

We Make Steam

High Efficiency Oil and Gas Fired Packaged Boilers



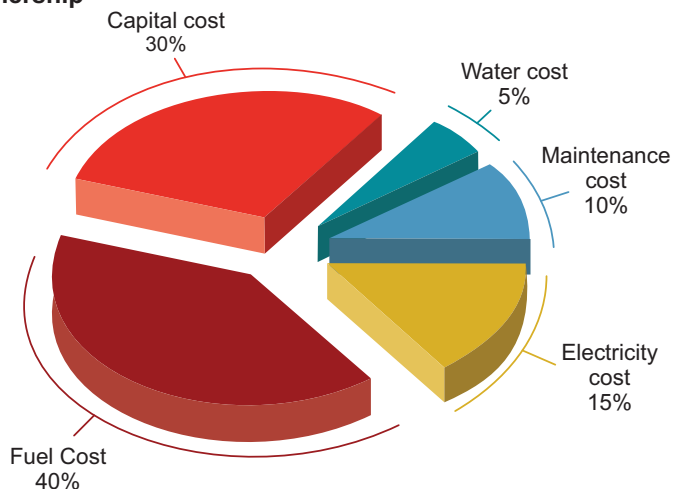
We Make Steam

Steam is the major source of thermal energy for process industry. Steam accounts for 5% to 40% of total processing cost based on the type of industry segment.

Our combined knowledge in combustion and steam engineering helps us build solutions for the complete steam system, beyond boilers.

For over 70 years, we have partnered Industry in providing solutions in steam generation, control instrumentation, energy conservation and environmental monitoring. Our teams of the finest engineers are dedicated to serve process industry across diverse sectors. World class manufacturing facilities and technology enables us to deliver quality solutions globally. Our unique complimentary expertise in steam engineering and process control enables us to engineer customised systems that improve manufacturing processes, conserve energy and are environmentally sustainable.

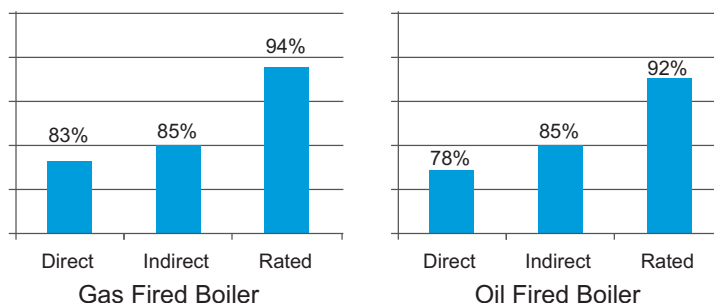
Cost of Ownership



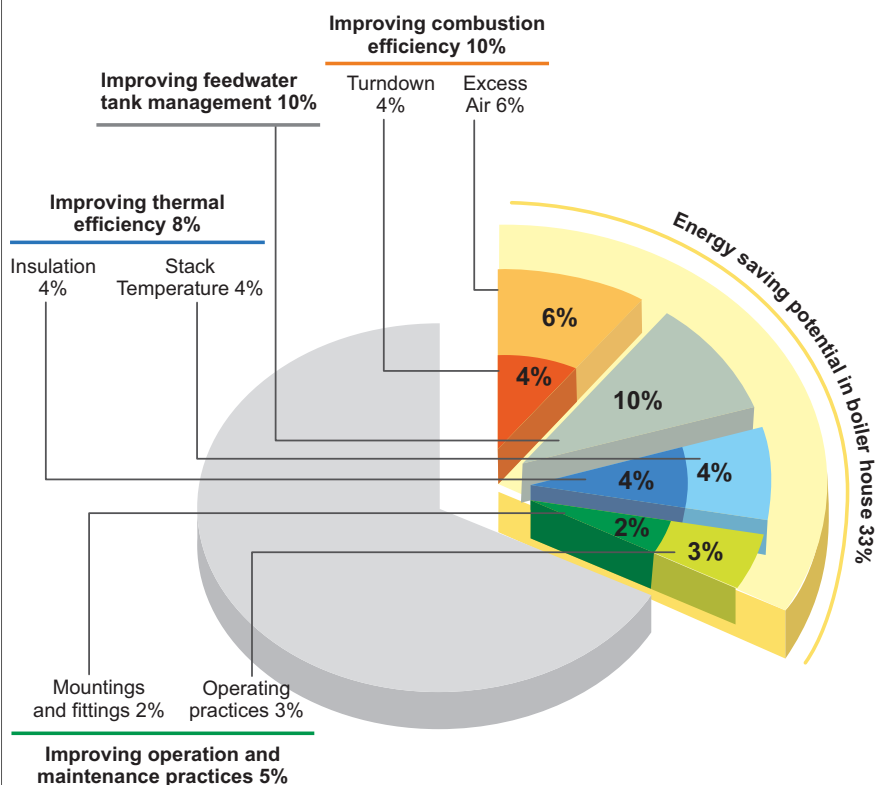
Fuel cost forms a significant proportion of the cost of steam.

Selection of the right boiler ensures high uptime with lowest cost of ownership.

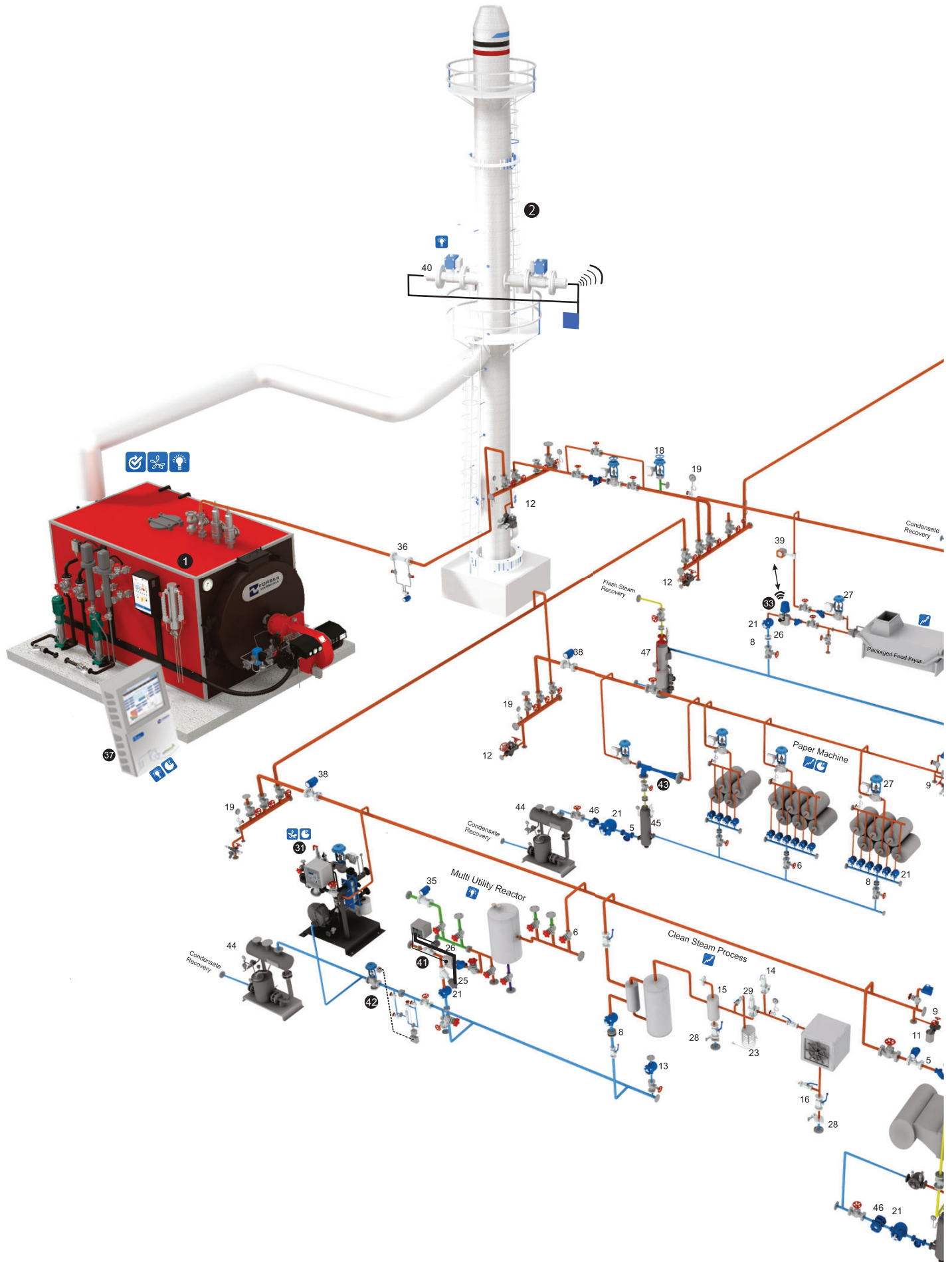
Gaps Between Rated and Indirect Efficiency

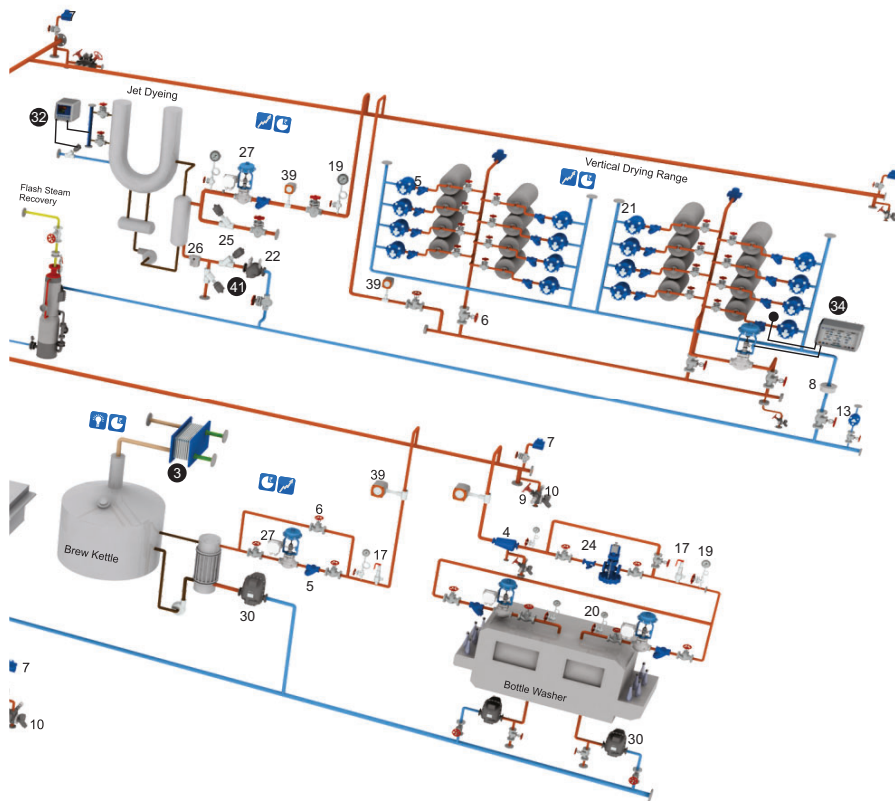


Energy Saving Potential in the Boiler House



The Steam and Condensate Loop





Product Key

Steam Generation

- 1 Oil fired boiler
- 2 Chimney

Heat Recovery Solutions

- 3 Heat recovery systems

Steam Distribution

- 4 Forbes Marshall Moisture Separator
- 5 Forbes Marshall Cast Strainers
- 6 Piston Valves
- 7 Forbes Marshall Air Vent
- 8 Forbes Marshall Disk Check Valves
- 9 Forbes Marshall Pipeline Connector
- 10 Forbes Marshall Universal Thermodynamic Trap
- 11 Forbes Marshall Universal Inverted Bucket Trap
- 12 Compact Module Thermodynamic Trap
- 13 Forbes Marshall Air Eliminators
- 14 Clean Steam Safety Valve
- 15 Clean Steam Moisture Separator
- 16 Ball Valves
- 17 Forbes Marshall Safety Relief Valve
- 18 Desuperheater
- 19 Forbes Marshall Pressure Gauges
- 20 Forbes Marshall Temperature Gauge

Process Control Efficiency

- 21 Single Orifice Float Trap
- 22 Compact Module Two Orifice Float Trap
- 23 Sample Cooler
- 24 Forbes Marshall Pilot Operated Pressure Reducing Valve
- 25 Forbes Marshall Piston Actuated Valves
- 26 Forbes Marshall Sensor Chamber
- 27 Forbes Marshall Control Valves
- 28 Clean Steam Valve
- 29 Clean Steam Pressure Reducing Valve
- 30 Steam Operated Pumping Trap
- 31 HeatMax
- 32 Level Control System
- 33 Wireless Trap Monitoring System
- 34 Moisture Control System

Metering and Monitoring Systems

- 35 Electromagnetic Flowmeters
- 36 Orifice Type Steam Flowmeter
- 37 Boiler Efficiency Monitoring System
- 38 Vortex Steam Flowmeter
- 39 Vortex Steam Flowmeter
- 40 Opacity Monitoring

Condensate and Flash Steam Recovery

- 41 Utility Automation System
- 42 Condensate Contamination Detection System
- 43 Thermocompressor System
- 44 Pressure Powered Pump Packaged Unit
- 45 Forbes Marshall Flash Vessel
- 46 Forbes Marshall View Glass
- 47 FlashJet Pump

Utility Key

- Steam
- Condensate
- Flash steam
- Product / process fluid
- Hot / cold water
- Boiler blowdown
- Water vapour / process fluid vapour

Icon Key



Reliability



Energy Efficiency



Environmental Awareness



Productivity



Ease of Operation

Complete Solutions in Steam Generation

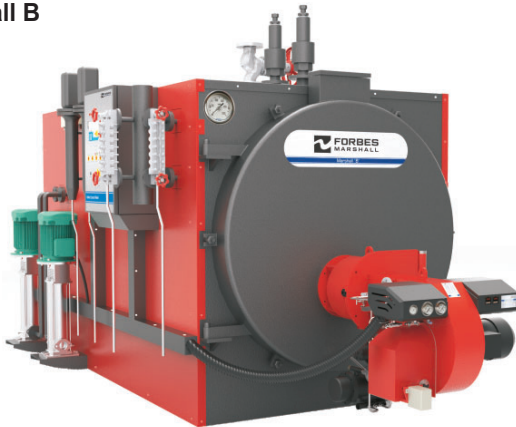
Dynamax and Minimax



Minimax Modular



Marshall B



Modular B



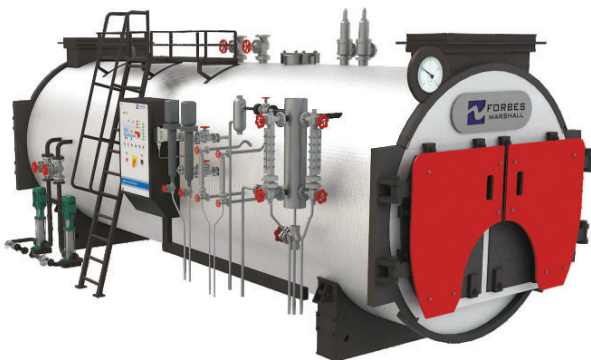
Marshall C



Marshall C Modular



Waste Heat Recovery



Burners



The Efficient Boiler House



High Efficiency

- Boiler and burner perfect match
- Dual insulation
- Online efficiency monitoring system
- Oxygen trim control
- Truly wet back construction
- Heat recovery unit - variable 'Q' technology
- Burner technology - ECR

Combustion and Turndown Ratio

- Turndown of 1:4 on oil and 1:6 on gas
- Electronically modulated air to fuel ratio control
- Suitable for oils with high level of CCR and moisture
- Electronic compound regulation burners, fuel saving by 2-3%
- Ratiotronics for gas modulation

Safety

- Twin water level controllers
- SafetyMax for safety redundancy
- High sinking time
- VPS (valve proving system) for gas firing

Environment

- Compliance to environmental norms
- Equipped with online SPM, Sox, and NOx monitoring system



High Uptime

Reliable components

- Zero leak piston valves
- Vertical multistage centrifugal feed water pump in SS construction.
- Complete instrumentation from Forbes Marshall

Digital fault detection system with data logging

Ease of Installation

Completely packaged construction

Skid mounted, no foundation

Monoblock burner, no foundation required

Packaged modular boiler house

Installation in 72 hours

Pre-wired and factory insulated with no site work

Ease of Operation and Maintenance

Fully automatic and unmanned operation.

Equipped with self-diagnostic systems for trouble shooting

Complete access for maintenance and cleaning

Automatic boiler blowdown control system

Dynamax and Minimax Boilers

Small in size, big on savings

Dynamax and Minimax boilers are compact, efficient oil and gas fired packaged boilers. These boilers offer substantial savings as compared to coil type boilers.

Minimax Modular



Minimax and Dynamax Boilers

Compact Unit : Skid-mounted, pre-wired, ready to steam boiler

Process Benefits : Dry, high quality steam, under fluctuating loads. This results in lower batch timings, higher production rate and better productivity.

Maintenance : Easy accessible parts, low sensitivity to feed water quality and low maintenance

Minimax



Technical Data

Steam Generation Capacity	Kg/hr	300	500	750
Transportation Weight	Kgs	1100	2595	2595
Operating Weight	Kgs	1545	4049	4049
Overall Length	mtr.	1900	2975	2975
Overall Width	mtr.	1600	2405	2405
Overall Height	mtr.	1350	2205	2205
Main Steam Stop Valve	NB	40	40	40
Blow Down Valve	NB	25	25	25
Feed Water line	NB	25	25	25
Flue Gas Outlet Diameter	mm	125	190	190
Flue gas Exhaust Volume	m ³ /hr	300	800	1200
Total Connected Load	kW	2.70	10.50	10.50
Industrial Application	Garment, laundry, R&D centres, kitchen and bakery, pilot plants			

High pressure designs available on request

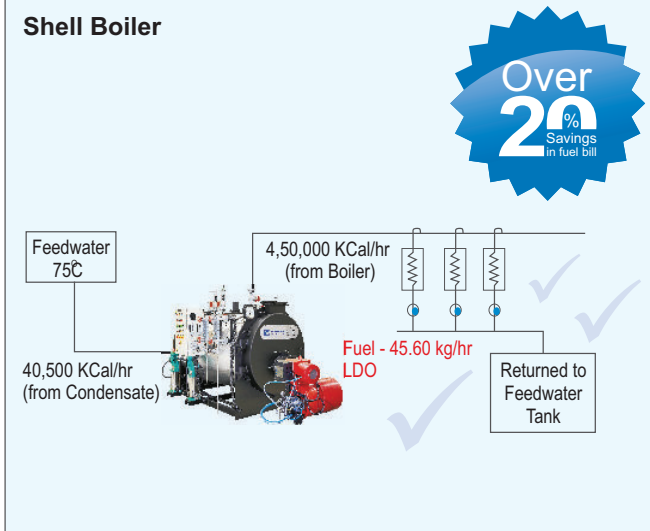
Efficiency as per BS 845 part I on furnace oil at 10.55 kg/cm² on NCV basis

Boilers designed as per EN/ ASME/ code available on request

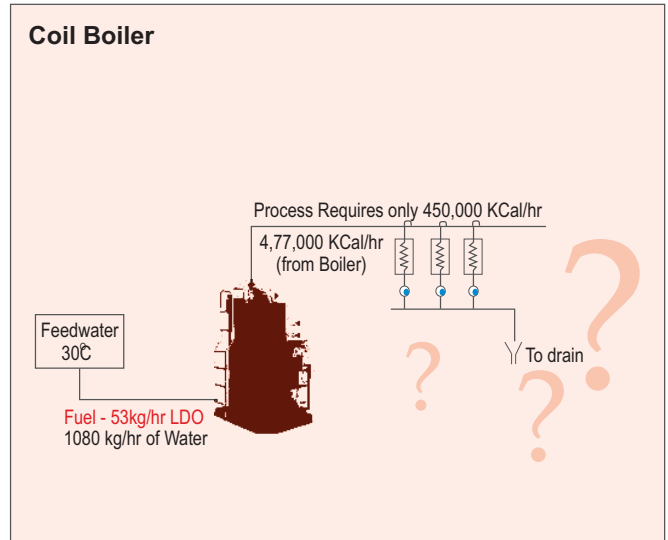
300 kg/hr available in 7 kg/cm² design pressure

Comparison of Coil Type with Dynamax and Minimax Boilers

Shell Boiler



Coil Boiler



Performance Rating Comparison

Response Time	Dynamax and Minimax	Water Tube/ Vertical Boiler
Constant loads	10	8
Fluctuating loads (Batch type)	10	6
Instantaneous loads	10	4
Steam Quality		
Dryness, Cleanliness	10	3
Efficiency		
Boiler	10	10
System Efficiency	10	7
Maintenance		
Boiler	10	4
System	10	2
Safety	10	7
Space Requirement	8	10
Statutory Regulations	6	10
Water Quality	10	7
Condensate return	10	0
Fuel Adaptability	10	7
Cost	8	10

Feature	Dynamax / Minimax	Coil Type Boilers
Number of passes	3	Single pass
Water holdup	1.454 m ³	0.22 m ³
Steam space	0.22 m ³	Nil

Process Benefits

Response to fluctuating loads: High water holdup and steam space provide necessary thermal flywheel to respond to sudden surge loads of process and deliver dry steam.

Batch time: Dynamax and minimax boilers generate 98% dry saturated steam that ensures superior heat transfer and reduced batch time. Coil type boilers have dryness fraction of 60-80% which adversely affects productivity.

Product Quality: Most process plants require right quality of steam (pressure and dryness fraction) to ensure desired heating rates and gradients.

Dynamax and Minimax boilers supply right quality of steam under varying process conditions.

Cost of Ownership

Parameter	Dynamax / Minimax	Coil Type
Average life	18-20 years	7-8 years
Replacement of pressure parts	Rare	Every 3 years
Condensate return	100%	Nil
Scaling of downstream equipment	No (dry steam)	Yes (wet steam)
Efficiency	86%	65-76%*

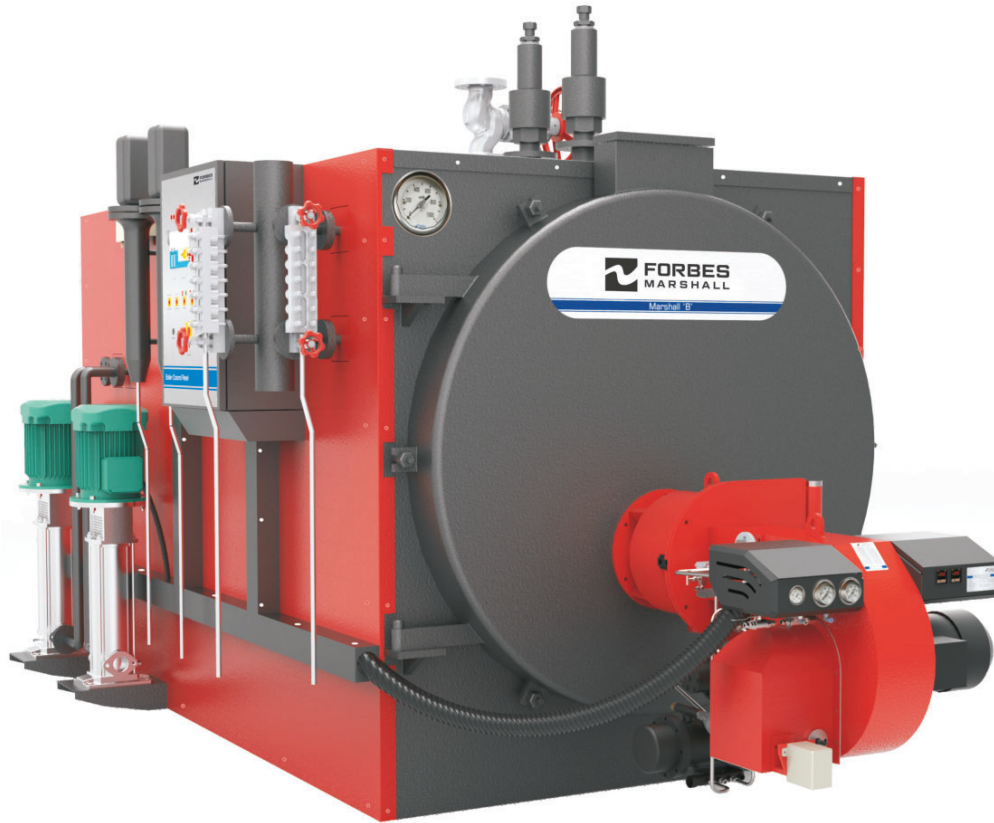
* practical operating efficiency

Marshall B and C Boilers

Truly packaged, three pass, oil and gas fired boilers

Marshall B and Marshall C Boilers are truly packaged with minimum site work, designed for easy maintenance and operation with access to all working parts. Boilers are skid mounted and eliminate civil work.

Marshall B



Marshall C



Technical Data

Steam Generation Capacity	Transportation Weight	Operating Weight	Overall Length	Overall Width	Overall Height	Main Steam Stop Valve	Blow Down Valve	Feed water line	Flue Gas Outlet Diameter	Flue Gas Exhaust Volume	Total Connected Load
Kg/hr	Kgs	Kgs	mtr.	mtr.	mtr.	NB	NB	NB	mm	m ³ /hr	kW
1120	4050	5910	3605	2455	2230	50	25	25	230	1790	17
1500	3720	6184	3750	2230	2450	80	25	25	305	2390	19
2000	5870	8837	4250	2450	2450	80	25	25	305	3190	19
2500	7400	12035	4190	3055	3055	80	40	40	355	3990	27
3000	7780	12600	4875	3070	2700	100	40	40	380	4900	30
3500	8000	15000	5065	3105	3105	100	40	40	400	5580	30
4000	8650	15800	5460	3260	2900	100	40	40	425	6550	30
5000	13200	22200	5755	3375	3190	125	40	40	485	8200	43
6000	15150	25220	6100	3850	4040	125	50	50	535	9800	48
8000	20500	34146	7000	4200	4200	150	50	50	635	12750	60
10000	23600	39910	7450	4350	4350	150	50	50	685	15940	75
12000	27500	47326	8100	4450	4450	200	50	50	750	19120	85
14000	32800	56045	8100	4700	4700	200	50	50	815	22310	117
15000	34300	58798	8200	4800	4800	200	50	65	840	23900	124
16000	37500	63785	8400	5000	5000	200	50	65	880	25500	135
18000	44000	75000	7000	5000	5600	250	50	65	500 x 700	29400	139
20000	45500	82500	8200	5200	5600	250	50	65	500 x 700	32700	145

Industrial Application

Packaged food, beverage and brewery, hospitality, tyre, oil and petrochemical, paper and corrugation board, textiles, pharmaceuticals, infrastructure

High pressure designs available on request

Efficiency as per BS 845 Part 1 on furnace oil at 10.54 kg/cm² on NCV basis

Boilers designed as per EN/ASME code available on request

(Above data is for 10.54 kg/cm²)

Standard Efficiency

Oil : 89% without HRU / 92% with HRU

Gas : 89% without HRU / 95% with HRU

NCV

FO : 9650 Kcal/kg

NG : 8500 Kcal/sm³

HSD : 10500 Kcal/kg

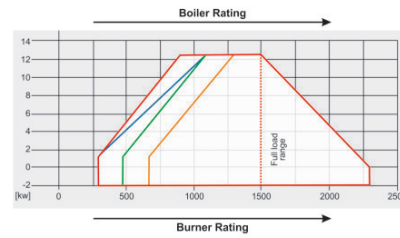
Features and Benefits of Skid Mounted Marshall B and C Boilers

Monoblock burner



No civil work. Integrated combustion unit, blower, heating and pumping unit.

High turndown



Boiler and burner perfect match.

Equipped with online efficiency monitoring



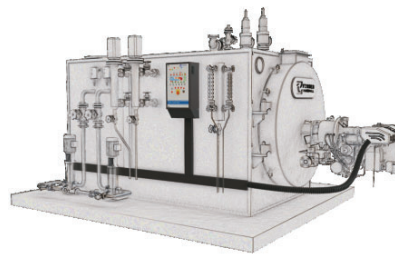
Continuous monitoring and control for rated operational efficiencies.

Skid mounted



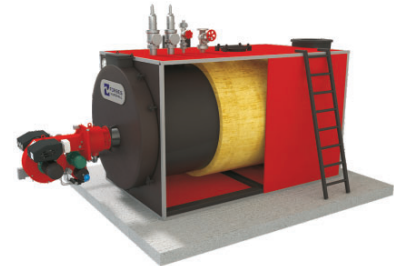
No civil foundation. Simple PCC.

Pre-wired



Pre-wired at factory, no site cabling.

Pre-insulated



Factory insulated and cladded for high quality and minimum radiation losses.

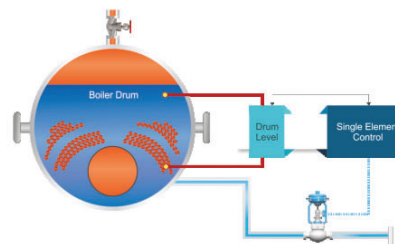
High quality mounting and accessories



Forbes Marshall make mountings and fittings

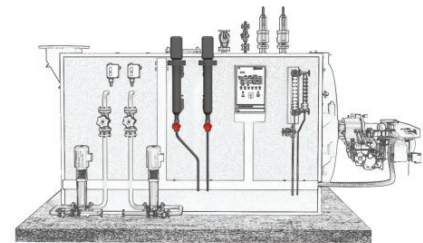
- Disc check valve
- Zero leak piston valve
- Full lift safety valve

Single element drum control



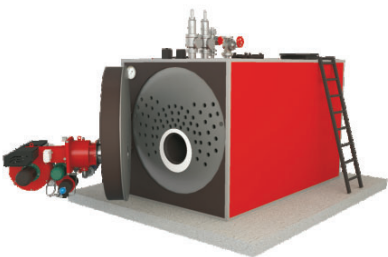
Reduced thermal stresses.
Dry steam under fluctuating loads.

Twin water level controller



Superior operating dryness fraction of 98%.
Minimises swell and shrink effect.

Ease of maintenance



Complete access to all parts without dismantling.

Feedwater pump



Vertical multi stage centrifugal pump with high reliability and low maintenance.

Burners



High turndown, low maintenance.

*Single element drum level control standard for 8.0 TPH and above boiler

*Piston valves glandless class VI shut off

Modular Boiler House
Packaged and ready to fire

Modular boiler house is not just a boiler but a complete boiler house that is ready to fire with integrated feedwater tank and oil tank. Completely equipped with all instrumentation and controls.

Modular B



Modular C



Duplex Modular B



Benefits of Modular Boiler over Standard Boiler

20% more compact

15% savings in cost on site jobs

80% reduction in erection time

Benefits of Modular Boiler over Conventional Boiler

Scope Description	Forbes Marshall Modular Boiler	Standard Boiler
Boiler with Burner		
FD Fan and oil pump	✓	✓
Insulation and cladding of boiler	✓	✓
Control panel for boiler	✓	✓
Power and control cabling from control panel to boiler instruments	✓	X
Cable trays and supports	✓	X
Skid for boiler foundation	✓	*Civil
Tanks		
Feed water tank and day oil tank with inlet/outlet valves Thickness 5mm insulation and cladding of the tanks	✓	*Site fabricated
Tank Instrumentation		
Level indication and control for feed water deaerator head (SS304) Vent head, outflow heater for day oil tank, level gauge and level controller for day oil tank	✓	*Bought out
Supports and Structure		
Supports for feed water tank and day oil tank Platform, ladder, railing for the tanks Support for control panel and feed water and day oil piping Common skid for FWT and DOT	✓ Skid provided	*Site fabricated Skid provided
Interconnecting Piping		
Interconnecting piping between FWT, DOT and boiler Strainers / isolation valve for FW pump suction Duplex filter	✓	*Site fabricated
*Extra cost will be incurred at site		

Boiler Capacity (Kg/hr)	500-750	1000-1100	1500-2000	2800	3000	3500	4000-4500	5000	6300
Boiler height	2200	2300	2500	3100	3100	3250	3250	3500	3900
Boiler with tank height	5000	5900	6150	5650	5500	5600	5750	5700	6800
Width	2500	3000	3200	4200	4500	4800	5000	5200	5600
Length	3300	3900	4500	4500	5100	5200	5500	6100	6500
Capacity feed water tank	1800	2200	4000	6060	6280	7250	9155	10400	13330
Capacity day oil tank	300	700	1120	1580	1710	2000	2530	2820	4100

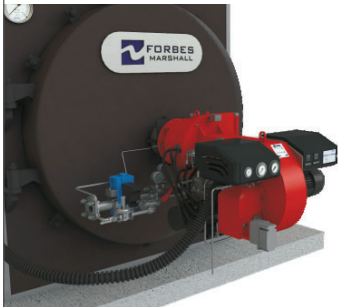
High pressure designs available on request
Efficiency as per BS 845 part I on furnace oil at 10.55 kg/cm² on NCV basis
Boilers designed as per EN/ ASME/ code available on request

Electronic Compound Regulation Burners

State of the Art Burner Technology for Efficient Combustion



Boiler and Burner Perfect Match

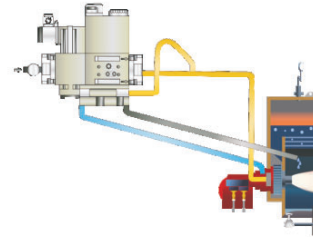


Ease of Setting LCD Display

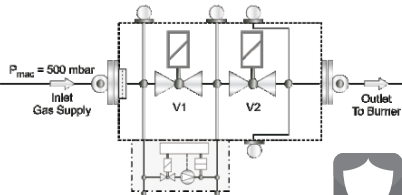
NORMAL OPERATION	
Step 1: Close Damper	20.00 19.98
Step 2: On/Off/Up/Down Temp	
Step 3: Open Damper	70.00 69.22
Step 4: Pre Purge	20
Step 5: Set Damper	14.00 14.54
Step 6: Set Fuel	0.00 0.00
Step 7: Ign. (sec)	5
Step 7: Ign. + Fuel (sec)	0
Step 8: Normal Firing	
Step 9: Open Damper	70.00 0.00
Step 10: Post Purge (sec)	20
Controls	



Ratiotronics



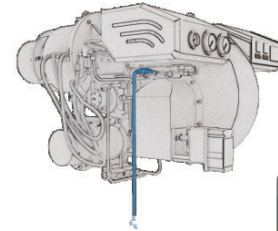
Valve Proving System



Two Stage Ignition



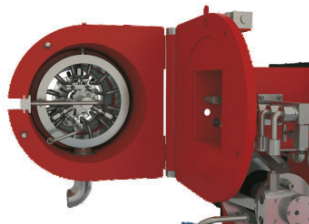
Auto Moisture Drain



Ease of Maintenance



Hinge Design



Self Controlled Combustion Head



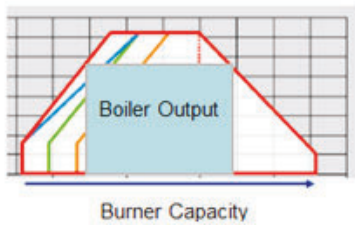
Electronic Progressive Modulation Burner

The quality of atomisation in multistage progressive modulating burners remains constant at varying loads

Superior atomisation and enhanced turndown



High turndown - 1:4



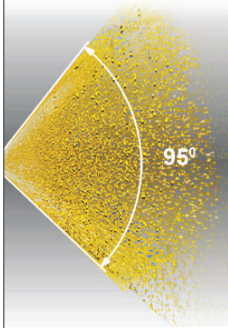
Fully automatic complete load regulation through sequence programme



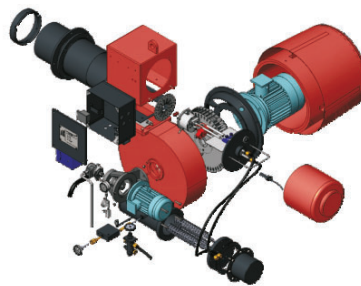
Soot free burner. Superior atomisation minimum soot and smutting



Fine atomisation

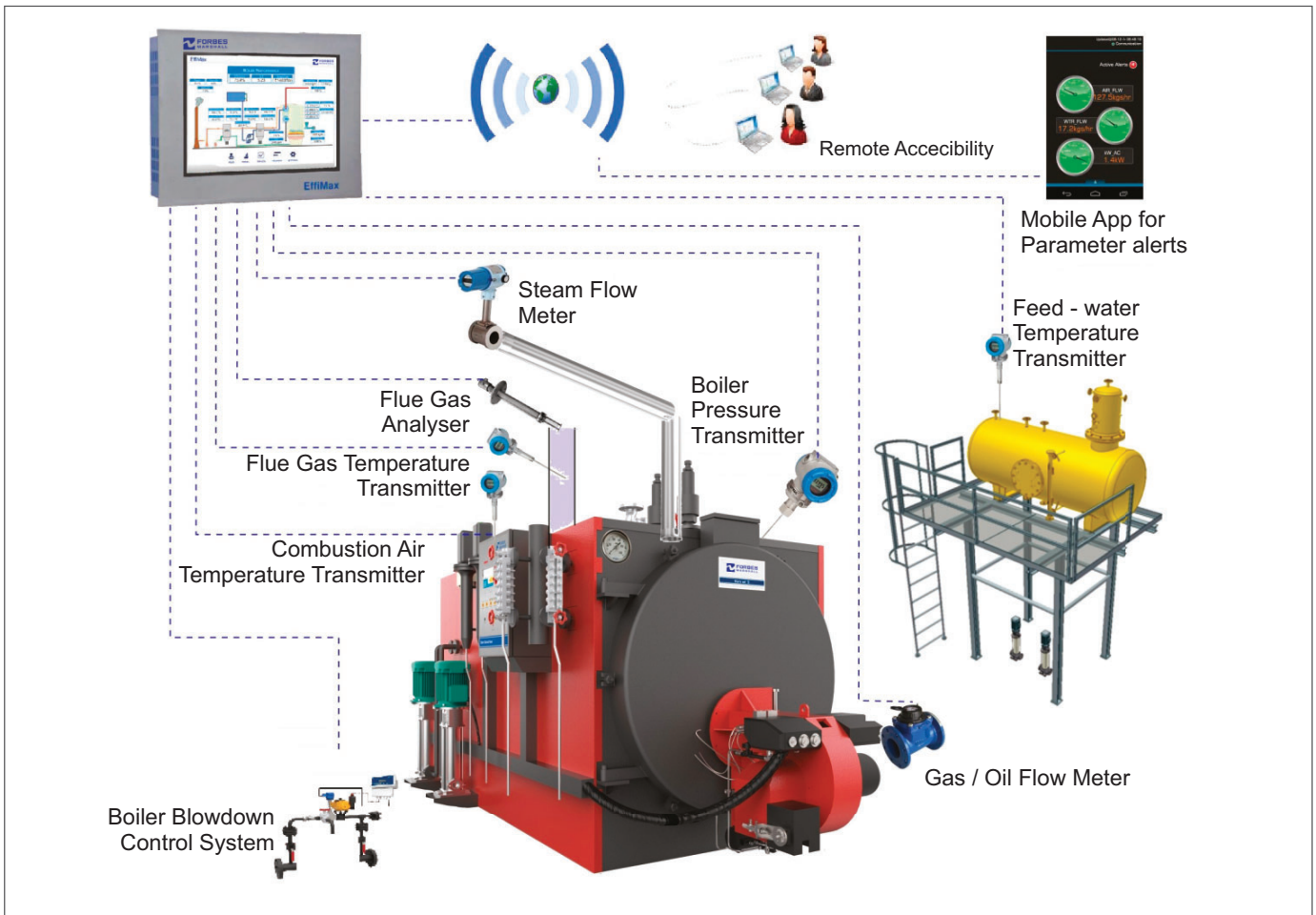


Simple construction and ease of maintenance



EffiMax
Efficiency Monitoring System

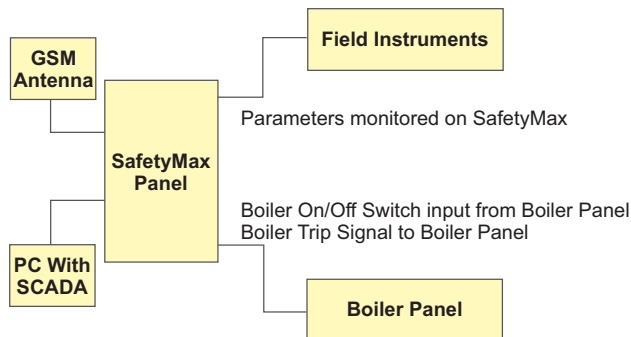
A complete solution that helps improve boiler efficiency and reduce steam cost.



EffiMax System	Direct Efficiency	Indirect Efficiency	Blowdown Control	Trim Control
1000	Provided	Not Provided	Not Provided	Not Provided
2000	Not Provided	Provided	Provided	Not Provided
3000	Provided	Provided	Provided	Not Provided
4000	Provided	Provided	Provided	Provided

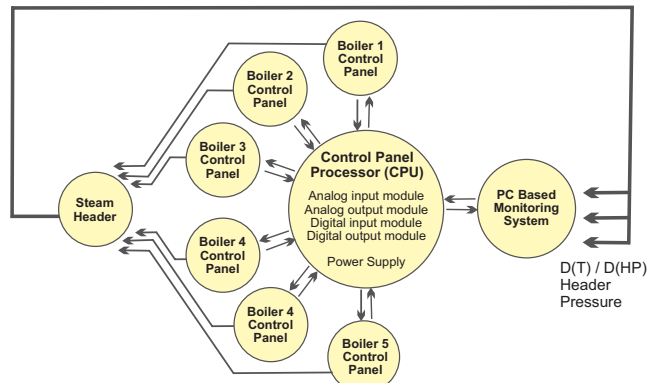
SafetyMax

The Forbes Marshall SafetyMax is a safety monitoring system for boilers. It inspects all the critical safety related instrumentation and gives one complete picture of the safety of the boiler operation.

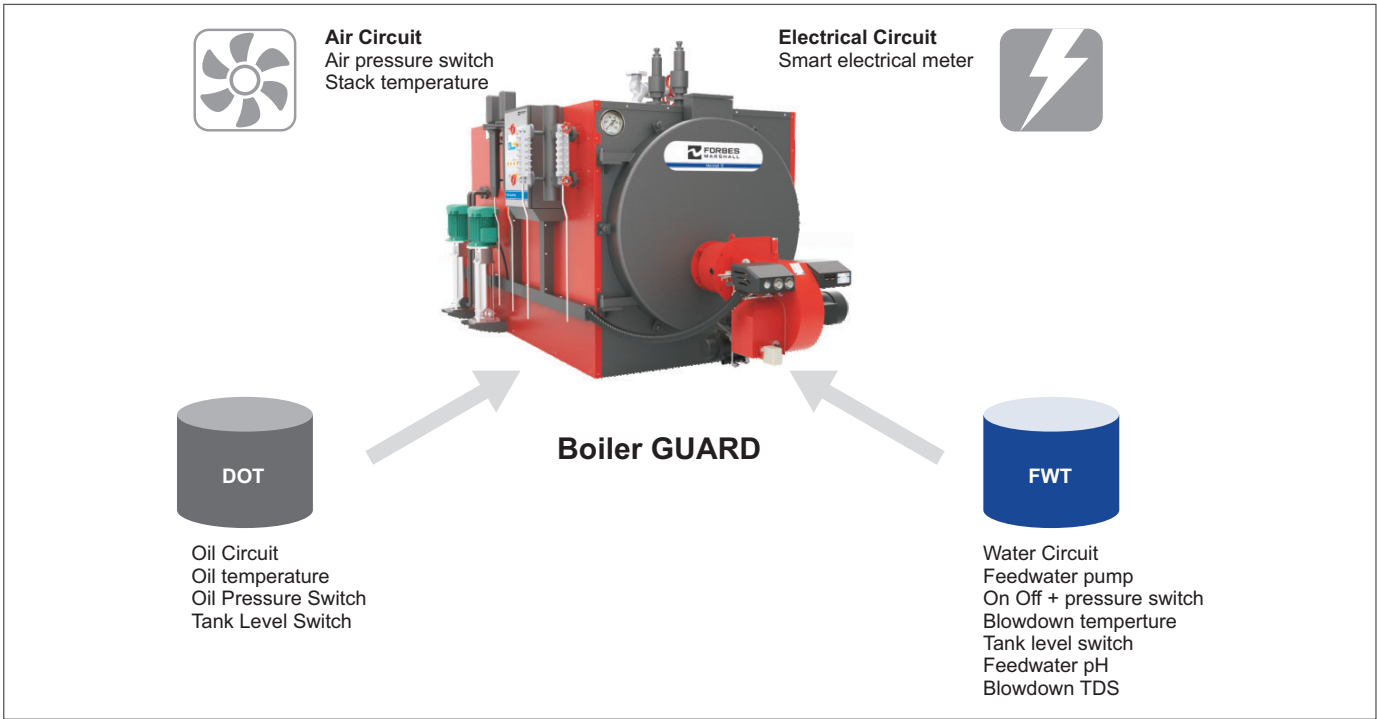


Boiler Load Management

Operating multiple boilers at best efficiency. A system that enables boilers to talk to each other.



Boiler GUARD
Predict | Prevent | Perform



Web Based for Motoring and Events Analysis

Dashboard

Reports

Trends

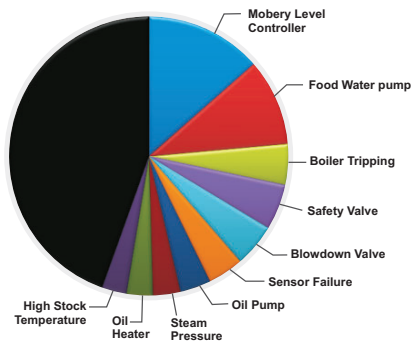
Alarms

Mobile Alerts

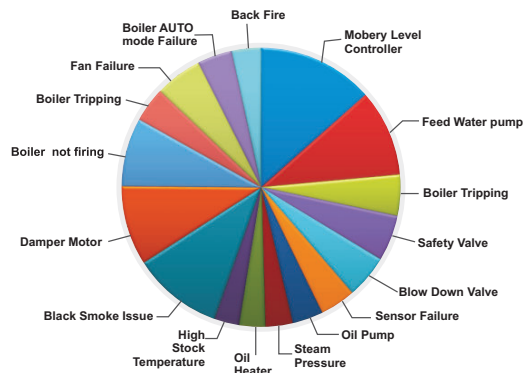
GET IT ON
Google Play

Available on the
App Store

60% Increase in Uptime Through Boiler Identification and Prediction



Typical Shutdown in Boiler House



Complete Turnkey Projects Execution



Retrofit and Modernisation

Skilled Service Engineers



Proactive Inspection



Knowledge and Training



Modernisation of Boiler Plant



Retro Fit of Burners



Root Cause Analysis



World Class Manufacturing



A Legacy of Partnership, Spanning over 70 Years

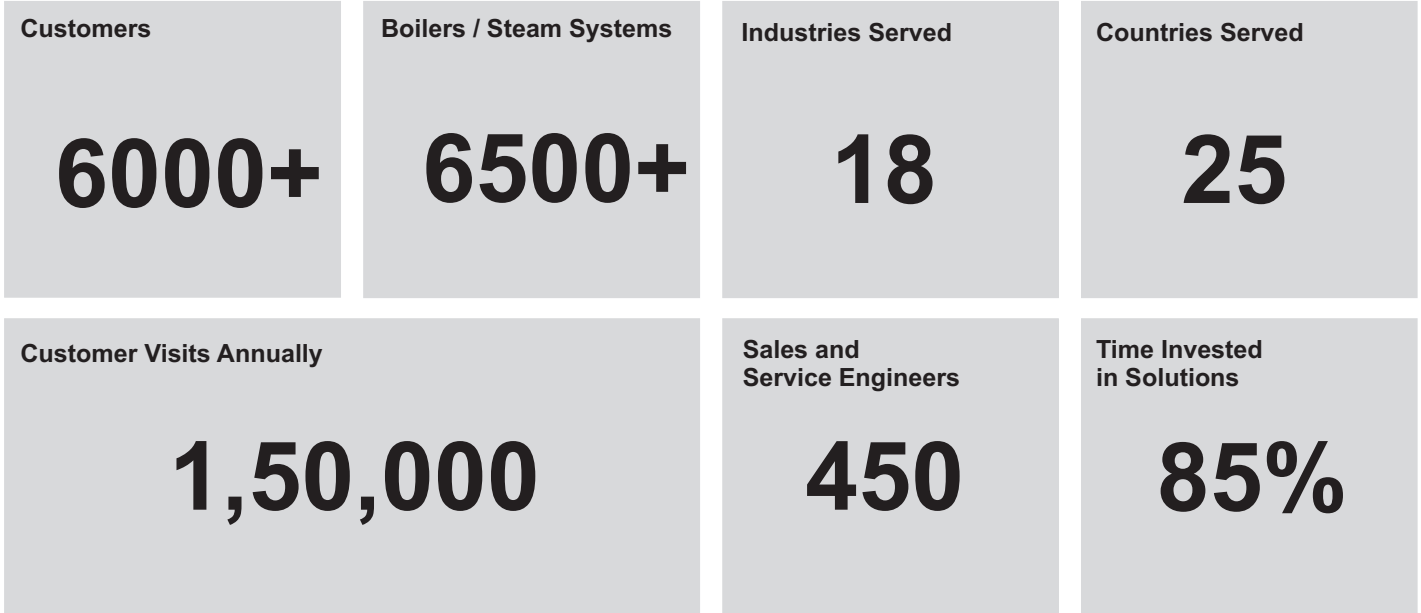
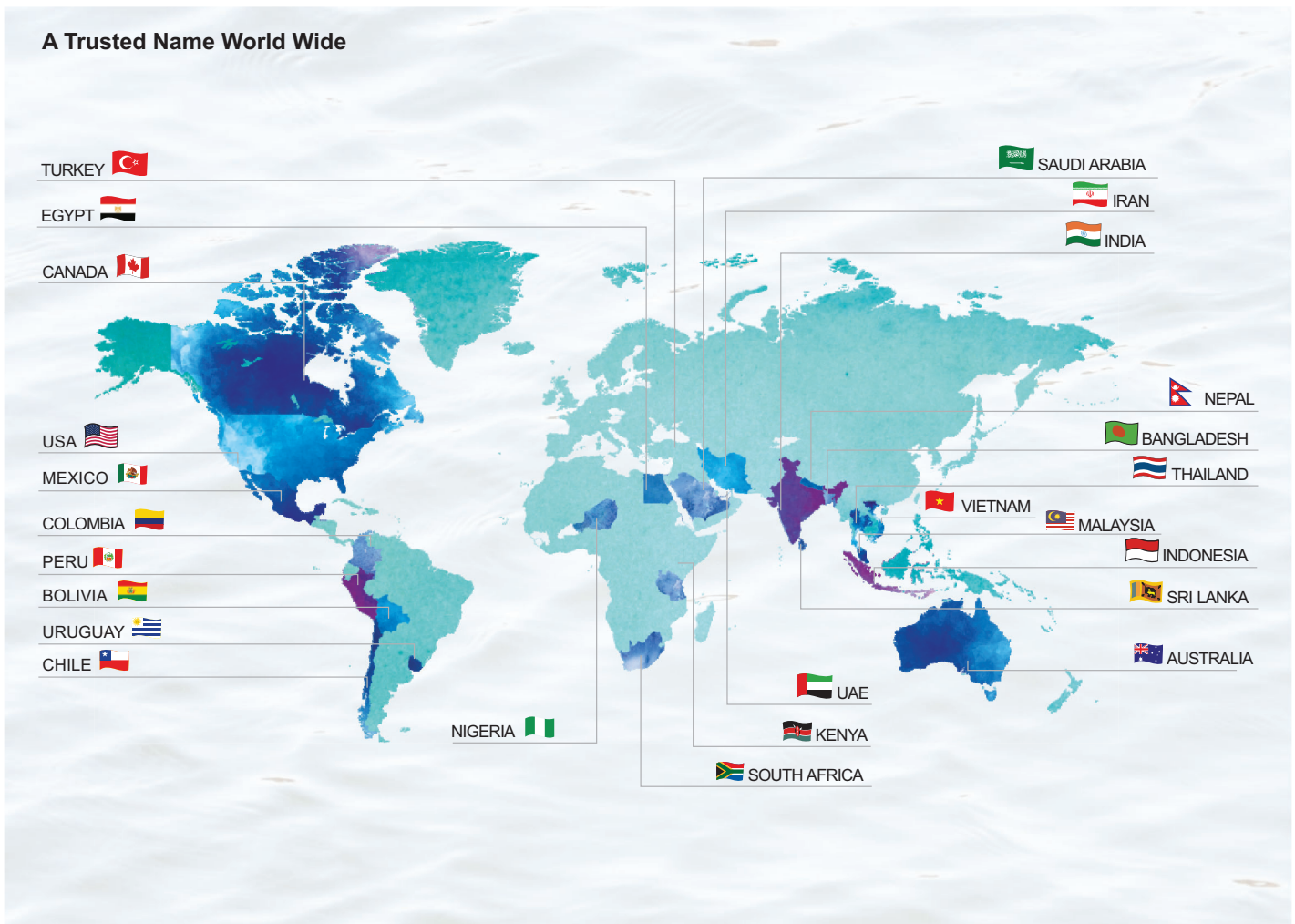
Amul Factory, 1955



Amul Factory, 2015



A Trusted Name World Wide



Forbes Marshall
Krohne Marshall
Forbes Marshall Arca
Codel International
Forbes Solar
Forbes Vyncke
Forbes Marshall Steam Systems

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