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SECTION 1 - NAMING CONVENTION AND SERIAL TAG

A. MACHINE PART NAMES:

- Hydraulic Enclosure
- Pneumatic Connection
- Disconnect Switch
- Electrical Enclosure
- Main Post Bearing
- Pedestal
- Electrical Connection – Top Feed
- Electrical Connection – Bottom Feed
- Down Shaft
- Main Post Assembly & Lift Cylinder
- Middle Joint
- Flanged End joint Assembly (FEA)
- Leveling Jack Assembly

B. SERIAL TAG NOMENCLATURE:

- Machine Mass
- Machine Working Load (Capacity below the down shaft)
- Serial Number
- Provide for Service Support
- Electrical Voltage/Hertz/Phase
- Manual Document Number
- Full Load Current
- Short Circuit Current Rating
- Serial Tag Location

![Model Information]

MODEL: TPA 25  SN: 014901-01A
MACHINE MWL: 2,700 LB (1,225 KG)
MACHINE MASS: 5,100 LB (2,313 KG)
(V/HZ/PH): 400-480/50-60/3  12 A
SCCR: 10 kA
MAIN DOC: MAN-14901, MFG YEAR: 2016
POSITECH  LAURENS, IA 50554
800-831-6026  WWW.POSITECH.COM
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. HYDRAULIC SPECIFICATIONS
See Profile Drawing for specification.

D. ELECTRICAL SPECIFICATIONS
- 400-480V / 50-60 Hz / 3 PH, 20A

E. 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)

F. 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.

G. CONVERSION FACTORS TO SI UNITS

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

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMERGENCY STOP: When depressed will disable machine functions by disabling all output functions.</td>
<td>Side of the enclosure</td>
</tr>
<tr>
<td>ELECTRICAL CABINET INTERLOCK: Disconnect power to electrical circuit when enclosure is opened. Power may still be present at incoming lines.</td>
<td>Front of the electrical enclosure</td>
</tr>
<tr>
<td>HYDRAULIC CABINET INTERLOCK: Hold the hydraulic cabinet door closed while the electrical cabinet interlock is engaged.</td>
<td>Inside the Hydraulic Enclosure</td>
</tr>
<tr>
<td>MAIN POST DRIVE GEAR COVER: Covers the drive gear teeth meshing to the main post gear.</td>
<td>Main Post</td>
</tr>
</tbody>
</table>
| **LIFT CYLINDER COUNTER BALANCE VALVE:**
| Hold lift arms at current height when hydraulic oil is not being supplied.
| ![Image of lift cylinder counter balance valve]
| **Main Post**

| **SYSTEM PRESSURE REGULATOR:**
| The valve stack has a system pressure regulator to limit maximum pressure to the hydraulic components.
| ![Image of system pressure regulator]
| **Hydraulic Valve Stack**

| **MIDDLE JOINT AND END JOINT BRAKES:**
| Hold position of manipulator when parked or to help slow down arm rotation to a stop.
| ![Image of middle joint and end joint brakes]
| **Middle Joint and End Joint**

| **TOOL COUNTER BALANCE VALVE:**
| Hold tool at current rotation when hydraulic oil is not being supplied.
| ![Image of tool counter balance valve]
| **Tool Helac Rotator**

| **Warning:** Oil pressure may be present from counter balance valve to the cylinder. Support arms before beginning any service work on counter balance valve and mounting. To release energy place a catch container under the connection fitting, cover with a rag, and slowly loosen the fitting and allow oil to slowly drip out.

| **Hydraulic Valve Stack**

| **Tool Helac Rotator**
<table>
<thead>
<tr>
<th><strong>TOOL ROTATION SHIELD:</strong></th>
<th>Cover the tool rotation adjustment bolts</th>
<th>Front of Helac Rotator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GRIP LOCK VALVE:</strong></td>
<td>The Kepner lock valve is used to grip the part in ID or OD configurations.</td>
<td>Attached to the Grip Cylinder</td>
</tr>
<tr>
<td></td>
<td>Oil pressure may be present within the hard piped lines to the grip cylinders. To release energy cycle the grip cylinder to a neutral center position (no at end of stroke position), place a catch container under the connection fitting, cover with a rag, and slowly loosen the fitting and allow oil to slowly drip out.</td>
<td></td>
</tr>
<tr>
<td><strong>BELLEVILLE WASHER FOR GRIP ACUMULATOR:</strong></td>
<td>Belleville washers have been added to give the tool the ability to make up for small part shifts.</td>
<td>Inside the Grip Cylinder</td>
</tr>
<tr>
<td></td>
<td>When lifting a part if the part is not gripped tight. Stop. Set the part down and re-grip.</td>
<td></td>
</tr>
</tbody>
</table>
| **LOW GRIP PRESSURE SENSOR:** | If the pressure in the grip cylinder drops 20% of the pre-set pressure three events will happen:  
  - The low pressure alarm will automatically sound.  
  - The low pressure light will automatically light.  
  - Finally the grip cylinder will re-energize to the preset pressure. | Attached to the Grip Cylinder |
<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOW GRIP PRESSURE ALARM AND LIGHT:</strong></td>
<td>When the grip pressure drops to 20% of the pre-set pressure the low pressure alarm will sound and the light will light before the grip cylinder re-grips.</td>
</tr>
<tr>
<td><strong>HYDRAULIC OVER TEMPERATURE / FLUID LEVEL ALARM:</strong></td>
<td>When the hydraulic fluid level becomes too hot or needs to be refilled an alarm will be sounded and this light will light.</td>
</tr>
<tr>
<td><strong>OPEN/CLOSE WITH PROOF BUTTONS:</strong></td>
<td>The operator will need to push two buttons to either open or close the gripper jaws.</td>
</tr>
<tr>
<td><strong>MAIN POST OUT OF LINE PROX:</strong></td>
<td>Proximity switch that will sense the flag when the manipulator is out of the welder. Adjust the location of the sensor on the pedestal until the correct flag location is registered.</td>
</tr>
<tr>
<td><strong>UP STOP ARM LIMIT:</strong></td>
<td>Limits the up stroke of the lift arm.</td>
</tr>
</tbody>
</table>
I. PEDESTAL SPACER MOUNTING PATTERNS

TPA 5

TPA 10 & 15

TPA 25
J. 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.

K. SOIL CONDITION:

The minimum soil compaction required is 2500 lb/ft².

L. FULLY REINFORCED CONCRETE FLOOR CONDITION:

<table>
<thead>
<tr>
<th>TPA FLOOR CONDITIONS</th>
<th>TPA 5</th>
<th>TPA 10</th>
<th>TPA 15</th>
<th>TPA 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINIMUM CONCRETE THICKNESS</td>
<td>IN</td>
<td>IN</td>
<td>IN</td>
<td>IN</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>FULLY REINFORCED CONCRETE WITH A MINIMUM COMPRESSIVE STRENGTH</td>
<td>PSI</td>
<td>PSI</td>
<td>PSI</td>
<td>PSI</td>
</tr>
<tr>
<td>3,500</td>
<td>3,500</td>
<td>3,500</td>
<td>4,000</td>
<td></td>
</tr>
<tr>
<td>CONCRETE MUST BE CRACK FREE WITH A RADIUS</td>
<td>IN</td>
<td>IN</td>
<td>IN</td>
<td>IN</td>
</tr>
<tr>
<td>48</td>
<td>60</td>
<td>60</td>
<td>132</td>
<td></td>
</tr>
</tbody>
</table>

M. Poured Foundation Condition:

<table>
<thead>
<tr>
<th>FOUNDATION DIMENSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH IN</td>
</tr>
<tr>
<td>TPA 5</td>
</tr>
<tr>
<td>TPA 10</td>
</tr>
<tr>
<td>TPA 15</td>
</tr>
<tr>
<td>TPA 25</td>
</tr>
</tbody>
</table>

N. PLATING ON CONCRETE:

Contact Positech for drawings or ordering information.

<table>
<thead>
<tr>
<th>CONCRETE MOUNTING PLATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANCHORS NEED TO BE 6 DIAMETERS FROM A CRACK</td>
</tr>
<tr>
<td>LENGTH IN</td>
</tr>
<tr>
<td>TPA 5 &amp; 10</td>
</tr>
<tr>
<td>TPA 15 &amp; 25</td>
</tr>
</tbody>
</table>
SECTION 3 - INSTALLATION INSTRUCTIONS

Positech’s Taurus® Positioning Arm (TPA) will require electric and may require pneumatic connections for motion. Refer to the profile drawing, schematic drawings, and component literature supplied by Positech for the specific electric and 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. TPA 5 PEDESTAL INSTALLATION:

LEVEL PEDESTAL BEFORE INSTALLING MANIPULATOR. (TPA 5 pedestal shown below) See Pedestal drawings for torque requirements.

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

1. Locate the pedestal so the electrical or air line can be routed through the supplied hole in the location and orientation desired. 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 four 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. TPA 5 SPACER INSTALLATION:

LEVEL SPACER BEFORE INSTALLING MANIPULATOR ON SPACER: (See LEVELING THE MIDDLE JOINT for leveling the manipulator if it is already installed on spacer.)

TPA 5 spacer shown below. See profile drawing for torque requirements.

Overhead structure must support the manipulator with a deflection of less than 1/8°.

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. TPA 10, 15, & 25 PEDESTAL AND SPACER 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 electrical and/or air line can be routed through the supplied hole in the location and orientation desired. 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.
D. TPA 10, 15, and 25 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 1/8°.

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.
E. 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.

F. 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:**
    - TPA 5: 1,200 lb
    - TPA 10: 2,000 lb
    - TPA 15: 2,500 lb
    - TPA 25: 4,000 lb
  
  - Refer to machine specific installation instruction sheet for more information and tools supplied in the installation package.

  - **TOP ELECTRIC TERMINATION:**
    Bring electrical line to connect to the junction box. Electrical line needs to be long enough to allow for twist and must not catch on the manipulator or building during rotation.

  - **TOP PNEUMATIC CONNECTION:**
    Bring 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 ELECTRICAL TERMINATION:**
    The pedestal electrical box has two cored grips. When installing the pedestal pull the supply power wire in the bottom cord grip. Before lowering the TPA over the pedestal install a fish tape through the pedestal exiting the top cord grip hole to pull the electrical wire from the manipulator for termination.

  - **Fish Tape**
  - **Supply Power**
G. LIFTING THE MANIPULATOR WITH A FORK TRUCK AND CONECTING POWER

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:
- TPA 5: 1,200 lb
- TPA 10: 2,000 lb
- TPA 15: 2,500 lb
- TPA 25: 4,000 lb

Refer to machine specific installation instruction sheet(s) for more information and tools needed for the installation.

TOP ELECTRIC TERMINATION:
Bring the electrical line to the junction box. The electrical line needs to be long enough to allow for twist and must not catch on the manipulator or building during rotation.

TOP PNEUMATIC CONNECTION:
Bring 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 rotation.

BOTTOM ELECTRICAL TERMINATION:
The pedestal electrical box has two cored grips. When installing the pedestal pull the supply power wire in the bottom cord grip. Before lowering the TPA over the pedestal install a fish tape through the pedestal exiting the top cord grip hole to pull the electrical wire from the manipulator for termination.
H. 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 TPA and base assembly ONLY by the base, because the weight of the base suspended from the TPA could damage the manipulator’s bearings.

TPA 5: 4,200 lb
TPA 10: 8,200 lb
TPA 15: 8,700 lb

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

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

Although the TPA 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
# I. LIFTING THE MANIPULATOR WITH A MOBILE BASE

## Warning
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.

## Warning
Lift the TPA and base assembly ONLY by the base, because the weight of the base suspended from the TPA could damage the manipulator's bearings.

- **TPA 5:** 5,200 lb
- **TPA 10:** 9,200 lb
- **TPA 15:** 9,700 lb

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

The TPA is normally shipped installed on the mobile or portable base. Remove the packaging material and hook up the electrical and/or pneumatic supply line(s) as shown on the electrical and pneumatic schematic.

Although the TPA 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.

For rail version the rails need to be level within 1/8”

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

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 on LEVELING THE MIDDLE JOINT for leveling instructions on the middle joint.

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

1. STEPS TO POWER UP

See profile drawing for incoming power requirement.

Move the disconnect handle to the on position

Twist and pull out E-stop button.

Press “RESET” button to power up manipulator

Press the UP and DOWN buttons to verify the machine operation and the direction of motor rotation. If the manipulator moves the wrong direction or does not move the hot leads are wired incorrectly and need to be switched.

2. STEPS TO POWER DOWN

Press “STOP” to suspend work during each shift with the manipulator.

Press “E-STOP” to power down the manipulator at the end of a shift or in an emergency.

“DE-ENERGIZING THE SYSTEM”
Move the disconnect handle to the off position and secure with a lockout device. Verify the disconnect device removed the incoming energy from the device.
L. 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.

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.
M. 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.

**N. 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>SCFM</th>
<th>Length of run in feet, Air line size in inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLOW</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>½</td>
</tr>
<tr>
<td>18</td>
<td>¾</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>45</td>
<td>1½</td>
</tr>
<tr>
<td>60</td>
<td>2</td>
</tr>
<tr>
<td>90</td>
<td>1½</td>
</tr>
<tr>
<td>120</td>
<td>2</td>
</tr>
<tr>
<td>150</td>
<td>2½</td>
</tr>
</tbody>
</table>

**O. ELECTRIC SERVICE WIRE SIZING**

Note: See the profile drawing for the required AC electrical power, FLA, and minimum recommend service. The manipulator may or may not be supplied with an electrical lockout tag out device. Refer to the profile drawing, schematic drawings, and component literature supplied by Positech for the specific electrical requirements for this specific project’s needs. All connections and clearances need to comply with local and national codes.
## SECTION 4 - SERVICE INSTRUCTIONS – MAINTENANCE, ADJUSTMENTS, & INSPECTIONS

### A. SERVICE INSTRUCTIONS

<table>
<thead>
<tr>
<th>图像</th>
<th>说明</th>
</tr>
</thead>
</table>
| ![lock-out-tag-out-icon](image) | **LOCK OUT TAG OUT** – Remove power from upstream power supply disconnect, apply lock and tag, then disconnect power at the machine. Apply lock and tag at machine after disconnecting power.  
  - Follow any site specific requirements for lock out tag out procedures. |
| ![arc-flash-warning-icon](image) | **ARC FLASH WARNING** – The possibility of arc flash occurrence exists. Wear appropriate PPE. Work on circuit components in the de-energized state. |
| ![power-cord-protection-icon](image) | **POWER CORD PROTECTION** – The power supply cord for this product acts as the main-disconnect. It should be routed or installed in such a manner to protect it from being walked on or pinched. The unit should be powered down completely before connecting or disconnecting the power cable. The power cord should be removed before moving the unit. The power cord must be placed near an easily accessible unobstructed socket outlet. |
| ![cleaning-icon](image) | **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. |
**DAMAGE REQUIRING SERVICE** – Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:

- When the power supply cord is damaged.
- If liquid has been spilled into the enclosure of the unit.
- 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.
- If the product has been damaged in any way.
- 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 manner. 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).
   - Electrical disconnect may be on the main electrical enclosure or in a separate smaller box. Move the handle to the off position and secure with a lockout device.
   - Verify the disconnect device removed the incoming energy from the device. The top of the picture below is a representation.
• If equipped a Grace port is installed that will operate a 120 VAC device for maintenance purposes, this will be powered by a transformer which will not have its power source removed, this transformer is wired to the line side and is identified with an orange wire, this circuitry will be the only circuitry powered up when the disconnect is disconnected.

• If pneumatics is used on the equipment move the handle to the off position and secure with a lockout 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 hydraulic fluids or air pressure. Catch leaking fluid in containers for proper disposal.
• Preform work to be completed.
• Review the profile drawing for the hydraulic fluid specified to be used in the manipulator.
• 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 lockout device should be the person that removes the lockout 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.
- Bleed any air that may be in hydraulic lines using bleed screws and if needed carefully cover and slowly loosen pressure fittings to allow for air release. Fittings should only be slightly loosened to prevent uncontrolled release of hydraulic fluids. Catch leaking fluid in containers for proper disposal.
- Verify the fault has been corrected.

### C. ELECTRICAL/MECHANICAL ADJUSTMENTS

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCREW TO BLEED OIL FROM LIFT CYLINDER (If equipped)</td>
<td>TOP OF LIFT CYLINDER ON LIFT ARMS</td>
</tr>
<tr>
<td>PUSH BUTTON CONTROL HANDLE POT ADJUSTMENT SWITCHES FOR MOTOR SPEED (If equipped)</td>
<td>PUSH BUTTON CONTROL HANDLE</td>
</tr>
</tbody>
</table>

*Figure 2 - Trim Pot Adjustment 1*
<table>
<thead>
<tr>
<th>TWIST METERING CONTROL HANDLE POT ADJUSTMENT SWITCHES FOR MOTOR SPEED (If equipped)</th>
<th>TWISTING METERING CONTROL HANDLE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Figure 4 - TMC Trim Pot Adjustment 1</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VALVE STACK ADJUSTABLE BLEED ORFICE (If equipped)</th>
<th>VALVE MANIFOLD (Usually on the top valve)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Figure 3 - Adjustable Bleed Orifice 1</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DRAG BRAKE ADJUSTMENT</th>
<th>POINTS OF MANIPULATOR &amp; TOOLING ROTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Figure 5 - Drag Brake 1</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONNECTION POINT OF PLC (If equipped)</th>
<th>ELECTRICAL CABINET</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Figure 6 - Connection Port to Teco 1</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VALVE STACK ADJUSTABLE FLOW CONTROL (If equipped)</th>
<th>VALVE MANIFOLD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Figure 7 - Adjust Fluid Flow Speed 1</strong></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.

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, that all automatic mechanisms functions properly, and that no functions interfere with current operation of the work cell.
• Wipe down cable and inspect cable jacket and ensure that the coating is smooth and free of damage.
• Inspect cable for discoloring, kinking, crushing, bird caging, corrosion, broken or cut strands, and any other obvious defects along any section of wire rope.
• Inspect the lower end of wire rope where it attaches to the handle, swivel assembly, or tooling for signs of damage or excessive wear.
• Replace cable assembly if any evidence of a potential failure is observed.
• Verify all electrical connections and wires terminations are tight (check for loose screws and hardware)
• Visually inspect the electric motor for damage, signs of wear, or signs of overheating

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 spacer mounting bolts if overhead mounted and torque 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 TPA 5 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.
• Once cable has been inspected ensure that sealing action at cable gland is uniform. (It is recommended that "Snoop" leak detection fluid is used).
• If cable gland seal is leaking replace entire cable assembly.
• Further inspection can be done by measuring cable diameter at varying intervals along the length of cable.
• If cable "necks down" to a smaller diameter within a short distance or is discolored these could be signs of a potential failure.
• Visually inspect all electrical components for abnormalities or signs of excessive overheating
• Visually inspect all wiring and electrical connections for signs of excessive heating
• Verify all electrical connections and wires terminations are tight (check for loose screws and hardware)
• Verify operation of all circuit breakers and E-stop functions
• Visually inspect electrical enclosure to ensure it is clean and no foreign objects are present
• Visually inspect the electric motor for damage, signs of wear, or signs of overheating
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 (DO NOT OVER-GREASE)</td>
<td>NLGI GRADE 2 EP LITHIUM GREASE MOBILGREASE XHP 462 RECOMMENDED</td>
</tr>
<tr>
<td>1st ARM GREASE ZERK (if equipped)</td>
<td>2 SHOTS PER PERIODIC SCHEDULE</td>
<td>NLGI GRADE 2 EP LITHIUM GREASE</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>
<tr>
<td><strong>TOOL ROTATION</strong></td>
<td><strong>GREASE FITTING</strong> (if so equipped – see tool print for supplied points to be greased on tooling)</td>
<td><strong>2 SHOTS PER PERIODIC SCHEDULE (TYPICAL)</strong></td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td><strong>POWER UNIT FILL</strong></td>
<td><strong>CAP EXAMPLES</strong></td>
<td><strong>SITE GLASS SHOULD BE FULL TO AT LEAST THE MINIMUM MARK WITH ALL ACTUATORS RETRACTED AND ARMS FULL DOWN</strong></td>
</tr>
<tr>
<td><strong>HYDRAULIC FILTER ON POWER UNIT</strong> (if supplied / may be different base on supplier)</td>
<td></td>
<td><strong>AT OIL CHANGE</strong></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. 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>
</table>
| 1.  | Motor will not turn when any button is depressed or twist metering control is rotated. | • See that electrical power is on.  
• Is input power supply fuse blown?  
• Is fuse on power supply board blown?  
• Check electrical connections after turning power off.  
• Check to see that the control cable is properly connected at the operator’s control.  
• Control wires to the operator's control are damaged or broken or operator's control is not functioning properly - replace or repair.  
• Turn off power and check for loose connections at the terminals inside the power unit enclosure.  
• Turn off power and check to see that all connectors are firmly in place on the control circuit.  
• Rotary electric brushes on electric joint not making contact with the brush ring assembly. Check after turning power off.  
• Control circuit is defective - replace with a new or rebuilt circuit. |
| 2.  | The machine will lower but will not raise. | • The machine is overloaded - operate the down control to reset and remove the overload.  
• The overload sensor is defective - disconnect hydraulically or electrically to see if the machine works. If so, reset or replace the pressure switch.  
• Check to see that the control cable is properly connected at the operator’s control.  
• Control wires to the operator's control are damaged or broken or operator's control is not functioning properly - replace or repair.  
• Turn off power and check for loose connections at the terminals inside the power unit enclosure.  
• Turn off power and check to see that all connectors are firmly in place on the control circuit.  
• Control circuit is defective - replace with a new or rebuilt circuit. |
| 3.  | Machine moves in both directions, but motion is jerky and noisy. Especially near the full-up position. | • Low in hydraulic fluid - fill and bleed air out of the lift cylinder.  
Hydraulic oil is full is when oil in the sight glass is at the level marked on the reservoir with the arms are fully down and all actuators are retracted.  
(See Adding Oil - Figure 1 - Filling the Reservoir) |
| 4.  | Machine will not hold its vertical position when at rest. | • Main check seal in the lift cylinder metering valve needs replacement.  
• Seals in the metering cartridge of the lift cylinder metering valve need replacement.  
• The metering valve spring is broken. Replace after lowering the arm to the full down position.  
  o See lift cylinder assembly print - drawings and spare parts list section. |
| 5.  | Machine will not shut off when the controls are released. | • Control is sticking - clean buttons and lightly oil or disassemble the TMC, clean and lubricate.  
• Disassemble the operator’s control, clean, adjust and lubricate.  
• Control wires to the operator’s control are damaged or broken or operator’s control is not functioning properly - replace or  
  o Control circuit is defective - replace with a new or rebuilt circuit.  
  o See operator control assembly print - drawings and spare parts list section. |
| 6.  | Motor runs at varying speeds as either control button is pushed, but the arm will not raise or lower. | • Determine if the 4-way solenoid valve is shifting via the manual overrides on the valve. If the valve is not shifting, replace the appropriate fuse on the speed control board. |
| 7.  | Motor runs, but speed does not vary in one direction regardless how far the control is operated. Install 0-2500 psi pressure gage at Gage P (1/8” NPT) on the motor/ pump adapter plate and observe if the pressure varies as the control is operated. | • The slide resistor tab in the push button operator’s control is broken off.  
• Disassemble the operator’s control and replace the broken slide resistor.  
• The slide resistor in either type of control is worn out. Replace.  
• Check for broken or unsoldered wires in the operator’s control.  
• Check to see that the control cable is properly connected at the operator’s control.  
• Control wires to the operator's control are damaged or broken or operator's control is not functioning properly - replace or repair.  
• Turn off power and check for loose connections at the terminals inside the power unit enclosure.  
• Turn off power and check to see that all connectors are firmly in place on the control circuit.  
• Control circuit is defective - replace with a new or rebuilt circuit.  
  o See operator control assembly print - drawings and spare parts list section. |
| 8.  | Machine lowers rapidly with no control when the down control is operated. (Install a 0-2500 psi 1/8” NPT gage in Port Gage P.) | • The adjustable bleed orifice is plugged or adjusted too far closed. This is usually evident by a high (900 psi or above) pressure reading when the down control is operated slightly and the motor is running slowly. Unscrew the bleed screw about 3 turns and operate the down and up controls to try to remove the blockage. Readjust the bleed screw for proper operation. If the blockage does not clear, disassemble the needle screw assembly and clean passages. Readjust for proper operation.  
  o Figure 3 - Adjustable Bleed Orifice 1  
• If the motor runs at high speed when the down button is slightly pushed; the trim pot in the push button operator's control probably has a broken engagement tab. |
<table>
<thead>
<tr>
<th>Issue Description</th>
<th>Solutions</th>
</tr>
</thead>
</table>
| The trim pot tab in the push button operator's control is broken off.            | - The trim pot tab in the push button operator's control is broken off.  
- See Figure 2 - Trim Pot Adjustment 1  
  - If the arm lowers quickly at low (100 to 500 psi) pilot pressure, the metering spring in the lift cylinder mounted valve is possibly weak or broken. Another symptom is that the arm does not maintain its vertical position when at rest. The metering valve spool possibly is not in the fully closed (off) position. Lower the arm to the full down position and replace the metering valve spring. Check to make sure the metering valve spool snap ring is properly in place.  
  - See lift cylinder assembly print - drawings and spare parts list section. |
| The arm lowers slowly even though the pressure reading in port gage P shows normal pilot pressure readings as the down button is pushed. | - A return line to the reservoir is almost totally blocked. Look for kinked hoses or other causes. Replace as required.  
- Not likely, but possible. The arm bearings have been adjusted too tight or are galled. Check, clean and/or replace necessary parts and adjust, if necessary. |
| Machine moves in only one direction, regardless of which way the operated. (If equipped) | - Most likely, one limit switch in the operator's control is not being properly tripped on the push button control. Carefully bend the trip lever for the up/down controls. The switch from the mounting card is tripped by a tapered cam when at rest.  
  - See twist metering control assembly print - drawings and spare parts list section.  
  - The twist metering control has a screw to adjust the limit switch trip point.  
  - See push button control assembly print - drawings and spare parts list section.  
  - The operator's control button or cam is not going to full off position and, consequently, is not tripping the limit switch inside the operator's control. Clean and lubricate the control.  
  - See twist metering control assembly print - drawings and spare parts list section. |
| Machine operates intermittently, when any control is operated. (If equipped)     | - Check to see that the control cable is properly connected.  
- Check to see that the control cable is not damaged.  
- Check to see that the control cable has enough slack, so it is not being stretched, especially when the arm is at the full down position. Reposition and secure well, if necessary.  
- Disconnect the electrical power and check to see that the rotary electric joint brushes are making proper contact. Intermittent operation, while rotating the machine around the main post, is a strong indication of rotary brush problems. Disassemble and realign the brushes and secure. Do not overtighten the brush holder clamps, because they can be broken easily. Be sure the mounting stud bolt is tight. |
<p>| | | |</p>
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<thead>
<tr>
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<th></th>
<th></th>
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</thead>
</table>
| 12. | The arms move quickly (jump) for several inches, when changing direction, especially when going down fast and immediately pushing the up button. | • This is a normal machine features, which results from the motor coasting for several seconds, when releasing either button. The motor requires up to 3 seconds to stop, after the button is released from full on. The effect is intensified from the up to down direction, if the adjustable bleed is highly closed off.  
  o  Figure 3 - Adjustable Bleed Orifice 1 |
| 13. | Arm(s) drift horizontally. | • Check for loose bolts and nuts - tighten.  
• Check and adjust leveling of the main post, middle joint, and endjoint axes.  
  o INSTALLATION INSTRUCTIONS  
  o LEVELING THE MIDDLE JOINT  
  o  
  o LEVELING THE END JOINT  
• Tighten the drag brakes. |
| 14. | Arms difficult to move over center when transitioning from extended angled one direction to the other. | • Reposition pedestal or spacer mounting so arms do not have to move through fully transition. Maximum reach should be 85% of overall length.  
  o INSTALLATION INSTRUCTIONS |
| 15. | Cannot fold forearm fully back toward parallel arms; may not hear grating sound when turning | • Drag brake too tight - loosen.  
• Brake puck has slipped out of its housing. May need to be replaced with a new puck.  
  o Figure 5 - Drag Brake 1 |
| 16. | Middle joint or end joint does not stop its rotation, according to specifications. | • Stop bolt on brake disc sheared - replace after disassembly to remove broken pieces. |
| 17. | Drag brake not effective. | • Tighten brake adjustment plug.  
• Clean brake disc.  
• Replace brake puck.  
• Brake housing sheared off - repair.  
  o Figure 5 - Drag Brake 1 |
| 18. | Motor overheats and/or reservoir overheats | • Using the manipulator harder than operating cycle permits. Add a cooling device.  
• Ambient temperature is too high.  
• Motor is dirty - clean.  
• Vents or air filter are dirty - clean.  
• Machine is overloaded - check the overload sensor for proper operation at the rated load.  
• All power is not getting shut off when at rest - check the operator's control and control circuit. |
| 19. | Need to add oil frequently. | • Hose connections are not tight - tighten.  
• Drain plug on reservoir is not tight - tighten.  
• Various plugs on pump adaptor plate or cylinder valve block are leaking - tighten.  
  o See lift power unit assembly print - drawings and spare parts list section.  
• Cylinder seals are leaking – replace  
• Valve seals are leaking - replace seals and/or valve part |
<table>
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<th>o See lift cylinder assembly print - drawings and spare parts list section.</th>
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</thead>
</table>
| 20. | Operating speed is erratic as a control is operated. (If equipped) | • Check for a worn out slide resistor in the operator's control. Disassemble and replace both slide resistors.  
  o Figure 4 - TMC Trim Pot Adjustment 1  
• Check for good control cable connections.  
• Check the control cable for damage.  
• Make sure control cable isn't being stretched.  
• Replace the control circuit with a new one. |
| 21. | The machine will not lift the load, even though the load is definitely not more than the maximum rated load. Install a 0-2500 psi 1/8" NPT pressure gage in port gage P. Refer to the hydraulic schematic and check for proper pressures. The maximum system pressure can be read on the gage by raising the arm to the full up position. The pressure can be varied easily by varying the distance the up control is operated. (If equipped) | • The pressure switch will shut off the machine after a .5 to 1 second delay when the pressure is at the setting on the hydraulic schematic. Adjust, if necessary.  
• The pressure relief valve will relieve the pump at a pressure about 50 psi higher than the pressure which trips the pressure electrically or hydraulically, disconnect the pressure switch to prevent it from shutting off the power unit. Then, check the pressure at which the pressure relief valve opens. Refer to the hydraulic schematic and adjust, if necessary.  
• The down pressures can be checked with the arm at any position, including the full down position. The full variable speed range on the arm is with a pilot pressure of about 200 psi (arm not moving) to about 800 psi (arm moving at maximum down speed). The machine has electrical trimmers in the controls and an adjustable hydraulic needle valve to allow the user to precisely set the operating characteristics to suit his purposes.  
  o Figure 2 - Trim Pot Adjustment 1  
  o Figure 3 - Adjustable Bleed Orifice 1  
  o Figure 2 - Trim Pot Adjustment 1  
  o Figure 4 - TMC Trim Pot Adjustment 1  
  • NOTE: It is sometimes necessary to readjust the hydraulic relief valve for the proper operating pressure after the machine has been in use for some time. This is a result of spring relaxation after use. Refer to the hydraulic schematic and use a gage in port P to read the pressure while adjusting. The relief valve is located on the right and to the back in the motor/pump adaptor plate. |
| 22. | Tooling rotates / pitches too slow or fast | • Adjust the flow controls on the valve stack on the hydraulic power unit. May also be supplied with flow controls located at the tooling.  
  o Figure 7 - Adjust Fluid Flow Speed 1  
• A return line to the reservoir may be blocked. Look for kinked hoses or other causes. Replace as required. |
**SECTION 5 - OPERATOR INSTRUCTIONS**

The TPA 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 Operation Icon]</td>
<td>Do not operate this equipment without all guards and covers in place.</td>
</tr>
<tr>
<td>![Electric Shock Icon]</td>
<td>Do not operate this equipment from any power source that does not match the voltage rating stamped on the equipment. Refer to the serial tag for operational requirements.</td>
</tr>
<tr>
<td>![Hearing Protection Icon]</td>
<td>Hearing protection required if level of continuous acoustic pressure is greater than 80 dB (A scale).</td>
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SEE PROFILE DRAWING FOR DETAILED PICTURE AND LABELS OF CONTROLS
A. MANIPULATOR MOVEMENT

TPA 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 TPA and for actuation of the functions.

Lifting devices may require electric and pneumatic connections for motion. See air and electric 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 TPA.

Tool function and control needs to be factored into safe operation of the TPA 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