

I N T E R N A T I O N A L

Sheet Metal

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**Accent on
hot forming**

Plus...

- Focus on coil processing
- New press forming processes
- Hydraulic and mechanical presses

Straight an



ISMR examines the process and elements involved in the development of a corrective leveler

Understanding the difference between a corrective leveler and a straightener is key when specifying what type of equipment is required for certain coil processing jobs. A straightener will only correct for coil set and some cross bow as it has no adjustable back-up rolls. These coils have typically already been leveled and only have the memory from being wound up (coil-set) within them. This condition can be corrected by using a straightener and adjusting the head-tilt based on material thickness from entry to exit to flatten the strip. Coils that have other conditions, such as edge wave or centre buckle, require the use of a corrective leveler to obtain flat material from these coil conditions.

Top: Three levelers from B&K

A corrective leveler has power-adjusted back-up rolls to allow a user to work the material in specified regions, as required, to flatten the strip. A coil that has edge wave requires the centre of the strip to be worked and stretched to have the same length material as the outside edges. In centre buckle applications, just the opposite is required. The centre of the material is longer than the edges so the edges of the material must be worked to be the same length as the centre, resulting in flat material exiting the corrective leveler.

Levelers have traditionally been considered as just being used in cut-to-length or blanking applications in the past. This is because service centres often obtain coils directly from steel mills and these coils sometimes have edge wave and centre buckle present which need to be removed before producing blanks.

However, in today's press feed market segment, more and more people are looking to process HSLA (high strength low alloy)

d level

material as a requirement of the automotive markets. This material is thinner and much stronger and is a benefit to the automotive arena as the parts are lighter than those manufactured from mild steel. The drawback, when processing this HSLA material, is that the yield strength is very high and usually requires more work to be performed than a conventional straightener can provide. A leveler with 17 or 19 work rolls, a smaller diameter and closer centre distances allows the material to be worked beyond its yield point and remain in a flat state after being blanked in a press.

The development path

So what elements go into the development of a corrective leveler? ISMR tracks the R&D route of a corrective leveler produced by US manufacturer, Formtek Maine . . .

B&K was founded in 1956 and specialized in corrective levelers and roll forming systems. In 2000, the company was purchased by the Formtek Metal Forming Group. The roll forming activity was transferred to Formtek Cleveland and the correc-

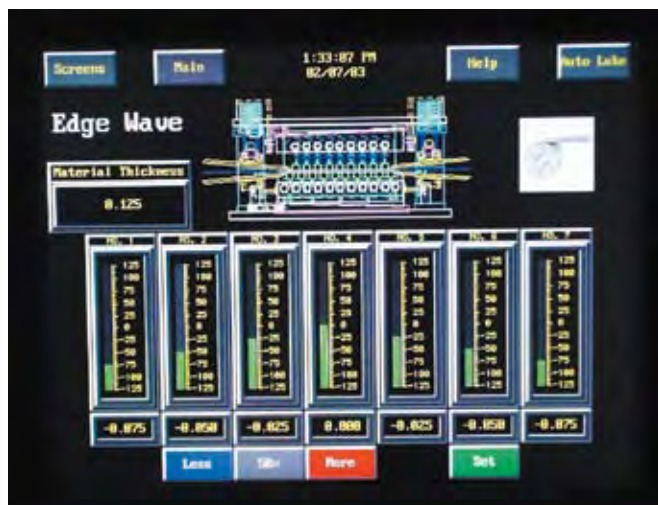
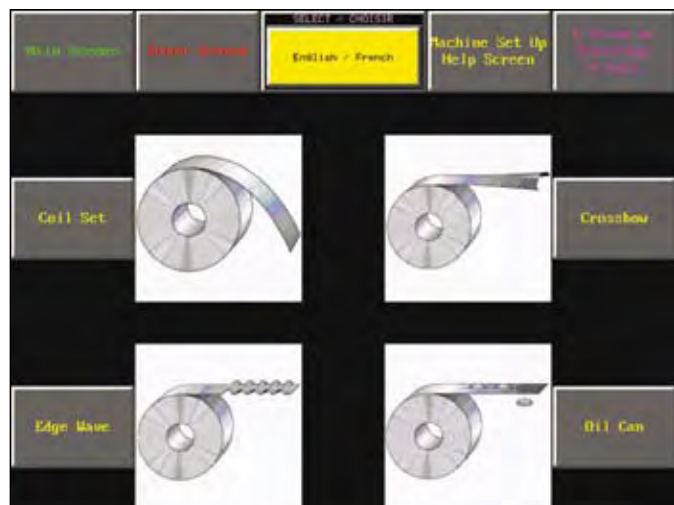
tive levelers and high speed decoilers were transferred to Formtek Maine. There are hundreds of B&K levelers in use today, located in over thirty countries.

Upon receiving the rights to the B&K leveler, Formtek Maine placed it into a research and development programme and started analyzing what changes were required to equip the leveler with cutting edge technology.

"Mechanically, it was decided to develop the 5-hi and 6-hi leveler configurations with floating intermediate rolls," the company told ISMR. "This concept traps the intermediate rolls between bronze wearite plates and does not use journals on the ends of the rolls. This design allows the end user the ability to grind the work rolls to clean them (this is a common occurrence with a leveler, usually performed annually).

"When the work rolls are ground, the circumference of the roll is decreased and this poses a problem for machines that trap the intermediate rolls in journals as now there is a space difference between the rolls. Our design allows the intermediate rolls to drop right into position upon the newly-ground work rolls and, once the upper back-ups are adjusted, there is no space difference between the intermediate rolls and the work rolls," the company explained.

Access to clean the work rolls is always a concern in corrective levelers due to the number of rolls within the machine. Levelers quite often process critical finish materials



Above: Sample help screen (left) and preset back-up roll adjustments based upon edge wave condition (right)



Above: B&K 84-inch leveler for Tier One automotive manufacture

and any foreign matter on the works rolls quickly transfers to the end product resulting in excess scrap material being produced.

"Downtime to clean the rolls and scrap material are very costly for a user, so we incorporated a powered high-rise head design into every leveler," explained Matt Watson, B&K national sales and marketing manager. "This feature allows the head of the leveler to open with a push of a button and provides 6" of clearance for quick and easy access to clean the rolls."

A new control platform was designed to allow all the settings in the leveler to be accomplished through the HMI (touch-screen) interface. The HMI (Human Machine Interface) also provides other operator benefits. A complete maintenance manual is provided as well as an operator thread-up training manual and a complete diagnostics package has been developed. A help screen has been integrated to allow the operator a reference setting based on incoming material surface conditions (see the bottom of page XX).

Leveler retrofit installation

The B&K 84" wide 1.75" roll diameter leveler was integrated into an existing press feed line for a Tier One manufacturer of automotive components. The spread-centered flat-tener/straightener, that was originally sold in

the press feed line, could not meet the part quality requirements. To replace the flat-tener/straightener and integrate a precision leveler into the existing line required a custom hold-down peeler-threader and a custom-consolidated control package including push-button controlled thread-up.

B&K's engineering department was able to design a control that would not only run the precision corrective leveler but also control the existing equipment in the press feed line.

"Our ability to maintain 98% of our product production within our facility allows us full control over our shop throughput," explained Matt Watson. "Our 85,000ft² facility is designed to allow product to flow from raw material, at the fabrication end of the building, to finished product shipping to our customers from the assembly end of the building. In the centre of our building, product flows through a machine shop which uses multiple horizontal turning centres and multiple CNC machining centres. A CNC bridge mill with travel capacity of 69"x x 126"y x 53"z is also critical to our operation."

B&K's facility in the US also has roll hardening and grinding capabilities. Programming for the machine shop is done with Surf cam software. Its manufacturing department is staffed with seventy-one employees, it has an engineering staff of seven people, ten sales staff and seven people in the service department. It offers a 24/7 service programme, allowing customers direct contact with a factory technician at any time.



Above: The B&K 85,000-square foot manufacturing facility in Clinton, Maine (USA)

Left: B&K 60-inch leveler for a leading appliance manufacturer



Leveler cut-to-length applications

A leading appliance manufacturer requested Formtek Maine to supply multiple complete cut-to-length systems, incorporating B&K corrective levelers, to supply specialty blanks to their cabinet line for upright refrigerator/freezers.

One system designed to produce the wrapper, or complete outer shell of the refrigerator, had several custom features which needed to be incorporated into the leveler. The material to be processed was pre-painted critical finish and needed to be trimmed to a precise width. The other systems were designed to supply the door and back bottom blanks for the refrigerators. All the complete systems also required special Allen Bradley control platforms to meet the requirements of the customer.

Formtek Maine supplied CWP CTL systems with B&K corrective levelers to meet the customer requirements. The models supplied were BK60/1.156/19/5/3-5HI machines. These units were 60" wide with

roll diameters of 1.156", nineteen work rolls, five backup flights, three adjustable backup flights and used a 5 HI design for single side critical finish applications. The small roll diameter with adjustable backups allowed for material from 0.008" - 0.045" to be leveled to supply quality flat strip for downstream operations.

The B&K leveler, within the wrapper line, also had to drive an edge trimmer and chopper unit as the blanks for the outside of the refrigerators could not have any deviation in the width of the blank. The edge trimmer was mechanically geared to the leveler drive train. This was to ensure that the edge trimmer ran at the same speed as the leveler output so no slack material was accumulated between the leveler and the trimmer unit (see above).

New press feed application

In January 2006, a Tier One automotive supplier requested Formtek Maine to supply a duplicate CWP press feed system, with a B&K corrective leveler, to the one that

Left: B&K 36-inch leveler with custom consolidated control package



it had installed in June 2003. The system had the same requirements as the previous system and needed to process material from 0.021"- 0.120" thick with a yield strength of 135,000psi. A B&K36/2.25/17/3/1-4HI machine was provided for the application.

The leveler (as seen above) was 36" wide with roll diameters of 2.250", seventeen work rolls, three backup flights, one adjustable backup flight and was a 4 HI design for non-surface-critical finish applications. It had a 40 HP AC vector drive with encoder feedback to regulate line speed at 150FPM and reduce coil clock springing within the looping area.

A custom-consolidated control package, including push-button controlled thread-up, was included. A multi-colour diagnostic HMI (touch screen) interface provided operator prompting of threading procedures, a maintenance schedule with service points for the entire system, on-screen digital roll position readouts and in-depth diagnostic fault messages with recommended remedies.

Any press feed system equipped with a corrective leveler is able to offer added flexibility to the overall facility offerings. These systems can feed the conventional progressive die applications as well as supply quality blanks cut within the press. The tooling within the press can provide standard rectangular blanks or, with the right tool, custom-shaped blanks. These blanks can be used to feed transfer operations in other locations within the facility or allow the option of supplying quality blanks to other facilities.

ISMRR

CONTACT:

FORMTEK Europe
Route du Petit Moncor 1
CH-1752 Villars-sur-Glane
Switzerland
Tel: +41 26 400 07 70
Fax: +41 26 400 07 73
E-mail:
formtek.eu.ms@bluewin.ch
Website: www.formtek.eu

B&K — a division of
Formtek Maine
76 Hinckley Road
Clinton, ME 04927, USA
Tel: 1-800-247-2645
Fax: 207-426-8868
Email: sales@bklevelers.com
Website:
www.bklevelers.com