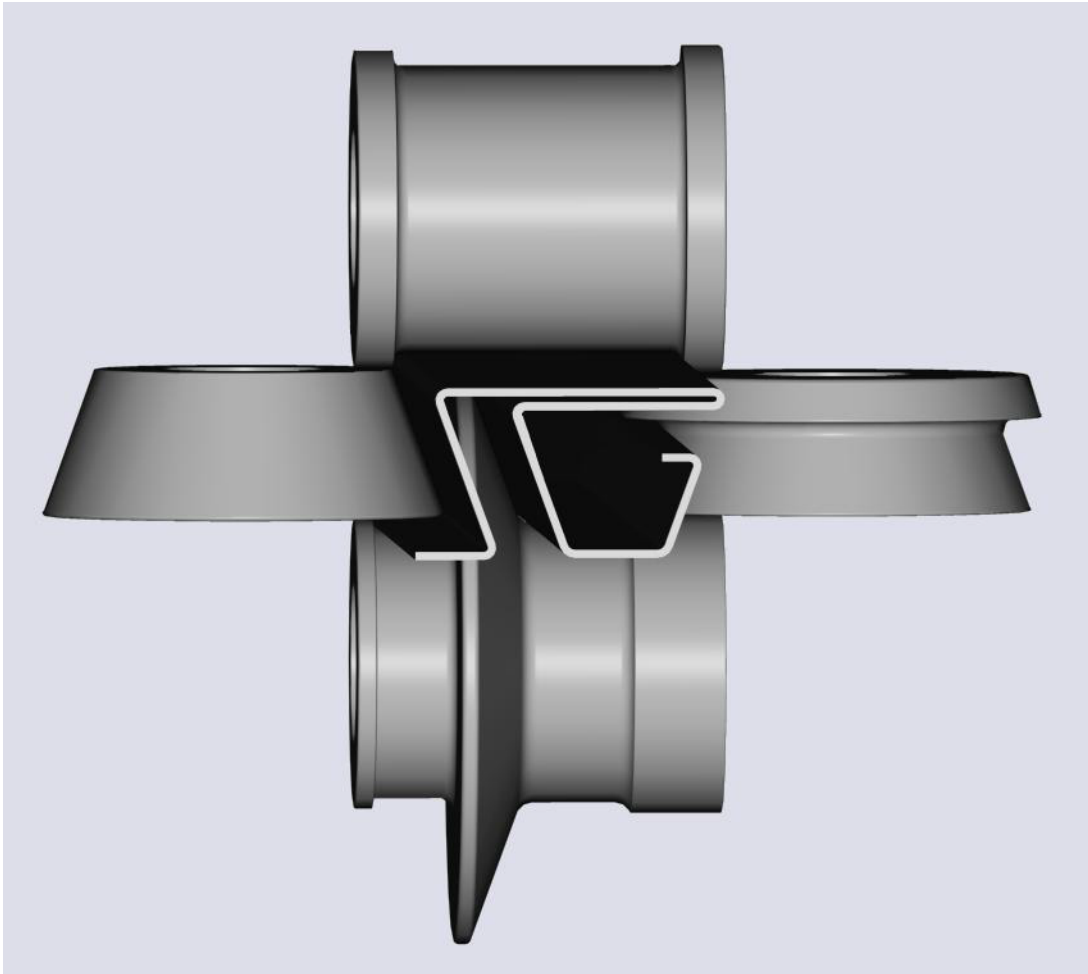
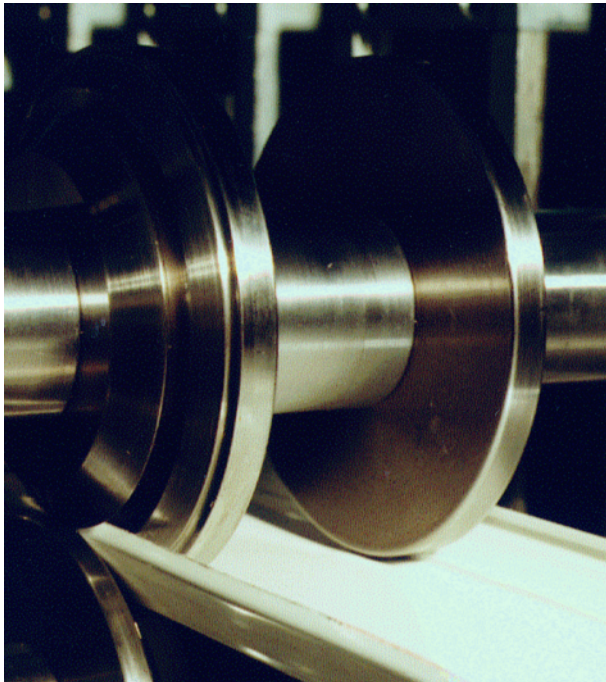


PROFIL

Rollform Design Software





Rollforming

Rollforming is a continuous bending operation in which sheet or strip metal is gradually formed in tandem sets of rollers until the desired cross-sectional configuration is obtained. Roll forming is ideal for producing parts with long lengths or in large quantities.

What is PROFIL?

PROFIL is the roll design software for every manufacturer of cold roll-formed profiles or seamed tubes from sheet metal and for designers of rollformers and tube forming machines.

PROFIL enables quicker working and cost reductions in planning, design, calculation and drawing of the profile, the flower pattern (bending steps) and the roll tooling.

PROFIL is available for all WINDOWS platforms and has an easy to use WINDOWS-based user interface, which enables experienced rollform designers to learn through self-tuition.

PROFIL has built in CAD interfaces (DXF, IGES and MI), which can be used for generating drawings in any CAD system. For AutoCAD, SolidWorks, and LOGOCAD Triga, the very modern ActiveX-interface is used.

What are the aims of PROFIL?

PROFIL will not replace the engineer. This is not possible. But it will give him practical help for a quicker and safer design.

To achieve these aims, the software must relieve the designer of tedious work, e.g. calculating the developed length, drawing the profiles and roll tools, compiling the parts list etc. So the designer is able to fully concentrate on the design.

A designer, in most cases, is not a computer technician. Therefore the software must speak the designer's language. And the software must be easy to operate and easy to learn.

The software must fulfil practical requirements and must have great flexibility to adapt to specific requirements. It also must contain the latest results of scientific research.

What does PROFIL do?

PROFIL supports the section definition. Create new profiles by entering the dimensions into the system, by importing a CAD contour or by using the design toolbox for standard profiles, or by combining these powerful tools to get your design.

PROFIL works as your assistant while designing. Besides determining the neutral line and calculating the developed length of the sheet metal, **PROFIL** calculates all the important data for the bending process: spring back, statics, and the stress of the band edge.

PROFIL speeds up your work designing the flower pattern. Simply change angle or radius values with the editor or by using the modify toolbox to create the bending steps. You may select constant developed length or a constant radius method.

PROFIL supports modification and optimization of the flower. After every modification of a bending angle, the stress of the band edge is recalculated and displayed.

PROFIL speeds up the roll design by directly using the profile contour or any contour drawn in CAD. Use the powerful commands to modify the rolls to your individual needs. Create roll drawings just by key stroke. Roll tool drawings are dimensioned automatically.

PROFIL supports manufacturing of the roll tools by creation of parts lists and NC-programs (DIN 66025).

PROFIL supports the quality management by checking the final design with the calculation of stress of band edge, the profile stress analysis (PSA), and the finite element simulation (FEA).

PROFIL helps searching for suited rolls, if existing old rolls of the roll stock should be re-used in a new project.

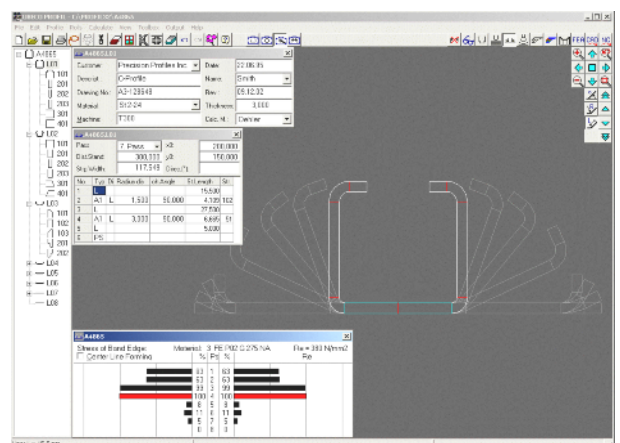
PROFIL helps searching for recent projects, if the designer wants to consider experience from similar profiles that are produced in the past.

The PROFIL story

PROFIL has been designed by **UBECO** in co-operation with the German rollforming industry. When it was presented at the Euro-BLECH exhibition in 1986, the attendees were impressed by the capabilities of the software. Soon **PROFIL** became a leading software for rollforming design in Germany.

The first version was running under MS-DOS and HP-UNIX. Since 1997 the WINDOWS version has been available. Because of its very easy to handle graphical user interface **PROFIL** became famous world-wide.

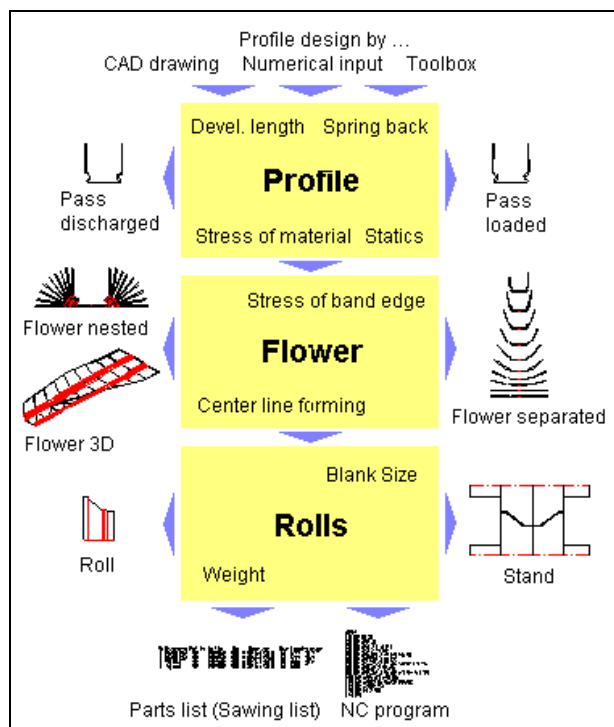
In the mean time more than 350 systems have been sold. Customers in more than 25 countries are using **PROFIL** for their design.



The PROFIL user interface

Working with **PROFIL** is like working with a CAD system: The drawing of the profile, the flower pattern or the roll tools is permanently displayed on the screen. This enhances the user friendliness of the software and allows bending of the profile by mouse click directly into the drawing. The corresponding numerical data including profile list, statics, and stress of band edge are shown in separate windows and are always updated while bending.

Designing with PROFIL



Profile Design:

Enter the geometry of the desired profile, either graphically by drawing it in CAD or numerically by entering the data (length, angle, radius etc.) into the system. Or use the profile toolbox for quick and easy defining of U-, C- Hat- or Z-profiles. **PROFIL** provides the drawing of the shaping pass loaded and discharged, the developed length, the spring back, the stress of the material and the statics.

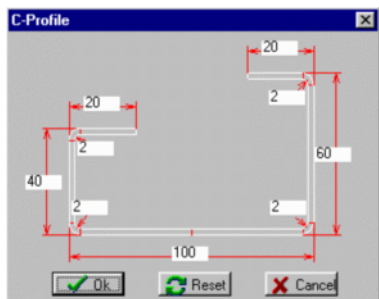
Flower Design:

Derive the flower out of the shaping pass by defining the angle sequence. **PROFIL** provides the drawings of the flower, the stress of band edge for normal and for center line forming.

Roll Design:

Derive the geometry of the rolls from the passes. **PROFIL** provides all the drawings of the rolls, the blank size and the weight, the parts list (sawing list) and the NC-program.

Designing the profile



by the Profile Design Toolbox:

The quickest method for defining a simple profile like U-, C-, Hat- or Z-profile is to use the Profile Design Toolbox (example: C-profile).

Open the appropriate toolbox window and simply enter the dimensions of the desired profile into the input fields. Further toolbox windows can be used for applying extension segments to the profile (straight and bent elements and combinations of them).

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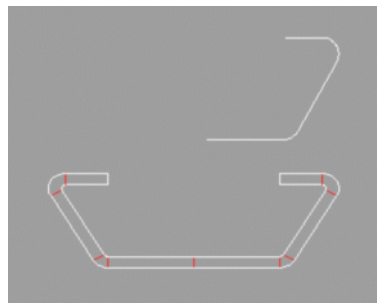
Pass: 9, Pass: x0: 200,000
Dist Stand: 600,000 y0: 150,000
Strp.Width: 196,746 Direc.('):

No.	Typ	Di	Radius	dis	ch	Angle	St.Length	Str.
1	L						25,000	
2	A1	L	2,000	120,000			6,021	51
3	L						5,000	
4	A1	R	2,000	90,000			4,444	51
5	L						5,000	
6	A1	L	2,000	60,000			2,908	51
7	S						50,000	
8	PS							

by entering the numerical data:

A very quick method for defining a simple profile is to enter the numerical data directly into the profile list. After every input the drawing of the profile is updated. So the correct input can be checked immediately.

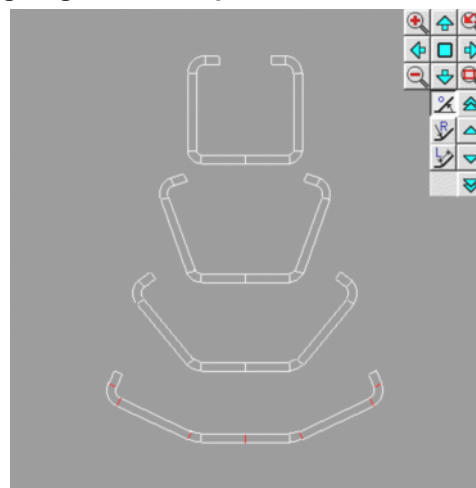
The profile list is the numerical description of the profile. Each line of this list describes either a straight segment (L = Line) or a bent segment (A=Arc) of the profile. Entity "PS" terminates the profile list and gives the profile the attribute symmetric; the other half of the profile will be mirrored automatically. Entity "P" splits a profile in two asymmetric halves. After "P" follows the second half.



by CAD drawing:

This is the most comfortable method for defining a profile. It is suited for every kind of profile, especially most complicated ones. Create a drawing inside of your CAD system. You have to draw the lower contour line only, the sheet thickness is entered later. If you want to design a symmetrical profile, you only need to draw one half (see example in the top). When finished, simply transfer the drawing to **PROFIL**.

Designing the flower pattern



by the Toolbox Modify:

Select by pressing the button "Angle" or "Radius", if you want to modify angle or radius by predefined step values. Select by clicking on the profile, which arc segment of the profile should be bent (marked in light blue color). Now press "Up" or "Down" or "Fast Up" or "Fast Down" and the arc will be modified.

Whether the bending method A1 (constant straight length) or one of the methods A2 or A3 (constant radius) is used for calculating, can be defined in the profile list previously.

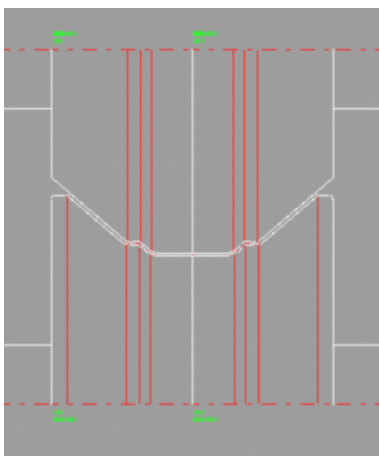
While designing the flower pattern, open the Stress of Band Edge Window and take care to not exceed the yield point.

No.	Tvo	Di	Radius	dis	ch	Angle	St.Length	Str.
1	L						25,000	
2	A1	L	2,000	120,000			6,021	51
3	L						5,000	
4	A1	R	2,000	90,000			4,444	51
5	L						5,000	
6	A1	L	2,000	60,000			2,908	51
7	S						50,000	
8	PS							

by entering the angle sequence:

Alternatively, you can enter the new radius or angle of the arc segment directly into the appropriate column of the Profile List. The profile will be bent dependent on the selected bending method (A1, A2 or A3) and the drawing of the flower will be updated immediately.

Designing the roll tools



by automatic generation:

If the rolls should get the same contour as the profile, the automatic generation from the profile list is very useful. This method works for every kind of profile, folded too.

Afterwards, the rolls can be modified by a set of powerful functions:

- conical, cylindrical, and arched extension
- split at corner, split between corners, join
- turn, move, mirror, delete
- cut, copy, paste (to and from the clipboard)
- change width, diameter and fillet radius at each corner
- attach clearance angle

by CAD design:

Otherwise, if you want to define the roll contour by yourself, the CAD design is recommended. Simply transfer the profile drawing to CAD and design the desired roll contour by modifying the profile contour. Afterwards transfer the roll contour back to PROFIL.

by using rolls from the roll stock:

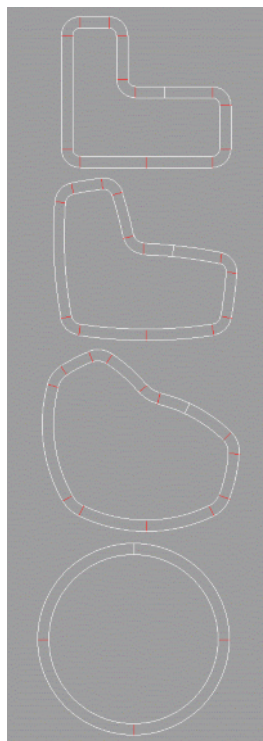
To re-use existing rolls from the roll stock, use the Roll Stock Management.

Designing round and shaped tubes

The Tube Design Toolbox contains a set of powerful functions for designing:

- calibration stands for round and shaped tubes
- welding pass
- fin passes
- break down passes for normal and W-forming
- top and bottom roll for the fin passes
- top and bottom roll for the break down passes
- side rolls

Example: designing calibration stands for a shaped tube



Shaped tubes are formed from a round tube by calibrating stands or by drawing rings. Designing the cross sectional pattern of the intermediate stages is a very time-consuming task if it has to be done manually.

PROFIL is able to do this automatically. The pre-defined calibrating factor says how much the developed length of the tube decreases in each stand and the pre-defined forming degree enables the designer to distribute the 100% of the forming between the welded tube and the shaped tube to each stand. The software proposes the cross sectional pattern for all passes until the round welded tube.

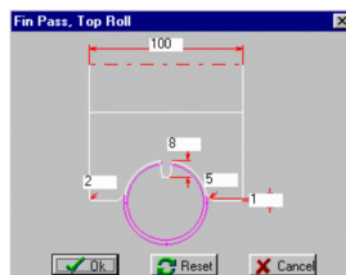
If you call this function repeatedly, PROFIL always creates other variants since there are many solutions of the same problem. Choose the solution that is closest to your mind.

Example: designing the fin pass



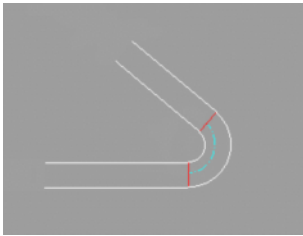
Simply enter the fin width, the tube is bent open automatically to the given width.

Example: designing the top roll for a fin pass



Simply enter the roll width, the fin height, the fillet radii and the air gap between top and bottom roll. The roll is created automatically.

Calculating the developed length

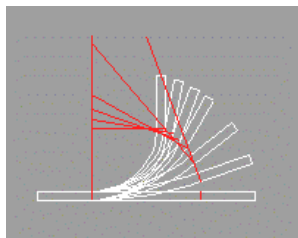


Oehler method: This is the most precise one of all known methods, because it calculates the developed length dependent on the sheet thickness, the bending radius and the angle.

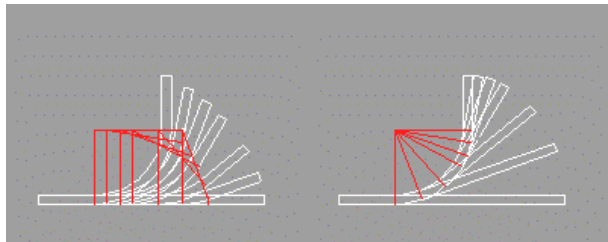
DIN 6935 method: It calculates the developed length dependent on the sheet thickness and the bending radius and is as a result of it less precise than the Oehler method.

User defined methods: Further user defined methods can be added to consider company specific standards.

Bending methods

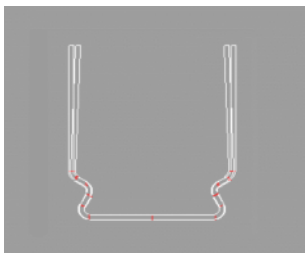


Constant developed length method A1: While the developed length is constant, either the angle is pre-set and the radius is calculated or the radius is pre-set and the angle is calculated.



Constant radius method A2/A3: While the radius is constant, the angle is pre-set and a new length is calculated. In order to keep the strip width constant, the length of the previous (left) or the next segment (right) or both are corrected. **Track Holding Method A4:** The surplus length is divided automatically to the previous and next segment, that the strip is guided straightaway with constant intersection point of the tangents on the inner or outer side.

Calculating the spring back



If the bent profile leaves the machine, the legs of the profile spring back. This is calculated dependent on the material, the sheet thickness and the bending radius and angle.

Both for the single arc and for the whole profile can be selected, if the drawing should be displayed loaded or discharged. This is important for the roll design, at least the last attacking roll tool should be designed for the loaded state to compensating for the spring back.

Calculating the statics

Kp0999.L01				
Statics:	Related to:	x	y	
Centroid of an Area	Ref. Point x0/y0	0,000	25,022	mm
Shear Center Point	Ref. Point x0/y0	0,000	-29,411	mm
Moment of Inertia	x/y in Centroid	19,538	29,669	cm4
Moment of Inertia	in Principal Axes	29,669	19,538	cm4
Moment of Resistan.	x/y in Centroid	4,440	8,983	cm3
Moment of Resistan.	in Principal Axes	8,983	4,440	cm3
Max. Distance	in Principal Axes	4,400	3,303	cm
Inertial Radius	in Principal Axes	2,746	2,228	cm
Area of Cross Sec.			3,935	cm2
Weight			3,089	kg/m
Princip. Axes Angle	x-Axis in Centroid		90,000	deg
Vault Resistance	Shear Center Point		124,007	cm6
Torsion Moment	Centroid		0,052	cm4

If a profile is designed for a load-bearing construction and the strength calculation is necessary, the static parameters of the cross-section of the profile are needed. These are calculated automatically and are displayed in a separate window. By this, a profile can be designed by satisfying given parameters. The statics can be transferred to the CAD-system.

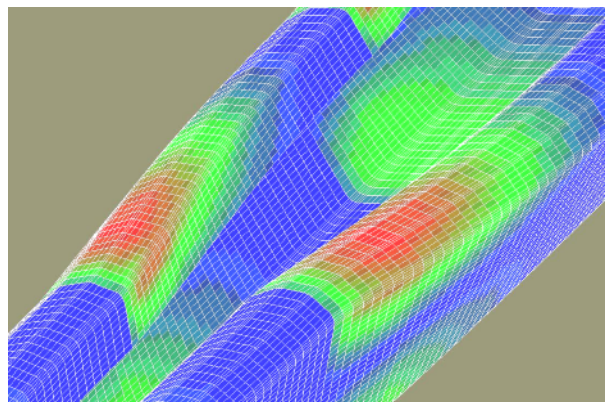
Calculating the stress of band edge

A4005				
Stress of Band Edge:		Material: 3 FE P02 G 275 NA		Re = 380 N/mm2
Center Line Forming	%	P%	%	Re
1	63	1	63	
2	63	2	63	
3	99	3	99	
4	100	4	100	
5	8	5	8	
6	11	6	11	
7	5	7	5	
8	0	8	0	

If the legs of a profile are bent step-by-step from one stand to another, the edges travel a longer way than the web of the profile. This causes strain and stress in the edges. If this process is limited to the elastic area of the material, the strain and stretching will return to the original length again, as the profile leaves the stand.

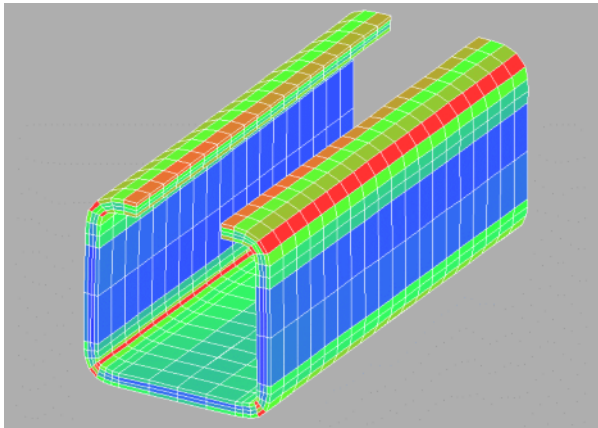
In the other case, if the stress of edge has exceeded the yield point between two bending steps, this will cause a remaining strain in the material causing problems like twists or waves at the edge of the profile. The relative stress related to the yield point is calculated and displayed in a separate window. By this, the designer can watch if the safe load of the band edges is kept while bending.

Profile Stress Analysis (PSA)



The sheet surface is divided in small rectangular shell segments. While running through the rollforming machine, the rectangles are deformed. From lengthening or shortening of the edges the expected strain and from it the stress can be derived. The stress related to the yield point of the material is assigned to a color and displayed in the 3D model. The profile stress analysis is an integrated feature of the software **PROFIL** and works without FEA (Finite Element Analysis), this means the results are available after key-stroke immediately. The longitudinal stress is calculated not only at the band edge but in the whole profile cross section. This is very important if maximum stress is not at the band edge, e.g. if folded edges are bent up.

Virtual rollforming machine



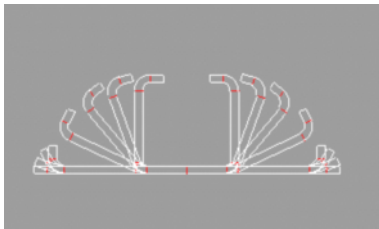
The FEA (Finite-Element-Analysis) simulation of the roll forming process enables the designer to get very precise information about stress and strain within the profile while running through the rollforming machine and after leaving the final stand of the machine. Furthermore it calculates the profile shape that is formed by the designed rolls. To enable the designer to benefit from the FEA result without being an FEA expert, the software **PROFIL** has a built-in interface to the leading FEA system **ABAQUS/Explicit** from ABAQUS Inc., Rhode Island USA.

The FEA system calculates explicit and is able to consider oil-canning effects that occur very often when thin sheet is formed. An implicit calculation needs special measures to avoid break off when the function becomes irregular.

As a result of the simulation the designer first gets the shape of the profile after leaving the final stand. This drawing can be compared with the designed shape. If the allowances are not kept, the designer can browse through the different time intervals within the machine to track the error. Colors inform about positions of high stress and remaining strain. This enables the designer to locate the reason for unwanted deformations and gives him the information which rolls need to be modified.

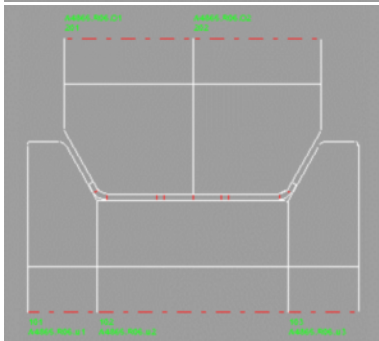
Drawings

All necessary drawings are created automatically. The single pass (loaded or discharged), or the complete flower pattern in different views, or the roll tools for a stand can be displayed. All drawings can be saved into a file. DXF, IGES, and MI formats are supported. By this, the drawings can be transferred to any CAD-system.



Example: Flower nested

For designing the flower, the drawing of the flower nested is very useful.



Example: Roll tools

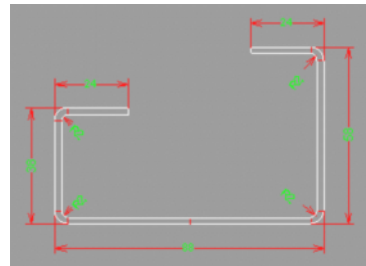
The drawing of one stand of roll tools shows how to set up the machine.

By using the Windows clipboard all drawings can be transferred to MS Word, Excel or any other application.

Dimensioning profiles and roll tools

Objects can be dimensioned associatively, meaning that if you modify any object, the dimensioning is modified automatically. The very important intersection point of the tangents of an arc is supported for dimensioning. The dimensioned drawings can be printed and transferred to CAD.

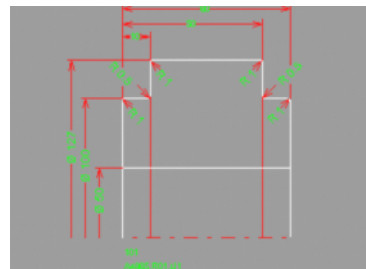
Example: Dimensioning a profile drawing



Profile drawings can be dimensioned manually. The end points of the entities are automatically caught; further catch points can be accessed via the right mouse button. The dimension text point can be modified also

for existing dimensions. With it the dimension text sticks to the cursor and can be moved as you like.

Example: Dimensioning a roll tool drawing



Roll tools drawings can be dimensioned manually and automatically. The very important diameter dimensioning is supported (radius is shown and diameter is dimensioned). You can select if the automatic dimensioning

should appear on the left, right, top or bottom. If necessary, the dimensioning can be positioned exactly afterwards.

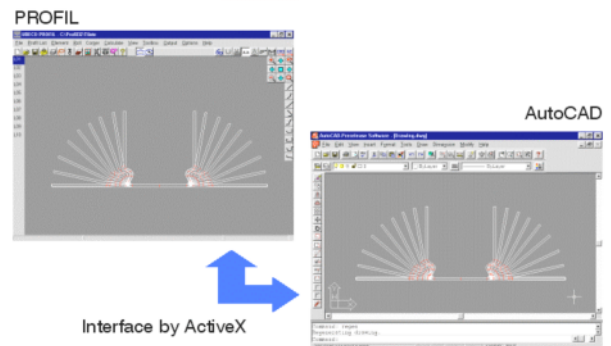
Metric and Imperial (English)

Units can be switched between metric (mm, kg, ...) and imperial (in, lb, ...). Projects that have been started in one unit system can be continued in the other.

CAD interface

PROFIL is able to co-operate with any CAD system. For some CAD systems, a special interface is provided.

Interface PROFIL <--> AutoCAD



AutoCAD, SolidWorks, LOGOCAD Triga:

The very modern ActiveX interface is used. That means, drawings to and from CAD are transferred not by interface file but directly via the operating system.

CoCreate ME10:

The drawings are transferred via MI-file and contour file. CAD macros are available for controlling the data exchange.

Others:

Data exchange is possible via DXF and IGES format or contour file.

Parts list

No	Designation	Roll No.	Part No.	Mat.	Blank Size	Boxes	Gross/Tin.	Weight
1	Beetwood	101	A4665.D01.VI	2080	= 121.5 x 57.0	50	6.9	4.3
1	TopRoll	201	A4665.D01.OI	2080	= 111.5 x 28.0	50	2.3	1.3
1	TopRoll	202	A4665.D01.O2	2080	= 162.0 x 23.0	50	2.7	2.5
1	TopRoll	200	A4665.D01.LI	2080	= 111.5 x 28.0	50	2.1	1.2
1	LeftRoll	301	A4665.D01.O3	2080	= 111.5 x 56.0	52	4.3	3.0
1	Beetwood	101	A4665.D02.VI	2080	= 121.5 x 56.0	50	6.9	4.2
1	Beetwood	101	A4665.D02.VI	2080	= 121.5 x 65.0	50	6.9	5.0
1	TopRoll	201	A4665.D02.OI	2080	= 101.5 x 36.0	50	2.3	1.4
1	TopRoll	202	A4665.D02.O2	2080	= 182.0 x 44.0	50	9.0	6.7
1	TopRoll	200	A4665.D02.O3	2080	= 101.5 x 36.0	50	2.3	1.4
1	LeftRoll	301	A4665.D02.LI	2080	= 111.5 x 27.0	50	2.1	1.2
1	RightRoll	401	A4665.D02.RI	2080	= 116.5 x 47.0	52	3.9	1.7
1	Beetwood	101	A4665.D03.VI	2080	= 102.0 x 57.0	50	14.3	9.4
1	Beetwood	102	A4665.D03.VI	2080	= 121.5 x 40.0	50	4.6	3.1
1	TopRoll	201	A4665.D03.OI	2080	= 121.5 x 57.0	50	14.3	9.4
1	TopRoll	201	A4665.D03.OI	2080	= 182.0 x 55.0	50	11.2	5.5
1	TopRoll	202	A4665.D03.O2	2080	= 182.0 x 55.0	50	11.2	5.5
1	Beetwood	101	A4665.D04.VI	2080	= 172.0 x 69.0	50	12.4	7.9
1	Beetwood	102	A4665.D04.VI	2080	= 126.5 x 41.0	50	4.0	2.8
1	TopRoll	201	A4665.D04.OI	2080	= 126.5 x 41.0	50	12.5	7.9
1	TopRoll	201	A4665.D04.OI	2080	= 182.0 x 65.0	50	13.3	7.4
1	TopRoll	202	A4665.D04.O2	2080	= 182.0 x 65.0	50	13.3	7.4
1	Beetwood	101	A4665.D05.VI	2080	= 126.5 x 70.0	50	6.9	4.7
1	Beetwood	102	A4665.D05.VI	2080	= 126.5 x 70.0	50	6.9	4.7
1	TopRoll	201	A4665.D05.OI	2080	= 126.5 x 70.0	50	6.9	4.7
1	TopRoll	202	A4665.D05.O2	2080	= 182.0 x 70.0	50	14.3	9.9

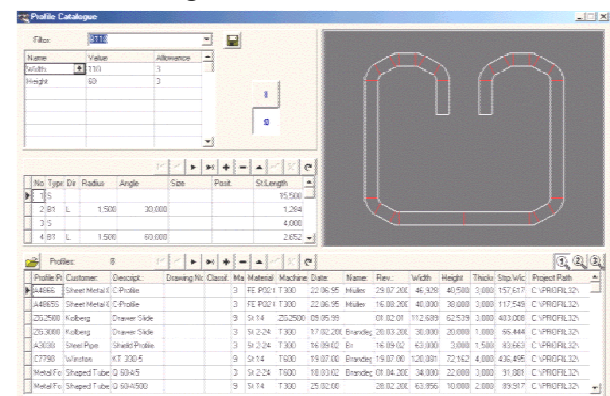
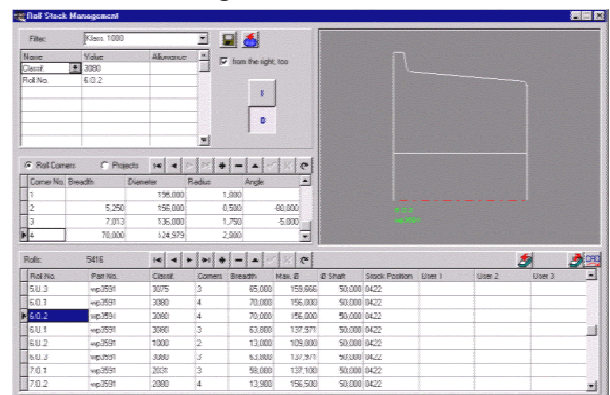
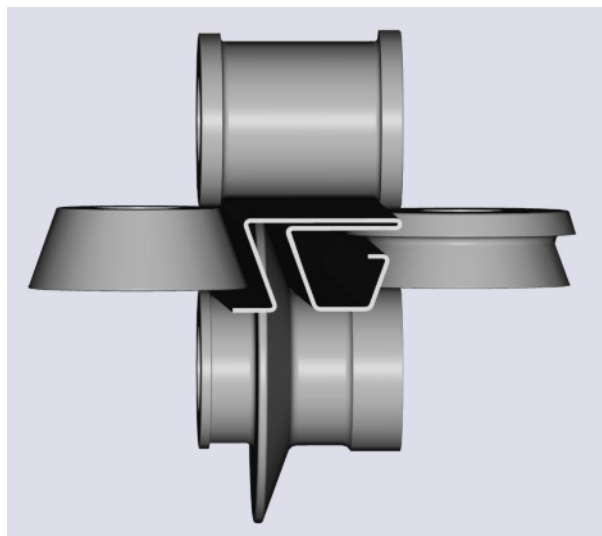


Photo Realistic Images



With the help of AutoCAD **PROFIL** creates photo realistic views of a stand or of a profile. These are useful for advertising, presenting, and offers.

Press Releases



From The Fabricator, May 2004:

Predicting stress and strain in roll formed profiles

Three methods to help prevent roll tool modifications

Roll forming is a continuous bending operation in which sheet or strip metal is formed gradually in tandem sets of rollers until the desired cross-sectional configuration is obtained. Tracking single points of the cross section can reveal movements on curves, which reveals the different strains and stresses on the material lengths.

As long as these stresses occur within the elastic bounds, strain disappears again after the profile leaves the final roll forming stand, and the desired profile form can be obtained. However, if yield stress is exceeded, the strain remains, and the resulting excess material causes rippled edges in symmetric profiles, as well as twists around the longitudinal axis or curving in nonsymmetric profiles. Time-consuming and expensive modification of the roll tools is needed to correct the problem.

Three software-based quality control options can help designers predict and track strain and stress to prevent costly modifications down the line.

(Excerpt, a reprint of the complete original article is available on request)



from Tubeworld, Issue 5, April/May 2003:

Roll form tools tested virtually

Software allows designers to verify the designed roll tool set by using finite element analysis.

Software launched by Ubeco allows designers of roll form tooling to analyse their prospective tools on screen by creating a 3D representation of what would be the resulting tube.

This roll form simulation uses finite element analysis tools to map out all stages of the forming process between sheet metal and complete tube - highlighting any design weaknesses or faults that would accrue from the proposed tooling. Colour coding indicates the levels of stress infliction on each section of tube so the designer can quickly check whether these fall within permissible limits.

This Virtual Roll-forming Machine (VRM) package is said to complement Ubeco's existing Profil software - used to design tube forming tools. Based on a Windows platform, Profil provides the engineer with a speedy design outcome by automatically "designing the cross section pattern of the intermediate stages" of a shaped tube, rather than leaving him to perform this manually.



From Metal Forming Magazine, 03/2002:

Rollforming Design Software Adds FEA Capability

Finite-element-analysis (FEA) simulation of the rollforming process enables designers to validate and optimize rollform designs at early stages before the rolls are manufactured, ensuring that final products meet particular needs. Profil rollform design software from Ubeco GmbH, Iserlohn, Germany, now provides an interface to such an FEA system, Abaqus/Explicit. This allows calculation of stress and longitudinal deformation within the whole profile.

Resulting from the FEA calculation is a CAD drawing of the profile, which can be dimensioned and checked to see if the deformation is within allowances. If not, the design must be modified. Because this occurs prior to roll manufacture, costly trial and error is eliminated.

With built-in CAD interfaces and its new FEA interface, Profil allows rapid planning, design, calculation and drawing of a rollform profile, bending steps and roll tooling.

Profil, in addition to FEA capability, now offers Undo/Redo functions, expanded roll data, improved clearance angle, an Open-Fold function and interface in Microsoft Word and Excel.



From Sheet Metal Industries, March 2000:

Designed to roll

A sophisticated CAD system is essential for designing accurate roll tools for cold rolled profiles. Roland Brandegger, president of Ubeco GmbH, points the way.

The designer of cold rolled profiles needs not only much experience but also must be prepared for a lot of tiresome, tedious work. Many drawings have to be made and although these can be done more quickly by CAD, they still need time.

The designer can automate most of this work by using a special CAD system for the design of cold rolled profiles. Because of this, he saves time and safety is improved. He can concentrate on his actual task, the design and optimising of the flower pattern and the geometry of the roll tools.

Software for the design of cold rolled profiles and roll tools won't replace the engineer. This is neither wise nor possible but it can allow better design. Improving quality reduces customer's complaints. (Excerpt, a reprint of the complete original article is available on request)

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