

With FCF technology, a wide range of product-size changes in profile mills is possible using the same set of tools

# No More Tooling Around

The flexible production of a wide range of longitudinally welded square and rectangular profiles is possible using the same set of tool rolls with the world-unique FCF system. Not only can plant productivity be increased, but less steel strip is required to produce the required products. FCF technology from Siemens VAI has been installed in profile mills in Spain and Austria.

**T**he downtime of tube mills for roll-tool changes and other operational interruptions means lost production time. This inflexibility increases costs and reduces profit. In order to sharpen their competitiveness, producers must be able to supply a wide range of products on a just-in-time basis and reduce their product stock.

As an answer to these demands, VAI Seuthe, the specialist company within Siemens VAI for tube, pipe and section mills, has successfully introduced FCF (Flexible Cold Forming) technology to the market. This is a highly flexible forming, welding and sizing system for the production of cold-rolled and longitudinally welded square and rectangular profiles. This technology is distinguished by the use of the same set of tools for the production of a complete product-size range without the need for forming- and sizing-tool changes. FCF fulfills all of the standard requirements of tolerance, corner radii and product-surface quality. Because no tool changes are necessary, the standstill times for product-dimensional changes are greatly reduced and overall productivity is substantially increased.

## Equipment features

FCF is the most flexible and productive solution on the market for the manufacture of longitudinally

welded products with square and rectangular cross sections. During forming and sizing operations, no tool change is required for the entire range of product dimensions. Product-size changes are automatically performed by means of central adjustment drives that are activated by computer control. Adjustments in the forming and sizing section are carried out within minutes, and tool settings as well as other key operational parameters are visualized by digital displays.

## FCF forming, welding and sizing sections

The essential difference between FCF forming and conventional forming systems with single forming stands is the arrangement of the tool rolls. Contrary to conventional forming stands, which are characterized by the opposite arrangement of the tools on a common shaft, the tool rolls in the FCF system are alternately mounted on the left and right cantilever shafts of the forming blocks. The left and the right strip edges are subsequently bent as they pass the individual tool rolls. Final bending and adjustment of a C profile to a profile ready for longitudinal welding is carried out by the top rolls.

Welding operations can be performed using high-frequency (HF), tungsten-inert-gas (TIG) welding or laser-welding systems. The strip edges to be welded

are squeezed with the use of two side rolls and two inclined top rolls, universally applicable for several product dimensions. Welding in the FCF line is performed centrally along the mill centerline.

Following welding of the profiles, final calibration of the square and rectangular sections is carried out in the FCF sizing section. The same set of universal tool rolls is used for the calibration of the final section dimensions and corner radii as well as for product-size changes.

### FCF benefits

By applying universal tools for the production of the complete range of line products, time-consuming tool changes are effectively eliminated. With the application of hard-metal tools, considerably reduced wear and thus longer tool lifetimes were achieved. This has led to an impressive 80 percent line availability for actual production work at the line of a producer, compared with a typical 40 percent production availability in conventional lines.

The direct forming concept employed in the FCF system allows the required steel-strip width to be reduced by between 2 percent and 6 percent, compared with the conventional production of squares starting with a round mother tube. This is explained by a thickening of the steel at the corners during shaping from round to square.

As a direct consequence of its high availability, the FCF production line is distinguished by its exceptional productivity, especially for the production of small order lots. All quality requirements with respect to tolerances, corner radii and product-surface quality are fully satisfied. This is the key not only for satisfying niche-product markets, but also for penetrating and succeeding in new market segments and regions.

The accumulative result of all benefits outlined above is enormous cost savings in production, maintenance, spare-parts management and time expenditures. Far less capital is bound in tool inventory and product storage. Depending on the local conditions, the return on investment (ROI) for a new FCF line is estimated to be at two-and-a-half to three years!

Not only can manufacturers of tubes and profiles profit from the above advantages offered by the highly innovative FCF solution, they also have a decisive competitive edge to succeed even in a difficult market environment. ■

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FCF line showing strip entry and FCF forming sections



View of a typical roll configuration of an FCF line

### Example of increased productivity and profitability with FCF technology

<b>Conventional line</b>		
Two-shift operation	48 weeks/year	
Partial roll change	5x/week, 2 hours each	= 480 hours/year
Complete roll change	2x/week, 4 hours each	= 384 hours/year
Line downtime per year		= 864 hours
<b>FCF line</b>		
Partial roll adjustments (no change necessary!)	5x/week, 0.2 hours each	= 48 hours/year
Complete roll adjustments	2x/week, 0.5 hours each	= 48 hours/year
Line downtime per year		= 96 hours
Additional production time	(864 minus 96 hours)	= 768 hours/year
<b>Productivity</b>		
Medium dimension	40 x 30 x 2.5 mm	
Weight of section	2.51 kg/m	
Line speed	50 m/minute	
Additional productivity	7.5 t/h x 768 hours/year	= 5,780 t/year
1) Example product price	€670/t	
2) Example raw material costs	€600/t	

**Additional possible profit with FCF Line**      1) minus 2)      = **€400,000/year**