



# ENGIS CORPORATION

**Superabrasive Finishing Systems for Hydraulic Valves & Systems**

**Machines • Fixtures • Tools**



# ENGIS® SINGLE-PASS PROCESS



## CASE STUDY

**INDUSTRY:**  
Construction Machinery Manufacturing

**MATERIAL:**  
Cast Iron

**PROBLEM:**  
Inconsistent bore geometry, high down-time, high perishable tool cost

**SOLUTION:**  
Engis Single-Pass Process

- Improved quality - Cpk > 1.67
- Improved bore roundness to less than 0.2µm
- Improved bore straightness
- Reduced perishable tool cost to under \$0.01 per part

## Do you Manufacture Hydraulic Components for Aerospace, Construction or Farm Equipment?

If so, you know all too well that the quality of your hydraulic system plays a key role in the performance and reliability of your products. A critical factor to this performance is the fit between the spool and the valve bore. Achieving optimal clearance between these two components results in improved performance, lower propensity for leaking, better hysteresis, fewer repairs and increased reliability.

Engis Single-Pass bore finishing technology delivers superior-fitting bores when compared to bores finished through conventional honing.

**WHY?** Conventional honing utilizes a reciprocating tool with relatively fast-wearing bonded stones that must expand and contract during each cycle. Single-Pass technology is just that; the work is spread over a series of progressively finer, pre-set diamond tools that only require a 'single pass' from each tool. It is this pre-set capability of the tooling, combined with the extremely slow wear of the diamond coating, that allows the Single-Pass process to achieve superior bore size capability.

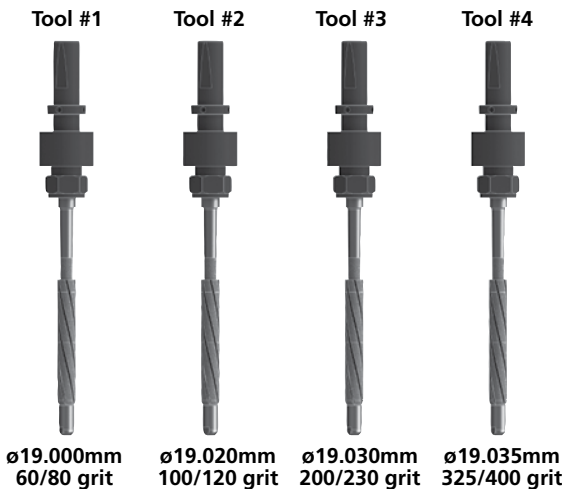
In addition, advanced tool design features from Engis, such as internal float mechanisms and extended cylindrical tool cutting lengths, help to produce unmatched overall bore cylindricity.

- Other benefits include:
- Fewer rejects/rework
  - Less downtime
  - Higher production rate
  - Consistent bore quality
  - Improved process capability
  - Less operator involvement
  - Reduced maintenance expense
  - Lower overall cost per finished part
  - Accuracy not effected by interrupted cut

### Comparison of Single-Pass and Conventional Honing



### The Engis Single-Pass Process Spreads the Workload over a Series of High-Precision Electroplated Diamond Tools





## The Secret is Out!

Our unique Internal Float Tool has been designed by our engineering team to allow:

- Tools that follow the existing bore with minimal pressure, resulting in superior part quality
- Tools capable of improving bore straightness and removing bow
- Tools that finish both blind and through bores
- Tools for seating applications

The best results are achieved when utilizing a complete Engis Bore Finishing System, however, Engis tooling can also be successfully retrofit into CNC machining centers, given certain operating conditions and parameters are met.

## A Wide Range of Equipment for Manufacturers of Hydraulic Systems

Engis offers a standard machine platform for virtually every hydraulic finishing application which can be customized to meet your unique production and part quality requirements. This approach helps keep the initial capital investment low and within budget. Additionally, Engis has the capability to design automation and/or robotic parts handling systems, brushing stations and in-line post- and pre-gauging systems which can further reduce labor and inspection costs.

Engis also manufactures custom machines through its Specialty Series offering. Features such as multi-columns, extended stroke lengths, specialty gauging packages, auxiliary operations and independent spindles are possible.



### INDUSTRY:

Automotive, Off-Road

### MATERIAL:

Cast Iron

### PROBLEM:

Inconsistent bore geometry, high down-time, high perishable tool cost

### SOLUTION:

Engis Single-Pass Process

- Improved quality - Cpk > 1.67
- Improved bore size control to better than 2µm
- Production rate: 60 parts per hour
- Reduced tool cost to \$0.02 per part
- Quick change over for a large variety of part families
- Ability to finish both through and blind bore varieties in production

## CASE STUDY

### Small Production Machine 'SPM'



The SPM series of machines is designed to meet the needs of job shops for small to medium size parts. Available in 4, 6, 8 and 10 spindle models, these systems are primarily for bores up to 51mm (2") diameter.

### Large Performance Machine 'LPM'



The LPM series of machines is designed to meet the needs of job shops for medium to large size parts. Available in 4, 6 and 8 spindle models, these systems are primarily for bores up to 152mm (6") diameter.

### Three Axis Machine 'FPM-3X'



Manufacturers of large hydraulic valve bodies face a challenge aligning and finishing bores once the bodies have been stacked. The FPM-3X enables bore finishing after stacking of the valves, improving overall cylindricity and roundness.



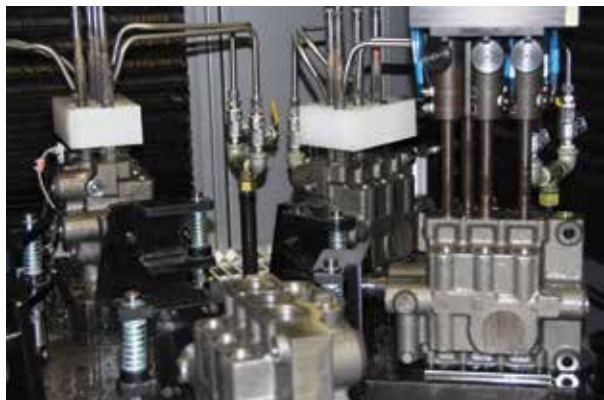
# Call 800.99.ENGIS

## Specialty Series Custom Machines

Specialty machines can be custom designed to finish all bores simultaneously for maximum productivity. Engis has extensive experience designing equipment from the ground up for even the most challenging applications.



- **Pre-Gauge Vision System** - confirms the correct number of holes are present and the part is loaded into the fixture correctly
- **Advanced Multi-Heads with 4 Spindles Per Head** - permits all 3 or 4 bores in a block to be finished simultaneously
- **Multiple Columns** - allows the rough, semi-finish and finishing operation to have completely independent programming for various speeds, feeds and stroke lengths
- **Advanced Post-Gauging with CNC Controlled Slide** - all 4 bores can have every land measured and documented in both the X and Y planes for superior bore qualification



Simultaneous precision finish and gauging of four bores in a hydraulic valve body

# Did You Know



## Single-Pass Reduces the Need for Match Grinding

To avoid potential leaking of the finished assembly and maximize performance of the hydraulic component, close mating of the spool and sleeve may require clearances of  $1.27\mu\text{m} - 0.508\mu\text{m}$  (.000050" - .000020"). This fit is often achieved by either 'Match Grinding' the spool to the finished sleeve or by skilled craftsmen who hand lap the sleeve to suit the mating spool.

The Engis Single-Pass process can eliminate additional manufacturing steps by achieving better Statistical Process Control on the sleeve to a single classification, achieving  $1\mu\text{m}$  with near perfect repeatability.

**RESULT – Save Time, Save Money . . .**

## Engis Hyprez® Systems for Lapping Hydraulic Seals, End Caps and Wear Plates


- Our lapping approach capitalizes on the cutting and polishing properties of diamond; the hardest substance known to man
- Diamond offers tremendous advantages over conventional lapping vehicles such as aluminum oxide or silicon carbide, reducing waste
- Engis designs and manufactures the complete system; machines, accessories and consumables and can demonstrate this capability in our Process Development Laboratory



# WHY CHOOSE ENGIS?

- We have over 30 years of focused experience in the development of Single-Pass technology, specifically for hydraulic applications.
- We will optimize your performance by offering custom solutions for even the most demanding hydraulic applications. Our team has engineered special tool designs targeted specifically for hydraulic applications, producing superior part roundness and straightness.
- Exclusive to Engis is our unique float design which, when combined with extended length sleeves with an ultra-precision cylindrical sizing area, allows users to reach previously unattainable bore geometries (roundness to under 0.2µm and cylindricity which is unmatched).
- Engis also has the ability to design special tooling for the finishing of seats, leading to higher precision and reduced leakage.
- Engis designs and manufactures your entire system in-house:
  - the machine tool
  - fixturing
  - precision diamond tooling
  - automation and accessories

This delivers the lowest cost per finished part in the industry. Our Process Development Lab works hand-in-hand with you to develop the optimum process prior to purchase, ensuring a successful installation when the Engis Bore Finishing System arrives on your shop floor.



**THE ENGIS GROUP OF COMPANIES**

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