



# GIANTS FOR ENERGY-EFFICIENT AND SAFE OPERATION

*PrimeDry Steel Yankee*

**ANDRITZ**

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"Hengan and ANDRITZ have been working together successfully for more than twenty years. We believe in a promising future because making the best tissue always starts with the best equipment."

Xu Lianjie  
CEO of the Hengan Group, China

"Drying efficiency has greatly improved compared to the cast-iron Yankee, with LPG use for the dryer hood being reduced by 30-50%."

Masashi Kobayashi  
CEO, Doh-Ei, Japan  
Tissue production, rebuilds

# PrimeDry Steel Yankees for all types of paper

ANDRITZ is breaking records worldwide with its *PrimeDry* Steel Yankee technology.

With diameters of up to 26 ft. and shell lengths up to 6.3 m, ANDRITZ is the technology leader for large steel Yankees. These high-performance drying cylinders are made entirely of steel, resulting in greater safety and 8-10% better machine performance than cast-iron Yankees.

30 of the over 80 ANDRITZ *PrimeDry* Steel Yankees already sold are in the large size range (> 18 ft. diameter and > 6 m shell length), amongst them the world's largest operating steel Yankee for tissue and MG paper.

The steel Yankees are available for tissue, paper, board, speciality paper like MG paper, and tobacco machines and can be installed in new or existing lines (rebuilds). This brochure explains what lies behind this technology, reports on mill results and provides examples of the technology's great success. If you have any questions, please do not hesitate to contact us!

Your ANDRITZ steel Yankee team



"With ANDRITZ, we had the best possible partner for this project. We are proud to have once again started up the world's largest steel Yankee."

Jürgen Rieger  
Head of Project Engineering  
Zellstoff Pöls AG

"We needed a new, reliable drying technology for our fast-growing market."

Frank Yang  
Vice General Manager, Golden Leaf, China  
Tobacco production, new lines



# What's it all about? A story of success in brief

Franz Harrer, Head of Technology, Tissue, talks about the development of the ANDRITZ drying technology.

There is a saying that "necessity is the mother of invention", and in these challenging times that papermakers are now operating in, the "necessity" of this era is that of getting much more out of a lot less, with as low a carbon footprint as possible, and all in an efficient and safe environment.

**In your opinion, why does the steel Yankee stand out above existing cast-iron technology?**

Cast-iron Yankees have been in operation for more than 100 years because, frankly, that was the best way of achieving the result. But metalizing has moved on, and working with steel provides many more advantages; less brittle, better thermal conductivity, and all sorts of operating properties that mean far better end results and savings for the papermaker at operational level.

**How did the breakthrough occur?**

It was clear to us at ANDRITZ as we embarked upon the R&D with the design of the steel Yankee that this was a winner from Day One. Our focus was initially on large and wide steel Yankees, where we concentrated on the welding technology, which is crucial as this, of course, is not cast steel and has joints. We first manufactured a 12 ft. Yankee for experimental purposes and perfected the welding technique and technology so that the seams had absolutely no influence on the performance of the cylinder.

**What are the main advantages?**

Apart from improved runability, energy savings, increased lifetime and reliable supply, one of the main advantages is safety. There is a big difference in the material behaviour between steel and cast iron. Steel is a ductile material, whereas cast iron is brittle. Ductile materials can withstand much larger strains before rupture compared to brittle ones, and steel will show considerable yielding before rupture. Cast-iron Yankees have been known to fail suddenly, and without warning.

In terms of energy, savings are made due to higher contact drying, which is more efficient than convection drying. And the life of the Yankee will be a lot longer due to the stable and uniform heat profile.

Another big advantage is the logistics; ANDRITZ is able to pre-fabricate the steel Yankees in the workshop and then assemble them at the mill site, enabling accessibility even to mills that are very hard to reach. We can customize steel Yankees to go with any machine, no matter how narrow, and we can adapt the shell width to any paper width. An added plus with the production environment is the reliability of supply. There is no danger of a spoiled casting and related delays or cancellations.



**"Our focus was initially on big and wide steel Yankees."**

**FRANZ HARRER**  
Head of Technology Tissue  
ANDRITZ

## SUCCESS ON THE MARKET

The *PrimeDrySteel* Yankees have been received extremely well. We have had orders for more than 80 of them, also orders outside the tissue sector in the area of graphic and speciality papers.

**WATCH THE VIDEO**  
on our steel Yankees  
and Franz Harrer



*PrimeDry Steel* YANKEES

Giants for energy-efficient  
and safe operation



# Innovative drying for safety and cost savings

ANDRITZ offers steel Yankees for all widths and covers the complete product range. The high-precision drying cylinders offer various advantages.

Material	Steel (P355 NH)	Cast iron (GGL 415)	Increase
Min. tensile strength	470 MPa	330 MPa	42%
Min. yield strength	315 MPa		
Modulus of elasticity	207,000 MPa	135,000 MPa	53%
Thermal expansion coefficient	1,25E-05 1/C	1.11E-05 1/C	13%
Thermal conductivity	43-46 W/mK	42 W/mK	2%

Material properties for stress and thermal analysis: better in capacity, safer in operation

### SAFETY AND ENERGY EFFICIENCY

Due to the elasticity of steel, any crack development is much more controlled than in a Yankee made of cast iron. Although it is not often seen nowadays, an unexpected event can lead to the sudden development of cracks in a cast structure, which themselves require the cylinder and other immediate parts to be replaced.

In view of the elasticity of steel, there is no risk of explosions due to unexpected accidents, cracks or thermal shocks. No derating is necessary due to the metallic coating, and there is no reduction of the wall thickness during the lifespan of the Yankee.

### INCREASE IN PRODUCTION AND RUNABILITY

The performance of a *PrimeDry* Steel Yankee is higher than that of an equally sized cast-iron Yankee. The thermal conductivity of the high-strength steel used is similar to that of gray cast iron, but thanks to the more favorable properties of steel, the wall thickness can be reduced. Lower resistance to the heat flux results in higher performance. This can either be used for higher production or for energy-cost savings by drying more with (typically) relatively cheap steam. A 15 ft. steel Yankee, for instance, can replace a 16 ft. cast-iron Yankee, running at the same machine speed, with the same impingement temperature and velocity in the hood.

### PERFECT FOR REBUILDS

ANDRITZ *PrimeDry* Steel Yankees are perfect for rebuilds. They can be operated at higher pressure than cast-iron Yankees, thus providing higher performance. This higher pressure can be achieved without any changes in the length of the existing drying section.

### ADDITIONAL FEATURE: STEAM AND CONDENSATE SYSTEM

The steam and condensate system provides uniform temperature distribution over the Yankee surface and even build-up of the chemical coating due to the homogeneous temperature distribution. The system also offers good dewatering performance and very high dimensional stability of the Yankee during production.

### TOP QUALITY

The steel Yankee shell has a metallized coating, applied according to the highest quality standards. The surface is harder than cast iron, meaning that excellent creping conditions are ensured as well as a constant surface quality over the long lifespan of the coating. The metallized surface enables stable coating and creping conditions and extended polishing and grinding intervals. *PrimeDry* Steel Yankees are welded and machined with the best technology available, in accordance with the high ANDRITZ standards, and are extensively tested and checked.

# Highest quality standards for Yankee manufacturing

*PrimeDry* Steel Yankees are calculated and designed using the latest state-of-the-art methods, including finite element analysis for example.

Quality checks	Shell	Heads	Center shaft	Journals	Cylinder
PT (100%) welding edges	X	X		X	
MT (100%) welds	X	X	X	X	
UT (100%) welds	X (TOFD)	X (TOFD)		X	
Dimensional inspection	X	X	X	X	X
Pressure test					X
Surface roughness test					X
Crowning curve measuring					X
Balancing test					X

Quality checks from the plate to the final Yankee



### STEEL YANKEE FACT BOX

Applicable to paper widths up to 6,300 mm  
Diameters: Up to 26 ft.  
Designed using state-of-the-art methods, e.g. Finite Element Analysis.  
All welds fully checked.

### STEEL VERSUS CAST IRON

- The wall of a steel Yankee is thinner, permitting more efficient heat transfer (evaporation rate).
- Steel is more elastic, allowing higher pressures and providing a safety margin against thermal shocks, mechanical maltreatment (accidents), or potential explosions.
- Steel Yankees perform from Day One. There is no run-in period required and no drop in performance over time.
- Steel requires less grinding and polishing during shutdowns.
- The steel Yankee is not subject to derating due to the wall becoming thinner or loss of metallic coating over its lifespan.
- The metallic coating of the steel enhances chemical coating and creping processes.
- No danger of spoiled castings jeopardizing delivery dates.
- Improved quality of output due to better creping on a more even surface temperature and a more stable coating.



# Europe: Manufacturing of steel Yankees at ANDRITZ Kft.

The ANDRITZ steel Yankee manufacturing facility in Hungary has long-term experience with heavy duty machining.



With some 300 employees, ANDRITZ Kft. produces welded components for turbo-generators, gas turbines and other machines, and is the European specialist for steel Yankee manufacturing.

## HISTORY

The predecessor of ANDRITZ Kft. was founded in 1929 as a private company and nationalized in 1947. In 1994, it was privatized again by the management and the company staff. Ever since its foundation, the company has manufactured components for the chemical industry, with special metal processing (titanium, tantalum, nickel, copper alloys, etc.) as a second important line. The company has been an affiliate of the ANDRITZ GROUP since 2007.

## WORKSHOP

ANDRITZ Kft.'s manufacturing workshops are located in Tiszaújváros on a 150,000 m<sup>2</sup> site. Where welded structures are concerned, the company numbers among Hungary's largest manufacturing companies. The site is equipped with the most modern manufacturing technologies for sandblasting, welding, CNC machining, surface treatment, and assembly. Over 90% of the products are exported to the European Union and the United States. The activities of ANDRITZ Kft. cover all stages from flame cutting to final assembly, for pieces weighing up to 150 tons. The company is thus capable of producing complete, fully assembled, insulated components ready for connection to other units at erection sites.

State-of-the-art infrastructure, such as industrial gas network, pressurized air network, and so on, to support manufacturing operations. Manufacturing processes are based on EN (European Norm), ASME (American Society of Mechanical Engineers) or special customer standards and norms required in certain contracts.

# Asia: Steel Yankee Business Center in Foshan

State-of-the-art manufacturing of *PrimeDry* Steel Yankees at the ANDRITZ Steel Yankee Business Center in Foshan, China.

With an area of 4,200 m<sup>2</sup>, the ANDRITZ Steel Yankee Business Center in Foshan, China, features the latest machinery to enable steel Yankee production and service at the highest quality level.

## MANUFACTURING PROCESS

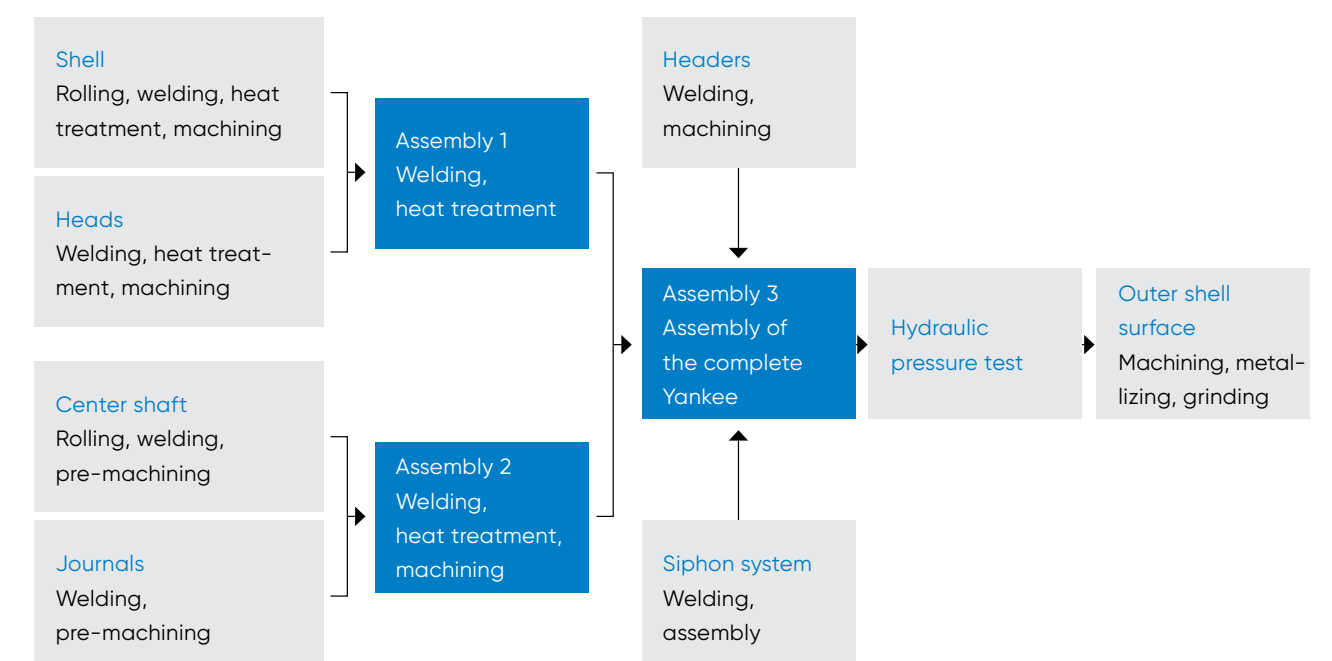
In a first step, the steel plates are rolled and welded together in the shape of a cylinder. The cylinder shell is placed on a vertical lathe, and the grooves are cut. At the same time, machining begins on the hollow shaft.

To complete assembly of the shell, the hollow shaft and the Yankee heads are mounted. The assembled Yankee is then heated with steam, coated, and ground.



State-of-the-art manufacturing

The steel Yankee manufacturing process at ANDRITZ in China





**FROM HUNGARY TO  
AUSTRIA**

The world's largest steel Yankees (22 ft and 24 ft. in diameter), for Zellstoff Pöls, Austria, were pre-machined at the ANDRITZ workshop in Hungary and finished and assembled in Pöls.





STEEL YANKEE  
BUSINESS CENTER  
FOSHAN

Steel Yankes being prepared  
for transport to customers  
worldwide





# Life cycle managment for Yankees

We focus on the overall added value for Yankees: from calculation, to manufacturing, coating (*PrimeCoat Stratos*), operation, and optimization.

## THE HEART OF YANKEE SERVICE

Suppliers often only provide single Yankee service components like grinding, or they leave customers to maintain and service the Yankee themselves after purchase. With Yankee life cycle management, we focus on the overall added value for Yankees. We are one of the few suppliers able to offer customers a life time forecast for their Yankees. This is possible due to our experience in Yankee development and manufacturing work at ANDRITZ – all from a single source.

## SEEING THE FULL PICTURE

As a machinery supplier able to offer complete lines for tissue, paper, board, and special paper production, our experts do not see the Yankee as a stand-alone solution but within its overall environment. In the

course of the life cycle management package, the Yankee is analyzed and maintained in its interaction with other key components, such as the condensate removal system, press, and so on. Apart from the Yankee itself, life cycle management covers everything surrounding the Yankee, namely press rolls, hood and process air system, doctors, and the chemical coating equipment.

One of our strengths is that we offer complete lines – we have the necessary knowledge of and experience with the entire production process. We are not limited to mechanical issues or chemical processes as we have the full range of process, automation, instrumentation and operational experience.

## LIFE CYCLE MANAGEMENT AT A GLANCE

Service	Examples
Mechanical on-site services	Grinding, metalizing, spot-repair, upgrade and repair of internal parts, ...
Diagnostics and analysis	On-the-run measurement, performance measurement, coating measurements, ...
Logistics and engineering	Customized rebuild solutions, on-site services like assembly and welding, ...
Performance checks and consulting	Drying-limit calculation, runability and energy consumption evaluation, ...
Troubleshooting	Steam leaks, vibrations, reduced drying performance, wear on doctor blades, ...
Safety and risk management	Life time calculation, inspections such as ultrasonic and metallurgical testing, and acoustic measurements, ...

# World's giants for tissue, paper and board

With diameters up to 26 ft. and shell lengths up to 7.4 m, ANDRITZ is the market leader in supplying the world's largest steel Yankees.

Unique engineering and logistics planning make the impossible possible: steel Yankees up to 26 ft. in diameter and 7.4 meters in shell length. These orders confirm their success:

## CARTA FABRIL, BRAZIL

ANDRITZ supplied a *PrimeLineST* W22 tissue machine with steel Yankee and steam-heated hood for the Carta Fabril mill in Anápolis, Brazil. The *PrimeDry* Steel Yankee delivered by ANDRITZ has a diameter of 22 ft. and thus is one of the largest for tissue worldwide. The combination with the steam-heated hood enables efficient drying with substantial energy savings and safe operation. The steam-heated hood is equipped with an innovative, automatic cleaning system and a dust removal system. The order also included the complete stock preparation plant, which processes 100% short fiber (eucalyptus). The ANDRITZ tissue machine has a design speed of 2,100 m/min and a width of 5.55 m. It uses 100% renewable energy generated from biomass and converted into steam. Carta Fabril ranks among the key players in the Brazilian tissue business, covering the complete product range of tissue papers. The company targets "green production" by minimizing liquid and solid waste, effluents, and CO<sub>2</sub> emissions.

## GUIZHOU CHITIANHUA, CHINA

The new *PrimeLineST* tissue machine with a design speed of 2,000 m/min and a paper width of 5.6 meters produces high-quality facial wipes, toilet paper, and paper tissues based on bamboo furnish. The steel Yankee has a diameter of 20 ft. and hence is among the largest in the world. It enables a high drying capacity and achieves remarkable cost savings compared to systems operated with gas because it uses steam. The Yankee was manufactured at the ANDRITZ plant in Foshan, China.

## ZELLSTOFF PÖLS AG, AUSTRIA

At Zellstoff Pöls AG, Austria, ANDRITZ successfully started up the second steel Yankee, which was the largest in the world at that time.

Following the successful start-up of an ANDRITZ MG paper production line (PM2) with a 22 ft. steel Yankee in 2013, ANDRITZ then started up an MG paper line with a 24 ft. steel Yankee in 2019.



Tissue: Carta Fabril, Brazil.  
Workshop impression of the steel Yankee with a 22 ft. diameter.



Tissue: Guizhou Chitianhua, China.  
Transport of the steel Yankee with a 20 ft. diameter to the customer.



MG paper: Zellstoff Pöls AG PM3, Austria.  
With a diameter of 24 ft., this is the world's largest steel Yankee.





## DISCOVER OUR FULL-RANGE PORTFOLIO FROM FIBER PROCESSING TO PAPERMAKING

An outstanding paper product requires outstanding production – matched with the particular needs of raw material and final product. Discover the full-range portfolio from ANDRITZ: Excellent stock preparation that allows best fiber development according to furnish and with economical use of resources. *PrimeLine* paper machines that are a synonym for producing top-quality tissue, paper, and board grades. Complete lines or single units, upgrades, and modernizations. Contact us and benefit from your individual package in papermaking technology.

### AUSTRIA

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**ANDRITZ.COM/PAPERBOARD**

**GET AN OVERVIEW**  
on our paper and board  
technologies and services

