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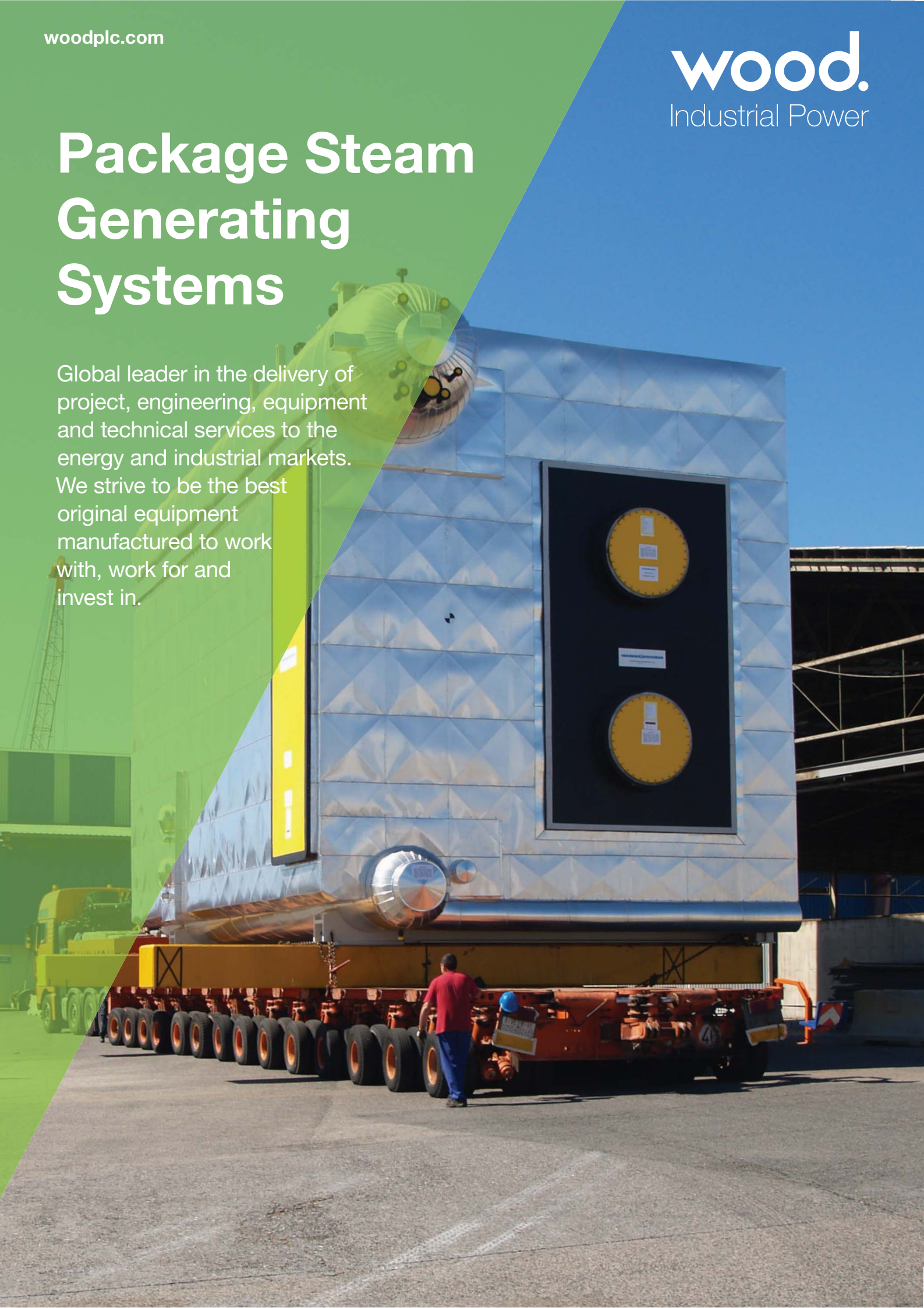
Industrial Power

Package Steam Generating Systems

Global leader in the delivery of project, engineering, equipment and technical services to the energy and industrial markets. We strive to be the best original equipment manufactured to work with, work for and invest in.



Wood package boiler
operating at Dow Chemical
in Alberta, Canada since 1994

wood.

FOSTER WHEELER

A long, successful history of proven and reliable package boilers

Industrial steam generation is all about high reliability at the lowest steam production cost. Wood provides a solution focused on these attributes.

Package Steam Generating Systems have been an integral part of Wood's product base for over 60 years. With over 500 installations, we have earned our reputation as a proven and responsible leader in this industry.

Our diligent pursuit of improved system performance and quality is founded on the concepts of system reliability, value engineering and execution excellence. We make it a priority to understand and address the unique requirements of your project, with the goal of delivering excellence.

Wood provides a complete power solution

For all industrial and power applications

Standard scope

- Burners with fuel valve trains
- Burner management systems
- Emissions control equipment
- Attemperation systems
- Instrumentation & controls
- Motor & turbine drives
- Economizers
- Stacks
- Valves & trim
- ASME piping
- Sootblowing systems
- Flues & ducts
- Platforms & walkways
- Structural steel

Extended scope

- Air pre-heaters
- Deaerators
- Feedwater pumps
- Blowdown systems
- Chemical feed systems
- Steam/water sampling system
- Water treatment systems
- Continuous emission monitoring
- Electrical equipment & lighting
- External piping
- System design
- Construction
- Subcooler condensers
- Remote monitoring & diagnostic system
- Complete boiler island

Fuels

- Natural gas
- Refinery process gases
- Landfill gas
- Blast furnace gas
- Coke oven gas
- Waste gases
- Heavy fuel oils
- Waste liquids
- Others

Emission control techniques

- Low NOx burners
- Flue gas recirculation
- CO oxidation
- SCR systems

Package boilers usage

- Demanding & critical processes
- Cogeneration or combined heat and power
- Emergency steam demand
- Increase in overall system availability
- Fast delivery of reliable steam supply

Broad industrial experience

- Chemical pants, gas plants & petroleum refineries
- Mining & oil sands
- Power, cogeneration plants & combined cycles
- Manufacturing & district heating
- Sugar cane & paper
- Desalination plants
- Landfill applications

Boiler features

AG series

We incorporate state-of-the-art design and construction standards adopted from our large utility products, best practices and company know-how. These standards have been refined and well proven through many years of experience with the oil & gas, chemical and power industries. Based on these standards and your needs we can customize each solution for your benefit.

The result is a boiler of superior construction, custom designed to project-specific requirements and focused on your project needs. Wood's proven AG series package boiler technology consists of six distinct series: 5000, 5100, 5200, 5300, 5400 and 5500. Each series offers a unique set of standard geometries and flexible features.

Standard Product Capabilities*

Capacity:	Up to 600,000 lb/hr (272 t/hr)
Pressure:	Up to 1800 psig (124 barg)
Temperature:	Up to 1005°F (540°C)
Emissions:	Best available emission abatement technologies
Scope:	Full turnkey

*Custom units can be designed beyond standard product capabilities to meet specific project needs

REFERENCE PROJECTS

La Rábida

Location:	La Rábida, Spain
Customer:	CEPSA
Start-Up Year:	2006
Capacity:	1 x 335 Kpph (152 t/h)
Fuel:	Natural Gas
Model:	AG-5375

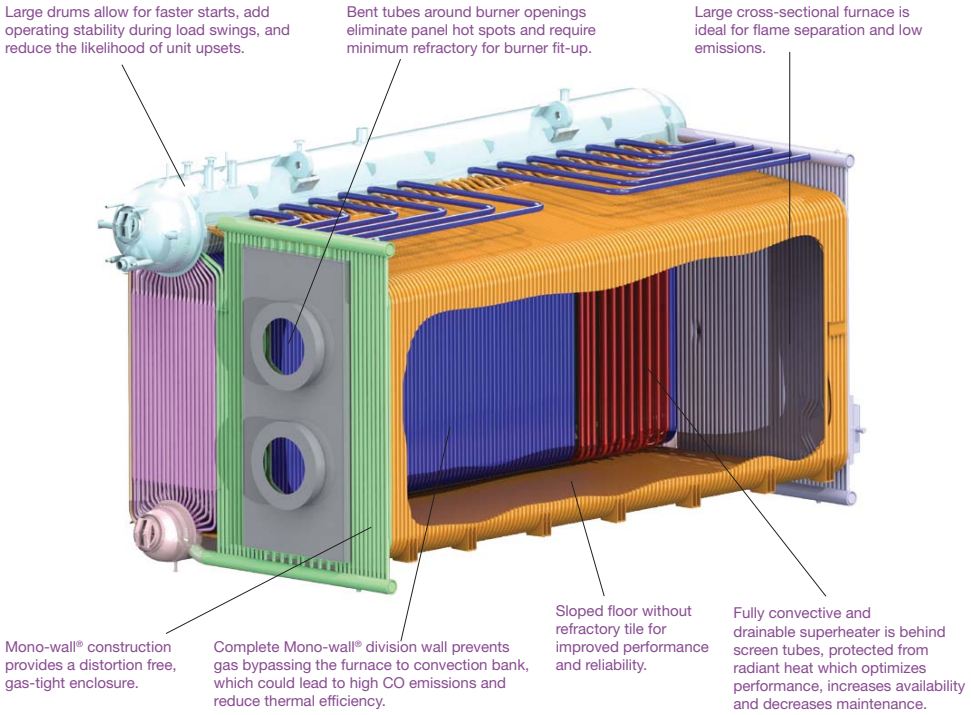
Karsto

Location:	Kartso, Norway
Customer:	Kellog / Statoil ASA
Start-Up Year:	2005
Capacity:	1 x 262 Kpph (119 t/h)
Fuel:	Process Gas, Refinery Gas
Model:	AG-5375

Perawang Mill

Location:	Balikpapan, Indonesia
Customer:	Pertamina UP-V
Start-Up Year:	2004
Capacity:	1 x 275 tph (125 t/h)
Fuel:	Oil
Model:	AG-5325

Typical Wood package boiler design



REFERENCE PROJECTS

Dupont New Johnsonville

Location:	New Johnsonville, TN, USA
Customer:	DuPonty
Start-Up Year:	2015
Capacity:	2 x 317 Kpph (144 t/h)
Fuel:	Natural Gas, Hydrogen Gas
Model:	AG-5275

Sturgeon Refinery

Location:	Alberta, Canada
Customer:	North West Redwater Partnership
Start-Up Year:	2015
Capacity:	3 x 357 Kpph (162 t/h)
Fuel:	Natural Gas, Hydrogen Rich Refinery Gas, Propane Rich Refinery Gas
Model:	AG-5325

Aughinish Alumina Refinery

Location:	Aughinish Island, Ireland
Customer:	Aughinish Alumina Refinery
Start-Up Year:	2014
Capacity:	2 x 330 Kpph (150 t/h)
Fuel:	Natural Gas
Model:	AG-5325

Boiler features

Wood's key design features are based on our experience with many different products and industries. Our company know-how and standards have been developed through our network of majority-owned manufacturing facilities, and in many cases is more stringent than internationally recognized codes, resulting in a very high quality product.

Maintenance-friendly access
Observation ports are supplied in the furnace and convection rear walls, while access to key maintenance areas is provided through large diameter man-ways in the furnace, water drum and steam drum. Generously-sized access platforms, walkways and stairs are standard, all of which will be adapted specifically to your project needs.

Wood's
Mono-wall® technology

Mono-Wall® construction
Wood boilers are constructed exclusively using a tubular membrane-wall (Mono-wall®) – for a distortion-free, gas-tight enclosure. Mono-wall® division wall prevents gas bypassing from the furnace to the convective bank which would otherwise lead to high CO emissions and reduced thermal efficiencies. A water-cooled front wall with nested burner opening is standard in our larger boilers to minimize the refractory areas and minimize long term maintenance costs.

Proven and reliable design
Two drum, D-Style design offers proven technology and reliability. Conservatively sized steam drums are standard, improving operational stability during load cycles and increasing drum retention time for maximum system availability.

Primary separators are utilized in conjunction with secondary stage chevron driers for maximum steam purity according to power generation standards.

Detailed circulation analysis
A detailed analysis of all operating conditions with our proprietary applications results in the proper circulation design for your boiler, thus eliminating localized recirculating patterns or steam blockages that could result in panel hot-zones and ultimately tube failures.

Detailed vibration analysis
For each boiler model, the gas flows have been analyzed and the boiler tube geometry designed to prevent vibration due to vortex shedding or standing waves. The result is a quiet running boiler operating with a low risk of tube fatigue related failures due to vibration.

Evaporator bank
Serrated tube-to-drum connections ensure integrity of the tube-to-drum seal with additional seal welding when required. All convective bank tubes are in-line to minimize gas-side draft losses and bare tube gas exposure to promote even heat transfer along the full length of the bank.

The bank is also custom engineered for optimum pitch and density to reduce fan power consumption. Large water-to-steam circulation ratios ensure proper cooling of all tubes and therefore higher reliability and operational stability.

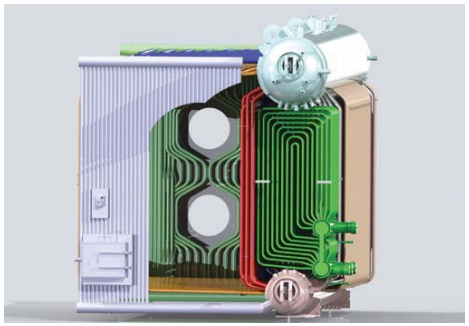
Superheaters
Fully convective and drainable superheaters are standard and are installed so that they are shielded from the radiant furnace by screen tubes. Metallurgical integrity is ensured through the optimization of steam mass flow rates and the balance of steam distribution within parallel passes. Inter-stage or final stage attemperation is used to ensure the necessary steam temperature during different operating cases while maintaining the steam quality.

Engineering expertise
Wood's engineering disciplines utilize our proven standards to ensure design consistency across all systems. Wood's standards are continually updated to improve the technology based on advanced engineering studies and validation of field data. This results in optimum performance, reduced auxiliary power consumption, stable and robust emission control and smooth operation across all operating ranges.

Engineering assessments of your process needs as well as studies are also available.

Worldwide sourcing, manufacturing and execution
Wood's global production and procurement network provides a strong local presence in many areas of the world. Local content can be optimized to minimize shipping costs or to maximize specific country content to support government-financed projects and customer preferences.

Wood's manufacturing facilities, regardless of where they are located, adhere to the same stringent manufacturing and quality standards. Wherever the boiler and auxiliary components are fabricated, our experienced shipping personnel will coordinate shipment of our products to any location worldwide.



REFERENCE PROJECTS

Kapolei

Location:	Kapolei, Hawaii
Customer:	Chevron Products Company
Start-Up Year:	2007
Capacity:	3 x 75 Kpph (34 t/h)
Fuel:	Refinery Gas, Fuel Oil
Model:	AG-5060

Manifa Saudi Aramco

Location:	Manifa, Saudi Arabia
Customer:	Téchnicas Reunidas
Start-Up Year:	2011
Capacity:	2 x 452 Kpph (205 t/h)
Fuel:	Natural Gas
Model:	AG-5475

Chevron

Location:	Pascagoula, MS, USA
Customer:	Chevron Products Co.
Start-Up Year:	2010
Capacity:	2 x 200 Kpph (91 t/h)
Fuel:	Natural Gas
Model:	AG-5240

REFERENCE PROJECTS

Thorold

Location:	Thorold, Canada
Customer:	Northland Powe
Start-Up Year:	2009
Capacity:	2 x 250 Kpph (113 t/h)
Fuel:	Natural Gas, Landfill Gas
Model:	AG-5250

Dow Chemical

Location:	Tarragona, Spain
Customer:	Dow Chemical Co.
Start-Up Year:	2006
Capacity:	220 Kpph (100t/h)
Fuel:	Natural gas

RAM/Tema Oil

Location:	Ghana
Customer:	RAM/Tema Oil
Start-Up Year:	2000/2006/2007
Capacity:	3 x 156 Kpph (71 t/h)
Fuel:	Fuel Gas , No. 2 Oil
Model:	AG-5150

Upgraded design for small package boilers

New HS boilers family nowadays consists of two easy to transport boilers named the HS040, HS070 model. These boilers are second to none in terms of delivery time and reliability.

Boiler Shop Prefabrication

The entire boiler pressure parts will be supplied as a single block. Predefined FD Fan and shop mounted Burners and Windbox.

Fully shippable for long distances by ship and short distances by special land carrier, thus eliminating the need for costly site erection, schedule delays and unnecessary safety risks.

Standard Product Capabilities

Capacity:	Up to 100,000 lb/hr (45 t/hr)
Pressure:	from 150 to 300 psig (10-21 barg)
Fuel:	Natural Gas
Model:	Fully pre-engineered model
Transport:	Easy to transport both by land and by sea
Emissions:	Best available emission abatement technologies
Scope:	Full turnkey

Boiler Series, Sizes and Steam Condition Ranges

Series	Operation Range kpph / *tonnes/hr*	Model	Overall Unit Dimensions			Weight tons / *tonnes*
			Height ft / *m*	Width ft / *m*	Length ft / *m*	
HS040	17,7 - 70 / *8 -32*	HS040-48-10	14,8 / *4,5*	11,5 / *3,5*	16,4 / *5*	30,3 / *27,5*
HS070	25 - 100 / *11 -45*	HS070-48-10	14,8 / *4,5*	11,5 / *3,5*	29,5 / *9*	45,2 / *41*

Package boiler specifications

The Generation 5000 family consists of six distinct groupings of boilers named the 5000, 5100, 5200, 5300, 5400 and 5500 series. Each series offers a unique set of standard geometries and flexible features.

Boiler Series, Sizes and Steam Condition Ranges

Series	Capacity kpph / *tonnes/hr*	Model	Overall Unit Dimensions			Weight tons / *tonnes*
			Height ft / *m*	Width ft / *m*	Length ft / *m*	
5000	50-100 / *23-45*	5050	14.2 / *4.3*	12.3 / *3.8*	29 / *8.8*	36 / *33*
		5060			31.3 / *9.6*	38 / *34*
		5070			33.7 / *10.3*	40 / *36*
		5080			36 / *11*	42 / *38*
		5090			38.3 / *11.7*	45 / *41*
5100	90-210 / *41-95*	5105	17 / *5.2*	13 / *4*	36.5 / *11.1*	48 / *44*
		5120			38.8 / *11.8*	52 / *47*
		5135			41.2 / *12.5*	59 / *54*
		5150			43.5 / *13.3*	66 / *60*
		5165			45.8 / *14*	71 / *64*
		5180			48.2 / *14.7*	76 / *69*
		5195	17.75 / *5.4*	13.3 / *4.1*	48 / *14.6*	83 / *75*
5200	190-270 / *86-123*	5205	19 / *5.8*	17.3 / *5.3*	49 / *14.9*	84 / *76*
		5225	19.5 / *5.9*	16.7 / *5.1*		78 / *71*
		5240	21.5 / *6.6*	19.3 / *5.9*		106 / *96*
		5250	20.5 / *6.2*	18 / *5.5*		91 / *83*
		5275	21.5 / *6.6*	19.3 / *5.9*		106 / *96*
5300	250-360 / *113-163*	5325	24.5 / *7.5*	21.7 / *6.6*	51.5 / *15.7*	150 / *136*
		5375	26.5 / *8*	22.3 / *6.8*		167 / *151*
5400	360-500 / *164-227*	5425	28.5 / *8.7*	23.3 / *7.1*	54.3 / *16.5*	198 / *180*
		5475	30.4 / *9.3*			211 / *191*
5500	500-600 / *227-272*	5525	32.2 / *9.8*	28 / *8.5*	54.3 / *16.5*	269 / *244*
		5575	34.5 / *10.5*			288 / *261*
Custom	600+ / 272+	—	*As per project request*	*As per project request*	*As per project request*	*As per project request*