

THE HONG KONG SECTION OF ASME INTERNATIONAL CUM
INSTITUTION OF MECHANICAL ENGINEERS HONG KONG BRANCH
TECHNICAL VISIT FOSTER WHEELER POWER MACHINERY CO., LTD.
ON 24/5/2014



ASME-HKS cum IMechE-HKB delegation visited FWPM [Victor Yu]

James Watts in 1781 led the world to leap into the era of steam. 223 years later, the world in the 21st century still lives in it. The world continues relying on steam to generate power, nowadays predominately in the form of electricity, for all applications in modern life. Although the principle remains, the means of generating steam has evolved significantly over the past two (2) centuries, becoming more safe, efficient and powerful. The boiler is always the equipment to turn water from liquid to gaseous form, and often a large single utility-type is able to power a municipal with hundreds of thousands of habitats, which at James Watts time in 1781 was surly inconceivable.

Modern life cannot function without modern boilers. Therefore, the technical visit to Foster Wheeler Power Machinery Company Limited (FWPM), jointly organised by the Hong Kong Section of ASME International (ASME-HK) and Institution of Mechanical Engineers Hong Kong Branch (IMechE-HKB) on 24th May 2014 (Saturday), was so timely for the privileged 29 delegates, for the first time ever, to appreciate how boilers were manufactured at the top standard.

Overview

FWPM is located in the Xinhui District of Jiangmen City, Guangdong China. They are a manufacturer specialising in the fabrication of all ranges of boiler components and assemblies. Some key accomplishments and milestones that have been achieved in their 17 year history are summarised in the following table:

Time	Milestone(s)
1993 December	Joint venture contract signed
1997 July	Plant construction completed and operation started with initial shop floor area of 235,000 ft ² across three (3) bays and a staff of 147 people.
2000 December	First 300 MW Circulating Fluidised Bed (CFB) boiler for JEA (former Jacksonville Electric Authority) delivered.
2006 June	The fourth bay entered production, expanding floor area to 369,000 ft ² and workforce to 732.
2008 September	First 730 MW once-through boiler for Longview Power Project delivered Workforce expanded to 863 people.
2012 December	Painting and Packing Bay entered production Workforce count of 745 people.
2014 April	First 4 × 550 MW ultra-supercritical CFB boilers for Korean Southern Power Company in Samcheok, Korea delivered

FWPM is a joint venture between Foster Wheeler Power Group Asia and its three (3) Chinese partners as listed in the table below. The day to day commercial and technical operations are managed exclusively by Foster Wheeler.

Shareholder	Shareholding
Foster Wheeler Power Group Asia	52 %
Guangdong Daguangming Group Co., Ltd.	18 %
Guangdong Electric Power Industry Development Co., Ltd.	15 %
China Huadian Engineering Co., Ltd.	15 %

Today, Foster Wheeler Power Machinery (FWPM) consists of five (5) fabrication bays and a designated Blasting and Painting facility. The manufacturing area covers 144,000 m², manned by a workforce of over 600 people. Annual workshop capacity is 1.2 million man-hours. The company is lead by General Manager, Mr. Ding, Xiaoming. It is worth noting that Mr. Ding has been with the organisation since its inception in 1994, having started his career with FWPM as a Welding Engineer following his graduation from Xian University in 1994. Under his supervision and leadership are six (6) direct reports whose function and responsibility are outlined in the table below:

Position	Department(s) and Role(s)
Vice-General Manager	Project Management Proposal Industrial Engineering Engineering (fabrication details) Health, Safety and Environment Project Cost Control
Director of Manufacturing	Construction Maintenance Production Product Control

Position	Department(s) and Role(s)
	Continuous Improvement Process
Financial Controller	Finance & Information Technology
Director of Quality	Quality Assurance Quality Control Non-Destructive Examination Welding Technology Laboratory
Procurement Manager	Purchasing & Import and Export
Human Resources and Administration Manager	H.R. & Administration

Products and service sectors

FWPM manufactures pressure parts for new-built steam generators and supplies replacement parts and component upgrades, (principally for use in supercritical boilers for the U.S. Utility market) the latter of which include components with corrosion/erosion resistant weld overlay products. Their boiler



Wall Panel in full final length assembled for Duke Energy project [W.H. Tsang]

production covers solid fuel types, such as CFB and pulverised coal, as well as oil and gas-fired type.



T23-made studs welded on P91 Header for Duke Energy project [W.H. Tsang]

With the exception of the steam drum and finned tube components [the latter of which is made in Foster Wheeler (FW)'s Thailand facility], FWPM fabricates the traditional boiler parts like Coil, Panel and Header and complex components like Heat Recovery Steam Generator modules, Package Boilers and Burner Cyclones. Being the largest production facility in the FW Global Power Group, FWPM is called upon to fabricate complex and high alloy steel tube components made up of T91, P91 and P92 materials.

To date, FWPM has built 102 units new boilers and completed an additional 134 service projects that have been delivered all over the world. Every project has been delivered on time.

Quality and qualification

FWPM employs an in-house comprehensive quality system to manage the quality of material, fabrication, inspection and documentation. 75 % of their fabrication processes involves welding which encompasses all methods like TIG, MIG, SAW and GMAW, and naturally great attention is paid to the quality of welds. FWPM has an excellent weld quality history. The 2013 statistics are outlined below:-

Annual Production Rate	Radiography Test Rejection Rate	
	FW global target	FWPM achieved 2013
62,000 automatic weld joints	0.25 %	0.14 %
50,000 manual weld joints	1.5 %	1.0 %

In 2012, FWPM was awarded and certified the first establishment in the region to qualify/certify Welders to the (GB) Chinese Code. All 390-plus welders in FWPM are qualified to weld to ASME Section XI. Of this same group, two-third are dual qualified to GB Code. FWPM has its own dedicated facilities to train and qualify welders to ASME and China boiler codes. Advanced computerised inventory management system is in place to monitor consumable distribution and identify work done, ensuring the top traceability is maintained.



622 Inconel over-lay weld on T11/T12 [W.H. Tsang]

Be it radiography, ultra-sonic testing (conventional or phased array), magnetic particle or else, FWPM conducts non-destructive examination of all methods in-house using their



Stud welded on tubes to grab refractory standards. [W.H. Tsang]

own certified employees. Shop hydrostatic test may also be performed according to contract requirement. The laboratory in FWPM renders mechanical, chemical and metallurgical analysis for welding procedure development, material development and control, failure analysis and manufacturing process verification. It also supports FW in the development of new generation of material manufacturing and engineering

Raw materials, principally pipes, tubes, forgings and castings are sourced from China, Europe and North America. FWPM adopts FW's stringent quality assessment standards in approving the use of domestic materials. Only the qualified material(s) produced by the qualified mill(s) is/are accepted for the fabrication of boilers and their components. Qualified mills are subject to vigorous assessments of FW, and these Suppliers work closely with FW in the development and controls of their in-house processes. Chinese mills are receptive to FW Quality Personnel performing oversight at their facilities as it helps their own quality standards to improve; which now not

only includes carbon steel products, but also advanced materials such as stainless steel, T91 and P91 to FWPM.

In terms of code compliance, the FWPM products can fulfil ASME (the U.S.), GB (China), PED / EN (Europe Union), METI (Japan), MOM (Singapore) and IBR (India). On the other hand, while the codes provide the minimum requirement of standard, FW imposes company standards on its work above and beyond the international codes; whereas the contract specification prevail where even higher conditions are required.

In November 2012, FWPM was certified to ISO 14001 and OHSAS 18001, approving its excellent performance in environment, health and safety (HSE). In addition, five (5) Certified Safety Superintendents are deployed in the plant to establish, maintain and improve the HSE.

Production and production capability

Pipes and tubes that are received are first unbundled, stamped with identification code, which indicates the material specification and Heat Number; they then undergo an automatically sand-blast and finally are stencilled along their length with project specific details necessary to specify the use of the material. Each spool, irrespective of its cut length has the code required data (material type/Heat Number) hard stamped/etched into its surface to ensure the correct material is used in every production process.



Bending Table [W.H. Tsang]

Coils are formed by bending single maximum 80 m long tube into shape. The tube is first cold-bent by the Bending Table to the radius of 1.3-1.5 times of the tube outer diameter (“1.5-D”). After cold-bending, the semi-finished Coil is hot-bended to reduce the bend radius from “1.5-D” to “1-D”, if required by design. The Bending Table is able to form 20 coils at maximum 75 mm outer diameter per shift.



Medium-Frequency Induction Furnace used in Coil bending from “1.5-D” to “1-D” [W.H. Tsang]

Wall Panels are fabricated by fin-to-tube welding. Typically, five (5) tubes are joined to six (6) fins through one of the two (2) Membrane Panel Welding Machines, which is fitted with 20 torches and utilises the GMAW process. This allows the sub-panels to be welded on both sides in one pass and assures a dimensionally sound end-product. Finally, the sub-panels are joined on their second membrane panel machine to produce the designed width panels for final processing.



Wall Panels fabricated [W.H. Tsang]

FWPM equipped with the largest electric Annealing Furnace in China, built and put into service in 2009. Being 14 m and 4 m in length and width respectively, it is capable to heat-treat large size stainless steel components to 1,260 °C. The heat

treatment process utilises an atmospheric inert gas purge (97 %) and a product ID purge (99.7 %) that yields a finished product with no measurable material loss due to oxidation.

Remarks

In the light of its outstanding production capability, efficiency and product quality, there is no question that FWPM is a model plant of pressure parts manufacturing for steam generators. Delegates of ASME-HK and IMechE-HKB were fortunate to observe and appreciate first-hand the excellence of FWPM in supplying top quality steam generator parts and packaged components that generate steam for power supply wherever it is needed across the world.

ASME-HK and IMechE-HKB thank Mr. Ding, Xiaoming (General Manager) for his generous support to the technical visit and Mr. Daniel Kish (Director of Quality), Mr. David Lee (Manger of Proposal Department), Mr. Jim Wu (Manager of Production) and Ms. Bonnie Xie (Secretary to General Manager) for their kind hospitality.

- END -

Encl.
WHT

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By courtesy of Foster Wheeler with compliment

ASME Hong Kong Section and
IMechE Hong Kong Branch

TECHNICAL VISIT FOSTER WHEELER BOILER MANUFACTURING FACILITY



Institution of
**MECHANICAL
ENGINEERS**

Accepted registrations will be notified to pay the registration fee within three (3) days of notification. Places are confirmed upon clearance of the payment of the fee.

Date: 24 May, 2014.

Time: 0730 hrs. to 1600 hrs.

In Xinhui, Jiangmen City, numerous mega-sized utility boilers which power millions of families and businesses across the world are manufactured there. It is Foster Wheeler's boiler manufacturing facility, where boiler components are fabricated, quality checked and tested and packed for shipment. With exception to the steam drum, it could fabricate all boiler pressure parts up to 600 MWe class size.

For the first time ever, ASME Hong Kong Section IMechE Hong Kong Branch together bring to you an invaluable opportunity to experience the birth of a boiler in a world-class production facility of its kind.

Registration is HK\$360 per head. 25 places are available on first-come-first-serve basis with priority given to ASME and IMechE members.

Registration and Enquiries

For registration, please write to tcheong@hkelectric.com with your name, membership number, membership (ASME or IMechE only), contact telephone number(s) and e-mail address(es) and employer name by 18/5/2014 (Sunday).

For more information please contact:
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