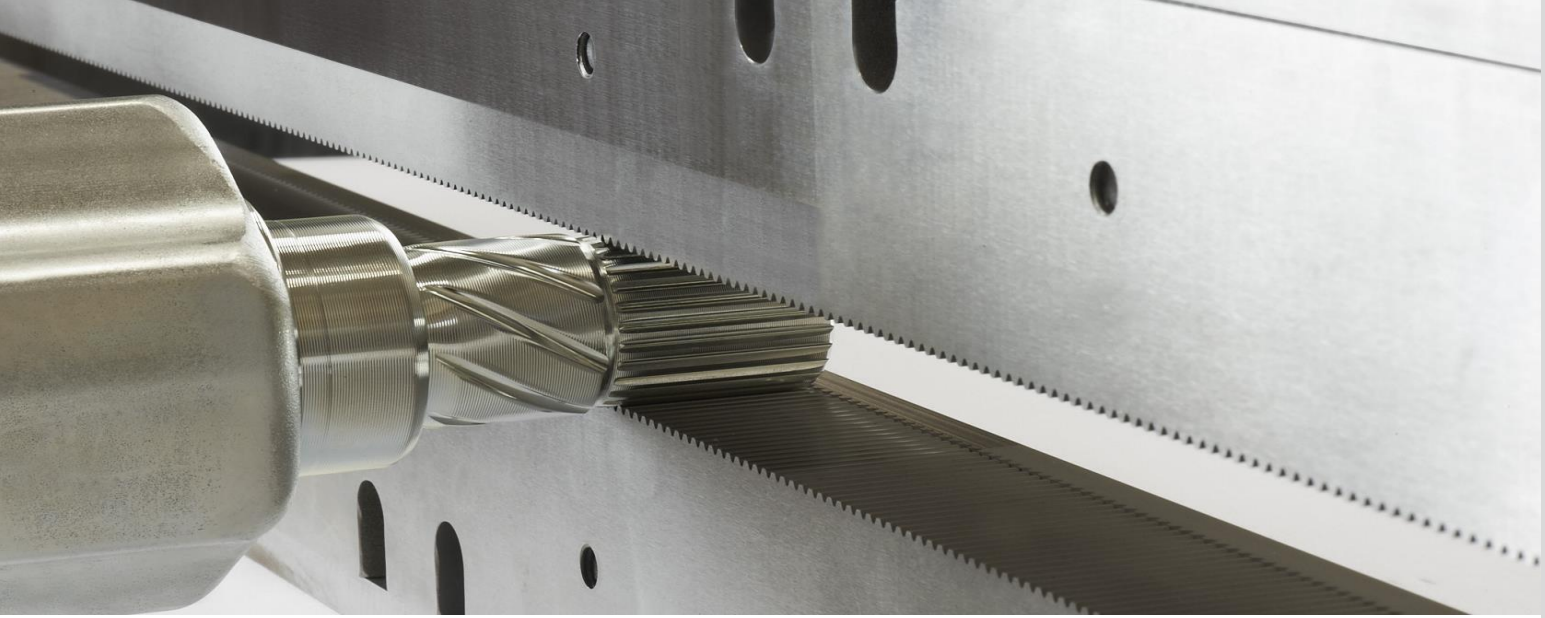


Spline Rolling Machine
XK 8xxEvolution-Series

OSG EX-CELL-O
COLDFORMING TECHNOLOGIES

MACHINE PICTURES

XK 851-8E(volution) Spline Rolling Machine

OSG EX-CELL-O

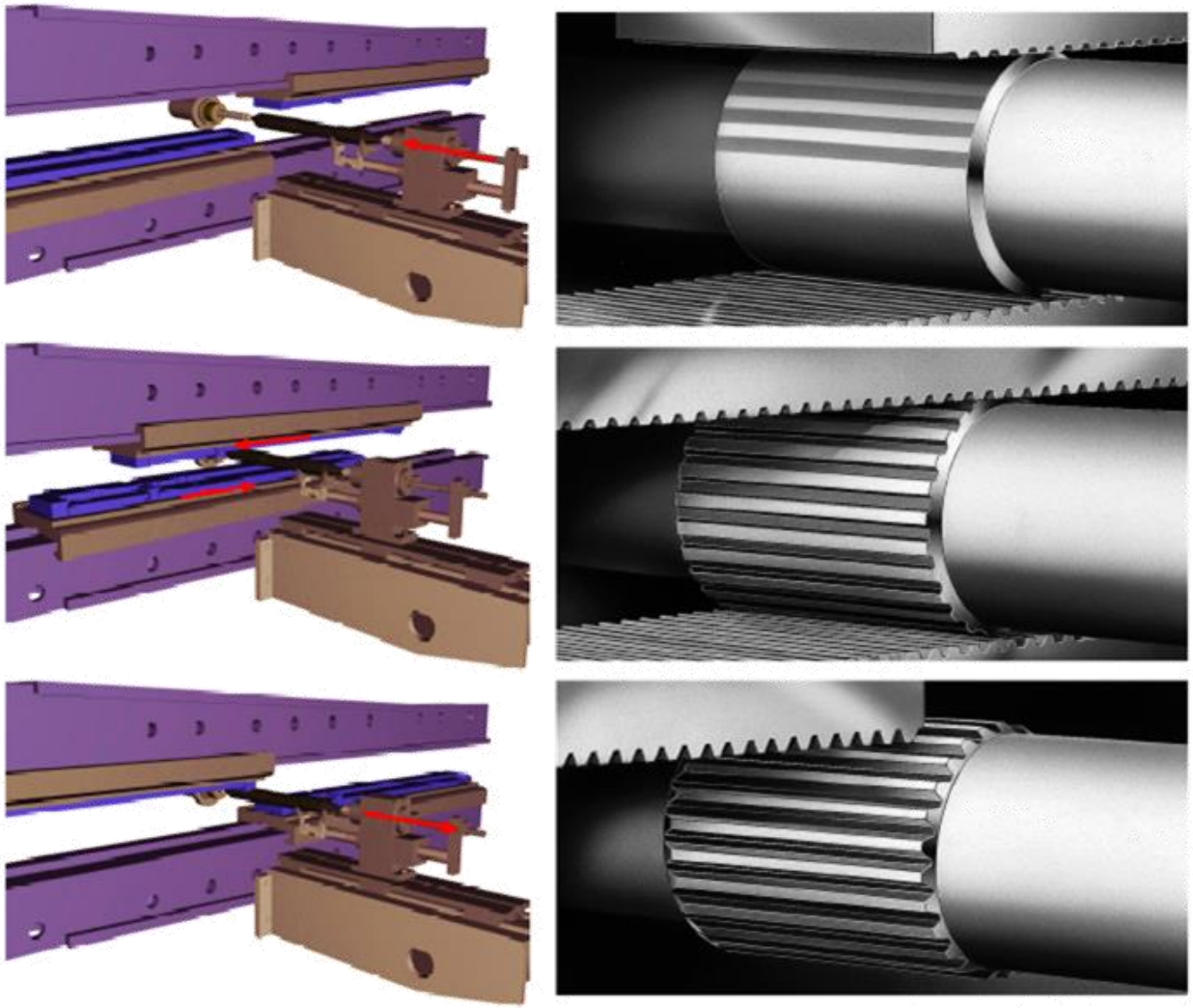
XK 851-8E(volution) Spline Rolling Machine

XK 851-8E(volution) Spline Rolling Machine

OSG EX-CELL-O

PROCESS

The Spline Rolling Process



Rollable Splines

OSG EX-CELL-O

- ✓ Involute Splines
  - ➢ Module 0,3 – 1,27*
  - ➢ Number of teeth 14 min. / 8 min. at helical splines
  - ➢ Pressure angle 20° - 45 °
  - ➢ Spline width up to 60mm*
  - ➢ Spline outside diameter up to 120mm
- ✓ Threads
  - ➢ DIN 13 / ANSI/ASME B1.1 / SAE
  - ➢ Up to diameter 70mm and pitch 2mm
- ✓ Oil grooves
- ✓ Knurls

*only as references

ADVANTAGES

Basic Advantages of XK 8E-Series

OSG EX-CELL-O

- ✓ Simplified, extended and flexible tool fixture
- ✓ Decrease change over time up to random mode between different workparts
- ✓ CNC technology shrinks scrap rate significantly up to zero, even after changeovers
- ✓ Improvement of spline quality by CNC control functions
- ✓ Optimized machine guarding concept
- ✓ Safety Integrated
- ✓ Direct driven CNC axes: w/o hydraulic aggregate, w/o mechanical syncronization
  - ➢ Less required floor space
  - ➢ Less energy consumption
  - ➢ Less noise level
  - ➢ Less heat absorption
  - ➢ Less maintenance costs

XK 8E – New Key Advantages

OSG EX-CELL-O

- ✓ Three tool stoke variants XK 825 (24“), 837 (36“), 851 (48“)
- ✓ **NEW:** Optionally as 2- axes, 4-axes, 6-axes or 8-axes machine available
- ✓ **NEW:** CNC-Taper-control-axes to manage spline tapers due to axial material flow deviations or heat treatment deviations
- ✓ **NEW:** Large workpart and tool variety through increased machine-opening-variance: 5.5“- 8.0“ in one machine.
- ✓ **NEW:** Latest FANUC control with touch screen HMI.
- ✓ **NEW:** Increased horizontal & vertical feed rates
- ✓ **NEW:** Reduced floor space

MODULARITY

Technology Comparison

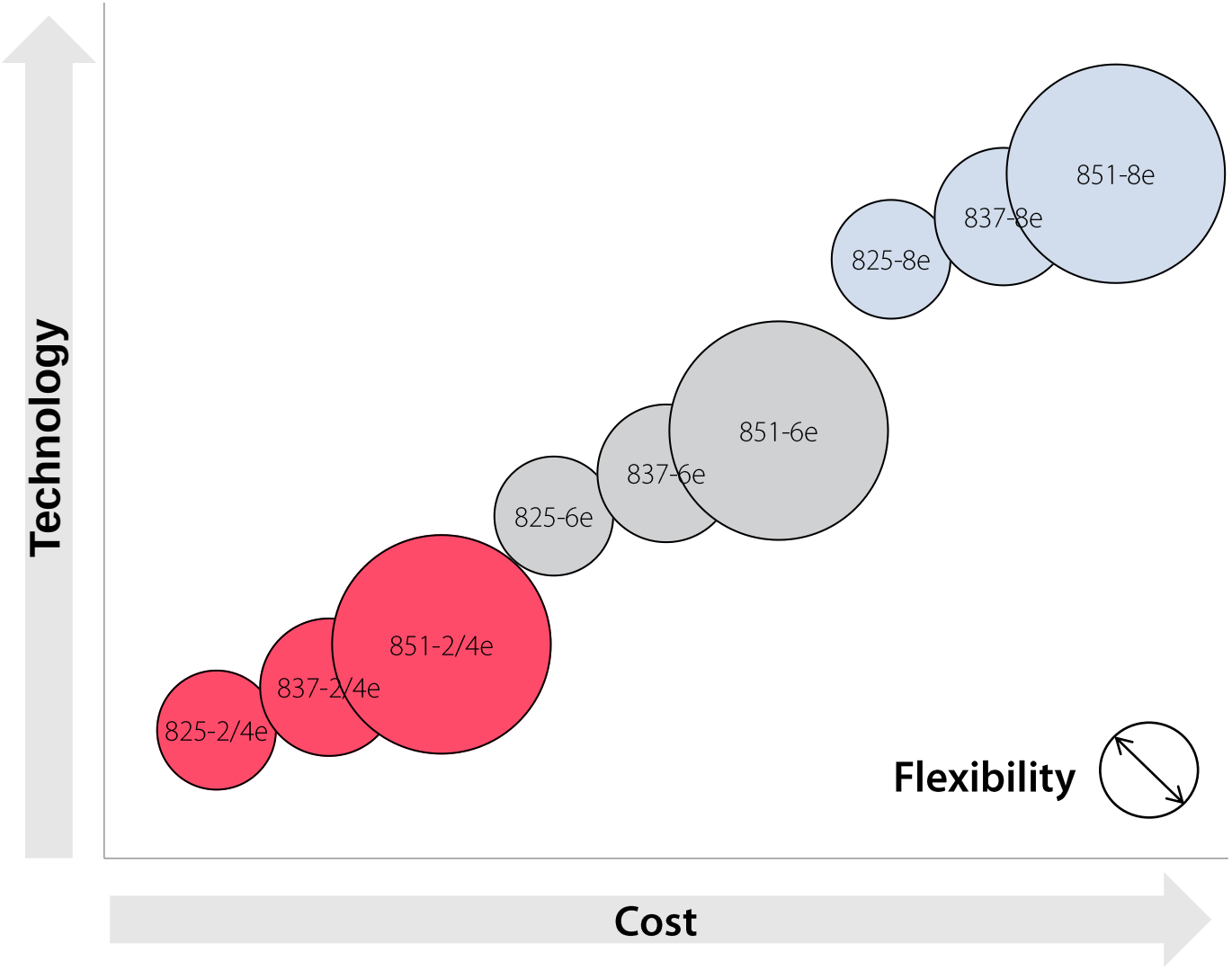
OSG EX-CELL-O

	Hydraulic Models	OSG EX-CELL-O XK8*E*			
		2ax	4 ax	6 ax	8 ax
Dimensional MOP correction by CNC	✗	✗	✗	✓	✓
Spacing error correction by CNC	✗	✓	✓	✓	✓
Taper correction by CNC	✗	✗	✗	✗	✓
Vertical feed during rolling (bite correction)	✗	✗	✗	✓	✓
Rolling speeds are individually programmable	✗	✓	✓	✓	✓
Variation of tooth quantity with the same tools	✗	✗	✗	✓	✓
Radial spline orientation by clamping technology	✗	✗	✗	✓	✓
All axis speeds controlled by 1 override	✗	✗	✓	✓	✓
Retract button to move safe into home position	✗	✗	✗	✓	✓
Tool Data and Production Data Management	✗	✓	✓	✓	✓

Dedicated Modular Design Concept XK 8E-Series

OSG EX-CELL-O

- Highest flexibility
- Highest quality
- Lowest scrap rate
- Taper setting by CNC
- Multiple workparts
- Multiple Splines
- MOP setting by CNC
- Taper setting manually
- Less changeovers
- Single Splines
- Lowest flexibility



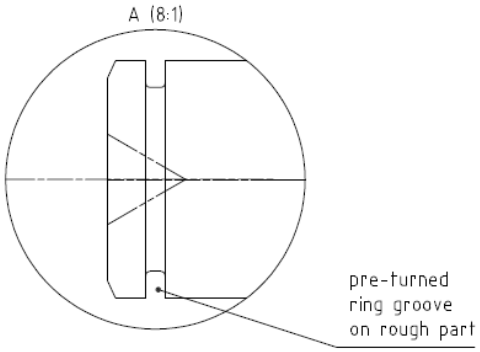
ADVANCED TECHNOLOGIES

Clearing of pre-machined Ring Grooves

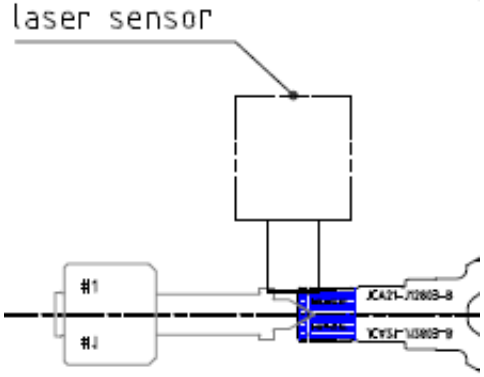
OSG EX-CELL-O

To manufacture ring grooves in heat treated splines is expensive. With our patented technology, ring grooves could already been manufactured in soft turning 3 process and can be kept free during spline rolling process. Our advanced manufacturing concept ensures process-reliable and chip-free results.

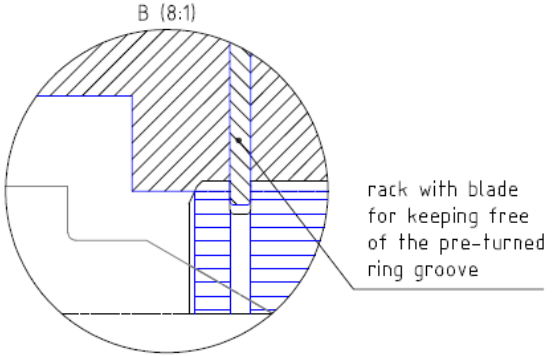
OP 10:
Pre Turned groove



OP 20:
Pre measuring groove



OP 30:
Coldforming spline incl. rack with blade



Compensation of Hardness Distortion by CNC

OSG EX-CELL-O

- ✓ Specially developed to compensate hardness distortions on induction hardened splines (especially axle components).
- ✓ CNC compensation of the flank taper happens by additional CNC axes. This shortens the set-up time significantly and improves finished splines quality level.

Advantages:

- ✓ Time and know-how intensive process optimization by using metal shims is obsolete
- ✓ µm precise CNC control possible via using a simple configuration parameter
- ✓ Limited worker know-how required to produce highest quality
- ✓ All process data saved in the CNC program. After re-setup first part = good part
- ✓ Foundation for developing of in-process compensation

Hollow Shaft Process

OSG EX-CELL-O

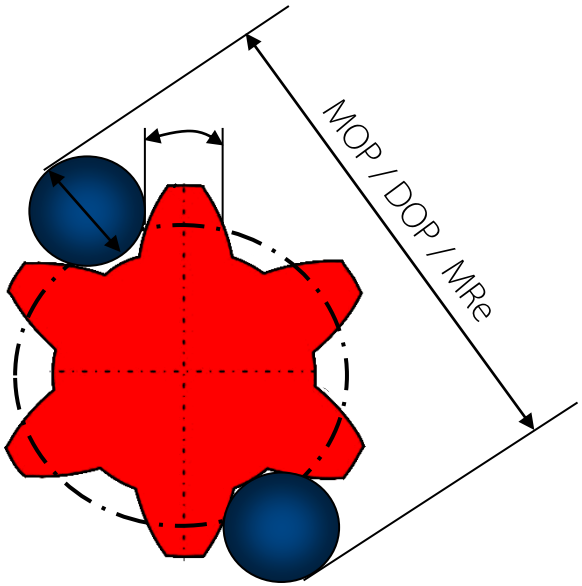
- ✓ Well spline quality at hollow shafts up to 3-5 mm wall thinkness
- ✓ Shifted pull- and push involutes ensure a well spline function in both turning directions
- ✓ Process request no special machine technology
- ✓ Same tooling design at new or reground racks

SET UP FEATURES

Dimensional Correction by CNC

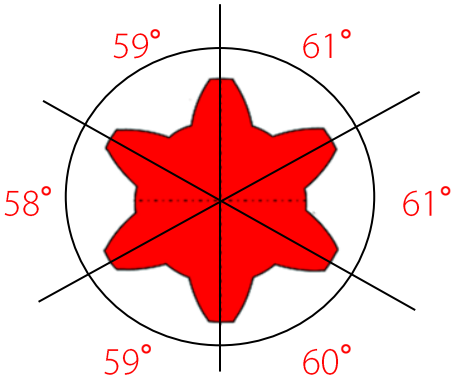
OSG EX-CELL-O

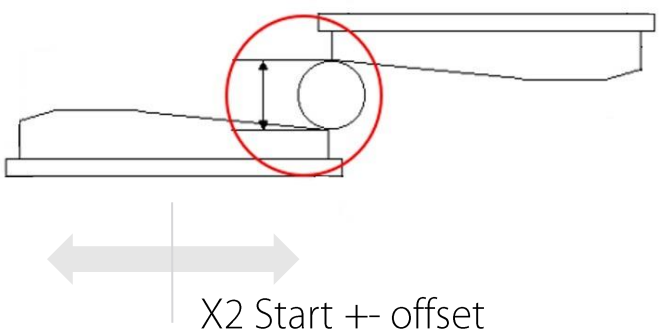
- ✓ Measurement over Pins (MOP) / Dimension over Balls (DOB) set up by CNC parameter.
- ✓ Correction value is limited to 100µm per change to avoid workers error.
- ✓ Individually saved to every workpart and every operation.



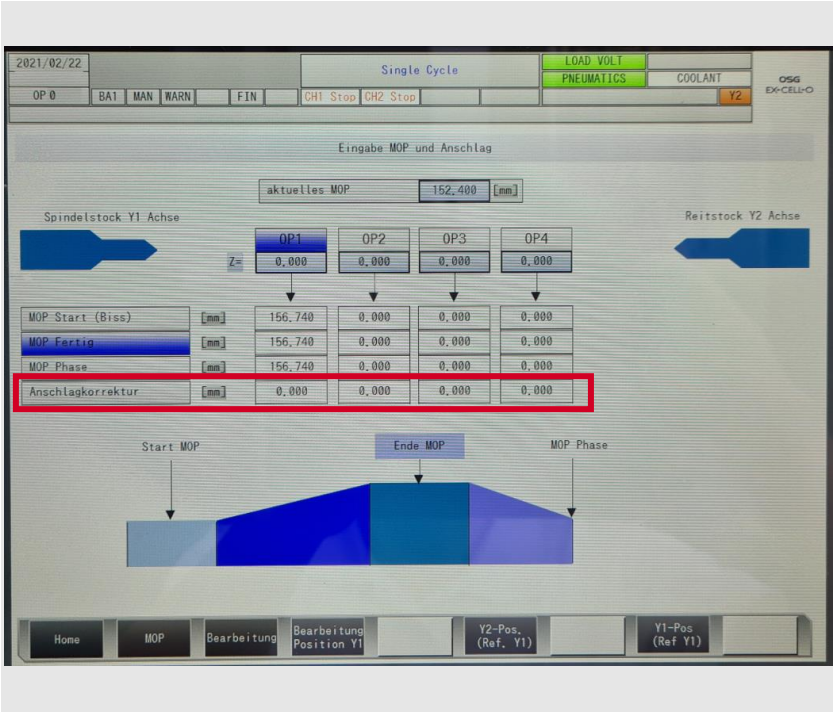
Spacing Error Correction by CNC

- ✓ Spacing Error fine correction by CNC parameter.
- ✓ Correction value is limited to 50µm per change to avoid workers error.
- ✓ Individually saved to every workpart and every operation.



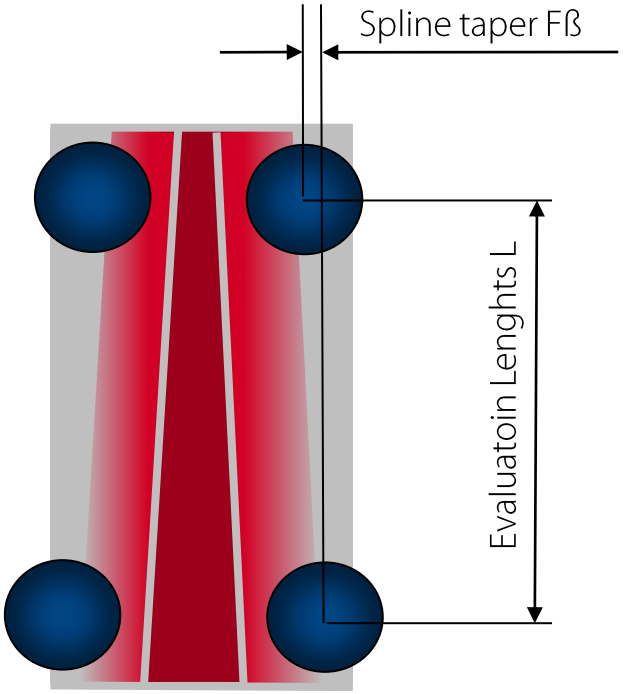


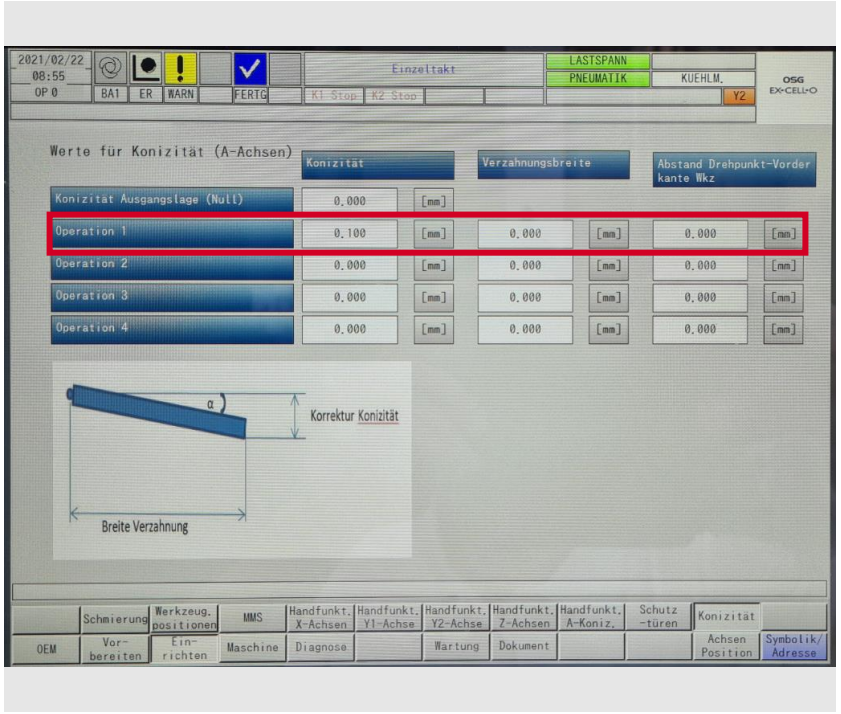
X2 Start +- offset



Taper Correction by CNC

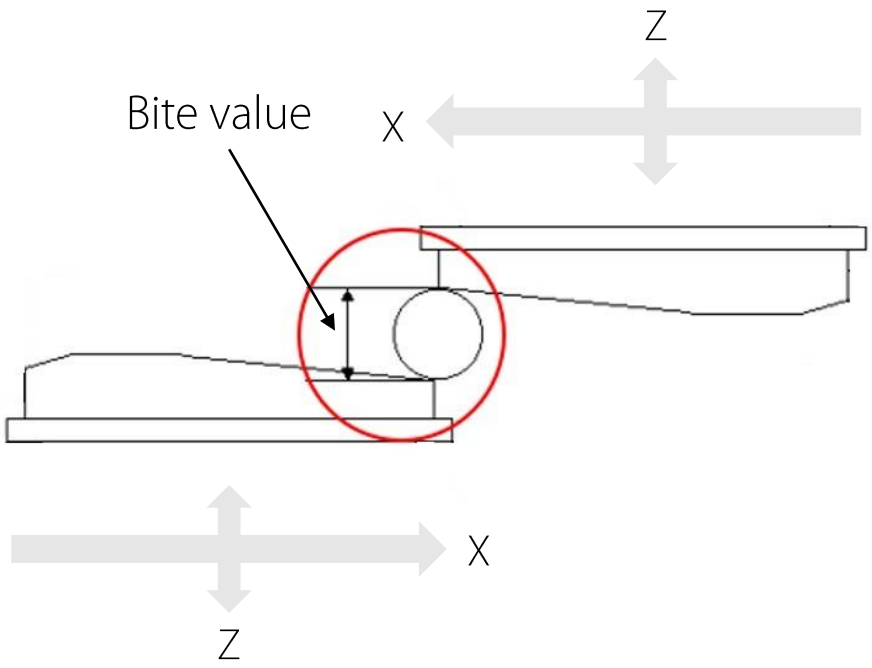
- ✓ Taper fine correction by CNC parameter.
- ✓ Input from values from CMM measurement protocol.
- ✓ Individually saved to every workpart and every operation.

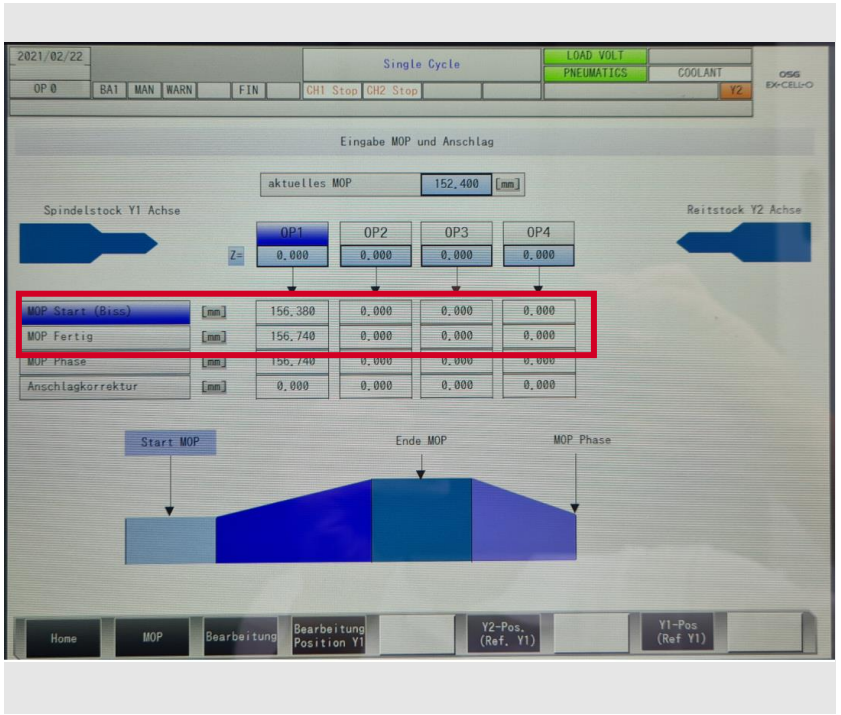




Vertical Feed During Rolling (Bite Correction)

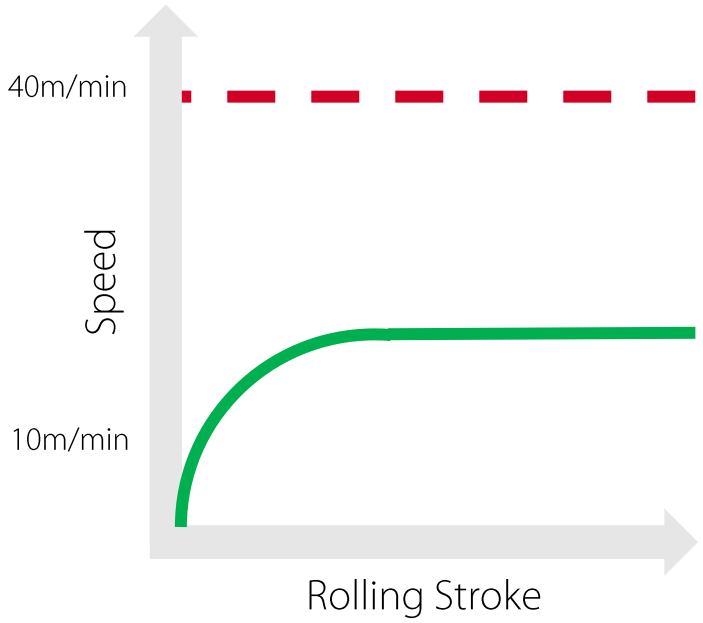
- ✓ „Bite value“ is very important parameter at setting excellent pitch error Fp-e.
- ✓ Bite machine opening to be set by CNC parameter. If bite and DOB machine opening is different, tool slider interpolates by X-Z movement in ramp zone.
- ✓ Individually saved to every workpart and every operation.

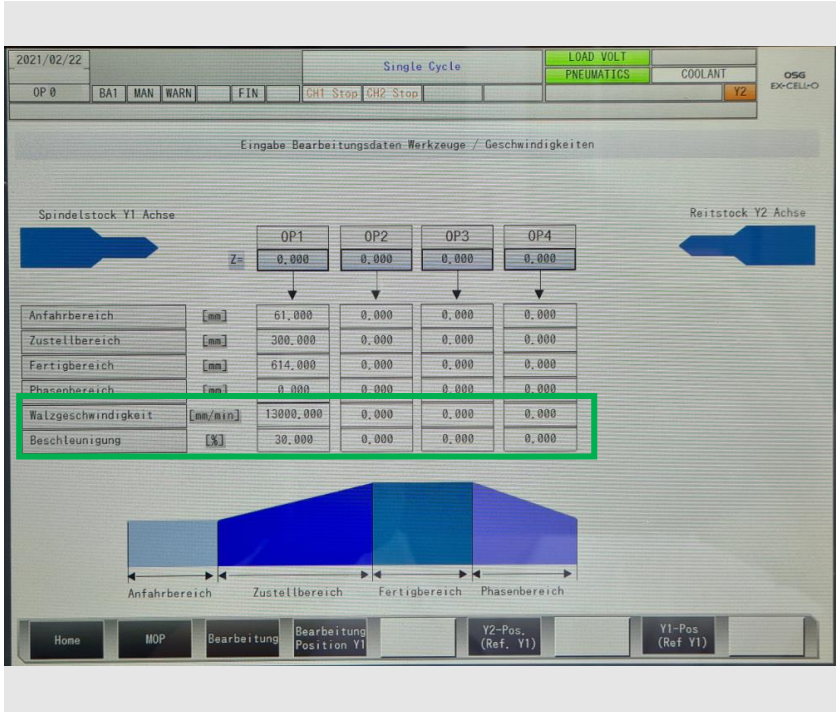




Individual Rolling Speeds

- ✓ Slow start, acceleration, end speed individually programable. Important for setting excellent pitch error Fp-e.
- ✓ Fast return up to 40 meters/min reduce unproductive times = lower cycle time.
- ✓ Individually saved to every workpart and every operation.

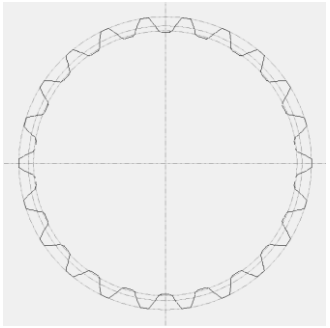




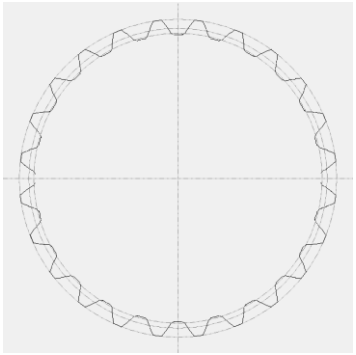
Variation of Tooth Quantity with same Tools

OSG EX-CELL-O

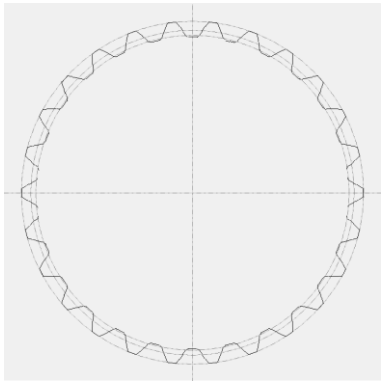
- ✓ At same module, pressure angle and tooth thickness different tooth quantities possible to roll – no changeover. E.g. T22, T24, T26, T28 with same tools, without changeover.
- ✓ Individually saved parameters to every workpart and every operation.



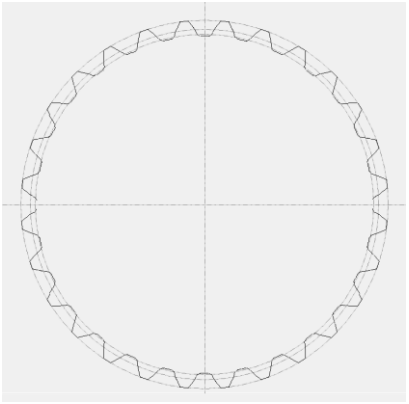
T22 X= 152,4mm



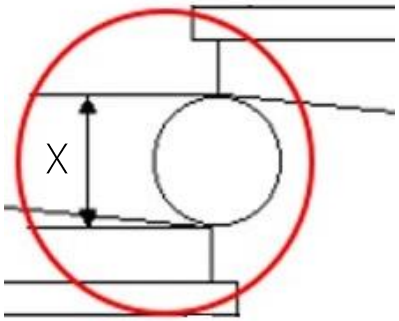
T24 X= 154,4mm



T26 X= 156,4mm



T28 X= 158,4mm



Radial Spline Orientation by Clamping Technology

OSG EX-CELL-O

- ✓ With clamping technology spline orientation to other geometry on workpart to improve workpart technology, manufacturing technology or assembly process.

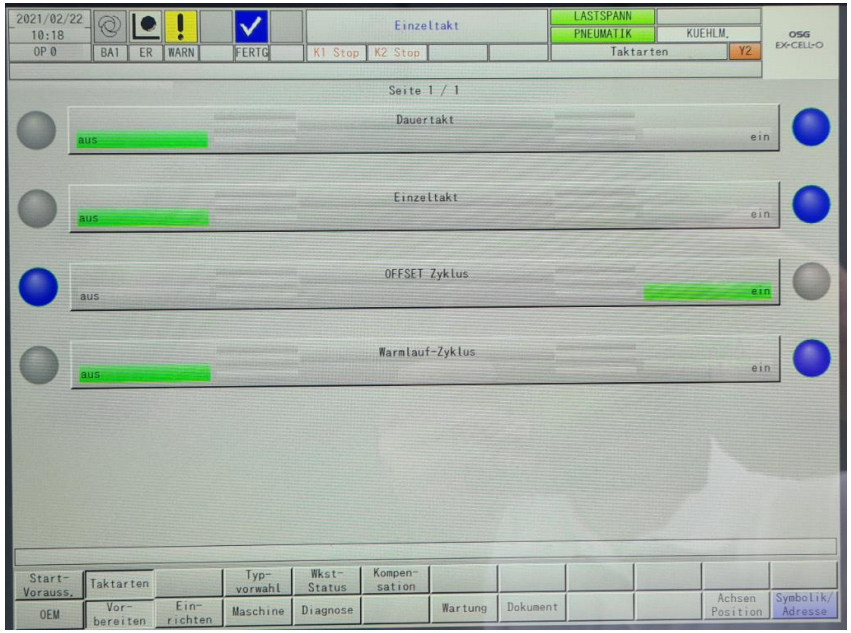
- ✓ Example 1:
  Stub Shaft. Spline orientation to „eye bores“

- ✓ Example 2:
  Crank Shaft. Blocked tooth to hub bearing

Process sequence:

Safe Process Control

- ✓ Modern FANUC control system with FANUC touch surface and many 4.0 functions
- ✓ „Offset mode“ for safe first process run with offset in vertical direction
- ✓ Override ensures safe and fully controlled process setup
- ✓ Retract button for automatic safe home



REFERENCE WORKPIECES/PROCESS

Some Reference Process

	DCT Shaft	DCT Shaft	Outer Race	Axle Shaft	Sun Shaft	Rotor Shaft
Operations	1	2	1	2	1	3
Automation	Conveyor	Conveyor	Robot	Gantry	Robot	Conveyor
Process	Hollow Shaft	Standard	Standard	Standard	Standard	Standard
Cycle time	~60 sec	~24 sec	~18 sec	~24 sec	~ 20sec	~26 sec
Process time	~45 sec	~18 sec	~6 sec	~18 sec	~8 sec	~20 sec
Anual Cap @ 5.100 h.p.y.	306.000	765.000	1.020.000	765.000	918.000	706.000

TECHNICAL DATA

Technical Data XK 8[xx]-[x]E

OSG EX-CELL-O

Machine type		XK 825-2E	XK 825-4E	XK 825-6E	XK 825-8E	XK 837-2E	XK 837-4E	XK 837-6E	XK 837-8E	XK 851-2E	XK 851-4E	XK 851-6E	XK 851-8E
Basic machine lenghts	mm	3560				4000				4650			
Basic machine depths	mm	1900				1900				1900			
Depths incl. Head- and Tailstock (ref.)	mm	3500				3500				3500			
Height	mm	2530				2530				2530			
Number of CNC Axis		2	4	6	8	2	4	6	8	2	4	6	8
Diameter adjustments		manual		CNC	CNC	manual		CNC	CNC	manual		CNC	CNC
Taper adjustments		manual			CNC	manual			CNC	manual			CNC
Slide stroke max.	mm	810				1200				1740			
Tool clamping width max.	mm	234				234				234			
Tool lenghts max.	mm	24" (610mm)				39" (990,60mm)				57" (1447,80mm)			
Feed force max.	kN	30				30				30			
Feed rate max.	m/min	40				40				40			
Radial feed	mm	1		84		1		84		1		84	
Radial feed rate max.	mm/s	manual		4,5		Manuell		4,5		Manuell		4,5	
Process force max.	kN	200				200				200			
Profile lenghts max. (ref.)*	mm	60				60				60			
Modul range (ref.)*	m	0,3 - 1,27				0,3 - 1,27				0,3 - 1,27			
Machine opening	Inch	5.5" / 6.0" / 7.0" / 8.0"		5.5" - 8.0"		5.5" / 6.0" / 7.0" / 8.0"		5.5" - 8.0"		5.5" / 6.0" / 7.0" / 8.0"		5.5" - 8.0"	
Weight w/o automation	kg	8.000		9.000		9.000		10.000		10.000		11.000	

* Values are individual guidelines

OSG EX-CELL-O

COLDFORMING TECHNOLOGIES

Thank you!

Browse our latest rolling technologies

Find your contact persons in charge

www.osg-excello.com