



Round Jaws – More Possibilities

RINDEX MULTI JAWS

A Simple "Quick change" system – For Quality and Profit

WWW.RINDEX.COM - MADE IN SWEDEN



M P C A U T O M A T I O N S Y S T E M S



DOCUMENTATION

The Rindex family – The full system displayed.....	1
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RINDEX SOFT & HARD JAWS

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PROFITABLE FACTS - BY SANDVIK COROMONT

Jaw Purchase cost Vs. Jaw User Cost

Tool cost Vs. total cost

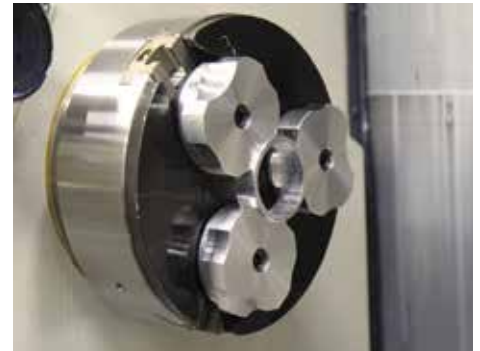
THE RINDEX FAMILY

Our Clamping Product Line

GRIPPEX BAR PULLER

RINDEX JAWS

RINDEX COUNTER - WEIGHTS



- * THREE MODELS
- * FOR BARS 1 - 105 MM
- * ROBOT PICK-UT UNIT

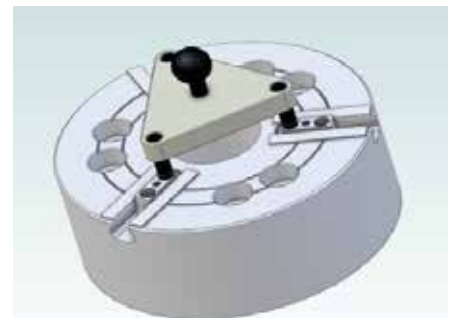
- * SIX CLAMPING POSITIONS
- * QUICK JAW CHANGE
- * 100 % CLAMPING SURFACE

- * CENTRIFUGAL COMPENSATION
- * ROUNDER PARTS, NO REWORK
- * FITS YOUR EXISTING CHUCK

SMART-NUTS

MULTI-NUTS

TRIPOD INDEXING TOOL

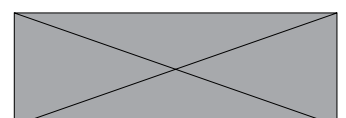


- * QUICK JAW CHANGE
FOR YOUR STANDARD
JAWS

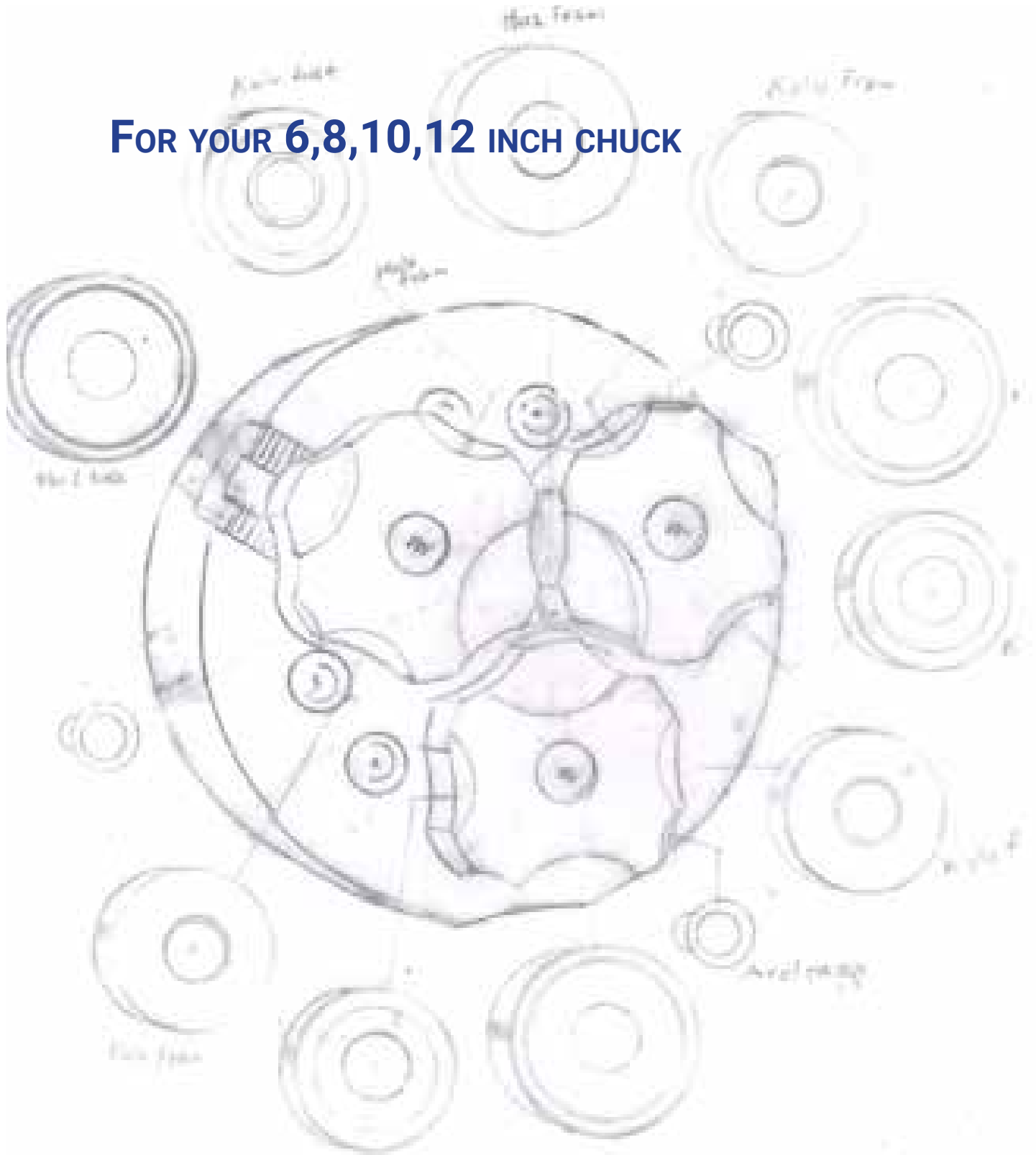
- * USE YOUR 10" JAWS ON
YOUR 8" CHUCK

- * USE YOUR 8" JAWS ON
YOUR 10" CHUCK

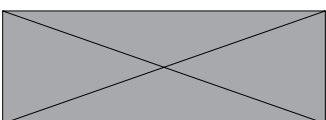
- * PRESET LOCATION OF T-NUT
- * QUICK CHANGE LOCATION
OF T-NUT



FOR YOUR 6,8,10,12 INCH CHUCK



*ORIGINAL DRAWING BY BO SVENSSON,
FOUNDER OF MPC AUTOMATION SYSTEMS*

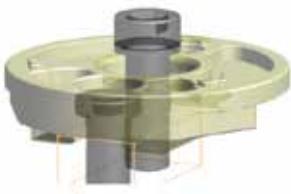


RINDEX CLAMPING JAWS

DIFFERENT MODELS

BASE JAWS

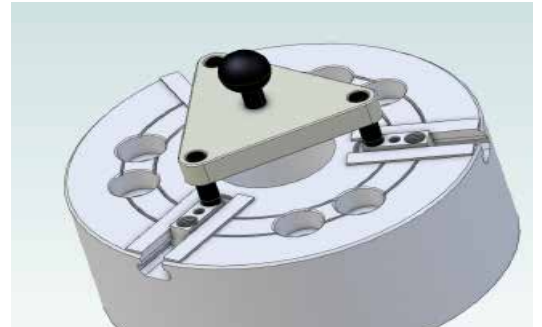
**STANDARD
BASE JAW**



**ADVANCED
BASE JAW**

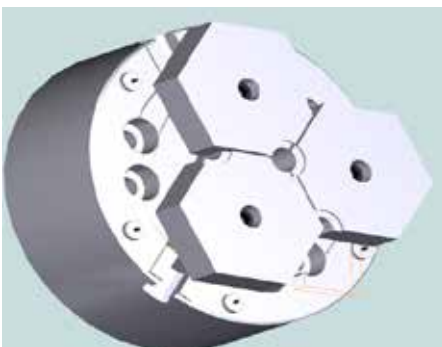


**QUICK CHANGE ASSEMBLY
TOOL - FOR T-NUT AND BASE
JAWS**



TOP JAWS

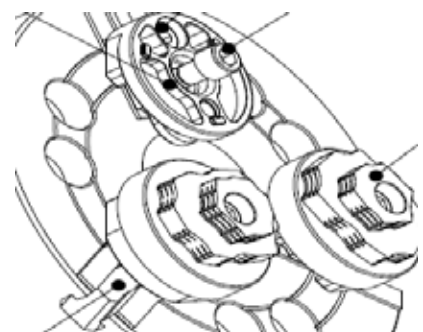
**HEXAGON
SOFT TOP JAWS**



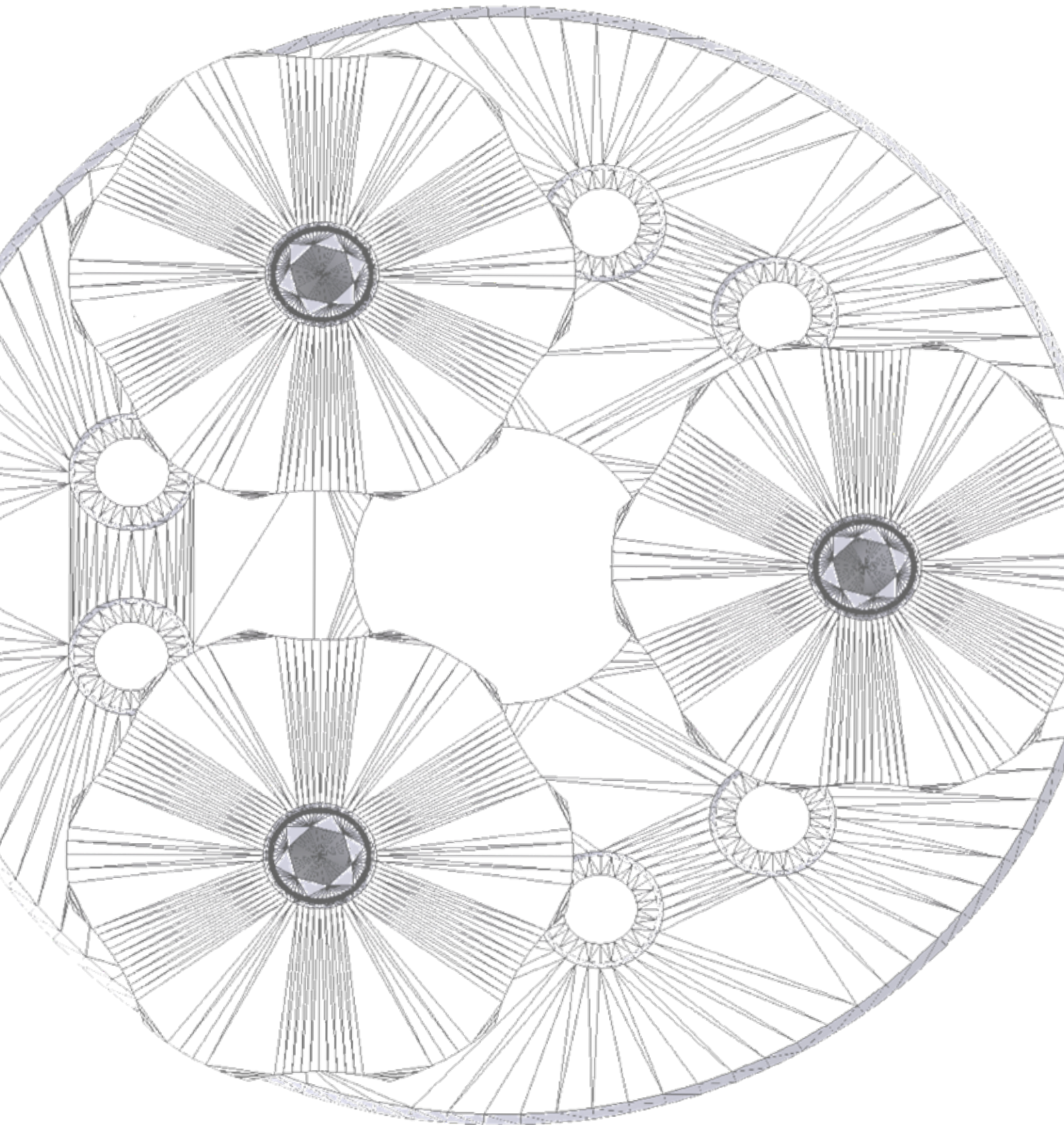
**ROUND
SOFT TOP JAWS**



**HARD
TOP JAWS**



A SWISS ARMY KNIFE FOR WORK HOLDING



Round(!) Soft Jaws - New Possibilities

**MORE JAWS FOR
YOUR MONEY**

**100 % CLAMPING
SURFACE**

**CLAMPING RANGE FROM
Ø10 – 300 MM**

**FOR YOUR 6", 8",
10" 12" CHUCK**

Why round soft jaws?

With Rindex Multi Jaws you can turn the jaws 360 degrees, giving you six optional clamping positions using your own chuck. You simply get more jaws for your money. With competing quick-change jaw systems, you may need to buy a new expensive chuck that only works with special jaws.

MORE than quick-change jaws

Because of the round shape of Rindex, you can achieve 100 % clamping surface. This means less deformation- and clamping marks, reduced rework and inspection time. With fully enclosing jaws up to Ø90 mm. you still have two more positions for clamping, without changing the position of the base jaw. If you want to clamp on a bar, or clamp as close to the center as possible, use hexagon shaped jaws.

Clamping range from Ø10 – 300 mm. on your 6", 8", 10" 12" chuck

With our soft- or hard top jaws, the base jaw only need to take on three different positions to cover the entire chuck surface. This operation takes less than 2 minutes with our smart t-nut. You can choose between large clamping surface when base jaws are mounted close to the chuck center or make smaller cuts on the top jaw when the base jaws are mounted further out on the chuck, using all the 6 positions available on the round top jaw for longer jaw lifetime.





Why use quick change jaws?

PROFIT

USER FRIENDLY

**LESS REWORK AND
MATERIAL WASTE**

Economy

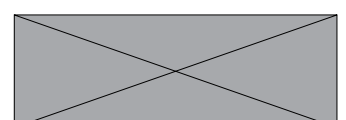
The real cost of jaws is when in use, not when purchased. If a machine cost €100 an hour, and you need to change the position of the jaws 3 times a day (30 minutes), you have a changeover cost of 150 € a day. By changing jaw positions within minutes with great repetition of 20 μ , you could increase your margin by almost 20 % for each eight-hour shift (800 €). Read more about profits and costs in section "PROFITABLE FACTS - BY SANDVIK COROMANT".

Efficiency

Since you do not lose machining time when changing diameters, you can manufacture parts one by one and get the first correct part much quicker, reducing rework, inspection time and waste. Great repeatability means less reboring. This will earn you a lot of time and money. F

Furthermore, jaws are in the correct position after rotation and no damage or loss of time will come from simple mistakes due to misplaced jaws. If you have frequently reoccurring jobs, you can save a set of jaws for the next batch, resulting in reduced set-up time.

With our special t-nut, which defaults to using only three fixed positions for the base jaw, you'll return to the correct position with the base- and top jaw in minutes.



CERTIFICATE

MM AWARD

MASCHINENMARKT



für das innovativste Produkt
der Kategorie: Spannmittel

Index

verliehen an

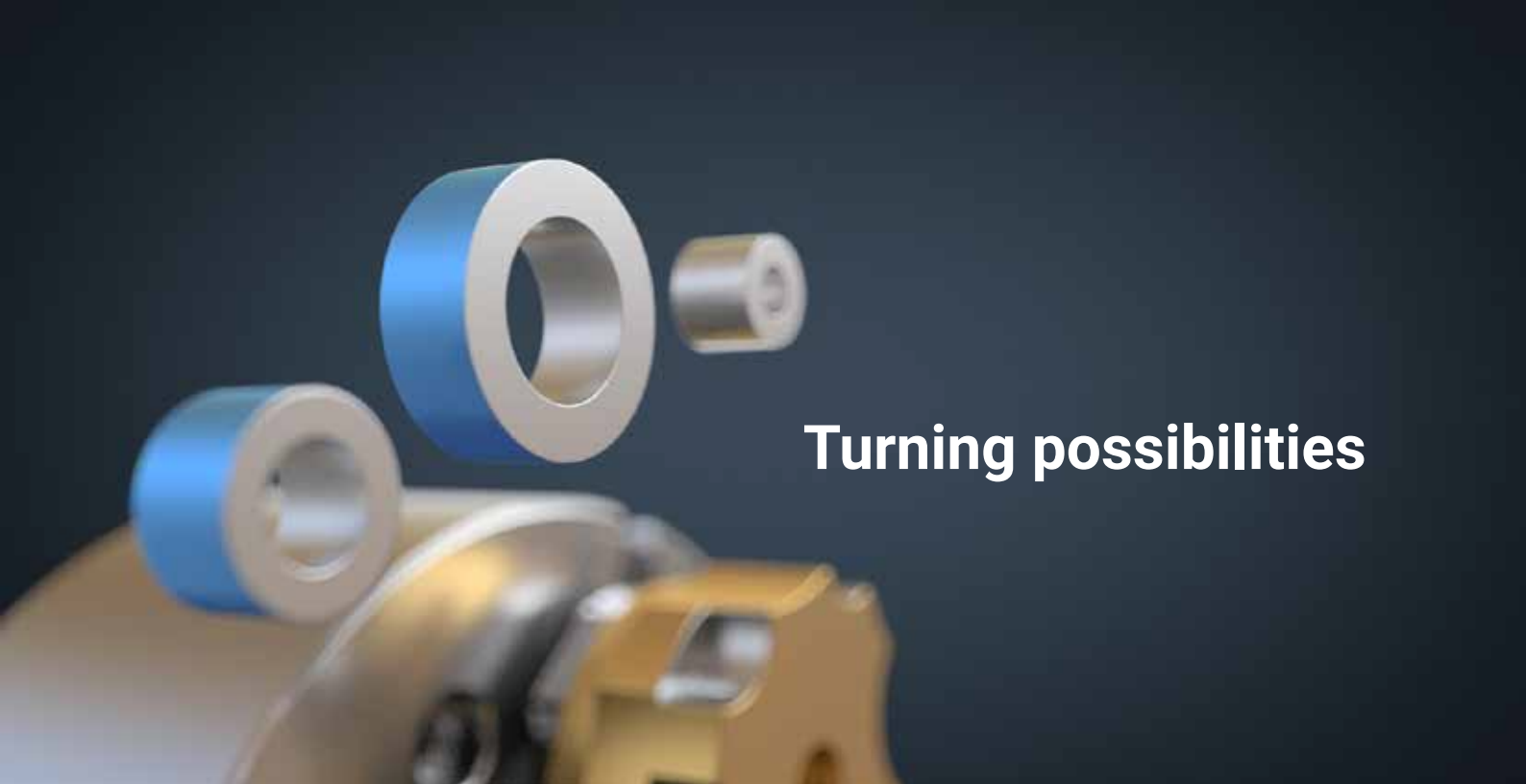
**C Automation
systems AB**

Hannover, 18. September 2011

Kai Foye

A silver metal plaque with a large, stylized 'MM' logo cutout. The plaque is mounted on a black base. The front of the plaque features the "MM AWARD" logo and the "EMO Hannover 2011" logo.

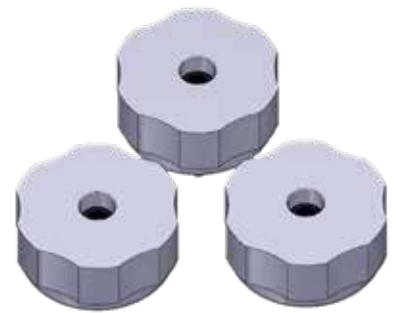
MM AWARD zur EMO Hannover 2011



Turning possibilities

100 % clamping surface

- Get your first part correct faster
- Less measuring, rework, grinding and waste
- Aluminum jaws - for soft clamping
- Steel jaws and counterweights - for high or low clamping force



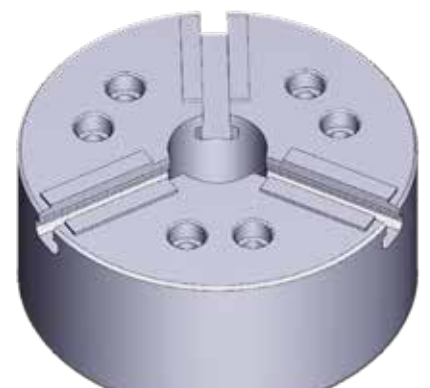
6 positions available

- * Cost efficient
- One jaw set ready for multiple operations
- Repeat accuracy 0,020 μ
- Save for recurrent jobs
- Easy to use in between shifts and jobs
- Easy to keep track of
- Plan for future jobs ahead



Cover the full diameter of the chuck

- Clamping range between \varnothing 8 - \varnothing 300 mm.
- 100% clamping surface up to \varnothing 90 mm.
- I.D. and O.D. clamping
- Use Counterweights for even softer clamping

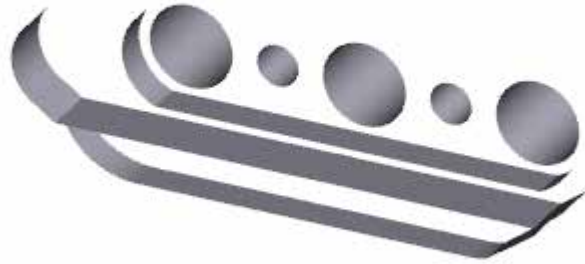


Quick Change Base Jaws

Cover the full diameter of the chuck

3-NUT

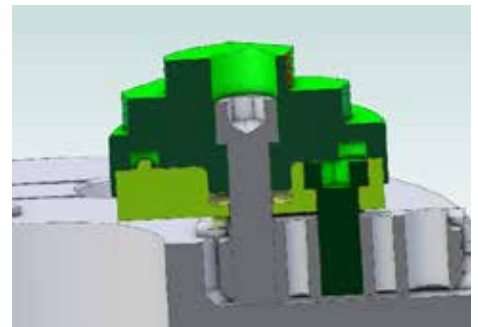
FOR QUICK CHANGE AND
REPETABILITY



Patent pending 3-nut

A 3-nut is a t-nut with three holes instead of two, which makes it almost as long as the t-nut slot. By fastening the 3-nut with a springy screw, it stays in the same place that gives you the following advantages.

- There is no risk of misplacing base jaws onto the wrong chuck teeth, which takes time and costs money
- You will get better repeatability
- You can still clamp on all diameters of the chuck because the top jaws have 6 jaw positions * 3 t-nut positions = 18 positions



Move the base jaws position within 2 minutes

Locate base jaw close to chuck center for:

- 100 % clamping surface
- small diameters
- Bar clamping

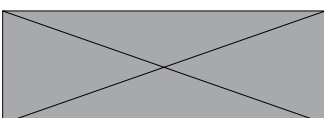
Locate base jaw in the middle or end of chuck surface for:

- Mid - large size parts
- Large clamping surface
- Small clamping surface - save soft jaw lifetime (by making smaller cuts)



Assembly

1. Push the 3-nut all the way down in the chucks t-nut slot
2. Fasten springy screw loosely



STANDARD BASE- AND TOP JAWS

6 SURFACES FOR CLAMPING

FITS YOUR EXISTING CHUCK

QUICK JAW CHANGE

LARGE CLAMPING SURFACE

Base Jaw

With 6 top jaw positions

For standard chucks

chuck sizes 6", 8", 10" & 12"

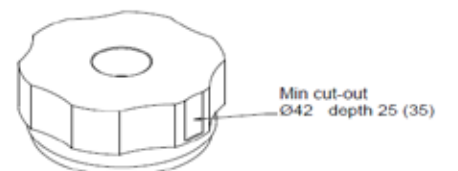


Soft top jaws

2 models, standard and hexagon shape

2 materials, steel and aluminum

2 heights, low (37,5 mm) and high (47,5 mm)

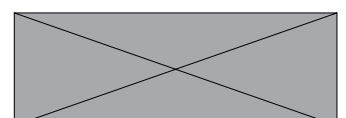
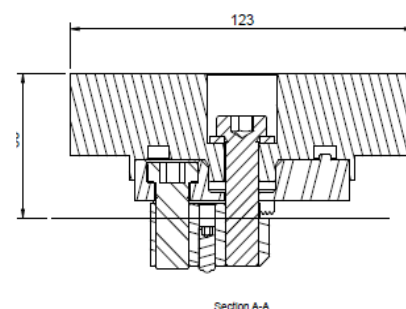


Cover the full size of the chuck

Diameter from 8-300 mm.

For I.D. and O.D. clamping

Compatible with 3-nut for fast change over



ADVANCED BASE- AND TOP JAWS

GREAT REPEATABILITY

COMPATIBLE WITH COUNTERWEIGHTS



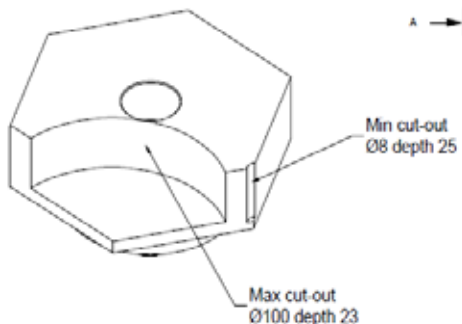
Base Jaw

with 6 top jaw positions

With great repeatability 0,02 mm

Compatible with Rindex Counterweights

chuck sizes, 6", 8", 10" & 12"

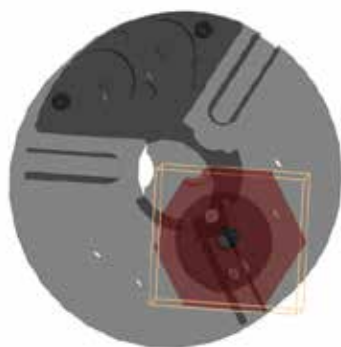


Soft top jaws

2 models, standard and hexagon shape

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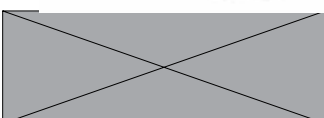
Centrifugal force compensation

Softer and harder Clamping possible

For I.D. och O.D. clamping

Add patented extra weights for perfect cutting data

For your 8-12 inch chucuk



CATALOGUE

BASE JAWS

ROUND TOP JAWS

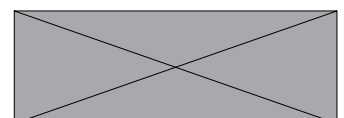
HEXAGON TOP JAWS

STEEL AND ALUMINUM

S= Standard model, A= Advanced model
 - A= Aluminium, - S= Steel
 1= height 37,5, 2= 47,5
 1= serration 1,5mm x 60, 2= 1/16 x 90

MZ = Material
 A = Diameter

Identification	Serration	M1	M2 A	H	Weight kg
J06S-S11	1,5mm x 60	Standard	Steel Ø66	25mm	.
J06S-S21			Steel	37,5mm	.
J06S-A11			Aluminum	25mm	.
J06S-A21			Aluminum	37,5mm	.
J06A-S11		Advanced	Steel	25mm	.
J06A-S21			Steel	37,5mm	.
J06A-A11			Aluminum	25mm	.
J06A-A21			Aluminum	37,5mm	.
J08S-S11	1,5mm x 60	Standard	Steel Ø88	37,5mm	.
J08S-S21			Steel	47,5mm	3,9
J08S-A11			Aluminum	37,5mm	1,3
J08S-A21			Aluminum	47,5mm	.
J08A-S11		Advanced	Steel	37,5mm	.
J08A-S21			Steel	47,5mm	.
J08A-A11			Aluminum	37,5mm	.
J08A-A21			Aluminum	47,5mm	.
J10S-S11	1,5mm x 60	Standard	Steel Ø88	37,5mm	.
J10S-S21			Steel	47,5mm	3,9
J10S-A11			Aluminum	37,5mm	1,3
J10S-A21			Aluminum	47,5mm	.
J10A-S11		Advanced	Steel	37,5mm	.
J10A-S21			Steel	47,5mm	.
J10A-A11			Aluminum	37,5mm	.
J10A-A21			Aluminum	47,5mm	.
J12S-S11	1,5mm x 60	Standard	Steel Ø88	37,5mm	.
J12S-S21			Steel	47,5mm	3,9
J12S-A11			Aluminum	37,5mm	1,3
J12S-A21			Aluminum	47,5mm	.
J12A-S11		Advanced	Steel	37,5mm	.
J12A-S21			Steel	47,5mm	.
J12A-A11			Aluminum	37,5mm	.
J12A-A21			Aluminum	47,5mm	.

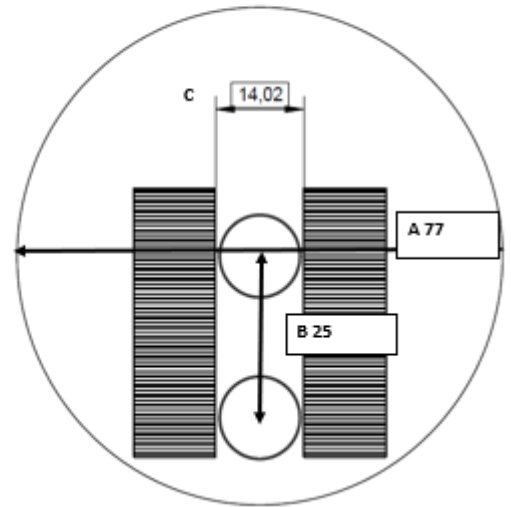


Base Jaw

BJ06S1	BJ=Base Jaw	A	=	Diameter
	06=chuck size inch	H	=	Height
	S=Standard model, A = Advanced model	C	=	Screw hole diameter
	1=serration 1,5mm x 60, 2 = 1/16 x 90	B	=	Screw hole distance

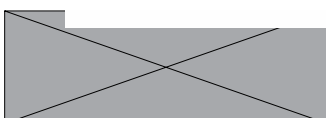
Base Jaws

Identification n°	Serration	A	H	C	B	Weight kg
BJ06S1	1,5mm x 60	Ø55	24,6mm	12	20	1
BJ06A1						
BJ08S1		Ø77	24,6mm	14	25	1,5
BJ08A1						
BJ10S1		Ø77	24,6mm	14	25	1,5
BJ10A1						
BJ12S1		Ø77	24,6mm	14	25	1,5
BJ12A1						
BJ06S2	1/16 x 90	Ø55	24,6mm	12	20	1
BJ06A2						
BJ08S2		Ø77	24,6mm	14	25	1,5
BJ08A2						
BJ10S2		Ø77	24,6mm	14	25	1,5
BJ10A2						
BJ12S2		Ø77	24,6mm	14	25	1,5
BJ12A2						



RTJ06S-S11	RTJ=Round Top Jaw, HTJ= Hexagon top jaw	M1	=	Index Model
	06= Chuck size inch, 08,10,12	H	=	Height
	S=Standard model, A = Advanced model	M2	=	Material
	- A= Aluminum, - S= Steel	A	=	Diameter
	1= height 37,5, 2 = 47,5			
	1=serration 1,5mm x 60, 2 = 1/16 x 90			

Identification n°	Serration	M1	M2	A	H	Weight kg
RTJ06S-S11	1,5mm x 60	Standard	Steel	Ø66	25mm	.
RTJ06S-S21			Steel		37,5mm	.
RTJ06S-A11			Aluminum		25mm	.
RTJ06S-A21			Aluminum		37,5mm	.
RTJ06A-S11		Advanced	Steel		25mm	.
RTJ06A-S21			Steel		37,5mm	.
RTJ06A-A11			Aluminum		25mm	.
RTJ06A-A21			Aluminum		37,5mm	.
RTJ08S-S11	1,5mm x 60	Standard	Steel	Ø88	37,5mm	.
RTJ08S-S21			Steel		47,5mm	3,9
RTJ08S-A11			Aluminum		37,5mm	.
RTJ08S-A21			Aluminum		47,5mm	.
RTJ08A-S11		Advanced	Steel		37,5mm	.
RTJ08A-S21			Steel		47,5mm	.
RTJ08A-A11			Aluminum		37,5mm	.
RTJ08A-A21			Aluminum		47,5mm	.
RTJ10S-S11	1,5mm x 60	Standard	Steel	Ø88	37,5mm	.
RTJ10S-S21			Steel		47,5mm	.
RTJ10S-A11			Aluminum		37,5mm	.
RTJ10S-A21			Aluminum		47,5mm	.
RTJ10A-S11		Advanced	Steel		37,5mm	.
RTJ10A-S21			Steel		47,5mm	.
RTJ10A-A11			Aluminum		37,5mm	.
RTJ10A-A21			Aluminum		47,5mm	.
RTJ12S-S11	1,5mm x 60	Standard	Steel	Ø88	37,5mm	.
RTJ12S-S21			Steel		47,5mm	.
RTJ12S-A11			Aluminum		37,5mm	.
RTJ12S-A21			Aluminum		47,5mm	.
RTJ12A-S11		Advanced	Steel		37,5mm	.
RTJ12A-S21			Steel		47,5mm	.
RTJ12A-A11			Aluminum		37,5mm	.
RTJ12A-A21			Aluminum		47,5mm	.



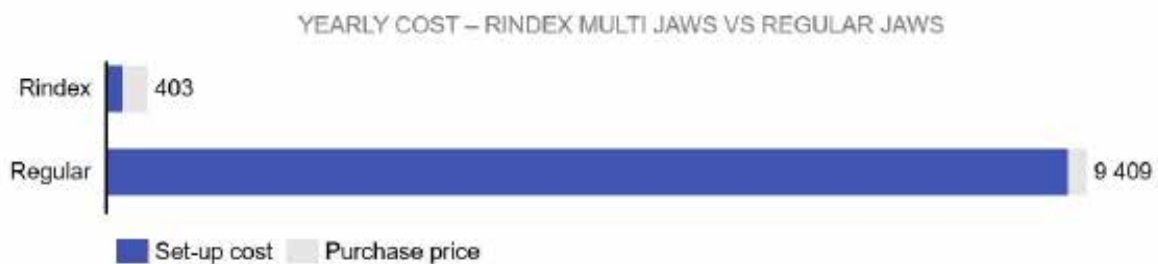
YOUR BUSINESS IN NUMBERS

*DATA BY SANDVIK COROMANT **

USER COST REDUCTIONS

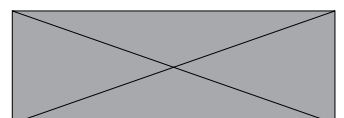
The purchase cost of standard soft jaws is a tiny fraction of the user cost. The total cost (purchase- and user cost) for Rindex Multi Jaws is about 3.5% of standard jaws *.

23x MORE COST EFFICIENT COMPARED TO REGULAR JAWS



Based on one jaw change per day during one working year for one machine.

* We are assuming that 3 sets of regular soft jaws are consumed in one year, compared to one set of Rindex Multi Jaws



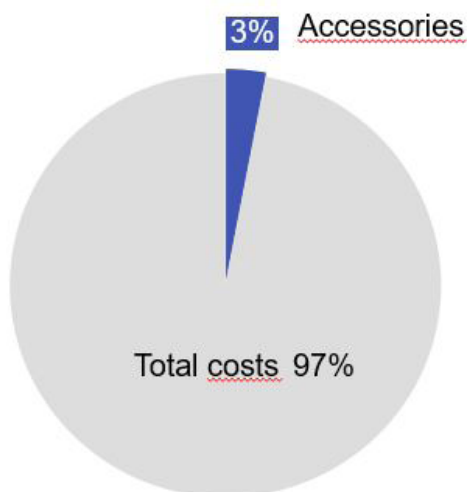
SANDVIK COROMANT *



SAVINGS ON TOOLS IS A FALSE ECONOMY

Cutting tools, jaws etc. amounts to about 3% of total costs. Savings on accessories does not effect on total costs. A quality quick change jaw system will reduce your machine- and labor costs, which amount to over 50% of the total costs.

ACCESSORIES AMOUNTS TO 3% OF TOTAL COST

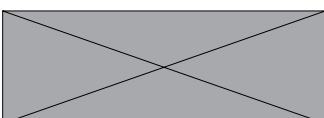


A SMART CHANGE

RINDEX IMPROVES QUALITY AND OUTPUT.

- * MORE MACHINING
- * LESS OPERATOR DOWN TIME
- * LESS MATERIAL WASTE

* <https://www.sandvik.coromant.com/sv-se/services/manufacturing/pages/default.aspx>



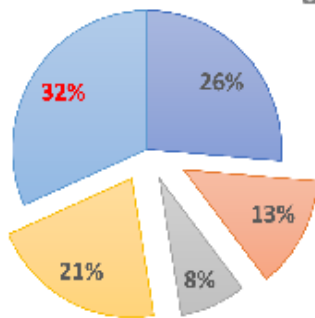
GOODBYE SET-UP COSTS

DATA BY SANDVIK COROMANT *



CALCULATIONS FROM CASE STUDY**

Internal setup time %, Conventional turning



- Insert, holder & tool eye change
- Jaw preparation & change
- Inspection
- Rework
- Machining

PRODUCTION POSSIBILITIES

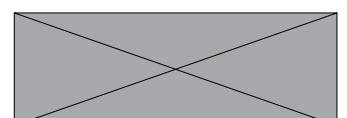
- + 134% more machining time
- + 65% in gross margin
- 57% component cost

HOW IT'S DONE

Jaw change-over time amounts to 13% of "set-up time and machining" time. Adding inspection- and rework time, non-productive tasks amount to 42% that could be spent on machining instead. Use Rindex Multi Jaws for speed and quality.

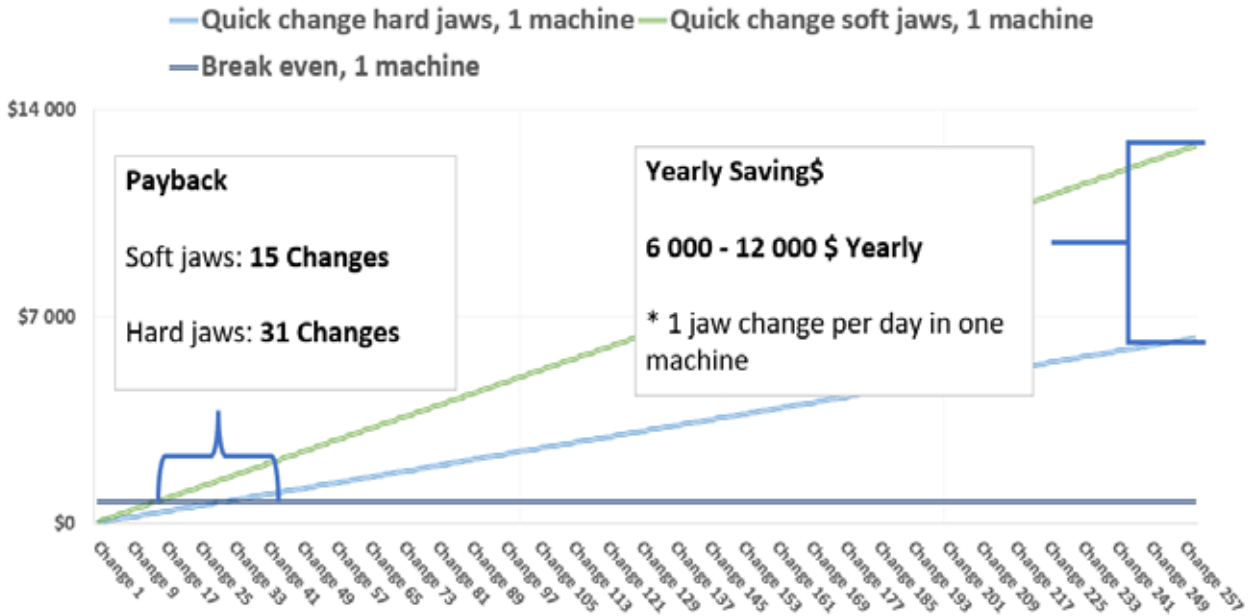
* <https://www.sandvik.coromant.com/sv-se/services/manufacturing/pages/default.aspx>

** "Head & Base Production Optimization: Setup Time Reduction". Haiqing Guo, 2007



PAYBACK TIME AND YEARLY PROFITS

SAVINGS \$ BY JAW CHANGE, ONE MACHINE



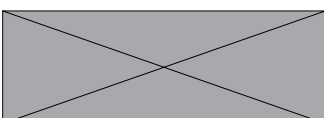
HOW TO MAKE \$42 300 IN ONE YEAR

Make 2 jaw changes a day in 2 machines during 1 year (230 workdays) and save \$ 42 300 (hourly machine rate \$ 80). Profits dont include quality aspects such as less rework and inspection time. Make your own calculations at www.rindex.com

HOW IT'S DONE

- * MINIMAL SET-UP & CHANGE OVER TIME
- * TOP JAWS WITH 6 DIFFERENT POSITIONS
- * CHANGE DIAMETER IN 1 MINUTE.

Operation	Conventio nal Jaws	Rindex Jaws
Locating jaws	5 min	0
Jaw change	10 min	30 sec
Reboring of jaws	20 min	0
Jaw Change / day	2	2
Number of machines	2	2
Working days / year	230	230
Machine cost/ \$ hour	\$ 80	\$ 80
Total cost	\$ 43 000	\$ 600
Profit per Year		\$ 42 300



RINDEX T-NUTS

DIFFERENT MODELS

RINDEX T-NUTS

RINDEX 2-NUT
SPRINGY STOP SCREW TO
KEEP T-NUT IN PLACE



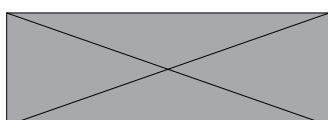
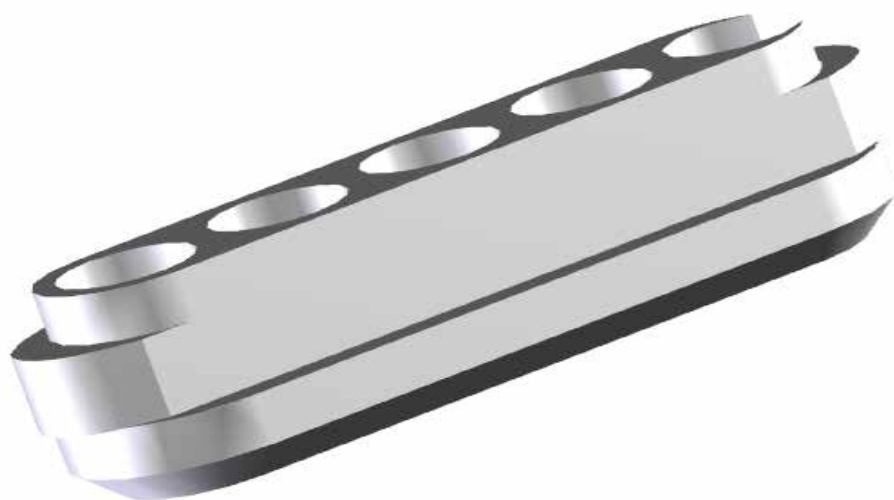
RINDEX 5-NUT
QUICK CHANGE FOR
STANDARS JAW



RINDEX HOLE IN HOLE NUT
USE 10" JAWS ON 8" CHUCKS
AND VISE VERSA



BILD PÅ CHUCK MED T-NUTS OCH KANSKE STANDARDBACKAR I OLIKA LÄGEN



Centrifugal force compensating weights

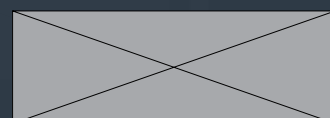
For soft and hard clamping forces

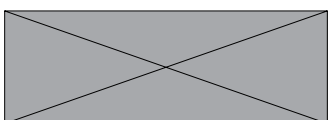
For your existing chuck

RINDEX COUNTERWEIGHTS

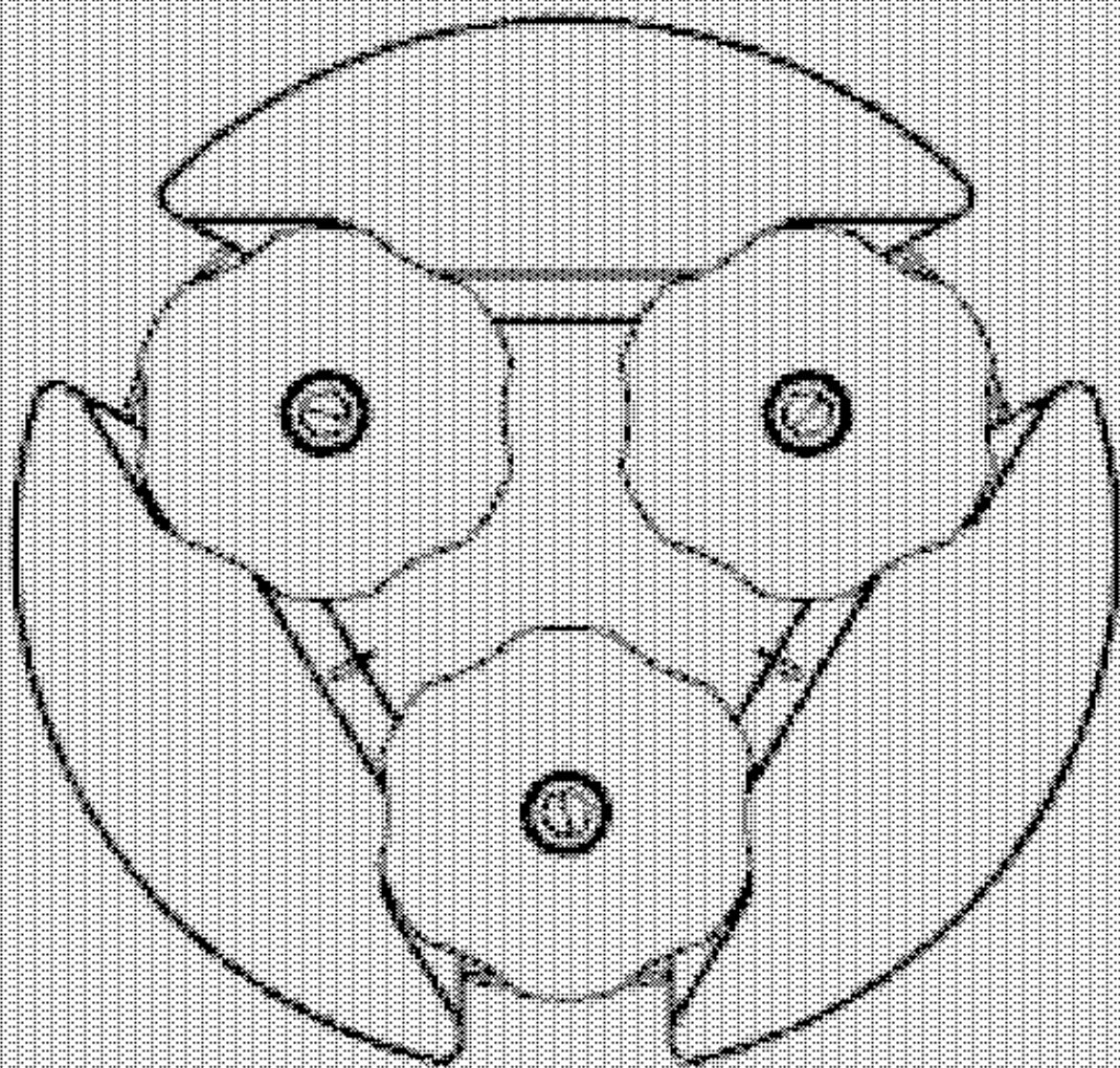
www.rindex.com

MADE IN SWEDEN





M P C A U T O M A T I O N S Y S T E M S



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Rindex Counterweights

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Instruction manuals

COUNTERWEIGHTS

FOR YOUR 8-12" CHUCK

MOUNT WITHIN FIVE MINUTES

HARD OR SOFT CLAMPING

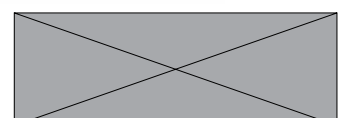
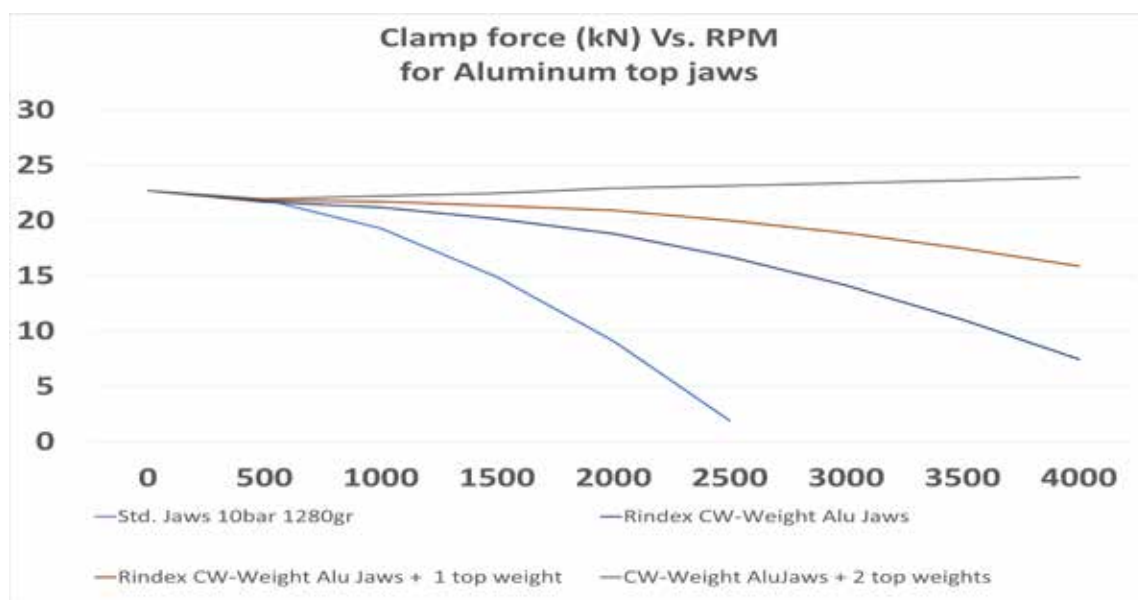
Soft Clamping

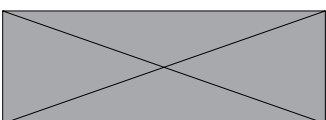
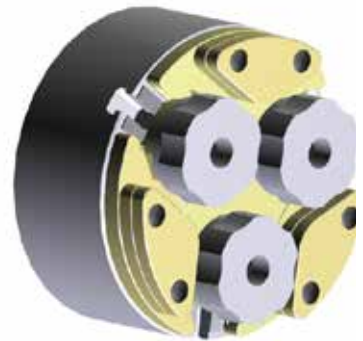
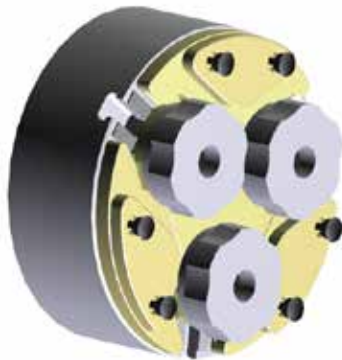
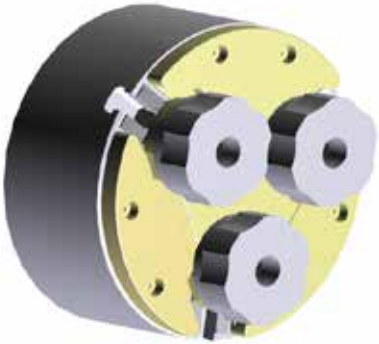
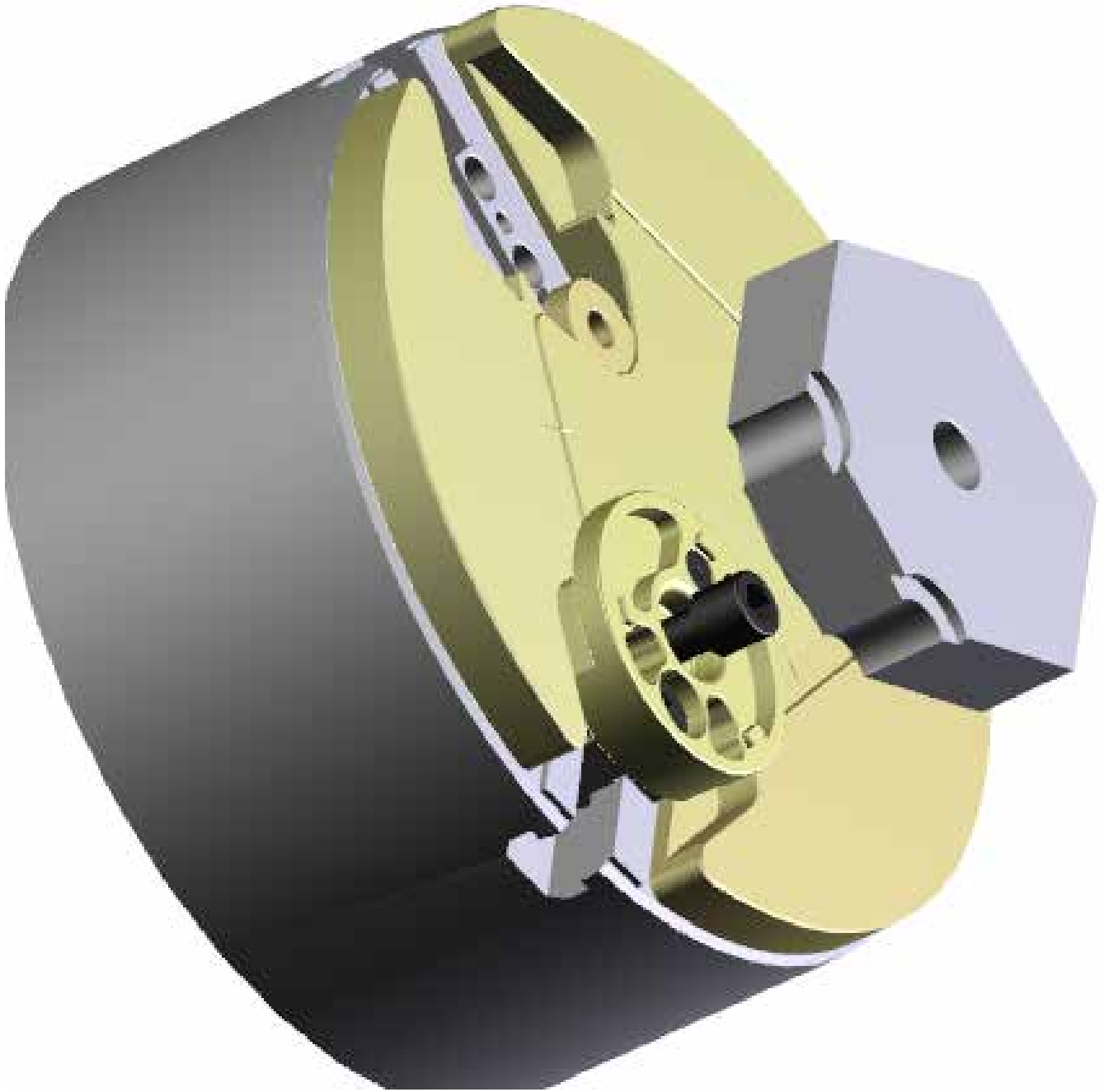
With Rindex Counterweights you can manufacture delicate or thin-walled parts without deformations or clamping marks. You can use heavy top jaws with 100% clamping surface without losing clamping force as the spindle speed (RPM) increases. Rindex Counterweights allow you to compensate for any top jaw.

Competing centrifugal force compensating chucks are costly and do not take top jaw weights into account.

Increase speed - increase output

You can choose between turning fast, for high metal removal rate, or turning at an optimal spindle speed for increased cutting tool life. The latest cutting tool technology allows faster turning, meaning reduced cycle time and better surface structure.





Turning Possibilities

HARD OR SOFT CLAMPING

HARD OR SOFT JAWS

HIGH SPEED TURNING

Hard and soft clamping possible

Set the clamping force as low as possible for soft I.D. or O.D. clamping.

Set clamping force as high as necessary for high torque operations, without losing clamping force with spindle speed (RPM)

Add extra weights

Compensate for top jaw weight due to size and material. Let the different tools operate at optimal clamping force and spindle speed.

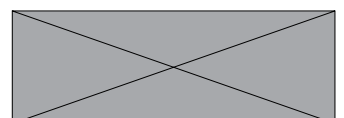
Produce perfect parts from the start

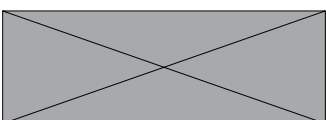
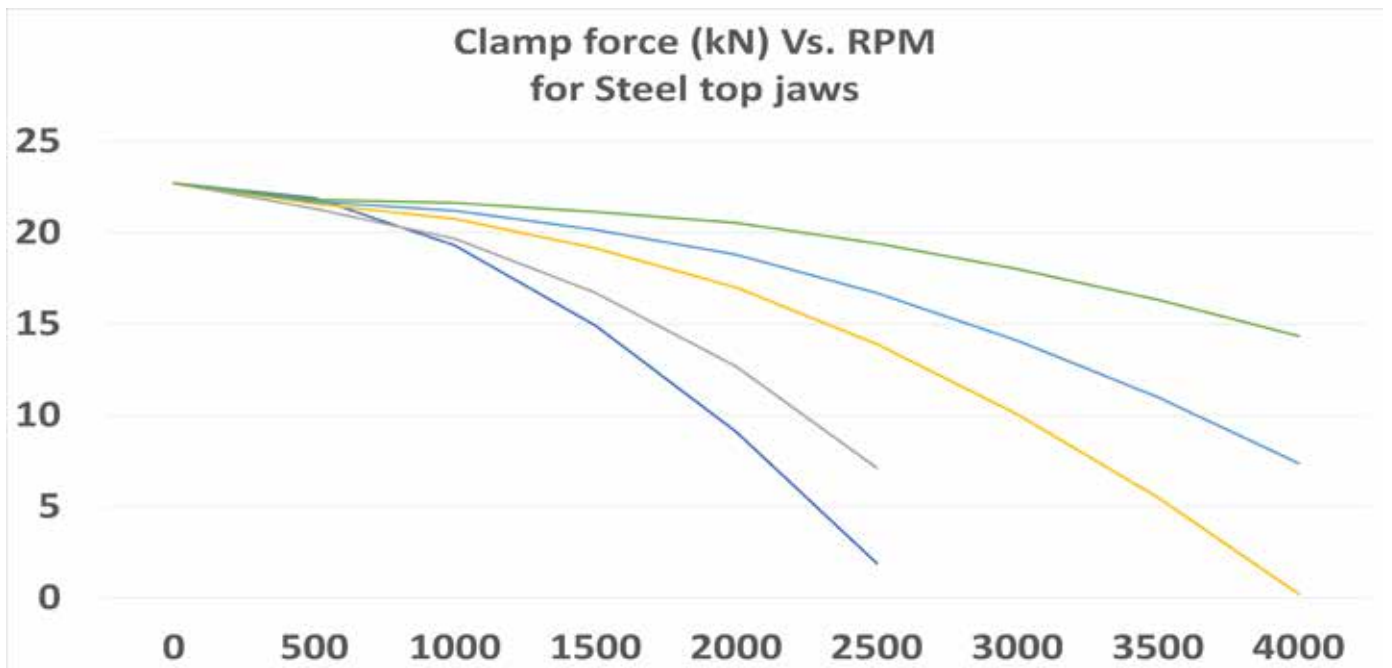
Manufacture parts within requirements from the start. Save inspection time, cut rework and material waste.

Machinists often set clamping force by chance, or worse, clamp too hard to be on the safe side. When clamping on soft or thin-walled parts your first parts will not meet tolerance requirements. This means wasting material and machining time as inspection- and rework time increase. Staying well within tolerance requirements from the start.

Use correct cutting data for your cutting tools

To get perfect surface structure, you may want to experiment with RPM without worrying about clamping too hard or too soft. Follow instructions from your tool provider for each operation.





Turning Possibilities

QUALITY

HIGH SPEED MACHINING

OPTIMAL CUTTING DATA

No CLAMPING MARKS

High Quality parts from the start

- Use low clamping force with heavy and enclosing jaws
- Use high clamping force for high torque operations
- No Clamping marks – fewer quality checks
- Rounder parts – less material waste

Maximal spindle speed optional

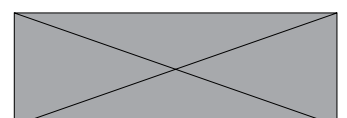
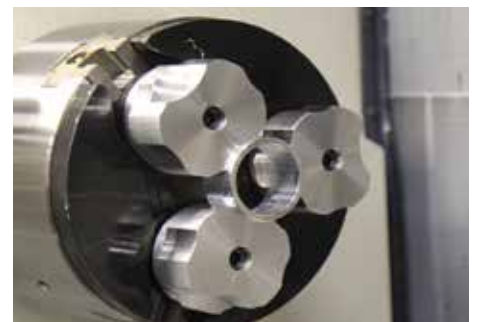
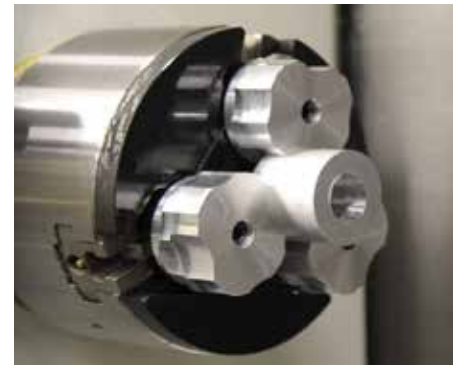
- Increase metal removal rate and parts per hour
- Superior surface finish
- Shorter delivery time

Optimal clamping force for I.D. and O.D. clamping

- Additional weights for top jaw compensation
- Follow instructions from your cutting tool provider
- Extra weights can decrease pressure as RPM increases,

Compatible with standard chucks

- One size available for 8" and 10" chucks
- Use large surface quick change jaws for increased profit
- Make notes and save jaws for recurrent jobs



Meassurments

**COMPATIBLE WITH RINDEX ADVANCED
BASE JAWS**

COMPATIBLE WITH STANDARD 8", 10" &

Counterweights MM

A	254
H	16,5
X	

Extra weight No.1

A	55,38
H	16,25
X	116,51

Extra weight No.2

A	55,38
H	16,25
X	116,51



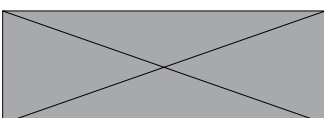
Order number

CW10-RDX

CW = Counterweights

10 = Chuck size

RDX = For Rindex base jaws



ACCESSORIES

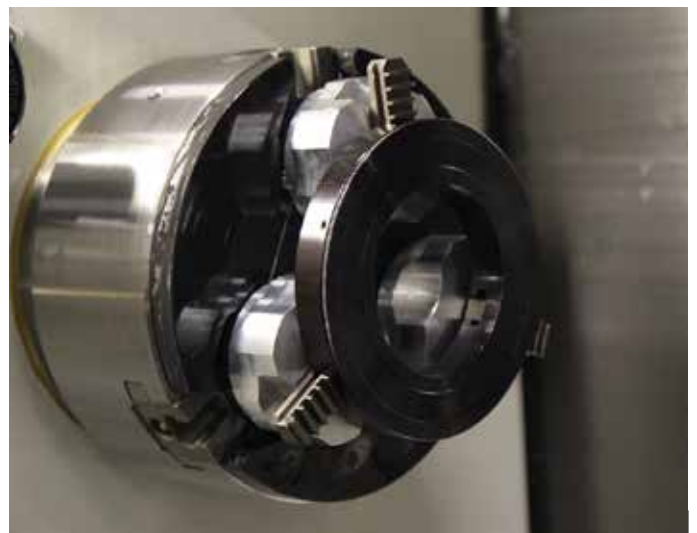
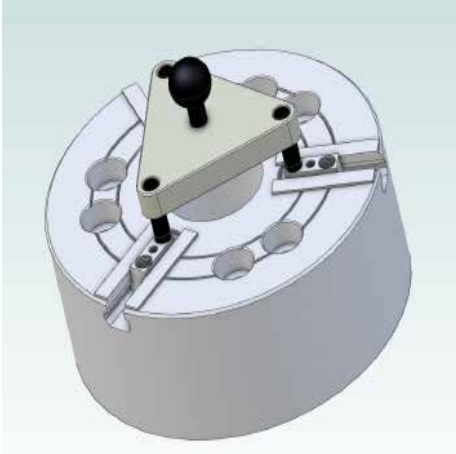
Higher Productivity

For Quality

User Friendly

We produce smart, simple and patented tools to compliment our offer to you, for your best experience.

Compliment with standard products for best result.





T-nuts

3-pod

3-POD AND T-NUTS

With our smart, simple and patented fastening solution, you will be able to mount and dislocate counterweights much faster than you mount standard jaws.

1. Specially designed t-nuts

keeps t-nuts in correct position while using...

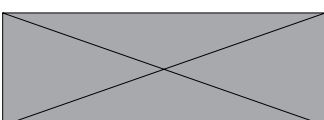
2. Magnetic counterweight

keeps CW-weights in place

3. Our 3-Pod

Center and lock t-nuts, counterweights and base jaws in the correct position

In order to finetune centrifugal force compensation, use a clamping force measurement tool and a boring ring for best result.



RINDEX COUNTERWEIGHTS

24 HOURS IN A MANUFACTURING COMPANY

When using an 8 hour shift, machine operating time is equal to about 4 hours. Out of these 4 hours, as much as half could be spent on rework and measurement time.

HOW MUCH CAN I MAKE?

* 3 TIMES RPM INCREASE POSSIBLE

* CUT REWORK & INSPECTION TIME

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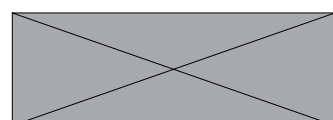
80% LESS IN COMPONENT COSTS

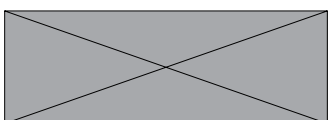
GAIN 300% GROSS MARGIN

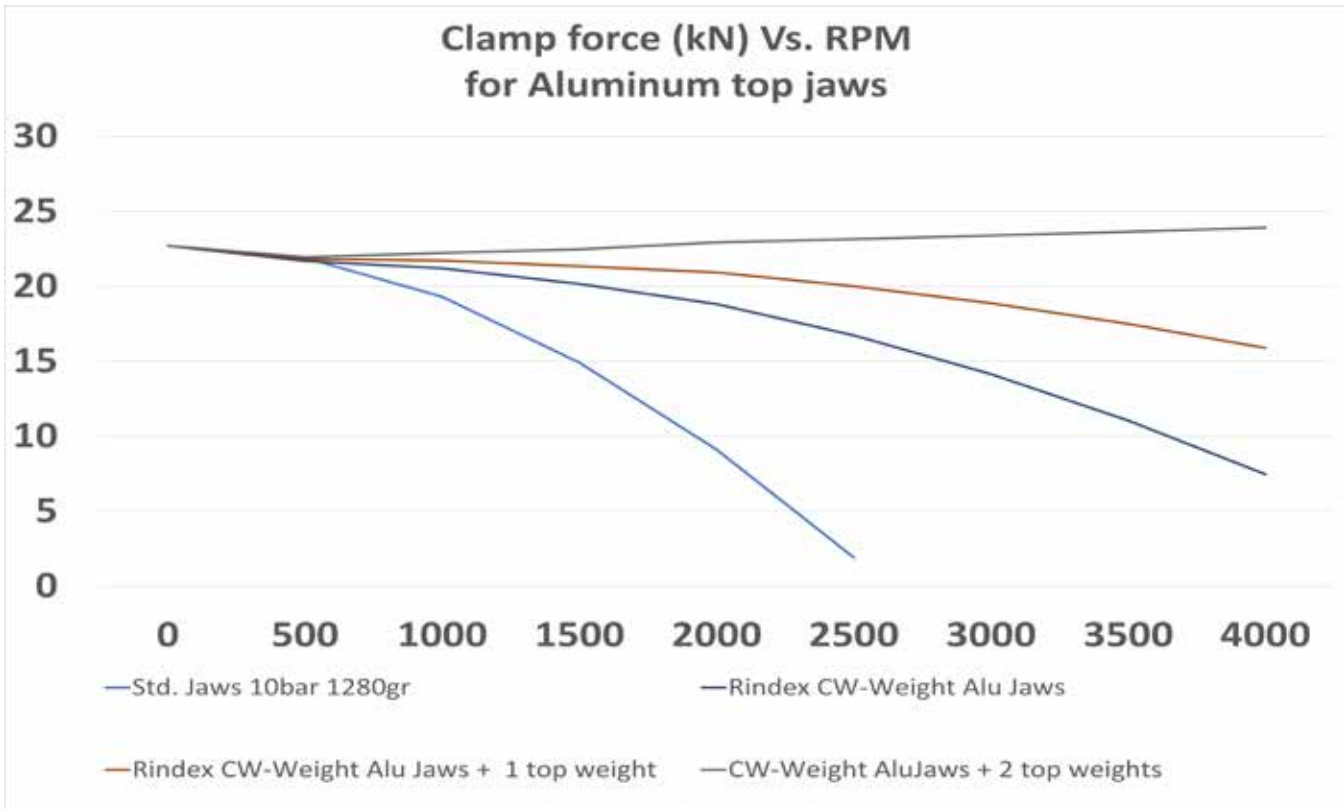
DATA BY SANDVIK COROMANT*

25% IMPROVED GROSS MARGIN
← THROUGH → **50%** INCREASE IN MACHINE UTILISATION

* <https://www.sandvik.coromant.com/sv-se/services/manufacturing/pages/default.aspx>







If clamping force is set to 25 kN the spindle speed is limited to 2000 RPM.

This effects: parts/ minute, surface structure and cutting tool life oppertunities.

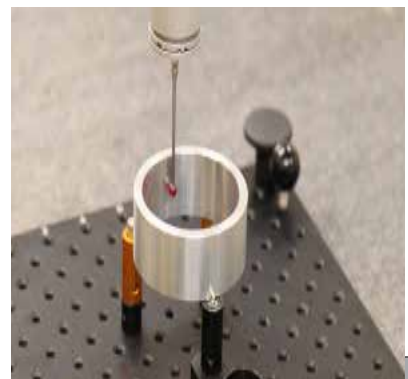
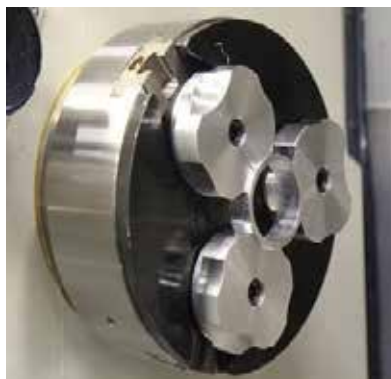
You will not be able to follow recommendations from your cutting tool provider.

SPEED UP - FOR FAST RETURNS

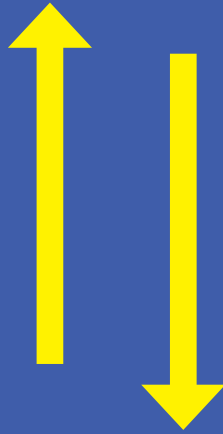
Sensitive or thin walled parts need low initial clamping force. You want to use large, enclosing jaws for best results.

The size, weight and location of jaws will greatly reduce clamping forces as spindle speed (RPM) increase.

Our counterweights solves your problem: **soft clamping and high RPM!**



MACHINE TIME
+600%



COMPONANT COST
-85%

AN EXAMPLE

Average Output = 50 pieces an hour

Cut rework-, inspection and jaw change time and make 115 pieces (+131%).

Turn 3 times faster = $3 * 115 = 345$ pieces

THAT IS AN INCREASE WITH 600%. Or, According to Sandviks calculations, A DECREASE IN COMPONENT COST BY 85%.

Let each part have its own goal. Choose between high quality, cost efficiency, profit or maximal number of parts per minute.

Optimal RPM, initial clamping force = 10 kN

