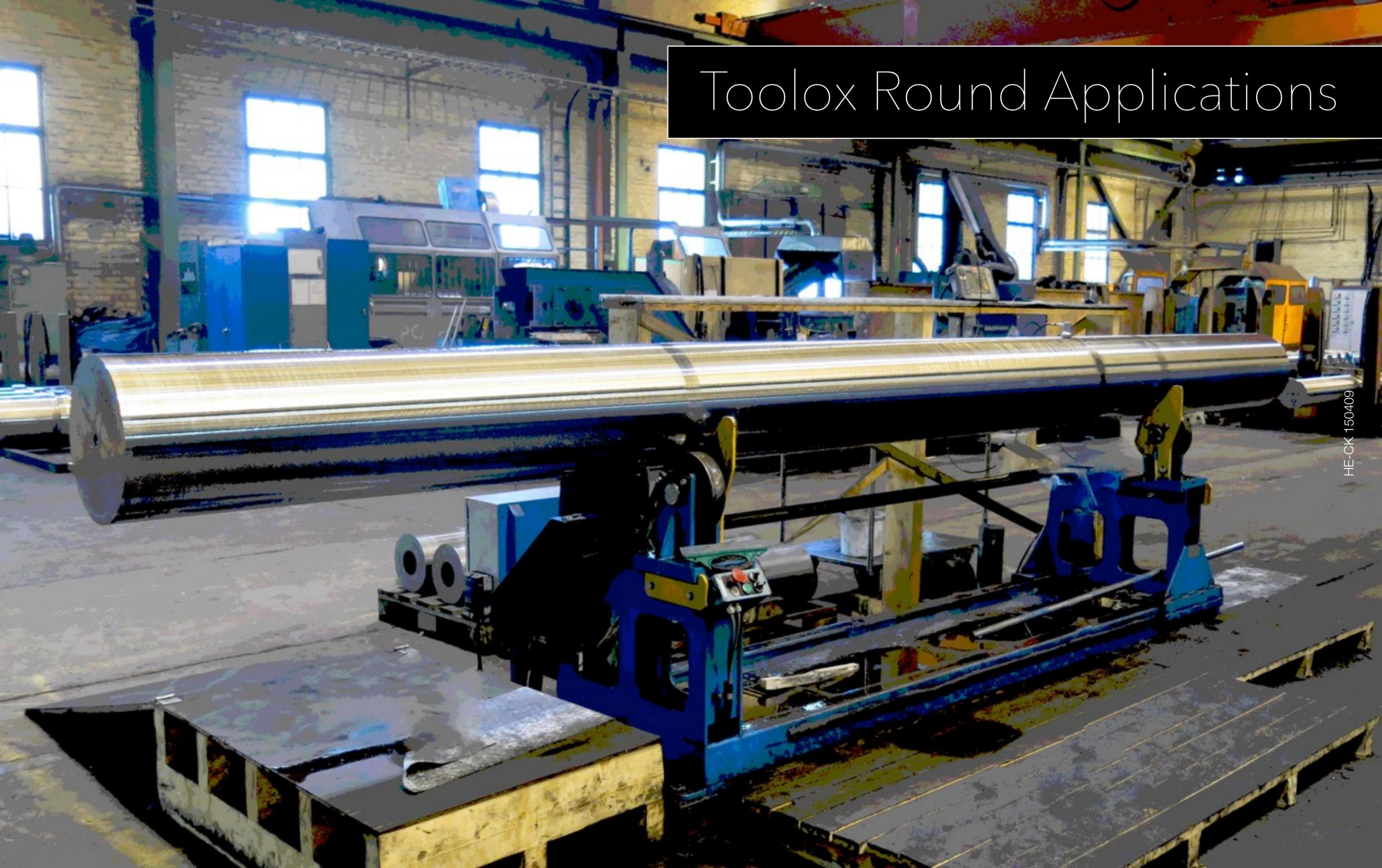


# Toolox Round Applications



## Benefits Of Toolox Round

- ✓ Ready to use – already heat treated
- ✓ High strength
- ✓ Crack resistance
- ✓ Superior and consistent quality
- ✓ Machinable and weldable
- ✓ Suitable for surface engineering
- ✓ Dimensional stability when machining and surface engineering





**Plate 5 - 130 mm**



**Round 16 - 141 mm**

	<b>42CrMo4 / 4140</b>	<b>Toolox 44</b>	<b>W.Nr. 1.2344 / H13</b>
Yield Strength	Min 650 MPa	Typical 1300 MPa	-
Tensile Strength	900 - 1100 MPa	Typical 1450 MPa	-
Hardness	Typical 250 - 300 HBW	410 - 475 HBW	45 - 55 HRC
Toughness Guarantee	None	Min 18 J @ RT	None
ESR Properties	No	Yes	Optional
C (Typical)	0.42	0.32	0.40
Mn (Typical)	0.75	0.80	0.40
S (Typical)	Max 0.035	Max 0.002	Max 0.030
Cr (Typical)	1.10	1.35	5.30
Mo (Typical)	0.22	0.80	1.40
CE II w (Typical)	1.01 - 1.27	0.90 - 0.94	1.80 - 2.13



<b>Inspection certificate</b> EN 10 204 - 3.1	A02	<b>Issuing department</b> Quality inspection	A05	<b>Purchaser order no</b> 061114-P	A07	<b>Our order no</b> 822887-12	A08	<b>Invoice no</b> 2635421	A19	<b>Certificate no and date</b> 15152628 2014-11-26	A03
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<b>Purchaser</b> A11 11326	<b>Product</b> Hot rolled bar		B01	<b>Marking</b> Manufacturer, MATERIAL ID				B06	<b>Standard/rules</b> Steel grade TOOLOX44			B02
	<b>Quantity</b> 1	<b>Dimensions [mm]</b> Ø 125 L 4600	B08	B09-B11	<b>Weight [kg]</b> 448			B12	<b>Deliv. Cond.</b>	B04	<b>Internal code</b>	B16
	<b>Consignee</b>					A06	<b>Customer marks</b>					B15

<b>MATERIAL ID</b> 11-0577-SSW212526	B07
---	-----

Chemical composition																C71-C92	Carbon equivalent etc	C93-C99
<b>Heat no</b> 11-0577	<b>C</b> .311	<b>Si</b> 1.09	<b>Mn</b> .81	<b>P</b> .009	<b>S</b> .002	<b>Cr</b> 1.34	<b>Ni</b> .67	<b>Mo</b> .81	<b>V</b> .14	<b>Ti</b> .01	<b>Cu</b> .02	<b>Al</b> .008	<b>Nb</b> .018	<b>B</b> .0020	<b>N</b> .003	<b>Cekv</b> .95	Cekv = C + Mn/6 + (Ni + Cu)/15 + (Cr + Mo + V)/5	

Testtype	C04	Millcode	C00	Specimen position	C01	Direction	C02	Treatment	B05	Specimen type	C10	Temp [degr C]	C03	Test results					
Tensile test		BIL311		Top end		Longitudinal		Delivery condition		Rectangular 380x40				C11 Rp0.2 [MPa] 1235	C12 Rm [MPa] 1371	C13 A5 [%] 13.0			
Impact test		BIL312		Top end		Longitudinal		Delivery condition		Charpy-V 10x10		20		C42 E [J] 22	C42 E [J] 24	C42 E [J] 25	C43 Ave [J] 23		
Hardness test		BIL313		Top end		Longitudinal		Delivery condition						C32 HB Ave 432					

Ultrasonic testing: Satisfactory results according to: En10308  
 Production time: 2014-10-16

# Tool Holders



**Tool Holder**

## Tool Holder

### DESCRIPTION

Custom tool holder for CNC machine.  
Diameter 61 mm

P20

Toolox 44 Round

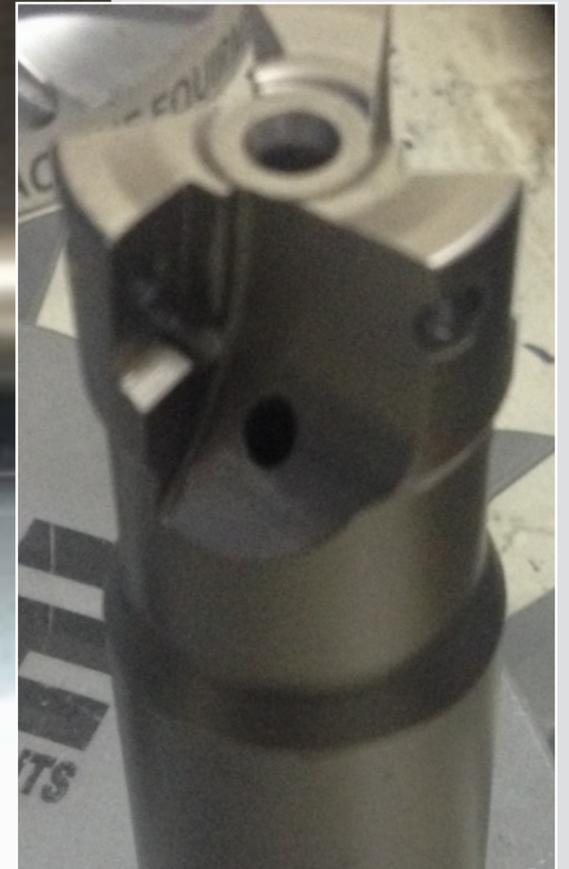
### EXPERIENCE

Previous solution failed due to cracks.

*Very dangerous for operator when this happens.*

Too long delivery time from regular tool supplier.





**Tool Holder**

## Tool Holder

### DESCRIPTION

Tool holders for specialised turning tooling.  
Various diameters starting from 17 mm.

4140 44-46 HRC

Toolox 44 Round

3x Life

### EXPERIENCE

Previous material showed cracks on thin sections.

Toolox 44 Advantages

- Long holder life.
- No heat treatment.
- Less wear on the tip connection holes.
- Less vibrations give better workpiece surface.





# Custom Made Tool Holder

## DESCRIPTION

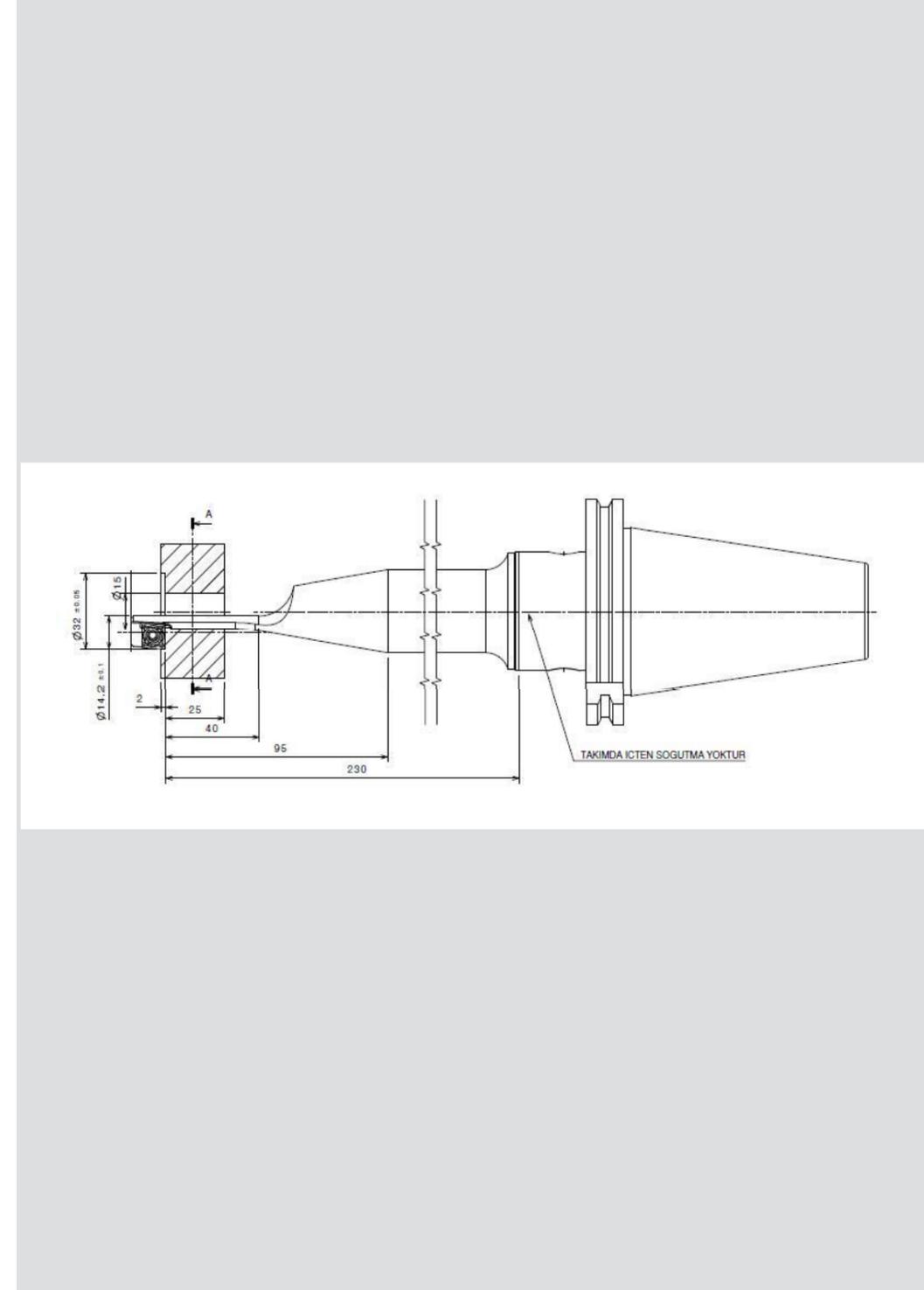
Custom made tool holder.

W.Nr. 1.2344 44-46 HRC	2 Days	CRACKING
Toolox 44 Round	10 Days	CRACKING

## EXPERIENCE

Cracking occurred on thin sections.

Customer will do a design change to fully utilize the toughness of Toolox and thus, further improve life.





**Custom Made Tool Holder**

## Tool Holder

### DESCRIPTION

Tooling for machining chain of yellow goods machinery.

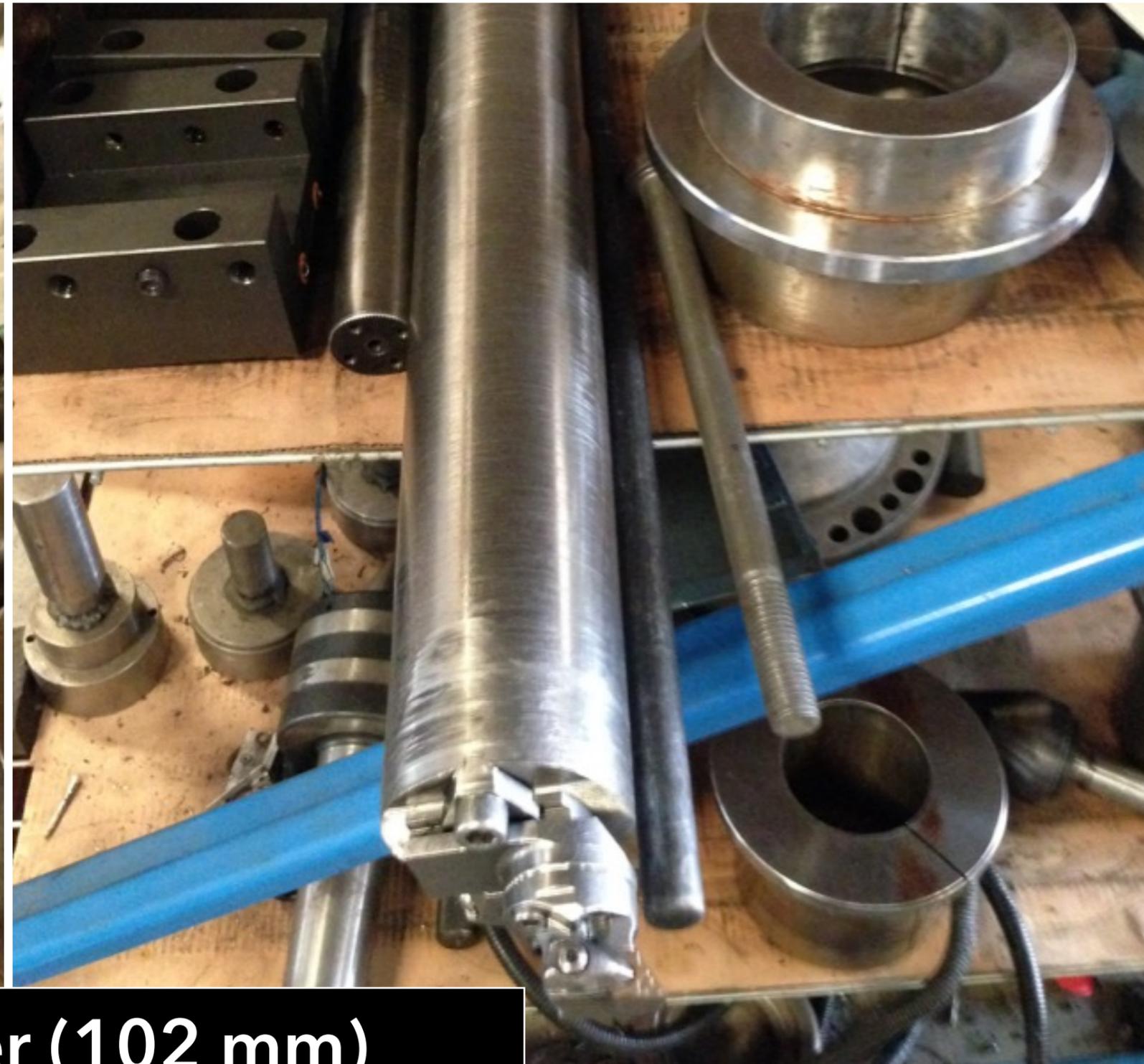
4340 HARDENED

Toolox 44 Round

### EXPERIENCE

High mechanical strength needed due to chain hardness  
Machining of Toolox without any complications.





**Tool Holder (102 mm)**



**Tool Holder (71 mm)**

## Tool Holder

### DESCRIPTION

Tool holders for ID boring machine in oil & gas industry.  
Diameters 71 mm, 102 mm

W.Nr. 1.6582

Toolox 44 Round

### EXPERIENCE

Toolox chosen to eliminate vibrations and have longer service life.

Previous material required extra honing process to achieve finish and tolerances. With Toolox customer can skip this process and save time.



# Rotating Equipment



**Axle**

## Axle

### DESCRIPTION

Axle in slag transport truck. 2 bars per truck.  
Diameter 300 mm

4340 240 HB

Toolox 44 Round

### EXPERIENCE

Previously failure due to wear.  
Forged bar of Toolox used. No surface hardening.  
Works perfectly since 2010.





**Positioning Bar**

## Positioning Bar

### DESCRIPTION

Rail positioning bar for train equipment manufacturer.  
Diameter 105 mm Length 2730 mm

2312 HARDENED

Toolox 44 Round

### EXPERIENCE

Previous material deformed due to heat treatment.  
Manufacturing took about 6.5 hours.

*Feed 60 mm/min | Rotation 325 rpm | Cutting Depth 2 mm*

Working since 3 years without any problems.  
Repeating customer buying 6-8 pieces a year.





**Transmission Component**

# Transmission Component

## DESCRIPTION

Transmission component in petrochemical industry.

4140

Toolox 44 Round

## EXPERIENCE

Previous solution experienced cracking.

Gear cutting of Toolox 44 more challenging as customer would experience “shrinking” of gear cuts. Adjusting parameters at the moment.





**Forming Tool Shaft**

# Forming Tool Shaft

## DESCRIPTION

Shaft for roll forming tool in truck rim production.  
Diameter 340 mm Length 2980 mm

42CrMo4 Q+T

6-8 months

**Toolox 44 Round**

**> 2 years**

## EXPERIENCE

Working material is 14 mm mild steel.  
Previous material failure due to cracking.  
Toolox component is still running.  
Customer is using 12 pieces in the same application.





**Gudgeon Pin**

## Gudgeon Pin

### DESCRIPTION

Gudgeon pin in petrochemical industry.  
Diameter 61 mm

W.Nr. 1.8580 HARDENED

6 months

**Toolox 44 Round NITRIDED**

**> 6 months**

### EXPERIENCE

Previous material quality varied a lot.

Toolox used for longer life and consistent results.

Machining of Toolox 44 done in house.

Salt bath nitriding done on Toolox 44 to reach 58 HRC.

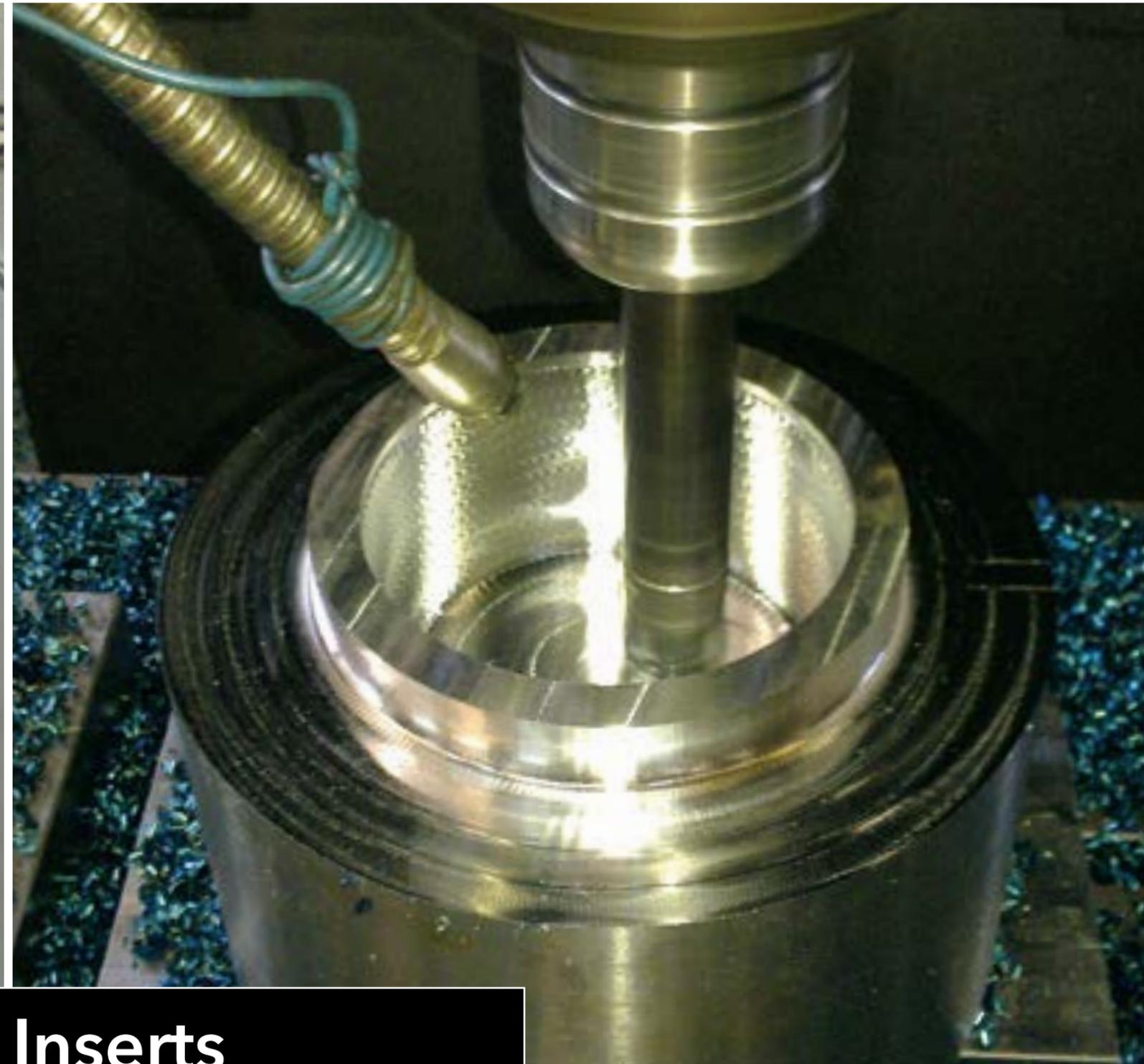
In operation since March 2014.



# Moulds & Dies



**Cavity Inserts**



**Cavity Inserts**

# Cavity Inserts

## DESCRIPTION

Cavity inserts for high volume fast cycle injection mould.  
Diameter 220 mm

Toolox 44 Round

> 90,000

## EXPERIENCE

The injected product is a 1.5 L round container.

Process	Tool / Strategy	Performance / Results
Milling (roughing)	Diameter 32mm P grade carbide inserts from SSM, reference SPKW08. Cutting speed = 140 m/min Cutting depth = 0.75 mm Feed = 3500 mm / min	Tool life = 80 minutes
Turning (finishing)	VGCT coated carbide insert from Taegutech.	Good surface finishing and tolerances achieved.
Drilling and Threading	OSG carbide tools.	Poor performance. Tool life was very short.
Polishing	Abrasive polishing stone from Gesswein 0.003 mm diamond paste.	High gloss polish achieved in all the molding area.





**Mould Components**

# Mould Components

## DESCRIPTION

Various plastic mould components.  
Diameter 50 mm Length 43 mm

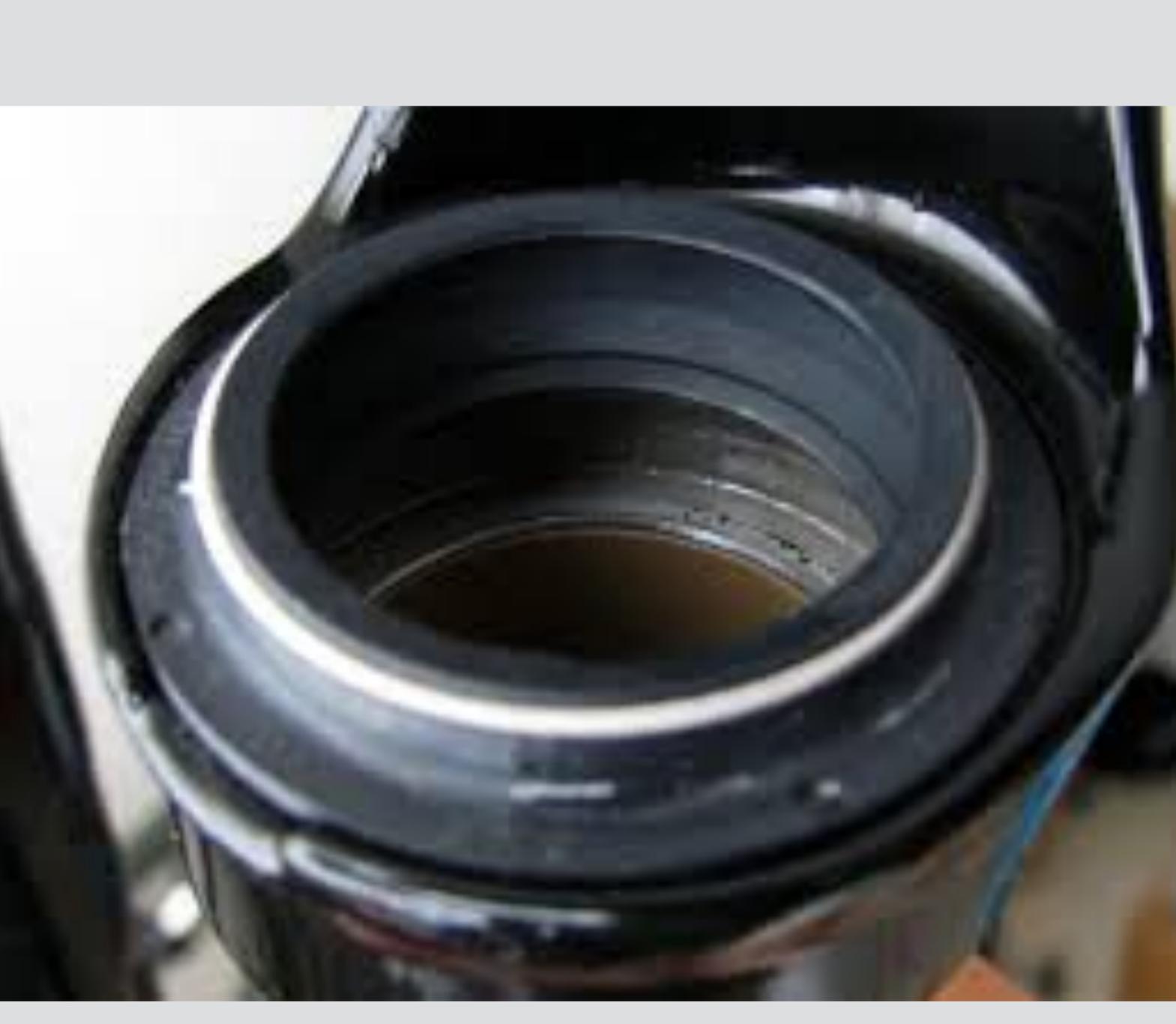
NAK 80

Toolox 44 Round

## EXPERIENCE

Decided to try Toolox due to better availability and price.  
Now very happy and using Toolox in many components.





**Rubber Moulds**

## Rubber Moulds

### DESCRIPTION

Silicone moulds for sealing solutions.  
Diameter 41 mm to 420 mm

W.Nr. 1.2343 ➡ **Toolox 44**

### EXPERIENCE

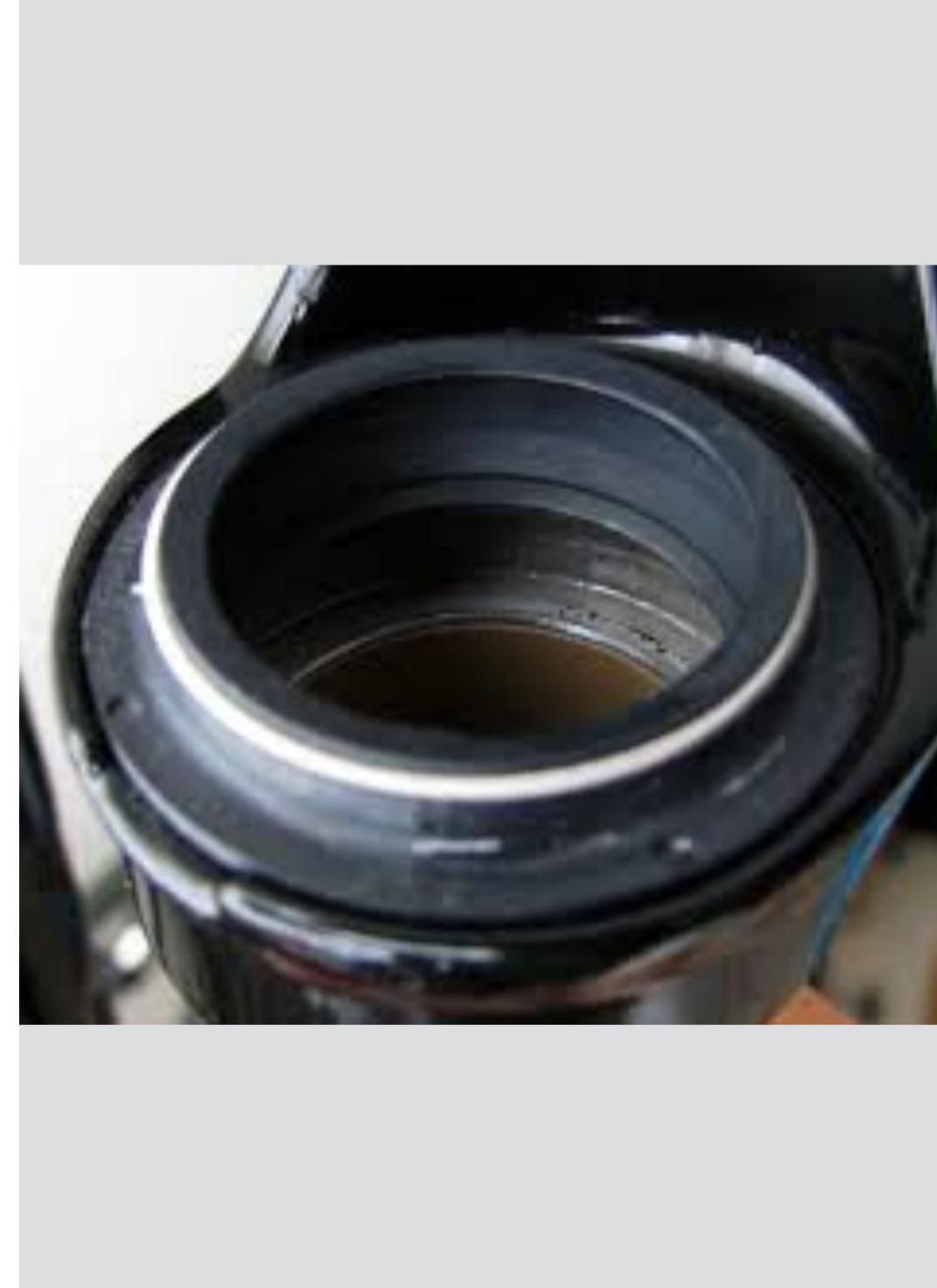
The customer is a global leader for standard and custom engineered sealing solutions.

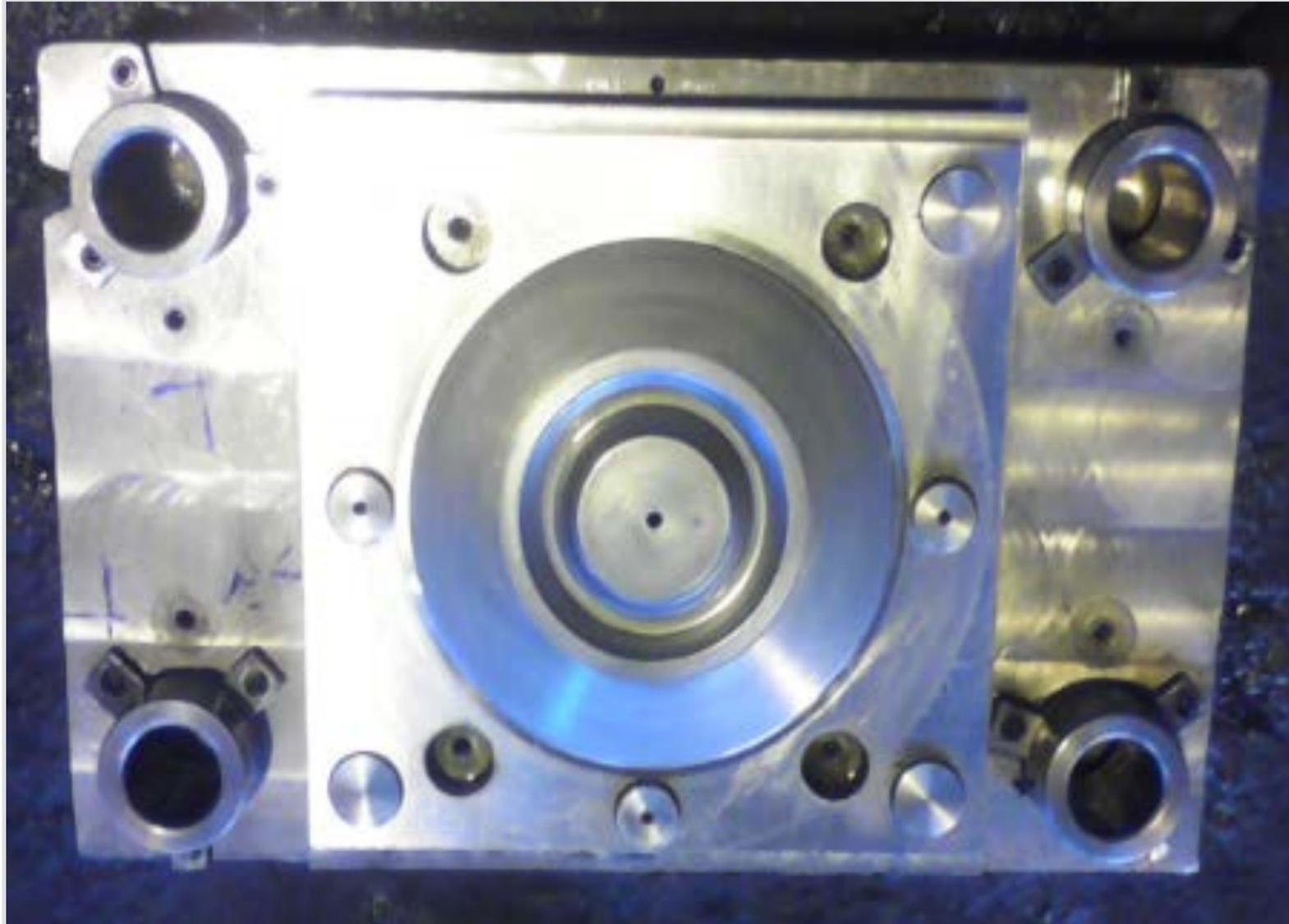
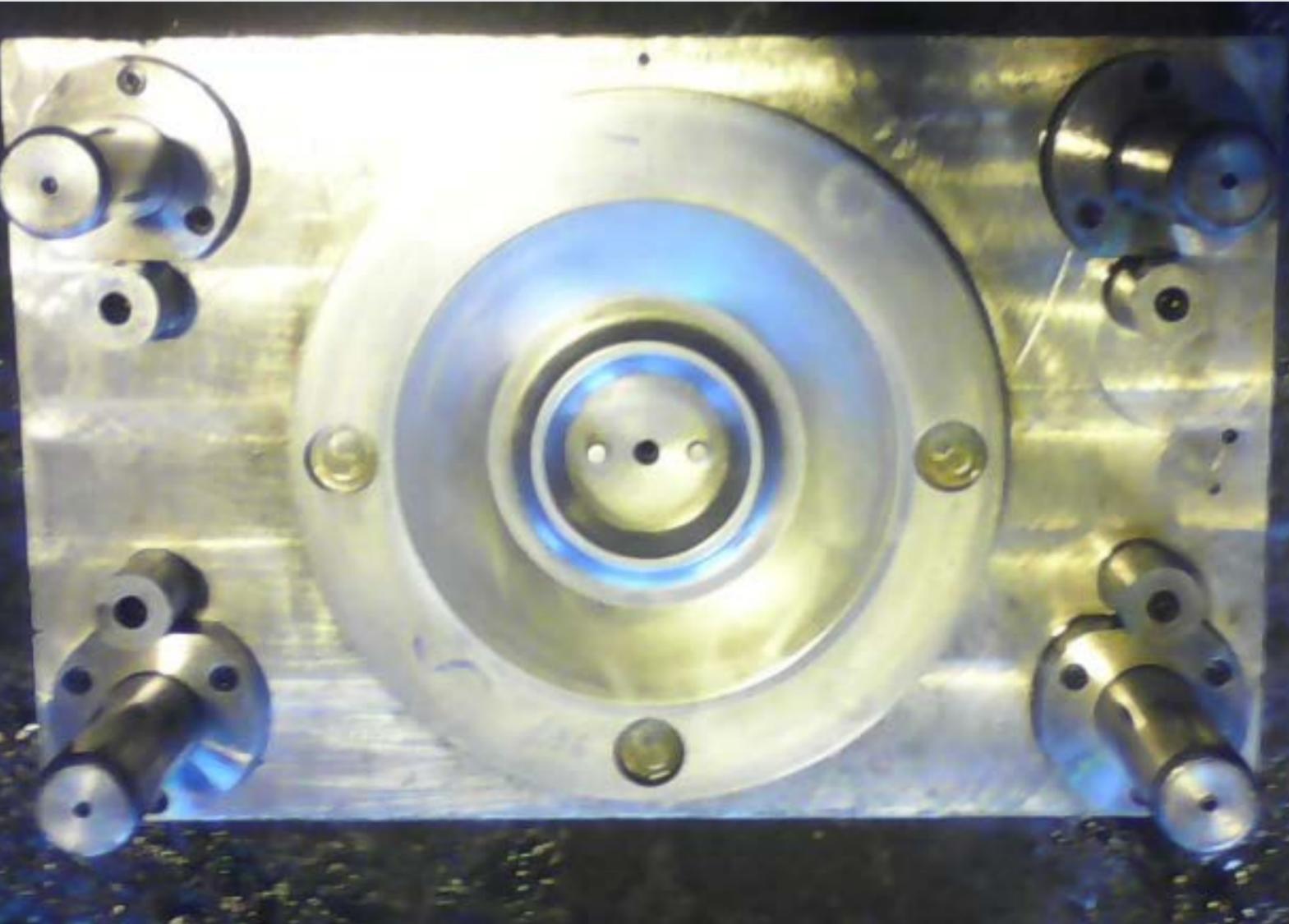
They have upgraded to Toolox 44 due to...

*... material delivered ready to use already heat treated.*

*... faster manufacturing time of tools.*

*... higher toughness.*





**Cold Forming Die**

## Cold Forming Die

### DESCRIPTION

Drawing die for producing diaphragm of automotive vacuum booster. 1 mm mild steel.  
Ø 260 mm L 210 mm - 2 pieces

W.Nr. 1.2379 56-58 HRC	1,500,000	CRACKING
Toolox 44 Round NITRIDED	3,000,000	STILL RUNNING

### EXPERIENCE

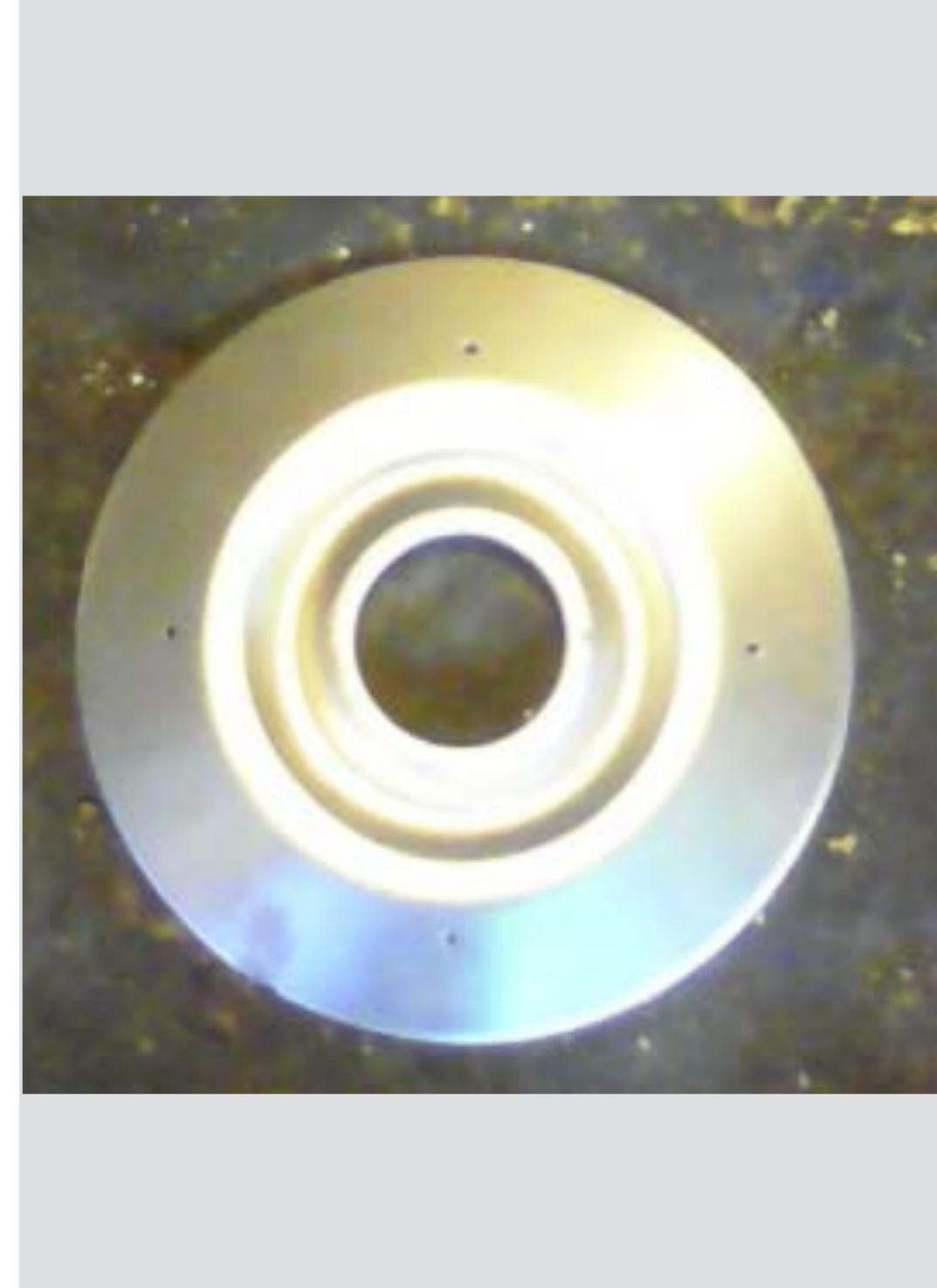
Customer had a lot of problems with cracking.

*During heat treatment and in use.*

Manufacturing time and cost reduced.

Polishing done with abrasive paper.

Customer very satisfied. Will use Toolox more.





**Trimming Die**

## Trimming Die

### DESCRIPTION

Trimming die for cylinder gaskets.  
Diameters 31 mm and 81 mm

W.Nr. 1.2363 58 HRC

1,000,000

Toolox 44 Round NITRIDED

Running

### EXPERIENCE

Work material is a combination of asbestos paper (1.2 mm) and ST13 steel (0.25 mm).

Previous solution showed deformation and crack problems as a result of heat treatment.

Toolox meets dimensional stability requirement.





**Cold Forming Die**

## Cold Forming Die

### DESCRIPTION

Aluminium cold forming die.

Diameter 120 mm

W.Nr. 1.2379 56-58 HRC

500

CRACKING

Toolox 44 Round

5,000

NO PROBLEM

### EXPERIENCE

Customer had a lot of problems with cracking.

*During heat treatment and in use.*

Manufacturing time and cost reduced.

Polishing done with abrasive paper.

Customer very satisfied. Will use Toolox more.





**Forging Die**

## Forging Die

### DESCRIPTION

Forging die for spare part for automotive aftermarket.

Diameters 120 mm, 160 mm

W.Nr. 1.2714 42 HRC	2,000	HOT WEAR
W.Nr. 1.2344 46-47 HRC	4,500	HOT WEAR / CRACK
<b>Toolox 44 Round</b>	<b>6,000</b>	<b>HOT WEAR / NO CRACK</b>

### EXPERIENCE

Toolox is now the standard for this die.





**Brass Forging Die**

## Brass Forging Die

### DESCRIPTION

Forging die for a valve in petrochemical industry.

Diameter 141 mm Length 180 mm

W.Nr. 1.2344 52 HRC	5,000	CRACKING
W.Nr. 1.2344 42-45 HRC	20,000	HEAT CHECKING
<b>Toolox 44 Round</b>	<b>50,000</b>	<b>OK</b>

### EXPERIENCE

Manufacturing time was reduced by 20%.

*Single machining setup. Eliminated heat treatment.*

*No surface engineering necessary.*

Full production of 50,000 pieces completed.

*Die stored for future order requirement.*



## Brass Forging Die

### ADDITIONAL INFORMATION

Customer had a lot of problems with cracking.

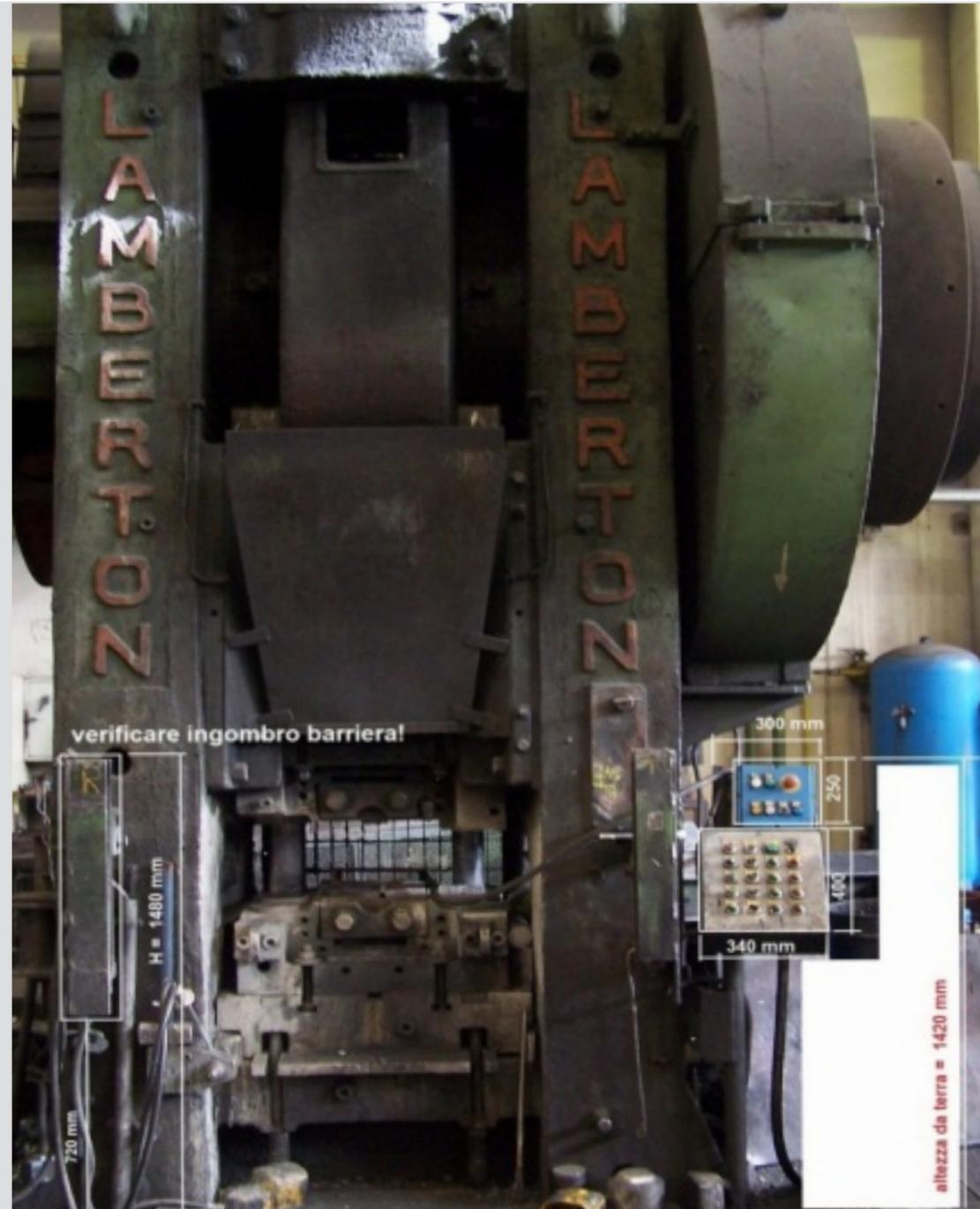
*During heat treatment, machining, and in actual use.*

A lot of different qualities of W.Nr. 1.2344 were tested with a variety of heat treatment parameters, but never a consistent result.

*This meant before multiple dies had to be made for a single production.*

The customer made the die with Toolox in January 2014.

*Only a single die had to be made for production run which led to big cost savings.*



# Hot Upset Forging



**Hot Upset Forging**

# Hot Upset Forging

## DESCRIPTION

Hot upset forging die to produce carbon steel and stainless steel products.

W.Nr. 1.2714 Q&T

W.Nr. 1.2343 HEAT TREATED

**Toolox 44 Round**

## EXPERIENCE

Operating temperature 1200 °C.

1500 tonnes press.

Result: Customer convinced to switch to Toolox.

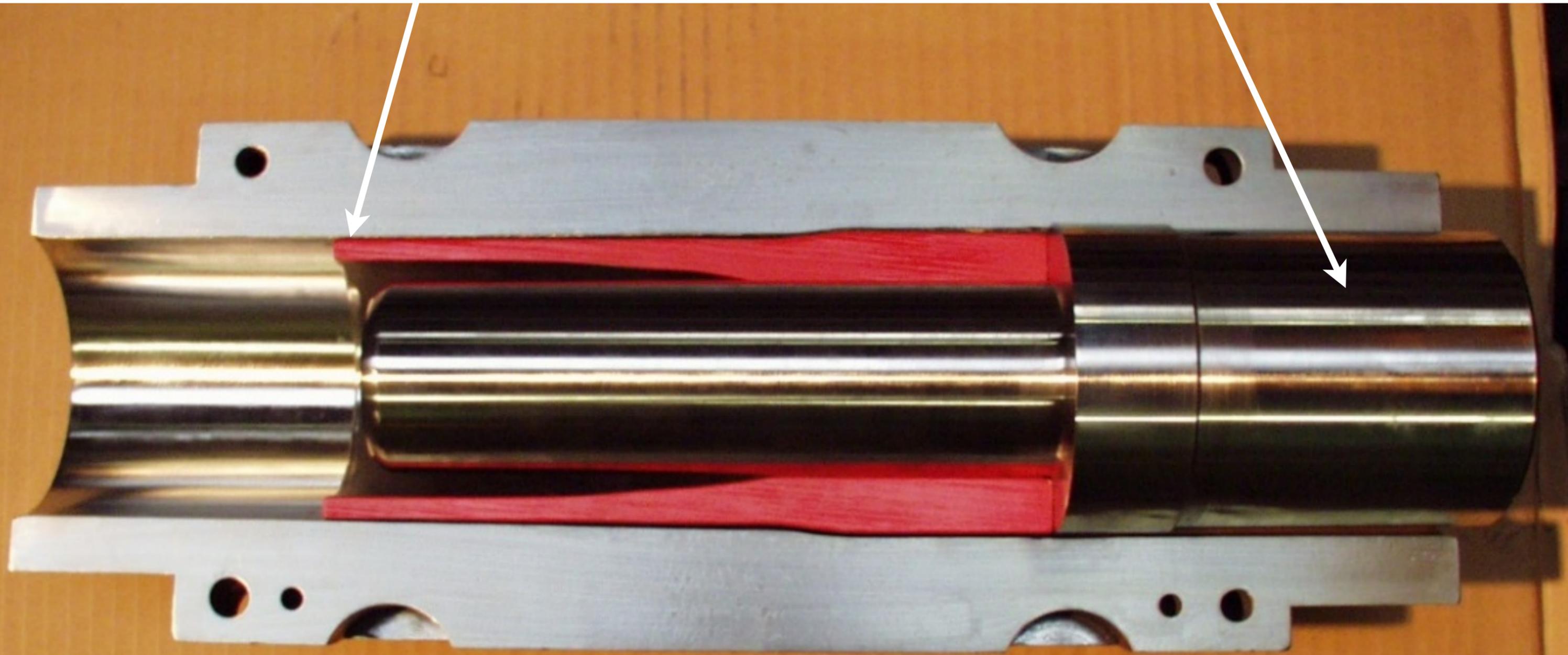




## Upsetting Tool & Mandrel

*upsetting tool*

*upsetting mandrel*



## Upsetting Tool & Mandrel

# Upsetting Tool & Mandrel

## DESCRIPTION

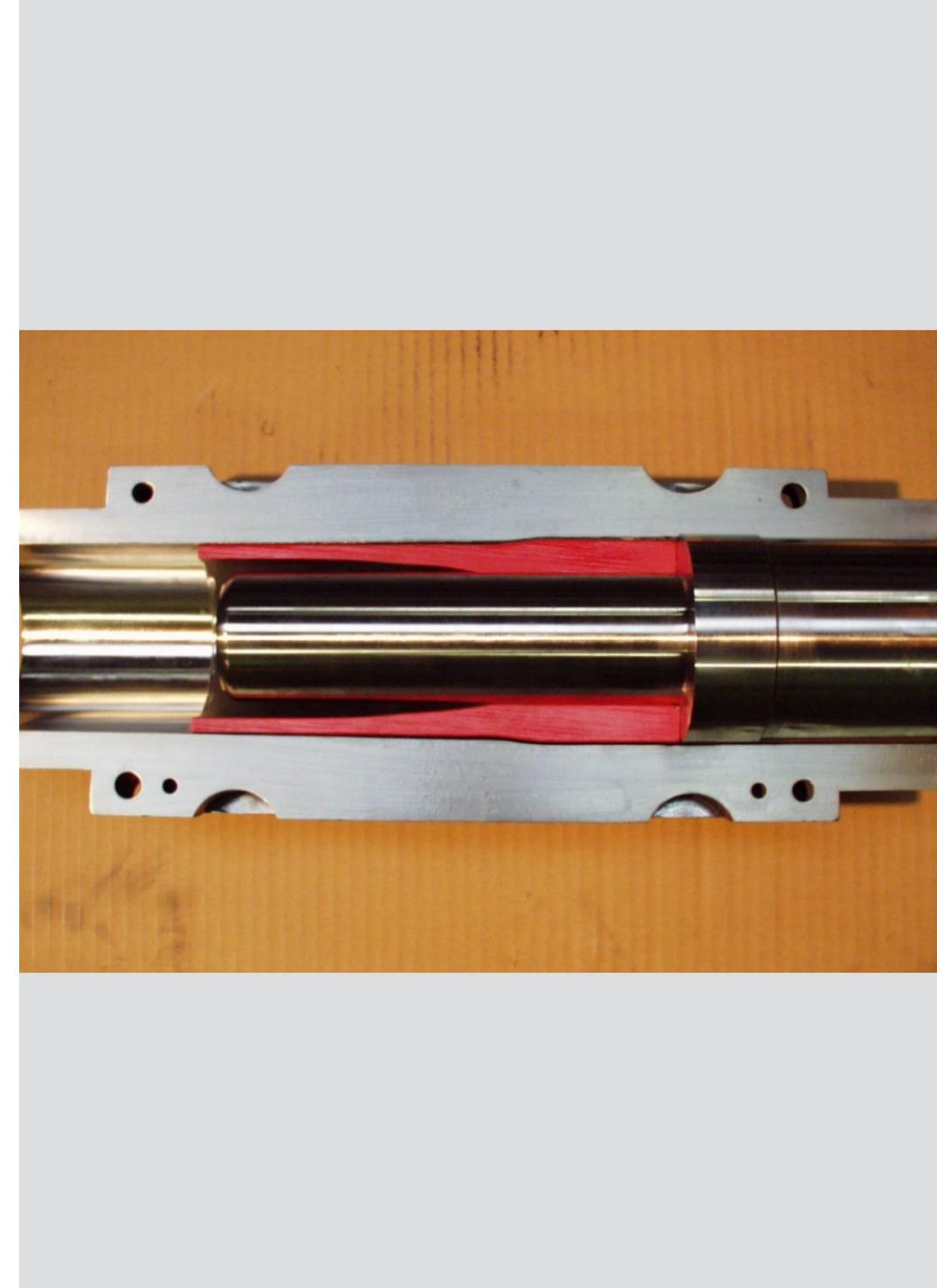
Forming of seamless tube upset ends in oil industry.  
Diameters 120 mm, 140 mm

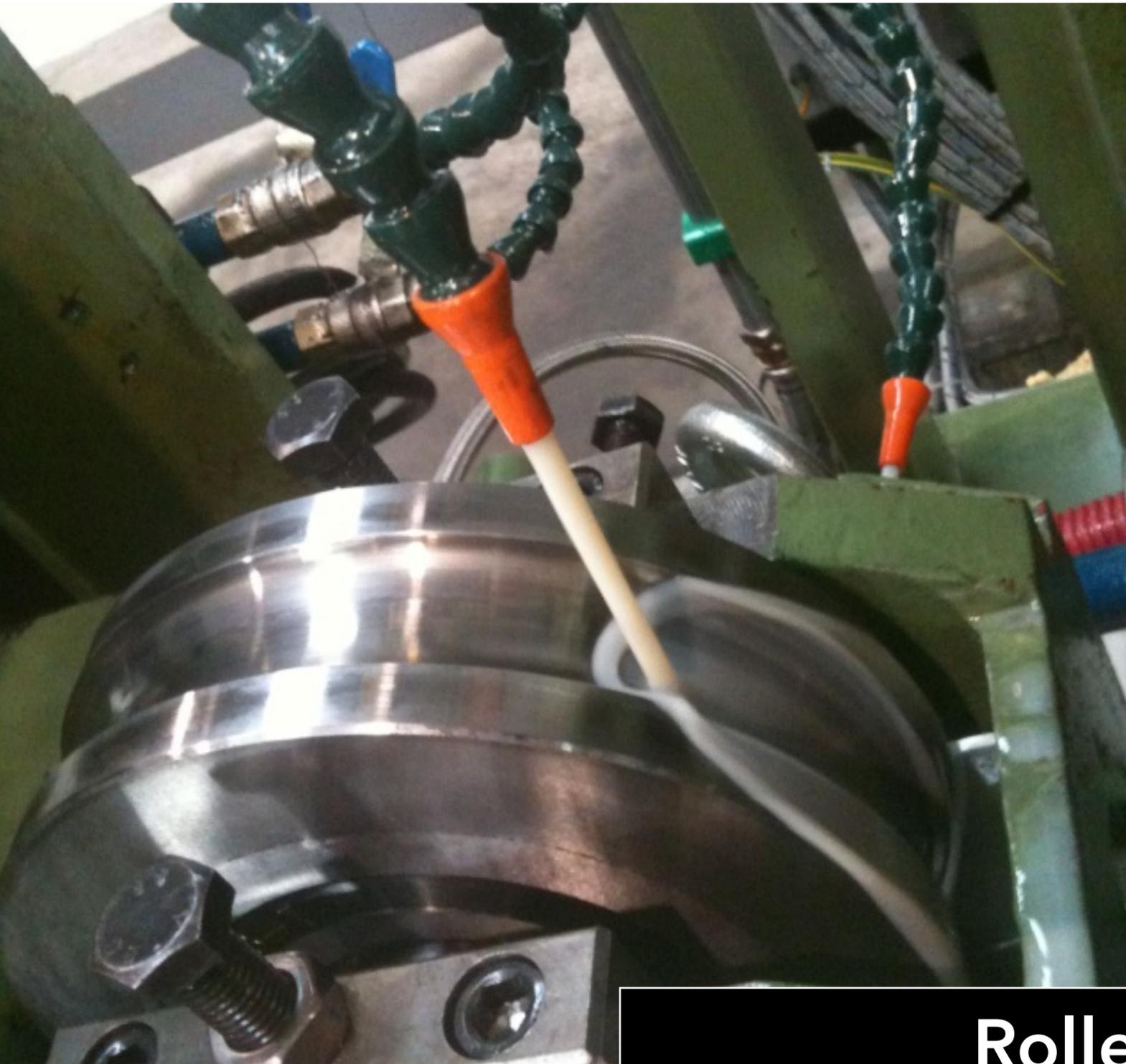
Böhler W400

Toolox 44 Round

## EXPERIENCE

Main reason for replacement was high toughness of Toolox which prevents heat checking.





**Roller Die**

## Roller Die

### DESCRIPTION

Roller die for oval shape tube (31 x 17 mm) in tube mill.

Diameter 220 mm

Work material Docol Roll 0.8 mm

Toolox 44 Round

> 500,000

### EXPERIENCE

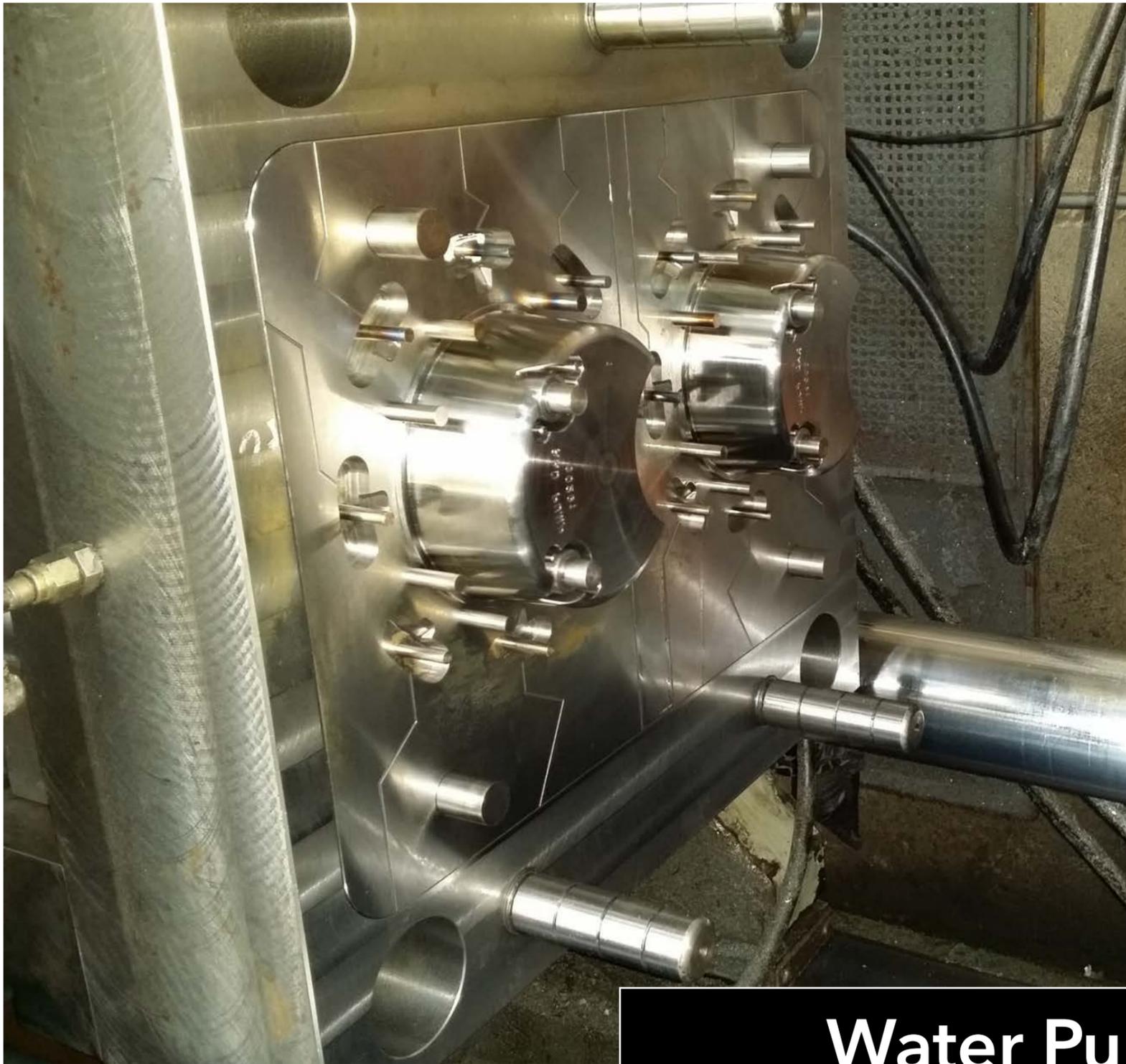
Toolox used for the heads to produce oval shape.

No nitriding was made.

Production ran 2 years producing 250,000 tubes / year.

No data after since tube mill was sold.





**Water Pump Cover**

# Water Pump Cover

## DESCRIPTION

Water pump cover die in aluminium die casting.  
Diameter 141 mm Length 200 mm

W.Nr. 1.2344 ESR 45-47 HRC	100,000
<b>Toolox 44 Round</b>	<b>&gt; 110,000</b>

## EXPERIENCE

Previous material failed due to heat checking.  
Initial challenges tapping Toolox 44.

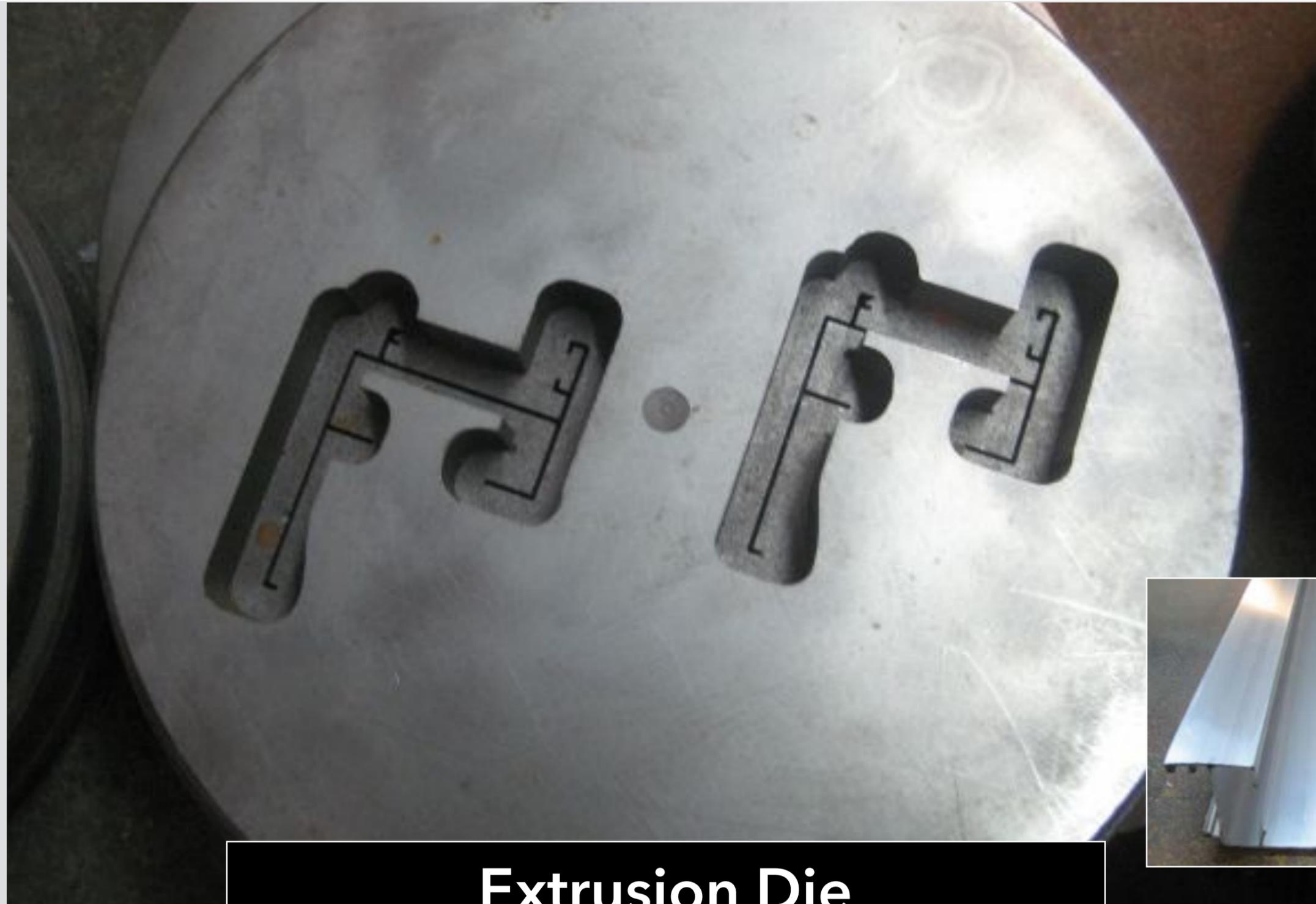
*We provided parameter recommendations.*

Toolox performing better and still running.

Toolox proved more economical.

*10% lower material cost and eliminate heat treatment.*





**Extrusion Die**

## Extrusion Die

### DESCRIPTION

Die in Aluminium extrusion.

Diameter 220 mm Length 40 mm

Orvar 2M

16 tons

Toolox 44 Round

> 21 tons

### EXPERIENCE

Aluminium grade AA 6063.

Profiles extruded with billet temperature of 555 °C.

Although threading was made, there were no major problems reported during machining.

The dies were nitrided before usage.





**Extrusion Die**

## Extrusion Die

### DESCRIPTION

Die and backer in Aluminium extrusion.  
Diameter 227 mm Length 120 mm

W.Nr. 1.2344 46-48 HRC

-

Toolox 44 Round

Running

### EXPERIENCE

All machining done without major problems,  
including M12 tapping.

Initial test run (without nitriding) was successful.

Waiting on nitriding and data of complete performance.





**Dummy Block**

## Dummy Block

### DESCRIPTION

Dummy block in Aluminium extrusion.  
Diameter 200 mm Length 80 mm

W.Nr. 1.2344 47-49 HRC

2-50 tons

**Toolox 44 Round**

**> 100 tons**

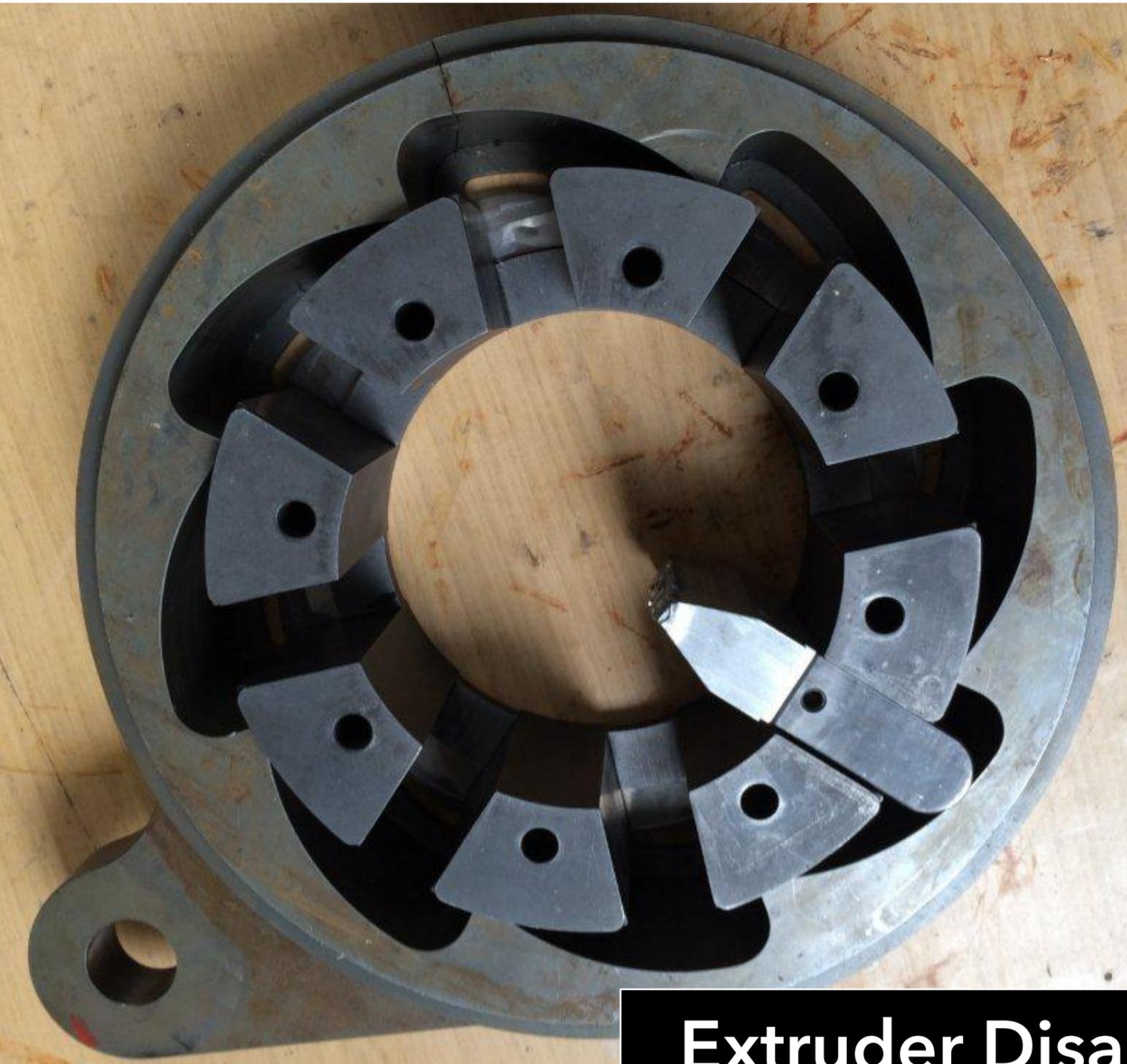
### EXPERIENCE

Previous solution suffered cracks.

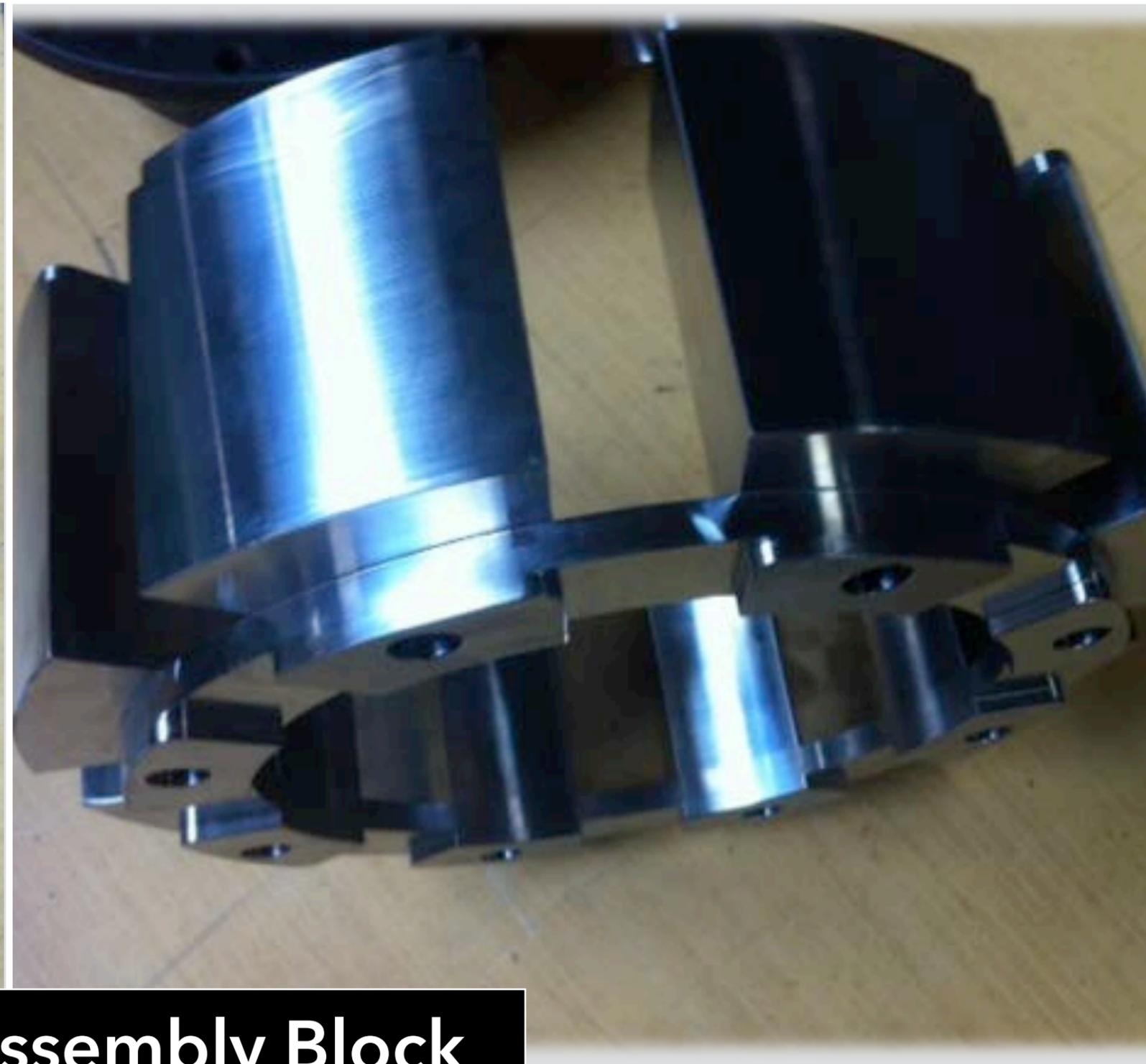
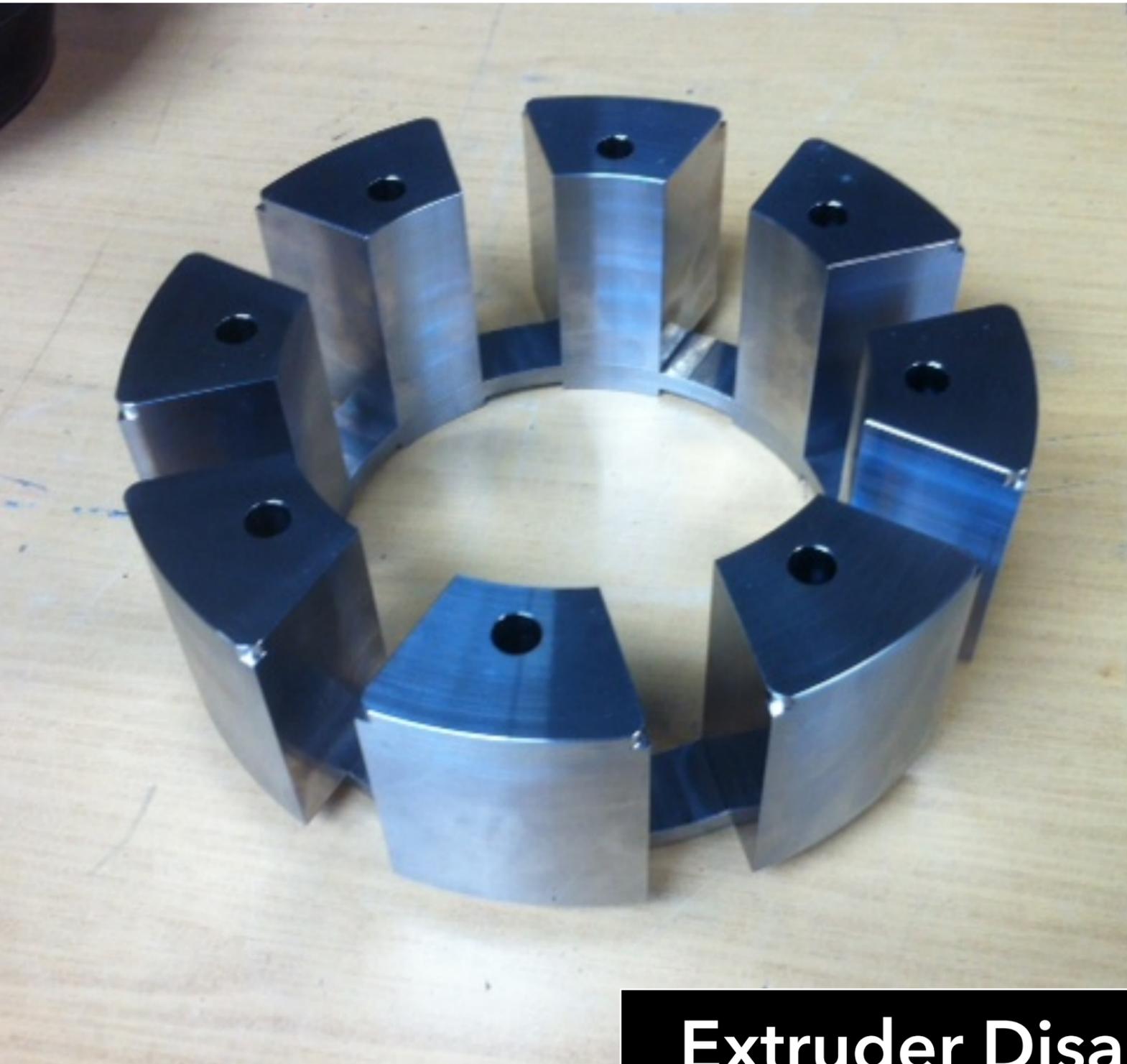
Much faster production due to no heat treatment.

In use since autumn 2012. Customer is very happy and is predicting the block to last until 150 tons.





**Extruder Disassembly Block**



**Extruder Disassembly Block**

## Extruder Disassembly Block

### DESCRIPTION

Core part in extruder disassembly block.

42CrMo4 → **Toolox 44**

### EXPERIENCE

Previously 42CrMo4 was used for the inner ring, but the component showed early cracking.

To improve toughness core ring was made out of Toolox 44.



# Miscellaneous



**Slag Remover**



**Slag Remover**

## Slag Remover

### DESCRIPTION

Slag remover of steel slabs.

*Steel plate producer gas cuts continuous cast slabs.*

*To remove slag from cut edges, roller with remover attachments is used.*

*Operational temperature of around 250 °C.*

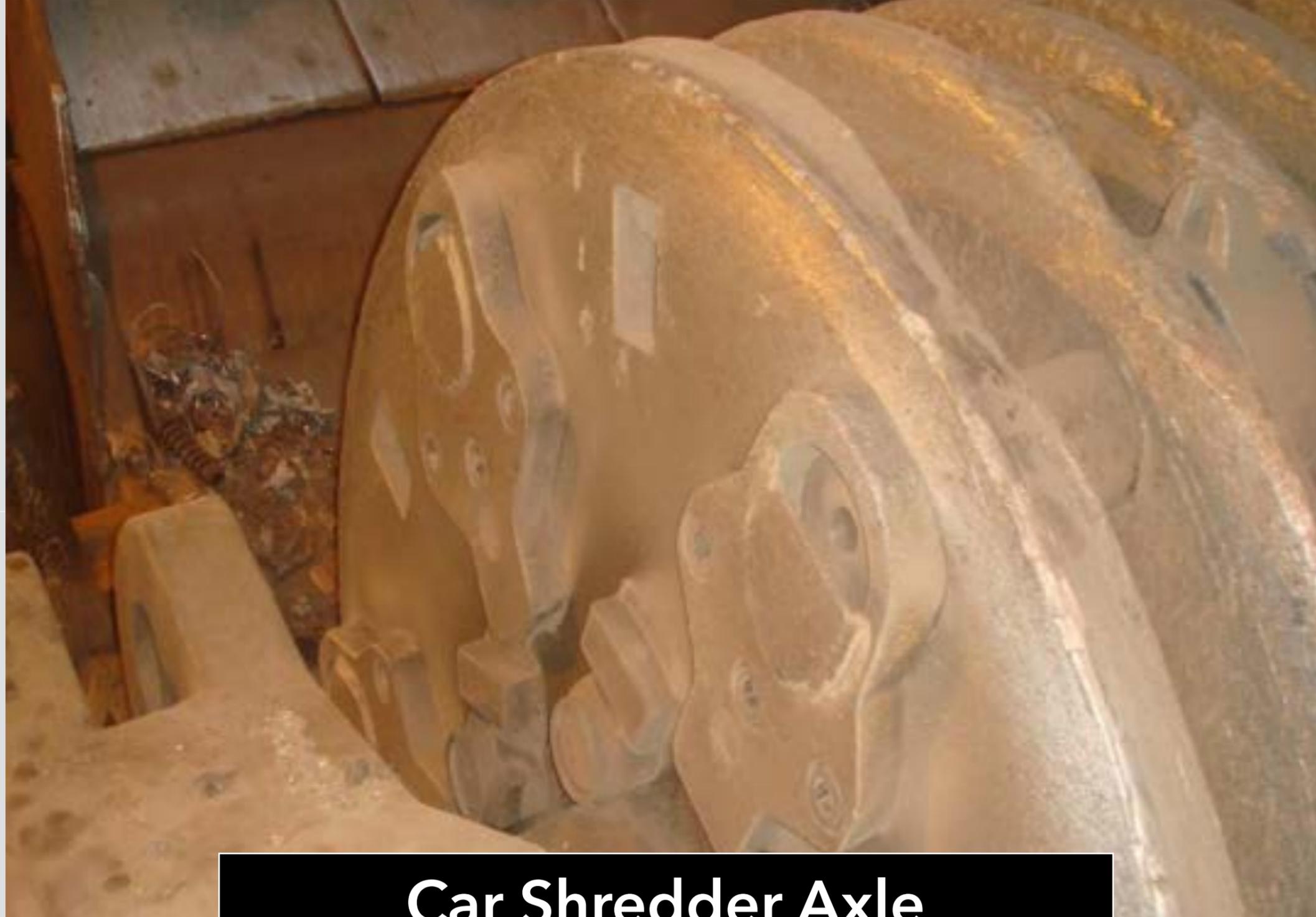
W.Nr. 1.2344  **Toolox 44**

### EXPERIENCE

Slag remover put in production and running thus far with no reported problems.

Machining went well after selecting right tooling and optimizing machining parameters.





**Car Shredder Axle**

## Car Shredder Axle

### DESCRIPTION

Axle around which the hammers rotate.

Diameter 101 mm, 121 mm, 125 mm

42CrMo4 HT	12 months	-
<b>Toolox 44 Round</b>	<b>15 months</b>	<b>STILL RUNNING</b>

### EXPERIENCE

Previous material problems with deformation after heat treatment.

Toolox 44 showed average service life increase of 30%.

Customer has introduced Toolox as standard for the application.





**Die Casting Machine Part**

## Die Casting Machine Part

### DESCRIPTION

Plunger rod in hot chamber lead die casting.

Diameter 201 mm Length 470 mm

W.Nr. 1.2344 52 HRC	3 months	CRACKING
Toolox 44 Round	> 12 months	STILL RUNNING

### EXPERIENCE

Plunger rod subject to high pressure.

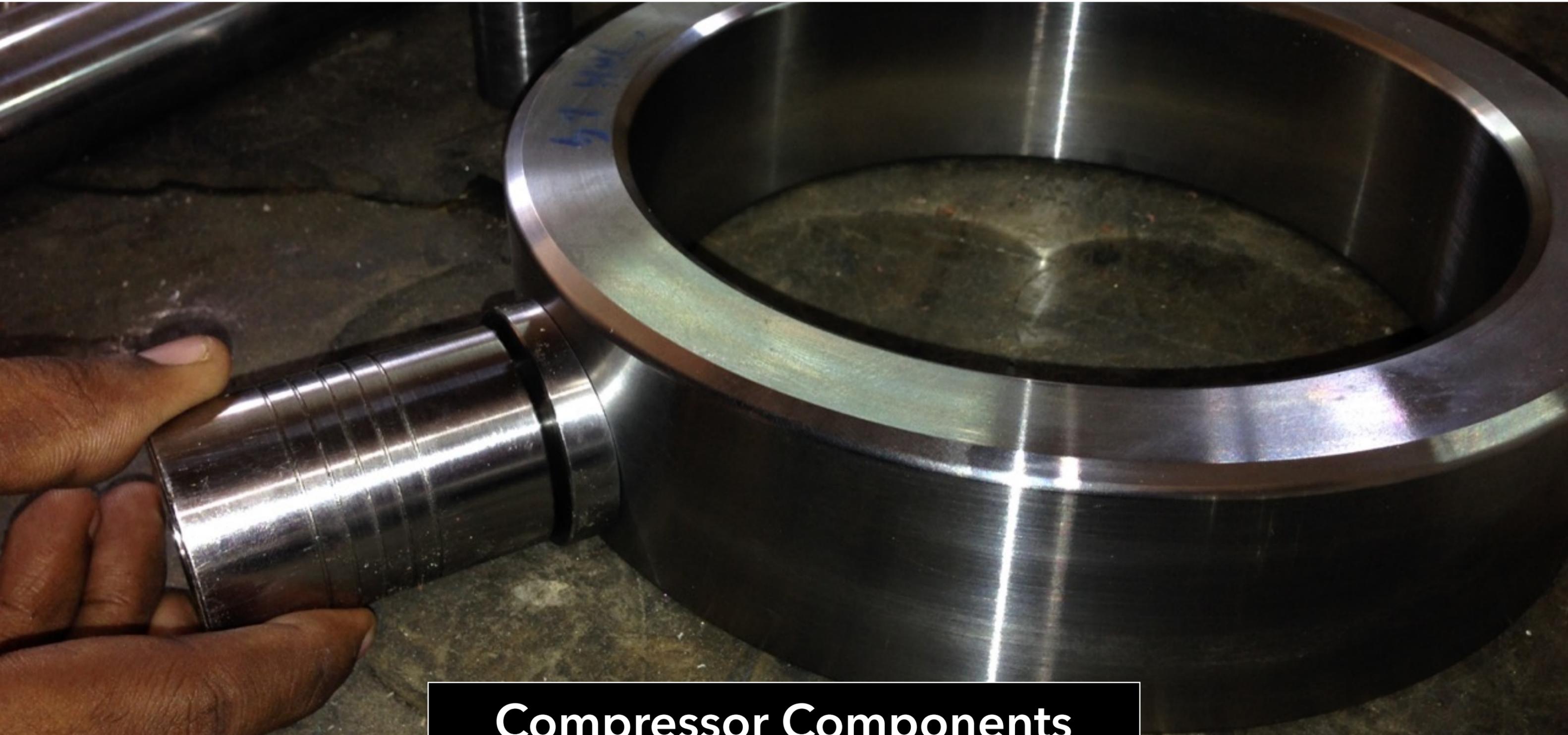
Manufacturing time was reduced by 40%.

*Eliminated heat treatment. No problems turning.*

The component is performing well and still running.

*February 2015 inspection showed no signs of wear or fatigue. Customer is extremely satisfied.*





**Compressor Components**

# Compressor Components

## DESCRIPTION

Speed control governor ring and push rod.

∅ 221 L 65 mm / ∅ 46 L 110 mm / ∅ 31 L 110 mm

OEM Part 39 HRC	–	WEAR
Toolox 44 Round	> 5 months	STILL RUNNING

## EXPERIENCE

Original component failed with lots of wear.

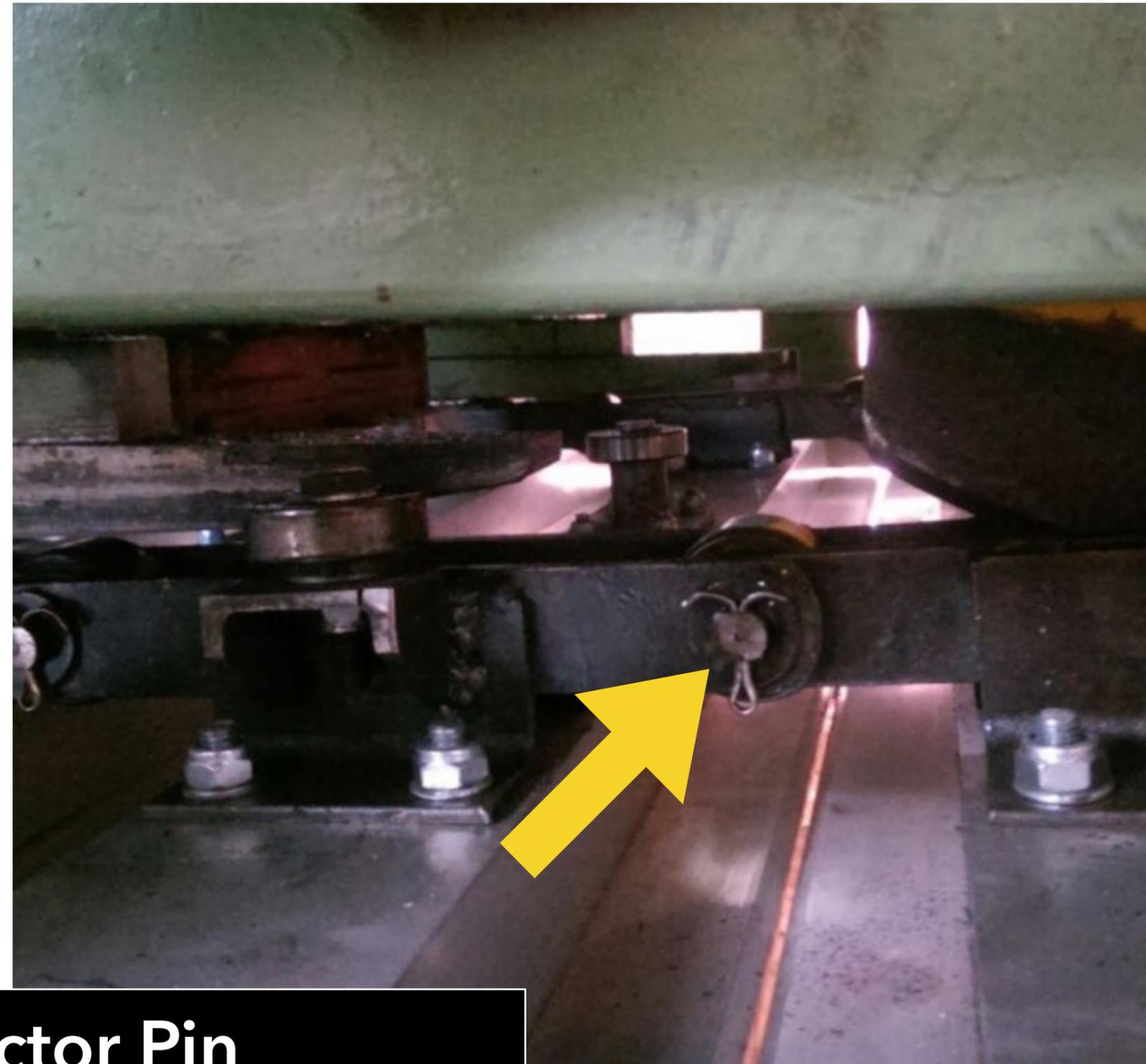
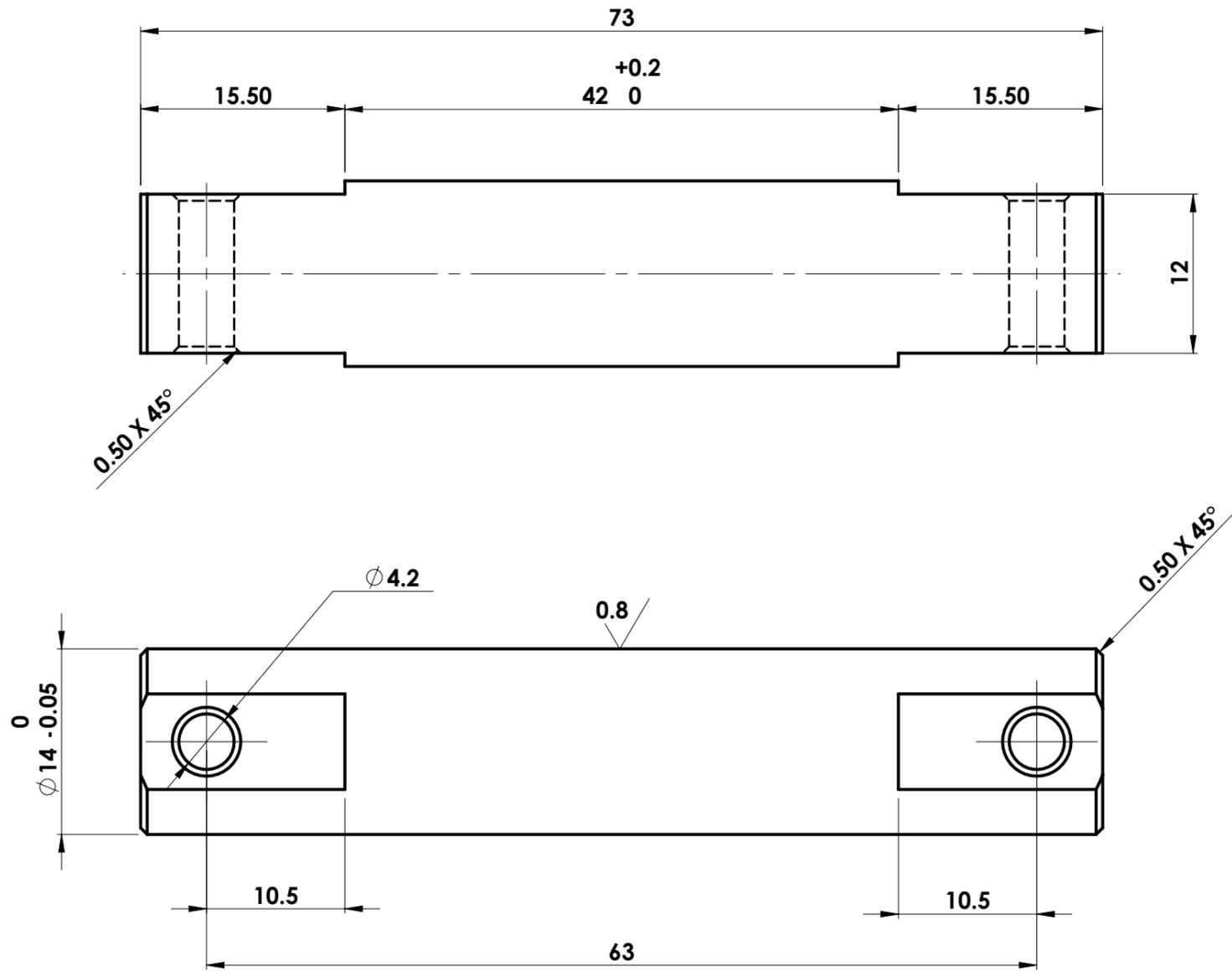
*Ordering spare part expensive and long delivery time.*

Customer required better wear resistance and good surface finish to minimize friction.

No problems machining and hollowing out.

Workshop and end user are satisfied.





**Connector Pin**

## Connector Pin

### DESCRIPTION

Connector pin in chain links for a conveyor.  
Diameter 14 mm Length 73 mm

W.Nr. 1.6582 / 4340 40 HRC

2-3 months

Toolox 44 Round

> 3 months

### EXPERIENCE

Previous material used to bend or shear the pin.

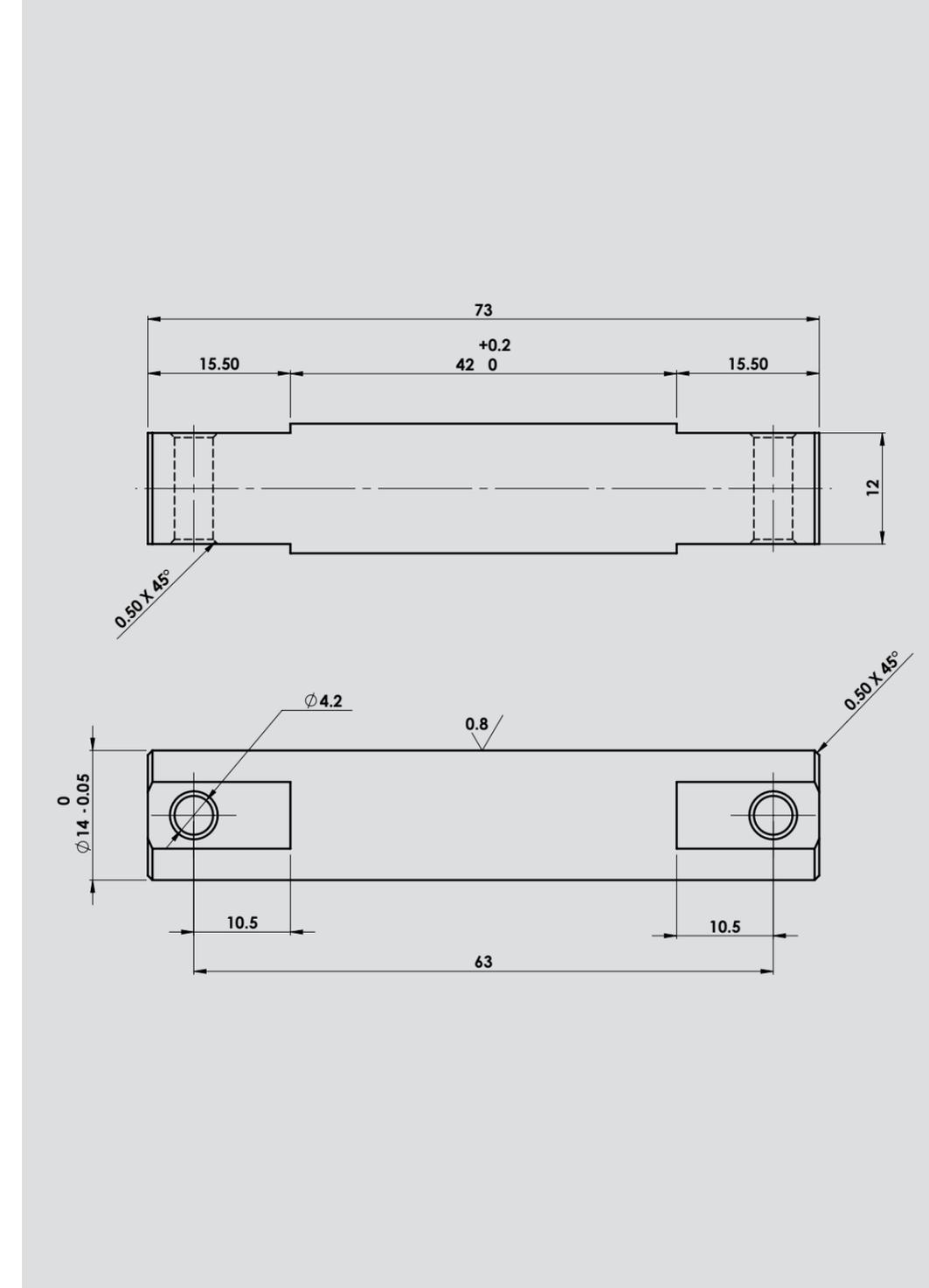
*Cause of failure was high load by sprocket.*

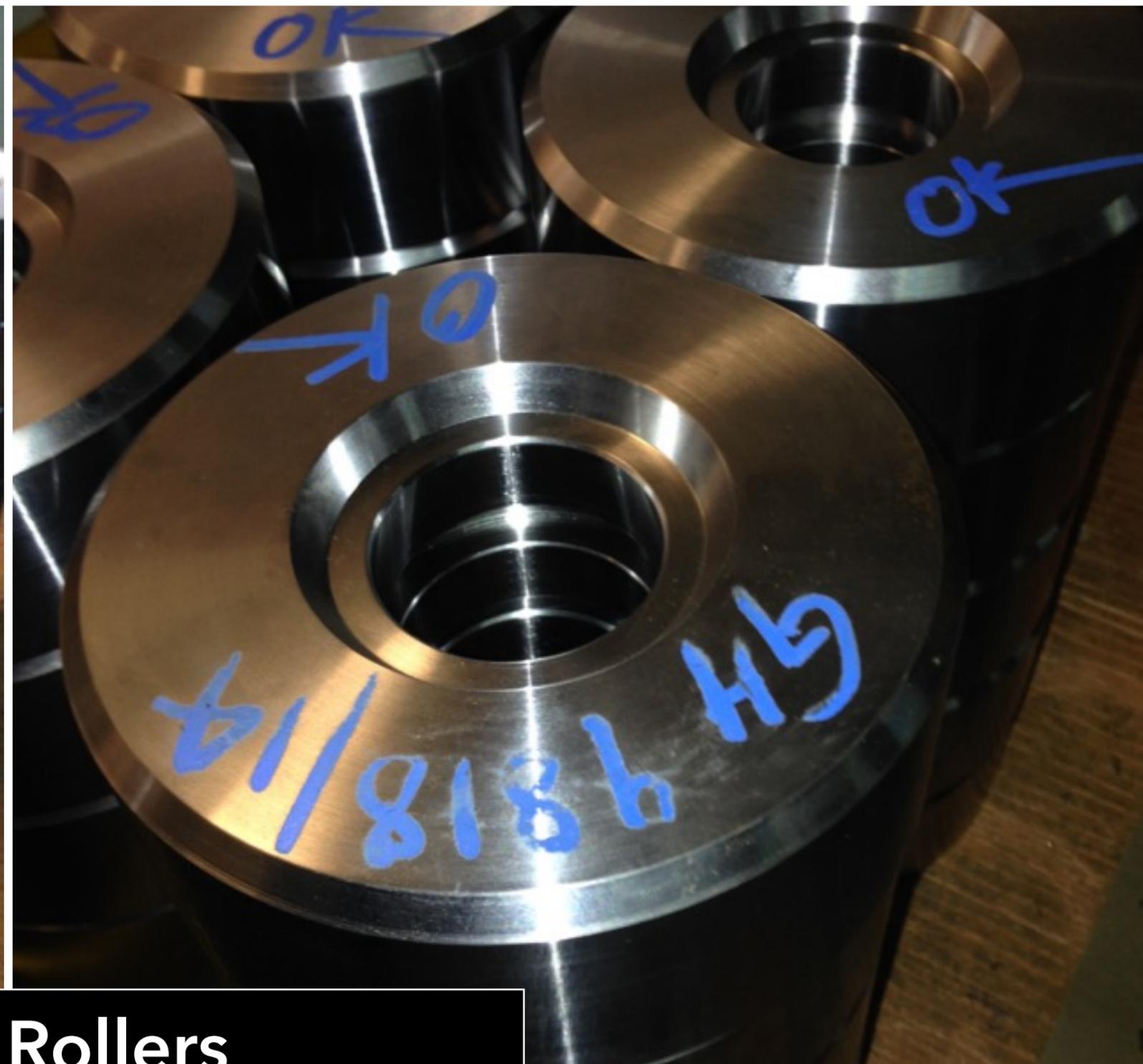
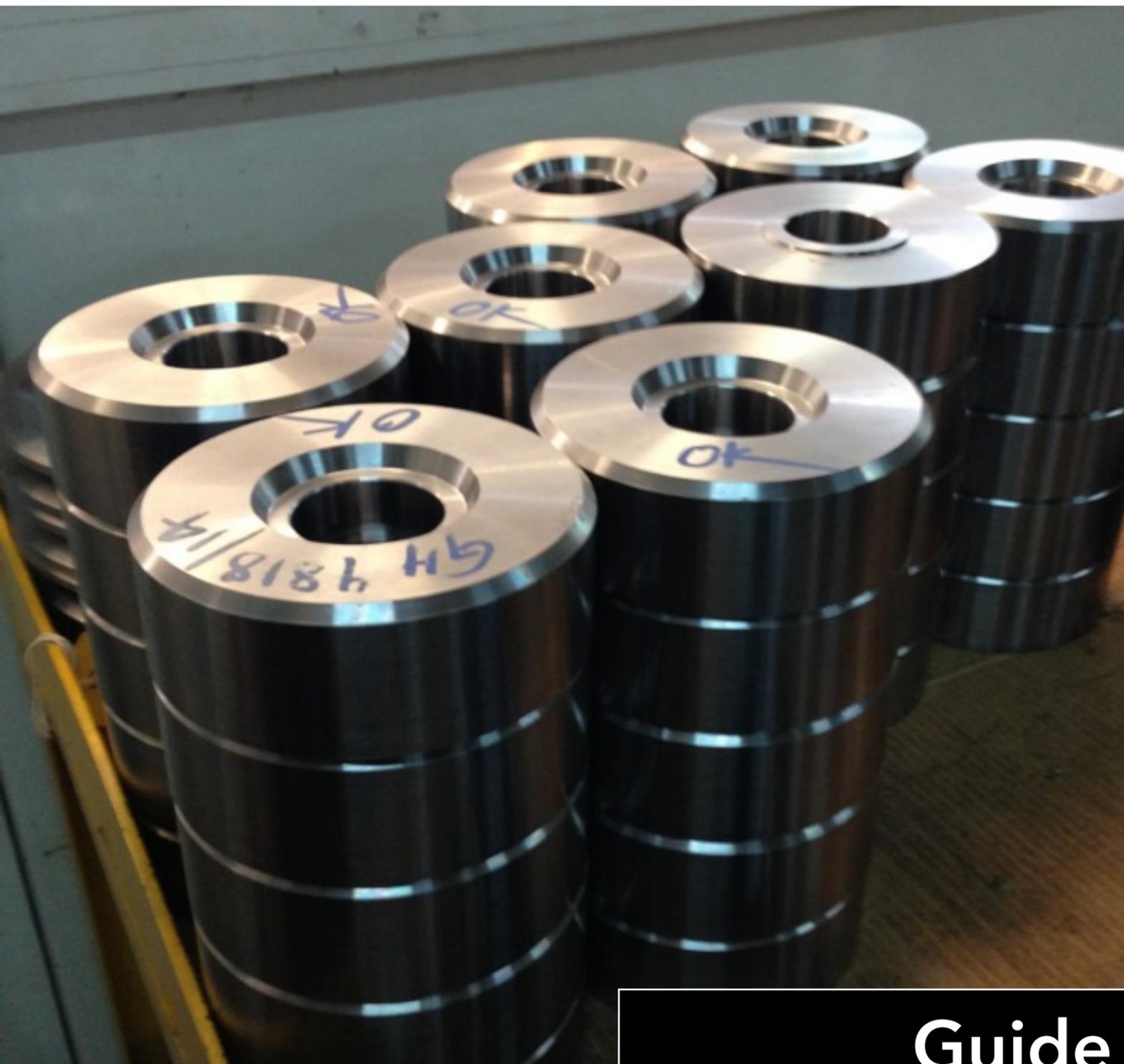
Machining pins in Toolox much easier.

*No heat treatment rejections. Dimensional stability.*

First set of 750 pins in operation working well.

Customer made Toolox standard, ordered more.





**Guide Rollers**

## Guide Rollers

### DESCRIPTION

Guide rollers in aluminium industry.

∅ 161 mm L 85 mm / ∅ 221 mm L 120 mm

42CrMo4 42-46 HRC

1 year

Toolox 44 Round

> 1 year

### EXPERIENCE

Lead time reduced by 10 days with Toolox.

*No need to send for heat treatment. One setup.*

*Almost no problems machining, boring, chamfering.*

Much better surface finish with Toolox.

*Provides better resistance to adhesive wear.*

After testing Toolox approved as new standard.



## Guide Rollers

### ADDITIONAL INFORMATION

Temperature in the environment is about 200 °C.

One cause of wear is oxides caught between moving material and rollers.

End customer tested 161 mm rollers first.

*After successful test ordered 161 mm and 221 mm diameters.*

We worked closely with workshop on drilling and tapping.

*For 161 mm diameter rollers required M5.*

*For 221 mm diameter rollers required M8.*

Toolox still running over a year now with visibly less wear than 42CrMo4 rollers.

Workshop happy, consultant happy, end customer happy.



**Drilling Rod Coupling**

# Drilling Rod Coupling

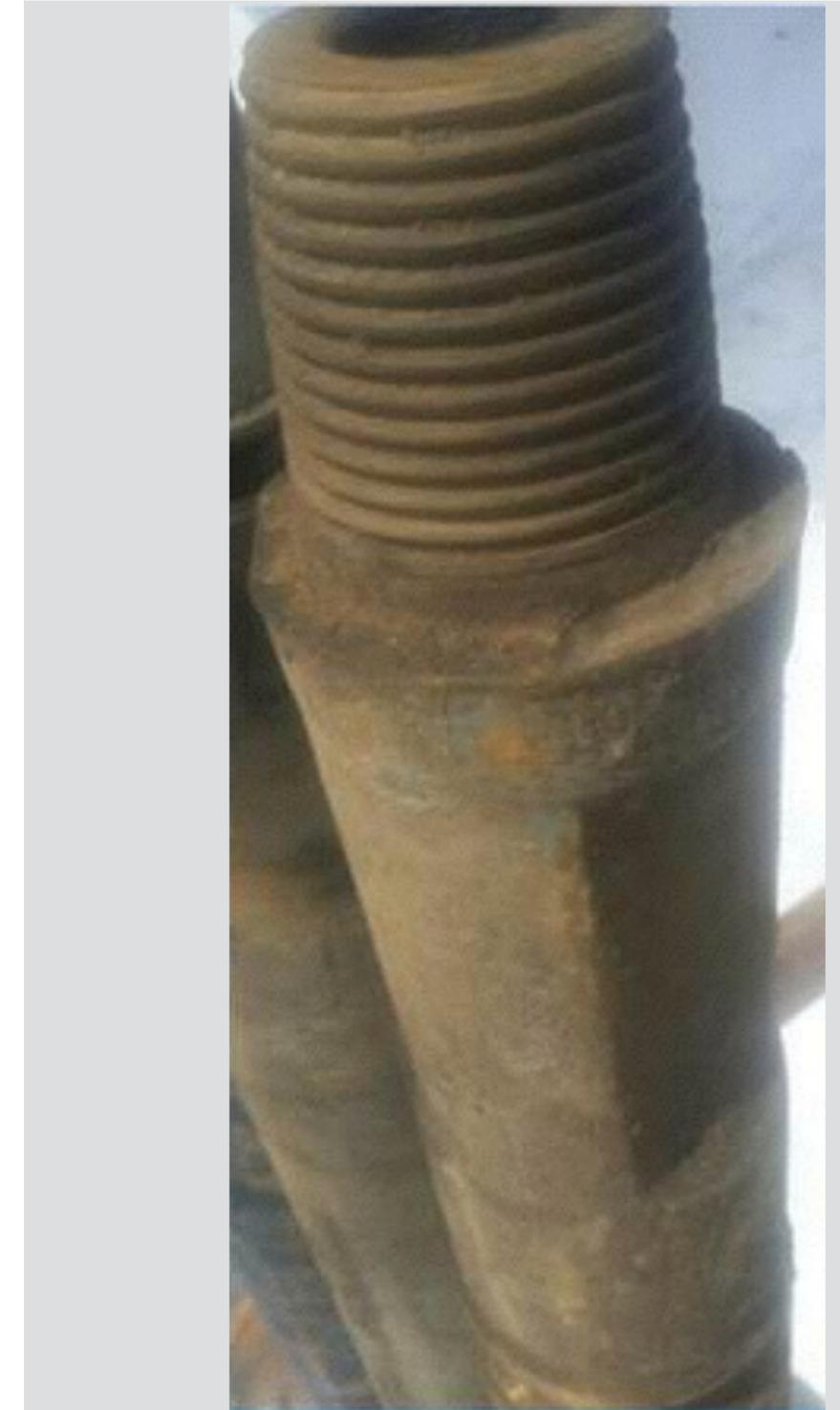
## DESCRIPTION

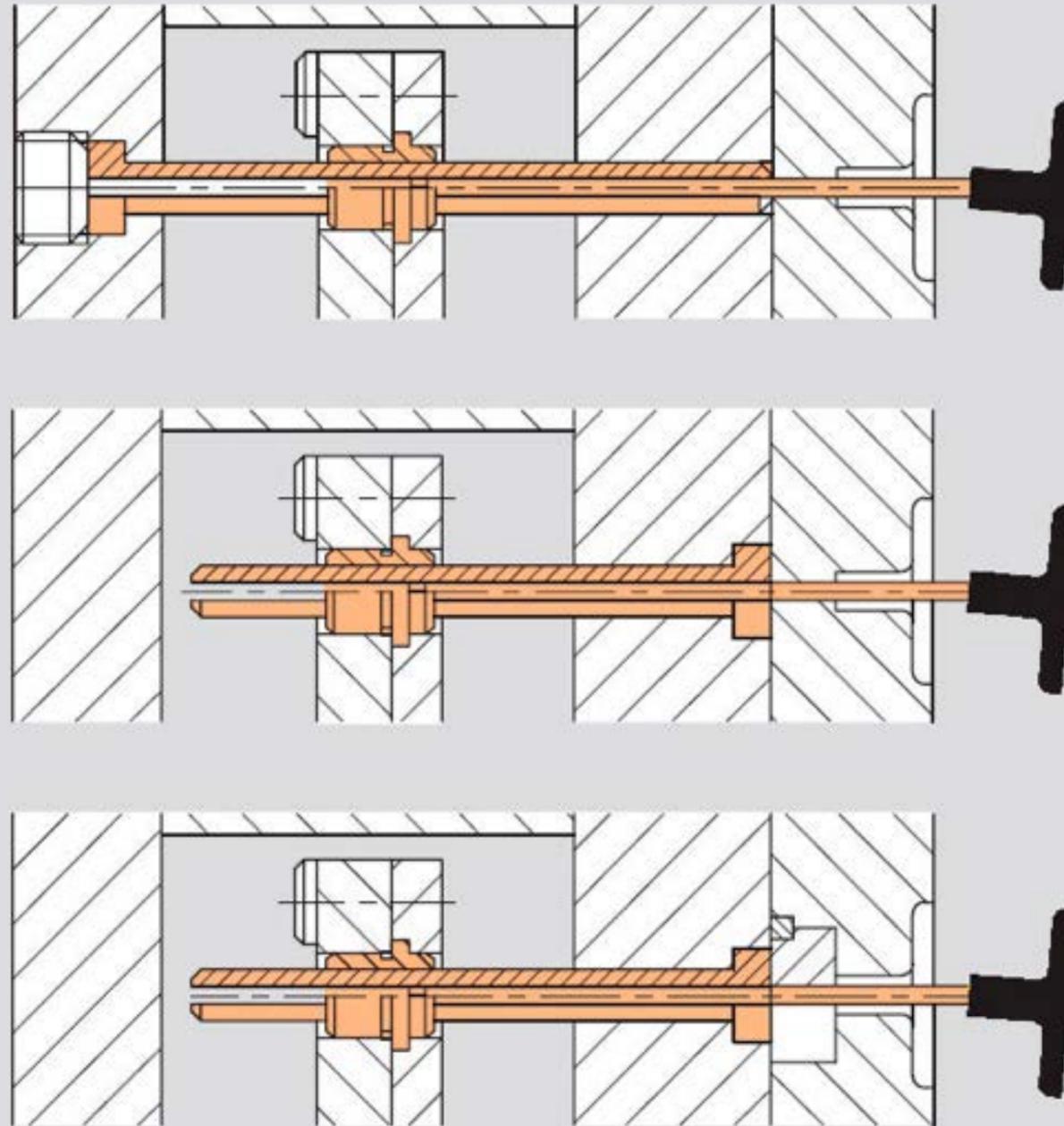
Drilling rod coupling in mining industry.  
Diameter 121 mm Length 420 mm

42CrMo4 42-46 HRC	1 month	WEAR
<b>Toolox 44 Round NITRIDED</b>	<b>&gt; 1 month</b>	<b>RUNNING</b>

## EXPERIENCE

Salt bath nitriding to 58 HRC after machining.  
Difficult environment combining wear and corrosion.  
Customer looking for much longer life and therefore willing to accept much higher cost (5x).  
Component still running.





**Ejector Pin**

## Ejector Pin

### DESCRIPTION

Ejector pin for sheet forming in automotive industry.  
Diameter 31 mm

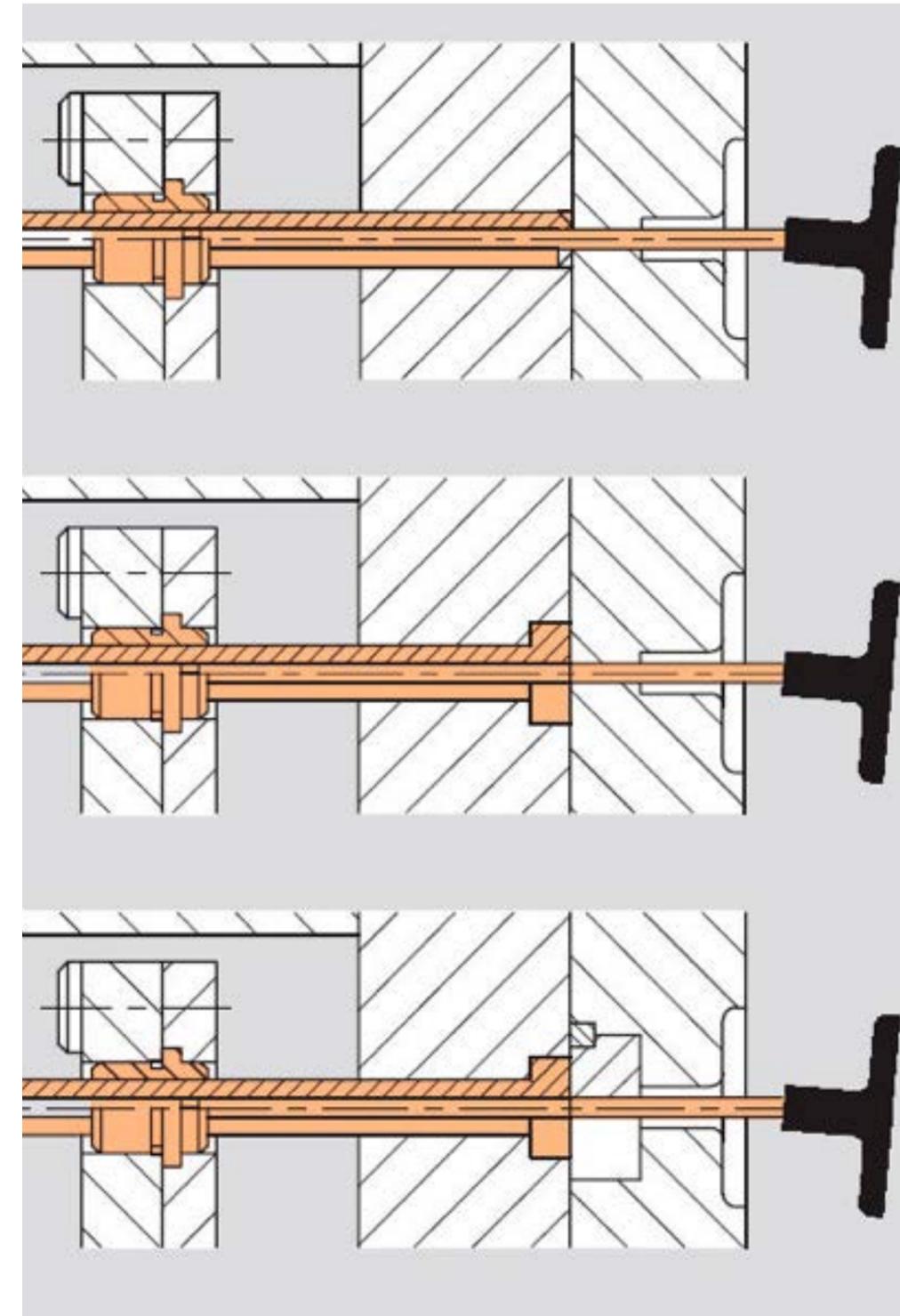
W.Nr. 1.2344 52 HRC

Toolox 44 Round

4x Life

### EXPERIENCE

Faster production time due to no heat treatment.  
Customer cited adhesive wear resistance as a factor to replace with Toolox.





## Connecting Bars

## Connecting Bars

### DESCRIPTION

Crane connecting bars for unloading garbage container.  
Diameter 60 mm Length 540 mm

Toolox 44 Round

### EXPERIENCE

Toolox 44 used to avoid plastic deformation.  
Manufactured in 2011. Since then no problems.  
Customer very happy, looking to introduce Toolox  
as a standard.





**Pivot Cap**



**Pivot Cap**

## Pivot Cap

### DESCRIPTION

Pivot cap for flood gates.  
Diameter 220 mm

42CrMo4

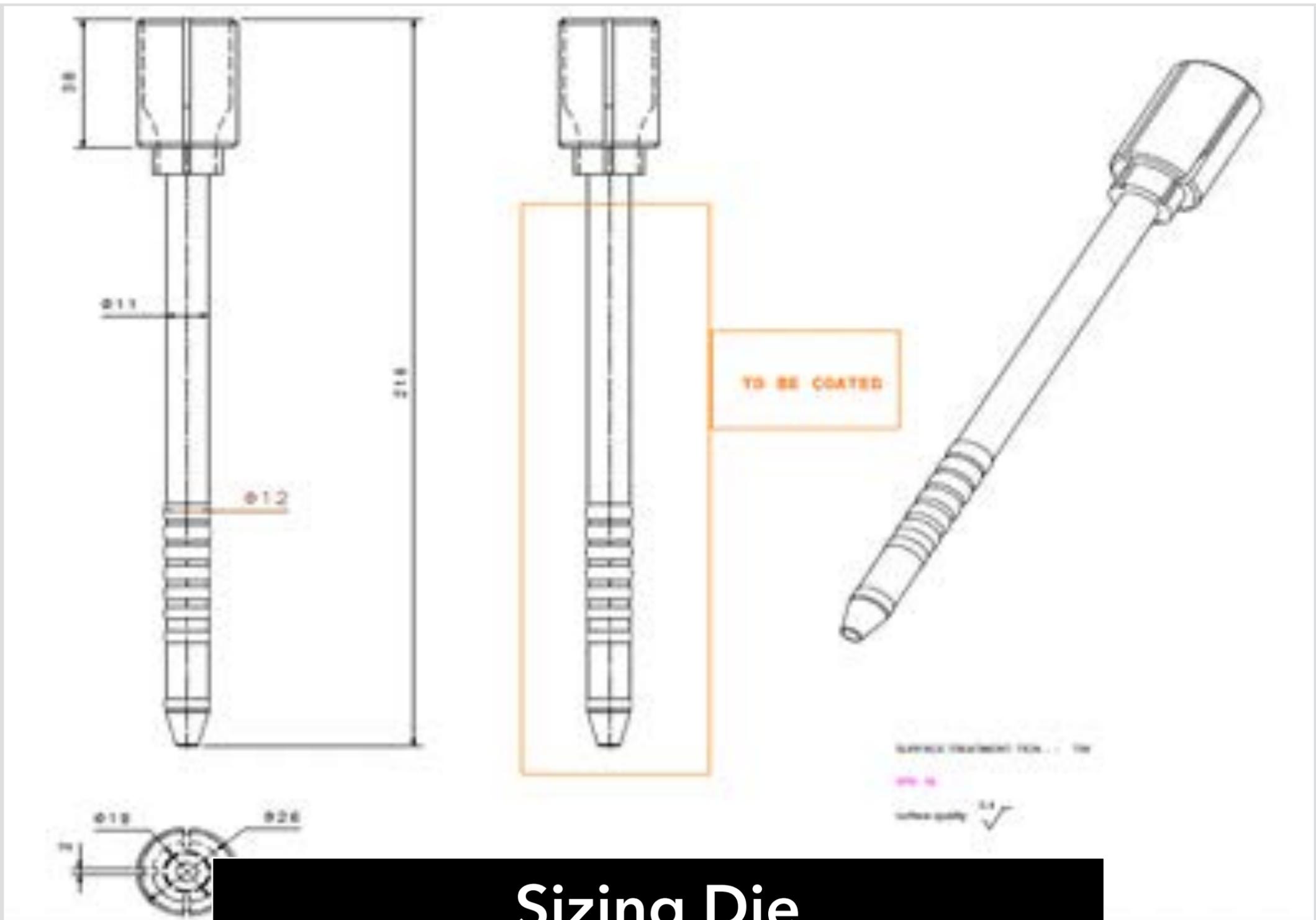
Toolox 44 Round

### EXPERIENCE

Alternative solution 42CrMo4 lower strength and is less suitable for coating.

Lunac 2 + Duplo corrosion and impact resistant coating.





**Sizing Die**

## Sizing Die

### DESCRIPTION

Sizing die in metal sheet production.  
Diameter 26 mm Length 216 mm

BOZ (NiCrMo) HEAT TREATED

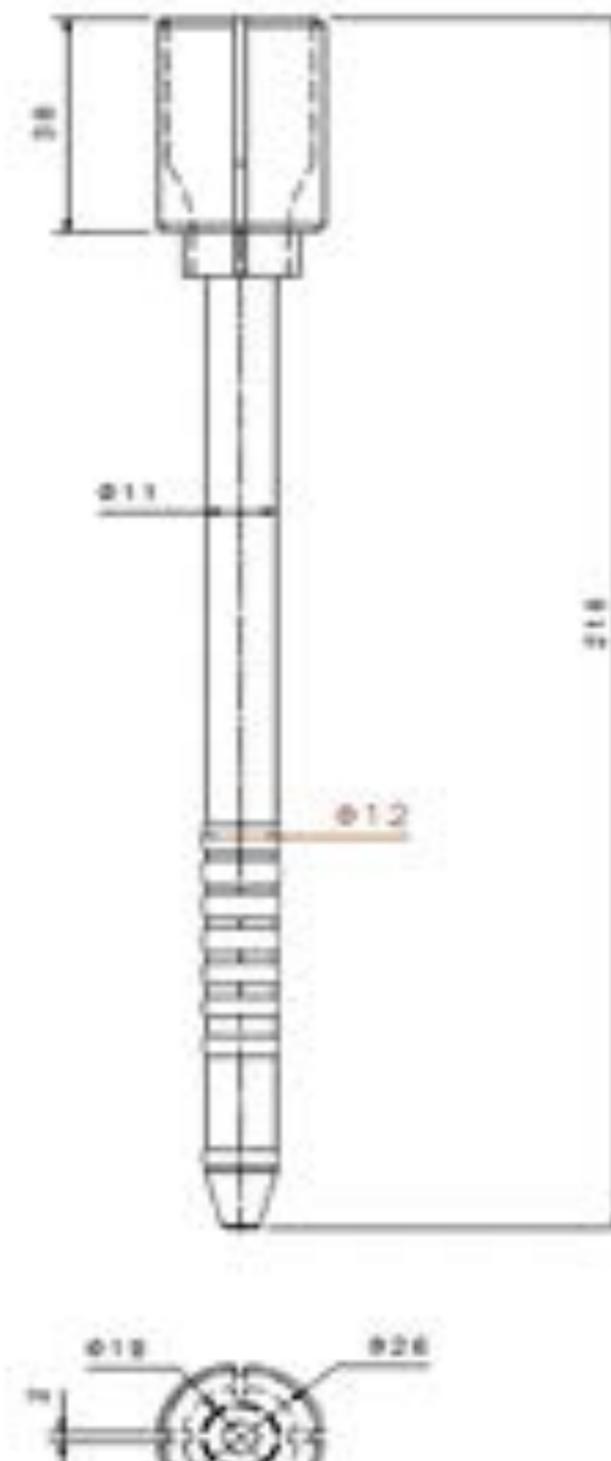
6 months

**Toolox 44 Round NITRIDED**

**Running**

### EXPERIENCE

Meets dimensional stability required in application.  
Customer expecting longer service life.



**SSAB**



*A stronger,  
lighter and more  
sustainable world*