



Design and Optimization of metal forging processes including the use of hydraulic cushion systems

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Design and Optimization of metal forging processes including the use of hydraulic cushion systems

Introduction

Examples of innovation in production by using cushion systems

*Shock Absorber
Claw pole
Part with splines
Special part produced with cushion system*

Examples of innovative approaches

*Production of a rotor from bar.
Production of the rotor from sheet metal*

Example of innovation by applying "unusual" processes

Brake Piston

Tool life improvement

*Valve Tappet
Six Lobe screw*

Conclusion



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Markets have become more and more demanding

Necessity to reduce production costs to win new orders and of continuous improvement of production to meet decreasing product prices

Flexibility in using the existing equipment is essential instead of big investments in new machinery that is difficult to justify and cannot be implemented quickly.

These requirements drive engineers to new efforts.

Creative ideas and innovation is vital. New ideas to develop more sophisticated processes and tooling are needed.

This presentation will show examples of how innovative engineering can meet these challenges. All examples are real industrial production cases.

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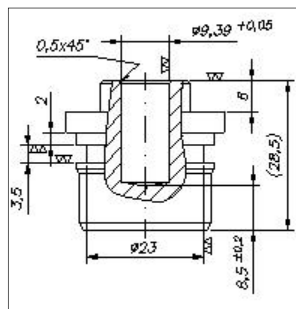
Six Lobe screw

Conclusion

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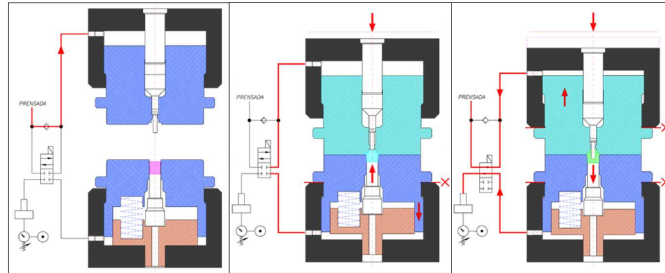
Examples of innovation in production by using cushion systems

Shock Absorber



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Examples of innovation in production by using cushion systems
Shock Absorber

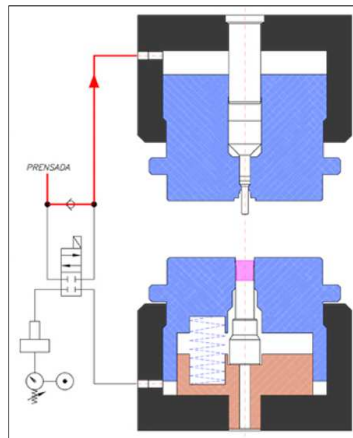


Function of the cushion system

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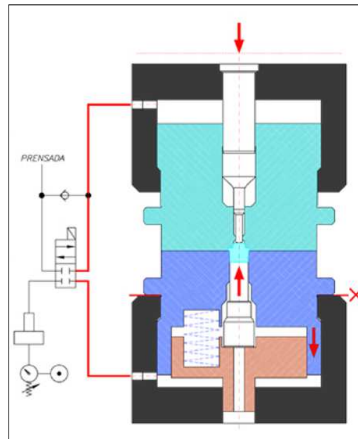


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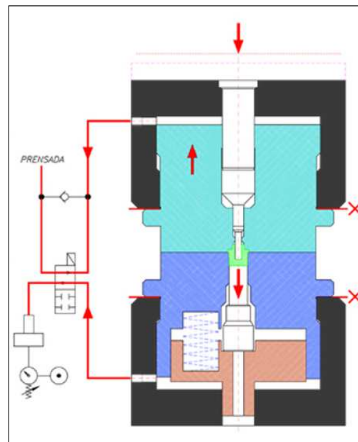
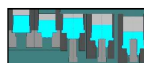


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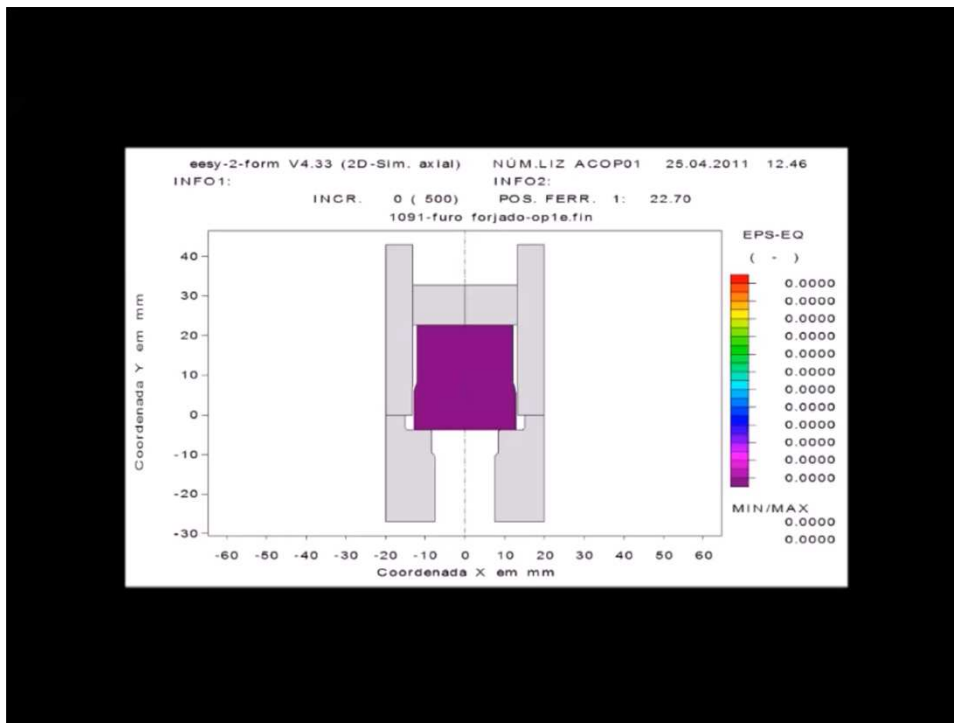
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Examples of innovation in production by using cushion systems

Shock Absorber



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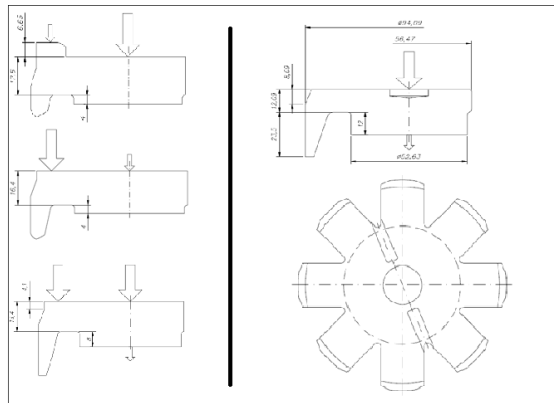
Six Lobe screw

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Claw pole



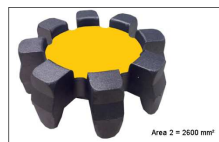
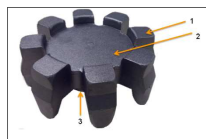
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Examples of innovation in production by using cushion systems

Claw pole



Calculation of the relevant contact areas

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Examples of innovation in production by using cushion systems

Claw pole



Cut off

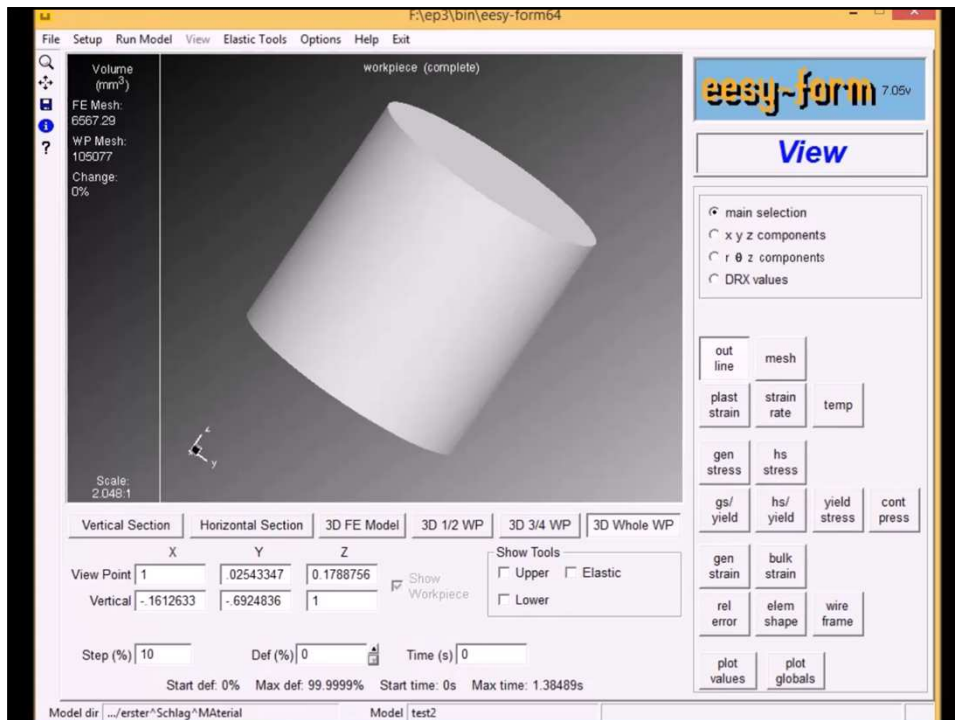


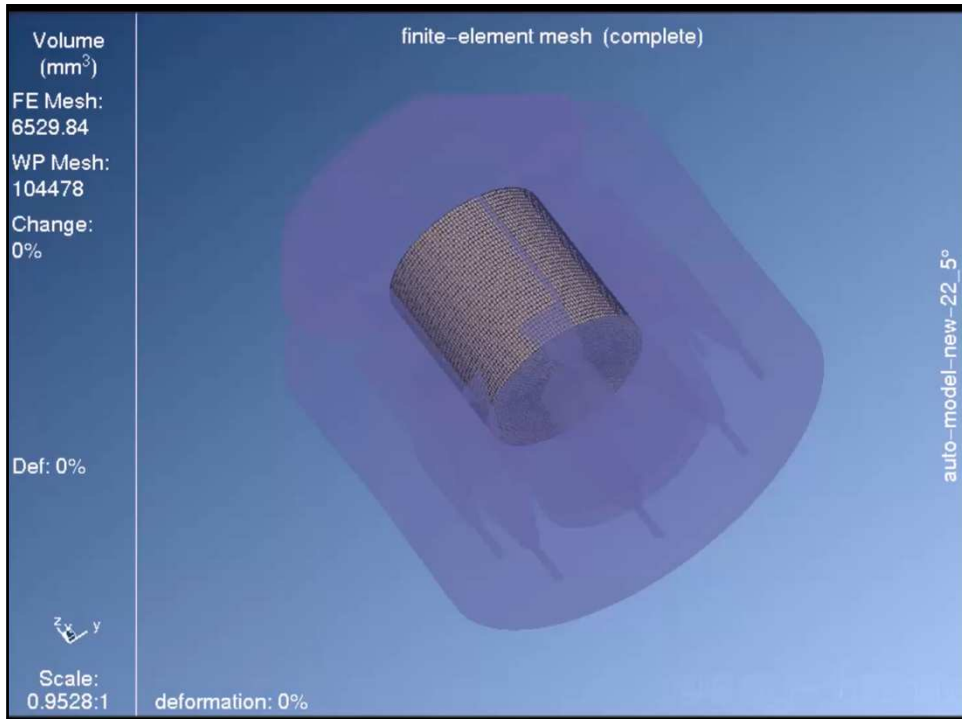
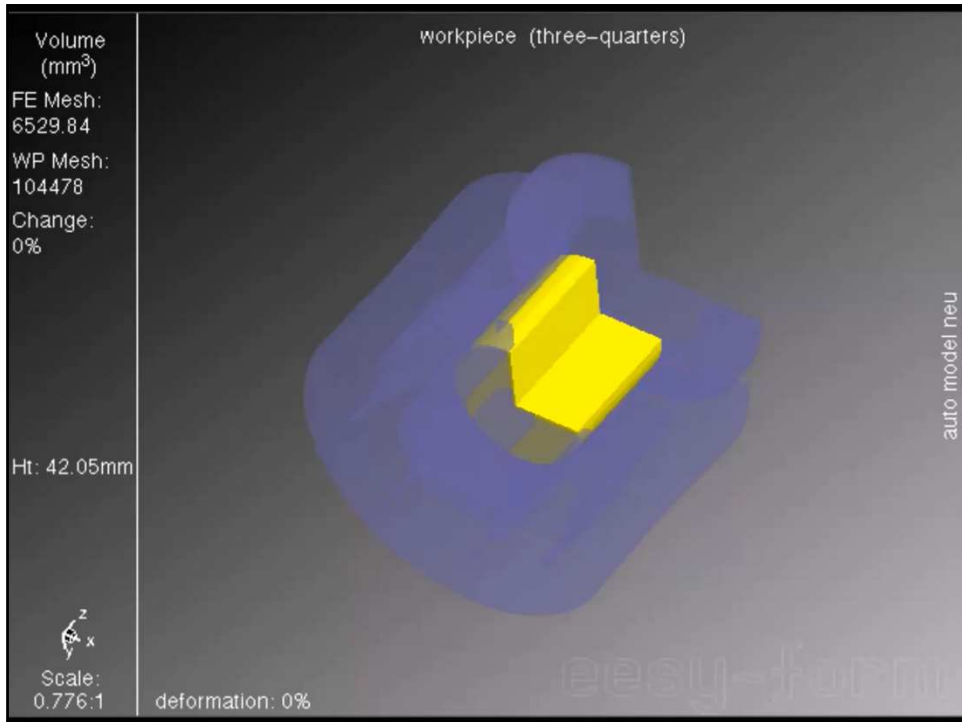
1. Op warm 600°C

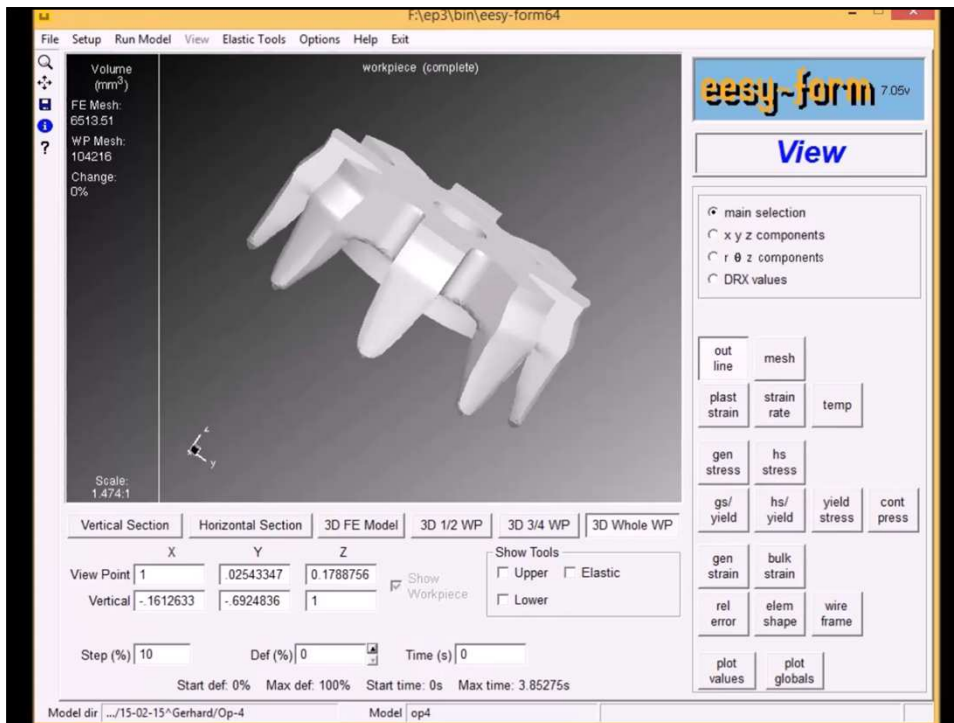


2. Op cold calibration

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Six Lobe screw

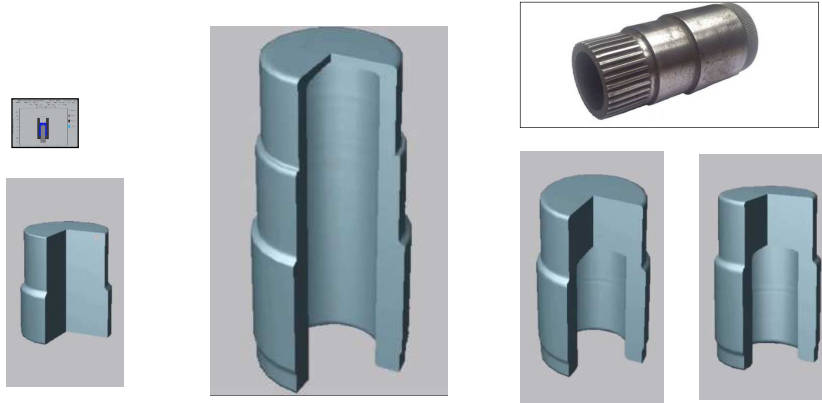
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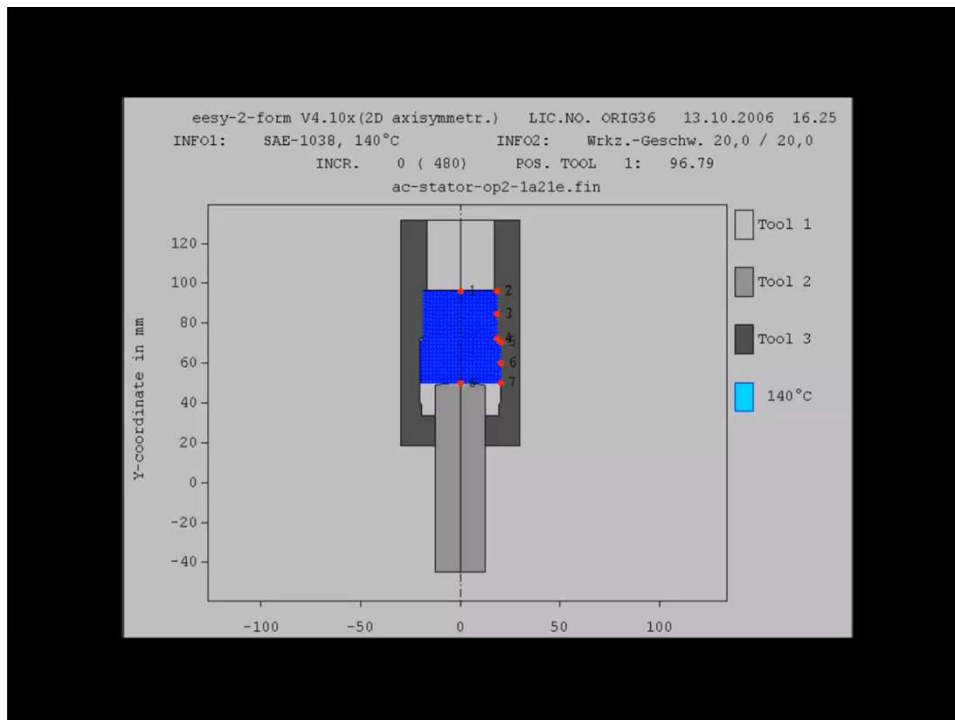
Examples of innovation in production by using cushion systems

Part with splines



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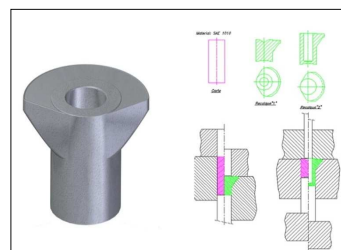
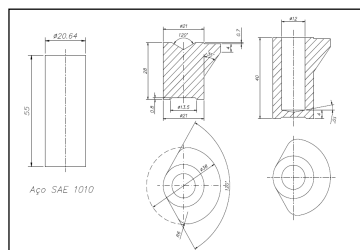
Six Lobe screw

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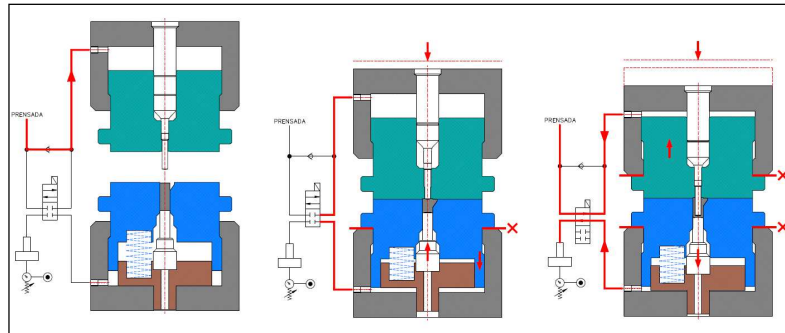
Examples of innovation in production by using cushion systems

Special part produced with cushion system



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Examples of innovation in production by using cushion systems
Special part produced with cushion system



Principle of the cushion system

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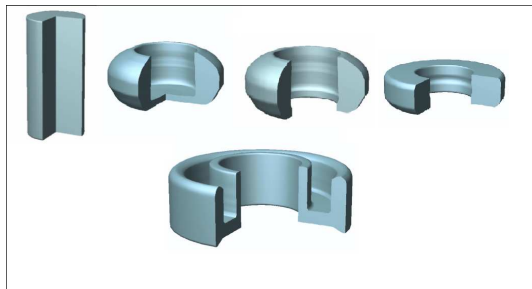
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Design and Optimization of metal forging processes including the use of hydraulic cushion systems

Examples of innovative approaches

Production of a rotor from bar.



four stage
progression

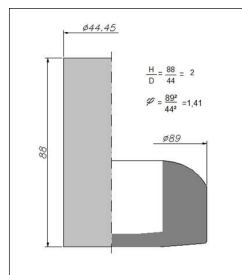
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Examples of innovative approaches

Production of a rotor from bar.



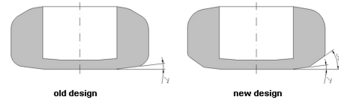
Production
problem in
first operation
-initial design

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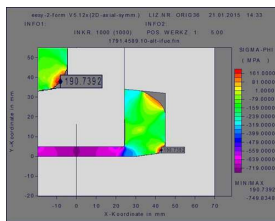
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Examples of innovative approaches
Production of a rotor from bar.

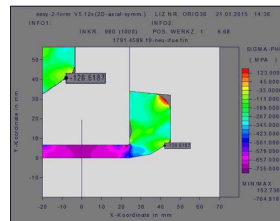


Design change
first stage



old design

stress analysis

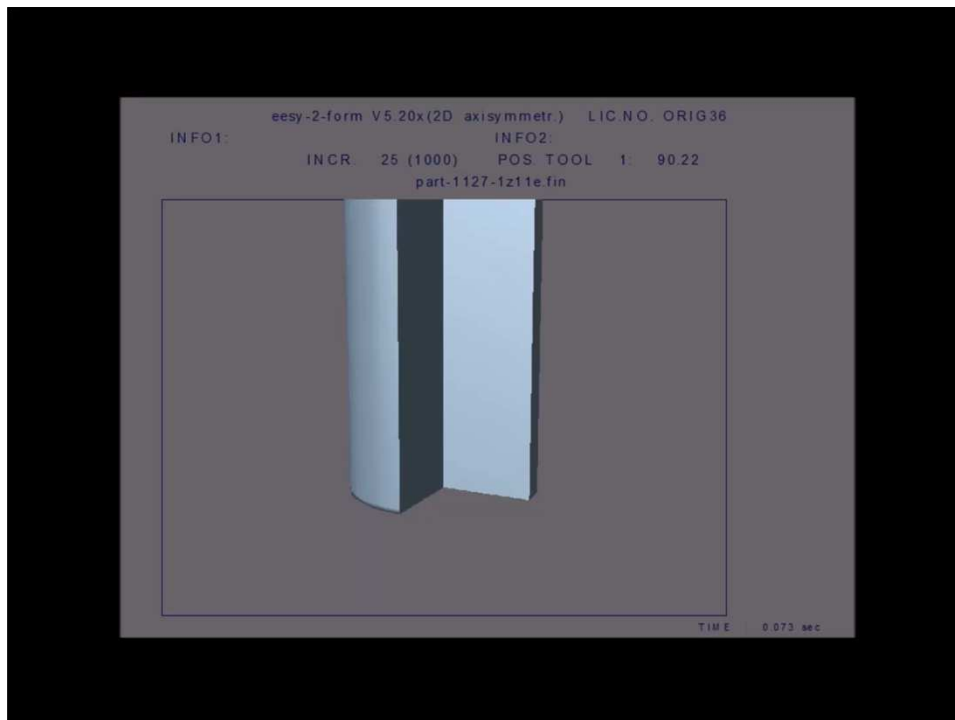


new design



First stage new design

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Tool life improvement

Valve Tappet

Six Lobe screw

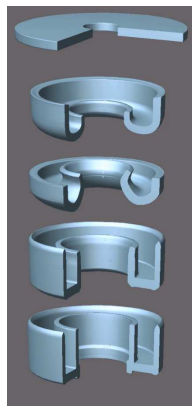
Conclusion



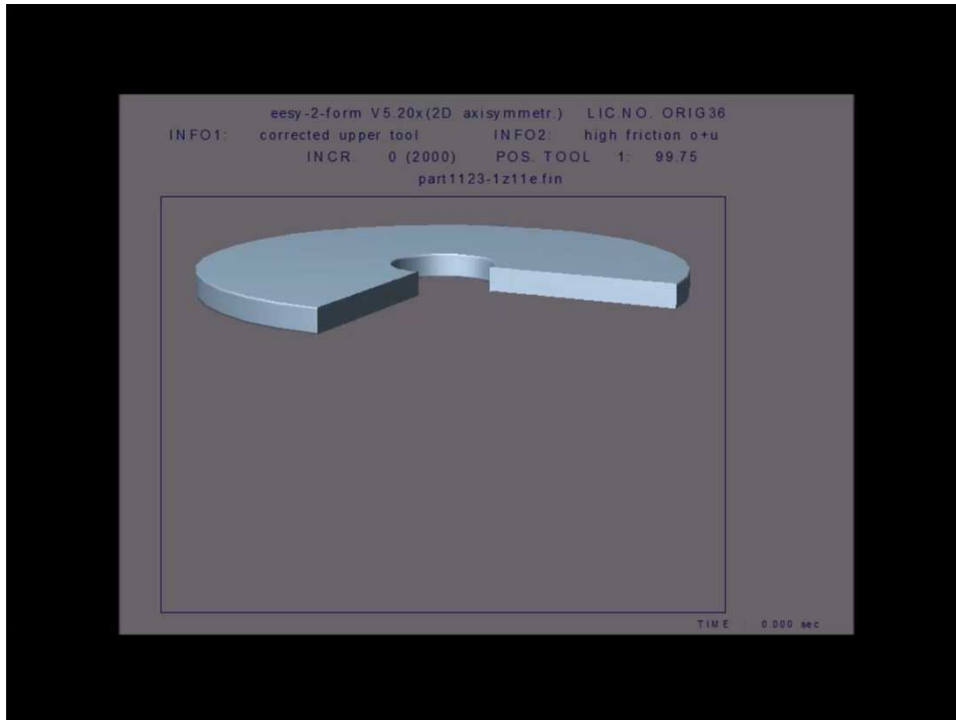
Design and Optimization of metal forging processes including the use of hydraulic cushion systems

Examples of innovative approaches

Production of the rotor from sheet metal



Alternative production of the rotor
from sheet metal



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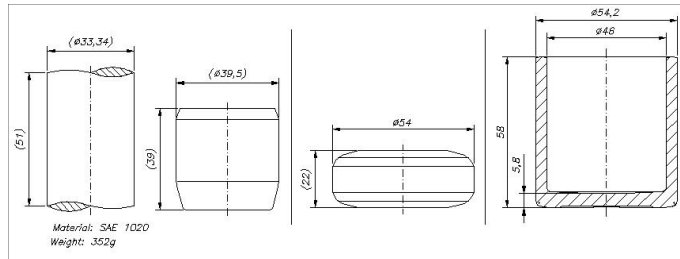
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Six Lobe screw

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Example of innovation by applying "unusual" processes
Brake Piston



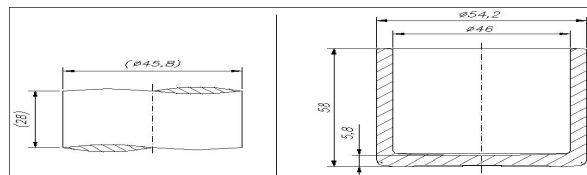
Conventional production sequence using backward extrusion

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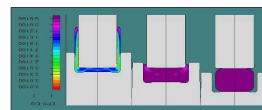
Design and Optimization of metal forging processes including the use of hydraulic cushion systems

Example of innovation by applying "unusual" processes
Brake Piston



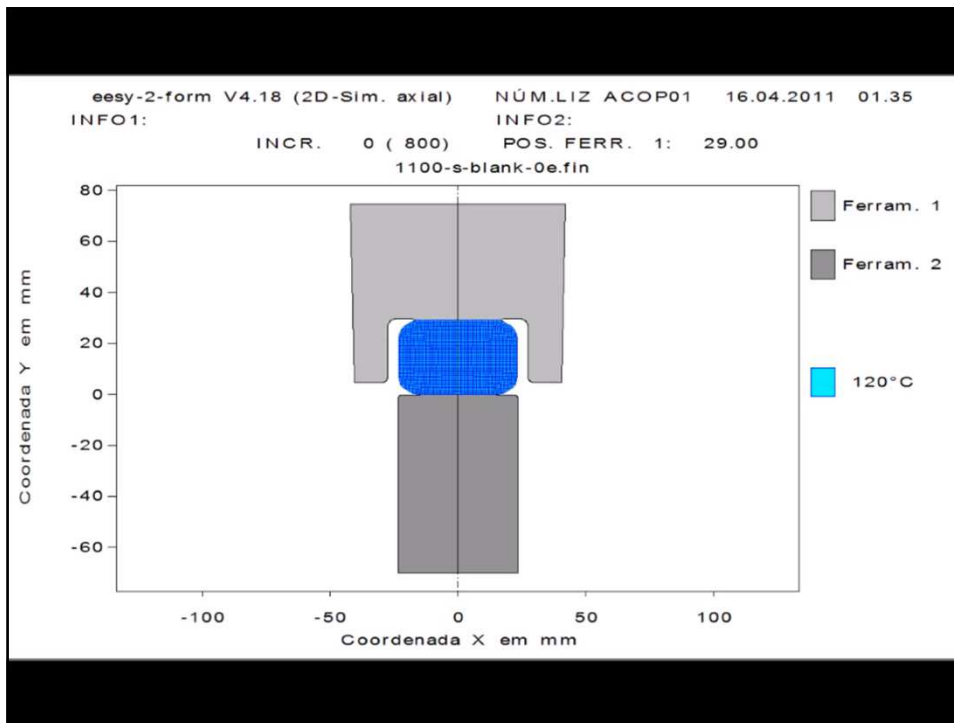
Conventional backward extrusion

Load ~ 450 to



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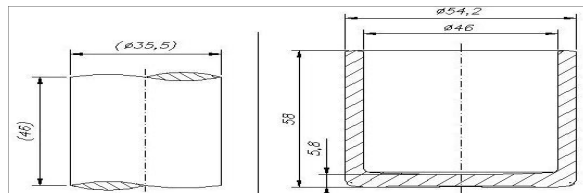
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Design and Optimization of metal forging processes including the use of hydraulic cushion systems

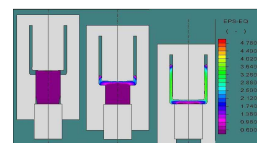
Example of innovation by applying "unusual" processes

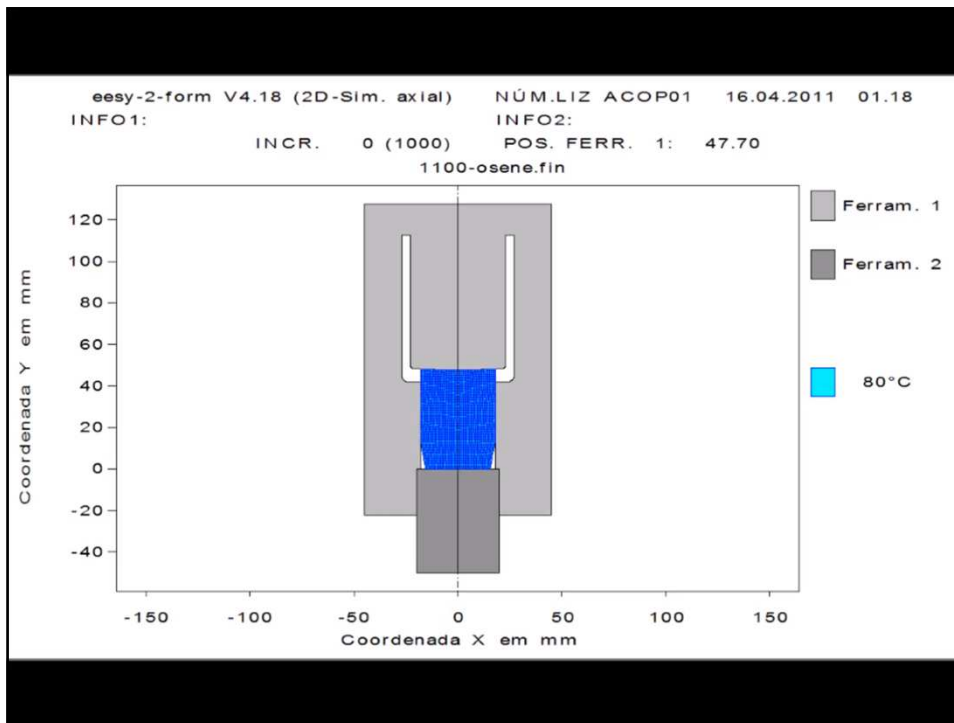
Brake Piston



"Osen" process

Load ~ 180 to





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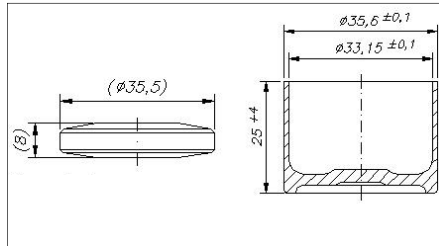
Valve Tappet

Six Lobe screw

Conclusion

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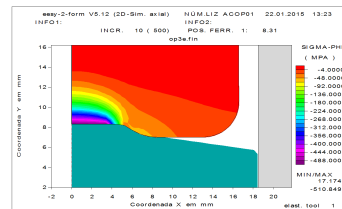
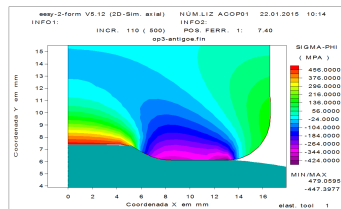
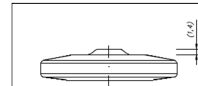
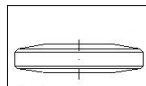
Tool life improvement
Valve Tappet



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Tool life improvement
Valve Tappet



Stress analysis old and new preform – tangential stress

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Design and Optimization of metal forging processes including the use of hydraulic cushion systems

Tool life improvement
Valve Tappet

Punches	pieces	average tool life
104	1.723.626	16.573

Operação	Descrição	Data	Data	quantidade	vida
furo	1112	entrada	Saída	produzida	média
		05/01/2013	22/01/2013	1	308862
		23/01/2013	01/02/2013	1	159514
		02/02/2013	07/02/2013	1	159009
		08/02/2013	25/02/2013	1	310984
		26/02/2013	06/03/2013	1	82310
		07/03/2013	14/03/2013	1	249464
		02/04/2013	05/04/2013	1	109904
		06/04/2013	11/04/2013	1	117252
		12/04/2013	16/04/2013	1	147344
		19/04/2013	24/04/2013	1	127711
		25/04/2013	26/04/2013	1	149130
		27/04/2013	03/06/2013	1	712489
		04/06/2013	20/06/2013	1	361138
		21/06/2013	30/06/2013	1	123517
Total				14	3.116.627
					222.616

Tool life improvement:
initial: 16573pieces/tool optimized:222616 pieces/tool
New tool cost < 8% of the initial costs

222.616

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Examples of innovative approaches

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Example of innovation by applying "unusual" processes

- Brake Piston*

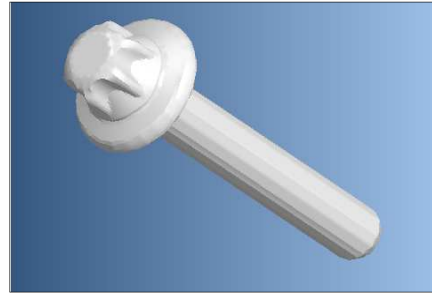
Tool life improvement

- Valve Tappet*
- Six Lobe screw***

Conclusion

Design and Optimization of metal forging processes including the use of hydraulic cushion systems

Tool life improvement
Six Lobe screw

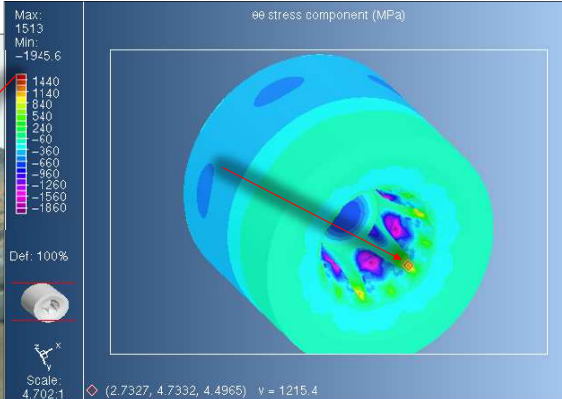
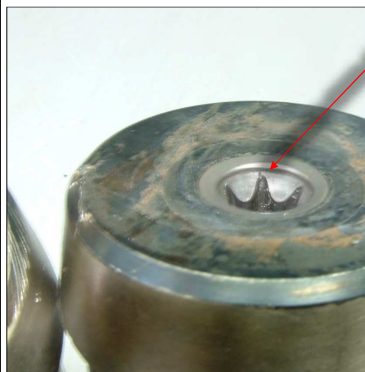


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Design and Optimization of metal forging processes including the use of hydraulic cushion systems

Tool life improvement
Six Lobe screw



Tool breakage

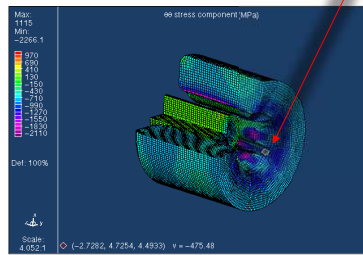
Stress analysis (tangential stress-positive >1.200MPa)

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Tool life improvement
Six Lobe screw



Parameter	Value	Unit	Material
Insertschneidene D1	10.00	mm	S20MnCr51
Aussenschneidene D2	45.00	mm	
Einsteckschneidene D1	20.00	mm	S100Mn
Schneidflankend R1	0.120	mm	
Einsteckflankend R1	0.050	mm	S100Mn
Einsteckflankend R2	0.050	mm	
Einsteckflankend R3	0.050	mm	S100Mn
Einsteckflankend R4	0.050	mm	
Einsteckflankend R5	0.050	mm	S100Mn
Einsteckflankend R6	0.050	mm	
Einsteckflankend R7	0.050	mm	S100Mn
Einsteckflankend R8	0.050	mm	
Einsteckflankend R9	0.050	mm	S100Mn
Einsteckflankend R10	0.050	mm	
Einsteckflankend R11	0.050	mm	S100Mn
Einsteckflankend R12	0.050	mm	
Einsteckflankend R13	0.050	mm	S100Mn
Einsteckflankend R14	0.050	mm	
Einsteckflankend R15	0.050	mm	S100Mn
Einsteckflankend R16	0.050	mm	
Einsteckflankend R17	0.050	mm	S100Mn
Einsteckflankend R18	0.050	mm	
Einsteckflankend R19	0.050	mm	S100Mn
Einsteckflankend R20	0.050	mm	
Einsteckflankend R21	0.050	mm	S100Mn
Einsteckflankend R22	0.050	mm	
Einsteckflankend R23	0.050	mm	S100Mn
Einsteckflankend R24	0.050	mm	
Einsteckflankend R25	0.050	mm	S100Mn
Einsteckflankend R26	0.050	mm	
Einsteckflankend R27	0.050	mm	S100Mn
Einsteckflankend R28	0.050	mm	
Einsteckflankend R29	0.050	mm	S100Mn
Einsteckflankend R30	0.050	mm	
Einsteckflankend R31	0.050	mm	S100Mn
Einsteckflankend R32	0.050	mm	
Einsteckflankend R33	0.050	mm	S100Mn
Einsteckflankend R34	0.050	mm	
Einsteckflankend R35	0.050	mm	S100Mn
Einsteckflankend R36	0.050	mm	
Einsteckflankend R37	0.050	mm	S100Mn
Einsteckflankend R38	0.050	mm	
Einsteckflankend R39	0.050	mm	S100Mn
Einsteckflankend R40	0.050	mm	
Einsteckflankend R41	0.050	mm	S100Mn
Einsteckflankend R42	0.050	mm	
Einsteckflankend R43	0.050	mm	S100Mn
Einsteckflankend R44	0.050	mm	
Einsteckflankend R45	0.050	mm	S100Mn
Einsteckflankend R46	0.050	mm	
Einsteckflankend R47	0.050	mm	S100Mn
Einsteckflankend R48	0.050	mm	
Einsteckflankend R49	0.050	mm	S100Mn
Einsteckflankend R50	0.050	mm	

Optimizing tool design to improve the pre-stressing of the insert

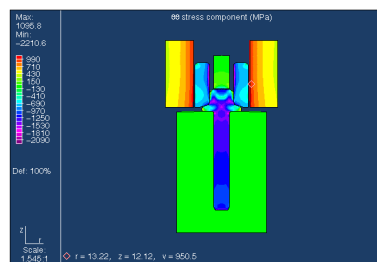
400MPa -> 550 MPa

Stress analysis (tangential stress-compressive ~-500MPa)

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Design and Optimization of metal forging processes including the use of hydraulic cushion systems

Tool life improvement
Six Lobe screw



Tool layout overview

Tool actual in production enjoying tool life of more than 2.000.000 pieces

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Design and Optimization of metal forging processes including the use of hydraulic cushion systems

Introduction

Examples of innovation in production by using cushion systems

Shock Absorber

Claw pole

Part with splines

Special part produced with cushion system

Examples of innovative approaches

Production of a rotor from bar.

Production of the rotor from sheet metal

Example of innovation by applying "unusual" processes

Brake Piston

Tool life improvement

Valve Tappet

Six Lobe screw

Conclusion



Design and Optimization of metal forging processes including the use of hydraulic cushion systems

Conclusion

This presentation shows that with
**good engineering skills, new ideas, the willingness to try new things and
the appropriate use of existing good software tools,
the challenges in the market can be met and overcome.**

New processes can be designed, tools may be constructed differently,
and the efficiency of forming processes may be improved.

Cold forging has a high potential for future development still.

This presentation is intended to encourage cold forging companies to be
forward-thinking and to use available technology intensively.

This will help them to survive in a future of increasing competition,
and the growing technological demands of their clients.



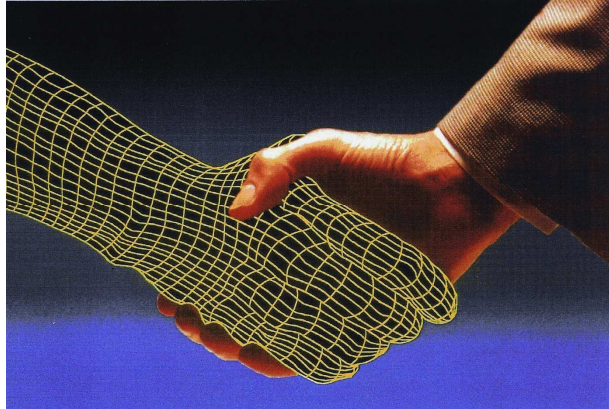
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CPM Gesellschaft für Computeranwendung,
Prozeß- und Materialtechnik GmbH



Combine ideas, technology and simulation

I think -> I know how-> I know why -> I may generate new know how



Thank you for your attention

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