

Modern technology simplifies handling

Automated smoke trolley loading improves work safety and increases throughput

The continuous production of sausages requires a large amount of staff, which is at times required to carry out monotonous and heavy physically demanding work. High levels of illness, and the challenge of continually having to find suitable personnel, is therefore a strain on every company. Automated systems for smoke trolley loading (Fig. 1) can significantly help to relieve this burden and increase throughput in this industry.

By Jens Hofschulte

In order to minimise the physical strain involved in lifting and carrying in accordance with section 2 of the German Load Handling Regulation (§2 Lastenhandhabungsverordnung) and to avoid endangering health, the German Employer's Liability Insurance for Foodstuffs and Hospitality (Berufsgenossenschaft Nahrungsmittel und Gastgewerbe) has issued guidelines based on the key indicator method of the German Federal Institute for Occupational Health and Safety (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin). These include reference values for lifting and carrying for men and women (Tab. 1).

When applying this to the production of sausages together with certain assumptions, this results

in direct limitations for the smoke stick loading. In the case of a sausage-meat density of 0.9 kg/dm^3 and a ratio of 1:5 between calibre and the overall length, the tonnage per shift as illustrated in Table 2 is achieved for a 1000 mm long smoke stick. This would mean that a 45 mm calibre sausage including both shoulders would be $5 \times 45 \text{ mm} = 225 \text{ mm}$ in length. When a minimum gap of 25 mm between the sausages and to the smoke stick ends is adhered, the calibre directly determines the number of sausages on each

smoke stick. With a sausage weight amounting to 1 kg and a calibre of 65 mm, 10 sausages are placed on each smoke stick for example. This has an overall weight of more than 10 kg and in accordance with the reference value issued by the Employer's Liability Insurance (Berufsgenossenschaft) may only be carried by men 5 to 10 m up to a total of 500 times per shift. However, at an output rate of 8,000 products per shift with 7.5 h of effective production time, 667 sticks need to be handled. The overall output of roughly 8 t can no longer be dealt with by hand as a result. A 400 g product with a 45 mm calibre on the other hand can still be hung-up manually by men even when 32,000 products per shift and consequently 12.8 t are produced (Fig. 2). In this case, 13 sausages fit on one stick meaning that it weighs less than 6 kg and this in turn means that it is not subject to any general limitations.

What is noticeable in this particular representation is that products with a weight of 1.5 kg can no longer be hung-up by hand on an industrial scale. The consequence occurring often as a result of this directive is a reduction of the smoke stick loading and with that a

gap which is significantly greater than 25 mm between the products. This however results in both a less efficient utilisation of the production capacities and reduced throughput.

Automated systems hang-up sausages precisely

An alternative solution is an automated hanging line that threads sausages onto smoke sticks so precisely that they have gaps of less than 25 mm. The position is controlled by software which means that it can differ from one product to the next. These types of machines can process more than 32,000 products per shift with a cycle time of less than 0.8 s. A manual threading in such cases would only be possible with extra staff.

In order to prevent any displacing or impacts with the smoke trolley when loading, a robot can grab the threaded smoke sticks and place them into the smoke trolley. The robot can easily handle 30 kg of smoke sticks and more. The robot carries out the loading movement with a path accuracy of less than 5 mm. The picking-up and the putting-down of the smoke sticks are carried out with an exactness



Fig. 1: The Type ASL-R robot is used for smoke trolley loading, the automated hanging line Type AHL significantly reduces the amount of physically-demanding work.

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Fig. 2: The automatic hanging line of the AHL type can position the sausage loops very precisely on the smoke stick.

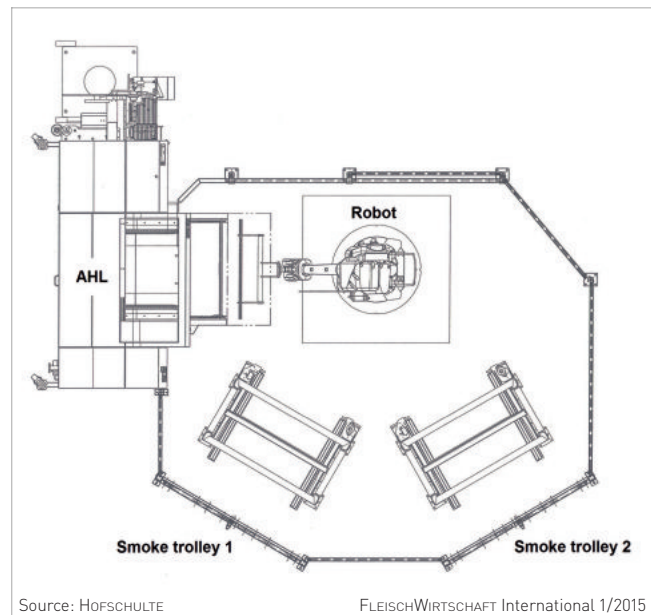


Fig. 3: The robot and the hanging line are secured with a protective safety fence.

down to a fraction of a millimetre. This ensures that the movement remains the same and no sausages are damaged, irrespective of whether it is the start of the shift or late in the evening. The quality remains constant allowing the smoke sticks to be loaded with the maximum amount of sausages and the space in the smoke trolley is

utilised most efficiently. The robot will never become ill and will not quit the job because it is physically-demanding or monotonous work.

Industrial robots with a suitable paint coating and which have already been used many hundreds of thousands of times globally for decades in the automobile

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Meat Industry / AgroProdMash	Oct 5-9	Moscow, Russia
Agro+Food+Drink+Tech Expo Georgia	Nov 18-20	Tbilisi, Georgia
MAFEX – Maghreb Food Exhibition	Dec 9-11	Casablanca, Morocco
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The physical exertion involved in sausage production is significant

Tab. 2: Implementation of the guidelines for lifting and carrying pursuant to the trade association (BG) guidelines

Cycle in s	Prod- ucts /Shift	Product weight and calibre												
		50g	100g	400g	700g	1,000g	1,500g	2,000g	3,000g	4,000g	5,000g	7,000g	9,000g	11,000g
		25mm	35mm	45mm	55mm	65mm	75mm	85mm	95mm	105mm	115mm	125mm	135mm	145mm
27.00s	1,000	0.1t	0.1t	0.4t	0.7t	1t	1.5t	2t	3t	4t	5t	7t	9t	11t
13.50s	2,000	0.1t	0.2t	0.8t	1.4t	2t	3t	4t	6t	8t	10t	14t	18t	22t
6.75s	4,000	0.2t	0.4t	1.6t	2.8t	4t	6t	8t	12t	16t	20t	28t	36t	44t
3.38s	8,000	0.4t	0.8t	3.2t	5.6t	8t	12t	16t	24t	32t	40t	56t	72t	88t
1.69s	16,000	0.8t	1.6t	6.4t	11.2t	16t	24t	32t	48t	64t	80t	112t	144t	176t
0.84s	32,000	1.6t	3.2t	12.8t	22.4t	32t	48t	64t	96t	128t	160t	224t	288t	352t

Tonnage is output per shift; green can be lifted by both men and women in accordance with Employer's Liability Insurance guidelines, yellow only by men and red may no longer be carried manually.

Source: HOFSCHULTE

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industry are the best type of robot to use. These robots are designed for these types of repeated movements and payloads. The costs for servicing and maintenance are minimal compared to the effort when people are employed in the same area. The robot is equipped with a ventilated cover for hygiene purposes as this ensures that no food can come into contact with it. In order to guarantee the perfect interplay between the clip-machine, hanging line and robot, they are interconnected by industrial fieldbusses. Product parameters only need to be entered at one human-machine interface and are distributed automatically to

all machines. The machines consider these parameters automatically which prevents incorrect operation. This way, this type of automated sausage-production system can also be operated by personnel with limited training and without any technical knowledge of robots. For safety reasons, the robots and the hanging line are separated from normal working areas by a protective safety fence (Fig. 3).

The operators place the smoke trolleys in the transfer stations in such a way that the robot always finds them in the exact same position. As soon as one smoke trolley has been fully loaded, the

robot switches to loading the second, which gives the operator a sufficient amount of time to remove the fully-loaded trolley and replace it with the next one to be loaded.

Incorporating the robot into the production process means that the number of staff required at each individual production line can be reduced to just one worker per shift. This remaining worker carries out the changing of the sausage casings and reloads smoke sticks into the hanging line. Where two or even more workers are currently required, the automated system means significant savings in terms of

staff. Parallel to the savings made thanks to the reduction in staff numbers, the quality and the product throughput volumes are increased. Considering the product throughput volumes per person, the introduction of one automated hanging line and robot can more than triple the productivity.

References

1. Load Handling Regulation dd 4th of December 1996 (Federal law gazette BGBl. I, 1842), amended by Article 436 of the Regulation dd 31st of October 2006 (Federal law gazette BGBl. I, 2407). – 2. Regulations of the Employer's Liability Insurance for Health and Safety at Work (Employer's Liability Insurance Regulations), BGR 229 Working in the meat processing industry, Edition 04/2004. – 3. Federal Institute for Occupational Health and Safety (BAuA) and The Commission for Occupational Safety and Safety Engineering of the Federal States (LASI) (2001): Key indicator method for assessing lifting, holding and carrying.



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Health hazards due to physical strain must be avoided

Tab. 1: Guidelines according to the trade association for food and restaurants (BGN) for lifting and carrying

Load kg	Lifting, depositing, transferring and holding duration < 5s		
	Men		
< 10	generally no limitations		
10–15	max. 1000 times		
15–20	max. 250 times		
20–25	max. 100 times		
> 25	only in connection with special preventive measures		
Load kg	Carrying, carrying distance		
	5–10 m	10–30 m	> 30 m
	Men		
< 10	generally no limitations		
10–15	max. 500 times	max. 250 times	max. 100 times
15–20	max. 100 times	max. 100 times	max. 50 times
20–25	max. 50 times	max. 50 times	
> 25	only in connection with special preventive measures		
	Women		
< 5	generally no limitations		
5–10	max. 500 times	max. 250 times	max. 50 times
10–15	max. 100 times	max. 100 times	max. 50 times
> 15	only in connection with special preventive measures		

Source: Trade association regulations for health and safety at work (BGN, BGR 229): Work in the meat-processing industry, April 2004

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