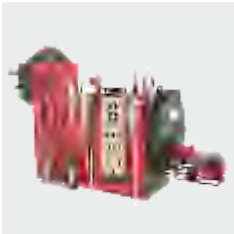
FORBES MARSHALL

Efficient Steam Generation

Fully packaged oil and gas fired boilers

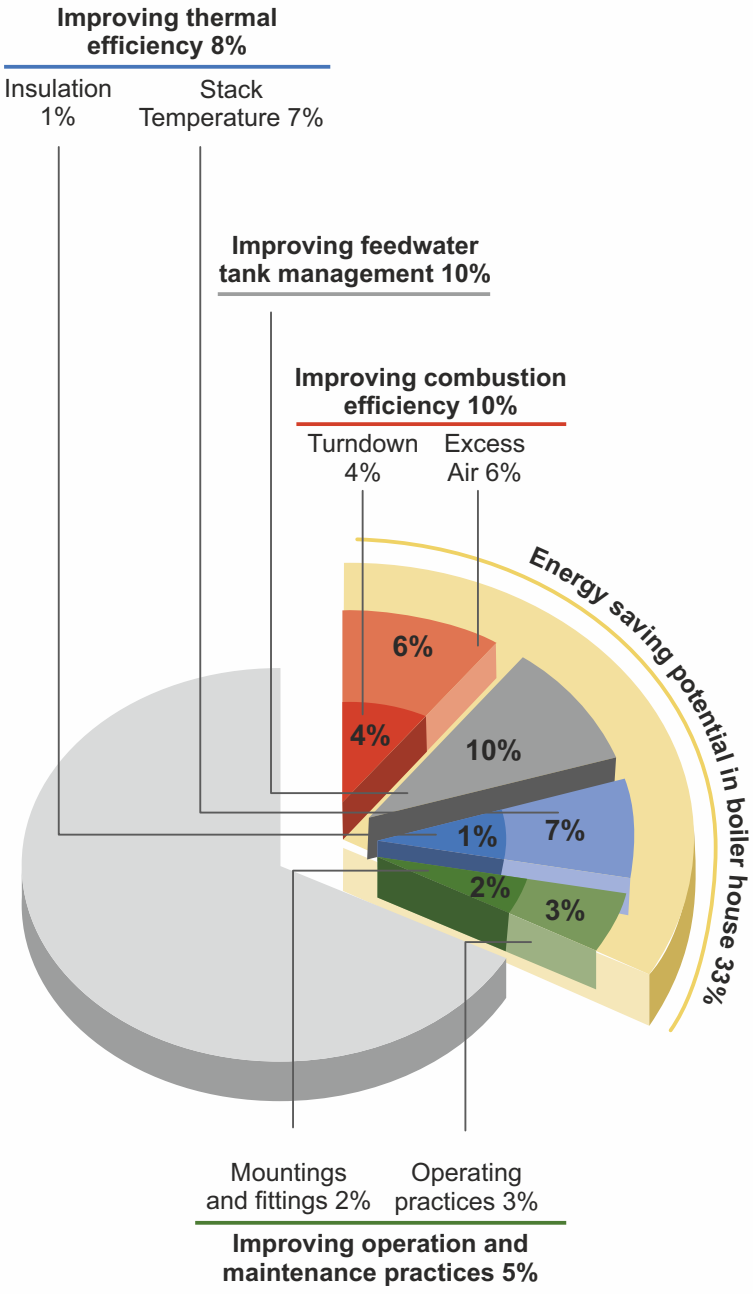


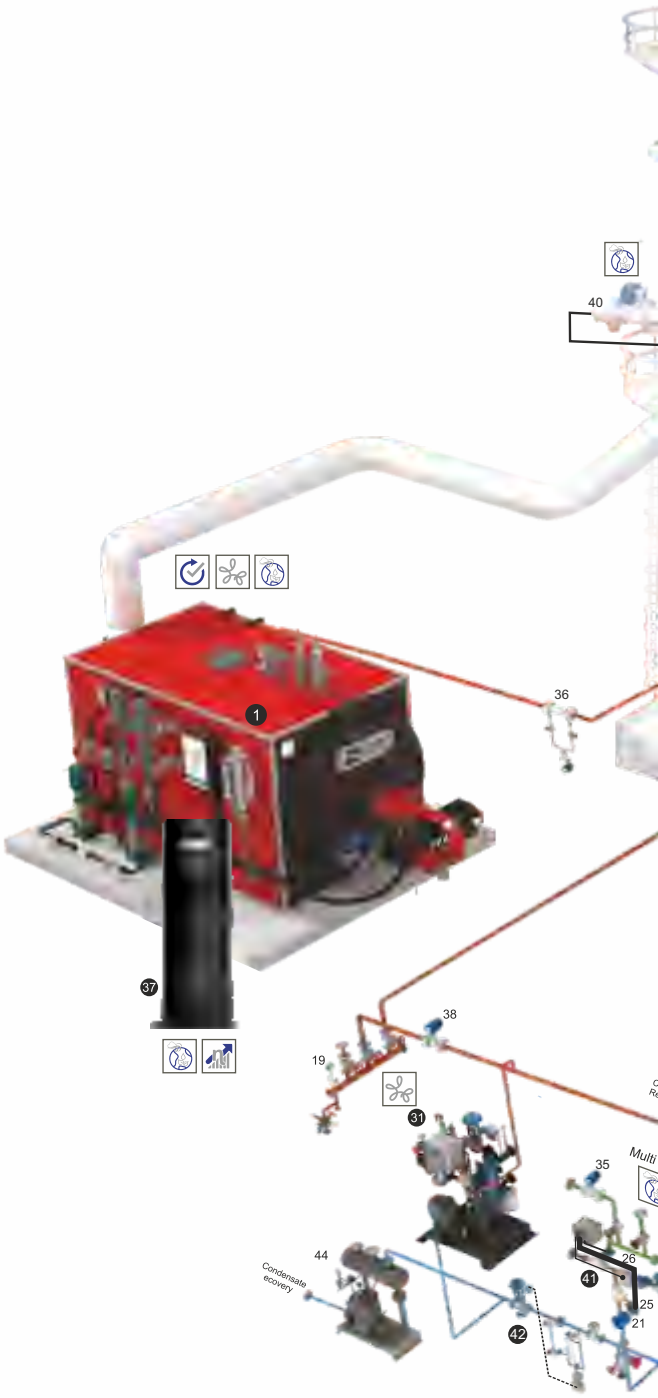
Efficient Steam Generation

For 80 years Forbes Marshall has been providing innovative steam generation solutions to help business reduce their cost of energy, improve production quality with high levels of reliable operations.

Our continued knowledge of combustion & steam engineering helps us build solutions for efficient, safe and environment compliant steam generation solutions.

Energy Saving Potential in the Boiler House





Icon Key

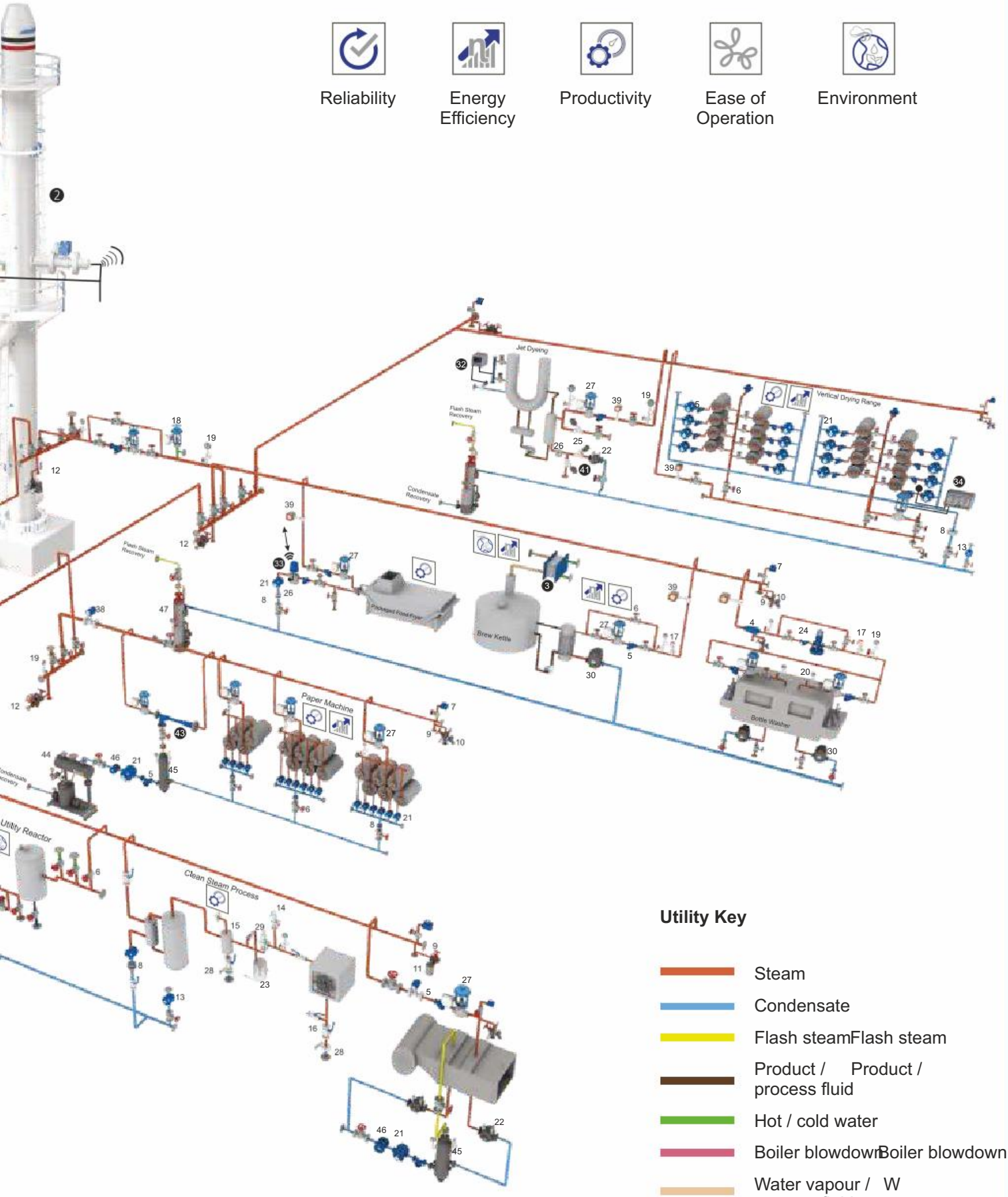
Reliability

Energy Efficiency

Productivity

Ease of Operation

Environment



Utility Key

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

Our Oil and Gas Fired Range

Dynamax and Minimax

Minimax Modular

Marshall B

Marshall B Modular

Duplex Modular B

Marshall BG

Our Oil and Gas Fired Range

Marshall BG Modular

Marshall C

Marshall CG

Marshall C Modular

Marshall F (Floating Furnace)

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

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

Features and specifications will vary based on product configuration

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

Capacity : 500 and 750 kg/hr (F&A 100°C)

Pressure range : 10.55, 14.50,17.50 kg/cm^{2}g

Dynamax and Minimax 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

Dynamax

Capacity : 300 kg/hr (F&A 100°C)

Pressure range : 7 kg/cm^{2}g

Technical Data

Steam Generation Capacity (F&A 100°C)	Kg/hr	300	500	750
Transportation Weight	Kgs	1100	2595	2595
Operating Weight	Kgs	1545	4049	4049
Overall Length	mm	1900	2975	2975
Overall Width	mm	1600	2405	2405
Overall Height	mm	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	m³/hr	300	800	1200

Fuel Consumption As Per Capacity

Boiler capacity in kg/hr (F&A 100°C)		300	500	750
Estimated Fuel consumption, without HRU / with HRU	HSD in kg/hr	18/NA	30/NA	45/NA
	LDO in kg/hr	18/NA	30/NA	45/NA
	FO in kg/hr	NA	31/NA	47/NA
	NG in sm3/hr	22/NA	36/34	54/51
	LPG in kg/hr	17/NA	28/26	41/39

High pressure designs available

Boilers designed as per BS code are available.

Fuel Calorific Value (NCV):

FO : 9650 Kcal/kg

HSD : 10200 Kcal/kg

LPG : 11000 kcal/kg

NG : 8500 Kcal/sm³

LDO : 10100 Kcal/kg

LSHS : 9500 Kcal/kg

** FO & LSHS - NA for Dynamax

Efficiency as per BS845 Part I, on NCV basis

For 300 kg/hr : 88% on NCV basis, available in 7 kg/cm^2 g design pressure

For 500 - 750 kg/hr : 89% on NCV basis, For Pressure range to be 10.55,14.50,17.50 kg/cm^{2}g

For 500 - 750 kg/hr : 94% on NCV basis with HRU (Applicable for NG & LPG only), For Pressure range to be 10.55,14.50,17.50 kg/cm2 g

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 thereby eliminating the need for civil work.

Marshall B

Capacity : 1.12 TPH to 5 TPH (F&A 100°C)
Pressure range : 10.55, 14.50, 17.50 kg/cm^{2}g

Marshall C

Capacity : 6 TPH to 16.8 TPH (F&A 100 Deg C)
Pressure range : 10.55, 14.50, 17.50 kg/cm^{2}g

Boilers with Integral Economiser

Marshall BG and CG Boilers

Marshall BG (patented) and Marshall CG Boilers are truly packaged with 4th pass integral economiser. The boilers are skid mounted with minimum site work.

Marshall BG

Capacity : 1.12 TPH to 5 TPH (F&A 100ºC)

Pressure Range : 10.55, 14.50, 17.50 kg/cm^{2}g

Fuel Suitability : HSD, NG, LPG, FO

Feed water temperature to be maintained at 70°C

Efficiency :
93% with Economiser on Oil

95% with Economiser on Gas

Marshall CG

Capacity : 6 TPH to 16 TPH (F&A 100ºC)

Pressure range : 10.55, 14.50, 17.50 kg/cm^{2}g

Fuel Suitability : HSD , NG , LPG, FO

Feed water temperature to be maintained at 70°C

Efficiency :
93% with Economiser on Oil

95% with Economiser on Gas

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.

Marshall B Modular

Marshall C Modular

Marshall BG Modular

Duplex Modular B

Benefits of Modular Boiler over Conventional Boiler

20% more compact

15% savings in cost on site jobs

80% reduction in erection time

Scope Description	Forbes Marshall Modular Boiler	Conventional 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
**Excluded for 6 TPH

Boiler Capacity (Kg/hr, F&A 100°C)	Unit	500-750	1120	1500	2000	2500	3000	3500	4000-4500	5000	6000
Boiler height (With 150 mm Foundation and Platform)	mm	2300	2500	2600	2650	5800	5700	6000	6000	5800	7000
Boiler with tank height	mm	5100	5600	5600	5600	3250	3100	3400	3500	3700	3900
Width with tank	mm	2500	3500	4200	4200	4900	4600	5000	5200	5200	6300
Length	mm	3200	3900	4200	4500	4700	4900	5200	5500	6000	6800
Capacity Feed water Tank	KL	1.8	2.7	3.85	4.4	6.35	6.5	7.35	9.7	11	12.9
Capacity Day oil Tank	KL	0.34	0.85	1.3	1.3	1.7	1.8	2	2.7	3	4

High pressure designs available

Efficiency as per BS 845 Part I , on NCV basis

Boilers designed as per BS code are available.

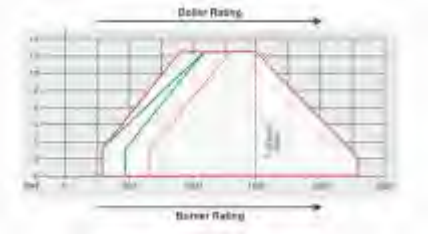
Features and Benefits of Skid Mounted Marshall B and Marshall C Boilers

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

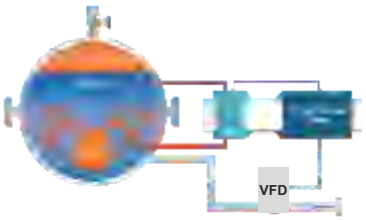
Factory insulated and cladded for high quality and minimum radiation losses.

High quality mounting and accessories

Forbes Marshall make mountings and fittings
- Disc check valve
- Zero leak piston valve
- Full lift safety valve

Single/Two/Three element drum level control

Reduced thermal stresses.
Dry steam under fluctuating loads.



Heat recovery unit

Higher operating efficiency
Oil - 93% Gas - 95%

Ease of maintenance

Complete access to all parts without dismantling.

Feedwater pump

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

ECR-P/A

High turndown, low maintenance.

ECR-P

ECR-AM

*Single element drum level control standard for 8.0 TPH and above boiler
*Piston valves glandless class VI shut off

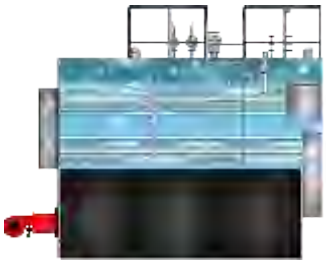
Marshall F (Floating Furnace Boiler)

Floating furnace boilers are truly packaged with minimum site work, designed for high pressure and high capacities with ease of maintenance and operation. Boilers are skid mounted thereby eliminating the need for civil work.

Features and Benefits of Marshall F boiler

4 Pass Design

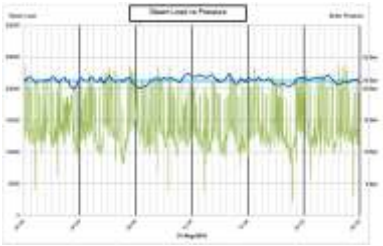
Two radiation passes and two convective passes



Rapid Steam Generation

Stable pressure under fluctuating loads

Reduced start up time by 35%



Environment Friendly

Lower adiabatic temperatures

Average furnace temperature lower by 6 - 10%

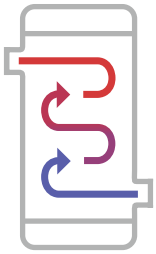
Low NOx emission levels

Efficient Heat Transfer

40% Higher furnace volume

75% Radiation heat transfer

Higher efficiency by 1.5 to 2 %



Floating Furnace

Lower thermal stresses and enhanced life of pressure parts

Low volumetric heat release rates

Skid Mounted

No civil foundation

Simple PCC

Pre-insulated

Factory insulated and cladded for high quality and minimum radiation losses

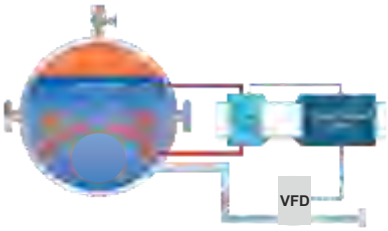
Equipped With Automatic Blowdown Control

Controlled drum TDS, reduced scaling and saving of 1% in fuel bill

Single/Two/Three element drum level control

Reduced thermal stresses

Dry steam under fluctuating loads

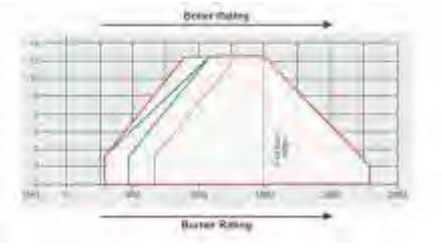


Feedwater Pump

Vertical multi stage centrifugal pump with high reliability and low maintenance

High Turndown

Boiler and burner perfect match



Equipped With Online Efficiency Monitoring

Continuous monitoring and control for rated operational efficiencies

Technical Data

Type Of Boiler	Steam Generation (F&A 100°C)	Transport-ation weight	Operating weight	Overall Length	Overall Width	Overall Height	Main Steam	Blow Down	Feed Water Line	Flue Gas Outlet	Flue Gas Exhaust
	Kg/hr	Kgs	Kgs	mm	mm	mm	NB	NB	NB	mm	m^3/hr
	1120	4050	5910	3605	2455	2230	50	25	25	230	1790
	1500	3720	6184	3750	2230	2450	80	25	25	305	2390
	2000	5870	8837	4250	2450	2450	80	25	25	305	3190
Marshall B	2500	7400	12035	4190	3055	3055	80	40	40	355	3990
	3000	7780	12600	4875	3070	2700	100	40	40	380	4900
	3500	8000	15000	5065	3105	3105	100	40	40	400	5580
	4000	8650	15800	5460	3260	2900	100	40	40	425	6550
	4500	11200	19200	5500	3500	3500	100	40	40	455	7170
	5000	13200	22200	5755	3375	3190	125	40	40	485	8200
	6000	15150	25220	6100	3850	4040	125	50	50	535	9800
	8000	20500	34146	7000	4200	4200	150	50	50	635	12750
	10000	23600	39910	7450	4350	4350	150	50	50	685	15940
Marshall C	12000	27500	47326	8100	4450	4450	200	50	50	750	19120
	14000	32800	56045	8100	4700	4700	200	50	50	815	22310
	15000	34300	58798	8200	4800	4800	200	50	65	840	23900
	16000	37500	63785	8400	5000	5000	200	50	65	880	25500
	18000	44000	75000	7000	5000	5600	250	50	65	500 x 700	29400
	20000	45500	82500	8200	5200	5600	250	50	65	500 x 700	32700
Marshall F	25000	52000	80000	112000	4200	6650	250	50	50	615 X 1515	26216
	30000	56000	84000	12000	4200	7200	300	100	100	715 X 2015	31436
	35000	60000	90000	12000	4200	7300	300	100	100	715 X 2015	36675

Fuel Consumption As Per Capacity

Boiler capacity in kg/hr (F&A 100°C)		1120	1500	2000	2500	3000	3500	4000	4500	5000	6000	8000	10000	12000	14000	15000	16000
Estimated Fuel consumption, With HRU	HSD in kg/hr	64	85	114	142	171	199	228	256	285	342	455	569	683	797	854	911
	LDO in kg/hr	64	86	115	144	172	201	230	259	287	345	460	575	690	805	862	920
	FO in kg/hr	67	90	120	150	181	211	241	271	301	361	481	602	722	842	903	963
	NG in sm3/hr	75	100	134	167	201	234	267	301	334	401	535	669	802	936	1003	1070
	LPG in kg/hr	58	78	103	129	155	181	207	233	258	310	413	517	620	723	775	827

Standard Efficiency

Oil : 89% without HRU / 93% with HRU
Gas : 89% without HRU / 95% with HRU

NCV

FO : 9650 Kcal/kg
NG : 8500 Kcal/sm^3
HSD : 10200 Kcal/kg
LDO : 10100 Kcal/kg
LPG : 11000 kcal/kg
LSHS : 9500 Kcal/kg

Industrial application

Packaged food, beverage and brewery, hospitality, tyre and rubber , oil and petrochemical, paper and corrugation board, textiles, pharmaceuticals, infrastructure, steel, speciality chemicals, pollution control

High pressure designs available

Efficiency as per BS 845 Part I, on NCV basis

Boilers designed as per BS code available on request.

Standard pressure range is available for 10.55, 14.50, 17.50 kg/cm^2g
Above data is for 10.55 kg/cm^2g

Electronic Compound Regulation Burners

Suitable for FO, LSHS, LDO, HSD, NG, LPG

ECR-P

Regd. Design No. 327972-001, 327973-001

ECR-AM

ECR-AD

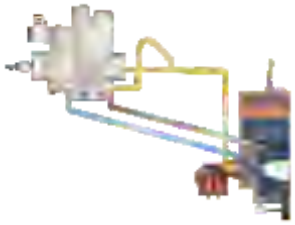
Features and Benefits

Boiler and Burner Perfect Match

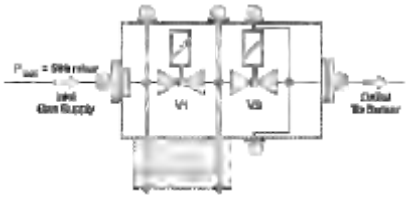
Ease of Setting LCD Display

*2.5TPH and above boiler capacity

Ratiotronics for Gas



Valve Proving System



Two Stage Ignition

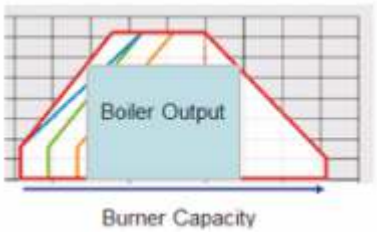
Auto Moisture Drain

Ease of Maintenance

Hinge Design

Self Controlled Combustion Head

High turndown - 1:4



Fully automatic complete load regulation through sequence programme

Soot free burner. Superior atomisation minimum soot and smutting

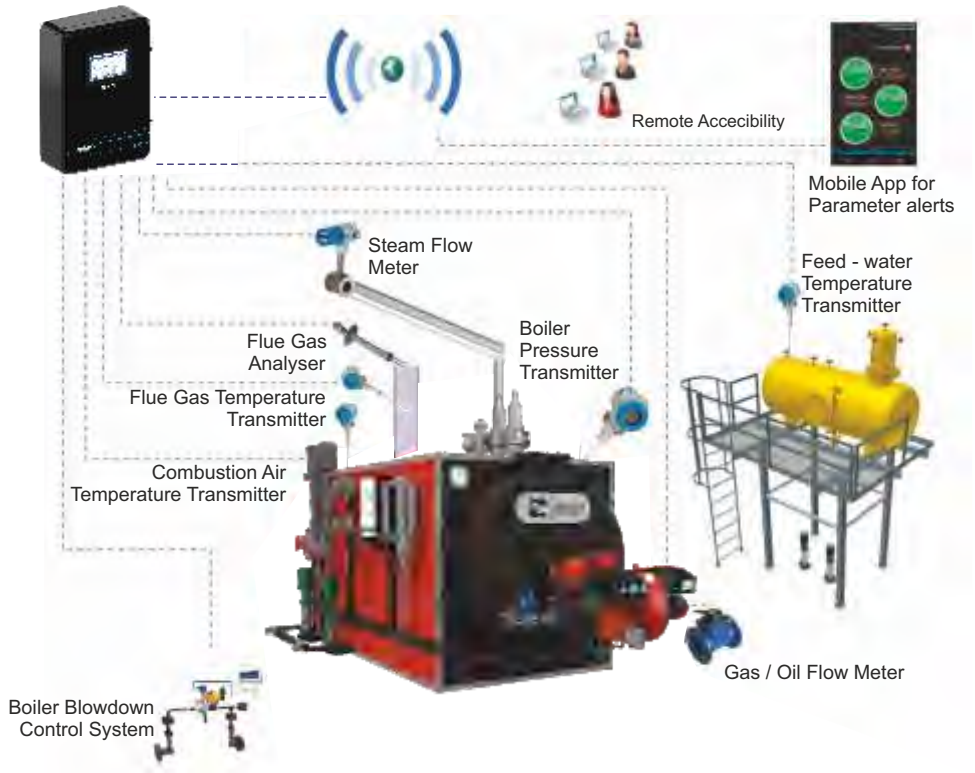
Fine atomisation

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	Provided	Not Provided
3000	Provided	Provided	Provided	Not Provided
4000	Provided	Provided	Provided	Provided

Boiler Efficiency - What do we do?

Monitor - FM Cloud

Analyse

Report

Parameter	Value	Targeted Value
Stack O2%	4	2 to 4
Efficiency % (NCV)	91	93 to 94
Stack Temperature°C	162 to 167	120 to 130
Blowdown TDS	2608	3400 to 3600
SF ratio	13.05	14.14

Examples of Recommendations

Reduce air flow

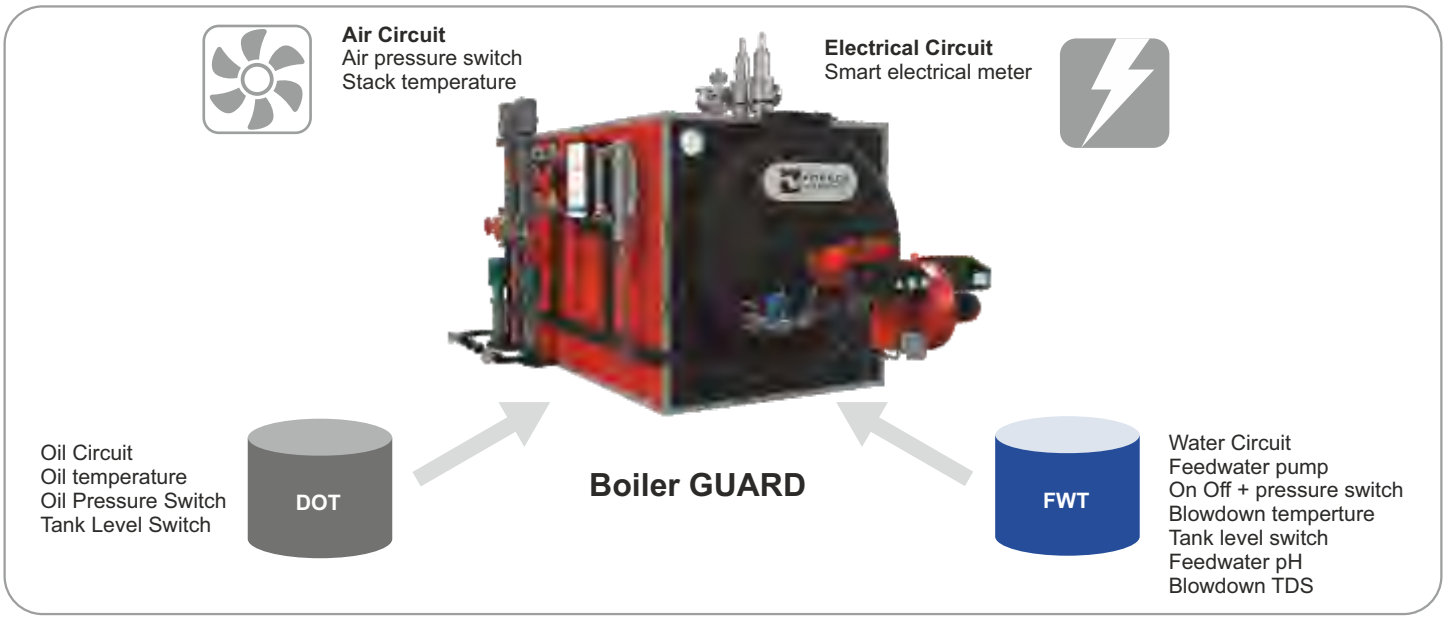
Temperature sensor failure

Increase set point for oxygen

Increase pressure band

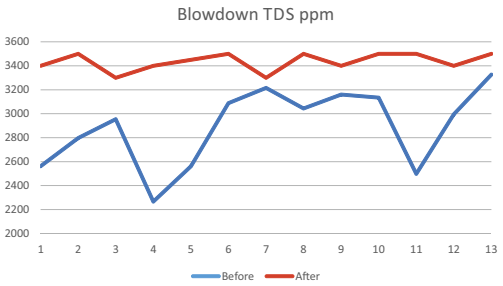
Digital Services

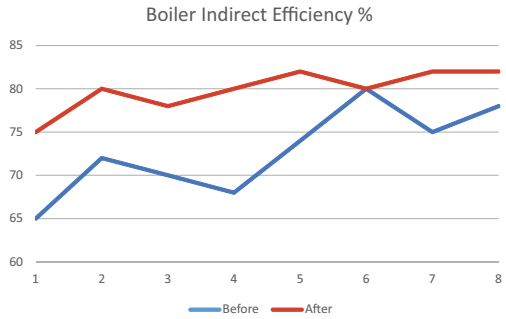
Predict | Prevent | Perform

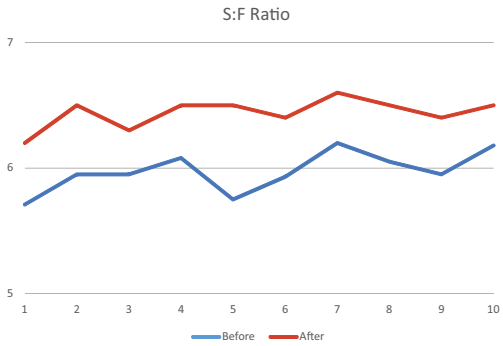


Sustenance Service for Boiler Efficiency

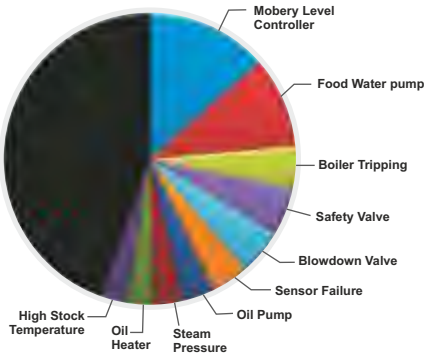
Steam demand in plants varies significantly due to dynamic process requirements. The boiler efficiency sustenance service offers real time engagement for monitoring efficiency and steam to fuel ratio, analysing variations and providing actionable insights. Data on key performance parameters from the boiler is continuously collected by the EffiMaxTM boiler monitoring system and sent to the Forbes Marshall Cloud. Our experts monitor this data, analyse deviations, provide corrective actions and set SOPs to ensure that the boiler is maintained at maximum efficiency and zero incident operation of the boiler house.



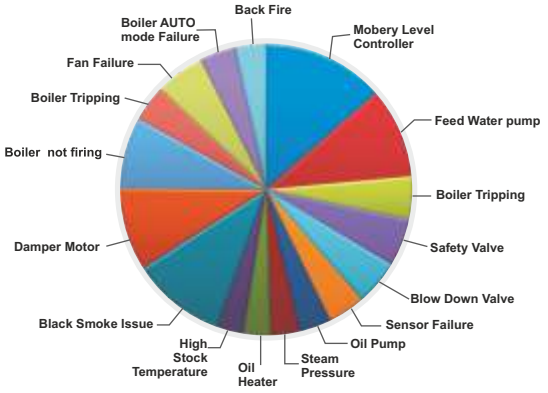




60% Increase in Uptime Through Realtime Data Analysis and Prediction



Typical Shutdown in Boiler House

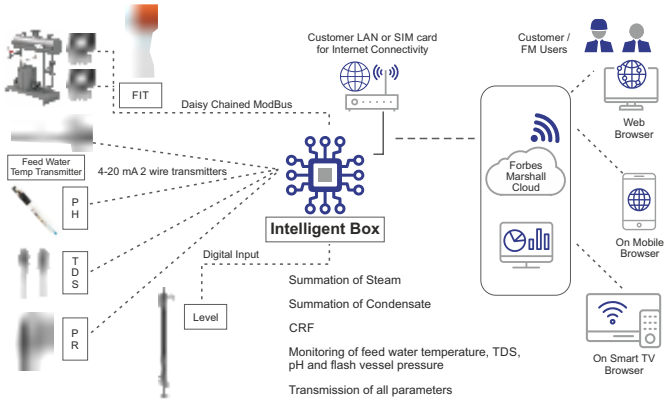


Smart Feed Water Tank

Condensate Recovery Factor (CRF) is an important key performance indicator (KPI) measured across every plant. A drop in CRF leads to incremental fuel and fresh water consumption in the boiler and possibly a higher effluent load (ETP cost).

Most plants seek reasons to two key issues – poor condensate recovery factor and daily variations.

Through the smart feed water tank we can do real time monitoring of these parameters and can detect issues and take corrective actions to sustain the performance of the steam system.



Smart Feed Water Tank Dashboard

Maintenance, Retrofit and Operations (MRO)

Uninterrupted asset uptime is of paramount importance for efficient operation. Our MRO services are designed to maximise asset availability and improve operational efficiencies.

Spares Management

Ensuring asset availability and uptime depends on the timely supply of quality spares. At FM, we are equipped with a dedicated sales, supply, and service network. Our service teams, spread across the country and beyond, proactively assist customers with asset maintenance recommendations and quick turnaround on spares quotations. Our supply chain, supported by depots in strategic locations, ensures timely delivery to meet operational needs.

Retrofits

Optimizing asset utilization is a key aspect of our MRO initiative. Our retrofit solutions, including burners, heat recovery units (HRUs), and other efficiency-boosting components, enhance the performance and lifespan of existing assets. We undertake complete turnkey projects involving burner replacements, HRU retrofits, pressurized deaerators, and control panel upgrades for existing boiler systems.

Comprehensive Service Offerings

Boiler Health Mapping Studies: Assess and optimize all boiler house parameters, including mountings and accessories, to enhance uptime and efficiency.

Residual Life Analysis: Evaluate the mechanical health and remaining lifespan of boilers to ensure safe and continued operation.

Annual/Comprehensive Maintenance Contracts (AMC/CMC): We offer both routine and emergency maintenance services, covering spares supply, regular inspections, and periodic maintenance for installations in India and abroad.

Additional Services: We also provide troubleshooting and preventive maintenance visits tailored to customer needs.

Skilled Service Engineers

Proactive Inspection

Knowledge and Training

Modernisation of Boiler Plant

Retro Fit of Burners

Root Cause Analysis

A Legacy of Partnership, Spanning over 70 Years

Amul Factory, 1955

Amul Factory, 2015

Complete Turnkey Projects Execution

Energising Businesses and Communities Worldwide

A Multinational with Indian Roots

41	Countries
35	Offices Worldwide
33	Distribution Centres
500	Sales and Sevices Engineers
8,000	Customers Worldwide

World Class Technology from World Class Facilities

Enabling Results

Energy Efficiency

Safety and Regulatory Compliance

Environmental Responsibility

Optimum Productivity

Improved Asset Uptime

Process Efficiency

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