eastec®

MAY 14-16, 2019

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eastec®

Optimizing CNC Machine Tooling and Increasing Productivity by 10-40%

Robbie McKee / Sales

JM PERFORMANCE PRODUCTS, INC.

The Industry Leader in Milling Machine Optimization

eastec®

Identifying and eliminating issues that are costing CNC milling manufacturers money in terms of time, tooling, and production.

Problems Associated with CNC Milling:

- Vibration
- Chatter
- Run-out
- Poor finishes
- Need to reduce depth of cuts
- Need to slow down
- Shortened tool life
- Higher power consumption
- Excessive spindle wear

A Closer Look at Milling Problems

Vibration and Chatter

- Caused by the inherent natural frequency of a cutting tool
- Creates surface finish problems
- Shortens tool life, especially carbide
- Increases wear and tear on the machine

A Closer Look at Milling Problems

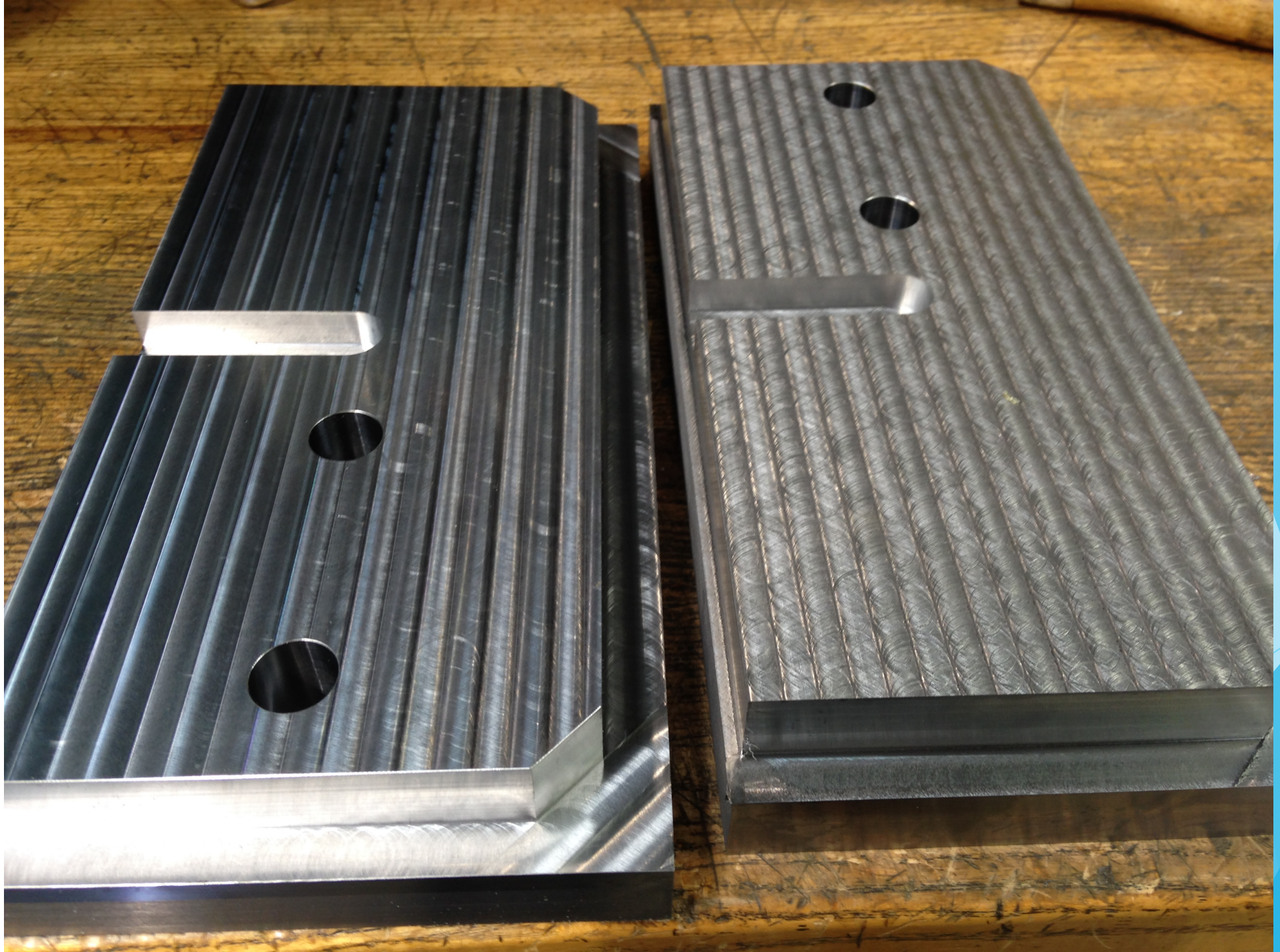
Runout

- Negatively impacts tool life, especially carbide tooling
- Causes poor surface finishes

A Closer Look at Milling Problems

Poor Finishes

- Require additional benching operations
- Adds to cycle times
- Compromise part quality
- Create scrap
- Delay deliveries
- Destroy perishable tooling



A Closer Look at Milling Problems

Shortened Tool Life

- Increased cycle times
- Increased costs per part
- Impacts ability to move to Lights Out manufacturing

Tooling Test & Cost Savings Results

Testing Parameters

Tool Data (New, Two identical):
Tool holder: Kennametal CV40EM100400
Insertable End Mill: Kennametal KIPR100AN162304CInserts: Kennametal ANGT16232PPER3LG Grade 725M

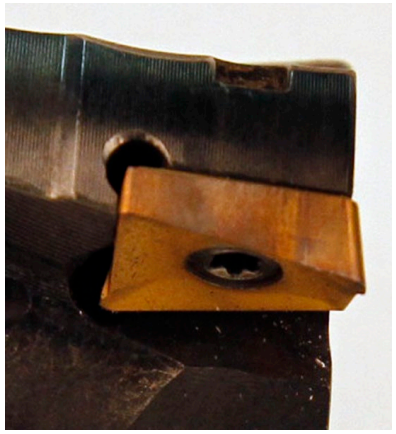
Material:
AISI 4142 pre heat treated Rc 35-40
Cutter: 1.0”
Depth of cut: .100
Radial engagement: .720
Surface feet per minute (SFM): 430
Revolutions per minute (RPM): 1643
Feed per tooth (IPT): .005
Feed per Revolutions (FPR): .015

Results

Standard Retention Knob

Setup failed at 93.4 cu in

High Torque Retention Knob



Setup failed at 356.7 cu in

At $25.13 per insert, the cost to remove 356.7 Cu In:	
$301.56	$75.19

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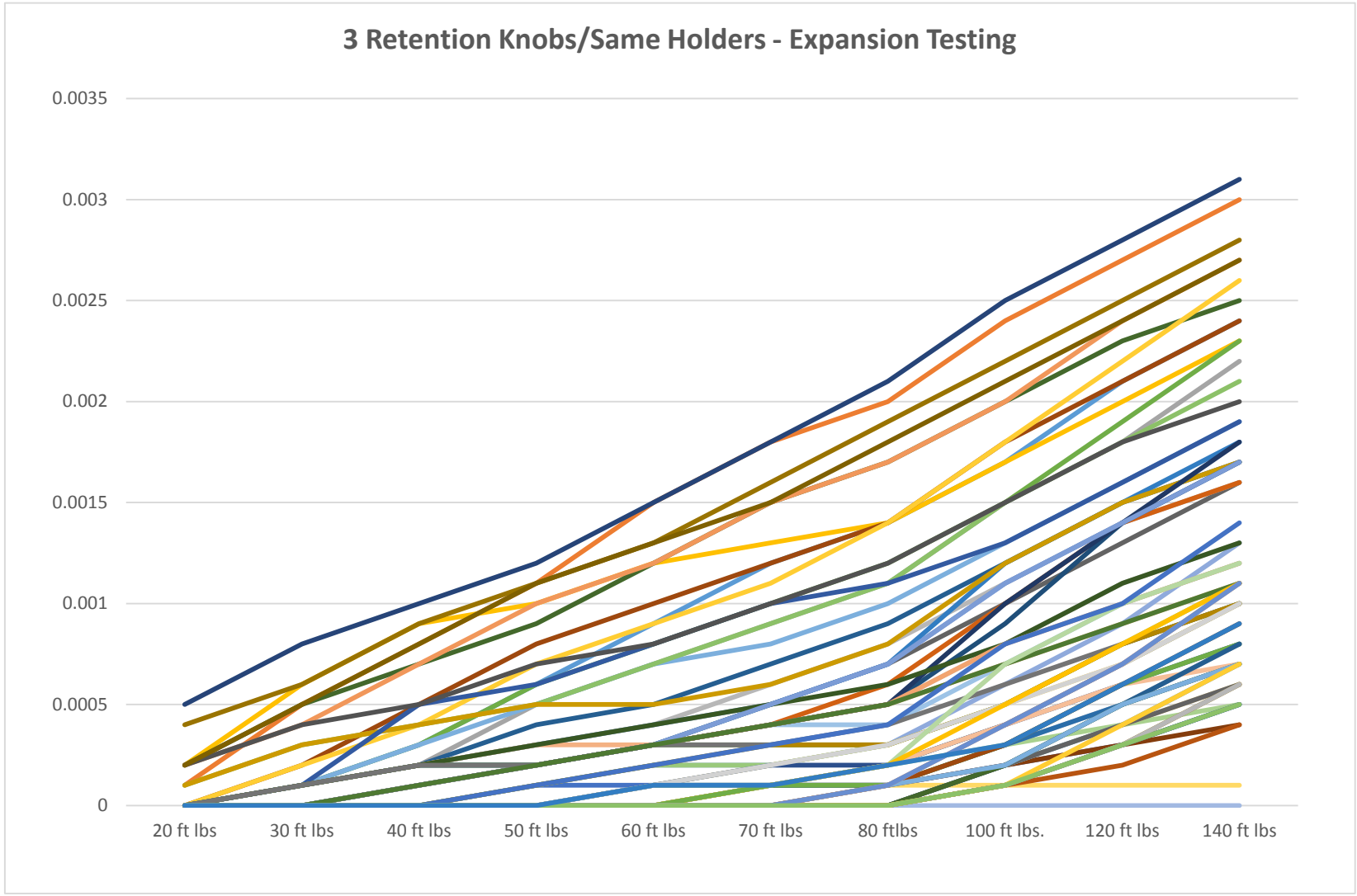
Causes of Poor Toolholder to Spindle Contact

- Dirt and debris on the spindle surface
- Dirt and debris on the toolholder surface
- Reduction in Draw Bar force
- **Toolholder expansion**


polishin


3 Retention Knobs/Same Holders - Expansion Testing
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
20 ft lbs
30 ft lbs
40 ft lbs
50 ft lbs
60 ft lbs
70 ft lbs
80 ftlbs
100 ft lbs.
120 ft lbs
140 ft lbs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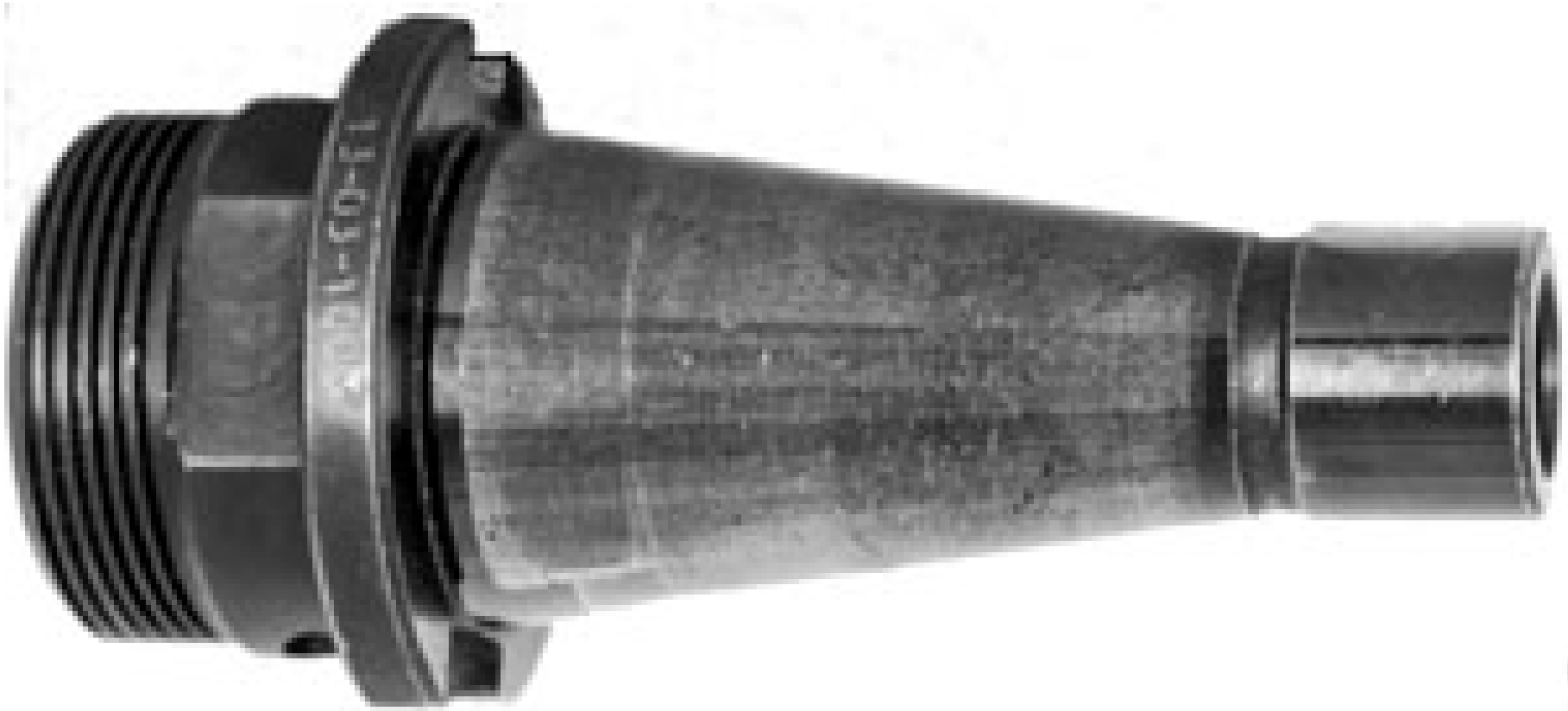
Toolholder expansion

NMTB Holder



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Depth of Cut .100
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SFM 430
RPM 1643
Feed Per Tooth (IPT) .005
Feed Per Revolution (FPR) .015

Tool Data

Toolholder Kennametal
CV40EM100400
Kennametal Insertable End Mill
KIPR100AN162304C
Inserts Grade 725M
ANTGT16232PPER3LG

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Tool Life Increased 3.82 Times

Retention Knob JM31226HT

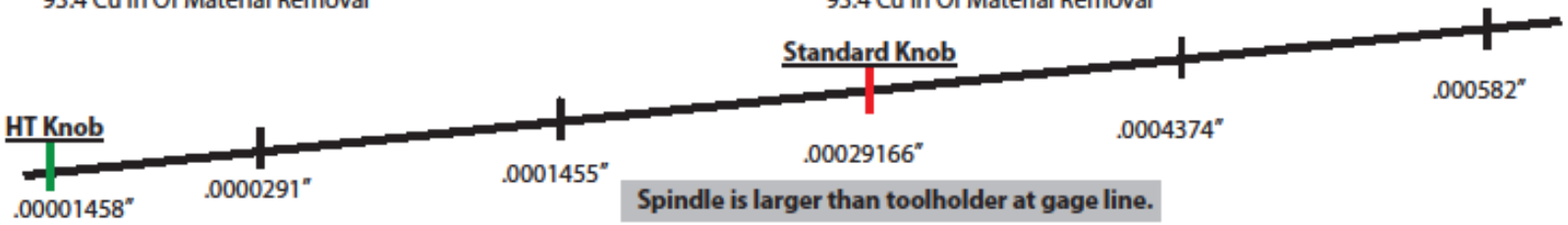
Total Removal Before Tool Failure 315.3 Cu in
Axial Movement .00005"
Diameter Increase At Gage Line
.00001458"

Observed Insert Wear After
93.4 Cu in Of Material Removal

Retention Knob Command RC4E-0002

Total Removal Before Tool Failure 93.4 Cu in
Axial Movement .0010"
Diameter Increase At Gage Line
.00029166"

Observed Insert Wear After
93.4 Cu in Of Material Removal



Spindle is larger than toolholder at gage line.

Distance Short Of Full Engagement In Spindle.

Enter number of milling machines	1
Enter the number of hours worked a day	8
Enter number of days per week your mills run	5
Enter your hourly rate charged per milling machine	$100
Enter average monthly cost of tooling per milling machine	$1,000
Enter the hourly rate of the set-up person	$25
Enter number of hours per week setting up milling	5
Number of retention knobs used per machine	30
Price each - High Torque Retention knobs	$30.00

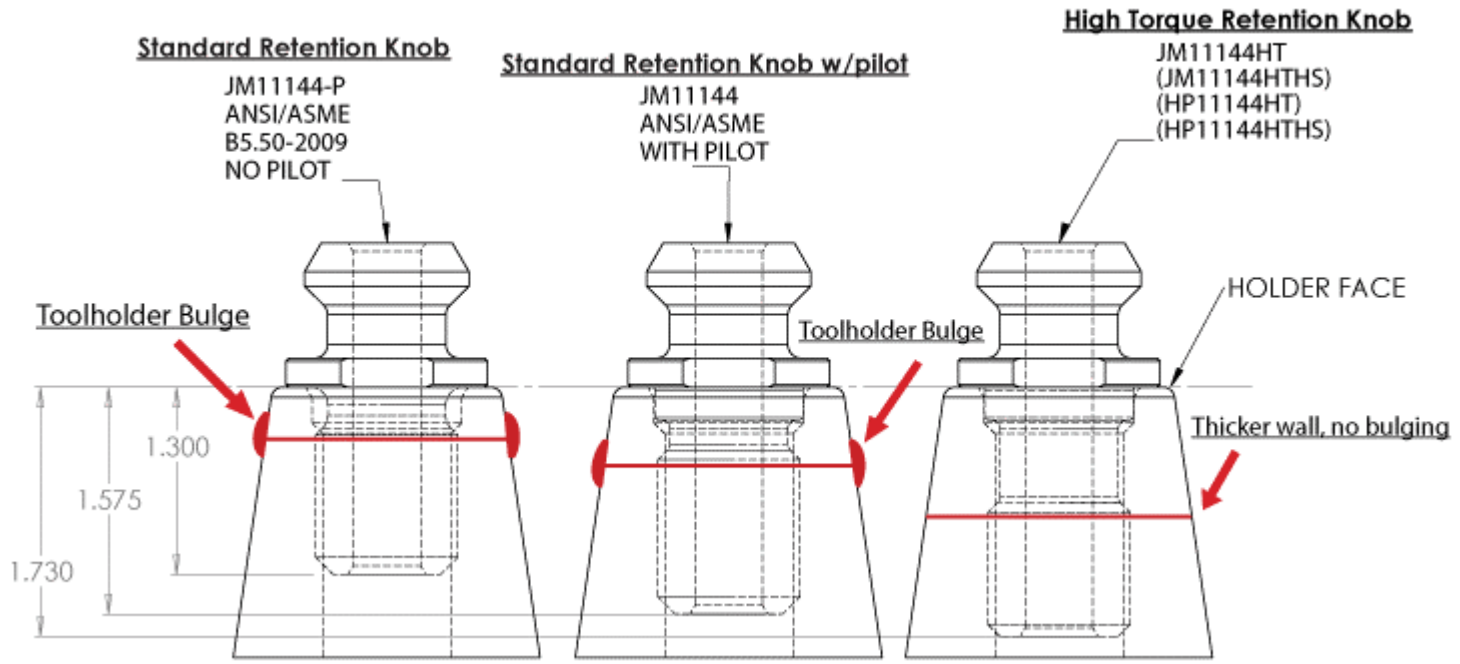
Savings Increase	10%
Increase Revenue	$20,800
Tooling Savings	$1,200
Setup Savings	$650
Total Increase	$22,650

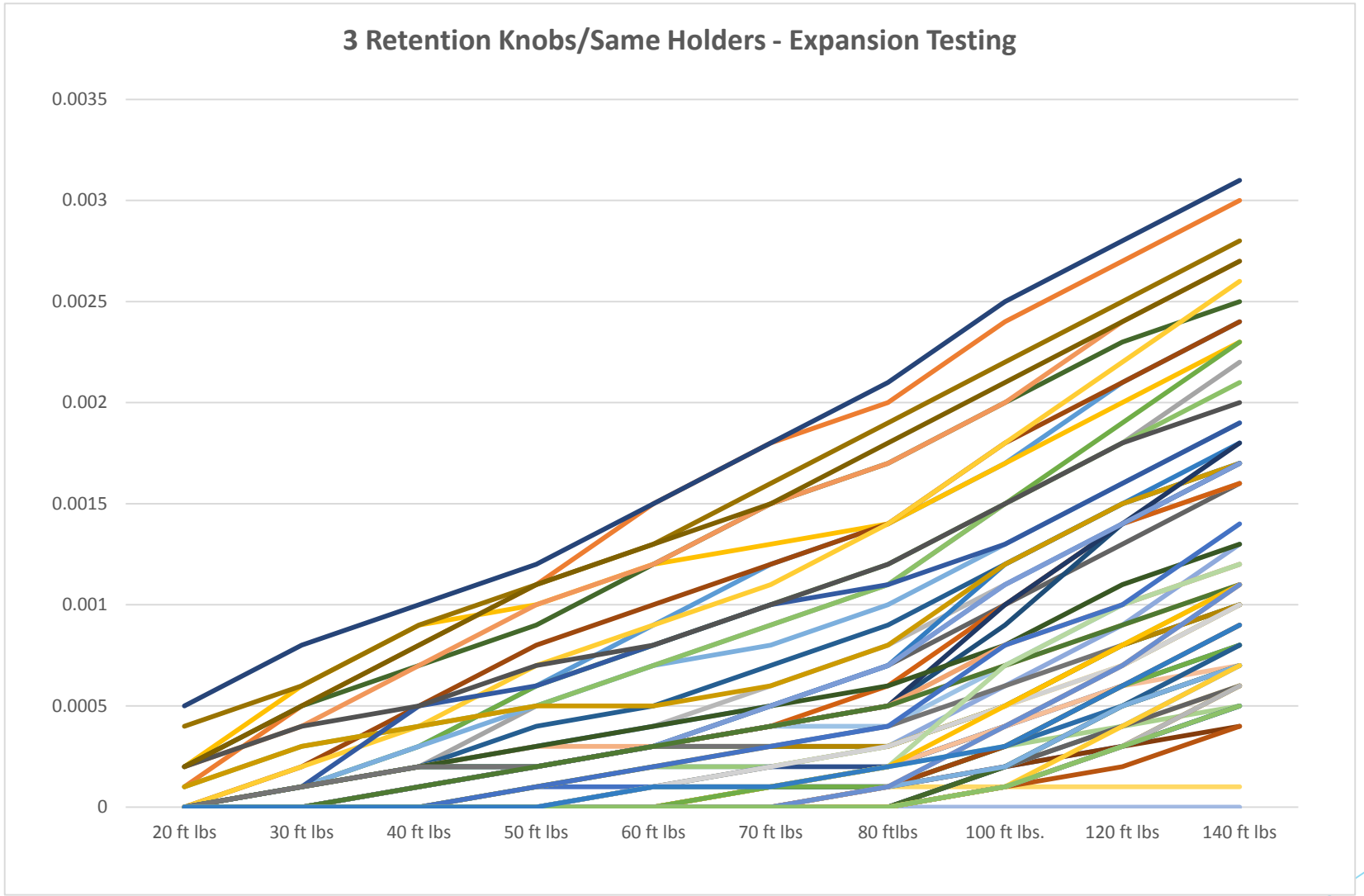
Excerpt from JM Performance Products ROI Calculator

High Torque Retention Knobs – Correcting the Flaw

- Modifications to the standard retention knob design to eliminate toolholder expansion:
- Precision Pilot
- Relief beneath the pilot forces the threads deeper into the toolholder where the cross-section of steel is thicker.
- Threads are cut to start and finish 180° from each other
- Eliminated any non-mechanically beneficial threads
- The mass of the knob is dynamically balanced by design
- Calculated tightening specifications based on the size of the taper and the draw bar force of the machine.

Standard Retention Knobs vs. High Torque Retention Knobs

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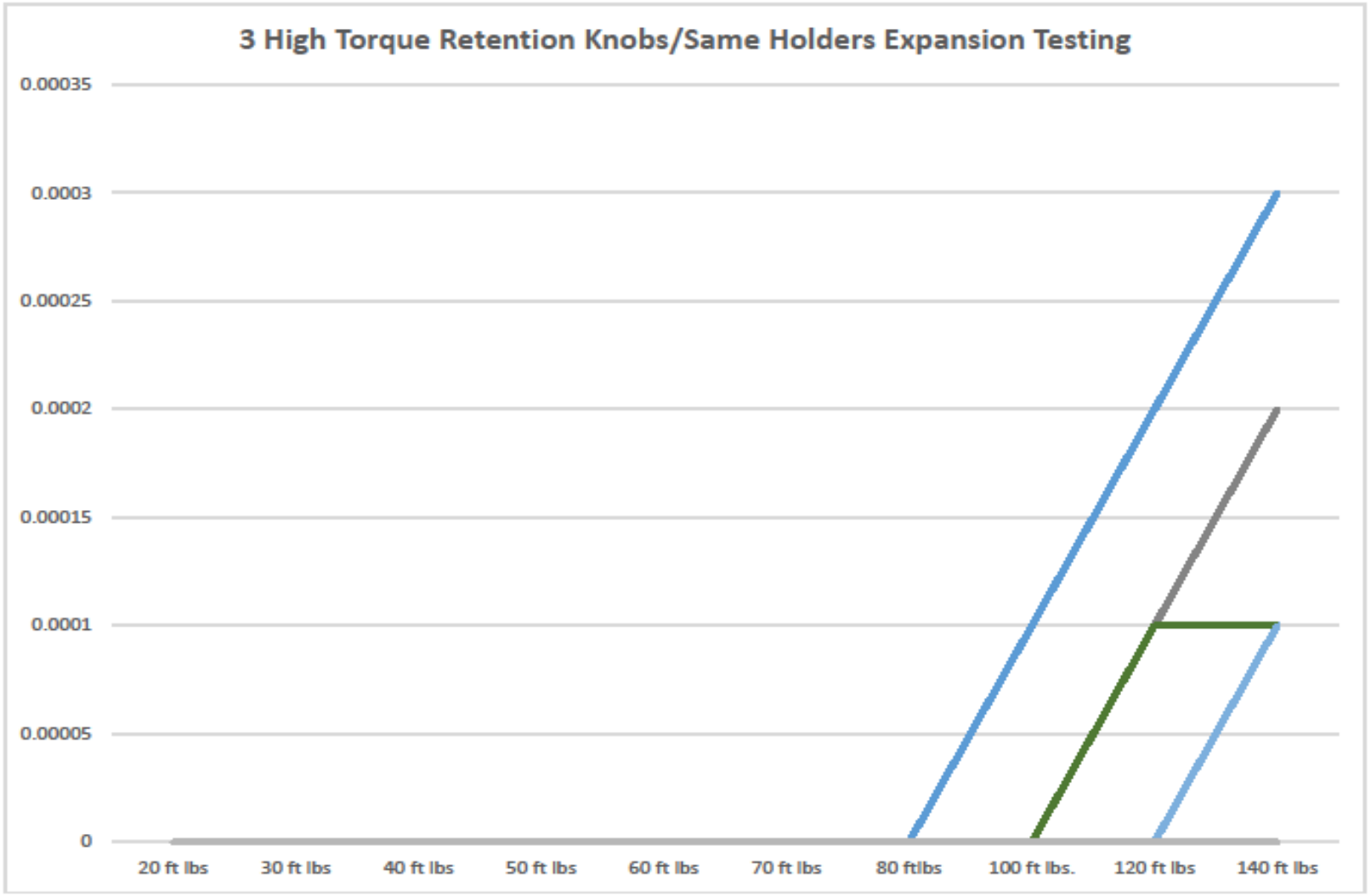
3 High Torque Retention Knobs/Same Holders Expansion Testing
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0.00025
0.0002
0.00015
0.0001
0.00005
0
20 ft lbs
30 ft lbs
40 ft lbs
50 ft lbs
60 ft lbs
70 ft lbs
80 ftlbs
100 ft lbs.
120 ft lbs
140 ft lbs

Customer Feedback

Customer: Evolution Gun Works,

Quakertown, PA

Target: Avoid chatter and improve surface finishes

Steve Seaman, CNC Shop Foreman: “The knobs were easy to use and we saw the effect instantly. We would run an end mill and have chatter, then change to the High Torque retention knobs with the same lot of material, same coolant, on the same machine, then no chatter-impressive! The resulting surfaces are now consistently smooth with no imperfections.”

HANSEN ENGINEERING COMPANY

Harbor City, CA

Target: Increase productivity and decrease machine load

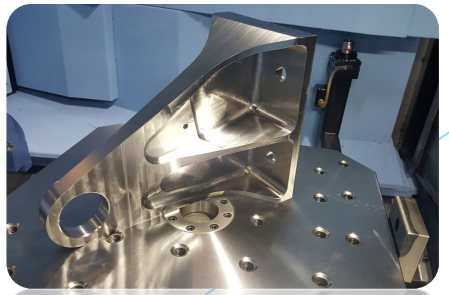
- Replacing standard knobs with High Torque knobs yielded 15% increase in productivity and decrease in downtime respectively
- Noticed lower spindle loads, which is better for the machine
- Reported a 5% spindle load decrease using a 3.0” hi-feed insert mill running titanium
- When roughing titanium and stainless steel with the new knobs, they recorded a significant reduction in power consumption and overall tool life was improved

DELTA MACHINE CO.

Precision CNC Machining Since 1980

- Increased tool life in titanium from $2^{1/2}$ hours to just under 5 hours
- Improved cycle time:
  - Part 1: 5 hours 54 minutes compared to 12 hours originally
  - Part 2: 11 hour cycle time compared to 19 hours originally

Tooling and mills are performing the way they're designed to perform: efficiently, cost effectively, and precisely



Customer: Enterprise Welding and Fabricating, Inc.

Mentor, OH

Target: Eliminate the bulge in toolholders (aka resolve toolholder expansion)

Bob Ludwig, Manufacturing Engineer – “These were new machine investments, and the previous knobs and toolholders we used had bulged in the past, so we didn’t want to go down that path again. The assembly was simple, and we’ve used the knobs for over 6 months with high efficiency and no problems.”

Customer: Olson Custom Designs

Pittsboro, IN

Target: Improve finishes and cycle times

Mitch Olson, Owner – “We’ve got the machines to handle nearly any material and run size, and any complexity so the job will be done right every time. There’s a lot of money invested in the tooling and JMPP’s knobs provide better overall finishes, require less hours, and shorter runs for us as a job shop.”

“We will often machine exotic alloys and harder metals like titanium and stainless steel. We won’t skimp out on tooling or workholding. JMPP’s knobs are critical to the process, helping ensure quality feeds, speeds and finishes.”

Proper Installation, Handling, Inspection, Life Expectancy of Retention Knobs

1 shift - 3 years
2 shifts - 2 years
3 shifts - 1 year

Customer: CapTherm Systems, Inc.

Target: Improve machine performance, wear patterns and tool life

Timo Minx – “During the troubleshooting of wear patterns on our Cat 40 toolholders we started analyzing spindle and toolholder runout. We had always been torqueing pull studs and collets and were very concerned about the poor performance of our machine. After having switched to JM’s High Torque retention knobs, the problem completely disappeared. We switched all of our toolholders over to HT pull studs and now consistently achieve perfect wear patterns on our tools. Using Haas Advanced Tool Management we tracked tool life, and this improved from around 8 hours to 10 hours on a ½” carbide endmill.

Customer: Briney Tooling Systems

Target: Better finishes, less bench time

Justin London, Sales Engineer – “Like most people I was skeptical that the change from a standard retention knob to JM’s new high torque style would have much, if any, improvement on our tool holding. When we received the test knob in plant, it was used on our toughest machining application: high speed surfacing on hardened YXR33 material at 50 Rc. The initial visual look at the part, after the cycle, showed that nothing really seemed different. We did not see the real difference the knob made until our operator began to hand polish the part to the required surface finish. This process was taking 28 minutes per part, and after switching to the High Torque knob it only took the operator 2 minutes to polish the part into the correct surface finish (8 micro). That was an immediate savings of 26 minutes per part. This reason alone was enough to switch over all of our milling centers to High Torque Retention Knobs.”

Customer: Jergens Industrial Sales

Target: Improve tool life

Mark Politi, Sales – I have a customer that cuts aluminum and keeps track of tool life by hours. They switched a CAT 40 holder on their Haas VF2 machine from a standard retention knob to JM's High Torque JM31514HT and tightened as recommended. Tool life on an 1/8" diameter mill at same speeds and feeds went from 6 hours to 8 hours. Customer is very happy with results and want to order 20 more knobs." - 30% increase in tool life

Customer: Northwest Machine Technologies (distributor)

Target: Improve tool life, tool runout

Lee Knowlton, Sales Manager – “A local customer purchased a new 5 axis Mazak vertical mill for high tolerance stainless and aluminum machining. They are always concerned about tool runout for part finishes, tool life, and machined feature tolerances. Most of their tools are also small diameter to as little runout as possible is critical…With a conventional quality retention knob the tool runout on the taper of a higher quality ER collet chuck was .0003” to .0004”. Using the JM High Torque knob it is consistently .00015” to .0002”.”

Customer: Carlstrom and Associates

Target: Achieve accurate boring results without multiple passes

Dan Carlstrom, Owner - “The customer was having a problem holding size on a component, so they had to take multiple boring passes and then do a final reaming pass to get this hole to size. When they used the High Torque retention knob on the toolholder, the boring tool was able to cut the hole to size, in tolerance, in one pass.”

Date	5/24/2011
Customer	Natural gas compressor mfr
State	Ohio
Component	Compressor piston
Material	Ductile iron - 00-240 Bhn
Operation	6-3/4" diameter x 14-3/4" bore depth line bore
Requirement/problem	Eliminate waviness in finish
Machine	Okuma VTM-80Y
Through coolant	Yes - semi-syn - chipblaster - 1000psi
Retention knob used	JM36145HT
Current bar used	Seco steel finishing bar - 43.1 lbs.
Wohlhaupter bar used	565049 Digital balanced - 26.1 lbs.
Current insert used	CCGT 32.51 Walter high positive TicN
Wohlhaupter Insert used	CCGW 21.51 N34 CBN
Current cutting data	240SFM @ .004FPR
Wohlhaupter cutting data	1000SFM @ .005FPR
Results	Finish consistent, waviness eliminated; Balanced tool cut to within .0001 of what it was set to both back and front of bores

Customer	Tool and die mfr.
State	Kentucky
Component	AR15 upper receiver
Material	T7075 aluminum
Operation	1.1005 x 8" deep bore with interruptions
Requirement/problem	Eliminate centerline drift caused by drilling operation while maintaining cycle time
Machine	Haas VC3
Through coolant	Yes - semi-synthetic
Retention knob used	JM31114HT
Current bar used	Seco
Wohlhaupter bar used	365031 balanced finish boring tool with 299003 carbide shank
Current insert used	Seco
Wohlhaupter Insert used	CCGW 21.50 N34 PCD
Current cutting data	800SFM @ .004FPR
Wohlhaupter cutting data	2500SFM @ .0025FPR
Results	Took .150 total DOC in one pass and held .0001 consistently while eliminating two intermediate boring passes and reducing cycle time by 65%.

Date	11/15/2010
Customer	Vacuum mold mfr.
State	Ohio
Component	Vacuum mold guide bushing bore
Material	A36
Operation	3.00" x 6.5" bore
Requirement/problem	Reduce cycle time by eliminating intermediate boring passes
Machine	Toshiba 110R16
Through coolant	Yes - semi-syntetic
Retention knob used	JM31118BHT
Current bar used	Parlec
Wohlhaupter bar used	404008 CombiLine
Current insert used	Kennametal
Wohlhaupter Insert used	097862 WHT10 cermet
Current cutting data	400SFM @ .004FPR
Wohlhaupter cutting data	750SFM @ .005FPR
Results	Completed 6- bores holding .0001 total tolerance; finish is fantastic; reduced cycle time from 30 minutes to 6 minutes.

Date	11/15/2010
Customer	Mining equipment mfr.
State	Pennsylvania
Component	Electrical case
Material	A36
Operation	2.500" x 8.00" gage length
Requirement/problem	Reduce cycle time by eliminating intermediate boring passes
Machine	Mazak H800
Through coolant	Yes - semi-syntetic
Retention knob used	JM11144HT
Current bar used	Kaiser
Wohlhaupter bar used	404008 CombiLine
Current insert used	Iscar
Wohlhaupter Insert used	097862 WHT10 cermet
Current cutting data	450SFM @ .004FPR
Wohlhaupter cutting data	750SFM @ .006FPR
Results	Held .0002 tolerance on all bores, improved hole roundness and finish; reduced cycle time by 55%

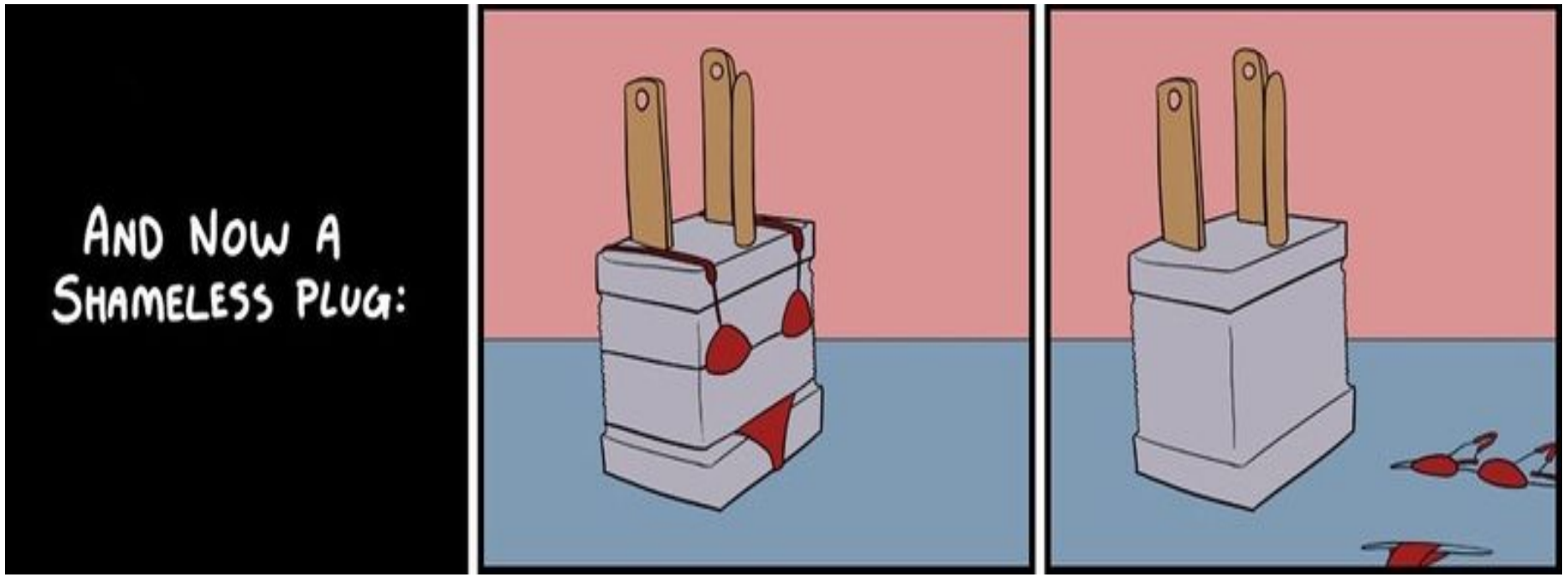
Date	10/22/2010
Customer	Generator engine mfr.
State	Indiana
Component	Connecting rod pin bore
Material	Bronze
Operation	75mm diameter x 68mm deep bore
Requirement/problem	Simplify setting process while maintaining tool life and finish requirements
Machine	Mazak Integrex
Through coolant	Yes - semi-syntetic
Retention knob used	JM31275HT
Current bar used	Kennametal Romicron
Wohlhaupter bar used	565045 Digital balanced
Current insert used	RCMA 43 PCD
Wohlhaupter Insert used	CCGW 32.52 PCD
Current cutting data	3000SFM @ 100mm/MIN
Wohlhaupter cutting data	same
Results	Tool cut exactly to adjustment made; unable to achieve .25Ra finish they're getting with round insert; closest we could come was .291; did prove accuracy and repeatability of tool though.

Medical Device Manufacturer

- **Investment:** $110,000
- **Return:**
  - 40% increase in feed rates
  - 20% more parts
  - 15% - 25% longer tool life
- $20.6 million in annual production
- Funding for facilities expansion

Benefits Beyond Tool Life and Production Increase:

- Improved tolerances
- Improved finishes
- Reduced bench time for finishing and polishing
- Better Operator efficiencies
- Reduced scrap
- Reduced machine maintenance down-time
- Reduction of overtime
- Reduction/elimination of custom tooling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