NANO 1000T Polisher

INSTRUCTION MANUAL

3601 E. 34th St. Tucson, AZ 85713 USA Tel. +1 520-882-6598 Fax +1 520-882-6599 email: pace@metallographic.com Web: http://www.metallographic.com

Equipment Type:	8 and 10-inch diameter Single Grinder / Polisher
Model:	***NANO 1000T***
Speed (rpm)	0-1000 rpm
Electrical Requirements:	110 / 220 Volts (single-phase input) (Power converted to 3-phase for motor - higher torque)
Frequency:	50/60 Hz
Motor Horsepower:	1 hp (750 W)
Manual Revision Date:	April 2014

Please read this instruction manual carefully and follow all installation, operating and safety guidelines.

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Customer assumes and shall bear the risk of all loss or damage to the Products from every cause whatsoever, whether or not insured, and title to such Products shall pass to Customer upon PACE Technologies delivery of the Products to the common carrier of Pace Technologies choice, or the carrier specified in writing by Customer, for shipment to Customer. Any claims for breakage, loss, delay, or damage shall be made to the carrier by the Customer and Pace Technologies will render customer reasonable assistance in prosecuting such claims.

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4. ACCEPTANCE:
Customer shall inspect the Products promptly upon receipt of delivery. Unless customer objects in writing within thirty (30) business days thereafter, customer shall be deemed to have accepted the Products. All claims for damages, errors, or shortage in Products delivered shall be made by Customer in writing within such five (5) business day period. Failure to make any claim timely shall constitute acceptance of the Products.

5. PAYMENT:
Customer agrees to provide timely payment for the Products in accordance with the terms of payment set forth on the reverse side hereof or in any proposal submitted herewith. If any payment is not paid on or before its due date, Customer shall pay interest on such late payment from the due date until paid at the lesser of 12% per annum or the maximum rate allowed by law.

6. DEFAULT:
If Buyer is in default (including, but not limited to, the failure by Buyer to pay all amounts due and payable to Seller) under the work or purchase order or any other agreement between Buyer and Seller, Buyer's rights under the warranty shall be suspended during any period of such default and the original warranty period will not be extended beyond its original expiration date despite such suspension of warranty rights.

7. MISCELLANEOUS PROVISIONS:
This agreement has been made in and shall be governed by the laws of the State of Arizona. These terms and conditions and the description of the Products on the reverse side hereof or in any proposal submitted herewith constitute the entire agreement and understanding of the parties with respect to this sale and supersede all prior and contemporaneous agreements or understandings, inducements or representations, expressed or implied, written or oral, between the parties with respect hereto. Any term or provision of this Agreement may be amended, and any observance of any term of this Agreement may be waived, only by a writing signed by the party to be bounds. The waiver by a party of any breach shall not be deemed to constitute a waiver of any other breach. Should suit be brought on this Agreement, the prevailing party shall be entitled to recover its reasonable attorneys' fees and other costs of suit including costs and attorneys' fees incurred on appeal or in collection of any judgment.

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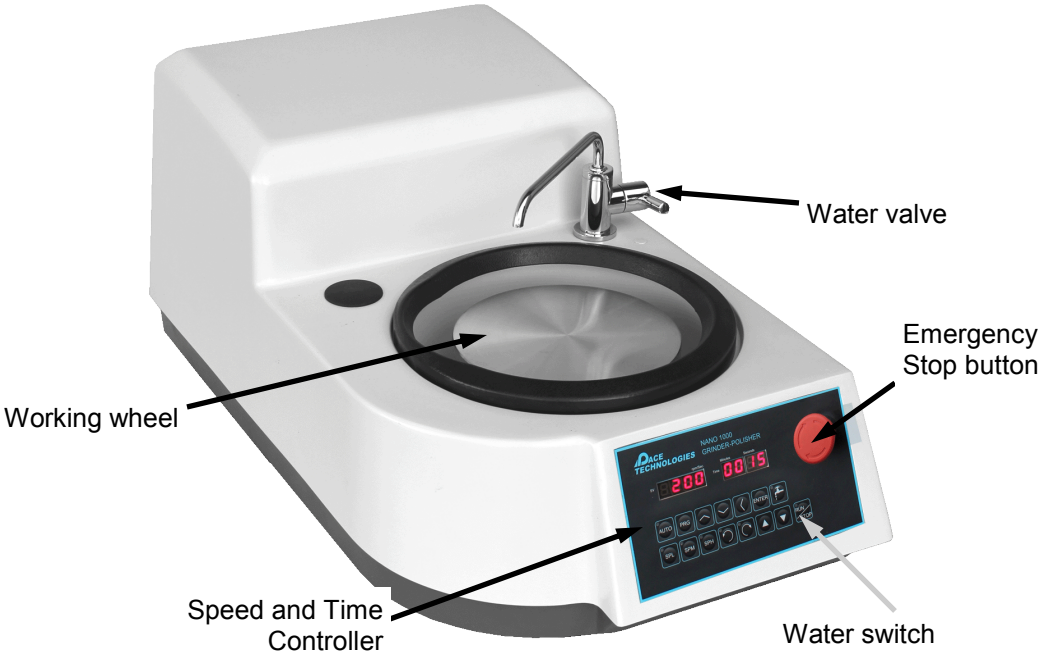
1.0 Product Description

1.1 General Description



The NANO 1000T is a 8 or 12-inch single wheel grinding/ polishing machine for manual wet grinding or polishing of metallographic specimens.

The NANO 1000T is a variable speed (0-1000 rpm) with three programmable fast speed buttons (approx. 100, 200 and 300 rpm) polisher.

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1.2 Technical Specifications

Electrical specifications:	110 / 220V (50/60 Hz) (single phase input - motor runs on 3-phase power for more torque)
Working wheel:	8-inch (200 mm) or 10-inch (250 mm) diameter
Motor power:	1 hp (750 W)
Polishing base speed:	0 to 1000 rpm variable speed (20 rpm increments). Fast speed buttons pre-programmed for 100, 200 and 300 rpm)
Weight:	Approx. 102 lbs (46 kg)
Dimensions (WxHxD):	Approx. 14” x 10” x 23” (350 mm x 260 mm x 580 mm)
Working temperature:	32° - 100°F (0 - 40°C)
Shipping temperature:	32° - 100°F (0 - 40°C)
Storage temperature:	32° - 100°F (0 - 40°C)
Maximum diameter sample	1/3 diameter of working wheel

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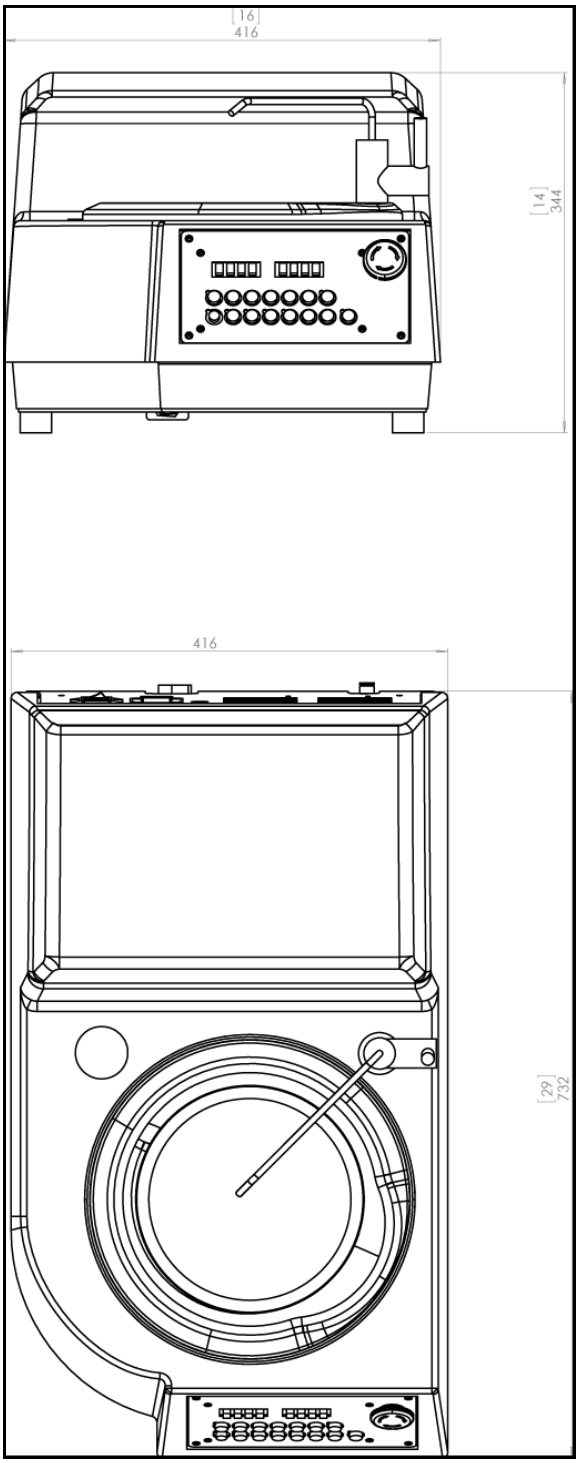
1.3 Mechanical Schematic

Note: Installation of the NANO 1000T should be on a flat sturdy surface, with easy access to drain, water and electrical connections.



1.4 Features

The ***NANO 1000T*** is equipped with a powerful motor, connected to the polishing wheel through a maintenance-free V-belt.

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2.0 Unpacking, Shipping and Installation

2.1 Unpacking

Unit is delivered in a box. Unpack and check for completeness of parts.

Measures WxHxD:

Weight: Varies, depending upon model (approximately).

2.2 Shipping

When moving box, lift from bottom.

! **Caution:** Heavy equipment. Take care to avoid bodily injury.

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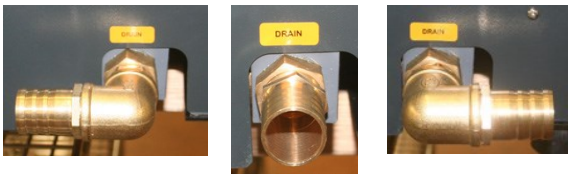
2.3 Installation

! Install unit carefully! Improper installation voids warranty.

The ***NANO 1200*** should be placed on a flat stable surface.
Connect to air, water supply, drain and electrical connections.

After water, drain and electrical connections are completed, the system is ready for operation by activating the main power switch.

Backside connections



Connect drain for best direction to drain with fittings

External water supply: The water supply line requires a 1/4-inch compression fitting. It is recommended that the water supply be turned off when the unit is not in use. Inlet water should be clean and contamination-free to extend the life and performance of the systems.

Electrical connection: Connect six-foot electrical power cable to source.

Note: Inspect the operating voltage on the name plate.

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3.0 Safety Guidelines

3.1 Warning Sign

! This sign points to special safety features on the machine.

3.2 Safety Precautions

! Careful attention to this instruction manual and the recommended safety guidelines is essential for the safe operation of the ***NANO 1000T***.

! Proper operator training is required for operation of the ***NANO 1000T***. Any unauthorized mechanical and electrical change, as well as improper operation, voids all warranty claims. All service issues need to be reported to the manufacturer / supplier.

! Operate unit as specified in this manual.

! Disconnect power before opening unit.

! Do not leave any specimen or other parts on the working wheel.

! Ensure that the air slots on polishing base are not obstructed.

! When unit is not in use turn off water.

! Securely hold the sample, preferably with two hands.

3.3 Emergency Statement

The NANO 1000T polisher has been designed for polishing metallographic specimens up to 2-inch diameter. DO NOT GRIND OR POLISH oversize sample (greater then 1/3 diameter of working wheel. Always follow proper operational guidelines and avoid contact with moving parts, lubricants and abrasives. Seek appropriate medical care for cutting injuries.

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3.4 Safety Test

! Examine and verify that the ***NANO 1000T*** safety devices and operating performance are in good working condition prior to use. The following safety check is considered important:

Emergency stop switch

Emergency stop switch

Test:	Activate main switch. Depress emergency stop switch.
Proper Response:	Machine powers down.
Malfunction:	Machine does not lose power.
Corrective measure:	If system does not power down, disconnect power supply cord and call service technician.

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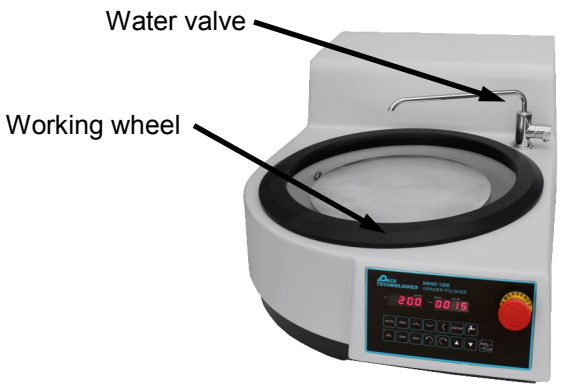
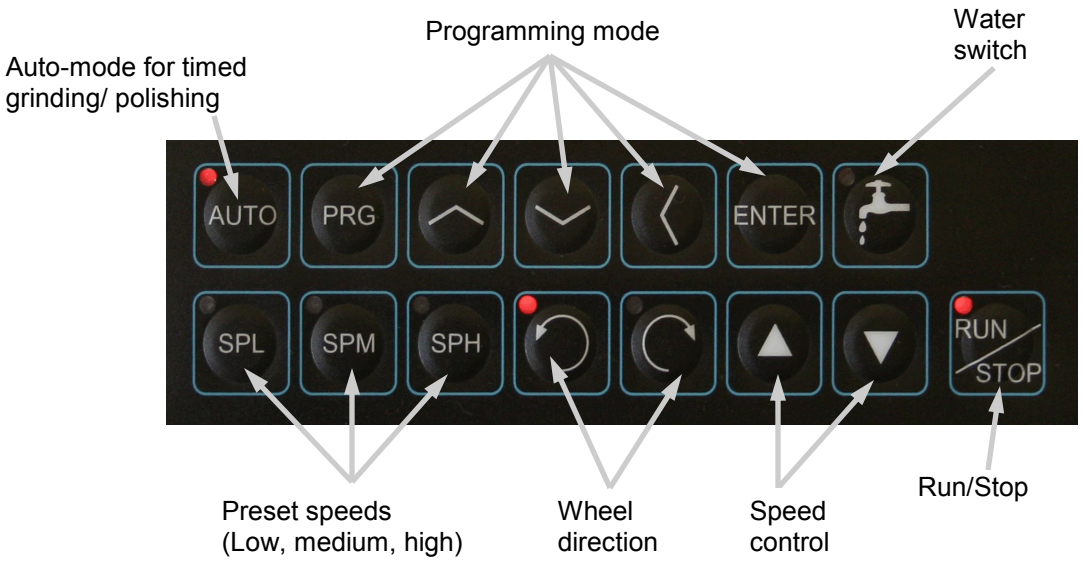
4.0 Start-up and Operation

4.1 General

The ***NANO 1000T*** is a hand grinding/ polishing machine. By adding the FEMTO power head, semi-automated polishing can be



4.2 Control Panel



Emergency stop button:	Emergency stop switch cuts power to the motor immediately.
Wheel direction:	Clockwise rotation and counter clockwise rotation.
Run / stop buttons:	Start/stop the polishing wheel in both manual and auto mode.
Water switch:	Activates the water solenoid for the rinse bowl and rinse spout.
Preset speeds:	Allows for faster speed control, SPL - low speed, SPM - medium speed, SPH - high speed (factory setting approx. 100, 200, 300 rpm.
Auto-mode:	Allows for running pre-programmed speeds and times (factory setting approx. 200 rpm, FWD, 30 seconds).

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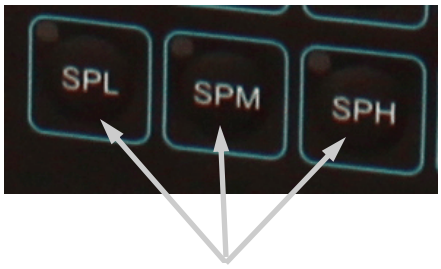
4.2.1 Direction and speed controller (manual)

1. To change direction of the wheel:

   -Press clockwise or counter clockwise button, LED will light

2. To change the speed of the wheel:

   Select low, medium or high speed fast buttons and use up and down arrows to fine tune speed if required



Fast speed buttons

4.2.1 Programmable Mode

1. The programming mode can be used to pre-set the polishing speed, direction and time for automated polishing. It can also be used to change the fast speed buttons.

2. To change the speed of the wheel:

   Press the PRG button and use the up and down keys to SP1 and press ENTER. Use the up and down < key to change the speed. Press ENTER to save.

3. To program a grinding/ polishing time:

   Press the PRG button and use the up and down keys to t1 and press ENTER. Use the up and down < key to change the time (enter in seconds - displayed min-sec)

4. To operate the pre-programmed conditions:

   PRESS the AUTO button and then start the program with the RUN/STOP button. The pre-programmed conditions will be executed.

To change the speed setting for the fast speed buttons use the following procedure:

Press the PRG button and use the up and down keys to SL (slow speed) and press ENTER. Use the up and down < key to change the speed. Use Sn for changing the medium speed and SH for the fast speed.

4.3 Grinding / polishing by hand

1. Install working wheel and attach grinding papers / polishing cloths.
2. Switch on the machine in the back and set the mode, speed, and time (if required).
3. Position flexible water spout over working wheel. During sample preparation adjust water flow by turning water control knob as required. Note: Initial operation of water valve may contain air in the lines. Turn water on slowly to purge air from system.
4. Press RUN/STOP start and stop the machine in the manual mode.

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4.4 Metallographic Specimen Preparation Basics

A typical metallographic specimen preparation consists of the following basic steps:

Preparation Stage	***Purpose***
Initial documentation:	• To document the initial condition of the sample, • To map the sample surface, • To highlight the area of interest.
Sectioning / cutting:	• To reduce the size of large samples and to sample the specimens close to the area of interest.
Rough, or planar grinding:	• To obtain a planar surface, • To remove sectioning damage, • To approach the area of interest.
Rough polishing:	• Ideally to remove all the subsurface damage and microstructural damage produced during cutting and rough grinding (Superficial scratches may still be present after this step).
Final polishing:	• Generally, more for cosmetic purposes than for removing microstructural damage. In most cases, this stage should be minimized to avoid overpolishing and distorting the microstructural features.
Etching:	• To enhance microstructural features such as grain boundaries, grain size, phase differences, etc.
Examination:	• A variety of examination techniques are used in metallography, including: optical microscopy, electron microscopy and hardness testing.

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4.4.1 Rough / Planar Grinding

Rough or planar grinding, is required to produce flat specimens and to reduce the damage created by sectioning. The planar grinding step is accomplished by decreasing the abrasive grit particle size sequentially to obtain surface finishes that are ready for polishing. Care must be taken to avoid being too abrasive in this step, and actually creating greater specimen damage than produced during cutting. This is especially true for very brittle materials such as ceramics and silicon.

The machine parameters which affect the preparation of metallographic specimens include: grinding / polishing pressure, grinding direction, and the relative velocity distribution between the specimen and the polishing wheel.

Grinding Pressure
Grinding / polishing pressure is dependent upon the applied force (pounds or Newton's) and the area of the specimen and mounting material. Pressure is defined as the Force/Area (psi, N/m^2 or Pa). For specimens significantly harder than the mounting compound, pressure is better defined as the force divided by the specimen surface area. Thus, for larger hard specimens, higher grinding / polishing pressures increase stock removal rates. However, higher pressure also increases the amount of surface and subsurface damage produced in the specimen.

Note regarding SiC grinding papers: as the abrasive grains dull and cut rates decrease, increasing grinding pressures can extend the life of the SiC paper.

Higher grinding / polishing pressures can also generate additional frictional heat which may be beneficial for the chemical mechanical polishing (CMP) of ceramics, minerals and composites. Likewise for extremely friable specimens (such as nodular cast iron), higher pressures and lower relative velocity distributions can aid in retaining inclusions and secondary phases.

Grinding Direction
The orientation of the specimen can have a significant impact on the preparation results, especially for specimens with coatings. In general, when grinding and polishing materials with coatings, the brittle component should be kept in compression. In other words, for brittle coatings, the direction of the abrasive should be through the coating and into the substrate. Conversely, for brittle substrates with ductile coatings, the direction of the abrasive should be through the brittle substrate and into the ductile coating.

Manual Preparation
In order to ensure that the previous rough grinding damage is removed when grinding by hand, the specimen should be rotated 90 degrees and continually ground until all of the scratches from the previous grinding direction are removed. When necessary, the abrasive paper should be replaced with a newer paper to maintain cutting rates.

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4.4.2 Rough Polishing

The purpose of the rough polishing step is to remove the damage produced during cutting and planar grinding. Proper rough polishing will maintain specimen flatness and retain all inclusions or secondary phases. By eliminating the previous damage and maintaining the microstructural integrity of the specimen at this step, a minimal amount of time is required to remove the cosmetic damage at the final polishing step.

Rough polishing is accomplished primarily with diamond abrasives ranging from 9 micron to 1 micron. Polycrystalline diamond - because of its multiple and small cutting edges - produces high cut rates with minimal surface damage. Therefore, polycrystalline diamond abrasives are recommended for metallographic rough polishing on low-napped polishing cloths.

Rough Polishing Guidelines

Material	Recommendations
Metals (ferrous, non-ferrous, tool steels, superalloys, etc.)	Rough polishing typically requires two polishing steps, e.g., a 6-micron diamond followed by a 1-micron diamond on low-napped polishing cloths.
Ceramics and ceramic matrix composites (CMC)	Low-nap polishing pads using polycrystalline diamond, alternating with colloidal silica. This provides a chemical mechanical polishing (CMP) effect which results in a damage-free surface
Polymer matrix composites (PMC)	Diamond-lapping films are recommended.
Biomaterials	Low-napped polishing pads with polycrystalline diamond, alternating with colloidal silica. Alternatively, diamond-lapping films may work well.
Microelectronic specimens	Diamond-lapping films are recommended.
Plastics and polymers	800 and 1200 grit SiC abrasive paper are recommended.
Plasma spray materials	Diamond-lapping films or low-napped polishing pads with alternating diamond and colloidal silica abrasives.

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4.4.3 Final Polishing

The purpose of final polishing is to remove only the cosmetic surface damage. It should not be used to remove any damage remaining from cutting and planar grinding. If the damage from these steps is not completely removed, the rough polishing step should be repeated or continued.

Final Polishing Guidelines

Material	Recommendation
Metals (ferrous, non-ferrous, tool steels, superalloys, etc.)	High-napped polishing pads with a nanometer alumina polishing abrasive. The polishing times should nominally be less than 30 seconds.
Ceramics and ceramic matrix composites (CMC)	Low-napped polishing pads using 1-um polycrystalline diamond, alternating with colloidal silica or colloidal silica alone.
Polymer matrix composites (PMC)	Fine abrasive diamond-lapping films, followed by a very light polish on a high-napped polishing pad.
Biomaterials	Low-napped polishing pads with polycrystalline diamond, alternating with colloidal silica.
Microelectronic specimens	Diamond-lapping films followed by a very light polish on a high-napped polishing pad.
Plastics and polymers	Light polish with alumina on a high-napped polishing pad.
Plasma spray materials	Diamond-lapping films followed by a very light and short alumina or colloidal silica polish on a high-napped polishing pad.

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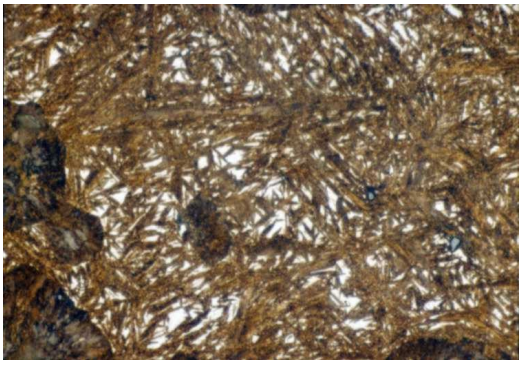
4.5 Selected Polishing Procedures

4.5.1 1095 Carbon Steel (Pearlite and Martensite Phases) Preparation of high carbon steels is fairly straight-forward. Depending upon the heat treatment, the grinding and polishing times may increase for the harder martensite phase.

Abrasive/surface	Lubricant	Time
PDGD-125M Diamond Grinding Disk	water	Until plane
SIRIUS Composite grinding disk	9 um DIAMAT Diamond	3 minutes
ORION Composite grinding disk	3 um DIAMAT diamond	3 minutes
1 um DIAMAT diamond on ATLANTIS pad	DIALUBE Extender	2 minutes
0.05 um Nanometer alumina on MICROPAD or TRICOTE pad		1 minute

1095 Steel, Furnace-Cooled, etched with 2% nital, 400X B.F.
Microstructure: Pearlite structure



1095 Steel, Water-Quenched, etched with picric acid, 1000X B.F.
Miicrostructure: Martensite structure

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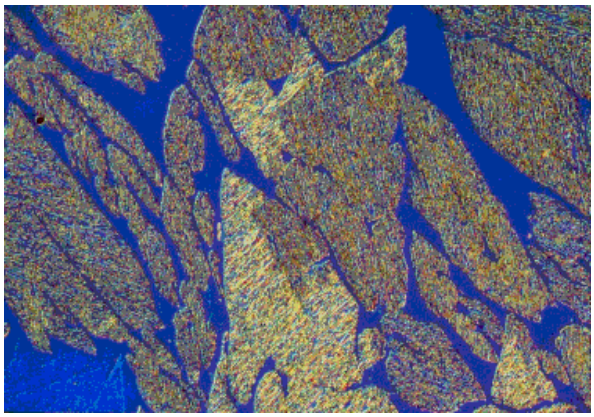
4.5.2 Stainless Steel

Stainless steels have high concentrations of chromium (>12%) and are generally relatively soft as compared to heat-treated steels. This makes stainless steel more susceptible to smearing. Preparation is relatively straight-forward.

Abrasive/surface	Lubricant	Time
320 grit SiC paper 400 grit SiC paper 600 grit SiC paper 800 grit SiC paper 1200 grit SiC paper	water	Until plane 1 minute 1 minute 1 minute 1 minute
1 um DIAMAT diamond on TEXPAN pad	SIAMAT colloidal silica	2 minutes
0.05 um Nanometer alumina on NAPPAD pad		1 minute



431 Stainless Steel microstructure

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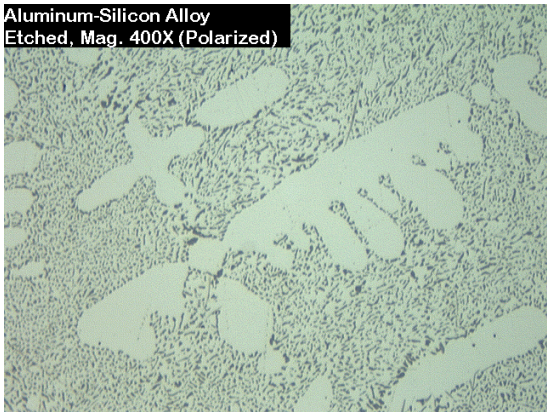
4.5.3 Aluminum and Aluminum Alloys

Aluminum and aluminum alloys are difficult to prepare because they are soft and contain oxide particles which can become dislodged and scratch the surface. The key to polishing aluminum is to use very fine polishing abrasives (fine aggregates).

Abrasive/surface	Lubricant	Time
P220 grit ALO paper P500 grit ALO paper P1200 grit ALO paper	Water	Until plane 1 minute 1 minute
1 um DIAMAT diamond on ATLANTIS pad	DIALUBE Purple Extender	2 minutes
0.05 um Nanometer alumina on NAPPAD pad		1 minute



Aluminum - Silicon Alloy microstructure, Kallings etchant

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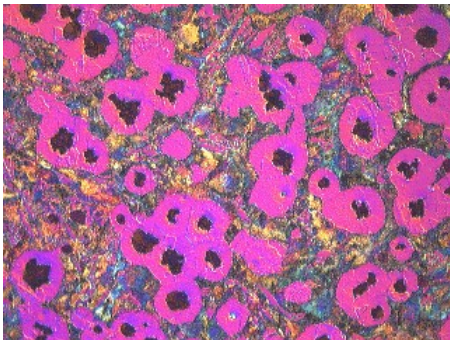
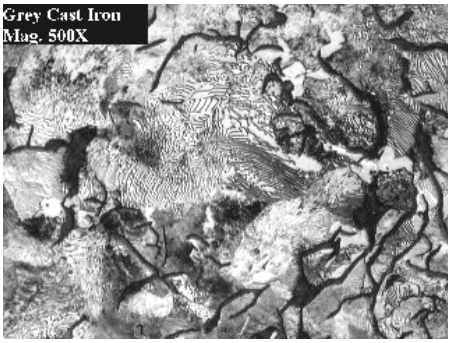
4.5.4 Cast Iron

Cast irons are difficult materials to prepare properly because the graphite nodules (or graphite flakes) are easily pulled out during preparation. By minimizing the sectioning damage and by starting with a modest-grit-size SiC paper, retaining these difficult particles can be accomplished.

Abrasive/surface	Lubricant	Time
320 grit SiC paper 400 grit SiC paper 600 grit SiC paper 800 grit SiC paper 1200 grit SiC paper	water	Until plane 1 minute 1 minute 1 minute 1 minute
1 um DIAMAT diamond on GOLDPAD pad	DIALUBE Purple Extender	3 minutes
0.05 um Nanometer alumina on TRICOTE pad		1 minute



Nodular Cast Iron microstructure, Etchant 2% nital, Mag. 100X



Graphite Cast Iron microstructure, Etchant 2% nital, Mag. 500X

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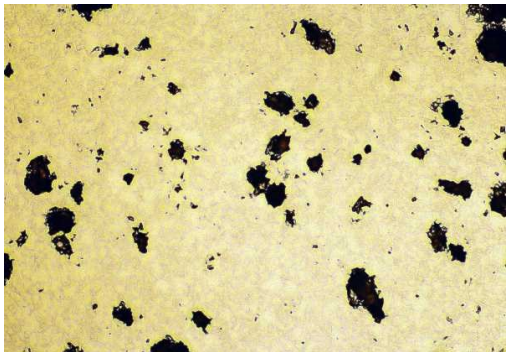
4.5.5 Alumina Ceramic

The preparation of hard / brittle / porous ceramic materials is not especially difficult when a few simple preparation tricks are known for this class of materials. First, to minimize grain pull-out (which may be falsely characterized as porosity), sectioning damage must be minimized. This is accomplished by sectioning with the appropriate diamond wafering blade and using the finest practical abrasive for initial grinding.

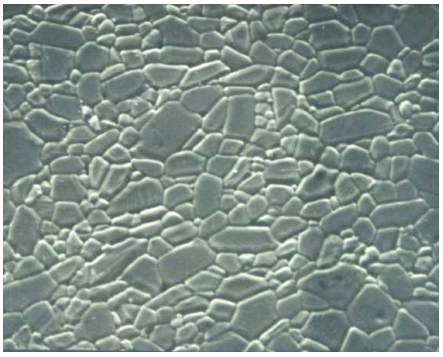
Planar grinding is best achieved with the use of the smallest diamond abrasive possible on a metal mesh cloth. Note that there is a trade-off between planar grinding time (abrasive size) and induced damage. In some cases for ceramics, it is better to take more time and minimize damage at planar grinding in order to reduce overall polishing times.

The use of SIAMAT™ colloidal silica also provides a chemical mechanical polishing (CMP) action, which is the most effective means for eliminating both surface and subsurface damage. The combination of SIAMAT™ colloidal silica with a DIAMAT™ polycrystalline diamond also produces excellent surface finishes.

Abrasive/surface	Lubricant	Time
30 um DIAMAT diamond on CERMESH metal mesh cloth		Until plane
6 um DIAMAT diamond on TEXPAN polishing pad	SIAMAT colloidal silica	5 minutes
1 um DIAMAT diamond on GOLDPAD polishing pad	SIAMAT colloidal silica	5 minutes
SIAMAT Colloidal silica on TEXPAN pad		5 minutes



85% Alumina microstructure, 500X (note the sharp edges - edge retention)



99+% Alumina microstructure, 5000X (thermally etched)

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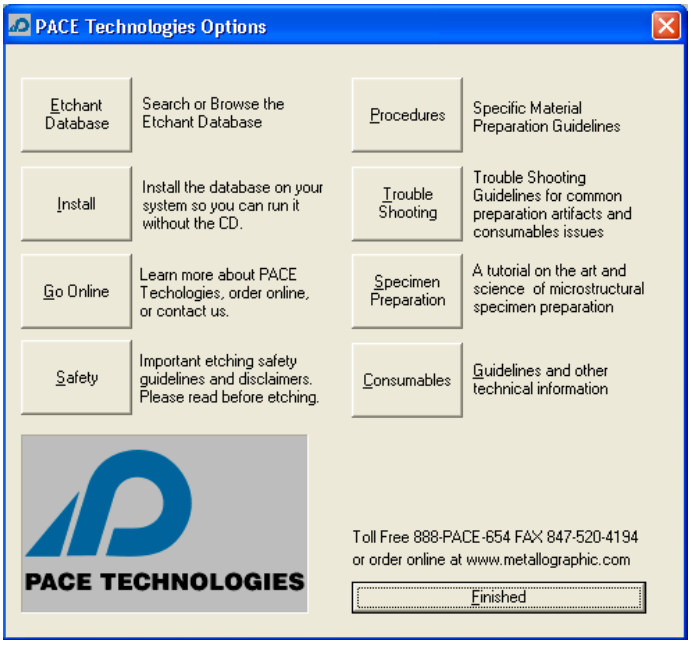
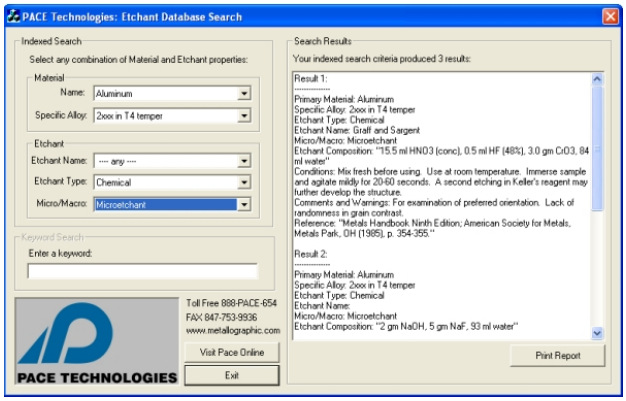
Educational Etchant and Procedure Database CD (optional)

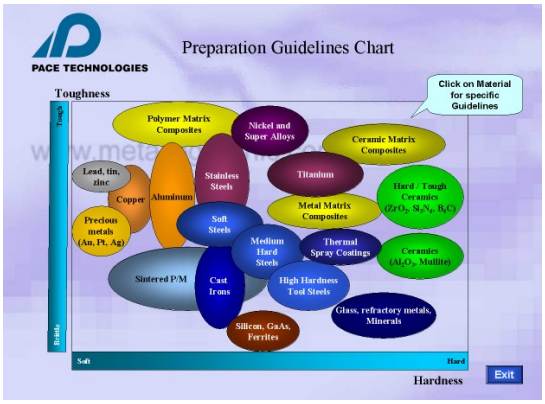
- **Etchant Database - *OVER 2200 ETCHANTS***
- **Search Fields**
  - Material or metal type
  - Specific alloys
  - Etchant name
  - Micro vs. Macro etchant
  - Keyword
- **MSDS for Etchant Chemicals**
- **Preparation Guidelines**
- **Preparation Basics**
- **Preparation Trouble Shooting**



Etchant Database



Preparation Guidelines



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5.0 Maintenance

5.1 Introduction

The ***NANO 1000T*** requires very minimal maintenance. However, to increase the life of the polisher, it is suggested that the unit be rinsed after use.

5.2 Cleaning outside cabinet

The cabinet should be cleaned occasionally with a moistened cloth. Do not use any chemicals or cleaning abrasives.

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6.0 Trouble Shooting

More extensive trouble shooting, repair guides, video's, parts list are provided online at www.metallographic.com or

http://www.metallographic.com/PACE-service/NANO-service.html

Problem	Cause	Solution
No power or function	a. Unit is disconnected from main electrical power supply b. Main power switch is off c. Blown fuse	a. Verify electrical source and connection. b. Turn on main power switch. c. Replace fuse
No water supply	a. Water valve closed b. Water tube is extremely bent	a. Open valve b. Straighten out water tube.
Working wheel is not running plane (flat)	a. Dirt (abrasive between working wheel and carrier wheel)	a. Clean or replace if necessary.
Error Message E1	a. Motor power surge.	a. Turn polisher off and wait until LED discharges. Turn unit back on, if problem persist contact PACE service department

Pry open fuse holder with small flat head screwdriver

Replace fuse (10 amp fast blow)

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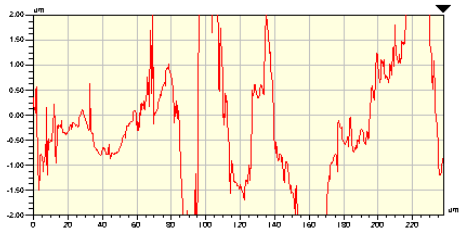
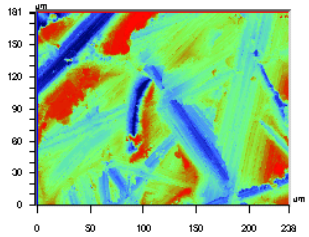
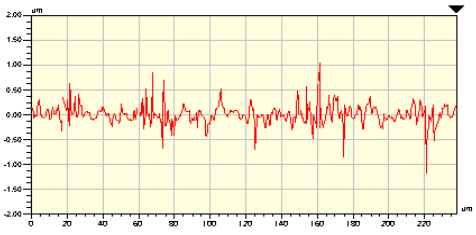
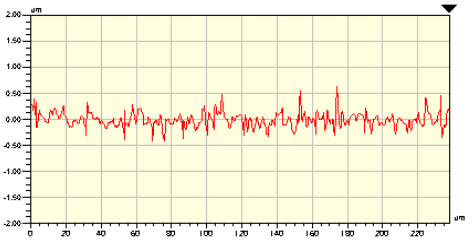
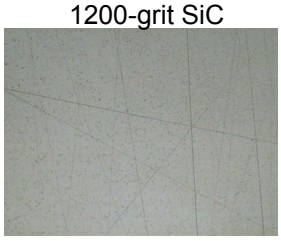
7.0 Metallographic Consumables

7.1 SiC Abrasive Paper, Surface Roughness

	2-dimensional line profile	3-D optical contour mapping
60-grit SiC		
240-grit SiC		
400-grit SiC		
600-grit SiC		
1200-grit SiC		

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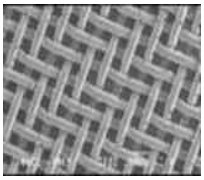
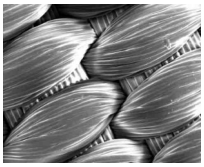
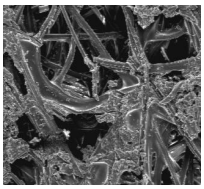
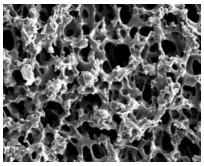
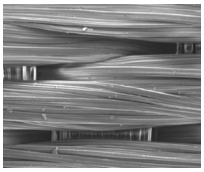
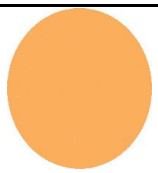
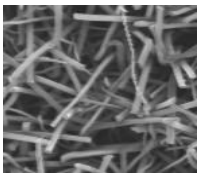
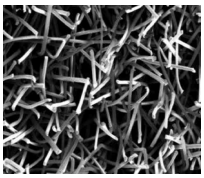
7.3 Polishing Pads

	**Metal Mesh Cloth.** This is a wire mesh material useful for coarse and intermediate lapping / polishing. The texture of this wire allows for the abrasive to become semi-fixed, thus offering the advantage of increased stock removal, while minimizing damage.	
	**POLYPAD™ Polishing Pad.** This cloth is a synthetic polyester polishing pad which has a similar action to a nylon pad, except that it is much more durable. It is used in the intermediate polishing steps.	
	**TEXPAN Polishing Pad.** This is the most commonly used polishing cloth material for the intermediate polishing steps. TEXPAN™ Polishing pad is a low-napped cloth.	
	**Black CHEM™ 2 Polishing Pad.** This porometric polymer pad has the consistency similar to a rubber type of pad. Black CHEM™ 2 pad has a low nap but behaves as an intermediate polishing pad with a performance between low-napped and high-napped pads.	
	**GOLDPAD Polishing Cloth.** This is a woven low-napped polishing pad used mostly for intermediate diamond polishing for ceramics and metals and polymers.	
	**ATLANTIS Polishing Cloth.** This polishing pad is a laminated polishing cloth having a resilient foam backing. The foam backing allows the polishing to conform better to the specimen surface.	
	**MICROPAD™ and MICROPAD™ 2 Polishing Cloth.** This is the most commonly used high-napped final polishing cloth for metals and polymers. Its high nap provides a very soft and gentle polishing action.	
	**NAPPAD™ Polishing Pad.** This is another high-napped final polishing pad useful for most metals and polymers. It has a higher nap than MICROPAD™, providing the most gentle polishing action of all the cloths.	

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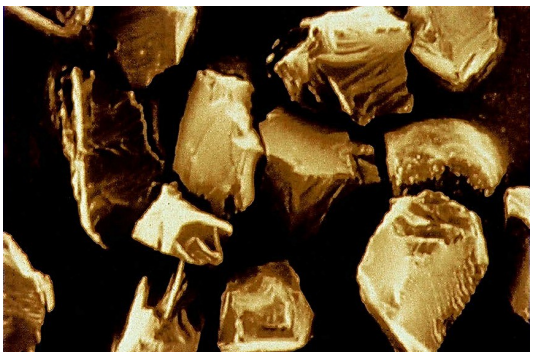
7.4 Polycrystalline Diamond Abrasives

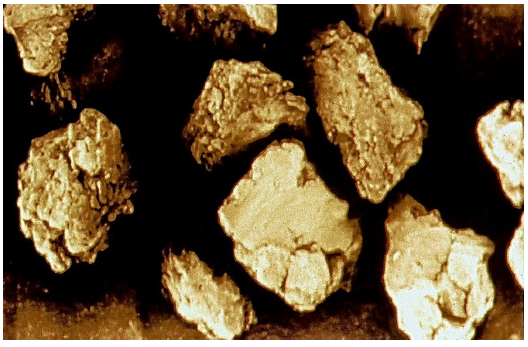
Polycrystalline diamond is a synthetic diamond which provides better surface finishes and higher removal rates than monocrystalline diamond. The following are the advantages of a polycrystalline diamond over a monocrystalline diamond:

- Higher removal rates (self-sharpening abrasive)
- Very uniform surface finish
- More uniform particle size distribution
- Harder / tougher particles
- Blocky - shaped particles
- Hexagonal (equally hard in all directions) microcrystallites
- Extremely rough surface (more cutting points)
- Surface area is 300% greater than with a monocrystalline diamond
- No abrasion-resistant directionality (abrasion independent of particle orientation)

Diamond Size (um)	Color code
0.10	Charcoal
0.25	Gray
0.50	White
1.0	Blue
3.0	Green
6.0	Yellow
9.0	Red
15	Brown
30	Orange
45	Purple



Monocrystalline blocky - diamond



Polycrystalline multi-faceted diamond

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7.5 Final Polishing Abrasives

Final polishing abrasives include fine diamond, alumina and colloidal silica. For successful microstructural preparation, the polishing abrasive / cloth combination must be appropriately matched to the specimen hardness, fracture toughness and corrosion properties of the specimen.

Colloidal Silica
Colloidal silica is a relatively soft abrasive with high chemical activity. It is an ideal chemical mechanical polishing (CMP) abrasive. The chemical activity of colloidal silica results from the electrochemical balance (zeta potential) required to keep very fine particles from aggregating. This chemical balance also produces a surface phenomenon which makes the specimen surface more chemically active. This produces a surface layer which can be mechanically removed by the colloidal silica particles themselves, or by the mechanical scrubbing of the surface with the polishing pad.

For ceramics, the combination of fine polycrystalline diamond and colloidal silica improves surface finishes and increases polishing rates.

Nanometer Alumina
Nanometer alumina is a polycrystalline colloidal alumina processed by a proprietary seeded gell process. Polycrystalline alumina offers two significant improvements over conventional alumina calcining processes:

1. Tighter, more controlled particle size distributions
2. Harder alpha alumina particles

The tighter, more controlled particle size distribution is a result of less particle aggregation which produces significantly less scratching in soft metals, such as aluminum, tin, lead, copper and soft steels.

Nanometer alumina is available in an acidic (pH 4) or basic (pH 10) range.

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8.0 Spare Parts

Part no.	Description	Images
	Electrical	
N1-007b	NANO 1000T and 2000T Motor (750 W - 1 hp)	
N1-007c	NANO 1200T Motor (1.5 hp)	
N1-008b	NANO 1000T/2000T PC board / frequency convertor (new machine using 24V transformer)	
N1-008c	NANO 1200T PC board / frequency convertor (new machine using 24V transformer)	
N1-008T	PC board (top only) for 1 rpm increments	

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Part no.	Description	Images
	Electrical	
N1-012b	Transformer (24V)	
N1-013	Emergency Stop	
N1-015b	Front Panel (with time display) with PC board	
N1-015c	Front panel connection cable (with time display)	
FUSE-C	Controller T6.3A fuse - (each)	
FUSE-NA	10 amp fuse for NANO Polishers (3/ package)	
PS-001	On/Off switch	
24RELAY	24 volt relay switch	

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Part no.	Description	Images
	Electrical	
RELAY-B	24 volt relay switch base	
NANO-R	Rectifier	
N1-009b	Solenoid Valve (24 V)	
CORD-110V	110V power cord	
CORD-220R	220V round time power cord	
CORD-220F	220V three prop flat connector	

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Part no.	Description	Images
	Mechanical Components	
PW-800	**NANO 1000-2000 8-inch working wheel**	
PW-1000	**NANO 1000-2000 10-inch working wheel**	
PW-1200	**NANO 1200 12-inch working wheel**	
PW-1400	**NANO 1200 14-inch working wheel**	
N1-001	NANO 1000 Single Wheel FRP cover	
N2-001	NANO 2000 Double Wheel FRP cover	
N12-001	NANO 1200 FRP cover	
N1-002	NANO 1000-2000 Polishing Table Support Platen	

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Part no.	Description	Images
	Mechanical Components	
N12-002	NANO 1200 Polishing Table Support Platen	
N1-002PEG	Table support PEG's without o-rings (3/set)	
N1-002-O-Ring	Table support PEG O-ring (3/pkg)	
N1-003S	NANO 1000T/2000T Spindle assembly	
N1-025	FEMTO 1100 post collar (mounts on the NANO 1000-2000 polisher)	
N1-003P	NANO 1000-2000 Pulley wheel for spindle wheel	
N1-006	NANO 1000-2000 Pulley for motor	

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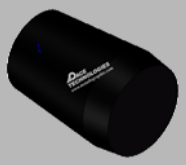
Part no.	Description	Images
	Mechanical Components	
N1-005	NANO 1000T Single Wheel Belt	
N2-005	NANO 2000T Double Wheel Belt	
N12-005	NANO 1200T Single Wheel Belt	
PTM-125-005	8-inch plain backed paper ring	
PTM-125-006	10-inch plain backed paper ring	
PTM-225-005	12-inch plain backed paper ring	
PTM-225-006	14-inch plain backed paper ring	
PTM-125-007	8 and 10-inch polisher cover	
PTM-225-007	12 and 14-inch polisher cover	
PTM-225-007H	Cover handle	

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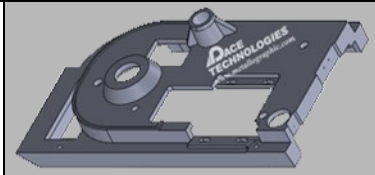
Part no.	Description	Images
	Mechanical Components	
PTM-125-001	8 and 10-inch splash guard	
PTM-125-207	12 and 14-inch splash guard	
FT-004	Feet (4/pkg)	
N1-T	NANO 1000T Template	
N2-T	NANO 2000T Template	
N12-T	NANO 1200T Template	
N1-M-001	NANO 1000 Casting	

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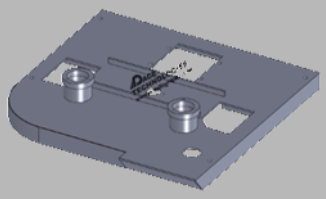
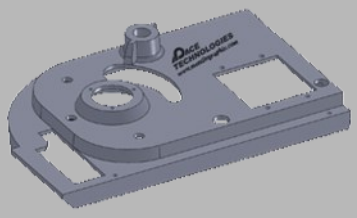
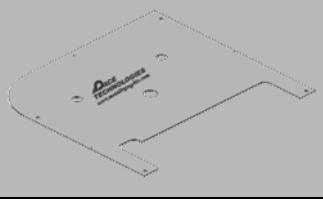
Part no.	Description	Images
	Mechanical Components	
N2-M-001	NANO 2000 casting	
N12-M-001	N1200 casting	
N1-M-002	Plastic cover	
N1-M-003	Femto slot holder	
N1-M-004	NANO 1000 Bottom cover	
N2-P-BC	NANO 2000 Bottom cover	

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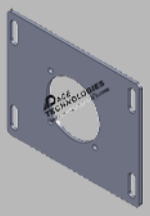
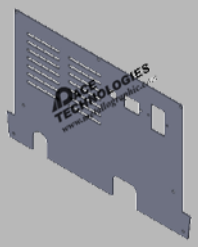
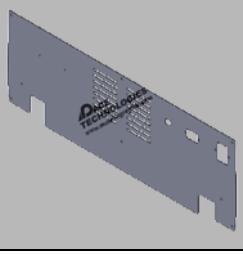
Part no.	Description	Images
	Mechanical Components	
N12-BOT	NANO 1200 plastic bottom cover	
N1-M-008	NANO 1000T Motor holder	
N2-M-003	NANO 2000T Motor holder	
N12-M-003	NANO 1200 Motor holder	
N1-014b	NANO 1000 rear panel	
N2-M-002	NANO 2000 rear panel	

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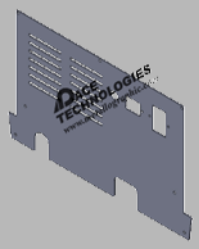
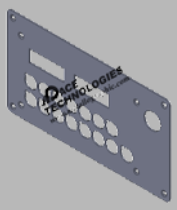
Part no.	Description	Images
	Mechanical Components	
N12-BP	NANO 1200 rear panel	
N1-M-007	Front Panel for NANO 1000T/1200T/2000T Polisher (each)	
N1-M-005	Solenoid bracket	
N1-M-006	Water adapter bracket	
N1-M-009	Water hose clamp	

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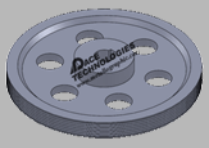
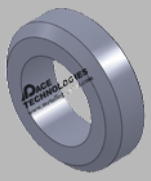
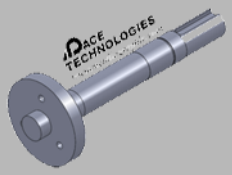
Part no.	Description	Images
	Mechanical Components	
N12-M-002	NANO 1200 Spindle	
N12-M-004	NANO 1200 Wheel pulley	
N12-M-CR	NANO 1200 copper ring	
N12-M-005	NANO 1200 Spindle shaft	
N12-M-SSA	NANO 1200 Spindle shaft adapter	
N12-M-RSH	NANO 1200 roller shaft housing	

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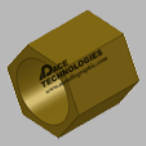
Part no.	Description	Images
	Plumbing Components	
W-6M	6 mm diameter water supply hose connector	
W-E-8MM	Elbow 8mm quick water connector	
W-S-8MM	8mm water split quick connector	
P-Drain	Drain hose (~2 meters)	
P-Inlet	Water inlet hose (~2 meters)	
N-P-CFA	Copper female adapter	
N1-010	Drain connector set (elbow, nipple, hose barb)	

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Part no.	Description	Images
	Plumbing Components	
N2-009	NANO 2000 Drain T-fitting	
D-REDUCER	Drain Reducer	
D-ELBOW	Drain elbow	
D-NIPPLE	Drain-nipple	
D-BARB	Drain hose barb	
P-RINSE	Rinse bowl water sprayer	
P-ADAPTER	Rinse bowl water connector	
PVL	Water value (right side) - single unit and right side double	
PVR	Water value (left side) - double unit only	

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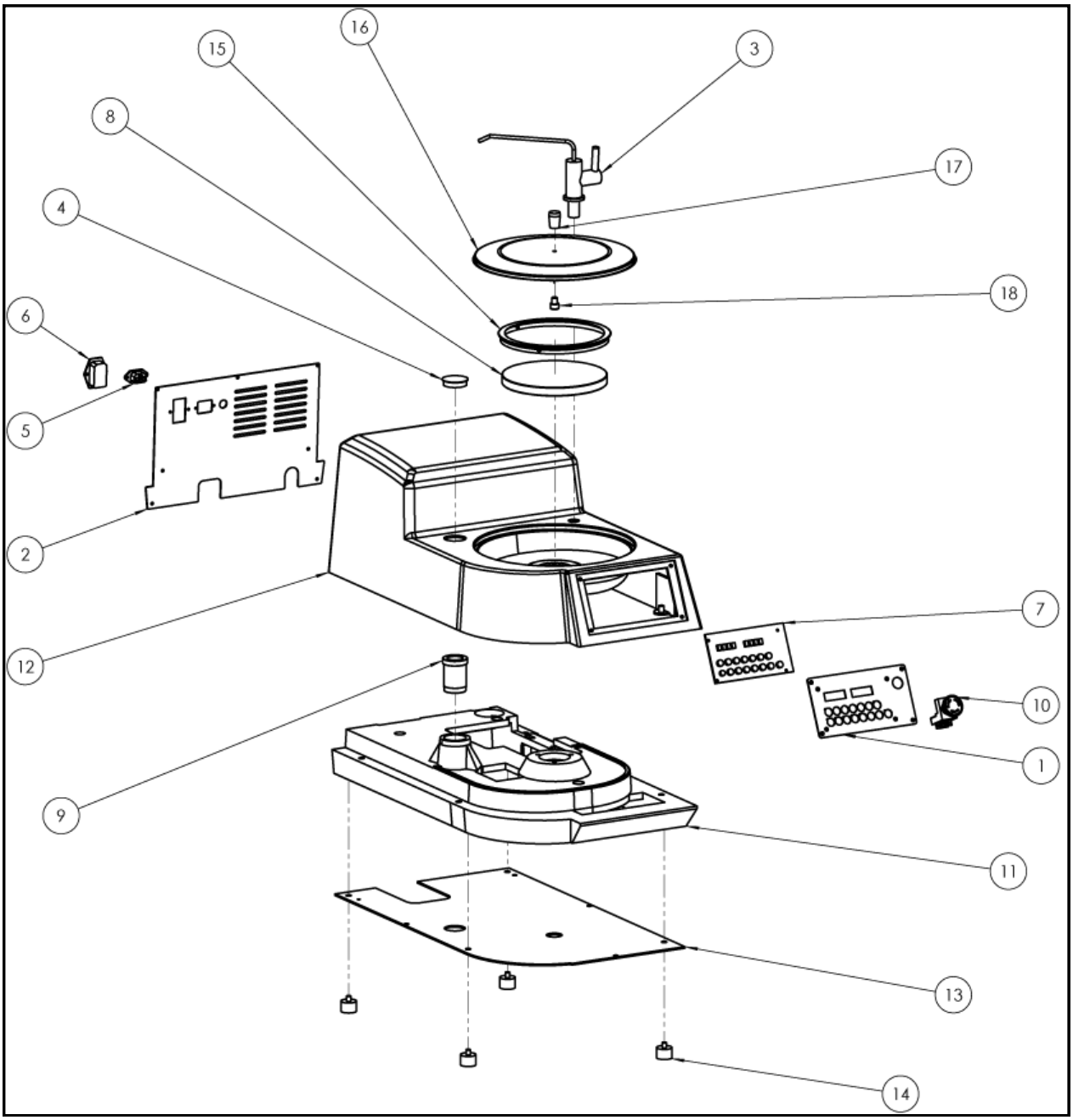
9.0 Schematics (NANO case assembly)



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9.0 Schematics (NANO case assembly)

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	N1-M-007	Front panel	1
2	N1-014B	Back panel	1
3	PVR	Water valve right side	1
4	N1-M-002	Plastic cover	1
5	IEC INLET	IEC female	1
6	PS-001	ON/OFF switch	1
7	N1-015B	PC board	1
8	PW-800	8-inch wheel	1
9	N1-025	FEMTO post colar	1
10	P150-210	Emergency switch	1
11	N1-M-001	NANO 1000 Casting	1
12	N1-001	NANO 1000 FRP cover	1
13	N1-M-004	NANO 1000 bottom cover	1
14	FT-004	Rubber Feet	4
15	PTM-125-005	8-inch plain backed paper ring	1
16	PTM-225-007	Polisher cover	1
17	PTM-225-007H	Cover handle	1
18	PTP-S1-01 (M10X12)	M10x12 socket screw	1

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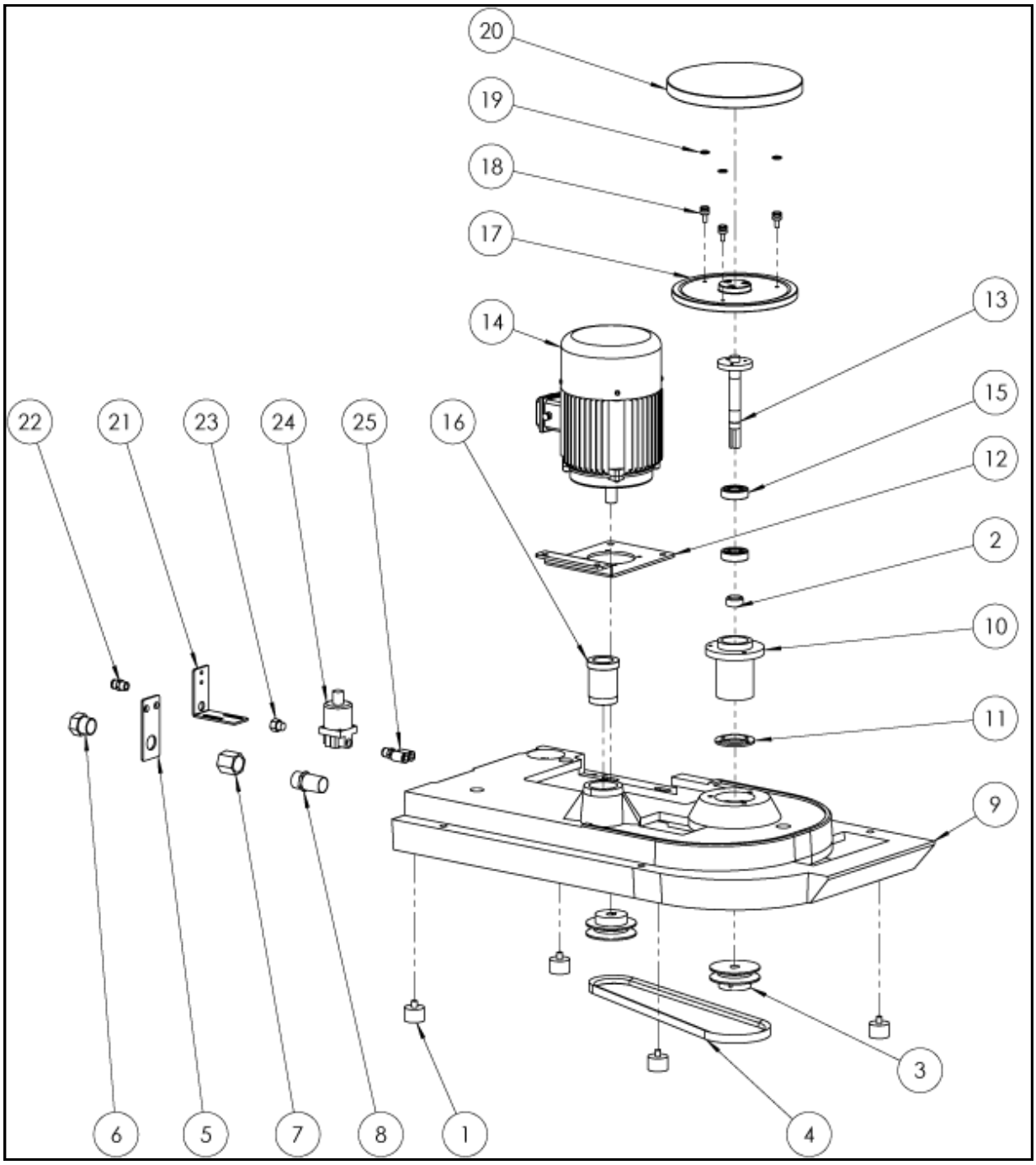
9.1 Schematics (NANO internal mechanical assembly)



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9.1 Schematics (NANO internal mechanical assembly)

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	FT-004	Rubber Feet	4
2	N1-M-CR	NANO 1000 copper ring	1
3	N1-003P	N1-003P	2
4	N1-005	NANO 1000 single wheel belt	1
5	N1-M-006	Water adapter bracket	1
6	D-REDUCER	Drain reducer	1
7	N-P-CFA	Copper female adapter	1
8	D-BARB	Drain hose barb	1
9	N1-M-001	NANO 1000 casting	1
10	N1-003S3	NANO 1000 spindle shaft housing	1
11	N1-M-SSA	NANO 1000 spindle shaft adapter	1
12	N1-M-008	NANO 1000 Motor holder	1
13	N1-003S-1	NANO 1000 spindle shaft	1
14	N1-007B	NANO 1000-2000 Motor	1
15	N1-M-BEARING	NANO 1000 spindle shaft bearing	2
16	N1-025	FEMTO post colar	1
17	N1-002	NANO 1000 polishing table support platen	1
18	N1-002PEG	Table support PEG's	3
19	N1-002-O-RING	Table support PEG's O-ring	3
20	PW-800	8-inch wheel	1
21	N1-M-005	Solenoid bracket	1
22	W-8MM	8mm water supply hose connector	1
23	D-REDUCER-B	Water reducer	1
24	N1-009B	24V solenoid valve	1
25	W-S-8MM	8mm water split quick connector	1

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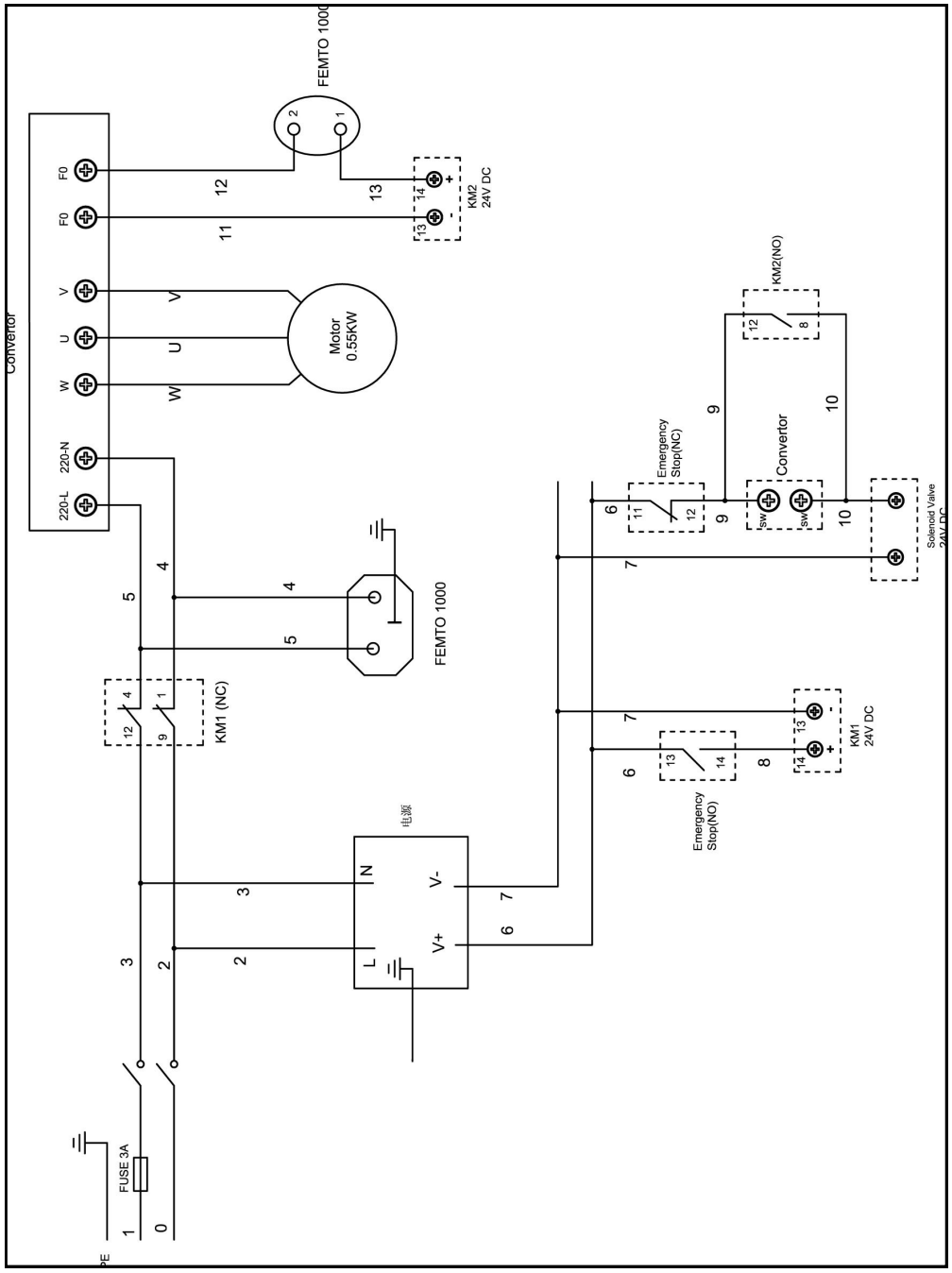
9.3 Electrical Schematic



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9.1 Full Programming Parameters

NANO 1000T/2000T and 1200T with 20 rpm increments (1 and 1.5 hp motor)

Note:
Do not start or run the motor before the correct input voltage is programmed;

RESET DEFAULT BEFORE REPROGRAMMING
Go to dF → Enter → -def → Enter

Steps to set converter input voltage and frequency response:

Go into Program "U" (Password:0253) → Enter → input "1001" →Enter → input "2020" → Enter → input "3030" →Enter→ input "4170" →Display "OVER" →Enter

Go into Program "U" (Password:0253) → Enter → input "1030" →Enter → input "2170" → Enter → input "3050" →Enter→ input "4255" →Display "OVER" →Enter

Go into Program "U" (Password:0253) → Enter → input "1050" →Enter → input "2225" → Enter → input "3120" →Enter→ input "4255" →Display "OVER" →Enter

2. Go into Program "nS" (Password:0253) → Enter → input "2" → Enter

3. Go into Program "Sr" (Password:0253) → Enter → input "1.4" → Enter

Steps to set converter input voltage and frequency response:

FOR 110V
Go into Program "U" (Password:0253) → Enter → input "1001" →Enter → input "2025" → Enter → input "3050" →Enter→ input "4255" →Display "OVER" →Enter

Go into Program "U" (Password:0253) → Enter → input "1050" →Enter → input "2255" → Enter → input "3120" →Enter→ input "4255" →Display "OVER" →Enter

FOR 220V
Go into Program "U" (Password:0253) → Enter → input "1001" →Enter → input "2025" → Enter → input "3050" →Enter→ input "4225" →Display "OVER" →Enter

Go into Program "U" (Password:0253) → Enter → input "1050" →Enter → input "2225" → Enter → input "3120" →Enter→ input "4225" →Display "OVER" →Enter

2. Go into Program "nS" (Password:0253) → Enter → input "2" → Enter

3. Go into Program "Sr" (Password:0253) → Enter → input "1.4" → Enter

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NANO 1000T/2000T and 1200T with 20 rpm increments (1 and 1.5 hp motor)

Programming Step	Value	Description
SR	1.4	Belt ratio - DO NOT CHANGE (Enter PW 0253 to access)
SP1	SPEED	Disc Speed - VARIABLE
T1	TIME	Runtime for SP1
SP2 to SP8	200	Multiple step disk speed - DO NOT CHANGE
T2 to T8	0	Runtime for multiple steps - DO NOT CHANGE
CN	1	Number of cycles – DO NOT CHANGE
SL	100	Disc speed for SPL - preset to 100 rpm
SN	200	Disc speed for SPM - preset to 200 rpm
SH	300	Disc speed for SPH - preset to 300 rpm
DF		Defaults—DO NOT CHANGE
U		SET 110/220V—DO NOT CHANGE
ST	65	Shutoff motor temperature - DO NOT CHANGE
CT		Current motor temperature - DO NOT CHANGE
CD1	0	Controlled by RUN/STOP button - DO NOT CHANGE
CD2	10	Display speed - DO NOT CHANGE

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NANO 1000T/2000T and 1200T with 1 rpm increments (1 and 1.5 hp motor)

Note:
Do not start or run the motor before the correct input voltage is programmed;

RESET DEFAULT BEFORE REPROGRAMMING
Go to dF → Enter → -def → Enter

Steps to set converter input voltage and frequency response:

Go into Program "U" (Password:0253) → Enter → input "1001" →Enter → input "2042" → Enter → input "3050" →Enter→ input "4255" →Display "OVER" →Enter

Go into Program "U" (Password:0253) → Enter → input "1050" →Enter → input "2225" → Enter → input "3120" →Enter→ input "4255" →Display "OVER" →Enter

2. Go into Program "nS" (Password:0253) → Enter → input "2" → Enter

3. Go into Program "Sr" (Password:0253) → Enter → input "1.4" → Enter

NOTE: If any of the numbers are entered incorrectly in the above sequence, the process requires that the default be reset and the program the sequence entered again until it is exactly correct. THIS IS VERY CRITICAL OTHER WISE AN E01 ERROR CAN OCCUR.

Steps to set converter input voltage and frequency response:

The above settings are for maximum torque which will result is a slight vibration between 240-280 rpm, to reduce the vibration at the slight loose of torque rest these parameters:

Go into Program "U" (Password:0253) → Enter → input "1001" →Enter → input "2040" → Enter → input "3011" →Enter→ input "4050" →Display "OVER" →Enter

Go into Program "U" (Password:0253) → Enter → input "1011" →Enter → input "2050" → Enter → input "3014" →Enter→ input "4050" →Display "OVER" →Enter

Go into Program "U" (Password:0253) → Enter → input "1014" →Enter → input "2050" → Enter → input "3050" →Enter→ input "4225" →Display "OVER" →Enter

2. Go into Program "nS" (Password:0253) → Enter → input "2" → Enter

3. Go into Program "Sr" (Password:0253) → Enter → input "1.4" → Enter

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NANO 1000T/2000T and 1200T with 1 rpm increments (1 and 1.5 hp motor)

Programming Step	Value	Description
SP1	SPEED	Disc Speed - VARIABLE
T1	TIME	Runtime for SP1
SP2 to SP8	200	Multiple step disk speed - DO NOT CHANGE
T2 to T8	0	Runtime for multiple steps - DO NOT CHANGE
Cn	1	Number of cycles – DO NOT CHANGE
SL	100	Disc speed for SPL - preset to 100 rpm
SN	200	Disc speed for SPM - preset to 200 rpm
SH	300	Disc speed for SPH - preset to 300 rpm
DF		Defaults—DO NOT CHANGE
U		SET 110/220V—DO NOT CHANGE
ST	65	Shutoff motor temperature - DO NOT CHANGE
CT		Current motor temperature - DO NOT CHANGE
CD1	0	Controlled by RUN/STOP button - DO NOT CHANGE 0: Front board control 1: External control of board
CD2	10	Display speed - DO NOT CHANGE 10: Displays speed (rpm) 11: Displays frequency (Hz)
CD3		Motor control method – DO NOT CHANGE
CD4	1000	Max. speed (rpm)
CD5	100	Min. speed (rpm) (do not go below 100 rpm)
CD6	15	Carrier wave value – DO NOT CHANGE