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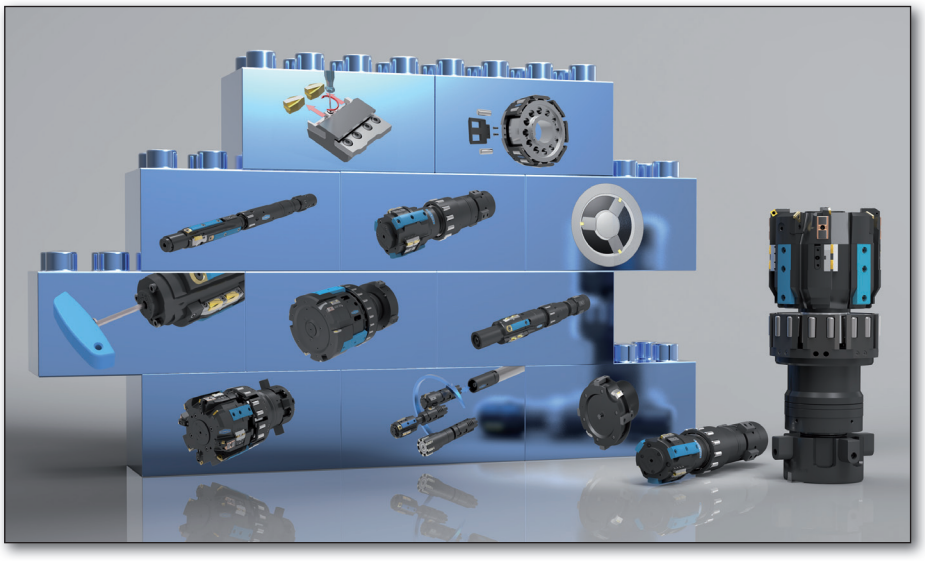
Processing Cylinders with the OMEGA-System (RDO, RIO)

Modular System for Combined Processing of Cylinders and Cylinder Liners



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ECOROLL's OMEGA system combines skiving and roller burnishing for machining hydraulic cylinders and cylinder liners. While the OMEGA skiving head cuts the cylinder's inner surface to the exact size and form required, the roller head burnishes it. The simultaneous skiving and burnishing process has almost completely replaced honing as the alternative machining process, since it is much more economic and faster. Thanks to its modular design, customized tools can be configured based on pipe quality and machining length.

Characteristics

- 2-fold tools for combined skiving and burnishing (RDO, RIO), 3-fold tools (RIOA) for combined drilling, skiving and burnishing, 4-fold tools (RIOA quattro) for combined pre-drilling, drilling, skiving and burnishing.
- Tubes with radial circle irregularities up to 0.5 mm (.02") are skived in one operation. The remaining circle irregularity is reduced to 0.01 mm (.004"). The waviness existing in longitudinal direction is reduced simultaneously.
- Diameter tolerances IT8 or IT9; surface roughness R_a = 0.05 - 0.4 (R_z = 0.5 - 2) micron attainable.
- It is recommended to not fall below R_a = 0.2 (R_z = 1.0) micron in order to ensure sufficient lubrication of seal lips.
- Based on the tool control system (RETRAC- or international system) tool types RDO or RIO can be selected.

	RETRAC-system	International system
Control cycle	Treatment pressure-less, retreat with appr. 20 bar	Treatment: 100 bar hydraulic pressure, retreat pressure-less
Area	Mainly Europe	Worldwide
Activation cylinder	RETRAC-cylinder intregrated in boring bar	Integrated in tool
Control connec-tion	Mechanical automatic connection in thread connection boring bar/tool	Hydraulic automatic connection in thread connection boring bar/ tool
Compat-ible tools	RDO (combined, skiving and burnishing)	RIOA, RIOF, RIOK (2-, 3- or 4-fold combined (pre-drill, drill-out, skiving, burnishing)

RDO Series
(hydraulic activation during retraction, RETRAC)

- Skiving and roller burnishing of hydraulic cylinders and cylinder tubes with lengths until approximately 20 m of length.
- Diameters from 38 to 500 mm.
- Tool bodies and roller heads are identical with older series RDS-R and RDZ. Conversion kits for upgrade to the OMEGA-system are available.

RDO

Tubes	ø from... to... (mm)	Length from... to... (m)	Parameters
cold drawn or hot-rolled and counter-bored	38-500	0.5-<20	V_c 300 m/min f 3...5 mm/rev

RIO Series
(hydraulic activation during operation)

- Big cutting performance.
- Suitable configurations available for:
  - seamless or longitudinally welded tubes.
  - hot rolled tubes in different lengths.
- Quick connect in the boring bar/tool thread connects the control hydraulic automatically.
- A uniform activation pressure of 100 bar is recommended for all sizes.
- Under pressure: Working position.
- Release pressure after the tube end is reached. Skiving knives retract, roller head collapses.

RIOF

- Skiving head is mounted on tool.
- Recommended for tube lengths ≤ 5 m.
- Version RIOF can be converted to RIOA by replacement of the front cover with a counter boring head.

RIOF

Tubes	ø from... to... (mm)	Length from... to... (m)	Parameters
cold drawn	28-550	max. L = 25 x d (for d = 38 to 200; for d > 200 on request)	V_c up to 300 m/min f 3...5 mm/rev

RIOA

- 3- and 4-fold tool for combined pre-drilling, drilling, skiving and burnishing of hot-rolled tubes.
- The boring head is equipped with three cutter cassettes with one indexable insert each.
- Three carbide guide pads serve for a clearance-free radial guide.
- Maximum straightness deviation 0.5 mm/m.
- The skiving head is equipped with three skiving knives.

RIOA

Tubes	ø from... to... (mm)	Length from... to... (m)	Parameters
hot rolled	63-550	0.5 bis 4	V_c 150...180 m/min f 1.2...1.8 mm/rev

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- The skiving head is floating.
- Three guide pads.
- Recommended for the treatment of tubes with a length > 4.5 m.
- Eliminates wobbling, straightness failures and misalignments, which can influence machining depending on tube length and other circumstances.
- Avoids „black patches“ (not skived black areas).

RIOK for long tubes

Tubes	ø from... to... (mm)	Length from... to... (m)	Parameters
cold drawn	50-500	4.0->10	V_c 300 m/min f 3...5 mm/rev

RIOB (for small range 38-79,90 mm)

Tubes	ø from... to... (mm)	Längen from... to... (m)	Parameters
cold drawn	38-79.90	1,5-4.0 (10*)	V_c 200...300 m/min** f 2...4 mm/rev

Note: * only possible with stabilized boring bar
** max. number of revolution: 1200 min^{-1}

SK and GZ Series

Sometimes for various reasons, tubes have to be skived and burnished separately or both processes have to be carried out one after the other. Therefore, all SK skiving heads can be delivered also as separate tools. SK skiving heads are then used in conjunction with GZ roller burnishing tools. In the first pass the SK skiving head peels the cylinder, and in the second pass the GZ tool burnishes it smooth. For cylinders with blind holes or steps, special blind hole skiving heads are available.

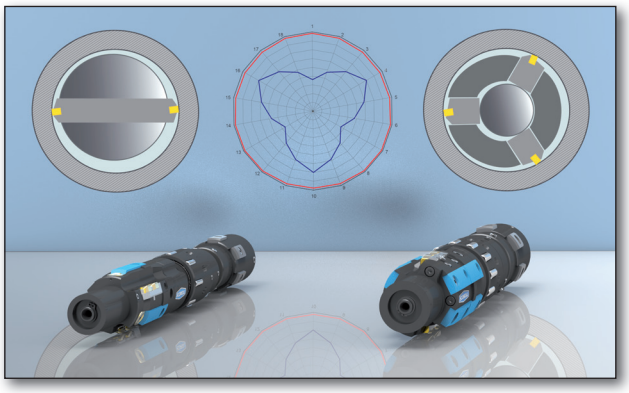
For machining short hydraulic cylinders with a length to diameter ratio of L/Ø ≤ 15, ECOROLL's SKOC and GZC tools can be applied directly on the lathe in one setting. The cylinders are pre-machined by a skiving head. After an automatic tool change the work piece is finish machined by a separate roller burnishing tool. This process usually requires two tool places with one boring bar.

Skiving tool SKOC

Roller burnishing tool GZC

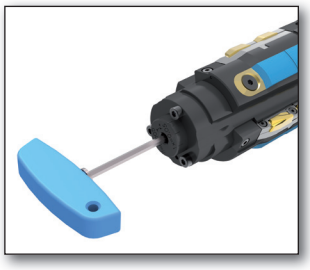
Advantages

- Better circular and cylindrical form, avoidance or reduction of rippling.

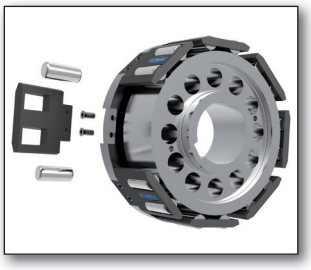


Improvement of circular shape

- Shorter process time by higher cutting speed and larger feed rates.
- Treatment of tubes with bigger irregularities in one operation.
- Larger cutting depth possible.
- Longer life time of wear parts.
- Drastically shortened machine down time.
- Simple diameter adjustment.



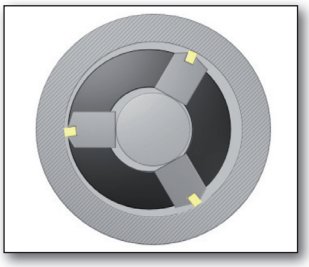
Central diameter adjustment



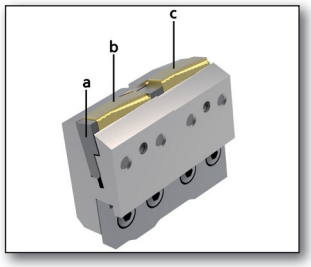
Segment cage

- Easy and fast exchange of the wear parts (cage, interior cones and rollers) by quick connect; the machine down time for tool maintenance is shortened drastically.
- Segment cages simplify exchange of burnishing rolls with Ø ≥ 205 mm.

Basic Construction



OMEGA-system



Skiving knife (a: insert seat, b: finish cutter; c: pre-cutter)

- Skiving knives are supported by a floating cone to allow radial adjustment of knife assembly.
- The skiving knives are activated by the cone before machining. After the treatment, skiving knives and burnishing rollers are hydraulically retracted in order to avoid damage of the surface during tool retraction.
- The cone is also used for the central adjustment of the skiving diameter. For this, only an Allen key is inserted in the center bore at the front side.
- A clearly marked scale at the front side of the tool makes precise and reproducible adjustment easy.
- Skiving heads are connected with tool base by quick connect enabling fast and easy separation of skiving head and tool base without special tool.
- The skiving knives come with two consecutively arranged cutting inserts (b) and (c).
- The pre-cutters are arranged with different selectable off-set of 0.1; 0.2; 0.4; 0.6 or 0.8 mm deeper than the finish cutters.
- Exchangeable insert seats (a) position the cutters precisely.
- Hydraulic tool activation system.

Parameters

Tool	Ø (in mm)	Circumferential speed m/min	Feed mm/rev
RDO	38-500	300	3 – 5
RIOA	63-550	150 – 180	1.2 – 1.8
RIOF	28-550	300	3 – 5
RIOK			
– 4 - 10 m	50-500	300	3-5
– 1.5 - 4 (10*) m	38-79.99	200-300**	2-4

Note: * only possible with stabilized boring bar
** max. number of revolution: 1200 min^{-1}

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