

WARGA BOILER

ADVANCED FIRE TUBE BOILER DESIGN

Scotch Marine boiler downsides

- Too numerous tubes & too many passes
- Tubesheet cracking
- Efficiency degradation at part load
- Large amount of refractory lining being a heat sink

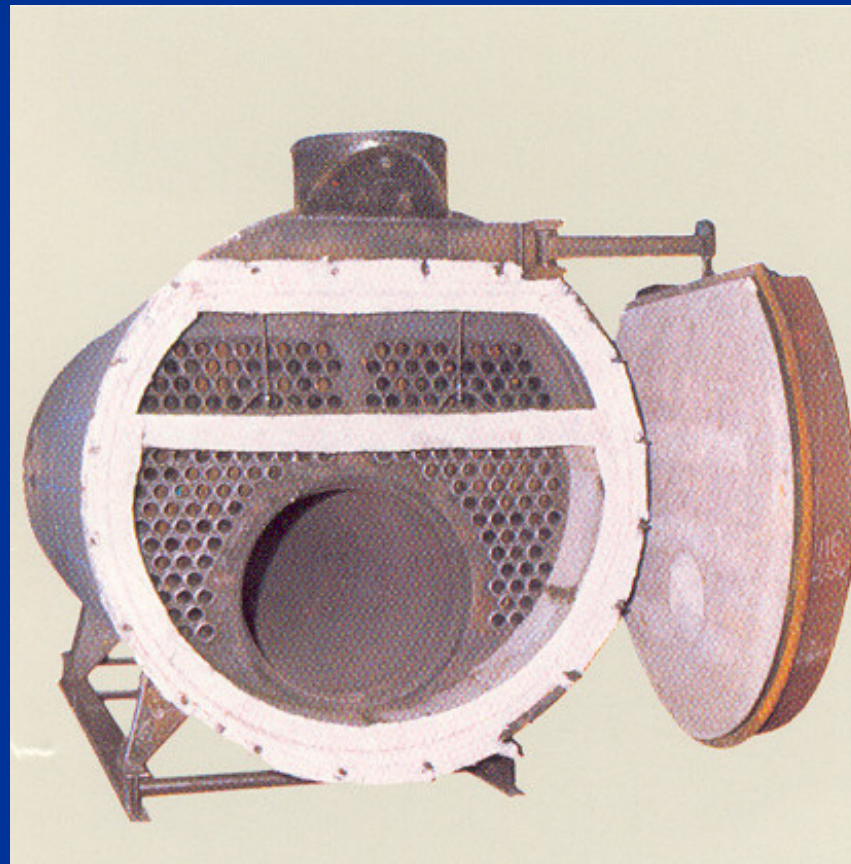
Scotch Marine boiler downsides

Too numerous tubes in up to 4 passes



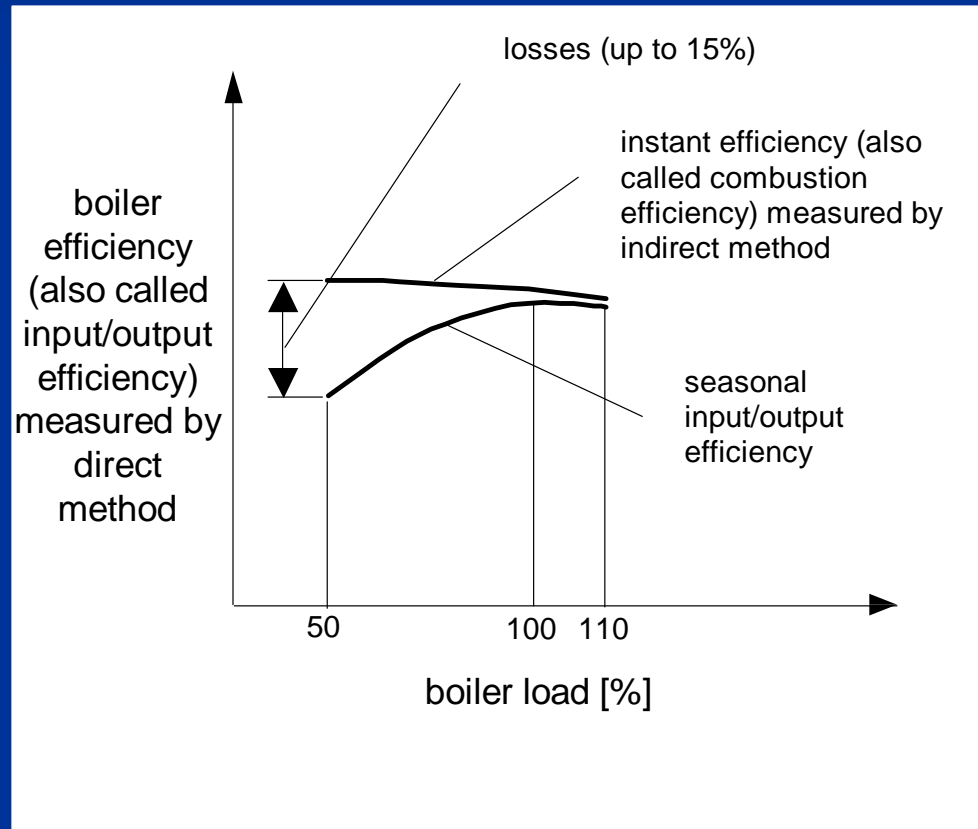
Scotch Marine boiler downsides

Large amount of refractory lining at front and rear



Scotch Marine boiler downsides

Efficiency degradation at part load



Main areas of improvements of Scotch Marine boiler design

- Tube & passes number reduction
- Elimination of refractory lining

Ways to improve Scotch Marine boiler design

- Exact heat transfer calculation
- Introduction of cooled door
- Common platform

WARGA BOILER

- Up to 70% less tubes
- Up to 100% intensified heat transfer (2.5sq.ft./HP boiler)
- Only 2 passes in reverse flue design
- No refractory lining
- Cooled door design meeting all criteria applicable also on steam boilers
- No efficiency degradation at part load (efficiency increases at part load - unique in industry)
- Absence of tubesheet cracking
- Common platform
- Retrofit of installed Scotch Marine boilers possible

WARGA BOILER IN USA

Tucson Medical Center



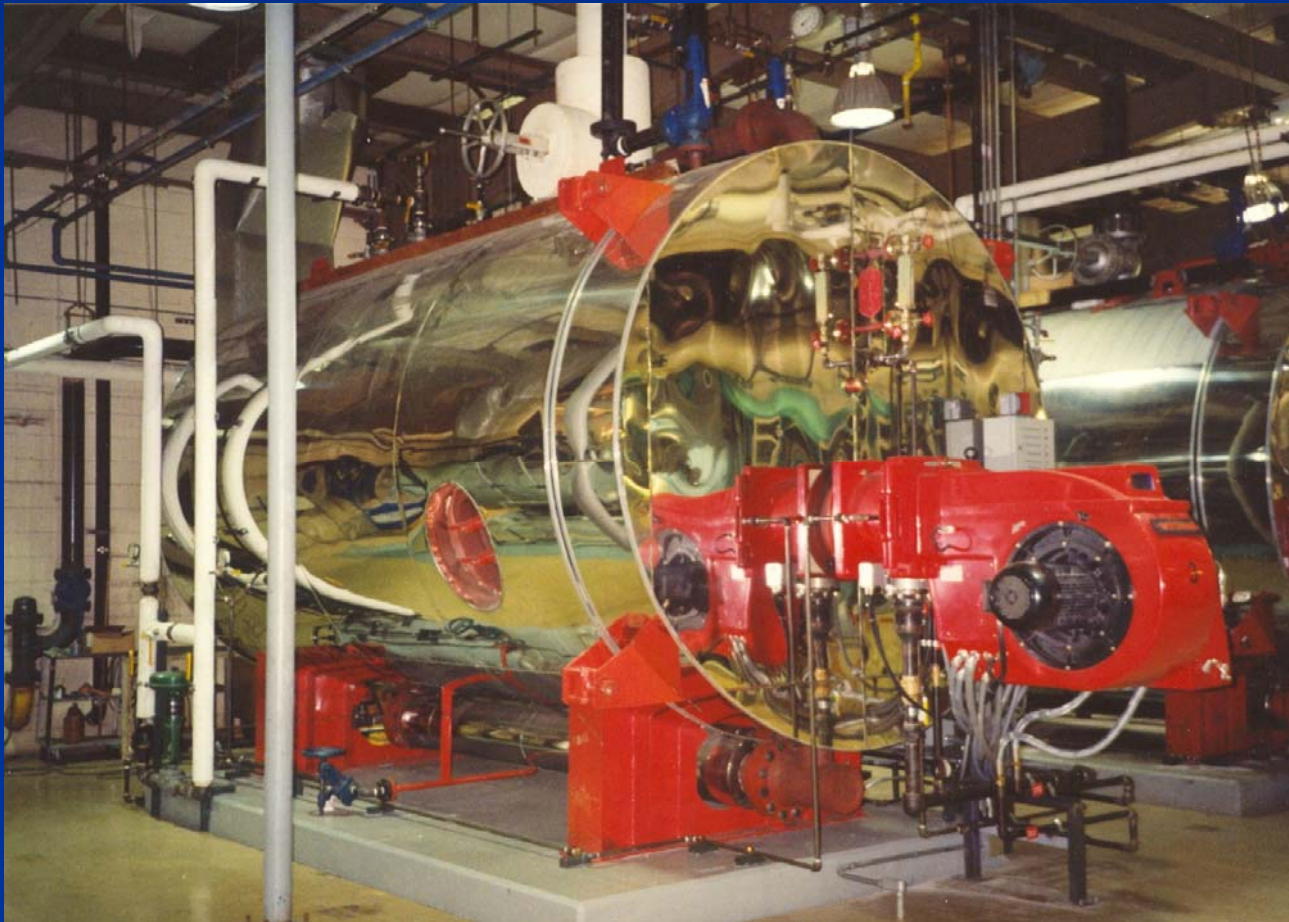
WARGA BOILER IN USA

Tucson Medical Center

- 3 high pressure 400HP steam boilers installed in 1999
- Design and claims proven with data log
- Return on investment in 2 years
- 20.5% reduced fuel usage for same amount of steam generated at unchanged fuel-to-steam efficiency(!)
- No downsides observed
- No trace of tubesheet chacks after 10 years of operation (on previous two 600HP boilers tubes replaced 2 times in 20 year operation, furnace rewelded in first year)

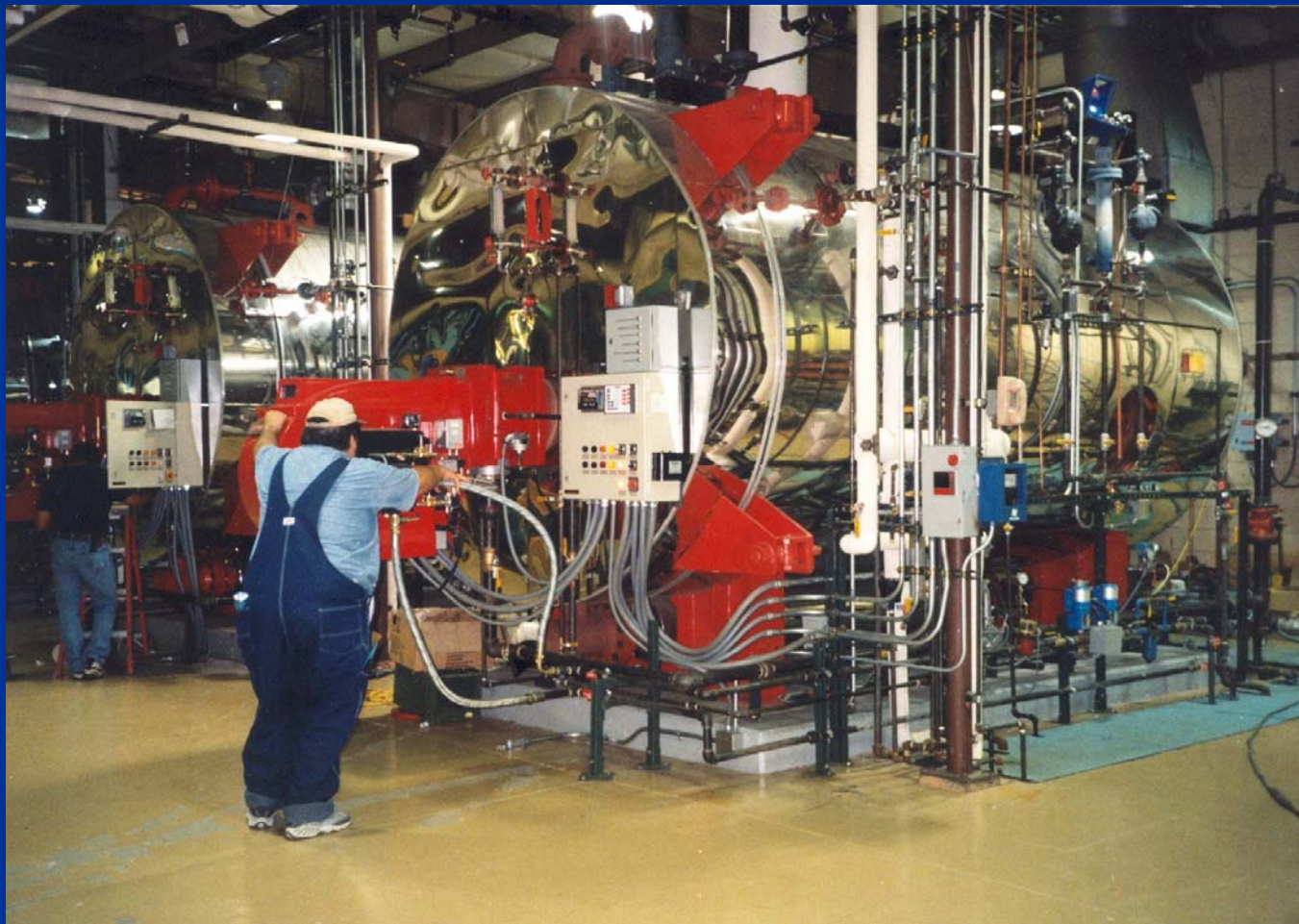
WARGA BOILER IN USA

Side view



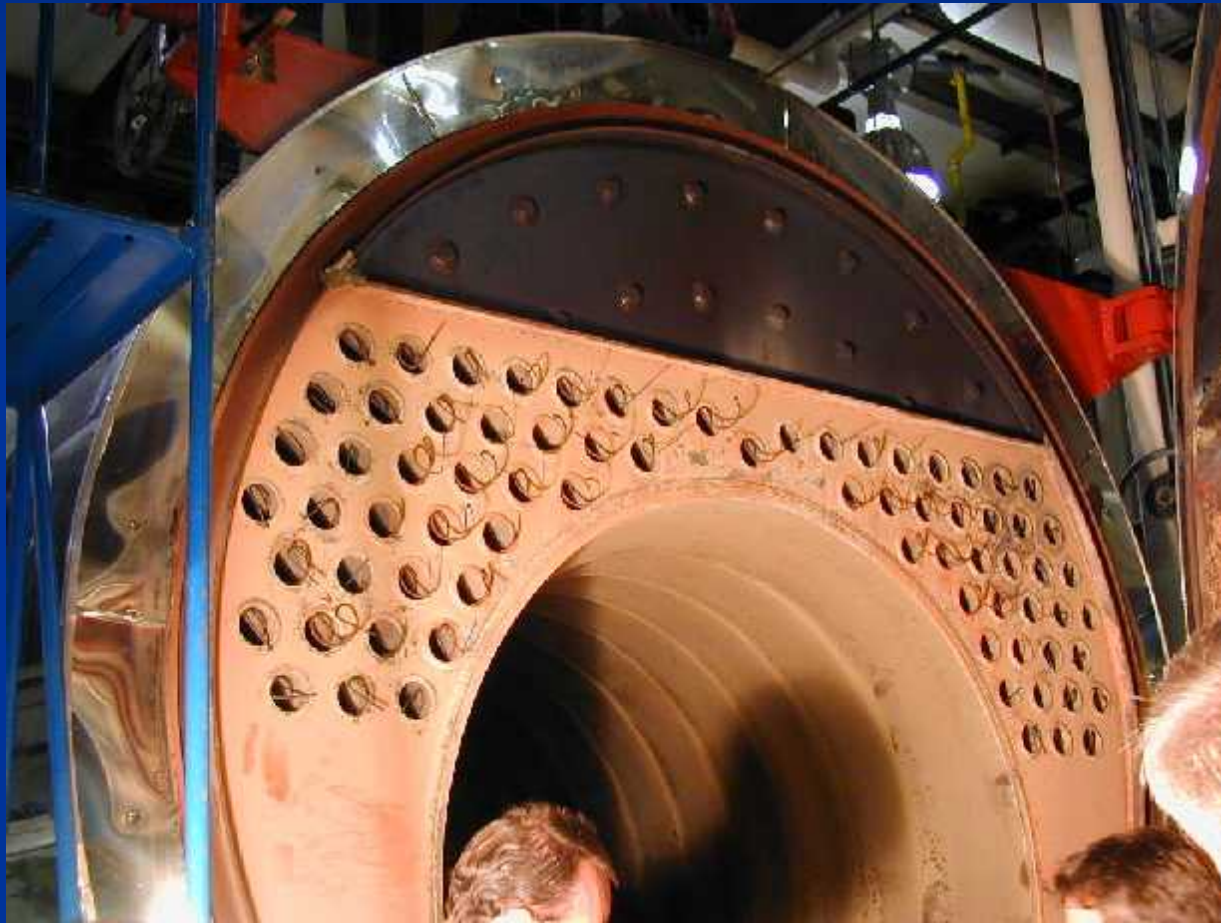
WARGA BOILER IN USA

Side view



WARGA BOILER IN USA

Just 75 2.5" tubes in 400HP boiler



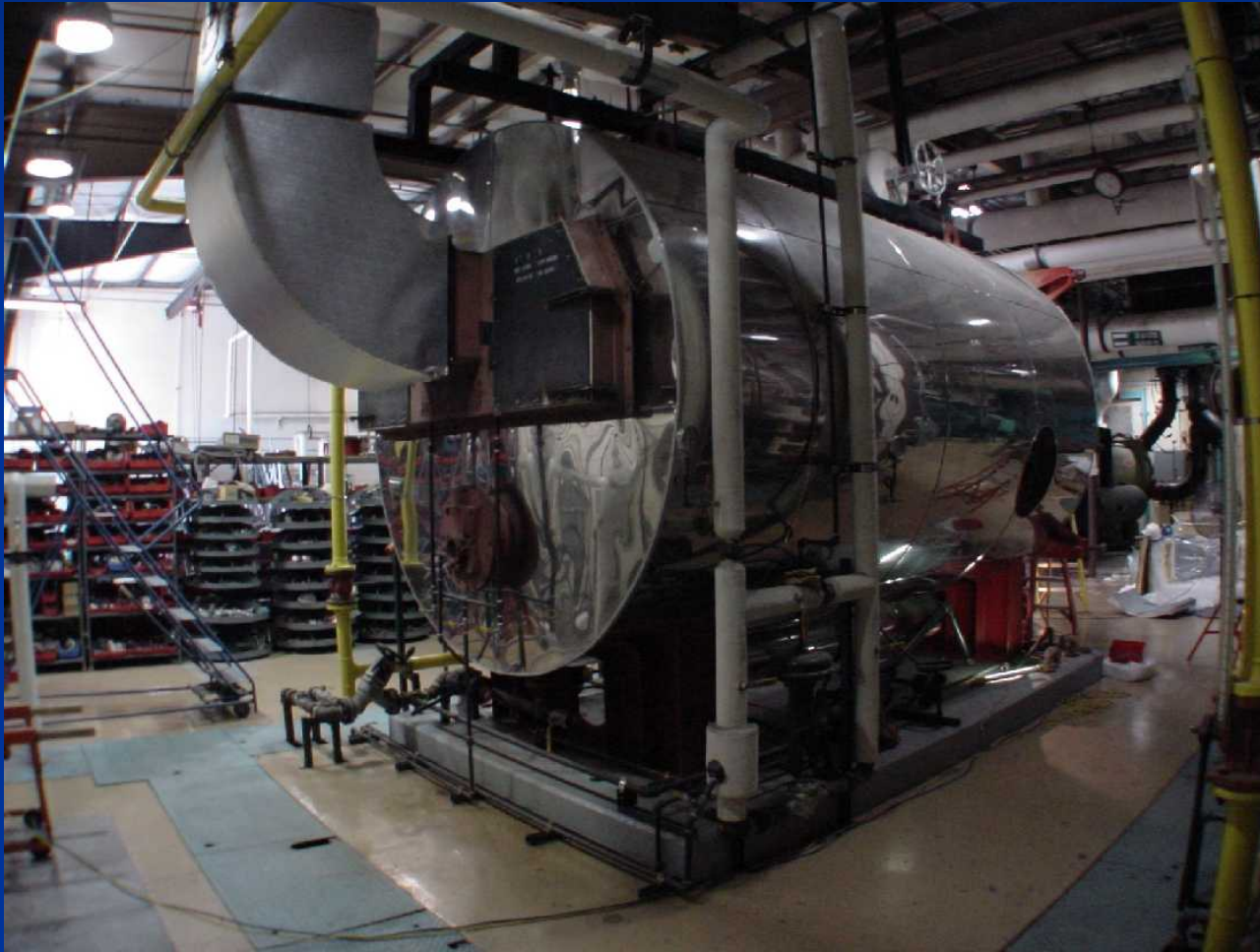
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Cooled door with burner orifice



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Rear view



US BOILER RETROFIT MARKET SIZE

Application	Total <u>Establishments</u>	Establishments <u>(100 - 500 kW)</u>	Establishments <u>(500 - 1000 kW)</u>	Establishments <u>(1 - 5 MW)</u>	Establishments <u>(> 5 MW)</u>
Hotels/Motels	66,400	12,010	895	540	220
Nursing Homes	19,200	4,610	4,050	1,570	25
Hospitals	16,400	2,945	1,290	2,110	215
Schools	123,890	32,400	9,690	390	0
Colleges/Universities	4,090	1,005	580	680	205
Commercial Laundries	7,275	830	400	10	0
Car Washes	20,630	1,150	40	0	0
Health Clubs/Spas	12,610	3,020	4,060	15	0
Golf Clubs	14,040	3,800	820	205	30
Museums	9,090	330	290	50	0
Correctional Facilities	3,950	1,190	740	610	45
Water Treatment/Sanitary	8,770	2,055	490	65	0
Extended Service Restaurants	271,000	25,475	495	330	0
Supermarkets	148,000	16,300	1,160	140	0
Refrigerated Warehouses	<u>1,460</u>	<u>595</u>	<u>640</u>	<u>75</u>	<u>5</u>
Total	726,805	107,715	25,640	6,790	745
Office Buildings	<u>705,000</u>	<u>57,000</u>	<u>12,000</u>	<u>2,900</u>	<u>290</u>
Total	1,431,805	164,715	37,640	9,690	1,035