HERGEN
CONVERGE TO EVOLVE

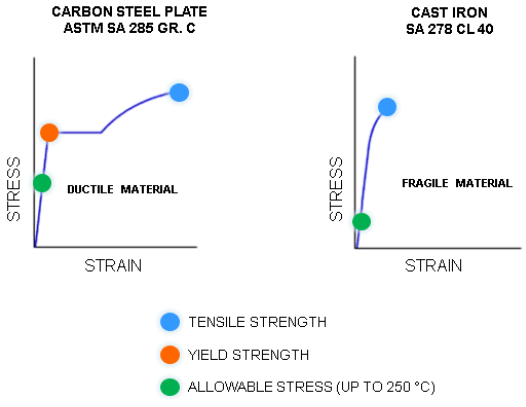
Dryer Cylinders

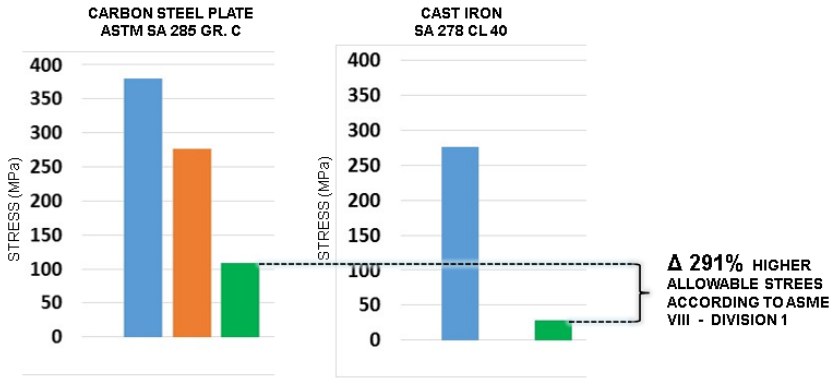
SMART STEEL DRYER

Hergen SA is a family run business located in the southern part of Brazil and it is on the market for over 45 years. The company has an important position between the suppliers of equipment and services for tissue and packaging paper. Hergen is also one of the leading worldwide suppliers of fabricated Yankees and steel drying cylinders and its facility is the biggest manufacturing site for this kind of products in the whole Latin America.

The fabricated dryers are since quite some time the main technology for paper drying, thanks mainly to its heat transfer advantages and also for operational safety. The steel fabrication enables drying cylinders which are thinner than the regular cast iron ones which results on about 10% higher drying capacity when working on the same pressure, however most of paper mills feature old cast iron dryers with working pressure of 5 bar to 8 bar and for these mill the replacement to steel dryers with working pressure up to 10 bar the gains will be even higher. We present below the comparison between both materials to show the reason why the fabricated dryer is thinner and yet safer than the cast iron ones.

Shell Material	Carbon Steel	Cast Iron
e = Shell Thickness	18 mm	33 mm
k = Thermal Conductivity Coefficient	46,00 W/m.k	46,52 W/m.k
h cond. = Condensate Thermal Conductivity Coefficient	2.271,3 W/m².K	2.271,3 W/m².K
h cont. = Contact Thermal Conductivity Coeficient	482,7 W/m².K	482,7 W/m².K
Global Heat Transfer Coefficient	**341,9 W/m².K**	**310,4 W/m².K**
Increase on Global Heat Transfer Coefficient	**9,9 %**	**0%**
Equation for Global Heat Transfer Coefficient Calculation	$U_{Fefu} = \frac{1}{\frac{1}{h_{cond}} + \frac{e}{k} + \frac{1}{h_{cont}}}$	

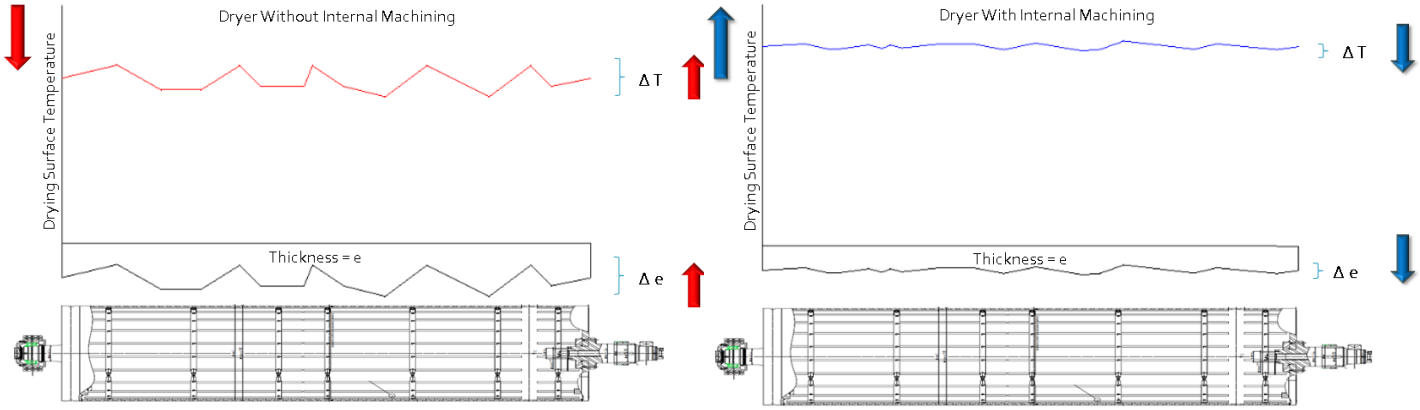




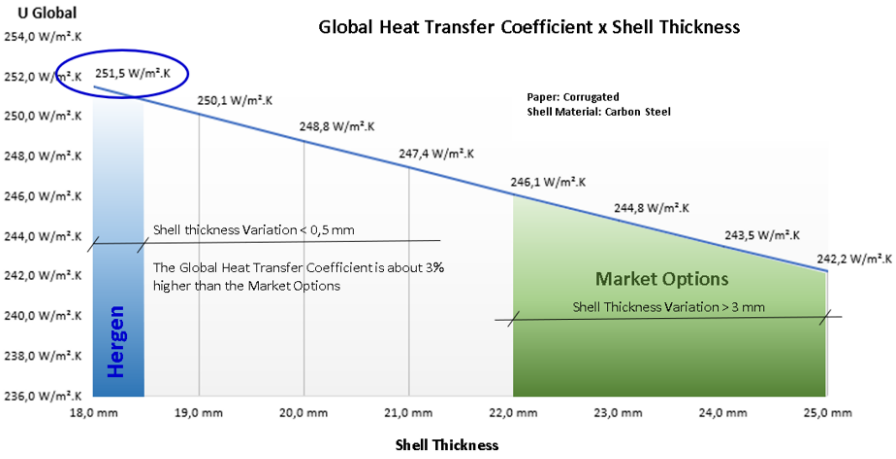
The new trends of packaging paper industry, named, papers with basis weight as low as possible, higher speeds, starch application and strict moisture profile control, demands dryers with body shell as thin as possible for the maximum drying capacity and internal machining for an excellent temperature profile which results on a optimal starch application and higher working speed.

These features are only achieved by strict process control since the purchase of the steel plates, throughout the whole design and manufacturing processes

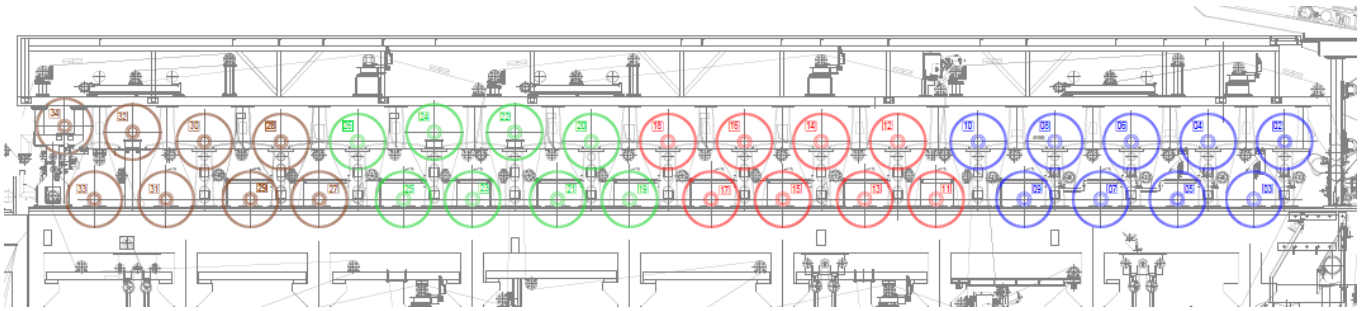
We present below two pictures that show the impact of internal machining on temperature and moisture profile on a drying cylinder.



Besides the clear advantages when compared to cast iron ones, the dryers manufactured by Hergen feature a higher drying capacity even when compared with other steel dryers from the market, due the quite precise dimensional control, strict process monitoring and internal machining, which guarantees the minimum shell thickness variation throughout the whole length. The picture above shows the differences in drying performance that is acquired by the internal machining.



We present below a case study of the production gains on a machine rebuild in which the customer replaced the existing cast iron dryer by new steel fabricated ones. This machine produces packaging paper with the following drying configuration and production parameter:

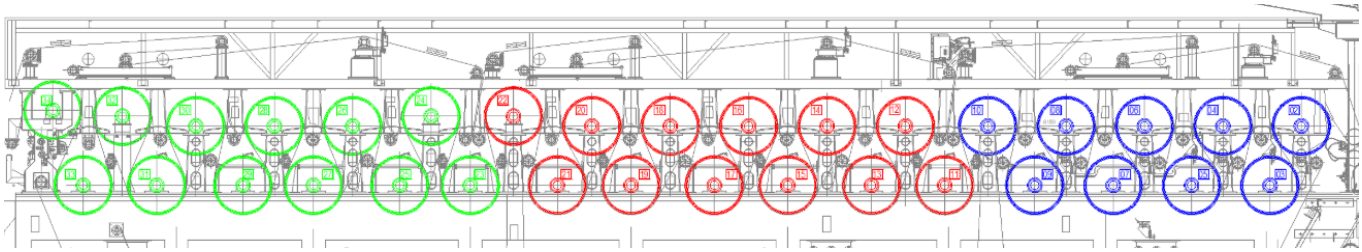


Drying Cylinder Diameter (mm)	Dryer Number	Pressure Group	Number of Dryers	Working Pressure(Bar)
1500 (Cast Iron)	1 - 9	1	9	2,6
1500 (Cast Iron)	10 - 17	2	8	2,6
1500 (Cast Iron)	18 - 25	3	8	2,6
1500 (Steel)	26 – 33	4	8	8,8
Summary			33	4,10 (Average)

	Unit	Medium	Medium	Medium	Medium
Basis Weight	g/m^2	114,04	122,53	148,97	184,33
Dryness at Pope Reel	%	91,8%	91,9%	91,8%	91,9%
Dryness After Press	%	51,00%	51,40%	53,00%	51,00%
Evaporation Rate	$kg/h.m^2$	18,88	18,70	17,33	18,88
Drying Area	m^2	606,5	606,5	606,5	606,5
Average Drying Pressure	Bar	4,41	4,41	4,41	4,41
Average Steam Temperature	℃	155	155	155	155
Working Speed	m/min.	526,0	498,0	414,0	332,0
Paper Width at Pope Reel	mm	3900	3900	3900	3900
Paper Machine Production	t/d	336,88	342,68	346,37	343,69

This customer had the target to increase the paper production, but the machine length should remain the same due to building limitations. Base on these premises we decided to replace part of the cast iron dryers by new steel dryers keeping only the dryers from the first group to be replaced on a future rebuild step.

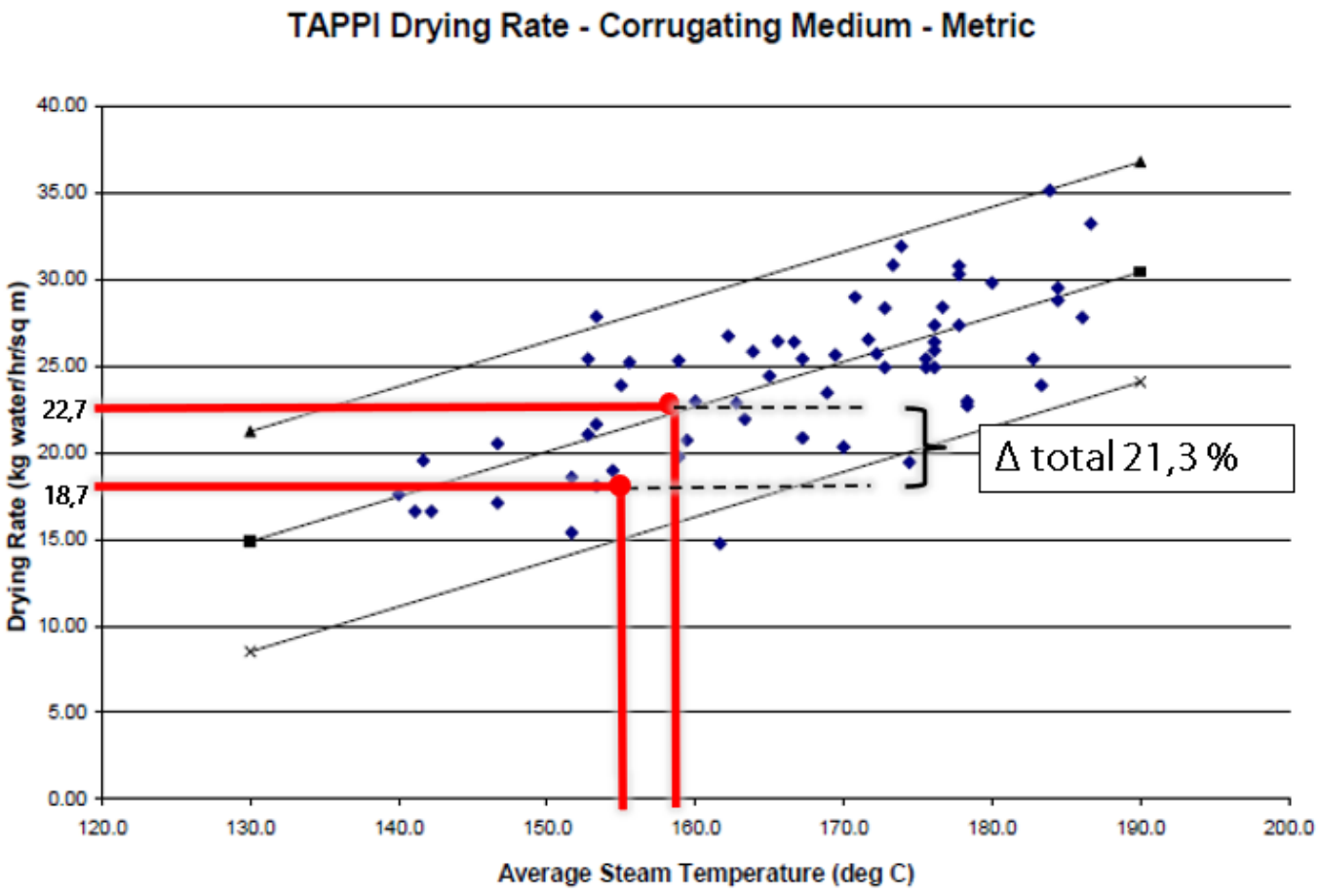
We present below the machine drying configuration and parameter after its rebuild:



Drying Cylinder Diameter (mm)	Dryer Number	Pressure Group	Number of Dryers	Working Pressure(Bar)
1500 (Cast Iron)	1 - 9	1	9	2,6
1500 (Steel)	10 - 21	2	12	6
1500 (Steel)	22 - 33	3	12	6
	SUMMARY		33	5,07 (Average)

With the new steel dryers which are designed for a working pressure up to 10 bar (please notice that by the moment of our evaluation they were working at 6 bar), and are much thinner than the exiting ones we were able to increase the evaporation rate more than 20% which results on an important production gain.

We present below the evaporation rate curve to illustrate its increase due to the raise of average working pressure and material benefits (thinner dryer)



The new production data is shown below:

	Unidad	Medium	Medium	Medium	Medium
Basis Weight	g/m^2	114,04	122,53	148,97	184,33
Dryness at Pope Reel	%	91,8%	91,9%	91,8%	91,9%
Dryness After Press	%	51,00%	51,40%	53,00%	51,00%
Evaporation Rate	$kg/h.m^2$	20,05	20,66	22,68	20,62
Drying Area	m^2	606,5	606,5	606,5	606,5
Average Drying Pressure	Bar	5,07	5,07	5,07	5,07
Average Steam Temperature	°C	159	159	159	159
Working Speed	m/min.	545,0	545,0	502,0	395,0
Paper Width at Pope Reel	mm	3900	3900	3900	3900
Paper Machine Production	t/d	349,05	375,02	420,01	408,90
Production Increase	t/d	12,17	32,34	**73,62**	65,21
Production Increase	%	3,6%	9,4%	**21,3%**	19,0%

As the numbers show, the machine rebuild was a huge success and there is still room for production increase when the new dryers will be operating at its full capacity.

Besides the production gain the temperature profile of the new dryers are much more even resulting on an important quality improvement for our customer.

The case above is another example to the benefits of the fabricated dryers over cast iron ones, and a witness of the potential of the Hergen drying cylinders in terms of production increase, operational safety and quality improvement, which proves that the Hergen drying cylinders are the best fabricated dryers in the world.

For more information, please goes to: https://www.hergen.com.br/en/products/paper-and-board/dryer-cylinders/