

Cross profile measurement on cut samples of hot or cold rolled strip

Vollmer Cross Profile Gauge VBP



There are continuously rising demands for tighter tolerances and steadier quality of cold rolled strip. This makes reliable and informative measurement methods becoming more and more important. The Vollmer VBP measurement device offers a complete system for measurement, registration and evaluation of cross sectional strip profile.

Even if strip thickness tolerance can be controlled within a very tight range by means of automatic measurement and control circuits for the controlling of roll gap, roll position, rolling force and mass flow, the final product quality still depends on the shape of the starting material - as of course the cross profile of a strip cannot be changed on a cold rolling mill unless one is prepared to get buckled or curved strip.

Basic tool for warm and cold rolling

The foundation for final product quality is laid already with the cross profile shape which is produced on hot rolling and on breakdown mills. The best re-

sult can be achieved if there are no unwanted thickness changes across the strip. If the cross profile is already measured at this stage, the basic material can be produced with a good parallel profile, due to appropriate roll gap adjustment.

However, even when rolling high quality starting material, the cold rolling mill operator should know the cross sectional profile of the ingoing strip, as he has to adjust the roll gap to match with the original strip shape.

The Vollmer cross sectional measurement and registration system VBP measures the cross sectional thickness profile on cut samples of hot or cold rolled strip. The machine does not only show a recorder curve of

the measurement data. In connection with the VBP evaluation program it provides a graphic display and a mathematical and statistical measurement data evaluation.

The samples are clamped between two hydraulically operated clamping brackets. Then they are measured across the width. Measurement is done by a traversing sled which is carrying two electronic transducers (LVDT), one each at the bottom and the top, or one transducer and one micrometer fine adjustment. The sled is moved across the sample by a spindle drive.

Easy to operate

The two sensors measure the strip from both sides by their measurement tips and register all thickness changes along the measurement section. A VMF measurement amplifier indicates the difference between the actually measured thickness and the selected nominal size. Additionally the measurement data curve is plotted (proportional to the measurement distance) by a recorder. The measurement distance is controlled by a rotary pulse encoder which is running parallel with the drive of the measurement sled. The resolution of the recorder curve is adjustable.

For protection of the transducer tips, the gauge automatically stops to traverse the measurement sled before crossing a strip edge. A pressure valve limits the hydraulic pressure of the clamping brackets in order to protect the entire gauge construction.

The VBP takes its electric power from the standard main power supply. The electronic cabinet on the gauge contains the entire control electronics as well as the measurement amplifier as an analogue indicator.

The VBP data evaluation program

The VBP measurement device is available with a data evaluation program which displays real-time cross profile measurement data on a monitor and stores the data after measurement.

Digital measurement data which is continuously put out during the measurement pass, are sent to the computer via a bus system. Additionally the pulses of a rotary pulse encoder are read into the computer. The pulse encoder data are required to compute the measurement distance.

A monitor displays a profile curve, a wedge index and a crown index of the measured cross profile. Additionally it indicates the width of the sample and shows numerical data about the cross profile deviation from its nominal size. All data and graphics can be stored and printed out.

The wedge index and the crown index help to calculate how to set the correction elements of a hot rolling mill in order to achieve the required strip shape.

This is calculated by a regression analysis of the second order, with the center of the sample as reference position. When utilizing these data it is necessary to regard the distance between strip center and center of the correction element.

- Wedge index

The absolute value is an index for the size of the wedge in the cross sectional profile. The sign indicates the direction of the wedge, (+) indicates a profile with thickness increase towards the right side, (-) indicates a profile with thickness increase towards the left side.

- Crown index

The absolute value is an index for the size of the crown in the cross sectional profile. The sign indicates the direction of the crown, (+) indicates a profile with thickness increase towards the edges, (-) indicates a profile with thickness decrease towards the edges.

The VBP program stores cross profile measurement data, it provides data evaluation and measurement documentation on a monitor or as a printout. Such an evaluation provides very effective measures for product quality controlling:

- regulation of the production process in case of unsatisfactory results

- faults can be detected early when there is still time to eliminate the causes

This results in:

- decrease of scrap production and increase of production efficiency

- guaranteed product quality

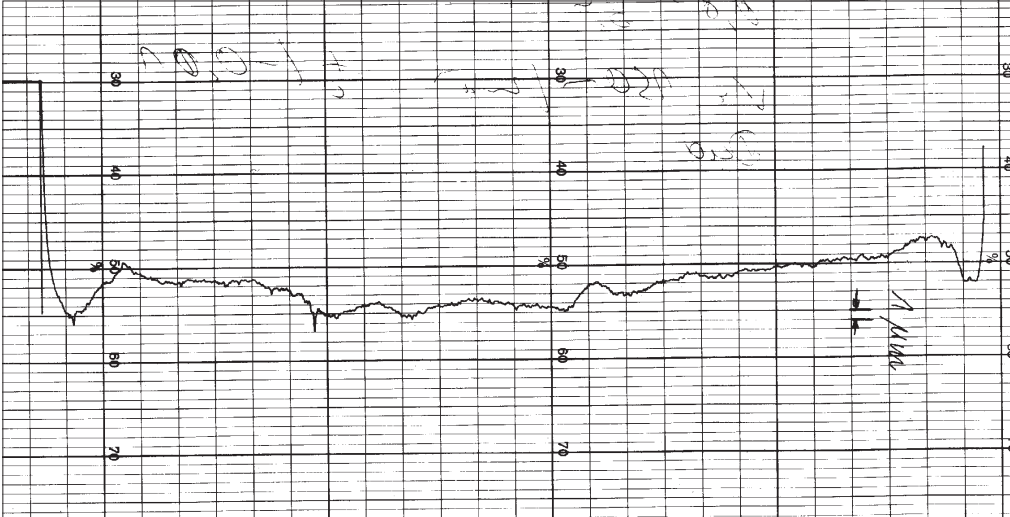
- documentation of the producers quality control as a record for the customer

The entire Vollmer VBP system consists of a VBP cross profile measurement machine, software which can individually be modified according to each customers requirements, a personal computer AT 386 with math co-processor, a color monitor, a dot-matrix printer (color or b/w) and a special interface.

Custom tailored

The applications described above are only examples for the wide range of measurement data evaluation. The software can be converted to match the individual requirements of each user.

VBP controls and measurement recorder: Below the measurement amplifier VMF there are two lines of controls and control lights. The bottom shows the wheel for sample centering and the handle to operate the hydraulic clamping brackets.



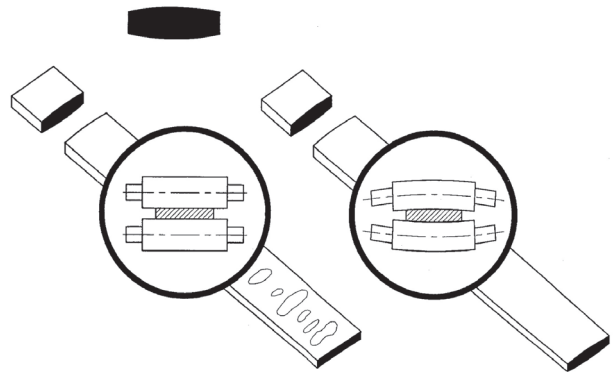
Part of a VBP recorder strip: The curve shows the exact cross profile thickness of a sample of 500 microns nominal size. There is a separate brochure about the VBP program and its monitor graphs.



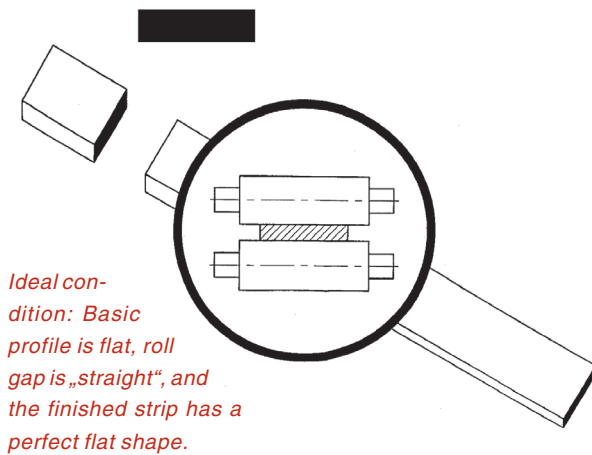
VBP measurement machine: This type can measure strip samples up to 1500mm wide. On the right hand is the electronic cabinet with a VMF measurement amplifier and a measurement recorder.

Examples for strip shape defects due to wrongly set shape of the roll gap

Any attempt to alter the cross sectional profile of a strip in a cold rolling mill, will definitely result in strip shape defects. This is because those (thicker) strip zones which become over-rolled, receive more elongation than the thinner strip zones, thus resulting in material tensions which show as strip shape defects. In order to avoid such effects, the mill operator will always try to adjust the shape of the rolling gap to match with the shape of the ingoing strip. This requires exact data of the strip thickness measured across the entire strip width.

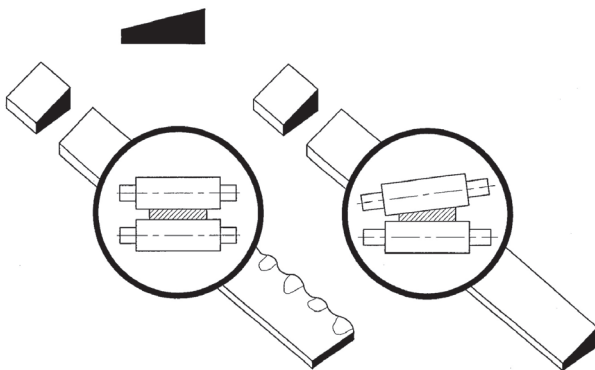


Convex profile: A straight gap produces center buckles, but a gap of a corresponding shape will roll a flat strip.

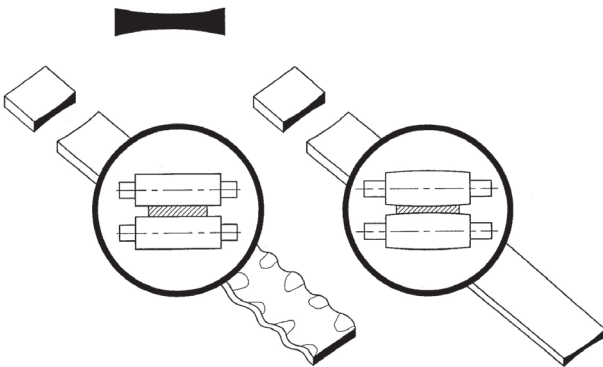


Ideal condition: Basic profile is flat, roll gap is „straight“, and the finished strip has a perfect flat shape.

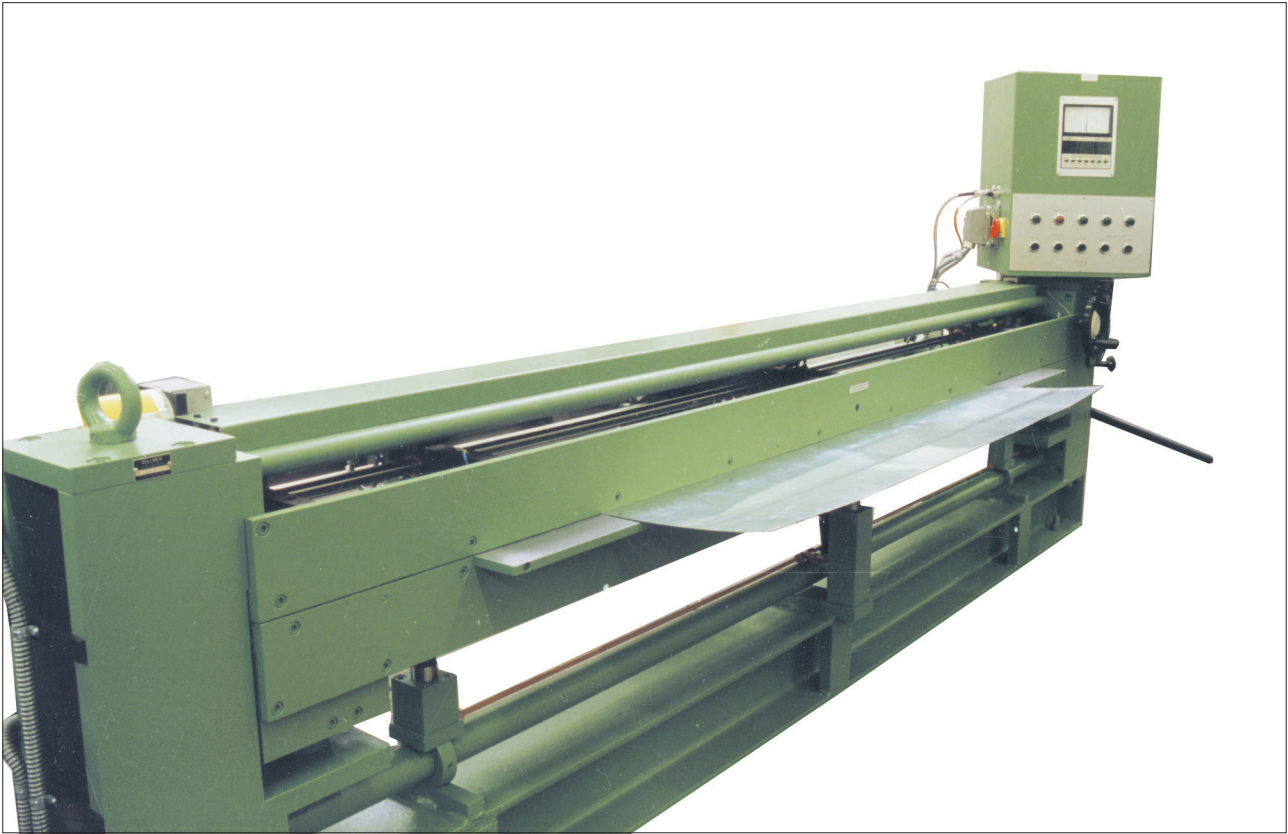
A mill can produce flat strip only if the cold rolling gap matches with the ingoing strip shape. The Vollmer VBP-machine offers a complete system for measurement, registration and computerized evaluation of the cross sectional strip profile.



Wedge profile: A straight gap produces strip curvature and a wavy edge; only a wedge shaped gap can roll flat strip.



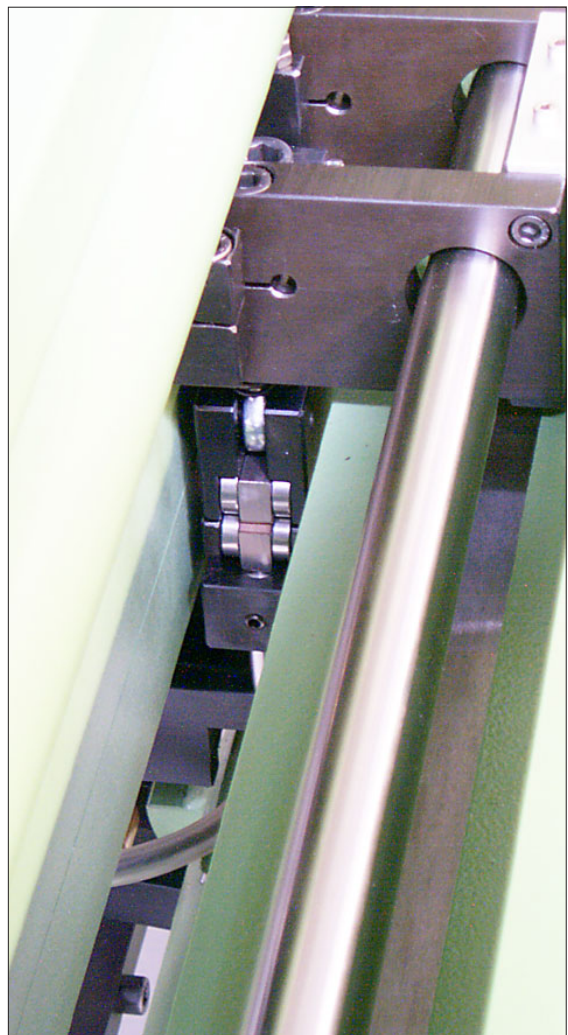
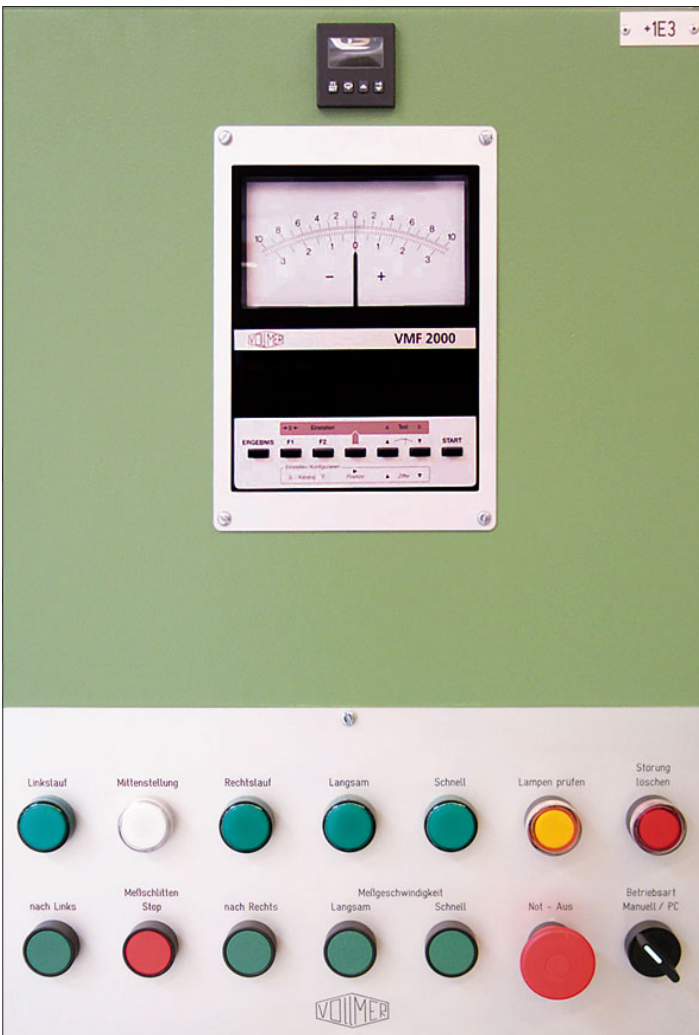
Concave profile: A straight gap will roll wavy edges, but a gap with corresponding shape produces a flat strip.




Above: Large VBP gauge

Below left: VBP control panel

Below right: VBP flat rollers in the measurement frame



VBP Win



Lot No: 6846	Date: 26.04.02
Order No: 565	Time: 10:57:14
Project No:	Filename: c:\VBP\data\1.vpm
Customer: Müller	

Test Number: 1	DropOffLeft(mm): 3	SampleProblem: No
Start End: L	DropOffRight(mm): 3	Operator: Herr Meier
Meas. Width(mm): 60,2	Edge Offset(mm): 2	Comments1: OK
TargetThickness(µm): 500	Regression Order: 8	Comments2:
NumOfMeasValues: 1205	SmoothCurveOff.(µm): 0	Comments3:
Meas. Step Incr.(mm): 0,05	VMF Scale(µm): 0	

NewDataSet(F4)

EditDataSet (F5)

Cancel (F6)

OK (F7)

Delete Data Set

New Measurement (F2)

ViewMeasurement (F3)

Info (F8)

Service

Setup (F9)

Exit (F10)

Lot No:

Order No:

Customer:

Search Database

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Screenshots of the VBP data evaluation software.

