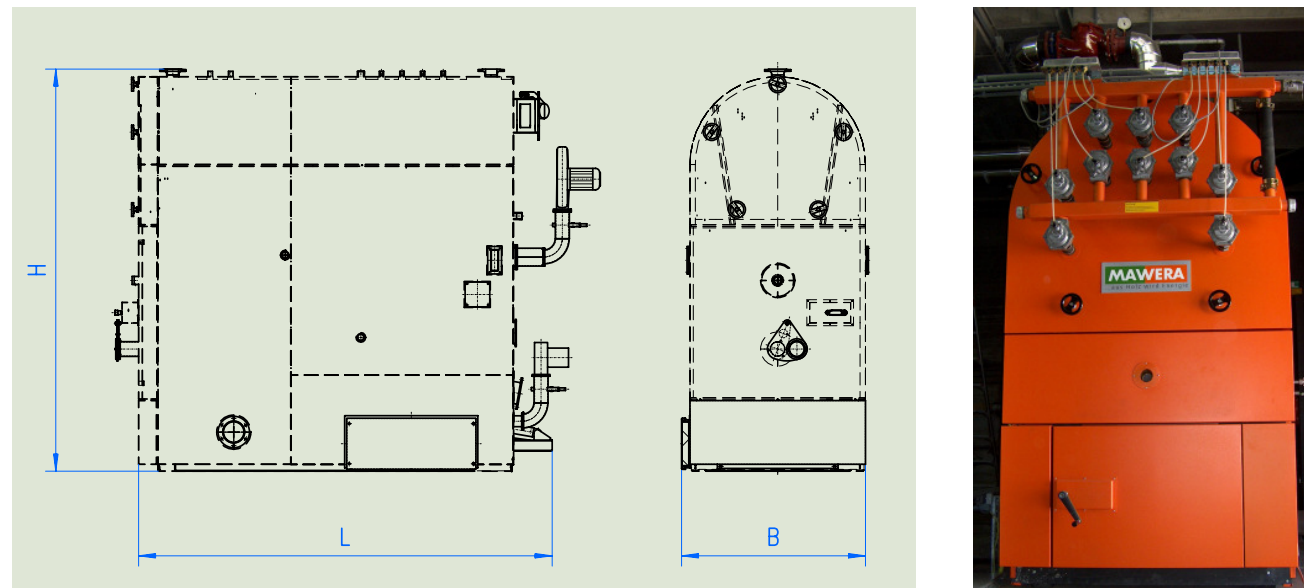


Facts and Figures:

MAWERA Firebox Boiler with a Flat Moving Grate, Product Line FSB

Model	Capacity*		
FSB 180	45 - 180 kW	0.15 - 0.61 MBTU/h	Boiler model: Standard boiler with 230°F (110°C) outlet temperature and 58 PSI (4 bar) operational pressure; the boiler can also be built for higher operational pressure, higher outlet temperature and with an individual certification by the German Technical Inspection Agency (German TÜV) or ASME (USA & Canada). The following wood fuel may be used: Wood residue from forestry operations („slush“), wood from landscaping (bark), wood waste from sawmills (trims, cut-offs, planer shavings, saw dust, sander dust, fines), particle boards, MDFs (medium density fiberboard). Fuel moisture content: 10% to 55% m.c. (wet basis) Fuel grade: particle size from 7/16" to 4" (11.2 to 100 mm) conveyed by a Screw, above 4" conveyed by hydraulic push ram
FSB 220	55 - 220 kW	0.19 - 0.75 MBTU/h	
FSB 280	70 - 280 kW	0.24 - 0.96 MBTU/h	
FSB 350	90 - 350 kW	0.31 - 1.20 MBTU/h	
FSB 440	110 - 440 kW	0.38 - 1.50 MBTU/h	
FSB 550	140 - 550 kW	0.48 - 1.88 MBTU/h	
FSB 700	175 - 700 kW	0.60 - 2.39 MBTU/h	
FSB 850	215 - 850 kW	0.73 - 2.90 MBTU/h	
FSB 1,100	275 - 1,100 kW	0.94 - 3.76 MBTU/h	
FSB 1,400	350 - 1,400 kW	1.20 - 4.80 MBTU/h	
FSB 1,700	425 - 1,700 kW	1.45 - 5.80 MBTU/h	

* heat output depends on the type of fuel used, particularly its moisture content



MAWERA Holzfeuerungsanlagen Gesellschaft mbH
A 6971 Hard am Bodensee
Neulandstraße 30
T +43 - (0)5574 - 74 301-0
F +43 - (0)5574 - 74 301-20
info@mawera.com
www.mawera.com

MAWERA Kessel & Maschinenbau GmbH
D 88131 Lindau
Robert-Bosch-Straße 15
T +49 - (0)8382 - 977 012
T +49 - (0)8382 - 977 013
info@mawera.com
www.mawera.com

MAWERA (Canada) Ltd.
104 Sixth Street East, P.O. Box 2716
Revelstoke, BC
VoE 2S0 Canada
P +1 (250) 814 - 7184
F +1 (250) 837 - 5556
info@mawera.ca
www.mawera.ca

MAWERA (UK) Limited
31 Enterprise Ind. Est.
Britannia Way
LICHFIELD
Staffordshire WS 14 9UY
P +44 - (0)1543 - 25 88 44
F +44 - (0)1543 - 41 63 11
info@mawera.com
www.mawera.com

Product information

MAWERA Firebox Boiler with a Flat Moving Grate

FSB Series

0.6 MBTU/h to 5.8 MBTU/h (180 to 1,700kW)

Design and Operation

Apart from conventional biomass, this flat moving grate is particularly designed to burn wood fuel with a high ash and high moisture content.

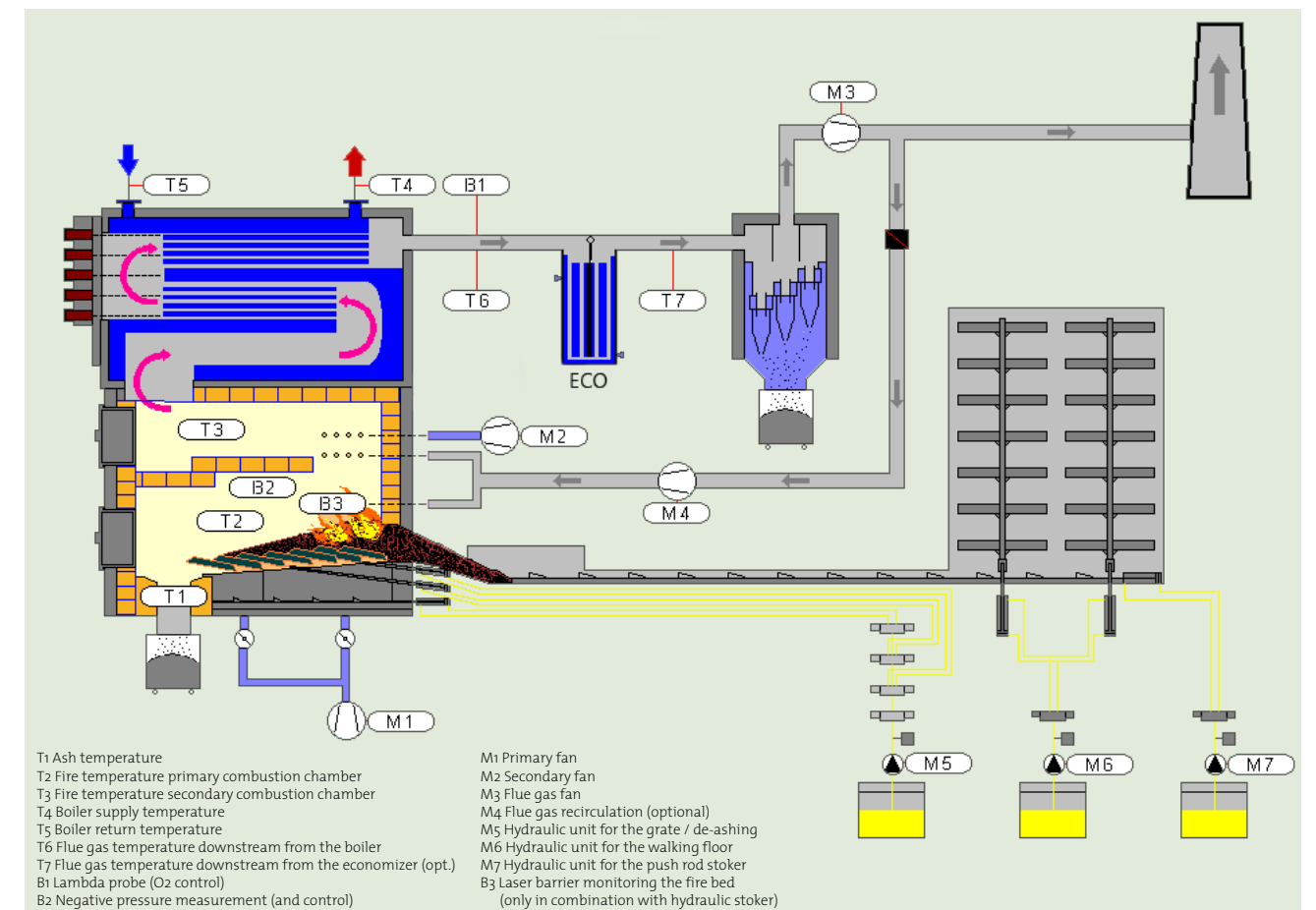
Significant advantages of the flat moving grate combustion in the FSB Series are:

1. a wide variety of wood fuel can be used, and
2. lower particulate matter emissions due to an undisturbed fuel bed.

MAWERA's flat moving grate boilers use a Low-NOx firebox technology. Our Low-NOx combustion chamber is equipped with variable and controlled primary

air supply, automatic modulation flame control, and O₂ regulation (Oxygen Trim System) thus reducing NO_x emissions. The geometry of the combustion chamber was developed based on research at our test facilities and in cooperation with Graz Technical University. As a result, NO_x emissions are reduced by 80% compared to fireboxes with a conventional moving grate technology.

Wood fuel is discharged from bunkers or silos using MAWERA's hydraulic push rams or MAWERA's silo discharge system. Depending on architectural constraints and the particle size of the fuel, push rods, chain conveyors or tube screw augers can be used to transport the fuel.



T1 Ash temperature
T2 Fire temperature primary combustion chamber
T3 Fire temperature secondary combustion chamber
T4 Boiler supply temperature
T5 Boiler return temperature
T6 Flue gas temperature downstream from the boiler
T7 Flue gas temperature downstream from the economizer (opt.)
B1 Lambda probe (O₂ control)
B2 Negative pressure measurement (and control)

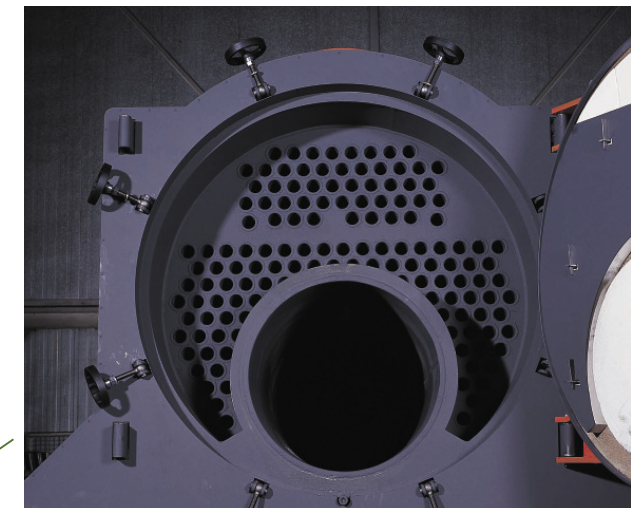
M1 Primary fan
M2 Secondary fan
M3 Flue gas fan
M4 Flue gas recirculation (optional)
M5 Hydraulic unit for the grate / de-ashing
M6 Hydraulic unit for the walking floor
M7 Hydraulic unit for the push rod stoker
B3 Laser barrier monitoring the fire bed (only in combination with hydraulic stoker)

MAWERA Fire Box Boiler FSB with Flat Moving Grate Design and Operation

The entire system is controlled by the well proven micro-processor MAWERA Logic 300 operated by a touch screen panel. In addition, a modem for remote maintenance, a human-machine interface ("MAVIS") and a tele-emergency alert system are available.

Main Features:

- high efficiency: up to 91%
- available for temperatures above 230°F (110°C) according to German TUEV standards or ASME (USA & Canada)
- minimal radiation losses through complete insulation of the entire boiler unit
- resting firebed yields significantly lower emissions
- built-in emergency heat exchanger allows quick operational changes; meets DIN 4751 part 2 (German industrial standard)
- overlapping, pre-stressed grate bars keep fuel from falling through the grate (ash is removed permanently and automatically underneath the grate)
- three-pass flame tube boiler with flue gas temperatures below 374°F (190°C) at full-load
- high wear-resistance due to generously-sized grate surface
- heat output can be gradually varied between 25% to 100% of the rated capacity; low emissions even at partial load



Three-pass flame tube boiler - a back-up oil or gas burner can be added to the cover, swivelling into the flame tube



Add-on soot blower for cleaning heat exchanger



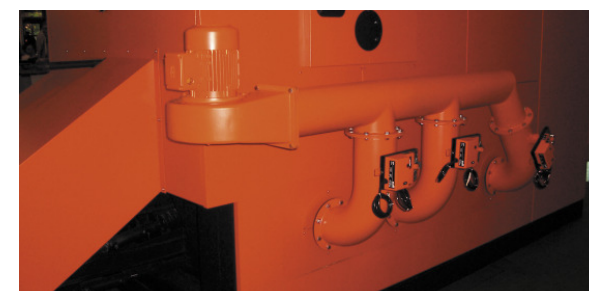
Combustion chamber design - unique multi-sectional insulation and high quality brick refractory lining



View into the combustion chamber with dome-shape brick refractory



Flat moving grate FSB - hydraulically driven (two independently moving sub-grates available for boilers with a nominal capacity of 850 kW / 2.9 MBTU/h and larger)



Hydraulic fuel stoker (left) and controlled primary air distribution (right)

