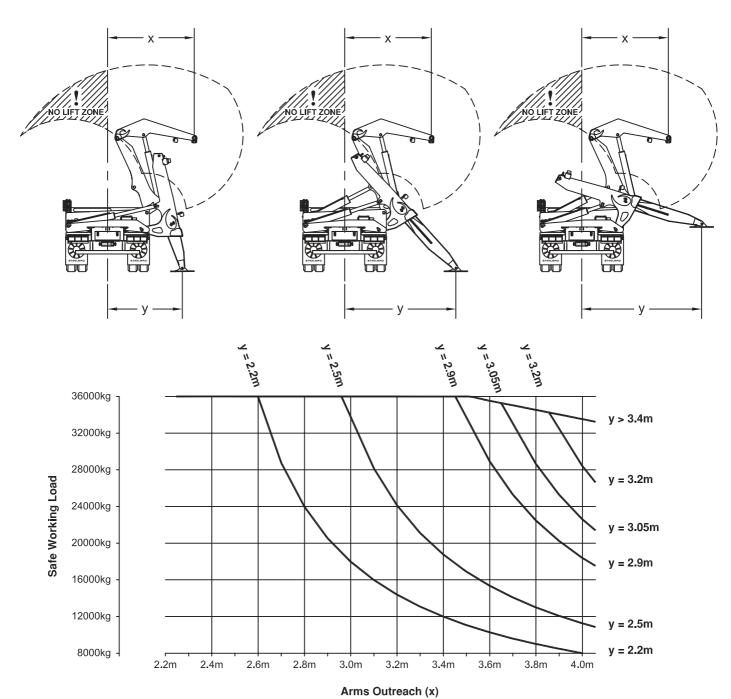
SWL Chart



WARNING

This machine must only be operated by authorised personnel in accordance with the instructions in the Operator's Manual.

If the unit is trailer mounted a tractor unit must always be coupled to the sidelifter when lifting. Stabiliser legs must always be deployed before lifting.



STEELBRO SB401



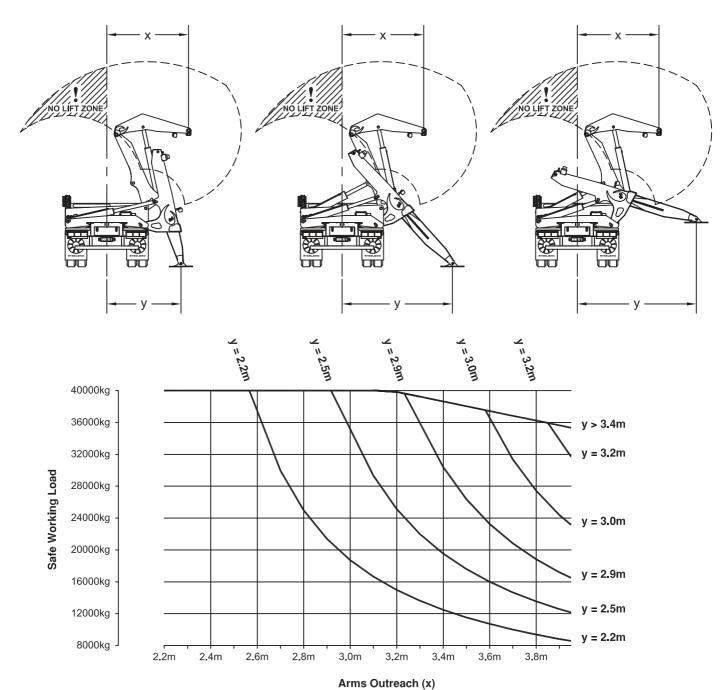
SWL Chart



WARNING

This machine must only be operated by authorised personnel in accordance with the Instructions In the Operator's Manual.

If the unit is trailer mounted a tractor unit must always be coupled to the sidelifter when lifting. Stabiliser legs must always be deployed before lifting.





Dept. of Industrial Relations Dept. of Employment & Training

12 DEC 2003

LIGROPOREGISTRATION OF REGISTRABLE PLANT DESIGN

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cy Lift, Escalators or Noveltons Arch of Indicator Speed
Moving Walkway*
5c People Mover* Write Comm NowLham on hack Max. Speed (MICTO)
5d Amusement Pade Name Fixed or taken
5e Pressure Peasing surface (m²) Volume Spectration
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CERTIFICATE OF PLANT **DESIGN REGISTRATION**



Occupational Health & Safety Act 2000 Occupational Health & Safety Regulation 2001

ABN: 77 682 742 966 Phone: (02) 4321 5498 Fax: (02) 4325 5094

Registration No: CR 6-80750/05 **ABN:** 14052430243 Issue Date: 12/05/2005

Controller: STEELBRO AUSTRALIA PTY LTD

Postal 92 WILLIAM ANGLISS DR

Address: **LAVERTON NORTH VIC 3026**

Plant Type: **Crane Original**

Model Number/ Trade Name: SB 360

Design Description:

Crane Design Type Mobile Crane Crane Max Rated Capacity (t) 36.0000 Crane Max Radius (m) 4.00

Crane Max Free Height (m) 2.74

Crane Luff Type Hydraulic

Crane Boom Type **Hydraulic Extension**

Crane Slewing Type Non Slewing

Drawing Number Design SB360RS2040 G002

CONDITIONS:

This registration applies only to the design described above which has been notified to WorkCover NSW in accordance with the OHS Regulation 2001.

The plant owner will require a copy of this certificate. A copy of the certificate must therefore be supplied to the manufacturer so that it can, in turn, be provided to the supplier and owner with the item of plant or equipment.

WorkCover NSW reserves the right to audit the registered design at any time to assess compliance with its Acts and Regulations. If an audit is

undertaken, detailed information may be requested relating to the design of the plant. Design systems of work and documentation may also be audited. If an audit identifies non-compliance, all plant built to that design may require modifications, and in some cases, may be prohibited from use. This Registration is automatically invalidated if the design is altered to an extent that requires new measures to control risks. A person must not use, or cause or allow plant manufactured to the original design to be used at a workplace unless notification of the alteration, or the prescribed form, has been confirmed by WorkCover NSW.

The Registration Number should be quoted in all correspondence to WorkCover regarding this item. Any queries should be addressed to WorkCover's Licensing Unit.

Fee Paid: \$ 65.00 Receipt No: 5-3975

CERTIFICATE OF PLANT DESIGN REGISTRATION



Occupational Health & Safety Act 2000
Occupational Health & Safety Regulation 2001

ABN: 77 682 742 966 Phone: (02) 4321 5498 Fax: (02) 4325 5094

Registration No: <u>CR 6-80751/05</u> ABN: 14052430243 Issue Date: <u>12/05/2005</u>

Controller: STEELBRO AUSTRALIA PTY LTD

Postal 92 WILLIAM ANGLISS DR Address: LAVERTON NORTH VIC 3026

Plant Type: Crane Original

Model Number/ Trade Name: SB361

Design Description:

Crane Design Type Mobile Crane
Crane Max Rated Capacity (t) 36.0000

Crane Max Radius (m) 4.03
Crane Luff Type Hydraulic

Crane Boom Type Hydraulic Extension
Crane Slewing Type Non Slewing

Crane Slewing Type Non Slewing
Drawing Number Design SB361RS2040 G002

CONDITIONS:

 This registration applies only to the design described above which has been notified to WorkCover NSW in accordance with the OHS Regulation 2001

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5. The Registration Number should be quoted in all correspondence to WorkCover regarding this item. Any queries should be addressed to WorkCover's Licensing Unit.

Fee Paid: \$ 65.00 Receipt No: 5-3975

CERTIFICATE OF PLANT **DESIGN REGISTRATION**



Occupational Health & Safety Act 2000 Occupational Health & Safety Regulation 2001

ABN: 77 682 742 966 Phone: (02) 4321 5498 Fax: (02) 4325 5094

ABN: 14052430243 Registration No: CR 6-80749/05 Issue Date: 12/05/2005

Controller: STEELBRO AUSTRALIA PTY LTD

Postal 92 WILLIAM ANGLISS DR Address: **LAVERTON NORTH VIC 3026**

Plant Type: Crane Original

Model Number/ Trade Name: SB 401

Design Description:

Crane Design Type Mobile Crane Crane Max Rated Capacity (t) 40.0000 Crane Max Radius (m) 3.91

Crane Max Free Height (m) 3.17 Crane Luff Type

Hydraulic Crane Boom Type

Hydraulic Extension Crane Slewing Type Non Slewing

Drawing Number Design SB401RS2040-G002

CONDITIONS:

This registration applies only to the design described above which has been notified to WorkCover NSW in accordance with the OHS Regulation 2001.

The plant owner will require a copy of this certificate. A copy of the certificate must therefore be supplied to the manufacturer so that it can, in turn,

be provided to the supplier and owner with the item of plant or equipment.

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The Registration Number should be quoted in all correspondence to WorkCover regarding this item. Any queries should be addressed to WorkCover's Licensing Unit.

Receipt No: 5-3975 Fee Paid: \$ 65.00



SUSPENSION AND BRAKE CERTIFICATION NUMBERS

SINGLE AXLE SARN-7862 SS

TANDEM AXLE SARN-7850 SS

TRI-AXLE SARN-7849 SS

QUAD AXLE SARN-25775 SS

ROAD FRIENDLY CERTIFICATE No. – RF2008

DRUM BRAKE HTA 001B 16.5 BRAKE FAMILY: SARN-16549 FB

DISC BRAKE HTD-430 DISC BRAKE: SARN-29348 FB

STEELBRO Operator & Service Manual

Sidelifter Operations & Service

V1007



STEELBRO

Container Handling Solutions

Warranty Summary

This warranty statement is a summary of the full product warranty and does not constitute a full statement of the warranty terms and conditions.

The following warranty is given in lieu of and to the exclusion of any other guarantee, condition or warranty, either expressed or implied by statute or otherwise and whether regarding goods manufactured by ourselves or others. Provided the terms of payment are promptly complied with by you, we undertake to remedy with reasonable despatch, any original defects arising from faulty workmanship, in any goods manufactured by us, which under proper and normal conditions of use, are revealed within twelve (12) calendar months or one thousand (1000) hours of operation, whichever occurs soonest from the date of delivery, provided the defective item is returned to our Works, freight paid both ways, or in the case of the item not being returnable, then provided the expenses of travelling, transport, plant hire and accommodation are to your account.

Any goods supplied or work done in remedying such defects shall not extend our liability under this clause beyond the time stipulated above. At the expiration of such time, all further liability on our part shall cease. In the case of goods or material not of our manufacture, we shall endeavor to secure for you, the benefit of any guarantee given to us in respect thereof. In no case, shall we be liable for the cost of replacing and fitting of defective goods, and goods replaced shall become our property. No responsibility will be accepted for any defect, unless we first receive a written complaint, and we have been given first priority and ample opportunity to rectify the defect.

Liability for consequential damage or loss arising from defects, faulty materials, omissions, or negligence of workmanship, in any goods supplied by us is excluded.

Labour charges for work carried out under the terms of this warranty are to the purchaser's account.

Variations to the above are subject to Steelbro New Zealand Limited Management approval.

Claims under warranty will only be accepted if all conditions of warranty are satisfied.

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Foreword

This Operators Manual deals with your new Steelbro Sidelifter. Take the time to read it through - it will be time well spent. The manual contains a short description of the Sidelifter together with instructions on its operation and maintenance. Generally this manual is provided along with other documentation, including manuals provided by third party manufacturers, parts lists, technical drawings and schematics and compliance certification, either in bound print format, in a folder, or on a data CD.

If you wish to ensure a long life for your Sidelifter, you should carefully carry out all the maintenance instructions. However, all servicing, apart from lubrication and minor repairs should wherever possible be entrusted to factory trained service facilities.

We reserve the right to introduce, without notice, changes in data and equipment and amendments to the instructions for maintenance and other servicing work.



In this document:



This symbol means that the instruction in the shaded area is essential to the safe operation of your Sidelifter and failure to follow the instruction is likely to lead to injury or damage to property



This symbol means that the instruction in the shaded area relates to safe or recommended practice and failure to follow the instruction could lead to damage or accident.



This symbol means that the information in the shaded area is useful and/or is something we wish to emphasise.



Owner and Operator Responsibilities

Regulation Compliance

It is the responsibility of the **OWNER** to ensure that use of the Sidelifter fully complies with all Local Authority, State and Government regulations covering lifting equipment, road use, health and safety in the country where the Sidelifter is being used.

Health and Safety Compliance

The **OWNER** must provide and maintain work environments, systems of work, and equipment that is, as far as practicable, safe and without risks to health.

The **OWNER** must ensure that only properly trained and approved operators use the Sidelifter. In some locations, the law requires an operator's Certificate of Competency. The **OWNER** must ensure that they comply in full with such requirements.

Operators must consistently demonstrate:

- 1. Healthy and safe work practices.
- 2. Medical and mental fitness for the task.
- 3. A sound knowledge of emergency procedures.
- 4. A sound knowledge of the contents and requirements of the **STEELBRO** Manuals.

If there is a hazard to health or safety that cannot be eliminated, the **OWNER** must immediately cease using the Sidelifter and contact **STEELBRO** for advice.

Maintenance and Servicing

The **OWNER** should readies that the reliability, safety, and longevity of the Sidelifter depends greatly on the standard of maintenance and servicing that it receives during its working life. The maintenance and servicing schedules set out in the **STEELBRO** Manuals must be met, and **ONLY** suitably qualified technicians should carry out this work.

Design and Modifications

Where **STEELBRO** notify that a modification is required, it is the responsibility of the **OWNER** to ensure that the modification is carried out in accordance with the instructions from **STEELBRO** and if requested, to withdraw the machine from service until the modification has been carried out.



The **OWNER** should withdraw the Sidelifter from use where any deficiencies are identified during inspection of the Sidelifter which may affect its safe operation, until the design or operational deficiency is rectified.

The **OWNER** should ensure that neither the Sidelifter nor any of its components are used beyond their design capacity. For crane design capacity refer to the Safe Working Load decal and for the chassis design capacity (when applicable) refer to the Chassis Plate decal. Print copies of both of these are included in the Manual.

Particular care should be taken to ensure that the emergency stop controls are always operational.



Safety Instructions



It is the responsibility of the Owner to ensure that a Steelbro Sidelifter is only operated by an operator:

- Who is well trained, mentally alert and physically prepared
- Who is working under safe conditions in a comfortable environment
- Utilising a properly maintained and inspected machine in a safe manner
- Has knowledge of operational and safety measures before operating the Sidelifter

Operator Safety

Do not wear radio or music headphones while operating the Sidelifter.

In case the operator becomes unable to continue crane operation due to injury or illness, the Sidelifter must be stopped immediately and the fact must be reported to a responsible person. All operations must be disabled until it has been established whether the Sidelifter caused the injury or illness and the Sidelifter has been assessed as suitable for service.

Back care is important. Take all reasonable precautions wherever bending down or manual lifting is required. This includes changing tyres.

All Sidelifter operations may be carried out at ground level. **DO NOT** climb onto the crane structure. For maintenance or other operations that require 'working at height' refer to the appropriate regulations.

Shift Safety Practices

For the first lift of a working shift and the first lift of each shift where the load is greater than 50% of the rated capacity, the load must be raised a short distance to test the system before continuing the operation.

At the end of a working shift the Sidelifter should be left in a safe condition in a designated parking area and reasonable precautions taken against unauthorized operation. **SAFE CONDITION** is defined as power supply turned off and, if unladen, with cranes fully stowed. If laden, the container/s should be properly loaded onto the twistlocks, not suspended in any way.

Tractor Unit Safety

A Sidelifter should not be operated unless a tractor unit is coupled to it for stability purposes.

Always apply the vehicle park brake before operating the Sidelifter.

Never overload axles.

Regularly check tyre pressure. Improper pressure decreases road hold and increases tyre wear.





When some tractor unit park brakes are applied, they stop the provision of air to the Sidelifter. As the Sidelifter with engine-driven power-pack requires an air supply to operate, the application of the Sidelifter park brake may be necessary in some vehicles, rather than the tractor park brake, to maintain sufficient air supply for the Sidelifter to operate.

Stabiliser Legs

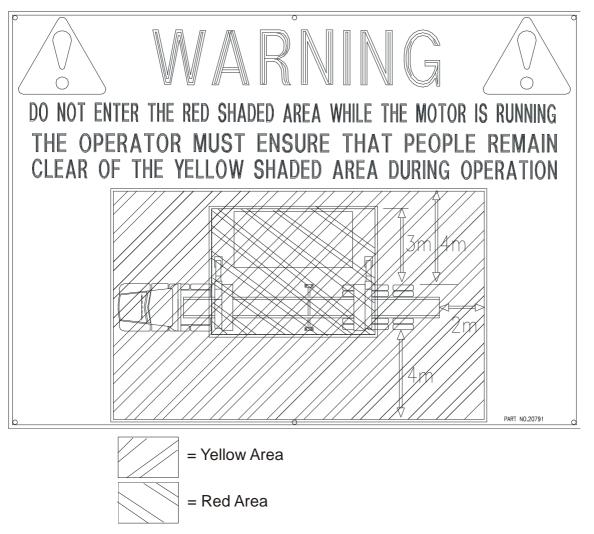
Always deploy the stabiliser legs before operating the cranes. Check that the feet have a firm surface sufficient to withstand the combined weight of the Sidelifter and load, which could be as much as 25 tonne per foot, before commencing any lifting or unloading.



The stabiliser legs must never be operated when the Sidelifter cranes are under load.



Work Area Safety



During operations unauthorised personnel **MUST** keep out of the working area of the Sidelifter as shown in the Dangerous Zone Warning decal.

Always keep the Sidelifter clean and keep loose parts stowed away securely. (Use toolbox provided for this specific purpose)

Never walk or stand below a suspended load.

Never leave the Sidelifter unattended with the load on the hooks and/or the operation controls enabled.

When transferring containers to or from other vehicles the operator must not stand between those vehicles. He should operate from the end of the companion vehicle. Refer to Lifting Safety (on page 7) for more information on the recommended operating areas.

Lifting Safety

This Steelbro Sidelifter is designed to lift from one side only. Do not lift any load beyond the centre-line of the Sidelifter onto the 'non-lifting' side, referred to in this document as the 'offside'. Do not attempt to lift a container from the offside.



Never exceed the maximum capacity stated on the Safe Working Load Chart for your unit.

Always ensure the twistlocks are unlocked prior to commencing lifting operations.

With Sidelifters that traverse to handle different container sizes, lifting is only permitted when the crane modules are placed into the set lift positions.

Lifting lugs are left hand and right hand and must be used in their correct positions. Ensure that lugs are fitted according to the instructions in this manual: Lifting Lug Instructions (on page 25)

Do not lift containers from the top lifting points without the use of a Steelbro top-lifting frame.

When ISO Tanktainer containers are being charged or discharged, the engine must be **SHUT DOWN** and the battery isolating switch turned **OFF**. When ISO Tanktainers are being loaded or unloaded from the Sidelifter ensure that **ALL TANKTAINER VALVES ARE SHUT**.

The Sidelifter Operator must have a full view of the load during the lift and if required sufficient competent persons must be available to assist. The recommended operating area is shown below:



This is a view from above. Operator stands on the lifting side at least 2metres back from the rear of the Sidelifter where he has a clear field of vision of both the lifting side and rear of Sidelifter. This position is also recommended for transfer to or from a companion vehicle



For transfer to or from a railway carriage, the recommended Operating Area is at least 2m back from the rear of the Sidelifter, close enough to the gap between the Sidelifter and carriage to be able to see both.

Overhead Power Lines and Cables

Do not operate the Sidelifter close to power lines or cables.



Driving Safety

Never drive with a suspended load.

Never use the cranes to drag a container along on the ground.

Always check that the stabiliser legs are fully retracted, the cranes stowed in the low folding position and that nothing is protruding beyond the width of the vehicle before driving away.

Always ensure the twistlocks are locked prior to driving away.

While driving always pay attention to the road conditions and adapt driving style to suit.

Take extreme care when approaching and taking turns. The huge inertia mass of the Sidelifter and its tendency to go straight could cause a sideways skid of the whole unit, particularly on a slippery road surface. Road train drivers should take special care.

Take particular care when reversing the Sidelifter.

Unladen Trombone machines should only be driven with the chassis in the retracted position.

Crane Traverse Safety

Sidelifters that can handle different sized containers by moving the crane modules must have all arms and stabilisers in the stowed position when the crane modules are moved.



Never move the crane modules with modules loaded or the arms and stabilisers extended.

Emergency Stop Button

In an emergency, depress the emergency stop button on the remote control, until the engine has stopped.

As an extra precaution, and if it is safe to do so, turn off the engine key switch on the main control panel.

Modifications

No modification may be carried out on the Sidelifter without written authority from Steelbro.

Hydraulic System

Always ensure that when disconnecting hydraulic tubing and hoses there is no hydraulic pressure in the line before switching off the power supply to the system.



General Description

Steelbro Sidelifters are able to load ISO containers to and from:

- The ground
- Truck decks
- Other trailers
- Rail wagons
- Stacked two high (units with chain shorteners)

Because the Steelbro Sidelifter lifts the container using chains and lifting lugs attached to the bottom container corner castings, it is ideal for handling tanktainers and containers that do not have forklift pockets.

Sidelifters are available with different lifting capacities and also in different mounting configurations.

The three main types covered by this manual and their main components are detailed separately in the following sections of this manual.



Commissioning Checks

Prior to operation of your new Sidelifter, make the following checks:

- Examine the Sidelifter, checking that the specification is as ordered
- Check for any damage to exposed equipment that may have occurred during the delivery journey (lights, mudguards, bodywork etc.)
- If the battery and night work lamps have been stowed in the toolbox for security purposes during shipping, then these need to be fitted. Ensure that the battery has sufficient electrolyte and is fitted with negative terminal to earth
- Check tractor unit turntable compatibility to ensure safe coupling of the kingpin to the tractor unit and fitting of any kingpin blocks in the case of fifth wheel couplings mounted on oscillating 5th wheels
- Lubricate the tractor coupling; trailer upper fifth wheel plate and kingpin with a good grease (hub grease is ideal). Couple and uncouple the Sidelifter to ensure the coupling lock operates freely
- Connect up brake hoses and see that couplings are seating correctly. Listen for air leaks. Check brake operation. Ensure spring brakes have had the release bolts removed
- Check tractor unit electrical coupling and layout compatibility, ensuring proper operation of clearance marker lights, brake lights and indicator lights
- Ensure tyres are inflated to correct pressure
- Examine axle alignment for any damage during delivery journey
- Check axle oil level in hubs if oil filled hubs fitted
- Ensure landing legs wind up and down while trailer is coupled to tractor
- Check dry thread torque settings:

Wheel nuts 10 stud	375 - 400 lb.ft (550 - 600 Nm)
Wheel nuts 5 spoke	180 - 200 lb.ft (245 - 275 Nm)
Suspension "U" bolt nuts	375 - 400 lb.ft (510 - 540 Nm)
Rocker shaft nuts	215 - 260 lb.ft (294 - 353 Nm)
Radius rod fixing bolts	215 - 260 lb.ft (294 - 353 Nm)
Radius rod pinch bolts	75 lb.ft (103 Nm)
Drop out bolt	35 lb.ft (49 Nm)

- Check that Hydraulic oil level is between "Min" and "Max" levels as indicated on the hydraulic reservoir sight glass with all crane lifting modules and stabiliser legs fully stowed at the 20' position
- Ensure sufficient engine oil and engine coolant is in the Power Pack engine when fitted



Commissioning the Sidelifter

- 1. For cable remotes, connect the remote control lead from the Sidelifter control cabinet to the remote control box.
- 2. Clean down the area where the module slides over the chassis top flanges with a clean dry cloth.
- 3. Start the engine in the following sequence:
- Check the tractor unit is correctly coupled with the park brake applied



In tractor/trailer combinations where the trailer parks on spring brakes, the park brakes when applied stop the provision of air to the semi-trailer from the tractor. The Sidelifter requires an air supply to retract the crane module locking pins and operate the engine stop and speed control. There is normally enough air stored in the trailer system when it is parked to provide this for a reasonable number of applications. However it is essential that the Sidelifter brake system and piping are always free from air leaks, which waste the stored air. On systems where parking is performed by applying air pressure to the service lines this does not apply.

- Ensure all the Emergency stops are released and remote control (cable or radio) is working
- Insert the key into the Sidelifter start switch and turn to the preheat position. Hold the key in this position until the amber preheat lamp beside the key switch goes out



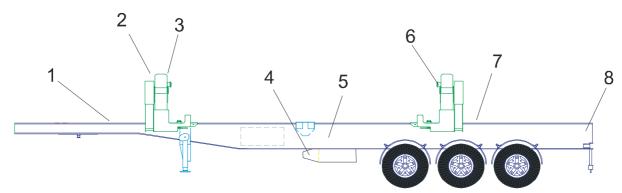
Pre-heating the engine is only necessary when the engine is cold.

Turn the key to the start position. When the engine starts release the key

- 1. If the lifting chains have been stowed in the toolbox during shipping then these need to be fitted as follows:
- On the remote control, select Legs, and place the feet on the ground
- Select High speed () and raise the bottom arms to their maximum
- For Clevis pins, attach the hammerlocks of the chains to the Clevis. For chains with an oblong link, fit the oblong link over the G pin
- Raise the top arms until the chains hang freely in the air
- Check that the lifting lugs, which are left and right handed, are correctly positioned, i.e. ensure that the left and right lifting lugs are in their correct positions. If not, lower the top arm, and reposition. Raise the top arm and check lug position is now correct
- Return the lifting arms to their stowed position ensuring the lifting chains are in the chain trays beside the twistlocks
- 2. Move each lifting module independently from the delivery position to the opposite end of its traverse. Clean down chassis surfaces along where the lifting module moves.
- Shut down the engine by turning off the remote control or pressing any of the red emergency stop buttons on remote control box. Turn off the key ignition
- Always turn off the radio control when not in use



Main Components



The main component systems of the Sidelifter are:

- 1. Chassis, suspension and axles
- 2. Crane lifting modules
- 3. Stabiliser legs
- 4. Hydraulic system
- 5. Power pack and control system (if fitted)
- 6. Lifting accessories
- 7. Pneumatic system
- 8. Electrical system

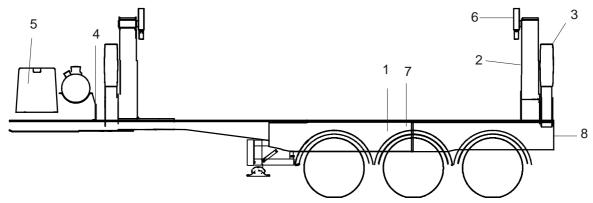
This type of Sidelifter has at least one traversing module and can carry one 20 foot, one 40 foot or 2 x 20 foot containers.

All that is necessary for operating the Sidelifter is a tractor unit of sufficient size, with compatible braking, electrical and kingpin couplings.

Sidelifters running on a Power Take Off (PTO) system, require a tractor unit with a PTO unit, pump and hydraulic coupling.



Main Components Fixed Module Models



The main component systems of the Fixed Module Sidelifter are:

- 1. Chassis, suspension and axles
- 2. Crane lifting modules
- 3. Stabiliser legs
- 4. Hydraulic system (position may vary)
- 5. Power pack and control system (if fitted position may vary)
- 6. Lifting accessories
- 7. Pneumatic system
- 8. Electrical system

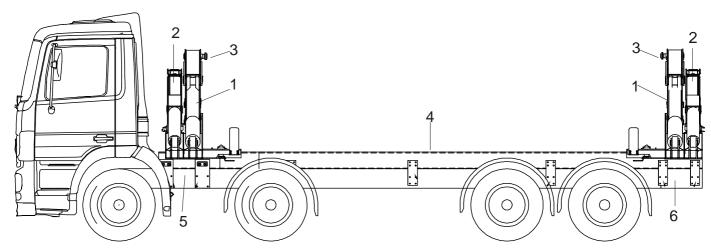
This type of Sidelifter has fixed modules and carries 20 foot ISO containers.

All that is necessary for operating this Sidelifter is a tractor unit of sufficient size, with compatible braking, electrical and kingpin couplings.

Sidelifters running on a Power Take Off (PTO) system, require a tractor unit with a PTO unit, pump and hydraulic coupling.



Main Components Truck Mounted Models



The main components of the truck mounted Sidelifter are:

- 1. Crane lifting modules
- 2. Stabiliser legs
- 3. Lifting accessories
- 4. Subframe
- 5. Hydraulic system (position may vary)
- 6. Electrical system

Truck mounted Sidelifters are fixed to a subframe and can carry one 20 foot container.

Truck mounted Sidelifters run on a Power Take Off (PTO) system, and require the truck to have a compatible PTO unit, pump and hydraulic coupling.

Chassis, Suspension and Axles

Parts of this chassis are fabricated from high tensile steel and must not be welded without authority from Steelbro or its authorised service representative.

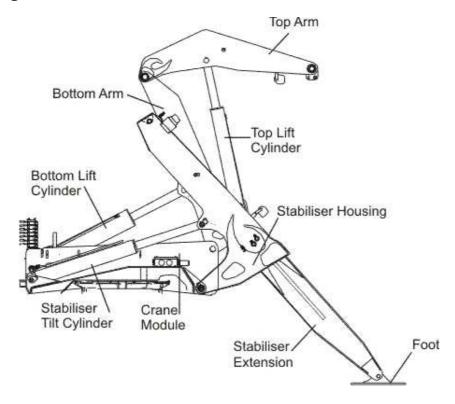
The standard Kingpin is a 2" S.A.E. removable (bolt in) type.

Two-speed wind up landing legs are fitted behind the gooseneck.

The brand, style, maintenance and servicing of this Sidelifter's axles and suspensions are detailed in separate sections of this manual.



Stabiliser Legs



The stabiliser legs are continuously welded box sections constructed from high tensile steel. The pins are mounted in glacier bearings.

The versatility of the Steelbro Sidelifter stabiliser legs greatly assists the transfer of containers to or from other vehicles.

By being able to extend the leg, then tilt the leg, or tilt the leg, then extend the leg, gives the operator several options.

- The legs can be placed on the ground either:
 - At maximum outreach, or,
 - In a close-in position, or,
 - Underneath the deck of a companion vehicle.
- The legs can also be placed on the deck of a companion vehicle.

Sidelifters with bending Stabiliser legs have the extra versatility of being able to work at a close in position with a companion vehicle while maintaining a greater maximum safe working load. These are documented separately.



Never operate the Sidelifter without first deploying the stabiliser legs.



Proximity Switches (units without SMARTlift only)

Proximity switches are mounted on the stabiliser housing. These switches signal warning lights on the remote control and main control panel to indicate the stabiliser leg is tilted beyond the point of ideal stability. This warns the operator that stability has been reduced, and therefore lifting should not take place unless it is for the restricted loads shown on the lifting diagram.



These lights may be activated when a stabiliser foot is placed into a hollow or a descending slope. In such cases it is necessary to build up the ground level by placing timber (dunnage) under the relevant stabiliser foot in order to restore full lifting capacity.

Ground Pressure

Steelbro can only give figures based on the Rated Load Lifting Capacity of the Sidelifter. The fact that Sidelifters can lift heavier loads because of their built in Safety Margins must also be considered by designers when designing surfaces on which a Sidelifter will stand during its operations. Based on the Rated Load Lifting Capacity of the Sidelifter, and allowing for the 60/40-ratio load imbalance of containers, the ratings are:

Model	Weight of box at Max SWL*:	Load per Foot (tonne)	Ground Pressure (MPa)
SB300	30	20	1.3
SB330	33	22	1.3
SB360	36	23	1.3
SB361	36	24	1.3
SB401	40	26	1.7
SB121	12	10.5	0.85
SB180	18	14	0.85
SB200	20	15	0.85
SB250	25	18	0.85
SE400	40	31	1.5

^{*}SWL= Safe Working Load.



Where the pre-operational risk assessment reveals the presence of cellars, underground services, ducts or the like, a competent person must assess whether the ground is stable enough to support the load of the stabiliser foot.



Stabiliser Interlock System

The Stabiliser Interlock system prevents lifts from being attempted without the stabilisers being deployed. A plunger switch fitted to the stabiliser housing is activated when the foot has positive downward pressure. Until that time the lifting arms are disabled.

All Sidelifters with the SMARTlift control system have this functionality, as do SB360 Sidelifters in Australia.



Never move the stabilisers with any load on the arms. This is highly dangerous. If the stabilisers lift off the resting place during a loading operation, the correct action is to move the load back over the stabilisers before manoeuvring the load back over the trailer, keeping the distance between the bottom of the load and the twistlocks as small as practicably possible. If the stabilisers continue to lift then first return the load to the ground before deploying the stabilisers further in order to increase foot pressure.

Operation

When the unit is started up, a warning beeper sounds and a warning light on the crane illuminates until both stabilisers are deployed.

The 'top arm up' and 'bottom arm down' functions are disabled until there is a positive downward pressure on the stabiliser foot.

If during a lift the stabiliser foot loses contact with its resting place, the warning will resume and the 'top arm up' and 'bottom arm down' functions are disabled until the foot again makes contact.

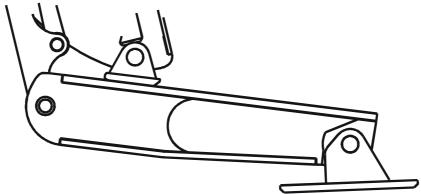


Never move the stabilisers with any load on the arms. This is highly dangerous. If the stabilisers lift off the resting place during a loading operation, the correct action is to move the load back over the stabilisers before manoeuvring the load back over the trailer, keeping the distance between the bottom of the load and the twistlocks as small as practicably possible. If the stabilisers continue to lift then first return the load to the ground before deploying the stabilisers further in order to increase foot pressure.

System Logic	Warning Buzzer and Light	Relay (no)	Top Arm Up	Top Arm Down	Bottom Arm Up	Bottom Arm Down
Both Stabilisers touching the ground	NO	CLOSED	YES	YES	YES	YES
Either or both Stabilisers off the ground	YES	OPEN	NO	YES	YES	NO



Bending Leg Option - for SB360, SB361 and SB401

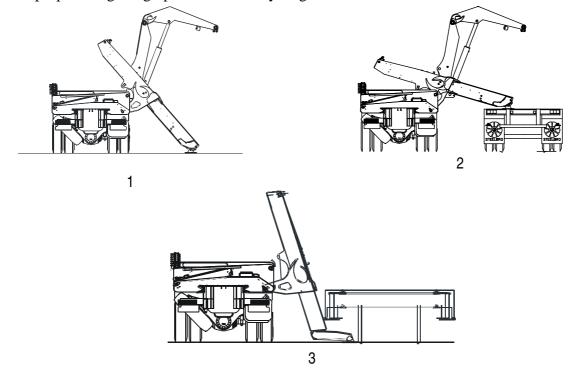


Close up of the Ankle which gives the Bending Leg Stabiliser its versatility.

The Steelbro Bending Leg Stabiliser has the same lifting capabilities as the standard stabiliser, while also giving superior stability in situations where the stabiliser foot is placed close in to the sidelifter. This allows the sidelifter to be positioned close to railway wagons and trailers, as the ankle can fit underneath.

The stabiliser can be deployed:

- 1. With the Ankle fully retracted and the foot resting on the ground giving the same stabiliser outreach as a standard stabiliser.
- 2. On the deck of a rail wagon or trailer, with the Ankle fully retracted, the same way as with a standard stabiliser.
- 3. With the Ankle fully extended / rotated and the stabiliser housing fully tilted giving the same reach and stability as a standard stabiliser. This ankle position should only be used for the purpose of getting up close to railway wagons or trailers.





How to Operate the Bending Leg

The extension and retraction of the bending leg "ankle" is operated from the remote control. It is essential that the operator follow the instructions below.

Ankle Mode:	
Extend Bending leg ankle	Joysticks Up
Retract Bending leg ankle	Joysticks Down
Extend Stabilisers	Joysticks Out
Retract Stabilisers	Joysticks In



Lifting can only take place when the bending leg ankle is either fully extended or fully retracted. NEVER attempt to lift on the bending leg ankle when it is not fully extended.

Follow these steps to deploy the front and back Bending Leg Stabilisers.

- 1. Tilt the legs over as far as possible.
- 2. Switch the remote to Ankle Mode (on the SB360 this is shown by the symbol).
- 3. Start extending the Ankles by pushing both joysticks directly upward.
- 4. As the Ankles start to curve round into position, extend the stabiliser extensions by pushing the joysticks at an angle between the extend positions (North West on the left joystick and North East on the right, relative only to the remote itself of course) until the ankles are fully extended and the feet placed on the ground.
- 5. If necessary, adjust the position further, ensuring that both feet are on a firm, flat surface. If a foot is not at the correct angle, a warning will go off as discussed in the following section.



Retracting the Bending Leg Ankles

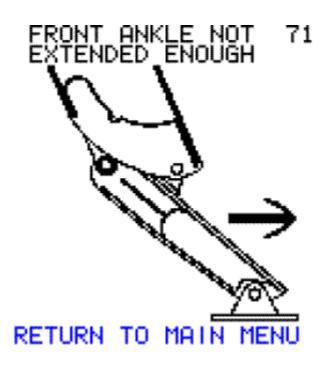
- 1. Set the remote to Ankle mode/
- 2. Begin retracting the stabiliser housings by pushing joysticks in.
- 3. Once the feet have left the ground, begin to retract the ankles by pushing joystick down, watching for edges that an ankle or foot may get caught on.
- 4. Once the stabiliser extensions and ankles are fully retracted, switch to Stabiliser mode/ and return the legs to their retracted position.

Safety Controls - SB361 and SB401 only



Never apply any load to the foot before the Ankle is either fully extended, or fully retracted! This is to prevent serious damage to the construction that will consequently result in an unstable/unsafe operation.

If the ankle is not fully extended and you try to switch out of Ankle mode, an alarm will sound and the warning below will appear on the display screen until you complete the deployment of the ankle.





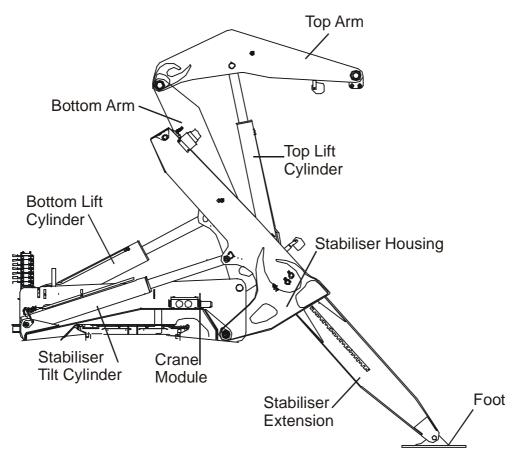
Never apply any load to the rear joint of the Ankle. This will damage the construction and consequently result in an unstable/unsafe operation.



If the stabiliser leg is tilted at too shallow an angle, the result is the back joint of the ankle touching the ground as shown in the screen display below. Therefore, if the stabiliser housing is not angled steeply enough, the controls for the Ankle Mode are locked out and attempting to use them will result in the alarm sounding and the warning screen displaying as below.



Crane Lifting Modules





The crane modules and lifting arms are continuously welded box sections constructed from high tensile steel.

The pins are mounted in replaceable lubricated glacier bearings.

Over-Centre Valves

The hydraulic system is fitted with pilot operated over-centre valves on the crane arms which are preset at the factory to cope with all foreseen shock loads or attempts to lift more than the crane's rated Safe Working Load.

The over-centre valve:

- Prevents the arms from moving unless there is a pressure signal from the main hydraulic valve.
- Helps keep the movement of the load controlled and constant when being lowered, regardless of the pressure that may be in the cylinder.
- Ensures that the cylinders are held in position, should the hydraulic system lose pressure. This stops the arms from dropping and thus preventing any run away of the load in the event of a hose failure.

Lifting Chains - Clevis Hook (SB330, SB360, SB361 and SB401)

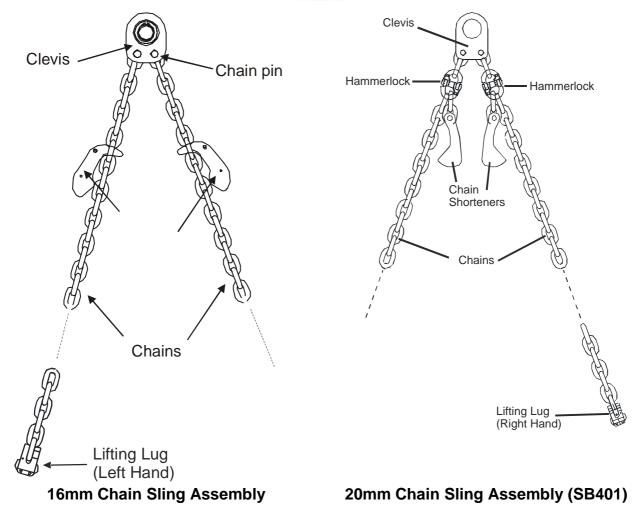
The clevis hook lifting chain assemblies for 16mm and 20mm chain slings are illustrated below. The chains, clevis hook, shorteners and lugs are all individually tested and then the whole sling is tested and certified. They should never be welded in any way and should be replaced if there is any sign of distortion, excessive wear or damage. Shorteners are included in chain slings where the unit is capable of stacking containers two high. Instructions for their use are in the section **CHAIN SHORTENING INSTRUCTIONS**.



Never switch chains from one machine to another as they may vary between one Sidelifter and another in length and size.

Chains should be proof tested annually. **STEELBRO** recommends that the inspection certificates supplied be retained for history.





Lifting Chains - Oblong Link/Top Hook (some SB330's and SB360's)

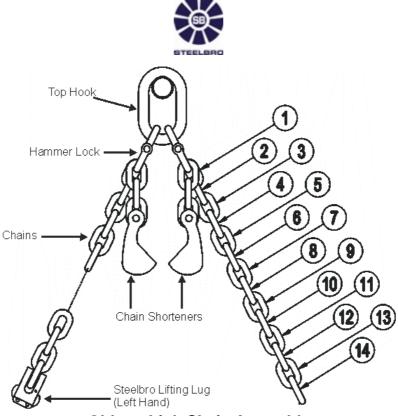
The oblong link or top hook lifting chain assembly is illustrated below. The chain slings are tested and certified. They should never be welded in any way and should be replaced should there be any sign of distortion, excessive wear or damage. When handling the top hook, take care to place it on the lifting pin with the left and right chain legs in their correct position, and facing towards the container. Shorteners are included in chain slings where the unit is capable of stacking containers two high. Instructions for their use are in the section **CHAIN SHORTENING INSTRUCTIONS**.



Never switch chains from one machine to another as they may vary between one Sidelifter and another in length and size.

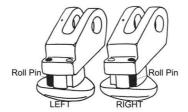
The hammerlocks are equipped with a stress pin linkage. Any sign of the hammerlocks not being able to fold fully means that the chain assembly has been subjected to excessive stress. In such cases the chain should be sent to an approved testing facility, for re-certification and replacement of all damaged parts.

Chains should be proof tested annually. **STEELBRO** recommends that the inspection certificates provided with the manual be retained for history.



Oblong Link Chain Assembly

Lifting Lug Instructions



The only, but significant, difference between a left-hand Lug and a right-hand Lug is the position of the roll-pin (marked in black above), which prevents the lug from accidentally falling out of the container-corner-casting. When standing in front of the container, facing the container, the container-corner casting at your left-hand-side is the Left Hand Container Corner Casting.

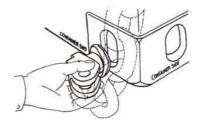


Only ever use the correctly handed lifting lug to corner casting i.e. the left lug to the left corner casting and the right lug to the right corner. Failure to do this may result in the container coming loose during a lift with obvious potentially fatal results.



Using the Container Lifting Lugs

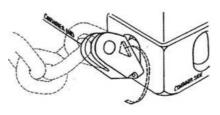
1. With the clevis of the lug facing out from the container, position the lug in the corresponding container-corner-casting-cavity.

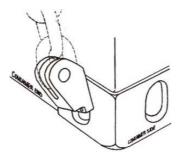


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2. Rotate the Lifting Lug over the top of the lug until the rollpin prevents it from rotating any further.

3. The clevis is now pointing IN-wards, under an angle of approximately 60 degrees "UP". The rollpin prevents the lug from accidentally falling out of the container-corner-casting.





4. When lifting the container, the lug will slide to the top of the container-corner-casting-opening, and in a slightly steeper angle (this to prevent the rollpin from taking any real load), before lifting the container.

The slope of chain legs ensures that the lifting lugs stay locked inside the container castings during the lift cycle.



Using the Sidelifter lifting chains instead of appropriate lifting accessories for handling non-ISO container items, or for top lifting of ISO containers, will cause severe damage to the machine, and place personnel at risk. Any such action will void our warranty.



Power Pack

The power pack is a Kubota V2203 diesel engine. This engine develops approximately 40 horsepower at 2800 rpm and the motor speed is governed to the required pump speed of 2800 rpm.

The power pack control panel is within a weatherproof cabinet, located either on the side or the rear of the machine.

The electric start key and switch are situated on the control panel, as are any or all of the following, depending on the model and control system:

- Hour meter, water temperature and oil pressure gauges
- Generator and pre-heat warning lamps
- E-stop circuit lamp and a glow lamp

.

Electrical System Power Pack Version

The electrical system consists of the following:

- A 12-volt supply from the engine alternator system
- A main junction box mounted in a cabinet located at the rear of the chassis
- Two crane module mounted junction boxes
- One chassis mounted junction box adjacent to the power pack
- Remote control/s cable, radio or both according to customer specification
- A chassis mounted junction box for the SMARTlift control system, if fitted

System Operation

The main control box is equipped with a key/starter switch, oil and alternator warning lamps, water temperature gauge, glow plug indicator lamp and an hour meter.

When you turn the key, the 12 volt system is energised and the run stop control (solenoid pneumatic actuated air cylinder) moves to the run position, providing the trailer air system is fully charged. The engine can now be started. Movement of the joysticks signals the engine speed control (solenoid pneumatic actuated air cylinder) to maximum speed. When the joysticks are returned to their neutral position the engine speed returns to idle after approximately three seconds. (A timer unit is fitted in the main junction box and set to three seconds to give this delay).



The remote control is equipped with two joysticks to operate all hydraulic functions. A function selector switch allows selection of stabiliser legs, crane arms, and for units with crane traverse function, crane traverse. This allows joystick signals to be transmitted via relays in the main junction box directed to the Danfoss control valves and function diverter valves via the crane mounted junction boxes. The joysticks also incorporate micro switches that independently signal the dump solenoid relay and the "PVEM power relay" (powers up the Danfoss control valve coils). There are more details on how to use the remote control to operate the cranes in the section Crane Operations (on page 125).

Also mounted in the remote control is a two-position switch for "High Speed" and "Low Speed" selection. When "High Speed" is selected, two relays in the main junction box are activated, one to direct joystick signals to the Danfoss control valve coils, the other to activate the "High speed load sensed unloader valve" solenoid coils. When "Low Speed" is selected these unloader valve relays are de-energised and the joystick signals are now directed via the E.H.F's. (Electronic Hydraulic flow controllers) to the Danfoss control valves. An emergency stop button ("Mushroom" type) is fitted to the remote control to shut down all systems in an emergency.

System Lay Out

Electrical power is supplied from the Kubota alternator system to the main junction box. The cable remote is plugged into this junction box and for radio control, the receiver unit is plugged into this junction box. The main junction box is connected to the chassis mounted junction box and the two crane mounted junction boxes. If SMARTlift control is fitted, it is located on the chassis between the main junction box and the crane mounted junction boxes.

Electrical System - PTO Version

The electrical system consists of the following:

- A 12 or 24 Volt power supply from the front chassis services panel
- A main junction box mounted in a cabinet located at the rear of the chassis
- Two crane module mounted junction boxes
- One cable remote control and/or radio remote control
- A chassis mounted junction box for the SMARTlift Control system where fitted
- Electro hydraulic coils for a crane control valve

System Layout

Electrical power is supplied from the front services panel to the main junction box. The cable remote is plugged into this junction box (for radio control the receiver unit is plugged into this junction box).

The main junction box is connected to the two crane mounted junction boxes. If the Smartlift Control system is fitted, it is located on the chassis between the main junction box and the crane mounted junction box.



System Operation

The remote control is equipped with two joysticks to operate all hydraulic functions. A function selector switch allows selection of stabiliser legs, crane arms, and for units with crane traverse function, crane traverse. This allows joystick signals to be transmitted via relays in the main junction box directed to the Danfoss control valves and function diverter valves via the crane mounted junction boxes. The joysticks also incorporate micro switches that independently signal the dump solenoid relay and the "PVEM power relay" (powers up the Danfoss control valve coils). There are more details on how to use the remote control to operate the cranes in the section Crane Operations (on page 125).

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Hydraulic System - Power Pack Version

The hydraulic system consists of the following:

- Hydraulic oil reservoir with return oil filter and a breather assembly
- Direct coupled tandem hydraulic pump
- High speed load sensed unloader valve assembly
- High-pressure oil filter
- Two Danfoss proportional control valves
- Four hydraulic cylinders fitted with double check valves operating the stabiliser legs
- Two hydraulic cylinders fitted with single over-centre valves operating the top lifting arms
- Two hydraulic cylinders fitted with double over-centre valves operating the bottom arms
- Four hydraulic cylinders or four hydraulic motors to traverse the cranes (except on truck mounted and fixed crane units)
- A solenoid operated dump valve connected to the load sense system (optional)
- A hydraulic pressure gauge

System Control

The system is controlled by a cable remote or the optional radio remote carried by the operator. These have identical ergonomics, consisting of a pair of two axis joysticks, a function selector switch, a high/low speed selector switch and an emergency stop button.

System Operation

The tandem pump delivers oil to the high speed load sensed unloader valve, where the two flows can be combined to give high speed operation, or split to give low speed with the second pump flow returning to the oil reservoir.

Also fitted to this valve is a solenoid operated dump valve that is activated by the joystick controllers and the emergency stop buttons.

The pump flow from the high speed load sensor (LS) unloader valve passes through the high pressure filter and is divided and supplied to the front and rear control valves. These valves are connected to each other with a load sense line. This helps to maintain synchronisation of the crane lifting arms when unequal loads are handled.

Fitted into the load sense line is an optional solenoid operated dump valve. When the valve is in the de-energised condition, load sensed (LS) oil is dumped to tank. When the valve is energised, the LS line is blocked to tank and allows the hydraulic system to operate.

A hydraulic gauge is fitted into the LS line and indicates the pressure in the system.



The crane control valves are Danfoss PVG 32 proportional type and are signalled from the joysticks for directional control. High or low speed can be selected at the remote control. The low speed function only applies to the lifting arms. The stabiliser legs are always in high speed irrespective of the position of the high/ low speed selector switch.

For units without Digital Control only (SB360, SE400, some SB330's)

When "Low Speed" is selected only one pump is supplying the system. The joystick signals pass via an electronic hydraulic flow (EHF) control and the function speed is reduced by 50% to allow fine control under heavy and difficult loading conditions.

High Speed Load Sense (LS) Unloader Valve Logic

Following is a summary of the logic and function of the "High speed load sense unloader valve".

Speed Mode	High speed	Low Speed
Operating oil flow	120l/min	601/min
Operating Pressure	140bar (2000psi) @ HS- LS-U valve	280bar (4000psi) @ Danfoss PVG32
No of pumps operating	2 x Pumps	1 x Pump (second pump to tank)
High speed Solenoid	Energised	De-energised
High Speed relief	140bar (2000psi)	Not Active
Load Sense Solenoid	Energised	De-energised
Load Sense Relief	140bar (2000psi)	Not Active

Hydraulic System - PTO Version

The hydraulic system consists of the following:

- High pressure supply coupling and low pressure return coupling on the front chassis services panel
- High Pressure Filter
- Two Danfoss proportional control valves
- Four hydraulic cylinders fitted with two check valves operating the stabiliser legs
- two hydraulic cylinders fitted with one over-centre valve operating the top lifting arms
- two hydraulic cylinders fitted with two over-centre valves operating the bottom arms
- two hydraulic cylinders or four hydraulic motors to traverse the cranes (except on Fixed and Truck-mounted units)
- A solenoid operated dump valve connected to the load sense line
- A hydraulic pressure gauge



System Control

The system is controlled by a cable remote or the optional radio remote carried by the operator. These have identical ergonomics, consisting of a pair of two axis joysticks, a function selector switch, a high/low speed selector switch and an emergency stop button.

System Operation

High pressure oil is supplied via the supply coupling on the front services panel to the high pressure filter, beyond this filter it is divided and supplied to the front and rear control valves. These valves are connected to each other with a load sensing line. This helps to maintain synchronisation of the crane lifting arms when unequal loads are handled. Fitted into the load sense line is a solenoid operated dump valve. When the valve is in the de-energised condition load sensed (LS) oil is dumped to tank. When the valve is energised the LS line is blocked to tank enabling the hydraulic system to operate. A hydraulic gauge is fitted into the LS line indicating hydraulic system pressure.

The crane control valves are Danfoss PVG 32 proportional type and are signalled from the joysticks for directional control. High or low speed can be selected at the remote control. The low speed function only applies to the lifting arms. The stabiliser legs are always in high speed irrespective of the position of the high/ low speed selector switch.

Units without Digital Control only (SB360, SE400, some SB330's): When "Low Speed" is selected only one pump is supplying the system and the joystick signals pass via an electronic hydraulic flow (EHF) control and the function speed is reduced by 50% to allow fine control under heavy and difficult loading conditions.



Pneumatic System

This system comprises the following elements:

- A hold back protection valve
- An engine speed control cylinder (Power Pack only)
- An engine stop control cylinder (Power Pack only)
- Self steer axle (if fitted)

Hold Back Protection Valve

This valve protects the trailer brake system and isolates the auxiliary pneumatic system if the trailer air system drops below a predetermined level as shown in the auxiliary circuit drawing provided.

Crane module locks (applies to R&P Traverse only)

Only Sidelifters with rack and pinion style traverse have crane module locks.

Two single acting air cylinders are mounted on the underside of the crane lift module between the chassis rails. The cylinders are connected to a plunger style-locking pin that locks the lifting modules in their correct lifting positions. They are spring loaded to lock and air actuated to unlock.

Engine Speed Control

An ON/OFF air solenoid valve when activated by either remote joystick supplies system air pressure to the base end of the speed control cylinder to obtain maximum engine speed (2800rpm). An air pressure regulator supplies a balanced air pressure to the rod side of the speed control cylinder, retracting the cylinder and returning the engine to the idle speed (approximately 1400rpm).

Engine Run/Stop Control

An engine RUN/STOP control solenoid activated by the key switch and emergency stop buttons supplies system air pressure to activate the cylinder. This cylinder requires air pressure for the engine to run and is spring loaded to the stop position.

Self Steer Axle (if fitted)

On Sidelifters with a self-steer axle there is an air supply fitted to the rear axle to control the steering of the self-steer axle. For further information refer to the manufacturer's documents supplied.



Trombone Chassis



Warnings:

When travelling unladen, the chassis MUST be fully retracted.

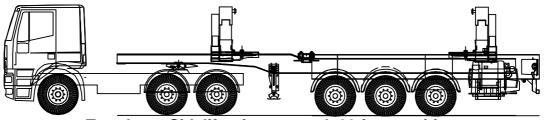
ONLY use the rear 20' position in yard operations and not for travelling on roads.

NEVER attempt to extend or retract the chassis when the Sidelifter is laden.

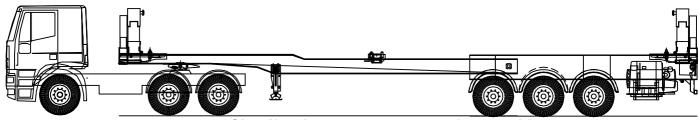
The trombone Sidelifter comprises a two part chassis that slides in and out (hence the name "trombone"). When fully extended the trombone Sidelifter can carry one 40 foot container or two 20 foot containers. If specified it can also carry a 45 foot container. When fully retracted, it can carry one 20 foot container.

The trombone Sidelifter has either a rack and pinion traverse front crane module and cylinder traverse rear crane module, or rack and pinion for both modules. The engine is mounted on the side of the trailer.

There are two kinds of trombone mechanisms available - hydraulic and manual. The hydraulic trombone mechanism uses a hydraulic cylinder to extend and retract. The manual trombone mechanism uses the tractor unit to extend and retract. Instructions for extending and retracting each type follow.



Trombone Sidelifter in retracted, 20 foot position



Trombone Sidelifter in extended, 40 - 45 foot position.



Extending and Retracting the Trombone Sidelifter



Either type of trombone Sidelifter must be coupled to a tractor unit during extending or retracting.

NEVER attempt to extend or retract the chassis when the Sidelifter is laden.

Instructions for extending/retracting the hydraulic trombone chassis:

Before trying to extend the trombone chassis, ensure the modules are in the retracted 20 foot position. If the unit has a front lift axle then this should be raised. A rear lift axle should remain lowered at all times. Apply park brake on the tractor unit and release the trailer brakes.

- 1. On the remote control, select Low Speed and Arms Mode.
- 2. On the chassis, push in the trombone lock release button located in the clear box at the landing legs (see A).
- 3. Move the extend/retract lever (B) in the direction required (down for extend and up for retract) and hold it in place.

Once the mechanism starts to move, release the trombone lock release button (A), but keep holding the lever as you walk beside the unit. Once released the lock will self reset so the locks will automatically lock when they get to the next lock position.





Instructions for extending/retracting the manual trombone chassis:

Before trying to extend the trombone chassis, ensure the modules are in the retracted 20 foot position. If the unit has a front lift axle then this should be raised. A rear lift axle should remain lowered at all times.

- 1. Unlock the trombone locks with the Trombone lock key located on the control panel at the front of the rear half of the trailer (C). The key has two positions UNLOCK and RESET.
- 2. Apply the trailer brake in the tractor unit and **SLOWLY** drive forward for extension, or reverse for retraction. The trombone locks will automatically reset as the chassis moves and will self lock when in correct position.

If the tractor unit is not equipped with a "trailer brake only" option, disconnect the air lines between the tractor unit and the trailer so that the spring brakes will apply automatically and hold the rear half of the chassis in place and allow the chassis to extend or retract.





Driving too fast when extending the unit can cause the locks to break. Always drive very slowly until the locks engage before increasing driving speed.





Digital Control and SMARTlift Load Monitoring System

Digital Control is included as standard on most SB330 and all SB361 and SB401 model Sidelifters.

The SMARTlift Load Monitoring System is part of the Steelbro commitment to stay at the cutting edge of Sidelifter design and technology. The system uses advanced electronic technology to enable intelligent control and improved Sidelifter safety.

SMARTlift Load Monitoring is available as an additional factory option, or can be added later as an upgrade to a Sidelifter model equipped with Digital Control.

The SMARTlift Load Monitoring system controls all crane and power pack electrical systems via two electronic controllers, one situated on each crane.

READ THIS SECTION BEFORE USING SMARTLIFT



The SMARTlift Load Monitoring System is NOT a fail-safe safety system. Its purpose is to monitor the load and to make the operator aware of potentially unsafe practices but it will not prevent these from happening should the operator continue with an action.

SMARTlift is not a substitute for responsible operation and operator training. It is essential that operators follow safety procedures, making themselves aware of the operator manual and taking heed of the warnings and cautions contained in it. If in doubt, they should seek further training.

It is essential that the system is properly maintained. In the unlikely event of a fault the owner must report this immediately to the service agent. Until the fault is repaired, the system cannot be considered fully operational.

Voltage

The system voltage is 12v for Sidelifters fitted with a Kubota power pack. For Power Take Off (PTO) versions, the system voltage is supplied from the tractor unit, normally 24v.

Components

The Digital Control system consists of the following components:

- Electronic Control Unit (ECU) x 2, one located on each crane base
- Danfoss electro-hydraulic proportional control actuators
- An LCD display located at the rear of the chassis
- A radio remote control.
- Stabiliser deployed microswitch sensors
- Kubota engine run/stop and rpm control
- Hydraulic high/low speed valve solenoids



Radio Remote

The radio remote offers an exceptional level of performance and reliability.

The receiver features industry standard 2-wire CANbus communication, which eliminates complex wiring looms and an IP65 rated enclosure. The transmitter features proportional joysticks for precise control of crane speed, and a rugged IP65 rated housing. All crane functions including the starting of the onboard powerpack and crane mounted worklamps can be controlled remotely.

The radio remote is protected against electromagnetic fields and radio interference. Radio remote controls use the latest frequency synthesizer technology to eliminate the problems typically associated with radio remote control systems.

The radio remote control system includes a transmitter and a receiver. These systems operate over the 400-470 MHz radio band range (70 cm band) and are FCC approved.

The transmitter generates the electronic signal that communicates with the receiver. The transmitter and receiver are set with identical address codes and frequency channels. This allows operation of multiple Sidelifters within the same area without signal interference.

As an additional safety feature, the Danfoss valves are only energised when the joysticks are moved off-centre. Also the load sense dump solenoid is only energised when the joysticks are moved off-centre, or when the manual override PIN number has been entered.

Overriding the E-Stop Circuit

Sidelifter control valves have manual levers located in the cylindrical container in the side tool box. In the event of an electrical breakdown, the operating cycle can be completed manually by using these levers, but the load sense dump solenoid must be energised first.

You can override the E-stop circuit and energise the load sense pump solenoid by pressing the rubber covered button in the left hand end of the start-key 'E' junction box.

Operator Controls

All operator controls are on the remote control transmitter. This transmitter has:

- Two joystick controls which operate all lift arm and stabiliser leg operations
- A two position stay put switch for high/low speed
- A positional rotary switch which selects Off, module traverse, stabiliser legs or lifting arms, plus any other optional functions.
- A red "mushroom" type stop button for Emergency Stop.



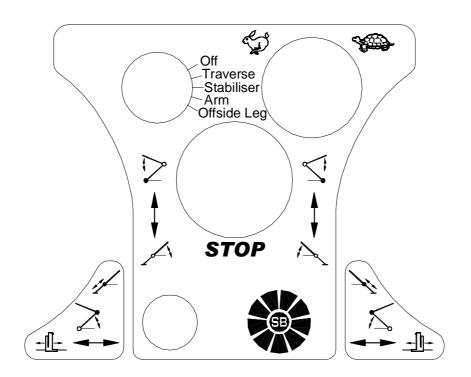


Figure 1 – Joystick Function

Arms Mode:

Function	Movement
Top arm up	Joysticks up
Top arm down	Joysticks down
Bottom arm out	Joysticks out
Bottom arm in	Joysticks in

Stabiliser Mode:

Function	Movement
Stabiliser out	Joysticks out
Stabiliser in	Joysticks in
Tilt ram up	Joysticks up
Tilt ram down	Joysticks down

Traverse Mode:

Function	Movement
Module traverse to 40 foot position	Joystick out
Module traverse to 20 foot position	Joystick in



Emergency Stop

For all emergency situations, push the E-stop pushbutton in.

To restart the system, disengage the E-stop pushbutton and press the Start/Horn pushbutton.

Be sure any dangerous conditions are corrected and follow the Sidelifter Starting Procedure.

Safe Mode

When the transmitter voltage drops below approximately 3.4 volts, the system automatically goes into Safe Mode. A buzzer will sound to indicate a low battery. After a further 30 seconds the transmitter sends the E-stop signal and all Sidelifter motion commands stop.

To restart the system, a fully charged battery must be inserted into the transmitter. Proceed with the Sidelifter Starting Procedure. Always place the discharged battery directly into the charger.

Radio Remote Battery Charging System

The battery charger is connected permanently to the main battery and is available for use even when the Sidelifter start key is turned to the **OFF** position.

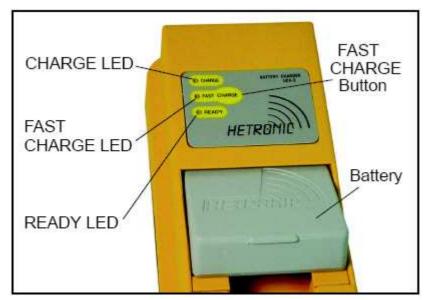


Figure 2

When the battery is inserted into the charger, the charge LED flashes. The charge process is terminated it detects peak battery voltage, or after 5 hours, after which the ready LED glows. While the ready LED is glowing, the charger continues to trickle charge the battery. The battery cannot be damaged by leaving it in the charger. Fast charge is less than 2 hours.



If the battery is bad and has an open cell, no LEDs will light up. If the battery has a shorted cell, the charge LED will blink continuously. In either case, do not use the battery. Properly dispose of a bad battery.



Sidelifter Starting Procedure

If the Kubota Engine is cold, use the **COLD STARTING PROCEDURE**. If the Kubota Engine is warm, use the **WARM STARTING PROCEDURE**.

SMARTlift System / Kubota Power Pack Cold Starting Procedure

- 1. Complete all the pre-operation checks as detailed in the Kubota Operators Manual
- 2. Ensure that the tractor unit is connected to the trailer and that the pneumatic circuit is fully charged. The throttle actuator and run/stop actuator require air to operate. The engine will not start without a fully charged auxiliary pneumatic circuit.
- 3. Ensure that all E-stop buttons are released.
- 4. Turn the start key clockwise one click to the **ON** position.
- 5. Select the instruction according to the type of remote control:

HETRONIC RADIO REMOTE: Turn the transmitter key clockwise to the **ON** position. Wait until the second beep – this indicates that the self test routine was successful. Press the green button on the side of the transmitter to energize the E-stop circuit and start the SMARTlift system.

CABLE PENDANT: Release the E-stop to energize the E-stop circuit and start the SMARTlift system

- 6. The green E-stop circuit light should illuminate. Turn the start key clockwise to the **GLOW** position and hold for five seconds.
- 7. Turn the start key clockwise to the **START** position and hold until the engine has started.

You will know that the start is successful when on the LCD display screen, the wheel pattern rotates to spell out S-M-A-R-T-L-I-F-T on each segment.

If the engine fails to start refer to the Troubleshooting Section of this manual and the Kubota Operators Manual.



Caution: The Start Key can be left in the ON position during the day, but must be switched to the OFF position at the end of each day to prevent the Control system battery from depleting.

SMARTlift System / Kubota Power Pack Warm Starting Procedure

A warm start is when the start key is left in the **ON** position during the working day.

1. Select the instruction according to the type of remote control:



RADIO REMOTE: Turn the transmitter key clockwise to the **ON** position. Wait until the second beep – this indicates that the self test routine was successful. Press the green button on the side of the transmitter to energize the E-stop circuit and start the SMARTlift system.

CABLE PENDANT: Release the E-stop to energize the E-stop circuit and start the SMARTlift system

2. Press the engine start button on the left hand end of the radio remote until the engine starts.



Sidelifter Shutdown Procedure

- 1. If using the **CABLE PENDANT**, press the E-stop button **IN**.
- 2. If using the **HETRONIC RADIO REMOTE**, turn the transmitter key anti-clockwise to the **OFF** position. The transmitter key is the main black key switch on the side of the radio remote.



Do not use the E-stop button to shutdown the Sidelifter as this button is for emergency use only and should be left in the OUT position.

1. If the Sidelifter is not to be used for more than 3 hours turn the start key anti-clockwise to the **OFF** position to prevent the control system battery from depleting.



Operational Modes

The remote has a Mode dial with the settings:

- Off
- Traverse
- Stabiliser
- Arm

These settings direct the functions of the joysticks. This section explains the purpose of each mode and its characteristics.

Other modes may be available relating to specific additional features. These are explained in the section of the manual relating to their function.

Off Mode

Off mode turns off power to the Danfoss valves. If the vehicle is moved while the SMARTlift system is operating, the dial **MUST** be set to **OFF.** Otherwise, any accidental movement of the joysticks while the vehicle is moving may activate the hydraulics and cause damage.



For on-highway driving it is essential for safety reasons that the SMARTlift system is completely switched off by depressing any of the E-stop buttons (or switching the radio key to the OFF position for Hetronic models).

Traverse Mode

Traverse mode is for moving the crane modules along the chassis rails. Not required for truck mounted units.

• While the stabiliser is in contact with the ground, Traverse mode is disabled

STABILISER
DEPLOYED

TRAVERSE FUNCTION DISABLED

RETURN TO MAIN MENU

Figure 3

• **HIGH SPEED** is automatically selected for Traverse mode



Stabiliser Mode

Stabiliser mode is for extending and retracting the stabilisers.

On SB361 and SB401 models with the rack and pinion crane traversing system, Stabiliser mode
is disabled when the crane modules are not properly "on station"



Figure 4

HIGH SPEED is automatically selected for Stabiliser mode

Arm Mode

Arm mode is for extension and retraction of the crane arms.

Whenever you select Arm mode during an operation, the sensors automatically check that the stabilisers are firmly in contact with the ground or a companion trailer. If there is no contact, Arm mode is disabled and a warning sound (the horn) and screen message are activated



Figure 5

 However, if a stabiliser lifts off the ground during the loading operation, the lift is allowed to continue



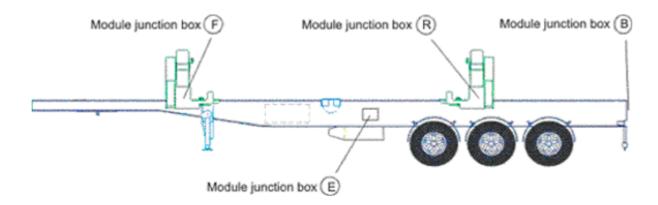
Optional Modes

If your unit has bending leg stabilisers, offside stabilisers and/or you use a top-lifting frame, there are corresponding modes marked on the remote control.



Electrical System

The figure below shows the location of the electrical junction boxes on the Sidelifter. The state of the LEDs in the E box, and the F and R boxes (SB361 and SB401 only) can be used for initial fault finding.



Junction Box E



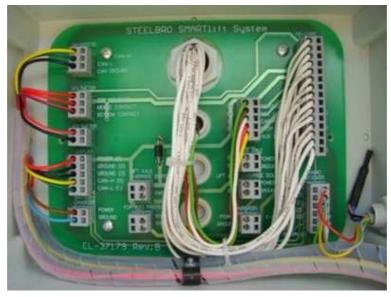
This is the main junction box where most fuses and relays are found. Controls engine functions.

Key:

- A Relay switches. A lit green LED signifies that the relay is energised.
- B Table showing fuse layout.
- C Fuses. A lit red LED indicates that the fuse is blown.



Junction Box B



Junction Box B runs the display screen and radio receiver.

Steer axle lock and lift axle override (where used) are wired from this junction box.

There are no LEDs on the fuses located in Junction box B

Junction Boxes F and R

These junction boxes are located on crane modules. They sensor inputs and control hydraulic valves on the crane modules.

The circuitry layout of the F and R boxes is identical.



SB361 and SB401 F and R junction boxes (above)

Key:

A ECU supply voltage LEDs (green). LED3, UE, is lit continuously when the the SMARTlift system is operational. LED4, D+, is only lit when the green button (horn) on the Hetronic radio remote is pressed.



B Fuse LEDs (red). For LED1, Angle Sensor Ground, and LED2, ECU UE, a lit LED indicates that the fuse is blown.



SB330 F and R junction boxes (above)



Display Screen

The SMARTlift system is equipped with an interactive LCD display screen.

The LCD display screen is used for:

- Displaying system information, warnings, alarms and crane settings.
- Carrying out crane synchronisation and manual override tasks.



Figure 18

Navigating the Screen

You can navigate the screen using the display dial, positioned as shown in the diagram above. Please note that the three buttons are not used.

To move through the screens and menu items, turn the display dial.

To make a selection from a menu or change a variable, press the display dial.

Accessing the Menu Structure

To access the Menu Structure, from the default screen, turn the display dial until the menu icon is highlighted, then press the dial. Each of the main menu items gives access to the next layer of the menu structure. The lower menus and screens have a Return to the Main Menu or previous menu item, like the one in Figure 24 – Operating Time, which allows you to back out of the menus.



Figure 19 below shows all of the menus and functions available and the paths to follow to access them.

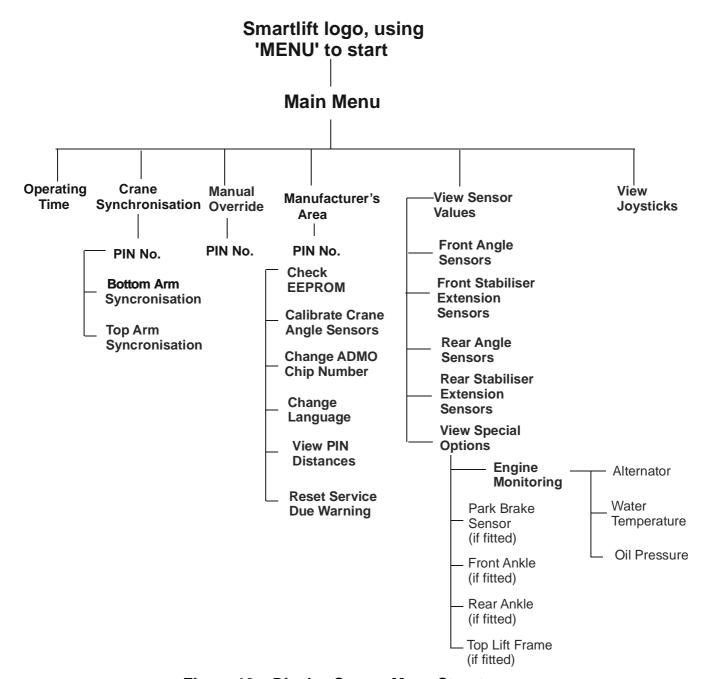


Figure 19 - Display Screen Menu Structure

Operating Time

The operating time of the Sidelifter is available from the LCD display screen by navigating to the Operating Time menu item, see Figure 19 – Display Screen Menu Structure.

Figures 20 to 22 show the screens you navigate to get to the Operating Time screen.





Figure 20 – Default Screen

MAIN MENU

CHK. OPERATING TIME
CRANE SYNCRONISATION
MANUAL OVERRIDE
MANUFACTURERS AREA
VIEW SENSOR VALUES
VIEW JOYSTICKS

Figure 21 – Main Menu

Ver.ปีปีป SIDELIFTER OPERATING TIME

aaaa Hours

RETURN TO MAIN MENU

Figure 22 – Operating Time

56

Manual Override

To access Manual Override mode, via the LCD display screen enter the Single Lift manual override PIN 1970. This will allow you to override the SMARTlift system for one operation only. The system should only be overridden in the event of a system failure.



In manual override mode safety features of the load monitoring system are disabled and the operation of the arms is extra slow.

MANUAL OVERRIDE MODE

ENTER CODE

മൈമ

RETURN TO MAIN MENU

MANUAL MODE!

WARNING! SAFETY FEATURES ORE DISORIED

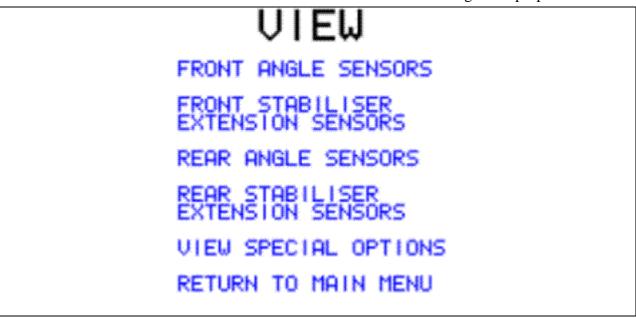
RETURN TO MAIN MENU

Figure 35 Figure 36



View Sensor Values

The View Sensor Values menu enables access to information useful for diagnostic purposes.



Front Angle Sensors

The Front Angle Sensors option displays information on the extension of the front stabiliser in millimeters, the angle of the stabiliser top and the bottom arms in degrees, and the pressure in the top arm lifting cylinder.

Front Stabiliser Extension Sensors

The Front Stabiliser Extension Sensors option displays information on the magnetic counter and the magnetic reset sensors, and the stabiliser deployed microswitch.

Rear Angle Sensors

The Rear Angle Sensors option displays information on the extension of the front stabiliser in millimeters, the angle of the stabiliser top and the bottom arms in degrees, and the pressure in the top arm lifting cylinder.

Rear Stabiliser Extension Sensors

The Rear Stabiliser Extension Sensors option displays information on the magnetic counter and the magnetic reset sensors and the stabiliser deployed microswitch.

View Special Options

To view engine management information, and information on optional features (if fitted) installed on the Sidelifter, select View Special Options.



VIEW SENSORS

ENGINE MONITORING

PARK BRAKE

FRONT ANKLE

REAR ANKLE

TOP LIFT FRAME

RETURN TO MENU

The View Special Options menu displays information on:

Engine Monitoring

An Engine Monitoring system continuously monitors the Kubota engine oil pressure, water temperature and the alternator. If there is low oil pressure, high water temperature or the alternator is not charging, then an audible alarm is triggered and a message is displayed on the LCD display screen. If low oil pressure or high water temperature is detected the Kubota engine will shutdown automatically after twenty seconds to prevent permanent damage from occuring.

Park Brake Sensor (if fitted)

The Park Brake Sensor prevents operation of the Sidelifter without first activating the park brake. Either the status ON or OFF is displayed.

Front Ankle (if fitted)/Rear Ankle (if fitted)

The retract, extension and error status of the ankles of the bending leg stabilisers are monitored and displayed.

Top Lift Frame (if fitted)

The Top Lift Frame sensor detects and displays when all four twistlocks on top lift frame have made contact with all four corner casting pocket on the container and the twistlocks have engaged.



View Joysticks Option

Selecting the View Joysticks option displays information useful for diagnostic purposes. Values displayed are useful for determining if there are communication errors between the radio remote and the electronic control units located on each crane base.



The possible values displayed for each menu item are described below:

- MODE: one of OFF MODE, TRAVERSE, STABILISER, ARMS, OFFSIDE LEG, BANDY LEG or TOP LIFT FRAME
- SPEED SWITCH: either HIGH or LOW
- ENGINE START, WORKLAMPS and HORN: either 0 (off) or 1 (on)
- EMERGENCY STOP: either OUT or IN
- RIGHT JS X-AXIS and LEFT JS X-AXIS: the function of the joysticks in the up/down position is represented numerically, from 85 to 171, with a neutral position of 127
- RIGHT JS Y-AXIS and LEFT JS Y-AXIS: the function of the joysticks in the in/out position is represented numerically, from 85 to 171, with a neutral position of 127
- RADIO RECEPTION: the level of radio reception beween the radio remote and the electronic control units is displayed via a bar graph



Crane Synchronisation

The Crane Synchronisation menu is protected by a PIN number to prevent unauthorised or untrained access. It is highly recommended that only trained personnel perform crane synchronisation.

Crane synchronisation is the process of matching the speed of the front and rear cranes in **LOW SPEED** only. If they are "out of sync", one function will appear to move faster than the other.

The cranes are synchronised before the trailer leaves the factory. However, if you notice that the cranes are operating at different speeds, it is possible to synchronise the cranes again by following the procedure below. This is not uncommon after about 50 hours of use, by which time the hydraulics have bedded in a little.

How to Synchronise the Cranes

LOW SPEED SYNCRONISATION CHK. OPERATING TIME ENSURE LOW SPEED I SELECTED ON REMOTE CRANE SYNCRONISATION FRONT UP = 00 % REAR UP = 00 % MANUAL OVERRIDE TOP ARM SYNC. FRONT DOWN = 00 % MANUFACTURERS AREA BOTTOM ARM SYNC. REAR DOWN = 00 % VIEW SENSOR VALUES RETURN TO SYNC MENU RETURN TO MAIN MENU VIEW JOYSTICKS

Figure 23 - Main Menu

Figure 24 – Crane Sync. Menu

Figure 25 – Top Arm Sync Screen

Crane synchronisation is available through the LCD display screen menu structure. Synchronisation is only effective when **LOW SPEED** is selected on the Hetronic radio remote.

- 1. Set the correct engine speed.
 - If using Power Pack version: Check the engine maximum speed is 2800 rpm.
 - If using PTO version: Set the truck engine rpm to obtain 100-120 l/min oil flow to the Sidelifter.
- 2. On the remote control, select **LOW SPEED** and Arm mode.
- 3. On the LCD display screen, go to the Main Menu and select Crane Synchronisation.
- 4. Enter the PIN number provided with this manual by turning the display dial and pressing it when the correct digit appears, then turning the dial to go to the next field and pressing, and turning to select the number etc.
- 5. When the PIN is correctly submitted, the Crane Synchronisation menu appears as shown in Figure 24.
- 6. Select Top Arm Sync, and the Top Arm screen appears as shown in Figure 25.



7. On the Hetronic remote control, select both top arms up with the joysticks at full deflection and time the arms in seconds, over their full stroke.

	SB330	SB361	SB401
Top Arm Up	48 sec	52 sec	54 sec
Top Arm Down	30 sec	32 sec	35 sec
Bottom Arm Up	65 sec	90 sec	90 sec
Bottom Arm Down	50 sec	70 sec	70 sec

If the time of either or both does not match the time in the table above, you will need to adjust the percentage values on the screen until it does. To do this, select the appropriate function by turning the dial then pressing it. You can then adjust the value up or down by turning the dial back or forward, and then save the new value by pressing the dial again.

8. Repeat for the bottom arms.

Testing the Synchronisation Settings

Test the settings when lifting a 15-20 tonne container to check that the arms are synchronised under normal loading and unloading conditions. Small adjustments of the percentage values may be required to achieve this.



Try slowing down the fast arm instead of speeding up the slow arm as you run the risk of running out of available oil flow to gain speed / synchronisation. Remember to actuate both front and rear cranes simultaneously when doing the timing.



Navigating the Screen

You can navigate the screen using the display dial, positioned as shown in the diagram above. Please note that the three buttons are not used.

To move through the screens and menu items, turn the display dial.

To make a selection from a menu or change a variable, press the display dial.



Dangerous Goods Specifications

Dangerous goods specification machines are fitted with a dual pole battery isolation switch.



Never turn the battery isolation switch while the Kubota engine is running! This will cause a Load Dump to occur which will damage the electrical system.



Service Due Warnings

Service due warnings operate at 50hrs, 100hrs and at every 100hrs after that.

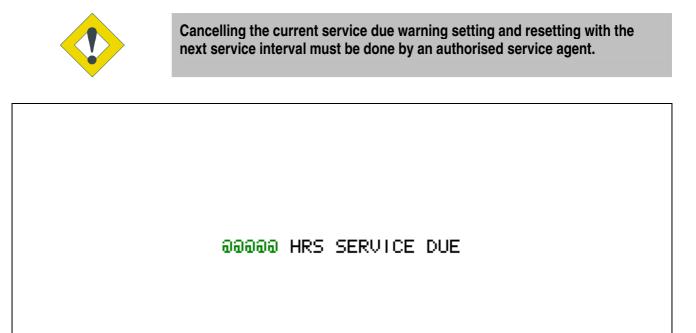


Figure 6



Digital Control Warnings and Alarms

The following screens are used in both the Digital Control and SMART*lift* systems.

33 39 FRONT CRANE FRONT CRANE FRONT STABILISER STABILISER NOT **DEPLOYED** DEPLOYED TRAVERSE FUNCTION DISABLED ARM FUNCTION DISABLED STABILISERS CANNOT BE DEPLOYED RETURN TO MAIN MENU RETURN TO MAIN MENU RETURN TO MAIN MENU

Figure 26

Figure 27 (rack and pinion only)

Figure 28



SMARTlift Load Monitoring System, Optional



Use of the SMARTlift LM System is not a replacement for proper operator training. The system is installed as an AID to safe operation of the Sidelifter. The system cannot react to the high momentum generated by a heavy, violently swinging container which WILL result in the Sidelifter becoming unstable. ALWAYS ensure that the load is properly under control.

SMARTlift is available as an addition to Digital Control on most SB330 and all SB361 and SB401 Sidelifters.

SMARTlift uses its intelligent software and sensors to monitor and control the lifting operation with precision and reliability. SMARTlift warns the operator when the load has moved to the limit of the safe working envelope and prevents the operator from moving the load further into an area where stability might be compromised.

Components

The SMARTlift system consists of the following components:

- All of the components listed under SMARTlift Control
- **Top arm angle sensor** x 2, located on each top arm.
- **Bottom arm angle sensor** x 2, located on each bottom arm.
- **Stabiliser angle sensor** x 2, located on each stabiliser housing.
- Magnetic proximity sensor x 4, located on each stabiliser housing.
- **Encoder strip** x 2, located on the stabiliser extension.
- **Reset magnet** x 4, located on each end of the stabiliser extensions.
- **Trailer angle sensor** x 1, located on the trailer chassis.

Electrical Control Units

Each crane is equipped with an Electronic Control Unit (ECU) which monitors the following Sidelifter parameters:

- Stabiliser angle
- Stabiliser extension
- Stabiliser foot in contact with ground
- Bottom lifting arm angle
- Top lifting arm angle
- Top lifting arm hydraulic cylinder pressure
- Trailer camber and elevation



Location of Sensors

The sensors are marked by dots and labelled in the diagram below.

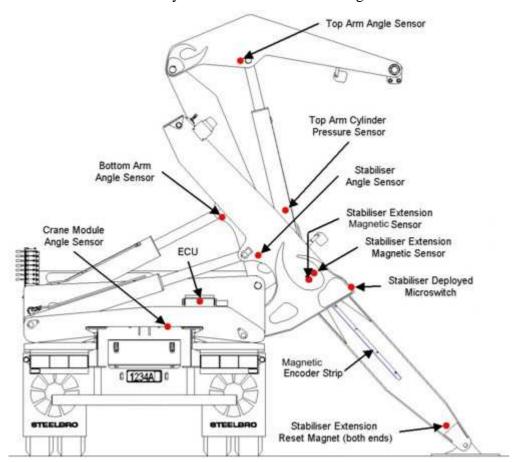


Figure 17



Angle and Pressure Sensor Failures

Angle and pressure sensor failures stop the operation of the Sidelifter. To continue operating the Sidelifter it is necessary to enter manual override mode. To do this, via the LCD display screen enter the Single Lift manual override PIN provided with this manual. This will allow you to override the SMARTlift system for this one operation only.



In manual override mode safety features of the load monitoring system are disabled and the operation of the arms is extra slow.

Operational Modes

This section lists the characteristics that are in addition to those described in the section Operational Modes (on page 45)

Arm Mode

A number of the special functions of SMARTlift are available while in Arm mode.

- Whenever you select Arm mode during an operation, the sensors automatically check that the stabilisers are firmly in contact with the ground or a companion trailer. If there is no contact, Arm mode is disabled and a warning sound (the horn) and screen message are activated
- However, if a stabiliser lifts off the ground during the loading operation, the lift is allowed to continue
- The first time you select Arm mode during an operation, the sensors automatically check the trailer camber and elevation. If these are outside safe working parameters, Arm mode is disabled. In such a case, it may be possible to correct the trailer camber using the stabilisers

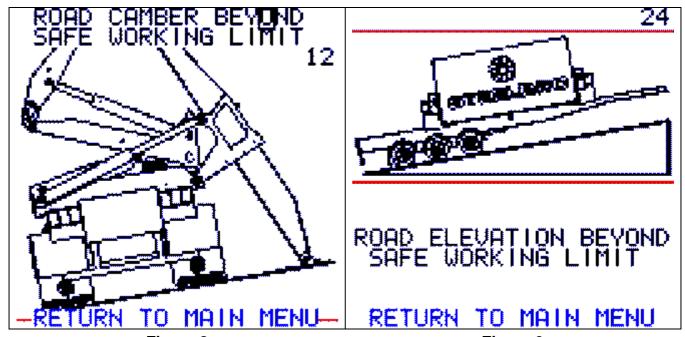


Figure 8 Figure 9



Offside Stability Alarm: If the lifting G-PIN horizontal distance is within 250mm from the trailer centre line on the stabiliser side and the base of the container is higher than the top of the offside bash plates, the offside alarm is engaged. Bottom Arm Down and Top Arm Up functions are disabled. Below this height, the offside bash plates will prevent the container from going too far offside. The SMARTlift system also engages the offside alarm if the G-PIN crosses the centre line of the trailer while loaded

27

FRONT CRANE

STABILITY ALARM

BOTTOM ARM EXTEND DISABLED

<u>RETURN TO MAIN MENU</u>

Figure 10

- The pressure in the top arm cylinder is also measured, which enables the system to estimate the
 mass on the lifting pin. This value is displayed to the nearest tonne whenever the Sidelifter is in
 Arm mode
- If the road elevation is such that one end of the Sidelifter trailer is higher than the other then the system will allow the high end of the container to be lifted higher than offside bash plate height, so that the container can be placed on the twist-locks
- When lifting two 20-foot containers together it is sometimes necessary to gain extra height above the offside bash plates to position the containers over the centre twist-locks. To gain extra height, press the horn button, the green button on the side of the remote, once to override the SMARTlift height limitation. The SMARTlift system will then beep once in reply. A message on the LCD display screen confirms that Double Twenty mode is operational. The SMARTlift system will stay in Double Twenty mode until either the engine is switched off or the horn button is pressed once. This procedure only works when the Sidelifter is in Arm mode.
- Each crane Electrical Control Unit (ECU) calculates the position of the stabiliser foot and the position of the lifting **G-PIN**. When the **G-PIN** is extended beyond the **STABILISER FOOT** (**K-PIN**), the system calculates the stability of the Sidelifter on the loading side. As the **G-PIN** is extended the system first warns that an unstable situation is imminent. If the operator carries on, the system disables the functions that increase the distance of the **G-PIN** from the trailer. If the stabiliser is very steeply angled and the container is very heavy, then the SMART*lift* system may prevent the **G-PIN** from even being extended beyond the **K-PIN**.



29

FRONT CRANE

STABILITY WARNING

LOW-SPEED FORCED

RETURN TO MAIN MENU

FRONT CRANE

27

STABILITY ALARM

BOTTOM ARM EXTEND DISABLED

RETURN TO MAIN MENU

Figure 11 Figure 12

- Figure 13 shows a situation where a container has been unevenly loaded on the side nearest the Sidelifter. During loading it is necessary for the operator to:
 - a) lift the container higher than normal above the twist-locks and
 - b) move the **G-PIN** further over the offside than normal.

These situations can cause the SMARTlift offside protection to activate earlier than desired. There are three ways to work around the issue.

- 1. Move the Sidelifter and pick the container up from the other side.
- 2. Shorten the chains so the container can be lifted higher.
- 3. If in the experience of the operator it is safe to attempt the lift, then via the LCD display screen enter the Single Lift manual override PIN provided with this manual. This will allow you to override the SMARTlift system for this one operation only.



In manual override mode safety features of the load monitoring system are disabled and the operation of the arms is extra slow.

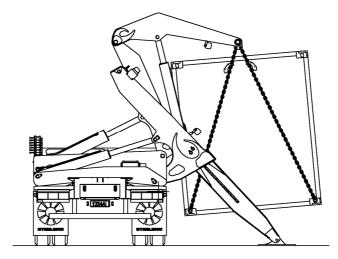


Figure 13



Stabiliser Mode

 Stabiliser mode is disabled if there is any load on the lifting pin and a warning sound (the horn) and screen message are activated



Figure 7

Traverse Mode

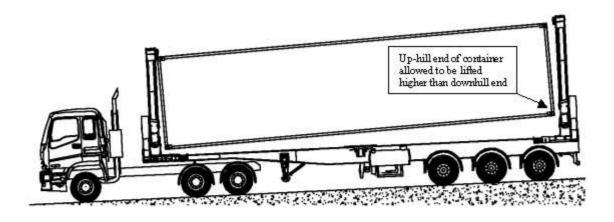
• If the stabiliser is extended for any distance, Traverse mode is disabled and a warning sound (the horn) and screen message are activated.

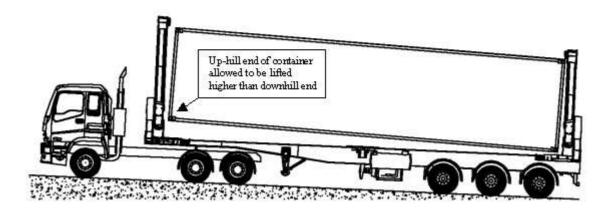


Lifting Containers on Steep Elevations

When lifting containers on steep elevations it is necessary to lift one end of the container higher than the other so that it can be located on the twist-locks.

The procedure is always to lift the up-hill end of the container higher than the downhill end.





The SMARTlift system measures the road elevation and allows the uphill end of the container to be lifted higher than normal, so as to allow the downhill end to be located on the twist-locks.

Automatic Fault Detection

The system will detect common electrical faults such as wire breakages and short-circuits in the angle sensors, pressure sensors and the stabiliser deployed microswitch.



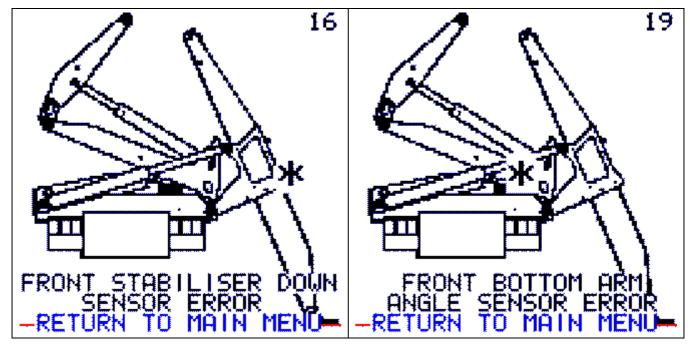


Figure 14 Figure 15



Troubleshooting

With the SMARTlift system, there is a comprehensive range of error messages including screens and sounds.

This chapter covers:

- Message screens why they appear and what to do if this happens
- Miscellaneous other troubleshooting or fix information

LCD Error or Warning Screens

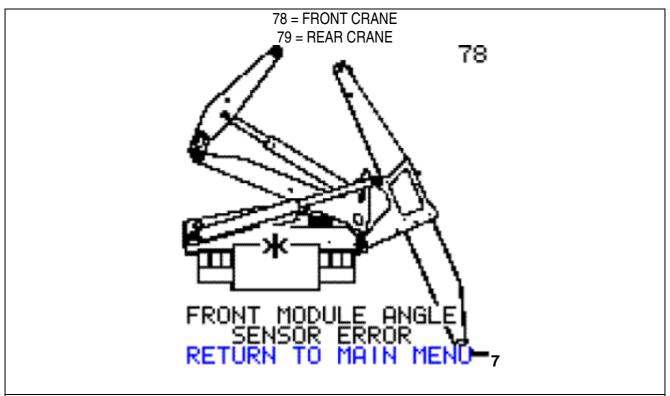
This section references each of the error or warning screens and possible causes and fixes.



If contacting Product Support over a system issue, it is very helpful to be able to give them the number of the screen or screens that have displayed.



Module Angle Sensor Error F78 R79



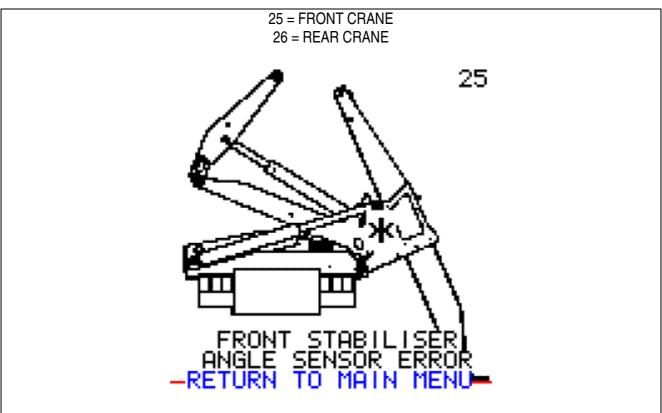
Front (or Rear) ECU is receiving an angle sensor signal outside 0.5 .. 4.5V range

The module angle sensor measures the elevation and camber of the trailer.

- For damage to the sensor cable and ingress of moisture into connecting plug
- Replace the sensor (correct orientation is important) and recalibrate using procedure SL0005
- With the trailer parked on level ground the elevation should be 0° and the camber should be 0°. These values can be seen at View Sensor Values
- Remember, all angle sensors are the same component so it is possible to swap sensors in order to help diagnose faulty wiring or a faulty sensor. Just remember to recalibrate any sensor that is moved!



Stabiliser Angle Sensor Error F25 R26



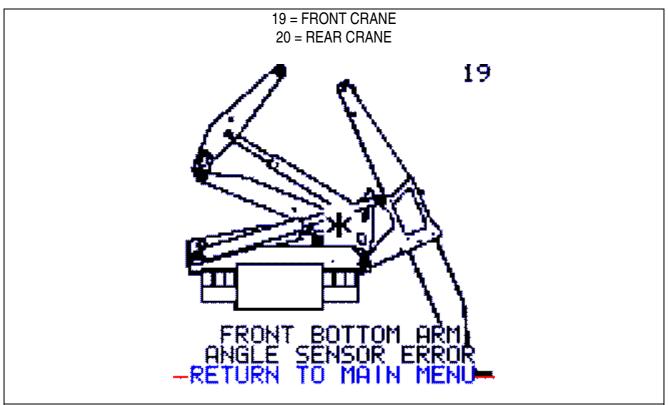
Front (or Rear) ECU is receiving an angle sensor signal outside 0.5 .. 4.5V range

The Stabiliser Angle Sensor measures the angle of the stabiliser.

- For damage to the sensor cable and ingress of moisture into connecting plug
- Replace the sensor (correct orientation is important i.e. with the cable pointing upwards) and recalibrate using procedure SL0005
- Check the calibration by hanging a Plumb-Bob from the L-Pin and move the Stabiliser so that L-Pin is vertical to the H-Pin
- With the diesel engine not running but SMARTlift switched on, go to MANUFACTURERS
 AREA VIEW PIN DISTANCES-VIEW FRONT OR REAR PIN DISTANCES-VIEW
 HORIZONTAL DISTANCE HL. The distance should be zero +/- 10mm.
- Remember, all angle sensors are the same component so it is possible to swap sensors in order to help diagnose faulty wiring or a faulty sensor. Just remember to recalibrate any sensor that is moved!



Bottom Arm Angle Sensor Error F19 R20



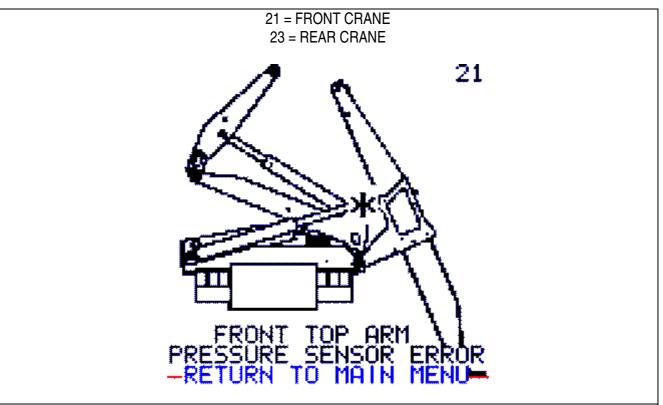
Fault detected between Crane Junction Box and Bottom Arm Angle Sensor

The Bottom Arm Angle Sensor measures the angle of the bottom arm.

- For damage to the sensor cable and ingress of moisture into connecting plug.
- Replace the sensor (correct orientation is important i.e. with the cable. pointing upwards) and recalibrate using procedure SL0005.
- Check the calibration by hanging a Plumb-Bob from the D-Pin and position the bottom arm in the vertical position so that the D-Pin is vertical to the A-Pin.
- With the diesel engine not running but SMARTlift switched on, go to MANUFACTURERS AREA – VIEW PIN DISTANCES-VIEW FRONT OR REAR PIN DISTANCES-VIEW HORIZONTAL DISTANCE AD. The distance should be zero +/- 10mm.
- Remember, all angle sensors are the same component so it is possible to swap sensors in order to help diagnose faulty wiring or a faulty sensor. Just remember to recalibrate any sensor that is moved!



Top Arm Pressure Sensor Error F21 R23



Front (or Rear) ECU is receiving a Pressure Sensor signal outside 4.20mA range

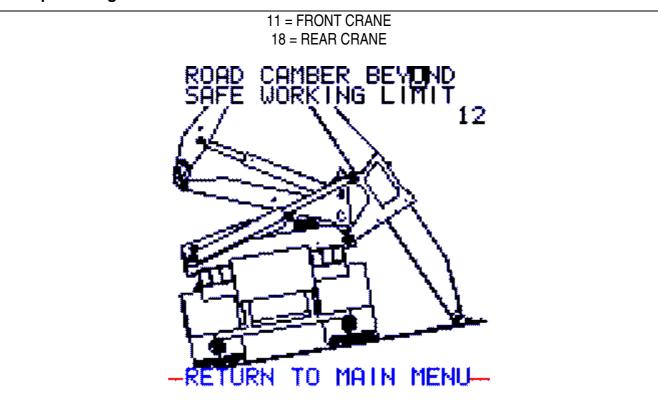
The Pressure Sensor measures the hydraulic pressure in the piston side of the top arm cylinder and is located on the A-port of the top arm lifting cylinder.



- For damage to the sensor cable and ingress of moisture into connecting plug
- Go to VIEW SENSOR VALUES, VIEW FRONT (or REAR) ANGLE SENSORS and check that when the top arm is fully extended that the pressure reading increases as expected
- Replace sensor if pressure does not change or is incorrect when cross checked with the analogue pressure gauge mounted on the rear crane



Top Arm Angle Sensor Error F11 R18



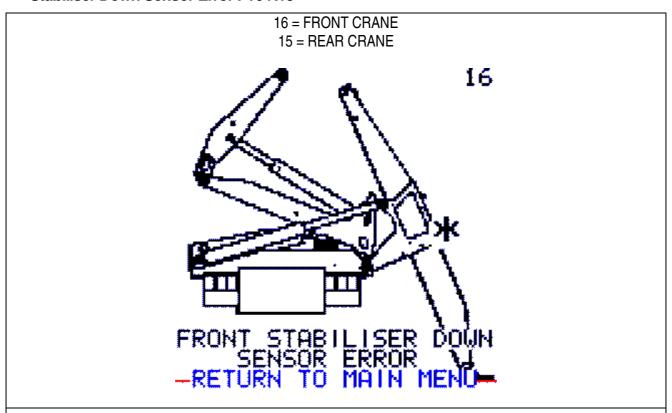
Fault detected between Crane ECU and Top Arm Angle Sensor

The Top Arm Angle Sensor measures the angle of the Top Arm.

- For damage to the sensor cable and ingress of moisture into connecting plug
- Replace the sensor (correct orientation is important i.e. with the cable pointing upwards) and recalibrate using procedure SL0005
- Check the calibration by hanging a Plumb-Bob from the G-Pin and position the bottom arm in the vertical position so that the G-Pin is vertical to the D-Pin
- With the diesel engine not running but SMARTlift switched on, go to MANUFACTURERS
 AREA VIEW PIN DISTANCES-VIEW FRONT OR REAR PIN DISTANCES-VIEW
 HORIZONTAL DISTANCE DG. The distance should be zero +/- 10mm
- Remember, all angle sensors are the same component so it is possible to swap sensors in order to help diagnose faulty wiring or a faulty sensor. Just remember to recalibrate any sensor that is moved!



Stabiliser Down Sensor Error F16 R15



Stabiliser Down Microswitch is not operating correctly

The microswitch has a Normally Open (NO) and a Normally Closed (NC) contact.

- On the LCD screen go to **VIEW SENSOR VALUES** then **FRONT** (or **REAR**) **STABILISER EXTENSION SENSORS**. At the bottom of the screen the switch state is displayed
- With the Stabiliser on the ground NO = 1 and NC = 0, with the stabiliser foot not in contact with the ground NO = 0 and NC = 1
- If NO=0 and NC=0, or NC=1 and NO=1 if then the above error page will be displayed



Communication With Front Crane Lost! 60

COMMUNICATION WITH
FRONT CRANE LOST !!

FAULT FINDING

1) CHECK FUSES 9 & 17

2) TRY A RESTART
AFTER REPLACING
FUSE

3) CHECK WIRING

RETURN TO MAIN MENU

The rear crane ECU has lost communication with the front crane ECU

Possible causes:

- Check fuses, blown fuse could be caused by a pinched sensor wire
- Power has been lost to the ECU, check:
 - ECU D+, Pin 28
 - ECU UE, Pin 54
 - ECU Ground, Pin 55
- Check CANbus continuity by measuring resistance between CAN-H and CAN-L at the diagnostic plug, remember to turn key switch off before trying this. $60\Omega = \text{good}$, $120 \Omega = \text{break}$ in CANbus



Communication With Rear Crane Lost! 61

COMMUNICATION WITH REAR CRANE LOST !!

FAULT FINDING

- CHECK FUSES 10&15
- 2) TRY A RESTART AFTER REPLACING FUSE
- 3) CHECK WIRING ^{LI}

RETURN TO MAIN MENU

The front crane ECU has lost communication with the rear crane ECU.

Possible causes:

- Check fuses, blown fuse could be caused by a pinched sensor wire
- Power has been lost to the ECU, check:
 - ECU D+, Pin 28
 - ECU UE, Pin 54
 - ECU Ground, Pin 55
- Check CANbus continuity by measuring resistance between CAN-H and CAN-L at the diagnostic plug, remember to turn key switch off before trying this. $60\Omega = \text{good}$, $120 \Omega = \text{break}$ in CANbus



Low Control System Voltage 62

LOW 62 CONTROL SYSTEM VOLTAGE!

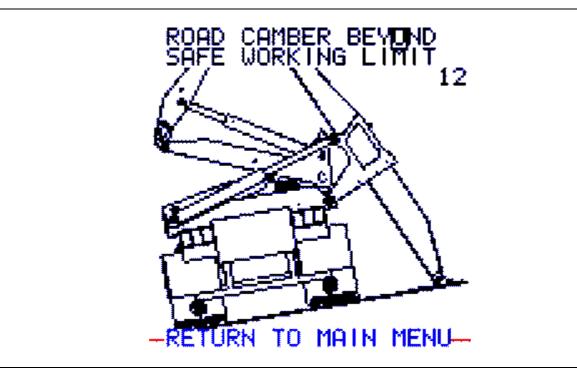
START ENGINE TO CHARGE BATTERY RETURN TO MAIN MENU

The voltage in the motorbike battery located on the Kubota engine frame has fallen to below 11V

- This is caused by the system being left 'ON' while the Kubota engine is not running
- The motorbike battery is only used to provide a stable voltage to the electronic components of the SMARTlift system while the Kubota engine is being started
- Once the Alternator is spinning the system voltage will rise to 14.2V then current can flow across the diode to allow the motorbike battery to charge from the main battery
- If this message is displayed during operation of the machine check that the Alternator is operating correctly



Road Camber Beyond Safe Working Limit 12

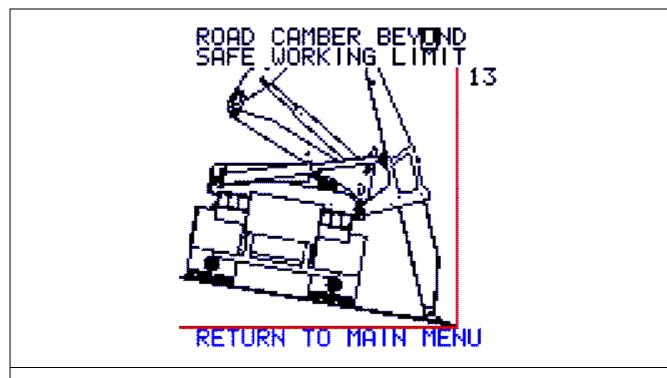


Either the front, rear or both crane bases are angled beyond acceptable limits

- Park the trailer on level ground and go to VIEW SENSOR VALUES then VIEW FRONT (or REAR) ANGLE SENSORS
- The trailer camber and elevation angle sensor readings should = 0 degrees
- If not then first check that the angle sensor has not come loose before recalibrating using procedure SL0005
- If the recalibration fails then check the wiring before replacing the sensor.
- Remember, all angle sensors are the same component so it is possible to swap sensors in order to help diagnose faulty wiring or a faulty sensor. Just remember to recalibrate any sensor that is moved!



Road Camber Beyond Safe Working Limit 13

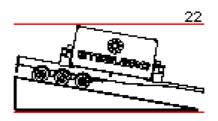


Either front, rear or both crane bases are angled beyond acceptable limits

- Park the trailer on level ground and go to VIEW SENSOR VALUES then VIEW FRONT (or REAR) ANGLE SENSORS
- The trailer camber and elevation angle sensor readings should = 0 degrees.
- If not then first check that the angle sensor has not come loose before recalibrating using procedure SL0005
- If the recalibration fails then check the wiring before replacing the sensor.
- Remember, all angle sensors are the same component so it is possible to swap sensors in order to help diagnose faulty wiring or a faulty sensor. Just remember to recalibrate any sensor that is moved!



Road Elevation Beyond Safe Working Limit 22



ROAD ELEVATION BEYOND SAFE WORKING LIMIT

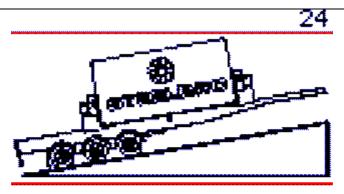
RETURN TO MAIN MENU

Either front, rear or both crane bases are angled beyond acceptable limits

- Park the trailer on level ground and go to VIEW SENSOR VALUES then VIEW FRONT (or REAR) ANGLE SENSORS
- The trailer camber and elevation angle sensor readings should = 0 degrees.
- If not then first check that the angle sensor has not come loose before recalibrating using procedure SL0005
- If the recalibration fails then check the wiring before replacing the sensor.
- Remember, all angle sensors are the same component so it is possible to swap sensors in order to help diagnose faulty wiring or a faulty sensor. Just remember to recalibrate any sensor that is moved!



Road Elevation Beyond Safe Working Limit 24



ROAD ELEVATION BEYOND SAFE WORKING LIMIT

RETURN TO MAIN MENU

Either front, rear or both crane bases are angled beyond acceptable limits

- Park the trailer on level ground and go to VIEW SENSOR VALUES then VIEW FRONT (or REAR) ANGLE SENSORS
- The trailer camber and elevation angle sensor readings should = 0 degrees.
- If not then first check that the angle sensor has not come loose before recalibrating using procedure SL0005
- If the recalibration fails then check the wiring before replacing the sensor.
- Remember, all angle sensors are the same component so it is possible to swap sensors in order to help diagnose faulty wiring or a faulty sensor. Just remember to recalibrate any sensor that is moved!



Warning Angle Sensors Not Calibrated F53 R113

53 = FRONT CRANE 113 = REAR CRANE

53

WARNING FRONT ANGLE SENSORS NOT CALIBRATED

RETURN TO MAIN MENU

The ECU has detected that the angle sensor calibration data has been lost, this may cause unexpected stability alarms to be activated

- Sidelifter should be recalibrated using the Plumb-Bob Calibration Method
- Ensure that the latest software version is being used, confirm with Steelbro
- Report the problem to Steelbro



Stability Warning F29 R32

29 = FRONT CRANE 32 = REAR CRANE

29

FRONT CRANE

STABILITY WARNING

LOW-SPEED FORCED

RETURN TO MAIN MENU

The Arms have been extended within 250mm of the edge of the safe working envelope on the Stabiliser side of the Sidelifter

- If High speed is selected then Low speed automatically activates
- High speed can be re-entered only if the Arm extension is reduced and both joysticks are in the neutral position

- Check that the Stabiliser Extension measurement is operating correctly
- Check the calibration of the Stabiliser, Bottom and Top Arm Angle Sensors. Do this by hanging a plum bob one at a time between pins A&D, D&G and H&L as described in the calibration procedure SL0005 and then go to the MANUFACTURERS AREA then VIEW PIN DISTANCES and check that the HORIZONTAL DISTANCES, AD, DG and HL are zero mm (±10mm) when the plumb bob is lined up



Stability Alarm F27 F30

27 = FRONT CRANE 30 = REAR CRANE

27

FRONT CRANE

STABILITY ALARM

BOTTOM ARM EXTEND

RETURN TO MAIN MENU

The arms have been extended to the edge of the Safe Working Envelope on the stabiliser side of the Sidelifter

- All arm functions that could move the load further away from the trailer are disabled
- If the Top Arm is above horizontal, then only Top Arm up will be allowed
- If the Top Arm is below horizontal then only Top Arm Down will be allowed
- Bottom Arm Up is disabled
- Bottom Arm Down is enabled

- Check the operation of the stabiliser extension magnetic counter by going to VIEW SENSOR VALUES then FRONT (or REAR) STABILISER EXTENSION SENSORS. As the Stabiliser Extension is deployed the LCD display screen should display a changing count as the magnetic counter reads the magnetic strip. With the Stabiliser Extension fully extended, the magnetic counter should display as 1 and the top reset magnet should display as 0. With the Stabiliser Extension arm fully retracted the magnetic counter should display as 0 and the top reset magnet should display as 1
- Check the calibration of the Stabiliser, Bottom and Top Arm Angle Sensors. Do this by hanging a plum bob one at a time between pins A&D, D&G and H&L as described in the calibration procedure SL0005 and then go to the MANUFACTURERS AREA then VIEW PIN DISTANCES and check that the HORIZONTAL DISTANCES, AD, DG and HL are zero mm (±10mm) when the plumb bob is lined up



Offside Stability Alarm F28 R31

28

FRONT CRANE

OFFSIDE STABILITY ALARM

BOTTOM ARM RETRACT AND TOP ARM EXTEND DISABLED

RETURN TO MAIN MENU 28 = FRONT CRANE

31 = REAR CRANE

The most likely causes are:

- The lifting pin (G-Pin) has crossed the centreline of the trailer with load
- The operator has lifted the container too high and has come within 200mm of the centreline of the trailer. In this case the operator must lower the container to a more suitable height for landing on the trailer twistlocks

If this is clearly not the issue:

Check the calibration of the Bottom and Top Arm Angle Sensors. Do this by hanging a plum bob one at a time between pins A&D and D&G as described in the calibration procedure SL0005 and then go to the MANUFACTURERS AREA then VIEW PIN DISTANCES and check that the HORIZONTAL DISTANCES, AD and DG are zero mm (±10mm) when the plumb bob is lined up.



Stabiliser Not Deployed - Arm Function Disabled F33 R34

33 = FRONT CRANE 34 = REAR CRANE

33

FRONT CRANE

STABILISER NOT DEPLOYED

ARM FUNCTION DISABLED

RETURN TO MAIN MENU

Arms Mode has been entered without the stabiliser being properly deployed

That is, enough pressure being put on the foot so that the gap between the Stabiliser Extension and Stabiliser Housing closes, thereby activating the Stabiliser Down Microswitch.

If this is clearly not the issue:

- Check that the Stabiliser Down Microswitch is functioning correctly
- On the LCD screen go to VIEW SENSOR VALUES then FRONT (or REAR) STABILISER EXTENSION SENSORS. At the bottom of the screen the switch state is displayed
- With the Stabiliser on the ground NO = 1 and NC = 0, with the stabiliser foot not in contact with the ground NO = 0 and NC = 1



Load On Lifting Pin – Stabilisers Cannot Be Deployed F37 R38

37 = FRONT CRANE 38 = REAR CRANE

FRONT CRANE 37



STABILISERS CANNOT BE DEPLOYED

RETURN TO MAIN MENU

Stabiliser Mode has been entered while there is still load on the lifting pin (G-Pin)

If this is clearly not the issue:

- Check the Top Arm Pressure Sensor Value by going to VIEW SENSOR VALUES then FRONT (or REAR) ANGLE SENSORS. At the bottom of the page the Pressure in the Top Arm Cylinder will be displayed. With no load on the G-Pin the pressure should be less than 20bar
- If the reading is stuck no matter what weight is on the G-Pin then replace the pressure sensor
- When replacing the sensor make sure that the top Arm is fully folded down and that all hydraulic pressure in the cylinder is released by using the manual lever on the Danfoss PVG valve. Wear eye protection



Module Off Station – Stabilisers Cannot Be Deployed F39 R40

39 = FRONT CRANE 40 = REAR CRANE

39



STABILISERS CANNOT BE DEPLOYED

RETURN TO MAIN MENU

This is only possible on SB361/SB401 with rack and pinion crane traverse fitted



Stabiliser Deployed – Traverse Function Disabled F45 R44

45 = FRONT CRANE 44 = REAR CRANE

FRONT CRANE

45

STABILISER DEPLOYED

TRAVERSE FUNCTION DISABLED

RETURN TO MAIN MENU

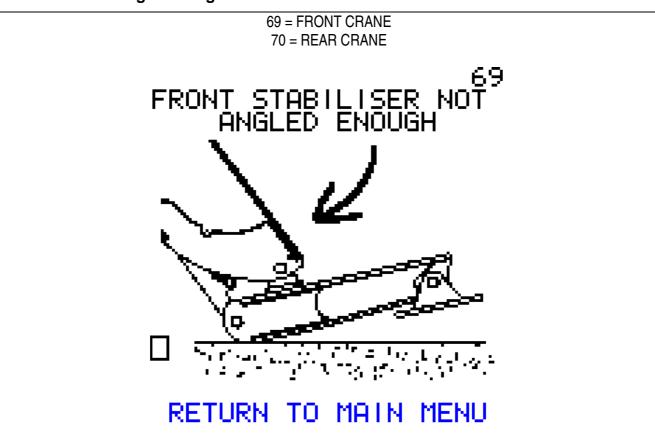
Operator has entered traverse Mode without the Stabiliser first being fully retracted

If this is clearly not the issue:

- On the LCD screen go to VIEW SENSOR VALUES, then FRONT (or REAR) STABILISER EXTENSION SENSORS. Check that the foot down micro switch values change when the foot is placed on the ground and lifted off the ground. When the foot is on the ground, the values displayed should read NORMALLY OPEN=1, NORMALLY CLOSED=0. When the foot is off the ground, the values displayed should read NORMALLY OPEN=1, NORMALL CLOSED=1. If the stabiliser is fully folded and retracted, but the foot down switch's indicate that the foot is on the ground check, and if needed, adjust the microswitch on the stabiliser housing
- Check that the magnet located on the side of the stabiliser extension near the foot end is still in place
- Check that the stabiliser counts in and out correctly by looking at the LCD screen during operation of the stabiliser. During retraction the counter should reach zero mm by the end of the magnetic strip. During extension the counter will only start when the first magnet of the magnetic strip is reached
- Go to VIEW SENSOR VALUES then FRONT (or REAR) STABILISER EXTENSION SENSORS. With the stabiliser extension fully retracted the values displayed should read MAGNETIC COUNTER =1, RESET MAGNET = 0. With the stabiliser extension fully extended the values displayed should read MAGNETIC COUNTER =1, RESET MAGNET = 1



Stabiliser not angled enough F69 R70

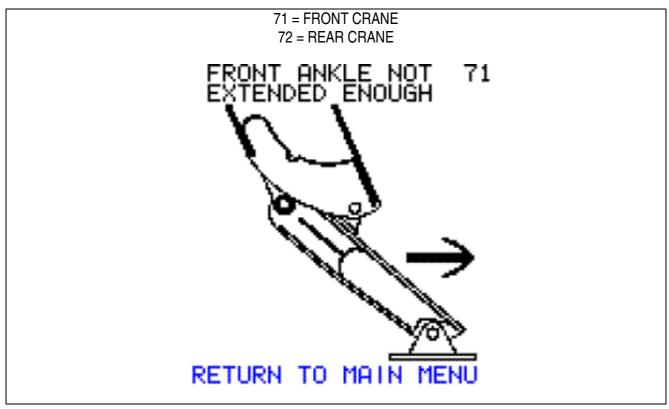


The Stabiliser must be sufficiently angled so that when the Bending Leg is deployed the foot comes into contact with the ground, not the ankle

- The Stabiliser Angle is checked when the MODE SELECT SWITCH is turned to BENDING LEG MODE.
- If the Stabiliser is already at maximum angle and this message still appears then ensure that the trailer camber is not over +3° (i.e. chassis leaning towards the non-stabiliser side). If this is the case it may not be possible to safely deploy the Bending Leg.
- Check the calibration of the Stabiliser Angle Sensor by hanging a Plumb-Bob from the L-Pin and move the Stabiliser so that L-Pin is vertical to the H-Pin.
- With the diesel engine not running but SMARTlift switched on, go to MANUFACTURERS AREA, VIEW PIN DISTANCES, VIEW FRONT OR REAR PIN DISTANCES, VIEW HORIZONTAL DISTANCE HL. The distance should be zero +/- 10mm.



Ankle not extended enough F71 R72



The Bending Leg must be fully deployed (or fully retracted) before any lifting can take place

- When ARMS MODE is selected SMARTlift checks if the Bending Leg is fully extended or fully retracted.
- If the Bending Leg is either fully extended or fully retracted but this screen still displays, then it is most likely that either the Bending Leg Fully Extended Sensor or Bending Leg Fully Retracted Sensor is faulty or requires adjustment.
- The easiest method of checking the operation of the sensors is by going to VIEW SENSOR VALUES, VIEW SPECIAL OPTIONS, FRONT (or REAR) ANKLE.
- Actuate the Bending Leg between the fully retracted and fully extended positions. Observe that
 the ANKLE POSITION should change from Fully Retracted to Partially Extended to Fully
 Extended. The individual switch values can also be viewed and they should be as follows.

	Leg Retracted Sensor NO Switch	Leg Retracted Sensor NC Switch	Leg Extended Sensor NO Switch
Fully retracted	CLOSED	OPEN	OPEN
Partially Extended	OPEN	CLOSED	OPEN
Fully extended	OPEN	CLOSED	CLOSED



Ankle Retract Sensor Error F104 R105

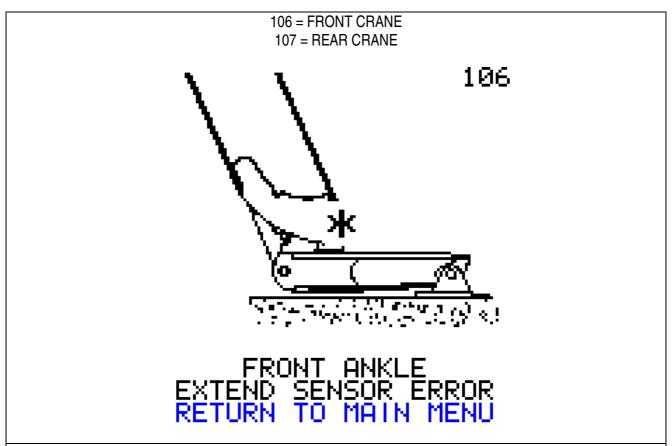


The Bending Leg Retract Sensor is faulty

- Check the operation of the sensor is by going to VIEW SENSOR VALUES, VIEW SPECIAL OPTIONS, FRONT (or REAR) ANKLE.
- The error message appears when the both the Leg Retracted Switches are in the CLOSED state or when both switches are in the OPEN state.
- If both switches are in the CLOSED state then it is most likely there is a wiring fault, a short circuit or a sensor failure.
- If both switches are in the OPEN state then it is most likely there is a damaged wire, a wiring fault, loss of power to the sensor, or a sensor failure.



Ankle Extend Sensor Error F106 R107



The Bending Leg Extend Sensor may be faulty, or most likely requires adjustment

- This sensor only has one switch, so it cannot be diagnosed in the same way as the Retract Sensor.
- The screen appears when the both the Fully Retract Sensor and the Fully Extend Sensor are sensing the Bending Leg. Clearly it is not possible for the leg to be fully retracted and fully extended at the same time.
- If this error page shows only when the Bending Leg is fully retracted then it is most likely that the Extend Sensor just needs adjusting slightly away from pivot.

 Refer to the table below for the correct switch states; 	Leg Retracted Sensor NO Switch	Leg Retracted Sensor NC Switch	Leg Extended Sensor NO Switch
Fully retracted	CLOSED	OPEN	OPEN
Partially Extended	OPEN	CLOSED	OPEN
Fully extended	OPEN	CLOSED	CLOSED



Joystick Error Reported L65 R66

65 = LEFT JOYSTICK 66 = RIGHT JOYSTICK

65

LEFT JOYSTICK ERROR REPORTED

REPORT PROBLEM TO STEELBRO OR HETRONIC

RETURN TO MAIN MENU

This error occurs if a Control Pendant Joystick has a fault

- It may appear intermittently, but the Joystick should be replaced
- It is not possible to service the Joystick, it should be returned to Hetronic or Steelbro



No Joystick Data Received 64

64

NO JOYSTICK DATA RECEIVED

PRESS GREEN BUTTON
ON SIDE OF REMOTE
TO RESET

RETURN TO MAIN MENU

The Hetronic radio has detected minor radio interference, or there has been an internal error with the data from the Hetronic radio receiver

• This has not been sufficient to trigger the E-Stop Circuit, and the problem can be resolved by pressing the Green button on the side of the remote.



Mode Select Switch Error 75

75

MODE SELECT SWITCH ON REMOTE IS FAULTY, CONTACT STEELBRO FOR REPLACEMENT

RETURN TO MAIN MENU

The Mode Select switch is not in any valid mode

- Valid Modes are (clockwise from the switch OFF position):
 - Off
 - Traverse
 - Stabiliser
 - Arm
 - Off-Side Stabiliser
 - Bending Leg
 - Top Lift Frame
- Go to **VIEW JOYSTICKS**, and observe how the Mode changes on the screen as the rotary switch is rotated. The switch is equipped with a stop pin so that unused modes are not available
- If the Modes are not in the order listed above then the switch is faulty



ECU communication lost with Radio Receiver F96 R97

NT ECU 97 = REAR ECU

96

FRONT CRANE ECU
COMMUNICATION LOST
WITH HETRONIC
RADIO RECEIVER

RETURN TO MAIN MENU

The front (or rear) crane ECU is not receiving any Joystick data on the CANbus from the radio receiver

Check:

- Go to **VIEW JOYSTICKS** to confirm that there is no communication
- Check the integrity of the CANbus
- Check the state of the LED's inside the radio receiver



Front Crane Has Lost Communication with Engine ECU 95

95

FAULT

FRONT CRANE HAS LOST COMMUNICATION WITH ENGINE ECU CHECK FUSES 1 & 7

RETURN TO MAIN MENU

The front crane ECU has lost communication with the engine ECU

Possible causes:

- Check fuses 1 and 7
- Check CANbus continuity by measuring resistance between CAN-H and CAN-L at the diagnostic plug, remember to turn key switch off before trying this. $60\Omega = \text{good}$, $120 \Omega = \text{break}$ in CANbus
- Power may have been lost to the engine ECU, check:
 - ECU UE, Pin 3
 - ECU Ground, Pin 11



Diesel Engine Oil Pressure too low 100

100

DIESEL ENGINE

OIL

PRESSURE

TOO LOW

ENGINE WILL SHUTDOWN

IN OO SECONDS

From SMARTlift 2.0 (SB7661) onward

If the Oil Pressure is too low while the engine is running then this screen will appear and the Sidelifter will shutdown after 20 seconds to protect the engine from further damage.

- Check the oil level.
- If the ORANGE wire to the Oil Pressure switch has continuity with earth while the engine is running (i.e. when the supply voltage is over 13volts) then the screen will appear.
- Check that the Oil Pressure Switch contact does not have continuity with earth when the engine is running.
- Disconnect the orange wire and see if the message disappears, if not check the continuity of the wire between the Oil Pressure Switch and Pin 17 on the Front ECU. There must be no shorts to earth.



Diesel Engine Water Temperature too High 99

99

DIESEL ENGINE

WATER

TEMPERATURE

TOO HIGH

ENGINE WILL SHUTDOWN
IN OO SECONDS

From SMARTlift 2.0 (SB7661) onwards

If the water temperature is too high this screen with appear and the Sidelifter will be shutdown after 20 seconds to protect the engine from damage.

- Allow the radiator to cool before checking the coolant level
- If the YELLOW wire to the Temperature Switch has continuity with earth while the engine is running (i.e. when the supply voltage is over 13volts) then the screen will appear
- Check that the Temperature Switch contact does not have continuity with earth when the engine has cooled
- Disconnect the yellow wire and see if the message disappears, if not check the continuity of the wire between the Temperature Switch and Pin 16 on the Front ECU. There must be no shorts to earth



Alternator Not Charging 109

109

DIESEL ENGINE

ALTERNATOR

NOT CHARGING BATTERY

CHECK OPERATION AND ELECTRICAL CONNECTIONS

RETURN TO MAIN MENU

From SMARTlift 2.0 (SB7661) onwards

The Alternator on the Kubota Diesel Engine is not charging the battery.

- If the BLUE wire to the Alternator has continuity with earth while the engine is running (i.e. while oil pressure is sensed) then the above screen will be displayed
- Check the voltage at the Alternator and ensure that it reaches at least 14.1V when the engine is running
- Disconnect the spade connector from the Alternator and see if the message disappears
- If the message does not disappear check the continuity of the wire between the Alternator and Pin 38 on the Rear ECU. There must be no shorts to earth
- Otherwise check directly on the alternator to ensure that the contact floats when the Alternator is spinning



Trailer Park Brake Not Applied 110

WARN I NG !

TRAILER PARK BRAKE MUST BE ENGAGED TO OPERATE SIDELIFTER

JOYSTICK'S DISABLED

RETURN TO MAIN MENU

Optional feature

This is an optional feature for customers who may wish to prevent the operation of the Sidelifter until the park brake has been engaged. An additional sensor is added to the brake circuit. This screen shows if the operator attempts to operate the Sidelifter without the Park Brake 'ON'.

- If the sensor becomes disconnected or the connecting wire is damaged then this screen will show
- With the park brake 'ON' the Park Brake sensor closes between contacts 1 & 4. With the park brake 'OFF' between 1 & 2. Contact 1 is connected to the Rear ECU via wire 8. Contact 2 is not connected. Contact 4 is connected to earth in junction box 'E'
- Check the continuity of the wire from contact 1 on the sensor to pin 39 on the rear ECU
- If the switch does not close between contacts 1&4 when the park brake is applied then adjust the switching point by removing the electrical plug and turning the adjusting screw



Top Lift Frame - Twistlock Switch Error FR120 FL121 RR 122 RR 123

120 = FRONT RIGHT
121 = FRONT LEFT
122 = REAR RIGHT
123 = REAR LEFT

* 120

FRONT RIGHT
121 = FRONT LEFT

122 = REAR RIGHT
123 = REAR LEFT

* 120

FRONT RIGHT TWISTLOCK
SWITCH ERROR

RETURN TO MAIN MENU

The Twistlock Switches sense the position of the top lift frame twistlocks

- Each individual switch has complementary outputs (i.e. Normally Open and Normally Closed switches). If the Front ECU detects that both switches are the same state then the error screen will be displayed.
- This means that the switch cable is either shorting or broken, or that the switch has failed.
- If unsure swap the switch with another corner and see if the error moves with the switch.



Top Lift Frame - Contact Sensor Error FR124 FL125 RR126 RL127

124 = FRONT RIGHT
125 = FRONT LEFT
126 = REAR RIGHT
127 = REAR LEFT

* 124

FRONT RIGHT CONTACT
SENSOR ERROR

RETURN TO MAIN MENU

The Contact Sensors sense when the Top Lift Frame is resting on top of the container. There is a sensor for each corner of the Top lift Frame

- Each individual sensor has complementary outputs (i.e. Normally Open and Normally Closed outputs). If the Front ECU detects that both sensor outputs are the same state then the error screen will be displayed
- This means that the sensor cable is either shorting or broken, or that the sensor has failed
- If unsure swap the sensor with another corner and see if the error moves with the sensor



Top Lift Frame – Twistlocks Are In-between Open and Closed 128



If any of the Twistlocks are sensed to be between the fully open or fully closed positions then the Sidelifter Arms will be disabled

Enter Top Lift Frame Mode and open or close the twistlocks.

If this is clearly not the issue:

- It is easy to determine which corner of the top lift frame is giving problems by going to VIEW SENSOR VALUES, VIEW SPECIAL OPTIONS, TOP LIFT FRAME, TWISTLOCKS, here individual twistlock states can be seen. Activate the twistlocks and observe the changing states
- Check the twistlock switches are operating correctly by removing the inspection covers on top of the problem corner



Top Lift Frame Is Not Fitted 129

129

TOP LIFT FRAME IS NOT FITTED !

RETURN TO MAIN MENU

If the Mode Select Switch on the remote is set to Top Lift Frame Mode but the Top Lift Frame is not fitted then this message will appear

- If the Top Lift Frame is plugged in and this message appears then there is no communication between the Front ECU and the top lift frame controllers
- Check the continuity of the CANbus and also check that power is reaching both top lift frame control cards



Max Rated Load Exceeded 58

58

MAX RATED LOAD EXCEEDED

RETURN TO MAIN MENU

Optional feature

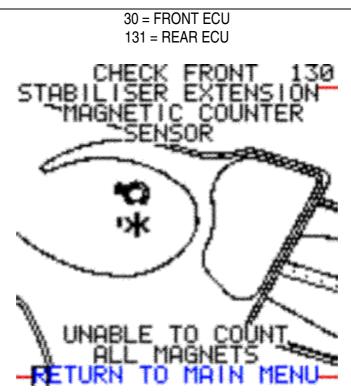
This is an optional feature for customers who may want to electronically de-rate their Sidelifter.

The message appears if the operator attempts to lift a load that is greater than the allowed load.

- The maximum rated load can be set via the Manufacturers Area Menu Change Crane Rating screen. This option will only be effective if the feature has been enabled in the factory
- Note that the maximum rated load will have to be set approximately 1000kg above the actual max load because the force induced in the hydraulic cylinder during lifting is greater than the actual load



Stabiliser Extension Magnetic Counter Sensor F130 R131



IF THE UNIT HAS OPTICAL SENSORS AND A CASTELLATED PLASTIC STRIP CONTACT STEELBRO PRODUCT SUPPORT FOR ASSISTANCE.

The ECU has counted the number of steps on the plastic strip between the stabiliser fully retracted and the stabiliser fully extended positions and has either over-counted or under-counted compared to the correct number of steps.

This could mean that the magnetic sensor is too close or too far away from the magnets embedded in the plastic strip.

- Check the sensor values screen under stabilisers and observe the count as the leg travels up and down. It is often possible to see where exactly on the strip the magnetic sensor cannot read the magnets properly. A proper set up will count evenly as the leg moves. If the counting stops in certain sections this indicates where the problem might be.
- Ensure the plastic strip is lined up along the length of the leg. To do this, take the magnetic sensor off the stabiliser housing and look through the hole as the leg moves in and out. The plastic strip should remain centered in the hole through the entire length. If it does not it may need to be moved into better alignment.
- If the magnetic sensor is not reading anything at all check wiring and power to the sensor. If there are no problems with the wiring the sensor may be faulty and could need replacing.



Angle Sensor Calibration Failure

FRONT TOP ARM CALIBRATION FAILED

This message can refer to any of the eight angle sensors on the Sidelifter

The message only occurs during angle sensor calibration.

Check:

- The Angle Sensor is bolted to the correct side of the Arm or Stabiliser and that the orientation is correct (i.e. wire pointing upwards)
- The angle sensor selected on the display menu corresponds with the Arm or Stabiliser that has been set-up with the Plumb-Bob
- If difficulty is encountered with calibrating the Top Arm Angle Sensor, then try swapping it with the Bottom Arm Angle Sensor and recalibrate both

Memory Sector One Corrupt

FRONT MEMORY SECTOR ONE CORRUPT

This message can appear for either the Front or Rear ECU

- Memory Sector One of the Rear ECU saves the:
 - Last Stabiliser Extension
 - Last Load
 - Operating Hours
 - Estimated Number of Lifts (only from 2007)
 - Next Service Due
- The Rear ECU Memory Sector One variables are accessible via the LCD screen
- The variables are saved back to memory every time the SMARTlift system is switched off
- Data corruption can occur if the battery supply is interrupted while the system is operating. i.e. The motorcycle battery is disconnected while SMARTlift is 'ON'



- In the event of the Rear Memory Sector being corrupted it is likely that the Operating Hours will need to be reset. Also the Next Service Due Hours should also be reset
- The Front ECU contains a duplicate of the above information but it is NOT accessible via the LCD screen

Procedure for resetting the Operating Hours

Enter the MANUFACTURERS AREA using the PIN 2111



- Using the Dial select the point in the top right hand corner of the screen
- The Change Operating Hours Screen will appear, enter the PIN number (Steelbro must be contacted for authorisation) using the dial
- Once the PIN number is entered a moving OK will display next to the PIN number
- The Estimated Operating Hours can now be set
- The Service Due Hours can be set in the normal way by following procedure SL0025_1GB





Memory Sector Two Corrupt

FRONT MEMORY SECTOR TWO CORRUPT

This message can appear for either the Front or Rear ECU

- Memory Sector Two of each ECU saves the Angle Sensor Calibration Data
- If this message appears then the Front or Rear Crane will have to be recalibrated according to procedure SL0005

Memory Sector Three Corrupt

FRONT MEMORY SECTOR THREE CORRUPT

This message can appear for either the Front or Rear ECU

- Memory Sector Three of each ECU saves the Crane Synchronisation Data
- If this message appears then the cranes will have to be re-synchronised according to the procedure described in the Sidelifter Operators Manual



Manufacturer's Area

The Manufacturer's Area menu is protected by a PIN number to prevent unauthorised access. Only appropriately authorised personnel can access this area.

Flat ECU Battery

When the ECU battery (Motor-cycle battery) becomes too weak, it is not possible to start the Sidelifter the usual way.

If this weakness is due to the Sidelifter being unused for a period of time or during below zero °C temperatures, use the procedure below to 'jump start' the unit.

If the ECU battery continually cannot hold a charge then it must be replaced as soon as possible.

Models and Markets:

All SMARTlift models using Hetronic Radio remotes (This procedure does not work when using a cable remote).

Procedure:

Follow instructions below using the E-stop Override Button:

- 1. Make sure all three E-stops are OUT (located on radio remote, E Box and front of trailer respectively)
- 2. Bring the radio remote over to the Start Key Enclosure (E Box) so both are within reach. Ensure there is a charged battery in the radio remote. Turn the radio remote on.
- 3. Press the E-stop Override button located on the left side of the Start Key Enclosure. Keep your finger on this button. See photo below (indicated by red arrow):





- 4. With the other hand start the engine by turning the start key. Wait 5-10 seconds for the alternator to charge the ECU battery slightly.
- 5. While still pressing the E-stop Override button, push the green start button on the radio remote.
- 6. Release the E-stop Override button.
- 7. If all three E-stops are depressed, the engine should continue to run and the Sidelifter should work normally. Give the ECU battery a chance to charge (5-10 minutes) before turning the engine off again.



Only use this as a temporary fix. If the ECU battery continually cannot hold a charge then it must be replaced.



SL0005 Calibrating SMARTlift Angle Sensors Using the Plumb-Bob Method

SL0005 Version 3 SMARTlift 14-04-09	
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Calibration procedure for Smartlift SB330/200/361/401









Safety precautions for SMARTLIFT Calibration

- Connect both Emergency and Service Airlines to the Trailer and apply the park brake.
- Ensure the trailer's brakes are applied and working.
- Keep non-involved Staff out of the calibration area.
- Attach the Exhaust Hose to the Powerpack's Exhaust Pipe to vent Exhaust Gases outside.

Special Tool Requirements for SMARTLIFT Calibration

- Spirit Level
- A Plumb Bob

Instructions

- Place the Spirit Level firstly ALONG the Chassis Rails and secondly ACROSS the chassis rails.
- Use Hydraulic Jacks to level the trailer, in Camber (across) and Elevation (along).



<u>MAIN MENU</u>

CHK. OPERATING TIME
CHECK LOAD
CRANE SYNCRONISATION
MANUAL OVERRIDE
MANUFACTURERS AREA
VIEW SENSOR VALUES

- Start the Engine on the Sidelifter and wait for the Smartlift System to "Boot Up" on the Smartlift LED Screen.
- Use the Rotary Switch to enter the Main Menu Area and Select the Manufacturers Area.

2. Calibration

MANUFACTURERS AREA

ENTER ACCESS CODE aaaa

RETURN TO MAIN MENU

- Enter the Manufacturers Area Code: 2111 and press the Rotary Switch in to enter the code.
- IMPORTANT: When Calibrating the angle sensors make sure that the engine is not running, so as to avoid unnecessary vibrations.



LAST USED EEPROM=0000
CHECK EEPROM
ANGLE SENSOR CALIB.
CHANGE ADMO CHIP NO.
VIEW PIN DISTANCES
RESET SERVICE WARNING

MANUFACTURERS AREA

• Enter the Manufacturers Area and select the Angle Sensor Calibration folder, press the Rotary Switch in to enter the folder.

4. Calibration

ANGLE SENSOR CALIBRATION

1)CALIBRATE ALL CRANE ANGLE SENSORS

2)CALIBRATE INDIVIDUAL ANGLE SENSORS

RETURN TO MENU

■ Enter the Angle Sensor Calibration folder and select the 2ND folder: Calibrate Individual Angle Sensors. Press the Rotary Switch in to enter the folder.



5. Calibration	
INDIVIDUAL ANGLE SENSOR CALIBRATION	 The Calibration of the Individual Angle Sensors must be completed in the approved sequence order working from the Crane base upwards.
FRONT TOP ARM FRONT BOTTOM ARM FRONT STABILISER	The approved sequence for calibration is:
FRONT CRANE MODULE	1, Front Crane Module
	2, Rear Crane Module
REAR TOP ARM REAR BOTTOM ARM	3, Front Stabiliser
I REAR STABILISER	4, Rear Stabiliser
REAR CRANE MODULE	5, Front bottom Arm
RETURN TO MENU	6, Rear bottom Arm
	7, Front Top Arm
	8, Rear Top Arm

6. Calibration FRONT MODULE ANGLE CALIBRATION Once the Chassis has confirmed to be level on both Axis and the Cranes are in their full folded positions ENSURE THAT THE DIESEL ENGINE IS NOT RUNNING. Move from the Individual Angle Sensor Calibration Folder to the Front Module Angle Calibration folder, move to the CALIBRATE portion of the screen and press the Rotary Switch in. The calibration should now be complete and the RETURN TO MENU CALIBRATION OK folder will flash. (If the FRONT MODULE ANGLE CALIBRATION OK CALIBRATION FAILED folder flashes; inform Steelbro electrical staff) Once completed repeat FRONT MODULE CALIBRATION FAILED process again with the Rear Module. It is now ok to start the engine.



FRONT STABILISER CALIBRATION

USING A PLUMB BOB ENSURE THAT PIN-L TO PIN-H IS VERTICAL

PRESS CALIBRATE

CALIBRATE

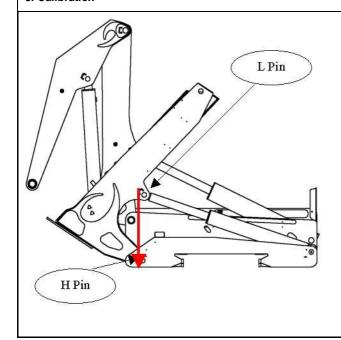
FRETURN TO MENU
FRONT STABILISER
CALIBRATION OK

FRONT STABILISER CALIBRATION FAILED

Once you have calibrated the Modules you must now move to the Stabilisers starting with the front unit.

- Begin by hanging a Plumb Bob from the L Pin as in the diagram below.
- Move the Stabiliser until the Plum Bob is vertical from the L Pin to the H Pin.
- You have a Tolerance at the H Pin of ± 10 mm.
- For all Calibration Tasks that require the use of Plumb Bobs the Powerpack must be turned off once the Plumb Bob is in the required position.

8. Calibration



- Enter the Angle Sensor Calibration folder and select the 2ND folder: Calibrate Individual Angle Sensors. Press the Rotary Switch in to enter the folder.
- Select the Front Stabiliser folder move to the CALIBRATE portion of the screen and press the Rotary Switch in. The calibration should now be complete and the CALIBRATION OK folder will flash. (If the CALIBRATION FAILED folder flashes; inform Steelbro electrical staff) Once completed repeat process again with the Rear Stabiliser.



FRONT BOTTOM ARM
CALIBRATION

USING A PLUMB BOB
ENSURE THAT PIN-D
TO PIN-A IS VERTICAL

PRESS CALIBRATE
WHEN READY

CAL I BRATE

RETURN TO MENU

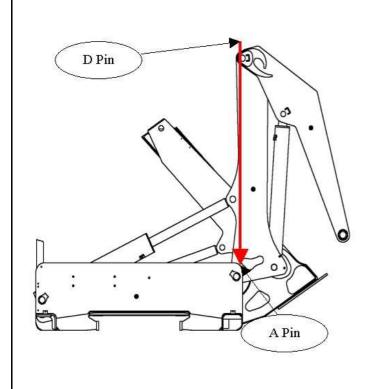
FRONT BOTTOM ARM CALIBRATION OK

FRONT BOTTOM ARM CALIBRATION FAILED

Once you have calibrated the Stabilisers you must now move to the Bottom Arms starting with the front unit.

- Begin by hanging a Plumb Bob from the D Pin as in the diagram below.
- Move the Bottom Arm until the Plum Bob is vertical from the D Pin to the A Pin.
- You have a Tolerance at the A Pin of ± 10 mm.
- For all Calibration Tasks that require the use of Plumb Bobs the Powerpack must be turned off once the Plumb Bob is in the required position.

10. Calibration



- Enter the Angle Sensor Calibration folder and select the 2ND folder:
 Calibrate Individual Angle Sensors.
 Press the Rotary Switch in to enter the folder.
- Select the Front Bottom Arm folder move to the CALIBRATE portion of the screen and press the Rotary Switch in. The calibration should now be complete and the CALIBRATION OK folder will flash. (If the CALIBRATION FAILED folder flashes; inform Steelbro electrical staff) Once completed repeat process again with the Rear Bottom Arm.



FRONT TOP ARM
CALIBRATION

USING A PLUMB BOB
ENSURE THAT PIN-G
TO PIN-D IS VERTICAL

PRESS CALIBRATE
WHEN READY

CAL I BRATE

RETURN TO MENU

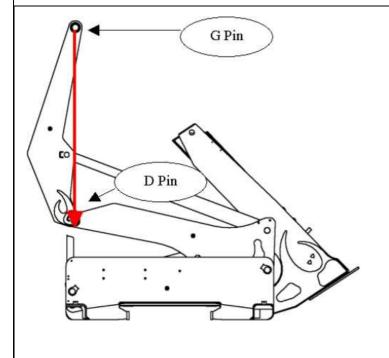
FRONT TOP ARM CALIBRATION OK

FRONT TOP ARM CALIBRATION FAILED

Once you have calibrated the Bottom Arms you must now move to the Top Arms starting with the front unit.

- Begin by hanging a Plumb Bob from the G Pin as in the diagram below.
- Move the Bottom Arm until the Plum Bob is vertical from the G Pin to the D Pin.
- You have a Tolerance at the D Pin of ± 10 mm.
- For all Calibration Tasks that require the use of Plumb Bobs the Powerpack must be turned off once the Plumb Bob is in the required position.

12. Calibration



- Enter the Angle Sensor Calibration folder and select the 2ND folder:
 Calibrate Individual Angle Sensors.
 Press the Rotary Switch in to enter the folder.
- Select the Front Top Arm folder move to the CALIBRATE portion of the screen and press the Rotary Switch in. The calibration should now be complete and the CALIBRATION OK folder will flash. (If the CALIBRATION FAILED folder flashes; inform Steelbro electrical staff) Once completed repeat process again with the Rear Top Arm. The Sidelifter is now fully Calibrated.

Important – Verification

With the Trailer Level: Fully fold away the Arms and Stabilisers on both cranes. From the MAIN MENU select VIEW SENSOR VALUES and select FRONT ANGLE SENSORS check that the angles equal (within \pm 1 degree) those listed in the tables below, repeat for REAR ANGLE SENSORS.



for SB361	
Stabiliser Angle*	11°
Top Arm Angle	16°
Bottom Arm Angle	167°
Front Elevation	0°
Front Camber	0°

For SB401	
Stabiliser Angle*	11°
Top Arm Angle	18°
Bottom Arm Angle	167°
Front Elevation	0°
Front Camber	0°

For SB330	
Stabiliser Angle	0°
Top Arm Angle	10°
Bottom Arm Angle	159°
Front Elevation	0°
Front Camber	0°

^{*} Note: For machines equipped with tromboning stabiliser extensions: The angle when fully folded will equal $0^{\rm o}$



Crane Operations

This section covers how to operate the cranes when performing different kinds of lifts.

Crane Module Operation - Cable Control

Steelbro Sidelifters have three types of control systems - SMARTlift, Digital Control, and Series 3. Digital control and SMARTlift generally have radio remote controls and the details on how to operate them are in the SMARTlift chapter of this manual. This section details the remote control for the Series 3 control system (SB360, SE400).



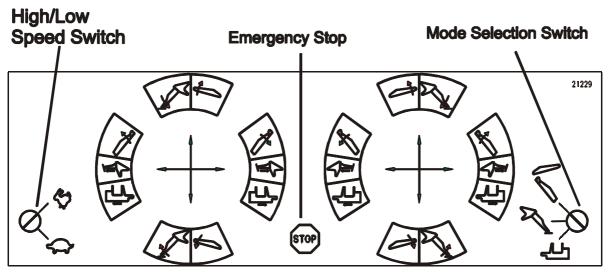
Note that while the operating control systems and their remotes are different, the joystick operations are almost the same.

All operator controls are on the remote control box. This remote control box contains:

- Two joystick controls that operate all lift arm and stabiliser leg operations
- A two position stay put switch for High Low Speed
- A three position stay put switch to select module traverse arm operations operations
- A Red "Mushroom" type stop button for Emergency Stop

As an option the Sidelifter can be specified with radio remote control. Both the cable and radio controls are identical in function.

Sidelifter control valves have detachable manual levers. In the event of an electrical breakdown the operating cycle can be completed manually by using these levers. The levers are stored in tool box.





Arms:	
Top Arm Up	Joysticks Up
Top Arm Down	Joysticks Down
Bottom Arm Out	Joysticks Out
Bottom Arm In	Joysticks In

Stabilisers:	
Stabiliser Out	Joysticks Out
Stabiliser In	Joysticks In
Tilt Ram Up	Joysticks Up
Tilt Ram Down	Joysticks Down

Traverse:	
Module Traverse to 40' position	Joystick Out
Module Traverse to 20' position	Joystick In



Operating Near Power Lines



Do not operate a Sidelifter close to power lines.

Electricity supply bodies in each State/Country may have issued regulations or guidelines for the use of cranes in the vicinity of overhead conductors (power lines). The Sidelifter operator must be familiar with these regulations and carry out a site-specific risk assessment prior to the start of any operation where working within close proximity to power lines is required.

All aerial conductors (power lines) must be treated as alive unless the electricity distributor or transmission line operator has stated otherwise. Such a statement must be in writing and include date and time frame of the isolation of the power lines.

The Sidelifter, the lifting arms and the load must be kept at least the listed distances from any power lines during operation:

Voltage	Minimum Distance Required
Up to 500	2.0 metres
500 to 40 000	4.0 metres
40 000 to 133 000	6.4 metres
Over 133 000	10 metres

Where the above stated minimum distances cannot be achieved, the electricity distributor must be notified in writing and the Sidelifter must not be operated within the minimum distance until the following requirements are satisfied:

For Power lines up to and including 133 000 V

- Written permission from the electricity distributor has been obtained
- All conditions specified by the electricity distributor are complied with.
- The electricity distributor is notified before work commences.
- A 'Spotter' performs spotting duties.
- A pre-start site/job meeting has been convened and a risk assessment completed.

For power lines greater than 133 000 V

- The electricity distributor has provided an easement entry permit.
- Written permission from the electricity distributor has been obtained
- All conditions specified by the electricity distributor are complied with.
- The electricity distributor is notified before work commences.
- A 'Spotter' performs spotting duties.
- A pre-start site/job meeting has been convened and a risk assessment completed.



Contact with Power Lines (Aerial Conductors)

If the Sidelifter or load contacts power lines, the relevant electricity distributor must be notified immediately. The Sidelifter operator must warn other personnel not to touch any part of the Sidelifter or load and if possible without anyone approaching operate the Sidelifter to break contact.

When unable to move or untangle the Sidelifter from the power line, no further action must be taken until the power is isolated and conditions are confirmed safe.

When a Sidelifter has been in contact with a power line, it must be checked by a suitably competent person and must not be returned into service until all recommended repairs have been completed.



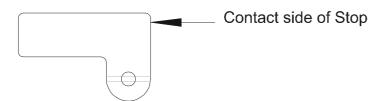
Positioning the Lifting Cranes

The process of positioning the lifting cranes should happen in this order:

- 1. Position the Lifting Cranes in the appropriate positions for the size of container.
 - a) Select Traverse (or or or).
 - b) To move modules out to 40' position, push joysticks out. To move to 20' position, push joysticks in.
- 2. Position the Sidelifter trailer for lifting the container. Do this second so that, in the instance of lifting a container onto the Sidelifter, it is easier to line the cranes up beside the container.

The furthest apart the Cranes can be positioned is 40 feet, and the closest is 20 feet.

If the Sidelifter has additional positions for one or both of the Cranes, it will be fitted with intermediate stops. In this case the Crane module will need to be positioned on the contact side of the stop yet far enough so the stop can be flipped over. Once the stop has been flipped over the Crane module can be moved until it contacts the stop giving the desired position. See the diagram below.





Lifting a Container from the Ground

On a Sidelifter with bending leg stabilisers, refer to the section on how to deploy them before reading the instructions below:



Before performing a lift, ensure the following conditions are met:

Sidelifter must be attached to the prime mover.

Sidelifter park brake is applied.

Ensure that the strength of the ground surface is sufficient to withstand a 27 tonne maximum point loading. If in any doubt, place hardwood timber packing of at least 50mm thick and 200mm x 500mm under each stabiliser foot.

If the stabiliser feet have been placed into a hollow or downward slope then sufficient timber packing will need to be placed under the feet to lift them back up to a level position, if you wish to handle a loaded container.

- Park the Sidelifter alongside the container with approximately 300mm clearance between the container and the Sidelifter
- Do the following checks:
 - a) Sidelifter twistlocks are directly opposite the container corner castings.
 - b) Sidelifter Brake is applied!
 - c) No hazards and obstructions such as overhanging building awnings, electric power lines or telephone cables.
 - d) Nothing is in the way of the Stabiliser Legs and/or Feet and surface is solid enough to bear them.
 - e) Twistlocks on the Sidelifter are in the raised position and unlocked.
- Start the engine and select High speed () operation on the remote control
- Select Stabilisers (or). Extend the stabiliser leg extensions to their maximum then tilt the legs until the feet touch the ground. Do not load feet Additional pressure will not give additional stability



Do NOT carry out any lifting if the stabiliser warning lights are flashing unless the load is within the reduced capability as shown on the load chart.

■ Set the mode selection switch on the remote control to Arms (). Manoeuvre the top and bottom arms until the chains are positioned centrally to the ends of the container, and fit the lifting lugs into the corner castings of the container, ensuring that there are no twists or tangles in the chains and that the left and right hand lifting lugs are in their correct positions





Do not try to force the cranes alongside a container. If the lifting arms will not clear the container, the lifting equipment and stabiliser legs should be returned to the stowed position and the Sidelifter moved so it will clear the container.

- Take an initial strain on the chains by raising the top arms upwards. Ensure that the lift pins of the crane are in the centre of the container. Choose between the movement of the top and bottom arms to centralise the lift pins. Take the weight of the container and check that the Sidelifter is stable with the weight being lifted
- Select Low Speed (or or or) on the remote control
- Lift the container approximately 150mm (6in) off the ground by raising the top arms. In the event that the container is lifting unevenly it may be necessary to operate one end only to bring the lower end of the container up to a level position. Move the container, just above the ground, towards the Sidelifter, until it is about 300 mm from the side of the Sidelifter
- Raise the top arms until the bottom of the container is level with the top of the Sidelifter chassis
- Lower the bottom arms until the container corner castings are above their respective twistlocks



Rapid starting and stopping movements are stressful on the equipment, and may cause the container to swing, which may damage the cranes and twistlocks. To ensure smooth movement, feather the controls in and out of operation.

- Lower the container down onto the twistlocks by locating either front corner onto a Twistlock cone, and then the rear visible corner onto its Twistlock cone. With practice operators will be able to land the containers onto the twistlocks in one smooth operation
- Select high speed () and lower the lifting arms to their stowed position
- Select Stabiliser Mode and return the stabiliser legs to their stowed position
- Stop the engine, turn the key off and stow the controls (With cable remotes avoid twisting and knotting the cable.)
- Lock the twistlocks

The Sidelifter can now be driven to the unloading site.



Placing a Container on the Ground



Before performing a lift, ensure the following conditions are met:

Sidelifter must be attached to the prime mover.

Sidelifter park brake is applied

Lifting area complies with safety zones recommended on decal and is clear of any obstructions

The ground beneath where the stabilisers will be deployed is firm and can withstand up to 1.7Mpa of pressure. If not, placing packing under the feet as described in previous section.

- Park the Sidelifter alongside the area where the container is to be placed, ensuring that conditions above are all met
- If they are not already attached, attach the lifting chains to the container
- Unlock the twistlocks



Ensure the twistlocks are unlocked prior to lifting

- Start the engine. Select High speed () on the High/Low Speed Switch
- Fully extend the stabiliser legs and place the feet on the ground
- Raise the top and bottom arms until the chains are evenly tensioned
- Select low speed (or or) on the remote control
- Raise the top and bottom arms to lift the container clear of twistlocks
- Move the container across the chassis until the container is 300mm clear of the side of the Sidelifter
- Lower the top arms to place the container on the ground. If it is necessary to move the container further out from the Sidelifter, do this with the container no more than 150mm, (6in) above the ground
- Once the container is placed firmly on the ground, slacken the lifting chains and remove the lifting lugs from the container
- Switch to high-speed operation () and return the lifting arms to the stowed position, ensuring the lifting chains are in the chain trays beside the twistlocks
- Return the stabiliser legs to the stowed position. It is also good practice to fully stow cranes when transporting containers between facilities
- Stop the engine, turn the key off, and stow the controls



Transferring Containers to and from a Truck or Trailer



Ensure that the spacing between the vehicles is such that the stabiliser foot is able to reach the centre line of deck on companion truck or trailer. Always refer to stability chart before commencing lift.

Follow the procedure as described previously for loading to and from the ground:

Stabiliser leg placed on deck or chassis

Where the deck length permits, legs should be placed on top of the companion truck or trailer. If the deck of the companion truck or trailer has been designed for operating with a Steelbro Sidelifter, position the stabiliser foot in the designated area. Alternatively place the Stabiliser feet with care, ensuring that the point of contact is strong and stable enough to bear the weight of the lift. Timber dunnage may help to distribute the weight load.

Stabiliser leg placed on ground

If there is insufficient room to place the feet on the deck they can be placed on the ground.

Park the two vehicles approximately 1 metre apart. Place one leg on the ground at the rear of the companion truck. Place the other leg as far as possible under the front of the companion truck on the ground. Longer truck decks can be treated as per transferring 20' containers onto 40' trailers.

Transferring 20' Containers to and from 20' Trailers or 40' Containers to and from 40' Trailers

Follow the loading to and from the ground procedure except:

- Park the two vehicles approx 1 metre apart, with twistlocks aligned
- Place one stabiliser leg on the ground at the rear of the companion trailer
- Place the other stabiliser leg on the ground under the tractor unit chassis, if it can be placed there fully extended without obstruction. If not, jack-knife the companion tractor unit to 45 degrees enabling the stabiliser leg to be placed on the ground fully extended in front of the companion trailer



Always ensure the twistlocks on both vehicles are unlocked before commencing transfers.

Double Stacking Containers

Double stacking is where one container is placed on top of another, to save floor or ground space. We recommend that operators receive training in this technique before attempting it themselves.

This topic explains how to double stack and unstack.



Do not place a 20' box on top of a 40' box or a 40' box on top of a 20' box.

No anti slip protection is provided on the legs. If you use them as an access platform



you do so at your own risk.



Do not use Sidelifter lifting chains in the top castings of the ISO container as this may cause severe damage to the machine, and place personnel at risk. Any such action will void our warranty. Top lifting should only be attempted with a top-lifting frame.

Double Stacking - lifting container from Sidelifter to place on top of another container

- 1. Shorten the chain assemblies in accordance with the relevant "Chain Shortening Instructions" and attach to container.
- 2. Load container onto Sidelifter.
- 3. Position the Sidelifter 300-600mm from the side of the container on the ground with the ends parallel.
- 4. Fully extend the stabiliser legs and place the feet on the ground. Packing needs to be placed under the feet in soft or doubtful ground.
- 5. Raise the container off the Sidelifter, within the area as described above, to clear the top of the container on the ground. To do this, follow these steps:
 - 1. Move the bottom arms OUT until the lifted container almost touches the container on the ground.
 - 2. Raise the container vertically until the lifted container clears the top of the container on the ground. Be very careful not to allow the container to move over the offside/non lift side.
- 6. Keeping your lifted container low, move it out across the top of the container on the ground.
- 7. Align the corner castings of the bottom and the top containers, release and remove the lifting chains, and re-stow the cranes.

Unstacking - lifting top container back onto Sidelifter

- 1. Shorten the chain assemblies in accordance with the relevant "Chain Shortening Instructions"
- 2. Position the Sidelifter 300-600mm from the side of the container on the ground with the ends parallel.
- 3. Fully extend the stabiliser legs and place the feet on the ground. Packing needs to be placed under the feet in soft or doubtful ground.
- 4. Connect the lifting chains.
- 5. Gently lift the container as it may swing a little when first lifted. Once the container is lifted and is stable, move it in across the top of the container on the ground towards the Sidelifter.
- 6. Bring the lifted container in towards the Sidelifter until it is just clear of the container under it. Start to lower and manoeuvre the container towards the Sidelifter until it is just above the twistlocks. Be very careful not to allow the container to move over the offside/non lift side.



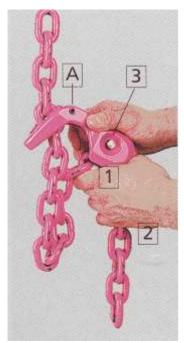
- 7. Once the container is back on the twist locks it will be necessary to completely lower the top arms and then the bottom arms, to get the container to sit on the twist locks. This will also help to keep the weight on the stabilizer legs.
- 8. Stow the cranes and the stabilisers.

The Sidelifter is ready to be moved and the container can be removed as per procedure for unloading a container from the Sidelifter to the ground.

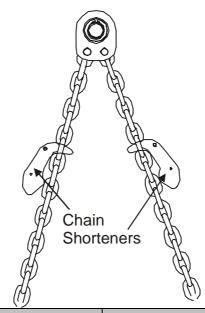


Chain Shortening Instructions 16mm Chain

To shorten the chains, follow these instructions:



- From, and including, the first free link below where the chain shortener is joined into the chain (A), count down the appropriate number of links (see table below)
- Holding the chain so it is slack, slot the link into the pocket of the chain shortener
- Pull it down to ensure it is seated properly. If required, depress the spring loaded securing bolt (3). Securing bolt locks automatically. Check locking
- Check all four chains are equally shortened before lifting container.
- To release the chain again, reverse the procedure, depressing securing bolt at the same time

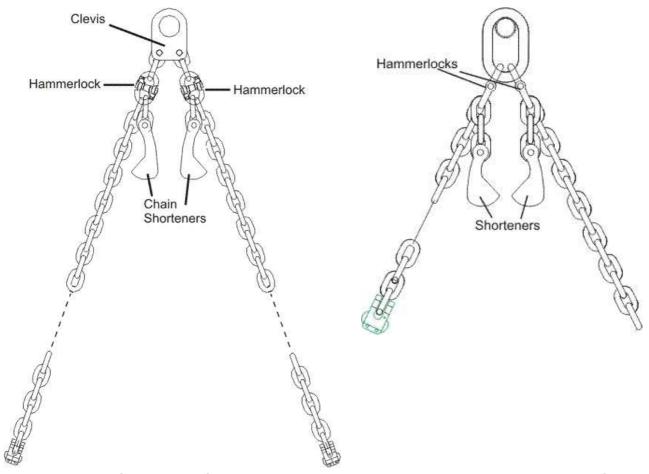


Model	# links counted from shortener
SB300	13
SB330	13
SB360	11
SB361	11



Chain Shortening Instructions 20mm Chain

Counting the link that is attached to the hammerlock, place the appropriate link (see table below) in the slot provided in the "chain shortener." Check all four chains are equally shortened before lifting container.



20mm clevis style chain shorteners

20mm oblong loop style chain shorteners



Check all four chains are equally shortened before lifting the container.

Model	#links counted from the hammerlock)
SB360	17
SB360 (with extended arm)	14
SE400	9
SB401	9



Transferring 2 x 20' Containers to a 40' Trailer

If not using container joiners to transfer 2 x 20 foot containers onto a 40 foot trailer, two separate transfers are required, from the 20-foot position on the Sidelifter onto two different positions on the companion trailer. For it to work, the companion trailer needs to be designed for wide spaced 20 foot carrying. This is not necessary when using container joiners.



This does not work in reverse i.e it is not possible to unload two x 20 foot containers from a Sidelifter using its own cranes, as two separate lifts. To achieve this, use the container joiners.

Follow loading from the ground procedure except:

- 1. Load the first container onto the front of the 40 foot trailer in the most forward position achievable and lock the twistlocks.
- 2. Load the 2nd container onto the rear set of twistlocks of the 40 foot trailer:
 - 1. Lock the twistlocks at the front of the container.
 - 2. Lift the rear of the container slightly to ensure maximum spacing.
 - 3. Lower and lock the rear twistlocks.

Transferring Containers to and from Rail Wagons

If the containers are spaced (i.e. there is sufficient room at either end to place the stabiliser leg onto the rail wagon) and there is access to the bottom corner castings, then these transfers can be done in the same manner as trailer transfers.

If there is insufficient access to the corner castings of the containers to allow the lifting lugs to be attached then a Top lift frame will be required.

If the stabiliser legs cannot be placed onto the rail wagon, it is necessary to park the Sidelifter to allow the stabiliser feet to be as far as possible underneath the wagon, with the legs extended to their maximum.



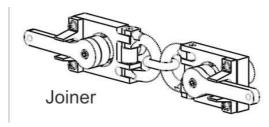
Do not place stabiliser feet on rail tracks. Feet must be placed on level surface.

Lifting 2 X 20' Containers using Container Joiners



ALWAYS ensure container joiners and spacers are attached on both the lifting and non-lifting sides of the containers BEFORE starting a lift.





The purpose of Container Joiners is to join two 20-foot containers so that they may be lifted together as if they were one 40-foot container.

The system is simple –

- The containers are joined at the bottom abutting container corner castings on both "lifting side" and "non-lifting" by the joiner, which is fitted then locked into position.
- The spacer is hooked in the top casting on both sides. It has a 'stem' that sits in the 75mm gap between the containers and therefore stops them from angling into one another. If containers are different heights, hook the spacer onto the lower container.
- The pole has two roles it makes it easier for the operator to fit the spacer into place, and then becomes the means to anchor the spacer into place. A band attached to the bottom of the pole is looped around the spacer and ratcheted tight.

The result is a secure locking and stabilising system. The components all have chassis mounting brackets so they can be stowed out of the way when not in use to the sidelifter chassis.

Rating

Steelbro container joiners (Part Number LF-20020) are rated to be used to lift 2 containers each with a maximum gross mass of 15,000 kg.



Recommended Companion Vehicles

Steelbro have noticed that many Sidelifter operators are not aware of the ways in which specifying other transport equipment can help their Sidelifter operations.

We have therefore set out some points that may be helpful when you are purchasing other new equipment.

- 1. When buying 12.5 metre or longer semi-trailers we recommend an extra set of twistlocks to allow wide spacing of two 20' containers i.e. An extra set of twistlocks at the front or rear outside the existing 40' set to give Sidelifter arm access when two 20' containers are carried.
- 2. When specifying truck flat-decks we recommend a space of 215mm between the twistlock centres and the headboard. This allows sufficient room to fit the lifting lugs to the container. A further consideration is that if you buy a mini-Sidelifter for handling empty containers then a space of 800mm will be required.
- 3. When buying drop deck container trailers, we recommend a space of 215mm between the drop in deck, and the twistlock centres, to allow sufficient room to fit the lifting lugs to the container.
- 4. When setting up tractor units for use with a semi-trailer to be loaded or unloaded by the Sidelifter, appropriate reinforcing across the chassis rails of the tractor unit enables the Sidelifter to put a leg on this reinforcing rather than uncoupling or jack-knifing the tractor unit.



Maintenance

Why Genuine Parts?

When you or your service workshop carry out service or repair work on your Steelbro Sidelifter, it is important that you fit genuine Steelbro Sidelifter Spare Parts.

The Steelbro Sidelifter is a product of high technical standard. A guarantee that this quality will continue throughout the life of the Sidelifter requires that it gets regular service and that only genuine spare parts are used.

Preventative Service

The following section describes the service and maintenance requirements of the Sidelifter. All components must be checked regularly for proper functioning and adjustments made only if necessary. Before the Sidelifter left the factory, every valve in the hydraulic system was thoroughly tested and properly adjusted and the complete unit was test operated at full lifting capacity. A duly competent person must carry out all servicing and any subsequent adjustment.



When using a steam cleaner on the Sidelifter, avoid cleaning near hydraulic cylinder shafts, electrical control boxes or junction boxes and switches. While the latter are fully water proofed, they may not tolerate hot steam cleaning jets.



Grease and Oil Specifications

The hydraulic system and the hydraulic fluid are matched in respect of lubricating performance, effect on seals, and non-compatibility with other materials. For this reason do not mix different types of hydraulic fluid, such as mineral oils, synthetic fluids and water based fluids, and never adulterate your hydraulic fluid with diesel oils or alcohol based products.



We recommend the use of non-molybdenum based greases as these do not deteriorate the crane bushings.

Use	Recommended Product
Hydraulic Oil	Castrol Hyspin AWS46 or equivalent*
 Bearing Grease 	Shell Alvania EP or equivalent
 Hub Grease 	Shell Alvania EP2 or equivalent
Hub Oil	Castrol Multitrax 80w/140 or equivalent
Wheel Stud Grease	Shell Alvania EP2 or equivalent

* May vary for different markets depending on temperature range:

Temperature Range	Recommended Product
From -20°C to +30°C	Castrol Hyspin AWS 32
From -10°C to +40°C	Castrol Hyspin AWS 46
From 0 to 50°C	Castrol Hyspin AWS 68

Servicing Trailer Running Gear

For servicing detail refer to the **SUSPENSION** and **AXLE MANUALS**.

Records

All checks, adjustments, replacement of parts, repairs and inspections performed, and all irregularities or damage potentially effecting the Sidelifter's safety should be recorded in an orderly manner. In some countries this is mandatory.

A Steelbro comprehensive service programme is available through your distributor. As this is designed specifically to support the safety, operation and maintenance requirements of your Sidelifter, we recommend that you contact your distributor for more information if you do not already this programme in place.

For your convenience, a service programme summary logbook is provided.



Daily Inspection Requirements

Hydraulics

- Check the engine oil and water levels
- Check the oil level in the hydraulic reservoir. (The oil level needs to be between the "Max" and "Min" levels on the sight glass when the Sidelifter is in the stowed position). Check pump suction line shutoff valves are open
- Check that the lifting arms and stabiliser legs can be operated with ease and that the controls automatically return to the neutral position
- Inspect the hydraulic lines, connections and other components to detect any oil leakage or damage. Tighten any loose or leaking connections



Ensure that when connecting Quick Release Couplings, the low-pressure line is always correctly fitted before fitting the high-pressure line.

When disconnecting hydraulic tubing and hoses, always ensure that no hydraulic pressure has been retained in the line after the power supply to the system has been switched off.

Refer to Precautions with Over-Centre Valves and Check Valves (on page 150).

Lifting Gear and Chassis

- Check the lifting chains, lifting lugs, hammerlocks and other components of the chain assemblies to ensure that they are not damaged. The hammerlocks should be able to fold otherwise they have been overstressed and are in need of replacement
- Check the Sidelifter, chassis and twistlocks for damage. For example, check that the container guides on the far side of the crane bases are present and not unduly bent or deformed.
- Inspect the lifting module sliding areas on top of the main chassis for cleanliness.

Brakes - Air Pressure Systems

- Run the truck engine to achieve maximum air system pressure. Stop the truck engine and check the truck air gauge does not show a rapid loss of pressure that would indicate an air leak
- Apply and release the brake pedal twice. Air pressure should not drop abnormally when brakes are applied. Check that the brakes release immediately. Check that the slack adjusters on the trailer axle camshafts do not have excess movement that indicates brake adjustment is required
- Check that all hoses are firmly connected and that there is no damage caused by cuffing or knotting
- Vent air reservoirs to expel condensate by using the drain valves



Lights

- Inspect switches and lights for broken brackets, fused bulbs and cracked lenses. Check for loose wiring connections - usually indicated by flickering, dull or intermittent lights
- Clean light lenses and reflectors

Wheels and Tyres

- Check tyre pressures are correct, check that the valves are not damaged and trailer axle dust covers are in place
- Remove all objects trapped in the tyre tread and ensure tread depth complies with road regulations
- Ensure tyres have no cuts or bulges
- Examine all wheels for damage caused by "kerbing" or severe road shock
- Check that the wheel nuts are properly seated and show no signs of running loose
- Check oil level in the axle hubs is between the minimum and maximum levels if the axles are of the oil filled type



After any removal and refitting of any wheel with ISO wheel nuts, ensure nuts are re-tightened within 50 to 100km of travel. Neglecting to do so could result in loss of a wheel.

Suspension

- Check springs for shifting or missing leaves, loose or missing clips and any damage
- Check suspension U- bolt, bearings and bushes for security and condition
- Check air bags for damage, chaffing etc



Weekly Inspection and Service Requirements



Perform all activities required for daily and weekly inspections and in addition carry out the following service procedures.

Chassis

- Grease all grease nipples on the chassis, brake slack adjusters and landing legs with Shell Alvania E.P. grease
- Grease semi trailer rub plate and kingpin with a good quality hub grease
- Clean down lifting module sliding areas on top of main chassis and then wipe over with clean cloth



Grease points are detailed on the lubrication chart in this manual.

Lifting Modules

- Grease all lifting arms and cylinder pivot bearings at front and rear
- Check all pivot pin keeper plates and circlips for security

Landing Legs

Check landing legs for damage and serviceability

Monthly Inspection and Service Requirements



Perform all activities required for daily and weekly inspections and in addition carry out the following service procedures.



Hydraulic System and Chassis

- Check all bolts on the Sidelifter, particularly pin keeper plates around the power pack if there is one, and the combined hydraulic reservoir/fuel tank mounting. Tighten any loose bolts
- Check that the Sidelifter operator notices are in place
- Check the lifting arms and stabiliser legs to detect any visual signs of damage, deformation or wear in the bearings
- Service engine air filter and change as required
- Check the Emergency Stop button and the electrical safety devices

Brakes - Air Pressure Systems

- Check that the linkages on the trailer axle camshafts do not have excessive movement. If so adjust brakes in accordance with brake servicing instructions
- Listen to air system for any noise of an air leak and tighten any loose connections

Lights

Check all cables are firmly connected and not damaged by scuffing or pinching

Wheels and Tyres

Check wheel bolt/nut torque settings as detailed in the AXLE MANUAL



WARNING: After any removal and refitting of any wheel with ISO wheel nuts, ensure nuts are re-tightened within 50 to 100km of travel. Neglecting to do so could result in loss of a wheel.

Six Monthly Inspection and Service Requirements



Perform all activities required for daily, weekly and monthly inspections and in addition carry out the following service procedures.

Hydraulic System

- Check all hydraulic hoses and pipe work for wear, scuffing and fretting
- Check the mountings of the hydraulic reservoir for condition and security
- Change the following filters (where applicable):
 - Engine oil



- Engine fuel
- Hydraulic oil tank
- Hydraulic oil pressure
- Change the oil in the power pack
- Clean the hydraulic tank breather element
- Change the hydraulic oil if required. If water contamination is present oil should be changed. See hydraulic oil change guide at the end of the maintenance section of this manual
- Check fan belt tension
- Check condition of radiator hoses.
- Check engine coolant for condition as detailed in Kubota Operators Manual.



For detailed instructions on power pack routine required maintenance, refer to The Kubota Engine Operators Manual.

Chassis

- Disconnect the tractor unit from the trailer and check the king pin for wear and security of attachment
- Thoroughly clean the Sidelifter
- Check chassis components for signs of stress, damage, cracking, corrosion etc



Avoid spraying the chrome shafts of the hydraulic cylinders with a water blaster or system cleaner.

Suspension and Axles (As detailed in the suspension and axle manuals)

- Carry out brake servicing
- Check out suspension servicing
- Check axle alignment
- Check nut torque settings

Annual Inspection and Testing



Perform all activities required for daily, weekly and six monthly inspections and in addition carry out the following service procedures.



King Pin

The king pin connecting the Sidelifter to the tractor unit should be crack tested or renewed. The latter is often the cheaper alternative. This check is required by automotive testing stations in New Zealand, and is recommended to all Sidelifter owners because of the stresses applied when lifting loads.

Lifting Chains

Remove both lifting chain assemblies, and inspect and measure, as per the PWB Herc-Alloy Chain Recommendations. Each country has its own requirement for inspection and testing of lifting chains and slings. These must be adhered to. Steelbro recommends that chains are proof tested annually and that the records are retained for history.

Lifting Equipment

Carry out a full monthly and six monthly inspection, and pay particular attention to the lifting arms, stabiliser legs, and their mountings for any signs of cracking, or other damage. Check top arm lifting pins for wear by ensuring the pins can be rotated in their bearings. Check the emergency stop and the electrical safety devices.

Overload Test

After all other checks have been completed, carry out a 10% Overload Test:

- The load should be 10% of the maximum load shown on the lifting chart, eg.30,000kg +3,000kg = 33,000kg.
- When lifting off the Sidelifter, keep the test load close to the Sidelifter
- Carry out test at 300mm clearance from the Sidelifter side rail (i.e. 2800mm from Sidelifter centre line)



Testing After Repairs to the Cranes



No modification may be carried out on the Sidelifter without written authorisation from Steelbro. Unauthorised modifications automatically void all warranties and service agreements.

After repairs on the crane and before putting it back into use, an **OVERLOAD TEST** must be carried out as described in the previous section.

Maintenance Notes

Pressure Line Filter

This filter is of the full flow type with a bypass valve fitted. It has a replaceable element and this should be changed after the first 50 hrs of operation and thereafter at every 200 hours or six months.

Return Line Filter

This filter is of the full flow type with bypass and should be changed at the same intervals as the pressure filter.

Filler Breather

One filler breather is on the hydraulic oil reservoir.

The filler cap breather gauze of this unit needs washing out with cleaning solvent and blown dry with compressed air every 500 hrs or 6 months or as required particularly if operating in dusty conditions.

The strainer gauze in the tank aperture should be checked for condition and cleaned as required. Ensure the gauze is intact and no splits or damage is evident.

Emergency Instructions in Case of Electrical Faults

The PVG control valves are fitted with manual operating handles for emergency or servicing use. In the event of an electrical fault in the control system, they can be used independently to complete the loading or unloading of a container.



The plug on the affected solenoid will have to be disconnected before manual control can be operated as the valves are held in neutral with the electrical system connected.



Precautions with Over-Centre Valves and Check Valves

Cylinders, fitted with Check Valves and or Over-centre Valves, can remain pressurised. The pipes connecting the 'B' port to the Check/Over-centre Valve Block Assembly, mounted to the 'A' port, can remain pressurised.

To relieve the pressure in these systems, carry out the following steps:

(For units fitted with Over-Centre Cartridges)

- Slacken the adjustment lock nut and relieve the cylinder pressure by turning the adjustment screw anticlockwise until no resistance is noticeable (about 5 full turns)
- The Over-Centre Cartridge can now be screwed outward to a point where the sealing surfaces are separated, thus guaranteeing no pressure remains trapped in the cylinder or pipe work



Notes on Tractor/Semi Trailer Operation

Coupling and Uncoupling

Periodically check that coupling jaws or hook locks are free, working easily and are well lubricated. If the main plate is covered with road dirt and grit, clean off with solvent and re-lubricate with a good quality grease (hub grease is ideal).

Regularly inspect tractors and trailers for damage to couplers, kingpins and pick-up plates, caused by violent impact.

We recommend this, as it is the practice of some drivers to back up to trailers too fast, when coupling.



Undetected damage resulting from the careless and dangerous habit of backing up to the trailer too fast can endanger life and goods.

Experience Counts

Everyone connected with articulation is familiar with the sound of a tractor being coupled to a trailer - but it is difficult to draw a line between the firm, positive "clunk" and an impact between tractor and trailer severe enough to cause damage.

Chief Cause of Trouble

Coupling heights of loaded trailers when parked will vary due to many operating factors, such as difficult road or yard surfaces. Fleet surveys have shown that most damage is caused by attempting to couple up units that are unsuited in terms of coupling heights.

Many of the older tractors have rear springs with a high deflection rate, and when uncoupling a loaded trailer, the landing gear is wound down at the loaded height. As the tractor moves away from the trailer, the tractor springs rise to the unladen position. Thus, when re-coupling, the tractor springs have to be forced down to permit the fifth wheel to pass under the trailer plate. This action requires considerable effort, but if the driver uses too much power, an excessively violent coupling takes place. Damage is often caused to the trailer plate in this way and periodic checks should be made to ensure that the plate is not distorted and that the kingpin is square to the face of the trailer pick - up plate.

Damage can also be caused to the coupler throat, and spreading of the hook jaws, if the trailer is too high for the tractor unit. The surfaces of the trailer pick up plate and fifth wheel coupler should be in contact to obtain correct connection.



Drawing showing a typical damage and misalignment of kingpin caused by an excessively violent coupling of tractor and trailer:



Simple Checking Devices for Semi Trailers

The plate and kingpin can be checked very quickly by using a straight edge. This can be any straight flat piece of metal or timber with an appropriate rectangular section cut out to clear the kingpin.

Place the straight edge across the trailer plate, first across the trailer and then longitudinally, and you will soon see any bow or distortion in the plate. Also by having a cut-away rectangular shape square to the flat edge, any damage or misalignment of the kingpin can be seen. The cut-away portion should be made to the correct depth - the same as the kingpin depth - thus serving to show that the kingpin has not been forced upwards, which would probably impair the coupling mechanism.

To check the tractor coupling, it's a good idea to use part of an old plate of convenient size with a kingpin mounted in position. This way the coupling action can be simulated. When coupled, the pin should be held firmly and snugly without slack.



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STEELBRO Spare Parts

Sidelifter Spare Parts

SB300/330, SB360, SB361/401

V1101



STEELBRO

Container Handling Solutions



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Page i



Ordering Parts

This section contains information about genuine Steelbro parts for all Sidelifter models, trailer models and their accessories. OEM parts lists, for example suspension and axles, are included with the rest of the information about that component elsewhere in this manual.

Each page or section is labelled according to the model/s it covers.

When ordering parts, ensure either that the parts list you use is the correct one for the Sidelifter, or quote the serial number of the Sidelifter and:

- include the part number, description and quantity
- include your complete address
- specify how the parts are to be sent

We have enclosed a standard order form, which will ease your order processing.

Orientation (Left and Right)

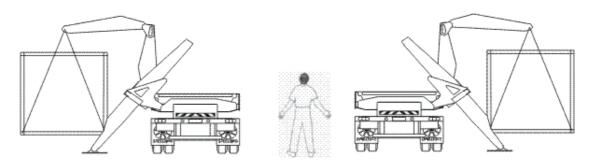
We use the terms **LEFT** and **RIGHT** in two different contexts:

- left and right hand lifts
- left and right cranes

This section explains the difference between them.

Several parts on the Sidelifter are 'handed', i.e. they are mirror images of each other, usually referred to as left hand and right hand parts, as they are not interchangeable. 'Handed' parts have a different part number for each hand. Within the parts manual the part number for the right hand item is listed first with left hand items listed in brackets.

The left hand and right hand side of the trailer are as seen when standing at the rear of the trailer facing the tractor unit.



Left hand lift Right hand lift



The left and right hand crane modules are determined by facing the Sidelifter from the lifting side. While it may seem more logical to refer to them as front and rear, this does not work because the modules have an inner and outer side. Therefore on a Right Hand Lift unit, the module at the front is the same as the rear unit on a Left Hand Lift and vice versa. Because our parts need names that apply to all the instances in which they are used, the left and right crane distinction works.





Parts Providers

Steelbro has a network of parts providers worldwide. If unsure where to go for spare parts, please refer to the list below.

When ordering parts please do so via e-mail. This allows the parts provider to keep your customer information together, and therefore ensure the best possible service.

Steelbro trailers are manufactured to customer specifications so it is essential that you provide the trailer serial number with any order or inquiry.

Location	Parts Provider	Contact
New Zealand and	Steelbro NZ Ltd	Email: parts@Steelbro.com
locations not listed below		Tel: +64 3 341-2335 or
		+64 3 341-2335
		Fax: +64 3 341-2356
Melbourne	ServiceWorks	Email: service@serviceworksoz.com
		Tel: +61 3 9369 3233 or
		1300 798 881
		Fax: +61 3 93690438
Perth	ServiceWorks	Email: pellard@serviceworksoz.com
		Tel: +61 8 9453 6066
		Fax: +61 8 9453 6055
Brisbane	ServiceWorks	Email: gfeeney@serviceworksoz.com
		Tel: +61 7 3390 8111
		Fax: +61 7 3390 8311
Sydney	ServiceWorks	Email: sydneyservice@serviceworksoz.com
		Tel: +61 2 9557 7072
		Fax: +61 2 9557 7098
South Africa	Versatile Container	Email: harry@containers.co.za
	Handling	Tel: +27 41 37 30 416
		Fx: +27 41 37 30 703
French Territories		Cornut
Malaysia	Steelbro (M) Sdn Bhd	Email: steelbro@pd.jaring.my
		Ph: +603 31 76 3833 or
		+603 12 210 6500
		Fx: +603 31 76 2833



Chile and Bolivia	SPITEC	Email: b.zwanzger@spitec.cl
		Ph +56 2 601 8290 or
		+ 56 09 346 3696
		Fx +56 2 601 9995
Scandinavia and Iceland	Steelbro Scandinavia	Email: hallqvist@Steelbro-scandinavia.nu
		Ph: +46 31 51 32 90 or
		+46 70 735 55 94
		Fx: +46 31 23 14 79



Serial Number

Parts Order Form

Quantity

Part Number

If you do not have access to email, please fax this form instead. Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Description/ Descripcion

	to:		
			
•			
Payment will be	made as follo	ows:	
(Freight charges	s to be paid o	n collection.)	
COMMENTS:			
Signed:			
Name:			
Phone Number:			
Company:			



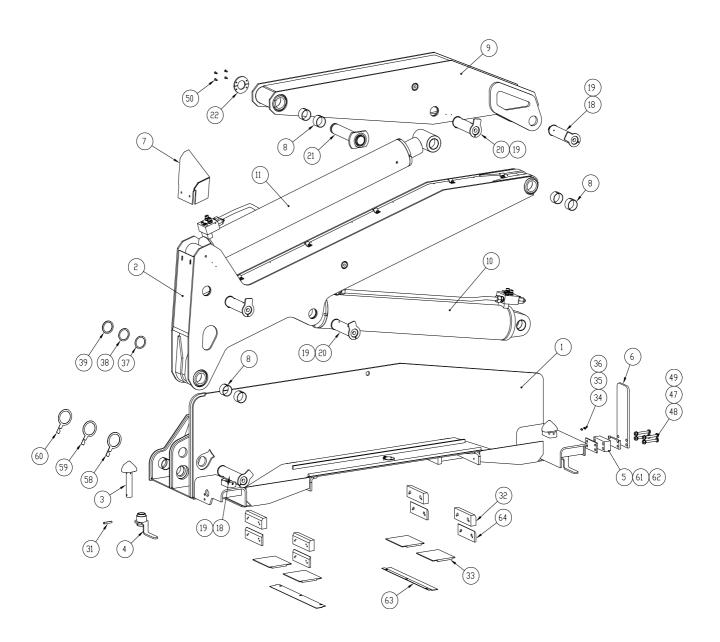
Crane Parts

This section lists the crane parts for the Sidelifter models:

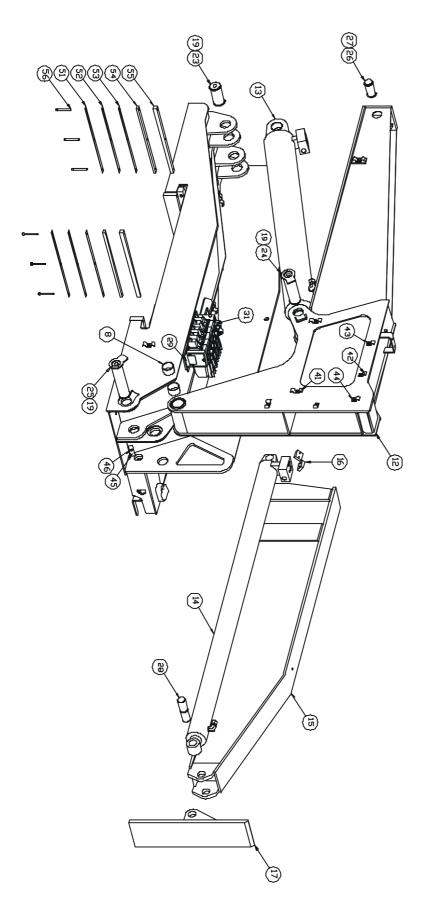
- SB300/SB330
- SB360
- SB361/SB401



Crane Assembly SB300/330









Item	Part Number	Description (SB300/330)	Qty	Notes
1	S3-25980	Crane Base SB330 LH	1	
	S3-25981	Crane Base SB330 RH		1
2	S3-25928	Arm Bottom SB330	1	
3	S3-26034	Centre Twistlock Crane Base SB330	2	
4	S3-26040	Handle Twistlock Crane Base SB330	2	
5	S3-26044	Block Spring Offside Bash Plate SB330	1	
6	S3-26048	Plate Bash Offside Crane Base SB330	1	
7	S3-25963	Plate Bash Bottom Arm SB330 LH	1	
	S3-25967	Plate Bash Bottom Arm SB330 RH		1
8	BE-29011	Bearing Glacier 60 ID x 40 long	8	
9	S3-25938	Arm Top SB330	1	
10	HC-37529	Cylinder Hyd Bottom Lift SB330	1	SB330
	HC-31630	Cylinder Hyd Bottom Lift SB300		SB300
	HC-23366	Block Cartridge Double Port	1	
	HC-25754	Cartridge Overcentre Non Vent 200-30	2	
	BE-29011	Bearing Glacier 60 ID x 40 long	4	
	HF-VST11/4A3AC	Plug BSPP 1/4" Allen Key Head	2	
	HC-37802	Feed Tube Bottom Lift SB330	1	SB330
11	HC-37545	Cylinder Hyd Top Lift SB300/330 LH	1	
	HC-37544	Cylinder Hyd Top Lift SB300/330 RH		1
	HC-25753	Block Cartridge Single Port	1	
	HC-25754	Cartridge Overcentre Non Vent 200-30	1	
	BE-29011	Bearing Glacier 60 ID x 40 long	4	
	HF-VST11/4A3AC	Plug BSPP 1/4" Allen Key Head	1	
	HC-37801	Feed Tube Top Lift SB330	1	SB330
12	S3-39214	Stabiliser Housing SB300/330	1	
13	HC-37561	Cylinder Hyd Stab Tilt SB300/SB330	1	
	HC-23366	Block Cartridge Double Port	1	
	HC-25143	Cartridge Pilot Check IH 4CK901	2	
	BE-29011	Bearing Glacier 60 ID x 40 long	4	
	HF-VST11/4A3AC	Plug BSPP 1/4" Allen Key Head	2	
	HC-37804	Feed Tube Stab Tilt SB300/330	1	
14	HC-37631	Cylinder Hyd Stab Ext SB300/SB330	1	
	HC-23366	Block Cartridge Double Port	1	
	HC-25143	Cartridge Pilot Check IH 4CK901	2	
	HF-VST11/4A3AC	Plug BSPP 1/4" Allen Key Head	2	
	HC-37803	Feed Tube Stab Ext SB300/330	1	
15	S3-39214	Stabiliser Extension SB300/330	1	
16	S1-18365	Support Lower Stabiliser Leg Cyl SB360	2	
17	S3-21833	Foot SB300	1	
18	PN-21819	Pin A & D SB300 Ø60	2	
19	FA-28935	Circlip 60mm	11	
20	PN-21821	Pin C E & F SB300 Ø60	3	
21	PN-30685	Pin G SB330 Clevis Type	1	SB330
۱ ک	PN-21822	Pin G SB300 Ø60		SB300
22	S3-21824	Plate Keeper Pin G SB300	2	35300
23	PN-21812	Pin B & I SB300	2	
24	PN-21826	Pin L SB300 Ø60	1	



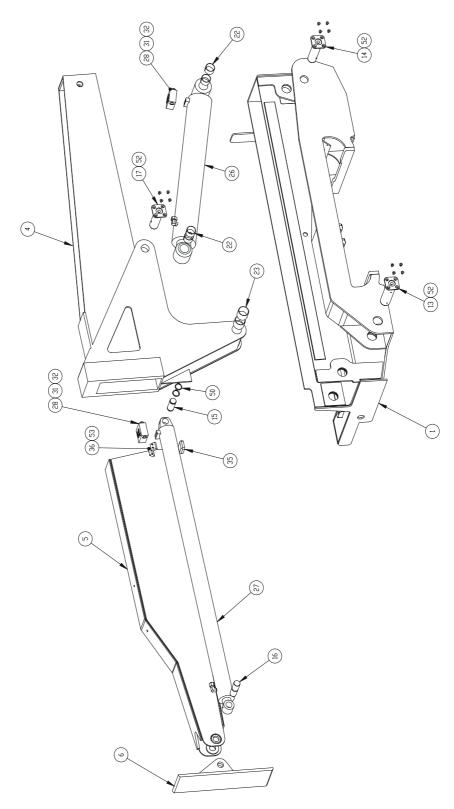
Item	Part Number	Description (SB300/330)	Qty	Notes
25	PN-21823	Pin H SB300 Ø60	1	
26	PN-18322	Pin J SB360 SB300 Ø45	1	
27	FA-28923	Circlip External M45	2	
28	PN-21817	Pin K SB300 Ø45	1	
29	S1-21933	Bracket Control Valve	1	
30				
31	-	Danfoss valve PVEM	1	
	HC-27073	Coil Danfoss 12V PVEM 157B4116	5	1
	HC-27074	Coil Danfoss 24V PVEM 157B4128	5	1
31	FA-27891	Pin Roll M10 X 55	2	
32	S1-31066	Wear Pad Side Flange C/Base 35mm	4	
33	S3-31068	Wear Pad Crane Base 10mm SB330	4	
34	TP-22361	Ball Steel	2	
35	TP-22382	Spring Twistlock Centre	2	
36	FA-28750	Screw Grub M10 X 012	2	
37	S1-22507	Shim 60 I.D. X 75 O.D. X 1mm SB300	1	
38	S1-22508	Shim 60 I.D. X 75 O.D. X 2mm SB300	1	
39	S1-22509	Shim 60 I.D. X 75 O.D. X 5mm SB300	1	
40				
41	HC-20674	Clamp Double 16mm Pipe	5	
42	HC-18602	Clamp Single 16mm Pipe	13	
43	FA-28604	Screw Set Hex Gr 8.8 M8X20 ZP	18	
44	FA-28827	Washer Flat M8X19 ZP	28	
45	HC-25811	Clamp Double 1/2 Hose Plastic Dipped	10	
46	FA-29759	Screw Socket Cap Gr 12.9 M8X20 ZP	10	
47	FA-28838	Washer Flat M12X28.5 ZP	8	
48	FA-28647	Bolt Hex Gr 8.8 M12X80 ZP	4	
49	FA-28772	Nut Nyloc M12 ZP	4	
50	FA-28730	Screw Socket Flat Head Gr 12.9 M6X20 ZP	4	
51	S3-26156	Shim Load Transfer Foot 3mm SB300/SB330	2	
52	S3-26155	Shim Load Transfer Foot 2mm SB300/SB330	2	
53	S3-26154	Shim Load Transfer Foot 1mm SB300/SB330	2	
54	S3-22162	Block Load Transfer 20mm SB330	2	
55	S3-22161	Block Load Transfer 12mm SB330	2	
56	FA-28711	Screw Socket Cap Gr 12.9 M8X80 Blk	6	
57				
58	S6-25959	Spacer Washer SB360 A&H Pin 2mm	1	
59	S6-25958	Spacer Washer SB360 A&H Pin 1mm	1	
60	S6-20471	Spacer Washer SB360 A&H Pin 4mm	1	
61	S3-31031	Spacer OS Bash Plate C/Base SB330	1	
62	S3-31032	Washer Spring Block Offside Bash Plate	1	
63	S1-31484	Retainer Long Wear Pad C/Base	1	
64	S1-31067	Wear Pad Side Flange C/Base 10mm	4	
65	S3-34590	Bracket E-Chain Mount (New Hyd)	1	1

Notes

1. Part not shown in drawing

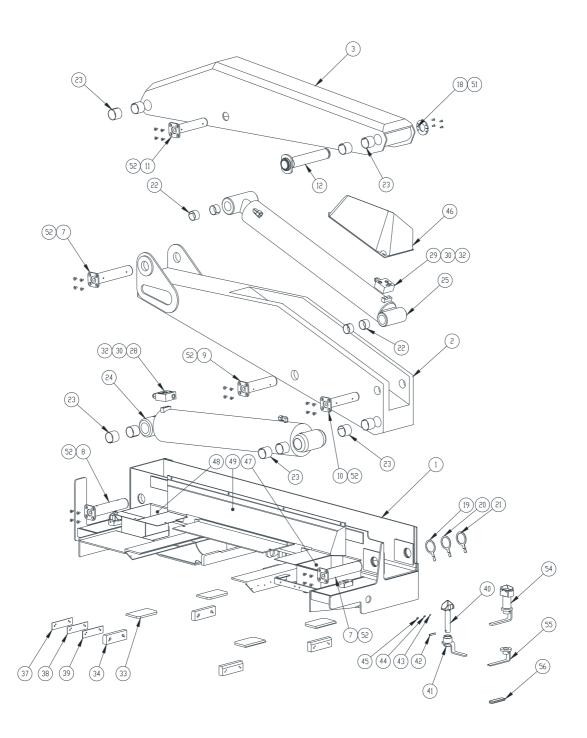


Crane Assembly SB360



V1101 Sidelifter Spare Parts Page 11







Item	Part Number	Description (SB360)	Qty	Notes
	S6-29497	Crane Assy SB360 RH Standard Arm (Shown)	1	
	S6-29496	Crane Assy SB360 LH Standard Arm		
1	S6-22129	Crane Base R/H SB360	1	
	S6-22130	Crane Base L/H SB360		
	S6-29276	Crane Base R/H Trombone Front		
	S6-29277	Crane Base L/H Trombone Front		
2	S6-18200	Arm Bottom SB360	1	
3	S6-18202	Arm Top SB360 (Obsolete rep by S6-22387) (EC1349)	1	
	S6-22387	Arm Top SB360 Extended Reach		
4	S6-18075	Stabiliser Housing SB360	1	
5	S6-25513	Stabiliser Extension SB360	1	
6	S6-18076	Foot SB360 Sidelifter	1	
7	PN-19710	Pin A & D SB360 Ø70	2	
8	PN-19711	Pin B SB360 Ø70	1	
9	PN-19712	Pin C SB360 Ø70	1	
10	PN-19714	Pin E SB360 Ø60	1	
11	PN-19715	Pin F SB360 Ø60	1	
12	PN-18319	Pin G SB360 Ø70	1	
13	PN-19716	Pin H SB360 Ø70	1	
14	PN-19717	Pin I SB360 Ø60	1	
15	PN-18322	Pin J SB360 SB300 Ø45	1	
16	PN-18323	Pin K SB360 Ø45	1	
17	PN-19719	Pin L SB360 Ø60	1	
18	S1-00907	Keeper Pin G SB360 (Half Circle)	2	
19	S6-25958	Spacer Washer SB360 A&H Pin 1mm		
20	S6-25959	Spacer Washer SB360 A&H Pin 2mm		
21	S6-20471	Spacer Washer SB360 A&H Pin 4mm		
22	BE-29011	Bearing Glacier 60 ID x 40 long	8	
23	BE-29013	Bearing Glacier 70 ID x 60 long	12	
24	HC-31628	Cylinder Hyd Bottom Lift SB360 Type 2	1	
	HC-25801	Cylinder Hyd Bottom Lift SB360 (Metric Type 1)		
	HC-18203	Cylinder Hyd Bottom Lift SB360 (Imperial)		1
25	HC-25802	Cylinder Hyd Top Lift SB360	1	
	HC-18275	Cylinder Hyd Top Lift SB360 (Imperial)		1
	HC-25803	Cylinder Hyd Top Lift Extended Reach SB360		
26	HC-25804	Cylinder Hyd Stabiliser Tilt SB360	1	
	HC-18081	Cylinder Hyd Stabiliser Tilt SB360 (Imperial)		1
	HC-27087	Kit Seal Stabiliser Tilt SB360		
	HC-37445	Kit Seal Stabiliser Tilt SB360 (DAS)		
27	HC-25805	Cylinder Hyd Stabiliser Extension SB360 SB300/SB330	1	
	HC-18273	Cylinder Hyd Stabiliser Extension SB360 (Imperial)		1
	HC-27101	Kit Seal Bottom Lift SB360		
	HC-37446	Kit Seal Bottom Lift SB360 (DAS)		
	HC-27100	Kit Seal Top Lift SB360		
	HC-37445	Kit Seal Top Lift SB360 (DAS)		
	HC-27089	Kit Seal Stabiliser Extension SB360		



Item	Part Number	Description (SB360)	Qty	Notes
	HC-33836	Kit Seal Stabiliser Extension SB360 (DAS)		
28	HC-23366	Block Cartridge Double Port	3	
29	HC-25753	Block Cartridge Single Port	1	
30	HC-25754	Cartridge Overcentre Non Vented	3	
31	HC-25143	Cartridge Pilot Check	4	
32	HF-VST11-4A3C	Plug BSPP 1/4" Allen Key Head	7	
33	S6-20657	Wear Pad 13mm Crane Base	4	
	S6-18900	Wear Pad Top Flange 10mm Crane Base SB360		1
34	S1-31066	Wear Pad Side Flange C/Base 35mm	4	3
	S1-31067	Wear Pad Side Flange C/Base 10mm		3
	S1-20829	Wear Pad Side Crane Base 36mm SB360		1
	S6-18725	Wear Pad Side Flange 10mm Crane Base SB360		1
35	S6-20695	Support Stabiliser Leg Cylinder SB360	1	
36	S1-18365	Support Lower Stabiliser Leg Cyl SB360	2	
37	S1-21161	Shim 200 X 060 X 01.5mm	1	
38	S1-21162	Shim 200 X 060 X 02mm	1	
39	S1-21163	Shim 200 X 060 X 03mm	1	
40	S6-31037	Centre Twistlock Crane Base SB360	2	
41	S3-26040	Handle Twistlock Crane Base SB330	2	
42	FA-27891	Pin Roll M10 X 55	1	
43	TP-22361	Ball Steel	1	
44	TP-22382	Spring Twistlock Centre	1	
45	FA-28750	Screw Grub M10 X 012	1	
46	S6-18559	Plate Bash Lower Arm R/H Rear SB360	1	
. •	S6-18562	Plate Bash Lower Arm L/H SB360		
47	S6-21586	Chain Box R/H SB360	1	
	S6-21585	Chain Box Small R/H SB360		5
48	S6-21587	Chain Box L/H SB360	1	+
	S6-21584	Chain Box Small L/H SB360	<u> </u>	6
49	S6-21590	Plate Bash Crane Base SB360	1	+
50	FA-28923	Circlip External M45	2	
51	FA-28730	Screw Socket Flat Head Gr 12.9 M10X25 ZP	4	
52	FA-28736	Screw Socket Flat Head Gr 12.9 M10X25 ZP	36	
53	FA-29755	Screw Socket Cap Gr 12.9 M6X20 ZP	4	
54	YK-783560-01	Centre Twistlock C/W Shear Pin	1	2
55	CP-18000	Handle Twistlock Single Extended	1	2
56	TP-25850	Grip Handle Twistlock	1	-
	HC-20674	Clamp Double 16mm Pipe	6	7
	HC-18602	Clamp Single 16mm Pipe	10	7
	HC-25811	Clamp Double 1/2" Hose Plastic Dipped	1	7
	HC-31535	Clamp Pipe Pressed 20mm Single	2	7
	S1-20507	Spacer Pipe Clamp Stabilizer Leg C/Base	1	7
	S6-29543	Bracket Pipe Clamp Crane base Mk6	1	7
	FA-28719	Screw Socket Cap Gr 12.9 M10x60 Blk	8	7
	S6-26118	Bracket Pipe Crane Base Mk6	1	7
	EL-27434	Gland Cable 16mm	1	7
	EL-27697	Enclosure Remote S3 C/W Cut Lid	1	7



Item	Part Number	Description (SB360)	Qty	Notes
	EL-27694	Locknut PVC 32mm	6	7
	EL-27709	Nipple Screwed PVC 32mm.	3	7
	TP-25606	Twistlock Body SBSK339D (Machined)	2	7
	HC-29503	Valve Danfoss PVG32 No Coils SB360 Ram R	1	7
	HC-29504	Valve Danfoss PVG32 No Coils SB300 LHC	1	7
	HC-27073	Coil Danfoss 12V PVEM 157B4116	5	7
	HC-27074	Coil Danfoss 24V PVEM 157B4128	5	7

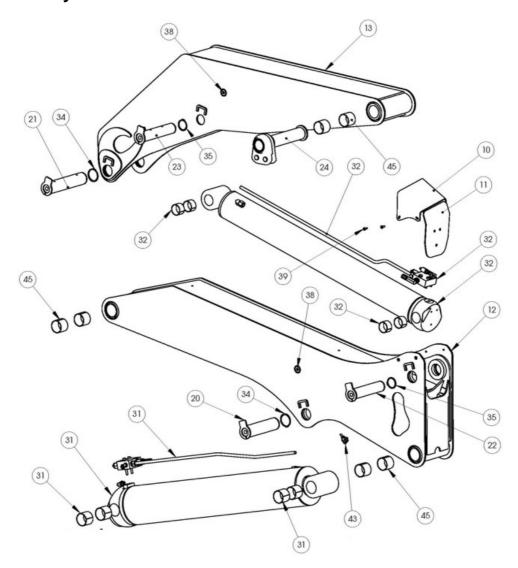
Notes:

- 1. Early version MK6
- 2. Early version MK6 Plus non-retractable twistlock center beams
- 3. Used on units from serial number SB6869
- 4. Rams changed from Imperial to Metric as of unit SB6326 in 1998
- 5. Replaces S6-21586 when offside stabilizer leg is fitted
- 6. Replaces S6-21587 when offside stabilizer leg is fitted
- 7. Not shown in drawing

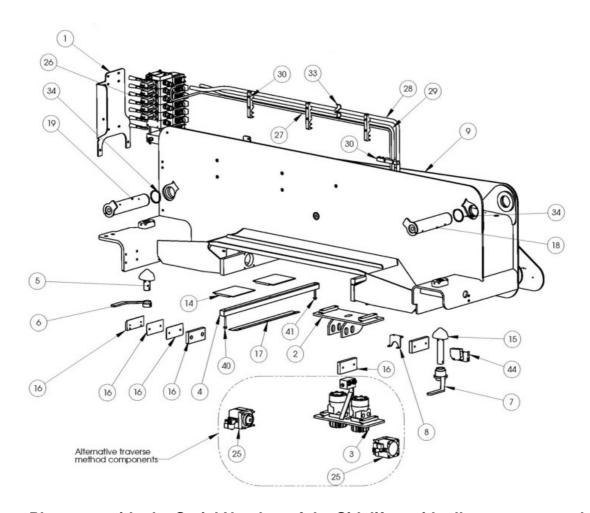




Crane Assembly SB361/401





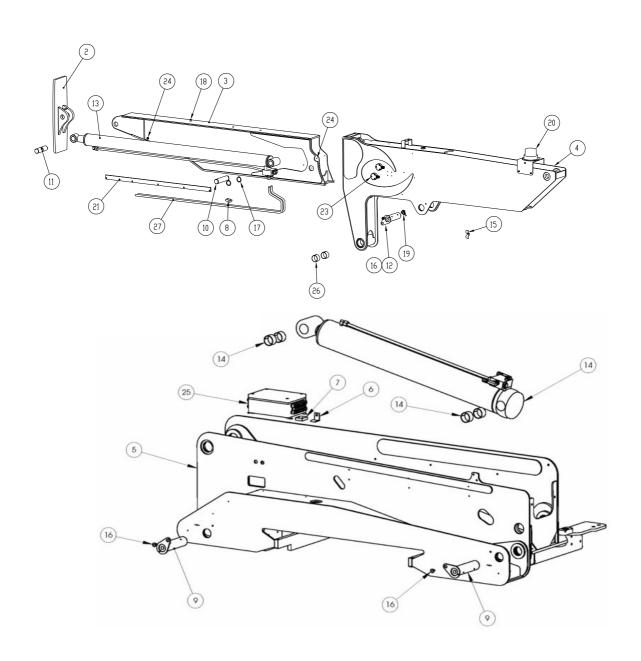


Item	Part Number	Description	Qty
1	S8-33620	Plate Mounting RH Danfoss Bank SB401/SB361	1
2	S8-33316	Assy Cylinder Traverse SB401/SB361	1
3	S8-33311	Assy Centre Drive Traverse SB401/SB361	1
4	S8-33306	Block Load Transfer 32mm SB401/SB361	2
5	S8-33070	Bolt Anvil Machined TL Offside SB401/SB361	1
6	S8-33069	Handle Twistlock Offside RH SB401/SB361	1
	S8-33290	Handle Twistlock Offside LH SB361/401	
7	S8-33028	Handle Twistlock Liftside RH SB401/SB361	1
	S8-33288	Handle Twistlock Liftside LH SB361/401	
8	S8-33022	Plate Mount Plug Base SB401/SB361	1
9	S8-33011	Crane Base RH SB401/SB361	1
10	S8-32258	Bash Cover R/H Bottom Arm SB401/SB361	1
11	S8-32257	Bash Plate R/H Bottom Arm SB401/SB361	1
12	S8-32240	Arm Bottom SB401/SB361	1
13	S8-32300	Arm Top SB361	1
	S8-32211	Arm Top SB401	
14	S3-31068	Wear Pad Crane Base 10mm SB330	4
15	S3-26034	Centre Twistlock Crane Base SB330	1
16	S1-33275	Assy Wear Pad Side SB401/SB361	4
17	S1-31484	Retainer Long Wear Pad Crane Base Bolted	2
18	PN-34235	Pin A SB401/SB361	1



19	PN-33248	Pin B SB401/SB361	1
20	PN-33252	Pin C SB401/SB361	1
21	PN-33254	Pin D SB401/SB361	1
22	PN-33256	Pin E SB401/SB361	1
23	PN-33258	Pin F SB401/SB361	1
24	PN-33260	Pin G SB401/SB361	1
25	PM-33302	Assy Lock Crane Base SB401/SB361	2
26	HC-33658	Valve Danfoss 4 Slice	1
27	HC-33643	Tube 10mm LS RH Crane Base SB401/SB361	1
28	HC-33642	Tube 20mm Tank RH Crane Base SB401/SB361	1
29	HC-33641	Tube 16mm Pressure RH Crane Base SB401/SB361	1
30	HC-33614	Clamp Hyd Tube SB401 Crane Base	4
31	HC-32284	Assy Cylinder Hyd Bottom Lift SB361/SB401 RH	1
	HC-33800	Assy Cylinder Hyd Bottom Lift SB361/SB401 LH	
32	HC-32280	Assy Cylinder Hyd Top Lift SB361	1
	HC-32282	Assy Cylinder Hyd Top Lift SB401	1
33	HC-25811	Clamp Double 1/2 Hose Plastic Dipped	1
34	FA-31071	Circlip External M70	4
35	FA-28935	Circlip External M60 ZP	2
36	FA-28827	Washer Flat M8X19 ZP	18
37	FA-28770	Nut Nyloc M8 ZP	4
38	FA-28755	Screw Socket Grub M16X16 ZP	4
39	FA-28733	Screw Socket Flat Head Gr 12.9 M8X25 Blk	4
40	FA-35375	Screw Socket Cap Gr 12.9 M8X90 Blk	4
41	FA-28710	Screw Socket Cap Gr 12.9 M8X70 Blk	2
42	FA-28605	Screw Set Hex Class 8.8 M8X25 ZP	8
43	EL-34171	Sensor Inclinometer VTI 2-Axis M12 Plug	2
44	EL-22723	Switch Photo Sensor Sick WT260S280	1
45	BE-29013	Bearing Glacier 70 ID x 60 long	6





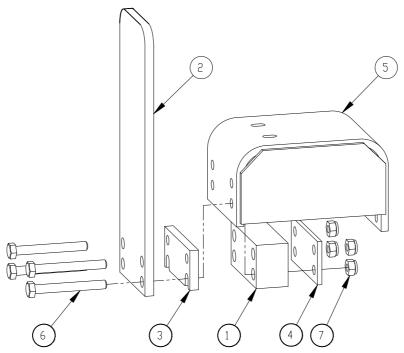
Item	Part Number	Description	Qty
1			
2	S8-36978	Foot Stabilizer (07)	1
3	S8-36980	Stabilizer Extension (07)	1
4	S8-37059	Stabilizer Housing (07)	1
5	S8-33011	Crane Base RH SB401/SB361	1
	S8-33013	Crane Base LH SB401/SB361	
6	S1-33842	Bracket Module Pressure Gauge Low Height	1



7	S1-34174	Packer Spirit Level Module Mounted	1
8	S1-18365	Support Lower Stabilizer Leg Cyl SB360	3
9	PN-33250	Pin H & I SB401/SB361	2
10	PN-37120	Pin J (07)	1
11	PN-21817	Pin K SB330 SB401 Ø45	1
12	PN-35349	Pin L SB401	1
13	HC-40243	Assy Cyl Hyd Stabilizer Ext (07)	1
14	HC-38167	Assy Cyl Hyd Stab Tilt R/H (07)	1
	HC-38168	Assy Cyl Hyd Stab Tilt L/H (07)	
15	HC-25811	Clamp Double 1/2 Hose Plastic Dipped	1
16	FA-34402	Screw Socket Head Shouldered Retainer	3
17	FA-28923	Circlip External M45	2
18	FA-28755	Screw Socket Grub M16X16 ZP	2
19	EL-34171	Sensor Inclinometer VTI 2-Axis M12 Plug	1
20	EL-33346	Strobe Beacon no Conduit SB401/SB361	1
21	EL-37327	Mag Strip Stab Ext SB401/SB361	1
22			
23		Assy Mount Sensor Magnetic SB401/SB361 (EL-33269)	2
24	EL-32921	Magnet Reset Stabilizer	3
25	EL-32863	Enclosure	1
26	BE-29011	Bearing Glacier 60 ID x 40 long	2
27	HC-37156	Pipe 16mm Stab Extn (07) Cyl	2



Offside Bash Plate - SB361, SB401



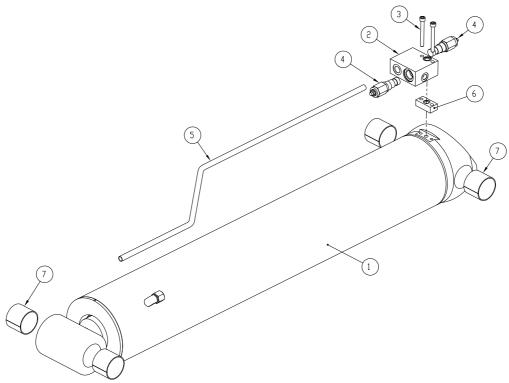
Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Refer to section "Offside Stabiliser Leg Assembly" if fitted with an offside stabiliser.

Item	Description	Part Number	Qty	Notes
1	Block Spring Offside Bash Plate	S3-26044	1	
2	Plate Bash Offside Crane Base	S3-26048	1	
3	Spacer Offside Bash Plate Crane Base	S3-31031	1	Used where allowable vehicle width exceeds 2500 mm
4	Washer Spring Block Offside Bash Plate	S3-31032	1	
5	Mount Offside Bash Plate SB401	S8-33340	1	
6	Bolt Hex Class 8.8 M12x100 ZP	FA-28649	4	
7	Nut Nyloc M12 ZP	FA-28772	4	



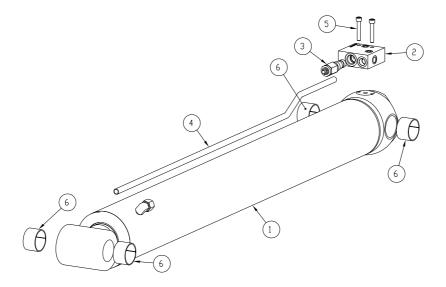
Hydraulic Cylinders SB361/401



Note: Please provide the Serial Number of the sidelifter with all spare parts orders.

Item	Part Number	Description (SB361/401)	Qty	Notes
	HC-32284	Cylinder Hyd Bottom Lift SB361/401 RH Crane Assy (Shown)		
	HC-33800	Cylinder Hyd Bottom Lift SB361/401 LH Crane Assy		
1	HC-38033	Cylinder Hyd Bottom Lift SB361/401 (DE)	1	1
	HC-32283	Cylinder Hyd Bottom Lift SB361/401		2
2	HC-32294	Block Cartridge Low Height Double Port	1	
3	FA-32715	Screw Socket Cap Gr 12.9 M10x90 Blk	2	
4	HC-25754	Cartridge Overcentre Non Vent 200-30	2	
5	HC-32831	Feed Tube Feed RH Bottom Lift Cyl (shown)	1	
	HC-32833	Feed Tube Feed LH Bottom Lift Cyl (LH Crane Assy)		
6	HC-32295	Block Riser Cartridge	1	
7	BE-29013	Bearing Glacier 70 ID x 60 long	4	

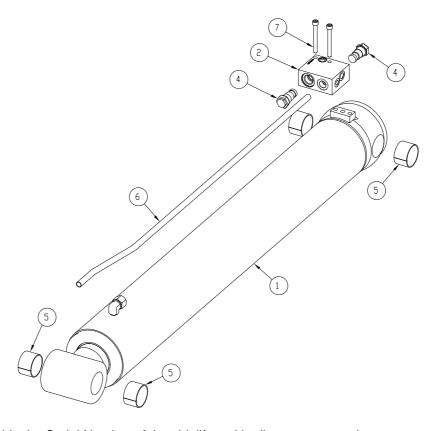




Note: Please provide the Serial Number of the sidelifter with all spare parts orders.

Item	Part Number	Description (SB361/401)	Qty	Notes
	HC-32280	Assembly Cylinder Hyd Top Lift SB361 (Shown)		
	HC-32282	Assembly Cylinder Hyd Top Lift SB401		
1	HC-38007	Cylinder Hyd Top Lift SB361 (DE)	1	1
	HC-32279	Cylinder Hyd Top Lift SB361		2
1	HC-38022	Cylinder Hyd Top Lift SB401 (DE)	1	1
	HC-32281	Cylinder Hyd Top Lift SB401		2
2	HC-32293	Block Cartridge Low Height Single Port	1	
3	HC-25754	Cartridge Overcentre Non Vent 200-30	1	
4	HC-32829	Tube Feed Top Lift Cylinder SB361	1	
	HC-32830	Tube Feed Top Lift Cylinder SB401		
5	FA-28720	Screw Socket Cap Gr 12.9 M10X65 Blk	2	
6	BE-29011	Bearing Glacier 60 ID x 40 long	4	

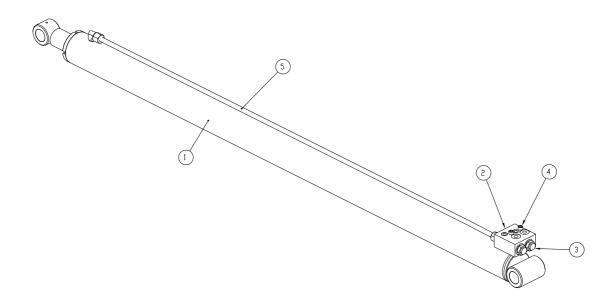




Note: Please provide the Serial Number of the sidelifter with all spare parts orders.

Item	Part Number	Description (SB361/401)	Qty	Notes
	HC-38168	Assembly Cylinder Hyd Stab Tilt LH		
	HC-38167	Assembly Cylinder Hyd Stab Tilt RH		
1	HC-38132	Cylinder Hyd Stabiliser Tilt	1	1
2	HC-32294	Block Cartridge Low Height Double Port	1	
3	HC-32295	Block Riser Cartridge	1	
4	HC-25143	Cartridge Pilot Check IH 4CK901	2	
5	HC-32832	Tube Feed Stab Tilt Cylinder SB361/401	1	
6	BE-29011	Bearing Glacier 60 ID x 40 long	4	
7	FA-28725	Screw Socket Cap Gr 12.9 M12x100 Blk	2	





Note: Please provide the Serial Number of the sidelifter with all spare parts orders.

Item	Part Number	Description (SB361/401)	Qty	Notes
	HC-40243	SB361/401 Cylinder Hyd Stabiliser Extend		
1	HC-40200	Cylinder Hyd Stab Extn	1	
2	HC-23366	Block Cartridge Double Port	1	
3	HC-25143	Cartridge Pilot Check IH 4CK901	2	
4	FA-28719	Screw Socket Cap Gr 12.9 M10X60 Blk	2	
5	HC-36975	Tube Feed Stab Ext Cylinder	1	

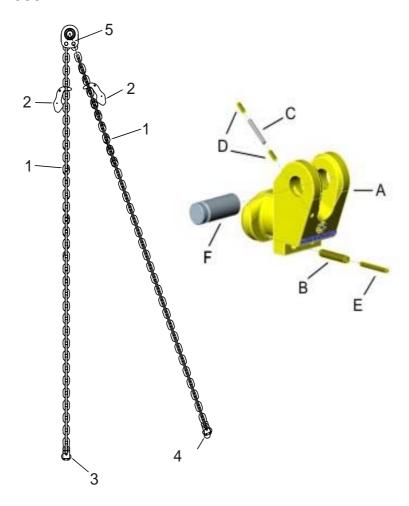
Notes:

1. For identification, always provide serial numbers of sidelifter and/or cylinder.



Lifting Accessories - all models

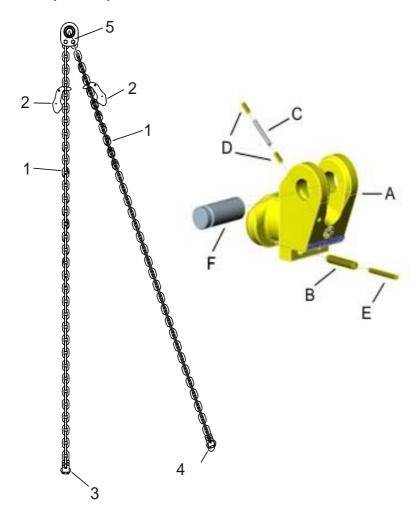
Chain Sling SB330



Item	Part Number	Description	Qty	Notes
	LF-32125	Whole Assembly - Chain Sling (not inc. Clevis)	2	per unit
1	LF-36200	Chain 72 link 16mm	2	per sling
2	LF-32489	Shortening Claw VIP 16mm	2	per sling
3, 4		Lifting Lug assembly 16mm chain		Refer to close up
Α	LF-34974	Lug Lifting Cast 16mm Chain Type 2	1	
В	FA-25659	Pin Roll M8 x 40 Blk	1	
С	FA-30057	Pin Dowel Hardened M4x28mm	1	
D	FA-30058	Pin Wave M4 x 12 S/S	2	
Е	FA-30059	Pin Roll M5 x 40 Blk	1	
F	LF-26201	Pin Lifting Hook Tested 16mm Chain	1	
5	PN-30685	Clevis SB330	1	per sling



Chain Sling SB360 (16mm)

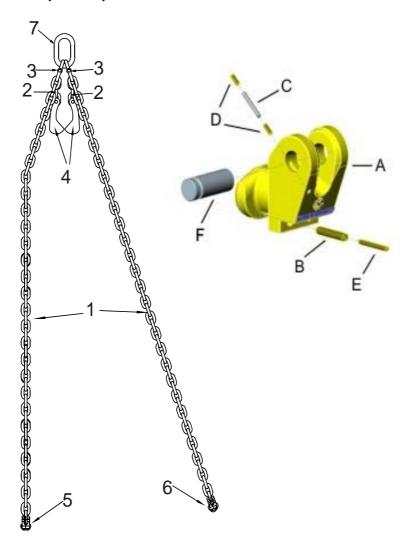


Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Item	Part Number	Description	Qty	Notes
	LF-30246	Whole Assembly - Chain Sling SB360 16mm (not inc. Clevis)	2	per unit
1	LF-36199	Chain 66 link 16mm	2	per sling
2	LF-32489	Shortening Claw VIP 16mm	2	per sling
3, 4		Lifting Lug assembly 16mm chain		Refer to close up
Α	LF-34974	Lug Lifting Cast 16mm Chain Type 2	1	
В	FA-25659	Pin Roll M8 x 40 Blk	1	
С	FA-30057	Pin Dowel Hardened M4x28mm	1	
D	FA-30058	Pin Wave M4 x 12 S/S	2	
Е	FA-30059	Pin Roll M5 x 40 Blk	1	
F	LF-26201	Pin Lifting Hook Tested 16mm Chain	1	
5	PN-30040	Clevis SB360	1	per sling



Chain Sling SB360 (20mm)

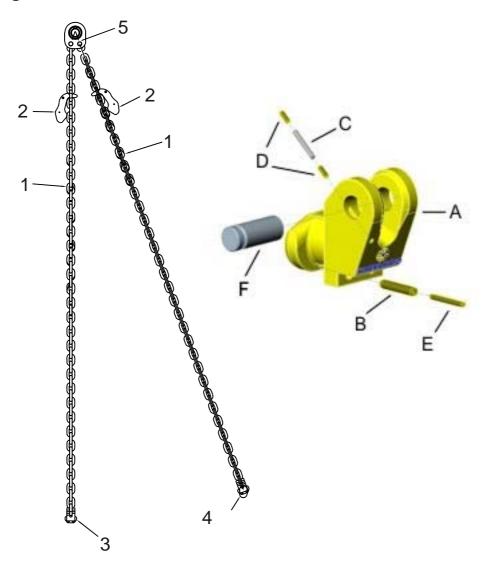


Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Item		Part Number	Description	Qty	Notes
		LF-25820	Assembly - Chain Sling w shortener SB360 20mm	2	per unit
		LF-29244	Assembly - Chain Sling w/o shortener SB360 20mm	2	per unit
1		LF-36187	Chain leg, chain only, 54 link 20mm	2	per sling
2		LF-36187	Chain short piece, 3 link only	2	per sling
3		LF15282	Hammerlocks	2	per sling
4		LF-36173	Shortening Claw 20mm	2	per sling
5, 6			Lifting Lug assembly 20mm chain		Refer to close up
	Α	LF-33328	Lug Lifting Cast 20mm Chain Type 2	1	
	В	FA-25659	Pin Roll M8 x 40 Blk	1	
	С	FA-30057	Pin Dowel Hardened M4x28mm	1	
	D	FA-30058	Pin Wave M4 x 12 S/S	2	
	Е	FA-30059	Pin Roll M5 x 40 Blk	1	
	F	LF-26200	Pin Lifting Hook Tested 20mm Chain	1	
7		LF-18945	Oblong Ring	1	per sling



Chain Sling SB361

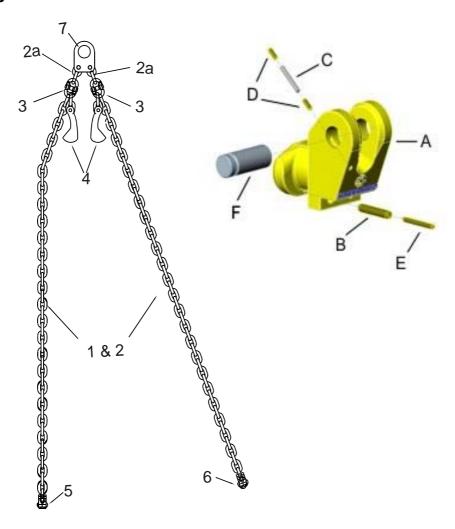


Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Item	Part Number	Description	Qty	Notes
	LF-33352	Whole Assembly - Chain Sling (not inc. Clevis)	2	per unit
1	LF-36199	Chain 72 link 16mm	2	per sling
2	LF-32489	Shortening Claw VIP 16mm	2	per sling
3, 4		Lifting Lug assembly 16mm chain		Refer to close up
Α	LF-34974	Lug Lifting Cast 16mm Chain Type 2	1	
В	FA-25659	Pin Roll M8 x 40 Blk	1	
С	FA-30057	Pin Dowel Hardened M4x28mm	1	
D	FA-30058	Pin Wave M4 x 12 S/S	2	
Е	FA-30059	Pin Roll M5 x 40 Blk	1	
F	LF-26201	Pin Lifting Hook Tested 16mm Chain	1	
5	PN-33285	Clevis SB361	1	per sling



Chain Sling SB401

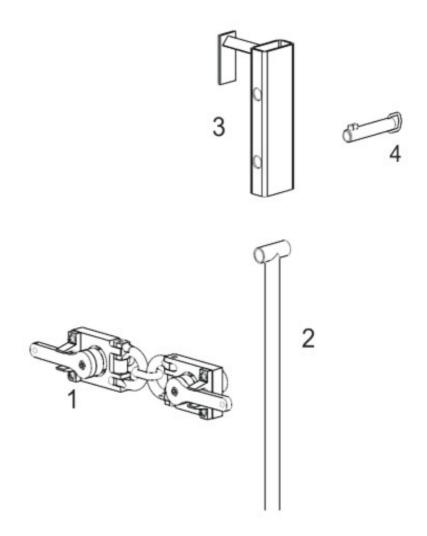


Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

	<u> </u>		_	1
Item	Part Number	Description	Qty	Notes
	LF-33353	Assembly - Chain Sling SB401 (not inc. Clevis)	2	per unit
1	LF-33677	Chain leg SB401 20mm w/shortener	2	per sling
2	LF-36187	Chain leg, chain only, 50 link 20mm	2	per sling
2a	LF-36187	Chain short piece, 2 link only	2	per sling
3	LF-15282	Hammerlocks	2	per sling
4	LF-36173	Shortening Claw 20mm	2	per sling
5, 6		Lifting Lug assembly 20mm chain		Refer to close up
Α	LF-33328	Lug Lifting Cast 20mm Chain Type 2	1	
В	FA-25659	Pin Roll M8 x 40 Blk	1	
С	FA-30057	Pin Dowel Hardened M4x28mm	1	
D	FA-30058	Pin Wave M4 x 12 S/S	2	
E	FA-30059	Pin Roll M5 x 40 Blk	1	
F	LF-26200	Pin Lifting Hook Tested 20mm Chain	1	
7	PN-33260	Clevis SB401	1	per sling



Container Joiners (linklock system)



Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Item	Part Number	Description	Qty	Notes
1	LF-20020	Connector Base Container Joiner	2	
2	LF-19956	Pole Container Joiner with Load Binder	2	1
3	LF-19955	Spacer Top Container Joiner	2	1
4	LF-19957	Pin Top Spacer Container Joiner	2	1
5	S1-34058	Bracket Pole Front Container Joiner Web Mn	2	2
6	S1-34060	Bracket Pole Rear Container Joiner	2	2
7	S1-26126	Bracket Stowage Container Joiner	2	2

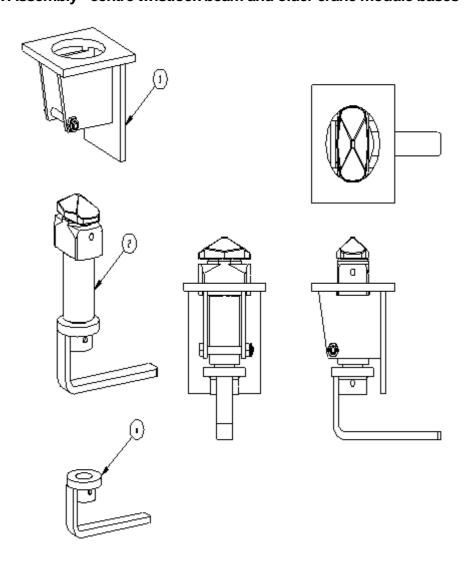
Notes:

- 1. Optional item
- 2. Optional item (not shown)

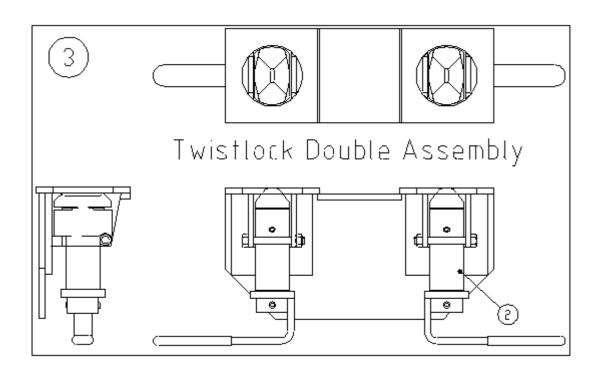


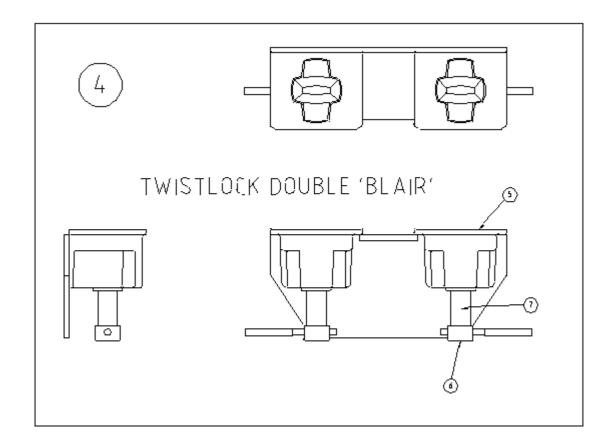
Twistlock Assemblies

Twistlock Assembly - centre twistlock beam and older crane module bases









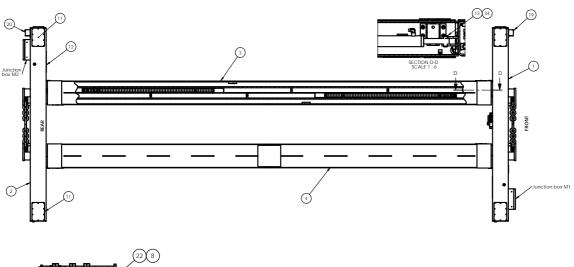


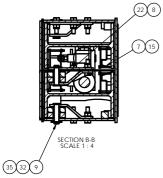
Item	Part Number	Description	Qty
1	TP-31459	Housing For Twistlock C/W Bolt & Spacer	1
2	YK-783560-01	Centre Twistlock C/W Shear Pin	1
а	CP-18000	Handle Twistlock Single Extended	
	TP-25850	Grip Handle Twistlock	
	TP-22361	Ball Steel	
	TP-22382	Spring Twistlock Centre	
	FA-28750	Screw Socket Grub	
3	TP-25949	Twistlock Double YORK	1
4	TP-33455	Twistlock Double Retractable BLAIR	1
5	TP-33454	Twistlock Single Retractable	
6		Handle Retractable Twistlock BLAIR	
7		Shaft Retractable Twistlock BLAIR	





TopLift Frame SB361 Spare Parts 1

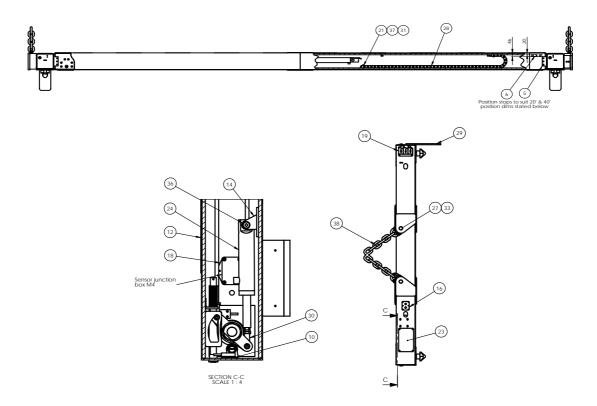




Item	Part Number	Description
1	TF-35517	# Ext Beam & TL Mech Front RHL TLF SB361
2	TF-35518	# Ext Beam & TL Mech Rear RHL TLF SB361
3	TF-35519	# Sleeve Cylinder Assy Ext-TLF SB361
4	TF-35520	# Sleeve Plain Assy Ext-TLF SB361
7	TF-35545	Clamp Hose & Conduit Ext-TLF SB361
8	TF-35550	Bush Roller Ext-TLF SB361
9	TF-35566	Pin Roller Spindle Short Ext-TLF SB361
11	TF-35568	Plate Cover Twistlock Mech Ext-TLF SB361
12	TF-35569	Plate Cover TL Cyl Access Ext-TLF SB361
13	TF-35612	Pin Ext Cylinder Mount Ext-TLF SB361
15	TF-35622	Spacer M6 x 10 OD x 12 Long
19	TF-35673	Bracket Assy LED Front Ext-TLF SB361
20	TF-35674	Bracket Assy LED Rear Ext-TLF SB361
22	BE-35589	Bearing Roller
32	FA-28845	Washer Flat M16X32 ZP
34	FA-30046	Circlip External M22
35	FA-35474	Circlip External Dia 14 Zinc Plated



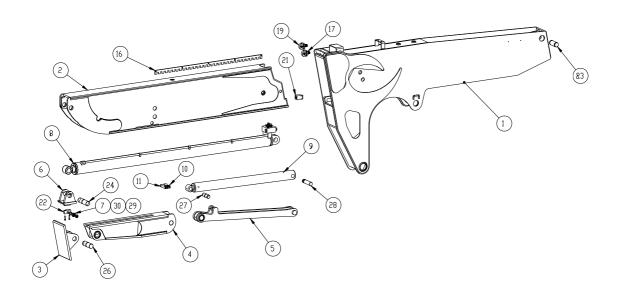
TopLift Frame SB361 Spare Parts 2



Item	Part Number	Description
5	TF-35532	Block Stop Retracted Ext-TLF SB361
6	TF-35533	Block Stop Extended Ext-TLF SB361
7	TF-35545	Clamp Hose & Conduit Ext-TLF SB361
10	TF-35567	Packer Proximity Sensor Ext-TLF SB361
12	TF-35569	Plate Cover TL Cyl Access Ext-TLF SB361
14	TF-35619	Ram Mount Ext-TLF SB361
16	TF-35629	Plate Bulkhead Ext-TLF SB361
18	TF-35655	Plate Mounting Sensor Terminal Block
19	TF-35673	Bracket Assy LED Front Ext-TLF SB361
21	TF-35690	Plate Washer Energy Chain Ext-TLF SB361
23	EL-35652	Kit Electrical Ext-TLF SB361
24	HC-35587	Cylinder Hyd Twistlock Top Lift Frame
26	HC-33619	Valve Diverter DFE052/6B18ES-Y201-12VDC
27	PN-20187	Pin Lifting Lug Top Lift Frame
28	S1-30994	Chain Energy Type Kolibri 2 (48 Links)
29	S3-26048	Plate Bash Offside Crane Base SB330
30	FA-15018	Rod End Female M12 RH Thread
31	FA-28767	Nut Nyloc M4 ZP
33	FA-29723	Screw Socket Grub M10X16ZP
36	FA-35608	Screw Socket Cap Shoulder 16x50xM12
37	FA-35691	Screw Socket Cap Gr 12.9 M4x45
38	LF-35613	Chainsling Ext-TLF SB361
39	TF-35699	Pole Assy Stowage Ext-TLF SB361



Bending Leg Stabiliser SB361, SB401



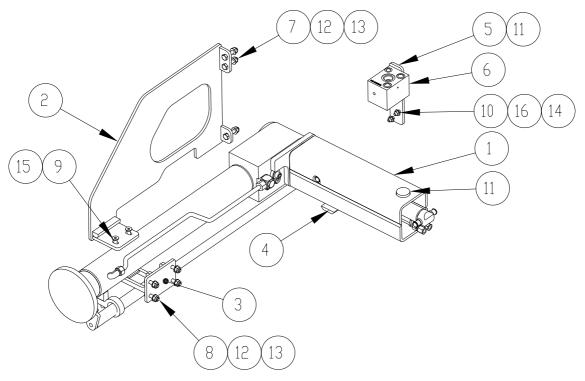
Item	Part Number	Description	Qty
1	S8-35157	Stabiliser Housing Bending leg	1
2	S8-35118	Stabiliser Extension Bending Leg	1
3	S8-35174	Foot - BL	1
4	S8-35098	Ankle Assembly BL	1
5	S8-35113	Link Assembly BL	1
6	S8-35107	Foot Swivel BL	1
7	BE-35577	Double Ball Bearing	2
8	HC-35570	Hydraulic Cylinder Assembly - Stabiliser Extension	1
9	HC-35169	Cylinder Assembly Ankle Extension	1
10	HC-35277	Clamp - Rear Ankle Extension Cylinder BL	1
11	HC-35278	Clamp - Front Ankle Extension Cylinder BL	1
12	S8-35706	Sensor Leg Deploy Mounting Block	1
13	S8-35708	Cover Proximity Sensor Leg Deploy	1
14	S8-35164	Bracket -Ankle Extended Sensor	1
15	S8-36525/S8-35167	Bracket -Ankle Retracted Sensor	1
16	EL-32922	Encoder Strip Stabiliser Extension -BL	1
17		Mount - Sensor Magnetic Assembly (EL-33269)	1
18	EL-35135	Sensor Inductive Proximity Type IQ10-06NPS-KT1	1
19	EL-33270	Optical Sensor Mount Assembly	1
20	EL-32921	Magnet Reset Stabiliser	2
21	EL-35136	Sensor -Inductive Proximity Type IQ40-35NPP-KCK	1
22	S8-35194	Pin - Foot Swivel	1
23	PN-18322	Pin J Ø45	1
24	PN-21817	Pin K Ø45	1
25	PN-35187	Pin M B L	1
26	PN-35166	Pin N BL	1



27	PN-35191	Link Pin - Ankle Cylinder BL	1
28	PN-35192	Pin - Ankle Cylinder BL	1
29	FA-35474	Circlip, External Diameter 14 (Zinc Plated)	2
30	FA-28845	Flat Washer M16X32 ZP	4
31	FA-28708	Screw- Socket Cap Grade 12.9 M8X35 Blk	2



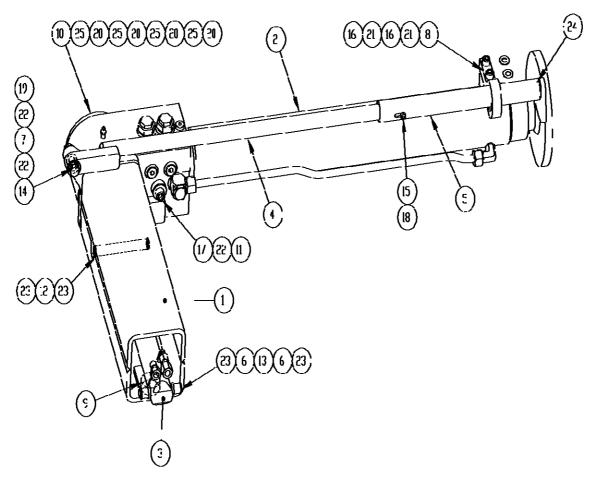
Offside Stabiliser Leg Assembly



Note: Please provide the Serial Number of the sidelifter with all spare parts orders.

Item	Part Number	Description	Qty
1	S8-32314	Assembly Offside Stabiliser RH 361/401	1
2	S8-33026	Assy OS Bash RH Crane Base SB401	1
3	S8-33331	Offside Stab Cylinder Rest Assy SB401	1
4	S8-33349	Pad Wear Insert Offside Stabiliser SB401	1
5	S8-33628	Bracket Mtg O/S Leg Hyd Block SB361/401	1
6	HC-35333	Block Cartridge Offside Leg SB361/SB401	1
7	FA-28627	Bolt Hex Class 8.8 M10X50 ZP	3
8	FA-28625	Bolt Hex Class 8.8 M10X40 ZP	4
9	FA-28738	Screw Socket Flat Head Gr 12.9 M10X25 ZP	2
10	FA-28734	Screw Socket Flat Head Gr 12.9 M8X30 ZP	2
11	FA-28733	Screw Socket Flat Head Gr 12.9 M8X25 Blk	2
12	FA-28771	Nut Nyloc M10	7
13	FA-28832	Washer Flat M10X21 ZP	7
14	FA-28770	Nut Nyloc M8 ZP	2
15	FA-28761	Nut Hex Class 8.8 M10 ZP	2
16	FA-28827	Washer Flat M8X19 ZP	2





Note: Please provide the Serial Number of the sidelifter with all spare parts orders.

Item	Part Number	Description	Qty
	S8-32314	Assembly Offside Stabiliser RH SB361/SB401 (Shown)	1
	S8-32315	Assembly Offside Stabiliser LH SB361/SB401	1
1	S8-32316	Beam Slide RH Offside Stabiliser	1
	S8-32317	Beam Slide LH Offside Stabiliser	1
2	HC-32290	Assy Cyl Hyd Off Stab Ext R/H SB361/SB401	1
	HC-32310	Assy Cyl Hyd Off Stab Ext L/H SB361/SB401	1
	HC-33837	Kit Seal Stab Offside Retract SB361/SB401	1
3	HC-32291	Cyl Hyd Offside Stab Deploy SB361/SB401	1
	HC-33839	Kit Seal Stab Offside Deploy SB361/SB401	1
4	S8-32326	Push Rod Offside Stabiliser SB361/SB401	1
5	S8-32329	Push Tube Offside Stabiliser SB361/SB401	1
6	S8-32332	Spacer Tube Offside Stabiliser SB361/SB401	2
7	S8-32333	Bush Pivot Offside Stabiliser SB361/SB401	1
8	S8-32334	Plate Guide Offside Stabiliser SB361/SB401	1
9	S8-32335	Pad Wear Offside Stabiliser SB361/SB401	1
10	S8-32336	Plate Cap Offside Stabiliser SB361/SB401	1
11	S8-32340	Roller Stop (0) Offside Stab SB361/SB401	1
12	PN-32338	Pin Front Offside Stabiliser SB361/SB401	1
13	PN-32339	Pin Rear Offside Stabiliser SB361/SB401	1
14	FA-28642	Bolt Hex Class 8.8 M12X55 ZP	1



Item	Part Number	Description	Qty
15	FA-28701	Screw Socket Cap Gr 12.9 M6X40 ZP	1
16	FA-28716	Screw Socket Cap Gr 12.9 M10X30 Blk	2
17	FA-28721	Screw Socket Cap Gr 12.9 M12X30 Blk	1
18	FA-28769	Nut Nyloc M6 ZP	1
19	FA-28772	Nut Nyloc M12 ZP	1
20	FA-28827	Washer Flat M8X19 ZP	4
21	FA-28832	Washer Flat M10X21 ZP	2
22	FA-28838	Washer Flat M12X28.5 ZP	3
23	FA-32309	Circlip External M16	4
24	FA-32337	Washer Belleville M12 (12.2 x 25.0)	20
25	FA-29759	Screw Socket Cap Gr 12.9 M8X20 ZP	4



Hydraulic Parts All Models - Miscellaneous

Part number	Description	Notes
HC-25754	Cartridge Overcentre Non Vented 200-350bar pressure	Stamped 1CE90 (1CE90 F-35S4)
HC-32481	Cartridge Overcentre Non Vented 70-225bar pressure	Stamped 1CE90 (1CE90 F-20S4)
HC-25143	Cartridge Pilot Check	stamped 4CK90
HC-18874	Cartridge Overcentre Non Vented 120Lpm	stamped CBEGLJN
HC-18875	Cartridge Overcentre Non Vented 60Lpm	
HC-25140	Valve Relief Single Overcentre	stamped CAEGLGN
HC-18966	Cartridge Pilot Check 120 lpm	Stamped CKEDXCN



	HC-18967	Cartridge Pilot Check 060 lpm	Stamped CKCDXCN
00000	HC-20149	High low speed cartridge block	Stamped HS0863
00000	HC-32480	High low speed cartridge block / Intergrated BSPP / UN oring	Stamped SB8121
00000	HC-32480	High low speed cartridge block / Intergrated all BSPP ports	Stamped SB8121
000000000000000000000000000000000000000	HC-23366	Cartridge block double	Stamped 23366
000	HC-25753	Cartridge block Single	Stamped 25753
	HC-XXXXX	Cylinder Hyd Traverse SB360	Sidelifter serial number must be provided for cylinder purchases
	HC-18969	Valve Relief Load Sensing Safety	RV08
	HC-18970	Cartridge Armature Load Sensing	SV58-20
	S3-21600	Coil Cartridge Dump Valve	SV58-21



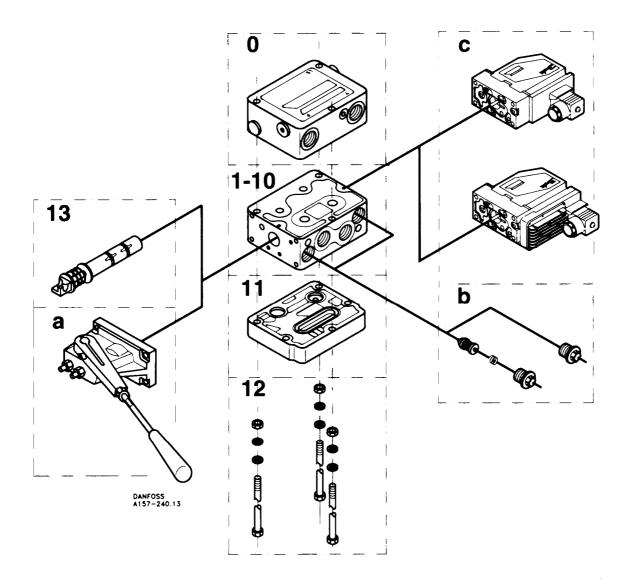
HC-18971 Cartridge Armature H/S Unloader SV12 HC-18972 Valve Relief H/Sp Unloader RV10 HC-31968 Cartridge SX204N-H12 HC-31969 Cartridge S501N-H12 HC-31970 Cartridge 1DR30-P20S	(7/22/7)	HC-18968	Valve Check Suits 22416	CV12
HC-18972 Valve Relief H/Sp Unloader RV10 HC-31968 Cartridge SX204N-H12 HC-31969 Cartridge S501N-H12 HC-31970 Cartridge 1DR30-P20S				
HC-31968 Cartridge SX204N-H12 HC-31969 Cartridge S501N-H12 HC-31970 Cartridge 1DR30-P20S		HC-18971	Cartridge Armature H/S Unloader	SV12
HC-31969 Cartridge S501N-H12 HC-31970 Cartridge 1DR30-P20S	A MUNICIPAL DE	HC-18972	Valve Relief H/Sp Unloader	RV10
HC-31970 Cartridge 1DR30-P20S		HC-31968	Cartridge	SX204N-H12
		HC-31969	Cartridge	S501N-H12
HC-31971 Cartridge 3CA80-1.5S		HC-31970	Cartridge	1DR30-P20S
HC-31973 Cartridge SX203N-H12				
HC-31977 Plug CP08-20		HC-31977	Plug	CP08-20



PVG32 Control Valve - Build Specifications

This topic lists the options available for assembling the parts which make up a hydraulic control valve bank for control of Sidelifter crane arms.

The diagram below shows the parts schematics. The tables below the diagram show the options of each component available.



0 PVP Pump side modules

Code 157b(pipe threads, ISO 228/1)	For PVE
Open centre T=G3/4, P=G3/4	5110
Closed centre T=G3/4, P=G3/4	5111
Weight (kg)	3.0



1-10 PVB Basic Valves

Code No 157b (Pipe threads,	No facilities for shock valves	Facilities for shock valves
ISO228/1)	A & B	A & B
With check valve	6100	6120
With Compensator valve	6200	6220
With compensator valve,	6202	6222
LS A/B relief valve and		
LS _{A/B} shuttle valve		
Weight (kg)	3.1	3.0

11 End Plates PVS, PVS1

Code No. 157B		Weight (kg)
PVS No LX	2000	0.05
PVS c/w LX	2011	0.05

12 PVAS, Assembly kit

Number of PVB	4	5	6	7
Code No. 157	8004	8005	8006	8007
Weight (kg)	0.40	0.45	0.50	0.60

13 Standard main spools

Code No. 157b	101	401	651	1001
Open centre	7001	7002	7003	7004
Closed centre	7100	7102	7103	7104

a PVM, mechanical actuations

Code No. 157b	Angle on base	
Standard	3171	22.5
	3172	35.7



b PVLA, anti-cavitation valve

Code No. 157b		7	Weight (kg)		
Plug A or B	1002	0.04			
	1080		1128	117	5
PVLP, shock & anti- cavitation valve					
Code No. 157b					
Setting in bar	80		125	175	
Wight (kg)	0.05		0.05	0.05	5

c PVE, electrical actuation

Code No. 157b	12 volt	24 volt	Weight (kg)
PVEO	4216	4228	0.9
PVEM	4116	4128	1.0



Electrical Parts

Electrical Parts All Models - Miscellaneous

	Part Number	Description	Notes
	HC-18973	Coil H/S & Safety Valve	
8 E S	EL-27729	Block Contact N/O Block Only ZB2 BE101	2 switches shown
83.0	EL-27730	Block Contact N/C Block Only ZB2 BE102	2 switches shown
	EL-27728	Block Contact N/C C/W Collar ZA2 BZ102	Base for el-27729/30
	EL-27717	Switch Stayput 3 Pos Head Only Telemec	
	EL-27716	Switch Stayput 2 Pos Head Only Telemec	
	EL-27721	Stop Mushroom Latching Head Only Telemec	
	EL-18753	Joystick 155B421200 Danfoss Prop	
	EL-27723(1)	Lamp Panel Red ZA2 BV04	EL-27723 and EL-27726 fit together



	EL-27726(1)	Holder Lamp ZA2 BV6	EL-27723 and EL-27726 fit together. EL-27726 comes with EL-27369 included
	EL-27369(1)	Bulb 12V 4W Single Contact BA9s Base	EL-27369 fits into EL-27726
	EL-29272(1)	Bulb 24V 04W Single Contact BA9s Base	EL-29272 fits into EL-27726
	PU- 067632000	Cable Remote 24 Core	Used between cable remote and control box
	EL-27485	Relay 12V 5-pin Hella 3081	24V version is EL-27486
	EL-27483	Relay 12 V 4 Pin Hella 3079	24V version is EL-27484
	EL-27540	Connector Relay 4 & 5 Pin	
	EL-20429	Relay Finder 12 V DC 55.34	
(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	EL-27407	Insert 24 Way Female Phoenix	
(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	EL-27408	Insert 24 Way Male Phoenix	



	T		
COSSESSES	EL-27409	Hood 24 Way Single Latch Phoenix	
	EL-27410	Base Panel Mt 24 Way Sgl Latch Phoenix	Height = 30 Back entry only. Main control box
	EL-27706	Box Mount C/W Cable Entry 24 Pin	Height = 57 Side entry only. Trombone only - chassis mounted control box
6000 6000 6000 6000	EL-20430	Base Relay Finder 94.74	
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	EL-18751	Controller Flow EHF Danfoss 155U090500	
	EL-27648	Holder Fuse Blade 6 Way Hella 8721	
(IB)	EL-27429	Flasher Unit 12V 3P	
(3)	EL-27377	Cable 02 Core 0.75mm Auto	
(29/57/1H (652) (652)	EL-27567	Meter Hour Run 10-30V DC	
	EL-27466	Lamp Pilot Red Hella 2706	
	EL-27428	Lamp Clearance Front Hella 2066	
	EL-27467	Switch Push Pull Hella 2761	



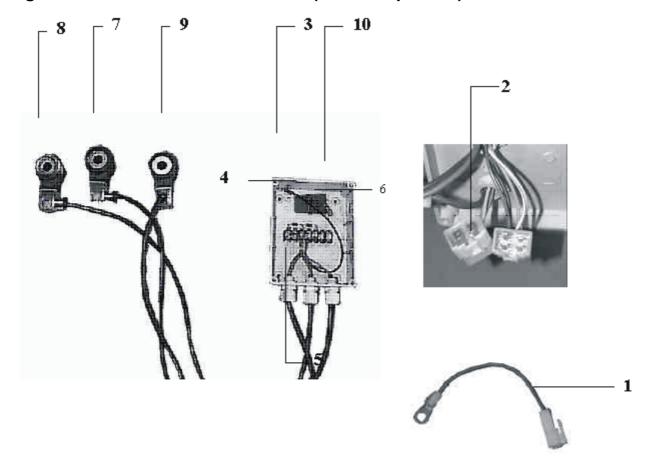
	EL-29674	Enclosure APO51 C/W Internal Steel Hinge	485 x 300 x 185
	EL-30888	Wire Fusible 21 Amp Kubota Engine	
	EL-27433	Wire Fusible 35 Amp Kubota Engine	
OI GI ST	KU-05712- 00408	Key	
OI SI SI	KU-05712- 00720	Key	
OF CALL	KU-15248- 63700	Key	
OFF CSL SS	KU-37410- 55150	Key	
(10568-F	EL-27465	Lamp Pilot Amber Hella 2704	
[0568-F]	EL-27464	Lamp Pilot Green Hella 2700	
[0568-F]	EL-27466	Lamp Pilot Red Hella 2706	
ANCORUM, O	EL-20424	Switch Hall Effect Module Lock	



	EL-27565	Timer 8 Pin 12 V DC Syrelec OCR-U	
ZCK-E64 ⊕	EL-27733	Plunger Head End Telemec	
	EL-27549	Switch Proximity P+F NJ15+u1+A	



Engine and Valve Plate Junction Box (with Dump - EEC)



Item	Part Number	Description	Qty
1	EL-30888	Fusible Link	1
2	EL-27495	Connector Plug	2
3	EL-27488	Enclosure	1
4	EL-27419	Diode	2
5	ELE 905	Gland	3
6	ELE 2394	Connector Bar	1
7	HC-18973	Dump Coil	1
8	HC-18973	High Speed Coil	1
9	HC-18973	Safety Coil	1
10	EL-27483	Relay	1



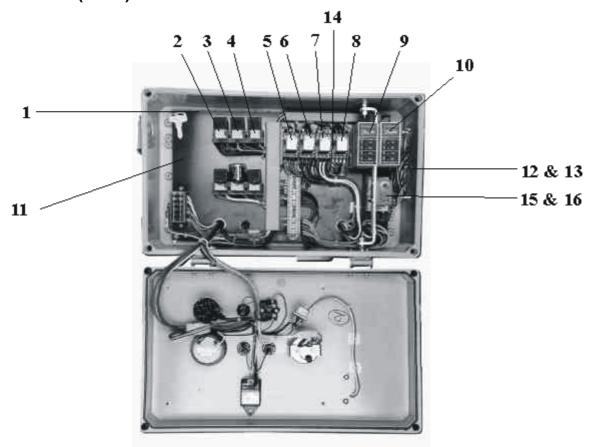


PCB Design

All SB402 machines and all SB360 machines from serial number SB8061 (excluding those with the CE system) have electrical control boxes which use a PCB design rather than a conventional wiring loom.

Electrical Control Boxes - All Other Models

Control Box (B Box) - Other Models



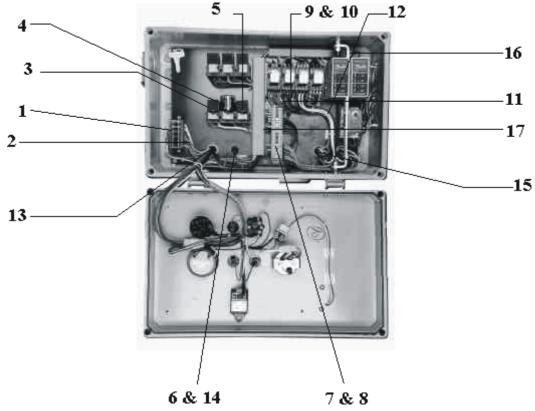
Item	Part Number	Description	Qty
1	25Y5W1	Connector Base	4
2	EL-27483	Battery Feed Relay	1
3	EL-27483	PVEM Relay	1
4	EL-27483	High Speed Relay	1
5	EL-20429	Mod. Trav. Relay	1
6	EL-20429	Stab. Func. Relay	1
7	EL-20429	Arm Func. Relay	1
8	EL-20429	EHF Relay	1
9	S3-22496	Mounting Bracket	1



10	EL-18751	Flow Controller	2
11	EL-29266	Gear Tray	1
12	EL-27408	Remote Connector	1
13	EL-27410	Mounting Base	1
14	EL-27418	Din Rail	1
15	EL-27565	Auto Idle Timer	1
16	EL-27566	Auto Idle Base	1



Control Box (B Box) - Other Models



Item	Part Number	Description	Qty
1	EL-27648	Fuse Box	1
2	ELE 910	Loom Conduit	1
3	EL-27485	Proximity Relay	1
4	EL-27429	Proximity Flasher	1
5	EL-27483	Worklamp Relay	1
6	EL-27376	2 Core Cable	1
7	EL-27402	Mini Strip Block	28
8	EL-27405	Mini Strip Rail	2
9	EL-27404	Strip End Covers	6
10	EL-27403	Strip End Holders	4
11	EL-27419	Diode	3
12	EL-29109	12 Core Cable	2
13	EL-27682	Gland	2
14	EL-27690	Gland	1
15	EL-27689	Gland	1
16	EL-27353	Ducting 15x15	
17	EL-27355	Ducting 25x25	



SMARTlift Spare Parts

This section contains spare parts for the SMARTlift Digital Control System.

SMARTlift Display Parts



Item	Part Number	Item Description	Qty
1	EL-32862	Display Graf - Syteco Time Clock Real	1
2	EL-32860	Controller ESX DIOS Module 8DO	1
3	EL-32858	Controller ESX 24V 1-4PWM 5-12PVG	2



SMARTlift Control Panel Parts - Power Pack

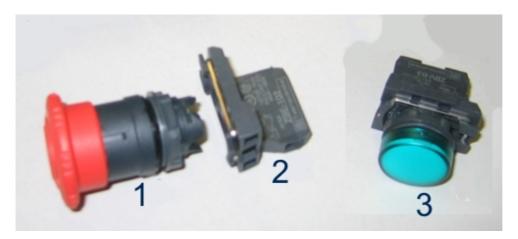


Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Item	Part Number	Item Description	Qty
1	EL-32875	Switch, Starter Diesel Pre-Heating	1
2	EL-31612	Lamp Indicator LED Amber	1
3	EL-31610	Lamp Indicator LED Green	1
4	EL-31080	Stop M/Room Latching Head Only ZB5-AS54	1
5	EL-31087	Block Contact N/C C/W Collar ZB5-AZ102	1



SMARTlift Control Panel Parts - PTO



Item	Part Number	Item Description	Qty
1	EL-31080	Stop M/Room Latching Head Only ZB5-AS54	1
2	EL-31087	Block Contact N/C C/W Collar ZB5-AZ102	1
3	EL-31610	Lamp Indicator LED Green	1



SMARTlift Remote Parts



Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Item	Part Number	Item Description	Qty
1	EL-32926	Remote Radio SMARTlift Canbus	1
1.1	EL-32903	Battery, rechargeable	1
1.2	Not available separately	Battery recharger	
1.3	Not available separately	SMARTlift Radio Receiver	
1.4	EL-35712	SMARTlift Receiver Plug	1
1.5	EL-36328	Joystick	2
1.6	EL-36715	Knob, Mode selection	1
1.7	EL-36714	Knob, Two-position selector	1
1.8	EL-36710	Knob, E-Stop	1
2	EL-35603	Antenna Gainflex	1
2.1	EL-35602	Extension Antenna TNC-TNC 1.0m Unit	1



SMARTlift Lamps



Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Item	Part Number	Item Description	Qty	Notes
1	EL-31984	Lamp LED Red, Stop, Tail	1	
2	EL-33298	Lamp Work FF Flood 12V/35W H. 1533	1	
	EL-27714	24V/55W Bulb	1	for 24V units only



SMARTlift Relay Spare Parts





Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Item	Part Number	Item Description	Qty	Notes
1	EL-32866	Relay 12V DC Safety Duelco NST-3	1	24V version is EL-34588
2	EL-32868	Voltmeter EMV 1200	1	
2.1	EL-33680	Cover Toggle Switch 1/4-40UNS	1	
2.2	EL-32869	Switch Toggle	1	
3	EL-35724	Diode SMARTlift 70A	1	
4	EL-27434	Gland		
5	EL-33852	Relay 12V Changeover With Diode Hella	1	24V version is EL-36429
6	EL-33851	Relay 12V 4-Pin With Diode Hella 3053	6	24V version is EL-34589
7	EL-37487	Relay 12V E-stop Tyco	1	24V version is EL-37490
8	EL-37489	Clip for Tyco Relay	1	



SMARTlift Bending Leg Parts

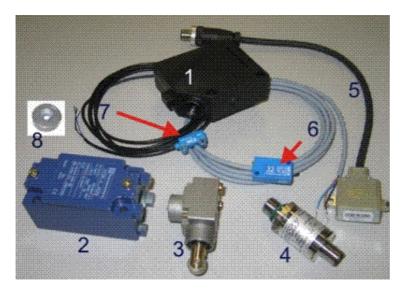


Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Item	Part Number	Item Description	Qty	Notes
1	EL-34810	Cable PUR M12 Female Straight 10M rear	2	
2	EL-35642	Cable PUR M12 Male 5-Core Straight 5.0m	2	
3	EL-35135	Sensor Inductiv 6mm range IQ10-06NPS- KT1	2	
4	EL-35638	Sensor Inductive 4mm Range IM12- 04NPPZC1	1	(instead of EL-32278 and EL- 37699 on standard unit)
5	EL-35136	Sensor Inductiv35mm range IQ40-20BPP-KCK	2	
6	EL-35186	Cable PUR M8 Female Straight 10M	2	

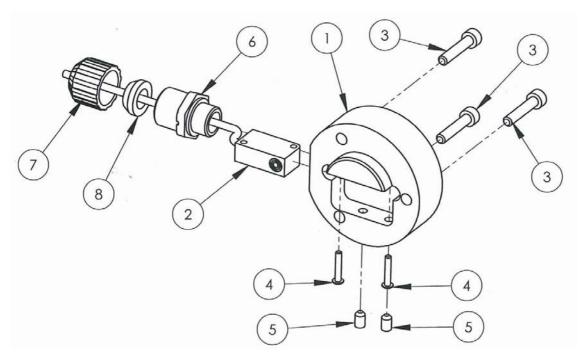


SMARTlift Sensor Parts



Item	Part Number	Item Description	Qty	Notes
1	EL-22723	Switch Photo Sensor	1	
2	EL-27734	Body Lim Switch 1 X N/C 1 X N/O Telemec	2	
3	EL-33684	Plunger Head End Telemec ZCK E65	2	
4	EL-32278	Sensor Pressure A09 Incl Damping Element	2	Not on bending leg unit
5	EL-37699	Sensor Inclinometer VTI 2-Axis M12 Plug	2	Not on bending leg unit
6	EL-32920	Sensor Magnetic Proximity	4	
7	EL-32919	Sensor Optical Proximity	2	Not in use on units from SB7952 onwards
8	EL-32921	Magnet MAG-2006-B (M3.0)	6	
9	EL-37327	Magnetic Encoder Strip Assembly	2	Not shown
	EL-33274	Strip Encoder Cas Stab Extn 31 teeth		Not shown
	FA-33662	Screw Sckt CSK M5x20 2P (used on EL33274)		Not shown



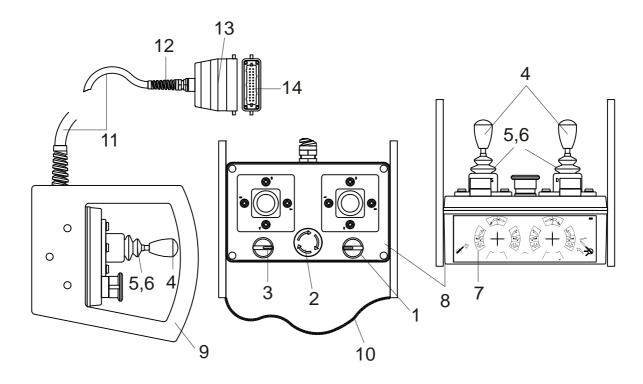


Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Item	Part Number	Item Description	Qty	Notes
1	EL-33898	Mount Magnetic Sensor SMARTlift	1	
2	EL-32920	Sensor Magnetic Proximity	1	(EL-33269)
	EL-32919	Sensor Optical Proximity		(EL-33270)
3	FA-28693	Screw Socket Cap Gr 12.9 M5x25 ZP	3	
4	FA-33272	Screw Socket Button Head M3x16 ZP	2	(EL-33269)
	FA-33271	Screw Socket Button Head M3x12 ZP		(EL-33270)
5	FA-33273	Screw Socket Grub M5x08 ZP	2	
6	EL-27576	Connector Conduit Straight 10mm 831001	1	
7	EL-27578	Nut Conduit 10mm Type 831044	1	
8	EL-27579	Seal Ring Conduit 10mm Type 831055	1	



Cable Remote Control Parts SB330/SB360



Item	Part Number	Description	Qty
	EL-21629	Remote Control - whole assembly	1
1	EL-31078	Mode Select Switch	1
2	EL-31080	Emergency Stop	1
3	EL-31077	High Speed Switch	1
4	EL-18753	Joystick	2
5	EL-19054	Joystick Boot	2
6	EL-18823	Boot Shield	2
7	DE-21229	Decal	1
8	EL-27697	Enclosure	1
9	EL-21479	Safety Frame	2
10	EL-21535	Carry Strap	1
11	EL-33483	Remote Cable	10M
12	EL-27676	20mm Spiral Gland	2
13	EL-27409	Gland Reducer	1
14	EL-27407	24 Pin Female Plug	1
15	EL-31089	Contact Block, NC (not shown)	4
16	EL-31088	Contact Block, NO (not shown)	4
17	EL-31087	Contact Block Collar, NC (not shown)	
18	EL-31247	Auto Cable, Blue (not shown)	
19	EL-31248	Auto Cable, Brown (not shown)	
20	EL-31252	Auto Cable, Red (not shown)	



Cable Pendant Spare Parts

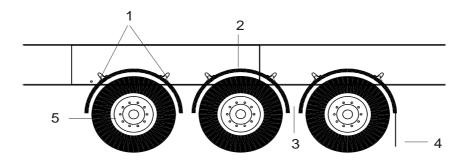


Item	Part Number	Description
1	EL-32657	XACA271 General Purpose 2 button Cable Pendant
2	EL-36260	Emergency Stop Button Protective Guard
3	EL-36258	Emergency Stop Button Switch (internal)
4	EL-36259	Emergency Stop Button Head



Mudguard Parts - all models

Wheels and Mudguards



Item	Description
1	Mudguard Bracket
2	Mudguard
3	Joiner
4	Mudflap
5	Wheel Steel

Mudguard Brackets

Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Item	Part Number	Description
1	MU-30569	Bolt-on, Pressed Type
2	MU-33668	Poles, 700mm
3	MU-29917	Weld-on, Plastic
4	MU-30568	Bolt-on, Aluminium

Mudguard

Item	Part Number	Description
1	MU-29210	Truckmate, Red
2	MU-31930	Truckmate, Silver
3	MU-29205	Truckmate, Black
4	MU-29209	Truckmate, Dark Blue
5	MU-29188	Low Profile, Red
6	MU-29197	S/Steer Low Profile, Red
7	MU-27096	Low Profile, Black
8	MU-27109	S/Steer Low Profile, Black



Item	Part Number	Description
9	MU-27098	Low Profile, Grey
10	MU-31597	Parlok, Black SS
11	MU-27113	Standard Black
12	MU-29199	Standard White
13	MU-27114	Standard Blue
14	MU-14192	Alloy Low Profile

Mudflap

Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

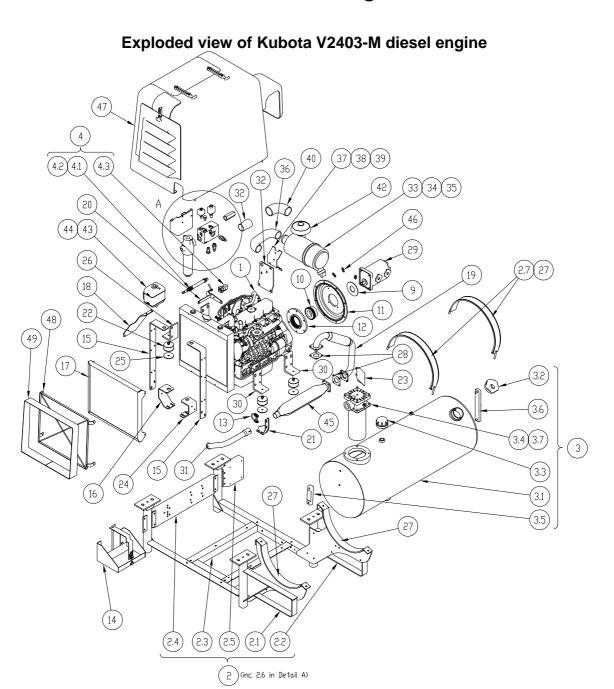
Item	Part Number	Description
1	MU-29918	Plastic Single
2	MU-32200	Plastic NZ
3	MU-32201	Plastic Full

Joiner

Item	Part Number	Description
1	MU-33743	100 Long
2	MU-33745	600 Wide, 340 Long
3	MU-33746	600 Wide, 430 Long

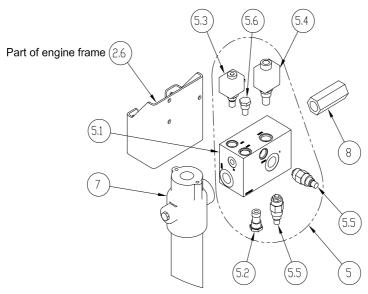


Power Pack - Kubota V2403-M Diesel Engine



Detail A





Main BOM (V2403)

Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Table 1: Main BOM

Item	Part Number	Description	Qty	UoM	Notes
1	KU-V2403-M-E3B-KEA- 2	Engine Kubota 2.4l	1	EA	
2		Frame Engine Assy	1	EA	See Table 2
3		Tank Assy	1	EA	See Table 3
4	PM-37971	Kit Throttle Ctrl	1	EA	
4.1	PM-38751	Cylinder Pneu	1	EA	
4.2	PM-31514	Rod End Spherical M8	1	EA	
4.3	PM-38750	Valve Throttle Stop Control	1	EA	
5	HC-32188	Valve Safety Highspeed Combination	1	EA	
5.1	HC-32480	Manifold Highspeed Unloader	1	EA	
5.2	HC-31971	Cartridge Check Valve	1	EA	
5.3	HC-31968	Cartridge Direction Control Valve	1	EA	
5.4	HC-31969	Cartridge TDirection Control Valve	1	EA	
5.5	HC-31970	Cartridge Relief Valve	2	EA	
5.6	HC-31977	Plug Cavity Type	1	EA	
7	HC-18740	Filter Pressure Line	1	EA	
8	HC-20799	Valve Check 3/4 In Line	1	EA	
9	HC-37091	Disk Pump Location	1	EA	
10	HC-37092	Hub Pump Group 3 Tapered	1	EA	
11	HC-37969	Bell Housing	1	EA	
12	HC-37970	Adaptor Flywheel	1	EA	
13	S1-30637	Clamp Exhaust 44mm	1	EA	
14	S1-32779	Battery Box	1	EA	



15	S1-38741	Bracket Upper Radiator	2	EA	
16	S1-37973	Bracket Lower Radiator	1	EA	
17	S1-37974	Screen Radiator	1	EA	Centre Mount Engines only
18	S1-37975	Bracket Eng Coolant O/flow Tank	1	EA	,
19	S1-37976	Exhaust Pipe	1	EA	
20	S1-37977	Bracket Assy Throttle Ctrl Mnt	1	EA	
21	S1-37994	Bracket Exhaust Clamp Mount	1	EA	
22	S1-37996	Mount Engine Rubber	4	EA	
23	S1-37999	Bracket Exhaust Manifold Mount	1	EA	
24	S1-38013	Bracket Lower Radiator	1	EA	
25	S1-38032	Packer Engine Mount	4	EA	
26	S1-38081	Mount Engine	3	MT	3m per tank
27	TA-18120	Rubber Tank Bracket	2	EA	
28	KU-T0070-16420	Gasket	2	EA	
29	HC-31472	Pump Tandem	1	EA	replaces HC- 18864 and HC- 26131
	HC-33515	Pump Single	1	EA	SB121M Only
30	S1-02682	Mount Engine	3	EA	
31	S1-27103	Exhaust Pipe Extension	1	EA	Centre Mount Engines only
	S1-31030	Exhaust Pipe Extension	1	EA	Side Mount Engines only
32- 42		Air Cleaner Items	1	EA	See Table 4
43	KU-15501-72404	Coolant Tank	1	EA	
44	KU-15521-72462	Bracket Mount Coolant Tank	1	EA	
45	KU-19077-12110	Muffler	1	EA	
46	S1-37549	Link Tie	4	EA	
47	S1-25781	Cover Engine Fibreglass (Cold Climate)	1	EA	Side Mount Engines only. (Louvered radiator panel)
	S1-38484	Cover Engine Fibreglass	1	EA	Side Mount Engines only. (Mesh radiator panel)
48	S1-38052	Frame Radiator Shroud	1	EA	Side Mount Engines only
49	S1-38073	Shroud Rubber Radiator	1	EA	Side Mount Engines only





Engine Frames

Figure 2.1: Engine Frame Assy Mid Mount Standard

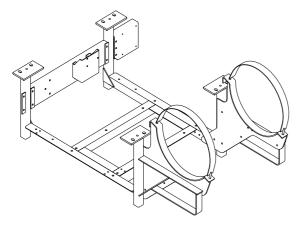


Figure 2.2: Engine Frame Assy Mid Mount SB330G

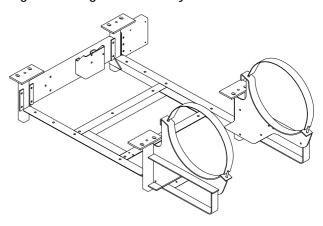
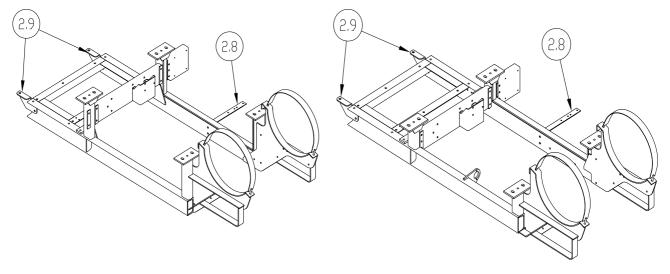


Figure 2.3: Engine Frame Assy Side Mount Standard

Figure 2.4: Engine Frame Assy Side Mount Trombone





Engine Frames

Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Table 2: Engine Frames

				Fig 2.1	Fig 2.2	Fig 2.3	Fig 2.4
				Mid Mount Standard	Mid Mount SB330G	Side Mount Standard	Side Mount Trombone
Item	Description	Qty	UoM		Part No		
2	Frame Engine Assy	1	EA	S1-31023	S1-32667	S1-33667	S1-36164
2.1	Frame Side RH	1	EA	S1-32776R	S1-33037R	S1-33686	S1-36165
2.2	Frame Side LH	1	EA	S1-32776L	S1-33037L	S1-33687	S1-36166
2.3	Base Frame	1	EA	S1-32777	S1-32777	S1-32777	S1-32777
2.4	Bracket Manifold		EA	S1-32780	S1-32780	S1-32780	S1-32780
2.5	Bracket Junction Box Mount	1	EA	S1-32781	S1-32781	S1-32781	S1-32781
2.6	Pressing Manifold Block Spacer	1	EA	S1-33039	S1-33039	S1-33039	S1-33039
2.7	Strap Tank	2	EA	S1-16291	S1-16291	S1-16291	S1-16291
2.8	Bracket Hoses Support	1	EA	n/a	n/a	S1-33778	S1-33778
2.9	Bracket Cover Mount	2	EA	n/a	n/a	S1-33688	S1-33688
2.10	Angle Assy LH	1	EA	n/a	n/a	n/a	n/a
2.11	Angle Assy RH	1	EA	n/a	n/a	n/a	n/a



Engine Frames - SB121M

Figure 2.5: Engine Frame Assy Mid Mount SB121M

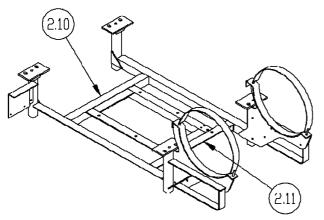


Fig 2.5 Engine Frame Assy Mid Mount SB121M

Engine Frames - SB121M

Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Table 2: Engine Frames

				Fig 2.5
				Mid Mount SB121M
Item	Description	Qty	UoM	Part Number
2	Frame Engine Assy	1	EA	S1-33485
2.1	Frame Side RH	1	EA	S1-33486
2.2	Frame Side LH	1	EA	S1-33487
2.3	Base Frame	1	EA	S1-32777
2.4	Bracket Manifold		EA	n/a
2.5	Bracket Junction Box Mount	1	EA	S1-32781
2.6	Pressing Manifold Block Spacer	1	EA	n/a
2.7	Strap Tank	2	EA	S1-16291
2.8	Bracket Hoses Support	1	EA	n/a
2.9	Bracket Cover Mount	2	EA	n/a
2.10	Angle Assy LH	1	EA	S1-38228
2.11	Angle Assy RH	1	EA	S1-38225





Tank Assembly

Table 3.1: Tank Assy Standard

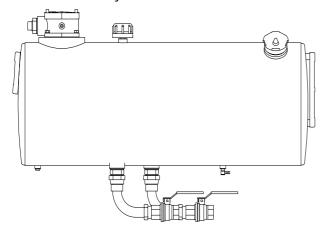


Table 3.2: Tank Assy 10' Position

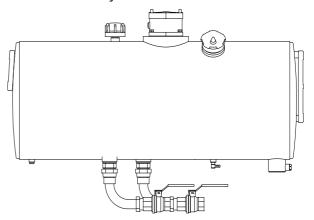
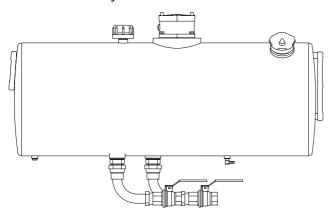


Table 3.3: Tank Assy Trombone





Tank Assembly

Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Table 3: Tank Assembly

				Fig 3.1	Fig 3.2	Fig 3.3
				Tank Assy Standard	Tank Assy 10' Position	Tank Assy Trombone
Item	Description	Qty	UoM		Part Number	
3	Tank Assy	1	EΑ	S1-38275	S1-38290	S1-38293
3.1	Tank Alloy Combination Oil/Fuel	1	EA	HC-37978	HC-38015	HC-38291
3.2	Cap Tank Hydraulic Alloy Lockable	1	EA	HC-32649	HC-32649	HC-32649
3.3	Breather Oil Tank	1	EΑ	HC-19063	HC-19063	HC-19063
3.4	Filter Assy Hyd Oil Tank Low Pressure	1	EA	HC-18954	HC-18954	HC-18954
3.5	Gauge Sight Oil 5 Inch M12	1	EA	HC-26250	HC-26250	HC-26250
3.6	Gauge Sight Fuel 10 Inch M12	1	EA	HC-26251	HC-26251	HC-26251
3.7	Element Filter Hyd Oil Tank		EA	HC-18955	HC-18955	HC-18955



Air Cleaners

Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Table 4: Air Cleaners

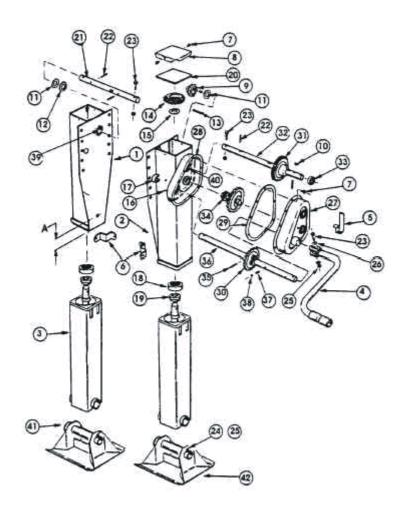
				Dual Element Filter (Plastic Body) on Side Mount Engine	Dual Element Filter (Plastic Body) on Mid Mount Engine	Single Element Filter (Metal Body) on Side Mount Engine	Single Element Filter (Metal Body) on Mid Mount Engine	
Item	Description	Qty	UoM		Part Nu	ımber		Notes
32	Bracket Mounting Air Cleaner	1	EA	n/a	S1-19903	n/a	S1-19903	
33	Air Cleaner Body	1	EA	S1-37296	S1-37296	KU-15606- 11013	KU-15606- 11013	
34	Element Filter Air Main (Outer)	1	EA	S1-37298	S1-37298	KU-15606- 11080	KU-15606- 11080	
35	Element Filter Air Safety (Inner)		EA	S1-37299	S1-37299	n/a	n/a	
36	Pipe Air Intake	1	EA	KU-16662- 11662	KU-16662- 11662	KU-16662- 11662	KU-16662- 11662	1
37	Support Air Cleaner	1	EA	KU-38430- 13942	KU-38430- 13942	KU-38430- 13942	KU-38430- 13942	
38	Cushion Rubber Air Cleaner Support	2	EA	KU-38430- 13972	KU-38430- 13972	KU-38430- 13972	KU-38430- 13972	
39	Strap Rubber Air Cleaner Retainer	2	EA	KU-38430- 13983	KU-38430- 13983	KU-38430- 13983	KU-38430- 13983	
40	Elbow 2.5 Inch 90 Degree	1	EA	S1-37297	n/a	S1-37297	n/a	
41	Reducer Exhaust 65mm- 57mm	1	EA	S1-37247	n/a	S1-37248	n/a	
42	Hood Inlet Air Cleaner	1	EA	S1-38752	S1-38752	S1-38752	S1-38752	2

NOTES:

- 1 May require cutting in accordance with Service Information K0002 to suit air cleaner arrangement
- 2 Part of KU-15606-11013



Landing Legs - Fuwa



Note: Please provide the Serial Number of the Sidelifter with all spare parts orders.

Item	Part Number	Description	Qty
1	FW-285001	Upper Housing LH	1
2	FW-285002	Upper Housing RH	1
3	FW-285003	Retracting Tube	2
4	FW-200001	Universal Crank	1
5	FW-200002	Crank Hanger	1
6	FW-200003	Strut Bracket	2
7	FW-240001	Screw	11
8	FW-200004	Cover	2
9	FW-220001	Pinion	2
10	FW-220002	Woodruff key	3
11	FW-240002	Thrust Washer	2
12	FW-240003	Thrust Washer LH	1
13	FW-240004	Groove Pin	2
14	FW-220003	Bevel Gear	2
15	FW240005	Washer	2

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16	FW240006	Grease Fitting	5
17	FW200016	Shift Shaft Support	1
18	FW220004	Thrust Bearing	2
19	FW200005	Collar	2
20	FW220005	Cover Gasket	2
21	FW200006	Jack Shaft LH	1
22	FW240007	Roll Pin	4
23	FW240008	Bolt	3
24	FW240009	Locking Nut	5
25	FW240010	Hex Bolt	2
26	FW240011	Flat Washer	2
27	FW200007	Gearbox Half Outside	1
28	FW200008	Gearbox Half Inside	1
29	FW220006	Gasket	1
30	FW220007	Input Gear	1
31	FW220008	Output Gear	1
32	FW200009	Jack Shaft RH	1
33	FW200010	Spacer Bushing	1
33	FW220009	Idler Gear	1
34	FW240012	Groove Pin	1
36	FW200011	Shift Shaft	1
37	FW240013	Shift Lock Spring	1
38	FW240014	Shift Lock Ball	1
39	FW200012	Bushing	2
40	FW200013	Step Boss	1
41	FW200014	Shoe Axle	2
42	FW200015	Shoe	2

Remote Control



Operating Instructions

Original Operating Instructions

eco

AOEM1G33







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Pictographs



Danger due to electrical voltage. Touching live parts inside the unit can be fatal or cause serious injuries.



Instructions for occupational health and safety. Not following these instructions can cause accidents, which can cause damage, serious injuries or even death.



Important information about the operation of the radio system

Manufacturer:

HBC-radiomatic GmbH • Haller Straße 45 – 53 • 74564 Crailsheim • Germany • Tel. +49 7951 393-0 • info@radiomatic.com. HBC.radiomatic GmbH is not liable for any misprints or errors! - Specifications and design subject to change without notice. ® radiomatic and radiobus are registered German trademarks. © 01 / 2010, HBC-radiomatic GmbH, 74564 Crailsheim, Germany

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Safety Instructions

Read through these operating instructions carefully before working with the radio system. This applies in particular to the installation, commissioning and maintenance of the radio system.

The operating instructions are a constituent part of the radio control system and must always be kept close at hand for the responsible personnel.

The term 'machine' is used in the operating instructions for the different possible uses of the radio system.

Intended Use

- The radio system serves to control machines and for data transfer. Observe the job safety and accident prevention regulations applicable to each application.
- The intended use also includes reading the operating instructions and adhering to all safety information contained therein.
- The radio system must not be used in areas where there is a risk of explosion, nor for the control of
 machines used to convey persons, unless it is explicitly approved by the manufacturer for these
 uses.
- Modifications to the radio system may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. All modifications must be documented at the factory in the radio control master file.
- The radio control system safety devices must not be modified, removed or bypassed. In particular, modifications to any part of the radio system's complete emergency-stop system are impermissible.

Safety Instructions for Installation and Operation

- The electrical connection per the accompanying output wiring diagram must be established by a qualified electrician exclusively.
- The receiver may only be opened by trained personnel. Components inside the receiver can be energized at life-threatening voltages. The supply voltage for the machine must be deactivated before the receiver is opened.
- Please also note with radio systems, that the presence of persons in the danger zone in particular beneath the load (cranes!) is prohibited in every instance.
- Select a safe location for radio control, from which you have a good and complete view of the working movements of the machine, the load movements and the surrounding working conditions.
- It is not permissible to put a radio transmitter unattended to one side whilst activated. Always switch the radio transmitter off when it is not required. This applies in particular if you change location, when working without radio control, during breaks and at the end of work. Always safeguard the radio transmitter against use by unauthorized persons, for example by locking it away.
- In the event of an emergency and with all faults, switch the radio transmitter off immediately by pressing the STOP switch.
- Only operate the radio system when it is in perfect working order. Faults and defects that could
 influence safety must be rectified before the system is put back into operation, by specialists who
 have been trained and authorized by HBC-radiomatic.
- Note that the operational directions of the operating elements may appear inverted depending on location and viewing angle to the machine. This applies in particular to rotary cranes, if your location changes from inside to outside the radius of the crane. The operator must make himself familiar with the directional markings on the machine before the start of work.
- Repairs may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. Use original replacement parts and accessories (e.g. rechargeable batteries) exclusively; otherwise it is possible that the equipment safety can no longer be guaranteed and our extended warranty will be voided.
- Remain vigilant when working with the radio system and familiarize yourself with its functions. This applies in particular if you are working with it for the first time or if you work with it only occasionally.
- Check each time before starting work the function of the STOP switch.
 When you press the STOP switch with the transmitter on, the status LED of the transmitter has to go out. If the status LED does not go out then you have to disable the radio control system immediately. Remove the battery and the radiomatic[®] iON from the transmitter and inform a service technician.



Operation

The transmitter is equipped with an electronic radiomatic[®] iON key. radiomatic[®] iON contains all the data required for operating the transmitter. Operation is not possible without radiomatic[®] iON!

Depending on the version the radiomatic[®] iON can also be used for operation of replacement transmitters of identical construction.

In the event of an interruption of the radio link during a working cycle – what can occasionally happen – both transmitter and receiver automatically shut down (so-called "compulsory switch-off").

To reactivate the system release all operator controls and allow the control elements to return to their zero position. After that the machine can react again to control commands. This feature hinders any uncontrolled or unwanted machine movement, should the radio link be interrupted.



Note:

If the machine is equipped with a main contactor you must actuate the start button before the machine can react again to control commands.

Activating the Transmitter

- 1. Insert a charged battery into the battery compartment.
- 2. Turn the STOP switch to unlock.
- 3. Actuate the start button.
 When the status LED flashes green, the transmitter is ready to operate.



Caution:

Before starting work always trigger the acoustic signal. This warns all colleagues that the machine is about to move.

Deactivating the Transmitter

Press the STOP switch.



Note:

Replace the battery when the status LED in the transmitter flashes red and an acoustic signal sounds. Otherwise, the transmitter will switch off in a few minutes. Recharge the empty battery in the respective charger.

Automatic Switch-OFF (APO Function)

For safety reasons we have equipped the transmitter with an automatic switch-OFF (APO function). The transmitter is automatically put out of circuit after approx. 15 minutes of non-use.

The automatic switch-OFF also saves battery power.

After an automatic switch-Off you must reactivate the transmitter by means of the start button.



Caution:

The automatic switch-OFF does not relieve the operator of his responsibility to turn off the transmitter with the STOP switch when not in use.



Battery and Battery Charger

NiMH Battery

The battery capacity depends on the age of the battery and the ambient temperature. Older batteries lose their capacity over time. The battery capacity diminishes more quickly at temperatures below 0 $^{\circ}$ C (32 $^{\circ}$ F) and above 40 $^{\circ}$ C (104 $^{\circ}$ F).



Note:

- Charge the battery fully before initial use and/or after storing for longer than 6 months. When doing so note that the battery will only reach its full capacity after 3 5 charge cycles (complete charging and discharging)
- Use only the associated HBC charger to charge the battery
- Charge the battery at an ambient temperature of 0 40 °C (32 104 °F).
- Recharge the battery only when the status LED on the transmitter flashes red and the acoustic signal sounds.
- Charge the battery fully before storing it for a prolonged period. Otherwise total discharge may occur.
- Always store rechargeable batteries at room temperature.
- · Protect the battery from short circuits and always store it in the protective cover provided.

When handled properly the battery can exceed 500 charging cycles

Battery Charger

Depending on customer selection, an AC or DC charger is available.



Ensure that you observe the following instructions:

- Use this charger only to charge the batteries specified on the type plate.
- The charger may not be used in hazardous areas.
- The charger has to be operated with the voltage indicated on the back.
- The charger has to be used in vehicles or indoors only.
- Use the charger only within the specified temperature range.
- Protect the charger against heat, dust and humidity.
- Do not cover the charger while it is in use.
- Disconnect the charger from the power supply when it is not in use.
- In case of any fault of the charger or the connecting cable disconnect it immediately and put it out of operation.
- Do not make technical changes to the charger or the connecting cable.
- Defects must be repaired by qualified personnel only.

Three LEDs indicate the actual operating state of the battery.

LED green: Illuminates when battery is charged.

LED orange: Illuminates when battery is charging.

LED red: Illuminates when battery is deep discharged or defective.



Note:

If a deep discharged battery is inserted into the charger, the red LED will illuminate for a few seconds before charging is started (LED orange illuminates).



QA109600 / QD109300 / QD309300 with EC Type-Approval

The charger is supplied with a connecting cable with a matching power plug.

Charging the battery:

- 1. Connect the charger via the connecting cable to the power supply.
- 2. Before charging a FuB 9 NM or BA2220_ battery it is required to insert the adapter supplied into the compartment of the charger.
- 3. Insert the battery in to the compartment.

Charging will start automatically.

Technical Data			
Operating voltage	100 – 240 V AC (QA109600)		
	10 - 30 V DC (QD109300 / QD309300)		
Charging time	1 – 2 h		
Operating temperature	10 – 40 °C (50 – 104 °F)		
Housing material	Plastic		
Protection class	II		



Options

The availability of the following functions depends on the design and configuration of your radio control system.

Safety Features

The safety features enable a quick shut-down of the radio control in specific emergency situations. Therefore, these intelligent functions prevent a dangerous unintended command from being given to the crane or machine.

radiomatic® shock-off can trigger a quick automatic shut-down of the radio control in case of an impact to the transmitter – e. g. if the transmitter is being hit by a massive object thereby getting out of control.

radiomatic® roll-detect can automatically detect rolling of the transmitter and, in this case, initiate a quick shut-down of the radio control.

radiomatic® **zero-g** can automatically detect if the transmitter is dropped or being thrown to another user. In such cases, zero-g can trigger a quick automatic shutdown of the transmitter.

inclination switch can deactivate the transmitter, if it exceeds an inclination angle of approx. $130^{\circ} - 170^{\circ}$ for a certain time and/or if it is placed front side down.

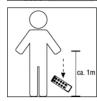
When the transmitter was shut down with radiomatic® shock-off/roll-detect/zero-g or inclination switch, the start button has to be activated until the status LED flashes green. Then the transmitter is ready to operate again.

 \triangle

The safety features do not relieve the operator of his responsibility to turn off the transmitter with the STOP switch when not in use.











Frequency Selection

Fixed Frequency

If the identification plate in the battery compartment of the transmitter shows a frequency value (e.g. 433,500 MHz), the transmitter operates with a fixed frequency.

Please contact you service department if the frequency has to be changed because the frequency channel is already assigned to another operator.

Frequency Selection via Scanner

Transmitter and receiver are equipped with four frequencies (refer to wiring diagrams).

If the frequency channel is occupied, you can switch to another frequency channel by using the rotary switch on the transmitter. The scanner in the receiver automatically resets the transmitter to the new frequency selected within one second.

Manual Frequency Switching

If the identification plate in the battery compartment of the transmitter shows the label man, the transmitter features manual frequency switching.

This function can be used to change the frequency channel during radio operation.

Actuate the start button until an acoustic signal sounds. Then release the button.

Please contact your service department if all available frequencies are occupied.

radiomatic® AFS

If the identification plate in the battery compartment of the transmitter shows the label AFS, the transmitter is equipped with radiomatic[®] AFS (Automatic Frequency Selection).

When activating the transmitter radiomatic[®] AFS will check if the present frequency channel is free. If the

frequency channel is occupied, the system automatically finds and saves a free frequency channel.

If the frequency channel currently in use is occupied by another radio control system, you must switch the transmitter off and on again in order to allow radiomatic® AFS to switch to a free frequency channel. The radiomatic® AFS option also includes the manual frequency switching function.



Note:

If radiomatic® AFS is to perform optimally, all the other radio systems in the immediate working environment (e.g. the factory hall or building site) should be switched on before starting to use the radio system for the first time. This allows radiomatic[®] AFS to detect automatically which radio channels are already being used in the working area, and thereby to choose a suitable free channel for its own use.

In addition, when switching the radio system on for the first time, the user should make sure that his distance from the radio receiver and from the machine is a realistic reflection of the working situation.

radiomatic[®] AFM

If the identification plate in the battery compartment of the transmitter shows the label AFM the transmitter is equipped with radiomatic® AFM (Automatic Frequency Management).

radiomatic® AFM detects available frequency channels constantly. If the frequency channel currently in use is occupied by another radio control system, radiomatic® AFM switches automatically to a free frequency channel.



Catch-Release

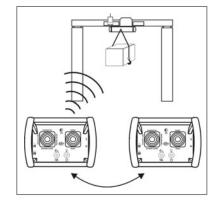
Via the Catch-Release option two or more transmitters can control a machine alternately.

When the receiver is switched on, the machine can initially be controlled via any associated transmitter. Once the receiver was taken over by one transmitter, the other transmitters no longer have access.

Take over machine

- 1. Switch the transmitter on.
- 2. Enter the "Catch" command on the transmitter and actuate the start button.

The access rights for the machine remain with that transmitter until the "Release" command is issued by that transmitter.



Release machine

- 1. Enter the "Release" command on the transmitter.
- 2. Switch the transmitter off.

The access rights for the machine are cancelled. Machine control can be taken over by another transmitter.

Operating Example:

Transmitter 1 has taken over the machine. Transmitter 2 is to be given control.

- 1. Enter the "Release" command on transmitter 1.
- 2. Switch transmitter 1 off.
- 3. Switch transmitter 2 on.
- 4. Enter the "Catch" command on transmitter 2 and actuate the start button.

Transmitter 2 now has sole access to all machine functions.



Notes:

- If a receiver has already been adopted by a transmitter can be displayed via a lamp on the machine.
- If the operating voltage of the receiver fails, the receiver returns to the starting condition in which it can be adopted by any transmitter. If necessary, the receiver must be adopted anew.
- If the transmitter is deactivated without the command "Release" having been issued, the other transmitters have no access to the receiver. The starting condition described above can only be resumed by deactivating the operating voltage at the receiver.



Tandem Operation

Tandem Operation T1

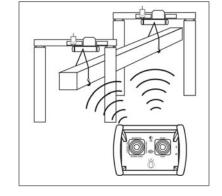
The radio system consists of 1 transmitter and 2 receivers for 2 machines. The transmitter can control the machines individually or in parallel

The machines are selected at the transmitter via a rotary switch:

A only machine A

A+B machine A + machine B

B only machine B



Tandem Operation T2

The radio system consists of 2 transmitters and 2 receivers for 2 machines. Both transmitters are master transmitters and can control the machines individually or in parallel.

During normal operation transmitter 1 controls machine A and transmitter 2 controls machine B. In order to be able to switch to machine B or A+B at transmitter 1, for example, the key must be removed from transmitter 2 and inserted in transmitter 1.

The machines are selected at the transmitter via a rotary switch:

A only machine A

A+B machine A + machine B

B only machine B

Operating Example: Control of machine A + B via transmitter 1.

- 1. Switch transmitter 1 and 2 off and remove the key from transmitter 2.
- Insert the key from transmitter 2 in transmitter 1.
 Machine selection via transmitter 1 is activated.
- 3. Turn the rotary switch of transmitter 1 to A+B.
- 4. Switch transmitter 1 on and actuate the start button.

The radio system now operates in tandem mode.

Tandem Operation TM/TS

The radio system consists of 2 transmitters and 2 receivers for 2 machines. One transmitter is a master transmitter and can control the machines individually or in parallel. The other transmitter is a slave transmitter and can only control machine B.

In order to be able to switch to machine B or A+B at the master transmitter, the key must be removed from the slave transmitter and inserted in the master transmitter.

The machines are selected at the transmitter via a rotary switch:

A only machine A

A+B machine A + machine B

B only machine B

Operating Example: Control of machine A + B via master transmitter.

- 1. Switch master and slave transmitter off and remove the key from slave transmitter.
- 2. Insert the key from slave transmitter in master transmitter. Machine selection via master transmitter is activated.
- 3. Turn the rotary switch of master transmitter to A+B.
- 4. Switch master transmitter on and actuate the start button.

The radio system now operates in tandem mode.



Catch-Release-Tandem Operation

With the Catch-Release-Tandem Operation two or more transmitters can control several machines alternately.

Each machine is equipped with a receiver that can receiver and monitor all transmitter frequencies.

After activating the receivers all transmitters have equal access to the radio control system.

Take over machine

- 1. Switch the transmitter on.
- 2. Turn rotary switch on the transmitter to the respective position.
- 3. Enter the "Catch" command on the transmitter and actuate the start button.

The transmitter with control over the machine(s) retains the access to the receiver until the operator has issued the "Release" command.

Release machine

- 1. Enter the "Release" command on the transmitter.
- 2. Switch the transmitter off.

The access rights for the machine(s) are cancelled. Machine control can be taken over by another transmitter.

Operating Example:

Transmitter 1 has taken over machine A. Transmitter 2 is to be given control over machine A+B.

- 1. Enter the "Release" command on transmitter 1.
- 2. Switch transmitter 1 off.
- 3. Switch transmitter 2 on.
- 4. Turn rotary switch on transmitter 2 to A+B.
- 5. Enter the "Catch" command on transmitter 2 and actuate the start button.

Transmitter 2 now has sole access to all machine functions.



Notes:

- If a receiver has already been adopted by a transmitter can be displayed via a lamp on the machine.
- If the operating voltage of the receiver fails, the receiver returns to the starting condition in which it can be adopted by any transmitter. If necessary, the receiver must be adopted anew.
- If the transmitter is deactivated without the command "Release" having been issued, the other transmitters have no access to the receiver. The starting condition described above can only be resumed by deactivating the operating voltage at the receiver.

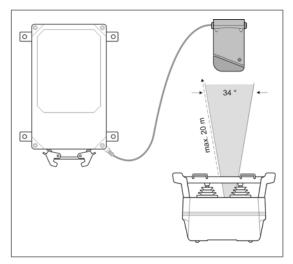


radiomatic[®] infrakey

The radio system can only be activated via an infrared link between the transmitter and the receiver. This increases the safety of operation, i.e. the machine can not become inadvertently enabled.

radiomatic[®] infrakey operates either with an infrared module in the receiver housing (radiomatic[®] infrakey internal) or with the offset infrared antenna focus I (radiomatic[®] infrakey external).

To activate radiomatic[®] infrakey, actuate the start button on the transmitter.



Function of radiomatic® infrakey with focus I



Notes:

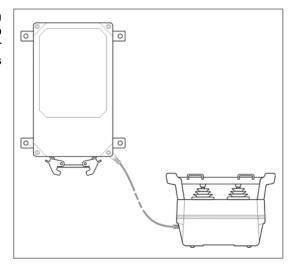
- The range of the infrared beam is max. 20 m (66 ft).
- The angle of radiation is 34°.
- The front panel of the receiver must be visible (only radiomatic® infrakey internal).

Cable Control

With a cable you can generate a direct data connection between the transmitter and receiver. The radio transmission is disabled. At the same time, the power supply of the transmitter is provided through the cable, as well.

Connecting the cable

- 1. Switch the transmitter off.
- 2. Remove the screw lock on the transmitter and receiver.
- 3. Connect the transmitter and the receiver with the cable. Ensure that the connector is locked.
- 4. Switch the transmitter on.





Notes:

- If you connect the cable while working with the system, the Actuate the start button to switch to cable operation.
- When the system is in cable mode the transmitter will receive the supply voltage from the receiver, i.e. the transmitter can be used without the battery.
- If you disconnect the cable from the transmitter and receiver, the system will switch off automatically. Actuate the start button to switch back to radio operation.



radiomatic[®] masterkey

This option offers the possibility for the operator to easily exchange a defective transmitter for a spare transmitter. radiomatic® masterkey (key) holds all the pertaining system information such as frequency and address code. When the radiomatic® masterkey is inserted into the spare transmitter all necessary information is transmitted.

Data transfer only works with transmitters that are equipped with this option. Otherwise the radiomatic[®] masterkey is only used for switching the transmitter on or off.

If a transmitter without radiomatic® masterkey preparation is operated with a radiomatic® masterkey (mechanically the key has the same function), it will therefore continue to function with "its" internally programmed receiver (see type plate).

Address Changeover via Coding Plug

The coding plug activates a preselected frequency and address coding in the transmitter which corresponds with the data of the respective receiver.

If the coding plug is inserted in a spare transmitter, it will receive the same data as the original transmitter. The spare transmitter can therefore now access the receiver

Changing the coding plug:



Turn the union nut to the left and pull out the coding plug.



Put the coding plug into the socket of the spare transmitter and lock it by turning the union nut to the right.



Notes:

- Operation is not possible without coding plug.
- If the coding plug is removed during operation the transmitter switches off immediately.
- The coding plug is labeled with the fabrication number of the respective receiver.

Transmitter Key up

With the transmitter key up function, radio commands are only transmitted at the touch of a key and the transmitter will automatically be switched off after 7 seconds of non-use. For example, self-monitoring gates can thus be opened or closed by several operators.

During longer breaks the transmitter must be switched off by pressing the STOP switch.

The "transmitter key up" function also saves battery power.



Caution:

The transmitter key up function does not relieve the operator of his responsibility to turn off the transmitter with the STOP switch when not in use.



Utilization of Button (1) as Shift Key

The RPM+ and RPM- buttons have a dual function.

If the button \odot is kept depressed and the RPM+ resp. RPM- button is also activated, the Motor Start resp. Motor Step command will be output.

Enabling of the Proportional Outputs

The start button must be depressed after the system has been activated and enabled via Si1 (at the receiver). It is not until this has been done that the function of the compact linear levers at the receiver will be enabled.

Rotary Switch for Preselected Speed

Using the rotary switch it is possible to choose between four maximum machine speeds, which are set in accordance with the customer's requirements.

The symbols for the speed adaptation have the following meanings:



= maximum speed 100 %



= maximum speed, limited to 75 %



= maximum speed, limited to 50 %



= maximum speed, limited to 25 %

Slewing Gear Release



Note:

Whenever the command "slewing gear release" is actuated by means of the radio control, it is important that the respective check be made.

Due to the above, a clearly visible indicator lamp should be installed on the machine.

Feedback by LED

Using this function, system or machine data can be displayed on the transmitter by LEDs.



Pre-selection of Trolley or Hoist

The operator is able to select the trolley or hoist that he wishes to control. It is also possible to simultaneously control both trolleys/hoists, for example in order to transport particularly long or wide loads.

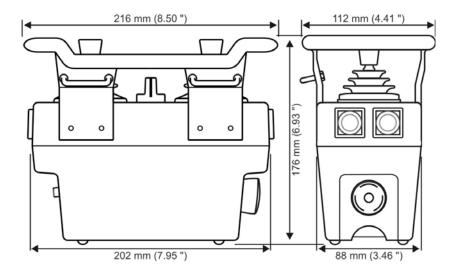


Technical Data

Max. number of control commands	32 digital + STOP or 24 digital + 8 prop. + STOP
Frequency range	334 – 338 MHz, 400 – 475 MHz ¹ , 865 – 870 MHz, 902 – 928 MHz DECT: 1880 – 1900 MHz ¹ Not all frequency ranges available.
Channel spacing	12,5 / 20 / 25 / 50 / 250 kHz DECT: 1,728 MHz
Transmitting power	TC/TX 641: < 10 mW TC 680/690: < 10 mW TC 681/691: < 5 mW TX 681/691: < 5 mW DECT: nominal 10 mW
Supply voltage	6 V
Battery type	BA2250_0 (NiMH)
Battery capacity	1500 mAh
Continuous operating time	ca. 20 h
Transmitter antenna	internal
Unique system addresses	over 1.000.000 combinations
Operating temperature range	−25 °C − 70 °C (−13 °F − 158 °F)
Housing material	impact-resistant ABS plastic
Dimensions	216 x 88 x 176 mm (8.0 x 3.5 x 6.9 ")
Weight (incl. battery)	ca. 1,5 kg (3.3 lb.)
Protection class	IP 65



Dimensions





Troubleshooting



Note:

Please check the functions using the cabin or cable controls first!

Problem	Possible Cause	Remedy
Transmitter does not react when switched on.	- No power.	Check battery contacts for damage or contamination.
		 Insert a fully charged battery into the battery compartment.
		 Recharge battery.
Low-power indication after minimal operating time.	 Battery contacts are contaminated or damaged. 	Check battery contacts for damage or contamination.
	 Battery not charged. 	 Recharge battery.
	Battery defective.	 Ensure that recharging process runs correctly.
		Check transmitter functions using a fully charged or replacement battery.
The display in the transmitter flashes green but it is not	Receiver has no voltage. No radio communication.	Check the connecting cable to the receiver.
possible to effect control commands.	"Crane On" command has not been given.	Check the functions via the LEDs in the radio status panel of the receiver.
Some commands are not	 Receiver defective. 	Check if all connecting
carried out.	 Interruption in the connecting cable to the machine. 	cables and cable junctions are tight.

If none of the measures mentioned resolve the problem, then please contact your service technician, dealer or HBC-radiomatic GmbH.



Maintenance

The radio control system is virtually maintenance-free. Please observe the following points:

- Check the STOP switch functionality at regular intervals. Dirt deposits on the switch can hinder the mechanism and impair the function.
- Check the rubber bellows or rubber seals of the operating elements at regular intervals for leaktightness. Replace immediately if cracks appear since the penetration of dirt and humidity may damage the function of the operating elements.
- Never use a high-pressure cleaner or sharp or pointed objects to clean the transmitter.
- Charge and discharge transmitter batteries regularly.

In the Event of a Fault



Warning:

Never operate a machine with a faulty or defective radio control system!

- Never try to repair the electronics of the radio control system! Opening the transmitter or receiver housing terminates the manufacturer guarantee.
 - Send any defective or faulty equipment to your local distributor or to the manufacturer. They are experts and have the necessary know-how and OEM spare parts.
 - Always send both transmitter and receiver and enclose a detailed description of the problem.
 - Do not forget to enclose your address and telephone number so that we can get in touch with you quickly if necessary.
- To avoid damage during transport, use the original packing supplied with the radio control system, otherwise pack securely. Send the consignment to your distributor or to the following address:

HBC-radiomatic GmbH Haller Str. 45 – 53 74564 Crailsheim, Germany Phone: +49 7951 393-0 Fax: +49 7951 393-50

E-Mail: info@radiomatic.com

• Should you choose to deliver a defective radio control system personally to your distributor or our factory, please call and arrange an appointment.

Frequency List for Europe (10/2007)



f-liste-en-2007-v1 [PMSK/DOKUS]

	433,050 MHz–434,790 MHz 100 % duty cycle according to ERC 70-03	434,040 MHz–434,790 MHz 100 % duty cycle according to ERC 70-03
Austria		X
Belgium		X
Bosnia and Herzegovina		X
Bulgaria		X
Croatia		1)
Cyprus		X
Czech Republic		X
Denmark		X
Estonia		Х
Finland		Х
France	X	X
Germany	Х	Х
Greece		
Hungary		1)
Iceland		Х
Ireland		Х
Italy		х
Latvia		х
Liechtenstein		х
Lithuania		х
Luxembourg		х
Macedonia		х
Malta		х
Montenegro		Х
Norway		Х
Poland		X
Portugal		X
Romania		
Serbia		х
Slovakia		х
Slovenia		х
Spain		х
Sweden	X	x
Switzerland		х
The Netherlands	Х	х
Turkey		х
United Kingdom	х	Х

1) with restrictions

Important note:
Equipment with CEO marking may only be placed on the market in countries marked with X. Please observe the frequency indicated on the name plate of the equipment.

Equipment with E marking may be placed on the market in all EU member states (e.g. frequency band 869,700 – 870,000 MHz).

Please observe the frequency indicated on the name plate of the equipment.

Additional national frequencies available on request.

ragung vorbehalten

Form

Return Delivery Note



HBC-radiomatic GmbH Haller Str. 45 - 53

74564 Crailsheim, Germany

	Phone:	+ 49 (0)7951 393 800
Transaction No. (provided by HBC):	Fax:	+ 49 (0)7951 393 802
,	Email:	service@radiomatic.com
	Internet:	www.hbc-radiomatic.com

Contact for further in	formation:					
Contact person:		Phone	ıe:		Fax:	
		Email	il:			
Reason for return *):						
Repair		Estim	nate re	quired?		yes ☐ no ☐
Modification						
Wrong order		custo	mer's	order no.:		
Wrong delivery						
For credit		corres	spondi	ng invoice no.:		
*) in order to work on you	r return rapidly, please	state precisely the	e fault re	eport and invoice no.		
HBC Fabr. No.:		Description o	of prob	olem:		
Transmitter:						
Receiver:						
Charger:						
Batteries:						
Cable:						
Other accessories:						
Absolutely necessary information::						
PCB		Problem appea	ars:	due to vibration / shoot if warm or hot if cold	ck 🔲	
aut. IVO.				sometimes always never		commonness:(in good order, not needed pcb)

Note:

For system repairs, please send (if possible) the complete system including transmitter, receiver, batteries, charger and cable with detailed description of the problem.

The return is subject to the conditions described in paragraph 8 (Guarantee) in our standard terms & conditions.

Returns will only be accepted **CIF Crailsheim**, **Germany**. Preferred shipping via **DPD** and **UPS Standard**.

Please use the original HBC packaging if possible. Please use proper packaging to avoid electrostatic discharge hazards with pcbs and/or modules. Warranty claims may not be accepted in case of improper packaging. Returns shipped ex works or unpaid will not be accepted without express written consent by HBC.



ragung vorbehalten

Formblatt

Rücklieferschein



HBC-radiomatic GmbH Haller Str. 45 – 53

74564 Crailsheim

	Tel.:	+ 49 (0)7951 393 800
/organgs-Nr. (von HBC vergeben)	Fax:	+ 49 (0)7951 393 802
rorgangs-ivi. (von nec vergeben)		` '
	E-Mail:	service@radiomatic.com
	Internet:	www.hbc-radiomatic.com

Kontakt bei Rückfragen							
Ansprechpartner:		Telefon:		Fax:			
		Email:					
Grund der Rücklieferung	 ; *):						
Reparatur]	Kostenvora	anschlag gewünscht	?	ja 🗌	nein□	
Umbau]						
Falschbestellung]	zu Bestell-	Nr.:				
Falschlieferung]						
zur Gutschrift]	zu Rechnu	ngs-Nr.:				
*) Um Ihre Rücklieferung ras	ch bearbeiten zu können, ç	geben Sie bitte die	e Fehlerbeschreibung	sowie die Rechnung	s-Nr. der Wa	re an.	
HBC Fabr. Nr.:	<u>Feh</u>	lerbeschreibur	ng:				
Sender:							
Empfänger:							
Ladegerät:							
Akkus:							
Anschlusskabel:							
Sonstiges Zubehör:							
	un	bedingt a	uszufüllen::				
Platine a	aus System Mar	ngel tritt auf:	bei Erschütterung				
mit Fabr. Nr.:			bei Wärme bei Kälte	H			
			manchmal immer nie	Häufigkeit:			

Hinweis:

Bitte senden Sie bei System-Reparaturen möglichst das komplette System zurück - inkl. Sender, Empfänger, Akkus, Ladegerät und eventuell Anschlusskabel mit einer detaillierten Fehlerbeschreibung.

Die Rücksendung erfolgt unter Beachtung der in Ziffer 8 (Gewährleistung) unserer Allgemeinen Geschäftsbedingungen enthaltenen Bestimmungen.

Bitte liefern Sie die Ware <u>frei Haus</u> an uns zurück! Bevorzugte Speditionen: **DPD** und **UPS Standard**. Verwenden Sie möglichst die original HBC Umverpackung für die Rücklieferung. Für elektronische Bauteile und/oder Platinen ist eine ESD-Schutz-Verpackung zu verwenden. Garantieansprüche können bei Fehlen der ESD-Schutz-Verpackung erlöschen. Anlieferungen "unfrei" ohne vorherige schriftliche Freigabe durch HBC werden nicht akzeptiert.



Erstellt am: 27.07.2004

Von: U. Weissmann / G. Brose / A. Hemming

Revision: 9 Seite: 1 von 1



Operating Instructions

Original Operating Instructions

FSE 727 radiobus®

A0727G03







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> Receiver Housing HR168 Connection Options

Troubleshooting Maintenance

Attachments: EC Declaration of conformity, return delivery note, frequency list, system specific views, circuit diagrams and /or output wiring

Pictographs



Danger due to electrical voltage. Touching live parts inside the unit can be fatal or cause serious injuries.



Instructions for occupational health and safety. Not following these instructions can cause accidents, which can cause damage, serious injuries or even death.



Important information about the operation of the radio system

Manufacturer:

HBC-radiomatic GmbH • Haller Straße 45 – 53 • 74564 Crailsheim • Germany • Tel. +49 7951 393-0 • info@radiomatic.com. HBC.radiomatic GmbH is not liable for any misprints or errors! – Specifications and design subject to change without notice. ® radiomatic and radiobus are registered German trademarks. © 01 / 2010, HBC-radiomatic GmbH, 74564 Crailsheim, Germany

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Safety Instructions

Read through these operating instructions carefully before working with the radio system. This applies in particular to the installation, commissioning and maintenance of the radio system.

The operating instructions are a constituent part of the radio control system and must always be kept close at hand for the responsible personnel.

The term 'machine' is used in the operating instructions for the different possible uses of the radio system.

Intended Use

- The radio system serves to control machines and for data transfer. Observe the job safety and accident prevention regulations applicable to each application.
- The intended use also includes reading the operating instructions and adhering to all safety information contained therein.
- The radio system must not be used in areas where there is a risk of explosion, nor for the control of
 machines used to convey persons, unless it is explicitly approved by the manufacturer for these
 uses.
- Modifications to the radio system may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. All modifications must be documented at the factory in the radio control master file.
- The radio control system safety devices must not be modified, removed or bypassed. In particular, modifications to any part of the radio system's complete emergency-stop system are impermissible.

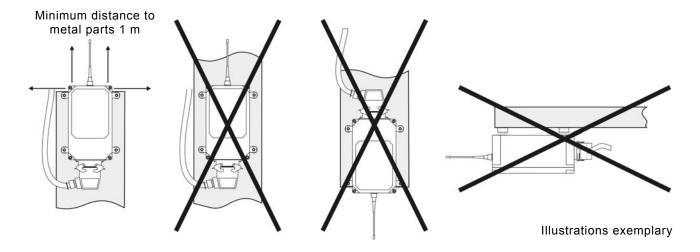
Safety Instructions for Installation and Operation

- The electrical connection per the accompanying output wiring diagram must be established by a qualified electrician exclusively.
- The receiver may only be opened by trained personnel. Components inside the receiver can be energized at life-threatening voltages. The supply voltage for the machine must be deactivated before the receiver is opened.
- Please also note with radio systems, that the presence of persons in the danger zone in particular beneath the load (cranes!) is prohibited in every instance.
- Select a safe location for radio control, from which you have a good and complete view of the working movements of the machine, the load movements and the surrounding working conditions.
- It is not permissible to put a radio transmitter unattended to one side whilst activated. Always switch the radio transmitter off when it is not required. This applies in particular if you change location, when working without radio control, during breaks and at the end of work. Always safeguard the radio transmitter against use by unauthorized persons, for example by locking it away.
- In the event of an emergency and with all faults, switch the radio transmitter off immediately by pressing the STOP switch.
- Only operate the radio system when it is in perfect working order. Faults and defects that could
 influence safety must be rectified before the system is put back into operation, by specialists who
 have been trained and authorized by HBC-radiomatic.
- Note that the operational directions of the operating elements may appear inverted depending on location and viewing angle to the machine. This applies in particular to rotary cranes, if your location changes from inside to outside the radius of the crane. The operator must make himself familiar with the directional markings on the machine before the start of work.
- Repairs may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. Use original replacement parts and accessories (e.g. rechargeable batteries) exclusively; otherwise it is possible that the equipment safety can no longer be guaranteed and our extended warranty will be voided.
- Remain vigilant when working with the radio system and familiarize yourself with its functions. This applies in particular if you are working with it for the first time or if you work with it only occasionally.



Installation of the Radio Receiver

- The receiver should be mounted vertically with the cable connection downwards.
- Ensure that there are no metal parts within a radius of 1 m (3 feet) above the receiver.
- When the receiver has to be mounted into a control cabinet, an offset antenna must be installed.
- Receivers with external antenna must be installed in such a way that the antenna stands freely and
 does not touch walls or metal parts. Otherwise an offset antenna must be used, which can be
 supplied if necessary.



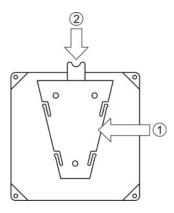
Installation with Snap-In Wall Bracket

The receiver is mounted with the snap-in wall bracket provided. Fix the wall bracket in place via the holes provided. Only use screws (max. M6) which are suitable for the installation location.

Receiver Housing HR145

(FSE 508, FSE 509)

Push the receiver with the mounting device \bigcirc from the top into the wall bracket and press the receiver downwards until it clicks into place.



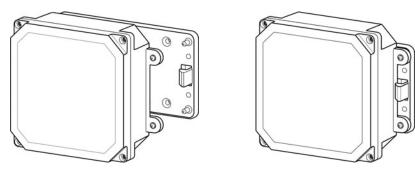
For removing the receiver, press the release device ② downwards and pull the receiver upwards out of the wall bracket.



Receiver Housing HR165

(FSE 510, FSE 511, FSE 512)

Place the receiver with the eyelets on the wall bracket pins and press it on the wall bracket until it clicks into place.



Press the engagement pins outwards with a large screwdriver, to remove the receiver from the wall bracket. This releases the receiver off the wall bracket from where it can be removed to the front.

Installation with integrated Mounting Loops

(FSE 516 with housing HR268, FSE 726/727 radiobus®)

The receiver is installed via the integrated mounting loops on the receiver sides. Use the shock mounts provided for installation to dampen any vibrations that may occur.

Installation with Mounting Loops

(FSE 516 with housing HR270 or HR272, FSE 524, FSE 736/737 radiobus®)

The receiver is installed via the provided mounting loops. Use the shock mounts provided for installation to dampen any vibrations that may occur. A detailed installation guide is enclosed with the delivery.



Electrical Connection

Depending on the version the radio receiver is connected either via a cable gland or with a Harting plug connection to the machine electrics.

Please observe that the receiver may only be connected to the supply voltage indicated on the type plate!



Warning - shock hazard!

- The electrical connection may only be carried out by skilled personnel.
- The electrical connection must comply with the enclosed wiring diagram.
- Switch off the supply voltage before opening the receiver. There is a risk of fatality from touching live parts inside the housing!

Control Display

The control display with LEDs indicating the operating state of the radio system is located behind the inspection window of the receiver cover lid.

The LEDs have the following significance:

On (yellow) illuminates as soon as operating voltage is present at the receiver, i.e. the connection to the electronic of the machine is established and operating voltage (12 V) is present.

RF (red) illuminates whenever the transmitter is switched off. It will be extinguished the very moment a signal is received by the receiver on its radio frequency.

Si 1 (green) illuminates after the transmitter is switched on, i.e. the receiver has identified its specific transmitter on the basis of the common message address (code). Safety circuit Si 1 is enabled.

Si 2 (green) refers to the internal safety circuit Si 2, responsible for a double switching off of the move commands whenever the control station is in the off (zero) position, i.e. "Si 2" will not illuminate. It is not until one or several drive commands (e.g. turn, trolley traveling, lifting gear or crane traveling) are input that the "Si 2" LED may illuminate!

Available for FSE 510, FSE 511, FSE 516, FSE 524, FSE 726/727/736/737 radiobus®:

Feedback (yellow) illuminates whenever the receiver is sending a feedback telegram to the transmitter.



Technical Data

Max. number of control commands	26 digital (8 via change-over contacts)
	18 digital (4 via change-over contacts) + 8 analog
Supply voltage	10 – 30 V DC
Power consumption	max. 10 W
Digital inputs	depending on equipment with input modules
Analog inputs	depending on equipment with input modules
Serial interfaces	CANopen, Profibus-DP, RS485, RS232, DeviceNet
Connection possibilities	Harting Han 32
	option: Harting Han 25 or Han 50 option: cable gland (metric M20/25)
EMS resp. Si1, Si2 control unit	1 x EMS output, high-side switch 10 A
RF interfaces	TC6XX
Frequency ranges	334 - 338 MHz, 400 - 475 MHz ¹ , 865 - 870 MHz, 902 - 928 MHz
	¹ Not all frequency ranges available.
Channel spacing	12,5 / 20 / 25 / 50 / 250 kHz
RX sensitivity	TC 641: -115 dBm / 10 ⁻² BER TC 680/690: -95 dBm / 10 ⁻² BER
Antenna	external, FL 30 or FL 70 option: offset antenna with 5 m cable and BNC connector
Unique system addresses	over 1.000.000 combinations
Operating temperature range	−25 °C − 70 °C (−13 °F − 158 °F)
	Hazardous areas zone 2: −20 °C − 60 °C (−4 °F − 140°F)
Housing material	plastic
Dimensions	165 x 165 x 115 mm (6.5 x 6.5 x 4.5 ")
Weight	ca. 2,6 kg (5.7 lb.)
Protection class	IP 65
EMS category	4 according to EN 954-1 (The EMS category of the radio control system depends on the respective transmitter)



Dimensions

Receiver Housing HR168

(FSE 726/727 radiobus®)

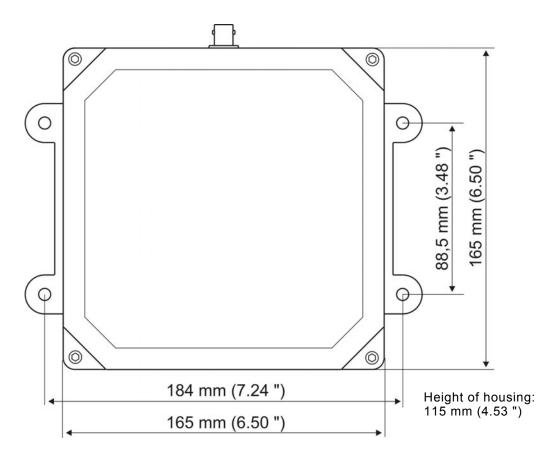


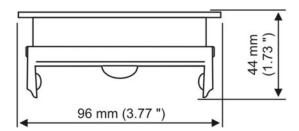
Illustration exemplary



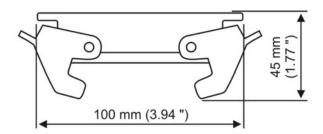
Connection Options

Harting Plug Connections

FSE 510, FSE 511, FSE 512

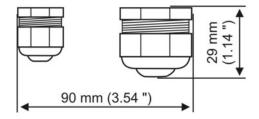


FSE 516, FSE 524, FSE 726/727/736/737 radiobus®

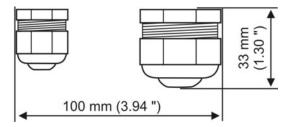


Metric Cable Glands

FSE 510, FSE 511, FSE 512

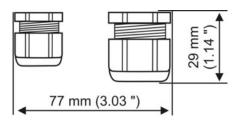


FSE 516, FSE 524, FSE 726/727/736/737 radiobus®



PG Cable Gland

FSE 508, FSE 509





Troubleshooting



Note:

Please check the functions using the cabin or cable controls first!

Problem	Possible Cause	Measures
Transmitter does not react when switched on.	- No power.	Check battery contacts for damage or contamination.
		 Insert a fully charged battery into the battery compartment. Recharge battery.
Low-power indication after minimal operating time.	 Battery contacts are contaminated or damaged. Battery not charged. Battery defective. 	 Check battery contacts for damage or contamination. Recharge battery. Ensure that recharging process runs correctly. Check transmitter functions using a fully charged or replacement battery.
Some commands are not carried out.	 Receiver defective. Interruption in the connecting cable to the crane or machine. 	Check if all connecting cables and cable junctions are tight.

If none of the measures mentioned resolve the problem, then please contact your service technician, dealer or HBC-radiomatic GmbH.



Maintenance

The radio control system is virtually maintenance-free. Please observe the following points:

- Never use a high pressure cleaner or sharp or pointed objects to clean the receiver.
- Whenever welding the machine:
 - Switch off the radio control system.
 - Switch off the machine.
 - Disconnect all electrical connections to the receiver.

Otherwise the receiver electronics can be destroyed.

In the Event of a Fault



Warning:

Never operate a machine with a faulty or defective radio control system!

- Never try to repair the electronics of the radio control system! Opening the transmitter or receiver housing terminates the manufacturer guarantee.
 - Send any defective or faulty equipment to your local distributor or to the manufacturer. They are experts and have the necessary know-how and OEM spare parts.
 - Always send both transmitter and receiver and enclose a detailed description of the problem.
 - Do not forget to enclose your address and telephone number so that we can get in touch with you quickly if necessary.
- To avoid damage during transport, use the original packing supplied with the radio control system, otherwise pack securely. Send the consignment to your distributor or to the following address:

HBC-radiomatic GmbH Haller Str. 45 – 53 74564 Crailsheim, Germany Phone: +49 7951 393-0

Fax: +49 7951 393-50 E-Mail: info@radiomatic.com

• Should you choose to deliver a defective radio control system personally to your distributor or our factory, please call and arrange an appointment.



Frequency List for Europe (10/2007)



f-liste-en-2007-v1 [PMSK/DOKUS]

	433,050 MHz–434,790 MHz 100 % duty cycle according to ERC 70-03	434,040 MHz–434,790 MHz 100 % duty cycle according to ERC 70-03
Austria		X
Belgium		X
Bosnia and Herzegovina		X
Bulgaria		X
Croatia		1)
Cyprus		X
Czech Republic		X
Denmark		X
Estonia		X
Finland		X
France	X	X
Germany	X	X
Greece		
Hungary		1)
Iceland		Х
Ireland		Х
Italy		х
Latvia		х
Liechtenstein		х
Lithuania		х
Luxembourg		х
Macedonia		X
Malta		х
Montenegro		X
Norway		X
Poland		X
Portugal		X
Romania		
Serbia		X
Slovakia		х
Slovenia		х
Spain		х
Sweden	х	x
Switzerland		х
The Netherlands	Х	х
Turkey		х
United Kingdom	х	Х

1) with restrictions

Important note:
Equipment with CEO marking may only be placed on the market in countries marked with X. Please observe the frequency indicated on the name plate of the equipment.

Equipment with E marking may be placed on the market in all EU member states (e.g. frequency band 869,700 – 870,000 MHz).

Please observe the frequency indicated on the name plate of the equipment.

Additional national frequencies available on request.

ragung vorbehalten

Form

Return Delivery Note



HBC-radiomatic GmbH Haller Str. 45 - 53

74564 Crailsheim, Germany

	Phone:	+ 49 (0)7951 393 800
Transaction No. (provided by HBC):	Fax:	+ 49 (0)7951 393 802
,	Email:	service@radiomatic.com
	Internet:	www.hbc-radiomatic.com

Contact for further information:						
Contact person: Phone: Fax:					:	
		Email	il:			
Reason for return *):						
Repair		Estim	nate red	quired?		yes ☐ no ☐
Modification						
Wrong order		custo	mer's	order no.:		
Wrong delivery						
For credit		corres	espondi	ng invoice no.:		
*) in order to work on you	r return rapidly, please	state precisely the	e fault re	port and invoice no.		
HBC Fabr. No.:		Description o	of prob	lem:		
Transmitter:						
Receiver:						
Charger:						
Batteries:						
Cable:						
Other accessories:	Other accessories:					
Absolutely necessary information::						
PCB		Problem appea		due to vibration / sho if warm or hot if cold	ck _]]]
aut. IVO.				sometimes always never		commonness:

Note:

For system repairs, please send (if possible) the complete system including transmitter, receiver, batteries, charger and cable with detailed description of the problem.

The return is subject to the conditions described in paragraph 8 (Guarantee) in our standard terms & conditions.

Returns will only be accepted **CIF Crailsheim**, **Germany**. Preferred shipping via **DPD** and **UPS Standard**.

Please use the original HBC packaging if possible. Please use proper packaging to avoid electrostatic discharge hazards with pcbs and/or modules. Warranty claims may not be accepted in case of improper packaging. Returns shipped ex works or unpaid will not be accepted without express written consent by HBC.



ragung vorbehalten

Formblatt

Rücklieferschein



HBC-radiomatic GmbH Haller Str. 45 – 53

74564 Crailsheim

	Tel.:	+ 49 (0)7951 393 800
/organgs-Nr. (von HBC vergeben)	Fax:	+ 49 (0)7951 393 802
rorgangs-ivi. (von nec vergeben)		` '
	E-Mail:	service@radiomatic.com
	Internet:	www.hbc-radiomatic.com

Kontakt bei Rückfragen	
Ansprechpartner:	Fax:
	Email:
Grund der Rücklieferung *):	
Reparatur	Kostenvoranschlag gewünscht? ja ☐ nein☐
Umbau	
Falschbestellung	zu Bestell-Nr.:
Falschlieferung	
zur Gutschrift	zu Rechnungs-Nr.:
*) Um Ihre Rücklieferung rasch bea	arbeiten zu können, geben Sie bitte die Fehlerbeschreibung sowie die Rechnungs-Nr. der Ware an.
HBC Fabr. Nr.:	<u>Fehlerbeschreibung</u> :
Sender:	
Empfänger:	
Ladegerät:	
Akkus:	
Anschlusskabel:	
Sonstiges Zubehör:	
	unbedingt auszufüllen::
Platine aus S	
mit Fabr. Nr.:	bei Wärme ☐ bei Kälte ☐
	manchmal Häufigkeit: immer

Hinweis:

Bitte senden Sie bei System-Reparaturen möglichst das komplette System zurück - inkl. Sender, Empfänger, Akkus, Ladegerät und eventuell Anschlusskabel mit einer detaillierten Fehlerbeschreibung.

Die Rücksendung erfolgt unter Beachtung der in Ziffer 8 (Gewährleistung) unserer Allgemeinen Geschäftsbedingungen enthaltenen Bestimmungen.

Bitte liefern Sie die Ware <u>frei Haus</u> an uns zurück! Bevorzugte Speditionen: **DPD** und **UPS Standard**. Verwenden Sie möglichst die original HBC Umverpackung für die Rücklieferung. Für elektronische Bauteile und/oder Platinen ist eine ESD-Schutz-Verpackung zu verwenden. Garantieansprüche können bei Fehlen der ESD-Schutz-Verpackung erlöschen. Anlieferungen "unfrei" ohne vorherige schriftliche Freigabe durch HBC werden nicht akzeptiert.



Erstellt am: 27.07.2004

Von: U. Weissmann / G. Brose / A. Hemming

Revision: 9 Seite: 1 von 1



Spare Parts Catalogue





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status quo: 11/05/09

Manufacturer:

HBC-radiomatic GmbH Haller Strasse 45-53 74564 Crailsheim Germany

Phone +49 7951 393-0 Fax +49 7951 393-50

info@radiomatic.com www.hbc-radiomatic.com

Spare-part-dept.: Phone +49 7951 393-520

Fax

+49 7951 393-802

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1. Transmitter - housings

Battery holder for transmitter contact block and downholder Art.-Nr. 106-04-00010



Battery holder for transmitter

contact block only Art.-Nr. 106-04-00007



Battery holder for transmitter

battery holder only Art.-Nr. 003-90-00031



Battery holder for transmitter

with tele-teach contacts, contact block

Art.-Nr. 106-04-00003



Plastic lower part for radiomatic®

VISIO

Art.-Nr. 106-90-00109



Plastic upper part for radiomatic® visio

VISIO

for 2x radiomatic® iCON, with flute, 2 LEDs and display window Art.-Nr. 190-03-00002



Plastic upper part for radiomatic® visio

for 1x radiomatic® iCON, with flute, 2 LEDs and display window $\,$

Art.-Nr. 190-03-00001



Protective kit cubix

colour: blu

Art.-Nr. AP000160



Transmitter housing lower part

with battery compartment, colour: black Art.-Nr. 303-01-00002

Please specify the fabrication number!



Transmitter housing lower part cubix Blue Edition

colour: orange

Art.-Nr. HTC21030









1. Transmitter - housings

Transmitter housing lower part

colour: orange Art.-Nr. HTC11031

Please specify the fabrication number!



Transmitter housing lower part eco and linus 6 (eco L)

with battery compartment, colour: orange

Art.-Nr. 310-01-00005



Transmitter housing lower part eco and linus 6 (eco L)

with battery compartment, key switch, STOP impact switch and 6-pin plug, colour: orange

Art.-Nr. HTE15130



Transmitter housing lower part micron 2

with battery compartment, colour:

orange

Art.-Nr. 305-01-00002

Please specify the fabrication number!



Transmitter housing lower part micron 4

with battery compartment for BA222060, colour: orange

Art.-Nr. 307-01-00007



Transmitter housing lower part

with battery compartment and viewport for radiomatic® infrakey,

colour: orange

Art.-Nr. HTM59530



Transmitter housing lower part micron 4/5

with battery compartment for FuB 9NM, colour: orange

Art.-Nr. HTM59330



Transmitter housing lower part micron 4/6

with battery compartment for

BA2230_0, colour: orange

Art.-Nr. HTM63230



Transmitter housing lower part micron 5

with battery compartment for BA222060, colour: orange

Art.-Nr. 308-01-00010



Transmitter housing lower part orbit

with battery compartment, for industry (TX641/TX681), colour: orange

Art.-Nr. HTO13230









1. Transmitter - housings

Transmitter housing lower part orbit

with battery compartment, for winches, colour: orange

Art.-Nr. HTO13330

Please specify the fabrication number!



Transmitter housing lower part orbit

with battery compartment, for industry (TX671/TX680), colour: orange

Art.-Nr. HTO13130

Please specify the fabrication number!



Transmitter housing lower part quadrix

with STOP slider and cable harness, colour: orange/blue

Art.-Nr. HTQ13130



Transmitter housing lower part spectrum 1

with battery compartment, tinned cable, colour: orange

Art.-Nr. 311-01-00005



Transmitter housing lower part

with battery compartment, key switch, STOP impact switch and wiring, colour:

Art.-Nr. HTS1B130

Please specify the fabrication number!



Transmitter housing lower part

with battery compartment for BA225030, tinned cable, colour:

Art.-Nr. 312-01-00013



Transmitter housing lower part spectrum 2

with battery compartment for BA214061, tinned cable, colour: orange

Art.-Nr. 312-01-00014



Transmitter housing lower part spectrum 2

with battery compartment, key switch, STOP impact switch and wiring, colour:

Art.-Nr. HTS2B130

Please specify the fabrication number!



Transmitter housing lower part spectrum 3

with battery compartment, tinned cable, colour: orange

Art.-Nr. HTS3A130



Transmitter housing lower part

with battery compartment, key switch, STOP impact switch and wiring, colour: orange

Art.-Nr. HTS3B130







1. Transmitter - housings

Transmitter housing upper part cubix Blue Edition x 6

drilled without front plate, colour:

Art.-Nr. HTC20130

Please specify the fabrication number!



Transmitter housing upper part cubix Blue Edition x 8

drilled without front plate, colour:

Art.-Nr. HTC20230

Please specify the fabrication number!



Transmitter housing upper part cubix x 6

drilled without front plate, colour:

orange

Art.-Nr. HTC10131

Please specify the fabrication number!



Transmitter housing upper part cubix x 8

drilled without front plate, colour:

orange

Art.-Nr. HTC10231

Please specify the fabrication number!



Transmitter housing upper part eco with roll over bar

drilled, with front plate after existing layout, colour: orange

threaded bolts and protective collar for short-lift key

Art.-Nr. 310-01-00015

Please specify the fabrication number!



Transmitter housing upper part eco with roll over bar

drilled, with front plate 31.214a,

colour: orange

threaded bolts and protective collar for short-lift key

Art.-Nr. 310-01-00007



Transmitter housing upper part eco with roll over bar

drilled, with **front plate 31.205a**, colour: orange

threaded bolts and protective collar for short-lift key

Art.-Nr. HTE10130



Transmitter housing upper part eco with roll over bar

drilled, with front plate 31.249a,

colour: orange

threaded bolts and protective collar for

short-lift key

Art.-Nr. HTE10230



Transmitter housing upper part linus 6 (eco L)

drilled for 6 linear joysticks and 2 rotary switches, with roll-over bar, colour: orange

Art.-Nr. HTL60130

Please specify the fabrication number!



Transmitter housing upper part linus 6 (eco L)

drilled for 6 linear joysticks, 1 rotary switch and 1 toggle switch, with roll-over bar, colour: orange

Art.-Nr. HTL60230







1. Transmitter - housings

Transmitter housing upper part micron 2

drilled, colour: orange Art.-Nr. 305-01-00001

Please specify the fabrication number!



Transmitter housing upper part micron 3/5

drilled for 10 push buttons and key switch, colour: orange Art.-Nr. HTM50330



Transmitter housing upper part micron 4

drilled for key switch, colour: orange Art.-Nr. HTM40230



Transmitter housing upper part micron 4

drilled for radiomatic® iON, colour: orange

Art.-Nr. HTM40230



Transmitter housing upper part micron 5

drilled for key switch, 9 push buttons and 1 rotary switch, colour: orange

Art.-Nr. HTM50230



Transmitter housing upper part

drilled for 10 push buttons, without hole for key switch, colour: orange

Art.-Nr. HTM50130



Transmitter housing upper part micron 5

drilled for 9 push buttons and 1 rotary switch, without hole for key switch,

colour: orange

Art.-Nr. HTM50030



Transmitter housing upper part micron 5

drilled for radiomatic® iON, 9 push buttons and 1 rotary switch,

colour: orange

Art.-Nr. HTM51230



Transmitter housing upper part micron 5

drilled for radiomatic® iON and 10 push buttons, colour: orange

Art.-Nr. HTM51330



Transmitter housing upper part micron 6

with display, colour: orange Art.-Nr. HTM60130







1. Transmitter - housings

Transmitter housing upper part orbit

drilled for industry, colour: orange

Art.-Nr. HTO10130

Please specify the fabrication number!



Transmitter housing upper part orbit

drilled for winches, colour: orange

Art.-Nr. HTO10230

Please specify the fabrication number!



Transmitter housing upper part orbit

drilled for rotary switch, colour: orange

Art.-Nr. HTO10330

Please specify the fabrication number!



Transmitter housing upper part patrol

drilled, without front plate, with belt clip,

colour: orange

Art.-Nr. 303-00-00002

Please specify the fabrication number!



Transmitter housing upper part quadrix

without light conductor and stickers for

quadrix

colour: orange

Art.-Nr. 190-03-00003



Transmitter housing upper part spectrum 1

drilled, colour: orange

Art.-Nr. 311-01-00018

Please specify the fabrication number!



Transmitter housing upper part spectrum 1

drilled, with front plate 31.200a,

colour: orange

Art.-Nr. 311-01-00001



Transmitter housing upper part spectrum 2

drilled, colour: orange

Art.-Nr. 312-01-00007

Please specify the fabrication number!



Transmitter housing upper part spectrum 3

drilled, colour: orange Art.-Nr. 313-01-00001

Please specify the fabrication number!



Transmitter housing vector

base part with housing cover rear,

colour: orange

Art.-Nr. 302-01-00001







1. Transmitter - housings

Transmitter housing lower part micron 3

with battery compartment, colour: orange

Art.-Nr. 306-01-00010







2. Transmitter - accessories

Adhesive stickers crane direction, (1

1 set = 2 pieces, d = 248 mm, colour: yellow/black Art.-Nr. 005-01-00413



Adhesive stickers double arrows, (1 set)

1 set = 4 pieces, coloured Art.-Nr. FSST0012



Adhesive stickers double arrows, DIN A4 (1 set)

1 set = 4 pieces, coloured Art.-Nr. FSST0013







Adhesive stickers SEB, DIN A3 (1 set)

1 set = 4 pieces, coloured Art.-Nr. FSST0001









Adhesive stickers SEB, DIN A6

1 set = 4 pieces, coloured Art.-Nr. FSST0011







Aluminium front plate construction crane standard

various sizes and inscriptions Art.-Nr. diverse

Please specify the fabrication number!



Aluminium tube for roll-over bar (SHB 190)

with eyelets for the snap hook, length:

Art.-Nr. 106-90-00001



Aluminium tube for roll-over bar (SHB 190)

without eyelets, length: 192 mm

Art.-Nr. 002-90-00121



Aluminium tube for roll-over bar (SHB 230)

without eyelets, length: 231 mm Art.-Nr. 002-90-00116



Aluminium tube for roll-over bar (SHB 230)

with eyelets for the snap hook, length: 229 mm

Art.-Nr. 106-90-00002







2. Transmitter - accessories

Aluminium tube for roll-over bar

with eyelets for the snap hook, length: 292 mm

Art.-Nr. 106-90-00003



Aluminium tube for roll-over bar

without eyelets, length: 292 mm

Art.-Nr. 002-90-00119



Aluminium tube for rolling roll-over

(SHB 190 Z)

with eyelets for the snap hook, length:

205 mm

Art.-Nr. 106-90-00014



Aluminium tube for rolling roll-over

(SHB 230 Z)

with eyelets for the snap hook, length:

243 mm

Art.-Nr. 106-90-00015



Aluminium tube for rolling roll-over

(SHB 230 Z)

without eyelets, length: 243 mm

Art.-Nr. 002-90-00162



Aluminium tube for rolling roll-over

(SHB 290 Z)

with eyelets for the snap hook, length:

302 mm

Art.-Nr. 106-90-00016



Aluminium tube for rolling roll-over (SHB 290 Z)

without eyelets, length: 302 mm

Art.-Nr. 002-90-00164



Aluminium tube for rolling roll-over

(SHB 190 Z)

without eyelets, length: 205 mm

Art.-Nr. 002-90-00160



Assembly kit for roll-over bar

for spectrum 1 (SHB 190)

Art.-Nr. 190-01-00002



Assembly kit for roll-over bar

for spectrum 2/3 (SHB 230 or 290)

Art.-Nr. 190-01-00003







2. Transmitter - accessories

Assembly kit for roll-over bar

for spectrum 2/3 (SHB 230-Z or 290-Z)

Art.-Nr. 190-01-00050



Assembly kit for roll-over bar

for spectrum 1 (SHB 190-Z)

Art.-Nr. 190-01-00049



Contact element battery compartment

Art.-Nr. 002-90-00209



External transmitter antenna BNC

with water protection cap, frequency range: 420-440 MHz

Art.-Nr. AA020003



External transmitter antenna SMA

with rubber seal, frequency range:

430-440 MHz

Art.-Nr. AA030003



Holding frame for RF data radio transmitter, micron 4/5

plastic

Art.-Nr. 003-90-00003



Housing antenna for transmitter

SMB-socket, one side open, length:

189 mm

Art.-Nr. AA040002



Housing antenna for transmitter

MMCX plug, one side open, length:

163 mm

Art.-Nr. AA080004

Please specify the fabrication number!



Insertion plate blank for spectrum and eco

colour: black

Art.-Nr. 005-01-00335



Insertion plate for eco and spectrum

with standard inscription, colour: black/white, metal

Art.-Nr. 005-99-00003







2. Transmitter - accessories

Plastic adhesive sticker for micron 6

black/white

Art.-Nr. 005-01-00452



Plastic adhesive sticker sheet for

6-colour with 50 standard symbols Art.-Nr. 005-01-00295



Plastic adhesive sticker sheet for micron 3/5

black/white with 50 special symbols

Art.-Nr. 005-01-00361



Plastic adhesive sticker sheet for micron 4

6-colour with 50 standard symbols

Art.-Nr. 005-01-00273



Plastic adhesive sticker sheet for micron 4

black/white with 50 special symbols Art.-Nr. 005-01-00274



Plastic adhesive sticker sheet for

black/white with 50 stickers Art.-Nr. 005-01-00275



Plastic adhesive sticker sheet for micron 6

6-colour with 50 standard symbols Art.-Nr. 005-01-00575



Plastic adhesive sticker sheet for micron 6

black/white with 50 special symbols Art.-Nr. 005-01-00445



Plastic adhesive sticker sheet for quadrix

black/white with 50 stickers Art.-Nr. 005-01-00550



Plastic adhesive sticker sheet for spectrum/eco

black/white with 21 special symbols Art.-Nr. 005-01-00609







2. Transmitter - accessories

Plastic adhesive sticker sheet for spectrum/eco

black/white with blank label Art.-Nr. 005-01-00610



Plastic adhesive sticker sheet for spectrum/eco

black/white with 21 special symbols Art.-Nr. 005-01-00607



Plastic adhesive sticker sheet for spectrum/eco

black/white with 21 special symbols Art.-Nr. 005-01-00608



Plastic adhesive sticker sheet for spectrum/eco

black/white with 21 stickers Art.-Nr. 005-01-00606



Plastic adhesive sticker sheet for spectrum/eco

black/white with 21 special symbols Art.-Nr. 005-01-00605



Plastic adhesive sticker sheet for spectrum/eco

black/white with 21 standard symbols Art.-Nr. 005-01-00604



Plastic adhesive sticker sheet for spectrum/eco

6-colour with 21 standard symbols Art.-Nr. 005-01-00603



Plastic adhesive sticker shield for cubix Blue Edition 6 x

with double arrows, colour: blue Art.-Nr. 005-01-00533



Plastic adhesive sticker shield for cubix Blue Edition 8 x

with double arrows, colour: blue Art.-Nr. 005-01-00534



Plastic adhesive sticker shield for cubix 6 x

with double arrows, colour: black Art.-Nr. FPST0005



Page 14



2. Transmitter - accessories

Plastic adhesive sticker shield for cubix 8 x

with double arrows, colour: black Art.-Nr. FPST0006



Plastic adhesive sticker shield for micron 3/5

with HBC-logo and battery symbol Art.-Nr. FSST0009



Plastic adhesive sticker shield for micron 3/5

with key switch symbol Art.-Nr. FSST0010



Plastic adhesive sticker shield for micron 3/5

micron 3/s

Art.-Nr. 005-01-00304



Plastic adhesive sticker shield for micron 3/5

inscription: Start-Stop Art.-Nr. 005-01-00421



Plastic adhesive sticker shield for micron 4

with battery symbol Art.-Nr. 005-01-00623



Plastic adhesive sticker shield for micron 5

with radiomatic® iON

with HBC-logo and battery symbol

Art.-Nr. 005-01-00529



Plastic adhesive stickerfor quadrix

Art.-Nr. 005-01-00485



Plastic frames for linus 4 rubber bellow

Art.-Nr. 003-90-00152



Plastic frames for linus 6 rubber bellow

Art.-Nr. 003-90-00153







2. Transmitter - accessories

Plastic light conductor for micron 3/5

transparent, 8 x 10 x 8 mm Art.-Nr. 003-90-00050



Plastic light conductor for micron 4

transparent, 6 x 16 mm Art.-Nr. 003-90-00051



Plastic light conductor for micron 4/5

with radiomatic® iON, transparent Art.-Nr. 003-90-00463



Protective collar for Short-lift push button

labelled with punch blank Art.-Nr. 106-90-00055



Protective kit for STOP impact switch

for vector and micron 2, colour: blue, rectangular

Art.-Nr. 003-90-00137



Protective kit for STOP impact switch micron 3/5

plastic, colour: black Art.-Nr. 106-90-00073



Roll-over bar eco

colour: black

Art.-Nr. AP000300



Roll-over bar linus 4

complete

Art.-Nr. AP001860



Roll-over bar linus 6 (eco L)

complete

Art.-Nr. AP000760



Roll-over bar spectrum 1 (SHB 190)

size: 190 mm

Art.-Nr. AP000400







2. Transmitter - accessories

Roll-over bar spectrum 1 with rolling side part (SHB 190-Z)

size: 190 mm Art.-Nr. AP000800



Roll-over bar spectrum 2 (SHB 230)

size: 230 mm Art.-Nr. AP000500



Roll-over bar spectrum 2 with rolling side part (SHB 230-Z)

size: 230 mm Art.-Nr. AP000900



Roll-over bar spectrum 3 (SHB 290)

size: 290 mm Art.-Nr. AP000600



Roll-over bar spectrum 3 with rolling side part (SHB 290-Z)

size: 290 mm Art.-Nr. AP001000



Side part for roll-over bar linus 4/6

left side, colour: blue Art.-Nr. 003-90-00034



Side part for roll-over bar linus 4/6 (eco L)

right side, colour: blue Art.-Nr. 003-90-00035



Side part for roll-over bar spectrum

Art.-Nr. 003-90-00070



Side part for roll-over bar spectrum

right side, colour: black Art.-Nr. 003-90-00002



Side part for roll-over bar spectrum

left side, colour: black Art.-Nr. 003-90-00001







2. Transmitter - accessories

Type plate for receiver

plastic, labeled

Art.-Nr. 005-99-00004

Please specify the fabrication number!



Type plate for transmitter

plastic, labeled

Art.-Nr. 005-99-00005







3. Transmitter - carrying options

Belt clip for transmitter

orbit, micron 4, vector, quadrix or cubix Art.-Nr. AS000200



Belt lock for waist carrying belt

Art.-Nr. 190-01-00025



Carrying bag cubix

colour: black with cubix-logo Art.-Nr. AS001000



Carrying bag micron 3/5

with belt, colour: black Art.-Nr. AS003200



Carrying bag orbit

colour: black Art.-Nr. AS001100



Carrying bag quadrix

colour: black Art.-Nr. AS004300



Carrying belt for micron and patrol

side-carrying, leather, length: 1,30 m

Art.-Nr. AS001500



Carrying clip micron 3/5

with button and holding rivet

Art.-Nr. AS000600



Carrying holder vector, orbit and cubix

plastic, colour: blue Art.-Nr. AS002060



Leather bag micron 1

in quiver form with belt strap, size: 205 x 70 x 56 mm

Art.-Nr. AS002700



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3. Transmitter - carrying options

Leather bag micron 3/5 in quiver form with belt strap, size: 205 x 65 x 65 mm Art.-Nr. AS001900



Protective kit caps micron 3/5 with elastic bands, colour: blue Art.-Nr. AP011060



Protective kit caps micron 3/5 with elastic bands, colour: yellow Art.-Nr. AP011040



Protective kit caps micron 3/5 with elastic bands, colour: black Art.-Nr. AP011000



Protective kit micron 4 with elastic bands, colour: blue Art.-Nr. AP000260



Protective kit micron 4 with elastic bands, colour: black Art.-Nr. AP000200



Rivets for waist carrying set for securing the snap hook Art.-Nr. 003-05-00044



Shoulder and neck belt with 2 side snap hooks Art.-Nr. AS003400



Snap hook for waist carrying set and shoulder strap

left side

Art.-Nr. 003-05-00030



Snap hook for waist carrying set and shoulder strap

right side

Art.-Nr. 003-05-00031





3. Transmitter - carrying options

Suspenders belt (1 pair)

with eye screws Art.-Nr. AS003500



Waist carrying belt

with inscription: HBC-radiomatic Art.-Nr. AS000800



Y-suspenders

additional for hip belt AS000800, with 3

Art.-Nr. AS003100







4. Transmitter - operating elements

Activating button for linear lever

colour: red

Art.-Nr. 101-90-00120



Activating button for linear lever

colour: black

Art.-Nr. 101-90-00119



Adapter piece for STOP impact switch micron 3/5

from plastic with micro-cellular rubber

seal

Art.-Nr. 101-90-00053



Bellows for DJET push button

with ring and push button cap Art.-Nr. 101-90-00113



Bellows for joystick Akerström

with screws, size: 53 x 53 mm

Art.-Nr. 101-90-00111



Bellows for joystick Euchner

Typ: SK-321, d = 30 mm

Art.-Nr. 011-01-00021



Bellows for joystick HBC

with screws, size 61 x 61 mm

Art.-Nr. AET00080



Bellows for linear lever x 6

Art.-Nr. 003-90-00444



Blind plug for short-lift push button or micron-push button

with seal

Art.-Nr. 190-01-00028



Blind plug M10 for front plate

plastic, colour: black sealing: 003-03-00006

plastic nut: 004-02-00045 Art.-Nr. 003-90-00445







4. Transmitter - operating elements

Blind plug M12 for front plate

plastic, colour: black sealing: 003-03-00007 plastic nut: 004-02-00046 Art.-Nr. 003-90-00446



Button for joystick HBC or Euchner Art.-Nr. 011-01-00171



Coil for radiomatic® masterkey and radiomatic® iON

with 100 mm cable Art.-Nr. 107-90-00005



Coil for radiomatic® masterkey and radiomatic® iON

with 300 mm cable Art.-Nr. 107-90-00006



DJET push button with bellows

Art.-Nr. IE230001



Flat seal

for blind plug M10 003-90-00445 Art.-Nr. 003-03-00006



Flat seal

for blind plug M12 003-90-00446

Art.-Nr. 003-03-00007



Holder for radiomatic® iON

for VDT1 code Art.-Nr. 107-90-00017



Holder for radiomatic® iON

for VDT2 code Art.-Nr. 107-90-00020



Joystick Euchner with cross link with bellows, type: KET 1234B

Art.-Nr. 011-01-00020

Please specify the fabrication number!





4. Transmitter - operating elements

Joystick Euchner without cross link

with bellows, type: KET 1234 BR

Art.-Nr. 011-01-00011

Please specify the fabrication number!



Joystick HBC

with button

Art.-Nr. diverse

Please specify the fabrication number!



Key switch

for micron 3/5, closure no. M1, with 1

Art.-Nr. IE420101



Key switch

for micron 4, linus and radius, closure no. 1, with 1 key

Art.-Nr. IE420201



Key switch

for eco, linus 6 (eco L) and spectrum, closure no. 1, with 1 key $\,$

Art.-Nr. IE420001



Linear lever

for linus 4/6 (eco L) and spectrum

Art.-Nr. diverse

Please specify the fabrication number!



Microswitch for joystick

HBC and Akerström

Art.-Nr. 011-01-00124



Plastic nut

for STOP impact switch micron 3/4/5

Art.-Nr. 004-02-00035



Plastic nut M10

for blind plug 003-90-00445

Art.-Nr. 004-02-00045



Plastic nut M12

for blind plug M12 003-90-00446

Art.-Nr. 004-02-00046







4. Transmitter - operating elements

Potentiometer 4,7 kOhm

type: PE30-AC-4,7k-A-20, without

Art.-Nr. IE340001



Push button one-step

for micron 3/4/5, without rubber cap

Art.-Nr. IE230004



Push button two-step

for micron 3/4/5, without rubber cap

Art.-Nr. IE230005



radiomatic® iON

with VDT1 code

Art.-Nr. diverse

Please specify the fabrication number!



radiomatic® iON

with VDT2 code

Art.-Nr. diverse

Please specify the fabrication number!



radiomatic® masterkey

without protection, with code

Art.-Nr. IE420121

Please specify the fabrication number!



radiomatic® masterkey

with protection, with code

Art.-Nr. IE420122

Please specify the fabrication number!



Rotary button for Elma rotary switch

Art.-Nr. 101-90-00072



Rotary button for rotary switch

for linus 4/6 (eco L), radius, vector, orbit and radiomatic® visio

Art.-Nr. 101-90-00017



Rotary button for rotary switch

for micron 4/5 with 3 steps

Art.-Nr. 101-90-00010







4. Transmitter - operating elements

Rotary button for rotary switch

for micron 4/5 with 4 steps Art.-Nr. 101-90-00011



Rotary button for rotary switch

for micron 4/5 with 5 steps Art.-Nr. 101-90-00012



Rotary button for rotary switch

for micron 4/5 with 2 steps Art.-Nr. 101-90-00009



Rotary button for rotary switch

for micron 4/5 with 0 steps, dummy Art.-Nr. 101-90-00008



Rotary button for rotary switch

for micron 3, plastic Art.-Nr. 101-90-00140



Rotary button for spring-return switch

for micron 4/5 with 3 steps, unlatched-0-unlatched Art.-Nr. 101-90-00013



Rotary switch 2 x 6 positions

for micron 3, linus, orbit and vector, with fastening material, without button Art.-Nr. 101-90-00116



Rotary switch Elma 1 x 12

for eco and spectrum, with button and cover platelet BV 22671 Art.-Nr. IE320005



Rotary switch Elma 2 x 6

for eco and spectrum, with button and cover platelet BV 22672

Art.-Nr. IE320002



Rotary switch Elma 3 x 4

for eco and spectrum, with button and cover platelet BV 22673

Art.-Nr. IE320003









4. Transmitter - operating elements

Rotary switch Elma 4 x 3

for eco and spectrum, with button and cover platelet BV 22674

Art.-Nr. IE320004



Rotary switch for micron 4/5

with nut, without button Art.-Nr. 011-01-00086



Rubber cap for micron push button

micron 3/5/6, with plastic clamp ring Art.-Nr. AET00050



Rubber cap for micron push button

micron 4, with plastic clamp ring Art.-Nr. AET00060



Rubber cap for quadrix push button

Art.-Nr. AET00150



Rubber mat cubix

with metal activator, x 8 Art.-Nr. AET00030



Rubber mat cubix

with metal activator, x 6

Art.-Nr. AET00020



Rubber mat orbit

with metal activator, x 8 Art.-Nr. AET00130



Seal disk for rotary switch micron 4/5

d = 19 x 6 mm

Seal ring large: 003-02-00005 Seal ring small: 003-02-00010

Art.-Nr. 003-90-00020



Seal for key switch micron 4

inside diameter = 16 mm Art.-Nr. 050-01-00046







4. Transmitter - operating elements

Seal for key switch or STOP impact

inside diameter = 22 mm Art.-Nr. 050-01-00035



Seal ring for micron 4/5 seal disk

7,5 x 1,8 mm, for seal disk 003-90-00020 Art.-Nr. 003-02-00010



Seal ring for micron 4/5 seal disk

13 x 2 mm, for seal disk 003-90-00020 Art.-Nr. 003-02-00005



Short-lift push button, long type

for spectrum, one-step, without protective kit Art.-Nr. IE230016



Short-lift push button, short type

for eco, one-step, without protective kit

Art.-Nr. IE230015



Single-axis analogue joystick

with 7-pole pin strip, JC 100-002 Art.-Nr. 011-01-00013 Please specify the fabrication number!



Spare key for key switch

micron 4, closure no. 1

Art.-Nr. 101-90-00049



Spare key for key switch

for eco, linus 6 (eco L) and spectrum,

closure no. 1

Art.-Nr. 101-90-00080



Spare key for key switch

micron 3/5, closure no. M1

Art.-Nr. 101-90-00001



Spring-return button Elma

type: BV 22572, without button

Art.-Nr. IE330001









4. Transmitter - operating elements

Spring-return key button closure no. 1, with 1 key
Art.-Nr. IE430001



STOP impact switch

for micron 3, with wiring, (without nut, without adapter)

Screw nut M16x1mm Article number 004-02-00035

Adapter Article number 101-90-00053

Art.-Nr. IE220005



STOP impact switch

for spectrum, eco and linus 6 (eco L) Art.-Nr. 011-01-00235



STOP impact switch

for micron 4/5, with wiring (without nut, without adapter)

Art.-Nr. IE220001



Toggle switch large type

without water protection cap

Please state function of the toggle switch!

Art.-Nr. diverse

Please specify the fabrication number!



Toggle switch latched-0-latched

small type, type: 8868-K-1

Art.-Nr. IE120003



Toggle switch latched-0-latched

large type, type: 8500-K-1

Art.-Nr. IE120007



Toggle switch latched-0-unlatched

small type, type: 8868-K-3

Art.-Nr. IE110001



Toggle switch latched-0-unlatched

large type, type: 8530-K-3

Art.-Nr. IE110002



Toggle switch latched-0-unlatched

large type, type: 8536 K-3-N, pull

locked

Art.-Nr. IE150001









4. Transmitter - operating elements

Toggle switch latched-latched small type, type: 8868-K-4 Art.-Nr. IE120009



Toggle switch latched-latched large type, type: 8530-K-4

Art.-Nr. IE120010



Toggle switch small type

without water protection cap Please state function of the toggle switch!

Art.-Nr. diverse

Please specify the fabrication number!



Toggle switch unlatched-0

small type, type: 8868-K-6 Art.-Nr. IE130001



Toggle switch unlatched-0-unlatched

small type, type: 8868-K-2 Art.-Nr. IE130002



Toggle switch unlatched-0-unlatched

large type, type: 8530-K-2 Art.-Nr. IE130005



Toggle switch, latched-O-latched

large type, type: 8536 K-1-A, pull

locked

Art.-Nr. IE150006



Water protection cap for toggle switch

without interlocking Art.-Nr. 011-01-00055





Water protection cap for toggle switch

with interlocking

Art.-Nr. 011-01-00075



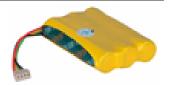
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5. Transmitter - batteries and accessories

Battery pack cubix

3,6 V/730 mAh, with cable Art.-Nr. BI2090B1



NC-battery FuB 07EEx

(EEx-explosion-protected), colour: black 8,4 V/ 500 mAh

Art.-Nr. BE207000

NiCd battery FuB 06 EEx

7,2 V/1000 mAh, explosion-protected, for FST 735, colour: black
Art.-Nr. BE206000



NiCd battery FuB 604

12 V/600 mAh, colour: grey Art.-Nr. BA604080



NiMH battery BA222060

6 V/650 mAh, colour: blue Spare for NiCd battery FuB 3 A, BA203060

Art.-Nr. BA222060



NiMH battery BA223000

3,6 V/2100 mAh, colour: black Art.-Nr. BA223000



NiMH battery BA223030

3,6 V/2100 mAh, colour: orange Art.-Nr. BA223030



NiMH battery BA225000

6 V/1500 mAh, colour: black Spare for NiCd battery FuB 05 AA/XL, BA205000 and BA206000

Art.-Nr. BA225000



NiMH battery BA225030

6 V/1500 mAh, colour: orange Spare for NiCd battery FuB 05 AA/XL, BA205030 and BA206030

Art.-Nr. BA225030



NiMH battery FuB 9 NM

6 V/650 mAh, colour: black Art.-Nr. BA209000









5. Transmitter - batteries and accessories

NiMH battery FuB 9 NM 6 V/650 mAh, colour: blue Art.-Nr. BA209060



NiMH-battery, BA214061

2 x 6 V/1500 mAh, color: blue Spare for NiCd battery FuB 10 AA/XL, BA210040, BA211060 and BA214060 Art.-Nr. BA214061



Tele Teach In battery TTB 05 with 2 push buttons, colour: orange Art.-Nr. BT225030



Tele Teach In battery TTB 10 with 2 push buttons, colour: red Art.-Nr. BT213020







6. Battery chargers and accessories

Charging slot adapter for QC005A00

to charge BA222060 colour: black Art.-Nr. 003-90-00084



Plug-in charger for cubix Blue Edition

with cigarette lighter plug, 12-32 V/DC, 600 mA Art.-Nr. QD107300



Plug-in charger for cubix Blue Edition

with 4 country adapters, 100-240 V/AC, 600 mA
Art.-Nr. QA107600



Power supply for cubix

with 4 country adapters, 100-240 V/AC Art.-Nr. PA006010



Power supply for cubix

with cigarette lighter plug, 12-24 V/DC Art.-Nr. PD009010



Rocker switch for double slot charger

FLG 701, FLG 702 or FLG 102 (green, illuminated)
Art.-Nr. IE120011



Rocker switch for FLG

FLG 701 and FLG 702, with O - I designation
Art.-Nr. IE120012



Single slot charger QA109600 100-240V/AC (EU)

700mA charging current for battery BA2250_0,BA222060 and BA2090_0,colour:black,with 2 charger slot adapters for BA222060 and BA2090_0 and EU connecting cable 2 m

Art.-Nr. 190-01-00059



Single slot charger QA109600 100-240V/AC (UK)

700mA charging current for battery BA2250_0,BA222060 and BA2090_0,colour:black,with 2 charger slot adapters for BA222060 and BA2090_0 and UK connecting cable 2 m

Art.-Nr. 190-01-00061



Single slot charger QA109600 100-240V/AC (US)

700mA charging current for battery BA2250_0,BA222060 and BA2090_0,colour:blackwith 2 charger slot adapters for BA222060 and BA2090_0 and US connecting cable 2 m

Art.-Nr. 190-01-00060









6. Battery chargers and accessories

Single slot chargerQD 115 10-30 V/DC

for battery BA214061, with cigarette lighter plug, colour: black
Art.-Nr. QD115300



Transformator for FLG 105B (QA105500)

Typ: UI30/10,5 with cable for 230 V/AC Art.-Nr. 007-01-00003





7. Receiver - accessories and antennas

Active antenna focus D

DECT-transceiver, cable length: 5 m Art.-Nr. AA070006



Antenna cable, length: 1 m

BNC-plug to mini crimp bushing,

matching for AA060006, AA060002, AA060003 Art.-Nr. AA020006



Antenna cable, length: 1 m

BNC-plug to N-plug,

matching for AA050006, AA050005 Art.-Nr. AA020012



Antenna cable, length: 10 m

BNC-plug to mini crimp bushing,

matching for AA060006, AA060002, AA060003 Art.-Nr. AA020009



Antenna cable, length: 10 m

BNC-plug to N-plug,

matching for AA050006, AA050005 Art.-Nr. AA020015



Antenna cable, length: 3 m

BNC-plug to mini crimp bushing,

matching for AA060006, AA060002, AA060003 Art.-Nr. AA020007



Antenna cable, length: 3 m

BNC-plug to N-plug,

matching for AA050006, AA050005 Art.-Nr. AA020013



Antenna cable, length: 5 m

BNC-plug to mini crimp bushing,

 $\begin{array}{ll} \text{matching for AA060006, AA060002,} \\ \text{AA060003} \end{array}$

Art.-Nr. AA020008



Antenna cable, length: 5 m

BNC-plug to N-plug,

matching for AA050006, AA050005 Art.-Nr. AA020014



Antenna focus I for radiomatic® infrakey

infrared receiver module, cable length: 5 m Art.-Nr. AI070001







7. Receiver - accessories and antennas

BNC built-in bushing

for single-hole assembly, 50 Ohm, max. 3,5 mm

Art.-Nr. 010-01-00004



Car antenna

minicrimp, frequency range: 870-960 MHz, length: 310 mm

Art.-Nr. AA060002



Car antenna

minicrimp, frequency range: 406-440

MHz, length: 180mm Art.-Nr. AA060006



Extension cable for focus D & I

length: 10 m Art.-Nr. AJST0094



Extension cable for focus D & I

length: 5 m

Art.-Nr. AJST0093



Extension cable for focus D & I

length: 20 m Art.-Nr. AJST0095



Holding magnet for receiver (1 piece)

size: 63 x 14 mm, with cylinder bore, 6,5 mm for M6

Art.-Nr. 009-90-00005



Receiver holding bracket (1 pair)

with screws and butterfly nuts

Art.-Nr. 190-01-00029



Receiver holding straps (1 pair)

for HEG 270, with fastening material

Art.-Nr. 106-02-00001



Silent block M6 (1 set)

1 set = 4 pieces with nuts and washers

25 x 20 mm

Art.-Nr. AS0004B0









7. Receiver - accessories and antennas

Silent block M8 (1 set)

1 set = 4 pieces with nuts and washers, 40 x 30 mm Art.-Nr. AS0005B0



UHF-antenna FL 30

BNC, with water protection cap, frequency range: 790-960 MHz Art.-Nr. AA020004



UHF-antenna FL 70

BNC, with water protection cap, frequency range: 410-470 MHz Art.-Nr. AA020002



Yagi antenna with mast holder

with N-bushing, frequency range: 432-438 MHz, with approx. 5 dB gain, length: 450 mm
Art.-Nr. AA050006



Yagi antenna with mast holder

with N-bushing, frequency range: 860-920 MHz, with approx. 5 dB gain,

length: 300 mm Art.-Nr. AA050005







8. Printed circuit boards and RF-modules

Auto-Power-Off-module

SMD-type

Art.-Nr. 172-90-00121



DECT module MD32

Version: TIS-SW 6.007 Art.-Nr. TDMD2021



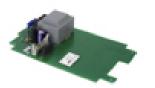
Receiver power supply printed

circuit board

for FSE 716

Art.-Nr. PA001010

Please specify the fabrication number!



Receiver relay printed circuit board

8 normally open relay, AC

Art.-Nr. OR005120

Please specify the fabrication number!



Receiver relay printed circuit board

6 normally open relay, 2 normally

closed relay, AC

Art.-Nr. OR005170

Please specify the fabrication number!



Receiver relay printed circuit board

6 normally open relay, 2 normally

closed relay, DC Art.-Nr. OR006121

Please specify the fabrication number!



Receiver relay printed circuit board

8 normally open relay, DC

Art.-Nr. OR006111

Please specify the fabrication number!



RF data radio receiver

FuE 671/3

Art.-Nr. diverse

Please specify the fabrication number!



RF data radio transmitter

FuS 671/3

Art.-Nr. diverse

Please specify the fabrication number!



RF transceiver module

TC 680

Art.-Nr. diverse

Please specify the fabrication number!









8. Printed circuit boards and RF-modules

Transmitter printed circuit board cubix

fitted with 8 push buttons
Art.-Nr. MT026013
Please specify the fabrication number!



Transmitter printed circuit board cubix

fitted with 6 push buttons
Art.-Nr. MT026023
Please specify the fabrication number!



Transmitter printed circuit board cubix Blue Edition

with 6 x two-step push buttons, VDT 2 Art.-Nr. MTC20021 Please specify the fabrication number!

Transmitter printed circuit board eco/spectrum

Art.-Nr. MT003020
Please specify the fabrication number!



Transmitter printed circuit board micron 3

equipped with 8 x two-step and 2 x one-step push buttons

Art.-Nr. MT002011

Please specify the fabrication number!



Transmitter printed circuit board micron 4

with 10 x two-step push buttons and 2 x rotary switches

Art.-Nr. MT019070

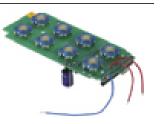
Please specify the fabrication number!



Transmitter printed circuit board orbit

equipped with 8 push buttons Art.-Nr. MT009010

Please specify the fabrication number!





9. Relays and fuses

Ceramic tube fine fuse 5 x 20 mm Please state current intensity (ampere) and release characteristics (T, MT, F) of the fuse!

Art.-Nr. diverse

Please specify the fabrication number!



Finest fuse Picofuse 0,5 A/250 V

axial (7,2 x 2,4 mm), F (super) quick-acting

Art.-Nr. 009-03-00071



Finest fuse Picofuse 1,0 A/125 V

axial (7,2 x 2,4 mm), F (super) quick-acting

Art.-Nr. 009-03-00055



Finest fuse Picofuse 2,0 A/125 V

axial (7,2 x 2,4 mm), F (super) quick-acting

Art.-Nr. 009-03-00066



Glass tube fine fuse 5 x 20 mm Please state current intensity (ampere) and release characteristics (T, MT, F) of the fuse!

Art.-Nr. diverse

Please specify the fabrication number!



Relay DE-1a1b-12V

1 x NC, 1 x NO

Art.-Nr. 011-02-00025



Relay DE-2a-12V

2 x NO

Art.-Nr. 011-02-00024



Schrack-relay

12 V, 1 x changeover contact

Art.-Nr. 011-02-00021



SDS-Relay

SP2-DC12 V, (emergency-stop-relay)

Art.-Nr. 011-02-00008



SDS-Relay

SP2-P-DC12 V, (emergency-stop-relay)

Art.-Nr. 011-02-00010







9. Relays and fuses

SDS-Relay S2 12 V, 2 x NO

Art.-Nr. 011-02-00012



SDS-Relay SF2-12 VDC 2 x NO, 2 x NC (emergency-stop-relay) Art.-Nr. 011-02-00003



SDS-Relay ST112 V, 1 x NC, 1 x NO
Art.-Nr. 011-02-00015



SDS-Relay ST2 12 V, 2 x NO Art.-Nr. 011-02-00014





10. Cables, plugs, miscellaneous

Antenna cable in receiver

with SMB-bushing to BNC-bushing,

length: 230 mm Art.-Nr. AA020010



Antenna cable in receiver

with SMB-bushing to BNC-bushing, length: 500 mm

Art.-Nr. AA020011



Antenna cable in receiver

with MMCX-plug to SMB-bushing,

length: 90 mm Art.-Nr. AA040005



Antenna cable in receiver

with MMCX-plug to BNC-bushing, length: 240 mm

Art.-Nr. AA080005



Antenna cable in receiver

with MMCX-plug to BNC-bushing,

length: 350 mm Art.-Nr. AA080006



Connection cable for cable option

length: 20 m Art.-Nr. AJST0081



Flat band cable 16 pins

1 plug, colour-coded, length: 550 mm

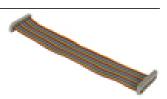
Art.-Nr. 012-04-00004



Flat band cable 34 pins

2 plugs, colour-coded, length: 250 mm

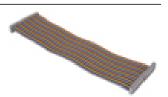
Art.-Nr. 012-04-00002



Flat band cable 60 pins

2 plugs, colour-coded, length: 290 mm

Art.-Nr. 012-04-00006



Fuse holder, vertical

square with 4 connections, 5 x 20 mm $\,$

Art.-Nr. 009-02-00002









10. Cables, plugs, miscellaneous

Fuse holder, vertical square with 2 connections, 5 x 20 mm Art.-Nr. 009-02-00003



Fuse holder, vertical circular with 2 connections, 5 x 20 mm Art.-Nr. 009-02-00009







HBC-General Sales and Delivery Terms and Conditions – Version dated September 2003

1. Exclusive validity

- 1.1 The following sales and delivery terms and conditions apply to all present quotations and deliveries from HBC and for dealers to all future ones as well. The customer's purchasing and other conditions apply only insofar as they do not contradict the following conditions or HBC has agreed them in writing.
- 1.2 Different agreements and (oral) additional clauses acquire validity only if they are confirmed in writing by HBC.

2. Quotation, signing of contract

- 2.1 Quotations from HBC are subject to alteration and are prepared on the basis of the documents and information available to HBC on the day the quotation is drawn up.
- 2.2 A contract comes into force only on receipt of the contract confirmation or when the goods are delivered by HBC.
- 2.3 The customer is bound by his orders for 21 days.
- 2.4 HBC retains the title and all copyrights to cost estimates, samples, drawings and other documents handed to the customer. They may not be made accessible to third parties without the agreement of HBC and, if requested, are to be returned to HBC together with all copies made therefrom.

3. Prices, payment conditions

- 3.1 Unless stipulated otherwise in the contract confirmation, invoices are due on receipt and payable within 10 days at a discount of 2% or within 30 days pure net. Repairs are payable immediately pure net without a discount.
- 3.2 Payments must be made free of costs and charges into HBC's bank accounts stated on the invoice.
- 3.3 Bills of exchange are not accepted by us, cheques merely in payment of a
- 3.4 All prices are understood to exclude VAT at the legal rate on the day of nvoicing as well as freight, packaging and transportation insurance ex works Crailsheim.

4. Default of payment

- 4.1 If a customer is more than ten days in arrears with a payment, if he allows bills of exchange or cheques to be protested, if insolvency proceedings are instituted against him or if individual enforcement measures are taken against him, HBC is entitled, without prejudice to other rights:
 - a) if the delay/protest relates to a financing or redemption agreement, to make all claims hereunder due immediately;
 - b) to withhold all deliveries or services from contracts not yet fulfilled or to provide them only against pre-payment;
 - c) to enforce all rights arising from the retention of title (paragraph 10).
- 4.2 In the case of a delay HBC is entitled in addition to claim default interest at the legal rate. HBC reserves the right to claim for a demonstrably greater loss.

5. Setting-off, retention

- 5.1 The customer can give notice of offsetting against the claims of HBC only if the customer's claim is undisputed or has been legally determined.
- 5.2 In commercial transactions the customer can claim a right to refuse to per form a service or a right to offset only if the customer's claim is undisputed or has been legally determined.

6. Delivery and delivery time, self-distribution

- 6.1 The observance of agreed delivery deadlines presupposes that the required permissions, documents to be provided by the customer, releases, services to be provided as well as other obligations on the part of the customer are provided or fulfilled punctually. If this does not happen or alterations are made at the customer's request after the contract has been signed, the deadline will be extended by an appropriate period. With agreed delivery deadlines it is not a question of fixed deadlines.
- 6.2 The delivery deadline is considered to have been observed if, before its expiry, the ordered goods have left the warehouse or the notice of readiness

- for despatch has been sent.
- 6.3 If the non-observance of an agreed delivery deadline is attributable to force majeure, legitimate industrial dispute, natural catastrophes, operational breakdowns, unforeseen obstacles or other circumstances not attributable to HBC, the delivery deadline will be extended for the duration of these events. This will apply appropriately should HBC be behind with its delivery at the start of one of these events.
- 6.4 In the case of a delay lasting more than 3 months in the provision of a service in the sense of paragraph 6.3, both HBC and the customer are entitled to withdraw from the contract on account of the delayed delivery, but in the case of non-observance of the delivery deadline for reasons other than those mentioned in paragraph 6.3, only the customer is entitled to withdraw. A pre-requisite for a withdrawal by the customer is that he has set HBC in writing an appropriate extension of the delivery deadline (of at least three weeks' duration).
- 6.5 HBC is entitled to make a delivery in advance as well as to make part-deliveries of a size suitable for the customer. Part deliveries can be invoiced immediately by HBC.
- 6.6 HBC reserves the right in each case to make a correct and punctual distribution itself unless in this respect HBC encounters a debt.

7. Transfer of risk and despatch

- 7.1 The customer is under an obligation to accept the goods at the agreed acceptance location within eight days of receipt of the notice of readiness
- 7.2 Insofar as the customer wishes to take delivery at another location this takes place at the customer's risk, being invoiced to the customer at cost price. The same applies to possible returned consignments unless these are as a result of a fault covered by guarantee or another circumstance, for which HBC is responsible. HBC determines the carrier, without accepting liability therefor, so that the cheapest and quickest method of despatch is obtained. The customer's despatch instructions are binding on HBC only if they have been confirmed by HBC in writing.
- 7.3 The risk is transferred to the customer with the handing over of the goods, in the case of 7.2 when the goods are handed over to the carrier, including cases where part deliveries are made or HBC has undertaken additional services, e.g. transport costs or carriage.
- 7.4 If the customer is late in accepting delivery or the delivery is delayed for other circumstances, for which he is responsible, the risk is transferred to the customer from the date of the notice of readiness. In these cases the purchase price is also due from the date of the notification of readiness for despatch. The customer is responsible for storage costs at the premises of HBC or of a third party. This does not affect a claim for compensation from the customer in excess of this.

8. Guarantee

- 8.1 Within the scope of the following clauses HBC guarantees that deliveries are free from defects in the legal guarantee sense and that the written agreed specifications have been observed as well as the properties guaranteed in writing by HBC.
- 8.2 The guarantee period amounts to 12 months. The legal guarantee period also applies to consumers in the cases referred to in §§ 438, para. 1 No.2 and 634a para. 1 No.2 of the German Civil Code.
- 8.3 In the case of justified complaints HBC, at its discretion, will either replace or rectify the faulty object free of charge. With regard to the delivery of goods (purchase), if the customer is a consumer he can choose between replacement and rectification. If HBC is not prepared or not in a position to be able to rectify the fault/provide a replacement and fails to do so beyond an appropriate deadline for reasons, for which HBC is responsible or if the rectification of the fault/ replacement fails in some other way, the customer is entitled, at his discretion, either to withdraw from the contract or to demand an appropriate reduction in the purchase price (reduction).
- 8.4 The rights under guarantee of the commercial customer require that the latter has properly fulfilled the investigative- and reciprocal obligations imposed upon him under §§ 377 and 381, para. 2 of the Commercial Code. Any complaints (including shortages) must be notified to us in writing without delay, at the latest, however, within 14 days following delivery, otherwise the purchaser can derive no further rights hereunder. Damage or losses





HBC-General Sales and Delivery Terms and Conditions – Version dated September 2003

caused during transportation must be notified to us without delay, at the latest, however, within the deadline stated on the packing units. Obligations to make further notifications (such as a claim for damage against the carrier) are not affected by this.

- 8.5 Claims under guarantee are not entertained if the faults, which have occurred, are in relation of cause and effect so that – an obvious fault is not notified with 2 weeks;
 - the purchaser has not observed the regulations concerning handling, maintenance, care and conditions of use;
 - the purchased object has been operated in a manner not recognised by the manufacturer/importer or repaired, maintained or serviced by the customer himself
 - spare parts not recommended by the manufacturer/importer have been used or accessories added.
- 8.6 In the case of a fault complained about by the customer, which is not a fault under guarantee, or for which the guarantee has expired, HBC is entitled to charge the customer for labour and material costs involved as well as an inclusive fee for travelling.
- 8.7 Insofar as deliveries from HBC contain foreign products guarantees provided by the manufacturer will be passed on to the customer, if applicable, without any liability on the part of HBC.

9. Liability

- 9.1 Claims for compensation no matter of what kind are excluded if HBC, its legal representative or agents have acted slightly negligently. This exclusion of liability does not apply if guaranteed properties are missing or important contractual obligations have been infringed in a manner endangering the fulfilment of the purpose of the contract. In the latter cases, however, liability is limited to the scope of the guarantee or, in the case of slightly negligent infringement of important contractual obligations to contractually typical, foreseeable losses.
- 9.2 The aforementioned limitation of liability does not apply to claims under the Product Liability Law.
- 9.3 Insofar as the liability of HBC is excluded or limited, this also applies to the personal liability of the staff members, contractors, assistants, representatives and agents of HBC.

10. Retention of title

- 10.1 HBC retains the title to the goods delivered to the customer until payment is made in full. The retention of title also applies to all claims, which had already arisen at the time this contract was signed; it addition it extends to all claims arising from subsequent business, particularly deliveries of spare parts and after sales services ("retained goods"). This also applies if individual or all claims are included in a current invoice and the balance is drawn and recognised.
- 10.2 The customer is under an obligation to treat the retained goods with care and particularly to take out and maintain, at his expense, insurance cover against the customary risks (including fire and theft). At his own expense the customer must undertake maintenance and inspection work punctually in accordance with the manufacturer's recommendations, or permit it to be undertaken by HBC or by a firm recognised by HBC or the manufacturer.
- 10.3 The customer is entitled to pledge, assign by way of security, hire or transfer the retained goods abroad only following the prior written agreement of HBC. The customer is entitled to sell on the retained goods in the course of his normal business operations.
- 10.4 The customer assigns at this stage to HBC all claims and demands for compensation, to which he is entitled in respect of the sale or otherwise of the retained goods (e.g. claims arising from unauthorised handling of the goods, insurance claims) to the amount of the invoiced value of the retained goods in an agreed current account amounting to the sum of the outstanding balance.
- 10.5 In the case of actions by a third party against the retained goods the customer has to draw attention to HBC's title and to notify HBC in writing without delay. If the third party is not in a position to compensate HBC for the legal and non-legal costs of a lawsuit in accordance with § 771 of the Rules of Civil Procedure, the customer is liable for the expenditure incurred.

- 10.6 If the retained goods are inseparably combined with objects, which do not belong to HBC, HBC acquires co-ownership in the new object in the proportion of the value of the retained goods to the other combined objects at the time of the combination. If the combination takes place in such a manner that the customer's article is to be regarded as the main article, it is considered to have been agreed that the customer transfers co-ownership to HBC proportionately. The customer will hold the sole-ownership or the co-ownership, which has thus come about, on behalf of HBC. The customer also assigns to HBC by way of security the claims against a third party, which accrue to him through the combination of the retained goods with a property.
- 10.7 If the realisable value of the securities assigned by the customer, to which HBC is entitled from the retention of title, exceed the existing total claim against the customer by more than 20%, HBC is obliged, at the customer's request, to release its choice of the securities, to which HBC is entitled under this agreement, down to the agreed value limit.

11. National postal regulations and export

- 11.1 Remote-controlled radio installations can be operated at home and abroad only with the special permission of the national postal authorities (Post, Telephone, Telegraph) and only on the assigned operational frequencies. Excepted from this is equipment with a temporary authorisation. Authorisation procedures vary from country to country.
- 11.2 In an individual case the purchaser must clarify whether PTT approval exists.
- 11.3 A sale by the purchaser to foreign clients takes place at his sole risk. In the case of an export the customer releases HBC from all claims relating to product liability. In such a case the customer is also responsible for observing the valid import and export regulations.

12. Place of fulfilment, place of jurisdiction

- 12.1 The place of fulfilment for all claims arising from the contract concluded between the customer and HBC is Crailsheim.
- 12.2 If the customer is a merchant in the sense of HBC, it is agreed with the c customer that Crailsheim is the place of jurisdiction for all disputes arising from the contracts.

13. Applicable law, validity, written form

- 13.1 The law of the German Federal Republic applies. The application of the standard international purchasing law (UN Convention on Contracts for the International Sale of Goods/UNCITRAD agreement) is excluded.
- 13.2 If individual integral parts of these sales and delivery terms and conditions are or become ineffective, the effectiveness of the remaining parts is not affected thereby.
- 13.3 Alterations and additions to the clauses contained in these conditions require the written form to become effective.
- 13.4 In accordance with § 33 of the Data Protection Act we draw your attention to the fact that, as part of our business operations, the necessary customer and supplier data is stored with the aid of electronic data processing.

General Sales and Delivery Terms and Conditions of the firm HBC-radiomatic \mbox{GmbH} ("HBC").





Bestellformular Ersatzteile / Order Form Spare Parts

Lieferadresse / Shipping address

Rechnungsadresse / Billing address

			(falls abweichend von Rechnu	ngsadresse / if deviating from your dilling address)							
Name Firma / Company Straße / Address PLZ, Ort / ZIP, City			Name Firma / Company Straße / Address Ort / City								
						TelNr. / Tel. no.					
						Fax			Bestell-Nr. / Order no.		
						E-Mail			UstID / VAT-ID		
Kunden-Nr. / Customer no.			Steuernr. / Tax no. (na	Steuernr. / Tax no. (national)							
Menge / Artikel-Nr. /		lachtexpress NET / NET ove	kelbezeichnung /	Bemerkung, Fabrikationsnummer /							
Quantity			Description	Remarks, fabrication number							
Datum / Date		Unterschrift / Sig	gnature								
Weitere Informationen und Ersatzteil-Bestellungen: For further information and spare part orders:		Fon: +49 7951 3 Fax: +49 7951 3 E-Mail: info@radior	393-802	Lieferungen ausschließlich gemäß unseren AGBs • Lieferung ab Werk • Es gelten die mit uns vereinbarten Zahlungsbedingungen! Delivery only according to our general business terms and conditions!							





E

Kubota Motor

This Section contains:

Kubota Operator and Service Manual

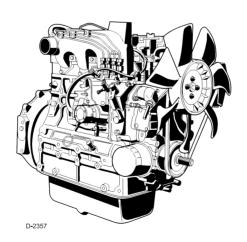
Kubota Spare Parts Manual

OPERATOR'S MANUAL

KUBOTA DIESEL ENGINE

MODELS

D1503-M-E3·D1703-M-E3·D1803-M-E3 V2003-M-E3·V2203-M-E3·V2403-M-E3·V2403-M-T-E3



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FOREWORD

You are now the proud owner of a KUBOTA Engine. This engine is a product of KUBOTA quality engineering and manufacturing. It is made of fine materials and under a rigid quality control system. It will give you long, satisfactory service. To obtain the best use of your engine, please read this manual carefully. It will help you become familiar with the operation of the engine and contains many helpful hints about engine maintenance. It is KUBOTA's policy to utilize as quickly as possible every advance in our research. The immediate use of new techniques in the manufacture of products may cause some small parts of this manual to be outdated. KUBOTA distributors and dealers will have the most up-to-date information. Please do not hesitate to consult with them.



This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully. It is essential that you read the instructions and safety regulations before you attempt to assemble or use this unit.

A

DANGER: Indicates an imminently hazardous situation which,

if not avoided, will result in death or serious

injury.

A

VARNING: Indicates a potentially hazardous situation which,

if not avoided, could result in death or serious

injury.

A

CAUTION: Indicates a potentially hazardous situation which,

if not avoided, may result in minor or moderate

injury.

IMPORTANT: Indicates that equipment or property damage

could result if instructions are not followed.

NOTE: Gives helpful information.



SAFE OPERATION

Careful operation is your best assurance against an accident. Read and understand this section carefully before operating the engine. All operators, no matter how much experience they may have, should read this and other related manuals before operating the engine or any equipment attached to it. It is the owner's obligation to provide all operators with this information and instruct them on safe operation.

Be sure to observe the following for safe operation.

1 OBSERVE SAFETY INSTRUCTIONS

- Read and understand carefully this "OPERATOR'S MANUAL" and "LABELS ON THE ENGINE" before attempting to start and operate the engine.
- Learn how to operate and work safely. Know your equipment and its limitations. Always keep the engine in good condition.
- Before allowing other people to use your engine, explain how to operate and have them read this manual before operation.
- DO NOT modify the engine. UNAUTHORIZED MODIFICATIONS to the engine may impair the function and/or safety and affect engine life. If the engine does not 1AAACAAAP008B perform properly, consult your local Kubota Engine Distributor first.



2. WEAR SAFE CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT (PPE)

- DO NOT wear loose, torn or bulky clothing around the machine that may catch on working controls and projections or into fans, pulleys and other moving parts causing personal injury.
- Use additional safety items-PPE, e.g. hard hat, safety protection, safety goggles, gloves, etc., as appropriate or required.
- DO NOT operate the machine or any equipment attached to it while under the influence of alcohol, medication, or other drugs, or while fatigued.
- DO NOT wear radio or music headphones while ¹AEAAAAAP0130 operating the engine.



3. CHECK BEFORE STARTING & OPERATING THE ENGINE

- Be sure to inspect the engine before operation. Do not operate the engine if there is something wrong with it. Repair it immediately.
- Ensure all guards and shields are in place before operating the engine. Replace any that are damaged or missina.
- Check to see that you and others are a safe distance from the engine before starting.
- Always keep the engine at least 3 feet (1 meter) away from buildings and other facilities.
- DO NOT allow children or livestock to approach the machine while the engine is running.
- DO NOT start the engine by shorting across starter

 1BAABADAP0010 terminals. The machine may start in gear and move. Do not bypass or defeat any safety devices.



4. KEEP THE ENGINE AND SURROUNDINGS CLEAN

- Be sure to stop the engine before cleaning.
- Keep the engine clean and free of accumulated dirt. grease and trash to avoid a fire. Store flammable fluids in proper containers and cabinets away from sparks and heat.
- Check for and repair leaks immediately.
- DO NOT stop the engine without idling: Allow the engine to cool down, first. Keep the engine idling for about 5 1AEAAAAAP0120 minutes before stopping unless there is a safety problem that requires immediate shut down.



5. SAFE HANDLING OF FUEL AND LUBRICANTS -KEEP AWAY FROM FIRE

- Always stop the engine before refueling and/or lubricating.
- DO NOT smoke or allow flames or sparks in your work area. Fuel is extremely flammable and explosive under certain conditions.
- Refuel at a well ventilated and open place. When fuel and/or lubricants are spilled, refuel after letting the engine cool down.
- DO NOT mix gasoline or alcohol with diesel fuel. The mixture can cause a fire or severe engine damage.
- Do not use unapproved containers e.g. buckets, bottles, jars. Use approved fuel storage containers and dispensers.



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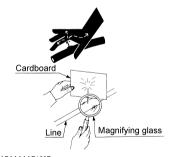
6. EXHAUST GASES & FIRE PREVENTION

- Engine exhaust fumes can be very harmful if allowed to accumulate. Be sure to run the engine in a well ventilated location and where there are no people or livestock near the engine.
- The exhaust gas from the muffler is very hot. To prevent a fire, do not expose dry grass, mowed grass, oil or any other combustible materials to exhaust gas. Keep the engine and muffler clean at all times.
- To avoid a fire, be alert for leaks of flammable substances from hoses and lines. Be sure to check for leaks from hoses or pipes, such as fuel and hydraulic fluid by following the maintenance check list.
- To avoid a fire, do not short across power cables and wires. Check to see that all power cables and wirings are in good condition. Keep all electrical connections clean. Bare wire or fraved insulation can cause a dangerous electrical shock and personal injury.



7. ESCAPING FLUID

- Relieve all pressure in the air, the oil and the cooling systems before disconnecting any lines, fittings or related items.
- Be cautious of possible pressure relief when disconnecting any device from a pressurized system that utilizes pressure. DO NOT check for pressure leaks with your hand. High pressure oil or fuel can cause personal injury.
- Escaping fluid under pressure has sufficient force to penetrate skin causing serious personal injury.
- Fluid escaping from pinholes may be invisible. Use a piece of cardboard or wood to search for suspected leaks: do not use hands and body. Use safety goggles or other eye protection when checking for leaks.
- If injured by escaping fluid, see a medical doctor 1ABAAAAAP120F immediately. This fluid can produce gangrene or severe allergic reaction.



8. CAUTIONS AGAINST BURNS & BATTERY EXPLOSION

- To avoid burns, be cautious of hot components, e.g. muffler, muffler cover, radiator, hoses, engine body, coolants, engine oil, etc. during operation and after the engine has been shut off.
- DO NOT remove the radiator cap while the engine is running or immediately after stopping. Otherwise hot water will spout out from the radiator. Wait until the radiator is completely cool to the touch before removing the cap. Wear safety googles.
- Be sure to close the coolant drain valve, secure the pressure cap, and fasten the pipe band before operating.
 If these parts are taken off, or loosened, it will result in serious personal injury.
- The battery presents an explosive hazard. When the battery is being charged, hydrogen and oxygen gases are extremely explosive.
- DO NOT use or charge the battery if its fluid level is below the LOWER mark.
 - Otherwise, the component parts may deteriorate earlier than expected, which may shorten the service life or cause an explosion. Immediately, add distilled water until the fluid level is between the UPPER and LOWER marks.
- Keep sparks and open flames away from the battery, especially during charging. DO NOT strike a match near the battery.
- DO NOT check the battery charge by placing a metal object across the terminals. Use a voltmeter or ^{1ARAEAAAP0520} hydrometer.
- DO NOT charge a frozen battery. There is a risk of explosion. When frozen, warm the battery up to at least 16°C (61°F).



1AEABAAAP0080





9. KEEP HANDS AND BODY AWAY FROM ROTATING PARTS

- Be sure to stop the engine before checking or adjusting the belt tension and cooling fan.
- Keep your hands and body away from rotating parts, such as the cooling fan, V-belt, fan drive V-belt, pulley or flywheel. Contact with rotating parts can cause severe personal injury.
- DO NOT run the engine without safety guards. Install safety guards securely before operation.





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10. ANTI-FREEZE & DISPOSAL OF FLUIDS

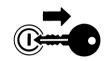
- Anti-freeze contains poison. Wear rubber gloves to avoid personal injury. In case of contact with skin, wash it off immediately.
- DO NOT mix different types of Anti-freeze. The mixture can produce a chemical reaction causing harmful substances. Use approved or genuine KUBOTA Antifreeze.
- Be mindful of the environment and the ecology. Before draining any fluids, determine the correct way to dispose of them. Observe the relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters and batteries.
- When draining fluids from the engine, place a suitable container underneath the engine body.
- DO NOT pour waste onto the ground, down a drain, or into any water source. Dispose of waste fluids according to environmental regulations.





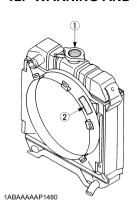
11. CONDUCTING SAFETY CHECKS & MAINTENANCE

- When inspecting the engine or servicing, place the engine on a large flat surface. DO NOT work on anything that is supported ONLY by lift jacks or a hoist. Always use blocks or the correct stands to support the engine before servicina.
- Disconnect the battery from the engine before conducting service. Put a "DO NOT OPERATE!" tag on the key switch to avoid accidental starting.
- To avoid sparks from an accidental short circuit always disconnect the battery's ground cable (-) first and reconnect it last.
- Be sure to stop the engine and remove the key when conducting daily and periodic maintenance, service and cleaning.
- Check or conduct maintenance after the engine, coolant, muffler, or muffler cover have cooled off completely.
- Always use the appropriate tools and fixtures. Verify that they are in good condition before performing any service work. Make sure you understand how to use them before 1BJABAAAP0200 service
- Use ONLY correct engine barring techniques for manually rotating the engine. DO NOT attempt to rotate the engine by pulling or prying on the cooling fan and Vbelt. This practice can cause serious personal injury or premature damage to the cooling fan and belt.
- Replace fuel pipes and lubricant pipes with their hose clamps every 2 years or earlier whether they are damaged or not. They are made of rubber and age gradually.
- When servicing is performed together by two or more persons, take care to perform all work safely.
- Keep a first aid kit and fire extinguisher handv at all times.





12. WARNING AND CAUTION LABELS



① Part No.19077-8724-1 or 16667-8724-1 (55mm in diameter) (37mm in diameter)



② Part No.TA040-4957-1 Do not get your hands close to engine fan and fan belt.



13. CARE OF WARNING AND CAUTION LABELS

- 1. Keep warning and caution labels clean and free from obstructing material.
- 2. Clean warning and caution labels with soap and water, dry with a soft cloth.
- Replace damaged or missing warning and caution labels with new labels from your local KUBOTA dealer.
- 4. If a component with warning and caution label(s) affixed is replaced with a new part, make sure the new label(s) is (are) attached in the same location(s) as the replaced component.
- Mount new warning and caution labels by applying to a clean dry surface and pressing any bubbles to the outside edge.

SERVICING OF THE ENGINE

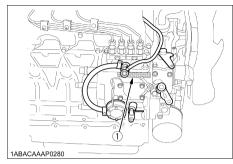
Your dealer is interested in your new engine and has the desire to help you get the most value from it. After reading this manual thoroughly, you will find that you can do some of the regular maintenance yourself.

However, when in need of parts or major service, be sure to see your KUBOTA dealer.

For service, contact the KUBOTA Dealership from which you purchased your engine or your local KUBOTA dealer. When in need of parts, be prepared to give your dealer the engine serial number.

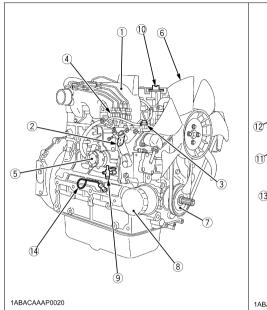
Locate the serial number now and record them in the space provided.

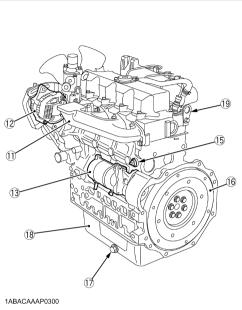
	Туре	Serial No.
Engine		
Date of Purchase		
Name of Dealer		
(To be filled in by purchaser)		



(1) Engine serial number

NAMES OF PARTS





- (1) Intake manifold
- (2) Speed control lever
- (3) Engine stop lever (4) Injection pump
- (5) Fuel feed pump
- (6) Cooling fan
- (7) Fan drive pulley
- (8) Oil filter cartridge
- (9) Water drain cock

- (10) Oil filler plug
- (11) Exhaust manifold
- (12) Alternator
- (13) Starter
- (14) Oil level gauge
- (15) Oil pressure switch
- (16) Flywheel
- (17) Oil drain plug
- (18) Oil pan
- (19) Engine hook

PRE-OPERATION CHECK

BREAK-IN

During the engine break-in period, observe the following by all means:

- Change engine oil and oil filter cartridge after the first 50 hours of operation. (See "ENGINE OIL" in "PERIODIC SERVICE" section.)
- 2. When ambient temperature is low, operate the machine after the engine has been completely warmed up.

DAILY CHECK

To prevent trouble from occurring, it is important to know the conditions of the engine well. Check it before starting.



CAUTION

- To avoid personal injury:
- Be sure to install shields and safeguards attached to the engine when operating.
- Stop the engine at a flat and wide space when checking.
- Keep dust or fuel away from the battery, wiring, muffler and engine to prevent a fire.
 Check and clear them before operating everyday. Pay attention to the heat of the exhaust pipe or exhaust gas so that it can not ignite trash.

ltem		Ref. page
1. Parts which had trouble in previous o	peration	-
2. By walking around the machine	(1) Oil or water leaks	15 to 20
	(2) Engine oil level and contamination	15,16
	(3) Amount of fuel	12
	(4) Amount of coolant	18 to 20
	(5) Dust in air cleaner dust cup	21
	(6) Damaged parts and loosened bolts and nuts	-
By inserting the key into the starter switch	(1) Proper functions of meters and pilot lamps; no stains on these parts	-
	(2) Proper function of glow lamp timer	-
4. By starting the engine	(1) Color of exhaust fumes	7
	(2) Unusual engine noise	7
	(3) Engine start-up condition	5
	(4) Slow-down and acceleration behavior	7

OPERATING THE ENGINE

STARTING THE ENGINE(NORMAL)



CAUTION

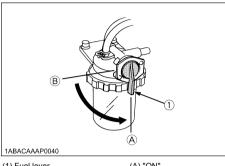
To avoid personal injury:

- Do not allow children to approach the machine while the engine is running.
- Be sure to install the machine on which the engine is installed, on a flat place.
- Do not run the engine on gradients.
- Do not run the engine in an enclosed area. Exhaust gas can cause air pollution and exhaust gas poisoning.
- Keep your hands away from rotating parts (such as fan, pulley, belt, flywheel etc.) during operation.
- Do not operate the machine while under the influence of alcohol or druas.
- Do not wear loose, torn or bulky clothing around the machine. It may catch on moving parts or controls, leading to the risk of accident. Use additional safety items, e.g. hard hat, safety boots or shoes, eye and hearing protection, gloves, etc., as appropriate or required.
- radio Do not wear music headphones while operating engine.
- Check to see if it is safe around the engine before starting.
- Reinstall safeguards and shields securely and clear all maintenance tools when starting the engine after maintenance.

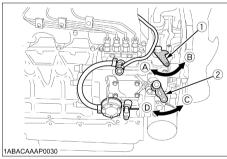
IMPORTANT:

- Do not use ether or any starting fluid for starting the engine, or a severe damage will occur.
- When starting the engine after a long storage (of more than 3 months), first set the stop lever to the "STOP" position and then activate the starter for about 10 seconds to allow oil to reach every engine part.

1. Set the fuel lever to the "ON" position.

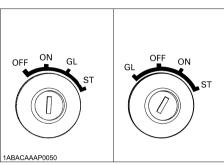


- (1) Fuel lever
- (A) "ON" (B) "OFF"
- 2. Place the engine stop lever to the "START" position.
- 3. Place the speed control lever at more than half "OPERATION".



- (1) Engine stop lever
- (2) Speed Control lever
- (A) "STOP"
- (B) "START"
- (C) "IDLING"
- (D) "OPERATION"

4. Insert the key into the key switch and turn it to the "OPERATION" position.



- (A) "OFF" SWITCHED OFF
- (B) "ON" OPERATION
- (C) "GL" PREHEATING
- (D) "ST" STARTING
- (A) "GL" PREHEATING
- (B) "OFF" SWITCHED OFF (C) "ON" OPERATION
- (D) "ST" STARTING
- 5. Turn the starter switch to the "PREHEATING" position to allow the glow lamp to redden.

NOTE:

(with lamp timer in use)

- The glow lamp goes out in about 5 seconds when the lamp timer is up. Refer to this for pre-heating.
 Even with the glow lamp off, the glow plug can be preheated by turning the starter switch to the "PREHEATING" position.
- Turn the key to the "STARTING" position and the engine should start. Release the key immediately when the engine starts.
- 7. Check to see that the oil pressure lamp and charge lamp are off. If the lamps are still on, immediately stop the engine, and determine the cause.

 (See "CHECKS DURING OPERATION" in "OPERATING THE ENGINE" section.)

NOTE:

- If the oil pressure lamp should be still on, immediately stop the engine and check;
 - if there is enough engine oil.
 - if the engine oil has dirt in it.
 - if the wiring is faulty.

Warm up the engine at medium speed without load.

IMPORTANT:

- If the glow lamp should redden too quickly or too slowly, immediately ask your KUBOTA dealer to check and repair it.
- If the engine does not catch or start at 10 seconds after the starter switch is set at "STARTING" position, wait for another 30 seconds and then begin the engine starting sequence again. Do not allow the starter motor to run continuously for more than 20 seconds.

COLD WEATHER STARTING

If the ambient temperature is below -5° C(23° F)* and the engine is very cold, start it in the following manner: Take steps (1) through (4) above.

5. Turn the key to the "PREHEATING" position and keep it there for a certain period mentioned below.

IMPORTANT:

 Shown below are the standard preheating times for various temperatures. This operation, however, is not required, when the engine is warmed up.

Ambient temperature	Preheating time
Above 10°C (50°F)	NO NEED
10°C (50°F) to -5°C (23°F)	Approx. 5 seconds
*Below -5°C (23°F)	Approx. 10 seconds
Limit of continuous use	20 seconds

Turn the key to the "STARTING" position and the engine should start.

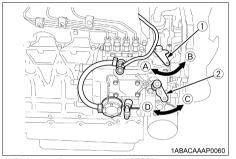
(If the engine fails to start after 10 seconds, turn off the key for 5 to 30 seconds. Then repeat steps (5) and (6).)

IMPORTANT:

- Do not allow the starter motor to run continuously for more than 20 seconds.
- Be sure to warm up the engine, not only in winter, but also in warmer seasons. An insufficiently warmed-up engine can shorten its service life.
- When there is fear of temperature dropping below -15°C (5°F) detach the battery from the machine, and keep it indoors in a safe area, to be reinstalled just before the next operation.

STOPPING THE ENGINE

- Return the speed control lever to low idle, and run the engine under idling conditions.
- 2. Set the engine stop lever to the "STOP" position.
- 3. With the starter switch placed to the "SWITCHED OFF" position, remove the key. (Be sure to return the engine stop lever to the "START" position to be ready for the next start.)



- (1) Engine stop lever (2) Speed control lever
- (A) "STOP"
 - (B) "START" (C) "IDLING"
 - (D) "OPERATION"

IMPORTANT:

If equipped with a turbo-charger, allow the engine to idle for 5 minutes before shutting it off after a full load operation.

Failure to do so may lead to turbo-charger trouble.

CHECKS DURING OPERATION

While running, make the following checks to see that all parts are working correctly.

■Radiator Cooling water(Coolant)



WARNING o avoid personal injury:

 Do not remove radiator cap until coolant temperature is well below its boiling point. Then loosen cap slightly to the stop position, to relieve any pressure, before removing cap completely.

When the engine overheats and hot coolant overflows through the radiator and hoses, stop the engine immediately and make the following checks to determine the cause of trouble:

Check item

- 1. Check to see if there is any coolant leak;
- 2. Check to see if there is any obstacle around the cooling air inlet or outlet:
- 3. Check to see if there is any dirt or dust between radiator fins and tube:
- 4. Check to see if the fan belt is too loose:
- 5. Check to see if radiator water pipe is clogged; and
- 6. Check to see if anti-freeze is mixed to a 50/50% mix of water and anti-freeze.

Oil pressure lamp

The lamp lights up to warn the operator that the engine oil pressure has dropped below the prescribed level. If this should happen during operation or should not go off even after the engine is accelerated more than 1000rpm, immediately stop the engine and check the following:

- 1. Engine oil level (See "ENGINE OIL" in "PERIODIC SERVICE" section.)
- 2. Lubricant system (See "ENGINE OIL" in "PERIODIC SERVICE" section.)

■Fuel



CAUTION

To avoid personal injury:

- Fluid escaping from pinholes may be invisible. Do not use hands to search for suspected leaks; Use a piece of cardboard or wood, instead. If injured by escaping fluid, see a medical doctor at once. This fluid can produce gangrene or a severe allergic reaction.
- Check any leaks from fuel pipes or fuel injection pipes. Use eye protection when checking for leaks.

Be careful not to empty the fuel tank. Otherwise air may enter the fuel system, requiring fuel system bleeding. (See "FUEL" in "PERIODIC SERVICE" section.)

■Color of exhaust

While the engine is run within the rated output range:

- The color of exhaust remains colorless.
- If the output slightly exceeds the rated level, exhaust may become a little colored with the output level kept constant
- If the engine is run continuously with dark exhaust emission, it may lead to trouble with the engine.

■Immediately stop the engine if;

- The engine suddenly slows down or accelerates.
- Unusual noises are suddenly heard.
- Exhaust fumes suddenly become very dark.
- The oil pressure lamp or the water temperature alarm lamp lights up.

REVERSED ENGINE REVOLUTION AND REMEDIES



CAUTION

o avoid personal injury:

- Reversed engine operation can make the machine reverse and run it backwards. It may lead to serious trouble.
- Reversed engine operation may make exhaust gas gush out into the intake side and ignite the air cleaner; It could catch fire.

Reversed engine revolution must be stopped immediately since engine oil circulation is cut quickly, leading to serious trouble.

■How to tell when the engine starts running backwards

- Lubricating oil pressure drops sharply. Oil pressure warning light, if used, will light.
- Since the intake and exhaust sides are reversed, the sound of the engine changes, and exhaust gas will come out of the air cleaner.
- A louder knocking sound will be heard when the engine starts running backwards.

■Remedies

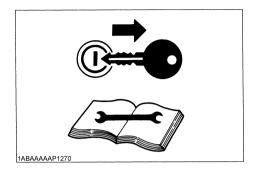
- Immediately set the engine stop lever to the "STOP" position to stop the engine.
- After stopping the engine, check the air cleaner, intake rubber tube and other parts, and then replace parts as needed

MAINTENANCE



CAUTION
To avoid personal injury:

- Be sure to conduct daily checks. periodic maintenance, refueling or cleaning on a level surface with the engine shut off and remove the key.
- Before allowing other people to use your engine, explain how to operate. and have them read this manual before operation.
- When cleaning any parts, do not use gasoline but use regular cleanser.
- Always use proper tools, that are in good condition. Make sure you understand how to use them, before performing any service work.
- When installing, be sure to tighten all bolts lest they should be loose. Tighten the bolts by the specified torque.
- Do not put any tools on the battery. or battery terminals may short out. Severe burns or fire could result. Detach the battery from the engine before maintenance.
- Do not touch muffler or exhaust pipes while they are hot; Severe burns could result.





SERVICE INTERVALS

Observe the following for service and maintenance.

The lubricating oil change intervals listed in the table below are for Class CF lubricating oil of API classification with a low-sulfur fuel in use. If the CF-4, CG-4, CH-4 or Cl-4 lubricating oil is used with a high-sulfur fuel, change the lubricating oil at shorter intervals than recommended in the table below depending on the operating condition. (approximately half)

Interval	Item	Ref. page		
Every 50 hours	Check of fuel pipes and clamp bands	14		@
See NOTE	Change of engine oil (depending on the oil pan)	15 to 17	0	
	Cleaning of air cleaner element	21	*1	@
	Cleaning of fuel filter	14		
Every 100 hours	Check of battery electrolyte level	22,23		
	Check of fan belt tightness	24		
	Draining water separator	-		
	Check of radiator hoses and clamp bands	19		
Every 200 hours	Replacement of oil filter cartridge (depending on the oil pan)	17	0	
	Check of intake air line	-		@
Every 400 hours	Replacement of fuel filter cartridge	15		@
Lvery 400 flours	Cleaning of water separator	-		
	Removal of sediment in fuel tank	-		
Every 500 hours	Cleaning of water jacket (radiator interior)	18 to 20		
	Replacement of fan belt	24		
Every one or two months	Recharging of battery	22,23		
Every year	Replacement of air cleaner element	21	*2	@
Every 800 hours	Check of valve clearance	26		
Every 1500 hours	Check of fuel injection nozzle injection pressure	-	*3	@
Every 3000 hours	Check of turbo charger	-	*3	@
Lvery 3000 flours	Check of injection pump	-	*3	@
	Change of radiator coolant (L.L.C.)	18 to 20		
	Replacement of battery	22,23		
Every two years	Replacement of radiator hoses and clamp bands	19		
	Replacement of fuel pipes and clamp bands	14	*3	@
	Replacement of intake air line	-	*4	@

IMPORTANT:

- The jobs indicated by

 must be done after the first 50 hours of operation.
- *1 Air cleaner should be cleaned more often in dusty conditions than in normal conditions.
- *2 After 6 times of cleaning.
- *3 Consult your local KUBOTA Dealer for this service.
- *4 Replace only if necessary.
- When the battery is used for less than 100 hours in a year, check its electrolyte yearly. (for refillable battery's only)
- The items listed above (@ marked) are registered as emission related critical parts by KUBOTA in the U.S. EPA
 nonroad emission regulation. As the engine owner, you are responsible for the performance of the required
 maintenance on the engine according to the above instruction.

Please see the Warranty Statement in detail.

NOTE:

Changing interval of engine oil

Models	*Oil pan depth		
Modelo	124 mm (4.88 in.)	*90 mm (3.54 in.)	
D1503-M-E3 D1703-M-E3			
D1803-M-E3			
V2003-M-E3	200 Hrs	150 Hrs	
V2203-M-E3			
V2403-M-E3			
V2403-M-T-E3			
Initial	50 Hrs		

^{* 90} mm (3.54 in.) oil pan depth is optional.

- American Petroleum Institute (API) classification: above CF
- Ambient temperature: below 35°C (95°F)

NOTE:

Lubricating oil

With strict emission control regulations now in effect, the CF-4 and CG-4 engine oils have been developed for use with low sulfur fuels, for On-Highway vehicle engines. When a Non-Road engine runs on high sulfur fuel, it is advisable to use a "CF or better" classification engine oil with a high Total Base Number (a minimum TBN of 10 is recommended).

• Lubricating oil recommended when a low-sulfur or high-sulfur fuel is employed.

: Recommendable X : Not recommendable

Lubricating	**Fuel		Remarks
oil classification	Low-sulfur	High-sulfur	Romano
CF	0	0	*TBN≧ 10
CF-4	0	Х	
CG-4	0	X	
CH-4	0	Х	
CI-4	0	Х	

^{*} TBN: Total Base Number

- Diesel Fuel Specification Type and Sulfur Content % (ppm) used, must be compliant with all applicable emission regulations for the area in which the engine is operated.
- Use of diesel fuel with sulfur content less than 0.10 % (1000 ppm) is strongly recommended.
- If high-sulfur fuel (sulfur content 0.50 % (5000 ppm) to 1.0 % (10000 ppm)) is used as a diesel fuel, change the engine
 oil and oil filter at shorter intervals. (approximately half).
- DO NOT USE Fuels that have sulfur content greater than 1.0 % (10000 ppm).
- Since KUBOTA diesel engines of less than 56 kW (75 hp) utilize EPA Tier 4 and Interim Tier 4 standards, the use of low sulfur fuel or ultra low sulfur fuel is mandatory for these engines, when operated in US EPA regulated areas. Therefore, please use No.2-D S500 or S15 diesel fuel as an alternative to No.2-D, and use No.1-D S500 or S15 diesel fuel as an alternative to No.1-D for ambient temperatures below -10 °C (14 °F).
 - 1) No.1-D or No.2-D, S500: Low Sulfur Diesel (LSD) less than 500 ppm or 0.05 wt.%

No.1-D or No.2-D, S15: Ultra Low Sulfur Diesel (ULSD) 15 ppm or 0.0015 wt.%

 CJ-4 classification oil is intended for use in engines equipped with DPF (Diesel Particulate Filter) and is Not Recommended for use in Kubota E3 specification engines.

^{**}Standard replacement interval

^{**}Fue

 Oil used in the engine should have API classification and Proper SAE Engine Oil according to the ambient temperatures as shown below:

Above 25°C (77°F)	SAE30, SAE10W-30 or 15W-40
0 to 25°C (32°F to 77°F)	SAE20, SAE10W-30 or 15W-40
Below 0°C (32°F)	SAE10W, SAE10W-30 or 15W-40

Recommended API classification

Refer to the following table for the suitable American Petroleum Institute (API) classification of engine oil according to the engine type (with internal EGR, external EGR or non-EGR) and the Fuel Type Used: (Low Sulfur, Ultra Low Sulfur or High Sulfur Fuels).

	Engine oil classification (API classification)	
Fuel type	Engines with non-EGR Engines with internal EGR	Engines with external EGR
High Sulfur Fuel [0.05 % (500 ppm) ≤ Sulfur Content < 0.50 % (5000 ppm)]	CF (If the "CF-4, CG-4, CH-4 or CI-4" engine oil is used with a high-sulfur fuel, change the engine oil at shorter intervals. (approximately half))	
Low Sulfur Fuel [Sulfur Content < 0.05 % (500 ppm)] or Ultra Low Sulfur Fuel [Sulfur Content < 0.0015 % (15 ppm)]	CF, CF-4, CG-4, CH-4 or Cl-4	CF or CI-4 (Class CF-4, CG-4 and CH-4 engine, oils cannot be used on EGR type engines.)

EGR: Exhaust Gas Re-circulation

PERIODIC SERVICE

FUFL

Fuel is flammable and can be dangerous. You should handle fuel with care.



CAUTION

To avoid personal injury:

- Do not mix gasoline or alcohol with diesel fuel. This mixture can cause an explosion.
- Be careful not to spill fuel during refueling. If fuel should spill, wipe it off at once, or it may cause a fire.
- Do not fail to stop the engine before refueling. Keep the engine away from the fire.
- Be sure to stop the engine while refueling or bleeding and when cleaning or changing fuel filter or fuel pipes. Do not smoke when working around the battery or when refueling.
- Check the fuel systems at a well ventilated and wide place.
- When fuel and lubricant are spilled, refuel after letting the engine cool off.
- Always keep spilled fuel and lubricant away from engine.

■Fuel level check and refueling

- Check to see that the fuel level is above the lower limit of the fuel level gauge.
- If the fuel is too low, add fuel to the upper limit. Do not overfill.

Flash Point, °C (°F)	Water and Sediment, volume %	Carbon Residue on, 10 percent Residuum, %	Ash, weight %
Min	Max	Max	Max
52 (125)	0.05	0.35	0.01

Tempe °C (Distillation Temperatures, °C(°F) 90% Point		Viscosity Kinematic cSt or mm²/s at 40 ℃		osity bolt, S at (100 °F)
Min	Max	Min	Max	Min	Max
282 (540)	338 (640)	1.9	4.1	32.6	40.1

Sulfur, weight %	Copper Strip Corrosion	Cetane Number
Max	Max	Min
0.50	No. 3	40

- Cetane Rating: The minimum recommended Fuel Cetane Rating is 45. A cetane rating greater than 50 is preferred, especially for ambient temperatures below -20°C (-4°F) or elevations above 1500 m (5000 ft).
- Diesel Fuel Specification Type and Sulfur Content % (ppm) used, must be compliant with all applicable emission regulations for the area in which the engine is operated.
- Use of diesel fuel with sulfur content less than 0.10 % (1000 ppm) is strongly recommended.
- If high-sulfur fuel (sulfur content 0.50 % (5000 ppm) to 1.0 % (10000 ppm)) is used as a diesel fuel, change the engine oil and oil filter at shorter intervals. (approximately half).
- DO NOT USE Fuels that have sulfur content greater than 1.0 % (10000 ppm).
- Diesel fuels specified to EN 590 or ASTM D975 are recommended.
- No.2-D is a distillate fuel of lower volatility for engines in industrial and heavy mobile service.
 (SAE J313 JUN87)
- Since KUBOTA diesel engines of less than 56 kW (75 hp) utilize EPA Tier 4 and Interim Tier 4 standards, the use of low sulfur fuel or ultra low sulfur fuel is mandatory for these engines, when operated in US EPA regulated areas. Therefore, please use No.2-D S500 or S15 diesel fuel as an alternative to No.2-D, and use No.1-D S500 or S15 diesel fuel as an alternative to No.1-D for ambient temperatures below -10 ℃ (14 ℃).
 - 1) SAE: Society of Automotive Engineers
 - 2) EN: European Norm
 - 3) ASTM : American Society of Testing and Materials
 - 4) US EPA: United States Environmental Protection Agency
 - 5) No.1-D or No.2-D, S500 : Low Sulfur Diesel (LSD) less than 500 ppm or 0.05 wt.%
 - No.1-D or No.2-D, S15 : Ultra Low Sulfur Diesel (ULSD) 15 ppm or 0.0015 wt.%

IMPORTANT:

- Be sure to use a strainer when filling the fuel tank, or dirt or sand in the fuel may cause trouble in the fuel injection pump.
- For fuel, always use diesel fuel. You are required not to use alternative fuel, because its quality is unknown or it may be inferior in quality. Kerosene, which is very low in cetane rating, adversely affects the engine. Diesel fuel differs in grades depending on the temperature.
- Be careful not to let the fuel tank become empty, or air can enter the fuel system, necessitating bleeding before next engine start.

■Air bleeding the fuel system



 Do not bleed a hot engine as this could cause fuel to spill onto a hot exhaust manifold creating a danger of fire.

Air bleeding of the fuel system is required if;

- after the fuel filter and pipes have been detached and refitted:
- after the fuel tank has become empty; or
- before the engine is to be used after a long storage.

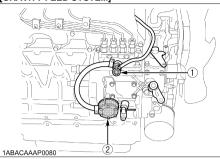
[PROCEDURE A] (gravity feed fuel tanks only)

- Fill the fuel tank to the fullest extent. Open the fuel filter lever.
- 2. Open the air vent cock on top of the fuel injection pump.
- Turn the engine, continue it for about 10 seconds, then stop it, or move the fuel feed pump lever by hand (optional).
- Close the air vent cock on top of the fuel injection pump.

IMPORTANT:

 Always keep the air vent cock on the fuel injection pump closed except when air is vented, or it may cause the engine to stop.

IGRAVITY FEED SYSTEM1



- (1) Air vent cock
- (2) Fuel feed pump

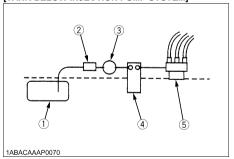
[PROCEDURE ®] (fuel tanks lower than injection pump)

- For fuel tanks that are lower than the injection pump.
 The fuel system must be pressurized by the fuel system electric fuel pump.
- 2. If an electric fuel pump is not used, you must manually actuate the pump by lever to bleed.
- The primary fuel filter must be on the pressure side of the pump if the fuel tank is lower than the injection pump.
- 4. To bleed, follow (2) through (4) above.

IMPORTANT:

 Tighten air vent plug of the fuel injection pump except when bleeding, or it may stop the engine suddenly.

ITANK BELOW INJECTION PUMP SYSTEM1



- (1) Fuel tank below injection pump
- (2) Pre-filter
- (3) Electric or Mechanical pump
- (4) Main Filter
- (5) Injection pump

■Checking the fuel pipes

A

CAUTION

To avoid personal injury;

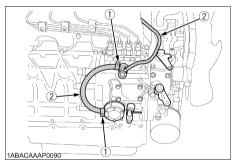
 Check or replace the fuel pipes after stopping the engine. Broken fuel pipes can cause fires.

Check the fuel pipes every 50 hours of operation. When if;

- 1. If the clamp band is loose, apply oil to the screw of the band, and tighten the band securely.
- If the fuel pipes, made of rubber, become worn out, replace them and clamp bands every 2 years.
- If the fuel pipes and clamp bands are found worn or damaged before 2 years' pass, replace or repair them at once.
- 4. After replacement of the pipes and bands, air-bleed the fuel system.

IMPORTANT:

 When the fuel pipes are not installed, plug them at both ends with clean cloth or paper to prevent dirt from entering. Dirt in the pipes can cause fuel injection pump malfunction.

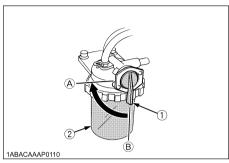


- (1) Clamp band
- (2) Fuel pipe

■Cleaning the fuel filter pot

Every 100 hours of operation, clean the fuel filter in a clean place to prevent dust intrusion.

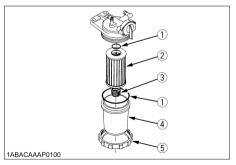
1. Close the fuel filter lever.



- (1) Fuel filter lever
- (A) "OFF"
- (2) Fuel filter pot
- (B) "ON"
- Remove the top cap, and rinse the inside with diesel fuel.
- 3. Take out the element, and rinse it with diesel fuel.
- After cleaning, reinstall the fuel filter, keeping out of dust and dirt.
- 5. Air-bleed the injection pump.

IMPORTANT:

 Entrance of dust and dirt can cause a malfunction of the fuel injection pump and the injection nozzle. Wash the fuel filter cup periodically.



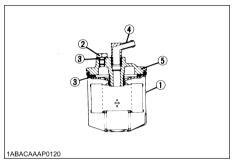
- (1) O ring
- (2) Filter element
- (3) Spring
- (4) Filter bowl
- (5) Screw ring

■Fuel filter cartridge replacement

- 1. Replace the fuel filter cartridge with a new one every 400 operating hours.
- 2. Apply fuel oil thinly over the gasket and tighten the cartridge into position by hand-tightening only.
- 3. Finally, vent the air.

IMPORTANT:

Replace the fuel filter cartridge periodically to prevent wear of the fuel injection pump plunger or the injection nozzle, due to dirt in the fuel.



- (1) Fuel filter cartridge
- (2) Air vent plug
- (3) O ring
- (4) Pipe joint (5) Cover

FNGINF OIL



CAUTION

To avoid personal injury:

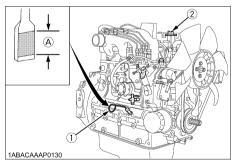
- Be sure to stop the engine before checking and changing the engine oil and the oil filter cartridge.
- Do not touch muffler or exhaust pipes while they are hot; Severe burns could result. Always stop the engine and allow it to cool before conductina inspections. maintenance, or for a cleaning procedure.
- Contact with engine oil can damage your skin. Put on gloves when using engine oil. If you come in contact with enaine oil. wash it immediately.

NOTE:

 Be sure to inspect the engine, locating it on a level place. If placed on gradients accurately, oil quantity may not be measured.

■Checking oil level and adding engine oil

- 1. Check the engine oil level before starting or more than 5 minutes after stopping the engine.
- 2. Remove the oil level gauge, wipe it clean and reinstall
- 3. Take the oil level gauge out again, and check the oil level.



- (1) Oil filler plug
- (2) Oil level gauge

[Lower end of oil level gauge] (A) Engine oil level within this range is proper.

- 4. If the oil level is too low, remove the oil filler plug, and add new oil to the prescribed level.
- 5. After adding oil, wait more than 5 minutes and check the oil level again. It takes some time for the oil to drain down to the oil pan.

Engine oil quantity

Model	Oil pan depth		
Wodel	124 mm (4.88 in.)	*90 mm (3.54 in.)	
D1503-M-E3 D1703-M-E3 D1803-M-E3	7.0 L (1.85 U.S.gals.)	5.6 L (1.48 U.S.gals.)	
V2003-M-E3 V2203-M-E3 V2403-M-E3 V2403-M-T-E3	9.5 L (2.51 U.S.gals.)	7.6 L (2.01 U.S.gals.)	

^{* 90} mm (3.54 in.) oil pan depth is optional. Oil quantities shown are for standard oil pans.

IMPORTANT:

 Engine oil should be MIL-L-2104C or have properties of API classification CF or higher. Change the type of engine oil according to the ambient temperature.

Above 25°C (77°F)	SAE30 or SAE10V SAE15V	
0°C to 25°C (32°F to 77°F)	SAE20 or SAE10V SAE15V	
Below 0°C (32°F)	SAE10W or SAE10W SAE15W	

When using oil of different brands from the previous one, be sure to drain all the previous oil before adding the new engine oil.

■Changing engine oil



To avoid personal injury:

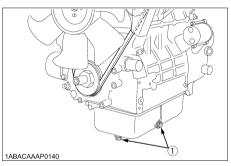
- Be sure to stop the engine before draining engine oil.
- When draining engine oil, place some container underneath the engine and dispose it according to local regulations.
- Do not drain oil after running the engine. Allow engine to cool down sufficiently.
- 1. Change oil after the initial 50 hours of operation and every 200 hours thereafter. (See table below.)

NOTE:

Changing interval thereafter

Models	Oil par	n depth
Models	124 mm (4.88 in.)	*90 mm (3.54 in.)
D1503-M-E3 D1703-M-E3 D1803-M-E3		
V2003-M-E3 V2203-M-E3 V2403-M-E3 V2403-M-T-E3	200 Hrs	150 Hrs
Initial	50	Hrs

- * 90 mm (3.54 in) oil pan depth is optional.
- **Standard replacement interval
- API classification : above CF
- Ambient temperature : below 35°C (95°F)
- 2. Remove the drain plug at the bottom of the engine, and drain all the old oil. Drain oil will drain easier when the oil is warm



(1) Oil drain plug

3. Add new engine oil up to the upper limit of the oil level gauge.

■Replacing the oil filter cartridge



CAUTION

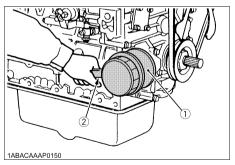
To avoid personal injury:

- Be sure to stop the engine before changing the oil filter cartridge.
- Allow engine to cool down sufficiently, oil can be hot and cause burns.
- Replace the oil filter cartridge. Oil filter cartridge should be replaced, as following operation hours.

Models	Oil par	n depth
Wodels	124 mm (4.88 in.)	*90 mm (3.54 in.)
D1503-M-E3		
D1703-M-E3		
D1803-M-E3		
V2003-M-E3	200 Hrs	150 Hrs
V2203-M-E3		
V2403-M-E3		
V2403-M-T-E3		
Initial	50	Hrs

^{* 90} mm (3.54 in.) oil pan depth is optional.

- 2. Remove the old oil filter cartridge with a filter wrench.
- 3. Apply a film of oil to the gasket for the new cartridge.
- Screw in the cartridge by hand. When the gasket contacts the seal surface, tighten the cartridge enough by hand. Because, if you tighten the cartridge with a wrench, it will be tightened too much.



- (1) Oil filter cartridge
- (2) Remove with a filter wrench (Tighten with your hand)
- After the new cartridge has been replaced, the engine oil level normally decreases a little. Thus, run the engine for a while and check for oil leaks through the seal before checking the engine oil level. Add oil if necessary.

NOTE:

Wipe off any oil sticking to the machine completely.

RADIATOR

Coolant will last for one day's work if filled all the way up before operation start. Make it a rule to check the coolant level before every operation.



WARNING

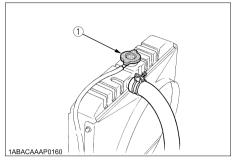
To avoid personal injury:

- Do not stop the engine suddenly, stop it after about 5 minutes of unloaded idling.
- Work only after letting the engine and radiator cool off completely (more than 30 minutes after it has been stopped).
- Do not remove the radiator cap while coolant is hot. When cool to the touch, rotate cap to the first stop to allow excess pressure to escape. Then remove cap completely.

If overheats should occur, steam may gush out from the radiator or recovery tank; Severe burns could result.

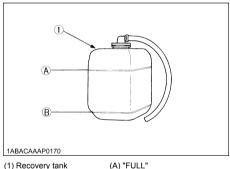
■Checking coolant level, adding coolant

 Remove the radiator cap, after the engine has completely cooled, and check to see that coolant reaches the supply port.



(1) Radiator pressure cap

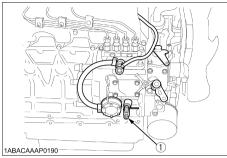
If the radiator is provided with a recovery tank, check the coolant level of the recovery tank. When it is between the "FULL" and "LOW" marks, the coolant will last for one day's work.

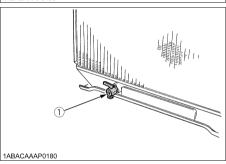


(1) Recovery tank

(B) "LOW"

- When the coolant level drops due to evaporation, add water only up to the full level.
- Check to see that two drain cocks; one is at the crankcase side and the other is at the lower part of the radiator as figures below.





(1) Coolant drain cock

IMPORTANT:

- If the radiator cap has to be removed, follow the caution and securely retighten the cap.
- If coolant should be leak, consult your local KUBOTA dealer.
- Make sure that muddy or sea water does not enter the radiator
- Use clean, fresh water and 50% anti-freeze to fill the recovery tank.
- Do not refill recovery tank with coolant over the "FULL" level mark.
- Be sure to close the radiator cap securely. If the cap is loose or improperly closed, coolant may leak out and decrease quickly.

■Changing coolant

- 1. To drain coolant, always open both drain cocks and simultaneously open the radiator cap as well. With the radiator cap kept closed, a complete drain of water is impossible.
- 2. Remove the overflow pipe of the radiator pressure cap to drain the recovery tank.
- 3. Prescribed coolant volume (U.S.gallons)

Models	Quantity
D1503-M-E3,D1703-M-E3	5.5 L (1.45 U.S.gals.)
D1803-M-E3	5.8 L (1.53 U.S.gals.)
V2003-M-E3,V2203-M-E3	8.1 L (2.14 U.S.gals.)
V2403-M-E3,V2403-M-T-E3	8.4 L (2.22 U.S.gals.)

- Coolant quantities shown are for standard radiators.
- 4. An improperly tightened radiator cap or a gap between the cap and the seat guickens loss of coolant.
- 5. Coolant (Radiator cleaner and anti-freeze)

Season	Coolant
Summer	Pure water and radiator cleaner
Winter (when temperature drops below 0° C (32° F)) or all season	Pure water and anti-freeze (See "Anti-freeze" in "RADIATOR" section.)

Remedies for quick decrease of coolant

- 1. Check any dust and dirt between the radiator fins and tube. If any, remove them from the fins and the tube.
- 2. Check the tightness of the fan belt. If loose, tighten it
- 3. Check the internal blockage in the radiator hose. If scale forms in the hose, clean with the scale inhibitor or its equivalent.

■Checking radiator hoses and clamp bands



To avoid personal injury:

 Be sure to check radiator hoses and clamp bands periodically. If radiator hose is damaged or coolant leaks, overheats or severe burns could occur.

Check to see if radiator hoses are properly fixed every 200 hours of operation or 6 months, whichever comes

- 1. If hose clamps are loose or water leaks, tighten hose clamp securely.
- 2. Replace hoses and tighten hose clamps securely, if radiator hoses are swollen, hardened or cracked.

Replace hoses and hose clamps every 2 years or earlier, if checked and found that hoses are swollen, hardened or cracked

■Precaution at overheating

Take the following actions in the event the coolant temperature is nearly or more than the boiling point, what is called "Overheating". Take these actions if the engine's alarm buzzer sounds or the alarm lamp lights up.

- 1. Stop the engine operation in a safe place and keep the engine unloaded idling.
- 2. Do not stop the engine suddenly. Stop it after about 5 minutes of unloaded idling.
- 3. If the engine stalls within about 5 minutes of running under no load, immediately leave and keep vourself away from the machine. Do not open the hood and any other part.
- 4. Keep yourself and others well away from the engine for further 10 minutes or while the steam blown out.
- 5. Checking that there gets no danger such as burn, get rid of the causes of overheating according to the manual, see "TROUBLESHOOTING" section. And then, start the engine again.

■Cleaning radiator core(outside)

If dust is between the fin and tube, wash it away with running water.

IMPORTANT:

Do not clean radiator with firm tools such as spatulas or screwdrivers. They may damage specified fin or tube. It can cause coolant leaks or decrease cooling performance.

■Anti-freeze



CAUTION

To avoid personal injury:

- When using anti-freeze, put on some protection such as rubber gloves (Anti-freeze contains poison.).
- If should drink anti-freeze, throw up at once and take medical attention.
- When anti-freeze comes in contact with the skin or clothing, wash it off immediately.
- Do not mix different types of antifreeze. The mixture can produce chemical reaction causing harmful substances.
- Anti-freeze is extremely flammable and explosive under certain conditions. Keep fire and children away from anti-freeze.
- When draining fluids from the engine, place some container underneath the engine body.
- Do not pour waste onto the grounds, down a drain, or into any water source.
- Also, observe the relevant environmental protection regulations when disposing of antifreeze.

Always use a 50/50 mix of long-life coolant and clean soft water in KUBOTA engines.

Contact KUBOTA concerning coolant for extreme conditions.

- Long-life coolant (hereafter LLC) comes in several types. Use ethylene glycol (EG) type for this engine.
- Before employing LLC-mixed cooling water, flush the radiator with fresh water. Repeat this procedure 2 or 3 times to clean up the radiator and engine block from inside.
- Mixing the LLC Premix 50% LLC with 50% clean soft water. When mixing, stir it up well, and then fill into the radiator.
- The procedure for the mixing of water and anti-freeze differs according to the make of the anti-freeze. Refer to SAE J1034 standard, more specifically also to SAE J814c.

Vol %	Freezing Point		Boiling Point *	
Anti-freeze	°C	°F	°C	°F
50	-37	-34	108	226

*At 1.013 x 10⁵Pa (760 mmHg) pressure (atmospheric). A higher boiling point is obtained by using a radiator pressure cap which permits the development of pressure within the cooling system.

5. Adding the LLC

- Add only water if the coolant level reduces in the cooling system by evaporation.
- (2) If there is a coolant leak, add the LLC of the same manufacturer and type in the same coolant percentage.
- *Never add any long-life coolant of different manufacturer. (Different brands may have different additive components, and the engine may fail to perform as specified.)
- When the LLC is mixed, do not employ any radiator cleaning agent. The LLC contains anti-corrosive agent. If mixed with the cleaning agent, sludge may build up, adversely affecting the engine parts.
- Kubota's genuine long-life coolant has a service life of 2 years. Be sure to change the coolant every 2 years.

NOTE:

 The above data represent industry standards that necessitate minimum glycol content in the concentrated anti-freeze.

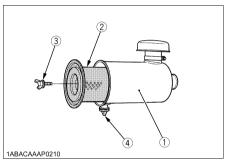
■Radiator cement

As the radiator is solidly constructed, there is little possibility of water leakage. Should this happen, however, radiator cement can easily fix it. If leakage is serious, contact your local KUBOTA dealer.

AIR CLEANER

Since the air cleaner employed on this engine is a dry type, never apply oil to it.

- Open the evacuator valve once a week under ordinary conditions - or daily when used in a dusty place. This will get rid of large particles of dust and dirt.
- Wipe the inside air cleaner clean with cloth if it is dirty or wet.
- 3. Avoid touching the element except when cleaning.
- When dry dust adheres to the element, blow compressed air from the inside turning the element. Pressure of compressed air must be under 205 kPa (2.1 kgf/cm², 30 psi).
- 5. Replace the element every year or every 6 cleanings.



- (1) Air cleaner body
- (2) Element
- (3) Wing bolt
- (4) Evacuator valve

IMPORTANT:

- Make sure the wing bolt for the element is tight enough. If it is loose, dust and dirt may be sucked in, wearing down the cylinder liner and piston ring earlier and thereby resulting in poor power output.
- Do not overservice the air cleaner element. Overservicing may cause dirt to enter the engine causing premature wear. Use the dust indicator as a guide on when to service.

■Evacuator valve

Open the evacuator valve once a week under ordinary conditions - or daily when used in a dusty place - to get rid of large particles of dust and dirt.

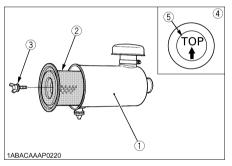
■For the air cleaner with a dust cup (optional)

Remove and clean out the dust cup before it becomes half full with dust; usually once a week, or even every day if the working surroundings are dusty.

Install the air cleaner dust cup with "TOP" indicated on the rear of the cup in the up position. (However, it may be installed in either direction when the cover is placed at the lower part.)

IMPORTANT:

 If the dust cup is mounted incorrectly, dust or dirt does not collect in the cup, and direct attachments of the dust to the element will cause its lifetime to shorten to a great extent.

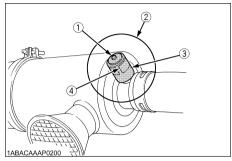


- (1) Air cleaner body
- (2) Element
- (3) Wing bolt
- (4) Dust cup
- (5) "TOP" mark

■Dust indicator (optional)

If the red signal on the dust indicator attached to the air cleaner is visible, the air cleaner has reached the service level.

Clean the element immediately, and reset the signal with the "RESET" button.



- (1) "RESET" button
- (2) Dust indicator
- (3) Service level
- (4) Signal

BATTERY



CAUTION

To avoid personal injury:

- Be careful not to let the battery electrolyte contact your body or clothing.
- Wear eye protection and rubber gloves, since the diluted sulfuric acid solution burns skin and eats holes in clothing. Should this occur, immediately wash it off with running water and get medical attention.

Mishandling of the battery shortens the service life and adds to maintenance costs. Obtain the maximum performance and the longest life of the battery by handling properly and with care.

Engine starting will be more difficult, if the battery charge is low. Be careful to recharge it at an early occasion before it is too late.

■Battery charging



DANGER

The battery comes in two types: refillable and non-refillable.

 For using the refillable type battery, follow the instructions below.

Do not use or charge the battery if its fluid level stands below the LOWER (lower limit level) mark.

Otherwise, the battery component parts may deteriorate earlier than expected, which may shorten the battery's service life or cause an explosion.

Immediately, add distilled water until the battery's fluid level is between the UPPER and LOWER levels.



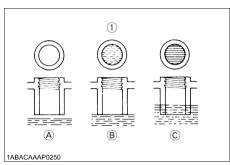
CAUTION

To avoid personal injury:

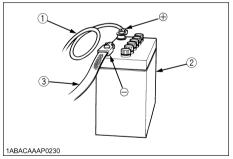
- When the battery is being activated, hydrogen and oxygen gases in the battery are extremely explosive. Keep open sparks and flames away from the battery at all times, especially when charging the battery.
- When charging the battery, remove the battery vent plugs.
- When disconnecting the cable from the battery, start with the negative terminal, and when connecting them, start with the positive terminal first.
- DO NOT check the battery charge by placing a metal object across the terminals. Use a voltmeter or hydrometer.

(B) "LOWEST LEVEL"

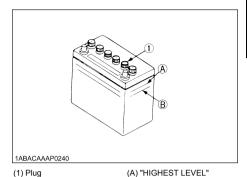
 Make sure each electrolyte level is to the bottom of vent wells, if necessary, add only distilled water in a well-ventilated place.



- (1) Battery electrolyte level
- (A) "TOO LOW"
- (B) "PROPER"
- (C) "TOO HIGH"
- To slow charge the battery, connect the charger positive terminal to the battery positive terminal, and the negative to the negative, then recharge in the standard fashion.
- 3. Quick recharging charges the battery at a high rate in a short time. This is only for emergencies.
- Recharge the battery as early as possible, or battery life will be extremely shortened.
- When exchanging an old battery for a new one, use battery of equal specification shown in Page 28.



- (1) Thick cable red(+)
- (2) Battery case
- (3) Earth cable black(-)



IMPORTANT:

- Connect the charger positive terminal to the battery positive terminal, and negative to the negative.
- When disconnecting the cable from the battery, start with the negative terminal first.

When connecting the cable to the battery, start with the positive terminal first.

If reversed, the contact of tools on the battery may cause a short.

■Direction for long term storage

- When storing the engine for long periods of time, remove the battery, adjust the electrolyte to the proper level, and store in a dry and dark place.
- The battery naturally discharges while it is stored. Recharge it once a month in summer, and every 2 months in winter.

ELECTRIC WIRING



CAUTION

To avoid personal injury:

- ♦ Shorting of electric cable or wiring may cause a fire.
 - Check to see if electric cables and wiring are swollen, hardened or cracked.
 - Keep dust and water away from all power connections.

Loose wiring terminal parts, make bad connections. Be sure to repair them before starting the engine.

Damaged wiring reduces the capacity of electrical parts. Change or repair damaged wiring immediately.

FAN BELT

■Adjusting Fan Belt Tension



CAUTION
To avoid personal injury:

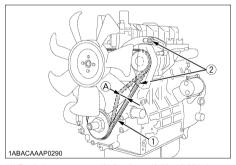
- Be sure to stop the engine and remove the key before checking the belt tension.
- Be sure to reinstall the detached safety shield after maintenance or checking.

tonsion	A deflection of between 7 to 9 mm (0.28 to 0.35 in.) when the belt is pressed in the middle of the span.
---------	--

- 1. Stop the engine and remove the key.
- 2. Apply moderate thumb pressure to belt between the pulleys.
- 3. If tension is incorrect, loosen the alternator mounting bolts and, using a lever placed between the alternator and the engine block, pull the alternator out until the deflection of the belt falls within acceptable limits.
- 4. Replace fan belt if it is damaged.

IMPORTANT:

 If belt is loosen or damaged and the fan is damaged, it could result in overheats or insufficient charging. Correct or replace belt.



- (1) Fan belt
- (2) Bolt and nut
- (A) 7 to 9 mm (0.28 to 0.35 in.) (under load of 10 kgf (22.1 lbs))

CARRIAGE AND STORAGE

CARRIAGE



CAUTION

To avoid personal injury:

- Fix the engine securely not to fall during operation.
- Do not stand near or under the engine while carrying it.
- The engine is heavy. In handling it, be very alert not to get your hands and body caught in.
- Use carrier such as crane when carrying the engine, or hurt your waist and yourself. Support the engine securely with rope not to fall while carrying it.
- When lifting the engine, put the hook securely to metal fittings attached to the engine. Use strong hook and fittings enough to hang the engine.

STORAGE



CAUTION

To avoid personal injury:

- Do not clean the machine with engine running.
- To avoid the danger of exhaust fume poisoning, do not operate the engine in a closed building without proper ventilation.
- When storing the engine just after running, let the engine cool off.

Before storing the engine for more than a few months, remove any dirt on the machine, and:

 Drain the coolant in the radiator. Open the cock at the bottom of the radiator, and remove the pressure cap to drain water completely. Leave the cock open. Hang a note written "No water" on the pressure cap. Since water may freeze when the temperature drops below 0°C (32°F), it is very important that no water is left in the machine.

NOTE:

- When using anti-freeze, it is not necessary to take step (1) above.
- Remove dirty engine oil, fill with new oil and run the engine for about 5 minutes to let the oil penetrate to all the parts.
- 3. Check all the bolts and nuts, and tighten if necessary.
- Remove the battery from the engine, adjust the electrolyte level, and recharge it. Store the battery in a dry and dark place.
- 5. When the engine is not used for a long period of time, run it for about 5 minutes under no load every 2 to 3 months to keep it free from rust. If the engine is stored without any running, moisture in the air may condense into dew over the sliding parts of the engine, resulting in rust there.
- If you forget to run the engine for longer than 5 to 6 months, apply enough engine oil to the valve guide and valve stem seal and make sure the valve works smoothly before starting the engine.
- Store the engine in a flat place and remove the key from engine.
- 8. Do not store the engine in a place where has flammable materials such as dry grass or straw.
- 9. When covering the engine for storage, let engine and muffler cool off completely.
- Operate the engine after checking and repairing damaged wirings or pipes, and clearing flammable materials carried by mouse.

TROUBLESHOOTING

If the engine does not function properly, use the following chart to identify and correct the cause.

■ When it is difficult to start the engine

Cause	Countermeasures	
Fuel is thick and doesn't flow.	Check the fuel tank and fuel filter. Remove water, dirt and other impurities. As all fuel will be filtered by the filter, if there should be water or other foreign matters on the filter, clean the filter with kerosene.	
Air or water mixed in fuel system	If air is in the fuel filter or injection lines, the fuel pump will not work properly. To attain proper fuel injection pressure, check carefully for loosened fuel line coupling, loose cap nut, etc. Loosen joint bolt stop fuel filter and air vent screws of fuel injection pump to eliminate all the air in the fuel system.	
Valve clearance is not as specified.	* Adjust valve clearance to 0.18 to 0.22 mm (0.007 to 0.0087 in.) when the engine is cold.	
Leaking valves	* Grind valve.	
Fuel injection timing is not as specified.	* Check injection timing	
Engine oil becomes thick in cold weather and engine cranks slow.	* Change grade of oil according to the weather (temperature.)	
Low compression	* Bad valve or excessive wear of rings, pistons and liners cause insufficient compression. Replace with new parts.	
Battery is discharged and the engine will not crank.	Charge battery. In winter, always remove battery from machine, charge fully and keep indoors. Install in machine at time of use.	

■ When output is insufficient

Cause	Countermeasures
Compression is insufficient. Leaking valves	Bad valve and excessive wear of rings, pistons and liners cause insufficient compression. Replace with new parts. Grind valves.
Fuel is insufficient.	* Check fuel system.
Overheating of moving parts	Check lubricating oil system. Check to see if lubricating oil filter is working properly. Filter element deposited with impurities would cause poor lubrication. Change element. Check the clearance of bearing are within factory specs. Check injection timing.
Valve clearance is not as specified.	* Adjust to proper valve clearance of 0.18 to 0.22 mm (0.007 to 0.087 in.) with engine cold.
Air cleaner is dirty	* Clean the element every 100 hours of operation.
Fuel injection pressure is wrong.	* Check injection pressure. 13.7 MPa (140 kgf/cm², 1991 psi)
Injection pump wear	Do not use poor quality fuel as it will cause wear of the pump. Only use No. 2-D diesel fuel.(See "FUEL" in "PERIODIC SERVICE" Section) Check the fuel injection pump element and delivery valve assembly and replace as necessary.

NOTE:

If the cause of trouble can not be found, contact your KUBOTA dealer.

■ When engine suddenly stops

Cause	Countermeasures	
Lack of fuel	* Check the fuel tank and refill the fuel, if necessary. * Also check the fuel system for air or leaks.	
Bad nozzle	* If necessary, replace with a new nozzle.	
Moving parts are overheated due to shortage of lubrication oil or improper lubrication.	Check amount of engine oil with oil level gauge. Check lubricating oil system. At every 2 times of oil change, oil filter cartridge should be replaced. Check to see if the engine bearing clearances is within factory specs.	

■ When color of exhaust is especially bad

Cause	Countermeasures
Fuel governing device bad	* Contact dealer for repairs.
Fuel is of extremely poor quality.	* Select good quality fuel. Use No. 2-D diesel fuel only.
Nozzle is bad.	* If necessary, replace with new nozzle.
Combustion is incomplete.	* Cause is poor atomization, improper injection timing, etc. Because of trouble in injection system or in poor valve adjustment, or compression leakage, poor compression, etc. Check for the cause.

■ When engine must be stopped immediately

Cause	Countermeasures
Engine revolution suddenly decreases or increases.	* Check the adjustments, injection timing and the fuel system.
Unusual sound is heard suddenly.	* Check all moving parts carefully.
Color of exhaust suddenly turns dark.	* Check the fuel injection system, especially the fuel injection nozzle.
Bearing parts are overheated.	* Check the lubricating system.
Oil lamp lights up during operation.	Check the lubricating system. Check, if the engine bearing clearances are within factory specs. Check the function of the relieve valve in the lubricating system. Check pressure switch. Check filter base gasket.

When engine overheats

■ When engine overheats					
Cause		Countermeasures			
Engine oil insufficient	*	Check oil level. Replenish oil as required.			
Fan belt broken or elongated		* Change belt or adjust belt tension.			
Coolant insuffic	eient *	Replenish coolant.			
Excessive concentration of antifreeze	of *	Add water only or change to coolant with the specified mixing ratio.			
Radiator net or radiator fin clog with dust		Clean net or fin carefully.			
Inside of radiate coolant flow roo corroded		Clean or replace radiator and parts.			
Fan or radiator radiator cap defective		Replace defective parts.			
Thermostat defective	*	Check thermostat and replace if necessary.			
Temperature ga or sensor defec		Check temperature with thermometer and replace if necessary.			
Overload runni	ng *	Reduce load.			
Head gasket defective or water leakage		Replace parts.			
Incorrect injectitiming	ion *	Adjust to proper timing.			
Unsuitable fuel used	*	Use the specified fuel.			

SPECIFICATIONS

Model	D1503-M-E3	D1703-M-E3	D1803-M-E3	
Туре	Vertical, water-cooled, 4-cycle diesel engine			
Number of cylinders	3			
Bore and stroke mm (in.)	83 x 92.4 (3.27 x 3.64)	87 x 92.4 (3.43 x 3.64)	87 x 102.4 (3.43 x 4.04)	
Total displacement L (cu.in.)	1.499 (91.44)	1.647 (100.51)	1.826 (111.43)	
Combustion chamber	Spherical Type (E-TVCS)			
SAE NET Intermittent kW / rpm H.P. (SAEJ1349) (HP / rpm)	21.7 / 2800 (29.1 / 2800)	24.3 / 2800 (32.6 / 2800)	26.5 / 2700 (35.5 / 2700)	
SAE NET Continuous kW/rpm H.P. (SAEJ1349) (HP/rpm)	18.8 / 2800 (25.2 / 2800)	21.1 / 2800 (28.3 / 2800)	23.0 / 2700 (30.8 / 2700)	
Maximum bare speed rpm	30	00	2900	
Minimum bare idling speed rpm	750 to 850			
Order of firing	1-2-3			
Direction of rotation	Counter-clockwise (viewed from flywheel side)			
Injection pump	Bosch Type mini pump			
Injection pressure	13.73 MPa, 1991 psi (140 kgf/cm²)			
Injection timing (Before T.D.C.)	0.28 rad (16.25°)	0.30 rad (17.25°)		
Compression ratio	22.8	22.0	24.3	
Fuel	Diesel Fuel No.2-D			
Lubricant (API classification)	above CF			
Dimension mm (in.) (length x width x height)	572.1 x 499.0 x 643.0 (22.5 x 19.8 x 25.3)		575.9 x 499.0 x 684.0 (22.7 x 19.8 x 27.0)	
Dry weight (BB Spec.) kg (lbs.)	148 (326.3)		151 (332.9)	
Starting system	Cell starter (with glow plug)			
Starting motor	12 V, 1.4 kW		12 V, 2.0 kW	
Charging generator	12 V, 480 W			
Recommended battery capacity	12 V, 70 to 80 AH 12 V, 100 to 120		12 V, 100 to 120 AH	

NOTE :

■ Specifications are subject to change without notice.

Model	V2003-M-E3	V2203-M-E3	
Туре	Vertical, water-cooled, 4-cycle diesel engine		
Number of cylinders	4		
Bore and stroke mm (in.)	83 x 92.4 (3.27 x 3.64)	87 x 92.4 (3.43 x 3.64)	
Total displacement L (cu.in.)	1.999 (121.94)	2.197 (134.07)	
Combustion chamber	Spherical Type (E-TVCS)		
SAE NET Intermittent kW / rpm H.P. (SAEJ1349) (HP / rpm)	29.8 / 2800 (39.9 / 2800)	33.1 / 2800 (44.4 / 2800)	
SAE NET Continuous kW/rpm H.P. (SAEJ1349) (HP/rpm)	25.9 / 2800 (34.7 / 2800)	28.7 / 2800 (38.5 / 2800)	
Maximum bare speed rpm	3000		
Minimum bare idling speed rpm	750 to 850		
Order of firing	1-3-4-2		
Direction of rotation	Counter-clockwise (viewed from flywheel side)		
Injection pump	Bosch Type mini pump		
Injection pressure	13.73 MPa, 1991 psi (140 kgf/cm²)		
Injection timing (Before T.D.C.)	0.30 rad (17.25°)		
Compression ratio	22.8	22.0	
Fuel	Diesel Fuel No.2-D		
Lubricant (API classification)	above CF		
Dimension mm (in.) (length x width x height)	667.1 x 499.0 x 633.5 (26.3 x 19.8 x 24.9)		
Dry weight (BB Spec.) kg (lbs.)	180 (396.9)		
Starting system	Cell starter (with glow plug)		
Starting motor	12 V, 1.4 kW		
Charging generator	12 V, 480 W		
Recommended battery capacity	mended battery capacity 12 V, 100 to 120 AH		

NOTE :

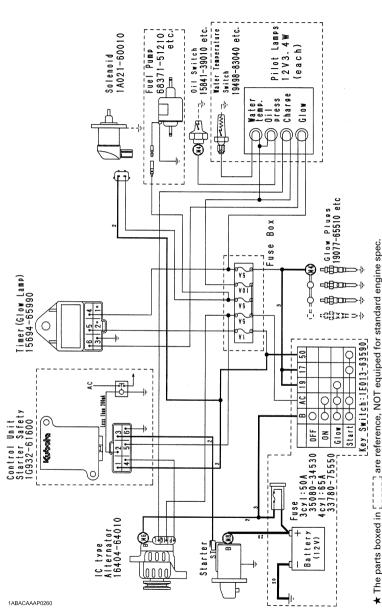
■ Specifications are subject to change without notice.

Model	V2403-M-E3	V2403-M-T-E3	
Туре	Vertical, water-cooled, 4-cycle diesel engine		
Number of cylinders	4		
Bore and stroke mm (in.)	87 x 102.4 (3.43 x 4.04)		
Total displacement L (cu.in.)	2.434 (148.53)		
Combustion chamber	Spherical Type (E-TVCS)		
SAE NET Intermittent kW / rpm H.P. (SAEJ1349) (HP / rpm)	33.9 / 2700 (45.4 / 2700)	41.2 / 2700 (55.2 / 2700)	
SAE NET Continuous kW/rpm H.P. (SAEJ1349) (HP/rpm)	29.4 / 2700 (39.4 / 2700)	35.8 / 2700 (47.9 / 2700)	
Maximum bare speed rpm	2900	2950	
Minimum bare idling speed rpm	750 to 850	850 to 950	
Order of firing	1-3-	1-3-4-2	
Direction of rotation	Counter-clockwise (viewed from flywheel side)		
Injection pump	Bosch Type mini pump		
Injection pressure	13.73 MPa, 1991 psi (140 kgf/cm²)		
Injection timing (Before T.D.C.)	0.30 rad (17.25°)	0.16 rad (9.25°)	
Compression ratio	23.2	22.5	
Fuel	Diesel Fuel No.2-D		
Lubricant (API classification)	above CF		
Dimension mm (in.) (length x width x height)	670.9 x 499.0 x 684.0 (26.4 x 19.8 x 26.9)	670.9 x 499.0 x 724.6 (26.4 x 19.8 x 28.5)	
Dry weight (BB Spec.) kg (lbs.)	184.0 (405.7)	188.0 (414.5)	
Starting system	Cell starter (with glow plug)		
Starting motor	12 V, 2.0 kW		
Charging generator	12 V, 480 W		
Recommended battery capacity	12 V, 100 to 120 AH		

NOTE:

• Specifications are subject to change without notice.

WIRING DIAGRAMS



★ Tile parts boxed in L____ are reference, NOT equipe
★ Non marked wire dia. is 0.8 ~ 1.25 mm².

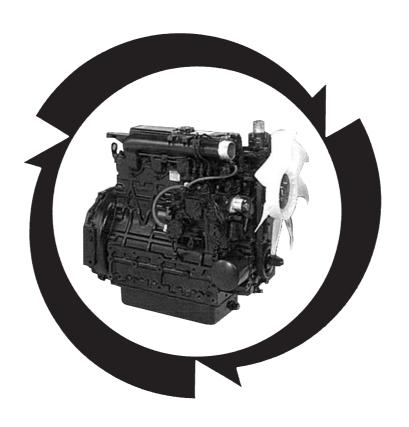
ILLUSTRATED PARTS LIST LISTA DE PIEZAS LISTE DES PIECES

KUBOTA

MODELO MODELE

V2403-M-E3B-SBR-1

DIESEL ENGINE MOTOR DIESEL MOTEUR DIESEL



Kubota

97898-77110 APR. ABRIL 2009 AVRIL

NOTICE

This Parts List is for the following purposes.

- 1. When ordering parts, check with this Parts List to confirm the part number and the name of parts.
- 2. When making repairs, refer to the illustrations in this Parts List.
- 3. This Parts List is subject to change without notice.

NOTA

Esta lista de piezas tiene el objetivo siguiente.

- 1. Cuando solicite piezas, consulte esta Lista de piezas para confirmar su número de referencia y nombre.
- 2. Al efectuar reparaciones, consulte las ilustraciones de esta Lista de piezas.
- 3. Esta lista de piezas está sujeta a cambios sin previo aviso.

NOTE

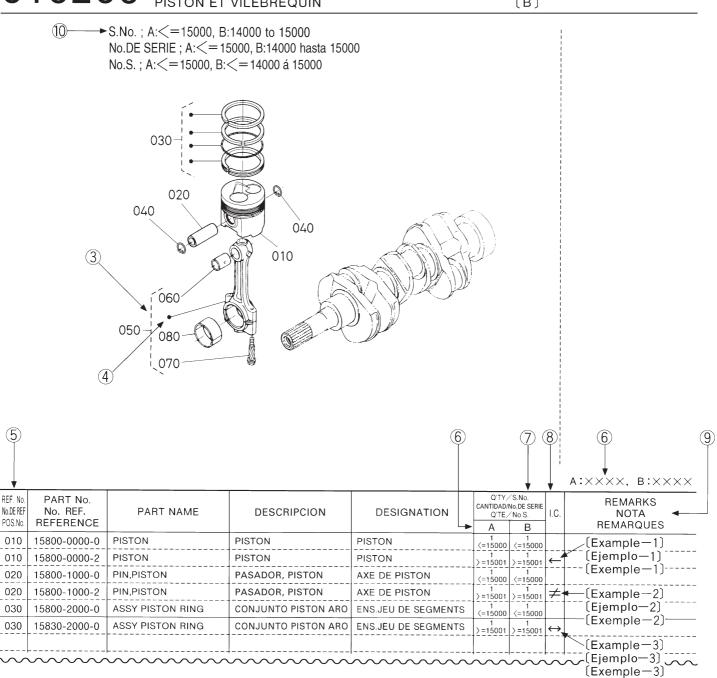
Utilisation de ce livre

- 1. A la commande d'une pièce, chercher la référence et le nom de la pièce.
- 2. Pour les rèparations, employez les illustrations.
- 3. La liste des pièces peut-être modifiè sans préavis.

MODEL	CODE No.
MODELO	No. DEL CODIGO
MODELE	No. DE CODE
V2403-M-E3B-SBR-1	1J466-72000

INSTRUCTIONS INSTRUCCIONES INSTRUCTION





- ① Fig. No. Represents No. corresponding to each group name.
- ② Specifications The types and destinations of sister models are indicated. These indications are (for sister models) given to tell their relevant pages in this book.
- 3 Components The components of an assembly are identified by a bracket of dotted lines.
- 4 Point Indicates that the parts is not sold independently.

The assembly (Ref.No.050) containing the part needs to be ordered.

6 Model name The name of the basic model is indicated in this column. Other applicable models are indicated on the "REMARKS" column 9.

 S. No. Indicates a group of serial numbers to which a design change is applied. (serial No.)

Engine Serial No.

<u>7</u> <u>J</u> <u>0001</u>

<u>7</u> K A001 ↑

Lower 4 digits in Numerals or Alphabetical letter (A to Z) and Numerals (start 0001 to max Z999).

5th digit Alphabetical letter (Month of manufacture).

0														
Month	1	2	3		4	5	6	7	8	9	, -	10	11	12
	A,B	C,D	E,I	F G	ì,H	J,K	L,M	N,P	Q,F	S,	Tι	J,V	W,X	Y,Z
6th digit ····· Numerals or Alphabetical letter (Year of manufacture).														
Year	1998	1999	2000	01	02	03	04	05	06	07	80	09	10	11
	W	Х	Υ	1	2	3	4	5	6	7	8	9	Α	В

8 I. C. Indicates the interchangeability of parts due to design change. (interchangeability)

Example-1 ← indicates that a new part can replace an old part, but not vice versa.

15800-0000-0 is applicable to the first serial number to S. No. 15000.

15800-0000-2 is applicable to the first serial number and above.

Example-2 ≠ indicates that the new and old parts are not interchangeable.

15800-1000-0 is applicable to the first serial number to S. No. 15000.

15800-1000-2 is applicable to S. No. 15001 and above.

REMARKS 1 In this column, enter other applicable model names, dimensions and other special items.

REMARKS 2 The following expressions are used in NOTE for each group.

Machines' serial numbers are indicated as follows.

<=15000 Serial number below 15000.

>=15001 Serial number above 15001.

14000 to 15000 Serial number 14000 to 15000.

For some models, the above expressions may also be used REMARKS 1 9.

1 Fig. No. Representa el No. que corresponde al nombre de cada grupo. ② Especificaciones ... Se indican los tipos y destinos de los modelos del mismo tipo. Éstas se dan para indicar (para los modelos gemelos) las páginas correspondientes a los modelos en este libro. 3 Componentes Los componentes de un conjunto se identifican mediante un paréntesis o líneas de puntos. Punto Indica que las piezas no se venden por separado. Es necesario solicitar el conjunto (No. DE REF. 050) que contiene la pieza. No. DE REF. En la ilustración se asignan números de referencia a las piezas. Puede identificar el número de código de una pieza de la ilustración consultando el número de referencia en la lista de piezas. 6 Nombre del modelo ... En esta columna se indica el nombre del modelo básico. Otros modelos se indican en la columna 9 "NOTA". No. DE SERIE Indica un grupo de números de serie al que se aplica un cambio de diseño. No. DE SERIE del motor 7 J 0001 <u>7</u> K A001 4 digitos menores de los números o de letra del alfabeto (A hasta Z) y los números (de 0001 hasta max. Z999). Quinto digito ······ letra del alfabeto (mes de fabricación). 4 5 6 10 11 12 Mes A,B | C,D | E,F | G,H | J,K | L,M | N,P | Q,R | S,T | U,V | W,X | Y,Z Sexto digito ····· Letra del alfabeto o número (año de fabricación). Año 1998 1999 2000 01 02 03 04 05 06 07 80 09 10 | 11 W Χ 1 3 5 6 I/C Indica la intercambiabilidad de piezas debida a un cambio en el diseño. (intercambiabilidad) Ejemplo-1 ← Indica que una pieza nueva puede sustituir a la anterior, pero no a la inversa. 15800-0000-0 es aplicable desde el primer número de serie hasta el No. S. 15000. 15800-0000-2 es aplicable al primer número de serie y a los siguientes. Ejemplo-2≠ indica que las piezas nuevas y viejas no son intercambiables. 15800-1000-0 es aplicable al primer número de serie hasta el No. S.15000. 15800-1000-2 es aplicable al número de serie 15001 y a los siguientes. Ejemplo-3 ↔ indica que las piezas nuevas y viejas son intercambiables. Tanto 15800-2000-0 y 15830-2000-0 son aplicables al primer número de serie y a los siguientes. 9 NOTA 1 Escriba en esta columna otros nombres de modelos, dimensiones y otros elementos especiales pertinentes. En este libro se utilizan los siguientes símbolos y abreviaturas: 29 * 12.00-15 ... tamaño del neumático sq.m ... m² sq.mm ... mm² cu.m ... m³ cu.mm ... mm³ D ... diámetro L ... longitud NOTA 2 Las siguientes expresiones se utilizan en las Notas para cada grupo. Los números de serie de las máquinas se indican del siguiente modo: <=15000 Números de serie inferiores a 15000. >=15001 Números de serie superiores a 15001. De 14000 a 15000 Número de serie entre 14000 y 15000. En algunos modelos, las expresiones anteriores también pueden utilizarse NOTA 19.

No. de Fig. Représente le No. de chaque nom de groupe.

(pour modèles soeurs)

Spécifications Les types et les destinations des modèles soeurs sont indiqués. Ces indications sont données pour donner leurs pages relatives dans ce livre.

Composantes Les composantes d'un ensemble sont identifiées par des parenthèses en pointillé.

4 Point Indique que la pièce n'est pas à vendre toute seule.

Elle doit être commandée avec l'ensemble (POS.No. 050) qui la contient.

POS.No. Des numéros de position sont donnés aux pièces représentées dans l'illustration.

Le référence d'une pièce de l'illustration peut être identifié en se reportant au même numéro de position indiqué dans la liste des pièces détachées.

Nom de type Le nom du type de base est indiqué dans cette colonne. Les autres modèles sont indiqués dans la colonne des "REMARQUES" 9.

No. S. Indique un groupe de numéros de série qui a subit des modifications de modèle. (No. de série)

No. de série de moteur

7 J 0001 <u>7</u> K A001

4 chiffres inférieurs en lettres numérals ou alphabétiques (de A à Z) et numérals (de 0001 jusqu'à Z999 au maximum).

5^{ème} chiffre ····· Lettre alphabétique (Mois de fabrication).

			•											
Mois	1	2	3		4	5	6	7	8	9		10	11	12
	A,B	C,E) E,	FC	Э,Н	J,K	L,M	N,P	Q,F	S,	ΤU	J,V	W,X	Y,Z
6ème chiffre ····· Numeral ou lettre alphabétique (Année de fabrication).														
Année	1998	1999	2000	01	02	03	04	05	06	07	80	09	10	11
	W	Χ	Υ	1	2	3	4	5	6	7	8	9	Α	В

I. C. Indique la permutabilité des pièces due à un changement dans le modèle. (permutabilité)

Exemple-1 ← indique que la nouvelle pièce peut remplacer la vieille, mais pas vice versa.

Le 15800-0000-0 s'applique au premier numéro de série jusqu'au No.S. 15000.

Le 15800-0000-2 s'applique au premier numéro de série et à ceux ci-dessus.

Exemple-2 ≠ indique que la nouvelle et vielle pièces sont permutables.

Le 15800-1000-0 s'applique au premier numéro de série jusqu'au No.S. 15000.

Le 15800-1000-2 s'applique au No.S. 15001 et à ceuxci-dessus.

Exemple-3 ⇔ indique que la nouvelle pièce et la vielle pièce sont interchangeable. Toules deux numéros 15800-2000-0 et 15830-2000-0 sont applicables a premier numéro de cette depuis.

REMARQUES 1 ... Cette colonne renferme d'autres noms de modèles applicables, les dimensions et autres éléments spéciaux.

10 REMARQUES 2 ... Les expressions suivantes sont utilisées dans la NOTE de chaque groupe.

Les numéros de série des machines sont indiqués de la manière suivante.

<=15000 Numéros de série au-dessous de 15000.

>=15001 Numéros de série au-dessus de 15001.

14000 to 15000 Numéros de série 14000 à 15000.

Pour certaines modèles, les expressions ci-dessus peuvent aussi être utilisées dans la rubrique des REMARQUES 1 9.

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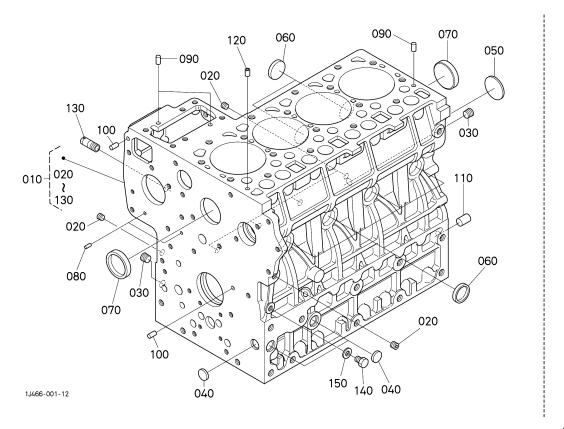
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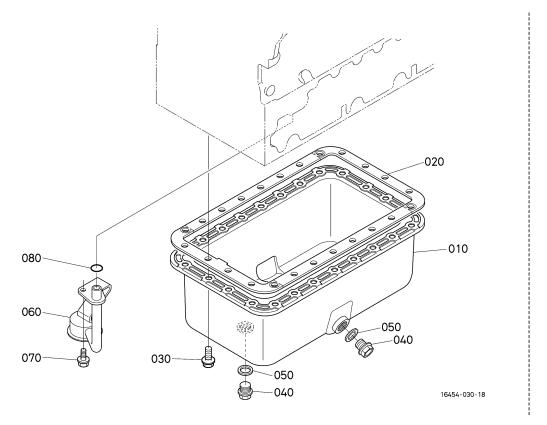
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030500	COUVERCLE	
030100	POMPE D'ALIMENTATION (MECHANIQUE)	
030000	FILTRE A CARBURANT	
020600	PORTE-INJECTEUR ET BOUGIE DE PRECHAUFFAGE	
020500	PLAQUE DE VITESSE-CONTROLE	
020400	REGULATEUR DE VITESSES	
020200	POMPE D'INJECTION	
020100	SOLENOIDE D'ARRET	
018000	DISPOSITIF DE RALENTISSEUR	
010500	ARBRE A CAMES DE CARBURANT ET ARBRE REGULATEUR	
010300	VOLANT MOTEUR	
010200	PISTON ET VILEBREQUIN	
010100	ARBRE A CAMES ET ARBRE DE PIGNON INTERMEDIAIRE	
010000	PALIERS DE VILEBREQUIN	
000800	POMPE D'HUILE	
000700	JAUGE D'HUILE ET GUIDE	
000600	FILTRE D'HUILE	
000500	COUVRE-CULASSE	
000400	CARTER DE DISTRIBUTION	
000300	CULASSE	
000200	CARTER D'HUILE	
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[V24U3-N	/I-E3B-SBR-1]	

000100 CRANKCASE BLOQUE MOTOR BLOC MOTEUR



REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	1G933-0101-4	COMP.CRANKCASE	COMP.BLOQUE MOTOR	BLOC MOTEUR COMPLET	1		
020	15521-9602-0	PLUG	TAPON	BOUCHON	6		
030	15521-9603-0	PLUG	TAPON	BOUCHON	2		
040	17391-9616-0	PLUG,EXPANSION	TAPON,EXPANSION	BOUCHON EXPANSIBLE	3		
050	16271-9616-0	PLUG,EXPANSION	TAPON, EXPANSION	BOUCHON EXPANSIBLE	1		
060	15221-0338-0	CAP,SEALING	TAPA,SELLADO	PASTILLE	6		
070	15221-0339-0	CAP,SEALING	TAPA,SELLADO	PASTILLE	2		
080	05012-00408	PIN,STRAIGHT	PASADOR	GOUPILLE CYLINDLIQUE	2		
090	05012-00609	PIN,STRAIGHT	PASADOR	GOUPILLE CYLINDLIQUE	3		
100	05012-00612	PIN,STRAIGHT	PASADOR	GOUPILLE CYLINDLIQUE	2		
110	05012-01018	PIN,STRAIGHT	PASADOR	GOUPILLE CYLINDLIQUE	1		
120	15221-3365-0	PIN,PIPE	PASADOR,TUBO	GICLEUR	1		
130	15321-7334-0	PIPE,WATER RETURN	TUBO,AGUA DEVOLVER	TUYAU RETOUR D'EAU	1		
140	15469-3361-0	PLUG	TAPON	BOUCHON	1		
150	15021-3366-0	GASKET	JUNTA	JOINT	1		
	+						
				→ Interchangeable: ≠ not Intercha	ngeable: ← r	ωw fo	or old: \longrightarrow old for new

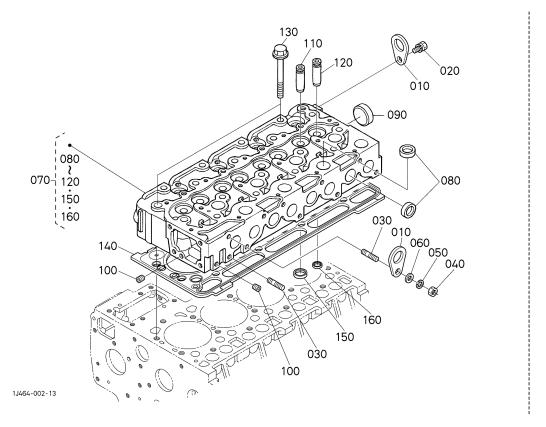
OIL PAN O00200 ENGRASE LA CACEROLA CARTER D'HUILE



4 1 10 100		000
A:V2403-	-M-E3B	-SBR-1

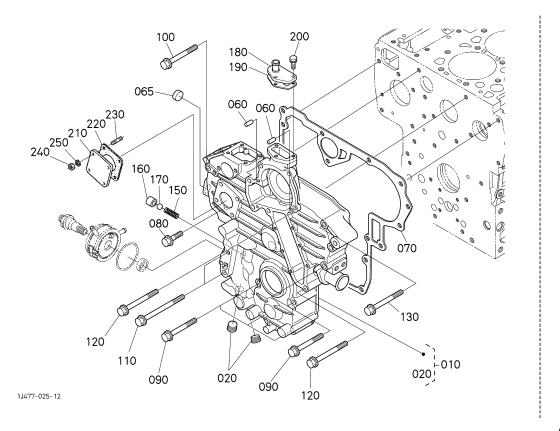
REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	19077-0150-0	COMP.OIL PAN	COMP.ACEITE CCRL	CARTER D'HUILE COMP.	1		
020	1G780-0162-0	GASKET,OIL PAN	JUNTA,ACT CCRL	JOINT	1		
030	17333-9101-3	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	24		
040	15707-3375-0	PLUG,DRAIN	TAPON, VACIAR	BOUCHON DE VIDANGE			
050	15451-9667-0	GASKET	JUNTA	JOINT	2		
060	1G850-3211-0	FILTER,OIL	FILTRO,ACEITE	FILTRE D'HUILE	1		
070	01754-50812	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	1		
080	04817-00160	O RING	O ARO	JOINT TORIQUE	1		
				\ -t			and all and the analysis

000300 CYLINDER HEAD CULATA CULASSE



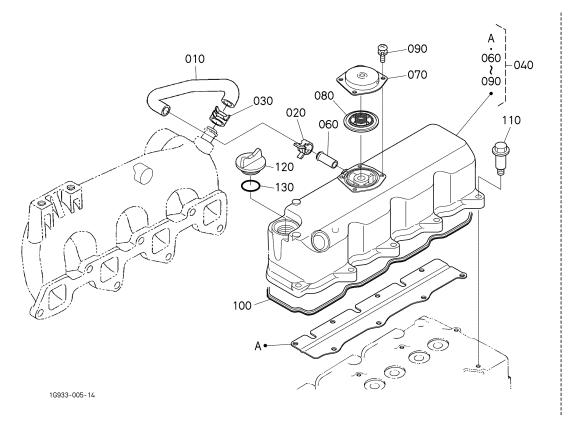
REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	15221-0175-0	HOOK,ENGINE	GANCHO,MOTOR	ANNEAU DE LEVAGE	2		
020	01123-60816	BOLT	BULLONE	VIS	1		
030	15471-9153-0	STUD	ESPARRAGO	GOUJON	2		
040	02156-50080	NUT	TUERCA	ECROU	1		
050	04512-60080	WASHER,SPRING	ARANDELA DE MUELLE	RONDELLE GROWER	1		
060	04012-50080	WASHER,PLAIN	ARANDELA,SIMPLE	RONDELLE FREIN	1		
070	1G896-0304-0	COMP.CYLINDER HEAD	COMP.CILINDRO CLT	CULASSE COMPLET	1		
080	15221-0337-0	CAP,SEALING	TAPA,SELLADO	PASTILLE	12		
090	15221-0349-0	CAP,SEALING	TAPA,SELLADO	PASTILLE	1		
100	15261-9601-0	PLUG	TAPON	BOUCHON	2		
110	17321-1358-0	GUIDE, INLET VALVE	GUIA,ENTRADA VALVULA	GUIDE SOUP.D'ADMISS.	4		
120	1C010-1356-0	GUIDE, VALVE, EXHAUST	GUIA,VALVULA,ESCAPE	OEIL-GUIDE,ECHAPPEME	4		
130	19013-0345-0	BOLT, CYLINDER HEAD	TORNILLO, CLNDR CLT	VIS DE CYLINDRE	18		
140	1G790-0360-2	GASKET,CYLINDER HEAD	JUNTA,CLNDR CLT	JOINT	1		1.15mm
140	1G790-0331-2	GASKET,CYLINDER HEAD	JUNTA,CLNDR CLT	JOINT	1		1.20mm
140	1G790-0361-2	GASKET,CYLINDER HEAD	JUNTA,CLNDR CLT	JOINT	1		1.25mm
140	1G790-0362-2	GASKET,CYLINDER HEAD	JUNTA,CLNDR CLT	JOINT	1		1.30mm
140	1G790-0363-2	GASKET,CYLINDER HEAD	JUNTA,CLNDR CLT	JOINT	1		1.35mm
150	16415-1362-0	SEAT,INLET VALVE	ASIENTO,ENTRD VLVL	SIEGE D'ADMI-SOUPAPE	4		
160	16415-1361-2	SEAT,EXHAUST VALVE	ASIENTO,ESCP VLVL	SIEGE D'ECHA-SOUPAPE	4		
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GEAR CASE 000400 ENGRANAJE CAJA CARTER DE DISTRIBUTION



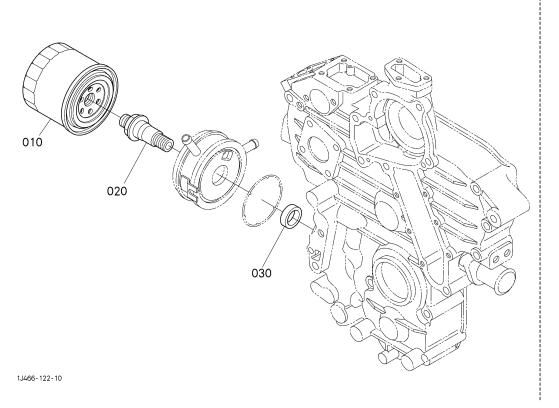
REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	1G489-0402-2	COMP.CASE,GEAR	COMP.CAJA,ENGRNJ	CARTER DISTR.COMP.	1		
020	16241-9602-0	PLUG	TAPON	BOUCHON	2		
030		BLANK	POSTIZO	BLANC	_		
040		BLANK	POSTIZO	BLANC	-		
050		BLANK	POSTIZO	BLANC	-		
060	05012-00612	PIN,STRAIGHT	PASADOR	GOUPILLE CYLINDLIQUE	2		
065	06311-85018	CAP,SEALING	TAPA,SELLADO	PASTILLE	1		
070	1G701-0413-0	GASKET,GEAR CASE	JUNTA,ENGRANAJE CAJA	l I	1		
080	01754-50830	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	1		
090	1A021-9103-0	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	5		
100	01754-50875	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	1		
110	1G841-9101-0	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	2		
120	01754-50885	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	4		
130	16467-9102-0	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	1		
140		BLANK	POSTIZO	BLANC	-		
150	15241-3695-0	SPRING	RESORTE	RESSORT	1		
160	15521-3693-0	SEAT,VALVE	ASIENTO, VALVULA	SIEGE DE SOUPAPE	1		
170	07715-03213	BALL	BOLA	BILLE	1		
180	15521-7332-0	FLANGE,WATER RETURN	BRIDA,AGUA DEVOLVER	BRIDE RETOUR D'EAU	1		
190	1A021-7333-2	GASKET,RETURN FLANGE	JUNTA, DEVOLVER BRIDA	JOINT	1		
200	01023-50620	BOLT	BULLONE	VIS	3		
210	15223-8334-0	COVER	CUBIERTA	COUVERCLE	1		
220	1G751-8813-0	GASKET,HOUR METER	JUNTA,HORA METRO	JOINT	1		
230	15221-8821-0	STUD	ESPARRAGO	GOUJON	4		
240	02056-50060	NUT	TUERCA	ECROU	4		
250	04512-60060	WASHER,SPRING	ARANDELA DE MUELLE	RONDELLE GROWER	4		
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000500 HEAD COVER COUVRE-CULASSE



REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	1G932-0551-0	TUBE,BREATHER	TUBO,RESPIRADERO	TUYAU DE REINFLARD	1		
020	09318-88155	CLAMP,HOSE	ABRAZADERA	COLLIER DE DURITE	1		
030	09318-88200	CLAMP,HOSE	ABRAZADERA	COLLIER DE DURITE	1		
040	1G790-1450-6	ASSY COVER, CYL. HEAD	CUBIERTA PRINCIPAL	ENS.COUVERCLE	1		
050		BLANK	POSTIZO	BLANC			
060	17331-7334-2	PIPE,WATER RETURN	TUBO,AGUA DEVOLVER	TUYAU RETOUR D'EAU	1		
070	1G801-0512-0	COVER,BREATHER	CUBIERTA,RESPIRADERO	COUVERCLE ASPIRATEUR	1		
080	1G911-0520-3	COMP.VALVE,BREATHER	COMP.VALVULA,RSPRDR	ENS.ROBINET DE REIN.	1		
090	03024-50510	SCREW,WITH WASHER	TORNILLO	VIS	4		
100	1G911-1452-3	GASKET,HEAD COVER	JUNTA,CLT CBRT	JOINT COUVRE-CULASSE	1		
110	1G911-9102-2	BOLT	BULLONE	VIS	10		
120	15852-3314-0	PLUG,OIL FILLER	TAPON,ACT TPPRS	BOUCHON, REMPLIS. H/L	1		
130	04817-50300	O RING	O ARO	JOINT TORIQUE	1		
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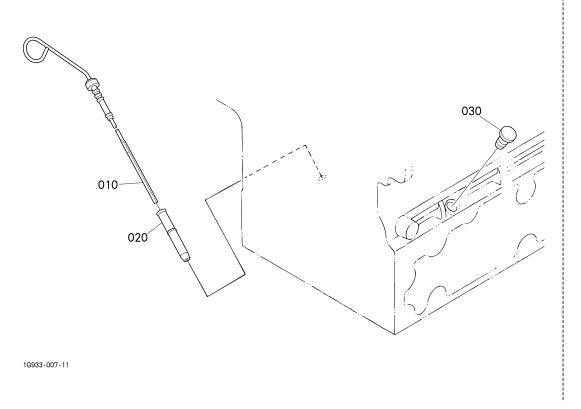
OIL FILTER 000600 ACEITE FILTRO FILTRE D'HUILE



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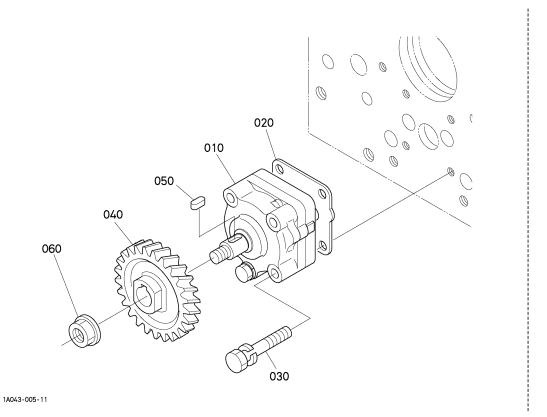
REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	HH164-3243-0	CARTRIDGE,OIL FILTER	CONJ.CARTUCHO,ACT	CARTOUCHE FILTRANTE	1		
020	1G622-3708-0	CONNECTOR	CONNETTORE	CONNECTEUR	1		
030	1G730-3709-0	COLLAR	COLLAR	COLLIER	1		
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000700 DIPSTICK AND GUIDE VARILLA DE NIVBL Y GUIA JAUGE D'HUILE ET GUIDE



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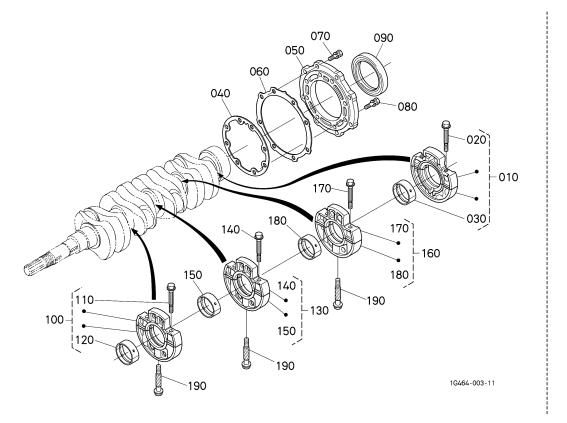
REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	OITV/O Na	REMARKS NOTA REMARQUES
010	1G790-3641-3	GAUGE,OIL	MEDIDOR,ACEITE	JAUGE D'HUILE	1	
020	17456-3642-0	GUIDE,OIL GAUGE	GUIA,ACEITE MEDIDOR	GUIDE	1	
030	1G513-3655-0	PLUG,OIL GAUGE		BOUCHON DE JAUGE	1	
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REF.No.	PART No.				Q'TY/S.No. CANTIDAD/No. DE SERIE	I.C.	REMARKS
No.DE REF. POS.No.	No. REF.	PART NAME	DESCRIPCION	DESIGNATION	Q'TE/No.S.	I/C I.C.	NOTA
010	15471-3501-3	ASSY PUMP,OIL	CONJ.BOMBA,ACT	ENS.POMPE A HUILE	1		
020	1A021-3515-0	GASKET,OIL PUMP	JUNTA,ACEITE BOMBA	JOINT	1		
030	01023-60650	BOLT	TORNILLO	VIS	4		
040	19202-3566-0	GEAR,OIL PUMP DRIVE		PIGNON ENTRAIN.POMPE	1		
050	05712-00410	KEY,FEATHER	LLAVE,PLUMA	CLAVETTE	1		
060	15221-3568-2	NUT,FLANGE	TUERCA,BRIDA	ECROU A EMBASE	1		
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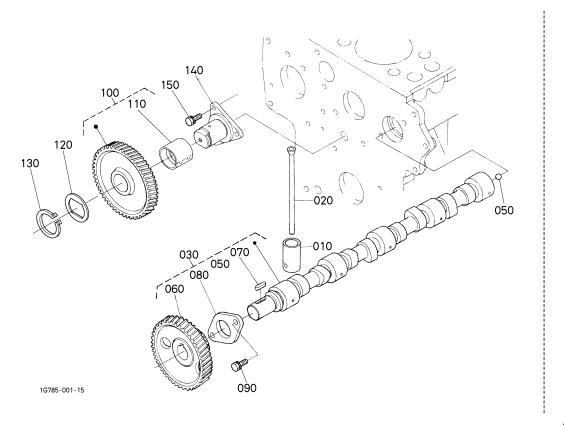
010000 MAIN BEARING CASE PRINCIPAL RODAMIENTO CAJA PALIERS DE VILEBREQUIN



4 1 10 100		000
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REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	1A091-0709-5	ASSY BRG.CASE,WHEEL	CONJ.PUENTE CJ,RD	ENS.PALIER VILEBREQ.	1		
020	1A091-0454-0	BOLT, BEARING CASE	TORNILLO,RDMNT CJ	VIS	2		
030	1A091-2348-2	METAL, CRANKSHAFT	METAL, CIGUENAL	COUSSINET DE VILEBR.	1		STD SET
030	1A091-2393-0	METAL, CRANKSHAFT	METAL, CIGUENAL	COUSSINET DE VILEBR.	1		-0.20mm SET
030	1A091-2394-0	METAL, CRANKSHAFT	METAL, CIGUENAL	COUSSINET DE VILEBR.	1		-0.40mm SET
040	1A091-0436-2	GASKET,BEARING CASE	JUNTA,RDMNT CJ	JOINT CART.DE RLMT	1		
050	1G851-0481-3	COVER,BEARING CASE	CUBIERTA,RDMNT CJ	PORTE JOINT	1		
060	1A091-0482-0	GASKET,CASE COVER	JUNTA,CAJA CUBIERTA	JOINT DE CARTER FOU.	1		
070	01123-50825	BOLT	BULLONE	VIS	8		
080	01123-50828	BOLT	BULLONE	VIS	8		
090	1G911-0446-0	SEAL,OIL	SELLO	BAGUE JOINT	1		
100	1A091-0704-5	ASSY BRG.CASE,MAIN	CONJ.PUENTE	ENS.PALIER VILEBREQ.	1		
110	1A091-0454-0	BOLT,BEARING CASE	TORNILLO,RDMNT CJ	VIS	2		
120	1A091-2348-2	METAL, CRANKSHAFT	METAL, CIGUENAL	COUSSINET DE VILEBR.	1		STD SET
120	1A091-2393-0	METAL, CRANKSHAFT	METAL, CIGUENAL	COUSSINET DE VILEBR.	1		-0.20mm SET
120	1A091-2394-0	METAL, CRANKSHAFT	METAL, CIGUENAL	COUSSINET DE VILEBR.	1		-0.40mm SET
130	1A091-0705-5	ASSY BRG.CASE,MAIN	CONJ.PUENTE	ENS.PALIER VILEBREQ.	1		
140	1A091-0454-0	BOLT,BEARING CASE	TORNILLO,RDMNT CJ	VIS	2		
150	1A091-2348-2	METAL, CRANKSHAFT	METAL, CIGUENAL	COUSSINET DE VILEBR.	1		STD SET
150	1A091-2393-0	METAL, CRANKSHAFT	METAL, CIGUENAL	COUSSINET DE VILEBR.	1		-0.20mm SET
150	1A091-2394-0	METAL, CRANKSHAFT	METAL, CIGUENAL	COUSSINET DE VILEBR.	1		-0.40mm SET
160	1A091-0706-5	ASSY BRG.CASE,MAIN	CONJ.PUENTE	ENS.PALIER VILEBREQ.	1		
170	1A091-0454-0	BOLT, BEARING CASE	TORNILLO,RDMNT CJ	VIS	2		
180	1A091-2348-2	METAL, CRANKSHAFT	METAL, CIGUENAL	COUSSINET DE VILEBR.	1		STD SET
180	1A091-2393-0	METAL, CRANKSHAFT	METAL,CIGUENAL	COUSSINET DE VILEBR.	1		-0.20mm SET
180	1A091-2394-0	METAL, CRANKSHAFT	METAL, CIGUENAL	COUSSINET DE VILEBR.	1		-0.40mm SET
190	15601-0456-0	BOLT, BEARING CASE	TORNILLO,RDMNT CJ	VIS DE VILEBREQUIN	3		
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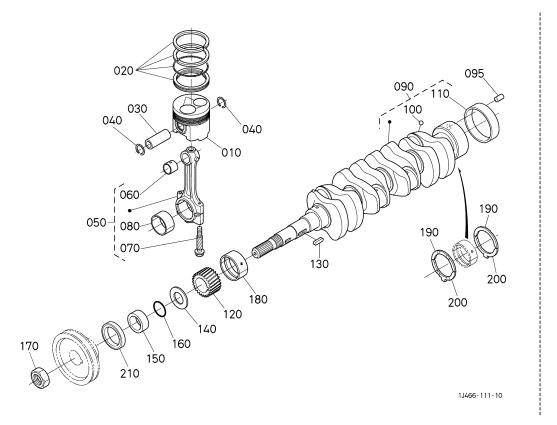
CAMSHAFT AND IDLE GEAR SHAFT ()10100 ARBOL DE LEVAS Y PUNTO MUERTO ENGRANAJE EJE ARBRE A CAMES ET ARBRE DE PIGNON INTERMEDIAIRE



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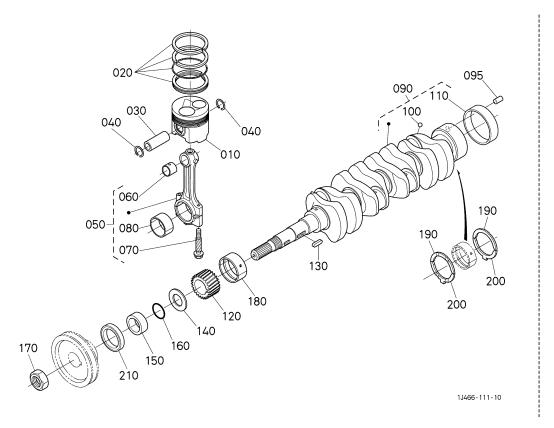
REF.No. No.DE REF POS.No.	No. REF.	PART NAME	DESCRIPCION	DESIGNATION	Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	15601-1555-0	TAPPET	EMPUJADOR	POUSSOIR	8		
020	1A091-1511-0	PUSH ROD	EMPUJAR VARILLA	TIGE DE POUSSOIR	8		
030	1A091-1601-0	ASSY CAMSHAFT	CONJ.ARBOL DE LEVAS	ENS.ARBRE A CAMES	1		
040		BLANK	POSTIZO	BLANC	-		
050	07715-00401	BALL	BOLA	BILLE	1		
060		GEAR,CAM	ENGRANAJE,LEVA	PIGNON	1		
070	05712-00720	KEY,FEATHER	LLAVE,PLUMA	CLAVETTE	1		
080	L	STOPPER,CAMSHAFT	TAPON,ARBOL DE LEVAS	BOUCHON ARBRE A CAME	1		
090		BOLT	BULLONE	VIS	2		
100	1G791-2401-0	COMP.GEAR,IDLE	COMP.ENGRANAJE	PIGNON FOU COMP.	1		
110	1A021-2498-0	BUSH,IDLE GEAR	CASQUILLO,PNT	BAGUE DU PIGNON	1		
120	l	COLLAR	COLLAR	COLLIER	1		
130	1	CIR CLIP,EXTERNAL	ANILLO,EXTERNO	CIRCLIP	1		
140	1	SHAFT,IDLE GEAR	EJE,PNT MRT ENGRNJ	ARBRE DE PIGNON FOU	1		
150	01123-50818	BOLT	BULLONE	VIS	3		
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010200 PISTON AND CRANKSHAFT PISTON Y CIGUENAL PISTON ET VILEBREQUIN



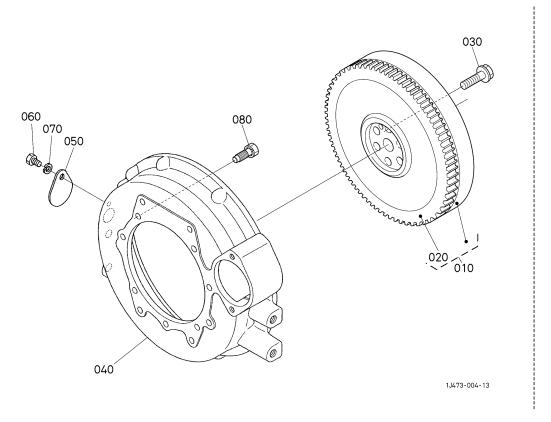
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1010 16466-2111-0 PISTON	REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
100 10400-2105-0 ASSY PISTON RING CONJUNTO PISTON ARO ENS. SEGMENT 4 10.25mm 100	010	1G466-2111-0	PISTON	PISTON	PISTON	4		STD
020	010	1G466-2190-0	PISTON	PISTON	PISTON	4		+0.25mm
030	020	1A091-2105-0	ASSY PISTON RING	CONJUNTO PISTON ARO	ENS.SEGMENT	4		STD
MACTAL M	020	1A091-2109-0	ASSY PISTON RING	CONJUNTO PISTON ARO	ENS.SEGMENT	4		+0.25mm
100 17311-2201-2 ASSY ROD, CONNECTING CONJUARILIA, CNCTND ENS. BIELLE 4	030	1A021-2131-0	PIN,PISTON	PASADOR,PISTON	AXE DE PISTON	4		
17311-2201-2	040	1G279-2133-0	CIR CLIP,INTERNAL	ANILLO,INTERNO	CIRCLIP	8		
1731-2296-0 BOSH, FISTON FIN CASQUILLO, FSTIN FSJIK BAGSUD DE BIELLE 8	050	17311-2201-2	ASSY ROD, CONNECTING	CONJ.VARILLA,CNCTND	ENS.BIELLE	4		
17311-2231-2	060	17331-2198-0	BUSH,PISTON PIN	CASQUILLO,PSTN PSDR	BAGUE DE BIELLE			
17311-2237-2 METAL,GRANKPIN METAL,MUNEQUILLA COUSSINET DE BIELLE 4 -0.20mm SET	070	15521-2214-2	BOLT, CONNECTING ROD	TORNILLO, CNCTND VRLL	VIS DE BIELLE	8		
17311-2298-0 METAL,CRANKPIN METAL,MUNEQUILLA COUSSINET DE BIELLE 4 -0.40mm SET	080	17311-2231-2	METAL, CRANKPIN	METAL, MUNEQUILLA	COUSSINET DE BIELLE	4		STD SET
100 17311-22301-7 COMP.CRANKSHAFT COMPLETO CIGUENAL VILEBREQUIN COMPLET COMPLETO CIGUENAL SOURCE COMPLETO CIGUENAL COMP	080	17311-2297-0	METAL, CRANKPIN	METAL, MUNEQUILLA	COUSSINET DE BIELLE	4		-0.20mm SET
095 1A021-2319-2 PIN,STRAIGHT PASADOR,RECTO GOUPILLE CYLINDLIQUE 1 100 07715-00401 BALL BOLA BILLE 4 110 19202-2328-0 BUSH,CRANKSHAFT CASQUILLO,CIGUENAL BAGUE DE VILEBREQUIN 1 120 1A021-2411-0 GEAR,CRANKSHAFT ENGRANAJE,CIGUENAL PIGNON DE VILEBREQ. 1 130 05712-00730 KEY,FEATHER LLAVE,PLUMA CLAVETTE 1 140 15471-2331-2 SLINGER,OIL DEFLECTOR,ACEITE DEFLECTEUR D'HUILE 1 150 19202-2325-0 COLLAR,CRANKSHAFT COLLARIN,CIGUENAL COLLIER VILEBREQUIN 1 160 04811-10300 O RING O ARO JOINT TORIQUE 1 170 15221-2336-0 NUT,CRANKSHAFT TUERCA,CIGUENAL ECROU DE VILEB. 1 180 1A091-2347-2 METAL,CRANKSHAFT METAL,CIGUENAL COUSSINET DE VILEBR. 1 -0.20mm 180 1A091-2392-0 METAL,CRANKSHAFT METAL,CIGUENAL COUSSINET DE VILEBR. 1 -0.40mm	080	17311-2298-0	METAL, CRANKPIN	METAL, MUNEQUILLA	COUSSINET DE BIELLE	4		-0.40mm SET
100 07715-00401 BALL BOLA BILLE 4	090	1G851-2301-7	COMP.CRANKSHAFT	COMPLETO CIGUENAL	VILEBREQUIN COMPLET	1		
100 07713-00401 BALL BOLA BUSH, CRANKSHAFT CASQUILLO, CIGUENAL BAGUE DE VILEBREQUIN 1 1 1 1 1 1 1 1 1	095	1A021-2319-2	PIN,STRAIGHT	PASADOR,RECTO	GOUPILLE CYLINDLIQUE	1		
120	100	07715-00401	BALL	BOLA	BILLE	4		
130 05712-00730 KEY,FEATHER LLAVE,PLUMA CLAVETTE 1 140 15471-2331-2 SLINGER,OIL DEFLECTOR,ACEITE DEFLECTEUR D'HUILE 1 1 1 1 1 1 1 1 1	110	19202-2328-0	BUSH,CRANKSHAFT	CASQUILLO,CIGUENAL	BAGUE DE VILEBREQUIN	1		
140 15471-2331-2 SLINGER,OIL DEFLECTOR,ACEITE DEFLECTEUR D'HUILE 1 150 19202-2325-0 COLLAR,CRANKSHAFT COLLARIN,CIGUENAL COLLIER VILEBREQUIN 1 160 04811-10300 O RING O ARO JOINT TORIQUE 1 170 15221-2336-0 NUT,CRANKSHAFT TUERCA,CIGUENAL ECROU DE VILEB. 1 180 1A091-2347-2 METAL,CRANKSHAFT METAL,CIGUENAL COUSSINET DE VILEBR. 1 -0.20mm 180 1A091-2391-0 METAL,CRANKSHAFT METAL,CIGUENAL COUSSINET DE VILEBR. 1 -0.40mm 180 1A091-2392-0 METAL,CRANKSHAFT METAL,CIGUENAL COUSSINET DE VILEBR. 1 -0.40mm 190 1A091-2395-0 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 STD 190 1A091-2396-0 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 +0.40mm 200 1A091-2354-2 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 5TD	120	1A021-2411-0	GEAR,CRANKSHAFT	ENGRANAJE,CIGUENAL	PIGNON DE VILEBREQ.	1		
150 19202-2325-0 COLLAR, CRANKSHAFT COLLARIN, CIGUENAL COLLIER VILEBREQUIN 1 160 04811-10300 O RING O ARO JOINT TORIQUE 1 170 15221-2336-0 NUT, CRANKSHAFT TUERCA, CIGUENAL ECROU DE VILEB. 1 180 1A091-2347-2 METAL, CRANKSHAFT METAL, CIGUENAL COUSSINET DE VILEBR. 1 90.20mm 180 1A091-2391-0 METAL, CRANKSHAFT METAL, CIGUENAL COUSSINET DE VILEBR. 1 90.20mm 180 1A091-2392-0 METAL, SIDE METAL, LADO COUSSINET DE LATERAL 2 STD 190 1A091-2395-0 METAL, SIDE METAL, LADO COUSSINET DE LATERAL 2 90.20mm 190 1A091-2396-0 METAL, SIDE METAL, LADO COUSSINET DE LATERAL 2 90.40mm 200 1A091-2354-2 METAL, SIDE METAL, LADO COUSSINET DE LATERAL 2 5TD	130	05712-00730	KEY,FEATHER	LLAVE,PLUMA	CLAVETTE	1		
19202-2323-0 COLLAR,CRAINGSHAFT COLLARIN,CIGUENAL COLLIER VILEBREQUIN 1 1 1 1 1 1 1 1 1	140	15471-2331-2	SLINGER,OIL	DEFLECTOR,ACEITE	DEFLECTEUR D'HUILE	1		
170 15221–2336–0 NUT,CRANKSHAFT TUERCA,CIGUENAL ECROU DE VILEB. 1 180 1A091–2347–2 METAL,CRANKSHAFT METAL,CIGUENAL COUSSINET DE VILEBR. 1 90.20mm 180 1A091–2391–0 METAL,CRANKSHAFT METAL,CIGUENAL COUSSINET DE VILEBR. 1 90.20mm 180 1A091–2392–0 METAL,CRANKSHAFT METAL,CIGUENAL COUSSINET DE VILEBR. 1 90.40mm 190 1A091–2353–2 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 STD 190 1A091–2395–0 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 90.40mm 190 1A091–2396–0 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 90.40mm 200 1A091–2354–2 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 5TD	150	19202-2325-0	COLLAR, CRANKSHAFT	COLLARIN,CIGUENAL	COLLIER VILEBREQUIN	1		
180 1A091-2347-2 METAL,CRANKSHAFT METAL,CIGUENAL COUSSINET DE VILEBR. 1 STD	160	04811-10300	O RING	O ARO	JOINT TORIQUE	1		
180 1A091-2391-0 METAL,CRANKSHAFT METAL,CIGUENAL COUSSINET DE VILEBR. 1 -0.20mm 180 1A091-2392-0 METAL,CRANKSHAFT METAL,CIGUENAL COUSSINET DE VILEBR. 1 -0.40mm 190 1A091-2353-2 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 STD 190 1A091-2395-0 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 +0.20mm 190 1A091-2396-0 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 +0.40mm 200 1A091-2354-2 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 STD	170	15221-2336-0	NUT,CRANKSHAFT	TUERCA,CIGUENAL	ECROU DE VILEB.	1		
180 1A091-2391-0 METAL, CRANKSHAFT METAL, CIGUENAL COUSSINET DE VILEBR. 1 -0.40mm	180	1A091-2347-2	METAL, CRANKSHAFT	METAL, CIGUENAL	COUSSINET DE VILEBR.	1		STD
190 1A091-2353-2 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 STD	180	1A091-2391-0	METAL, CRANKSHAFT	METAL, CIGUENAL	COUSSINET DE VILEBR.	1		-0.20mm
190 1A091-2393-2 IMETAL,SIDE IMETAL,LADO COUSSINET DE LATERAL 2 +0.20mm 190 1A091-2396-0 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 +0.40mm 200 1A091-2354-2 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 +0.40mm 200 1A091-2354-2 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 STD	180	1A091-2392-0	METAL, CRANKSHAFT	METAL, CIGUENAL	COUSSINET DE VILEBR.	1		-0.40mm
190 1A091-2393-0 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 +0.40mm 200 1A091-2354-2 METAL,SIDE METAL,LADO COUSSINET DE LATERAL 2 STD	190	1A091-2353-2	METAL,SIDE	METAL,LADO	COUSSINET DE LATERAL			STD
200 1A091-2354-2 METAL,SIDE METAL,LADO COUSSINET DE LATERAL ² STD	190	1A091-2395-0	METAL,SIDE	METAL,LADO	COUSSINET DE LATERAL			+0.20mm
200 TAU91-2354-2 METAL, SIDE METAL, LADO COOSSINET DE LATERAL - STD	190	1A091-2396-0	METAL,SIDE	METAL,LADO	COUSSINET DE LATERAL			+0.40mm
200 1A091-2397-0 METAL, SIDE METAL, LADO COUSSINET DE LATERAL 2 +0.20mm	200	1A091-2354-2	METAL,SIDE	METAL,LADO	COUSSINET DE LATERAL	_		STD
	200	1A091-2397-0	METAL,SIDE	METAL,LADO	COUSSINET DE LATERAL	2		+0.20mm



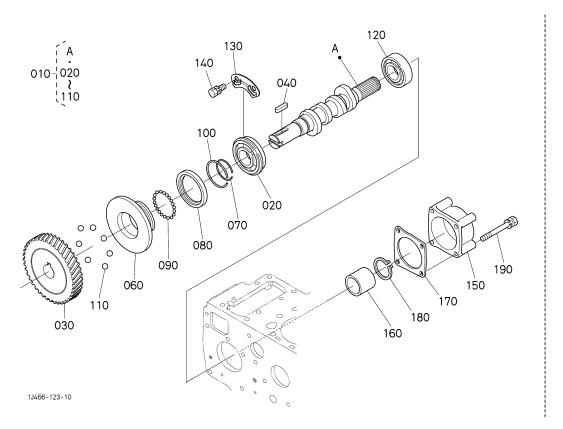
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REF.No. No.DE REF. POS.No.	l No. REF.	PART NAME	DESCRIPCION	DESIGNATION	OITV/O Na	I.C. I/C I.C.	REMARKS NOTA REMARQUES
200	1A091-2398-0	METAL,SIDE	METAL,LADO	COUSSINET DE LATERAL	2		+0.40mm
210	19202-0414-0	SEAL,OIL	SELLO	BAGUE JOINT	1		
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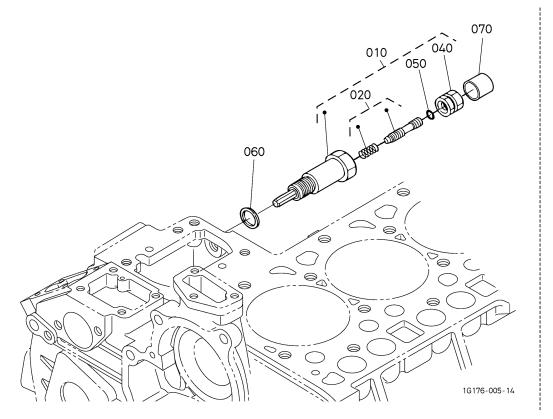


						240	3-IVI-E3B-3BR-1
REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	1G850-2501-5	COMP.FLYWHEEL	COMPLETO VOLANTE	VOLANT MOTELID COMP	A 1	1.0.	TREMANGOLO
		L	L	l	1		
020	1A021-6382-0	GEAR,RING	ENGRANAJE,ARO	COURONNE DE DEMARRE.	6		
030	1G916-2516-0	BOLT,FLYWHEEL	TORNILLO, VOLANTE	VIS DE VOLANT	1		
040	1G850-0461-3	HOUSING,FLYWHEEL	CARCASA, VOLANTE	CARTER VOLANT	·		
	31220-1417-0	COVER	CUBIERTA	COUVERCLE			
	01153-50812	BOLT	BULLONE	VIS	1		
	04512-60080	WASHER,SPRING	ARANDELA DE MUELLE	L	1		
080	16427-9101-0	BOLT	TORNILLO	VIS	11		
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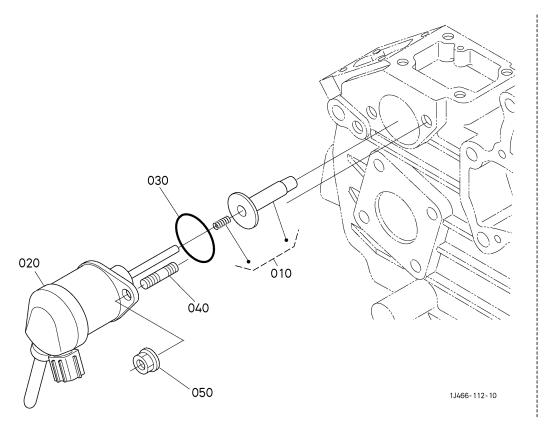
FUEL CAMSHAFT AND GOVERNOR SHAFT ()10500 COMBUSTIBLE ARBOL DE LEVAS Y REGULADOR EJE ARBRE A CAMES DE CARBURANT ET ARBRE REGULATEUR



REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	1A091-1602-6	ASSY CAMSHAFT, FUEL	CONJ.ARBOL	ENS.ARBRE A CAMES	1		
020	1G924-5175-0	BEARING,BALL	RODAMIENTO	ROULEMENT A BILLES	1		
030	16415-5115-0	GEAR, INJECTION PUMP	ENGRANAJE,INYCCN BMB	ENGRE.POMPE D'INJEC.	1		
040	05712-00525	KEY,FEATHER	LLAVE,PLUMA	CLAVETTE	1		
050		BLANK	POSTIZO	BLANC	_		
060	15611-5545-0	SLEEVE,GOVERNOR	CASQUILLO,REGULADOR	BAGUE DE REGULATEUR	1		
070	15221-5547-0	CIR-CLIP,GOV. SLEEVE	ANILLO	JONC D'ARRET	1		
080	15611-5569-0	CASE,GOVERNOR BALL	CAJA,REGULADOR BOLA	CUVETTE DE BILLES	1		
090	07715-03205	BALL	BOLA	BILLE	39		
100	15221-5574-0	CIR-CLIP	ANILLO	CIRCLIP	1		
110	07715-00403	BALL	BOLA	BILLE	7		
120	1G861-9730-0	BEARING,BALL	RODAMIENTO	ROULEMENT A BILLES	1		
130	1A091-1632-0	STOPPER,FUEL C/SHAFT	TAPON,CMBSTBL LV/EJ	BOUCHON ARBRE A CAM.	1		
140	01123-60814	BOLT	BULLONE	VIS	2		
150	15225-1621-4	COVER, FUEL CAMSHAFT	CUBIERTA, CMBSTBL	COUV.ARBRE A CAMES	1		
160	1G861-1619-0	COLLAR	COLLAR	COLLIER	1		
170	1G492-1622-0	GASKET	JUNTA	JOINT	1		
180	15471-9536-0	CIR CLIP,EXTERNAL	ANILLO,EXTERNO	CIRCLIP	1		
190	01123-50865	BOLT	BULLONE	VIS	4		
			<u> </u>	→ Interchangeable: ≠ not Intercha	angeable: ← r	new fo	or old: \longrightarrow old for new

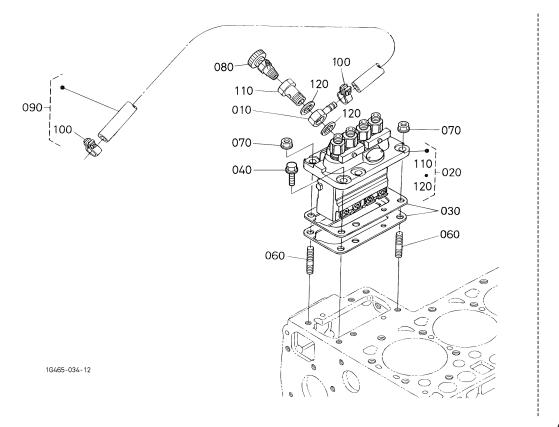


REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	1A021-5416-0	APPARATUS, IDLING	APARATO,AL RALENTI	DISPOSITIF DE RALENT	1		
020	1G911-5410-0	ASSY BOLT, ADJUSTMENT	CONJ.TORNILLO,AJST	ENS.BOULON AU POINT	1		
030		BLANK	POSTIZO	BLANC			
040	1G911-9201-0	NUT,SPRING	TUERCA,RESORTE	ECROU PRISONNIER	1		
050	04814-00060	O RING	O ARO	JOINT TORIQUE	1		
060	04724-00140	GASKET	JUNTA	JOINT	1		_
070	1G911-5427-0	CAP	TAPA	BOUCHON	1		
					 		
					 		
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1010 14021-5660-2 COMP.GUIDE, SOLENOID COMP.GUIA, SLND ENSEMBLE GUIDE 1	REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
030 04814-06310 O RING O ARO JOINT TORIQUE 1 040 15221-8821-0 STUD ESPARRAGO GOUJON 2	010	1A021-5660-2	COMP.GUIDE,SOLENOID	COMP.GUIA,SLND	ENSEMBLE GUIDE	1		
030 04814-06310 O RING O ARO JOINT TORIQUE 1 040 15221-8821-0 STUD ESPARRAGO GOUJON 2	020	1A021-6001-5	ASSY SOLENOID	SOLENOIDE, ASAMBLEA	ENS.SOLENOID	1		
040 15221-8821-0 STOD ESPARAGO GOOJON -	030	L	O RING	O ARO	JOINT TORIQUE	1		
050 02751-50060 NUT,FLANGE TUERCA,BRIDA ECROU A EMBASE TUERCA EC	040	15221-8821-0	STUD	ESPARRAGO	GOUJON	2		
	050	02751-50060	NUT,FLANGE	TUERCA,BRIDA	ECROU A EMBASE	2		
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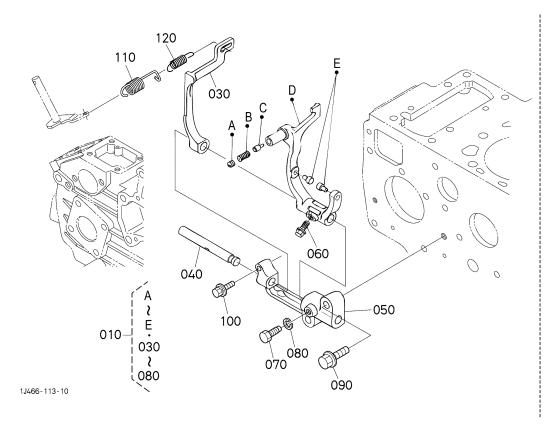
020200 INJECTION PUMP INVECTION BOMBA POMPE D'INJECTION



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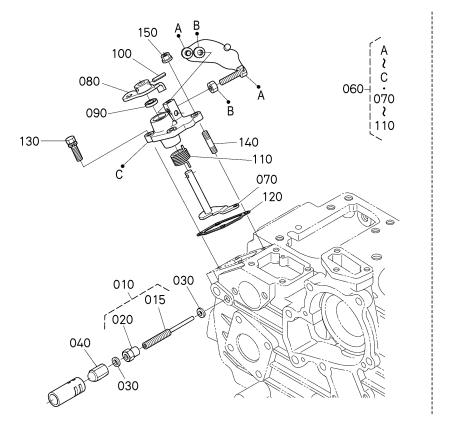
REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	15401-9569-0	JOINT,EYE	JUNTA,OJO	RACCORD	1		
020	1G762-5101-0	ASSY PUMP, INJECTION	CONJ.BOMBA,INYCCN	ENS.POMPE INJECTION	1		
030	1G896-5220-0	SHIM,INJECTION PUMP	SUPLEMENTO, INYCCN	CALE, POMPE INJECTION	1		0.175mm
030	19077-5209-2	SHIM,INJECTION PUMP	SUPLEMENTO, INYCCN	CALE, POMPE INJECTION	1		0.200mm
030	19077-5211-3	SHIM,INJECTION PUMP	SUPLEMENTO, INYCCN	CALE, POMPE INJECTION	1		0.250mm
030	19077-5212-3	SHIM,INJECTION PUMP	SUPLEMENTO, INYCCN	CALE, POMPE INJECTION	1		0.300mm
040	01754-50820	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	4		
050		BLANK	POSTIZO	BLANC	-		
060	15221-9153-0	STUD	ESPARRAGO	GOUJON	2		
070	02751-50080	NUT,FLANGE	TUERCA,BRIDA	ECROU A EMBASE	2		
080	14311-6050-4	ASSY COCK,JET START	CONJ.GRIFO	ROBINET DE PURGE	1		
090	14681-4201-0	ASSY PIPE,FUEL	CONJ.TUBO,CMBSTBL	ENS.TUYAU CARBURANT	1		
100	14301-4275-0	CLIP,PIPE	PRESILLA,TUBO	ATTACHE	2		
110	15471-5132-0	SCREW,HOLLOW	TORNILLO,HUECO	VIS	1		
120	15401-9665-0	GASKET	JUNTA	JOINT	2		
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O20400 REGULATEUR DE VITESSES



REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	1G896-5605-2	ASSY LEVER,FORK	CONJ.PALANCA,BFRCCN	ENS.LEVIER A FOURCHE	1		
020		BLANK	POSTIZO	BLANC	-		
030	1A021-5613-3	LEVER,FORK	PALANCA, BIFURCACION	LEVIER A FOURCHE	1		
040	1G911-5615-0	SHAFT,FORK LEVER	EJE,BFRCCN PLNC	ARBRE DE FOUR-LEVIER	1		
050	15221-5623-0	HOLDER,FORK LEVER	SOPORTE,BFRCCN PLNC	SUPP.FOUR-LEVIER	1		
060	01754-50618	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	1		
070	15221-6641-0	BOLT	TORNILLO	VIS	1		
080		WASHER,SPRING	L	RONDELLE GROWER	1		
	01754-50830	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	2		
100	01025-50630	BOLT	TORNILLO	VIS	1		
110	L	L	RESORTE,REGULADOR	L	1		
120	1A021-5642-2	SPRING,GOVERNOR	RESORTE,REGULADOR	RESSORT DE REGULATEU	1		

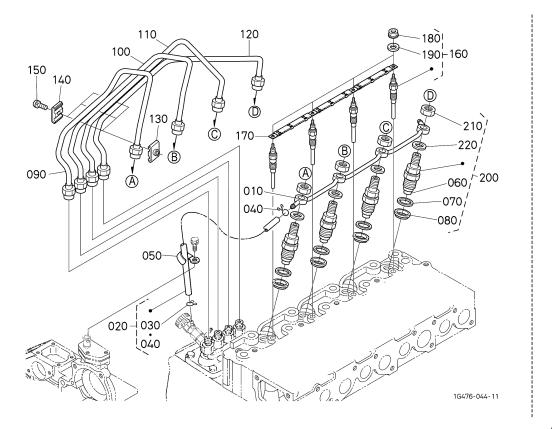
SPEED CONTROL PLATE 020500 VELOCIDAD CONTROL PLACA PLAQUE DE VITESSE-CONTROLE



1J466-114-10

1010 14021-5435-0 ASSY BOLTADJUSTMENT CONJ.TORNILLO, AJST ENS.BOULON AU POINT 1 1015 14021-5412-0 BOLT, ADJUSTING TORNILLO, AJUSTE VIS REGLAGE 1 1 1 1 1 1 1 1 1	REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S. A	I.C. I/C I.C.	REMARKS NOTA REMARQUES
020 15601–9201–2 NUT TUERCA ECROU 1 030 15601–9665–0 GASKET JUNTA JOINT 2 040 15841–1462–0 NUT TUERCA ECROU 1 050 —— BLANK POSTIZO BLANC — 060 16790–5700–4 ASSY PLATE,CONTROL CONJ.PLACA,CNTRL PLATEAU DE COMMANDE 1 070 1A021–5602–0 COMP.LEVER,GOVERNOR COMP.PALANCA,RGLDR AXE D'ACCELERATEUR 1 080 16790–5715–0 LEVER,SPEED CONTROL PALANCA,VLCDD CNTRL LEVIER DE VIT-CONTR. 1 090 16691–5798–0 SEAL,OIL SELLO BAGUE JOINT 1 100 05411–00420 PIN,SPRING PASADOR,RESORTE GOUPILLE-RESSORT 1 110 1A021–5792–0 SPRING,RETURN RESORTE,DEVOLVER RESSORT DE RAPPEL 1 120 1A021–5721–2 GASKET,PLATE JUNTA,PLACA JOINT 1 130 01023–50620 BOLT BULLONE VIS	010	1A021-5435-0	ASSY BOLT, ADJUSTMENT	CONJ.TORNILLO,AJST	ENS.BOULON AU POINT	1		
020 15601-9201-2 NOT TOERCA ECROU 1 030 15601-9665-0 GASKET JUNTA JOINT 2 040 15841-1462-0 NUT TUERCA ECROU 1 050 BLANK POSTIZO BLANC - 060 16790-5700-4 ASSY PLATE,CONTROL CONJ.PLACA,CNTRL PLATEAU DE COMMANDE 1 070 1A021-5602-0 COMP.LEVER,GOVERNOR COMP.PALANCA,RGLDR AXE D'ACCELERATEUR 1 080 16790-5715-0 LEVER,SPEED CONTROL PALANCA,VLCDD CNTRL LEVIER DE VIT-CONTR. 1 090 16691-5798-0 SEAL,OIL SELLO BAGUE JOINT 1 100 05411-00420 PIN,SPRING PASADOR,RESORTE GOUPILLE-RESSORT 1 110 1A021-5792-0 SPRING,RETURN RESORTE,DEVOLVER RESSORT DE RAPPEL 1 120 1A021-5721-2 GASKET,PLATE JUNTA,PLACA JOINT 1 130 01023-50620 BOLT BULLONE VIS 2 140 15221-8821-0 STUD ESPARRAGO GOUJON 2	015	1A021-5412-0	BOLT,ADJUSTING	TORNILLO,AJUSTE	VIS REGLAGE	1		
030 15001-9605-0 GASKET JUNTA JUNTA	020	15601-9201-2	NUT	TUERCA	ECROU			
1040 15841-1462-0 NOT	030	15601-9665-0	GASKET	JUNTA	JOINT	2		
060 16790-5700-4 ASSY PLATE, CONTROL CONJ.PLACA, CNTRL PLATEAU DE COMMANDE 1 070 1A021-5602-0 COMP.LEVER, GOVERNOR COMP.PALANCA, RGLDR AXE D'ACCELERATEUR 1 080 16790-5715-0 LEVER, SPEED CONTROL PALANCA, VLCDD CNTRL LEVIER DE VIT-CONTR. 1 090 16691-5798-0 SEAL, OIL SELLO BAGUE JOINT 1 100 05411-00420 PIN, SPRING PASADOR, RESORTE GOUPILLE-RESSORT 1 110 1A021-5792-0 SPRING, RETURN RESORTE, DEVOLVER RESSORT DE RAPPEL 1 120 1A021-5721-2 GASKET, PLATE JUNTA, PLACA JOINT 1 130 01023-50620 BOLT BULLONE VIS 2 140 15221-8821-0 STUD ESPARRAGO GOUJON 2	040	15841-1462-0	NUT	TUERCA	ECROU	1		
070 1A021–5602–0 COMP.LEVER,GOVERNOR COMP.PALANCA,RGLDR AXE D'ACCELERATEUR 1 080 16790–5715–0 LEVER,SPEED CONTROL PALANCA,VLCDD CNTRL LEVIER DE VIT-CONTR. 1 090 16691–5798–0 SEAL,OIL SELLO BAGUE JOINT 1 100 05411–00420 PIN,SPRING PASADOR,RESORTE GOUPILLE-RESSORT 1 110 1A021–5792–0 SPRING,RETURN RESORTE,DEVOLVER RESSORT DE RAPPEL 1 120 1A021–5721–2 GASKET,PLATE JUNTA,PLACA JOINT 1 130 01023–50620 BOLT BULLONE VIS 2 140 15221–8821–0 STUD ESPARRAGO GOUJON 2	050		BLANK	POSTIZO	BLANC	-		
080 16790-5715-0 LEVER,SPEED CONTROL PALANCA,VLCDD CNTRL LEVIER DE VIT-CONTR. 1 090 16691-5798-0 SEAL,OIL SELLO BAGUE JOINT 1 100 05411-00420 PIN,SPRING PASADOR,RESORTE GOUPILLE-RESSORT 1 110 1A021-5792-0 SPRING,RETURN RESORTE,DEVOLVER RESSORT DE RAPPEL 1 120 1A021-5721-2 GASKET,PLATE JUNTA,PLACA JOINT 1 130 01023-50620 BOLT BULLONE VIS 2 140 15221-8821-0 STUD ESPARRAGO GOUJON 2	060	1G790-5700-4	ASSY PLATE, CONTROL	CONJ.PLACA,CNTRL	PLATEAU DE COMMANDE	1		
080 16/90-5/15-0 LEVER, SPEED CONTROL PALANCA, VECDO CNTRE LEVIER DE VIT-CONTR. 090 16691-5798-0 SEAL,OIL SELLO BAGUE JOINT 1 100 05411-00420 PIN,SPRING PASADOR,RESORTE GOUPILLE-RESSORT 1 110 1A021-5792-0 SPRING,RETURN RESORTE,DEVOLVER RESSORT DE RAPPEL 1 120 1A021-5721-2 GASKET,PLATE JUNTA,PLACA JOINT 1 130 01023-50620 BOLT BULLONE VIS 2 140 15221-8821-0 STUD ESPARRAGO GOUJON 2	070	1A021-5602-0	COMP.LEVER,GOVERNOR	COMP.PALANCA,RGLDR	AXE D'ACCELERATEUR	1		
100 05411-00420 PIN,SPRING PASADOR,RESORTE GOUPILLE-RESSORT 1 110 1A021-5792-0 SPRING,RETURN RESORTE,DEVOLVER RESSORT DE RAPPEL 1 120 1A021-5721-2 GASKET,PLATE JUNTA,PLACA JOINT 1 130 01023-50620 BOLT BULLONE VIS 2 140 15221-8821-0 STUD ESPARRAGO GOUJON 2 2 140 15221-8821-0 STUD ESPARRAGO GOUJON 2 2 140 15221-8821-0 STUD ESPARRAGO GOUJON 2 2 140 14	080	1G790-5715-0	l	l				
110 1A021-5792-0 SPRING,RETURN RESORTE,DEVOLVER RESSORT DE RAPPEL 1 120 1A021-5721-2 GASKET,PLATE JUNTA,PLACA JOINT 1 130 01023-50620 BOLT BULLONE VIS 2 140 15221-8821-0 STUD ESPARRAGO GOUJON 2	090	16691-5798-0	SEAL,OIL	SELLO	BAGUE JOINT	1		
120 1A021-5721-2 GASKET,PLATE JUNTA,PLACA JOINT 1 130 01023-50620 BOLT BULLONE VIS 2 140 15221-8821-0 STUD ESPARRAGO GOUJON 2	100	05411-00420	PIN,SPRING	·		1		
130 01023-50620 BOLT BULLONE VIS 2 140 15221-8821-0 STUD ESPARRAGO GOUJON 2	110	1A021-5792-0	·	·	RESSORT DE RAPPEL	1		
130 01023-50620 BOL1 BOLLONE VIS - 140 15221-8821-0 STUD ESPARRAGO GOUJON ²	120	1A021-5721-2	L	JUNTA,PLACA		·		
140 13221-0021-0 STOD ESPARRAGO GOOJON	130	01023-50620	BOLT	BULLONE	VIS	=		
150 02751-50060 NUT,FLANGE TUERCA,BRIDA ECROU A EMBASE ²	140	15221-8821-0	STUD	ESPARRAGO	GOUJON			
	150	02751-50060	NUT,FLANGE	TUERCA,BRIDA	ECROU A EMBASE	2		
								_

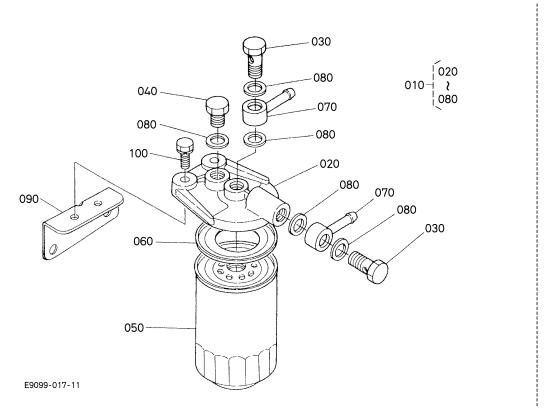
NOZZLE HOLDER AND GLOW PLUG 120600 TOBERA SOPORTE Y BUJIA DE CALENTAMIENTO TAPON PORTE-INJECTEUR ET BOUGIE DE PRECHAUFFAGE



A:V2403-M-E3B-SBR-1

REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	16454-4250-2	ASSY PIPE, OVER FLOW	CONJ.TUBO,ENCM CDL	ENS.TUYAU TROP-PLEIN	1		
020	17331-4250-0	ASSY PIPE, OVER FLOW	CONJ.TUBO,ENCM CDL	ENS.TUYAU TROP-PLEIN	1		
030	15271-4271-0	CLIP,PIPE	PRESILLA,TUBO	ATTACHE	1		
040	14971-4275-0	CLIP,PIPE	PRESILLA,TUBO	ATTACHE	1		
050	15241-6758-0	CLAMP,CORD	ABRAZADERA,CABLE	ATTACHE-FILS	1		
060	16454-5361-0	PIECE,NOZZLE	PIEZA,TOBERA	ELEMENT D'INJECTEUR	4		_
070	15841-5362-2	GASKET	JUNTA	JOINT	4		
080	19077-5365-0	SEAL,HEAT	RETEN,CALOR	JOINT DE CHALEUR	4		
090	L	PIPE,INJECTION	INYECTOR DE LA PIPA	LJ	1		
100	19077-5372-3	PIPE,INJECTION	INYECTOR DE LA PIPA	TUYAU D'INJECTEUR	1		
110	L	PIPE,INJECTION	INYECTOR DE LA PIPA		1		
120	19077-5374-3	PIPE,INJECTION	INYECTOR DE LA PIPA	TUYAU D'INJECTEUR	1		
130		CLAMP,PIPE	ABRAZADERA	COLLIER DE TUYAU	3		
	L	CLAMP,PIPE	ABRAZADERA	COLLIER DE TUYAU	3		
150	03024-50520	SCREW,WITH WASHER	l .	VIS	3		
160	19077-6551-2	GLOW PLUG	L	BOUGIE,PRE-CHAUFFAGE	4		
	1G778-6556-0	CORD,GLOW PLUG	CABLE,BJ CLNTMNT TPN	l	1		
180	02761-50040	NUT,FLANGE	TUERCA,BRIDA	ECROU A EMBASE	4		
190	04013-60040	WASHER,PLAIN	ARANDELA,SIMPLE	RONDELLE FREIN	4		
200	16454-5390-0	,	KIT SOPORTE, TOBERA	ENS.PORTE-INJECTEUR	4		
210	15841-9203-0	NUT	TUERCA	ECROU	4		
220	15841-9404-0	WASHER	ARANDELA	RONDELLE	4		

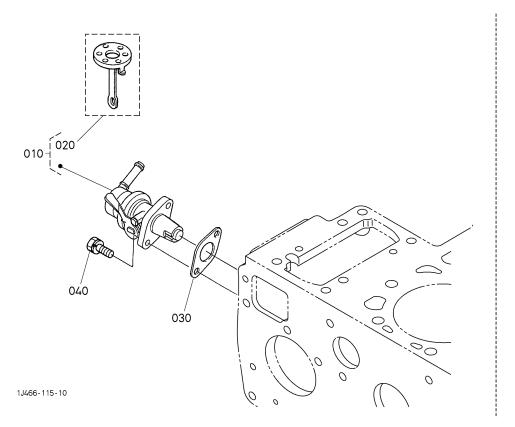
030000 FUEL FILTER COMBUSTIBLE FILTRO FILTRE A CARBURANT



A:V2403-M-E3B-SBR-1

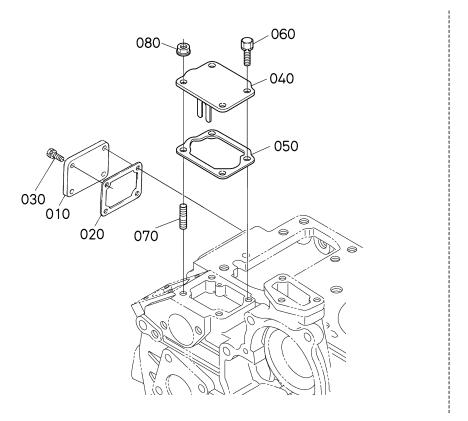
						240	13-1VI-E3B-3BR-1
REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	19077-4301-2	ASSY FILTER, FUEL	CONJ.FILTRO.CMBSTBL	ENS.FILTRE,COMBUST	1		· ·
020	16551-4321-0	COVER,FILTER	CUBIERTA	COUVERCLE	1		
030	16541-9579-0	BOLT,JOINT	TORNILLO DE JUNTA	VIS	2		
040	19077-4328-0	PLUG	TAPON	BOUCHON	1		
050	HH166-4356-0	ELEMENT, FUEL FILTER	ELEMENTO,CMBSTBL	ELEMENT DE FILTRE	1		
060	16541-4333-0	GASKET	JUNTA	JOINT	1		
070	19077-4361-0	CONNECTOR	CONNETTORE	CONNECTEUR	2		
080	17105-3368-0	GASKET	JUNTA	JOINT	5		
090	17298-4343-0	HOLDER, FUEL FILTER	SOPORTE, CMBSTBL FLTR	SUPPORT DE FILTER	1		
100	01133-51025	BOLT	BULLONE	VIS	2		
				\ Interchangeable: \(\psi\) not Interch		£-	

030100 FUEL PUMP (MECHANICAL) COMBUSTIBLE BOMBA (MECANICO) POMPE D'ALIMENTATION (MECHANIQUE)



A:V2403-M-E3B-SBR-1

REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	17539-5203-0	ASSY PUMP,FUEL	CONJ.BOMBA,CMBSTBL	ENS.POMPE D'ALIMEN.	1		
020	19844-5204-0	COMP DIAPHRAGM	COMPLETO DIAFRAGMA		1		
030	1G751-5214-0	GASKET,FUEL PUMP	JUNTA,CMBSTBL BMB		1		
040	01023-50616	BOLT	TORNILLO	VIS	2		
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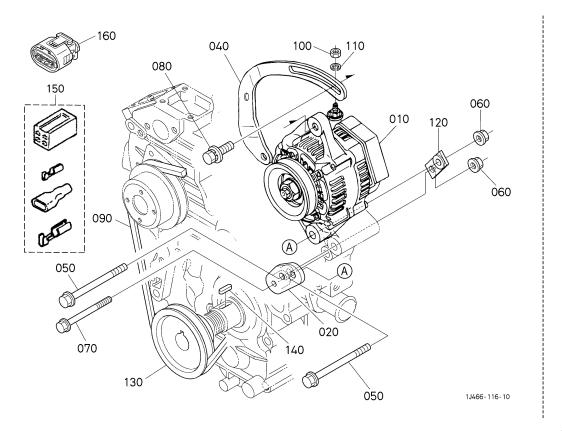


1J466-120-10

A:V2403-M-E3B-SBR-1

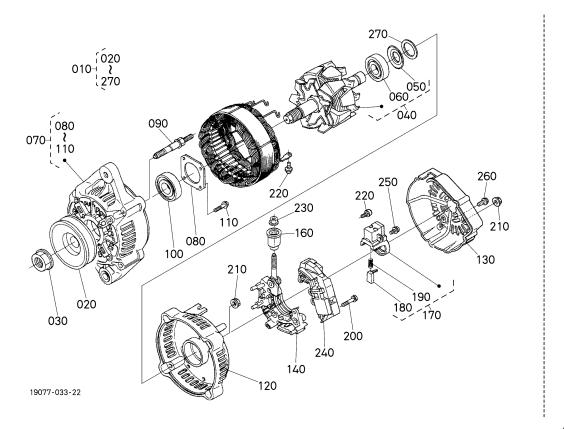
REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	1A053-5165-0	COVER,INJ.PUMP	CUBIERTA,INYCCN BMB	COUVERCLE FILTRE D'.	1		
020	1A021-5166-0	GASKET,PUMP COVER	JUNTA,BOMBA CUBIERTA	JOINT	1		
030	01023-50616	BOLT	TORNILLO	VIS	4		
040	1G778-5454-0	COVER,BOOST COM.HOUS	CUBIERTA,RFRZ CM,CS	COUV.DE COMPENS.	1		
050	1A021-5721-2	GASKET,PLATE	JUNTA,PLACA	JOINT	1		
060	01023-50616	BOLT	TORNILLO	VIS	2		
070	15841-9151-0	STUD	ESPARRAGO	GOUJON	2		
080	02751-50060	NUT,FLANGE	TUERCA,BRIDA	ECROU A EMBASE	2		
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040200 ALTERNATOR AND PULLEY ALTERNATOR Y POLEA ALTERNATEUR ET POULIE



						240	3-1VI-E3B-3BR-1
REF.No. No.DE REF. POS.No.	PART No. No. REF.	PART NAME	DESCRIPCION	DESIGNATION	Q'TE/No.S.	I.C. I/C	REMARKS NOTA
	REFERENCE				Α	I.C.	
010	19279-6401-0	ASSY ALTERNATOR	CONJUNTO ALTERNADOR	L	l 		12V 70A
020	1J403-6435-0	SUPPORT,ALTERNATOR	SOPORTE,ALTERNADOR	SUPPORT DE ALTERNATE	1		
030		BLANK	POSTIZO	BLANC	-		
040	1E167-6442-0	STAY,DYNAMO	SOPORTE, DINAMO	TENDEUR	1		
050	01774-51085	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	2		
060	02771-60100	NUT,FLANGE	TUERCA,BRIDA	ECROU A EMBASE	2		
070	01754-50890	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	1		
080	01127-50830	BOLT	BULLONE	VIS	1		
090	1G355-9701-0	V BELT,A	V CORREA,A	COURROIE	1		41.5in
100	02056-50060	NUT	TUERCA	ECROU	1		
110	04512-60060	WASHER, SPRING	ARANDELA DE MUELLE	RONDELLE GROWER	1		
120	1J403-6447-0	STAY,ALTERNATOR	ESTANCIA	SUPPORT DE ALTERNAT.	1		
130	1A085-7428-0	PULLEY,FAN DRIVE	POLEA, VNTLDR ACCNR	POULIE ENTRAIN.VENT.	1		
140	05712-00720	KEY,FEATHER	LLAVE,PLUMA	CLAVETTE	1		
150	19488-6583-0	ASSY COUPLER	CONJUNTO ACOPLADOR	ENS.COUPLEUR	1		
160	16678-6583-0	ASSY CONNECTOR	CONJUNTO CONECTOR	ENS.CONNECTEUR	1		
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				\ Interchangeable: \(\pm\) not Interch	angaabla. / r		rold: \ old for now

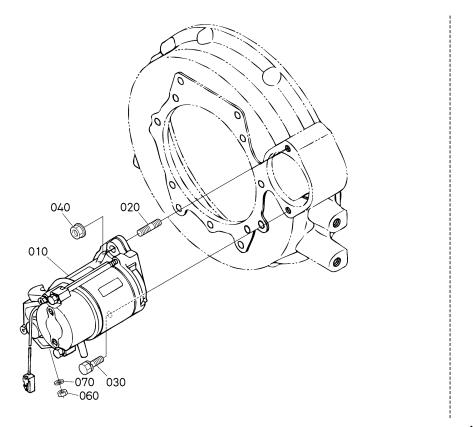
ALTERNATOR (COMPONENT PARTS) 040300 ALTERNATOR (COMPONENTE PIEZAS) ALTERNATEUR (PARTIES COMPOSANTES)



A:V2403-M-E3B-SBR-1

REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	19279-6401-0	ASSY ALTERNATOR	CONJUNTO ALTERNADOR	ALTERNATEUR COMPLET	1		
020	17559-6411-0	PULLEY, DYNAMO	POLEA,DINAMO	POULIE D'ALTERNATEUR	1		
030	16540-9201-0	NUT	TUERCA	ECROU	1		
040	17559-6412-0	ASSY ROTOR	CONJUNTO ROTOR	ENS.ROTOR	1		
050	15881-6480-0	COVER,BEARING	CUBIERTA,RODAMIENTO	COUVERCLE	1		
060	35999-1766-0	BEARING,BALL	RODAMIENTO	ROULEMENT A BILLES	1		
070	17559-6402-2	FRAME, DRIVE END	BASTIDOR,ACCNR FN	BATI	1		
080	16540-6471-0	PLATE,RETAINER	l '	PLAQUE RETENUE	1		
090	16540-6426-0	BOLT,THROUGH	TORNILLO,A TRAVES	VIS,PASSANT	4		
100	16540-6477-0	BEARING,BALL	RODAMIENTO	ROULEMENT A BILLES	1		
110	16540-9303-2	SCREW	TORNILLO	VIS	4		
120	35999-1769-0	FRAME,END	BASTIDOR,FIN	BATI	1		
130	19279-6423-3	COVER,END REAR	CUBIERTA,FIN	PALIER ARRIERE	1		
140	35999-1767-0	ASSY RECTIFIER	CONJ.RECTIFICADOR	REDRESSEUR	1		
150		BLANK	POSTIZO	BLANC	-		
160	16540-6491-0	BUSH,INSULATION	CASQUILLO,ASLMNT	BAGUE ISOLANTE	1		
170	16652-6431-0	HOLDER,BRUSH	SOPORTE,ESCOBILLA	PORTE-BALAI	1		
180	15881-6409-0	BRUSH	ESCOBILLA	PATTE D'ATTACHE	2		
190	15881-6433-0	SPRING,BRUSH	RESORTE,ESCOBILLA	RESSORT DE BALAI	2		
200	15881-9302-0	SCREW,ROUND HEAD	TORNILLO,RDND CLT		2		
210	15881-9202-0	NUT	TUERCA	ECROU	7		
220	15881-9303-0	SCREW,ROUND HEAD	TORNILLO,RDND CLT	VIS A TETE RONDE	6		
230	14182-9203-0	NUT	TUERCA	ECROU	1		
240	19279-6460-0	ASSY REGULATOR	CONJUNTO REGULADOR	REGULATEUR	1		
250	16540-9305-0	SCREW WITH WASHER	TORNILLO	VIS	1		
260	16540-9306-0	BOLT WITH WASHER	PERNO	VIS DE RONDELLE	1		
270	16540-9431-0	WASHER,ALTERNATOR	ARANDELA	RONDELLE DE ALTERNA.	1		
				> Interchangeable: ≠ not Intercha	ngoable: — r	OW fo	r old: —) old for now

040400 STARTER MOTOR DE ARRANQUE DEMARREUR

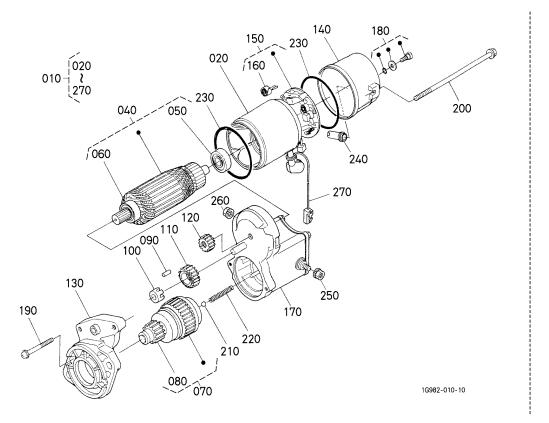


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REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	17490-6301-4	ASSY STARTER	CONJ.MOTOR ARRANQUE	ENS.DEMARREUR	1		12V 2.0kW
020	01517-51028	STUD	ESPARRAGO	GOUJON	1		
030	01133-51030	BOLT	BULLONE	VIS	1		
040	02771-60100	NUT,FLANGE	TUERCA,BRIDA	ECROU A EMBASE	1		
050		BLANK	POSTIZO	BLANC	_		
060	02114-50080	NUT	TUERCA	ECROU	1		
070	04512-60080	WASHER,SPRING	ARANDELA DE MUELLE	RONDELLE GROWER	1		
				> Interchangeable: ≠ not Interch	anaahla. / r		rold. \ ald for pour

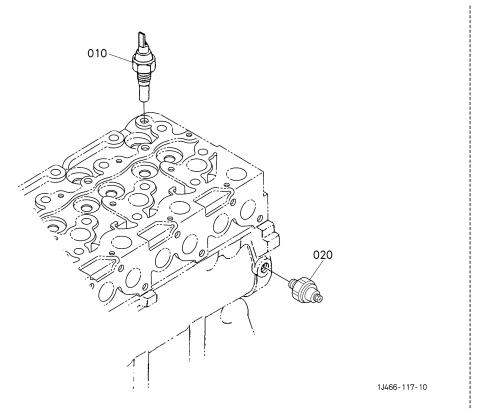
040500 STARTER (COMPONENT PARTS) MOTOR DE ARRANQUE (COMPONENTE PIEZAS) DEMARREUR (PARTIES COMPOSANTES)



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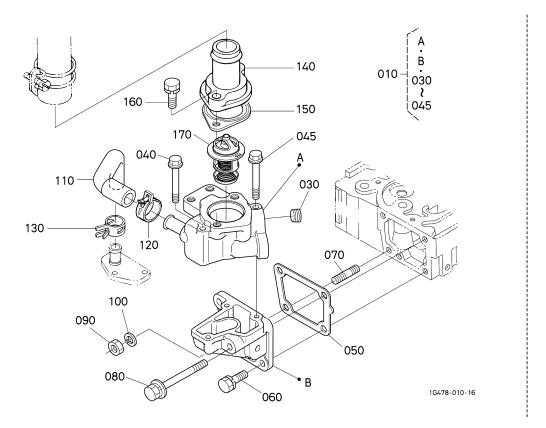
17490-6301-4 ASSY STARTER	REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
DOCUMENT DOCUMENT	010	17490-6301-4	ASSY STARTER	CONJ.MOTOR ARRANQUE	ENS.DEMARREUR	1		
17123-6307-0 ARMATURE INDUCIDO ARMATURE 1 1 1 1 1 1 1 1 1	020	17123-6308-0	YOKE	YUGO	FOURCHE	1		
050 17123-6350-0 BEARING RODAMIENTO ROULEMENT	030		BLANK	POSTIZO	BLANC	_		
100 17123-6300-0 BEARING RODAMIENTO ROULEMENT	040	17123-6307-0	ARMATURE	INDUCIDO	ARMATURE	1		
1400-63304-0 CLUTCH,OVER RUNNING EMBRAGUE,ENCM RCRRND EMBRAYAGE A INERTIE 1	050	17123-6350-0	BEARING	RODAMIENTO	ROULEMENT	1		
17311-6328-0 GEAR,PINION ENGRANAJE,PINON PIGNON 1	060	11460-6350-0	BEARING	RODAMIENTO	ROULEMENT	1		
190	070	17123-6304-0	CLUTCH, OVER RUNNING	EMBRAGUE,ENCM RCRRND	EMBRAYAGE A INERTIE	1		
100	080	17311-6328-0	GEAR,PINION	ENGRANAJE,PINON	PIGNON	1		
100	090	19212-6310-0	ROLLER	RODILLO	ROULEAU	5		
120	100	11460-6311-0	RETAINER	DETENEDOR	SUPPORT	1		
130 17123-6303-0 FRAME,DRIVE END BASTIDOR,ACCNR FN BATI	110	11460-6327-0	GEAR	ENGRANAJE	ENGRENAGE	1		
140 17123-6320-0 FRAME,END BASTIDOR,FIN BATI 1 150 17123-6338-0 HOLDER,BRUSH SOPORTE,ESCOBILLA PORTE-BALAI 1 160 17123-6314-0 SPRING RESORTE RESSORT 4 170 17490-6302-3 ASSY SWITCH,MAGNETIC CONJ.CONMUTADOR ENS.INTERRUPTEUR 1 1 180 17123-9331-0 SCREW TORNILLO VIS 2 190 17123-9332-0 SCREW TORNILLO VIS 2 200 17123-6332-0 BOLT,THROUGH TORNILLO,A TRAVES VIS,PASSANT 2 210 19212-9713-0 BALL BOLA BILLE 1 220 11460-6312-0 SPRING RESORTE RESSORT 1 230 15511-9666-0 O RING O ARO JOINT TORIQUE 2 240 15833-6357-0 PIPE,DRAIN TUBO,VACIAR TUYAU DE DRAINAGE 1 250 13963-9201-0 NUT,HEXAGON TUERCA,HEXAGONO ECROU HEXAGONAL 1	120	17123-6326-0	GEAR	ENGRANAJE	ENGRENAGE	1		
150 17123-6338-0 HOLDER,BRUSH SOPORTE,ESCOBILLA PORTE-BALAI 1 1 1 1 1 1 1 1 1	130	17123-6303-0	FRAME, DRIVE END	BASTIDOR, ACCNR FN	BATI	1		
150 17123-6338-0 HOLDER,BRUSH SOPORTE,ESCOBILLA PORTE-BALAI 1	140	17123-6320-0	FRAME,END	BASTIDOR,FIN	BATI	1		
170 17490-6302-3 ASSY SWITCH,MAGNETIC CONJ.CONMUTADOR ENS.INTERRUPTEUR 1 1 1 1 1 1 1 1 1	150	17123-6338-0	HOLDER,BRUSH	SOPORTE, ESCOBILLA	PORTE-BALAI	1		
180 17123-9331-0 SCREW TORNILLO VIS 2 190 17123-9332-0 SCREW TORNILLO VIS 2 200 17123-6332-0 BOLT,THROUGH TORNILLO,A TRAVES VIS,PASSANT 2 210 19212-9713-0 BALL BOLA BILLE 1 220 11460-6312-0 SPRING RESORTE RESSORT 1 230 15511-9666-0 O RING O ARO JOINT TORIQUE 2 240 15833-6357-0 PIPE,DRAIN TUBO,VACIAR TUYAU DE DRAINAGE 1 250 13963-9201-0 NUT,HEXAGON TUERCA,HEXAGONO ECROU HEXAGONAL 1 260 16285-9201-0 NUT,HEXAGON TUERCA,HEXAGONO ECROU HEXAGONAL 1	160	17123-6314-0	SPRING	RESORTE	RESSORT	4		
100 17123-9331-0 SCREW TORNILLO VIS 2 2 2 2 2 2 2 2 2	170	17490-6302-3	ASSY SWITCH, MAGNETIC	CONJ.CONMUTADOR	ENS.INTERRUPTEUR			
17123-9332-0 SCREW TORNILLO VIS 2 200 17123-6332-0 BOLT,THROUGH TORNILLO,A TRAVES VIS,PASSANT 2 210 19212-9713-0 BALL BOLA BILLE 1 220 11460-6312-0 SPRING RESORTE RESSORT 1 230 15511-9666-0 O RING O ARO JOINT TORIQUE 2 240 15833-6357-0 PIPE,DRAIN TUBO,VACIAR TUYAU DE DRAINAGE 1 250 13963-9201-0 NUT,HEXAGON TUERCA,HEXAGONO ECROU HEXAGONAL 1 260 16285-9201-0 NUT,HEXAGON TUERCA,HEXAGONO ECROU HEXAGONAL 1 2 2 2 2 2 2 2 2 2	180	17123-9331-0	SCREW	TORNILLO	VIS			
200 17123-0332-0 BOLT, THROUGH TORNILLO, A TRAVES VIS, FASSANT 210 19212-9713-0 BALL BOLA BILLE 1	190	17123-9332-0	SCREW	TORNILLO	VIS	_		
220 11460-6312-0 SPRING RESORTE RESSORT 1 230 15511-9666-0 O RING O ARO JOINT TORIQUE 2 240 15833-6357-0 PIPE,DRAIN TUBO,VACIAR TUYAU DE DRAINAGE 1 250 13963-9201-0 NUT,HEXAGON TUERCA,HEXAGONO ECROU HEXAGONAL 1 260 16285-9201-0 NUT,HEXAGON TUERCA,HEXAGONO ECROU HEXAGONAL 1	200	17123-6332-0	BOLT,THROUGH	TORNILLO,A TRAVES	VIS,PASSANT	2		
230 15511–9666–0 O RING O ARO JOINT TORIQUE 2 240 15833–6357–0 PIPE,DRAIN TUBO,VACIAR TUYAU DE DRAINAGE 1 250 13963–9201–0 NUT,HEXAGON TUERCA,HEXAGONO ECROU HEXAGONAL 1 260 16285–9201–0 NUT,HEXAGON TUERCA,HEXAGONO ECROU HEXAGONAL 1	210	19212-9713-0	BALL	BOLA	BILLE	1		
230 13311-9666-0 O RING O ARO JOINT TORIQUE 240 15833-6357-0 PIPE,DRAIN TUBO,VACIAR TUYAU DE DRAINAGE 1 250 13963-9201-0 NUT,HEXAGON TUERCA,HEXAGONO ECROU HEXAGONAL 1 260 16285-9201-0 NUT,HEXAGON TUERCA,HEXAGONO ECROU HEXAGONAL 1	220	11460-6312-0	SPRING	RESORTE	RESSORT	1		
250 13963–9201–0 NUT,HEXAGON TUERCA,HEXAGONO ECROU HEXAGONAL 1 260 16285–9201–0 NUT,HEXAGON TUERCA,HEXAGONO ECROU HEXAGONAL 1	230	15511-9666-0	O RING	O ARO	JOINT TORIQUE	2		
260 16285–9201–0 NUT,HEXAGON TUERCA,HEXAGONO ECROU HEXAGONAL 1	240	15833-6357-0	PIPE,DRAIN	TUBO,VACIAR	TUYAU DE DRAINAGE	1		
200 10283-9201-0 NOT, HEXAGON TUERCA, HEXAGONO ECROU HEXAGONAL	250	13963-9201-0	NUT,HEXAGON	TUERCA,HEXAGONO	ECROU HEXAGONAL	1		
270 16611-6366-0 CORD,STOP SOLENOID CABLE,PRR SLND PRISE DE SOLENOIDE 1	260	16285-9201-0	NUT,HEXAGON	TUERCA,HEXAGONO	ECROU HEXAGONAL	1		
	270	16611-6366-0	CORD,STOP SOLENOID	CABLE,PRR SLND	PRISE DE SOLENOIDE	1		

OIL SWITCH AND THERMOMETER 040600 ACEITE CONMUTADOR AND SENSOR CONTACT A HUILE THERMOMETRE



						240	3-M-E3B-SBR-1
REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010		SENSOR,THERMO	SENSOR THERMO	MANO CONTACT D'EAU	1		
	15841-3901-0	SWITCH,OIL		MANO-CONTACT D'HUILE	-		
020	13641-3901-0	3 VVI I CH, OIL	CONMOTADOR,ACEITE	IMANO-CONTACT DITUILE	·		
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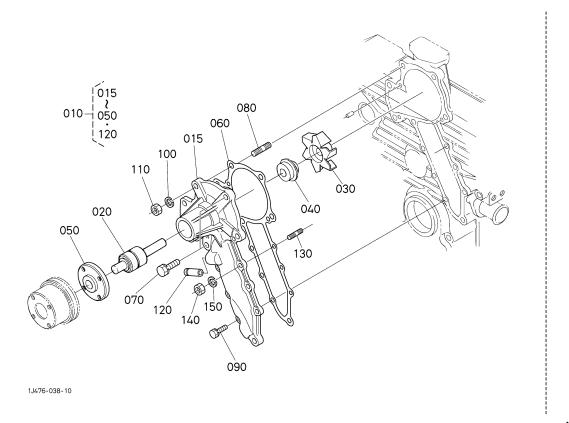
WATER FLANGE AND THERMOSTAT 050000 AGUA BRIDA Y TERMOSTATO BRIDE A EAU ET THERMOSTAT



A:V2403-M-E3B-SBR-1

REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	1G790-7270-3	COMP.FLANGE,WATER	COMPLETO BRIDA, AGUA	BRIDE A EAU COMP.	1		
020		BLANK	POSTIZO	BLANC	-		
030	1A021-9602-0	PLUG	TAPON	BOUCHON	1		
040	01754-50660	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	2		
045	01754-50665	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	1		
050	1A021-7292-0	GASKET,WATER FLANGE	JUNTA,AGUA BRIDA	JOINT DE BRIDE A EAU	1		_
060	01123-50820	BOLT	BULLONE	VIS	2		
070	15221-9153-0	STUD	ESPARRAGO	GOUJON	1		
080	1A021-9102-0	BOLT	TORNILLO	VIS	1		
090	02156-50080	NUT	TUERCA	ECROU	1		
100	04512-60080	WASHER,SPRING		RONDELLE GROWER	1		
110	1A021-7334-0	PIPE,WATER RETURN	TUBO,AGUA DEVOLVER	l	1		
120	1A021-1172-0	CLAMP,HOSE	ABRAZADERA	COLLIER DE DURITE	1		
130	09318-88180	CLAMP,HOSE	ABRAZADERA	COLLIER DE DURITE	1		
140	15321-7326-0	COVER,THERMOSTAT	CUBIERTA	COUV.DE THERMOSTAT	1		
150	16221-7327-0	GASKET,THERMOSTAT	JUNTA,TERMOSTATO	JOINT	1		
160	01123-50835	BOLT	TORNILLO	VIS	2		
170	1A021-7301-2	ASSY THERMOSTAT	CONJUNTO TERMOSTATO	THERMOSTAT COMP.	1		
				→ Interchangeable: ≠ not Intercha	angeable: ← r	new fo	$r \circ ld \longrightarrow old for new$

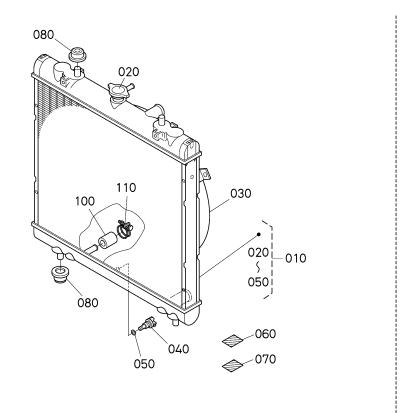
050100 WATER PUMP AGUA BOMBA POMPE A EAU



A:V2403-	M-E3B	-SBR-1
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REF.No. No.DE REF. POS.No.	No. REF.	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	1G730-7303-2	ASSY PUMP,WATER	CONJUNTO BOMBA,AGUA	ENS.POMPE A EAU	1		
015	1G730-7341-0	BODY,WATER PUMP	CARROCERIA,AG BMB	CORPS DE POMPE A.EAU	1		
020	15521-7355-0	BEARING	RODAMIENTO	ROULEMENT	1		
030	1A021-7351-0	IMPELLER,WATER PUMP	RODETE,AGUA BOMBA	TURBINE DE POMPE	1		
040	16661-7305-0	ASSY SEAL, MECHANICAL	CONJ.RETEN,MCNC	ENS.JOINT MECANIQUE	1		
050	1A021-7352-0	FLANGE,W/PUMP SHAFT	BRIDA,AGUA/BOMBA EJE	BRIDE	1		
060	1A051-7343-0	GASKET,WATER PUMP	JUNTA,AGUA BOMBA	JOINT DE POMPE A EAU	1		
070	01123-50828	BOLT	BULLONE	VIS	2		
080	01518-50822	STUD	ESPARRAGO	GOUJON	1		
090	01023-50618	BOLT	BULLONE	VIS	5		
100	04512-60080	WASHER,SPRING	ARANDELA DE MUELLE	L	1		
110		NUT	TUERCA	ECROU	1		
120		l	TUBO,AGUA DEVOLVER	L	1		
130	15221-8821-0	STUD	ESPARRAGO	GOUJON	1		
	02056-50060	NUT	TUERCA	ECROU	1		
150	04512-60060	WASHER,SPRING	ARANDELA DE MUELLE	RONDELLE GROWER	1		

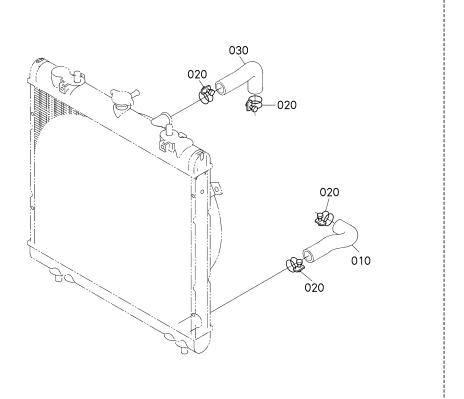
050200 RADIATOR RADIATEUR



1G387-026-10

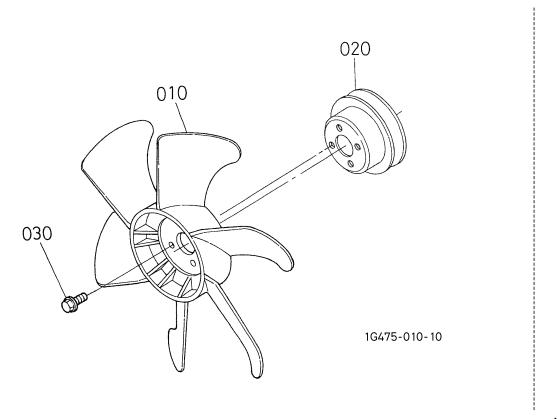
A:V2403-	M-E3B	-SBR-1
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REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	1K583-7206-2	ASSY RADIATOR	CONJUNTO RADIADOR	ENS.RADIATEUR	1		
020	17580-1606-0	CAP.RADIATOR	TAPA,RADIADOR	BOUCHON,RADIATEUR	1		
030	1K583-7233-0	SHROUD,FAN	ARMADURA, VENTILADOR	DEFLECTEUR DE VENTIL	1		
040	34070-1607-0	PLUG.DRAIN	TAPON, VACIAR	BOUCHON DE VIDANGE	1		
050	34070-1609-0	O RING	O ARO	JOINT TORIQUE	1		
060	16478-8823-0	LABEL,RADIATOR	ETIQUETA	ETIQUETTE	1		
070	19426-8788-0	LABEL, INSTRUCTION	ETIQUETA,INSTRUCCION	ETIQUETTE	1		
080	34070-1603-0	RUBBER	CAUCHO	CAOUTCHOUC	4		
090		BLANK	POSTIZO	BLANC	-		
100	19271-1615-0	CAP	TAPA	BOUCHON	1		
110	19269-1616-0	BAND	BANDA	COLLIER	1		
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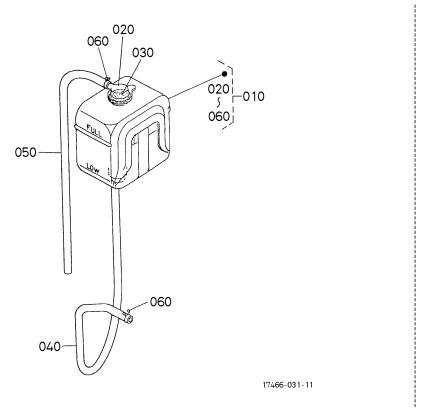
1G476-028-10

REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TE/No.S.	ମ ମ୍ନିମ	REMARKS NOTA REMARQUES
010	1G932-7285-0	HOSE,WATER	MANGUITO	TUYAU D'EAU	1		
020	15108-7287-0	BAND	BANDA	COLLIER	4		
030	1G364-7294-0	HOSE,WATER	MANGUITO,AGUA	TUYAU D'EAU	1		
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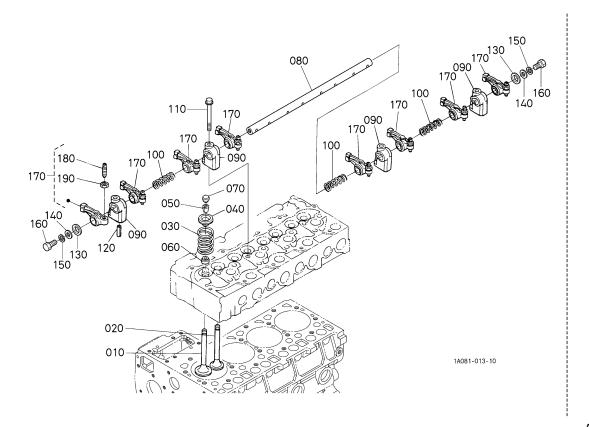
A:V2403-M-E3B-SBR-1

REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	15809-7411-0	FAN	VENTILADOR	VENTILATEUR	1		
020	17351-7425-0	PULLEY,FAN	POLEA, VENTILADOR	POULIE VENTILATEUR	1		
030	01754-50612	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	4		
			_	\rightarrow Interchangeable: \neq not Interch	angoable: 📛 r	DOW fo	or old: — ald for now

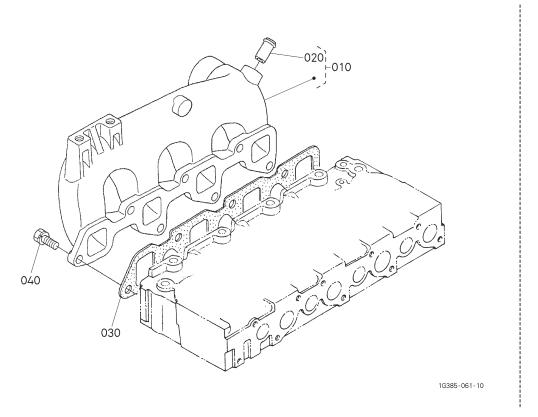


REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	OITV/O NI	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	15501-7240-0	ASSY TANK, RESERVE	CONJ.DEPOSITO,RSRV	ENS.VASE D'EXPANSION	1		
020	15272-7242-0	CAP	TAPA	BOUCHON	1		
030	15531-7243-2	GASKET	JUNTA	JOINT	1		
040	15501-7271-0	PIPE,WATER OVER FLOW		ENS.TUYAU TROP-PLEIN	1		
050	68111-4239-0		TUBO,AG ENCM CDL		1		
060	15501-7247-0	CLIP,PIPE	PRESILLA,TUBO	ATTACHE	2		
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060000 VALVULA Y BALANCIN BRAZO SOUPAPES ET CULBUTEURS

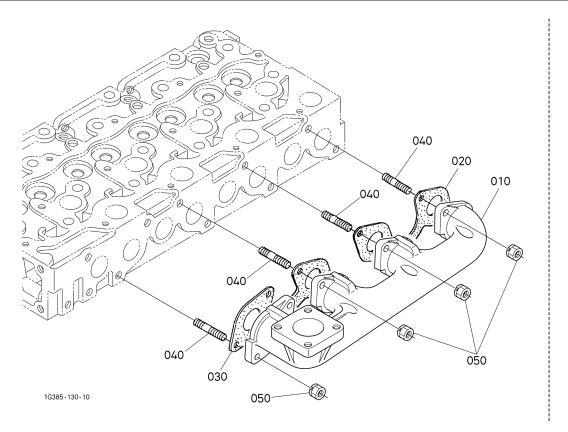


REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	1G896-1311-0	VALVE,INLET	VALVULA,ENTRADA	SOUPAPE D'ADMISSION	4		
020	1G896-1312-0	VALVE,EXHAUST	VALVULA,ESCAPE	SOUPAPE D'ECHAPMENT	4		
030	15221-1324-0	SPRING,VALVE	RESORTE, VALVULA	RESSORT DE SOUPAPE	8		
040	15221-1333-0	RETAINER, VALVE SP.	RETENEDOR, VLVL VLCDD	CUVETTE SUPERIEURE	8		
050	15221-1398-0	COLLET, VALVE SPRING	ENGASTE, VLVL RSRT	DEMI CLAVETTE	8		SET
060	15221-1315-3	SEAL, VALVE STEM	RETEN, VLVL VSTG	JOINT DE SOUPAPE	8		
070	15221-1328-0	CAP,VALVE	TAPA,VALVULA	CHAPEAU DE SOUPAPE	8		
080	1A091-1426-0		EJE,BALANCIN BRAZO		1		
090		LL	SOPORTE,BLNCN BRZ	LL	4		
100	15221-1431-0	SPRING,ROCKER ARM	RESORTE	RESSORT DE CULBUTEUR	3		
110	01754-50855	BOLT,FLANGE	TORNILLO,BRIDA	VIS DE BUTEE	4		
120	05411-00528	PIN,SPRING	l	GOUPILLE-RESSORT	1		
130		WASHER,R-ARM.SHAFT	ARANDELA,BLNCN-BRZ	L	2		
140	04013-60080	WASHER,PLAIN	ARANDELA,SIMPLE	RONDELLE FREIN	2		
150	04512-60080	WASHER,SPRING	ARANDELA DE MUELLE	RONDELLE GROWER	2		
160	01153-50812	BOLT	BULLONE	VIS	2		
170	15621-1403-0	ASSY ROCKER ARM	CONJ.BALANCIN BRZ		8		
180	15521-1423-0	SCREW,ADJUSTING	TORNILLO,AJUSTE	VIS DE REGLAGE	8		
190	15021-1424-0	NUT	TUERCA	ECROU	8		



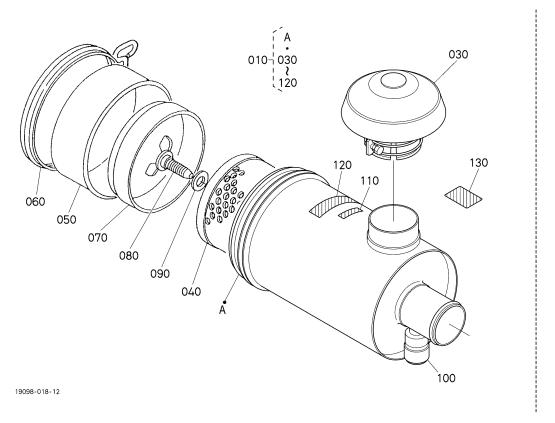
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REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	17114-1180-0	COMP MANIFOLD, INLET	COMP.COLECTOR,ENTRD	ENS.COLLECTEUR D'AD.	1		
020	17182-0555-0	JOINT,BREATHER	JUNTA,RESPIRADERO	RACCORD DE TUYAU	1		
030	1A091-1182-2	GASKET,IN-MANIFOLD	JUNTA,ENTRD-CLCTR		1		
040		BOLT	BULLONE	VIS	7		



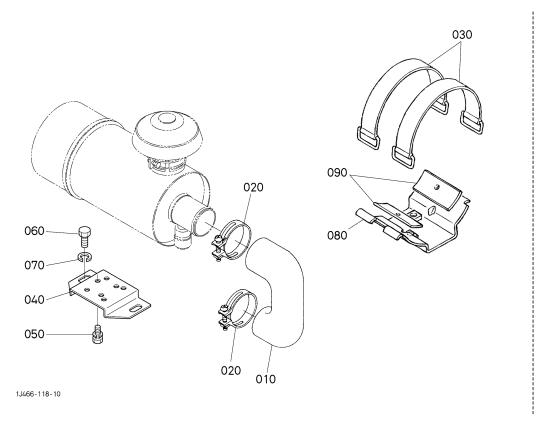
REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	1G896-1231-0	MANIFOLD, EXHAUST	COLECTOR,ESCAPE	COLLECTEUR D'ECHAPP.	1		
020	1A091-1236-0	GASKET,EX-MANIFOLD	JUNTA,ESCP-CLCTR	JOINT DE COLL.ECHAP.	1		
030	1A091-1235-0	GASKET,EX-MANIFOLD	JUNTA,ESCP-CLCTR	JOINT DE COLL.ECHAP.	1		
040	15221-9153-0	STUD	ESPARRAGO	GOUJON	8		
050	16429-9201-0	NUT	TUERCA	ECROU	8		

060300 AIR CLEANER FILTRO DE AIRE FILTRE A AIR



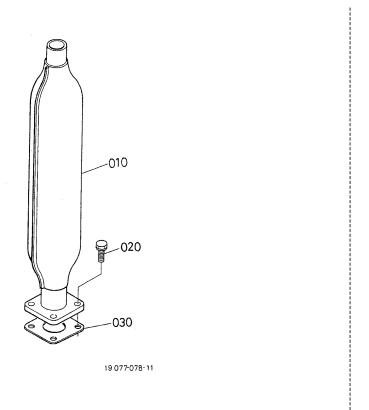
A:V2403-M-E3B-SBR-1

REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	15606-1101-0	ASSY CLEANER,AIR	CONJ.LIMPIADOR,AR	ENS.FILTRE A AIR	1		
020		BLANK	POSTIZO	BLANC	-		
030	68331-4364-0	CAP,AIR CLEANER	TAPA,AIRE LIMPIADOR	CHAPEAU D'AIR FILTRE	1		
040	15606-1108-0	ASSY ELEMENT,A/C	CONJ.ELEMENTO	ELEMENT FILTRE A AIR			
050	15606-1116-0	COVER,AIR CLEANER	CUBIERTA,AR LMPDR	COUV.FILTRE A AIR	1		
060	15606-1107-0	ASSY BAND, AIRCLEANER	CONJ.BANDA,AR LMPDR	COLLIER DE FILTRE	1		
070	15606-1141-0	COVER,BAFFLE	CUBIERTA, DEFLECTOR	COUV.DE DEFLECTEUR	1		
080	15606-9262-0	BOLT,WING	TORNILLO,ALA	VIS PAPILLON	1		
090	15401-9443-0	WASHER,WITH RUBBER	ARANDELA,CON CAUCHO	JOINT EN CAOUTCHOUC	1		
100	15126-1109-0	ASSY INDICATOR	CONJUNTO INDICADOR	ENSEMBLE TEMOIN	1		
110	15606-8775-0	MARK,FORM	MARCA,FORMA	MARQUE DE TYPE	1		
120	15401-8745-0	LABEL,AIR CLEANER	ETIQUETA,AR LMPDR	ETIQUETTE	1		
130	19426-8790-3	LABEL	ETIQUETA	ETIQUETTE	1		
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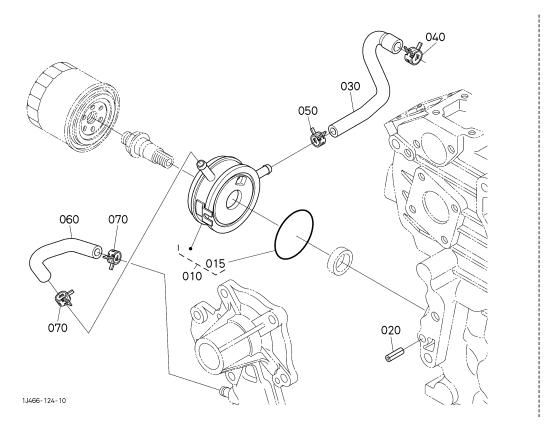
A:V2403-	M-E3B	-SBR-1
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REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	16662-1162-2	PIPE,INLET	TUBO,ENTRADA	TUYAU D'ADMISSION	1		
020	15606-1172-0	BAND,PIPE	BANDA,TUBO	COLLIER DE TUYAU	2		
030	38430-1398-0	BAND,AIR CLEANER	BANDA,AIRE LIMPIADOR	SANGLE	2		
040	19416-1157-3	STAY,AIR CLEANER	SOPORTE,AR LMPDR	ETAI,FILTRE A AIR	1		
050	01123-50820	BOLT	BULLONE	VIS	2		
060	19416-9101-0	BOLT	TORNILLO	VIS	2		
070	04512-60140	WASHER, SPRING	ARANDELA DE MUELLE	RONDELLE GROWER	2		
080	38430-1394-0	SUPPORT,AIR CLEANER	SOPORTE,AR LMPDR	SUPPORT FILT.A AIR	1		
090	38430-1397-0	CUSHION	BANQUETA	COUSSIN	2		
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REF.No. No.DE REF. POS.No.		PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010		MUFFLER	SILENCIADOR[TIPO ARCO]	SII ENCIEUX	1		
020	L	BOLT	BULLONE	VIS	4		
030		GASKET,MUFFLER	L	JOINT DE SILENCIEUX	1		
-030	10070-1042-0			JOHN DE SILLINGILOX			
				→ Interchangeable: ≠ not Intercha	angeable: ← r	DOW fo	or old: \rightarrow old for new

070200 RADIADOR DE ACEITE REFROIDISSEMENT



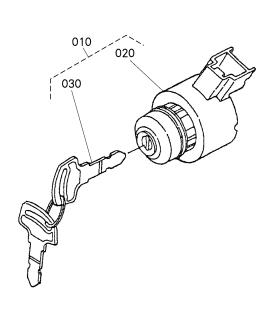
REF.No. No.DE REF. POS.No.	No. REF.	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDADINO. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010	1G730-3701-0	ASSY COOLER,OIL	CONJ.REFRIGERADOR	ENS.REFROIDISSEUR	1		
015	K7561-3312-0	O RING	O ARO	JOINT TORIQUE	1		
020	05411-00620	PIN,SPRING	PASADOR,RESORTE	GOUPILLE-RESSORT	1		
030	1A024-3715-2	HOSE,OIL COOLER	MANGUITO,ACT RFRGRDR		1		
040	09318-88180	CLAMP,HOSE	ABRAZADERA	COLLIER DE DURITE	1		
050	16241-7336-0	BAND,PIPE	BANDA,TUBO	COLLIER DE TUYAU	1		
060	L	HOSE,OIL COOLER	MANGUITO,ACT RFRGRDR	TUYAU	1		
070	16241-7336-0	BAND,PIPE	BANDA,TUBO	COLLIER DE TUYAU	2		
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1G662-020-10

							3-IVI-E3D-3DK-1
REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
	INEL EINEMOL				, ,	1.0.	INLIVIAINQUES
010	15694-6599-0	TIMER,GLOW LAMP	TEMPORIZADOR,BJ	TEMPORISATEUR	1		
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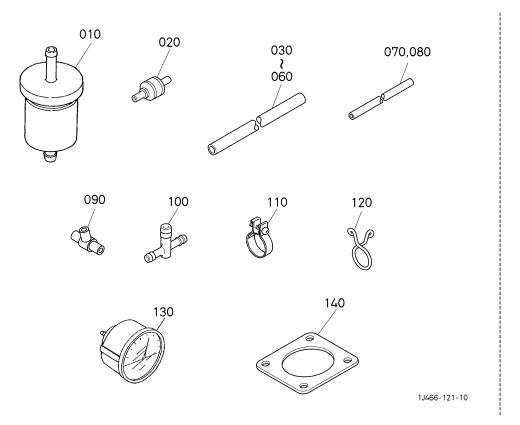
080100 STARTER SWITCH MOTOR DE ARRANQUE CONMUTADOR INTERRUPTEUR DE DEMARREUR



1G365-118-10

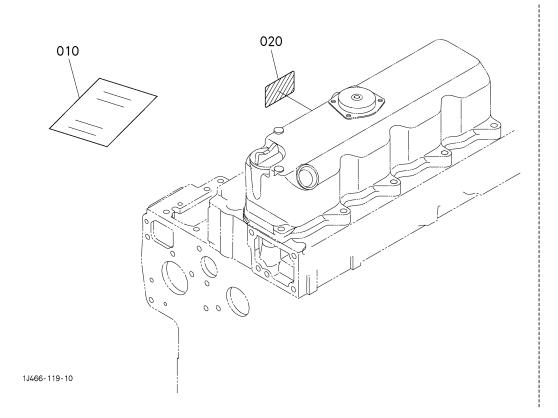
						270	3-1VI-E3D-3DK-1
REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TY/S.No. CANTIDAD/No. DE SERIE Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
	INEI EINEINOE	ACCV CWITCH CTARTER	CONTRON	ENC INTERRUPTEUR	1	1.0.	TEMARQUEO
010	15248-6359-0	ASSY SWITCH, STARTER			·		
020	6C040-5541-2	SWITCH,STARTER	CONMUTADOR,MTR ARRNQ				
030	15248-6370-0	KEY,STARTER	CONJUNTO LLAVE	CLAVETTE DE DEMARRE.	1		
							
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ACCESSORIES AND SERVICE PARTS 080800 ACCESORIOS Y SERVICIO PIEZAS ACCESSOIRES ET PIECES DE SERVICE



						240	3-M-E3B-SBR-1
REF.No. No.DE REF. POS.No.	PART No. No. REF. REFERENCE	PART NAME	DESCRIPCION	DESIGNATION	Q'TE/No.S.	I.C. I/C I.C.	REMARKS NOTA REMARQUES
010		ASSY FILTER, FUEL	CONJ.FILTRO.CMBSTBL	ENS.FILTRE,COMBUST	, ,		
020	1C010-4246-0	VALVE, FUEL CHECK	VALVULA,CMBSTBL	ROBINET CRAQUELRE	L		
030	L	PIPE,FUEL	TUBO	TUYAU	1		
040	09661-80210	PIPE,FUEL	TUBO	TUYAU	2		
050	09661-80100	PIPE,FUEL	TUBO	TUYAU	1		
060	09661-83000	TUBE,FUEL	TUBO	TUYAU	1		
070	09661-40060	TUBE,FUEL	TUBO	TUYAU	1		
080	09661-43200	PIPE,FUEL	TUBO	TUYAU	1		
090	RB411-5132-0	JOINT,PIPE	EMPALME	RACCORD DE TUYAU	1		
100	17454-4236-0	JOINT,T-PIPE	JUNTA,T-TUBO	RACCORD DE TUYAU	1		
110	14301-4275-0	CLIP,PIPE	PRESILLA,TUBO	ATTACHE	12		
120	14971-4275-0	CLIP,PIPE	PRESILLA,TUBO	ATTACHE	6		
130	19488-8303-0	THERMOMETER	TERMOMETRO	THERMOMETRE	1		
140	T0070-1642-0	GASKET,MUFFLER	JUNTA, SILENCIADOR	JOINT DE SILENCIEUX	1		
		*	*				
		•	<u></u>	Interchangeable: ≠ not Interchangeable	angeable: ← r	new fo	or old: \rightarrow old for new

080900 LABEL AND OPERATOR'S MANUAL ETIQUETA Y DEL OPERADOR MANUAL ETIQUETTE ET MANUEL DE L'UTILISATEUR



A:V2403-M-E3B-SBR-1

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KUBOTA

THE BASIC NECESSITIES GIANT

"Technology for the Needs of Tomorrow" is the ambition of everyone at Kubota. Through research and the development of new products for agriculture, industry, construction, and many other areas of modern life, we at Kubota hope to realize this goal.

EI GIGANTE DE LAS NECESIDADES BÁSICAS

La "tecnología para las necesidades del mañana" es la ambición de todos los que trabajamos en Kubota. A través de la investigación y el desarrollo de nuevos productos para la agricultura, industria, construcción y muchos otros ámbitos de la vida moderna, en Kubota esperamos cumplir este objetivo.

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Suspensions & Axles

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HENDRICKSON Suspensions Service Manual (including relevant service bulletins)

HT230TA15-523 Parts List

HT230TA15-524 Parts List

HT250 Parts List

HT300 Parts List

YORK Axle Service Manual

YORK Axles Parts Lists

YORK Mechanical Suspension Service Manual

YORK Mechanical Suspension Parts Lists

ROR Steer Axle Service and Parts Manuals

HTECHNICAL PROCEDURE

TRAILER SUSPENSION SYSTEMS

SUBJECT: System Maintenance

LIT NO: L578

DATE: December 1999

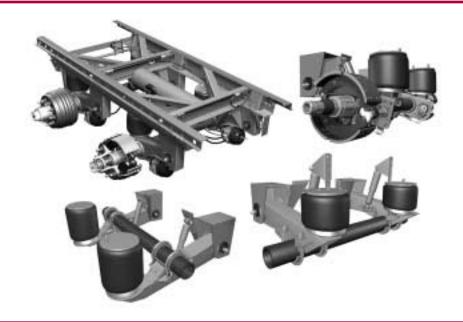


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INTRODUCTION

Hendrickson Trailer Suspension Systems (Hendrickson) designs its suspension systems to safely provide a long life and low-maintenance operation. The suspensions exhibit excellent ride characteristics under all legal load conditions. Your suspension was chosen to give your trailer the best ride, the correct load-carrying capability, and the required amount of roll control for your vehicle.

Hendrickson trailer air suspensions are manufactured in modern, quality-oriented facilities. Great care is taken to ensure that our customers receive the best product value for their purchasing dollar.

Hendrickson trailer air suspension systems deliver durability with a light-weight, simple, and trouble-free design. The suspensions will cushion the trailer, cargo and the driver with a quality ride not attainable without a Hendrickson air-suspension system.

Hendrickson supplies a wide variety of trailer suspension designs to meet your application needs. Each suspension system is intended for use in specific applications with maximum load capacities.

For a complete listing of Hendrickson products, contact your Hendrickson representative.

HENDRICKSON SUSPENSION FEATURES TRI-FUNCTIONAL® BUSHING

The TRI-FUNCTIONAL BUSHING (located at the suspension pivot) controls vehicle roll- and axle-alignment, yet allows easy up-and-down travel. It also controls forces generated by braking, accelerating and irregular road surfaces. Cavities located at top and bottom absorb vertical movement. Solid rubber molded around steel center sleeve absorbs horizontal and lateral movement. The cavities elongate to absorb forces as the vehicle turns and increase roll stability. The bushing and suspension pivot are virtually maintenance free.

RIGID-AXLE CONNECTION

The trailer axle is welded directly to the suspension beam. This design has no flexible connections, which may lead to maintenance or replacement due to instability. The HT series axle connection is also U-bolted. The INTRAAX® axle connection is integrated to the suspension beams with a patented "axle wrap"; circular welded to neutral axis. The beam mounting surface is machined and is continuously welded to the axle wrap, eliminating axle seats and U-bolts. The INTRAAX rigid-axle connection provides outstanding roll stability, maintains axle alignment to beam, and contributes to a straighter axle tube and controlled toe alignment.

ROLL STABILITY

The TRI-FUNCTIONAL BUSHING and rigid-axle connection result in a roll-stable installation. The trailer floor remains level, even when offset loading occurs, while using only one height control valve per trailer.

SOFT RIDING

The air springs and TRI-FUNCTIONAL BUSHINGS support the trailer load, while absorbing road shocks. This softer ride protects the driver, cargo and vehicle; it also provides longer vehicle life and greater driver comfort.

LOAD CONTROL

The single height control valve assures an evenly distributed load across all air-ride axles when properly installed. With the exception of tire deflection, the trailer's ride height remains constant whether loaded or unloaded.

DURABILITY

Hendrickson air suspensions and their components have been thoroughly tested to provide a long life that is virtually maintenance free. The sturdy construction of the trailer air suspensions has a history of proven durability.

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RIDE HEIGHT

Ride height is the measurement from the suspension mounting surface to the center of the axle. All Hendrickson air suspensions are designed to operate at a specific ride height. Care must be taken to ensure the correct loaded suspension ride height is maintained throughout the trailer's usage.

To determine the ride height of your Hendrickson trailer suspension, locate the suspension ID tag on the front of the HT frame bracket, the front crossmember of the HS slider box or on the inside of the suspension beam on an INTRAAX®. Check the indicated (bold) number in the following examples to find the designed ride height.

HT model: HT230-**14**-001 HS model: HS190T-**14**-4801A

INTRAAX model (early): AA230TBA...1 14A1A01... INTRAAX description (current): B15U71.5...

Changes in ride height affect the air spring height, which in turn, changes the suspension's load carrying capabilities. To provide an equal loading of the axles, Hendrickson trailer suspensions are intended to be used at ride heights which maintain equal air spring heights throughout the application.

Operating a suspension at an incorrect ride height can result in improper loading and can shorten the service life of the suspension. Hendrickson is not responsible for components which fail due to incorrect ride height settings.

FACTORS AFFECTING RIDE HEIGHT

The following features need to be considered when determining ride height:

FRAME-TO-GROUND HEIGHT

The height from the bottom of the trailer frame (or suspension mounting surface) to the ground must be determined at each suspension location (Figure 1). This dimension provides the desired trailer deck height.

TRAILER DECK HEIGHT

The suspension ride height is calculated by subtracting the LOADED tire radius from the LOADED frame-to-ground height. The radius of the tire will decrease as the trailer is loaded due to tire deflection, which in turn, affects the trailer deck height (Figure 2).

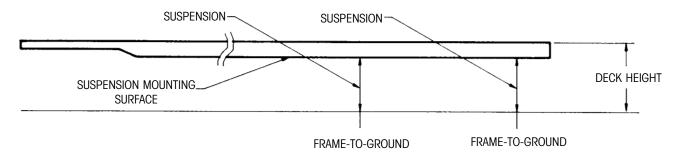


Figure 1. Frame-to-ground-height

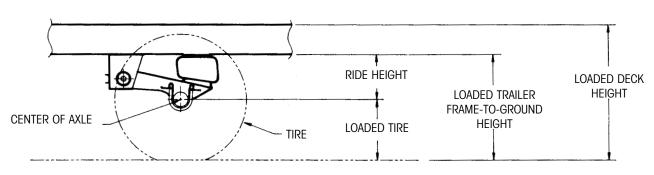


Figure 2. Trailer deck height

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FIFTH WHEEL HEIGHT

The tractor fifth wheel affects the height of the trailer frame. (For example: a low fifth wheel height would cause the trailer frame to slope downward.) Variations in the fifth wheel height will result in variations of suspension ride heights.

The correct suspension ride height must be determined at each suspension location (Figure 3). When ride height variations are required, consult the Hendrickson Trailer Engineering Department to evaluate load equalization capabilities.

FRAME DEFLECTION

Deflection of the trailer frame when loaded must be considered. Frame deflection will result in a suspension ride height different from the installed ride height. The

correct suspension ride height must be determined at each suspension location (Figure 4). When ride height variations are required, consult the Hendrickson Trailer Engineering Department to evaluate load equalization capabilities.

FRAME-TO-GROUND HEIGHT (CENTER LIFT AXLES) The height of the bottom of the trailer frame (or suspension mounting surface) from the ground must be determined at each suspension location (Figure 5). This dimension must provide the desired LOADED deck height.

A leaf spring suspension's ride height will change under various loads. The auxiliary air suspension's ride height must be specified to match the loaded leaf spring suspension's ride height.

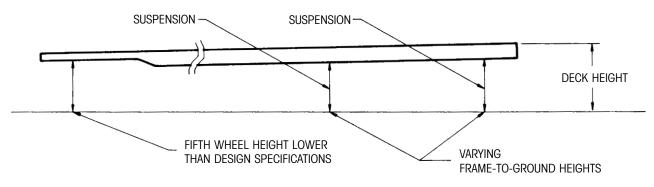


Figure 3. Fifth wheel height

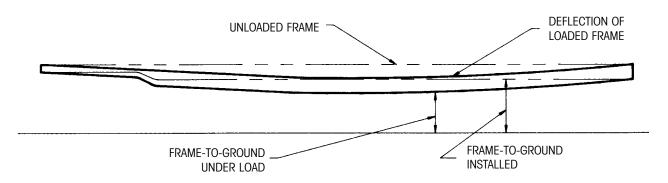


Figure 4. Frame deflection

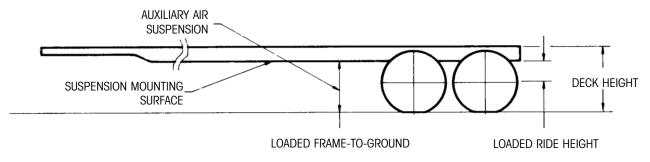


Figure 5. Frame-to-ground height (center lift axle)



SUSPENSION TRAVEL

Hendrickson Trailer Suspension Systems uses these terms to define the suspension travel:

Jounce Maximum amount of upward axle movement

allowed by the suspension (Figure 6).

Rebound Maximum amount of downward axle travel

allowed by the suspension (Figure 6).

When selecting a suspension, the amount of axle travel must be considered in both the loaded and unloaded conditions. Unloaded, the suspension rebound must not be less than 2".

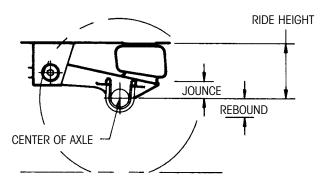


Figure 6. Suspension travel

TIRE CLEARANCE

In selecting a suspension, the trailer's tire clearance must be used to determine the maximum suspension jounce permitted by the trailer design. Hendrickson specifies that the tire clearance above the jounce requirement must include one inch for the "HT" series and INTRAAX models (Figure 7). "T" series models require two inches of tire clearance above the specified jounce requirement. A two inch clearance is specified between the trailer frame and inside tire inboard sidewall. This will provide sufficient clearance to allow for tire distortion and axle walk.

Example: 3" Jounce

 $\frac{+1''}{4''}$ Clearance for the "HT" Series and INTRAAX model 4" of space required above the tire at ride height.

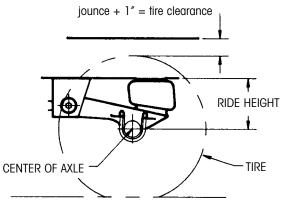


Figure 7. Tire clearance

The top dimensions in Figure 8 are for 35-inch suspension beam centers. The bottom dimensions (in parentheses) are for 41-inch suspension beam centers.

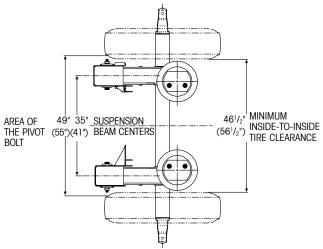


Figure 8. Inside-to-inside tire measurements

If the potential exists for tire interference, install the QUIK-ALIGN shear-type pivot bolt from the outboard side of the frame bracket.

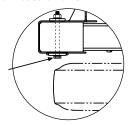


Figure 9. Alternative installation of the QUIK-ALIGN pivot bolt

CENTER LIFT SUSPENSIONS

Hendrickson offers center lift kits, which when added during a trailer suspension installation, provide a lifting capability (Figure 10). Only those suspensions with a minimum of 4'' of jounce are approved for use with a center lift kit.

Hendrickson's suspension jounce dimension includes an allowance for air spring bumper compression. As a result, the amount of lifted up travel will be less than the jounce.

The suspension lift distance indicates the amount of axle up travel. The resulting clearance under the tire will vary depending on both frame and tire deflection.

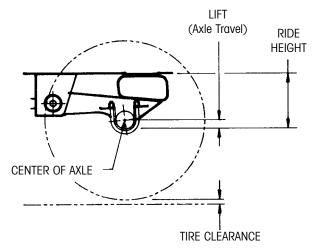


Figure 10. Center lift suspension



AIR CONTROL SYSTEM

Many types of air controls are available for Hendrickson trailer air suspensions. The most common system automatically regulates the designed ride height by controlling the air pressure supplied to air springs. When used in conjunction with other types of suspensions, such as a leaf-spring suspension, an operator-controlled pressure regulator is often employed. If using axle lifts or other special features, other air control circuits and components are added. All systems operate from the compressed air supply of the vehicle. The air pressure in springs controls the height or load on the axle.

The diagram (Figure 11) illustrates a typical air control arrangement in use with a Hendrickson trailer air suspension. One height control valve controls any number of primary air suspensions. Contact the trailer manufacturer for specific information about your trailer air control system.

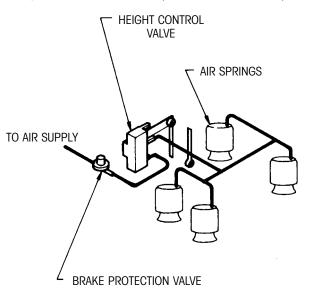


Figure 11. Height Control Valve

HEIGHT CONTROL VALVE

The height control valve on the Hendrickson trailer air suspension automatically responds to the relative position of the axle and vehicle frame. It meters air into or out of the air springs. Variations in load or temperature only affect the adding or exhausting of air. Since the Hendrickson trailer model air suspension is a mechanically stable suspension, only one height control valve is necessary. This system is less complex, less expensive and less troublesome than competitive systems.

In addition, it provides a safer system should an air spring blowout occur. Notice that only one height control valve is used per trailer or dolly; this grouping can include two, three, four or more axles. Hendrickson generally recommends that the height control valve be positioned on the rear axle on tandem axle arrangements and on the center axle of tri-axle arrangements. For trailers equipped with SURELOK®, it is important to place the height control valve on the same axle as the SURELOK locking leas.

When the actuating lever of the height control valve moves up, the valve opens and connects the air supply to the air spring. When the actuating lever moves down, the valve shuts off the air supply and opens the exhaust port to vent excess air from the air springs. A check valve prevents the loss of air spring pressure if the air supply fails. In the central position, air does not flow in or out of the air springs.

AIR DUMP VALVES

Air dump (or exhaust) valves increase stability during the loading and unloading of the trailer, as well as prolong component life. The valves can be controlled automatically, manually or by the use of an air-pilot valve.

When suspension air is exhausted, Hendrickson trailer air suspensions limit the suspension up travel (jounce) by a rubber bumper located inside the air spring. The air-spring bumpers adequately support the rated suspension capacity with the suspension air exhausted.

Hendrickson approves using air dump valves only when the control exhausts all the trailer air springs. Also, use of the air dump control is approved for the following situations:

- A trailer parked for any length of time, loaded or unloaded, either when connected to the tractor or supported by the landing gear leas.
- A trailer being loaded or unloaded, particularly when fork lift trucks are used.
- A dump trailer during the dump mode only.
- A trailer experiencing a sudden off loading of cargo, such as steel removed with a crane.

Any variation beyond these conditions must be approved in writing by Hendrickson Applications Engineering Department.

!\ CAUTION: Due to the geometry of all trailingbeam air suspensions, the trailer moves forward when air exhausts from the suspension and trailer brakes are locked. When supported by the trailer's landing gear, this movement may damage or collapse the legs. Always exhaust the suspension air before locking the brakes. (Automatic airdump systems are available.)

Variations in trailer deck height and, therefore, the suspension ride height will cause the longitudinal movement of the trailer. When loading and unloading the trailer, the changes in the load supported by the suspension will cause the deck height to change; this change results in the trailer moving away from the loading dock. Unless the air is properly exhausted from the air suspension, the above movement can damage or collapse the trailer landing gear, as well as result in a potentially dangerous gap between the trailer and the loading dock.

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PERIODIC INSPECTION SCHEDULE

The Hendrickson trailer air suspension requires very little attention. Your air suspension may well last the life of the vehicle by using the information in this publication and other Hendrickson technical publications.

ORIGINAL-INSTALLATION INSPECTIONS

The vehicle manufacturer is responsible for completing the installation to Hendrickson specifications. In your review of the vehicle for the first time, check the following:

- trailer is level
- all welds are of acceptable quality
- all bolts are in place and secure
- pivot-connection nut tack-welded to bolt threads (not required with a "Huck" fastener)
- no component interferences exist

DAILY INSPECTIONS

A quick look to verify a level trailer that is riding at the correct ride height is suggested. This inspection will help you find any obvious problems. A closer inspection can detect broken or loose parts before any serious problems appear.

30-DAY INSPECTION

At 30 days, inspect clearances around air springs, tires, shock absorbers and all other moving parts. Evidence of part interference requires immediate attention by a qualified mechanic. The 30-day inspection includes the following checks:

- bolts are secure
- axle connections are tight
- any sign of wear

If you have any questions about the suspension area, call the trailer manufacturer or Hendrickson Technical Service Department at (330) 456-7288.

90-DAY INSPECTION

At 90 days, thoroughly check all items that were inspected at 30 days. The 90-day inspection also includes these items:

- all welded connections for signs of deterioration
- frame attachment joints, crossmember structures and all pivoting and clamping connections for problems

Early detection and correction of problems can save expenses and prolong the life of your trailer.

It is unlikely that you will find any problems with your Hendrickson air suspension during these inspections. However, your careful attention to these periodic inspections can save a great deal of time and expenses by avoiding unexpected difficulties in remote locations. Contact your Hendrickson representative or the Hendrickson Applications Engineering Department at (330) 456-7288 to discuss any questions about the construction and/or operation of your Hendrickson trailer air suspension.

QUIK-ALIGN® INSPECTION

Inspection of the QUIK-ALIGN occurs at 3,000 miles and at every lining change.

WHEEL END MAINTENANCE

7.500 MILES

Visually inspect seal and hub cap for leakages and hub oil level (if oil bath type).

12 MONTHS OR 100,000 MILES

At 12 months or 100,000 miles, which ever occurs first, visually inspect seal and R&I hub cap. Visually inspect for contaminants, check wheel bearing adjustment, install new oil, if oil filled, and replace hub cap gasket-retorque. Repair if necessary.



SUSPENSION SYSTEMS MAINTENANCE

By correcting minor problems when found, your Hendrickson air suspension will provide excellent service throughout your trailer's life. This section will help you to determine what to expect from your suspension components and the proper maintenance procedures.

RIDE HEIGHT ADJUSTMENT

- 1. Connect the vehicle to a compressed air supply with approximately the pressure of the normal supply system.
- 2. Ensure the inflation of the air springs.
- 3. Measure the ride height by using this method:
 - a. Measure from the underside of the trailer frame to the top of the axle
 - b. Add $2^{1}/_{2}''$ (half the diameter of the axle) to the measurement

Example: $11^{1}/_{2}^{"}$ to the top of the axle with the $2^{1}/_{2}^{"}$ equals a 14" ride height

- 4. Raise or lower the trailer as necessary, so it is at the designed ride height.
- 5. Once the trailer is set at the correct designed ride height, set the HCV lever to the neutral (central) position.
- 6. Adjust the HCV linkage to fit between HCV lever and lower linkage attachment.

IMPORTANT: When adjusting the height control valve, block the tire and release the trailer brakes. The axle must rotate freely to avoid a false reading.

Some height control valves have very small openings and a time delay of as much as 15 seconds. Allow sufficient time for the system to react to the adjustment. The response time will appear to be lengthy, but be patient.

Once set to the designed ride height, test drive the trailer. After the test drive, check the ride height to assure an accurate adjustment.

Notice that the use of one height control valve removes the requirement for synchronization found with most other air suspension systems. This feature will save you time and expense in servicing your air system.

If you have any questions regarding the operation of your Hendrickson trailer air system, contact the Hendrickson Technical Service at (330) 456-7288.

AIR SPRING

Air springs will last almost indefinitely in most applications. However, air springs will fail quickly when rubbed, scuffed, or punctured. If an air spring fails, the trailer will settle on the internal rubber bumpers, so you can proceed to the nearest service facility at a lower speed. You should try to determine the cause of a failure, so you can avoid a costly repeat of the problem. If you have questions about the cause of a failure, contact Hendrickson Technical Service Department at (330) 456-7288.

To replace an air spring, follow these steps:

- 1. Exhaust all air from the suspension system
- 2. Raise and support the vehicle in a safe manner
- 3. Unbolt the air spring
- 4. Disconnect air-supply lines
- 5. Replace the air spring
- 6. Bolt the air spring in place
- 7. Connect the air-supply lines
- 8. Lower the trailer to the around
- 9. Supply air to the suspension system

SHOCK ABSORBER

Shock absorbers do not absorb shock; they absorb energy to prevent suspension oscillation. Shock absorbers are also used as rebound stops in most air suspensions. The shock absorber limits the stroke of an air spring, which prevents the air spring from being pulled apart. In some severe service applications, a shock strap is added to additionally aid in limiting the stroke of an air spring.

To remove an air spring, follow these steps:

- 1. Remove the end fasteners
- 2. Insert the new shock absorber
- 3. Secure with correct size locknut and bolts
- 4. Torque fasteners to specification

If your suspension has unique travel requirements, use only Hendrickson shock absorbers for replacements.

/!\ CAUTION: Do not lift the trailer without the shock absorbers in place. If shock absorbers are not in place, overextension of the air springs will occur. Damage may occur to the overextended air springs.

IMPORTANT: Hendrickson trailer air suspension design requires the use of specific air springs and shock absorbers. Only components purchased from Hendrickson or a Hendrickson-approved distributor can be used. Replacement with other components may cause premature failures and void the warranty.

PIVOT CONNECTION

A correct pivot connection is crucial to the life of the suspension. The pivot fastener must continually provide a sufficient clamp load through the bushing to prevent premature suspension failure.

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Hendrickson trailer air suspension models come equipped with either a "Huck"-type fastener or a conventional nutand-bolt arrangement at this location.

The factory installs the "Huck"-type fastener by using specialized hydraulic equipment. This fastener can only be removed by cutting the fastener apart.

Other factory-installed units are equipped with a nut and bolt at the pivot connection. This arrangement is also used when a field replacement is necessary. The pivot bolts are torqued to 800 ft-lbs. The nut is tack welded to the bolt threads to assure a permanent connection.

Hendrickson INTRAAX suspension systems come equipped with QUIK-ALIGN pivot connection hardware. The hardware consists of a specially plated shear bolt to ensure a proper clamp load, (550 ft-lbs, H-45 torque).

/!\ CAUTION: Failure to properly torque the pivot bolt or tack weld the pivot nut to the bolt will result in loss of warranty coverage.

TRI-FUNCTIONAL BUSHING

Hendrickson's TRI-FUNCTIONAL BUSHING has unique properties that will provide years of maintenance-free service. The TRI-FUNCTIONAL BUSHING (located at the suspension pivot) provides a resilient connection that allows an axle to walk without excessive flexing. The TRI-FUNCTIONAL BUSHING, in conjunction with the rigid axle connection, results in a roll-stable suspension design that resists trailer lean independent of the air spring loading.

There are times when a problem seemingly in the area of the suspension is diagnosed as a failed bushing. Closer inspection typically reveals another component or a faulty installation is the problem. If a problem is in the area of the suspension, refer to the TROUBLESHOOTING section on page 10. If a failed bushing is present, contact Hendrickson Technical Service Department at (330) 456-7288.

Rebushing of a suspension requires the use of a bushing removal/installation tool and bushing kit, containing the required components for rebushing. Contact Hendrickson for assistance. When rebushing the suspension, refer to L427 Bushing Replacement Procedures.

IMPORTANT: Literature is also available for installing the TRI-FUNCTIONAL BUSHING. Rebush using only the lubricant supplied in the bushing kit by Hendrickson Trailer Suspension Systems.



TROUBLESHOOTING: TRI-FUNCTIONAL BUSHING

COMMONLY MISDIAGNOSED BUSHING PROBLEMSWhile the following problems can result from a failed bushing, most often they are the result of the items listed below.

PROBLEM	CAUSE(S)	SOLUTION(S)							
TRAILER LEANS									
Constantly in one direction. Suspension beams installed out of parallel.		Determine which beam is out of parallel, cut from axle, reposition and reweld.							
Varies from side to side.	Axle welds missing or broken.	HT Models Only: Clear away old welds, reposition the beams to be parallel and reweld to axle.							
valies from side to side.	ANIC WOLUS THISSING OF BIONOTI.	INTRAAX Only: Replace the axle/beam weldment with a HALF-TRAAX unit.							
Varies in one direction. Pivot bushing failed.		Replace pivot bushing.							

PROBLEM	CAUSE(S)	SOLUTION(S)			
TRAILER "DOG TRACKS"					
Constantly to one side.	Trailer frame not square, king pin excessively off center or high crown highways.	Realign suspension per Hendrickson Trailer Suspension Systems and bias the alignment of both axles equally in opposite direction of the dog tracking.			
Varies from side to side.	HT Models Only: Loose pivot bolts.	Replace alignment collars, pivot bolts, nuts, TRI-FUNCTIONAL BUSHING and any worn suspension components.			
	HT Models Only: Missing or broken alignment collar welds.	Clear away failed welds and realign — welded style pivot connection.			
	All Models: Alignment collars loose (QUIK-ALIGN pivot connection).	Replace pivot bolt kit. Realign the trailer.			
To one side under load.	Suspension not square to the axle.	Contact Hendrickson Technical Service Department at (330) 456-7288.			
	Air springs misaligned.	Compare the installation to the suspension drawing and reposition as required; contact Hendrickson Technical Service Department at (330) 456-7288.			
	Failed pivot bushing (rare).	Replace the pivot bushing and realign per instructions; contact Hendrickson Technical Service Department at (330) 456-7288.			

IMPORTANT: Contact Hendrickson Technical Service Department at (330) 456-7288 for assistance.

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COMMONLY MISDIAGNOSED BUSHING PROBLEMS (CONTINUED)

PROBLEM	CAUSE(S)	SOLUTION(S)			
BUSHING WALK					
The suspension beams have shifted from the center of the pivot bushings.	Suspension beams are out of parallel (vertically or longitudinally).	HT Models Only: Determine which beams are out of position, cut the affected beams from the axle, reposition and reweld. Rebush both suspension pivots and realign per instructions. INTRAAX Only: Replace the axle/beam weldment with a HALF-TRAAX unit.			
	Alignment collars loose from QUIK-ALIGN pivot connection.	Inspect the suspension hanger, replace if necessary, rebush the suspension and realign according to instructions.			
	Frame bracket centers do not match the suspension beam centers.	Contact Hendrickson Technical Service Department at (330) 456-7288 for correct installation dimensions. Reposition the incorrect components and rebush both suspension pivots.			
	Use of improper bushing lubricant.	Rebush using only the lubricant supplied in the bushing kit by Hendrickson Trailer Suspension Systems.			
Pivot can be moved vertically.	Normal travel.	No action is required.			
Bushing protrudes from the bushing tube.	Faulty or worn bushing.	If excessive rubber protrudes from one end, then it can indicate a bushing walk condition. Replace the bushing if this condition is present.			
Grooving or deforming of wear pads.	Excessively dirty environment (i.e., farming, construction, on-off highway applications or sever service applications). Faulty or worn bushing	The wear pads act as filler pieces between the hanger and the bushing tube and bushing. The pads will show signs of wear due to the movement of the suspension beam during articulation. Replace pads if wear is excessive.			

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TORQUE SPECIFICATIONS

Use these torque specifications when installing the fasteners covered below.

COMPONENT DESCRIPTION	FT-LBS	N•m
QUIK-ALIGN Pivot Connection	505 to 595	685 to 807
Welded Pivot Connection (11/8 inches)	750 to 825	1017 to 1119
U-Bolts (HT Series)	475 to 525	644 to 712
Shock Bolts	210 to 235	285 to 319
Upper Air Spring Nuts	80 to 100	108 to 136
Lower Air Spring Nuts (HT Series)	40 to 50	54 to 68
Lower Air Spring Nuts (INTRAAX)	25 to 35	34 to 47
Brake Chamber Mounting Nut (INTRAAX)	100 to 110	136 to 149
S-Cam Support Bearing Mounting Nut (INTRAAX)	35 to 45	47 to 61

COMPONENT DESCRIPTION	IN-LBS	N•m
ABS Bracket Bolt and Nut (INTRAAX)	75 to 100	8 to 11
Dust Shield, Bolt-to-Spider (INTRAAX)	160 to 180	18 to 20
Dust Shield, Clamp-on (INTRAAX)	95 to 170	11 to 19

NOTE: Torque values are specified for the fasteners in the condition in which they are supplied by Hendrickson. **DO NOT APPLY ANY ADDITIONAL LUBRICANTS.**

ACAUTION: Overtorquing could result in fastener failure.



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TECHNICAL PROCEDURE

TRAILER SUSPENSIONS SYSTEMS

SUBJECT: Alignment Procedure

LIT NO: L579

DATE: April 2003 **REVISION:** B Supersedes previous versions of L579.

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TOOLS AND EQUIPMENT

The following tools and equipment are necessary to complete the procedure within this publication:

- 50-foot (minimum) steel tape measure with $^{1}/_{32}$ -inch or millimeter increments
- 12-foot (minimum) steel tape measure with $^{1}/_{32}$ -inch or millimeter increments, or a trammel bar
- Tape tensioning device; consisting of:
 - Fish (or engineering) scale
 - Clamp
 - String used to fasten the clamp to the fish scale
- Kingpin adapter or kingpin extender (pogo stick)
- Level used to plumb the kingpin extender
- Wheel-end (or spindle) extenders
- 1/2-inch breaker bar or ratchet
- E20 Torx socket; 1-inch drive recommended (refer to the section titled E20 TORX SOCKETS for more Torx socket details)
- Impact wrench with a minimum torque capability of 600 ft. lbs. (813 N•m)
- 1⁷/₁₆-inch shallow impact socket
- 1⁷/₁₆-inch combination wrench
- Tire changing equipment (as needed)

E20 TORX SOCKETS

Hendrickson offers three E20 Torx sockets that may be used on the shear-type bolt during alignment (refer to table 1). In addition to these tools, sockets from other vendors (Camcar TX-8120 or Strong Tools E-20 T.S.) are also available and may be used.

To avoid damaging the shear bolt's Torx head (regardless of the drive socket being used), the drive socket must fully engage the Torx head (figure 1).

DESCRIPTION	DRIVE SIZE	COMMENTS
Hendrickson E20 Torx Socket (part number A-24303)	¾ inch	Cost effective tool for occasional use (not recommended for use in high-volume trailer production environments)
Hendrickson E20 Torx Socket (part number A-24536)	1 inch	For medium-duty use (dealers, repair facilities, etc.)
Hendrickson E20 Torx Socket with sleeve (part number A-25119)	1 inch	For high-volume trailer production environments or manufacturing facilities. The sleeve provides greater operator control.

Table 1. Hendrickson E20 Torx socket summary

Hendrickson does not recommend the ¾-inch drive socket for use in high volume trailer production environments. The ¾-inch drive socket can back away from full Torx head engagement during the shearing process and strip the Torx-head splines. When damage occurs to the Torx-head splines, the proper torque and clamp load may not be achieved.

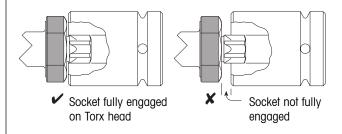


Figure 1. Socket engagement

For high volume trailer production and service facilities, Hendrickson recommends the one-inch drive E20 Torx socket with sleeve, part number A-25119 (figure 2). The sleeve helps support the tool by riding over the entire head of the shear bolt, including the heat shrink tubina. It also provides greater operator control at the moment of shear by preventing the heavy tool from veering. The operator can rest the tool on the bolt during the entire operation resulting in greater control of socket-to-bolt engagement, reduced fatigue and consistently torqued pivot connections. If you already own the one-inch drive E20 Torx socket without the sleeve (part number A-24536) and wish to add a sleeve to it, dimensions are included in figure 3. A local fabricating shop can make and assemble the sleeve for you using this information.

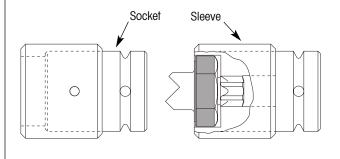
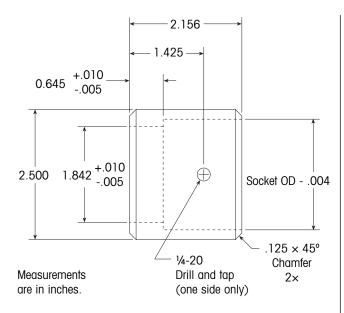


Figure 2. One-inch drive E20 Torx socket with sleeve





FABRICATION NOTES:

- 1. Sleeve undersized by .004; shrink fit socket into sleeve OD.
- 2. Drill and tap assembly for $1/4-20 \times .25$ (oval point) standard hex socket set screw.
- 3. Material: Ø2.500 6150 H.R.S.
- 4. Heat treatment (sleeve):
 - oil drenched: 1550° F (538° C) - tempered: 1000° F (843° C)

Figure 3. Sleeve dimensions

PIVOT CONNECTION HARDWARE

Hendrickson suspensions are equipped with either QUIK-ALIGN® or welded collar style pivot connections.

QUIK-ALIGN® STYLE PIVOT CONNECTION

The QUIK-ALIGN style pivot connection uses two flanged collars inserted into slots on each side of the frame bracket (figure 4). The eccentric collar on the outboard side of the frame bracket is used to adjust the position of the axle during an alignment. The alignment guides on the side of the frame bracket limit the eccentric collar to rotational movement in the frame bracket slot. Rotating the eccentric collar clockwise causes the axle to move forward. Rotating the eccentric collar counterclockwise causes the axle to move rearward (figure 5). The maximum range of adjustment is ±45 degrees from the 12 o'clock position.

Along with hardened flat washers, a shear-type bolt and a TORQ-RITE $^{\! \oplus}$ nut are also part of the

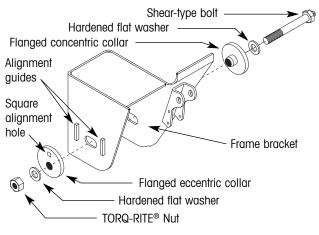


Figure 4. QUIK-ALIGN style pivot connection

QUIK-ALIGN style pivot connection. Use of this sheartype bolt and TORQ-RITE nut ensures proper clamping force without the use of a torque wrench.

ACAUTION:

DO NOT apply an anti-sieze compound to the pivot connection hardware or allow undercoating, paint, or any other commonly used compounds to contact the threads of the pivot connection fasteners. These compounds can act like a lubricant, reducing the friction between the threads of the nut and bolt. This can lead to overtightened

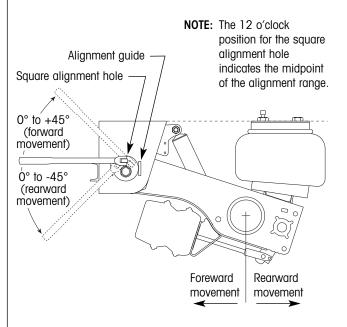


Figure 5. Rotating the flanged eccentric collar on the QUIK-ALIGN style pivot connection



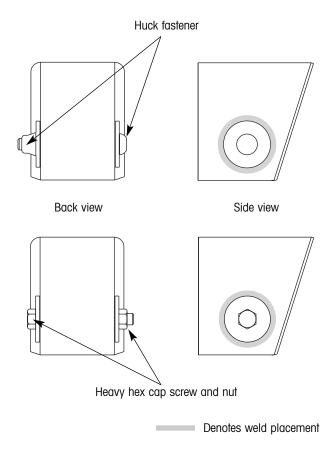


Figure 6. Welded collar style pivot connection

fasteners, unpredictable pivot connection clamp loads and unreliable axle alignments.

⚠ CAUTION: DO NOT apply undercoating to the suspension and frame brackets until after completing the glignment.

WELDED COLLAR STYLE PIVOT CONNECTION

The welded collar style pivot connection is clamped together by either a huck fastener or a 11/8-inch heavy hex cap screw and nut (figure 6). After the alignment is completed, the entire circumference of both inboard and outboard collars is welded to the frame bracket, and the nut is welded to the 11/8-inch heavy hex cap screw (if used instead of the huck fastener).

To realign this style of pivot connection, the collar welds must be removed so the pivot joint can be repositioned.

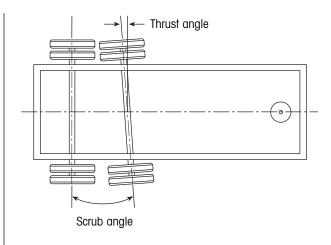


Figure 7. Tandem trailer axle angles

ALIGNMENT BACKGROUND

Properly aligned trailer axles optimize fuel economy and driveability, and help prevent excessive tire wear.

A perfect alignment scenario has all trailer wheels parallel to one another and perpendicular to the centerline of the trailer. However due to uncontrollable factors, this perfect scenario is often an unreasonable expectation. A more likely alignment scenario has the trailer wheels parallel within a very small tolerance range to one another and perpendicular within a very small tolerance range to the centerline of the trailer.

There are two important trailer axle angles that must be kept within recommended tolerance ranges: thrust angle and scrub angle (figure 7). These angles, when out of tolerance, can lead to increased rolling resistance, excessive tire wear and can contribute to trailer "dog tracking." Dog tracking is a condition where the trailer does not follow or track directly

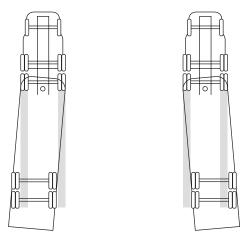


Figure 8. Examples of trailer dog tracking



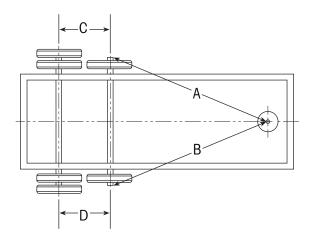


Figure 9. Measurements to check axle alignment

behind the truck as the vehicle is being operated in a straight line (figure 8) and is influenced by body rail alignment, king pin location, axle side-to-side location, and other things. The procedures presented in this publication detail how to check, and if necessary, bring these angles within the recommended tolerance range.

The front axle is used as a starting point to measure thrust angle. First, the measurement target value (or tolerance range) is determined. Then, the distance from the kingpin (used as the trailer centerline) to matching points on each end of the front axle is

measured (distances "A" and "B" in figure 9). The difference between these two measurements is then compared to the measurement target value to determine the axle thrust angle. If the difference between the "A" and "B" measurements is larger than the target value, the axle must be adjusted to achieve an acceptable axle thrust angle. If the difference between the "A" and "B" measurements is smaller than or equal to the target value, axle thrust angle is within the tolerance range and no adjustment is necessary. The remaining axles are then measured with respect to the front axle and adjusted, if necessary, to an acceptable scrub angle.

Even though distances are being measured using measurement points on the ends of the axle, it is the axle thrust angle that is important. As shown in figure 10, the acceptable axle thrust angle remains constant over the length of the axle. However, the measurement target value that coincides with the acceptable axle thrust angle varies over the length of the axle. Because of a simple geometrical relationship, the measurement target value gets larger as you move farther away from the center of the axle. For example, measuring from the king pin to a point 18 inches beyond the end of the spindle might produce a measurement target value of ± 0.218 ($^{7}/_{32}$) inches (figure 10). But a measurement from the kina pin to the brake drum might only produce a measurement target value of ± 0.094 ($^{3}/_{32}$) inches. Both of these measurements are within the acceptable axle thrust angle, but one is more than

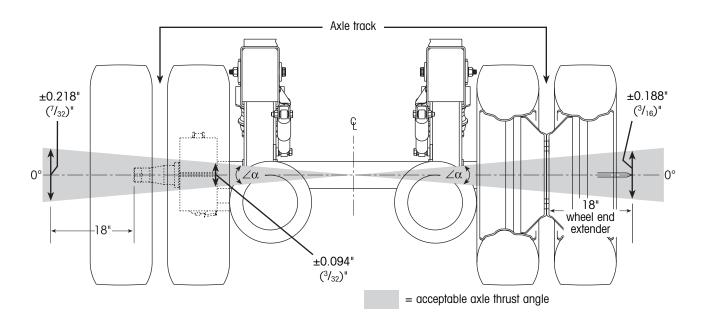


Figure 10. Thrust angle geometry example



two times larger than the other. This is because one measurement is taken at a point much farther away from the center of the axle than the other measurement.

The typical trailer industry alignment specification for thrust angle is ± 0.1 degrees, which equals $\pm 1/8$ inch when measured from the king pin to the axle track of a 71.5-inch track axle (distances "A" and "B" in figure 9). Hendrickson suspensions are no different. However, there are two additional clarifications to this specification that must be addressed. The first one deals with axle track (figure 10). Using the value for axle track simplifies the axle thrust angle calculation, but it is impractical to use axle track for a measurement. Not only does the outer tire/wheel assembly have to come off to even attempt the measurement, but where specifically on the spindle do you measure to? What point on the spindle defines axle track? A more practical approach is to use wheel-end extenders to provide a more accurate and consistent measurement point (more wheel-end extender information is presented later in this document).

The second clarification deals with measurement limitation. The ± 0.1 degrees of thrust angle is difficult to achieve because of measurement limitations. No currently existing alignment measurement method

MEASUREMENT METHOD	PRECISION/ TOLERANCE RATIO (±0.1°)	PRECISION/ TOLERANCE RATIO (±0.2°)
Tape measure to rim	330%	165%
Laser devices*	309%	155%
¹ / ₁₆ " graduated tape measure to wheel-end extenders	207%	104%
¹ / ₃₂ " graduated tape measure to wheel-end extenders	148%	74%
Extensometer	64%	32%

Table 2. Measurement method and associated accuracy

can consistently provide an alignment within this ± 0.1 degree tolerance. The reason for this is measurement error.

All measurement devices and procedures have variations that affect their accuracy. A study typically performed to identify measurement device or procedure accuracy is a gauge repeatability and reproducibility study. It evaluates how well the measurement device or procedure can perform with respect to specifications. The result of such a study is a factor called "precision to tolerance ratio." This ratio expresses the percent of the tolerance used up by measurement error. For example, say you have a measurement with a tolerance of ± 0.125 ($^{1}/_{8}$) inches. Say also that the result of a gauge repeatability and reproducibility study revealed a precision to tolerance ratio of 75 percent. This means that ± 0.0938 ($^{3}/_{32}$) inches (or 75 percent) of the $\pm^{1}/_{8}$ -inch tolerance could be attributed to measurement error.

As summarized by table 2, the measurement error introduced by current alignment measurement methods (except extensometer devices) is greater than the ± 0.1 degree industry specification.

With the two previously described clarifications in mind, Hendrickson continues to recommend using the ± 0.1 degree thrust angle alignment specification for initial alignments, realizing that, due to measurement error, the actual thrust angle may be in the ± 0.2 degree range. The ± 0.2 degree range complies with most tire manufacturers' recommendations for an allowable trailer axle thrust angle. Hendrickson also recommends using a steel tape measure with $^{1}/_{32}$ -inch or millimeter graduations, a tape tensioning device and wheel-end extenders to allow for greater measurement accuracy. Subsequent alignment verification measurements should use the ± 0.2 degree thrust angle range recommended by most tire manufacturers.

ALIGNMENT PREPARATIONS SELECT THE ALIGNMENT AREA

The alignment should be performed on a flat, level, debris-free surface.

PERFORM TIRE INSPECTION

The tires in each dual wheel set must be matched to within ¼ inch in diameter and ¾ inch in circumference.

^{*} per SAE technical paper 933046.



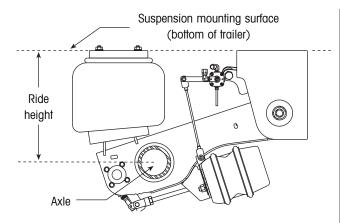


Figure 11. Ride height defined

The tires must also be at the manufacturer's recommended pressure when checking or performing an axle alignment. Inflate or deflate the tires to match this recommended pressure.

Also make sure that the same tires and rims are mounted on each side of the trailer.

SET SUSPENSION RIDE HEIGHT

The suspension must be at its designed ride height when checking or performing an axle alignment. A suspension's designed ride height is defined as the distance from the suspension mounting surface (the bottom of the trailer) to the center of the axle (figure 11). Refer to Hendrickson publication L459, Checking Trailer Ride Height, available at www.hendrickson-intl.com, for complete instructions on determining and setting ride height.

PROPERLY POSITION THE TRAILER

Trailer positioning is important during an axle alignment. The trailer suspension must be in a "relaxed" state without any pre-load applied to the TRI-FUNCTIONAL® Bushings.

IMPORTANT: A pre-loaded bushing will complicate the axle alignment process by providing inaccurate measurement data. Also, a seemingly-aligned axle that contains an unknowingly-compressed bushing may cause tracking problems and/or premature tire wear. To avoid these conditions, perform the proper trailer positioning procedure as follows.

1. Position the trailer for alignment:

Sliders

- a. Move the slider to the rear-most position of the trailer. Make sure the slider locking pins are fully extended through the body rail holes.
- b. With the trailer still coupled to the tractor, adjust the trailer landing legs so there is adequate ground clearance.
- c. Pull the trailer forward in a straight line for a minimum of 10 feet and gently apply the trailer brakes. This forces the slider locking pins to the rear of the body rail holes, removing locking pin slack and relieving bushing pre-load.

Non-sliders

- With the trailer still coupled to the tractor, adjust the trailer landing legs so there is adequate ground clearance.
- Pull the trailer
 forward in a straight
 line for a minimum
 of 10 feet and ease
 the trailer to a stop
 using only the
 service brakes, thus
 relieving bushing
 pre-load.

Lower the trailer landing legs so they contact the ground. Uncouple the trailer from the tractor and apply shop air to the trailer emergency glad hand to release the parking brakes.

IMPORTANT: Keep trailer parking brakes disengaged.

This allows wheel rotation to occur while positioning the suspension fore and aff.

SET DESIGNED KINGPIN HEIGHT

Set the front of the trailer to its designed kingpin height:

- Determine what the designed kingpin height should be. Check the trailer ID tag on the trailer front bulkhead or contact the trailer manufacturer for the designed kingpin height.
- Using a tape measure, determine the current trailer kingpin height by measuring from the ground to the kingpin mounting plate (figure 12).





Figure 12. Measuring the actual kingpin height

- 3. Adjust the landing legs to place the trailer at the designed kingpin height.
- 4. Verify the kingpin height by measuring from the ground to the kingpin mounting plate on both sides of the kingpin.

CHECK INITIAL AXLE ALIGNMENT

1. From a position at the front of the trailer, sight along a line under the trailer from the kingpin to each end of the front axle (figure 13).

If this sightline is free from under-trailer obstructions that would interfere with a measurement (i.e., landing legs, trailer frame, tool boxes, etc.), then the kingpin adapter (figure 14) can be used to make the measurement in step five.

If this sightline is obstructed, then the kingpin extender or pogo stick (figure 15) must be used to make the measurement in step five.

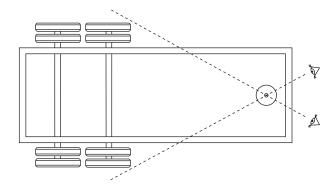


Figure 13. Checking for measurement obstructions

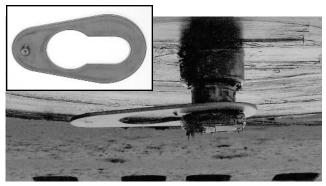


Figure 14. Kingpin adapter



Figure 15. Kingpin extender



Figure 16. Installed wheel-end extender

- 2. Place the kingpin adapter (figure 14) or kingpin extender (figure 15) onto the kingpin.
- 3. Following the manufacturer's recommended instructions, install wheel-end extenders on each end of the front axle (figure 16).



NOTE: A wide range of wheel-end extenders are available from various companies, ranging from simple fixtures to complex devices. Wheel-end extenders are designed to ease alignment by eliminating the need to remove the outer wheel when checking or aligning the axles. Once in place, wheel-end extenders position axle reference points far enough outside of the trailer to allow the measuring tape to clear the tires when measuring the "A" and "B" dimensions from the kingpin. Some wheel-end extenders require contact with the spindle plug through the hub cap oil fill hole. Others offer a more universal mount, fitting over the entire hub. Select wheel-end extenders that work best with your style of hubs.

IMPORTANT Make sure the wheel-end extenders are a matched pair and are properly installed. Failure to properly install a matched pair of wheel-end extenders will significantly reduce the accuracy of the alignment measurement.

- 4. Determine front axle target value as follows:
 - Measure the length of one wheel-end extender. Measure from the face of the wheel mounting to the tip of the wheel-end extender (figure 17).
 - b. Read the front axle target value from the following chart.*

WHEEL-END	AXLE TRACK		
EXTENDER LENGTH	71.5"	77.5"	
12"	± ⁵ / ₃₂ "	±3/16"	
13"	±3/16"	±3/16"	
14"	±3/16"	±3/16"	
15"	±3/16"	±3/16"	
16"	±3/16"	±3/16"	
17"	±3/16"	±3/16"	
18"	± ³ / ₁₆ "	±3/16"	
19"	± ³ / ₁₆ "	± ⁷ / ₃₂ "	
20"	± ⁷ / ₃₂ "	± ⁷ / ₃₂ "	
21"	± ⁷ / ₃₂ "	± ⁷ / ₃₂ "	
22"	± ⁷ / ₃₂ "	± ⁷ / ₃₂ "	
23"	± ⁷ / ₃₂ "	± ⁷ / ₃₂ "	
24"	± ⁷ / ₃₂ "	± ⁷ / ₃₂ "	

Table 3. Thrust angle target values

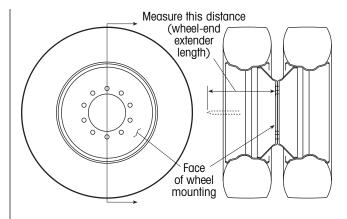


Figure 17. Measuring wheel-end extender length

For example, suppose the measured length of your wheel-end extender is 18 inches and your trailer has a 71.5-inch axle track. First, find the 18-inch row in the table. Then, find the column for 71.5-inch axle track and read down the column. The value shown where 18-inch wheel-end extender length and 71.5-inch axle track meet is $\pm^3/_{16}$ inch, which is the front axle target value. This front axle target value will be required for a comparison in step 6.

NOTE: Axle track can be read from the suspension model identification tag, found on the inside surface of the curbside beam (INTRAAX® suspensions) or on the roadside slider box side rail above the front frame bracket (VANTRAAX® suspensions). Refer to Hendrickson publication L760, New Product Identification System, available at www.hendrickson-intl.com, for complete details on reading the Hendrickson suspension identification tag.

^{*}The front axle (or thrust angle) target values presented in this chart have been pre-calculated for your convenience. To see the steps involved in this process and an example of a front axle target value calculation, refer to the section titled Front Axle Target Value Sample Calculation on page 18.





Figure 18. Using the tape tensioning device

5. Hook the 50-foot steel measuring tape to the kingpin adapter (or kingpin extender). Holding the measuring tape with the tape tensioning device (figure 18), measure the distances "A" and "B" from the kingpin to the wheel-end extender pointer on each end of the front axle (figures 19 and 20).

IMPORTANT: The same lateral tension (pulling force) applied to the measuring tape when measuring distance "A" must also be applied when measuring distance "B". When making the measurements, closely monitor the tensioning device scale to make sure that the same pulling force is used in both measurements.

Subtract the smaller of the "A" and "B"
measurements from the larger of the two, then
compare this difference with the target value
obtained in step four.

If the difference between the "A" and "B" measurements is smaller than or equal to the



Figure 19. Measuring the "A" and "B" distances

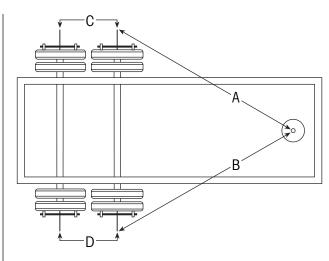


Figure 20. Axle alignment measurements

target value, the axle is within specification and no alignment is necessary.

If the difference between the "A" and "B" measurements is larger than the target value, the axle must be adjusted to bring this difference within the target value.

For example, suppose distance "A" was measured to be $420^1/_8$ inches and distance "B" was measured to be $420^{11}/_{16}$ inches. Subtracting yields this difference:

$$420^{11}/_{16}$$
" - $420^{1}/_{8}$ " = $9/_{16}$ "

When compared to the target value ($\pm^3/_{16}$ inches, read from the table in step 4), $^9/_{16}$ inches is larger. Therefore the axle must be adjusted to bring the "A" and "B" difference within the target value.

AXLE ALIGNMENT QUIK-ALIGN® STYLE PIVOT CONNECTION

THRUST ANGLE

If the front axle is found to be out of the acceptable thrust angle range, it must be realigned as follows:

- Remove and discard the existing shear-type bolt, TORQ-RITE® nut and hardened flat washers from both front axle pivot connections. If necessary, clean the surface rust from the alignment collars and frame bracket surface and inspect for excess wear. Replace if worn.
- 2. Install a new shear-type bolt, TORQ-RITE nut and hardened flat washers into both front axle pivot



connections, but do not fully tighten at this time. The pivot connection fasteners should be tight enough to hold the flanged eccentric collar in place against the alignment guides and flat against the frame bracket, but loose enough to permit the hardened flat washers to rotate freely.

ACAUTION: DO NOT apply an anti-sieze compound to the pivot connection hardware or allow undercoating. paint, or any other commonly used compounds to contact the threads of the pivot connection fasteners. These compounds can act like a lubricant, reducing the friction between the threads of the nut and bolt. This can lead to overtightened fasteners, unpredictable pivot connection clamp loads and unreliable axle alignments.

IMPORTANT:

The eccentric collar must remain flat against the frame bracket throughout the alignment procedure (figure 22a). If the pivot connection fasteners are too loose, the eccentric collar may raise up on the alignment guide, resulting in an improper alignment (figure 22c). If this condition occurs during alignment, refer to the raised eccentric collar information in the troubleshooting section.

3. On both front axle pivot connections, inspect the orientation of the square alignment hole in the

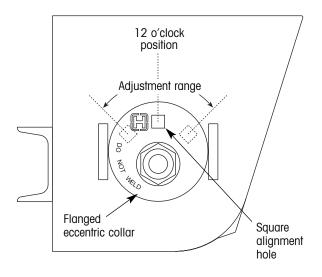


Figure 21. Eccentric collar orientation details

flanged eccentric collar (figure 21). The square alignment hole must be at the 12 o'clock position, which is the middle of the alignment adjustment range.

If the square alignment hole is not at the 12 o'clock position, insert a 1/2-inch breaker bar into the square alignment hole in the flanged eccentric collar and rotate the collar until the saugre hole is at the 12 o'clock position.

With the square alignment hole in the 12 o'clock position on both front axle pivot connections, recheck measurements "A" and "B" from the kingpin to each wheel-end extender pointer.

If necessary, insert a 1/2-inch breaker bar into the square alignment hole in one of the flanged eccentric collars and adjust the axle forward by rotating the collar clockwise or rearward by rotating the collar counterclockwise.

While rotating the flanged eccentric collar (on the outboard side of the frame bracket), tap on the flanged concentric collar (on the inboard side of the frame bracket) with a rubber mallet.

IMPORTANT: The tapping allows the concentric and eccentric collars to move and adjust in unison. If the collars do not move and adjust in unison, the concentric collar may wedge against the frame bracket (figure 22b), causing an inaccurate alignment and an improper pivot connection that could potentially loosen. If this condition occurs during the alignment procedure, refer to the "wedged collar" information in the troubleshooting section.

6. If the flanged eccentric collar is rotated more than 45 degrees in either direction from the 12 o'clock position and alignment is still not achieved, leave this flanged eccentric collar at the 45-degree limit and go to the pivot connection on the other end of the axle. Rotate that flanged eccentric collar until alignment is achieved.

IMPORTANT: There is no change in axle adjustment when the flanged eccentric collar is rotated beyond 45 degrees from the 12 o'clock position in either the fore or aft direction.



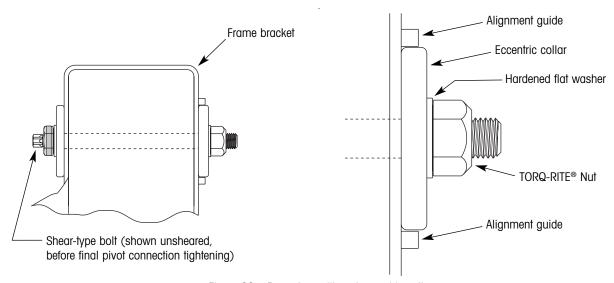


Figure 22a. Properly positioned eccentric collar

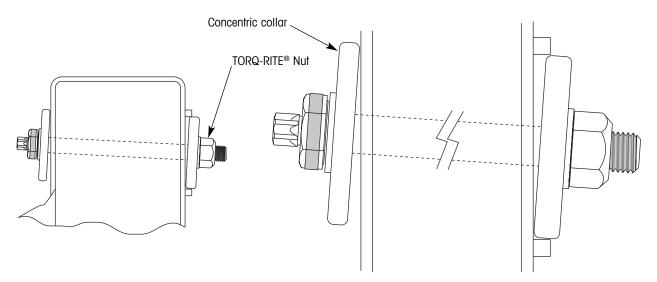


Figure 22b. "Wedged" pivot connection hardware

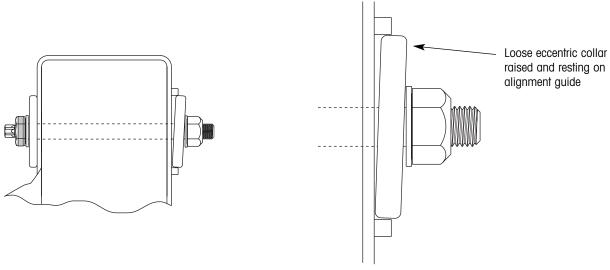


Figure 22c. "Raised" eccentric collar



7. Recheck measurements "A" and "B" from the kingpin to each wheel-end extender pointer.

If necessary, continue this adjust-and-measure procedure until the difference between the "A" and "B" measurements is within the target value.

8. With the front axle aligned, visually inspect the eccentric and concentric collars on both pivot connections to ensure that they are in place between the alignment guides and flat against the frame bracket.

If a collar is "wedged" or "raised", tap on the concentric collar (on the inboard side of the frame bracket) with a rubber mallet until it lays flat.

9. Hand tighten the pivot connection fasteners until the hardened flat washers do not rotate freely and recheck measurements "A" and "B" from the kingpin to each wheel-end extender pointer.

If the difference between the "A" and "B" measurements is still within the target value, proceed with step 10.

If the difference between the "A" and "B" measurements is not within the target value, repeat steps 3 through 8.

 Using an E20 Torx socket, tighten the shear-type bolt on both front axle pivot connections until the Torx head shears off. This ensures the proper torque of 550 ft. lbs. (±45 ft. lbs.).

IMPORTANT: An improperly torqued pivot connection can result in injury and/or property damage.

Anyone who assembles or reassembles the pivot connection (OEMs, dealers, repair facilities, etc.) is responsible for the proper installation of the shear-type bolt.

Do not attempt to reuse a shear-type bolt. Since it requires 550 ft. lbs. (±45 ft. lbs.) of torque to achieve the proper clamping force, the shear bolt's reuse indicator will show if an attempt was made to reuse the bolt.

Failure to reach the required torque can result in an insufficient clamp load and unreliable axle alignment.

⚠ CAUTION: Always wear eye protection when

operating pneumatic tooling.

⚠ CAUTION: Make sure the socket is securely

fastened to the pneumatic tooling.

SCRUB ANGLE

To be within the acceptable scrub angle range, the rear axle must be aligned to the forward axle:

- 11. Following the manufacturer's recommended instructions, install wheel-end extenders on each end of the rear axle.
- 12. Determine rear axle target value as follows:
 - a. Measure wheel-end extender length. Measure from the face of the wheel mounting to the tip of the wheel-end extender (figure 17).
 - b. Read the rear axle target value from the following chart.*

WHEEL-END	AXLE TRACK		
EXTENDER LENGTH	71.5"	77.5"	
12"	±3/ ₃₂ "	±3/ ₃₂ "	
13"	±3/32"	±3/32"	
14"	±3/32"	±3/32"	
15"	±3/32"	±3/32"	
16"	±3/32"	±3/32"	
17"	±3/32"	±3/32"	
18"	±3/32"	±3/32"	
19"	±3/32"	±3/ ₃₂ "	
20"	±3/32"	±3/32"	
21"	±3/32"	±3/32"	
22"	±3/32"	±3/32"	
23"	±3/32"	±1/8"	
24"	±3/32"	±1/8"	

Table 4. Scrub angle target values

*The rear axle (or scrub angle) target values presented in this chart have been pre-calculated for your convenience. To see the steps involved in this process and an example of a rear axle target value calculation, refer to the section titled Rear Axle Target Value Sample Calculation on page 19.



For example, suppose the measured length of your wheel-end extender is 18 inches and your trailer has a 71.5-inch axle track. First, find the 18-inch row in the table. Then, find the column for 71.5-inch axle track and read down the column. The value shown where 18-inch wheel-end extender length and 71.5-inch axle track meet is $\pm 3/32$ inch, which is the rear axle target value.

13. Using a trammel bar or a 12-foot tape measure with 1/32-inch or millimeter increments, measure the distances "C" and "D" from the front axle center to the rear axle center (figure 20).

IMPORTANT: If the tape measure is used, the tensioning device must also be used. The same lateral tension (pulling force) applied to the tape measure when measuring distance "C" must also be applied when measuring distance "D". When making the measurements, closely monitor the tensioning device scale to make sure that the same pulling force is used in both measurements.

14. Subtract the smaller of the "C" and "D" measurements from the larger of the two, then compare this difference with the rear axle target value obtained in step 12.

If the difference between the "C" and "D" measurements is smaller than or equal to the target value, the axle is within specification and no alignment is necessary.

If the difference between the "C" and "D" measurements is larger than the target value, the axle must be adjusted to bring this difference within the target value.

Repeat steps one through 10 of this procedure to realign the rear axle. On trailers equipped with more than two axles, measure and if necessary adjust each axle. Measure from the front axle to each remaining axle to prevent inaccuracies.

WELDED COLLAR STYLE PIVOT CONNECTION

THRUST ANGLE

If the front axle is found to be out of the acceptable thrust angle range, it must be realigned as follows:

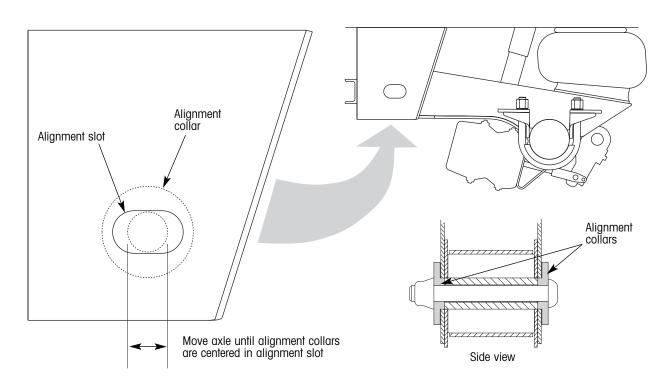


Figure 23. Axle positioning on the welded-collar type frame bracket when major adjustment (both axle ends) is necessary



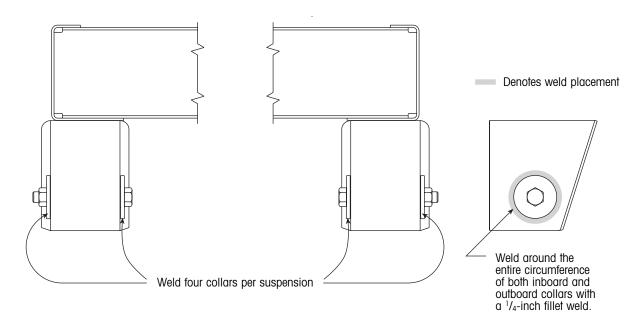


Figure 24. Welding locations on welded collars

 Select one side of the axle and carefully grind or cut the welds securing the inboard and outboard alignment collars to the frame bracket.

IMPORTANT: Do not remove the 11/8-inch heavy hex cap screw and nut or huck fastener. Axle alignment with the welded collar style pivot connection does not require pivot joint disassembly.

IMPORTANT: On model HT250U "Y" beam underslung suspensions, the alignment slots are on the beam assembly, and the inboard and outboard alignment collars are welded to the beam assembly itself.

2. Recheck measurements "A" and "B" from the trailer kingpin to each wheel-end extender pointer. Move the loose axle end fore or aft until the difference between the "A" and "B" measurements is within the target value.

If the alignment collars can no longer be moved within the alignment slots in the frame bracket and the axle is still not within the target value, the welds on the inboard and outboard alignment collars on the other side of the axle must also be carefully ground or cut loose. With both axle ends loose, move the axle until the alignment

- collars are centered in the frame bracket alignment slots (figure 23). The axle can now be repositioned until the difference between the "A" and "B" measurements is within the target value.
- 3. Remove all equipment used to reposition the axle.
- 4. Tack weld the alignment collars in place.
- 5. Verify correct alignment.
- 6. Weld around the inboard and outboard collars on each end of the axle with a 1/4-inch fillet weld (figure 24).
- 7. Verify that the weld goes around the entire circumference of all four collars.
- 8. If the $1^{1}/_{8}$ -inch heavy hex cap screw and nut is used, weld the nut to the cap screw.

SCRUB ANGLE

To be within the acceptable scrub angle range, the rear axle must be aligned to the forward axle as follows:

 Following the manufacturer's recommended instructions, install wheel-end extenders on each end of the rear axle.



- 10. Determine rear axle target value as follows:
 - a. Measure wheel-end extender length. Measure from the face of the wheel mounting to the tip of the wheel-end extender (figure 17).
 - b. Read the rear axle target value from the Scrub Angle Target Value Chart on page 13.

For example, suppose the measured length of your wheel-end extender is 18 inches and your trailer has a 71.5-inch axle track. First, find the 18-inch row in the table. Then, find the column for 71.5-inch axle track and read down the column. The value shown where 18-inch wheel-end extender length and 71.5-inch axle track meet is $\pm 3/32$ inch, which is the rear axle target value.

11. Using a trammel bar or a 12-foot tape measure with 1/32-inch or millimeter increments, measure the distances "C" and "D" from the front axle center to the rear axle center (figure 20).

IMPORTANT: If the tape measure is used, the tensioning device must also be used. The same lateral tension (pulling force) applied to the tape measure when measuring distance "C" must also be applied when measuring distance "D". When making the measurements, closely monitor the tensioning device scale to make sure that the same pulling force is used in both measurements.

12. Subtract the smaller of the "C" and "D" measurements from the larger of the two, then compare this difference with the rear axle target value obtained in step 10.

If the difference between the "C" and "D" measurements is smaller than or equal to the target value, the axle is within specification and no alignment is necessary.

If the difference between the "C" and "D" measurements is larger than the target value, the axle must be adjusted to bring this difference within the target value.

Repeat steps one through eight of this procedure using the "C" and "D" measurements to realign

the rear axle. On trailers equipped with more than two axles, measure and if necessary adjust each additional axle. Measure from the front axle to each remaining axle to prevent inaccuracies.

16



QUIK-ALIGN® STYLE PIVOT CONNECTION HARDWARE TROUBLESHOOTING WEDGED PIVOT-CONNECTION HARDWARE

APPEARANCE

The pivot-connection hardware (eccentric and concentric collars, hardened washers, shear-type bolt and TORQ-RITE® nut) is not flat against the frame bracket (Figure 22b, page 12). The shear-type bolt and the eccentric and concentric collars are "cockeyed" and not in their proper positions.

CAUSES

While being adjusted, the concentric (or inboard) collar did not move in unison with the eccentric (or outboard) collar.

RESULTS

An inaccurate alignment and an improper pivot connection that could potentially loosen. SOLUTIONS

Tap on the concentric collar with a rubber mallet while rotating the eccentric collar.

Visually inspect the pivot connection after alignment. If the eccentric and concentric collars are "wedged" against the frame bracket and the Torx head on the shear-type bolt has been sheared, remove and discard the pivot connection hardware and redo the alignment using new pivot connection hardware. If the eccentric and concentric collars are "wedged" against the frame bracket but the Torx head on the shear-type bolt has not yet been sheared, carefully loosen the pivot connection and redo the alignment.

RAISED ECCENTRIC COLLAR

APPEARANCE

The eccentric collar is not flat against the frame bracket; it is resting on an alignment guide. However, the shear-type bolt is properly positioned and the concentric collar is flat against the frame bracket (Figure 22c, page 12).

CAUSES

When installing the TORQ-RITE nut on the shear-type bolt, the nut was not tightened sufficiently. Initially, the pivot connection fasteners must be tight enough to hold the eccentric collar in place against the alignment guides and flat against the frame bracket, but loose enough to permit the hardened flat washers to rotate freely. The loose nut allowed the eccentric collar to move freely and work its way onto an alignment guide.

RESULTS

Initially, the alignment appears to be accurate. However, when the eccentric collar eventually slips off the alignment guide, the pivot connection will become loose and alignment accuracy will be lost.

SOLUTIONS

During assembly, tighten the TORQ-RITE nut so the eccentric collar is in place against the alignment guides and flat against the frame bracket, but loose enough to permit the hardened flat washers to rotate freely.

Visually inspect the eccentric collar after alignment. If the eccentric collar is resting on an alignment guide in the "raised" position and the Torx head on the shear-type bolt has been sheared, remove and discard the pivot connection hardware and redo the alignment using new pivot connection hardware. If the eccentric collar is resting on an alignment guide in the "raised" position but the Torx head on the shear-type bolt has not yet been sheared, carefully loosen the pivot connection and redo the alignment.



FRONT AXLE TARGET VALUE SAMPLE CALCULATION

- 1. Determine front axle target value as follows:
 - a. Measure the point-to-point width of the installed wheel-end extenders (figure 25).

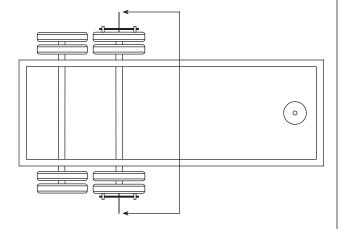


Figure 25. Measuring target value

As an alternative to measuring the point-topoint width of the wheel-end extenders, the following method can be used to approximate the distance (see figure 26):

wheel face-to-face distance + 2(wheel-end extender length)

point-to-point width of the installed wheel-end extenders

While the wheel face-to-face distance will vary with different wheel equipment, the following values can be used to approximate the distance without significantly impacting the alignment tolerance:

79.2" for a 77.5" axle track 73.2" for a 71.5" axle track

b. Multiply this width by 0.00175*. The resulting product is the front axle target value.

For example, suppose the point-to-point width of the wheel-end extenders is 122.625 inches. Multiplying this by the 0.00175 constant produces:

122.625" × $0.00175 = \pm 0.215$ "

This provides the front axle target value.

* For axle to kingpin distances of 10 feet or more, the 0.00175 constant can be approximated by using the sine of 0.1 degrees.

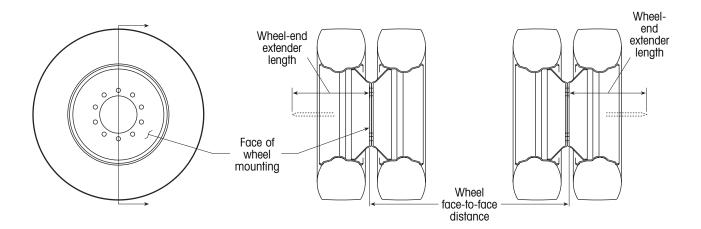


Figure 26. An alternative to measuring the point-to-point width of the wheel-end extenders



REAR AXLE TARGET VALUE SAMPLE CALCULATION

- 1. Determine rear axle target value as follows:
 - a. Measure the point-to-point width of the installed wheel end extenders (figure 27).

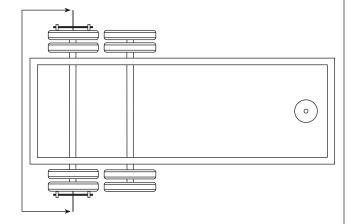


Figure 27. Measuring target value

As an alternative to measuring the point-topoint width of the wheel-end extenders, the following method can be used to approximate the distance (see figure 28):

wheel face-to-face distance
+ 2(wheel-end extender length)
point-to-point width of the installed wheel-end extenders

While the wheel face-to-face distance will vary with different wheel equipment, the following values can be used to approximate the distance without significantly impacting the alignment tolerance:

79.2" for a 77.5" axle track 73.2" for a 71.5" axle track

b. Multiply this measurement by 0.00087*. The resulting product is the rear axle target value.

For example, suppose the point-to-point width of the wheel-end extenders is 122.625 inches. Multiplying this by the 0.00087 constant produces:

 $122.625" \times 0.00087 = \pm 0.107"$

This provides the rear axle target value.

* For axle to kingpin distances of 10 feet or more, the 0.00087 constant can be approximated by using the sine of 0.05 degrees.

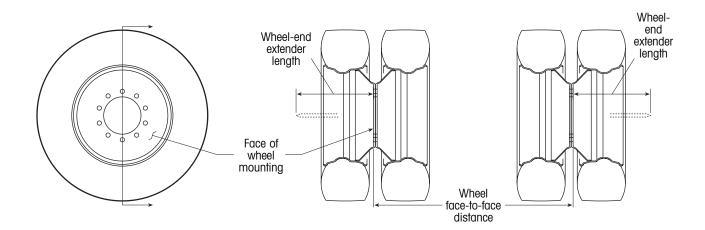


Figure 28. An alternative to measuring the point-to-point width of the wheel-end extenders



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HTECHNICAL PROCEDURE

TRI-FUNCTIONAL® BUSHINGS

SUBJECT: Bushing Tube Spacer

Inspection/Replacement Procedure

LIT NO: L750

DATE: January 2001

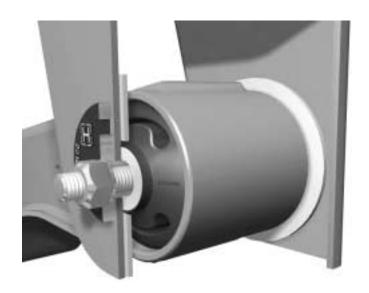


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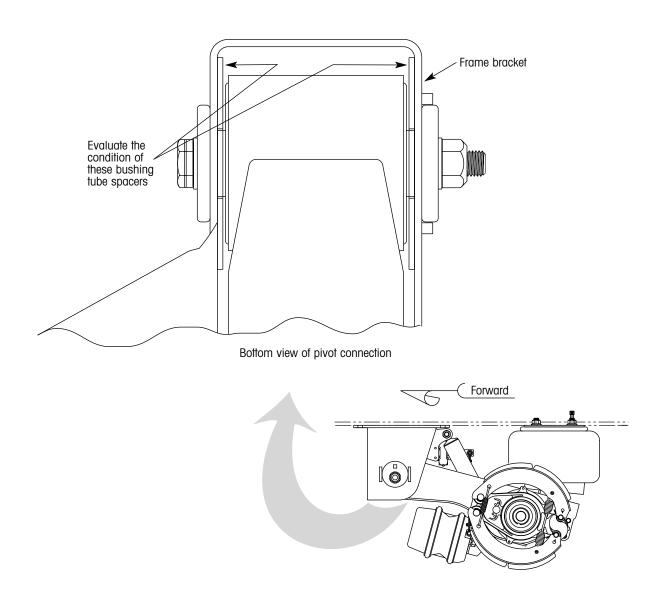






INSPECTING THE BUSHING TUBE SPACERS

Periodic inspections are an important part of your air suspension maintenance routine. Of particular inspection importance are the bushing tube spacers, which are located inside the frame brackets on each side of the TRI-FUNCTIONAL® BUSHING. A typical inspection should include an evaluation of all bushing tube spacers on the trailer.



During this inspection, you should visually verify that the bushing tube spacers are intact and that they are not missing, cut, worn-through or otherwise deteriorated. Due to the pivoting motion inherent with this connection, some bushing tube spacer wear is expected. Bushing tube spacer "cupping", where the bushing tube spacer forms around the bushing tube and resembles a shallow dish, is also normal. If you see these conditions, then no further inspection is required at this time. Your bushing tube spacers are in serviceable condition.

However bushing tube spacer "wear through", where the bushing tube spacer is completely missing or has been cut or worn-through, is considered abnormal. If an inspection reveals missing, cut or worn-through bushing tube spacers, a closer, more detailed inspection (detailed on the following pages) is required to prevent more serious or costly problems and to prolong the life of the suspension.

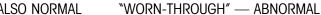
The following page illustrates these bushing tube spacer concepts with some typical examples.

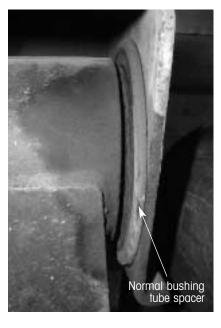
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BUSHING TUBE SPACER INSPECTION/REPLACEMENT PROCEDURE

NORMAL













Normal bushing tube spacer



An example of a "cupped" bushing tube spacer. Friction-generated heat causes the spacer to "form" or "cup" around the bushing and bushing tube. This is normal as long as the bushing tube spacer remains intact and does not become cut or worn-through.



Examples of "worn-through" bushing tube spacers. The spacer on the right is an example of extreme wear. Its circumference has been completely trimmed by the bushing tube.

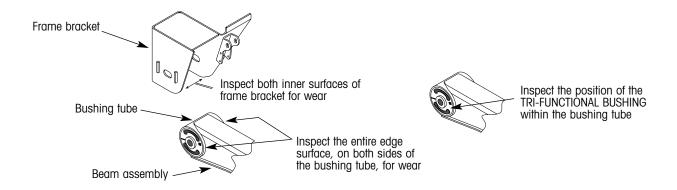


IF BUSHING TUBE SPACER "WEAR THROUGH" IS FOUND

If a missing, cut or otherwise worn-through bushing tube spacer is discovered, the suspension pivot connection must be disassembled and the beam assembly lowered to check for potential beam and/or frame bracket wear. Refer to L427 Bushing Replacement Procedures for complete pivot connection disassembly instructions.

MARNING: CHOCK THE TRAILER WHEELS AND APPLY THE TRAILER PARKING BRAKES SO THAT IT CANNOT MOVE DURING DISASSEMBLY.

With the beam assembly lowered, inspect the inner surfaces of the frame bracket and the edges of the bushing tube for wear. Also inspect the position of the TRI-FUNCTIONAL® BUSHING within the bushing tube. The condition of these three areas will dictate the repair requirements or the necessity to replace any parts as instructed in the table on page six.

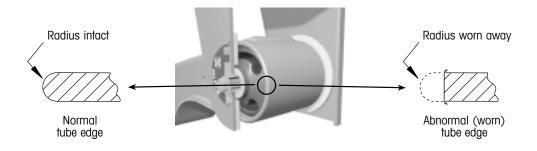


EVALUATING FRAME BRACKET WEAR

Some wear (polished metal) on the inner surface of the frame bracket is considered normal, due to the pivoting motion inherent with this connection. Gouges or grooves worn into the frame bracket are abnormal. If any gouges, grooves or missing metal is found, the frame bracket must be replaced. Refer to L341 INTRAAX® Installation Procedures for complete frame bracket replacement instructions on INTRAAX and VANTRAAX® suspensions, or L577 HT/HS/HK Installation Procedures for frame bracket replacement instructions on HT, HS or HK suspensions. After the frame bracket evaluation is complete, the next step is to evaluate bushing tube wear.

EVALUATING BUSHING TUBE WEAR

Some wear (polished metal) on the edge of the bushing tube is considered normal, due to the pivoting motion inherent with this connection. Missing metal, where the bushing tube's radius edge has been worn away, is

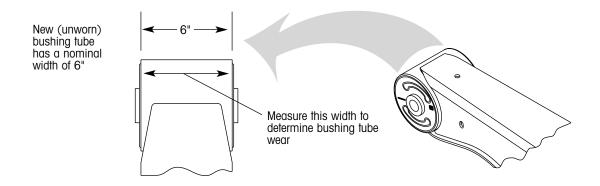


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considered abnormal. If you see this kind of wear, the next step is to determine how much wear has occurred and whether the edge can be repaired or whether the beam assembly (or HALF-TRAAX) must be replaced.

The bushing tube, when new, has a nominal width of six inches with the exception of the HKA180, which has a nominal width of three and one-eighth inches. The amount of bushing tube wear can be determined by measuring the width of the worn bushing tube and subtracting this measured dimension from six (or three and



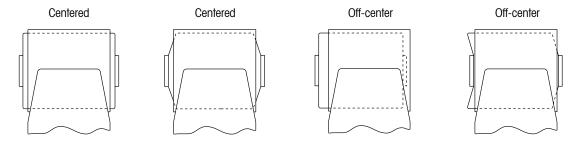
one-eighth) inches. For example, suppose your inspection reveals extensive bushing tube wear and the bushing tube measures five and fifteen-sixteenths inches. Subtracting five and fifteen-sixteenths from six reveals the amount of bushing tube material that has worn away, in this case one-sixteenth of an inch.

$$6'' - 5^{15}/_{16}'' = \frac{1}{16}''$$

After the amount of bushing tube wear has been determined, the next step is to evaluate the bushing position within the bushing tube.

EVALUATING BUSHING POSITION WITHIN THE BUSHING TUBE

For evaluation purposes, the TRI-FUNCTIONAL® BUSHING is considered either centered or off-center with respect to the bushing tube. The TRI-FUNCTIONAL BUSHING is considered off-center when a portion of it extends outside of the bushing tube on one side and not on the other. Some typical examples are shown below.



Typical examples of bushing position relative to the bushing tube (not representative of every possible case).

The TRI-FUNCTIONAL BUSHINGS will flex and elongate within the bushing tube to control the forces generated by braking, accelerating, irregular road surfaces, etc. Because of this, it may be difficult at times to tell the difference between normal bushing operation and an off-center bushing. The key to identifying an off-center bushing is the bushing tube spacers. If the bushing tube spacers are in serviceable condition (not missing, cut, worn-through or otherwise deteriorated), the bushing cannot be off-center. However if a bushing tube spacer is worn-through, the potential exists for an off-center condition (as described above).

Now that each component has been evaluated, refer to the following table for repair recommendations.



REPAIR RECOMMENDATIONS

Now that each pivot connection component has been evaluated (because missing, cut or otherwise worn-through bushing tube spacers were found), use the following table to determine the correct repair action. Do not add more bushing tube spacers than what is recommended in the table. A slight degree of freedom is required by the TRI-FUNCTIONAL® BUSHING within the frame bracket to flex, elongate and otherwise absorb forces generated by braking, accelerating and irregular road surfaces. If more bushing tube spacers than what is recommended are added, the TRI-FUNCTIONAL BUSHING will not have enough room within the frame bracket to function properly, and severe damage to the suspension could result.

IF THE BUSHING TUBE MEASURES:	AND THE BUSHING IS:	THEN:
6"	Centered 1	1. Replace both bushing spacers and realign the axle. ²
(NO WEAR ON THE BUSHING TUBE)	Off-center ^{1, 3}	 Install new bushing.⁴ Refer to L427 Bushing Replacement Procedures for complete instructions. Replace both bushing spacers and realign the axle.²
5 ⁷ / ₈ " TO 6" (WEAR UP TO ¹ / ₈ " ON THE BUSHING TUBE)	_	 Remove existing bushing and dress the radius on the bushing tube edge according to the instructions in this bulletin. Install new bushing.⁴ Refer to L427 Bushing Replacement Procedures for complete instructions. Replace both bushing spacers and realign the axle.²
5¾" TO 5 ⁷ /8" (WEAR OF ¹ /8" TO ¼" ON THE BUSHING TUBE)		 Remove existing bushing and dress the radius on the bushing tube edge according to the instructions in this bulletin. Install new bushing.⁴ Refer to L427 Bushing Replacement Procedures for complete instructions. Install three new bushing spacers; one on the non-worn side of the bushing tube, and two on the worn side. Realign the axle.²
LESS THAN 5¾" (MORE THAN ¼" OF WEAR ON THE BUSHING TUBE)		Replace the HALF-TRAAX or the beam assembly. Refer to L533 HALF-TRAAX Axle and Beam Removal/Replacement Procedures for complete HALF-TRAAX replacement instructions or L577 HT/HS/HK Installation Procedures for complete beam replacement instructions. Replace both bushing spacers and realign the axle. ²

¹ Refer to the paragraph titled "EVALUATING BUSHING POSITION WITHIN THE BUSHING TUBE" for centered/off-center bushing definitions.

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L750

² Refer to L579 alignment procedures for complete axle alignment instructions.

³ DO NOT attempt to center an off-center bushing. There is no acceptable procedure and any attempt will likely do more harm than good. Simply remove the off-centered bushing and install a new one.

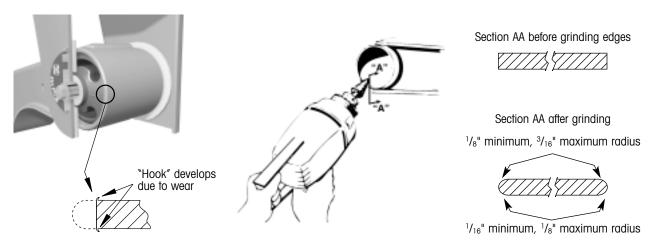
⁴ Install the new bushing from the worn side of the bushing tube. Refer to the paragraph titled "INSTALLING THE NEW BUSHING" for complete details.



BUSHING TUBE EDGE DRESSING

As described in the repair recommendations table, it is acceptable to reuse the bushing tube when ¼-inch of wear or less is observed. However, the bushing tube edge must be dressed before the new bushing is installed. When the bushing tube wears, a slight "hook" or "tooth" of metal may develop on both inside and outside diameters of the tube. As the vehicle turns, the unique design of the TRI-FUNCTIONAL® BUSHING allows it to elongate slightly to absorb the forces associated with road surface, load, etc. When the turn is complete and those particular forces are no longer present, the TRI-FUNCTIONAL BUSHING returns to its original position. If the "hook" or "tooth" on the bushing tube is not removed, it can "bite" into the rubber TRI-FUNCTIONAL BUSHING when elongated and hold or prevent it from returning to its original position (unacceptable). As this is repeated, the TRI-FUNCTIONAL BUSHING will eventually be pulled out of the bushing tube. The rubber TRI-FUNCTIONAL BUSHING may also become damaged by these irregular edges.

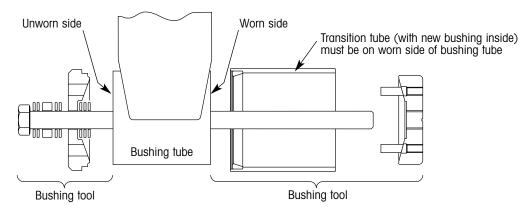
Before attempting to install a new bushing, the worn bushing tube edge must be dressed. Use a grinder to re-establish a radius on the edge of the bushing tube as shown below.



WARNING: AFTER REASSEMBLY, REMOVE WHEEL CHOCKS AND RELEASE THE TRAILER PARKING BRAKES BEFORE MOVING THE TRAILER.

INSTALLING THE NEW BUSHING

The new bushing must be installed from the worn side of the bushing tube. After the bushing tube edge and inside surface have been properly prepared, assemble the bushing tool as shown below so the new bushing is installed from the worn side of the bushing tube. Refer to L427 Bushing Replacement Procedures for complete bushing tool and bushing replacement details.



Call the Hendrickson technical services department at 800-455-0043 in the United States or 800-668-5360 in Canada for any additional technical support.



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Trailer Suspension Systems

HTECHNICAL PROCEDURE

HENDRICKSON SUSPENSION SYSTEMS

SUBJECT: Welding Procedures

LIT NO: L64

DATE: February 2000 **REVISION**: E

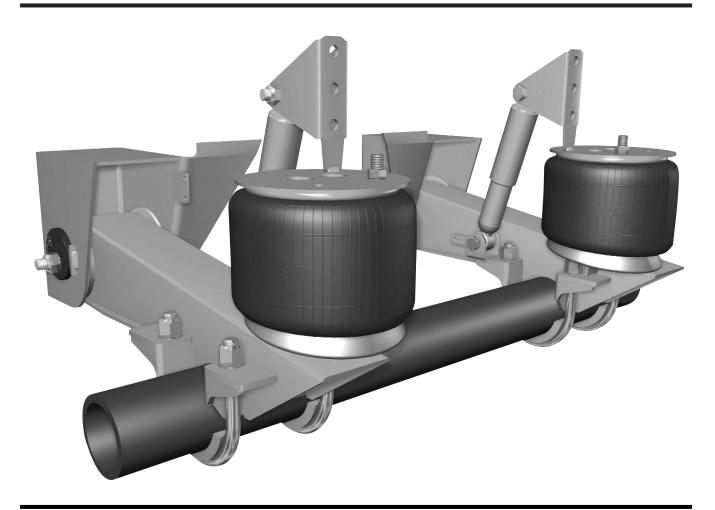


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WELDING PROCEDURES

⚠WARNING: IF THESE PROCEDURES AND

SPECIFICATIONS ARE NOT FOLLOWED,

DAMAGE TO THE AXLE OR

SUSPENSION COULD RESULT. THE RESULTING AXLE OR SUSPENSION DAMAGE COULD CAUSE AN ACCIDENT, PROPERTY DAMAGE AND/OR SERIOUS

INJURY.

NOTE: Suspension U-bolt installation and torquing should occur after completing the axle connection weld and allowing for sufficient cool-down time.

AXLE WELDING PARAMETERS — HT SUSPENSIONS ONLY

NOTE: A welder qualified in 2G position per ANSI/AWS D1.1-94 Section 5 Part C "Welder Qualification" must perform the welding.

NOTE: The specification shown below is for horizontal (2F) positioning. For flat (1F) positioning, see "Alternative Axle Weld Procedure" in the Appendix.

 Suspension components and their mating parts must be at a minimum temperature of 60°F (15.5°C) and free from moisture, dirt, scale, paint and grease.

NOTE: Preheating the axle connection at the axle and suspension seat may be recommended and/or required by the axle manufacturer. Consult axle manufacturer for their axle preheating specifications and the applicable effect on their warranty coverage.

2. All axle welds must be performed in a flat or horizontal position.

3. Achieve spray arc transfer with the following welding parameters:

Standard

Electrode: AWS E-7018 (Oven Dried)

— .125 DIA.

120-140 AMPS D.C. ELECTRODE POSITIVE

— .156 DIA.

120-160 AMPS D.C. ELECTRODE POSITIVE

Standard Wire: AWS ER-70S-6

— .045 DIA.

(i.e., LA-56 or NS-115)

• Optional Wire: AWS ER-70S-3

— .045 DIA.

(i.e., LA-50 or NS-101)

Volts: 26-30 DCRP

Current: 275-325 AMPS

Wire Feed

<u>Speed</u>: 380-420 IPM

Electrode

Extension: 3/4-1 inch

• Gas: 86% Ar 14% CO₂

at 30 to 35 CFH

NOTE: Any deviation from these welding parameters must be approved by Hendrickson Trailer Suspension Systems in writing.

SUSPENSION BEAM AND AXLE SETUP — HT SUSPENSIONS

- 1. Use a **clamping device** to secure the centered axle onto the positioned beams.
- 2. Use the Hendrickson locating fixture to properly position the suspension beams.

NOTE: Refer to "Using the 'HT' Series Fixture" in L577 *HT/HS/HK Installation Instructions*.

NOTE: If the Hendrickson locating fixture is not available, then refer to "Axle Installation without Fixturing" in L577 *HT/HS/HK Installation Instructions*.

IMPORTANT: At least one side of each axle seat radius must be tight against the axle. Any resulting gap must be no more than $^{1}/_{16}$ inch (Figure 1).

3. Place a 1-inch long tack weld in the center of each forward trailing arm/axle connection. There is one tack weld per suspension beam (Figure 2).

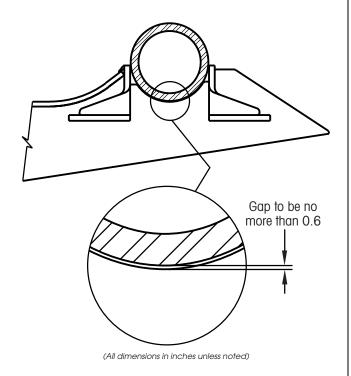


Figure 1. Axle seat gap

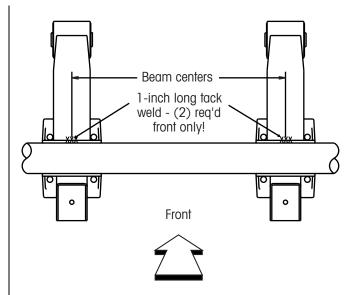


Figure 2. Locations of tack weld

AXLE WELD PROCEDURE — HT SUSPENSIONS

NOTE: If you are adjusting the weld position to the horizontal 2F position, with the suspension beams in the horizontal position, follow the welding procedure shown in Figure 3.

NOTE: If you are welding the 1F position with the suspension beams oriented in the vertical position, refer to the "Alternative Axle Weld Procedure" found in the Appendix.

IMPORTANT: Do not use attachment welds on an INTRAAX® axle.

Avoid all cold laps and undercuts. Fill all craters. Clean weld between each pass. If these steps are not followed, then failure may occur with the axle-to-suspension connection.

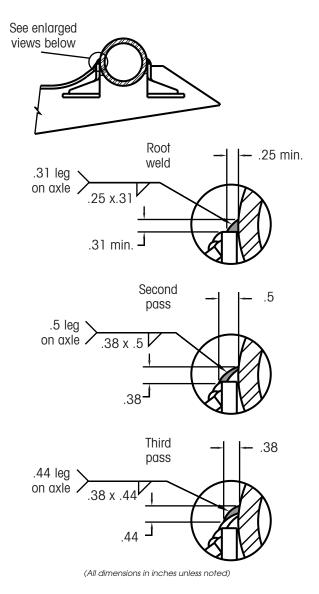


Figure 3. Axle weld passes — all HT suspensions

WELD PASS LENGTH AND PLACEMENT

AXLE WELD PASSES — SIZE AND LOCATION

NOTE: All axle seat connections require three weld passes. Figure 3 shows the location and size of each weld. All passes are to be performed as shown.

AXLE WELD LENGTH AND POSITION

Figures 4a and 4b show the length and position of the axle weld. All weld passes are to be performed as shown.

IMPORTANT: The weld length is dependent on the type of suspension being installed. When installing the HT190T, HT190U, HT230, HT250T, or HT300, use Figure 4a. When installing the HT250U or HT300U, use Figure 4b.

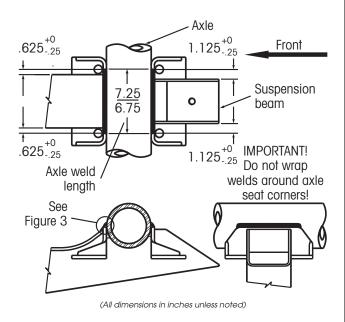
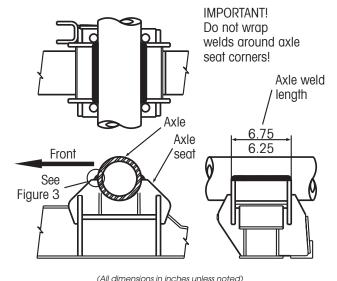


Figure 4a. HT190T, HT190U, HT230, HT250T and HT300T



() in anti-crisical in interior at necessitions

Figure 4b. HT250U and HT300U

WELD DIRECTION AND SEQUENCING

NOTE: The following instructions for direction and sequence must be followed when applying the weld.

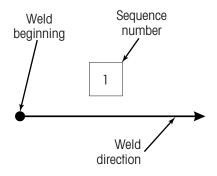


Figure 5a. Weld instructions legend

 Beginning on the rear side of the axle/seat connection, place four single root pass welds (Figure 5b).

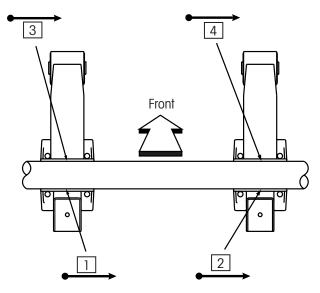


Figure 5b. Root pass sequence

2. Continue with the second and third weld passes after all four root passes (Figure 5c).

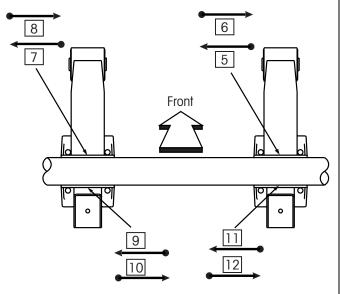


Figure 5c. Second and third pass weld sequences

U-BOLT INSTALLATION — HT SUSPENSIONS

1. Check the U-bolts for thread damage or burrs.

CAUTION: Do not apply additional lubricant to the U-bolt. Failure of the U-bolt could occur.

- 2. Install U-bolts and spacers on the axle and through the mounting holes in both suspension beams.

 Ensure U-bolt spacer fits properly in the mounting area (Figure 7).
- 3. Install the washers and nuts on the U-bolts and use a wrench to snug the nuts.
- 4. Check U-bolt spacers to ensure correct positioning on the axle.
- 5. Tighten the nuts on the U-bolts by alternately tightening opposing corners of the clamp assembly. Use a calibrated torque wrench set from 475-525 ft-lbs (Figure 6).

NOTE: Proper tightening will result in an equal amount of thread visible above the nut on each side of the U-bolt (Figure 7).

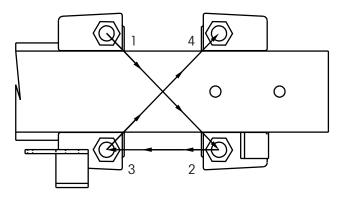


Figure 6. U-bolt nut tightening sequence

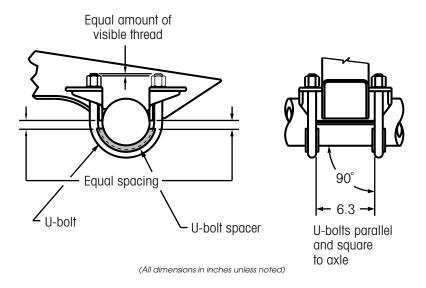


Figure 7. U-bolt positioning with U-bolt spacer

FRAME BRACKET, CROSSMEMBER, UPPER SHOCK BRACKET AND AIR SPRING MOUNTING WELDING PROCEDURES

Weld all miscellaneous suspension componentry using the parameters at the beginning of this section.

The following figures are examples of typical suspension installations. The procedures illustrated may need to be adapted due to varying trailer designs.

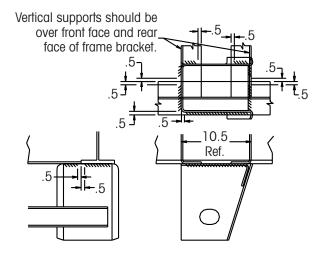
NOTE: Unless otherwise noted, all welds are to be $^{1}/_{4}$ inch minimum.

IMPORTANT: Starting and stopping points should be **no** closer than ¹/₂ inch from the mating edge of the suspension component and the trailer frame and/or the crossmembers.

NOTE: It is the responsibility of the suspension installer and the vehicle designer to provide both adequate vehicle frame design and proper securing method for the suspension system.

NOTE: The suspension installer has the responsibility to determine the proper welding parameters for the materials being used. For specifications of the suspension component material, contact Hendrickson.

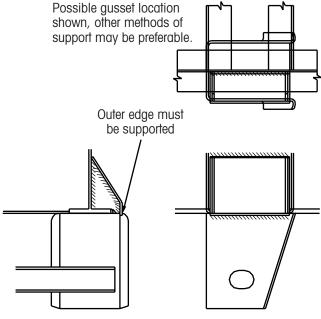
The attachments shown are designed to properly support the suspension. The suspension frame brackets are not to be used as a structural component of the trailer. Close attention should be paid to the attachment of the trailer crossmember to the trailer main rail to ensure that the frame bracket does not support this connection. Contact Hendrickson Trailer Suspension Systems at (330) 456-7288 with any questions concerning this connection.



(All dimensions in inches unless noted)

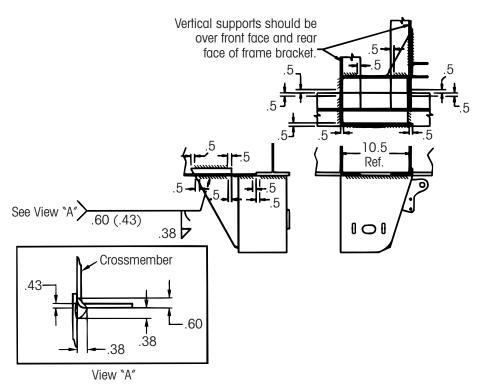
Figure 8. Typical frame bracket-to-frame attachment

If location is such that the outer face of frame bracket is not adequately supported, additional gussets may be required (not supplied by Hendrickson).



Weld shown to be performed in addition to the welds shown in Figures 8 or 10.

Figure 9. Severe offset frame bracket attachment; winged or wingless



(All dimensions in inches unless noted)

Figure 10. Typical winged frame bracket-to-frame attachment

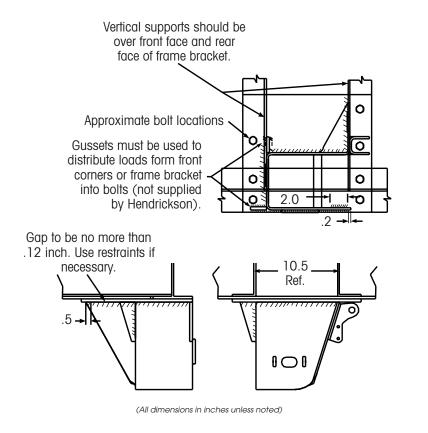


Figure 11. Frame bracket-to-mounting plate attachment (customer supplies bolt-on plate and gussets)

WELDING THE AIR SPRING MOUNTING PLATE

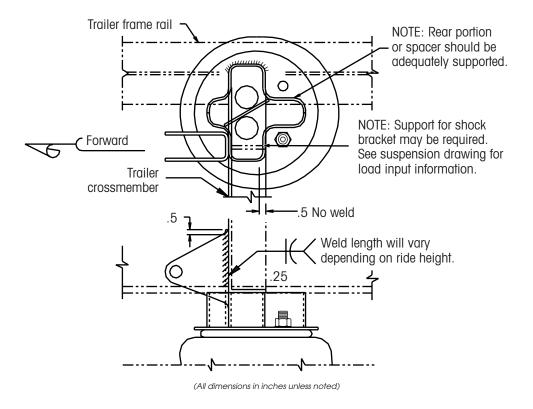


Figure 12. Air spring spacer attachment

NOTE: DO NOT ATTACH the air spring mounting plate or air spring to BOTH the trailer main rail and the trailer crossmember. The air spring mounting is not designed to resist the movement between the trailer crossmember and the main rail.

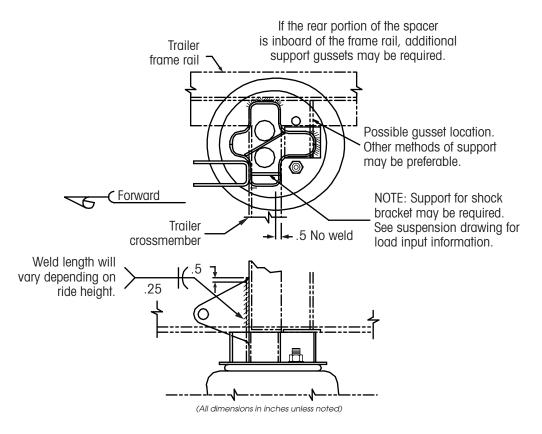


Figure 13. Severe offset mounting with spacer

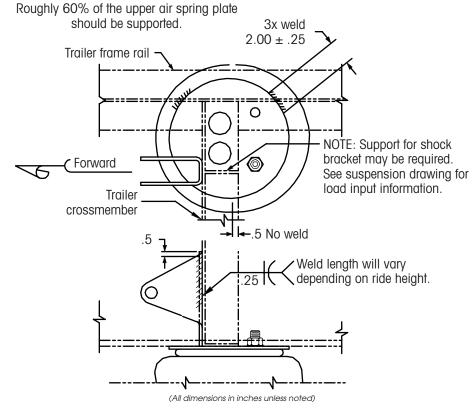


Figure 14. Air spring mounting plate attachment

If the air spring mounting plate is inboard of the frame rail, additional support gussets may be required.

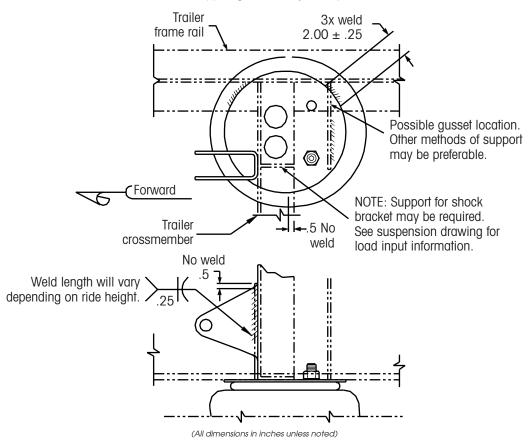


Figure 15. Severe offset mounting without spacer

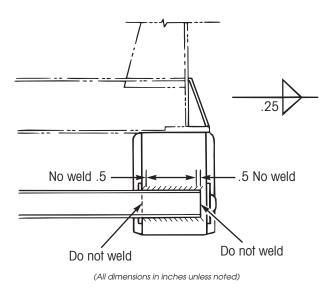


Figure 16. C-channel attachment to frame bracket

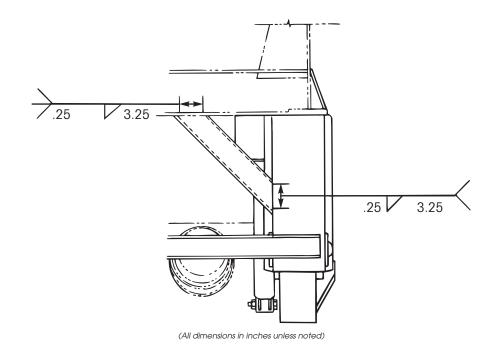


Figure 17. Frame bracket knee brace attachment

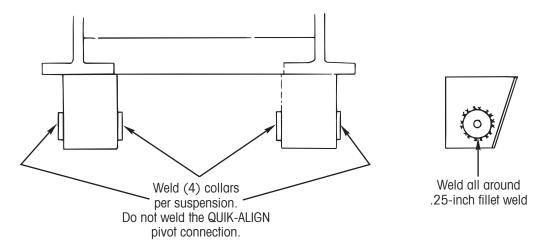


Figure 18. Welding collars

APPENDIX A: ALTERNATIVE AXLE WELD PROCEDURE

NOTE: If you are adjusting the weld position to the flat position 1F with the suspension beams in the vertical position, follow the alternative welding procedure shown in Figure A1.

NOTE: If you are welding the 2F position, refer to the AXLE WELD PROCEDURE — HT SUSPENSIONS section found on page 4.

Avoid all cold laps and undercuts. Fill all craters. Clean weld between each pass. If these steps are not followed, then failure could occur with the axle-to-suspension connection.

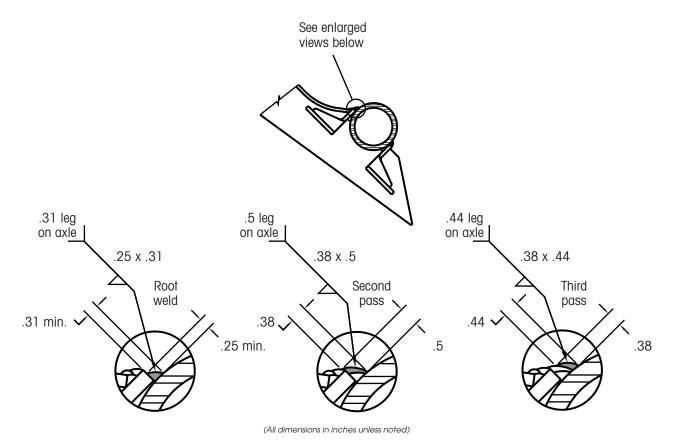


Figure A1. Axle weld passes — all HT suspensions

WELD PASS LENGTH AND PLACEMENT

AXLE WELD PASSES — SIZE AND LOCATION

NOTE: All axle seat connections require three weld passes. Figure A1 shows the location and size of each weld. All passes are to be performed as shown.

AXLE WELD LENGTH AND POSITION

Figures A2 and A3 show the length and position of the axle weld. All weld passes are to be performed as shown.

IMPORTANT: The weld length is dependent on the type of suspension being installed. When installing the HT190T, HT190U, HT230, HT250T, or HT300, use Figure A2. When installing the HT250U or HT300U, use Figure A3.

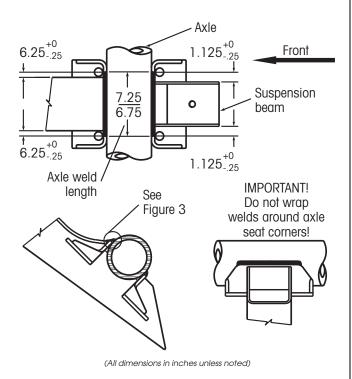


Figure A2. HT190T, HT190U, HT230, HT250T and HT300T

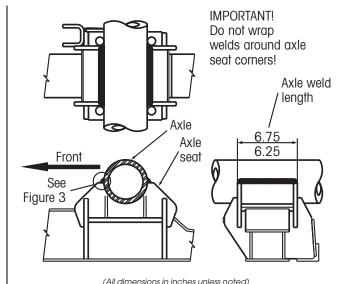


Figure A3. HT250U and HT300U

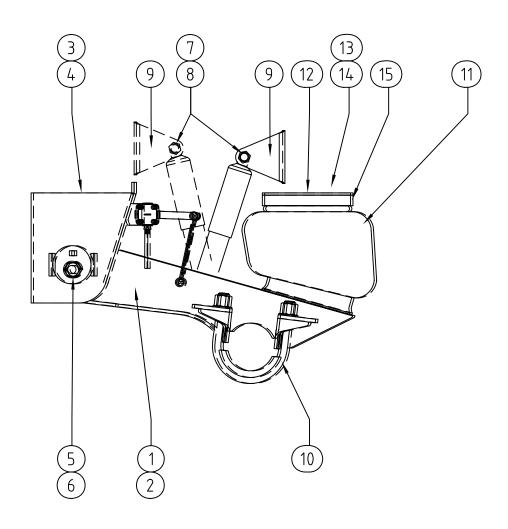


A Boler Company

2070 Industrial Place SE • Canton, Ohio 44707-2600 USA Phone (330) 456-7288 • Fax (330) 456-0105

250 Chrysler Drive, Unit #3 • Brampton, Ontario L6S 6B6 CAN Phone (905) 789-1030 • Fax (905) 789-1033

Hendrickson HT230TA15-523 Parts List

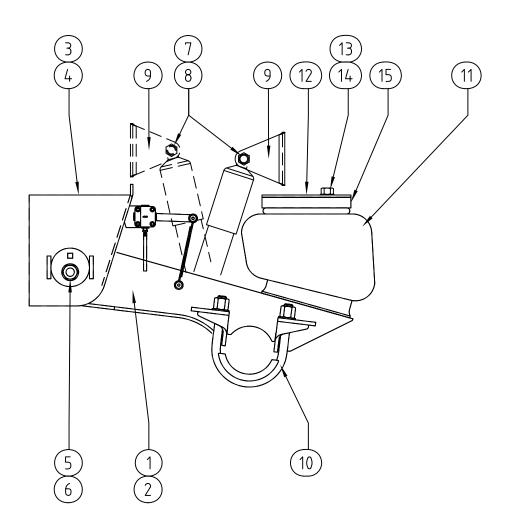


From HT230TA15-524 Steelbro.dwg

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		211d1 1610 2011 11 d1 1 2 1 2 1 2 1 1 1 1 2 2 2 1 1 1 1			
15	98947-001	Spacer Airspring	2.00		Only for 378-409 Ride height
14	S-22630	Hardware Kit Airspring	2.00		Only for 378-409 Ride height
13	S-21251	Air Spring Mounting Kit	1.00		Only for 350-381 Ride height
12	98948-001	Plate-Air Spring Mounting	2.00		
11	S-21208	Air Spring	2.00		
10	A-21140	U-Bolt/Spacer Kit	1.00		
9	C-20023	Upper Shock Clevis	2.00		Can be mounted in either position
8	A-20031	Shock Bolt Kit	1.00		Can be mounted in either position
7	A-20002	Shock absorber	2.00		Can be mounted in either position
6	S-24691	Tri-Function Bush Kit	2.00		
5	S-24680	Pivot Bolt/Washer Kit, QA	2.00		
4	D-21179-2	Frame Bracket assembly (RH)	1.00		
3	D-21179-1	Frame Bracket assembly (LH)	1.00		
2	D-20000-2	Beam Assembly (RH)	1.00		
1	D-20000-1	Beam Assembly (LH)	1.00		
Item	Part No	Description	Qty	Unit	Notes

Hendrickson HT230TA15-524 Parts List



From HT230TA15-524 Steelbro.dwg

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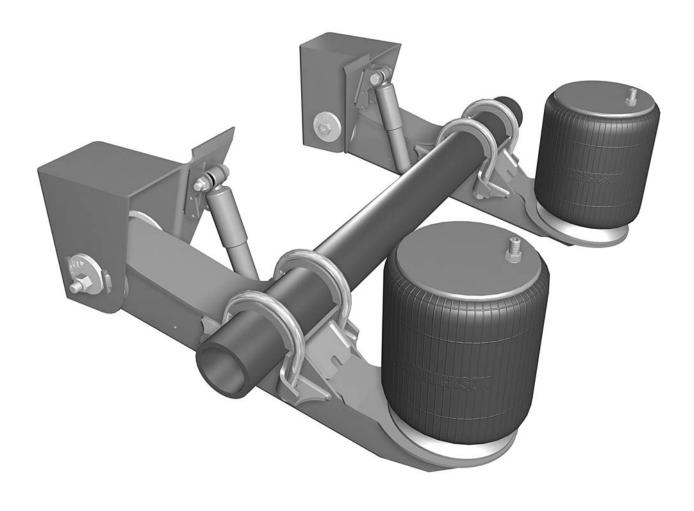
		indirection in direction in the state of the			
15	98947-001	Spacer Airspring	2.00		Only for 378-409 Ride height
14	S-22630	Hardware Kit Airspring	2.00		Only for 378-409 Ride height
13	S-21251	Air Spring Mounting Kit	1.00		Only for 350–381 Ride height
12	98948-001	Plate-Air Spring Mounting	2.00		
11	S-21208	Air Spring	2.00		
10	A-21140	U-Bolt/Spacer Kit	1.00		
9	C-20023	Upper Shock Clevis	2.00		Can be mounted in either position
8	S-27615	Shock Bolt Kit	1.00		Can be mounted in either position
7	S-21699	Shock absorber	2.00		Can be mounted in either position
6	S-24691	Tri-Function Bush Kit	2.00		
5	S-24680	Pivot Bolt/Washer Kit, QA	2.00		
4	D-21179-2	Frame Bracket assembly (RH)	1.00		
3	D-21179-1	Frame Bracket assembly (LH)	1.00		
2	S-27614-2	Beam Assembly (RH)	1.00		
1	S-27614-1	Beam Assembly (LH)	1.00		
Item	Part No	Description	Qty	Unit	Notes

HT250US

LIT NO: L582

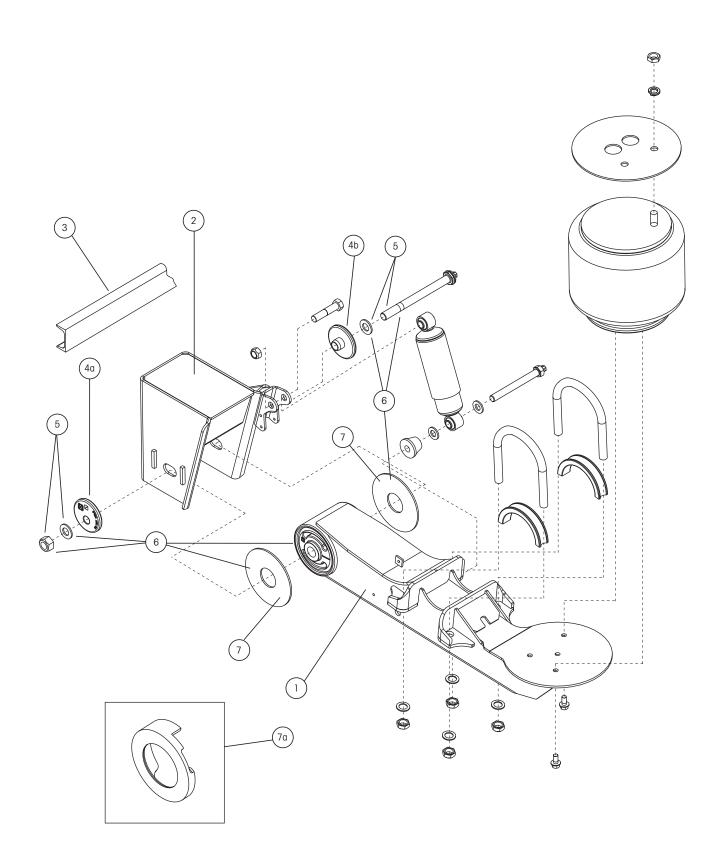
DATE: September 2002

REVISION: A









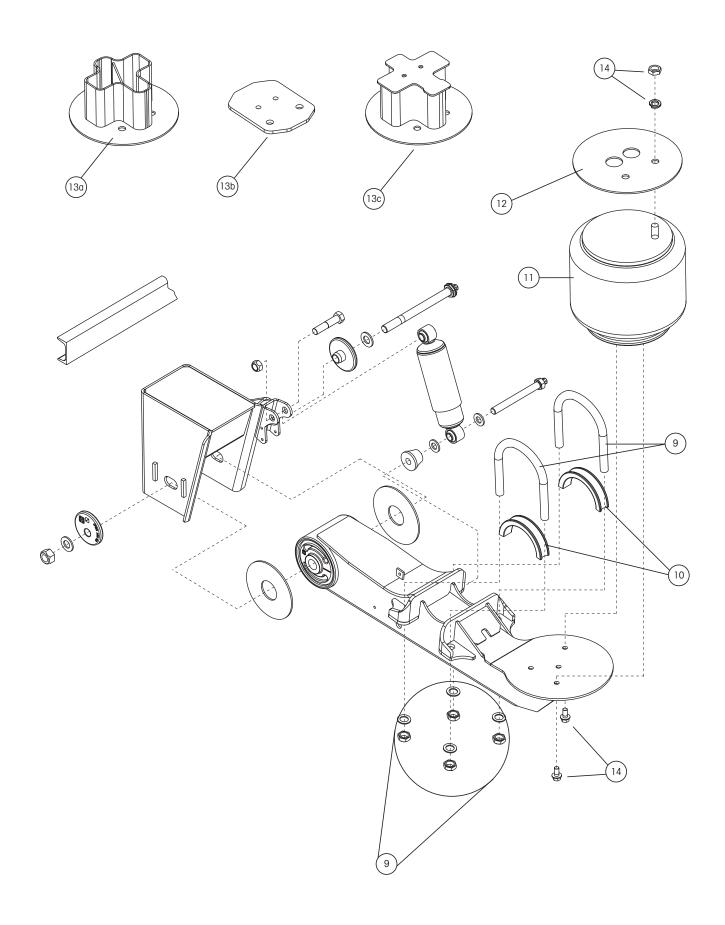


ITEM	DESCRIPTION	PART NO.	QTY.	NOTE				
	Available in ride heights of 3.5", 4", 5.5	", 6.5", 7.5", 9", 12", 1	14"					
1	BEAM ASSEMBLY	, , . , . , . , . , . , . , . , . ,						
	Roadside	D-24186-1	1	Includes bushing				
	Curbside	D-24186-2	1	Includes bushing				
2	FRAME BRACKET ASSEMBLY ¹ (Ride Hei	ght Specific)		· ·				
	Weld-on, 3.5" and 4" Standard Travel							
	Roadside	C-23848-1	1	Measures 4.5" from center of pivot hole to top plate;				
	Curbside	C-23848-2	1	8" overall height				
	Weld-on, 5.5" and 6.5" RH, Standard	Travel						
	Roadside	D-22826-1	1	Measures 8" from center of pivot hole to top plate;				
	Curbside	D-22826-2	1	11.5" overall height				
	Weld-on, 6.5" RH, Limited Jounce —		RH Stan					
	Roadside	D-22827-1	1	Measures 10" from center of pivot hole to top plate;				
	Curbside	D-22827-2	1	13.5" overall height				
	Weld-on, 12" RH, Standard Travel	D 22021 2	•	10.0 Ovoran Holgin				
	Roadside	D-22828-1	1	Measures 12" from center of pivot hole to top plate;				
	Curbside	D-22828-2	1	15.5" overall height				
		Weld-on, 12" RH, Limited Jounce — Weld-on, 14" RH, Standard Travel						
	Roadside	D-22829-1	1	Measures 14" from center of pivot hole to top plate;				
	Curbside	D-22829-1	1	17.5" overall height				
	Bolt-on, 5.5" and 6.5" RH, Standard 1		ı	17.5 Overdii Heigili				
	Roadside	D-23009-1	1	Measures 8.375" from center of pivot hole to top plate;				
			1					
		Curbside D-23009-2 1 11.875" overall height Bolt-on, 7.5" and 9" RH, Standard Travel — Bolt-on, 6.5", 7.5" and 9" RH, Limited Jounce						
			.5 0110					
	Roadside	D-23010-1	1	Measures 10.375" from center of pivot hole to top				
	Curbside	D-23010-2	I	plate; 13.875" overall height				
	Bolt-on, 12" RH, Standard Travel	D 00011 1	-	Manager 10 075 from a solar of about help to be				
	Roadside	D-23011-1]	Measures 12.375" from center of pivot hole to top				
	Curbside	D-23011-2	'	plate; 15.875" overall height				
	Bolt-on, 12" RH, Limited Jounce — B		ra Iravel					
	Roadside	D-23012-1	1	Measures 14.375" from center of pivot hole to top				
	Curbside	D-23012-2	1	plate; 17.875" overall height				
3	C-CHANNEL	A-1631-19	1					
_4	ALIGNMENT COLLARS							
<u>4a</u>	Eccentric Washer, QUIK-ALIGN®	S-20925	2	Pivot bolt hole is offset from center of collar				
4b	Concentric Washer, QUIK-ALIGN	S-20924	2	Pivot bolt hole is in center of collar				
5	QUIK-ALIGN PIVOT BOLT KIT	S-24679	2	Includes shear-type bolt, hexnut and hardened washers				
6	TRI-FUNCTIONAL® PIVOT BUSHING KIT	S-24691	2	Includes bushing, shear-type bolt, hexnut, bushing tube				
	with QUIK-ALIGN			spacers and hardened washers				
_7	BUSHING TUBE SPACER	S-11613	4	Sold individually				
7a	Bushing Tube Spacer — Glove Style	S-27446		Scheduled to replace item 7 in 2003.				
				Contains 2 molded and 1 flat spacer				
8	BUSHING TUBE SPACER KIT	S-26369	2	Includes shear-type bolt, hexnut, hardened washers				
				and bushing tube spacers (Not identified)				

Weld-on and Bolt-on refers to suspension frame attachment

¹ Other options exist. Contact your Customer Service Representative for specific model numbers.





4

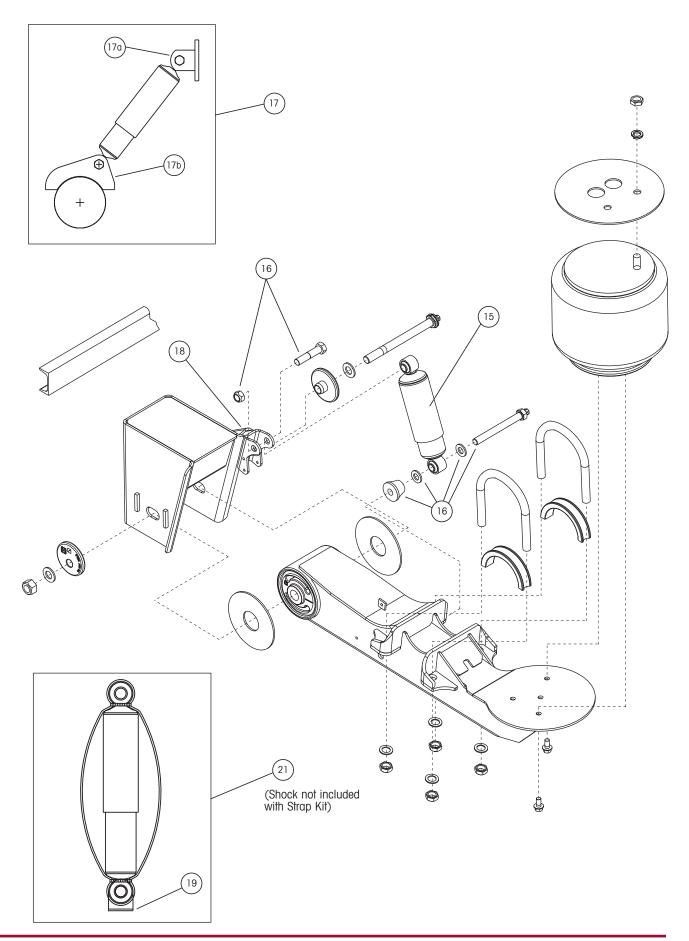


ITEM	DESCRIPTION	PART NO.	QTY.	NOTE	
9	U-BOLT KIT			All kits contain (1)	U-Bolt, washers and high nuts
	17.5" Tires, All Ride Heights, Standard Travel	S-22894/4	4	Flattened U-Bolt	
	17.5" Tires, 6.5" to 12" RH, Limited Jounce	S-22894/4	4	Flattened U-Bolt	
	17.5" Tires, 6.5" to 9" RH, Extended Rebound	S-22894/4	4	Flattened U-Bolt	
	19.5" Tires, 3.5" to 4" RH, Standard Travel	S-20032/4	4	Rounded U-Bolt	
	19.5" Tires, 5.5" to 6.5" RH, Standard Travel	S-22894/4	4	Flattened U-Bolt	
	19.5" Tires, 7.5" to 14" RH, Standard Travel	S-20032/4	4	Rounded U-Bolt	
	19.5" Tires, 6.5" to 12" RH, Limited Jounce	S-20032/4	4	Rounded U-Bolt	
	19.5" Tires, 6.5" RH, Extended Rebound	S-22894/4	4	Flattened U-Bolt	
	19.5" Tires, 7.5" to 9" RH, Extended Rebound	S-20032/4	4	Rounded U-Bolt	
10	AXLE SPACER	S-20701	4		
11	AIR SPRING ¹	0 20701	•		
	4" RH, Standard Mounting	S-20010	2	Replace C-20010	
	3.5" and 4" RH, Standard Mounting,	0 20010		11001000 0 20010	
	Hi PSI Spring	S-20223	2	Replace C-20223	
	5" through 14" RH, Standard Mounting	S-20223	2	Replace C-20127	
	5" through 14" RH, Rotated Mounting	S-20127	2	Replace C-20414	
	6.5" RH, Hi PSI, Short Bellows	S-20414 S-20716	2	Replace C-20414	
	7.5" through 14" RH, Hi PSI,	3-20710		Replace 6-20710	
	Standard Mounting	S-20124	2	Poplace C 20124	
	Rotated Mounting	S-20124 S-20413	2	Replace C-20124 Replace C-20413	
12	AIR SPRING MOUNTING PLATE	3-20413		· · · · · · · · · · · · · · · · · · ·	g plates fit standard and
12	AIR SPRING MOUNTING PLATE				.
	All to Oll Wold on Chandard Traval	D 01000		rotated mounting t	ypes
	4" to 9" Weld-on, Standard Travel	B-21209	2 2		
	6.5" to 9" Weld-on, Extended Rebound	B-21209	2		
13	5.5" to 9" Bolt-on, Standard Travel AIR SPRING SPACER ASSEMBLY Spacer with mou	B-21211		Air opring angeore	fit atandard and rotated air
13	AIR SPRING SPACER ASSEMBLE Spucer will flou	illing plute			fit standard and rotated air
				spring mounting ty	/pes
13a	6.5" and 7.5" Weld-on, Limited Jounce	C-21210-1	2	With 1" spacer	Without top plate for weld-on applications
	9" Weld-on, Limited Jounce	C-21210-3	2	With 3" spacer	
	12" Weld-on, Standard Travel	C-21210-3	2	With 3" spacer	
	12" Weld-on, Limited Jounce	C-21210-5	2	With 5" spacer	
	14" Weld-on, Standard Travel	C-21210-5	2	With 5" spacer	\
13b	5.5" to 9" Bolt-on, Standard Travel	B-22990-1	2		
13c	6.5" and 7.5" Bolt-on, Limited Jounce	C-21215-1	2	With 1.2" spacer	With top plate for bolt-on applications
	9" Bolt-on, Limited Jounce	C-21215-3	2	With 3.2" spacer	151
	12" Bolt-on, Standard Travel	C-21215-3	2	With 3.2" spacer	
	12" Bolt-on, Limited Jounce	C-21215-5	2	With 5.2" spacer	
	14" Bolt-on, Standard Travel	C-21215-5	2	With 5.2" spacer	—
14	AIR SPRING MOUNTING KIT	0 2 1 2 1 0 0		77111 O.Z OPGOOI	V
	3.5" and 4" RH, Weld-on, Standard Travel	S-20033/2	2	Order 1 kit per air	snring
	5.5" to 14" RH, Weld-on,	0 20000/2		order i kii per dii	opinig
	All Travel Specifications	S-20033/2	2		
	6.5" to 12" RH, Bolt-on, Limited Jounce	S-20033/2	2		
	5.5" to 9" RH, Bolt-on, Standard travel	S-20033/2 S-23123/2	2		
	12" to 14" RH, Bolt-on, Standard travel	S-20033/2	2		
	12 10 14 KH, Doll-OH, Sluthualu Huvel	3-20033/2			

Weld-on and Bolt-on refers to suspension frame attachment

¹ Other options exist. Contact your Customer Service Representative for specific model numbers.



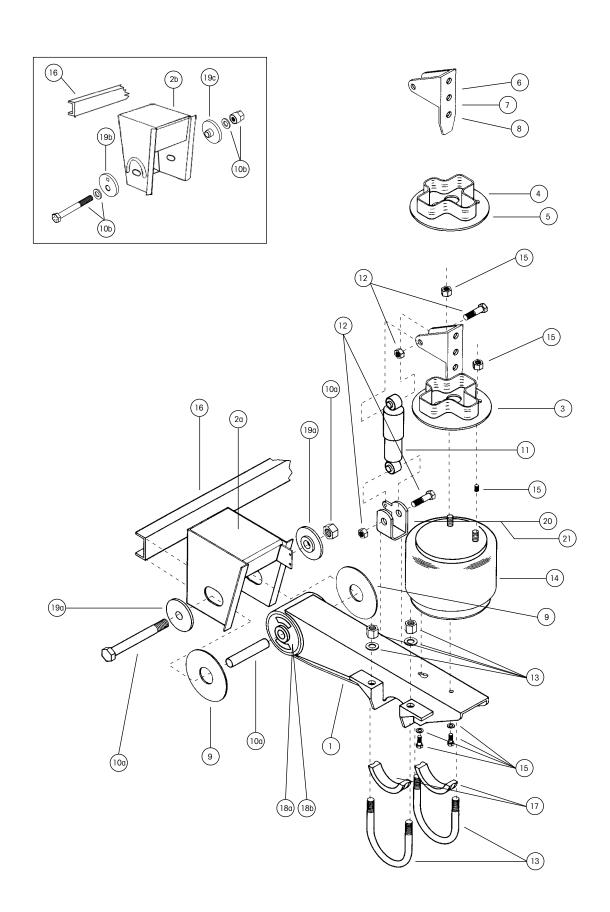




ITEM	DESCRIPTION	PART NO.	QTY.	NOTE
15	SHOCK ABSORBER			
	3.5" to 4" RH, Weld-on, Standard Travel	S-23548	2	Use to replace B-23548
	5.5" and 6.5" RH, Weld-on and Bolt-on,			
	Standard Travel	S-23650	2	Use to replace B-23650
	7.5" to 14" RH, Weld-on and Bolt-on,			
	Standard Travel	S-23649	2	Use to replace B-23649
	5.5" and 6.5" RH, Weld-on and Bolt-on,			
	High Dampening	S-23744	2	Use to replace B-23744
	7.5" to 14" RH, Weld-on and Bolt-on,			
	High Dampening	S-23743	2	Use to replace B-23743
	6.5" to 12" RH, Weld-on and Bolt-on,			
	Limited Jounce	S-23649	2	Use to replace B-23649
	6.5" to 12" RH, Weld-on and Bolt-on,			
	High Dampening, Limited Jounce	S-23743	2	Use to replace B-23743
	Remote location shock, weld-on frame			
	5.5" to 6.5" RH, Standard Travel	S-23650		Use to replace B-23650
	7.5" to 9" RH, Standard Travel	S-23649		Use to replace B-23649
	12" to 14" RH, Standard Travel	S-2212		Use to replace A-2212
	6.5" to 9" RH, Extended Rebound	S-2212		Use to replace A-2212
	5.5" to 6.5" RH, High Dampening,			
	Standard Travel	S-23744		Use to replace B-23744
	7.5" to 9" RH, High Dampening,			
	Standard Travel	S-23743		Use to replace B-23743
	6.5" to 9" RH, High Dampening,			
	Extended Rebound	S-23316		Use to replace B-23316
16	SHOCK BOLT KIT	S-24024		Standard and remote mounting
17	REMOTE SHOCK MOUNT			Also order shock bolt kit S-24024
17a	Upper Assembly	A-5431		Includes clevis and shock plate
7b	Lower Assembly	B-2723		Includes shock bracket
18	UPPER SHOCK CLEVIS			
	Standard	S-2592	2	
	For use with Shock Straps	C-20113	2	
19	SHOCK STRAP CLEVIS	B-20919		
20	OFFSET HCV BRACKET	B-23850		
21	SHOCK STRAP KITS			All kits include (2) straps, (2) clevis and (4) nylon ties
	3.5" to 4" RH, Weld-on, Standard Travel	C-23086-11		For use with shock B-23548
	5.5" and 6.5" RH, Weld-on and Bolt-on,			
	Standard Travel	C-23086-3		For use with shock B-23650
	7.5" to 14" RH, Weld-on and Bolt-on,			
	Standard Travel and High Dampening	C-23086-5		For use with shock B-23649 and B-23743
	5.5" and 6.5" RH, Weld-on and Bolt-on,			
	High Dampening	C-23086-10		For use with shock B-23744
	6.5" to 12" RH, Weld-on and Bolt-on,			
	Limited Jounce and Standard Travel	C-23086-5		For use with shock B-23649 and B-23743

Weld-On and Bolt-On refers to suspension frame attachment

MODEL HT300T (TOP MOUNT STYLE)



ITEM	DESCRIPTION	PART NO.	QTY	MODEL NO.	(HT300 <u>?</u> or N	N-HT300 <u>?</u>)
_1	BEAM ASSEMBLY	D 20196 1	1	A11		
	Roadside	D-20186-1	1	ALL		
	Curbside	D-20186-2	1	ALL		
2	FRAME BRACKET					
<u>2a</u>	Wingless, Welded Alignment,	0.00100.1	1	15 001	15.005	15.007
-	Roadside, Weld-on	C-20196-1	1	-15-001	-15-005	-15-007
-		C-20197-1	1	-17-001	-17-007	
		C-20286-1	1	-15-016	17.010	
	Wingless Wolded Alignment	C-20065-1	1	-17-003	-17-012	
	Wingless, Welded Alignment, Curbside, Weld-on	C-20196-2	1	-15-001	-15-005	-15-007
	Curbside, Weid-Oil	C-20196-2 C-20197-2	<u> </u>	-17-001	-17-005	-10-007
		C-20197-2 C-20286-2	1	-17-001	-17-007	
					17.010	
	Wingless Wolded Alignment	C-20065-2]	-17-003	-17-012	
	Wingless, Welded Alignment,	D 20100 1	1	17.000	10.004	
	Roadside, Bolt-on	D-20190-1	1	-17-002	-19-004	
		C-20189-1	1	-15-002	-15-011	
		C-21122-1	1	-15-025		
		D-22281-1	1	-17-022		
	Minutes Malded Alleger	C-20008-1]	-17-004		
	Wingless, Welded Alignment,	D 00100 0		17.000	10.004	
	Curbside, Bolt-on	D-20190-2	1	-17-002	-19-004	
		C-20189-2	1	-15-002	-15-011	
		C-21122-2	1	-15-025		
		D-22281-2	1	-17-022		
		C-20008-2]	-17-004		
2b	Wingless, QUIK-ALIGN®,	0.00700.1		TD15 001		
	Roadside, Weld-on	C-23790-1	1	TB15-001		
	Wingless, QUIK-ALIGN®,					
	Curbside, Weld-on	C-23790-2	1	TB15-001		
3	AIR SPRING/SHOCK MOUNT	0.00100.1		15.001	TD15 001	15.005
	Roadside	C-20199-1]	-15-001	TB15-001	-15-005
				-15-016		
		C-20191-1	1	-17-001	-17-002	-17-022
		C-20188-1	1	-15-002		
		C-20195-1	1	-17-003	-17-004	
		C-20708-1	1	-19-004		
	Curbside	C-20199-2]	-15-001	TB15-001	-15-005
				-15-016		
		C-20191-2	1	-17-001	-17-002	-17-022
		C-20188-2	1	-15-002		
		C-20195-2	1	-17-003	-17-004	
		C-20708-2]	-19-004		
_4	AIR SPRING SPACER ASSEMBLY					
	Roadside	C-20329-1	1	-17-007		
		C-20309-1]	-17-012		
	Curbside	C-20329-2	1	-17-007		
		C-20309-2	1	-17-012		
5	AIR SPRING PLATE	C-20192	2	-15-007		
6	UPPER SHOCK CLEVIS ¹	S-2592	2	-15-007	-17-007	-17-012
7	UPPER SHOCK BRACKET					
	Roadside	C-21797-1	1	-15-025		
	Curbside	C-21797-2	1	-15-025		

 $^{^{\}rm 1}$ Picture depicted may not resemble all models.

MODEL HT300T (TOP MOUNT STYLE) cont.

ITEM	DESCRIPTION	PART NO.	QTY	MODEL NO.	(HT300 <u>?</u> or	N-HT300 <u>?</u>)
_8	SHOCK BRACKET ASSEMBLY	S-9002	2	-15-011		
9	BUSHING WEAR PAD	S-11613	4	ALL		
10	PIVOT BOLT KIT					
<u>10a</u>	Welded Alignment	S-3646	2	-15-001	-15-002	-15-005
				-15-007	-15-011	-15-016
				-15-025	-17-001	-17-002
				-17-003	-17-004	-17-007
				-17-012	-17-022	-19-004
10b	QUIK-ALIGN®	S-21052	2	TB15-001		
11	SHOCK ABSORBER	S-20126	2	-15-001	TB15-001	-15-002
				-15-005	-15-016	-15-025
				-17-001	-17-002	-17-003
				-17-004	-17-022	-19-004
		S-2160	2	-15-007	-15-011	-17-007
				-17-012		
12	SHOCK ABSORBER BOLT KIT	S-20031/2	2	-15-001	TB15-001	-15-002
				-15-005	-15-016	-15-025
				-17-001	-17-002	-17-003
				-17-004	-17-022	-19-004
		S-2157/2	2	-15-007	-15-011	-17-007
				-17-012		
13	U-BOLT KIT	S-20032/4	4	ALL		
14	AIR SPRING	S-4771	2	ALL		
15	AIR SPRING BOLT KIT	S-4903/2	2	ALL		
16	FRAME BRACKET CHANNEL	A-1631-19	1	-15-001	TB15-001	-15-002
				-15-005	-15-007	-15-011
				-15-025	-17-001	-17-002
				-17-003	-17-004	-17-007
				-17-012	-17-022	-19-004
17	AXLE SPACER	S-20701	4	ALL		
18	TRI-FUNCTIONAL® II BUSHING KIT ²					
18a	Welded Alignment	A-6914	2	-15-001	-15-002	-15-005
				-15-007	-15-011	-15-016
				-15-025	-17-001	-17-002
				-17-003	-17-004	-17-007
				-17-012	-17-022	-19-004
18b	QUIK-ALIGN®	S-21166	2	TB15-001		
19	ALIGNMENT COLLARS					
19a	Welded Alignment	S-2770	4	-15-001	-15-002	-15-005
				-15-007	-15-011	-15-016
				-15-025	-17-001	-17-002
				-17-003	-17-004	-17-007
				-17-012	-17-022	-19-004
19b	Eccentric, QUIK-ALIGN®	S-20925	2	TB15-001		
19c	Concentric, QUIK-ALIGN®	S-20924	2	TB15-001		
20	LOWER SHOCK CLEVIS ³	C-20069	2	-15-001	-15-002	-15-005
				-15-016	-15-025	-17-001
				-17-002	-17-003	-17-004
				-17-022	-19-004	TB15-001
21	LOWER SHOCK BRACKET	S-2723	2	-17-007	-17-012	

² The Tri-Functional® II Bushing Kit includes Item #10 (Pivot Bolt Kit) and Item #9 (Bushing Wear Pad). Bushing Tool, S-21307, is required to correctly re-bush the suspension.

 $^{^{\}rm 3}$ Lower Shock Clevis is included when ordering Item #1 (Beam Assembly).



YORK TRANSPORT EQUIPMENT PTY LTD

13 Monterey Road Dandenong VIC 3175 ABN 25 006 303 206

YORK TRAILER AXLE SERVICE MANUAL

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SERVICE INFORMATION & WARRANTY CONDITIONS

York Trailer Axles

York trailer axles are guaranteed for one year against faulty parts and workmanship. However, attention to the following is crucial to that warranty:-

- (i) No York axle should be loaded to more than the design load of 10 tonnes or the design load agreed to by York (in writing) for any particular application.
- (ii) York axles must not be operated with the brake torque (chamber size and lever length) in excess of the Australian Design Rule compliance for that trailer.
- (iii) All welding to York axle beams should be carried out strictly in accordance with York's technical specifications.
- (iv) At point of manufacture, York have adjusted the wheel bearings in accordance with York's technical specification. This must be checked at the first 5000 Km service and readjusted, if necessary, to be within this range.
- (v) York have marked the outer nut at the spindle keyway to provide a reference to the initial factory setting. When the bearings have been readjusted the mark might not be at the keyway, this will be because of the bearings "settling in" during the initial service period. The locknut must be re-torqued to 340 to 400Nm each time the bearings are rechecked.
- (vi) Operation of York axles in correctly specified applications, with regular inspection adjustment and lubrication is vital to ensure maximum life of all components and to comply with York's warranty conditions. The enclosed Service Information Data sheet sets out the <u>minimum</u> servicing requirements.

ROBERT LAIRD General Manager



York Trailer Axles

First 500 Kilometres

Check tightness of all wheel nuts - On delivery

After wheel changes

Note: Recommended torque settings, dry threads (the use of power tools for torque settings is not recommended).

1. Wheel Nuts (Note: 1ft/lb = 1.36Nm)

ISO M22 studs - 550/600 Nm
ISO M24 studs - 650/750 Nm
BSF 7/8" BSF studs - 475/540 Nm
DIN 22mm studs - 515/540 Nm
Japanese M20 studs - 400/440 Nm
Japanese M24 studs - 650/750 Nm
Spider Hubs 3/4" UNC - 200/260 Nm

2. Camshaft Bracket Setscrews

M12 - 90/100 Nm M10 - 30/35 Nm

Lubricate camshaft grease nipples using EP2 grease.

First Service / 5,000 km Full bearing adjustment.

First & every 5,000 km Check and adjust brakes and check brake linings for wear.

Every 25,000 km Lubricate slack adjuster and camshafts using EP2 grease or equivalent.

Rotate wheels and check wheel bearings to ascertain if there is excessive

bearing movement. Readjust as necessary.

Every 100,000 km Remove hubcaps, inspect bearings and lubrication. Readjust and re-torque

the outer nut, resecure lock tabs.

Visually check the axle and ancilliary components for cracking, damage

and wear. Repair or replace as necessary.

Every 300,000 km Remove, wash and inspect wheel bearings, replace if necessary.

When re-assembling, bearings must be properly lubricated and adjusted to York's specifications. <u>IMPORTANT NOTE</u> - If the operating service conditions are severe, this procedure may be required at more frequent intervals. Re-adjust bearings after 5,000km's if bearings are replaced.

Bearing Lubricants: Grease - Mobil HP or equivalent.

Oil - Mobil 85W/140 or equivalent.



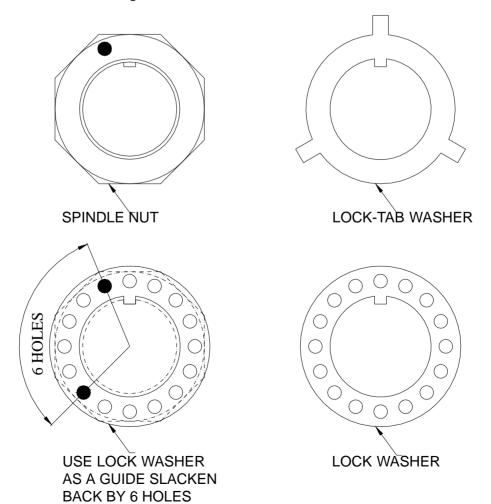
York Trailer Axles

Wheel Bearing Adjustment

We recommend that all axles should have the wheel bearings adjusted initially after the first 5,000 km and then at 100,000 km intervals. This does not preclude the need for inspecion and adjustment as necessary every 25,000 kms if service conditions require this.

The recommended wheel bearing adjustment procedure is:-

- 1. Make sure that the hub revolves freely and if necessary temporarily slacken off the brake adjustment to ensure complete freedom from brake binding (drag).
- 2 Rotate the hub in both directions at the same time tightening the bearing adjusting nut. Continue until a binding is felt and a torque setting of 100 Nm is reached.
- 3. Using the lockwasher as a guide, slacken the adjusting nut back 6 holes and refit the lockwasher. Fit the lock-tab washer. Taking care that the adjustment is not disturbed, fit and tighten the axle locknut to 380 Nm. Check end float. Check that the hub and drum rotates freely. Bend the tabs on the lock-tab washer over to prevent the locknut coming loose in service.





Con Met PreSet Hubs



Note: PreSet hubs are designed for extended service without any maintenance. If circumstances (overhaul, accident, abuse etc.) indicate service is required, PreSet hubs should be serviced with the close tolerance bearings indicated on the "Part Number Identification" chart. In the event that these bearings are not available, standard bearings can be used by following the conversion procedure below.

IDENTIFICATION: See "Part Number Identification" table on page 7.

HUB MAINTENANCE:

- 1. Thoroughly clean and inspect any hub that has been removed for service. Discard used seals and gaskets. Use new
 - seals and gaskets on reinstallation and replace worn or damaged parts.
- 2. Clean and inspect the wheel bearings, spacer and hub each time the hub is removed or when contamination is evident. If a bearing, cup or spacer needs to be replaced, replace all bearings and cups. See "Bearing Cup Replacement" under "Hubs with Manually Adjusted Bearings." Also, replace the spacer if it shows signs of damage. See the "Part Number Identification" chart for part numbers.
- 3. If, in case of emergency field repair, the PreSet hub bearings as listed in the identification chart are not available, your PreSet hub can be easily converted (see "Conversion Procedure" below) into a conventionally manually adjusted hub and bearing set by removing the spacer. Be sure to follow the manual bearing adjustment procedure (see "Specifications") if you convert your PreSet hub to the manually adjusted system.
- 4. For additional service information, see the required topic under "Hubs with Manually Adjusted Bearings".

CONVERSION PROCEDURE:

If any parts identified as manual adjust parts are used to service a PreSet hub follow the procedure below.

- 1. Remove the tubular spacer from the assembly. It is not used when the bearings are manually adjusted. Save the tubular spacer so the hub can be converted back into a PreSet hub.
- 2. Assemble the hub onto the spindle as a conventional hub and bearing assembly, as described in the section "Hubs with Manually Adjusted Bearings."
- 3. Use a spindle lock nut system as used on manually adjusted hubs to establish the bearing adjustment.
- 4. To return the hub to Preset configuration, replace all manual adjust cups, cones and seal with the PreSet parts listed in the "Part Number Identification" chart. Next, install the hub with the spacer following the instructions for "Installation" on page 7.

Hubs with Manually Adjusted Bearings

HUB MAINTENANCE:

- 1. Clean and inspect the wheel bearings and seal bore each time the hub is removed or when contamination is evident. Replace damaged bearings and cups as a unit (see "Bearing Cup Replacement").
- 2. See axle manufacturers publications for lubrication requirements and bearing service intervals.



Wheel Stud Removal

DETERMINATION OF DAMAGED WHEEL STUDS

- 1. Replace wheel studs that have damaged or distorted threads, are broken or bent, or are badly corroded. Also, replace the stud either side of the stud being replaced due to damage. If two or more studs have damage, replace all the studs in the hub.
- 2. Always use appropriate safety equipment and take appropriate safety precautions for the job. Safety glasses, gloves, ear protection etc., will be necessary depending on the equipment and process.

WHEEL STUD REMOVAL

- 1. Place the clean hub on a press with the hub supported evenly around and adjacent to the stud being removed.
- 2. Be sure the hub supported so that it will not tip when force is applied to the stud. Then press the stud out of the hub.

The configuration of some hubs is such that it is impractical to have supports that will prevent the hub from tipping when force is applied to the stud. If that is the case, support the hub on wood blocks on the floor and use a hammer to drive the studs out with several sharp blows. Be careful to avoid damage to the hub, particularly to the seal bore and ABS ring.

WHEEL STUD REPLACEMENT

- 1. Check stud length to verify that the stud stand out will be correct.
- 2. To In stall a new stud, support the hub evenly around and adjacent to the stud being installed.

Caution: Some studs have a flat edge on the head. Be sure that the edge is line with the groove or shoulder on the head.

3. Press the new stud all the way into the hub. Be sure the stud is fully seated and that the stud head is not embedded into the hub.

WARNING! If the stud head is embedded into the hub, the hub should be replaced.

BEARING CUP REPLACEMENT

- 1. Separate the hub from the spindle and wheels.
- 2. Thoroughly clean and degrease the hub with a nonflammable solvent.
- 3. It is recommended that the hub be heated evenly throughout in an oven or in boiling water to 175-215°F. See below for an alternative method.
- 4. Remove the hub from the oven or water and quickly press out the bearing cup. Take care to avoid damage to the bearing cup bore and shoulder. (Variations within tolerances of materials and oven temperatures may allow the bearing cup to drop in and out easily).

ALTERNATE PROCEDURE

Use an electric welder to weld a large bead around the bearing surface of the steel cup. Do not spatter weld on to the hub. Let the assembly cool, or quench it in water. The weld will cause the cup to shrink enough to allow it to be easily removed.

- 5. To replace the bearing cup, heat the hub evenly as in step 3 above.
- 6. Remove the hub from the oven or water quickly and press in the new bearing cup. Be sure the cup is properly aligned and fully seated. Take care to avoid damage to the bearing bore and shoulder. Be sure both cups are fully seated before installing the hub. If the cup is being pressed into an unheated hub, additional installation force will be required. To reduce the installation force the cup can be put in a freezer for an hour prior to installation.

Seal Replacement

- 1. The seal should be replaced every time the hub is removed from the spindle.
- 2. Follow the seal manufacturers instructions for removing and installing a new seal. Use the tools recommended by the seal manufacturer.

Con Met PreSet Hubs

Installation

- 1. All PreSet hubs are shipped ready for installation with a thin film of lubricant on the bearings. (Additional lubricant will have to be added after installation). Use only clean parts for service.
- 2. Install the PreSet hub all the way onto the spindle. Allow the temporary plastic alignment sleeve, if present, to be pushed out of the PreSet hub as it is installed onto the spindle. If an alignment sleeve was present, it can be discarded. Once the hub is on the spindle, never remove the outer bearing. Removing the outer bearing may cause the seal to become misaligned, resulting in premature seal failure.
- 3. Remove the temporary plastic bearing cover and install the spindle nut. Torque the spindle nut to 400 Nm. (300 lbft.). Do not back off the spindle nut. It may be necessary to tighten the spindle nut a little more to allow the alignment of the lock washer with the spindle nut. Install the lock tab washer and outer lock nut, toque the lock nut to 280 Nm. (200 lbft.)
- 4. Install the hub cap on the hub. The hub cap bolt holes must be free of debris, such as silicon gasket sealer, to ensure that the bolts will tighten properly to avoid leaks. Always use new gaskets. Use the recommended lubricants to fill the hub, with oil lubricated hubs it may be necessary to add oil to the hub three or four times to assure the correct oil volume.

Con Met PreSet Hub Installation

Torque Applied to all Spindle Nuts

300 lb.ft. (400 Nm.) LOCK IN PLACE - NO BACK OFF

If the locking device is not aligned and locked at 300 lb.ft. (400 Nm.) advance the nut to the next position that allows the nut to lock. Check the nut and verify that the locking system is engaged before installing the hub cap.

PART NUMBER IDENTIFICATION

Description	York Part No.	Timken Part No.
Outer Bearing Cone	79.787955/01	NP899357
Outer Bearing Cup	79.787955/02	NP026773
Inner Bearing Cone	79.787956/01	NP965350
Inner Bearing Cup	79.787956/02	NP503727
PreSet Bearing Spacer	79.104144	



Crewson Brunner

AUTOSLACK FIELD INSPECTION

No Autoslack can compensate for braking System Deficiencies. The brakes should be in good operating condition and be well maintained. Crewson Brunner Autoslacks should not require manual adjustment except for initial installation and brake relines. The Autoslack unit must be installed with a Crewson brunner clevis and template.

By constantly manually readjusting the Autoslack Adjuster, the internal clutch life can be shortened.

AUTOSLACK ON THE VEHICLE

Free Stroke

Free stroke is the distance the slack arm moves in order to make the brake shoes contact the drum. Move the slack arm with a small pry bar and measure the movement distance. This distance should be 10mm to 16mm.

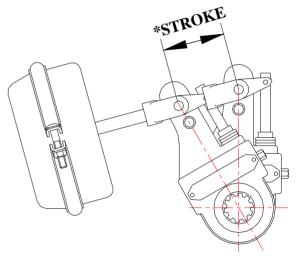
If free stroke is greater than 16mm, check the foundation brake components. Repair and replace as needed.

Push Rod Power Stroke

Measure the power stroke (the difference between when the brake is off and when air is fully applied) at 80 to 90 psi application pressure.

* This distance (Stoke) must be less than or equal to the maximum in the chart below.

Chamber Types	Adjusted stroke			
16, 20, 24	less than or equal to 44mm.			
30	less than or equal to 51mm.			
36	less than or equal to 57mm.			



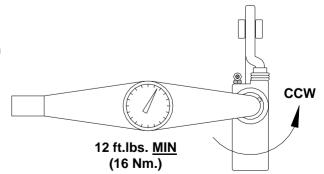
* If the stroke is correct the Autoslack is operating properly. No other tests are necessary.

Back Torque

With the Autoslack correctly installed on the axle, Back Torque (CCW Rotation) can be measured. Using a torque wrench, turn the Adjusting Hex CCW. Back Torque will increase to a peak value, then return to zero as the ratchet clutch disengages.

Replace Autoslack if the Back (CCW) Torque reading is less than 12 ft.lbs. (16 Nm.)

Rotate the Hex shaft a maximum of 5 clicks (ratchet teeth) while taking torque readings.





York Transport Equipment

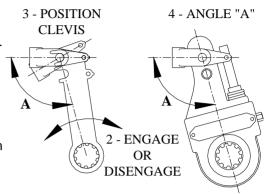
Autoslack Removed From Vehicle

Crewson Brunner Autoslacks are fully lubricated at the factory. A grease fitting is provided for normal maintenance.

Crewson Brunner Autoslacks can not be diassembled in the field. Never tamper with the units factory settings.

Verify Autoslacks Set Up

- 1. Select the correct template for the spline size and armhole location.
- 2. Fit Installation Template over S-Cam and put 1/2" pin into clevis.
- 3. Swing Template to engage 1/2" pin.
- 4. Screw clevis CW or CCW on push rod until 1/4" holes in clevis and template line up.
- 5. Template now indicates correct set up angle "A".
- 6. Remove template and 1/2" pin. Install Autoslack adjuster on S-Cam and turn the Hex nut CW until 1/2" and 1/4" holes line up with the clevis
- 7. Install and secure clevis pins. Turn nut CW until shoes contact the brake drum.
- 8. Back off Hex nut one half turn CCW to complete setup.



1 - FITS OVER S-CAM

5 - INSTALL AUTOSLACK ADJUSTER

Actuation Rod Movement

The Actuation rod will move as a slight force is used to turn the adjusting Shaft hex. 1/4 of a turn will cause full movement of the Actuation Rod. Full movement of the Actuation rod is about 1/2".

- * Clockwise (CW) movement of the Adjusting Shaft Hex will move the Actuation Rod into the Slack Body.
- * Counter Clockwise (CCW) movement of the Adjusting Shaft Hex will move the Actuation Rod out of the Slack Body.

Replace Autoslack if Actuation rod does not move.

Gear Movement & Front Torque

Using a torque wrench, rotate Adjusting hex nut through 6 full revolutions. Front Torque will increase to a peak value then return to zero several times on each revolution.

- * The spline should rotate about 90 degrees.
- * The Front (CW) Torque should be less than 75 in.lbs. (8.5 Nm.)

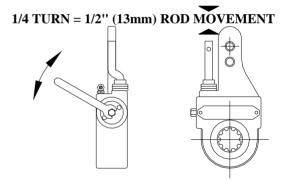
Replace Autoslack if spline does not rotate or if torque readings are greater than 75 in.lbs. (8.5Nm.)

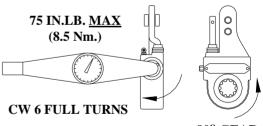
Back Torque

Assemble a crewson brunner clevis to the Autoslack Body and the Actuation Rod with the clevis pins. Using a torque wrench, turn the adjusting Shaft Hex CCW. Back torque will increase to a peak value, then return to zero as the ratchet clutch disengages.

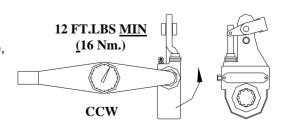
Replace Autoslack if the Back (CCW) Torque reading is less than 12 ft.lbs. (16 Nm.)

Rotate the Hex shaft a maximum of 5 clicks (ratchet teeth) while taking torque readings.





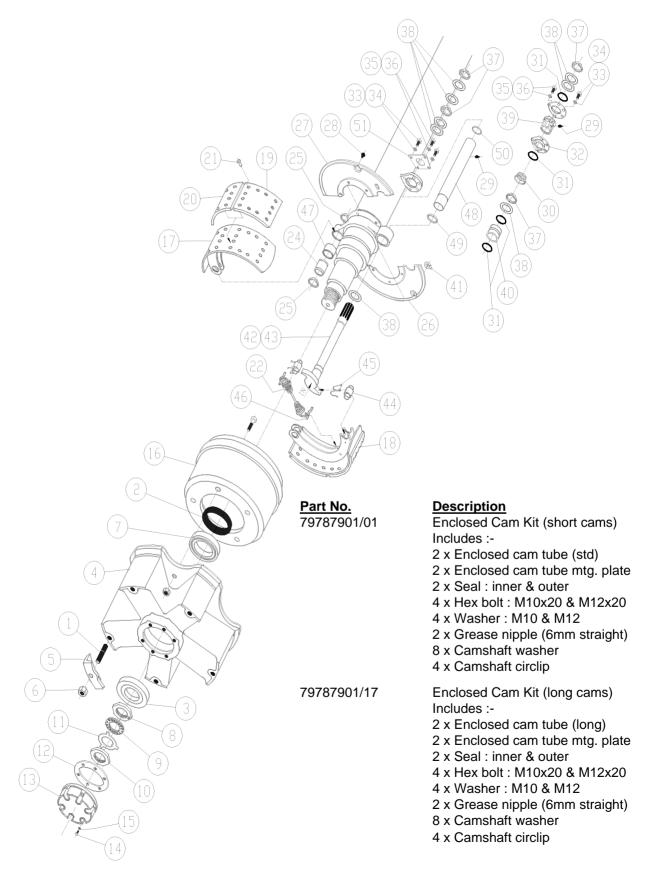
90° GEAR ROTATION





RK York Transport Equipment

AXLE TYPES 2782 and 2784 - 420 x 180 'S' CAM BRAKES DUAL and SUPER SINGLE SPIDER HUBS





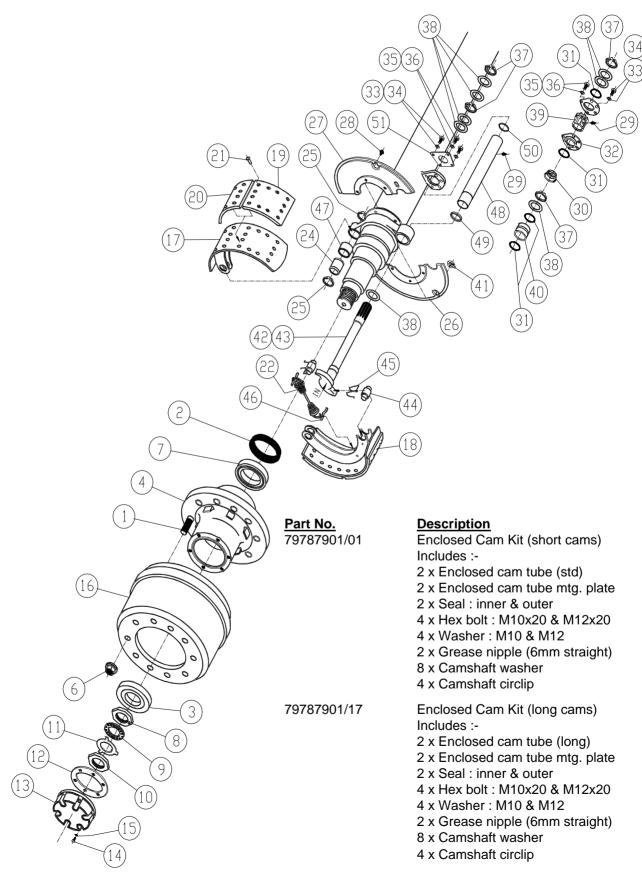
AXLE TYPES 2782 and 2784 - 420 x 180 'S' CAM BRAKES DUAL and SUPER SINGLE SPIDER HUBS

<u>ltem</u>	Part No.	<u>Description</u>	<u>ltem</u>	Part No.	<u>Description</u>
1	79787581	Wheel stud	30	79500686	Dust seal
2	79786114	Hub seal	31	79500375	'O' Ring
3	79786510/1	Outer bearing (cone)	32	79500363	Spherical bush housing
		HM212049	33	49HBM12175020	Hex bolt M12
	79786510/2	Outer bearing (cup)	34	49AWM12P	Lockwasher M12
		HM212011	35	49HBM10150020	Hex bolt M10
4	79787579	Spider hub dual	36	49AWM10P	Lockwasher M10
	7927051	Spider hub super single	37	79500374	Camshaft circlip
5	79786869	Rim clamp - dual	38	79500358	Camshaft washer
6	79787582	Spider wheel nut	39	79500362	Spherical bush
7	79786117/01	Inner bearing (cone)	40	79502765	Outer cam bush
		HM218248	41	79500848	Plug dust cover
	79786117/02	Inner bearing (cup)	42	79504723/01R	Camshaft RH (short) 525mm
		HM2182		79504723/01L	Camshaft LH (short) 525mm
8	79502461	Spindle nut	43	79504723/17R	Camshaft RH (long) 627mm
9	79501123	Spindle lockwasher		79504723/17L	Camshaft LH (long) 627mm
10	79502462	Spindle locknut	44	79500356/02	Cam roller 11/4" (knurled)
11	79790044	Locktab washer	45	79500373	Cam roller retainer spring
13	79501785	Hub cap - oil	46	79500372	Return spring retainer
	79501715	Hub cap - grease	47	79501787	Anchor pin bush
14	49HB5/16UNF1.00		48	79788529/01	Enclosed cam tube (std 525mm)
15	49AW5/16P	Washer-hub cap stud		79788529/17	Enclosed cam tube (long 627mm)
16	79787580	Brake drum-dual	49	79787721	Seal - hub end enclosed cam
	7960327-9	Brake drum-super single	50	79787720	Seal - inner end enclosed cam
17	79787525	Unlined shoe - 'Q'	51	79787590	Enclosed cam tube mtg plate
	79502906/01	Unlined shoe - 'P'	#	79B2-182	Rim clamp - super single
18	79787902/02	Lined shoe - 'Q'	#	79787905	Slack adjuster
	79502064/02	Lined shoe - 'P'	#	7921103	Automatic slack adjuster
19	79786281/02	Lining cam end (non asb)	#	798959051554	ABS pole wheel 100 tooth
20	79786282/02	Lining anchor end (non asb)	#	794410326340	ABS Sensor pole
21	79502245	Rivet	#	798997605104	ABS sensor pole bush
22	79786289	Return spring cam end	#	79787591	ABS sensor pole mounting block
	79787527	Return spring anchor end 'Q'	#	796550/3	Hubcap window kit
24	79787526	Anchor pin 'Q'		79506221	Booster bracket
	79787997	Anchor pin - bolt on type		79786275	Brake spider
00	79787723	Anchor pin 'P' heavy duty	,,	79787904	Non enclosed cam repair kit
26	79786336	Dust cover - RH	#	8512454-010	Spacer band 4"
27	79786335	Dust cover - LH		79/ABS301	ABS Sensor pole kit
28	49FHM08125012	Screw dust cover			



York Transport Equipment

AXLE TYPES 2782 and 2784 - 420 x 180 'S' CAM BRAKES DUAL and SUPER SINGLE STUD TYPE HUBS



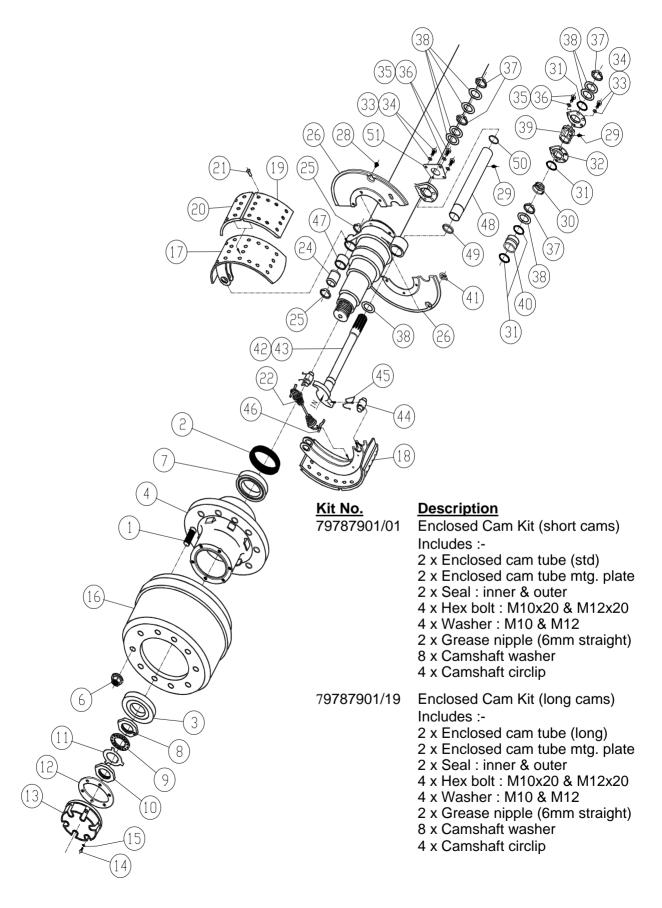


AXLE TYPES 2782 and 2784 - 420 x 180 'S' CAM BRAKES DUAL and SUPER SINGLE STUD TYPE HUBS

<u>ltem</u>	Part No.	<u>Description</u>	<u>ltem</u>	Part No.	Description
1	79786111	Wheelstud ISO 100mm	21	79502245	Rivet
	79786511	Wheelstud ISO 124mm	22	79786289	Return spring cam end
	79792155	Wheelstud SAE 100mm		79787527	Return spring anchor end 'Q'
	79792156	WheelstudSAE 124mm	24	79787526	Anchor pin 'Q'
	79786506	Wheelstud Japanese R.H. M20		79787997	Anchor pin - bolt on type
	79786507	Wheelstud Japanese L.H. M20		79787723	Anchor pin 'P' heavy duty
	79102188	Wheelstud M22 short(alum. hub)	26	79786336	Dust cover RH
	79102190	Wheelstud M22 long(alum. hub)	27	79786335	Dust cover LH
2	79786114	Hub seal	28	49FHM0812501	
3	79786510/01	Outer bearing (cone)HM212049	29	79786885	Grease nipple 6mm straight
	79787955/01	Outer bearing (cone) (pre set)	30	79500686	Dust seal
	79786510/02	Outer bearing (cup)HM212011	31	79500375	'O' Ring
	79787955/02	Outer bearing (cup) (pre set)	32	79500363	Spherical bush housing
4	79786106	Steel hub 10 x 335pcd(pre 1995)	33	49HBM1217502	
	79787712	Steel hub 10 x 335pcd	34	49AWM12P	Lockwasher M12
	79787531	Steel hub 10 x 285pcd	35	49HBM1015002	
	79787891	Steel hub 8 x 285pcd (Jap)	36	49AWM10P	Lockwasher M10
	79104894	Alum hub 10 x 285pcd (pre-set)	37	79500374	Camshaft circlip
	79105366	Alum hub 10 x 335pcd (pre-set)	38	79500358	Camshaft washer
6	79502917/01	ISO Wheelnut	39 40	79500362 79502765	Spherical bush Outer cam bush
	79790001	Japanese wheelnut set RH	41	79502765	Plug dust cover
	79790002	Japanese wheelnut set LH	42	79504723/01R	· ·
7	79786117/01	Inner bearing (cone)HM218248	42		Camshaft LH (short) 525mm
	79787956/01	Inner bearing (cone) (pre set)	43		Camshaft RH (long) 627mm
	79786117/02	Inner bearing (cup)HM218210	70	79504723/17L	, σ,
•	79787956/02	Inner bearing (cup) (pre set)	44	79500356/02	Cam roller 11/4" (knurled)
8	79502461	Spindle nut	45	79500373	Cam roller retainer spring
9	79501123	Spindle lockwasher	46	79500372	Return spring retainer
10 11	79502462 79790044	Spindle locknut Locktab washer	47	79501787	Anchor pin bush
12	79790044	Hub cap gasket 6 hole	48	79788529/01	Enclosed cam tube (std) 525mm
13	79501785	Hub cap gasker o noie Hub cap - oil 6 hole		79788529/17	Enclosed cam tube (long) 627mm
15	79501705	Hub cap - grease 6 hole	49	79787721	Seal - hub end enclosed cam
	79786215	Hub cap - grease 3 hole	50	79787720	Seal - inner end enclosed cam
14		Hub cap stud	51	79787590	Enclosed cam tube mtg plate
15	49AW5/16P	Washer - hub cap stud	#		ABS pole wheel 100 tooth
16	79787571	Brake drum 10 x 335pcd	#	79105459	ABS sensor ring (alum hub)
	79786875	Brake drum 10 x 285pcd	#		ABS sensor pole
	79790204	Brake drum 8 x 285pcd Jap(i/board)	#		ABS sensor pole kit
	79786108	Brake drum 10 x 335pcd	#	79787591	ABS sensor mounting block
	79ML100	Brake drum 10 x 285pcd	#	79787905	Slack adjuster
	79787886	Brake drum 10 x 285pcd-	#	7921103	Automatic slack adjuster
		Lightweight	#	79506221	Booster bracket
17	79787525	Unlined shoe - 'Q'	#	796550/3	Hubcap window kit
	79502906/01	Unlined shoe - 'P'		79786275	Brake spider
18	79787902/02	Lined shoe - 'Q'		79787904	Non enclosed cam repair kit
	79502064/02	Lined shoe - 'P'		79104144	Pre set bearing spacer
19	79786281/02	Lining cam end (Non Asb.)		79ABS301	ABS Sensor Pole Kit
20	79786282/02	Lining anchor end (Non Asb.)			



AXLE TYPE 2950 - 335 x 210 'S' CAM BRAKES





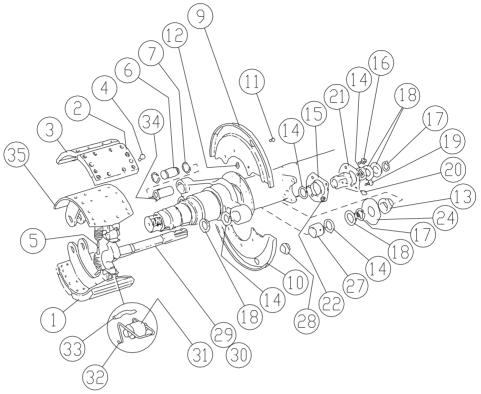
AXLE TYPE 2950 - 335 x 210 'S' CAM BRAKES

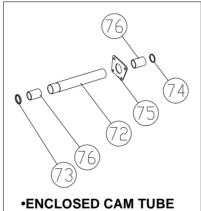
<u>ltem</u>	Part No.	Description	<u>Item</u>	Part No.	<u>Description</u>
2	79.786113	Wheelstud ISO 88mm	47	79.501574	Housing spherical bush
	79.786111	Wheelstud ISO 100mm	48	49.HBM12175020	Stud 1/2" UNF
	79.786511	Wheelstud ISO 124mm	49	49.AWM12P	Lockwasher
	79.102190	Wheelstud aluminium hub	50	79.500374	Camshaft circlip
3	79.786114	Hub Seal	51	79.500358	Camshaft washer
4	79.786510/01	Outer Bearing (Cone) HM212049	52	49.HBM10150020	Stud 3/8" UNF
	79.786510/02	Outer Bearing (Cup) HM212011	53	79.786885	Grease nipple
5	79.27140	3 Spoke Spider hub	54	79.500362	Spherical bearing
	79.787575	Steel hub 10 x 225pcd	55	49.AWM10P	Shakeproof washer
	79.787674	Steel hub 8 x 225pcd	56	79.787923	Camshaft bush - Vesconite
	79.787705	Steel hub 8 x 275pcd		79.502765	Camshaft bush - Plastic
	79.103077	Aluminium hub 8 x 275pcd	59	79.500848	Dust cover plug
	79.104906	Alum hub PreSet 8 x 275pcd	60	79.790238/01R	Camshaft RH 525mm
		includes bearings		79.790238/01L	Camshaft LH 525mm
8	79.502917	Wheelnut ISO	61	79.790238/19R	Camshaft RH 616mm
9	79.786117/01	Inner Bearing (Cone) HM218248		79.790238/19L	Camshaft LH 616mm
	79.786117/02	Inner Bearing (Cup) HM218210	62	79.500356	Cam roller
10	79.502461	Spindle nut	63	79.500373	Roller retainer spring
11	79.501123	Spindle lockwasher	64	79.500372	Return spring retainer
12	79.502462	Spindle locknut	65	79.501787	Anchor pin bush
13	79.787719	Gasket 6 hole	67	79.8959051554	ABS Pole wheel
	79.507228	Gasket 3 hole	69	79.4410326340	ABS Sensor
15	79.501715	Hub cap - grease 6 hole	70	79.8997605104	ABS Sensor Bush
	79.501785	Hub cap - oil 6 hole chrome	71	79.787591	ABS Sensor mtg block
	79.786215	Hub cap - grease 3 hole	72	79.788528/01	Enclosed cam tube: std
17	49.HB5/16UNC1.00	Hub cap stud		79.788528/19	Enclosed cam tube: long
30	79.786856	Brake drum spider	73	79.787721	Seal: hub end encl cam
	79.506412	Brake drum 10 x 225pcd	74	79.787720	Seal: inner end encl cam
	79.787675	Brake drum 8 x 225pcd	75	79.787590	Encl cam tube mtg plate
	79.787704	Brake drum 8 x 275pcd	76	79.788528	Enclosed cam bush
31	79.506613	Unlined brake shoe	77	79.790044	Locktab washer
32	79.506499/02	Lined brake shoe		79.787905	Slack adjuster
33	79.506464/02	Lining Cam End		79.21123	Automatic slack adjuster
34	79.506464/02	Lining Anchor End		79.787960	Non enclosed cam repair kit
35	79.502245	Rivet		79.6550/3	Hubcap Window kit
36	79.506498	Return spring		PreSet bearing hub	<u>spares</u>
38	79.501995	Anchor pin		79.787955/01	Outer bearing cone
39	79.758525	Circlip		79.787955/02	Outer bearing cup
41	79.506414	Dust cover		79.787956/01	Inner bearing cone
42	49.FHM08125016	Dust cover screw		79.787956/02	Inner bearing cup
43	79.786885	Grease nipple		79.104144	PreSet bearing spacer
44	79.507327/01	Grease nipple extension			
45	79.500686	Dust seal			
46	79.500375	'O' Ring			

^{*} Steel hubs do not include bearing cups, wheel studs or wheel nuts. Aluminium hubs include bearing cups & wheel studs.



AXLE TYPE 2783 / 2953, 15" AXLE - 311 x 178 'S' CAM BRAKES AXLE TYPE 2954, - 311 x 127 'S' CAM BRAKES

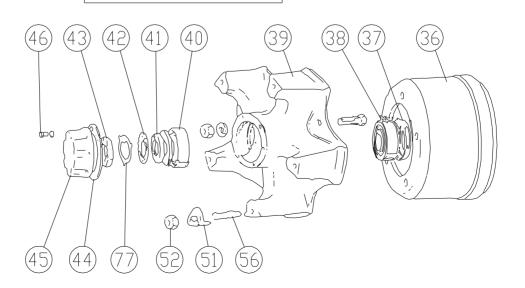




ENCLOSED CAM KITS

KIT No: 79.787901/01 - Short

KIT No: 79.787901/19 - Long





AXLE TYPE 2783 / 2953, 15" AXLE - 311 x 178 'S' CAM BRAKES AXLE TYPE 2954, - 311 x 127 'S' CAM BRAKES

<u>ltem</u>	Part No.	<u>Description</u>	<u>ltem</u>	Part No.	<u>Description</u>
1	79.502246/02	Lined brake shoe 311x178	34	79.501787	Anchor pin bush
	79.502263	Lined brake shoe 311x127	35	79.502904/02	Brake shoe unlined 311x178
2	79.501570/02	Lining cam end 311x178		79.502904/01	Brake shoe unlined 311x127
	79.501572/02	Lining anchor end 311x178	36	79.60328-6	Brake drum 15" dual 311x178
3	79.501568	Lining cam end 311x127		79.787598	Brake drum 6 x 222pcd 311x178
	79.501571	Lining anchor end 311x127		79.787900	Brake drum 6 x 222pcd 311x127
4	79.502245	Rivet	37	79.786114	Hub seal
5	79.501551	Brake return spring	38	79.786117/02	Inner bearing (cup) HM218210
6	79.501995	Anchor pin		79.786117/01	Inner bearing (cone) HM218248
7	79.758525	Anchor pin circlip	39	79.27140	Spider hub 15" dual
9	79.501576	Backing plate RH		79.787595	Hub 6 stud x 222 Jap steel
10	79.501577	Backing plate LH	40	79.786510/02	Outer bearing (cup) HM212011
11	49.FHM08125016	Stud - dust cover		79.786510/01	Outer bearing (cone) HM212049
12	79.786885	Grease nipple	41	79.502461	Spindle nut
13	79.500686	Dust seal	42	79.501123	Spindle lockwasher
14	79.500375	'O' Ring	43	79.502462	Spindle locknut
15	79.501574	Spherical bush plate	44	79.787719	Hub cap gasket - 6 hole
16	49.HBM12175020	Stud 1/2" UNF	45	79.501785	Hub cap - oil chrome
17	79.500374	Camshaft circlip		79.501715	Hub cap grease
18	79.500358	Camshaft washer	46	49.HB5/16UNF1.00) Hub cap stud
19	49.HBM10150020	Stud 3/8" UNF	51	79.3314	Wheel clamp
20	79.786885	Grease nipple	52	79.787582	Wheel nut
21	79.500362	Spherical bush	56	79.787581	Wheel stud
22	49.AWM10P	Shakeproof washer	72	79.788528/01	Enclosed cam tube - std
24	79.500810	Dust plate		79.788528/19	Enclosed cam tube - long
27	79.787923	Camshaft bush - Vesconite	73	79.787721	Seal - hub end enclosed cam
	79.502765	Camshaft bush - Plastic	74	79.787720	Seal - inner end enclosed cam
28	79.500848	Plastic plug	75	79.787590	Enclosed cam tube mtg plate
29	79.504742/01R	Camshaft RH 525mm	76	79.788528	Enclosed cam bush
	79.504742/19R	Camshaft RH 616mm	77	79.790044	Lock tab washer
30	79.504742/01L	Camshaft LH 525mm		79.787905	Slack adjuster
	79.504742/19R	Camshaft RH 616mm		79.21103	Automatic slack adjuster
31	79.500356	Cam roller		79.787960	Non enclosed repair kit
32	79.500373	Roller retainer clip		79.6550/3	Hubcap Window kit
33	79.500372	Return spring retainer			



YORK TRANSPORT EQUIPMENT PTY LTD

13 Monterey Road Dandenong Vic 3175 ABN 25 006 303 206

MECHANICAL SUSPENSION MACTECO MODEL MT 75 SERVICE AND INSTALLATION MANUAL

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MECHANICAL SUSPENSION INSTALLATION and ASSEMBLY INSTRUCTIONS MACTECO MODEL - MT 75

HANGER INSTALLATION

First position the two front hangers on the frame, ensuring they are square to the frame and locatated in line longitudinally and transversely. All diagonal measurements and dimensions to be within 2mm maximum variation. Position the rest of the suspension hangers on the frame, see dimensional detail leaflet for all layouts, all spacings to be held within 2mm of those shown.

Tack weld the hangers in position and recheck their position before final welding.

All welding to be low hydrogen electrodes or equivalent M.I.G. process. Weld all around the top of each suspension hanger bracket - **10mm continuous fillet weld.**

After installation of all hanger brackets fit between the front hangers and all pairs of equaliser hangers either a pipe or channel cross bracings. Fully weld the ends of the cross bracing to their respective hangers.

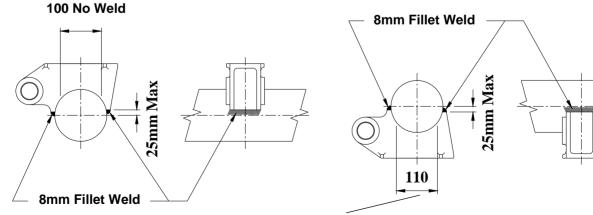
AXLE SEAT INSTALLATION

Position the axle seats on the axle at correct spring centres (Must match suspension hanger centres.) The axle seats must be positioned equally either side of the axle centre. The centre of each centre bolt hole must be at the top centre of the axle for overslung suspensions and at the bottom centre for underslung suspensions. (This applies to cambered axles only.) Axle seats must be flat and parallel with each other. Tack weld the axle seats in position and recheck their positioning before final welding.

Weld axle seats to the axle using low hydrogen electrodes or equivalent M.I.G. process, 8mm continuous fillet weld, see diagrams below.

OVERSLUNG SUSPENSIONS

UNDERSLUNG SUSPENSIONS



No welding at all on the bottom half of the axle beam. This includes positioning tack welds.



TORQUE ARM ASSEMBLY

Assemble the adjustable torque arms to the same length as the corresponding fixed torque arms. Fit the fixed torque arms on the kerb (near) side and the adjustable torque arms on the road (off) side of the trailer.

Fit the end of the torque arm in the suspension bracket and insert the bushes from each side, fit torque arm pin, flat washers and self locking nut, ensuring that the torque arms are central in the suspension bracket.

Tighten torque arm pin self locking nuts to: - 1"UNF 180/200 Nm. (Rubber bushes)

- 1"UNF 250/300 Nm. (Poly bushes)
- M24 150/200 Nm. (Rubber bushes)
- M24 240/270 Nm. (Poly bushes)

NOTE:a) On tandem and tri-axle suspensions the centre and rear torque arms will be longer than those on the front axle.

- b) On all underslung suspensions the adjustable torque arms must be installed with the clamp bolts to the top or as shown on the assembly drawings.
- c) Lubricate all tapered rubber bushes on the outer surfaces with liquid soap solution (do not use detergent or rubber grease) when assembling into the suspension castings.
- d) Lubricate all tapered poly bushes with rubber grease on the outer surfaces when assembling into the suspension castings.

FINAL ASSEMBLY

Assemble the springs onto the axles ensuring that:

The hook end of the spring is to be fitted to the rear of the axle on all axle positions.

Tighten U-bolt nuts evenly to a torque of: - 7/8"UNF 500/540 Nm.

- 1"UNF 750/800 Nm. - M22 500/500 Nm. - M24 600/600 Nm.

Fit the axle, spring and torque arm assemblies into position and connect the torque arms to the front and equaliser hangers, making sure the spring hooked ends fit into the equalisers. Insert spring retaining bolts into the equalisers and hangers.

Tighten torque arm pin locknuts to: - 1" UNF 180/200 Nm. (rubber bushes)

- 1" UNF 250/300 Nm. (poly bushes) - M24 150/200 Nm. (rubber bushes) - M24 240/270 Nm. (poly bushes)

ALIGNMENT and ADJUSTMENT

Measure from the centre of the kingpin to the centre of each end of the front axle and adjust as necessary with the adjustable torque arm screws until the dimensions are equal.

Alignment of the rear axle (axles) is then made by checking the distance between the centre of the front axle and rear axle (axles) at both sides of the trailer. Adjust as necessary with the adjustable torque arm screws until the dimensions are equal.

Tighten the torque arm clamp bolts to a torque of: - 1/2" UNF - 95 Nm.

- M12 **- 95 Nm.**



ALIGNMENT and ADJUSTMENT continued

NOTE: Alignment can also be acheived with an optical device or laser system designed

specifically for this purpose.

A visual inspection of the suspension after installation and assembly should be carried out to ensure that all components are correctly located and seated, as incorrect location or misalignment of the components will greatly reduce the service life of the suspension.

TIGHTENING TORQUE CHART

U Bolts - 7/8" UNF **500/540 Nm.**

- 1" UNF **750/800 Nm.** - M22 **500/540 Nm.** - M24 **640/680 Nm.**

Equaliser Shaft locknut - 1" UNF 290/350 Nm.

- M24 **290/350 Nm.**

Torque Arm Pin locknut - 1" UNF 180/200 Nm. (with rubber bushes)

- 1" UNF
- M24
- W24
- W24</l>

Torque Arm Pinch bolts - 1/2" UNF 90/100 Nm.

- M12 **90/100 Nm.**

Hanger / Equaliser Drop Out bolts - 1/2" UNF 75/85 Nm.

- M12 **75/85 Nm.**

SERVICING INTERVALS

First Service

500 km Check all torque settings and retorque.

Every

5,000 km Check all torque settings and inspect for visual damage. Repair and replace as necessary.

Every

50,000 km Check as for 5,000 km service.

or Annually Check the torque arm bushes, equaliser shaft bushes for wear or deterioration and replace as necessary.

Check the leaf springs for wear, cracks or corrosion and replace as necessary. Inspect the remainder of the suspension for wear or deterioration and replace any suspect parts as necessary.

Check the axle alignment and adjust as necessary. Axle alignment must be checked when ever severe kerbing, accident damage or the torque arm bushes have been replaced during servicing.

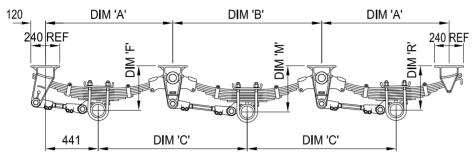


DIMENSIONAL LAYOUTS OVERSLUNG SUSPENSION

TRI-AXLE SUSPENSION

1232mm (8'1") & 1384mm (9'1") SPACINGS

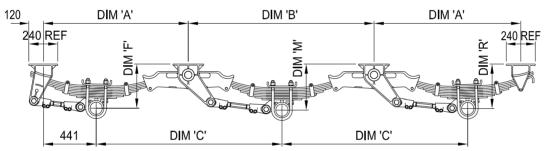
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TRI-AXLE SUSPENSION

1538mm (10'1") SPACING

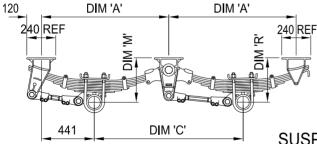
ADR No's 6305SS & 9074SS



TANDEM AXLE SUSPENSION

1232mm (4'0"), 1384mm (4'6") & 1538mm (5'0") SPACINGS

ADR No's 6307SS & 9076SS

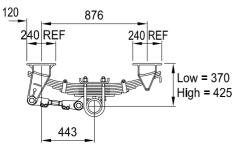


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AXLE SPREAD	MODEL	DIM A	DIM B	DIM C
1232mm (4'0")	MT2A or MT3A	1054	1232	1232
1384mm (4'6")	MT2B or MT3B	1130	1384	1384
1538mm (5'0")	MT2C or MT3C	1207	1538	1538

SINGLE AXLE SUSPENSION

ADR No's 6306SS & 6224SS



SUSPENSION MOUNTING HEIGHTS UNLADEN CONDITION

SPRINGS						
AXLE SEAT	DIMENSION	8 LEAF	9 LEAF	10 LEAF H/D	3 LEAF	
LOW	F-M-R	385mm	400mm	445mm	345mm	
HIGH	F-M-R	440mm	455mm	500mm	405mm	
PACKED - F	F	440mm	455mm	500mm	405mm	
PACKED - M	M	415mm	430mm	475mm	375mm	
PACKED - R	R	385mm	400mm	445mm	345mm	

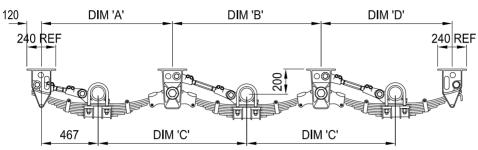


DIMENSIONAL LAYOUTS UNDERSLUNG SUSPENSION

TRI-AXLE SUSPENSION

1232mm (8'1") SPACING

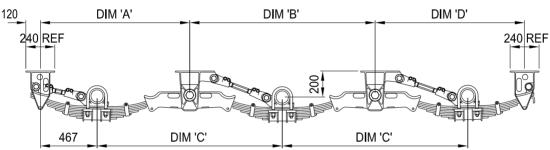
ADR No's 9075SS & 9130SS



TRI-AXLE SUSPENSION

1384mm (9'1") & 1538mm 10'1") SPACINGS

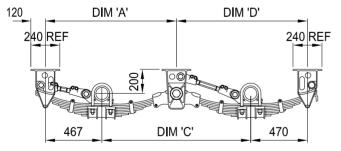
ADR No's 9075SS & 9130SS



TANDEM AXLE SUSPENSION

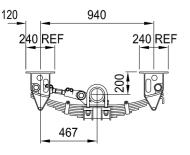
1232mm (4'0"), 1384mm (4'6") & 1538mm (5'0") SPACINGS

ADR No's 9073SS & 9132SS



SINGLE AXLE SUSPENSION

ADR No's 6223SS & 6360SS



NOTE: MOUNTING HEIGHT WITH 3 LEAF SPRINGS = 200mm (ALL AXLE SPACINGS).

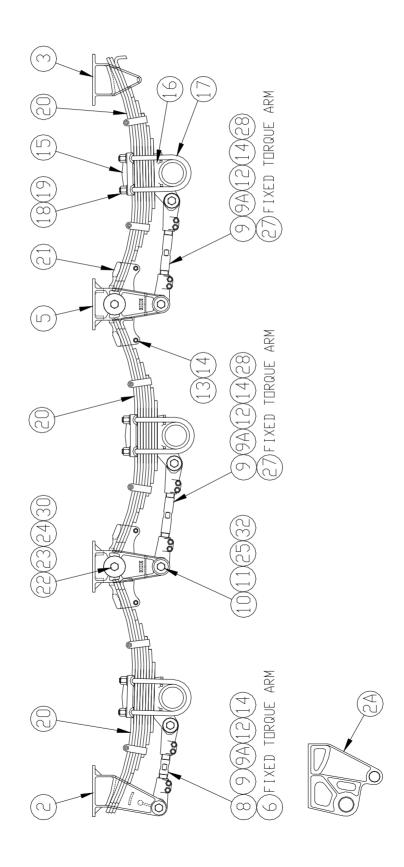
SUSPENSION DIMENSIONS UNLADEN CONDITION

AXLE SPREAD	MODEL	DIM A	DIM B	DIM C	DIM D
1232mm (4'0")	MT2A or MT3A	1086	1232	1232	1060
1384mm (4'6")	MT2B or MT3B	1162	1384	1384	1135
1538mm (5'0")	MT2C or MT3C	1239	1538	1538	1210



Suspension Spares - Overslung Tapered Bush

MT 75mm SUSPENSION





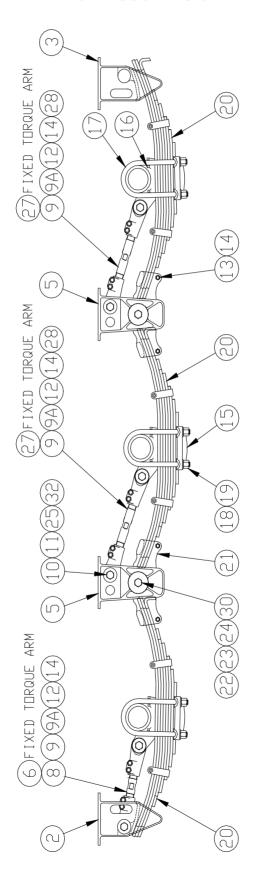
Suspension Spares - Overslung Tapered Bush

	<u>ltem</u>	Part No.	<u>Description</u>
	2	59900022	Front hanger
	2A	59900035	Front hanger - Drawbar type
	3	59900001	Rear hanger
	5	59900026	Equaliser hanger 8'1" & 9'1"(1232&1384mm)
		59900032	Equaliser hanger 10'1" (1538mm)
	6	59901100/395	Fixed torque arm front 5" rd & sq
	_	59901100/380	Fixed torque arm front 6" sq
	8	59900033/01	Adj. torque arm screw 260mm
	9 9A	59SB900024R 59SB900024L	Adj. torque arm end RH (includes nuts & bolts) Adj. torque arm end LH (includes nuts & bolts)
	10	59901012	Torque arm pin includes nut & washer
	11	59901006	Torque arm pin nyloc nut 1"
	12	59901001	Adj. torque arm bolt
	13	59901002	Spring retainer bolt 1/2" UNF
	14	59901004	Nyloc nut 1/2" UNF
	15	59900003	Spring top plate 5"
		59900009	Spring top plate 6"
	16	59900027	Spring seat 127mm round x 25mm high
		59900025	Spring seat 127mm round x 75mm high Spring seat 122mm square x 25mm high [Complete with
		59900049 59900071	Christ cost 122mm aguero y 75mm high
		59900008	Spring seat 152mm square x 75mm high nuts & washers]
	17	59901101/315	'U' bolt 127mm round x 315mm
		59901101/325	'U' bolt 127mm round x 325mm
		59901101/350	'U' bolt 127mm round x 350mm
		59901101/370	'U' bolt 127mm round x 370mm
		59901102/310	'U' bolt 122mm square x 310mm
		59901102/345	'U' bolt 122mm square x 350mm
		59901102/370	'U' bolt 122mm square x 370mm
		59901103/360 59901103/380	'U' bolt 152mm square x 360mm 'U' bolt 152mm square x 380mm
		59901103/410	'U' bolt 152mm square x 410mm
	18	59901007	Deep nut 7/8" UNF
	19	59901008	Flat washer 7/8"
	20	59770706	Spring 8 leaf
		59787505	Spring 9 leaf
		59770710	Spring 10 leaf - heavy duty
		59787520	Spring 3 leaf lightweight (taper leaf)
		59770706-1 59770706-3	1st & 2nd leaf of 8 & 9 leaf springs Single hook leaf - 8 & 9 leaf springs
	21	59900007	Equaliser 8'1"(1232mm)
		59900020	Equaliser 9'1"(1384mm)
		59900010	Equaliser 10'1"(1538mm)
	22	59900013	Equaliser shaft includes nut&washer
	23	59901006	Equaliser shaft nyloc 1" nut
	24	59901020	Equaliser bush
	25	59901020-P	Equaliser bush - poly
	25	59901019 59901019-P-01	Torque arm bush Torque arm bush - poly
	27	59901100/495	Fixed torque arm C/R 127mm rd &sq 8'1"(1232mm)
		59901100/470	Fixed torque arm C/R 152mm sq 8'1"(1232mm)
		59901100/565	Fixed torque arm C/R 127mm rd &sq 9'1"(1384mm pre-1991)
		59901100/380	Fixed torque arm C/R 152mm sq 9'1"(1384mm)
		59901100/470	Fixed torque arm C/R 127mm rd &sq 10'1"(1538mm)
		59901100/450	Fixed torque arm C/R 152mm sq 10'1"(1538mm)
	28	59900033/02	Adj. torque arm screw 350mm
	30	59900033/03	Adj. torque arm screw 420mm
	30 32	59901009 59901010	Equaliser shaft washer Torque arm pin washer
	33	59900023	Packer 25mm high
		59900025	Drawbar cheek plate
		59900096	Draw end housing
NAT-75	Consider 0 Inc.	59900097 all 200905	Drawbar end pivot casting
IVI 1 /5 3	Service & Insta	UU9U5 III	



Suspension Spares - Underslung Tapered Bush

MT 75mm SUSPENSION





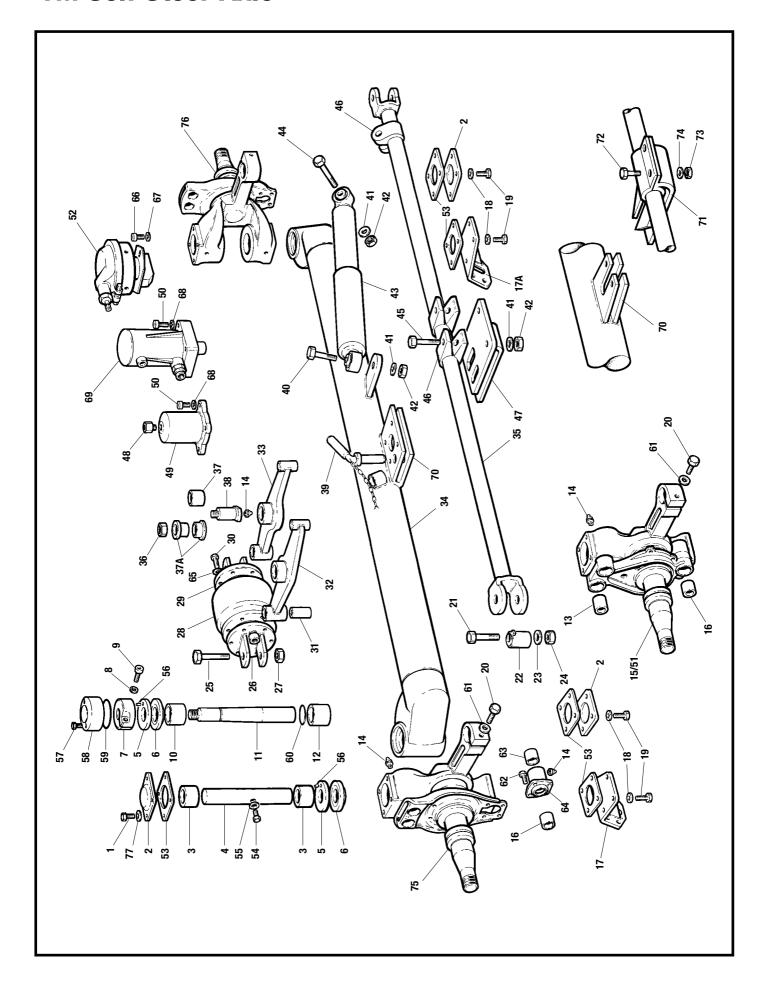
Suspension Spares - Underslung Tapered Bush

<u>Item</u>	Part No.	<u>Description</u>
2	59900037	Front hanger
3	59900037	Rear hanger
5	59900036	Equaliser hanger 8'1"(1232mm)
	59900089	Equaliser hanger 9'1" & 10'1"(1384&1538mm)
6	59901100/380	Fixed torque arm front 5" rd & sq
	59901100/360	Fixed torque arm front 6" sq
8	59900033/01	Adj. torque arm screw 260mm
9	59SB900024R	Adj. torque arm end RH (includes nuts & washers)
9A	59SB900024L	Adj. torque arm end LH (includes nuts & washers)
10	59901012	Torque arm pin includes nut & washer
11	59901006	Torque arm pin nyloc nut 1"
12	59901001	Adj. torque arm bolt
13	59901002	Spring retainer bolt 1/2" UNF
14	59901004	Nyloc nut 1/2" UNF
15	59900003	Spring bottom plate 5" rd & sq
	59900038	Spring bottom plate 5" rd & sq
	59900009	Spring bottom plate 6"
16	59900027	Spring seat 127mm round x 25mm high (Complete with
	59900049	Spring seat 122mm square x 25mm high nuts & washers)
	59900008	Spring seat 152mm square x 25mm high
17	59901101/240	'U' bolt 127mm round x 240mm
	59901101/315	'U' bolt 127mm round x 315mm
	59901102/240	'U' bolt 122mm square x 240mm
	59901102/310	'U' bolt 122mm square x 310mm
	59901103/360	'U' bolt 152mm square x 360mm
18	59901007	Deep nut 7/8" UNF
19	59901008	Flat washer 7/8"
20	59770706	Spring 8 leaf
	59787505	Spring 9 leaf
	59787520	Spring 3 leaf lightweight (taper leaf)
21	59900007	Equaliser 8'1"(1232mm)
	59900020	Equaliser 9'1" (1384mm)
	59900010	Equaliser 10'1"(1538mm)
22	59900013	Equaliser shaft includes nut & washer
23	59901006	Equaliser shaft nyloc nut 1"
24	59901020	Equaliser bush
	59901020-P	Equaliser bush - poly
25	59901019	Torque arm bush
	59901019-P-01	Torque arm bush - poly
27	59901100/470	Fixed torque arm C/R 127mm rd & sq 8'1"(1232mm)
	59901100/450	Fixed torque arm C/R 152mm sq 8'1"(1232mm)
00	59901100/395	Fixed torque arm C/R 9'1"(1384mm)
28	59900033/02	Adj. torque arm screw 350mm
20	59900033/03	Adj. torque arm screw 420mm
30	59901009	Equaliser shaft washer
32	59901010	Torque arm pin washer

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TM Self Steer Axle





Parts List

Item	Description	6/7 Ton	7 Ton	TM20000 TM22500	TM25000	TM20/22500 Twin Shock Absorbe
1	Screw M10 x 16	21212400	21212400	21212400	21212400	21212400
2 3	Cover	21212401	21212592	21212401	21223348	21212401
3 4	Bush – King Pin, Bronze King Pin – Parallel	21212413 21212403	_	_	_	21223340 21212477
5	Top Washer	21212404	21212579	21212406	21212457	21212477
6	Bottom Washer	21212405	21212580	21212407	21212458	21212405
7	Adjusting Nut – King Pin	_	21212581	21212453	21212483	-
8	Spring Washer	_	21212454	21212454	21212454	_
9	Screw TCEI M10x35	_	21212455	21212455	21212455	_
10	Bush – King Pin, Top	_	21212582	21212456	21212459	_
11	King Pin – Tapered	_	21212583	21212412	21212460	_
12	Bush – King Pin, Bottom	-	21212584	21212413	21212461	-
13	Bush – Anchor Pin	21221028	21221028	21221028	21221028	21221028
14	Grease Nipple Stub Axle L.H. – Series 1	21212415	21212415	21212415	21212415	21212415 21212475
15 16	Bush Camshaft	21212416 21209990	21209990	21212418 21209990	21212462 21209990	21209990
17	A.C.B. – LH Standard	21212420L	21212587	21212547L	21212547L	21212547L
17	A.C.B. – RH Standard	21212420R	21212588	21212547R	21212547E	21212547R
17	A.C.B. – LH Underslung	21212421L	_	21212531L	21212531L	21212531L
17	A.C.B. – RH Underslung	21212421R	_	21212531R	21212531R	21212531R
18	Spring Washer	21212422	21212422	21212422	21212422	21212422
19	Screw M10x25	21212423	21212423	21212423	21212423	21212423
20	Screw M16x60	21212424	21212424	21212424	21212424	21212424
21	Screw	21212445	21212445	21212445	21212425	21212445
22	Rubber Bush	21212489	21212489	21212489	21212426	21212489
23	Spring Washer	21212492	21212492	21212492	21212427	21212492
24	Nut	21212444	21212444	21212444	21212428	21212444
25	Screw M16x100	21212429	21212429	21212429	21212429	_
26	Disc – Air bellows c/w Air Connection	21212551	21212551	21212551	21212551	_
27	Locknut Torprose Air Pollows	21212430	21212430 21212549	21212430 21212549	21212430 21212549	_
28	Torpress – Air Bellows Disc – Air Bellows	21212549 21212431	21212549 21212431		21212549	_
29 30	Screw M8x16	21212431	21212431	21212431 21212432	21212431	_
30 31	Bush	21212432	21212432	21212432	21212432	_
32	Air Bellows Arm – LH	21212433 21212552L	21212552L	21212552L	21212433 21212552L	_
33	Air Bellows Arm – RH	21212552R	21212552R	21212552R	21212552R	_
34	Axle Beam	ZIZIZOOZII		Serial Number & Track		1
35	Track Rod		Specify	Serial Number & Track	lenath	
36	Locknut	21212438	21212438	21212438	21212438	-
37	Bush			See Item 37A		· —
37A	Bush	21212594	21212594	21212594	21212594	_
38	Anchor Pin – Air Bellows	21212440	21212440	21212440	21212440	_
39	Locking Pin	21212441	21212441	21212441	21212441	21212441
40	Screw M20x80	21212442	21212442	21212442	21212442	21212442
41	Spring Washer	21212443	21212443	21212443	21212443	21212443
42	Nut	21212444	21212444	21212444	21212444	21212444
43	Shock Absorber	21212534	21212534	21212534	21212534	21212469
44	Screw M20x130	21212445	21212445	21212445	21212445	21212445
45	Screw M20x100	21212446	21212446	21212446	21212446	21212446
46 47	Coupling Plate Locking Plate	21212447 21225634	21212447	21212447 21223371	21212447	21212447
47 48	Air Ding		21223370		21223371	21212479
48 49	Air Pipe Locking Cyl — Complete	21212449 21212550	21212449 21212550	21212449 21212550	21212449 21212550	_
49 50	Screw M10x25	21212350	21212350	21212350	21212350	_
50 51	Stub Axle – RH Series 1	21212451		21212430	21212465	21212474
52	Locking Chamber 9"	21223339	21223339	-	-	21223339
53	Gasket	21212560	21212590	21212560	21212598	21212560
54	Screw – King Pin 14x30	21223321			_	21223321
55	Washer ∅14	21223322	_	_	_	21223322
56	Roll Pin	21212591	21212591	21212561	21212561	21212591
57	Screw M6x14	_	21212485	21212485	21212485	_
58	Dust Cap	_	21212576	21212484	21212599	_
59	'0' Ring 80 Dia	_	21212577	21212486	21212486	_
60	'O' Ring		21212578	21212548	21223323	
61 22	Washer	21212562	21212562	21212562	21212562	21212562
62 63	Screw Bush	99535001 21204703	99535001 21204703	99535001 21204703	99535001 21204703	99535001
63 64	Bush Camshaft Support	21204703 21222568	21222568	21222568	21204703 21222568	21204703 21222568
65	Washer ⊘8	21222566	21222566	21212564	21222566	Z1ZZZ300
66	Screw M10x16	21212400	21212400		- 41414304	21212400
67	Washer Ø10	21212400	21212400	_	_	21212400
68	Washer ⊘10			21212422	21212422	
69	Locking Cyl Inverted (Tandem Applications)	_	_	21212422	21212490	_
70	Locking Plate		•	Specify Type	. 21212730	•
71	Locking Plate			Specify Type		
72	Screw M12x45	21212565	21212565	21212565	21212565	21212565
73	Nut M12	21212567	21212567	21212567	21212567	21212567
74	Washer Ø12	21212566	21212566	21212566	21212566	21212566
	Stub Axle LH - Series 2	21222331	21212585	21223319	21223324	
75	Otab / Mio Ell Oolioo E					1
75 76 77	Stub Axle RH - Series 2 Washer B10	21222332 21212563	21212586	21223320	21223325	21212563

Hydraulics

This pocket contains:	
Hydraulics Schematic Drawing	
Valve Build Sheets	

Н

Electrical

This pocket contains:	
Wiring Schematic	
Enclosure Drawing (SMART lift only)	
Electrical Layout (non-SMART lift only)	
Lighting Schematic (non-SMART lift only)	

Braking

This pocket contains:	
Brake Drawing	
Auxiliary Brake Drawing (if applicable)	
NZ Brake Coding (if applicable)	

Certificates

This pocket contains:	
Chassis Certificate / CODC (if applicable)	
Test Certificate	
Factory Order Entry	
Chain Certificate	
Lifting Lug Certificate	
SRT Certificates (NZ only)	
Other Compliance Certificates as required	