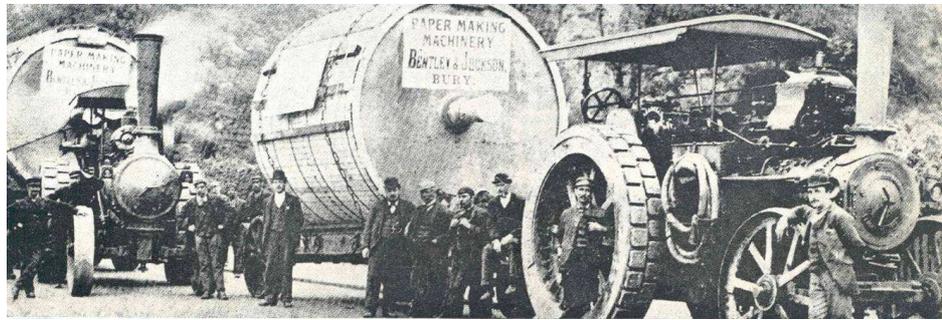


Yankee & MG Dryers



**Transporting
a Yankee in
the 1880's**



**Cast Iron
Dryer
Solutions
With History:**

PMT Yankee and MG dryers are designed and manufactured in Bolton, United Kingdom; at the 16043 m² factory where state of the art computerised design, engineering, foundry and machining resources combine with traditional skills and craftsmanship in a unique single location.

Around 500 Yankee and MG dryers have been designed and manufactured in the UK since 1884, continually developing designs and production techniques and building up a vast experience and know-how in this specialised area of papermaking technology.

All PMT's dryers are designed to meet the specific needs of the intended mill operation; and all meet the design and manufacturing requirements of the ASME unfired pressure vessel code.

PMT offers a complete Yankee and MG dryer technical capability for papermakers available from no other source, which includes:

**A Modern
MG Dryer**



Transporting a Yankee Today



- Full design and engineering services
- Transportation arrangements worldwide
- Erection, commissioning and start-up supervision
- Installation problem analysis and advice
- Operator and maintenance training
- On site refurbishment, upgrading and maintenance of existing dryers

Dryers designed and manufactured to date:

Yankee Dryers	
Diameter	Up to 5500 mm (18ft)
Shell Length	Up to 7747 mm (305 in)
Operating Speeds	Up to 2400 m/min (7874 ft/min)
Operating Steam Pressure	Up to 11 barg (160 psig)
Operating Press Loads	Up to 170 kN/m (970 pli)

MG Dryers	
Diameter	Up to 6718 mm (22ft)
Shell Length	Up to 6045 mm (236 in)
Operating Speeds	Up to 800 m/min (2625 ft/min)
Operating Steam Pressure	Up to 6.9 barg (100 psig)
Operating Press Loads	Up to 100 kN/m (571 pli)

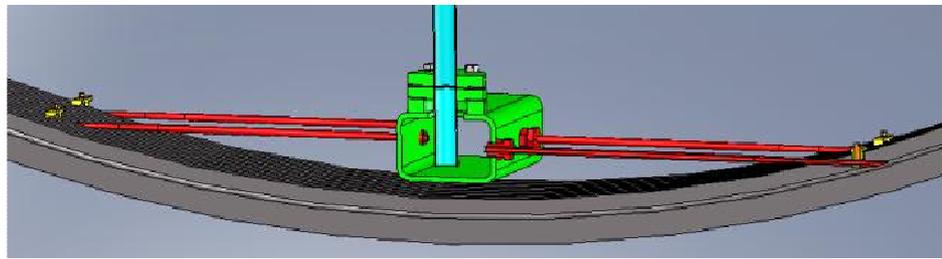
Nineteen Thirties Yankee Shell



Cast Iron Dryer Solutions With History



Outrigger Straw Model



Bespoke Drying Solutions:

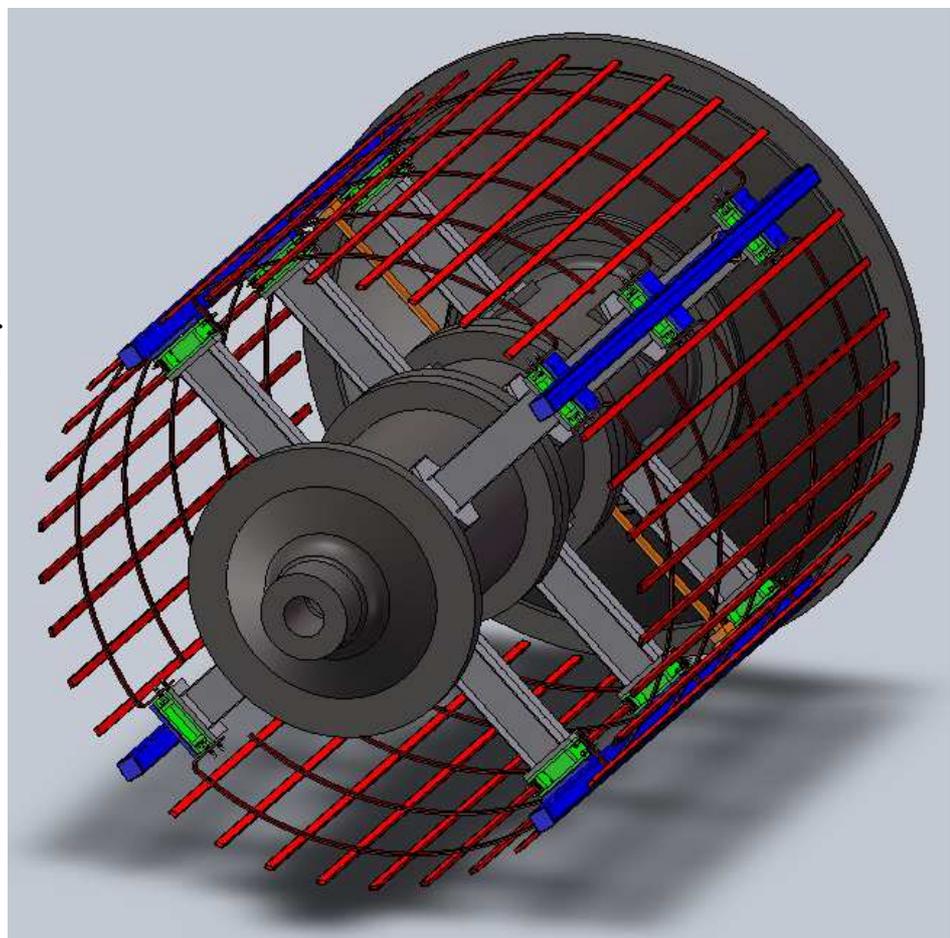
Yankee Dryers

Today's high performance tissue machines depend on high heat transfer rates from the Yankee dryer, to provide efficient drying and reduce energy costs.

PMT manufactures three types of Yankee dryers: the traditional plain bore shell (with and without turbulence bars), the conventional ribbed shell and the deep ribbed shell for high load press applications. The specific design is suited to specific machine operating conditions.

The ribbed shell design, in conjunction with the industry famous outrigger straw condensate extraction system, significantly increases drying capacity whilst maintaining even drying in both CD and MD directions; the most important requirement for today's tissue machines.

Model of Turbulence Bars and Full Width Scoops



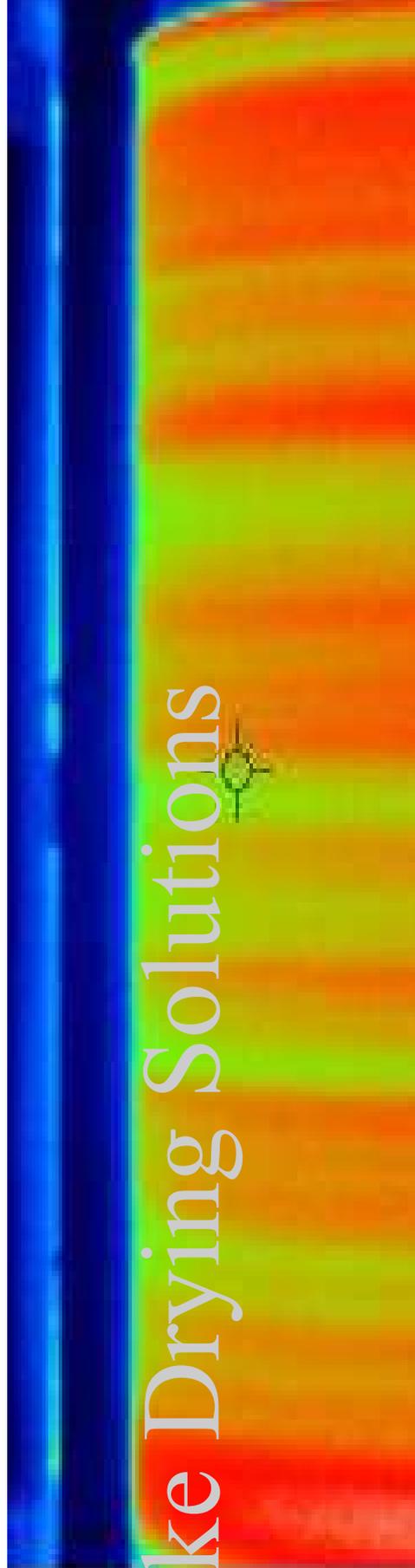
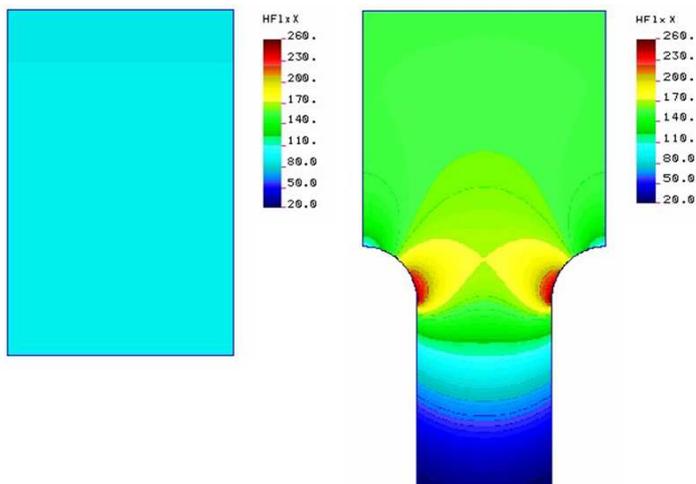
MG Dryers

PMT MG dryers have a highly polished external surface and are used to produce paper and board grades that require a glazed surface.

Through in depth knowledge and experience of the industry's needs and continued metallurgical research, the optimum shell material (class 45 iron) was developed for these medium pressure dryers.

The unique full width condensate extraction headers are specifically designed for effective condensate extraction with rimming or non-rimming conditions.

FEA Heat Flow Analysis on a Plain & Ribbed Shell



57.0°C

49.1°C

Bespoke Drying Solutions

Modelling a Yankee Journal



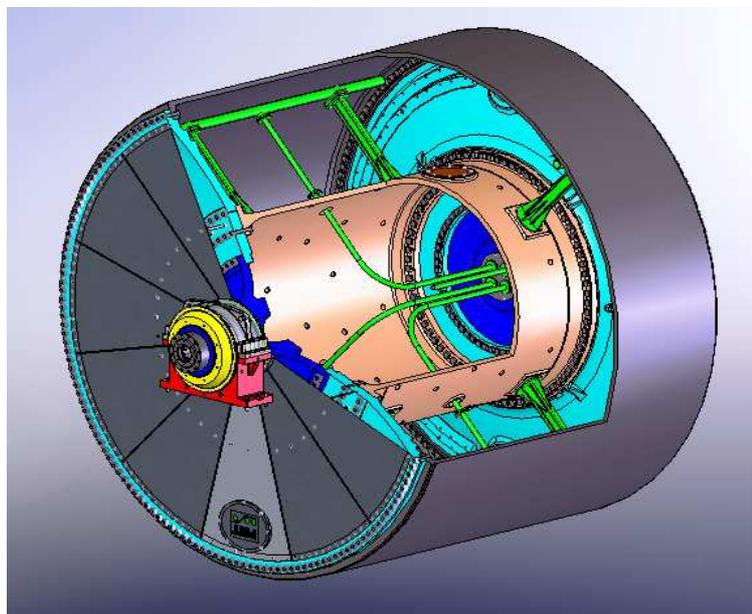
Design and Engineering Solutions:

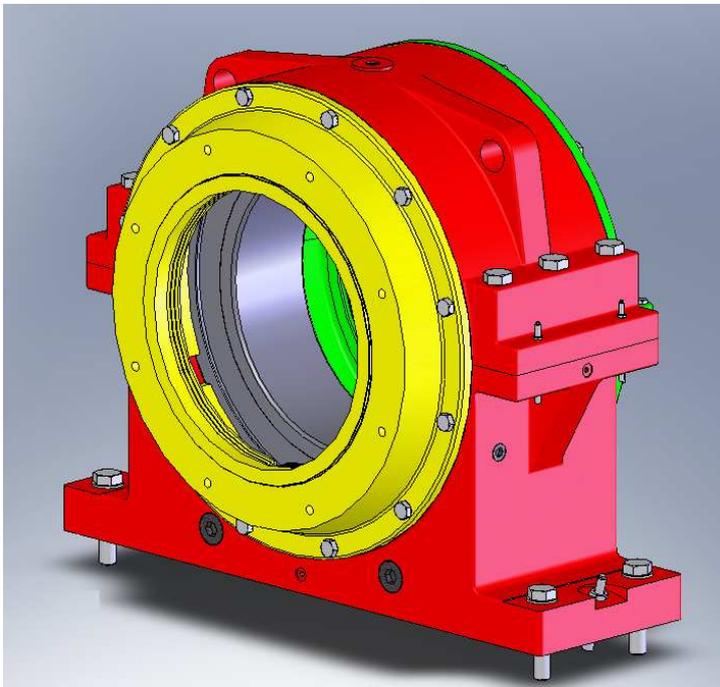
Steam heated dryers are the most efficient paper drying method on a paper machine. With ever increasing machine speeds and energy costs, the efficiency of Yankee and MG dryers becomes more critical.

Continuous design and engineering development, together with metallurgical research and stress analysis, ensure that all PMT dryers satisfy today's paper machine operating demands:

- Stress and deflections maintained with acceptable limits with the use of a large diameter centre stay which reduces the "head effect" on the shell shape.
- The most even heat transfer distribution across and around the shell by the use of the "outrigger" straw condensate extraction system.
- Static and alternating stresses are fully evaluated for each individual dryer by Finite Element Analysis of all pressure containing parts.
- Crevice corrosion and leaks have been eliminated by head to shell interface design and ample high loading bolts.
- Crown system audit by Finite Element Analysis for both dryer and press includes the effect of: geometry, pressure, temperature, press loading, vacuum, felt tension, rotation, sheet and hood, individually designed for specific operating conditions.
- Safe operation under the most severe operating conditions.
- Minimal maintenance.

MG Dryer Cutaway Model



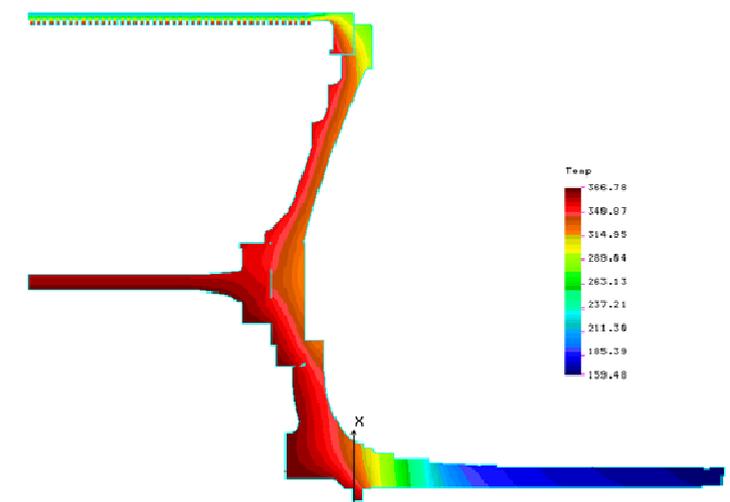


Bearing Housing Assembly Model

The Engineering department supports the service department both on-site and in-house. Services provided include:

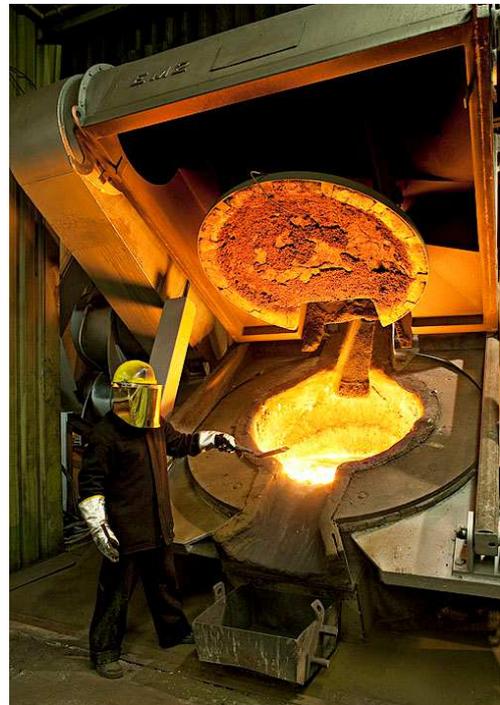
- Pressure vessel calculations.
- Drying rate and blow-through calculations.
- De-rating / re-rating calculations.
- FEA crown and stress analysis
- Proposals and solutions for specific problems.
- Machine drying audits.
- Moisture profile troubleshooting (chatter marks).
- Steam system audits.
- Commissioning and start-up assistance.
- Specialist training and seminars.

FEA Thermal Analysis on Yankee Dryer



Design and Engineering Solutions

Sampling the Melt



Casting Solutions:

The Bolton foundry has one of the largest and fastest melting medium frequency electric furnace installations in Europe.

The twin 9 MW inverter powered computer controlled furnaces melt 36 Tonnes of iron per hour, each 12 Tonne charge being melted to 1450 °C in just 38 minutes.

State of the art equipment plus the traditional foundry skills, craftsmanship and tight quality control systems ensure the integrity of all Yankee and MG dryer castings.

Two Ladle Shell Pour





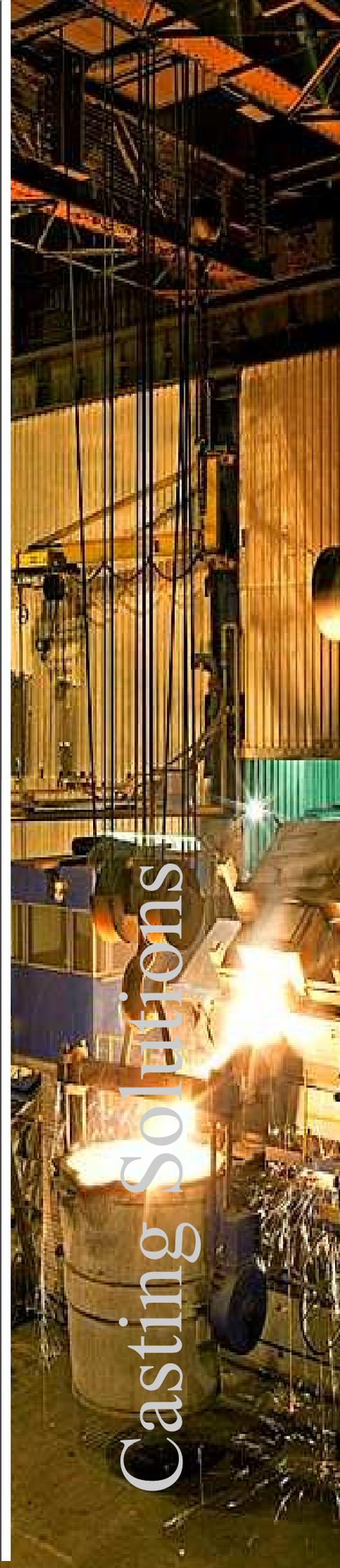
Casting a Yankee Shell

PMT provides unique metallurgical solutions for optimum performance of the end product:

- Class 60 material for Yankee dryer shells gives optimum hardness characteristics and tight tolerances in hardness variation to ensure minimum surface wear and grinding frequency.
- Specially developed class 45 material for MG dryer shells gives high heat transfer characteristics.
- Shell materials optimised on: thermal conductivity, tensile strength, hardness and homogeneity to give maximum and even drying across the full face of the dryer whilst maintaining safe stress limits.

Using the latest computer simulation programme for casting and mould design ensures casting quality and facilitates continuous development.

Casting Simulation of a Yankee Head



Machining and Assembly Shop



Machining and Assembly Solutions:

The Bolton Machining and Assembly shop is unique in that the shell and heads are machined and assembled in one location.

From receiving the shell casting from the foundry the whole dryer is machined, assembled, hydrostatically tested, finish ground at operating steam pressure and packed for shipping in one location. All this is completed by an experienced, highly skilled workforce operating to stringent quality systems.

Major production and quality benefits are gained by the ability to machine the full dryer shell in its operating condition without the need to turn over or move the shell.

Machining a Shell





Linishing Shell Surface

Dryers can be turned, finished and superfinished to an optimum compound crown profile.

A surface finish of 0.20 micrometer Ra (8 micro inch CLA) or better can be achieved where a high degree of finish is required, with a eccentricity of less than 0.05 mm (0.002”).

Assembling a Yankee Dryer



Machining & Assembly Solutions





ISO 9001:2008 Certified
Quality Management System



Total Quality Solutions:

The complete manufacturing process is subject to strict quality management systems which, as a minimum, satisfy the requirements of ISO 9001-2008, ASME and PED, for which we hold the relevant accreditations

From materials specification and preparation to moulding and casting, machining and assembly, finishing and testing, every manufacturing stage is checked by experienced personnel using the latest quality control instrumentation and measuring systems.

Radiographic, ultrasonic and magnetic particle testing is widely used to assess the quality of all castings. Records of inspection and testing are made available to the customer, who also has complete freedom to personally inspect at any stage of manufacture.

Shell Groove Inspection





Test Bar Tensile Testing Equipment

Using the latest techniques a full Spectrographic analysis is carried out on all melts prior to pouring, and again after pouring, with further tests for tensile strength as standard and thermal properties, Brinell hardness, metallography, radiography, magnetic particle and ultrasonic testing as required.



Shell Surface Inspection



Total Quality Solutions

Head to Shell Bolt Upgrade



Service Solutions:

PMT can supply specialists for: installation supervision, commissioning, start-up assistance and training on new installations. In addition there is an array of additional services PMT can supply for existing Yankee and MG dryers:

- Inspecting, maintaining, overhauling and resetting internals.
- Upgrading old dryers with the latest design features and condensate extraction system.
- Re-rating dryers.
- Leak sealing of old dryers.
- Shell thickness measurement.
- Dynamic balancing.
- Hydrostatic testing.
- Acoustic emission testing.
- NDT examination.
- Vibration analysis.
- UT bolt testing.
- Metallurgical examination.
- Fitness for service audits.
- Bearing changing and journal re-machining.
- Crown audits.
- Steam system surveys.
- Machine audits (troubleshooting).
- Thermography surveys.
- Grinding and spray coatings.

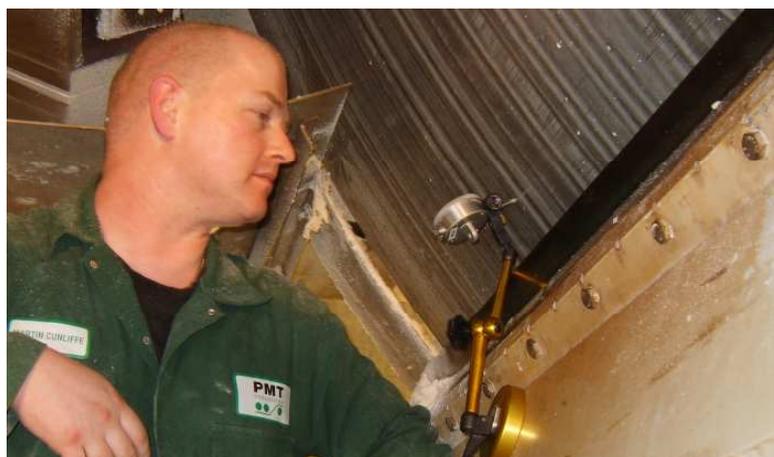


“R” Stamp

In addition, if an extraordinary event occurs that puts the safety of the vessel in question, PMT can help with immediate specialist advice and on-site service to ensure safety and minimise downtime.

PMT has the National Board “R” stamp authorisation that qualifies them to repair pressure vessels in the field.

Runout Measurement





Head Tilt Inspection to TAPPI Recommendations

PMT is in a unique position to offer specialist service for the following reasons:

- We are the OEM and, as such, are continually improving design
- We have the intellectual property rights to the detailed drawings
- We have the specialist service equipment
- We have the experienced workforce
- We hold the necessary authorisation in the ASME "U" and National Board "R" stamps
- We have the manufacturing capabilities
- We have the specialist Yankee Design Engineers

Replacing a Yankee Journal



Service Solutions

**Yankee Bolt
Assembly**



**Spare Part
Solutions:**

PMT has the intellectual property rights to Yankee dryers made at the Bolton foundry during the Sandusky Walmsley and Beloit Walmsley period. Therefore, not only can specialist service be offered but spare parts can quickly be delivered without the need for reverse engineering. Spare parts can include:

- Straw assemblies
- Bolt assemblies
- Expansion units
- Gaskets
- Internal piping
- Insulation sleeves
- Bearings & Housings
- Castings (e.g. Yankee journal)
- Steam joints and bars

**Replacement
Bearing
Housing**





Yankee Head Airfreight

PMT has a wide range of parts on stock, however, specific parts can be manufactured on a breakdown basis for fast response with air freight as an option.

Typical Stock Spares



Spare Part Solutions

The increased pressure to reduce our carbon footprints, coupled with the rapidly increasing price of energy supplies, has focused attention on the need for greater efficiency by reducing energy consumption but without detriment to output.

Head Insulation Solutions:

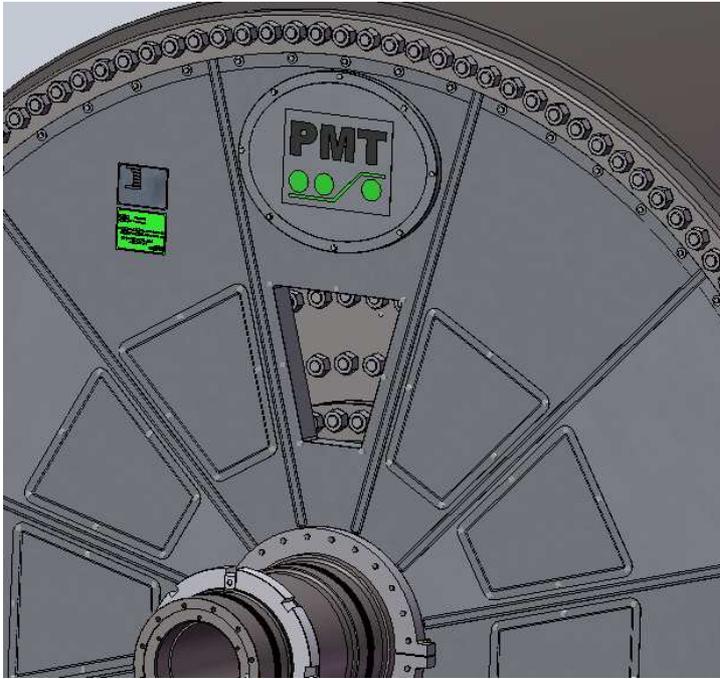
PMT Industries, ever mindful of our customers needs in this respect, has provided the option of head insulation on their range of Yankee and MG Dryers, which has been proven to reduce power consumption whilst ensuring that the maximum drying efficiency is obtained.

The design has been developed to ensure that the increase in efficiency does not come at the expense of the machine operation, and the smooth external finish helps with cleanliness on the dryer end, improves safety in the event that water sprays on the face of the head, and reduces dust build-up.

Due to PMT's experience of providing inspections and services to the paper industry serious consideration was given to ensure the insulation design did not impede inspection and maintenance. An option for removable bolt inspection panels is available.

Head Insulation on 15ft Yankee Dryer





Design Showing Bolt Inspection Panel Option

It is not only new machines that can reap the benefits of reduced energy consumption as we have also designed a head insulation package that can be retrofitted to most Yankee Dryers and MG cylinders by our well respected Yankee Dryer Service team.

Indications are that the cost of installation of this package can be recovered within 12 months from the resultant savings in the energy costs.

Experience gained over many years servicing all types of dryers means that the head insulation package can be installed with the minimum disruption to mill production and can be arranged to fit in with scheduled downtime.

Typical savings on a retrofit:

- Diameter 4.57m
- Steam Pressure 7.8 barg
- Measured Power saving 227 kW
- Reduction in steam consumption 9.6 Tonnes/day



Head Insulation Solutions

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ISO 9001:2008 Certified
Quality Management System