



LAPPING / POLISHING



Engis® Flat Lapping/Polishing Systems



The Engis® Total System

At Engis, we build the machines, configure the components and formulate our compounds and slurries with one goal in mind: to deliver a total system with the capabilities you need in your flat lapping and polishing operations – capabilities that include:

- *System Compatibility*
- *Operational Flexibility*
- *Consistent, Repeatable Performance*



System Compatibility with Engis Equipment

All Engis machines and their supporting components are engineered for maximum system compatibility, elevating both precision and performance.

Engis flat lapping and polishing machines bring high performance and economic efficiencies to your operation. Capable of consistently and repeatedly generating surface finishes to 0.5 nm Ra and surface flatness to 1/20 wavelength, Engis systems are suitable for processing virtually all solid materials, including metals, ceramics, glass, semiconductor substrates and electro-optical materials.

Engis offers the most comprehensive choice of machine models designed specifically for advanced materials.

Operational Flexibility with Hyprez Consumables

There is a Hyprez diamond product for virtually every application.

- *Our powders, slurries, compounds and pastes come in a wide variety of micron sizes and carriers.*
- *Engis offers the largest selection of lapping plates in the industry. Hyprez composite lapping plates are designed to maximize the cutting characteristics of Hyprez diamond slurries and compounds.*
- *Parts carriers, conditioning rings, dispensing accessories and other consumables are all designed to optimize system compatibility – enabling more efficient and effective performance, consistently and repeatedly.*

Process Development and Technical Support

Engis invests in its customers by making available a wealth of diamond expertise and technical support through our process development labs.

- *The Hyprez Process Development Lab enables customers to experiment with various options and combinations of machines, plates, compounds, lubricants and processing parameters. The result is a deep understanding of the capabilities of your Hyprez system and an on-going relationship with Engis engineers and support personnel.*
- *The Wafer Processing Lab is focused on producing specialized slurries, processes and machining parameters that boost yields and throughput in the superfinishing of wafer substrates for the semiconductor and compound semiconductor industries.*

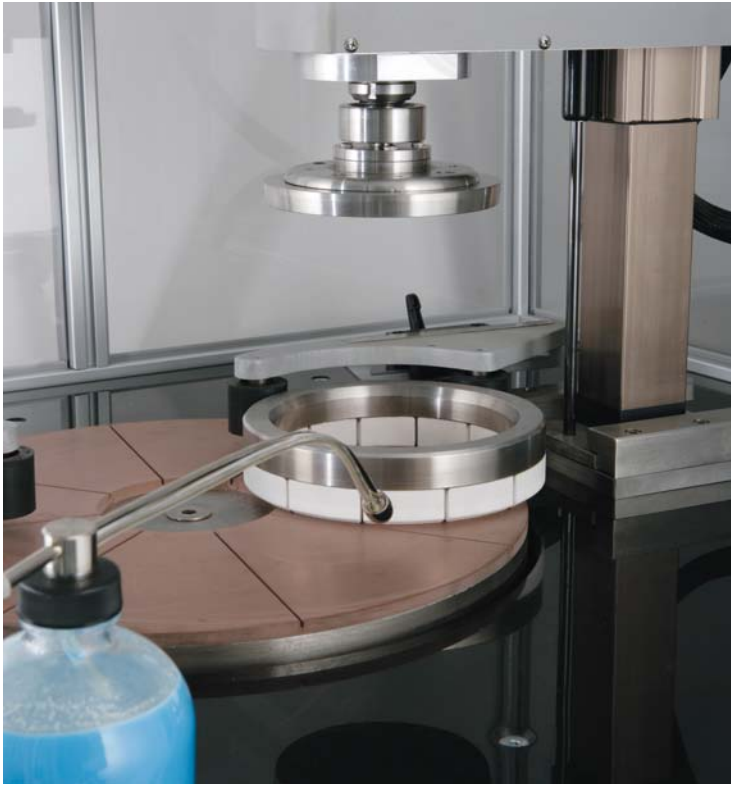
Totally Integrated Diamond Flat Lapping & Polishing Systems – Only from Engis



Engis lapping machines are available in single and double sided models, ranging from 15" table top models to 48" production floor models.



Both special composite and natural metal lapping plates are engineered to maximize the cutting characteristics and performance of diamond superabrasives.



Engis manufactures a complete line of standard-sized conditioning rings and part holders, as well as specialized controls, custom slurries, fixturing and other application-specific accessories.

Diamond Lapping Benefits

Machining Problems	Lapping - Benefits
Clamping distortion	Stress-free
Multiple machining steps	Single step to finish
Brittle parts	Low p.s.i. – low losses
Composite/dissimilar materials	Same stock removal
Non-metallic/magnetic materials	Easily accommodated
Thermal distortion	Eliminated – water cooled
Thin part capability – poor	Less than 0.005"

Important Factors in the Lapping Process

In order for superfinishing processes to yield precise, repeatable results, a complex set of factors must be brought into balance and matched to the application at hand.

Engis flat lapping and polishing machining systems are engineered to give you maximum control over these crucial factors:

- Precision dispensing and metering of slurries
- Pressure on the workpiece
- Speed of the plate (tool)
- Plate material and characteristics
- Plate surface configuration (grooves)
- Type and size of abrasive particles
- Type of carrier (vehicle) used, if applicable
- Optimum operating temperatures
- Plate flatness requirements, methods of measurement
- Requirements for lubricants, plus lubricant attributes
- Consideration of plate ramp-up/ramp-down speeds
- Consideration of ramping pressures for the workpiece
- Method of charging and conditioning the plate
- Conditioning/retaining ring in-process use
- Diamond delivery system and positioning



Electronic precision dispensing systems, conditioning rings, part holders and other accessories are designed by Engis to integrate your lapping system with maximum efficiency.



Hyprez diamond powders, slurries, compounds and lubricants make up the broadest in the industry, with micron sizes and formulations for virtually every application.

Leadership in Diamond Technology

Lapping with Diamond – The Benefits

The case for using diamond superabrasives rather than conventional abrasives in your operations can be summed up in three words. Diamond is faster, cleaner and cost-efficient.

With diamond slurries, the lapping and polishing phases of a finishing operation can often be combined into one step. Plus, less time is required for cleaning parts and processing waste, so your throughput increases, along with overall productivity.

Among the many application benefits diamond superabrasives bring to lapping and polishing operations are these:

- *Superior surface finish*
- *Aggressive material removal*
- *Lapping & polishing combined in one step*
- *Uniform edge-to-edge flatness*
- *Process virtually any solid material*
- *Surface finishes to .2 μ " Ra*
- *Flatness to 1/20th wavelength*
- *Superior cleanability*
- *Precise repeatability*

Lapping Applications

CERAMIC

Heat Sinks
Hybrid Substrates
Seals
Microwave Substrates
Sensing Devices
Valve Components
Read-Write Heads
Sapphire Windows
Ferrite Recording Heads
Ferrite Components
Capacitors
Thermoelectric Devices
Fiber Optic Connectors

CARBON

Seals
Pump Components
Carbon-Graphite Seals
Chemical Flow Components
Heart Valves

GLASS

LCD Glass
Optical Filters
Quartz Substrates
Camera Lenses
Fiber Optics
Copy Machine Mirrors
Video Disc Masters
Optical Flats
Optical Memory Discs
Glass Ornaments
Crystal Glassware
View Mirrors
Microscope Slides

PLASTIC

Contact Lenses
Fuel Pump Components
Engine Components
Printed Circuit Boards

METALS

Computer Components
Spacers
Gage Blocks
Fuel Injectors
Pump Components
Slitter Knives
Compressor Components
Cutting Inserts
Piston Rings
Valve Plates
Bearing Races
Heat Sinks
I.C. Boxes
Clipper Blades
Transmission Components
Brake Pads
Mechanical Seals
Power Stapler & Nailers
Components
Pump Housings
Valve Lifters
Compact Disc Molds
Pendants & Medals
Jewelry



Hyprez diamond slurries and lubricants from Engis – including our MultiTec line for perfecting the surface finishes of advanced materials – outperform conventional abrasives, generating superior surface finishes, faster stock removal rates and superior cutting characteristics when processing hard materials, such as ceramics.

Diamond vs. Conventional Abrasives

Diamond is the Most Cost-Effective Solution

In terms of total cost-effectiveness, diamond easily outperforms conventional abrasives, such as aluminum oxide and silicon carbide. Here's why:

Conventional Abrasive Costs

While diamond costs more, gram per gram, you must buy substantially larger volumes of conventional abrasives to achieve the same results produced by a single unit of diamond...

Conventional Vehicle/Carrier for Abrasive Costs

...And when you're paying for more conventional abrasives, you're also paying for larger volumes of vehicle/carrier fluids, as well.

Shipping, Handling & Storage Costs

Conventional abrasives are heavy and typically stored in drums. You're paying more for shipping, on-site handling and a larger storage footprint.

Spillage and Mixing Costs

Conventional abrasives have to be mixed on-site with the vehicle/carrier to make a lapping slurry. These messy operations often lead to extra costs in spillage and waste, as well as hidden costs created by improper mixing ratios.

Cleaning Costs

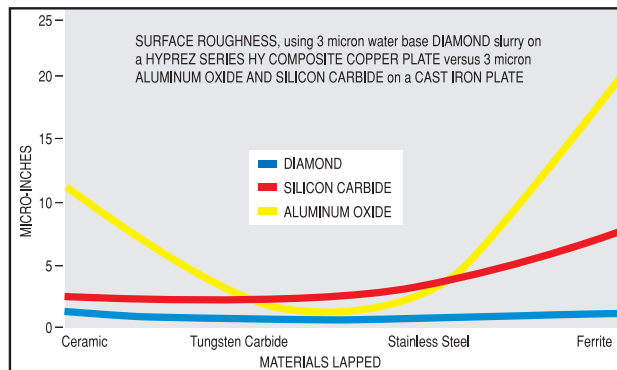
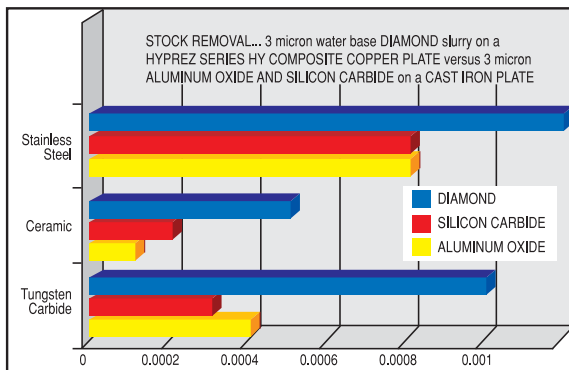
Unlike diamond, conventional abrasives require an extra cleaning step. In some applications, both mechanical and an ultrasonic cleaning process are required, driving costs up and productivity down.

Disposal Costs

A major cost factor in using conventional abrasives is the disposal of the large volumes of spent slurry/swarf, as well as disposal of empty abrasive & vehicle containers. Diamond slurries generate less waste by volume and are more environmentally friendly.



Stock Removal and Surface Finish Generation



Production Process Support

Hyprez® Process Development Lab

Located in our corporate headquarters, and staffed by some of the most seasoned experts in diamond flat lapping and polishing, there is one very important thing to keep in mind about the Hyprez Process Development Laboratory: ***This is your lab.*** Its purpose is to solve your application problems...tackle your toughest job requirements...meet your most challenging performance criteria.

As an example, when you need advice on processing two or more dissimilar materials to uniform planes of flatness... Or new technologies require you to attain higher tolerances in surface finish... Or you are exploring ways to lap and polish a wider variety of materials, while, at the same time, reducing costs...



...The Hyprez Process Development Laboratory is your optimum resource. Through the lab, we regularly assist customers by developing new products, and processes that:

- *Shorten cycle times*
- *Reduce the number of finishing steps*
- *Lower finishing costs*
- *Improve precision and performance*

The wealth of Engis' diamond finishing expertise is available to you through this laboratory. If you have a special application or processing problem, please contact Engis. We will be glad to assist you in any way we can.



Engis® LM Lapping/Polishing Systems

Setting a standard for rugged reliability and optimal processing flexibility, the Engis LM Series of lapping and polishing systems has been a mainstay, mission-critical superfinishing solution for a wide variety of industries and applications – from aerospace to automotive...data storage to photonics.

Engis LM machines are in service the world over. Designed and engineered to optimize the inherent superior finishing qualities of precision diamond abrasives, Engis LM machines are available in both 15" benchtop configurations, as well as floor standing models ranging in plate size from 24" to 42".

Standard Features:

Bench Top Models

- Variable speed drives for optimum feed travel rates – 0 – 120 RPMs
- Robust drive systems
- Digital Readout Cycle Timer (Fully adjustable, with digital readout and auto-reset)
- 3 Ring Arms (Roller Yoke Type)
- Dial Indicator Flatness Gauge (Model 15LM)

Floor Standing Models

- Pneumatic pressure or hand weight systems
- Individual pneumatic controls for each work station
- Electronic controls – Part of a two-hand control system to toggle the pressure plate up and down
- Plate cooling system controls (optional)

Applications:

Ceramic, Carbon, Glass, Plastic, Metals



Mounted on a swing arm, the main control panel can be positioned by the operator for optimum visibility and maximum accessibility to the parts.



Part: CMP Ring Assembly
Material: PPS Plastic / Stainless Steel

Requirements: Single process for both sides of part. Plastic side required visually scratch free finish (with no abrasive contamination). Stainless steel side required reflective surface with uniform scratch pattern. Both sides required 0.0002" flatness.

Process: Engis 28LM230VP single-side lapping system was used in a multiple step process using diamond slurry, composite lap plates and polishing pads.

Results: A surface finish of 1.7 μ " was achieved on SS side and a 1.5 μ " (scratch free) finish was achieved on plastic side. A flatness of ~1 lightband was achieved on each side (far exceeding the requirement).

Engis® FL FastLap Systems

Versatility and speed are the hallmarks for Engis' newest line of lapping and polishing machines. The Engis FastLap Series of floor-standing systems are designed to maximize the efficiency of diamond lapping processes while giving operators optimal speed and control. The result – greater per-piece-finished cost efficiencies.

Engis FL machines are available in models utilizing 24", 28", 36", 42" and 48" lapping plates. Robust, durable, variable speed drive systems, paired with touch-screen digital controls, give operators a range of pressure and speed settings of up to 1,100 pounds per head and 90 RPMs, respectively. This makes the Engis FL system both fast and flexible, capable of processing a wide range of industrial-grade materials within optimal timeframes.

Features:

- Models for five plate diameters – 24" / 28" / 36" / 42" / 48"
- Soft start ramp up to protect parts during start up
- Corrosion-resistant worktable, chrome pressure plates
- Integrated slurry dispensing system
- Protective enclosure system – optional
- Water cooling – optional
- Proface touch screen control
- Customization packages available

Applications:

Mechanical Seals, Ceramics, Carbide, Glass, Optics



FL-24VP FastLap Machine



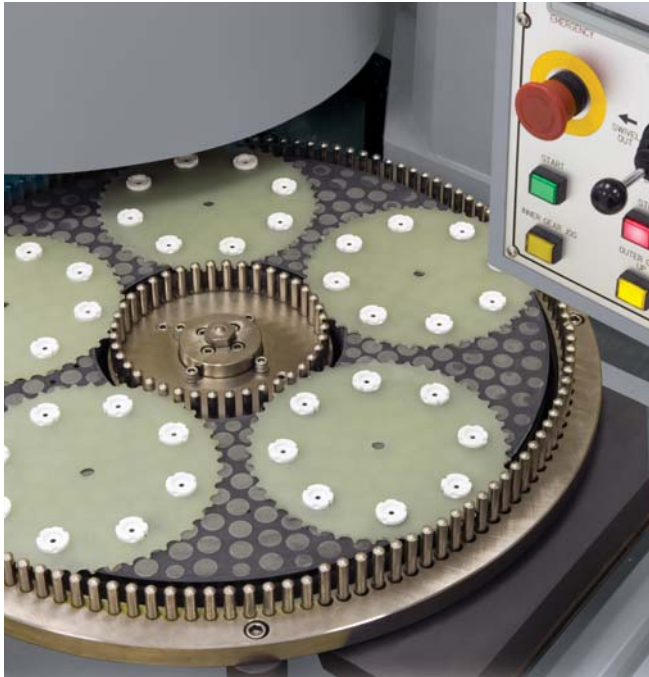
Part: Mechanical Seal
Material: Alinco V

Requirements: Flatness of 0.0000232" and reflective finish of 4 μ " or better. Customer was using a multi-step conventional lapping process but was experiencing difficulty meeting the quality and wanted to improve on productivity.

Process: The new process utilizes our Engis FL-24VP single-side lapping system with diamond slurry and composite lap plates.

Results: The process was reduced to a single-step providing a 0.7 μ " finish with a flatness within 0.0000116". Significantly less waste is produced and production potential more than doubled.

Double Sided Lapping & Fine Grinding Systems



Available in three models, plus optional accessories, Engis Omni 3 double sided finishing systems can be used on a variety of materials to achieve a high degree of accuracy in flatness, parallelism and surface finish. Designed for use with Engis diamond plates, Engis Omni 3 double sided systems reduce processing times, as well as overall costs.

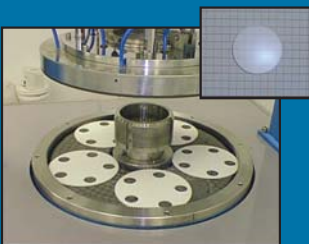
This unique system is suitable for either double sided lapping applications with free abrasive slurries or for fine grinding processes with fixed abrasive media.

Features:

- Digital Size Controller assures reliability
- Rigid body ensures no vibration for added accuracy
- Real 3-way system features Upper and Lower Wheel drives.
- Sun Gear is driven by independently geared motor with AC inverter
- Soft Touch Screen makes operation simple and user friendly
- Variety of applications for fine grinding, lapping and polishing
- Pre, main and post load position is controlled by simple setting
- Upper Wheel swivel provides operator with more space for loading and unloading

Applications:

Tungsten Carbide, Sinter Metal, Hard Metal, Bronze, Aluminum, Quartz, Crystal, Sapphire, Optical Glasses, MLCC, Ceramic Substrate, Zirconium, Engineered Plastics, Composites, NTC Substrate, PZT Substrate, Diamond Dicing Blade, Ferrite, Silicon Carbide and others.



Part: LASER WINDOW
Material: Calcium Fluoride

Requirements: The customer needed a process for "rough" sizing of parts. Current process was slow and labor intensive and left excessive sub-surface damage.

Process: Parts were processed on our double-sided diamond pellet grinding system using a water based coolant.

Results: The finish achieved off the pellet plates was $18.5 \mu''$ (Ra) with a maximum stock removal rate of $0.0137''/\text{min}$. The customer tested parts (after a final polishing) for transmission degradation after 1 million laser shots and found the results to be superior to their old process (attributed to less sub-surface damage).

MPC/AM Lapping/Polishing Systems

Maximum Process Control

Specifically designed for unique polishing, delayering and planarization applications where R&D, prototype and small volume processing is required, Engis systems are available in both AM-I5 bench top and MPC floor-standing models.

Each MPC system provides the kinematics and control required to develop processes that have 6-Sigma capability for material removal, flatness and surface finish generation. The menu-driven microprocessor control allows any polishing, delayering or planarization process to be fully optimized. The oscillation system provides 3-axis motion for true CMP kinematics.

Features:

- Ideal for universities and research labs, as well as commercial enterprises with unique, application-specific requirements
- A range of standard processes, developed by Engis, can be applied
- Compatible with both Engis precision diamond CMP-D slurries, as well as conventional abrasives, plates and other consumables and accessories
- Touch screen interface, fully customizable
- Operator interface mounted on swivel-style pendant
- All drives are programmable and reversible
- Data acquisition and program stringing
- Oscillation features are controlled from main input screen
- Integrated slurry dispensing system controls
- Digital readouts for all drive and pressure functions

Applications:

Silicon Carbide, Sapphire, metal foils, delayering planarization of SiO_2 and metalized depositions. Calcium Fluoride and Magnesium Fluoride preparation.



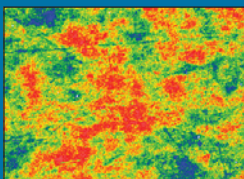
MPC Lapping Machine

Finishing Systems for Advanced Materials



AM-I5 BenchTop Lapping Machine

Engis designs specialized machines, part holders and fixtures for superfinishing applications in the compound semiconductor, MEMS and electro-optics industries.



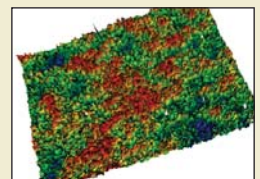
Area Shown: X-282.75 μm
Y-212.06 μm

Part: Wafer Epi-Polishing
Material: Indium Antimonide

Requirements: Achieve a sub-nanometer (nm) Ra surface finish.

Process: Three-step process utilized EHG-150 Horizontal Grinder; followed by stock removal lapping and CMP polish on an Engis AM-I5 lapping/polishing machine, P4 colloidal silica slurry and polishing pad.

Results: Achieved a surface finish of 0.7nm Ra, at a material removal rate of 2.8 $\mu\text{m/hr}$.



Ra-0.67 nm

Technology Development

Hyprez® Wafer Processing Lab



Engis is the leading force in pioneering new diamond superabrasive finishing systems for the manufacturers of disk drives and data storage components.

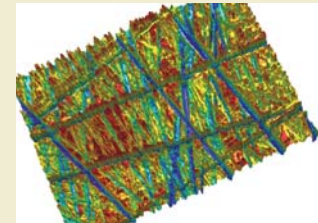
The Hyprez Wafer Processing Laboratory (WPL), a new facility within the Engis world headquarters complex in Wheeling, Illinois, is specifically designed to shorten the time it takes to move new magnetic and MR head technology into mass production.



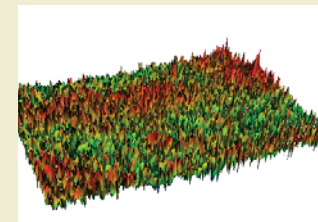
The Hyprez WPL collaborates with research and development teams at magnetic head manufacturers, developing new production processes concurrently with the creation of new head/disk drive designs. Manufacturers who partner with Engis are able to deliver new data storage technology to the end user much faster, with greater reliability.

The Hyprez WPL integrates Engis diamond superabrasive technology with its customers' bar/slider manufacturing technology. Engis has installed in the lab actual production equipment used by its customers. This enables Engis process engineers to control all of the variables in the production environment. These variables include how the diamond is micronized, how the slurry is formulated, selecting and properly charging the appropriate composite lapping plate, and how each production cycle is set up and run.

Advanced surface measuring systems are used to analyze pole tip recession and other factors influenced by the lapping/polishing process for magnetic heads and advanced materials, such as MEMS, electro-optics, and compound semiconductors.



These two 3D model images illustrate before (above) and after (below) results of a finishing process for CaF₂ crystals to be used in an optics application. A surface finish of 0.5nm Ra is achieved, followed by a pitch polish for excellent flatness.



Results	
Ra	0.49nm
Rq	0.62nm
Rv	-2.84nm
Rt	7.57nm
SRz	3.22nm

Image	
Size X	282.75µm
Size Y	212.06µm

Hyprez® Composite Lapping Plates



All lapping plates from Engis can be retrofitted to mount on most commercially available lapping machines.

Composite lapping plates are central to the superior performance of integrated diamond lapping systems. Hyprez lapping plates are formulated specifically to deliver optimum performance when used with Hyprez Diamond Slurries. The composite material efficiently and rapidly removes stock, while producing high quality surface finish and flatness with diamond superabrasives in both large volume operations and smaller hand lapping and polishing applications.

Special Composites vs. Natural Metals

Special composite laps are made with a unique blend of powdered metal or ceramic, combined in a resin system. These composite laps take a more uniform charge of diamond, compared to pure metal plates. The result is more consistent and controlled performance. Composite plates are also superior in applications where lapping and polishing are combined into one step.

Ultra-Precision Tolerances

Hyprez lapping plates, used in combination with Hyprez diamond slurries and compounds, are capable of achieving surface finishes to 0.5 nm Ra and flatness to a 1/20 wavelength on many materials.

Features:

- Accelerated stock removal
- Ultra-precise flatness and surface finish
- Consistent, repeatable results

Hyprez MINIMISER® & Autostirrer Dispensing System

Diamond is a premium abrasive. Economies of usage are critical, requiring dispensing accessories that maximize the effectiveness of diamond slurries while minimizing waste.

Both the Hyprez Autostirrer and MINIMISER have been engineered to deliver precisely controlled amounts of Hyprez diamond slurry and lubricants. These systems are designed for optimal use on all Hyprez lapping systems.



The Hyprez Autostirrer keeps diamond completely dispersed during usage by stirring the slurry with a magnetic spin bar.

The EMC -2 MINIMISER Electronic Dispenser, with digital readout, incorporates microprocessor based circuitry to provide consistent and repeatable performance, day in and day out.

The MINIMISER can be set for an interval cycle up to 999 seconds (16.65 min.) and a spray duration range of 1 to 9 seconds in increments of 1 second.

Both the Hyprez Autostirrer and MINIMISER can be retrofitted to all commercially available lapping machines.



Working together, the MINIMISER and Autostirrer deliver precisely timed and metered amounts of slurry and lubricant, minimizing waste and maximizing diamond dispersion.

Uniform Finishing of Dissimilar Materials

Hyprez lapping plates, when used with diamond, are ideal for finishing two or more dissimilar materials to a uniform plane of flatness. Engis process engineers will work with you to establish the optimum combination of Hyprez plates, diamond slurries and lubricants for finishing each multi-material part.

Plate Sizes & Patterns

Standard sizes are as follows: 6", 9", 12", 15", 16", 18", 24", 28", 36", 42" and 48" diameters. Special sizes are available on request. Square, spiral, concentric and radial grooves, as well as custom patterns, are available.

Hyprez® X08

Most Aggressive Stock Removal

- This plate is used when rapid stock removal is required.
- Second hardest composite iron plate.
- Provides excellent flatness, longer service life, low reconditioning needs and refined surface finishes.
- Often used as an alternative to cast iron plates.
- Produces good surface finish on most materials, especially metals and ceramics.



Hyprez® HY Iron

Aggressive Stock Removal

- Excellent primary/roughing lap plate, with a long service life.
- Often used as an alternative to cast iron plates.
- Produces a good surface finish on most materials, especially metals and ceramics.
- Typically used with coarse to medium diamond sizes.



Hyprez® TX-10A

Moderate Stock Removal

- Composite tin plate. Offers a lead (Pb) free working environment.
- Provides superior surface finish prior to CMP step.
- Works with coarser diamond slurries for fast stock removal while achieving extraordinary fine surface finish.
- Provides longer service life, low reconditioning needs and refined surface finishes.



Hyprez® HY Copper

Moderate to Aggressive Stock Removal

- Most widely used, universal composite lap plate.
- Excellent when primary and finishing lap are combined in a one-step operation.
- Suitable for virtually any solid material: metal, ceramic, glass, carbon, plastic, etc.
- Typically used with medium to fine diamond sizes.
- Minimizes fracturing and chipping tendencies when lapping crystal components.



Hyprez® Tin – Antimony

Low/Very Low Stock Removal

- Typical plate for head manufacturing industry (kiss lap process).
- Used in pre-polishing of hard materials, SiC, GaN.
- Resistant to temperature variations during lapping.
- Prevents changes in lubricant viscosity during continuous lapping operation.



Hyprez® HY Ceramic

Moderate Stock Removal

- Generally used to lap/polish ceramic parts and other stain-sensitive materials.
- Used in applications where metallic-type contamination cannot be tolerated.
- Affordable, more machineable alternative to "natural" ceramic plates.
- Very flexible – used with coarse to fine diamond sizes.



Hyprez® Conditioning Rings & Pads

Solid Ceramic Conditioning Rings

Ideal for use in the electronics, automotive, medical, audio/visual and optical industries, these high quality, alumina ceramic rings provide an unmatched level of control in the final finishing process. 12 serrations per ring. Available for 12" and 15" lap plates.

Stainless Steel-Backed Ceramic Conditioning Rings

Backed with 304 stainless steel for greater tensile strength, these rings are highly resistant to corrosion. Available for 12", 15", 24", 28", 36" and 42" lap plates.

Diamond-Plated Conditioning Rings

These diamond-plated rings are designed specifically for Hyprez Series HY composite lapping plates. Engineered to consistently regenerate surface texture and flatness of composite lap plates, these rings eliminate varying results usually associated with conventional abrasive reconditioning. Available for lap plates from 12" up to 42".



Hyprez Polishing Pads

In polishing operations, the holder of the abrasive is as important as the abrasive itself. The choice and composition of this holder is determined by the application and the materials being processed.

In extremely fine polishing operations you must use cloth, rather than, or in addition to, composite plates. Polishing discs are divided into three broad categories of fabric: woven, flocked and compressed.

Hyprez Polishing Cloth Discs are excellent for extremely high finishes on a variety of materials. All cloths have a plastic barrier between the cloth and the self-adhesive back. The plastic barrier not only provides a firm backing but prevents excess loss of abrasives.

Specialty Machines

Horizontal Grinding System – Engis® EHG-180 AV



The Engis EHG-180AV Horizontal Grinding Machine with vacuum chuck is designed for use with our specialty diamond wheel. This unique system is designed for surface grinding silicon carbide, as well as backside grinding Sapphire LED wafers to the highest levels of flatness and surface finish, economically, saving labor costs and time.

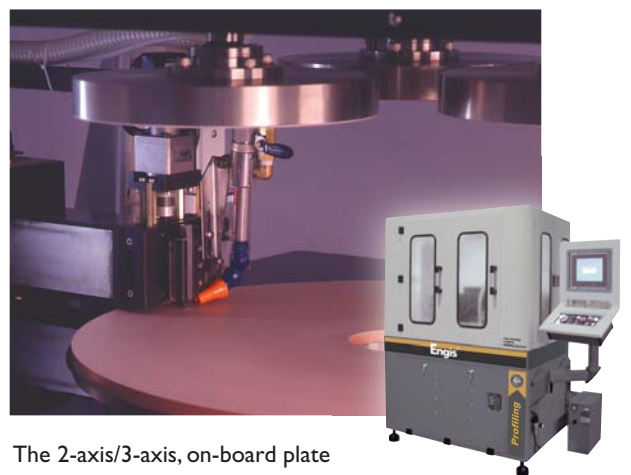
Wire Saw

Engis Corp. also represents wire saws and slurry re-claimers manufactured by Yasunaga Corporation (based in Japan), a pioneer in the development of wire saw machines. Yasunaga's wire saws are designed for high-speed and high-precision processing of crystal AT cutting, solar silicon and other materials utilizing thinner wire and wire reciprocation.

Profiling Machines

In addition to micronizing its diamond powders and formulating its slurries, Engis also manufactures specialized lapping/polishing machines for the data storage industry.

These machines feature an on-board plate facing device that shapes and texturizes composite and natural metal lapping plates on two separate axes, without the use of conditioning rings. Used in "kiss," or crown, lapping of bars/sliders, as well as other advanced operations, the machine shortens cycle times and provides more precise, custom processing options.



The 2-axis/3-axis, on-board plate facing attachment generates flat, conical and spherical surface geometries.

Leaders in Superabrasive Finishing Systems



Engis (UK) Ltd.

Henley-on-Thames
Oxfordshire, RG9 1DS ENGLAND
Tel: 44-1491-411117
Fax: 44-1491-412252
Email: sales@engis.uk.com



Engis Corporation

Wheeling, IL U.S.A.
Tel: (847) 808-9400
Fax: (847) 808-9430
Email: info@engis.com



Engis Japan K.K.

Yokohama, JAPAN
Tel: 81-45-474-0666
Fax: 81-45-474-0677
Email: email@engis.co.jp



Engis Asia Pacific Pte. Ltd.

SINGAPORE
Tel: 65-6745-1923
Fax: 65-6745-2907
Email: sales@engis.com.sg



Engis (Hong Kong) Ltd.

Kwai Chung, HONG KONG
Tel: 852-26100903
Fax: 852-24234509
Email: sales@engis.com.hk



Engis of Canada Ltd.

Burlington, Ontario, CANADA
Tel: (905) 632-3016
Fax: (905) 632-4250
Email: engiscanada@engis.com

THE ENGIS GROUP OF COMPANIES



Engis (H.K.) Ltd., Beijing R.O.

Beijing, CHINA
Tel: 86-10-64848398
Fax: 86-10-64848396
Email: lianjie@engis.com.hk



Helical Lap & Mfg. Company

Fraser, MI U.S.A.
Tel: (586) 293-6900
Fax: (586) 293-6903
Email: info@helicallap.com



Engis Korea Co., Ltd.

Gyeong Gi-Do, KOREA
Tel: 82-31-354-1426
Fax: 82-31-354-1430
Email: mkkim@engis.co.kr

Engis® Lapping/Polishing Systems

Beginning-to-end flat finishing systems – machines, plates, pads, diamond powders, slurries, lubricants and other accessories – plus customized equipment, specialized formulas, testing labs and technical support for process and technology development.

Hyprez® DiaMold® Toolroom Products

Comprehensive line of diamond polishing compounds, abrasive stones, sticks, bobs, brushes and files – plus powered hand finishing systems for every toolroom application.

Engis Single-Pass Bore Finishing Systems

Single-pass bore finishing systems – standard models and custom machines – plus diamond and CBN plated finishing tools, parts holders/fixtures and integrated automation systems.

Electrogrip® Grinding Systems

Advanced superabrasive grinding, cutting and dressing systems utilizing diamond and CBN materials. Specializing in the aerospace, medical, ceramic, automotive and composite industries.



® Leaders in Superabrasive Finishing Systems

ENGIS CORPORATION

105 W. Hintz Road • Wheeling, IL 60090-6038
Phone: 847/808-9400 • Toll Free: 1-800-99-ENGIS
FAX: 847/808-9430 • E-Mail: info@engis.com
Website: www.engis.com