TKMH specialises in custom-built stockyard handling systems for mining and quarrying ores, and in particular, systems designed to blend ores of different grades where consistency of a downstream process is critical. “The raw material that you get from any mine is never consistent in terms of quality,” Müller explains. “Poor coal with high ash content will follow better coal with much better calorific value out of the mine, for example. But when you burn coal at a power station, you need to feed the boiler with a fuel with a known average calorific value. It is the blending process at the stockyard that enables the power station to use an optimised average quality of coal.”

Similarly, at an iron ore mine, the ore going into the blast furnaces must be blended so that the process can be controlled and the required minimum quality of iron produced.

“Imagine what happens when a fleet of trucks is used to deposit ore onto the ground and an excavator is used to pick it up again and place it onto a conveyor belt. From 10 trucks, you might get 10 different qualities, but by simply discharging the ore and reloading it to send it on, you already achieve a measure of blending,” he says.

Simplistically, this is the role of stacker/reclaimer systems. But the way you offload

Stacking, reclaiming and blending effects

TKMH is a global specialist in blending systems for a full range of stacker types in combination with an associated range of reclaimers. Its expertise includes every possible combination of stockyard handling systems:

• Slewing/luffing stackers; wing stackers; overhead stackers, circular and radial stackers.
• Drum, portal; side scraper, plough, circular and bridge scraper reclaimers.
• Bucket wheel, bridge bucket wheel, half-bridge bucket wheel and combination stacker/bucket wheel reclaimers.
• Circular stackers along with uni- and bi-directional reclaimers.

“But to achieve the required level of blending from a particular mine for a particular process, you must first determine the most appropriate combination of stacking system and reclaiming system,” Müller emphasises.

Drum reclaimers, like this one in use at Sishen, are capable of handling up to 5 000 t/h and, with chevron stacking, can achieve blend ratios of 1:10.
and build the stack, and the way you pick up the material from the stack makes a huge difference to the degree of blending that you will ultimately achieve,” he adds. And trucks and excavators are only suitable for limited quantities. “You can use them for, say, 50 t/h but if you need to blend 1,000 t/h or more, then you need a blending plant,” he suggests.

Stacking methods
Stacking is at the starting point of blending processes and Müller describes four basic stacking methods: cone shell; chevron; strata; and windrow.

Beginning with the cone shell stacking method, Müller points to a picture of a stacking boom pouring material onto a stockpile. “The material comes along the belt conveyor and is discharged at a single point at the end of the boom,” he explains. The boom remains stationary until a cone of the required height is formed. The stacker is then moved along its rails by a short distance – between one and five metres – and material is again poured from a fixed point, connecting a new cone to the first. The effect is to extend the pile longitudinally along its length with interconnected cones of material of different grades. “Cone shell stacking can be done with a boom of fixed height, but it is usually done by a luffing boom, so that the boom height can be raised as the cone heights increase. This minimises the amount of dust created and prevents the material on top of the pile from being broken up by falling material,” he says.

Chevron stacking involves the creation of a longitudinal heap by pouring material off the end of the boom while the stacker is being slowly moved down the stockyard. Then, before turning back at each end, the boom is lifted a little to create room for a new layer. “By running the stacker up and down, you create a cross section with triangular bands, ie, the different qualities of material are in thin layers over the whole length of the heap.”

Strata stacking requires a slightly more sophisticated boom. “The boom used for strata stacking is longer and it must also be able to slew. An initial full-length small heap is created to the one side of the storage area. Once at the end of the pile, the boom is slewed back a little and lifted. The stacker boom begins travelling in the opposite direction, pouring new material behind the back of the first row to create a new layer. By repeatedly slewing and lifting the boom at each end, layers of different qualities are built up parallel to the back slope of the pile.

Windrow stacking also requires a long

<table>
<thead>
<tr>
<th>Type of reclamer</th>
<th>Portal scraper reclamer</th>
<th>Boom type bucket wheel reclamer</th>
<th>Bridge scraper reclamer</th>
<th>Bridge type bucket wheel reclamer</th>
<th>Drum reclamer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of product</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handling rate</td>
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<td>Up to 12 000 t/h</td>
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<tr>
<td>Stacking method</td>
<td>Cone shell; Chevron</td>
<td>Strata</td>
<td>Chevron</td>
<td>Windrow</td>
<td>Chevron</td>
</tr>
<tr>
<td>Blending effect</td>
<td>Max 1:2</td>
<td>1:3 to 1:4</td>
<td>1:4 to 1:5</td>
<td>1:5 to 1:6</td>
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<td>yes</td>
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</tbody>
</table>

A summary of the features of the most commonly used stacking and reclaiming combinations. Types of products: 1: Free flowing, grain size <120 mm; 2: Sticky, grain size >120 mm.
slewing boom. “Windrow stacking is a combination of chevron and strata,” Müller explains. “You make small separate piles by going up and down the stockyard. Then you begin to fill in the gaps between piles to build up the windrow.” The material quality is therefore layered in blocks across the pile’s cross section.

As well as longitudinal stockpiling options, all of these layering techniques can also be done using circular stacker systems. “The stacking techniques are exactly the same, but the stockpiles are created in circular, instead of longitudinal spaces.”

Reclaiming
At a blending plant, the reclaimer follows the stacker. Material from the stack is placed onto an output belt conveyor for further processing. “The type of reclaimer you need to use depends on the blending effect necessary for the process and the type of stacking system used,” says Müller.

He describes the different reclaimer technologies. A portal scraper reclaims from one side of the pile. It uses a boom suspended from an A-frame structure that travels over the top of the stockpile. The boom has a chain that drags scraper plates down the slope of the pile, pulling material over a ramp at the bottom and onto a conveyor running parallel to the pile. “The scraper is lowered onto the sloping surface of the pile, dragging material down and onto the conveyor. If reclaiming from the correct side of a strata-stacked pile, a portal scraper will cut across various quality layers and therefore give additional blending, but if scraping down the slope of a chevron-stacked pile, it will give hardly any blending effect at all,” Müller points out. “The combination of how you stack and how you reclaim is critical to blending,” he repeats.

A bridge scraper reclaimer, he says, is more often used with a chevron stacked pile if good blending is required. Bridge scrapers run on two rails up and down the stockyard, reclaiming material at ground level across the full width of the pile’s cross-section. A rake is used to roll material down the end slope and a chain system scrapes the material across to a conveyor on the side, running parallel to the stockpile’s length. When reclaiming a chevron-stacked pile, the bridge scraper is continually cutting across the quality layers in the pile, reclaiming material from every layer deposited at once, giving a typical blending effect ratio of 1:10. Bridge scrapers are often placed between two different stockpiles.

This enables material from one stockpile to be reclaimed while the pile at the other end is being stacked. Once a pile has been completely reclaimed, the bridge is simply moved back to the centre to begin reclaiming the new pile in the opposite direction.

Moving onto drum reclaimers, Müller tells us that TKMH South Africa is the world-centre-of-excellence within the ThyssenKrupp Fördertechnik Group for this technology and the company has numerous successes: at Kumba’s Sishen iron ore mine and at Sasol’s coal stockyards, for example. “The combination of chevron stacking with a luffing and slewing stacker, and reclaiming with a drum reclaimer offers the lowest operational cost per ton for this level (1:10) of blending,” he says. Drum reclaimers travel through the stockpile in the same way as bridge scrapers do, but a slowly revolving drum with buckets at all positions along its length scoops up the material from the pile and drops it onto a conveyor belt passing through its centre. “Automating this system is very simple, there is no slewing, fewer moving parts, and operational costs are lower because of less maintenance, fewer people needed and lower energy consumption. Fewer parts also mean fewer spares and the machines have a very long life, in excess of 30 years,” he tells MechTech.

Boom-type bucket wheels, in comparison, need a very long boom and, because they need to continuously slew across the pile, a big and expensive slew ring. “The drum reclaimer has only three movements, the rake, the forward movement on the rails and the slow rotation of the drum; so there are far fewer moving parts and it is much safer too,” Müller adds. But there is a capacity issue. Drum reclaimers are not suitable if you need 10 000 t/h or more. “Both boom-type and bridge-type bucket wheel reclaimers can cope with much higher speeds and capacities but with lower blending effect ratios.” He cites Richards Bay Coal Terminal as an ideal application for bucket wheel reclaimers. “At Richards Bay, the reclaimers need high capacity to load the ships as quickly as possible, but the coal is already blended,” he explains.

“In order to select the most appropriate stockyard handling solution, you first need to look at the blending effect that needs to be achieved,” he says, pointing towards a table summarising the capabilities of different stacker reclaimer combinations. “If there is no need for blending, eg, for gravel for road making, you could use a cone shell stacker in combination with a portal scraper reclaimer, which will give a 1:2 blending effect. But if the application needs better material consistency, then a bridge scraper reclaimer or a drum reclaimer with a chevron stacker could be used to give a much better (up to 1:10) blending effect.”

TKMH’s competitive advantage lies in its ability to tailor design solutions, based on any stacker/reclaimer combination, to best suit the specific needs of customers. “We have a solution for any possibility that may come up. We can engineer the most suitable solutions because we have access to and experience in all of the possible materials handling technologies,” Müller concludes.