



# SAS<sup>TM</sup> FORKS

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## HYDRAULIC ADJUSTABLE OPERATOR MANUAL

Manual v03.1

====Specific for serial numbers SAS F6023 & SAS F6024====

Purchaser Reference Numbers:

Contract No. M6700120P1302

MILSTRIP: M5016920SUTM007

PURCHASE Request No. M5016920SUTM007

Vendor/Contractor/Offeror:

Code 431D5, Facility 431D5



## SERIAL NUMBER LOCATIONS (PAGE 2) SAS™ HYDRAULIC ADJUSTABLE

Local Distributor or Supplier Name \_\_SAS Forks\_\_ Phone \_\_\_\_920-845-2198\_\_\_\_

Serial number of SAS FORKS are located on left hand side of carriage in two locations;

Stamped on the aluminum id plate.

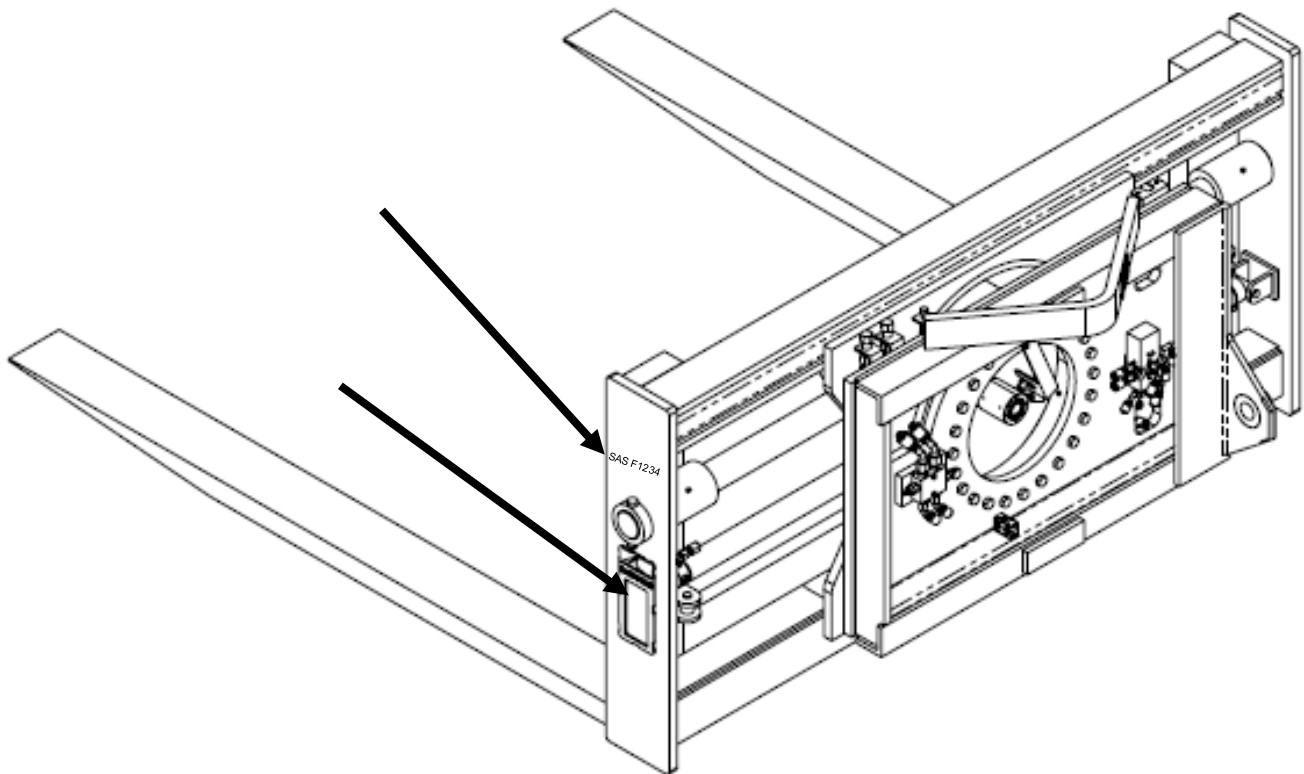
Stamped in the steel side.

Providing this information when contacting your local Distributor, Service Representative, or SAS FORKS will improve accuracy and level of service.

Make: SAS FORKS\_\_\_\_\_.

Model: Hydraulic Adjustable with fork positioner and rotate options

Serial Number: **SAS F6023 & SAS F6024**



**S.A.S. of Luxemburg, LLC. 133 Center Drive Hwy 54, PO Box 260, Luxemburg, WI 54217 USA**  
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### SAS™ HYDRAULIC ADJUSTABLE

#### ====Specific for serial number SAS F6023 & SAS F6024====

Intended limited use: This SAS Ultimate Hydraulic Adjustable Fork assembly is intended to be installed and secured properly to a wheel loader, with approximate curb weight of 33,500 lb. ( 15,000 kg ). This wheel loader shall have an auxiliary hydraulic function ( aka: 3rd spool ) operated by a separate control lever within the operator cab. The intended use of these forks is to lift pallets, containers of materials or equipment. Operators must read, understand and adhere to pre-operation inspection, maintenance, operation and safety protocols as required by the wheel loader OEM, manufacturer of item being lifted, and the guidelines within this manual. The SAS Ultimate Hydraulic Adjustable Fork is not meant to lift or move people.

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## INTRODUCTION LETTER (PAGE 4) SAS™ HYDRAULIC ADJUSTABLE

### **TO THE OWNERS, MANAGERS, AND OPERATORS OF LOADERS EQUIPPED WITH SAS™ HYDRAULIC ADJUSTABLE & SAS FORKS™**

Safety is the most important issue in the workplace. Observing safety guidelines, equipment capacities and using common sense will provide a work environment that is safe and efficient for employees, management and customers. It is important that you and your operators read and understand the information included in this manual prior to use of this equipment.

Safety warnings are highlighted through out this manual. Understanding the significance of these symbols is important. The following is a definition of each symbol you will encounter in this manual:



The Caution Symbol is intended to draw your attention to important safety information, hazard or precaution.



The Danger Symbol indicates a hazardous situation that if not avoided will result in serious injury or death



The Warning Symbol indicates a hazardous situation that if not avoided could result in serious injury or death



The Caution Symbol indicates a hazardous situation that if not avoided could result in minor injury or potential property damage



The Notice Symbol indicates worst credible severity of harm is property damage.

The following information presented in this Operator Manual for SAS FORKS™ is intended to be a guide only, and is not meant to encompass all issues that may need to be addressed for your particular type of business operation.

If you encounter any additional information that would be helpful to us, or others, please contact us.

Thank you for your business,

*SAS Ltd.*

S.A.S. OF LUXEMBURG, LLC.

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Phone:

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## GENERAL SAFETY GUIDELINES (PAGE 5)

### SAS™ HYDRAULIC ADJUSTABLE

Operation of equipment should only be performed by qualified and trained individuals. All persons operating or working in the area of operation should read this manual and a copy of this manual should be kept with the equipment. To be considered qualified you must:

- Understand the written instructions supplied by the manufacturer of the device, the manufacturer of the wheel loader, all company rules and any applicable OSHA regulations.
- Completed training including actual operation of the device.
- Know and follow the safety rules and regulations of the jobsite.
- Know and follow all guidelines outlined in this manual

#### **WARNING**

Operation of equipment by un-qualified or un-trained individuals can result in serious injury or death. Verify all operators have received proper training on operation of this equipment.

#### **WARNING**

Not designed to be operated in an explosive environment. Only use this equipment in well ventilated areas, a sufficient distance away from flammable or explosive gases, liquids or other hazards to avoid risk of ignition. Operating this equipment in an explosive environment may cause an explosion and fire resulting in injury, death, and substantial property damage.

#### **WARNING**

Operation of equipment under the influence of illegal, prescribed or over the counter drugs can result in potential injury or property damage. Consult your physician before operation of this equipment while on medication.

#### **WARNING**

Inspect the device and perform all preventative maintenance before operation at the start of every shift. Failure to perform inspections or proper maintenance can result in equipment failure resulting in serious injury or property damage.

#### **WARNING**

Read operators manual and follow all safety procedures for the equipment this device is attached to. Failure to follow Manufacturers recommendations can result in serious injury and property damage.

#### **DANGER**

This equipment is operated by high pressure hydraulics. Hydraulics are a stored power source and as such must be treated as energized at all times. Be certain pressure has been relieved prior to handling, inspecting or performing maintenance on this unit. Follow lockout tag out procedures and release all stored energy before servicing equipment. Failure to release energy or disable hydraulic energy can result in serious injury or death. High pressure fluids can also discharge at great velocity. Wear safety glasses while inspecting, operating and maintaining equipment.

#### **DANGER**

This equipment has numerous moving components. Do not wear loose fitting clothing, rings, jewelry or other items that may become entangled in the device. Be aware of resulting pinch points and keep clear during operation, inspection and maintenance. Pinch points exist between the puller and vehicle, puller and wheel loader, failure to keep clear while in operation can result in serious injury or death.

#### **DANGER**

Do not exceed posted weight limits on equipment or loader. Adhere to most restrictive load capacity and lift limitations of machine manufacturer and SAS Forks attachment device. Exceeding rated load limits will result in equipment damage, loss of steering control, tip over, possibly causing serious injury or death.

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## GENERAL SAFETY GUIDELINES (PAGE 6)

### SAS™ HYDRAULIC ADJUSTABLE



#### **PROTECTIVE EQUIPMENT & CLEAR OPERATING SPACE RECOMMENDED**



- Safety glasses with side shields
- Leather gloves
- Hard hat
- Fire extinguishing equipment
- Spill kit (oil dry, absorbent towels, etc. as required by your company)
- Other such safety equipment to protect personnel from injury.
- Clear operating space: All personnel should be at least 30 feet away from operating loader and Hydraulic Adjustable.



**Do not work under the fork or any object lifted by this equipment. An unexpected movement, shift in the object, or hydraulic failure may cause the forks and object drop. Serious injury or death may occur.**



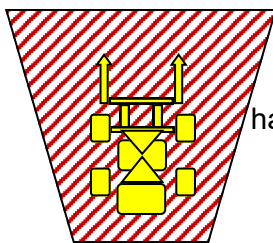
#### **PERSONNEL TRAINING & PREPARATION**



Prior to installation or use of this equipment all personnel should review the appropriate equipment & safety manuals and be trained by qualified personnel. Hazards, pinch points, and potential injury risks should be thoroughly covered to ensure personnel avoid these hazards at all times. Signed documentation certifying individual training is a must. Periodic refresher training meetings are highly recommended.

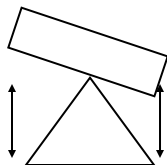


#### **SPOTTERS MUST STAY CLEAR**



Using a spotter is often helpful when positioning the forks under a load. Do not allow anyone to enter a potential pinch point or area where the load may fall, or any blind spot of the loader Operator. Always stand clear and a safe distance from this equipment and load. Example of area to stay clear of is illustrated in cross hatched diagram to right. Failure to observe this may result in serious injury or death.

#### **ACTUATION OF CONTROLS ON THIS DEVICE MAY CAUSE CARGO TO BECOME UNSTABLE**



Prior to lifting a load:

- Be sure load is adequately secured to pallet
- Position fork blades to widest possible position to provide best load stabilization.
- Be sure all persons and property are safely clear from the area.
- Move controls sufficiently slowly to enable adequate monitoring of load, surrounding persons and property to allow for the ability to timely stop and cease motion or corrective action in fork motions to avoid undesired contact or shifting of load.



**Failure to operate this device with caution may result in property damage, personal injury or death.**

## SPECIFIC NOTICES (PAGE 7)

### SAS™ HYDRAULIC ADJUSTABLE



#### **EMERGENCY STOP FUNCTION**

To immediately stop the motion of this equipment:

1. Operator is to release joystick button(s).

Additional secondary alternative measures to immediately stop the motion include:

2. Moving wheel loader's auxiliary hydraulic 3rd spool lever to neutral position
3. And/or turning off the ignition key of the wheel loader to shut off the engine

All three emergency stop options above ultimately stop the flow of hydraulic fluid.

**Notice:** Even after emergency stop function is followed, there is residual stored hydraulic pressure in the system. See following:



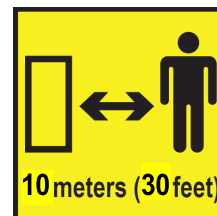
#### **THIS EQUIPMENT IS OPERATED BY HIGH PRESSURE HYDRAULICS.**

Hydraulics are a stored power source and as such must be treated as energized at all times. Be certain pressure has been relieved prior to handling, inspecting or performing maintenance on this unit. Follow lockout tag out procedures and release all stored energy before servicing equipment. Failure to release energy or disable hydraulic energy can result in serious injury or death. High pressure fluids can also discharge at great velocity. Be certain to wear safety glasses while inspecting, operating and maintaining equipment.



#### **STAY CLEAR**

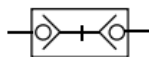
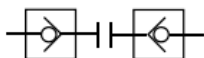
- Do not lift persons with this equipment.
- Always maintain a safe distance away from this equipment.
- Do not go near or under this equipment or any object lifted by this equipment.



#### **ENERGY ISOLATION**

Follow Refer to page with “**DISCONNECTION**” recommendation.

*The symbol at the left indicates hydraulic hose coupling quick release self sealing, which is recommended to be installed by the customer at the time this equipment is initially attached to the wheel loader.*



#### **POWER FAILURE**

In the event of electrical or hydraulic supply failure from the wheel loader occurs, the equipment will stop further motion. Under normal circumstances the equipment is not expected to drop a load. *The symbol at the left indicates the hydraulic controls on this equipment are normally closed.* Thus without electrical power the gate valves are closed, in essence halting further movement.



#### **SOUND**

This equipment does not emit more than 70dba.



#### **VIBRATIONS**

This equipment does not transfer vibrations in excess of 2.5m/s<sup>2</sup>.



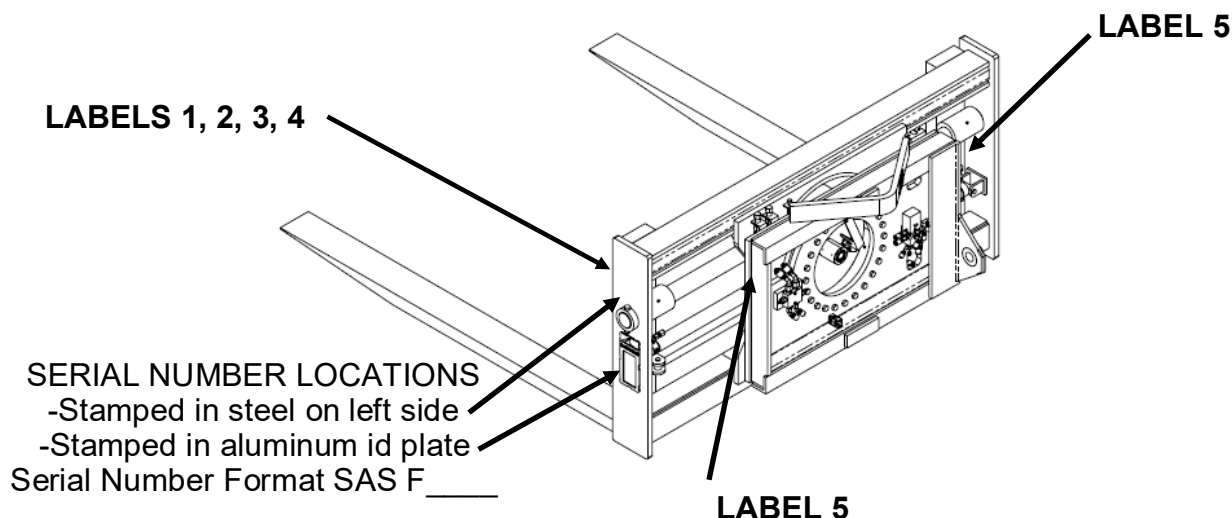
#### **OPERATING TEMPERATURE**

This equipment is best suited to operate in temperatures between 30°F to 90°F with minimum allowable temperature -25°F and maximum temperature 108°F.



## SAFETY LABELING (PAGE 8)

### SAS™ HYDRAULIC ADJUSTABLE



**LABEL 1:** KEEP AWAY FROM MOVING PARTS  
Label reorder # W-LAB-WARNING-PINCH



**LABEL 2:** HIGH PRESSURE HYDRAULICS.  
Label reorder # W-LAB-PRES-503600



**LABEL 3:** READ EQUIPMENT MANUALS  
Label reorder # W-LAB-READ-504060



**LABEL 4:** PRODUCT IDENTIFICATION LABEL  
SERIAL NUMBER, MODEL, LIFT CAPACITIES  
Label reorder # ID-PLATE  
Provide SAS Forks serial number.



**LABEL 5:** KEEP BACK 10 METERS (30 FEET)  
Label reorder # W-LAB-STAYBACK30FT  
Qty 2



## INSTALLATION (PAGE 9) ADVANCE PREPARATION

### TO HELP YOU GET UP & RUNNING QUICKER WHEN YOUR HYDRAULIC ADJUSTABLE ARRIVES:

- Review this operator manual and wheel loader manufacturer's OEM manual.
- ~~If you have optionally opted for SAS™ to be onsite to assist your mechanic with installation and provide training, please be sure the following items are completed:~~

### **Items you need to obtain before arrival of Hydraulic Adjustable:**

- (5) gallons of hydraulic fluid (specific for your machine)
- ~~Locate area to mount control module (i.e. recommend dry area, clear of seat and door)~~
- ~~Misc. nuts, bolts (1/4") or self tapping bolts~~
- Identify the hydraulic hose quick connections on your machine. Check with your machine manufacturer, and obtain the heaviest duty, highest volume self sealing male & female quick connections
- Locate a local hydraulic hose supplier who can make (2) 3/4" diameter 4,000 PSI hoses for auxiliary hydraulic connection **and (1) 1/2 diameter 1,500 PSI hose for 'valve case drain line'** with heavy duty quick connection fittings same day once proper length is determined during installation

### **~~Tools your mechanic may need for installation:~~**

- ~~Electric Drill & 1.25" hole drill saw~~
- ~~Basic socket and wrench set~~
- ~~(2) large adjustable wrenches or large wrench set~~
- ~~Teflon tape or thread sealer~~
- Wire cutter/crimper

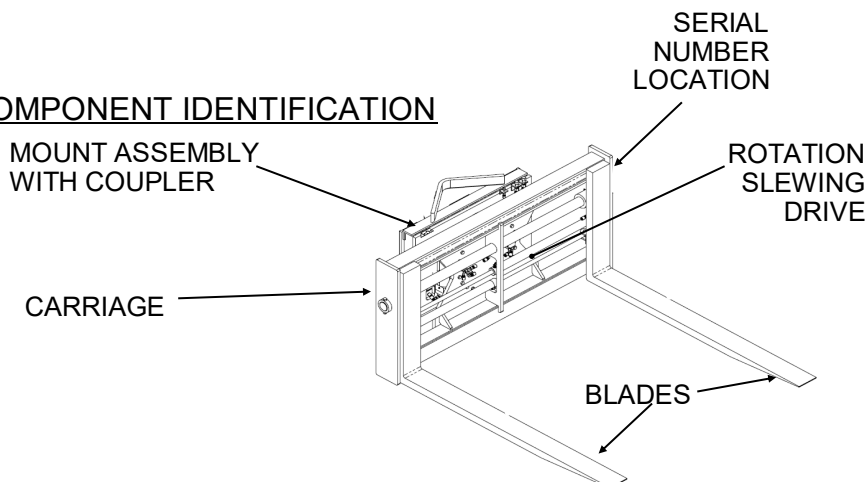
### **Service to do on your loader in advance:**

- Have the maintenance personnel replace the hydraulic system filters & fluid
- Pressure and flow test (recommend but not required)
- Inspect lift arm pins & bushings for wear (replace as needed)

### **Available for training:**

- ~~Designate an area (i.e. where it is safe to run the unit) and an employee to operate unit~~
- Your loader operator (person who can have conversation in English) Thank you.

### COMPONENT IDENTIFICATION



### QUESTIONS?

Call  
1-920-845-2198  
or Email:  
parts@sasforks.com  
sales@sasforks.com

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## INSTALLATION GUIDELINES (PAGE 10)

### SAS™ HYDRAULIC ADJUSTABLE

#### **WARNING**

- ▶ Installation of SAS Hydraulic Adjustable Forks (HA) on a wheel loader requires interfacing with electrical power system and high pressure hydraulic systems. Installation should be performed by qualified individuals.
- ▶ Failure to follow these instructions and precautions noted in the wheel loader manufacturer's service manual can result in serious damage to equipment and/or result in injury or death.
- ▶ Failure of hydraulic system can result in serious injury and property damage
- ▶ Use caution while testing operation of this unit. Be aware of:
  - Pinch points
  - High pressure hydraulic fluids or stored energy
  - Location of other individuals in the work area

#### STEP 1 - CONTROL:

- ~~Find a location to mount control module [A&B].~~
- Wires, fuse, utilizing existing customer equipment. Not provided by SAS Forks.
- ~~Needs to be within 2' of power supply.~~

#### STEP 2 - AUXILIARY JOYSTICK:

- Joystick existing customer equipment.
- Not provided by SAS Forks.

#### STEP 3 - POWER CABLE:

- Power, cable on existing customer equipment. Not provided by SAS Forks.

Existing Customer Equipment

Aux. Joystick  
(Fork Position  
& Rotate)

Main Joystick  
(Up/Down & Dump)

~~cable [A].~~

#### STEP 4 - ATTACH FORKS TO WHEEL LOADER:

- Quick Coupler Attachments:
  - Be sure lower locking pins fully extend to engage and lock coupler to SAS Forks.
  - This may require you to slightly lift or tilt the coupler to lock in.
  - It is recommended operator actually inspect each pin to be sure they are fully locked in.
- ~~Direct Pin Mounting:~~
  - ~~Remove existing pin attachment, align arms to H.A., insert and fasten pins in place. Apply ample grease to all pins.~~

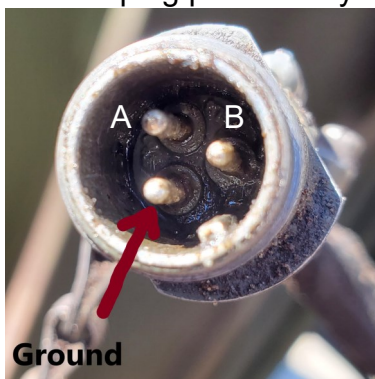
#### **WARNING**

Quick coupler locking pins are integral to the attachment of this unit to wheel loader. Verify the pins are locked in fully prior to lifting unit or use. Failing to verify proper engagement may cause the forks to fall off the loader resulting in property damage, injury or death.

## STEP 5 - CONTROL CABLE:

Control cable on machine arm utilizing existing customer equipment.  
Jumper cable from machine to SAS Forks provided by SAS Forks,  
P/N: **HC-CAB-S-ROT JUMP**

Photo of plug provided by customer:



### Auxiliary Hydraulic Joystick

Press rocker button one way, sends electrical to pin A  
Press rocker button opposite way, sends electrical to pin B  
Pressing rocker button will permit rotation control  
Not pressing rocker button will permit fork positioning



## STEP 6 - SECURE CABLES:

- Using plastic tie straps, all weather Velcro or similar non-marring strapping material to secure cables away from pinch, wear, or abrasive points. Damaged cable or wires will cause hydraulic

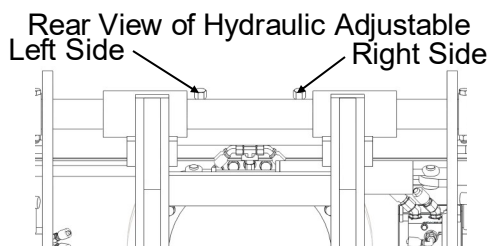


system to  
fail to op-  
erate  
properly.

This equipment is operated by high pressure hydraulics. Hydraulics are a stored power source and as such must be treated as energized at all times. Be certain pressure has been relieved prior to handling, inspecting or performing maintenance on this unit. Follow lockout tag out procedures and release all stored energy before servicing equipment. Failure to release energy or disable hydraulic energy can result in serious injury or death. High pressure fluids can also discharge at great velocity. Wear safety glasses while inspecting, operating and maintaining equipment.

## STEP 7 - HYDRAULIC HOSES:

- Determine adequate length of hoses needed from third function connections on loader arms to bulkhead lines on the forks. To decide length of line; raise unit, tilt unit full down; then measure distance required from bulkhead on fork carriage hydraulic fittings to loader connection. Make a loop in line to have sufficient length in hose to avoid creating tension in all positions.
- Use a 4,000 PSI minimum hose and heavy duty self sealing hydraulic quick coupler fittings on machine and  $\frac{3}{4}$ " (#12) Male JIC fittings on the forks.
- Use a 1,500 PSI minimum hose and heavy duty self sealing hydraulic quick coupler fittings on machine for 'valve case drain line' which is to be routed to a filter and back to the machine's hydraulic tank.



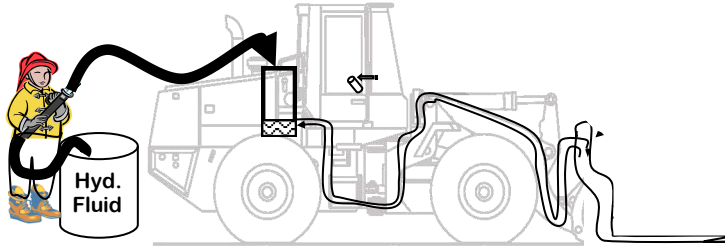
## INSTALLATION GUIDELINES (PAGE 12)

### SAS™ HYDRAULIC ADJUSTABLE

#### STEP 8 - HYDRAULIC FLUID LEVEL:



- You will need to add fluid at initial installation.
- Check level regularly. Refer to the wheel loader manufacturer's manual for proper filling specifications. Failure to keep fluid at proper operating levels can result in equipment failure.



#### STEP 9 - INITIAL INTERFERENCE TEST FOR LIFTING, TILTING, OR DUMPING MOVEMENTS:



- ▶ Watch for pinch points. Stay clear of moving parts while equipment is in operation. Moving parts can cause serious injury or death
- ▶ Watch for leaking hydraulic fittings, fix any leaks and clean up spills if they occur. Hydraulic fluid can cause eye irritation and slippery conditions which can result in injury.
- ▶ Watch for unexpected movements or erratic operation, stop test if unexpected movement occurs. Stored energy can cause unexpected movements that can result in serious injury or death.
- ▶ Verify all individuals are clear before performing test.

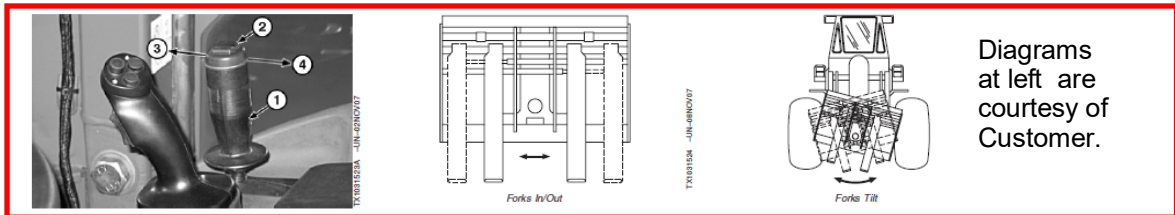


- Check for undesirable contact between loader lift arms and Hydraulic Adjustable framework. Watch for any loader arm, hoses, or cable pinch points.
- Begin testing by moving control levers slowly:
  - A. With carriage on the ground, fully roll back (fork tips up)
  - B. With carriage lifted high, fully rotate to the dump position (for tips down)
- ~~• Pin attach units may require addition of mechanical stops.~~
- ~~• If you experience interference you may need to install special roll back or dump stops. Contact SAS FORKS™ if you experience interference issues to discuss stop options.~~

#### STEP 10 - CHECK PROPER OPERATION: (CUSTOMER EXISTING JOYSTICK W/BUTTON)

**=====Specific for serial number SAS F6023 & SAS F6024=====**

- Hydraulic circuit on forks will default to directing fluid to fork positioner. Move auxiliary hydraulic (3rd spool) (#1 in photo) lever forward or back to reposition forks closer or farther apart.



- Engage button on joystick before actuating joystick to redirect fluid to rotate fork carriage.

If functions operate backwards from desired, simply switch or cross over main hydraulic hoses from loader to forks.

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# DAILY PRE-OPERATION INSPECTION (PAGE 13) (SUGGESTED MINIMUM INSPECTION GUIDELINES)

- > Inspection Required at start of each shift.
- > Responsible Person: First employee to use this piece of equipment on each shift, each day.
- > If you find any safety problems fix them immediately or tag and lock out this unit so no one uses it.
- > Notify your supervisor about any problems and arrange for immediate service.
- > A record of repairs made should be attached to this sheet for proof of safe operating condition
- > Park safely. Do not obstruct exit. set parking brake, lower forks with tips on ground, shut off lights.
- > When this page is full, turn page into office for filing request a blank form.
- > Office / Supervisor: Keep this completed sheet and associated records of repairs on file.

## A. WHEEL LOADER GENERAL PRE-OPERATION INSPECTION

Week Day #	Think Safety First Unit # ..... X=item OK ..... S=needs Service .....	Date	By Who	Hour Meter	Engine Off & Keys Out	Parking Brake Set	Engine Oil Level	Hydraulic Fluid Level	Antifreeze Level	Fan / Alternator Belts	Fuel System Leaks	Tire Condition	Tire Pressure	Tire Lug Bolts Tight	Hydraulic Hoses	Lift Arms / Chains	Grease Lifting Pins	Forks Secure	Seat Belt Operation	Fire Ext. Charged	Parking Brake	Dash Warning Lights	Fuel Level	Engine - No Noises	Horn	Lift operation	Steering System	Brake System	Reverse Warning
1																													
2																													
3																													
4																													
5																													
6																													
7																													

## B. SAS™ HYDRAULIC ADJUSTABLE (H.A.) PRE-OPERATION INSPECTION

Week Day #	Think Safety First Unit # ..... X=item OK ..... S=needs Service .....	Date	By Who	Hour Meter	Engine Off & Keys Out	Parking Brake Set	Forks on the ground	Quick Coupler (if any) free from cracks	H.A. Securely Mounted to Loader	Pivot Pin Lock Bolts	Pivot Pin Condition	Grease All Pins	Hydraulic Hoses Not Damaged or Worn	Power cable condition	Hydraulic Fitting Leaks	H.A. COUPLER Free From Cracks	H.A. REAR CARRIAGE Free From Cracks	H.A. BEARING free from cracks	H.A. BEARING fasteners secure	H.A. FRONT CARRIAGE Free From Cracks	H.A. FRONT CARRIAGE tilt stops in place	H.A. Hydraulic block cover in place	H.A. BLADES Free of cracks	H.A. Smooth Operation
1																								
2																								
3																								
4																								
5																								
6																								
7																								

Note: Check torque on slewing ring bolts. Replace any loose bolt & washer with new. See maintenance instruction detail in attached Slewing Drive OEM manual, on pages following SAS Forks manual.

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## CONNECTING / DISCONNECTING (PAGE 14)

### SAS™ HYDRAULIC ADJUSTABLE



- ▶ Hydraulic system may have unexpected pressure.
- ▶ Always train operators on proper procedures. Set forks on the ground, depressurize hydraulic system, wear safety glasses, gloves and other personal protective equipment required by your workplace before attempting to disconnect hydraulic hoses.
- ▶ Practice lockout tagout procedure to prevent operation of equipment while servicing.
- ▶ Failure to follow these instructions can result in serious injury or property damage.

### DISCONNECTING

When disconnecting from Hydraulic Adjustable:

- A. Rotate the “front carriage” so that it is level with the “rear carriage”, and then spread “blades” out the furthest position. This position with all of the components in their home positions is ideal for storage and stability.
- B. Set the Hydraulic Adjustable down to position the blades flat on level ground.
- C. Set the loader’s parking brake.
- D. Turn off loader.
- E. Turn the key of the loader back on without starting the engine.
- F. Cycle through all joystick buttons moving the joystick forward (hold for 10 seconds) and back (hold for 10 seconds) several times while pressing & holding each button (on the SAS joystick control), to relieve all the hydraulic pressure in the lines.
- G. Turn key off.
- H. Disconnect control cable and hydraulic hoses at quick release, self sealing fittings only. Carefully place control cable and hoses where they will not be damaged or get soiled.
- I. Disengage the quick coupler and drive away.



### NOTICE

Do not allow the hydraulic connections to get dirty. Allowing dirt into the hydraulics will damage the Hydraulic Adjustable hydraulics and may cause catastrophic failure of the wheel loader’s hydraulic pump.

### CONNECTING

To re-connect to the Hydraulic Adjustable:

- A. Drive straight up to the Hydraulic Adjustable and avoid contact with hydraulic lines or control cable.
- B. Engage the quick coupler. Visually verify quick coupler locking pins are fully engaged.
- C. Turn off the loader.
- D. Cycle joystick and other lift levers in cab to relieve pressure in hydraulic lines.
- E. Connect hydraulic lines and control cable.
- F. Start loader and ensure proper operation.

=====SPECIFIC FOR Serial Numbers SAS F6023 & SAS F6024=====

Hydraulically adjust fork POSITION:

With machine running, forks off ground, and no load,  
Do not press joystick button

Move 3rd spool lever (~~fitted with SAS Forks joystick~~) forward or back

Hydraulically ROTATE forks:

With machine running, forks off ground, all persons clear, and if load is present,  
load must be secured to avoid undesired dropping of load.,

Press joystick button, slowly move 3rd spool lever forward or back  
Move joystick forward to ROTATE opposite direction.

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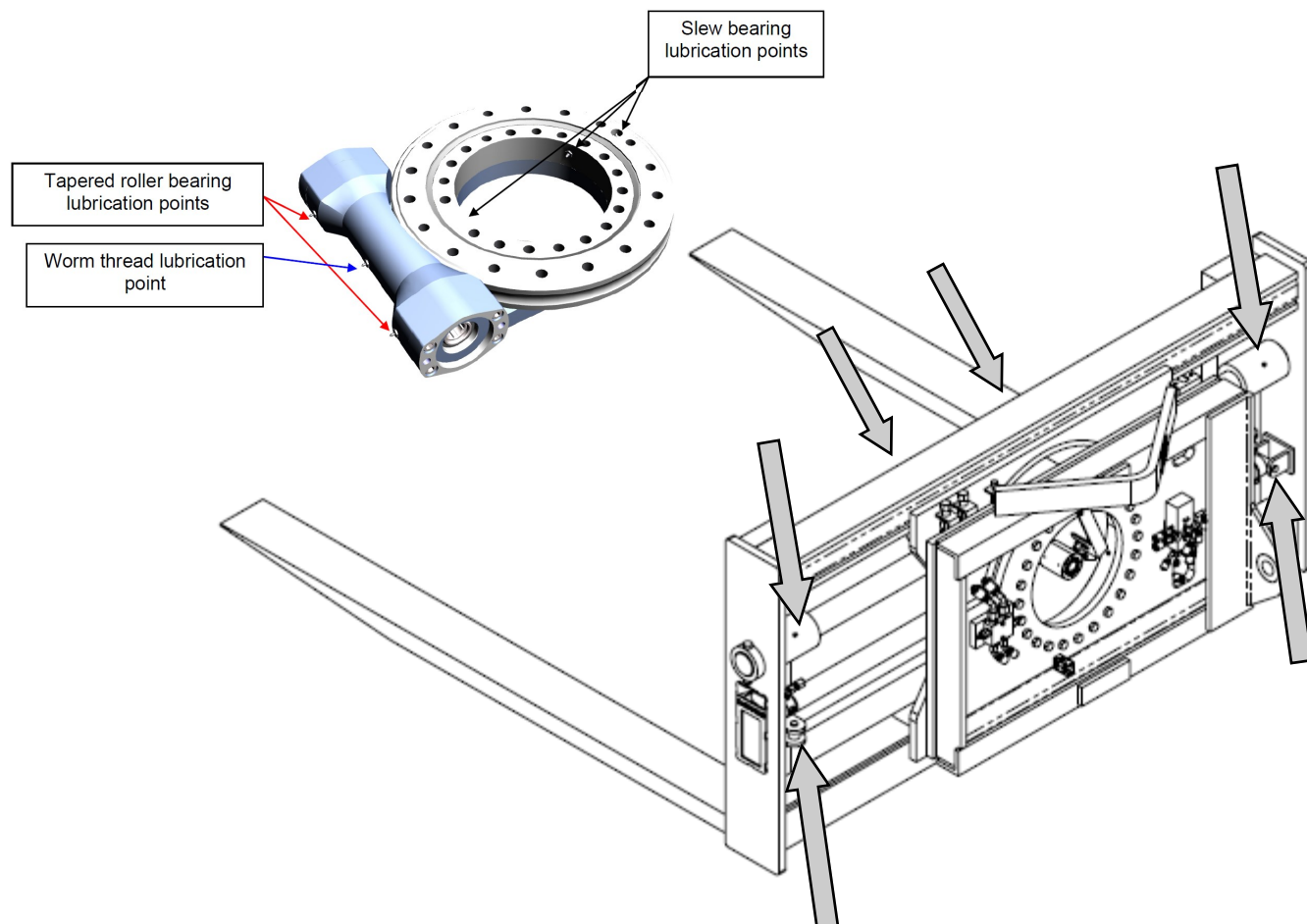
## PREVENTIVE MAINTENANCE (PAGE 15)

### SAS™ HYDRAULIC ADJUSTABLE



Set forks flat on the ground, turn off loader engine, depressurize hydraulic supply to forks, stay clear of pinch points during greasing. Safe and proper daily maintenance will help ensure long term performance and prevent failures. Failure to follow preventive maintenance guidelines can result in equipment failure resulting in injury or property damage.

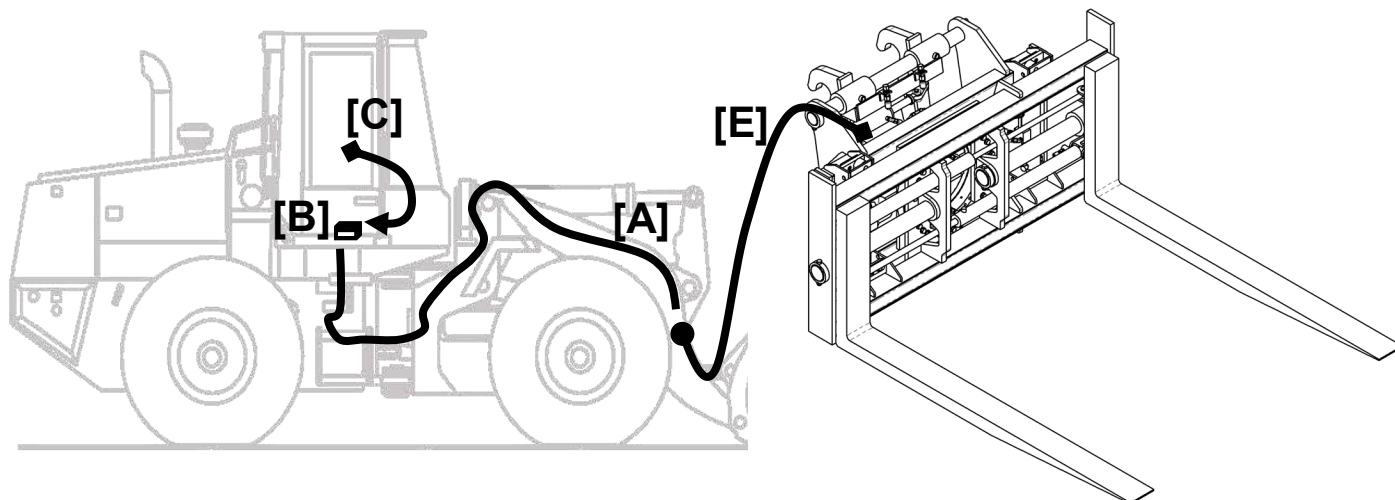
- A. Daily: Inspect all pivot point pins and slewing ring retaining bolts to be sure properly secured.
- B. Daily: Inspect forks, carriage, and Hydraulic Adjustable framework for damage or cracking.
- C. Daily: Check loader hydraulic fluid level. Add fluid as required to maintain proper level.
- D. Daily: Grease fork eyelets
- E. Weekly: Grease cylinder pin connections (right & left sides of each cylinder)
- F. Weekly: Inspect hose fittings to be sure they are tight.
- G. Weekly: Inspect hoses for pinching or rubbing. Correct or replace as needed.
- H. Periodically, per slewing ring OEM manual ([Slew Drive Model# HFWE-25AH0024](#)) ([Slew Drive OEM attached at end of SAS Forks manual](#)) grease three points of slewing ring, roller bearing and worm thread. Varies depending on use, from every 30 hours of use, for heavy use, to every 50 hours. **====Specifically for Serial Numbers SAS F6023 & F6024====**  
Grease recommended per Slew Drive OEM: Mobile, XHP 462-Moly



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## ELECTRONICS PARTS GUIDE (PAGE 16)

### SAS™ HYDRAULIC ADJUSTABLE



====Specifically for Serial Numbers SAS F6023 & F6024====

#### DESCRIPTION

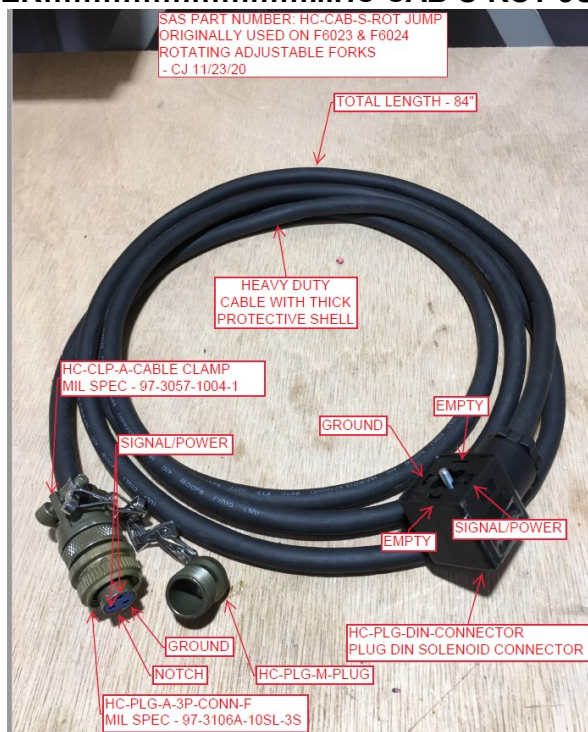
#### PART NUMBER

- [A] Cable from cab to front arms, using customer existing equipment. Not provided by SAS Forks
- [B] Relays (if any) and fuses, using existing customer equipment. Not provided by SAS Forks.
- [C] Joystick, using existing customer equipment. Not provided by SAS Forks.

#### [D] UNASSIGNED

#### [E] CABLE FROM COIL/VALVE ON FORKS TO LOADER.....HC-CAB-S-ROT JUMP

**SPECIAL CABLE & CONNECTOR  
TO MATCH CONNECTION  
ON LOADER FOR F6023 & F6024  
PROVIDED BY SAS FORKS  
CONTACT SAS FORKS FOR REPLACEMENT  
PHONE: 920-845-2198  
EMAIL: [parts@sasforks.com](mailto:parts@sasforks.com)**



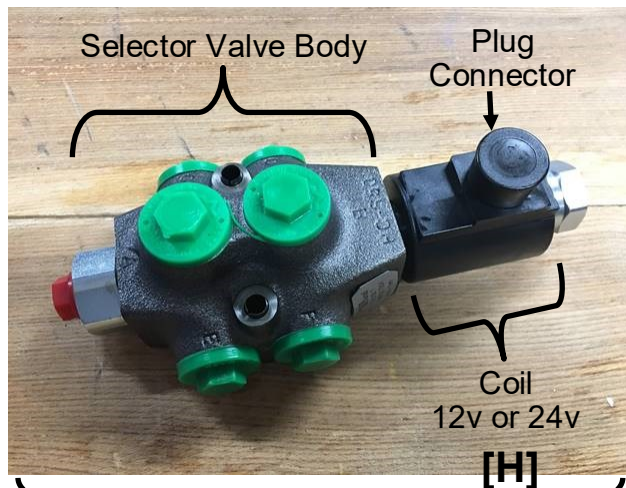
#### [F] UNASSIGNED

**See coil detail on next page**

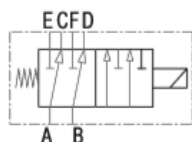
## VALVE BLOCK PARTS GUIDE (PAGE 17)

### SAS™ HYDRAULIC ADJUSTABLE

====Specifically for Serial Numbers SAS F6023 & F6024====

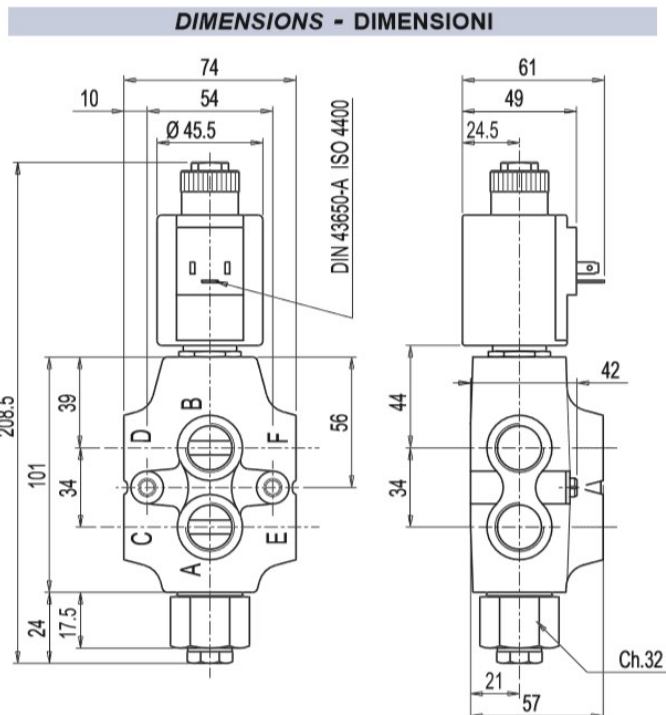


[G]



6 way  
A (B) normally in port C (D)  
6 vie utilizzo  
A (B) normalmente in utilizzo C (D)

**W029E**



#### DESCRIPTION

[G] **HYDRAULIC SELECTOR VALVE BODY W/COIL**

#### PART NUMBER

**HV-BLK-X26-40-006**

(NOTE: Specify 12v or 24v)

NOTE: Case drain line, filtered, back to hydraulic tank is required.

#### [H] SEPARATE COMPONENTS

H.1 COIL 24 Volt

(1 REQ.)

**HR-N-413172410**

H.2 COIL 12 Volt

(1 REQ.)

**HR-N-413174211**

#### [I] PRESSURE RELIEF BODY

I.1 PRESSURE RELIEF CARTRIDGE

1

**HY-PREREL-BODY**

**HY-PREREL-CARTRIDGE**

#### [J] FLOW DIVIDER BODY

J.2 CARTRIDGE

1

**HY-FLOW-CP10-4-8S**

2

**HY-FLOW-LO4A3-202ON**

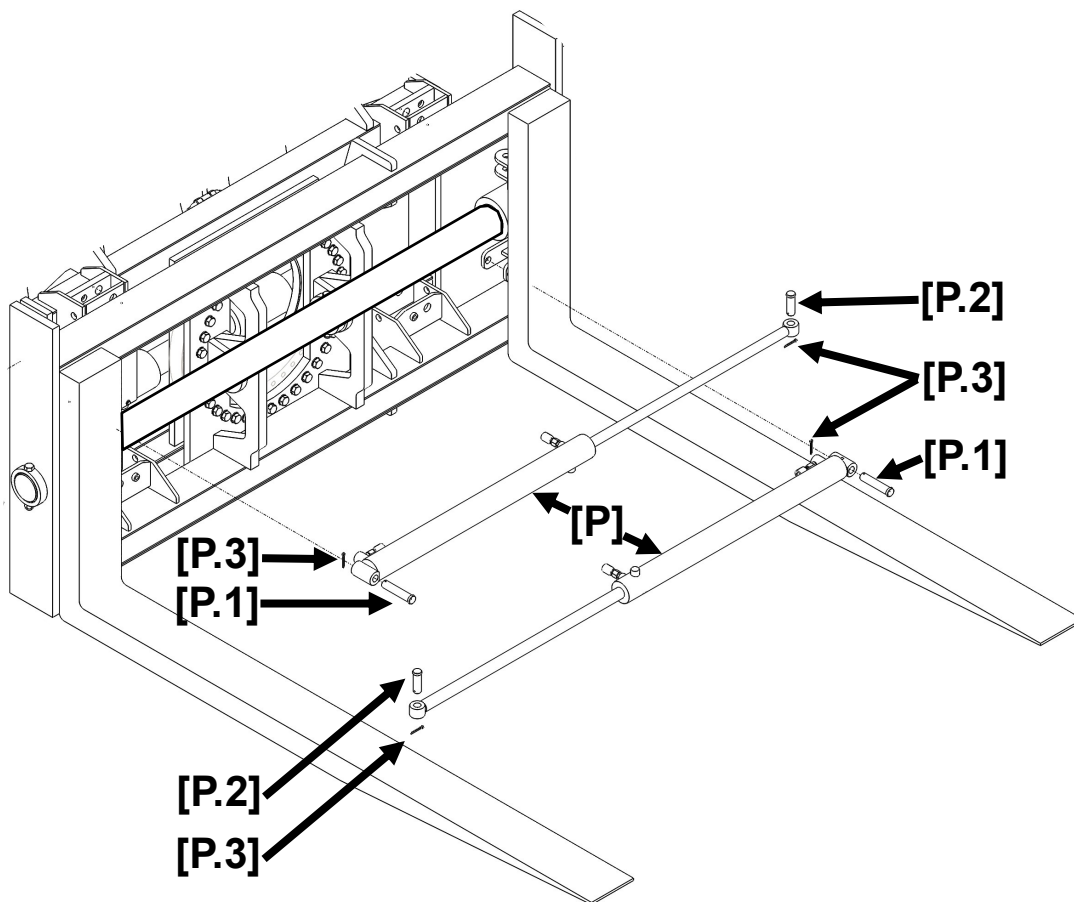


System may have stored hydraulic pressure. Disassembly of any hydraulic part, cartridge valve, coil or hose may result in sudden release of hydraulic fluid and may result in unexpected movement. Avoid this fluid or pinch hazard. Only qualified personnel should service this unit. The Hydraulic Adjustable unit should be lowered to the ground and secured.

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## CYLINDER & PIN DIAGRAM (PAGE 18)

### SAS™ HYDRAULIC ADJUSTABLE



#### DESCRIPTION

[N] UNASSIGNED  
[O] UNASSIGNED

#### QTY

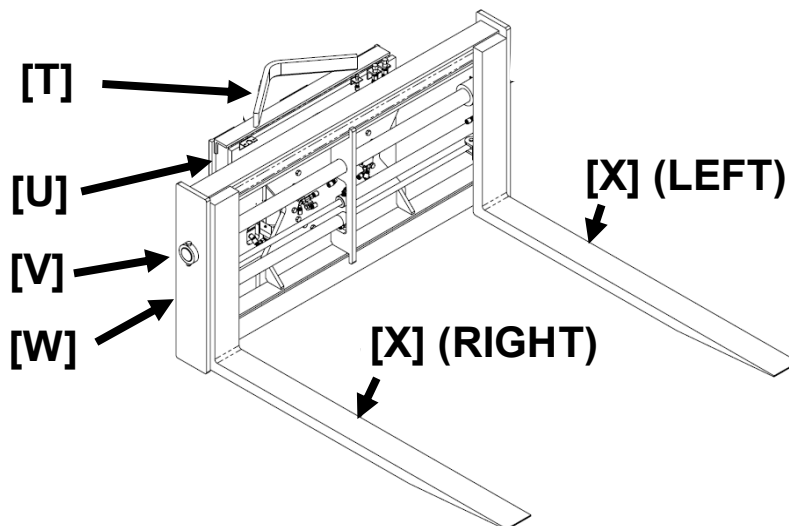
#### PART NUMBER

<b>[P] BLADE ADJUSTMENT CYLINDER</b>		<b>2</b>	<b>HY-CYL-250-40.00</b>
P.1 BASE CYLINDER END 4.5" PIN	(BOM ITEM 18)	2	PIN-98306A574
P.2 ROD CYLINDER END 3.0" PIN	(BOM ITEM 17)	2	PIN-98306A562
P.3 PIN RETAINER COTTER PIN	(BOM ITEM 19)	4	WPIN .125X1.25
P.4 COMPLETE CYLINDER SEAL PACKING KIT		1	HK-2.50-207100

[Q] UNASSIGNED  
[R] UNASSIGNED  
[S] UNASSIGNED

## FRAMEWORK PARTS GUIDE (PAGE 19)

### SAS™ HYDRAULIC ADJUSTABLE



DESCRIPTION	QTY	PART NUMBER
<b>[T] MOUNT PLATE w/ACS TRAM 1000 COUPLER</b>	<b>1</b>	<b>N/A</b>
NOTE: Dwg Ref: 1414JD624K-6023		
T.1 HOSE RETENTION CLAMP	1	HY-CLAMP-.750-2 HOSE
<b>[U] ROTATION SLEWING DRIVE ASSEMBLY (w/MOTOR)</b>	<b>1</b>	<b>HR-ROT-C-WE25-104B</b>
NOTE: Motor Maximum Pressure 10 MPa (1,450 psi), Maximum Flow 20 L/min (5 gpm)		
U.1 MOTOR	1	HR-C-200-A-78-6-RV-B
U.2 SLEW DRIVE (w/o motor)	1	HR-C-WE25104BBHR2289
U.3 3/4" BOLT SLEWING TO 'MOUNT PLATE' (BOM ITEM 15)	24	WBOLT 0.750X3.50 GR8
U.4 3/4" BOLT SLEWING TO 'CARRIAGE' (BOM ITEM 14)	25	WBOLT 0.750X2.50 GR8
U.5 ROTARY UNION (SWIVEL) (BOM ITEM 10)	1	HY-ROT-GP-420
U.6 ROTARY UNION BRACKET (BOM ITEM 6)	1	MANG04.00X4.00X.250
U.7 ROTARY UNION BOLTS (BOM ITEM 21)	4	WBOLT 0.3125X3.25
<b>[V] FORK SHAFT</b>	<b>1</b>	<b>MRND 3.500 SP 103.25"</b>
NOTE: Dwg Ref: 1410JD624K-96IN-6023 3.5IN FORK SHAFT		
V.1 SHAFT END RETENTION COLLAR	2	MTUBE 5.000X1.00W 1.375"
V.2 3/4" BOLT	2	WBOLT 0.750X6.00 GR8
V.3 3/4 NYLOCK NUT	2	WNUT 0.750-10-GR8-NY
<b>[W] CARRIAGE</b>	<b>1</b>	<b>1401JD624K-96IN-6023</b>
<b>[X] BLADES</b>	<b>2</b>	<b>BFL-300-08-96-48-30T</b>
NOTE: Dwg Ref:1409JD624K-6023 BLADE ASSEMBLY HAS LEFT AND RIGHT BLADES		
<b>[Y] UNASSIGNED</b>		
<b>[Z] UNASSIGNED</b>		

## WIRING SCHEMATIC GUIDE (PAGE 20)

### SAS™ HYDRAULIC ADJUSTABLE

==Specifically for s/n SAS F6023 & SAS F6024 using Customer Existing Electrical.==

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Detail below is Jumper Cable provided by SAS Forks from loader to SAS Forks carriage





## TROUBLE SHOOTING (PAGE 21)

== Specifically for s/n SAS F6023 & SAS F6024 ==

### WARNING

Hydraulic system may have stored energy. Electrical system is hazardous. Be certain to follow all safety procedures and guidelines while trouble shooting. Only qualified heavy equipment technicians should service this equipment. Malfunctions of equipment can result in un-expected movements resulting from stored energy releases. Failure to follow safe procedures or practices can result in property damage, injury or death.

Hydraulic Adjustable forks does not work properly or work at all?

1. Are hoses & wire properly connected between loader and forks?

No

Properly connect & lock hose & wire connectors in place

Yes

2. Any visible hydraulic leaks on Forks or wheel loader?

Yes

1a. Fix all leaks & start over

No

3. Is the hydraulic tank fluid level full?

No

Fill with new & clean hydraulic fluid to full mark

Yes

4. Is operator utilizing the correct joystick in the cab to allow fluid flow to the correct auxiliary spool which runs to the Hydraulic Forks?

No

Read Wheel Loader Operator's Manual. Identify correct joystick.

Yes

4. When joystick button is not pressed, do Fork positioners work?

No

Check hose connections, cylinder pins, & cyl condition

Yes

5. When joystick button is pressed, to redirect flow to rotate function, and joystick is moved to allow fluid flow, does Fork carriage rotate as expected?

Yes

End. Forks should be working. Contact SAS with explanation on issue.

No

6. Is the operator pressing and holding the joystick button fully during the attempted operation of the rotate function and actuating the joystick lever?

No

Hold button down while engaging joystick to provide for continuous electrical flow to coil which actuates diverter valve

Yes

7. Check for power and ground inside plug connected to coil on diverter valve bolted to rotator. Do you have power and ground inside the plug at coil when button in cab is pressed and key is on?

No

Inspect, test & repair cable from rotator to cab to relay, joystick button, relay & fuse

Yes

8. Remove coil from selector valve, attach electrical plug if removed, inside the opening on the coil, set a steel screw driver. With Engine Off, key 'on' press joystick button. Does coil generate magnetic field and attract steel screw driver with button pressed?

No

Replace coil.  
12 volt p/n:HR-R-108-0141  
-or-  
24 volt p/n:HR-R-108-0165

Yes

9. Reinstall coil and electrical plug on valve. With machine running and joystick activated, are there signs of pressure in the lines?

No

Call wheel loader service technician to test auxiliary spool pressure & operation

Yes

10. Call OEM wheel loader service technician to provide additional trouble shooting and/or contact SAS FORKS with your Serial # for advice. 920-845-2198

## TROUBLE SHOOTING (PAGE 22)

### SAS™ HYDRAULIC ADJUSTABLE

#### ⚠ WARNING

- ▶ Hydraulic system may have stored energy.
- ▶ Electrical system is hazardous.
- ▶ Be certain to follow all safety procedures and guidelines while trouble shooting.
- ▶ Only qualified heavy equipment technicians should service this equipment.
- ▶ Malfunctions of equipment can result in un-expected movements resulting from stored energy releases.
- ▶ Failure to follow safe procedures or practices can result in property damage, injury or death.

**PROBLEM** - The Hydraulic Adjustable (H.A) parts move backwards - or opposite of the direction indicated in the manual.

**STEP 1:** *The main hydraulic lines routed from the wheel loader to the H.A. are hooked up backwards to the H.A. Switch the two hoses where they connect to the H.A. Retest. Did that correct the problem?*

YES - End.

NO - Go to next step.

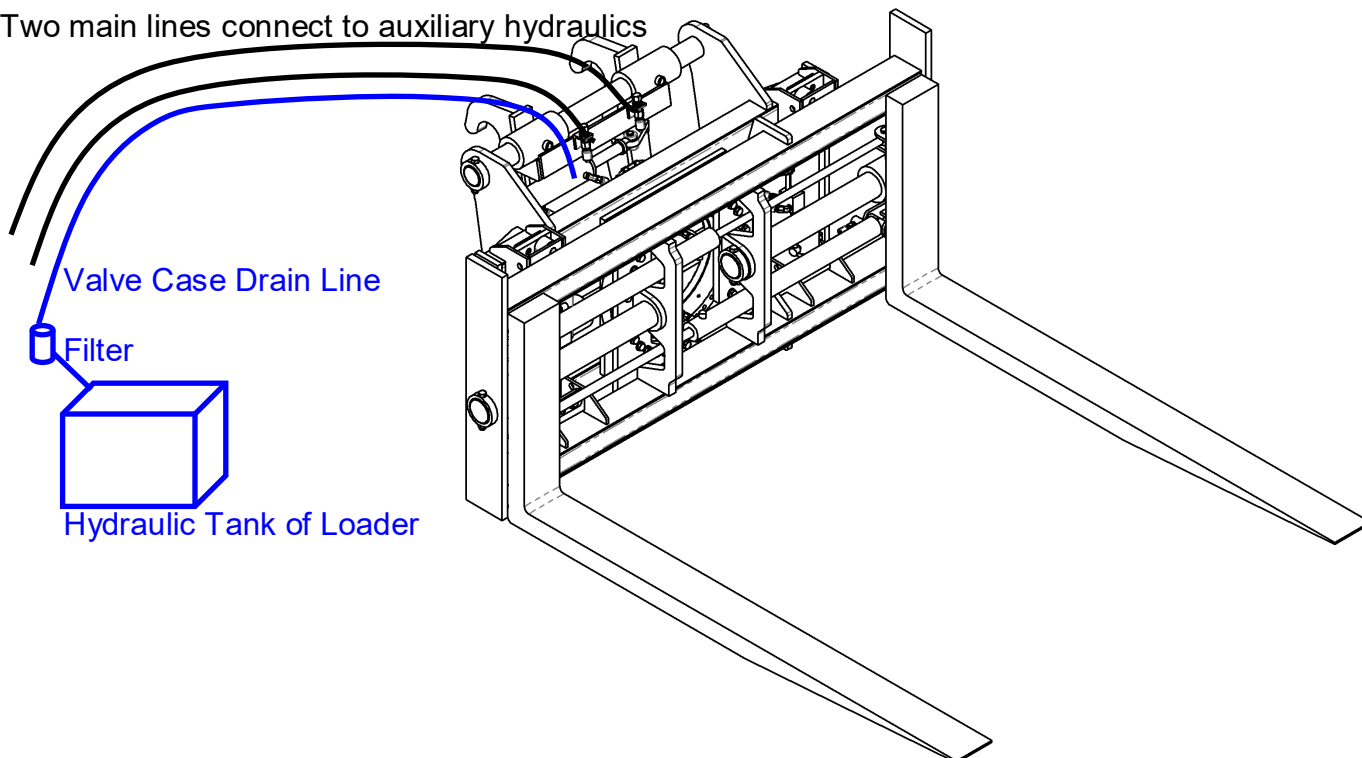
**STEP 2:** *Check to be sure harness [A], which provides the ground and power to the control box is hooked up properly. The wire with the fuse link should be positive power. The wire without the fuse should be ground. If the wires are not hooked up properly, then remove and hook up properly. Retest movement. Does the H.A. work properly now?*

YES - End.

NO - Go to next step.

**STEP 3:** *Contact a local wheel loader or hydraulics service technician or contact SAS™ with your H.A. Serial # for technical support.*

Two main lines connect to auxiliary hydraulics



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## TROUBLE SHOOTING (PAGE 23)

### SAS™ HYDRAULIC ADJUSTABLE

==Specifically for s/n SAS F6023 & SAS F6024 ==

#### WARNING

- ▶ Hydraulic system may have stored energy.
- ▶ Electrical system is hazardous.
- ▶ Be certain to follow all safety procedures and guidelines while trouble shooting.
- ▶ Only qualified heavy equipment technicians should service this equipment.
- ▶ Malfunctions of equipment can result in un-expected movements resulting from stored energy releases.
- ▶ Failure to follow safe procedures or practices can result in property damage, injury or death.

**PROBLEM** - The blades, front carriage, and/or coupler seem to move by themselves or when a different function is selected on the joystick.

**STEP 1:** *Is only 1 button on the joystick being selected before moving lever on joystick?*

YES - Go to next step.

NO - Only move the lever on the joystick forward or back after one of the buttons are engaged. If the lever on the joystick is moved without selecting one of buttons, full pressure hydraulic fluid circulated through the hydraulic block assembly.

**STEP 2:** *Is one function that is moving by itself consistently?*

YES - See "[ELECTRONIC PARTS GUIDE & WIRING SCHEMATIC](#)", Then follow directions:

PLACE FORKS FLAT ON GROUND

TURN ENGINE OFF & KEY IN "ON" POSITION FOR THESE TESTS

Disconnect cable, use test light end of cable.

*When no buttons are pressed, is the test light on?*

YES - The relay is bad. Replace & retest.

NO- Go to next step.

**STEP 3:** *Move joystick lever forward and back, without pressing any buttons. Does the test light come on occasionally?*

YES - The joystick cable is shorting out, likely just under the handle. Repair cable or replace joystick and cable assembly.

NO - Go to next step.

**STEP 4:** *Identify specifically which item is moving when you are not selecting that button. Does this uncontrolled or undesired movement happen all the time?*

YES - Replace the appropriate pair of solenoids cartridge valves in the valve block which control this specific function.

NO - If this only happens very rarely, you may have dirt in your hydraulic system which is interfering with the solenoid valve closing and sealing properly. Be sure prior to connecting hydraulic fittings, that both ends are clean.



## TROUBLE SHOOTING (PAGE 24)

### SAS™ HYDRAULIC ADJUSTABLE

#### **WARNING**

- ▶ Hydraulic system may have stored energy.
- ▶ Electrical system is hazardous.
- ▶ Be certain to follow all safety procedures and guidelines while trouble shooting.
- ▶ Only qualified heavy equipment technicians should service this equipment.
- ▶ Malfunctions of equipment can result in un-expected movements resulting from stored energy releases.
- ▶ Failure to follow safe procedures or practices can result in property damage, injury or death.

**PROBLEM** - The operator either cannot connect or disconnect the hydraulic quick disconnect fittings on the loader. The operator pushes real hard and the fittings still will not come off / on.

**STEP 1:** *Is the loader engine turned off?*

YES - Go-to next step.

NO - Turn off engine, and follow next step.

**STEP 2:** *Was the pressure released from the lines by:*

- A. Placing the Hydraulic Adjustable (H.A) flat on the ground. Set the parking brake on the loader.
- B. Position the “Blades”, “Front Carriage” and “Coupler” so they are centered and the H.A. gently resting on the ground.
- C. Shut off the engine of the loader and turn the key off.
- D. Turn the key to ‘on’ position (without starting engine) then move each hydraulic control lever forward and back a few times.
- E. Press each button on the joystick and move the joystick forward and back a few times.
- F. Turn off the key; then briefly move joystick forward and back.

*Were the hydraulic line able to be either connected or disconnected (with gloves and safety glasses worn)?*

YES - End.

NO - Go-to next step.

**STEP 3:** *Closely inspect the fittings. Do the fitting have a twist lock feature. (Common on Volvo machines for example)?*

YES - End.

NO - Go-to next step

**STEP 4:** *Closely inspect the fittings for damage or other reasons why they will not connect / disconnect. Try to resolve. Was the issue able to be resolved?*

YES - End.

No - Go-to next step

**STEP 5:** *Contact a local wheel loader or hydraulics service technician at your expense, or contact SAS™ with your H.A. serial # for technical support.*



## LIMITED WARRANTY (PAGE 25)

### SAS™ HYDRAULIC ADJUSTABLE

#### **SAFETY**

Buyer accepts the responsibility to (1) Ensure that all personnel that will use and/or work in the area of the purchased product will read the safety ID plate and the Operator Manual for machines equipped with SAS FORKS™ and the machine manufacturer's Operators Manual, prior to use; and (2) Ensure that all personnel follow the safety guidelines outlined on these materials.

S.A.S. OF LUXEMBURG, LLC. IS NOT RESPONSIBLE FOR SAFETY IN THE FIELD.

#### **GOALS OF THE S.A.S. OF LUXEMBURG, LLC. LIMITED WARRANTY PROCEDURE**

- ASSURE MINIMUM CUSTOMER DOWNTIME by resolving the problem correctly on a timely basis.
- ASSURE END-USER CONFIDENCE while maintaining an equitable warranty expense for both your company and SAS.
- PRODUCT IMPROVEMENT. We have an engineering staff ready to assist you. Call us at 1-877-SAS-FORK (1-877-727-3675)  
Please call S.A.S. of Luxembourg, LLC. (SAS™) before attempting any repair, modification, or questionable job applications.

#### **LIMITED WARRANTY FOR SAS FORKS™**

For products that SAS™ manufactures, SAS™ warrants that such products conform to all specifications for materials and workmanship for the period of time indicated below, after delivery, when used in compliance with the SAS FORKS™ Operator Manual.

PRODUCT	LIMITED WARRANTY PERIOD	ITEM	COVERED
HYDRAULIC ADJUSTABLE	1 year from original ship date	Carriage & Frame	Defects in materials & workmanship
HYDRAULIC ADJUSTABLE	90 days from original ship date	Hydraulic cylinders, controls, joystick	Defects in materials

No warranty on other products not listed above, unless otherwise specified on the face of the original invoice.

No warranty against abrasion wear, claw chip wear, fork tip damage, blade bending, fusible link, separation, bent fork mounting shafts, hoses, cables, or wires.

SAS™ does not warranty the products that it does not manufacture. Rather all warranties, if any, for these products are supplied by the manufacture. SELLER EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES, WHETHER EXPRESSED OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

#### **CALL FOR WARRANTY CONSIDERATION:**

To be considered for warranty repairs or replacement buyer must notify SAS™ of any warranty claim within 10 days after such claim arises, and prior to expiration of the warranty period and prior to the performance of any repairs being done, otherwise buyer waives all rights to such claim.

- Obtain the SAS™ Fork serial number & call SAS™ at 920-845-2198. Clearly describe the problem and the operation that was taking place when it occurred.
- Buyer is to return defective assembly, freight prepaid, or photographic evidence clearly showing the problem area and details of failure to SAS™ for review. When necessary, a factory representative may evaluate the problem in the field.

#### **WHAT SAS WILL DO:**

SAS™ will examine the defective product, and the details of the failure. If SAS™ determines that the failure of materials or workmanship was proven to be within the terms of this limited warranty, SAS™ will, at its option, repair or replace, Freight On Board (FOB) to the factory, in Luxembourg, WI, USA, the defective product. If the product cannot be returned to the factory, SAS™ may approve field repair of defective product. SAS™ will approve an appropriate amount of hours and cost for the repair before authorizing repairs to begin. No provisions will be made for incidental damages, mileage, travel time, overtime, down time, or special freight charges.

#### **CONDITIONS THAT WILL VOID YOUR WARRANTY:**

Failures, which in our determination were the result of:

- Improper installation.
- Misapplication - See SAS FORKS™ Operator Manual.
- Misuse or improper operation - See SAS FORKS™ Operator Manual.
- Exceeding the weight and/or lift limitation posted on the Identification Plate attached the SAS FORKS™.
- Negligence or failure to perform routine inspection and/or maintenance as outlined in the SAS FORKS™ Operator Manual.
- Unauthorized modification, welding, burning, grinding, installation of non-factory skid plates, etc. (other than specifically allowed in the SAS FORKS™ Operator Manual or as provided in a written authorization directly from SAS™ Factory Engineers.).
- Continued use after a malfunction of the hydraulic system in the forklift or loader.
- Accidental damage.

#### **LIMITED WARRANTY REMEDIES:**

Buyer must notify SAS™ of any warranty claim within 10 days after such claim arises; otherwise buyer waves all rights to such claim, unless agreed otherwise in writing. Buyer's sole remedy for breach of warranty is, at seller's option, the repair of the defect, or the providing of a replacement part FOB to seller's office. **Seller will not be responsible for costs of shipping, travel time, travel expense, dismantling or reassembling the product.** Further, seller will not be liable for any direct, indirect, consequential, incidental, or special damages arising out of a breach of warranty. These remedies are exclusive, and all other warranty remedies are excluded.

#### **PROPRIETARY RIGHTS:**

All designs and other proprietary rights provided by SAS™ to Buyer are to remain the property of SAS™, and Buyer shall honor all proprietary legends. Buyer agrees not to copy the design of SAS FORKS™ & SAS™ Hydraulic Adjustable or hire a third party to copy.

#### **LIMITATION OF LIABILITY:**

The seller's price is based on the enforceability of this limitation of liability, and the buyer understands that the price would be substantially higher without this limitation. Seller shall have no liability to buyer for lost profits or for special, consequential, exemplary, or incidental damages of any kind, whether arising in contract, tort, product-liability, or otherwise, even if advised of the potential damages in advance.

- In no event shall seller be liable to buyer for any damages whatsoever in excess of the contract price.
- In the event that any warranty or warranty remedy fails of its essential purpose, or is held to be invalid or unenforceable for any reason, in consideration of the other provisions of this agreement, the parties understand and agree that all limitations of liability under this provision will nevertheless remain in effect.

#### **SEVERABILITY:**

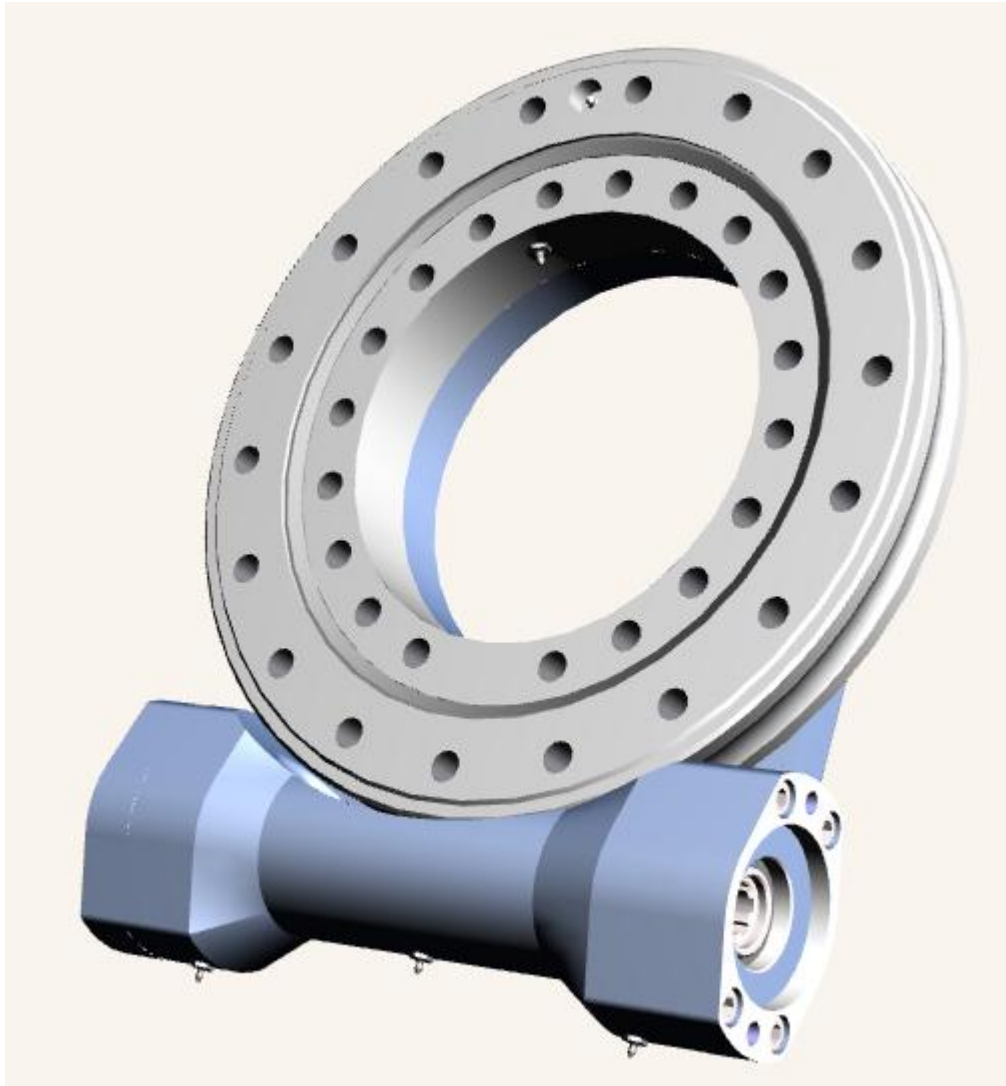
Any legally unenforceable provision may be severed from this agreement, and the remaining terms and conditions will be enforced as a whole.

#### **SALES TERMS:**

SAS FORKS™ SALES TERMS document is included as part of this document. See [www.sasforks.com/SalesTerms.pdf](http://www.sasforks.com/SalesTerms.pdf)



## **Slew Drive Installation and Maintenance Manual**





The following information is for your protection please read carefully:

- The following instructions provide the information needed for correct installation and maintenance of slew drive and slew bearings. Do not attempt to install or operate the slew drive or bearing until all of the instructions are read and thoroughly understood. If you have any questions, please contact Cone Drive.
- Exceeding the product ratings, output RPM or duty cycle will void the warranty. Please contact Cone Drive with any questions regarding rating and service factors.
- This product is provided without protective covers. It is the responsibility of the purchaser or user to provide guards for all exposed gearing, shafting, couplings, sprockets, sheaves, belts chains or any other moving parts in accordance with local, state and federal requirements.
- This slew drive has moving mechanical components and connected electrical or hydraulic components, operating under high voltage and pressure to achieve its intended purpose. Operation and repair should only be done by qualified personnel.
- Do not alter the product without approval from Cone Drive.

### **Contact Information:**

Cone Drive

240 E 12<sup>th</sup> Street PO Box 272

Traverse City, MI 49685

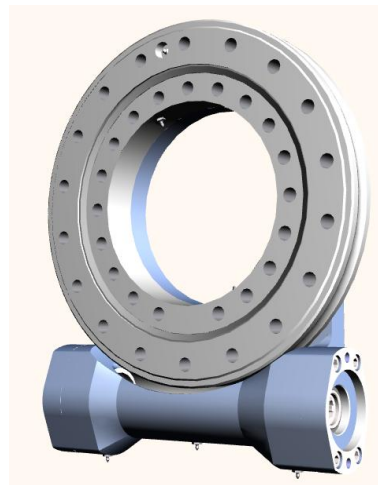
Ph: 231-946-8410

Fax: 231-933-8600

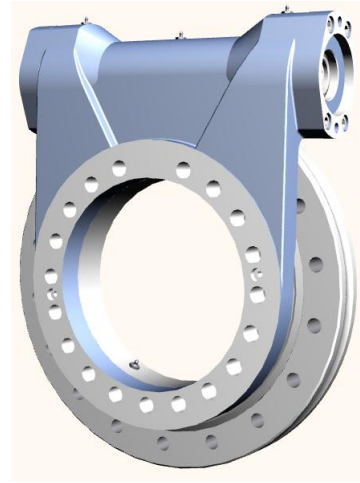
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## 1. Mounting Orientations



**Worm Under**



**Worm Over**

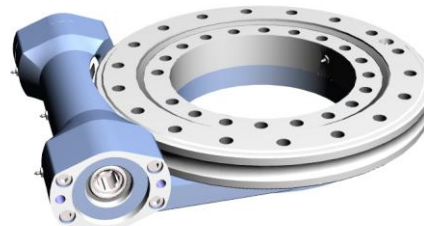
**Figure 1. Vertical Mounting Orientations**

When mounting a slew drive vertically we recommend mounting it in the worm over position. This will provide contamination protection for the gearing and bearings.

It is important to consider the source of potential contamination when mounting the slew drive and provide appropriate protective measures.



**Housing Up**



**Housing Down**

**Figure 2. Horizontal Mounting Orientations**

When mounting a slew drive horizontally we recommend mounting it with the housing up. This will provide contamination protection for the gearing and bearings.

It is important to consider the source of potential contamination when mounting the slew drive and provide appropriate protective measures.



**Notice:**

The following includes special notices and procedures that shall be observed. Failure to do so can result in premature failure of the unit.

**2. Transportation, handling and storage**

**2.1 Transportation**

When transporting the slew drive take special care to avoid impacts with the unit. The exposed nature of slew drive and slew bearing gearing can result in un-reparable damage. Slew drives come with the backlash preset. Impacts can alter this setting resulting in poor or excessive contact in the gearing.

**2.2 Handling**

When handling or moving the unit use appropriately rated eyebolts or hoist rings and the mounting holes in the slew bearing.

**2.3 Storage**

When storing the unit for more than 3 months it is recommended that the grease in the worm's slew bearing and gearing be purged with new grease prior to start up.

When storing the W product for a period of 5 months or less store indoors in the as shipped orientation. Keep the unit away from heat and moisture sources. Slew drive and bearings will come with surface corrosion protection that will prevent corrosion for a period of approximately 5 months if enclosed in the shipping packaging; longer period of storage require special protective measures.

**3. Installation**

**3.1 Preparation**

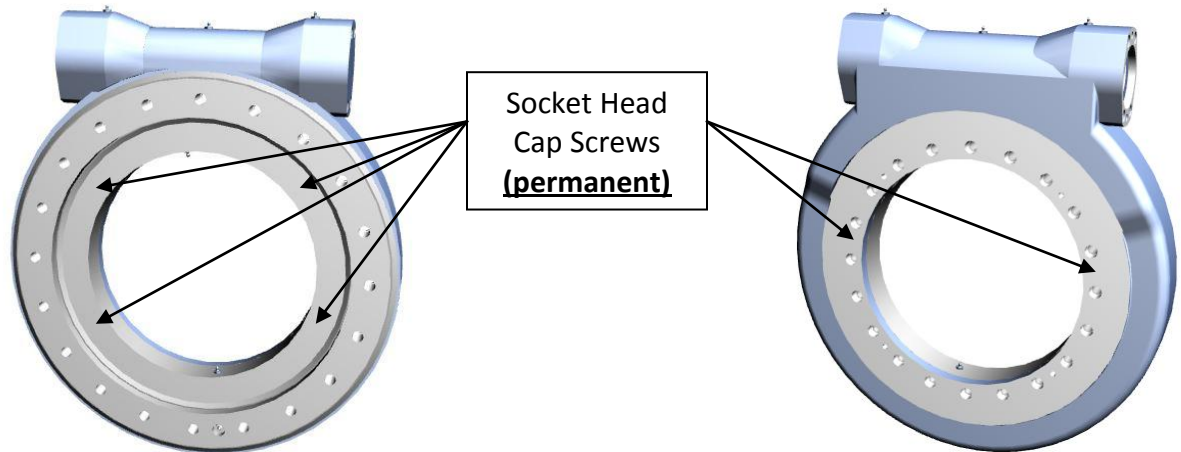
- Check the slew drive for physical damage.
- Clean the slewing drive and the mounting structure to remove any grease and debris.
- Remove extraneous materials from supporting surfaces.

**3.2 Cleaning**

- Clean the slew drive and bearing mounting surfaces and the mounting structure using a cold solvent. Use a solvent that will not damage the rubber seals of the bearing.
- Take care not to get any solvent into the slew bearing or gear mesh.

**3.3 Socket head cap screws and hex head bolts**

- W series Slew drives will come with socket head cap screws connecting the slew bearing to the housing. The socket head cap screws are recessed into the housing and shall not be removed. S series slew drives will come with hex head shipping bolts. Remove and discard these bolts prior to mounting the drive.



**Figure3. Shipping Bolts and Socket Head Screws**

### 3.4 Permissible flatness deviation of the mounting surface

Measurements to be taken circumferentially around the slew drive or bearing mounting surface. Peak values should not be measured more than once in 180 degrees and should resemble a smooth sinusoidal curve.

Size of Slewing Drive		7"	9"	12"	14"	17"	21"	19"	25"
Permissible flatness deviation	[mm]	0.11	0.16	0.23	0.26	0.32	0.42	0.45	0.49
Permissible flatness deviation	degree	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09

**Table 1. Permissible Flatness Deviations**



$\phi$  – Angle Deviation

x – Distance perpendicular Deviation

**Figure 4. Permissible Flatness Deviation**

### 3.5 Permissible Perpendicularity Deviation of the mounting surface

Measured from the inside diameter to the outside diameter around the slew drive or bearing mounting surface.

Size of Slewing Drive		7"	9"	12"	14"	17"	19"	21"	25"
Perpendicularity deviation	[mm]	0.1	0.12	0.15	0.15	0.15	0.15	0.2	0.2

**Table 2. Permissible Perpendicularity**

### 3.6 Mounting Bolts

As the slew drive manufacturer, we do not supply, warrant or recommend the mounting fasteners used.

- Please take great care in specifying which bolts will be used to mount the slew drive.
- Prescribed sizes, number and quality grades shall be used.
- Grip ratio (grip length to diameter of bolt) shall be observed, from minimum  $\geq 5$  to maximum  $\leq 10$ .

Slewing drive function, lifespan, and durability of the bolt connection are affected in case of non-compliance.

- Use flat washers of appropriate size and strength so that the permissible interfacial pressure is not exceeded.

#### 3.6.1 Tightening Torques

Use of split rings, split washers, polymeric washers of any kind are not permissible.

Metric mounting bolts		Imperial mounting bolts	
Mounting bolt	Tightening torque (N.m)	Mounting bolt	Tightening torque (ft.lb)
	Class 10.9		Grade 8
M12	97.7	1/2 -13UNC	80
M16	246	5/8-11UNC	159
M20	481	3/4-10UNC	285

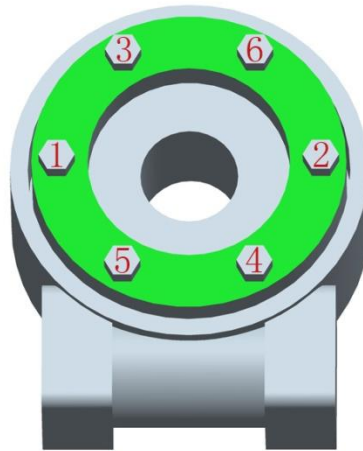
**Table 3: Tightening Torques for Reference Only**

### 3.6.2 Installation of Slewing Drive

- Clean the mounting structure to remove any welding spatter, residues, dirt, etc.
- Lift the slewing drive with eye bolts. Insure the eye bolts are fully threaded into the bolt hole. Use a minimum thread engagement of 1.5 times the bolt diameter.
- The slewing drive shall be mounted in unloaded condition.

### 3.6.3 Bolt Torque Sequence

- Apply thread lock liquid to threads (such as Loctite 242 or 271) according to manufacturer's instructions.
- Thread the bolts and washers, if required, into the slew drive hand tightening each bolt. Tighten one ring at a time. You can start with the inner ring or outer ring but you must follow the tightening procedure until the full tightening torque has been reached before moving to the next ring. The bolts should be tightened in a crosswise pattern as shown in Figure 5. Follow the crosswise pattern tightening each bolt to 30% of the tightening torque. Then repeat crosswise torque pattern tightening each bolt to 50% of tightening torque. Finally repeat the crosswise pattern tightening each bolt to 100% of the tightening torque. Proceed to the other ring and repeat the bolt torque sequence.



**Figure 5. Bolt Torque Sequence**

- Once the screw is fully tightened, make a permanent mark on the bolt head and mounting structure. This mark will act as a visual indicator during inspection to confirm the bolt has not loosened.

### 3.7 Paint Repair

- During the installation of slewing drive, any paint that is damaged shall be repaired. Failure to do so will result in corrosion issues and may affect the life of the slew drive.

## 4. Maintenance, Checks & Lubrication

### 4.1 Mounting Bolts and Checks

- To compensate for settling in the system, it is necessary to retighten the bolts to the prescribed torque .This shall be done after no more than 100 hours of operation without external loads applied to the bolt. This inspection shall be repeated annually at a minimum.
- If a loose bolt is discovered, replace the bolt and washer with new ones.

### 4.2 Lubrication and Mounting Bolts

On slew drives there are three places that will need lubrication. They are the slew bearing raceway, worm gearing and worm tapered roller bearings. Slew drives come preloaded with grease listed in Table 4. Table 5 has grease quantities required to fill the units. Slew bearings only require the raceway to be lubricated and will come prefilled with the grease listed in Table 4.

Parts needed to be lubricated	Tapered Roller Bearings, Slew Bearing, Gearing
Factory grease	Mobil, XHP 462-Moly
Applicable temp. range in °C	-40 ~+200
Color	Grey
Four-ball test	3500 N welding load
Viscosity (40 °C) cSt	460
Dropping Point °C	280
Penetration, Worked 25°C	280
Recommended Replacement Grease	Mobil, XHP 462-Moly

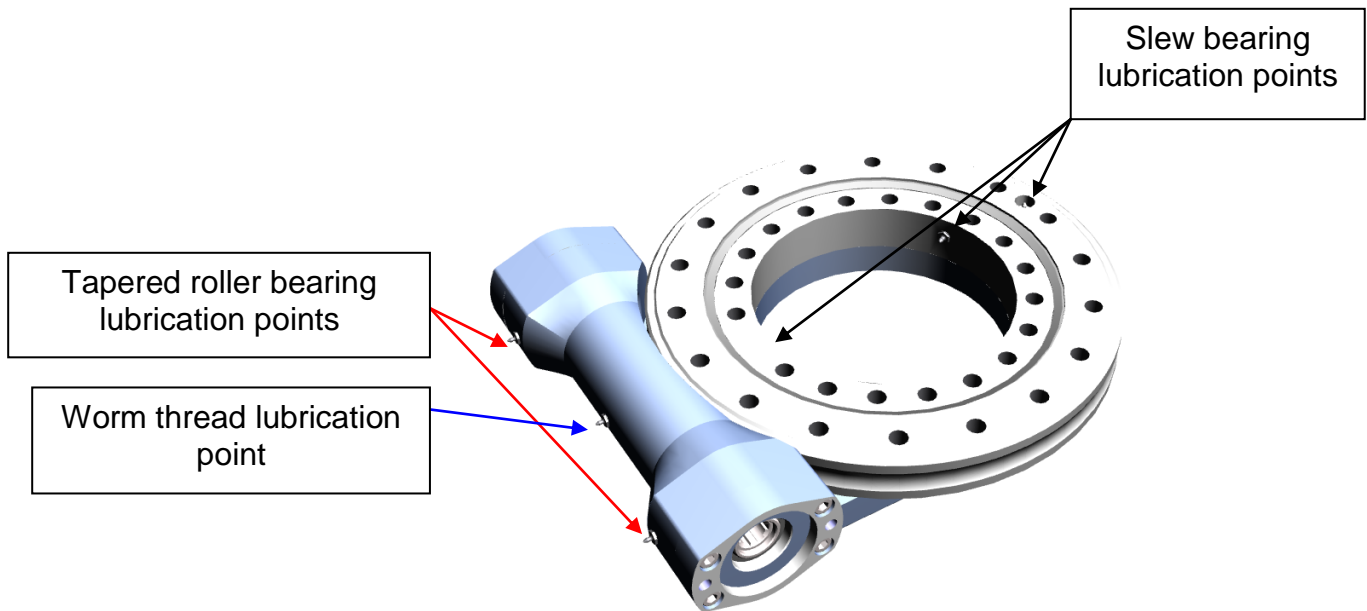
**Table 4. Grease Type**

Parts needed to be lubricated	Quantity of grease-filled (g)						
	7 "	9 "	12 "	14 "	17 "	21 "	25 "
Slew bearing raceway	15-20	30-35	45-50	55-60	70-75	120-130	140-150
Worm gearing	55-65	90-100	100-110	100-110	110-120	130-140	130-140
Worm tapered roller bearing	7±0.5	10±0.5	10±0.5	10±0.5	10±0.5	10±0.5	10±0.5

**Table 5 Grease Amount**

Manufacturer provisions about handling the respective lubricants must be observed.

- While rotating the slewing drive, inject grease into the cleaned grease nipples, according to table 5.



**Figure 6. Slew Drive Maintenance Points**

- At a minimum every 3 years completely replace all the grease by filling each cavity with new grease.

The specified lubrication intervals are valid for the following conditions

- Environmental operating temperature of slew drive -30 °C ~ +60 °C
- Driver rotational speed < 2 rpm (maximum speed varies depending on torque load applied during the same time)
- Low to medium output torques, Values below those listed in Table 6

Size	7"	9"	12"	14"	17"	21"	25"
Output torque (kN·m)	.75	3.25	3.75	4	5	7.5	9
Output torque (ft.lb)	553	2,397	2766	2950	3700	5500	6650

**Table 6. Low to Medium Output Torques**

Grease-filled slewing drive lubrication intervals			
Environment	Product Type		
	W/S	WE/SE	WEA/SEA
Dry and clean workshop, industrial positioners with shielding (turntables/robots, etc.)	Every 500 hours of operation or once a year.	Every 500 hours of operation or once a year.	Once a year.
Difficult conditions in open grounds (crane/ bulldozer, etc.) wind turbine, solar, man-lift	Every 30 hours of operation or once every 3 months	Every 50 hours of operation or once every 6 months	300 hours of operation or once every 6 months
Aggressive climatic conditions sea/desert/arctic climate/very dirty surrounding/more than 70 continuous operating hours per week	Every 25 hours of operation or once every 2.5 months	Every 40 hours of operation or once every 3 months	Every 150 hours of operation or once every 4 months
Extreme conditions (tunneling machines, steel mills, oil field)	Every 20 hours of operation, or once every 2 months	Every 30 hours of operation, or once every 3 months	Every 50 hours of operation, or once every 3 months

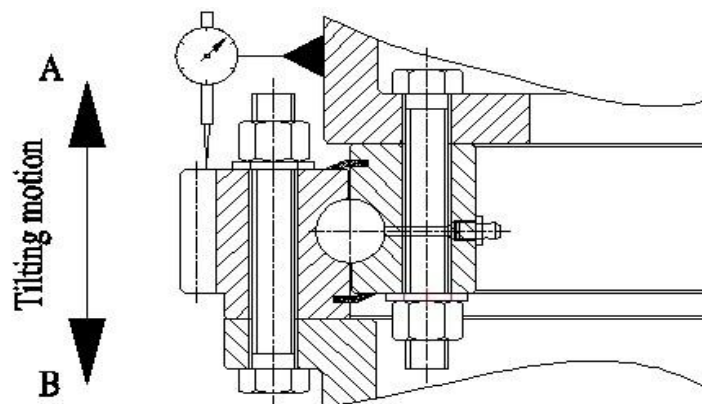
**Table 7. Recommended Grease Intervals**

Table 7 can never replace values established through experience; the most frequent cause of failure to slew drives is insufficient lubrication.

Cleaning a slewing drive with steam or pressure washer is not permissible.

### 4.3 Slew Bearing Wear

As a slew bearing wears the amount of tilting clearance will increase. To determine the increase in clearance you must measure the initial clearance of the bearing and record it for future comparisons.



**Figure 7. Tilting Clearance Measurements**

- Determine the maximum tilting moment A-B and mark the measuring point. The measuring point should be as close as possible to the bearing pitch diameter.
- Attach the dial gauge as shown in Figure 7.
- Apply the defined tilting moment, minimum 50% of the max operational load in direction “A”. Set the dial gauge to zero.
- Apply the defined tilting moment, minimum 50% of the maximum operational load in “B” direction.
- The measured value displayed corresponds to the tilting clearance and serves as a basis for comparison for later inspections.
- If the recorded increase or delta is larger than the value shown in table 8 replace the bearing
- All subsequent measurements are performed at the same measuring point, with the same position of the bearing rings relative to one another and in the same sequence.
- Recorded all measured values.

Size	7"	9"	12"	14"	17"	19"	21"	25"
Maximum Increase in Bearing Clearance (mm)	1.29	1.38	1.38	1.38	1.38	1.38	1.49	1.49

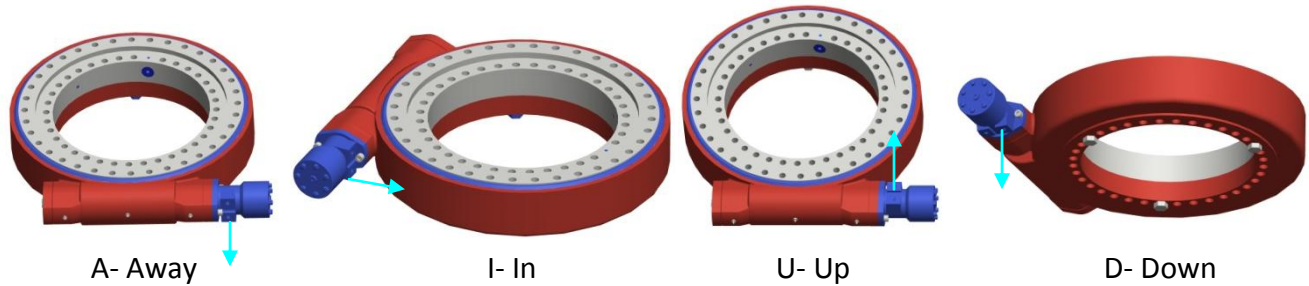
**Table 8. Maximum Increase in Bearing Clearance**

- If the bearing has less wear than what is shown in Table 8 but starts to make noise, experiences rough rotation, requires more power to rotate or has metal shavings in the grease the bearing should be replaced.

## **5. Drive & Control**

### **5.1 Mounting a Hydraulic motor**

- Clean mounting surface face of motor and slew drive (see section 3.2 Cleaning)
- Check motor hydraulic port mounting position (see Figure 8)
- Tighten motor bolt to appropriate torque level to achieve 70 % preload



**Figure 8. Oil Port Direction**

- Connect Hydraulic supply to motor.
- Rotate the motor and slew drive under no load to confirm it rotates smoothly
- Add rated load and test again



Please follow the specification provided with the motor Manufacturer!

**Cone Drive accepts no liability for:**

Failure to pass this manual to the related third party, Non-compliance with Installation and Maintenance Instructions, Any omissions or errors in following the manual