MetPrep 3™
Grinder/Polisher with PH-3™ or PH-4™ Power Head
(PH-3™ Shown)

Operation Manual
06/2016, Version 4.9.1

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Safety Precautions

Please read carefully before operating the machine.

1) All operators should be thoroughly trained in all aspects of machine operation, following the guidelines set forth in this manual, prior to use.

2) The machine should be placed on a stable, sturdy surface to allow for operation without hindrance to the controls.

3) Only consumables that are compatible with the operation of a grinding/polishing machine should be used.

4) Any local machinery and occupational standards must be strictly observed.

5) The operator must ensure the samples being polished are properly secured in the selected fixture prior to machine operation.

6) The operator should not be wearing any loose clothing, ties or jewelry that can get caught in the machine during operation.

7) The power cable included with the machine is exclusively for use with the MetPrep 3™. Using the power cable with any other devices is strictly prohibited.

Note: If the machine is subjected to misuse, neglect, incorrect installation, unapproved alterations, incorrect feed voltage, accidental damage or unauthorized/improper repair, Allied will accept no responsibility for the damage(s) to the user or owner of this equipment.
Safety Labels

Risk of Electric Shock
This label is located on the rear of the machine and indicates that a person accessing the electrical panel is subject to a risk of electric shock. Unplug the power cord when changing fuses or when performing any service.

Chassis Ground
This label is located inside the machine both on the baseplate and next to the control panel. It means that this machine is equipped with a chassis ground point to ground the cover to the baseplate and avoid the risk of electrical shock due to transient voltages and static buildup.

Physical Earth
This label is located inside the machine on the baseplate. It means that this machine is equipped with a connection point for the protective earth ground for incoming power, to avoid the risk of electrical shock due to an insulation fault.

Protective Earth (Ground)
This label is located inside the machine on the baseplate. It means that this machine is equipped with a connection point for the protective earth ground for incoming power, to avoid the risk of electrical shock due to an insulation fault.

Hand Entanglement
It is possible to entangle your hands or fingers in the moving parts of this machine. Please stop operation and use caution before reaching into the machine or when changing platens.

Protective Eyewear Recommended
It is recommended that protective eyewear be worn while operating the machine.

Further Information
This label indicates that further information about the machine is located in this operation manual.
## Machine Details

<table>
<thead>
<tr>
<th>Model:</th>
<th>MetPrep 3™ with PH-3™ or PH-4™ Power Head</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item Number:</td>
<td>with PH-3™: #5-2600</td>
</tr>
<tr>
<td></td>
<td>with PH-4™: #5-2700</td>
</tr>
<tr>
<td>Description:</td>
<td>Grinding/Polishing Machine with Power Head</td>
</tr>
<tr>
<td>Serial Number:</td>
<td>____________________</td>
</tr>
<tr>
<td>Voltage:</td>
<td>Can operate at 100-240 V AC</td>
</tr>
<tr>
<td>Frequency:</td>
<td>Can operate at either 50 Hz or 60 Hz</td>
</tr>
<tr>
<td>Power, Power Head:</td>
<td>186 W (¼ HP)</td>
</tr>
<tr>
<td>Power, MetPrep 3™:</td>
<td>373 W (½ HP)</td>
</tr>
<tr>
<td>Fuse:</td>
<td>Two (2) 10 A, 250 V AC, 5 x 20 mm</td>
</tr>
<tr>
<td>Date of Manufacture:</td>
<td>____________________ (dd/mm/yyyy)</td>
</tr>
<tr>
<td>Dimensions:</td>
<td>15&quot; (381 mm) W x 27&quot; (686 mm) D x 23&quot; (584 mm) H</td>
</tr>
<tr>
<td>Weight:</td>
<td>148 lb. (67 kg)</td>
</tr>
<tr>
<td>Shipping Dimensions:</td>
<td>34&quot; (863 mm) x 34&quot; (863 mm) x 34&quot; (863 mm)</td>
</tr>
<tr>
<td>Shipping Weight:</td>
<td>222 lb. (101 kg)</td>
</tr>
<tr>
<td>Software Version:</td>
<td>____________________</td>
</tr>
</tbody>
</table>

### Operational Environmental Conditions:

- **Recommended for indoor use only**
- **Temperature Range:** 50° F (10° C) – 100° F (40° C)
- **Humidity Range:** None established. If operated in humid climates, steel components such as bearing and spindle components can fail prematurely.
- **Altitude:** None established
- **Pollution:** Degree 2
- **Mains Supply Voltage:** Not to exceed ±10% of the nominal voltage
- **Transient overvoltages according to overvoltage category II**
Warranty

Thank you for choosing Allied!

This product is warranted by Allied High Tech Products, Inc., to be free of defects in material and workmanship for **two (2) years** from date of original purchase. This warranty does not cover damage from abuse, neglect, negligence, accidental breakage, improper use or failure to exercise reasonable care and maintenance in accordance with the instructions accompanying this product.

To obtain warranty support or spare parts please contact your Product Application Specialist or Allied Technical Support at (310) 635-2466, Monday through Friday, 8 a.m.–5 p.m. Pacific Time. Please be prepared to supply the serial number for the product you are calling about; this will help our staff confirm warranty eligibility and provide you with thorough, timely assistance.

At your discretion, in consultation with your Allied Product Application Specialist or an Allied Technical Services representative, we will be happy to send you replacement parts, at no charge, or have you send the product to Allied for warranty repair. Most Allied products are designed for ease of parts replacement, so customer repairs, with no-charge parts from Allied, are often the quickest and easiest way to return a product to active service.

If you wish to return a product to Allied for warranty repair, you must first obtain a Return Equipment Authorization (REA) number. An REA may be obtained from your Product Application Specialist, or from a member of our Technical Services staff. Please ensure that your REA number is referenced prominently on your shipping paperwork as outlined below. Please prepay shipping “to” Allied and provide an address and phone number for return shipping, which is paid for by Allied during the warranty period.

**Please return your product to:**

Allied High Tech Products, Inc.
REA#: ___________________
2376 East Pacifica Place
Rancho Dominguez, CA 90220 USA
P: (310) 635-2466

**Please Note:** Damage to products during transit to/from Allied, or resulting from improper inbound packaging, will not be the responsibility of Allied. Therefore, please ensure that your product is securely boxed or packaged. It is further recommended that you insure your shipment for the full value of the product. Should damage occur during inbound shipment, we will be happy to provide you with a formal quotation estimating the cost of materials and labor necessary to repair such damage. A Purchase Order will be required to make these repairs.
Repairs for Products No Longer Under Warranty

Allied will be happy to make repairs to products no longer under warranty. For these products we will be pleased to provide you with an estimate of the costs (materials and labor) necessary to make requested repairs. For non-warranty repairs, customer is responsible for inbound (to Allied) and outbound (from Allied to customer) shipping and handling costs. Non-warranty repairs are made with the same attention to detail and commitment to quality workmanship that is provided to “in” warranty customers.

What is NOT Covered Under Warranty

- Flooding, as a result of failure to clean the drain, that damages any internal electrical or mechanical components of the machine will not be covered under warranty.

- Failure to regulate and control the water pressure may cause failure of the water solenoids or overflowing the limits of the drain in the machine (page 11). Damage caused as a result will not be covered under warranty.

- Damage from abuse, neglect, negligence, accidental breakage, improper use, or failure to exercise reasonable care and maintenance in accordance with the instructions accompanying this product will not be covered under warranty.

Thank you for choosing Allied! Please let us know if you have comments or questions about these warranty provisions.
**Rear Service Panel**

![Rear service panel](image)

**Figure 1:** Rear service panel

1. This is the drain outlet; it is to be used solely for drainage with the supplied tubing for proper operation of the machine.

2. This is the power connection to the power head; it is to be used solely for the supplied power head.

3. This is the control connection to the AD-5™ automatic fluid dispenser; it is to be used solely with the AD-5™ (page 27).

4. This is the IF air connection to the power head; it is to be used solely for the supplied power head.

5. This is the CF air connection to the power head; it is to be used solely for the supplied power head.

6. The two (2) fuses are inside the AV inlet receptacle. See the Machine Details (page 5) or Electrical Installation (page 10) for more information regarding the fuse types and ratings.

7. This is the power switch for the machine. Turn the machine off using this switch before performing any maintenance.

8. This is the power connection for the machine. Use only a certified, properly rated power cord appropriate for your location.

9. This is the water inlet for the machine; it uses 6.35 mm (¼") tubing that is to be run from the supplied water filter assembly to the inlet. It is to be used solely as a water inlet.

10. This is the air inlet for the air filter into the machine; it uses 6.35 mm (¼") tubing that is to be run from the facility air supply to the inlet. It is to be used solely as an air inlet. The air filter must be used to avoid damage to the machine.
Installation

The MetPrep 3™ with Power Head should be placed on a sturdy, clean, dry surface with the control panel facing toward the operator. It is recommended the grinder/polisher be located close to a sink/faucet or cleaning basin so cleaning the samples is convenient. See the Machine Details (page 5) and the Dimensional Layout View (page 8) for more information regarding its dimensions, weight, electrical specifications, and other useful data for determining the ideal location for the machine’s installation. Access to the rear service panel (page 9) will be necessary to install the air, electrical, and water connections.

Air

**WARNING!** To ensure long, reliable life and avoid corrosion of air components, moisture-free, particle-filtered air should be supplied to the machine. For best results, the input air should meet Solids Class 3, Water Class 4, and Oil Class 3 of ISO Standard 8573-1:2010 (Compressed Air – Part I: Contaminants and Purity Classes).

Install the air tubing from the facility air source to the air filter inlet by pressing the flat end of the tubing into the fitting. To remove the tubing, push in the outer collar and pull the tubing out. Use the separate pieces of tubing to connect the “AIR TO PH ONLY” IF and CF connections to the rear of the power head (Figure 2).

<table>
<thead>
<tr>
<th>Inlet Tubing Size (OD):</th>
<th>¼” (6.35 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Inlet Air Pressure:</td>
<td>50 psi (3.52 kgf/cm²)*</td>
</tr>
<tr>
<td>Maximum Inlet Air Pressure:</td>
<td>100 psi (7.03 kgf/cm²)</td>
</tr>
</tbody>
</table>

The incoming air restrictor allows adjustment of the acceleration rate of the sample holders and pistons. It is factory set but can be adjusted to the preference of the operator.

**Note:** Failure to supply adequate air pressure will negatively affect power head force functionality.

Electrical

Machines operating on 115 V AC are supplied with an electrical cord that fits a North American (U.S.) outlet. Although Allied will supply a power cord for machines operating on 230 V AC, the prong pattern may not match the wall socket for that country of operation. A certified, properly rated power cord must be used.

Before the machine is plugged into the wall socket, make sure the power is switched to the “Off” position on the power inlet at the rear service panel. Plug the power head electrical connection (Figure 2) into the rear service panel, and then plug the cable from the rear service panel to the facility power source.

The only power switch is located on the rear service panel. The power inlet contains a fuse holder that accepts two (2) 10 A, 250 V AC, 5 x 20 mm fuses. If any maintenance is done to the machine that requires removing the cover, the power cord **MUST** be unplugged first.
Plumbing

Water is used during grinding and polishing as a lubricant and to wash debris from the grinding surface for improved performance and results. The water inlet and drain port can be found on the rear service panel.

Flow Rate: \(\frac{1}{2}\) gallons per minute (1.9 L/minute)
Minimum Inlet Water Pressure: 25 psi (1.76 kgf/cm²)
Maximum Inlet Water Pressure: 50 psi (3.52 kgf/cm²)
Inlet Tubing: \(\frac{1}{4}\)" OD (6.35 mm)
Drain Rate/Capacity: 1 gal/minute (3.8 L/minute) (recommended @ 30 psi)
Drain Tubing: 1¼" ID (32 mm)

**Note:** Do not use the valve at the water spout to completely shut off the water flow. It is rated for 30 psi and is only intended to restrict the water flow during polishing.

Drain

Three (3) hose clamps are included to attach the drain tubing at the rear service panel to additional fittings, tubing, etc. Use a 90 degree elbow fitting to direct the drain hose if the tubing does not bend sharply enough for proper installation. Do not SEAL the drain hose to the drain. A backup in the facility may cause the machine to flood. Any flooding of the interior of the machine that causes damage to components will void warranty coverage.

Water Inlet

To avoid particles in the facility water line from clogging the orifice of the solenoid and causing its failure, the supplied water filter **MUST be installed** to avoid damage to the solenoid. The use of DI water does not guarantee the water is particle filtered.

Before installing the tubing or filter, turn off the facility water. Install the water filter between the water source and the rear service panel. Additional filters are available from Allied using item number 27-3508. The filter accepts tubing that is \(\frac{1}{4}\)" OD (6.35 mm); for other sizes (such as 6 mm OD tubing in Metric facilities), an adapter is recommended to facilitate consistent water flow without leaks.

The water inlet and filter have quick-release connections that only require the tube to be inserted until it stops; no tools are required for this installation. Make sure the water direction flows according to the arrow found on the water filter (circled, Figure 3). Once the filter and tubing are installed, turn on the facility water.
Test the water inlet and drain connections by pressing the WATER button on the control panel (page 13). Water flow may need to be regulated or adjusted using the valve.

To remove the tubing from either the inlet or filter, simultaneously press the outer collar of the fitting in and pull the tubing out.

**Control Panel**
Initial Power-On

Turn the machine on using the power switch on the rear service panel (page 9). When it first powers on, the front display will read (in order from left to right):

| MetPrep 3 with PH-3 Power Head | Software Version X.XX MM/ YYYY | Step 1 ← Step 2 Step 3 Step 4 |

Button/ Function Glossary

These buttons and functions are all located on the faceplate of the MetPrep 3™.

**Water:** The WATER button activates and deactivates the water. During both manual and automatic operation, the water button will override any setting for water.

![Water Icon]

**Jog:** When pressed and released, the JOG button activates platen rotation. Jog is used when applying water to the platen for cleaning purposes or for applying abrasive media (such as diamond suspension or extender, alumina powder/suspension) onto a new or existing cloth before polishing. It can also be used to rotate the platen for manual grinding/polishing.

![Platen Jogging Icon]

**Arrows:** When using jog mode, use the down arrow to decrease the platen speed, and use the up arrow to increase the platen speed. When selecting a step or parameter, use the arrows to scroll up or down among steps or parameters. When changing a parameter within a step, use the arrows to select the desired value.

**Stop:** The STOP button deactivates every function during operation; pressing the stop button **does not** power the machine off. If any maintenance is done to the machine that requires removing the cover, the power cord **MUST** be unplugged.

**Start:** The START button activates the step toward which the arrow is pointing on the display.
Step: When pressed, the STEP button will access the step menu. The steps will be displayed when the arrow buttons are used to navigate the selection arrow through each line as follows:

```
Step 1
Step 2
Step 3
Step 4
1st screen

Step 9
Step 10
Step 11
Step 12
3rd screen

Step 25
Development

7th screen
```

See Programming Steps (page 16) for instructions on changing the parameters of each step.

Program: The PROGRAM button is used to program the individual parameters within each step and to change the password.

Select: SELECT is used to toggle the selection arrow in display windows and navigate to different screens and select steps for programming.

**EMERGENCY STOP:**

The Emergency Stop switch is located on the front of the machine just below the control panel. When pushed in, it will immediately shut off all power and stop operation of the machine. To restore power, turn the red knob according to the arrows on it. The machine will then restart its power-on sequence.
Operation

Manual Grinding/Polishing

To disable the power head and operate only the platen and water for manual use, the JOG button next to the START and STOP buttons is used.

During this operation, the platen always rotates clockwise and water can be activated by pressing the coolant button.

When using the jog function, the display looks like this:

![Platen Jogging Display]

Change the platen RPM using the arrow buttons (circled above) to the right of the display.

Semiautomatic Grinding/Polishing

To perform semiautomatic, unattended grinding/polishing, specific parameters can be changed and stored in each of the 25 programmable steps.

The MetPrep 3™ also features a “Procedure Development” step. This step is useful when developing a procedure by allowing the platen RPM, sample RPM and force to be adjusted while the machine is in operation, to experiment with varying conditions.

The following settings can be individually adjusted in each of the 25 steps:

- **Platen RPM:** 40-600, 10 RPM increments
- **Mode:** Comp/Contra
- **Time:** 0-120 minutes, 15 second increments
- **Sample RPM:** 0-150, 10 RPM increments
- **Force:** Individual/Central (adjusts force value accordingly)
  - **Central:** LbF (pound-force) or N (Newton), selectable units
    - **Central:** 5-50 LbF (1 LbF increments) or 22-219 N (~4 N increments)
  - **Individual, PH-3™:** 0-16 LbF (1 LbF increments) or 0-70 N (~4 N increments)
  - **Individual, PH-4™:** 0-12 LbF (1 LbF increments) or 0-55 N (~4 N increments)
- **Fluid:** Off, Water, AD-5™ (fluid dispenser)
- **Rinse:** 0-60 seconds, 1 second increments
- **Frc Reduce:** On/Off
- **Reduce Time:** 0-60 seconds, 1 second increments
- **Reduce %:** 0-90, 10% increments
- **Frc Start:** On/Off

Note: If a semiautomatic step is activated with the power head tilted up, the power head will not rotate. If the power head is tilted up during a semiautomatic step, the power head will immediately stop rotating. Restart the step with the power head lowered to resume rotation.
### Programming Steps

Navigate to the Steps menu:

- **Step 1**
- **Step 2**
- **Step 3**
- **Step 4**

Using the ARROW buttons to the right of the display, scroll the indicator arrow to the step to be programmed.

Once the arrow is aligned with the step to be programmed, press the SELECT button to enter the settings menu.

To change the value of any setting, scroll the arrow to that parameter and press the PROGRAM button. A “?” will appear next to it, and the arrow buttons can be used to adjust the value. Once the value has been selected, press PROGRAM to set it into memory.

### Adjustable Parameters

- **Sample RPM** displays the rotation speed of the sample holder, variable between 0 and 150 RPM, with 10 RPM increments.

- **Force** allows toggling between central force and individual (single) force modes. When a mode is selected, the power head automatically diverts the air pressure to provide consistent forces to the samples.

The **Force (LbF)** field changes depending upon the mode selection: when central force is used, it displays the total force acting on the sample holder; when individual force is used, it displays the force acting on each individual sample.

### Changing Units of Force: LbF/ N

The unit of force displayed may be either pound-force (LbF) or Newton (N). To switch between units, follow these steps:

1. Turn machine power off.
2. Press and hold the down arrow while turning on the machine.
3. Release the down arrow when the screen goes blank.
4. Toggle the unit by pressing the down arrow.
5. Press SELECT when the desired unit is displayed. The screen will now display the “step” menu screen and the parameters stored within the step, with the new units.

- **Step 1**
- **Platen RPM** 250
- **Mode** Comp
- **Time** 2:30

**Platen RPM** displays the rotation speed of the platen, variable between 40 and 600 RPM.
Mode: Comp/Contra

The terms “Comp” and “Contra” refer to the relative directions of the platen and sample holder. When “Comp” is selected the platen and sample holder rotate in the same, complimentary direction. This mode can be used for most applications, with exceptions listed in the “Contra” mode description below.

When “Contra” is selected the platen and sample holder rotate in the opposite, contradictory direction. This mode can be used for more aggressive material removal during grinding steps, for hard-to-prepare materials, or to reduce the final polishing time. Mount beveling may occur if “Contra” mode is used for too much time during grinding.

Time displays the total time that step will run before the machine automatically stops the platen, power head, and fluids. The time is adjustable between 0 and 120 minutes, in 15 second increments.

Fluid allows selection of lubricants: water, AD-5™ (fluid dispenser), or none (off). When set to “off” no water is activated when the step is started. Selection of “AD-5” will send a signal to the AD-5™ fluid dispenser, if it is connected to the machine, causing it to start when the step is started. When “water” is selected, water will be dispensed from the nozzle. Water is generally used for grinding applications and to flush/rinse the platen.

Rinse allows a flush, or rinse cycle, to be activated in the last XX seconds of a step. It is commonly used to rinse the cloth, samples and fixture with water, and it is strongly recommended when colloidal silica, colloidal silica/alumina or colloidal alumina are used.

Step 1

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rinse</td>
<td>0s</td>
</tr>
<tr>
<td>Frc Reduce</td>
<td>Off</td>
</tr>
</tbody>
</table>
Frc Reduce (Force Reduction): On/Off

At the beginning and end of any step, the force applied to samples can be reduced. In some cases, gradual application of force onto a sample produces a more shallow scratch and may protect delicate/brittle samples from cracking.

<table>
<thead>
<tr>
<th>Step 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce Time</td>
</tr>
<tr>
<td>Reduce %</td>
</tr>
<tr>
<td>Frc Start</td>
</tr>
</tbody>
</table>

Reduce Time defines the duration of the force reduction at the beginning and end of a step. If the Frc Reduce parameter is set to “Off”, nothing will happen.

Reduce % defines the percentage that the force will be decreased during the force reduction.

With Frc Start turned on, the force is reduced by 70% for the first ten (10) seconds as a “soft start”. This helps protect samples from damage due to a sudden application of full force.

Password Protection

When password protection is turned on, none of the settings in any step can be changed. Settings for each step are still viewable, but they cannot be changed unless the password is entered and password protection is deactivated.

Activating Password Protection

1) Press the STEP button while on the Steps menu to access the Password Routine screen.

2) Press SELECT to move the arrow to the “Password: Off” line. Press PROGRAM and then press the down arrow button to change the password from “Off” to “On”.

3) Press PROGRAM to accept the “On” selection.

4) Press PROGRAM and then use the arrow buttons to select the desired four-digit password. Press PROGRAM to store the password into memory.

5) Press the STEP button to exit the Password Routine screen.
Deactivating Password Protection

1) Press the STEP button while on the Steps menu to access the Password Routine screen.

2) Press PROGRAM and then use the arrow buttons to enter the password.

3) Press START two times and the password will be deactivated.

4) Press the STEP button to exit the Password Routine screen. Step settings can now be changed as necessary.

FORGOT THE PASSWORD? Contact Allied for the reset procedure. The machine can still be operated using either the “Procedure Development” step or “Jog” mode.

Power Head Operation

The power head can be used to semiautomatically prepare up to three (3) single samples or multiple samples secured into a common sample holder. These two methods are referred to as Individual Force (IF) and Central Force (CF), respectively.

Release Latch & Positioning Lever

The release latch located on the right side of the power head (Figure 4) is used to disengage the lock and allow the head to lift up and back from the platen. This helps to access the sample holder and samples, and to change the platen or abrasive. Once the sample holder is inserted and the machine is ready for use, the power head can be lowered by hand until it locks into place.

If a semiautomatic step is activated with the power head tilted up, the power head will not rotate. If the power head is tilted up during a semiautomatic step, the power head will immediately stop rotating. Restart the step with the power head lowered to resume rotation.

Figure 4: Release latch and positioning lever
The power head can be swiveled by loosening the positioning lever (Figure 4) and moving the power head so the sample holder is located away from the center of the platen. Lock the power head into place by tightening the lever.

**Securing Sample Holders**

Follow these steps to secure both CF and IF sample holders in the power head:

**Note:** Attachment and removal of sample holders should be done when the components on the machine have stopped moving and the power head has been tilted back, before the abrasive disc/cloth is changed. This helps prevent contamination of the abrasive and cloth surfaces with the previous step’s abrasive and debris.

1) On the power head cylinder, press in the oblong-shaped push-button.

2) With the button compressed, align the drive pin of the sample holder with one of the holes in the bottom of the cylinder, and push the drive pin fully into the cylinder.

3) Release the button and allow the locking mechanism to grab and hold the sample holder.

To remove the sample holder, press the button on the power head cylinder while supporting the sample holder with your hand so it does not fall.
Individual Force (IF): Sample Holders & Functionality

Individual force functionality allows one (1) or more samples to be prepared simultaneously. The advantage is that it allows removal of any number of samples from the grinding/polishing operation without affecting balance of the system. It is also ideal for applications where small geometry and site-specific cross-section requirements make alignment of more than three (3) samples to a common plane extremely challenging.

Individual force functionality provides options to prepare from one (1) to three (3) samples using the PH-3™ and from one (1) to four (4) samples using the PH-4™.

To use individual force during a step, the Force parameter needs to be set to “Single” so the value is accurate on the LCD display (page 16). If switching from central force mode, the power head will automatically divert the air pressure to the individual pistons to provide consistent forces to the samples. Different force values cannot be programmed for each position; the displayed force will be the force applied to each sample.

Secure the sample holder in the power head and lower the power head until it locks in position. Place the sample(s) in any open position(s) in the sample holder. During operation, the individual pistons will extend from the cylinder body to apply force to the backs of the samples. Where there is an empty location, the piston will stop above the platen surface so it does not make contact.

Single Mount Diameter Holders feature the same size cavities around the entire holder and are available in a variety of standard mount sizes.

Variable Mount Diameter Holders utilize spacer rings for specific diameter mounts. Rings can be mixed and matched for maximum versatility. 4-position and 6-position holders are used with the PH-4™ and PH-6™ power heads, respectively, both featuring 50 mm openings. Spacer rings are sold individually in a variety of standard mount sizes.
Central Force (CF): Sample Holders & Functionality

Central force sample holders secure samples on a common plane. A minimum of three (3) samples must be prepared at once for balance. The samples are secured in a sample holder and force is applied to all samples at once by the power head central hub. Since aligning more than three (3) samples to dissect a specific location within the mount is challenging, this method is not recommended for precision or site-specific applications.

It is important that the samples be equally positioned around the center of the sample holder so they grind and polish evenly and remain balanced. Failure to balance may cause damage to the machine, holder, or samples. Blank mounts should be used in open positions to balance the sample holder appropriately.

Teardrop Holders allow flexibility in the shape and size of the sample that can be held. A setscrew secures each sample.

Dual-Cavity Holders feature a single tightening point for each pair of sample cavities, which is useful for rapid insertion and removal of either one or two round or irregular shaped samples.

Rectangular/Square Holders can hold larger samples, either unmounted or cold mounted. Allied offers these sample holders in a variety of sizes, with matching silicone mold cups for use with epoxy or acrylic mounting systems.

Continuous Surface Holders feature flat surfaces on which samples can be mounted with hot mounting wax or double sided adhesive tape. These holders are useful for flat, large, or other non-traditional sample types.
Loading Samples into CF Sample Holders

The Sample Loading Fixture is used to set the depth of samples when secured in CF sample holders so they protrude an equal distance from the bottom of the holder. This minimizes the volume of material to be removed from all samples and saves time when establishing a common grinding plane (“planarizing” the samples).

The CF sample holder should be positioned on the sample loading fixture so it references against the machined edges. Once in position, the fixture locking pin can be used to secure the sample holder to the loading fixture. This will allow the set-screws to be tightened into the samples without shifting the sample holder or samples in the process.

To secure, apply pressure to the backside of the mount and tighten the set-screw with the provided Allen tool.

Sample Balancing

The **CORRECT** method has the samples evenly spaced around the central force pin, balancing the force being applied to the sample holder.

The **INCORRECT** method has the mounts located unevenly around the central force pin, creating an unbalanced condition.

**Note:** Sample holders are shown upside down to show the polished mount. The center engaging pin is located on the underside out of this view.
Using Blanks

In Figure 5, there are four (4) black mounts containing metallographic samples secured into a 6-position fixture. The other two orange mounts are “blanks”, which are mounts made to fill the open positions in the holder so it is evenly balanced.

Unloading Samples from CF Sample Holders

The Sample Loading Fixture is designed for “loading” and “unloading” of samples using the CF sample holders.

When flipped 180 degrees, the “unloading” side of the fixture can be used to unload each polished sample; this will preserve the polished surfaces so they are not scratched. When unloading, the sample holder is positioned upside down so the polished surfaces of the samples face upward. In this position, the samples can be inspected for light scratches and unloaded from the fixture by loosening the set-screws.
Platens

The MetPrep 3™ utilizes 8" (203 mm) diameter platens, sold separately from the machine. Additional platens may be purchased for use with plain, adhesive, or magnetic backed cloths, discs, and pads:

#5-2005 - Platen, 8", Aluminum
#5-2005M – Platen, 8", Magnetic

On the underside of each platen there are four (4) holes patterned to fit the two (2) drive pins on the platen base of the machine. A platen is properly installed when the counter-bore on the underside of the platen is aligned to the centering bore of the platen base, and then rotated to engage the two (2) drive pins so the platen rests flat and stable.

Splash Ring

Each machine comes with a splash ring that is designed to collect and direct the water into the drain bowl. To maintain cleanliness, avoid contamination, and ensure safety, it is strongly recommended the splash ring be used during operation. The splash ring should also be cleaned as needed to prevent buildup of dirt and debris.

Water Spout

The MetPrep 3™ has a fully adjustable, swiveling, removable water spout to provide precise placement of the water flow during operation. The water spout can be easily swiveled left or right by rotating the red pivot cylinder at its base. The height, angle, and position of the nozzle can be changed by adjusting the segments of the Loc-Line® spout assembly. The spout can also be lifted out of the base for ease of washing samples after a grinding or polishing step, rinsing the drain bowl, or cleaning the platen.
Grinding

Grinding is performed using various grinding products. The type of product and grit (or micron size) chosen depends on the material, total surface area and amount that must be removed from one or all samples.

- When grinding using **Central Force** functionality, all the samples must be ground to a common plane. Grinding is done to remove any deformation left over from the sectioning procedure and/or to expose a specific region in the sample from the bottom of the mount.

- The **speed** used should be determined based on preparation results. A platen speed of 200-300 RPM and sample speed of 150 RPM are most common for grinding applications.

- The **force** used will depend on the material type and sample surface area. Based on a common 1.25" (32 mm) mount diameter, a “per sample” force of 4-6 LbF is most common. As the sample size gets larger, the amount of force must increase to maintain pressure for the abrasive to work effectively and efficiently.

- **Silicon carbide** is the most common abrasive, and it can be used for almost any type of metallic or plastic sample. **Diamond** discs, such as Allied's Dia-Grid, are better suited for grinding non-metallic samples, composites, ceramics, refractory metals and other hard or tough samples.

Polishing

Polishing is performed to remove the scratches from grinding and any metallurgical deformation, revealing the true microstructure. Failure to use the appropriate cloth or abrasive will yield inaccurate results and may generate polishing artifacts (smearing, comet tails, rounding, etc.) that can interfere with accurate microstructural interpretation.

- Polishing is performed by using a **polishing cloth** in combination with a loose abrasive delivered as a liquid (suspension or mixed slurry) or paste, along with a lubricant.

- The platen and sample rotation **speed** selected will depend on user preferences and the applications, though 150 RPM is most common. Generally it is ideal for the platen and sample rotation RPM to match.

- The **force** used will depend on the material type and sample surface area. Based on a common 1.25" (32 mm) mount diameter, a “per sample” force of 4-6 LbF is most common, with the force generally decreased slightly during final polishing. As the sample size gets larger, the amount of force must increase to maintain pressure for the abrasive to work effectively and efficiently.

- A common **polishing sequence** will include an intermediate step or steps such as 9, 6 or 3 µm, followed by a final step. The surface finish requirements will depend on the sample feature size, magnification used to inspect the microstructure, and analysis goals.

- **Adhesive back** cloths can be adhered to dedicated platens or support discs, and **magnetic system** cloths can be attached to a single magnetic platen for quick and easy cloth changes.
Importance of Cloth Selection and Abrasive Combination

It is important not only that the right cloth be selected, but also that the right abrasive and particle size is used with the selected cloth. This will influence performance and outcome.

For instance, if a 1 µm abrasive were to be used with a coarse woven cloth, the diamond would fall into the weave and fail to make contact with the sample to remove scratches from the previous step.

Consult the “Polishing Cloth” section of Allied’s catalog for compatibility recommendations of abrasive particle sizes and polishing cloths.

With intermediate polishing, to maintain planarity and flatness of the sample and mounting material, a flat cloth is recommended. This keeps polishing time to a minimum to maintain flatness. It also effectively removes the scratches and the deformed material remaining from the final grinding step.

Cleaning Samples

Between each grinding and polishing step, the samples MUST be cleaned to ensure scratch-free surfaces and avoid contamination of remaining steps. Failure to clean the abrasive particles from the sample and holder between steps will bring these particles onto the surface of the next step, which will likely lead to contamination of that surface. In most cases, if contamination is present, it means the cloth must be cleaned or replaced.

AD-5™ Fluid Dispenser

An automatic fluid dispenser enables unattended operation of the polishing process. If the AD-5™ is used with the MetPrep 3™, it should be connected to the back of the grinder/polisher using the connector cable supplied with the AD-5™.

For more information regarding this product, consult the AD-5™ operation manual or contact Allied.

Maintenance

The MetPrep 3™ is designed to provide many years of trouble-free service. It should be cleaned after each use. There are no maintenance requirements for the motor or electrical components.

Sample holders and the outer surfaces of the power head should be cleaned after each use, to remove polishing suspensions, abrasive particles and other debris that may splash from the grinding/polishing process.

The drain bowl should be regularly inspected for clogging and cleaned as frequently as necessary to remove any debris that may collect or clog the orifice. Periodic “power” flushing of the drain is recommended to remove debris that settles in the drain from the bowl to the back of the machine.
## Recommended Spare Parts

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty/ Unit</th>
<th>Item #</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrical</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC Drive, 12 A, 115/230 V AC (must also order 21-4249-2, and 21-4259-1 or 21-4259-2)</td>
<td>2</td>
<td>21-4249</td>
</tr>
<tr>
<td>Signal Isolator, for use with KB Drive</td>
<td>1</td>
<td>21-4249-2</td>
</tr>
<tr>
<td>Resistor Plug-In Horsepower, 0.05 Ω (for power head motor)</td>
<td>1</td>
<td>21-4259-1</td>
</tr>
<tr>
<td>Resistor Plug-In Horsepower, 0.025 Ω (for platen motor)</td>
<td>1</td>
<td>21-4259-2</td>
</tr>
<tr>
<td>Solenoid, Fluid, 24 V, ¼ Tube I/O</td>
<td>1</td>
<td>21-2524</td>
</tr>
<tr>
<td>Faceplate and PCB Assembly</td>
<td>1</td>
<td>21-2512</td>
</tr>
<tr>
<td>AV Inlet Receptacle, Filtered 10 A, 115/230 V AC</td>
<td>1</td>
<td>21-7520</td>
</tr>
<tr>
<td>Fuse, Glass, 10 A, 250 V, 5 x 20 mm</td>
<td>2</td>
<td>21-4231</td>
</tr>
<tr>
<td><strong>Mechanical/ Structural</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC Motor 0.5 HP, 2500 RPM, 130 V DC (MetPrep 3™ base)</td>
<td>1</td>
<td>21-6230</td>
</tr>
<tr>
<td>Motor Assembly (power head)</td>
<td>1</td>
<td>27-3306</td>
</tr>
<tr>
<td>Spindle Assembly</td>
<td>1</td>
<td>10-SPINDLE-5</td>
</tr>
<tr>
<td>Splash Ring</td>
<td>1</td>
<td>21-9213</td>
</tr>
<tr>
<td>Platen Cover</td>
<td>1</td>
<td>21-7523</td>
</tr>
<tr>
<td>Gas Spring, 80 lb.</td>
<td>1</td>
<td>21-3451</td>
</tr>
<tr>
<td>Drive Pin, 3/8&quot; OD, Stainless Steel</td>
<td>2</td>
<td>21-2506</td>
</tr>
<tr>
<td>V-Ribbed Belt, J-Section, 300J 4 Micro-V (MetPrep 3™ base)</td>
<td>1</td>
<td>21-2128</td>
</tr>
<tr>
<td>Delrin Pad of IF Piston (PH-3™ power head) (pk/3)</td>
<td>1</td>
<td>5-DPPH3</td>
</tr>
<tr>
<td>Delrin Pad of IF Piston (PH-4™ power head) (pk/4)</td>
<td>1</td>
<td>5-DPPH4</td>
</tr>
<tr>
<td><strong>Water/ Air</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loc-Line Assembly, 7 element</td>
<td>1</td>
<td>27-6116-7</td>
</tr>
<tr>
<td>Air Regulator, Precision Electronic 0.25&quot; NPT Ports</td>
<td>1</td>
<td>21-6234</td>
</tr>
</tbody>
</table>
## Troubleshooting Guide - Grinding

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mount Mooning</td>
<td>The sample/holder sat too close to the center of the platen.</td>
<td>Move the sample/holder away from the center.</td>
</tr>
<tr>
<td>Chamfered Mount Circumference</td>
<td>The abrasive wore out.</td>
<td>Replace the abrasive more often or use a harder abrasive.</td>
</tr>
<tr>
<td></td>
<td>Grinding occurred on a compressible surface such as the surface of the magnetic platen.</td>
<td>Use a stiff grinding surface.</td>
</tr>
<tr>
<td>Beveled Sample</td>
<td>The sample was not registered flat or loaded evenly when it was loaded into a fixture.</td>
<td>Grind longer to pass the beveled region.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reload the samples and space them evenly.</td>
</tr>
<tr>
<td>Scratches or Cut Marks</td>
<td>The grinding time was insufficient.</td>
<td>Grind longer.</td>
</tr>
<tr>
<td></td>
<td>The abrasive wore out before the damage from previous steps was removed.</td>
<td>Replace the abrasive more often or use a harder abrasive.</td>
</tr>
<tr>
<td>Smeared Sample</td>
<td>An insufficient amount of lubricant was used.</td>
<td>Increase the amount or flow rate of lubricant.</td>
</tr>
<tr>
<td></td>
<td>The lubricant could not remove heat fast enough.</td>
<td>Use a more viscous lubricant.</td>
</tr>
<tr>
<td></td>
<td>Too much force was used.</td>
<td>Use lower force.</td>
</tr>
<tr>
<td>Abrasive Embedding</td>
<td>The sample was too soft.</td>
<td>Apply wax to the abrasive to hold the particles on the abrasive disc longer. Increase the flow rate of coolant.</td>
</tr>
<tr>
<td></td>
<td>Too much force was used.</td>
<td>Use lower force.</td>
</tr>
<tr>
<td>Cracked Sample</td>
<td>The bond hardness of the abrasive was too high.</td>
<td>Use a different abrasive.</td>
</tr>
<tr>
<td></td>
<td>Too much force was used.</td>
<td>Use lower force.</td>
</tr>
<tr>
<td></td>
<td>The sample was not properly supported.</td>
<td>Check for mounting gaps or air pockets around the sample. Review the mounting method.</td>
</tr>
<tr>
<td></td>
<td>The abrasive was too coarse.</td>
<td>Use a finer abrasive.</td>
</tr>
<tr>
<td>Water Overflow</td>
<td>The drain was clogged.</td>
<td>Remove the grinding debris. Clean the drain regularly.</td>
</tr>
</tbody>
</table>
## Troubleshooting Guide – Polishing

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edge Rounding</td>
<td>The edge was not properly supported, because there was a gap between the mounting material and the sample.</td>
<td>Use a mounting material with better adhesion.</td>
</tr>
<tr>
<td></td>
<td>The polishing cloth was too soft.</td>
<td>Use a more rigid polishing cloth.</td>
</tr>
<tr>
<td></td>
<td>The polishing time was too long.</td>
<td>Shorten the polishing time.</td>
</tr>
<tr>
<td></td>
<td>Too much force was used.</td>
<td>Use lower force.</td>
</tr>
<tr>
<td>Smeared Sample</td>
<td>An insufficient amount of lubricant was used.</td>
<td>Increase the amount or flow rate of lubricant.</td>
</tr>
<tr>
<td></td>
<td>The lubricant could not remove heat fast enough.</td>
<td>Use a more viscous lubricant.</td>
</tr>
<tr>
<td></td>
<td>Too much force was used.</td>
<td>Use lower force.</td>
</tr>
<tr>
<td></td>
<td>The polishing cloth was too soft.</td>
<td>Use a more rigid polishing cloth.</td>
</tr>
<tr>
<td>Pullout</td>
<td>The fibers of the polishing cloth pulled out sample constituents when they brushed across the surface.</td>
<td>Use a low nap polishing cloth.</td>
</tr>
<tr>
<td></td>
<td>An insufficient amount of lubricant was used.</td>
<td>Increase the amount or flow rate of lubricant.</td>
</tr>
<tr>
<td></td>
<td>The lubricant could not remove heat fast enough.</td>
<td>Use a more viscous lubricant.</td>
</tr>
<tr>
<td>Particle Embedding</td>
<td>The polishing cloth was too rigid.</td>
<td>Use a softer polishing cloth.</td>
</tr>
<tr>
<td></td>
<td>An insufficient amount of lubricant was used.</td>
<td>Increase the amount or flow rate of lubricant.</td>
</tr>
<tr>
<td></td>
<td>The lubricant could not remove heat fast enough.</td>
<td>Use a more viscous lubricant.</td>
</tr>
<tr>
<td></td>
<td>Too much force was used.</td>
<td>Use lower force.</td>
</tr>
</tbody>
</table>
## Troubleshooting Guide - Polishing

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comet Tails</td>
<td>The polishing motion was in one direction only.</td>
<td>Rotate the sample to create a random polishing pattern.</td>
</tr>
<tr>
<td></td>
<td>The power head and platen speeds were too different, which created a</td>
<td>Set the power head and platen to rotate at similar speeds.</td>
</tr>
<tr>
<td></td>
<td>unidirectional effect.</td>
<td></td>
</tr>
<tr>
<td>Lapping Tracks</td>
<td>The polishing cloth was too rigid.</td>
<td>Use a softer polishing cloth.</td>
</tr>
<tr>
<td></td>
<td>Not enough force was used.</td>
<td>Use higher force.</td>
</tr>
<tr>
<td>Large Scratches</td>
<td>Scratches from the previous steps were not removed.</td>
<td>Use a more rigid polishing cloth.</td>
</tr>
<tr>
<td></td>
<td>The polishing cloth did not support the abrasive size used.</td>
<td>If using a flocked cloth, use a more rigid flock.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If using a woven cloth, use a tighter weave.</td>
</tr>
<tr>
<td></td>
<td>The polishing cloth was contaminated.</td>
<td>Do not use the same cloth to polish materials with different hardness.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Replace the cloth with a new one.</td>
</tr>
<tr>
<td></td>
<td>The polishing cloth was worn and not removing material at its normal</td>
<td>Replace the cloth with a new one.</td>
</tr>
<tr>
<td></td>
<td>rate.</td>
<td></td>
</tr>
<tr>
<td>Relief &amp; Preferential</td>
<td>The polishing cloth was too soft.</td>
<td>Use a more rigid polishing cloth.</td>
</tr>
<tr>
<td>Polishing</td>
<td>The polishing time was too long.</td>
<td>Shorten the polishing time.</td>
</tr>
<tr>
<td></td>
<td>The applied force was too high.</td>
<td>Decrease the force.</td>
</tr>
<tr>
<td></td>
<td>The chemicals in polishing solutions affected the sample's constituents</td>
<td>Shorten the polishing time.</td>
</tr>
<tr>
<td></td>
<td>differently.</td>
<td>Use a different polishing solution.</td>
</tr>
</tbody>
</table>
## Troubleshooting Guide - Cleaning

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stained or Oxidized Sample</td>
<td>The sample reacted with the soap.</td>
<td>Rinse the sample with just water.</td>
</tr>
<tr>
<td></td>
<td>The sample reacted with water.</td>
<td>Rinse the sample with anhydrous alcohol.</td>
</tr>
<tr>
<td>Rusted or Corroded Sample</td>
<td>The sample was not fully dried after rinsing with water.</td>
<td>Rinse the sample with water, spray the sample with alcohol, and then dry it with warm air at an angle.</td>
</tr>
<tr>
<td>Scratching of Sample During Cleaning</td>
<td>The sample was scratched by a cotton puff or brush used during cleaning.</td>
<td>Rub the sample with a finger instead.</td>
</tr>
<tr>
<td>Colloidal Silica Suspension Stains</td>
<td>The colloidal silica suspension dried on the surface.</td>
<td>Clean the sample with micro organic soap to dissolve the colloidal silica suspension stains.</td>
</tr>
<tr>
<td>Water Spots</td>
<td>The sample was not dried after rinsing with water.</td>
<td>Rinse the sample with water, spray the sample with alcohol, and then dry it with warm air at an angle.</td>
</tr>
<tr>
<td>Liquid Bleeding</td>
<td>Liquid collected in the gaps and holes, and then bled out during drying.</td>
<td>Spray the sample with water and blow air into the gap at the same time, then apply alcohol and dry it with warm air at an angle. Apply candle wax to the polished surface and then re-polish it after all the gaps and holes are sealed.</td>
</tr>
</tbody>
</table>

## Troubleshooting Guide - Ultrasonic Cleaner

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stained or Oxidized Sample</td>
<td>The sample reacted with the GP cleaning solution.</td>
<td>Use water instead of the GP cleaning solution.</td>
</tr>
<tr>
<td>Cracks or Pits Forming on Sample Surface</td>
<td>The sample's structure was damaged by the ultrasonic cleaner.</td>
<td>Clean the sample using other methods.</td>
</tr>
<tr>
<td>Scratched Sample</td>
<td>The polished surface was in contact with the bottom of the tank/basket directly.</td>
<td>Wrap the sample in a tissue paper before placing it into the ultrasonic cleaner.</td>
</tr>
<tr>
<td>Inadequate Cleaning of Sample</td>
<td>The cleaning time was too short.</td>
<td>Ultrasonic clean the sample for at least 5 minutes.</td>
</tr>
</tbody>
</table>
Product Name: MetPrep 3™ with PH-3™ or PH-4™


The product cited above complies with the LVD and EMC Harmonized Standards listed below when installed and operated in accordance with the Installation and Users Manual Instructions provided. The product is Declared to Comply by Design, Testing and 3rd Party Evaluation. The Certification Program Management, Product Safety Testing and Evaluations, and EMC Testing were conducted by DNB Engineering, Inc. located in Riverside, CA 92503, USA.

PRODUCT SAFETY STANDARDS

|---------------------------|-----------------------|

EMC TEST STANDARDS

<table>
<thead>
<tr>
<th>EMC Directive 2014/ 30/ EU</th>
<th>Electromagnetic Compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standards To Which Conformity is Declared:</td>
<td>EN61000-6-4: 2006+A1:2011</td>
</tr>
<tr>
<td></td>
<td>EN55011 Class A Group 1</td>
</tr>
<tr>
<td></td>
<td>EN61000-6-2: 2005</td>
</tr>
<tr>
<td></td>
<td>EN61000-4-2</td>
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<td>EN61000-4-3</td>
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<td>EN61000-4-4</td>
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<td>EN61000-4-5</td>
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<td>EN61000-4-6</td>
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<td>EN61000-4-8</td>
</tr>
<tr>
<td></td>
<td>EN61000-4-11</td>
</tr>
</tbody>
</table>

RESPONSIBLE PARTY

Manufacturer's Name: Allied High Tech Products, Inc.
Manufacturer's Address: 2376 E. Pacifica Place, Rancho Dominguez, CA 90220, USA

We the undersigned hereby declare that the equipment specified above conforms to the noted Directives and the listed Standards.

MANUFACTURER

Signature: [Signature]
Typed Name: Charles Peterson
Title: Manufacturing Manager
Date: January 23, 2015
Global Distribution of the World’s Finest Products

2376 East Pacifica Place, Rancho Dominguez, CA 90220
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www.alliedhightech.com