

# **Sustainability in commercial laundering processes**

## Module 2 **Machine technology**

### Chapter 5

# Drying of textiles

# Content

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- Types of evaporators (dryer, finisher, ironer)
- Design and function of dryers
- Design and function of garment finishers
- Design of flatwork ironers
- Comparison: Rigid chest ironer - Heating band ironer

# Learning targets

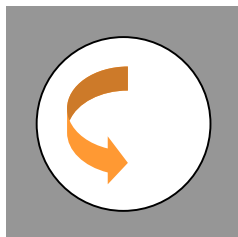
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After finishing the module you will

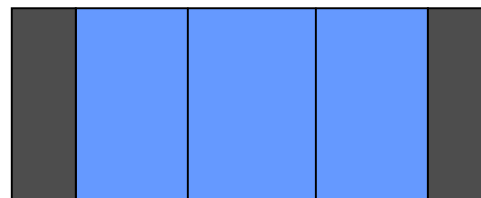
- know the different possibilities of thermal extraction (i.e. drying, finishing, ironing).
- be able to describe the application fields of compact dryers, batch dryers, garment finishers and ironers.
- know different design execution of dryers with respect to loading, unloading, heating, air circulation and switch-off-point determination.
- know the principle layout of garment finishers.
- be able to distinguish different designs of flatwork ironer beds.
- have a feeling for the energy saving potentials with modern heating band ironers.

# Evaporation

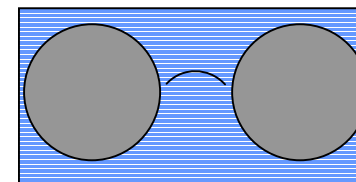
- After the mechanical extraction process with a press or spin, the remaining moisture has to be evaporated.
- Depending on the type of textile, the thermal evaporation of the remaining moisture is done in a dryer, a garment finisher or in a flatwork ironer.



**Dryer**



**Finisher**

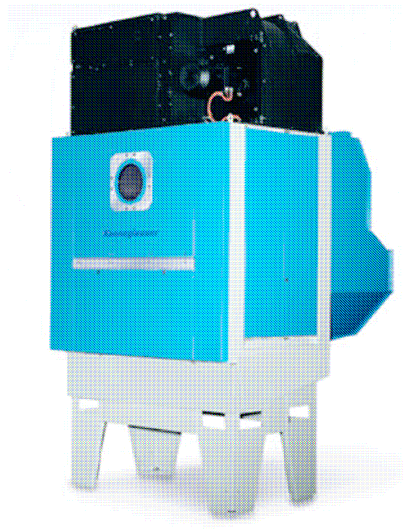


**Ironer**



## Compact dryer

- For manual loading and unloading
- For batches washed in a washer extractor
- For batches which need to be full dried, e.g. terry towels



## Batch dryer

- For automatic loading and unloading
- For batches washed in a tunnel washer
- For full drying (e.g. terry towels)
- For shaking processes (e.g. losing the press cake for flatwork ironing)



## Garment finisher

- Automatic process for unwrinkling of garments (e.g. workwear overalls, trousers, etc.)



## Flatwork ironer

- For calendering sheeds, bedcovers, tablecloths, napkins, etc.
- Comes in conjunction with a wide range of manual and automatic feeding and folding machines

## Design of Dryers

- According to the design, batch dryers can be loaded in different ways:

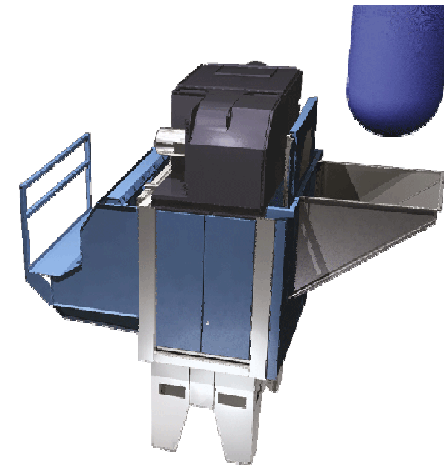


Lift conveyor  
belt loading

***Most common***

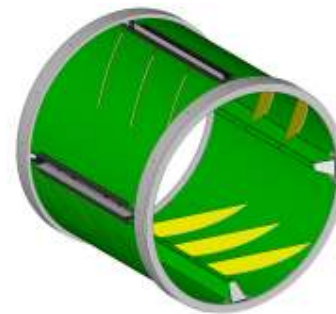


Vacuum  
loading



Bag loading  
via chute

- According to the design, **batch dryers** can be unloaded in different ways:
  - Tilting unloading
  - Airflow unloading (blowing out)
  - Paddel unloading



Paddel unloading



Tilting unloading

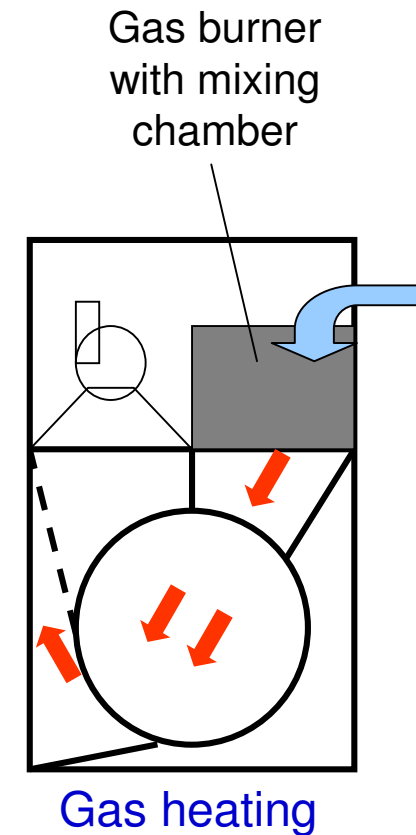
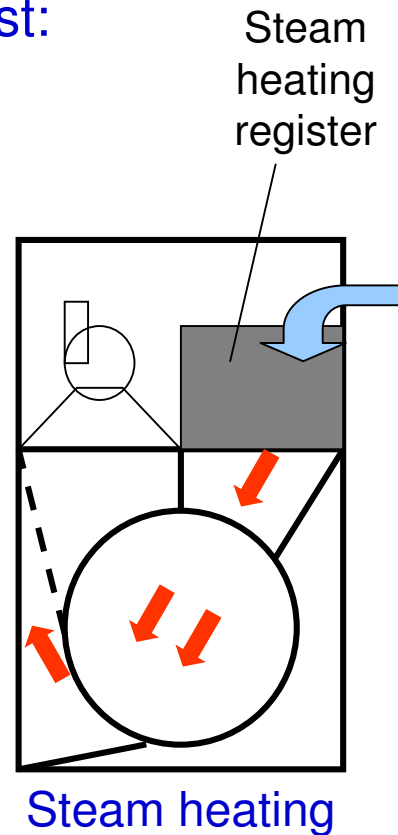
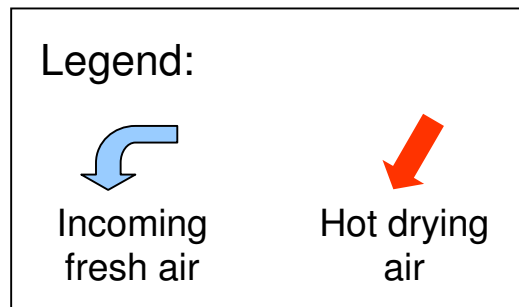
- Loading and unloading of a **compact dryer** is always manual.



## Heating of Dryers

The following heating types exist:

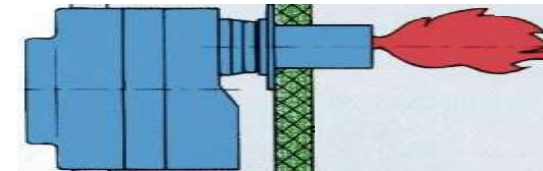
- Electric heating (only for small dryers with max. 30 kg batch size)
- Steam heating
- Gas heating



## Design of gas burners for dryers

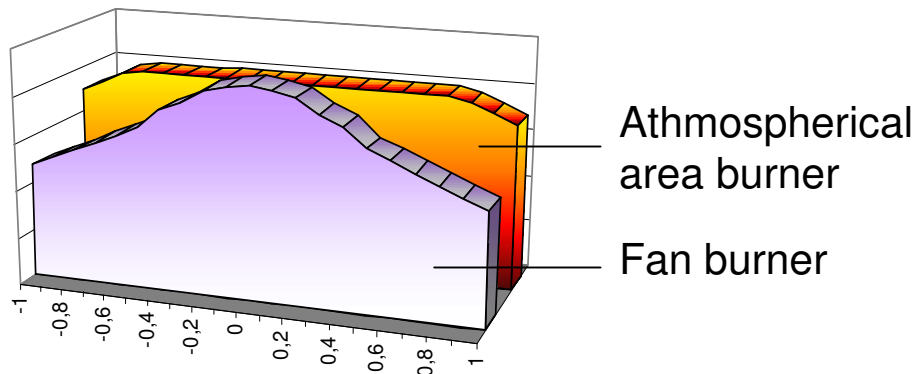
Traditional: **Fan burner**

New: **Athmospherical area burner**



Fan burner

The **athmospherical area burner** ensures uniform heat dissipation throughout the entire burner chamber width.

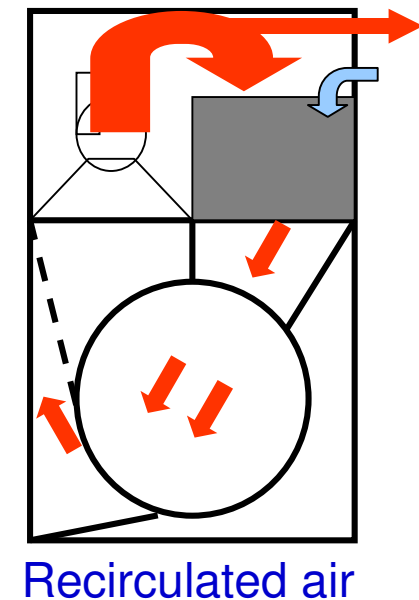
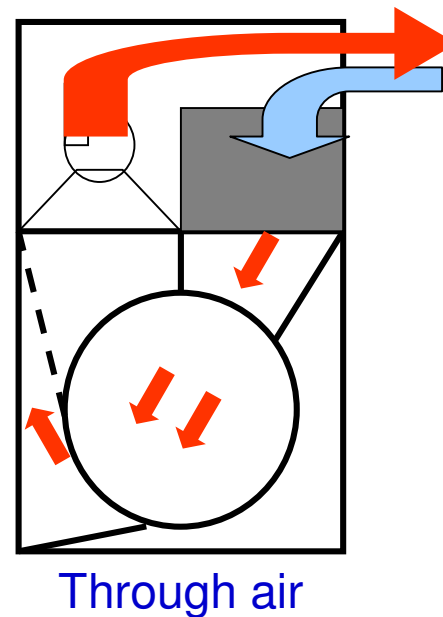
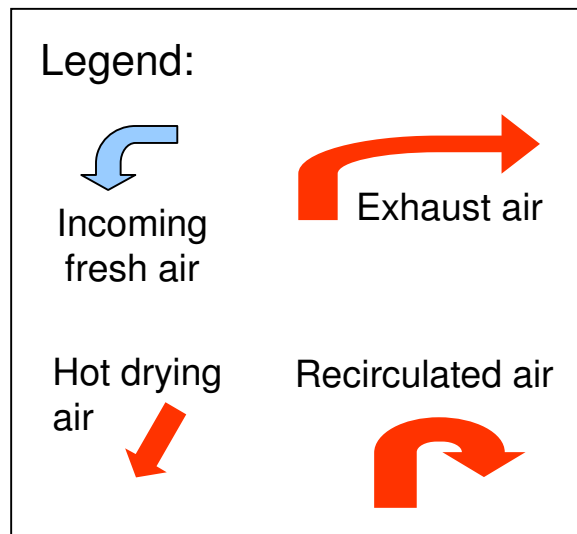


Athmospherical area burner

Heat utilisation throughout the drum width

## Drying air circulation

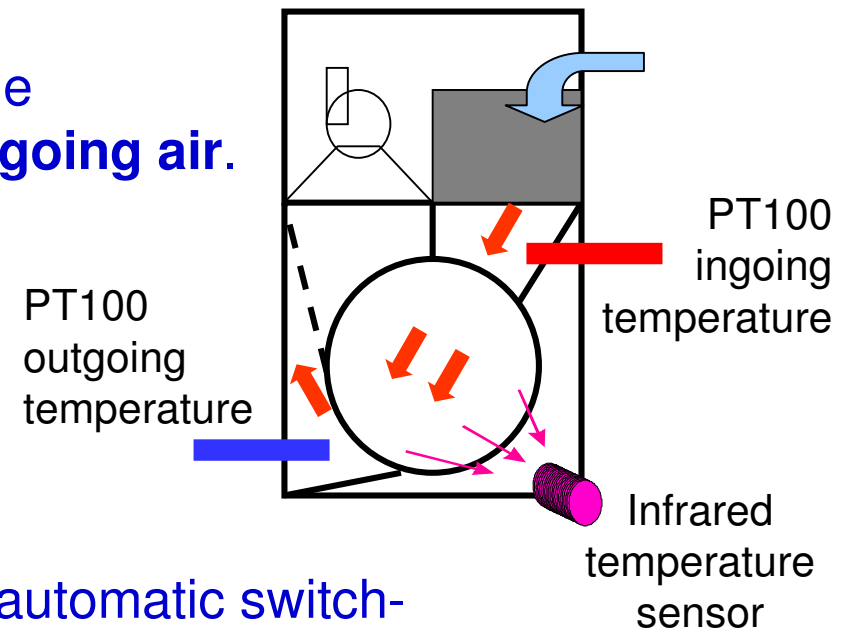
- With the drying air circulation, approx. 70-80 % of the hot drying air is circulated back into the chamber.
- The energy savings amount to approx. 30 %.



## Determining the drying switch off point

The following possibilities for determining the drying switch point exist:

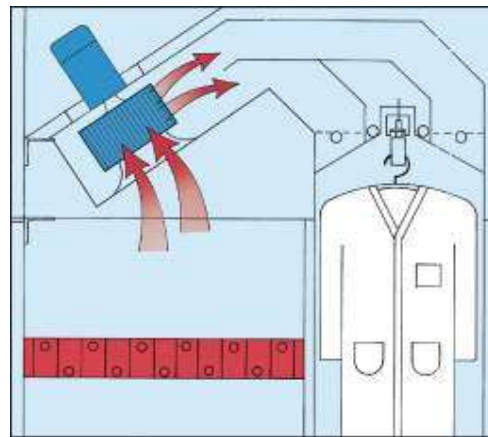
- Programming a **fixed drying time**
- Determining the switch-off point by the **difference of the ingoing and outgoing air.**
- Direct measuring: The drying time is precisely determined by the **contactless infrared temperature detection of the articles.**



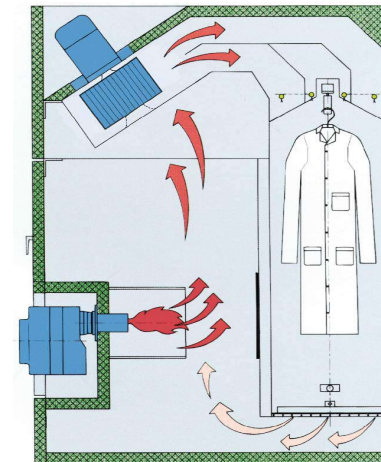
Only the direct measuring ensures an automatic switch-off when goods are dry by respecting the size of load, the residual moisture and the service condition of the dryer.

## Design of Garment Finishers

- The following heating systems for garment finishers exist:



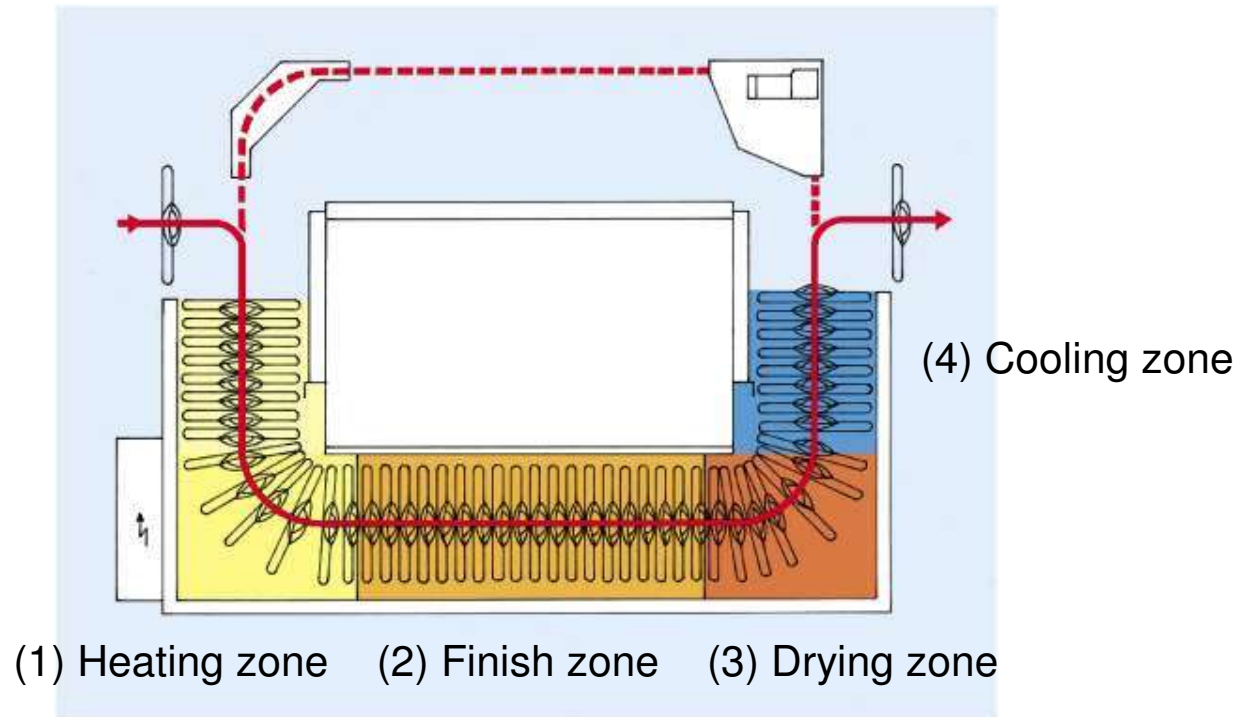
Steam heating



Gas heating

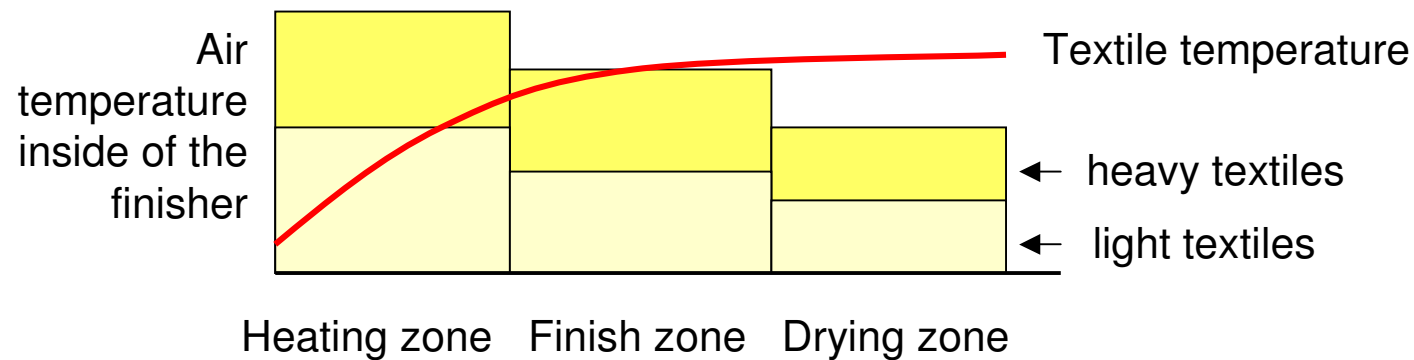
## Design of Garment Finishers

- The garment finisher consists of different zones:



## Design of Garment Finishers

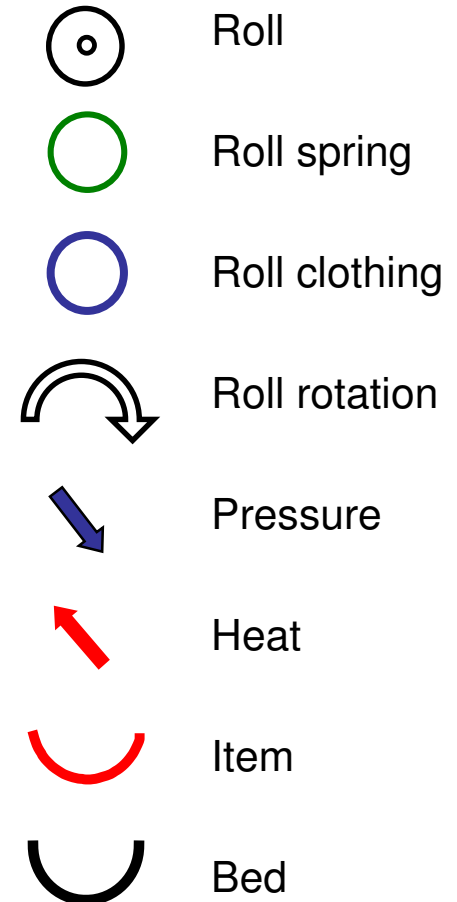
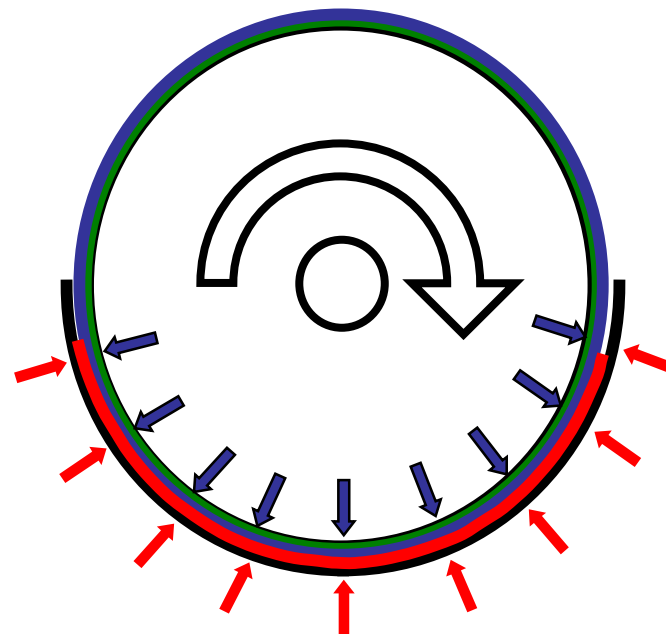
- Temperature distribution in the different finisher zones:



- The air temperature is decreasing to achieve a constant textile temperature.
- Approx. 90 % of the finisher air is recirculated.

## Design of Flatwork Ironers

- Principle of the ironing process:

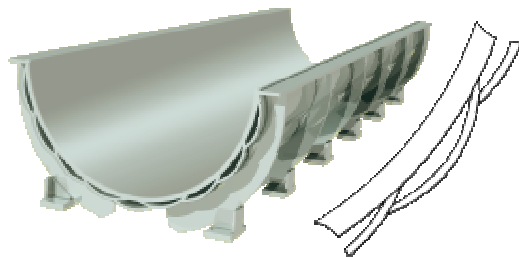




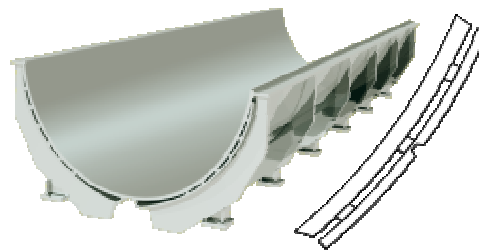
## Design of Flatwork Ironers

- The ironer bed can be designed as follows:

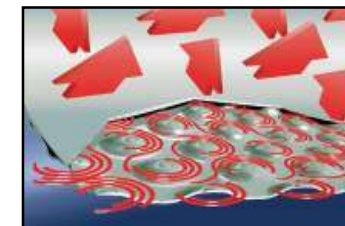
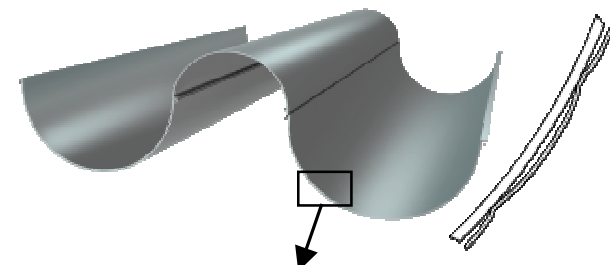
Rigid flow chest



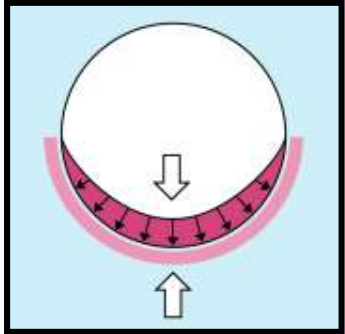
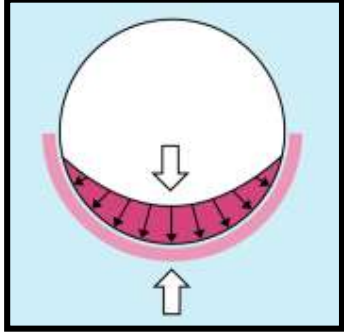
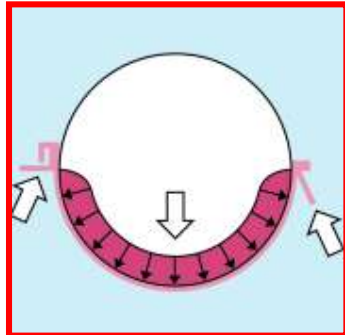
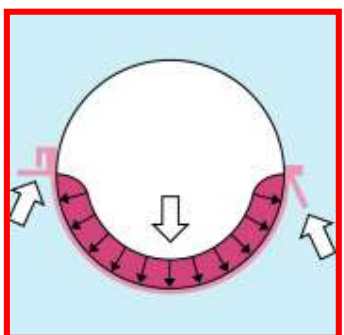
Cascade chest




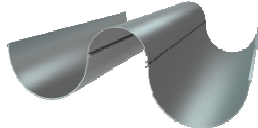
Heating Band



Steam distribution

<i>New padding</i>	<i>Worn-out padding</i>	
		<p><u>Distribution of pressure:</u></p> <p>A) Rigid Chest</p> <p>⇒ <i>Worn-out paddings lead to uneven pressure distribution.</i></p>
		<p>B) Heating band</p> <p>⇒ <i>The pressure distribution is not influenced by the padding and remains always even.</i></p>


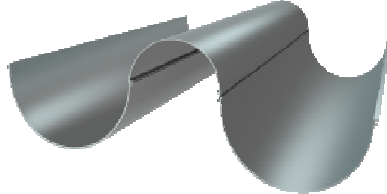
## Comparison: Rigid chest ironer – Heating band ironer

	Rigid chest ironer	Heating band ironer
Roll diameter:	1200mm / 48''	1200mm / 48''
Working width:	3500mm / 138''	3500mm / 138''
No. of rolls: *)	3	2
Capacity:	100 %	100 %
		

Working days: 250  
1-shift operation: 2000 h/year

\*) Note: A 2-rolls heating band ironer has the same capacity as a 3-rolls rigid chest ironer.

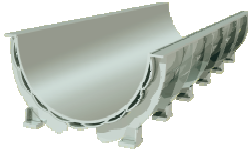
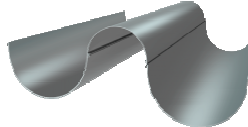
## Heating up

Rigid chest ironer	Heating band ironer
Weight of chests: 6 tons / 13'200 lbs 	Weight of heating bands: 0.62 tons / 1'370 lbs 
$6 \times 43 \text{ kg}^*) \times 250 \text{ days} =$ 64'500 kg steam / year	$0.62 \times 43 \text{ kg}^*) \times 250 \text{ days} =$ 6'700 kg steam / year

**Saving in steam = 57'800 kg/year**

\*) 43 kg is the amount of steam to heat up 1 ton of steel from 12 °C to 192 °C


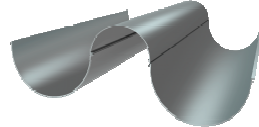
## Heat radiation

Rigid chest ironer	Heating band ironer
<ul style="list-style-type: none"> <li>▪ 3 modules <math>\Rightarrow</math> large surface</li> <li>▪ Covering incl. insulation of all 6 sides</li> </ul> <p>Radiation ~ 24 kW</p> 	<ul style="list-style-type: none"> <li>▪ 2 modules <math>\Rightarrow</math> small surface</li> <li>▪ Insulation of sides and top cover</li> </ul> <p>Radiation ~ 9 kW</p> 
<p><math>24 \text{ kW} \times 1,83 \text{ kg/h}^*) \times 2000 \text{ h/year} = 87'800 \text{ kg/year}</math></p>	<p><math>9 \text{ kW} \times 1,83 \text{ kg/h}^*) \times 2000 \text{ h/year} = 32'900 \text{ kg/year}</math></p>

**Saving in steam = 54'900 kg/year**

\*) 1,83 kg steam/h correspond to 1 kW heating energy

## Escaping vapour

Rigid chest ironer	Heating band ironer
<ul style="list-style-type: none"> <li>▪ Thermo-type condensate traps</li> <li>▪ 5 or more condensate traps</li> </ul>  <p>Escaping vapour ~ 20 kg/h</p>	<ul style="list-style-type: none"> <li>▪ Ball float traps</li> <li>▪ 3 condensate traps</li> </ul>  <p>Escaping vapour ~ 4 kg/h</p>
<p>20 kg/h x 2000 h/year = 40'000 kg/year</p>	<p>4 kg/h x 2000 h/year = 8'000 kg/year</p>

**Saving in steam = 32'000 kg/year**

## Total steam saving potential of Heating band ironers

Steam savings per year	1-shift-operation	2-shift-operation
Heating Up	57'800 kg	57'800 kg
Heat radiation	54'900 kg	109'800 kg
Escaping vapour	32'000 kg	64'000 kg
<b>Total</b>	<b>144'700 kg/year</b>	<b>231'600 kg/year</b>