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SECTION 1 - NAMING CONVENTION AND SERIAL TAG

A. MACHINE PART NAMES:

- Pneumatic Connection
- Pneumatic Enclosure
- Drag Brake
- Main Post Bearing
- Pedestal
- Pneumatic Connection - Bottom Feed
- Main Post & Lift Cylinder
- Middle Joint
- Down Shaft
- Flanged End joint Assembly (FEA)
- Leveling Jack Assembly

B. SERIAL TAG NOMENCLATURE:

Manipulator Capacity below the Flanged End Joint (Tooling and Payload) in lbs

Serial Number

Provide for Service Support

Air SCFM

Tool Weight in lbs

Air Pressure

Serial Tag Location
SECTION 2 - SPECIFICATIONS
See Profile Drawing for special notes.

A. MECHANICAL SPECIFICATIONS
Equipment reach and load limit specifications are identified on the Profile View supplied with specific projects.
This view will include application lift, and mounting configurations identified and supplied at time of sale.

B. PNEUMATIC SPECIFICATIONS
See Profile Drawing for specification.

C. AERIAL NOISE
Aerial noise measurements are taken at the operator’s work position and based on a 50th percentile operator’s height.
Hearing protection required if level of continuous acoustic pressure is greater than 80 dB (A scale)

D. ENVIRONMENTAL CONDITIONS
The equipment is designed to operate inside a protected site from outside environmental conditions. The operating environment needs be free of aggressive contaminants, acids, corrosive gases, salts, etc.

Operating Temperature
- This equipment will operate correctly in its intended ambient between 40°F – 120°F [5°C – 49°C]

Relative Humidity
- This equipment will operate correctly within an environment at 50% RH, +105°F [+40°C]. Higher RH may be allowed at lower temperatures but must be less than 95% RH
- Measures shall be taken by the Purchaser to avoid the harmful effects of occasional condensation.

Altitude
- This equipment will operate correctly up to 3280ft [1000m] above mean sea level.

Transportation and Storage
- This equipment will withstand, or has been protected against, transportation and storage temperatures of -10°F [-25°C] to 130°F [+55°C] and for short periods up to 160°F [+70°C]. It has been packaged to prevent damage from the effects of normal humidity, vibration and shock.

E. CONVERSION FACTORS TO SI UNITS

<table>
<thead>
<tr>
<th>UNITS</th>
<th>MULTIPLY BY</th>
<th>TO OBTAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISTANCE</td>
<td>IN</td>
<td>25.400 MM</td>
</tr>
<tr>
<td>MASS</td>
<td>LB</td>
<td>0.454 KG</td>
</tr>
<tr>
<td>FORCE</td>
<td>LBF</td>
<td>4.448 N</td>
</tr>
<tr>
<td>TORQUE</td>
<td>INLB</td>
<td>0.113 NM</td>
</tr>
<tr>
<td>SPEED</td>
<td>IN/SEC</td>
<td>0.0254 M/SEC</td>
</tr>
<tr>
<td>POWER</td>
<td>HP</td>
<td>0.746 KW</td>
</tr>
<tr>
<td>VOLUME</td>
<td>GAL</td>
<td>3.785 L</td>
</tr>
<tr>
<td>FLOW</td>
<td>GPM</td>
<td>3.785 L/M</td>
</tr>
<tr>
<td>DENSITY</td>
<td>LB/FT³</td>
<td>16.019 KG/M³</td>
</tr>
<tr>
<td>PRESSURE</td>
<td>PSI</td>
<td>6.895 KPA</td>
</tr>
<tr>
<td>TEMPERATURE</td>
<td>F</td>
<td>SUBTRACT 32 AND MULTIPLY BY 5/9 C</td>
</tr>
</tbody>
</table>
### F. SAFETY FEATURES

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAIN POST BRAKES: Hold position of manipulator when parked or to help slow down arm rotation to a stop.</td>
<td>Main Post Brakes</td>
</tr>
<tr>
<td>MIDDLE JOINT AND END JOINT BRAKES: Hold position of manipulator when parked or to help slow down arm rotation to a stop.</td>
<td>Middle Joint and End Joint Brakes</td>
</tr>
<tr>
<td>OPERATOR CONTROL STATION: Operator uses to steer the manipulator and operate functions. If provided: Indicators are provided to assist the operator to know the state of functions.</td>
<td>Control Station</td>
</tr>
<tr>
<td>AIR COUNTER BALANCE CONTROL: Used to help keep the operator’s controls within an ergonomic height. The air counter balance control is a balance device that will support the control station where ever the operator releases the control station.</td>
<td>Control Station</td>
</tr>
</tbody>
</table>
G. PEDESTAL SPACER MOUNTING PATTERNS

WM 450 & WM 550

2-12 UN X THRU EQ SPACED
ON A Ø27.250 BC

20X Ø0.6564010
EQ SPACED ON
A Ø 16.875 BC

Ø20.480

Ø27.250
H. FLOOR MOUNTING REQUIREMENTS

It is solely the customer’s responsibility to provide the proper foundation for the manipulator and if conditions are questionable or concrete does not look adequate consult a qualified professional to inspect and make recommendations.

I. SOIL CONDITION:

The minimum soil compaction required is 2500 lb/ft².

J. FULLY REINFORCED CONCRETE FLOOR CONDITION:

<table>
<thead>
<tr>
<th>WM FLOOR CONDITIONS</th>
<th>WM 450</th>
<th>WM 550</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINIMUM CONCRETE THICKNESS</td>
<td>IN</td>
<td>IN</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>FULLY REINFORCED CONCRETE WITH A MINIMUM COMPRESSIVE STRENGTH</td>
<td>PSI</td>
<td>PSI</td>
</tr>
<tr>
<td></td>
<td>3,500</td>
<td>3,500</td>
</tr>
<tr>
<td>CONCRETE MUST BE CRACK FREE WITH A RADIUS</td>
<td>IN</td>
<td>IN</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

K. Poured FOUNDATION CONDITION:

<table>
<thead>
<tr>
<th>FOUNDATION DIMENSIONS</th>
<th>LENGTH</th>
<th>WIDTH</th>
<th>HEIGHT</th>
<th>REFERENCE DRAWING NO.</th>
</tr>
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<tbody>
<tr>
<td>WM 450</td>
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<td>78</td>
<td>24</td>
<td>201531723</td>
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<tr>
<td>WM 550</td>
<td>78</td>
<td>78</td>
<td>24</td>
<td>201531723</td>
</tr>
</tbody>
</table>

L. PLATING ON CONCRETE:

Contact Positech for drawings or ordering information.

<table>
<thead>
<tr>
<th>CONCRETE MOUNTING PLATES</th>
<th>ANCHORS NEED TO BE 6 DIAMETERS FROM A CRACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH</td>
<td>WIDTH</td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>IN</td>
<td>IN</td>
</tr>
<tr>
<td>WM 450 &amp; 550</td>
<td>48</td>
</tr>
</tbody>
</table>
SECTION 3 - INSTALLATION INSTRUCTIONS

Positech’s World Manipulator® Positioning Arm (WM) will require a pneumatic connection for motion. Refer to the profile drawing, schematic drawings, and component literature supplied by Positech for the specific pneumatic requirements for this specific project’s needs. Lifting controls will vary depending on the style and options selected at the time of sale. All connections and clearances need to comply with local and national codes.

Refer to the profile drawing for recommended reach. Maximum usable reach is the sum of 80% of the first and second arms plus 100% of tool reach. Check level to avoid wandering before use.

A. WM 450 & 550 PEDESTAL INSTALLATION:

LEVEL PEDESTAL OR SPACER BEFORE INSTALLING MANIPULATOR.

See pedestal drawing for torque requirements.

Refer to FLOOR MOUNTING REQUIREMENTS for concrete guidelines before mounting pedestal.

1. Locate the pedestal so the air line can be routed through the supplied hole in the location and orientation desired for bottom routing. Review the profile for proper anchor size. Drill size is equal to anchor size. Using the pedestal as a templet drill through the leveling jacks to start the eight holes. Move the pedestal and final drill at least 2" deeper than the anchor length.

2. Clean holes with compressed air and nylon brush.

3. Add 1 flat washer between concrete and pedestal for each jack.

4. Assemble anchor with washer, lock washer, and nut below anchor bolt chamfer and drive in with hammer.

5. Torque anchor to the Torque Specs on the Profile to seat anchor. Then loosen.

6. Level pedestal by adjusting the leveling jacks. Use a machinist’s level to check in two directions perpendicular to each other.

7. Tighten the jam nuts on jacks against pedestal flange.

8. Torque the anchors to the Torque Specs on the Profile.

9. Verify level after completed.

FINAL NOTES:

- No grouting is required to mount this pedestal.
- Re-torque this pedestal one week after install.
- Re-torque pedestal according to suggested maintenance schedule.
B. WM 450 & 550 SPACER INSTALLATION:

LEVEL SPACER BEFORE INSTALLING MANIPULATOR ON SPACER:

See profile drawing for torque requirements.

Overhead structure must support the manipulator with a deflection of less than 1/4°.

1. Install jack and jam nut.
2. Install flat washer, bolts and lock nuts if necessary.
3. Loosen the jam nut for leveling.
4. Loosen the bolts enough to level spacer.
5. Level spacer by adjusting the leveling jacks and tightening the bolts. Use a machinist’s level to check in two directions perpendicular to each other.
6. Torque the bolts to the Torque Specs on the Profile.
7. Tighten the jam nuts against spacer.
8. Re-check level of spacer to make sure it is still level.
C. LIFTING AND ATTACHING MACHINE

Unpacking. Remove any surrounding crating and plastic protective wrap. Locate the box which contains the base installation bolts, washers and Operation/Service Manual (sometimes the manual is shipped separately) or an installation document package. **DO NOT** remove the machine from its skid and **DO NOT** remove any restraining bands, chains or clamps. Check for shipping damage and report damage immediately to the carrier. Any claim for damage is to be made by you, because normally products are shipped F.O.B. from Positech.

Transport the equipment on the pallet(s) to the location where it will be installed. Select the installation location with proper consideration to the working radius and operating space of the machine. Mark the post centerline on the floor with two lines at least 3 feet (1 meter) long at 90 degrees to one another.

Refer to INSTALLATION INSTRUCTIONS to install the pedestal or spacer.

D. LIFTING THE MANIPULATOR WITH A STRAP AND LIFTING DEVICE AND CONNECTING POWER

Below are shown general lifting points. Manipulator configurations may vary with different options changing the lifting point slightly. Only lift a few inches to verify the load balance and adjust the lifting point as needed to create the correct load center as needed.

- Remove tooling and down shaft before lifting the manipulator. Secure the second arm in the folded back position.

Lifting strap and lifting device must be able to lift:
- WM 450: 1,800 lb
- WM 550: 2,000 lb

Refer to machine specific installation instruction sheet for more information and tools supplied in the installation package.

TOP PNEUMATIC CONNECTION:
Bring the air line to connect to the FR. Air line needs to be long enough to allow for twist and must not catch on manipulator or building during rotation.

BOTTOM PNEUMATIC TERMINATION:
Pedestal hole to route air line. After installing and leveling the pedestal pull the air supply line through the pedestal hole and attach the air line to the bottom swivel on the WM. Pull slack the hose back through the hole while lowering the WM onto the pedestal.
### E. LIFTING THE MANIPULATOR WITH A FORK TRUCK AND CONNECTING POWER

<table>
<thead>
<tr>
<th>Action</th>
<th>Information</th>
</tr>
</thead>
</table>
| **Remove tooling and down shaft before lifting the manipulator. Secure the second arm in the folded back position.** | **Lifting device and clamps must be able to lift:**  
WM 450: 1,800 lb  
WM 550: 2,000 lb  
**Refer to machine specific installation instruction sheet(s) for more information and tools needed for the installation.** |
| **TOP PNEUMATIC CONNECTION:** Bring the air line to connect to the FR. Air line needs to be long enough to allow for twist and must not catch on the manipulator or building during lifting. |  |
| **ADD A SHAFT COUPLING TO THE LIFT CYLINDER SHAFT BEFORE LIFTING:** Add a 1.25” bore x at least 3” long shaft coupling to the lift cylinder shaft to prevent the main post from tipping. The second arm must be folded back and secured before lifting. |  |
| **BOTTOM PNEUMATIC TERMINATION:** Pedestal hole to route air line. After installing and leveling the pedestal pull the air supply line through the pedestal hole and attach the air line to the bottom swivel on the WM. Pull slack the hose back through the hole while lowering the WM onto the pedestal. | **Fish Tape** |

![Diagram of the manipulator](image)
F. LIFTING THE MANIPULATOR WITH A PORTABLE BASE

⚠️ The manipulator may upset if the corner jacks are not properly extended or if the manipulator is overloaded.

⚠️ Lift the WM and base assembly ONLY by the base, because the weight of the base suspended from the WM could damage the manipulator's bearings. WM 450: 8,500 lb WM 550: 8,700 lb

⚠️ Secure the second arm and down shaft folded back and the tooling before moving.

The WM is normally shipped installed on the mobile or portable base. Remove the packaging material and connect the pneumatic supply line(s) as shown on the pneumatic schematic.

The fork guides must be off the floor when leveling is complete.

Although the WM is leveled to the base prior to shipment, it is necessary to level the base with the corner jacks prior to use at each location.

LEVELING THE MIDDLE JOINT
### G. LIFTING THE MANIPULATOR WITH A MOBILE BASE

<table>
<thead>
<tr>
<th>Warning</th>
<th>Lift the WM and base assembly ONLY by the base, because the weight of the base suspended from the WM could damage the manipulator's bearings. WM 450: 9,500 lb WM 550: 9,700 lb</th>
<th>Secure the second arm and down shaft folded back and the tooling before moving.</th>
</tr>
</thead>
<tbody>
<tr>
<td>For the floor rolling versions the manipulator may upset if the corner jacks are not properly extended. In all cases the manipulator may upset if the manipulator is overloaded.</td>
<td>The WM is normally shipped installed on the mobile or portable base. Remove the packaging material and connect the pneumatic supply line(s) as shown on the pneumatic schematic.</td>
<td></td>
</tr>
<tr>
<td>For rail version the rails need to be level within 1/4°</td>
<td>Although the WM is leveled to the base prior to shipment, it is necessary to level the base with the corner jacks prior to use at each location. For rail versions it is necessary to level the manipulator to match the installed rail set up for best fine tuning.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The fork guides must be off the floor when leveling is complete.</td>
</tr>
</tbody>
</table>
H. ATTACHING THE TOOLING

Positech custom designs and builds special tooling according to the customer’s requirements. Usually, the tooling is shipped disconnected from the machine. See Section on LEVELING THE MIDDLE JOINT for leveling instructions on the middle joint.

Positech marks the hoses and mating connections to help the customer reconnect each line properly.

Refer to the Positech supplied drawings for information on how the tooling attaches to the manipulator and for torque specifications. Do not over tighten set screws.

See Section LEVELING THE END JOINT for leveling instructions on the end joint.
I. POWERING UP THE MANIPULATOR

1. STEPS TO POWER UP

- See profile drawing for incoming pneumatic requirements.
- Make air connection here
- Turn on factory air supply to the manipulator
- Adjust regulator to setting specified on the profile.

2. STEPS TO POWER DOWN

- Move the manipulator to a park position.
- Turn off factory air supply to the manipulator.
J. LEVELING THE MIDDLE JOINT
To reduce the force at the operator the main post must be level. The level used in this procedure will not read level but instead must read the same in all quadrants (the bubble will be in the same location in the site glass when level is achieved).

1. Loosen only the main post drag brake

The forearm and tool should be in a straight line.

Check three quadrants to (three positions at 90° to one another) to see the change in the level.

Making adjustments with four jacks on the main post. Loosen the leveling jack nut slightly and adjust the jacks to move the bubble to the same position (trying to reduce drift).

Repeat steps 3 & 4 until the main post is level.

Tighten the leveling jack nuts.

Verify the three quadrants are still level.
K. LEVELING THE END JOINT
The following information is for leveling the end joint shaft in the side to side direction.
1. First, disconnect any load from the machine and raise the end joint to a comfortable elevation. Move the forearm so it is straight out from the parallel arms. Then check the level of the main post and adjust it if necessary so it is properly leveled. See main post leveling above for the procedure.

Place a machinist's level on a flat surface of the tooling with the axis of the level perpendicular to the axis of the forearm. (Note the position of the bubble). Rotate the level 180° to see if the bubble is in the same position. If the bubble is centered, no adjustment is required.

Remove the level and slightly loosen each of the four flange bolt nuts and loosen each of the four setscrews in the flange.

Replace the level.

Adjust the set screws against their corresponding flange keys until the level reads level. Adjust all set screws with equal torque on the flange key.

Recheck and adjust the position until the level read level with good torque on the setscrews.

Retighten the four flange bolts and nuts. Recheck that the level reads level and adjust again if necessary.

The following procedure describes leveling the end joint shaft in the up and down direction. The shaft, in this direction, should be above the perfectly vertical position with no payload. When an average payload is applied the shaft deflection will be at the vertical position. When checking for level the average payload should be attached to the down shaft or tooling to deflect the end joint shaft to vertical then released to make further adjustments.
2. Place a machinist's level on a flat surface of the tooling with the axis of the level parallel to the forearm axis. Note the position of the bubble.

Check the bubble is in the same position at forearm arm straight out and forearm perpendicular the 1st arms.

Raise or lower the forearm by alternately loosening and tightening the adjustment bolt and nut on the threaded vertical rod near the middle joint shaft. Normally, the outer end of the forearm should be slightly high without payload.

Repeat steps 2 & 3 until the bubble reads the same.

Tighten the adjustment bolt nut when in the desired position.

**L. LEVELING THE TOOLING**

1. The tooling can be leveled by loosening the four ¾-10 SHCS mounting the tooling using a 5/8 allen wrench.
2. Adjusting the four ¾-10 set screws on the flanged end joint using a 3/8 allen wrench.
3. Snuggling up the mounting bolts and repeating until the desire level is achieved.
4. Final torque of the mounting SHCS should be 147 ft-lbs
M. PNEUMATIC SUPPLY LINE SIZING

Note: See the profile drawing for the required flow and pressure. The manipulator may or may not be supplied with a pneumatic lockout tag out pneumatic device. Refer to the profile drawing, schematic drawings, and component literature supplied by Positech for the specific pneumatic requirements for this specific project’s needs. All connections and clearances need to comply with local and national codes.

<table>
<thead>
<tr>
<th>FLOW</th>
<th>SCFM</th>
<th>Length of run in feet</th>
<th>Air line size in inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>6</td>
<td>½</td>
<td>½</td>
</tr>
<tr>
<td>50</td>
<td>18</td>
<td>½</td>
<td>½</td>
</tr>
<tr>
<td>75</td>
<td>30</td>
<td>¾</td>
<td>½</td>
</tr>
<tr>
<td>100</td>
<td>45</td>
<td>¾</td>
<td>¾</td>
</tr>
<tr>
<td>150</td>
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<td>500</td>
<td>150</td>
<td>2½</td>
<td>2½</td>
</tr>
<tr>
<td>1000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## SECTION 4 - SERVICE INSTRUCTIONS – MAINTENANCE, ADJUSTMENTS, & INSPECTIONS

### A. SERVICE INSTRUCTIONS

<table>
<thead>
<tr>
<th><strong>LOCK OUT TAG OUT</strong> – Remove power from upstream air supply, apply lock and tag. Apply lock and tag at machine after disconnecting power.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>•</strong> Follow any site specific requirements for lock out tag out procedures.</td>
</tr>
</tbody>
</table>

| **CLEANING** – If it should become necessary to clean this equipment, disconnect the unit from its power source first. Do not use liquid cleaners, aerosols, abrasive pads, scouring powders or solvents, such as benzene or alcohol. Use a soft cloth lightly moistened with a mild detergent solution. Ensure the surface cleaned is fully dry before reconnecting power. |

<table>
<thead>
<tr>
<th><strong>DAMAGE REQUIRING SERVICE</strong> – Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>•</strong> If the product does not function normally by following the instructions in the User’s Guide. Adjust only those controls that are covered by the operating instructions. Improper adjustment of other controls may result in damage and will often require rework by a qualified technician to restore the product to its normal operation.</td>
</tr>
<tr>
<td><strong>•</strong> If the product has been damaged in any way.</td>
</tr>
</tbody>
</table>

When the unit displays a negative and distinct change in performance.

### MATERIAL DISPOSAL

- **Hydraulics/Lubricants** – Must be recycled as required by local environmental law – do not dispose of by pouring down the drain.
- **Electronics** – Must be recycled as required by local environmental law – do not dispose of by adding to the Municipal waste stream.
- **Metal/Other Parts of the System** – Must be recycled as required by local environmental law.
B. PREPARING THE EQUIPMENT FOR MAINTENANCE

1. Identify any functional issues with daily operations. Operate the equipment to confirm issues. Arrange the work area to allow full and unobstructed operation of the unit.

2. Lockout/tag out refers to the specific practices and procedures of preventing equipment from being energized, starting, or the release of hazardous energy during service or maintenance and taking steps to verify the energy has been properly isolated. Steps also need to be reviewed if any potential energy is stored or if any re-accumulation of stored energy needs to be released in a safe manor. The lockout device needs to hold the energy-isolation device in the off position to prevent the equipment from being energized or from startup that no one can remove without a key or extraordinary means. Tag out devices are a warning device fastened to the energy-isolating device to warn other employees not to reenergize the machine during service and require training of all personnel in the work area. For more information on this subject refer to OSHA 29 CFR 1910.269 and 1910.333

3. Items to complete before Lockout/Tag out of the manipulator:
   - Notify operators and personnel in the work zone that the equipment is going to be serviced.
   - Remove/release item being lifted.
   - Lower the arm to full down.
   - When replacing (servicing) the lift cylinder support the cylinder at 3.0” above full down.
   - Blocking will need to be able to support 3,000 lb and not allow motion.
   - If lifting/supporting with a hoist/fork truck type device use an adequately sized sling and lifting device.
   - Cycle any grip, pitch, or rotate functions on the tooling and manipulator to a neutral center or lowest position (no at end of stroke position).
   - On the pneumatic lockout device move the handle to the off position and secure with a lockable device.
   - If the system uses any pneumatic cylinders or other devices; exhaust the air pressure by depressing the operation levers on the hand control station and holding until all air is exhausted.
   - If cylinders are stopped at the end of stroke and need to be de-energized. Carefully cover and slowly loosen pressure fittings to prevent uncontrolled release of air pressure.
   - Perform work to be completed.
   - After work is completed, area is cleaned up, the equipment is restored to proper working condition, and all personnel are clear in the work zone. The person who applied the lockable device should be the person that removes the lockable device.
   - All personnel in the work zone and personnel that use the equipment need to be notified that the equipment will be restored to service.
   - The equipment may be reenergized for service.
   - Verify the fault has been corrected.
## C. PNEUMATIC/MECHANICAL ADJUSTMENTS

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DRAG BRAKE ADJUSTMENT</strong></td>
<td>MAIN POST</td>
</tr>
<tr>
<td><strong>AXIS BRAKES</strong></td>
<td>MAIN POST MIDDLE JOINT END JOINT</td>
</tr>
<tr>
<td>Adjust the brake with a spanner wrench until the brake contacts the disk then .030” more. Verify the rotation joint rotates freely when released.</td>
<td></td>
</tr>
<tr>
<td><strong>MAIN POST ROTATION STOPS:</strong></td>
<td>MAIN POST</td>
</tr>
<tr>
<td>To change rotation angle move bolts to new hole position.</td>
<td></td>
</tr>
</tbody>
</table>
D. ROUTINE AND PREVENTATIVE MAINTENANCE INSPECTIONS

Maintenance, adjustments, and inspections fall into three categories: every lift, frequent, and periodic and should be performed by personnel authorized and qualified to perform each task.

**Every lift evaluations:** are visual examinations completed by operator before and during each lift.

**Frequent evaluations:** are visual examinations completed by the operator or designated persons with records not required. The period to complete these evaluations is based on a service rating of normal (monthly), heavy (weekly), or severe (daily) as explained below.

**Periodic evaluations:** are visual examinations completed by qualified personnel completing records of apparent external condition to provide a basis for continuing evaluation. The period to maintain these records is based on a service rating of normal (yearly), heavy (semiannually), or severe (quarterly) as explained below.

<table>
<thead>
<tr>
<th>Normal Rating</th>
<th>Heavy Rating</th>
<th>Severe Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 65% of rated load</td>
<td>65% to 100% of rated load</td>
<td>At 100% of rated load</td>
</tr>
<tr>
<td>Operate in an industrial environment free of aggressive contaminants</td>
<td>Operate in an industrial environment free of aggressive contaminants</td>
<td>Operate in abnormal environment</td>
</tr>
<tr>
<td>Life of manipulator is 2,000,000 cycles</td>
<td>Life of manipulator is 1,000,000 cycles</td>
<td>Life of manipulator is 500,000 cycles</td>
</tr>
</tbody>
</table>

For a manipulator that is outside these conditions refer to the profile drawing and/or consult the factory for specific instructions.

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E. EVERY LIFT EVALUATIONS

- Remove excess debris from surface of the load.
- Verify grip contact or vacuum cup is free of contaminant. Replace if excessively worn.
- Check the condition of the operator’s controls and gauges on controls
- Verify the load is secure after actuation of tooling and before moving the manipulator.

F. FREQUENT EVALUATIONS

- Move the manipulator in and out and around each axis and check for free motion. Check bearing seals for leakage or damage. Replace any bearings showing signs of binding or damage.
- Check friction devices, linkages, and other mechanical parts for excess wear and replace as needed. Check brake pucks for adjustments and excessive wear.
- Check welds on structural members for cracks. Look for cracked or missing paint over a weld. If welds are torn from the base steel, cracked, or broken the manipulator should not be used until repaired or determined safe. Consult factory for solution or parts.
- Check structural members for deformations. Consult factory for solution to findings.
• Check pivoting points and hook points for excessive wear and replace as needed.
• Replace missing guards, fasteners, covers, stops, decals, warning labels, or nameplates.
• Check for loose fasteners, especially set screws, and retighten.
• Check for leaks. Inspect condition and routing of all external hoses. Replace any leaky components or cracked hoses.
• See LUBRICATION SCHEDULE for lubrication information.
• Operating the manipulator: Check that all functions are in adjustment and that no functions interfere with current operation of the work cell.

G. PERIODIC EVALUATIONS

• Complete the frequent evaluations along with the following evaluations.
• Complete Inspection checklist included with this manual. Not any open issues, adjustments or actions completed. Include parts installed, or requirements to solve faulty operation
• Check air supply to manipulator. See profile drawing for required pressure and flow.
• Check pedestal mounting bolts or spacer mounting bolts if overhead mounted and torque to the Torque Specs on the Profile.
• Inspect main post bearing. Replace if a variation of .015 inch [.381 mm] is observed in the overall thickness of the bearing.
• Check for worn or cracked gears, pulleys, sheaves, sprockets, bearings, chains, or belts and replace as needed.
• Inspect cylinders and valves for leaks.
• Inspect all wear parts and replace as needed.
• Check manipulator for drift in all quadrants. If the manipulator is level, the manipulator will not wander or wander very little. See WM 450 & 550 PEDESTAL INSTALLATION: or leveling the manipulator to eliminate drift in all operating quadrants.
• Check powered brakes for proper adjustment. Tighten brake until it touches the disk; tighten the brake about .030” farther. Verify the brake retracts off of the disk when the switch is activated.
• Grease all grease fittings with grease specified on the profile.
The manipulator should already be adjusted for level, be fully lubricated, and the reservoir should be full of oil but all points on the machine should be checked before use. Many bearing points are Teflon lined which do not require lubrication. The following chart lists the lubrication requirements.

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>AMOUNT</th>
<th>RECOMMENDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAIN POST ROTATION BEARING ZERK</td>
<td>2 SHOTS PER PERIODIC SCHEDULE</td>
<td>NLGI GRADE 2 EP LITHIUM GREASE MOBILGREASE XHP 462 RECOMMENDED</td>
</tr>
<tr>
<td>MIDDLE JOINT ROTATION BEARING ZERKS</td>
<td>2 SHOTS PER PERIODIC SCHEDULE</td>
<td>NLGI GRADE 2 EP LITHIUM GREASE</td>
</tr>
<tr>
<td>ENDJOINT BEARING HOUSING</td>
<td>2 SHOTS PER PERIODIC SCHEDULE</td>
<td>NLGI GRADE 2 EP LITHIUM GREASE</td>
</tr>
</tbody>
</table>

* Excessive grease in the drag brakes will reduce brake effectiveness.
I. TROUBLE SHOOTING

ALWAYS USE SAFE PROCEDURES WHEN WORKING ON THE MACHINE. SHUT OFF PRESSURE FOR CYLINDER REPAIRS. DO NOT REMOVE ANY LIFT CYLINDER VALVE PARTS, UNLESS THE LIFT IS FULLY DOWN AND SUPPORTED. DO NOT REMOVE ANY BOLTS, UNLESS THE MACHINE OR LIFT IS SAFELY SUPPORTED.

<table>
<thead>
<tr>
<th>No.</th>
<th>Symptom</th>
<th>Check and Possible Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Machine does not move up or down</td>
<td>• Check main air supply&lt;br&gt;• Check main regulator&lt;br&gt;• If used, check lift cylinder on/off switch&lt;br&gt;• Check pilot to lock valve&lt;br&gt;• Check lock valve</td>
</tr>
<tr>
<td>2.</td>
<td>Drifts up</td>
<td>• Check metering valve for leaks&lt;br&gt;• Check GSC valve for leaks&lt;br&gt;• If used, check 6 passage rotary manifold for leaks&lt;br&gt;• Check minimum lift setting</td>
</tr>
<tr>
<td>3.</td>
<td>Drifts down</td>
<td>• Check metering valve&lt;br&gt;• If used, check 6 passage rotary manifold for leaks&lt;br&gt;• Check for leaky lift cylinder seal, blocking valve connection&lt;br&gt;• Check white poly lines for leaks</td>
</tr>
<tr>
<td>4.</td>
<td>Main post rotation difficult</td>
<td>• Check for main post bearing wear&lt;br&gt;• If used, check drag brake adjustment&lt;br&gt;• Check rails on trolley systems</td>
</tr>
<tr>
<td>5.</td>
<td>Grip release without being supported</td>
<td>• Check GSC setting&lt;br&gt;• If used, check 6 passage rotary manifold for leaks&lt;br&gt;• Verify proper hose connections&lt;br&gt;• Check bleed down speed</td>
</tr>
<tr>
<td>6.</td>
<td>Oil discovered on machine</td>
<td>• Check hydraulic lines to brakes&lt;br&gt;• Verify FRL lubricator is not set too high&lt;br&gt;• Check FRL</td>
</tr>
<tr>
<td>7.</td>
<td>Up/Down movement difficult</td>
<td>• Check lift cylinder and muffler&lt;br&gt;• Verify supply pressure and sufficient flow</td>
</tr>
<tr>
<td>8.</td>
<td>Rotation drift at tooling</td>
<td>• Check main post level&lt;br&gt;• Check anchor bolts on main post&lt;br&gt;• Check middle joint leveling</td>
</tr>
</tbody>
</table>
**SECTION 5 - OPERATOR INSTRUCTIONS**

The WM is used for manipulating and moving parts through the work cell. Manual and powered functions are available to allow the movements necessary to perform the tasks.

Refer to safety warnings, precautions, and Dos and Don’ts for general manipulator safety and use.

<table>
<thead>
<tr>
<th>![Warning Icon]</th>
<th>Do not use this equipment for any purpose not described in this manual.</th>
</tr>
</thead>
<tbody>
<tr>
<td>![No Access Icon]</td>
<td>Do not operate this equipment without all guards and covers in place.</td>
</tr>
<tr>
<td>![Hearing Icon]</td>
<td>Hearing protection required if level of continuous acoustic pressure is greater than 80 dB (A scale).</td>
</tr>
</tbody>
</table>

SEE PROFILE DRAWING FOR DETAILED PICTURE AND LABELS OF CONTROLS
A. MANIPULATOR MOVEMENT

WM movement is manually controlled. Speed of movement should be maintained at a controllable and safe level by the operator to allow for ease of stopping and positioning.

Manipulators with longer arms and heavier lift capacities usually have greater mass and take more operator forces to control and position. Therefore, consideration needs to be given when reviewing work cell layout and cycle rates for these larger and heavier manipulators.

Use of excess speed can result in momentum that can be difficult to control and dangerous for the operator. The mass of the machine moving at a fast speed can create forces that are dangerous for the operator to control and expose the operator to physical injury when trying to stop due to loss of control. Part and customer equipment damage may also result.

Drag brake application can be used to control arm movement. Small amounts of drag brake force can help control arm movements due to operator use and arm deflection.

B. END OF ARM LIFTING

End of arm lift assist tooling varies to customer application. When lifting equipment is added to the end of arm, the weight of the lifting equipment must be factored into the moment loading and capacity of the equipment.

When a fixed lifting device is included, this serves as a location to mount an operator controls station for movement of the WM and for actuation of the functions.

Lifting devices require pneumatic connections for motion. See the air requirements identified on Profile View, schematics, and component literature for equipment supplied by Positech for requirements. Lifting controls will vary depending on the style and options selected at the time of sale.

C. TOOLING

End of lift or end of arm tooling varies per customer application requirements. Positech supplies tooling options that are reflected in the tool drawings and equipment supplied. Weight of the tooling must be factored into the capacity of the WM.

Tool function and control needs to be factored into safe operation of the WM movements. Part security, working clearances, and controllable operator speeds are all factors in the machine operation.
APPENDIX A: MACHINE OPERATION PROCEDURE
APPENDIX B: DRAWINGS, SPARE PARTS LIST