

LAPPING / POLISHING



Engis® Lapping / Polishing Systems



Engis® – Your Partner in High Precision Lapping & Polishing

Since 1938 the Engis Hyprez® brand name has been synonymous with high precision, high quality lapping systems. Our goal then, as it is today, is to provide solutions to the most challenging surface finishing applications by offering customers unsurpassed expertise in diamond, including a full R&D department, unique diamond micronizing capabilities, three process development laboratories and a worldwide sales and service network.

State-of-the-Art Equipment and Consumables

- All Engis machines, and their supporting components, are engineered for maximum system compatibility, elevating both precision and performance.
- Slurries, compounds, lap plates and accessories are designed to ensure consistent, efficient and effective performance.

Cutting Edge Process Development

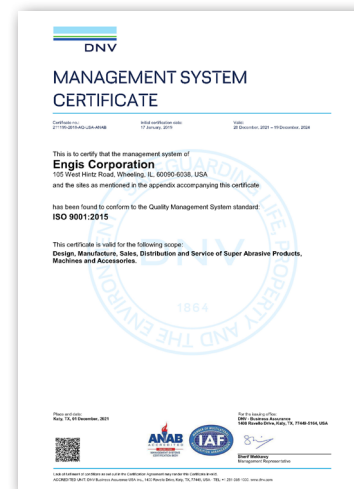
- Engis invests in its customers by making available a wealth of diamond expertise and technical support through our process development laboratories.
- Our labs are staffed with professionals who have decades of experience in real-world lapping environments in the data storage, advanced materials and industrial markets.
- Additional process development support is available in both Japan and Europe.



Unified Global Presence

- Engis has sales and service offices located in North America, East Asia and Europe, supplemented by our global distribution network.
- Hyprez lapping systems have already been successfully installed and are operating throughout the world.
- Our field sales engineering support team has decades of experience assisting customers in all major manufacturing markets. High quality and high ethical standards are guiding principles throughout the Engis Group of Companies.

Engis is committed to providing superior products and services. We faithfully comply with all of the requirements of our ISO 9001 Quality Management System and renew this pledge through continual improvement of our products and motivation of our global staff.



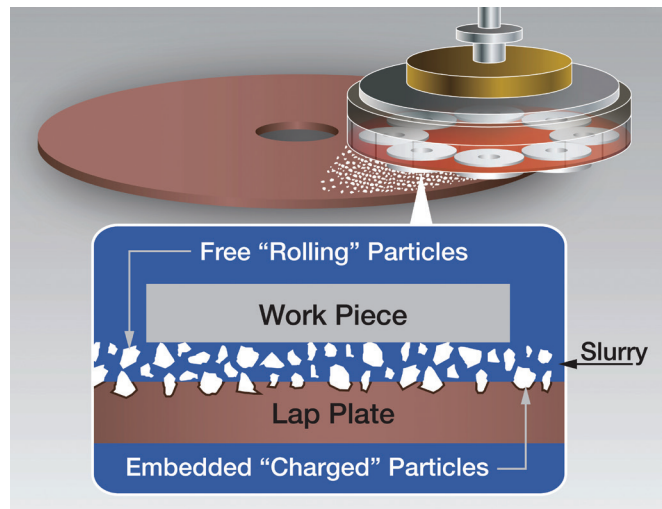
Lapping with Diamond

FASTER ■ MORE EFFICIENT ■ CLEANER ■ ENVIRONMENTALLY FRIENDLY

Lapping involves a medium (superabrasive and associated paste or liquid carrier) that is applied between the workpiece surface and a lapping plate.

While some of the diamond particles become embedded in the lapping plate to perform a fine grinding action, abrasive particles in lapping may also be continuously loose and rolling. Therefore, lapped surfaces do not have directional scratch marks.

The lapping process works by pushing the points of the diamond grains into the work surface to abrade microchips of material. Imagine this kneading or abrading action on the work surface being repeated millions of times to produce effective material removal, as well as provide a simultaneous polishing action (especially when using abrasive particles as fine as 50nm).



Lapping uses a combination of embedded and free diamond abrasive particles.

Benefits of Diamond vs. Conventional Abrasives:

- Increased Productivity and Throughput**
 Diamond cuts and polishes faster than conventional abrasives – cycle times can be reduced as much as 80%.
- Cleaner Work Environment**
 Lapping with diamond produces less waste significantly reducing housekeeping costs.
- Easy to Clean**
 Clean cutting diamond slurry and lapping residue are easily removed from the workpiece without staining.
- Lower Consumable Costs**
 Due to its efficiencies, lower amounts of diamond slurry are required to produce the same material removal rates.
- Environmental Impact and Disposal Costs**
 With lower amounts of swarf being produced, the costs associated with disposing of waste and effluent are considerably reduced.

STEEL LAPPING CASE STUDY

	Non-Diamond Process	Diamond Process
No. of Process Steps	2	1
Cycle Time	20 min cycle, plus 1 min hand polish	20 min cycle, no hand polish needed
Slurry Consumption	1 gallon/8 hours	1 pint/4 hours
Sludge Generation	8 gallons/8 hours	1/4 gallon/8 hours
Workpiece Finish	Matte Finish	Reflective
Workpiece Cleanliness	Heavy sludge requires 2 cleaning steps	Relatively clean requires light cleaning after 1 step
Slurry Cost/8 hours	\$331	\$94

One-step diamond process reduced slurry cost and cleaning while improving part finish

The Hyprez[®] Advantage

SURFACE ENGINEERING THROUGH DIAMOND EXPERTISE

For over 85 years Engis has used our extensive knowledge of natural and synthetic diamond to help customers unlock the lapping and polishing potential of the hardest material known to man.

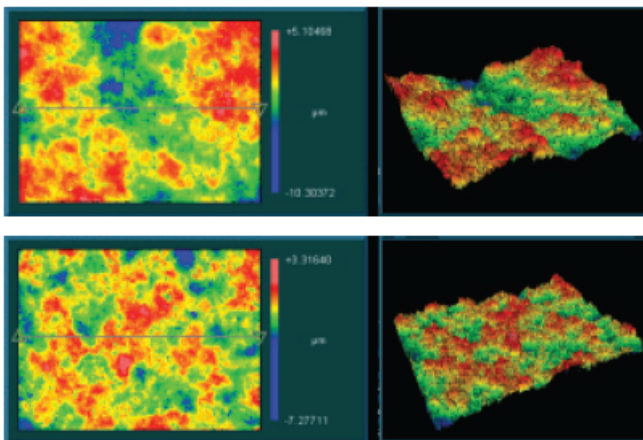
Engis Offers:

- Full Systems Solutions – machines, consumables and accessories
- In-house micronizing for superior quality control and customized diamond particle size distribution (PSD)
- Three Process Development Labs equipped to assist with your application challenges
- Research and Development Labs specializing in diamond characterization and carrier chemistry
- Processes that consistently generate surface finishes to 0.5nm Ra and surface flatness to 1/20 wavelength
- Tailored equipment offerings that give maximum process control, including a unique precision lap plate facing option

The 5 Keys to Diamond Characterization



No other company puts as much care and control into its selection of diamond powders as we do at Engis.



Engis deploys the latest surface measurement technology to continually improve its surface engineering solutions. Sophisticated metrology displays “before” and “after” images of data measuring surface flatness.

The Engis® Technology Center

The cornerstone of our advanced process development capability is our state-of-the-art Technology Center. This is where we work hand-in-hand with you to develop products and processes that can finish components to sub-wavelength flatness and achieve mirror surfaces.

The Center houses three labs staffed with technicians who have decades of experience in both the lapping and polishing of a wide variety of materials.



The AMP provides process solutions for engineered substrates used in optical, photonic, compound semi-conductor, MEMS and wafer applications.

ADVANCED MATERIALS LAB

Providing process solutions for engineered substrates used in optical, photonic, MEMS, wafer and compound semi-conductor applications.



HARD DISK DRIVE LAB

Simulating the HDD process for the development and testing of Hyprez® precision products.



INDUSTRIAL MATERIALS LAB

Developing cost effective solutions for lapping and polishing of components utilized in medical, mechanical seal, ceramic, automotive and other industrial markets.



Hyprez® Consumable Products for Precision Lapping & Polishing

**DIAMOND SLURRY ■ COLLOIDAL SILICA ■ POLISHING SLURRY
LUBRICANT ■ DIAMOND COMPOUND**

Hyprez consumable formulas are the result of Engis' complete understanding of diamond and its application in the lapping process. Our expertise on how to mill, shape and grade diamond of various types and friability is unmatched. Coupled with this experience is our knowledge of chemistry, compounding techniques, carrier formulations and concentrations which provide superior efficiencies and results.

Hyprez Diamond Slurries

- **Oil Based Slurries** – Our S1313 is recognized as the workhorse slurry for a broad range of lapping applications. It provides superior plate wetting and highly reflective finishes.
- **Water Based Slurries** – When part clean up is a concern, water based slurries are widely used. Hyprez formulation S4889 is available in a wide range of abrasive sizes and offers superior results in finishing a myriad of materials.
- **Emulsion Slurries** – S841 is a good choice for final polishing steps. S841 maintains good particle dispersion of the diamond without settling for long periods of time. This slurry offers the benefits of oil while still being easy to clean.
- **Suspensions** – Our S4243 water based slurry requires no stirring to maintain abrasive particle dispersion. This high viscosity suspension is useful when using a polishing pad on double side applications where it is important to fully wet and cover the lap throughout the work cycle.

Colloidal Polishing Slurries

Hyprez P2 and P5 colloidal polishing slurries are specifically designed to bring out the final finish on a wide variety of electronic components and metals.

Supporting a Clean Environment

Our environmentally-friendly Ecolap slurries provide excellent performance on a wide variety of materials such as hard ceramics, metals, plastics. Available in both oil based (Ecolap 1001) and water based (Ecolap 2000) formulations and can be formulated with a wide variety of diamond sizes and types.



Our ISO 9001 certified quality systems have made Hyprez the most trusted name in diamond consumable products throughout the world.

Engis is an industry leader respected throughout the world for producing high quality superabrasive slurry, compound and lubricant formations.

Hyprez® Diamond Compounds

Engis has been manufacturing diamond compound since the early 1940s, when our products were used to improve guidance systems on military and commercial aircraft. Our Five-Star® compound is recognized as a premium product in Asia, Europe and the Americas.

- **Five-Star** – Combines the excellent cutting characteristics of blended natural and synthetic diamonds in a carrier that is both water and oil soluble. This compound is the flagship of our diamond compound family of products.
- **Hyprez L** – An oil soluble compound is designed for use on hard materials such as carbides or ceramics.
- **Hyprez OS** – This oil based compound is self-lubricating and ideal for rapid stock removal applications.
- **Hyprez W** – A water based formulation that permits easy cleaning from the workpiece. Especially suitable for high luster polishing.
- **Hyprez SC** – Specifically formulated with the polishing professional in mind. Oil based formula incorporating an exceptionally sharp diamond type and particle size distribution resulting in superior cutting action.

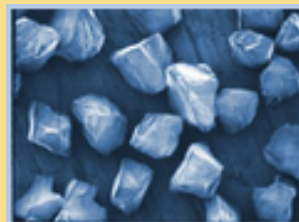


Engis has a complete range of lapping lubricants specifically formulated for use with our diamond slurries and compounds.

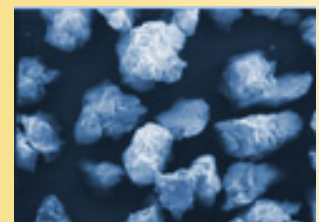
- **Hyprelube®** – Our premium performance lubricant, which can be used with either water or oil based slurries and compounds. Hyprelube has unsurpassed abrasive wetting properties and superior lubricity.
- **OS Type IV Lubricant** – This low viscosity oil soluble lubricant is compatible with oil based slurries and compounds.
- **W Lubricant** – Our water based lubricant is slightly thicker than OS Type IV and can be used with water based compounds and slurries.
- **Ecolube** – Our environmentally-friendly lubricant that maintains performance benefits with all Engis diamond slurries. Available in both oil soluble (Ecolube 101) and water based (Ecolube 200 & 202)



The key to any successful lapping application is choosing the appropriate diamond type.



Hyprez MA Diamond
Strong monocrystalline structure and 3-D blocky particle shape. Used in applications requiring a strong monolithic crystal.



Hyprez PC Diamond
Features microfracturing characteristics within a polycrystalline structure. Provides high removal rates and superior finishes thanks to its self-sharpening action.

Engis® Range of Lapping and Polishing Machines

For High Precision Lapping & Polishing, FastLap™ Is a Proven Winner

- The FastLap series of lapping & polishing systems is engineered for demanding lapping and polishing processes giving you maximum efficiency and quality control.
- This line of machines features lapping plates 15", 20", 24", 28", 36", 42", 48" or 60" in diameter. Intermediate or larger sizes are available upon request.
- Selecting a machine tailor-made for your application results in exceptional part quality, increased throughput and reduced per-piece finishing costs.



Options:

- Dust cover
- Water cooling system (lap plate)
- Customization packages are available
- Abrasive pump
- Abrasive slurry reservoir
- Stainless work and drainage area
- Integrated plate facing and/or grooving
- Power arms — motorized roller to drive work rings

The FastLap™ Series

HAND WEIGHT SYSTEMS				
Model Number:	FL-15V	FL-20V	FL-28V	FL-36V
Lap Plate Diameter (in/mm):	15" / 381mm	20" / 508mm	28" / 711mm	36" / 914mm
Conditioning Ring OD/ID (in/mm):	7" / 5.5" 178mm / 140mm	8.976" / 7.48" 228mm / 190mm	13.858" / 12.007" 352mm / 305mm	16.496" / 14.488" 419mm / 368mm
Work Stations/Rings:	3	3	3	3
Work Area Available (sq. in/sq. cm):	71 sq. in / 458 sq. cm	132 sq. in / 852 sq. cm	339 sq. in / 2187 sq. cm	495 sq. in / 12573 sq. cm
Standard RPM:	0-90	0-90	0-90	0-70
Main Drive Motor (H.P. / kilowatts):	1 H.P. / 0.7kW	3 H.P. / 2.2kW	5.5 H.P. / 4kW	7.5 H.P. / 5.5kW
Operating Voltage:	110 or 220 VAC 1 Phase	230-460 VAC 3 Phase	230-460 VAC 3 Phase	230-460 VAC 3 Phase
FLC @ 230 VAC:	5.0A	9.0A	15A	20A
Optional: Water Cooling Rate @ 10 PSI:	1 GPM	1 GPM	1.5 GPM	1.5 GPM
Machine Weight (lbs/kg):	198 lbs / 90 kg	1,800 lbs / 816 kg	1,900 lbs / 864 kg	2,700 lbs / 1224 kg
Dimensions (in/mm):	25" x 23" x 17" 635 x 584 x 432mm	47" x 53" x 39" 1194 x 1346 x 991mm	65" x 68" x 39" 1651 x 1727 x 2007mm	72" x 69" x 39" 1829 x 1753 x 991mm
PNEUMATIC PRESSURE SYSTEMS				
Model Number:	FL-15VP	FL-20VP	FL-28VP	FL-36VP
Required Air Pressure:	0-80 PSI, 1.32 CFM 5.4 Bar	60 PSI, 3.2 CFM 4.1 Bar	60 PSI, 8.2 CFM 4.1 Bar	60 PSI, 24.2 CFM 4.1 Bar
Pneumatic Down-Force Range (lbs/kg):	0-100 lbs / 0-45.36 kg	0-200 lbs / 0-90 kg	0-500 lbs / 0-226.8 kg	0-1100 lbs / 0-498.9 kg
Machine Weight (lbs/kg):	286 lbs / 130 kg	2,100 lbs / 953 kg	2,315 lbs / 1050 kg	3,300 lbs / 1497 kg
Dimensions (in/mm):	25" x 23" x 42" 635 x 584 x 1067mm	47" x 53" x 74" 1194 x 1346 x 1880mm	65" x 68" x 79" 1651 x 1727 x 2007mm	72" x 69" x 84" 1829 x 1753 x 2134mm

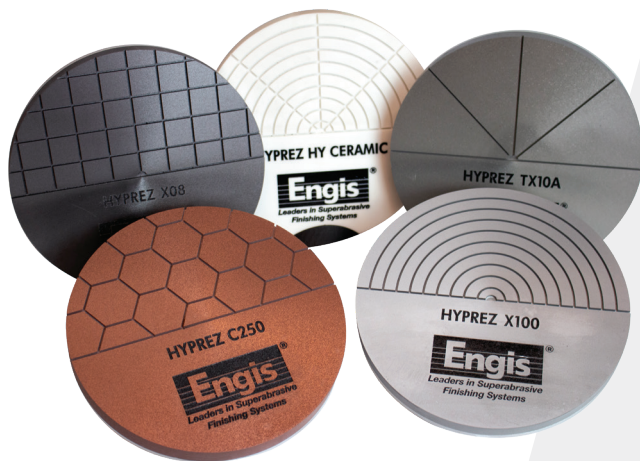
All dimensions & weights are rounded.
Other sizes are available upon request.

Features & Benefits:

- Heavy duty, high torque powertrain exceeds industry standards with soft start and variable speed drives for improved parts protection.
- Corrosion resistant work area, with optional all-stainless steel for demanding polishing environments.
- All floorstanding FastLap machine functions are PLC controlled with easy touch screen interface:
 - Full control of all manual or automatic machine functions
 - 4-stage events in recipe building with recipe storage and recall
 - Optional integrated onboard facing brings plate control into the process recipe



Hyprez® Composite Lapping Plates



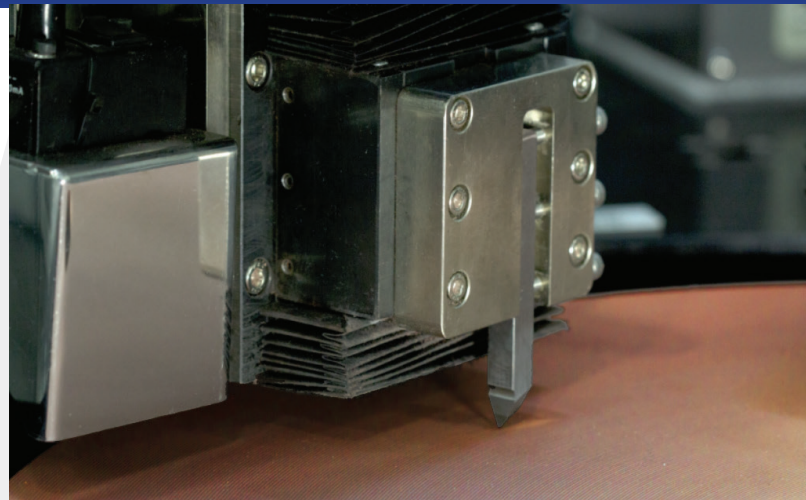
Uniform Finishing of Dissimilar Materials

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 slurry and lubricants.
- 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.

Plate Sizes & Patterns

- Engis has a complete range of composite lap plates from the aggressive iron composite, with enhanced material removal characteristics, to the soft TX10 which yields superior flatness and finishes. The HY copper composite is our best workhorse solution, featuring good stock removal rates and high quality surface finishes for virtually any application.
- Not only do we manufacture the standard lapping plate sizes, but special diameters up to 4200mm are available on request. We also have the capability to machine spiral, concentric, radial, and waffle patterns onto the plate surface.



Your Key to Ultra Precision Lapping & Polishing

Maintaining the flatness of your lapping plate is critical to a stable process. The facing device, in combination with the pneumatic pressure heads of the FastLap™ machine, establishes a process that consistently achieves:

- Accurate plate conditioning
- Controlled surface geometry and texture
- Repeatable work pressure
- Fast, predictable stock removal



Hyprez Conditioning Rings

Engis manufactures two types of conditioning rings for lapping applications:

- Stainless Steel Backed Ceramic Work Rings not only serve to charge diamond particles into the lapping plate, but also to hold the parts carriers in position.
- Diamond Plated Conditioning Rings remove the previous layer of charged diamond, presenting a new face to be charged with fresh particles. They can also be used to bring the lapping plate back into its original flatness and parallelism.

Hyprez® Slurry Dispensing Units and Pads

For the Ultimate in Precision

Engis® manufactures stirring and dispensing control units complemented by our convenient-to-use spray nozzles.

- The **EMC-3 MiniMiser®** is a compact, reliable dispensing system used to lightly spray fluids ranging from very thin to thick viscosity onto a lap plate or other surface. The MiniMiser combines a compact design ('Mini') with an atomizer ('Miser') providing strict control over both the duration of the spray and the intervals between sprays. This results in enhanced surface coverage and significant cost savings due to less vehicle being used.
- The **Hyprez Autostirrer** keeps diamond completely dispersed by stirring the slurry with a magnetic spin bar, ensuring even diamond concentration through the lapping cycle.
- **Engis Spray Nozzles and Accessories** are matched to your particular needs. A removable nozzle stand is also available for difficult to reach locations



Hyprez Planarization and Polishing Pads

Engis offers a full selection of pads and cloths to meet demanding polishing and planarization requirements for industrial, as well as advanced material finishing.

In addition to industry standard pads, Engis can engineer and supply special pads to meet your needs.

World Leader in Superabrasive Finishing Systems



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Hyprez® Lapping/Polishing Systems
Beginning-to-end 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.

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

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.



World Leader in Superabrasive Finishing Systems

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