FCX Boiler

a zero clearance, oil fired condensing boiler

What does condensing have to do with efficiency?



Why is this glass sweating?

Because the reaction from warm air meeting a cold surface; condensation.

How condensation is utilized in obtaining higher efficiencies

by condensing water vapor in the exhaust gases and in doing so recovering its **latent heat of vaporization** (*When water changes state from a gas to a liquid goes from a <u>gas at 212°</u> to <u>liquid at 212°</u> it gives off heat that is <i>absorbed by the water in the boiler*), which would otherwise have been wasted.



Typical Oil Fired Boiler/Furnace System



Most non-condensing boilers could be forced to condense through simple control changes. Doing so would reduce fuel consumption considerably, but would quickly destroy any mild steel or cast-iron components of a conventional high-temperature boiler due to the corrosive nature of the condensate. For this reason, most condensing boiler heatexchangers are made from stainless steel or aluminum/silicon alloy. External stainless steel economizers can be retrofitted to noncondensing boilers to allow them to achieve condensing efficiencies. Temperature control valves are used to blend hot supply water into the return to avoid thermal shock or condensation inside of the boiler.

Examples of 90+ Oil Furnaces



Drawings taken from Adams Manufacturing Co sales brochure.







Return temperatures are the single most important thing to the condensing boiler.

Return water temperatures must below 115F for condensing to begin.

100F or less out for maximum efficiency

75 to 85F return water maximum efficiency- *try that on a conv. system*

Up to 130F out will still provide some condensing

Numbers have been confirmed by Brookhaven Laboratory study.

FCX COMES IN TWO MODELS FCX 22 and 30

(They both share the same exterior panels but the interior components differ)

SPECIFICA	TIONS	FCX 22	FCX 30		
Rated Output		76,000 8 ti A	104,000 8tv/k		
Rated Input		81,250 8 tv /k	107,500 8tv/k		
Combustion Chamber Le	ength	8.96*	9.41*		
Combustion Chamber D	iameter	11 <i>ឆ</i> •	13.78		
Combustion Chamber V	olume	915 C (blo li clies	1,403C (bic holes		
Combustion Prod. Circui	it Volume	3Д51 Citble Inches	3,204 C (bio Inches		
lue Pressure Drop		H20 0.10*	H20 0.10°		
Max. Heating Service Pro	essure	43.5 PSI	43.5 PSI		
Max. Heating Circuit Wa	ter Temperature	158%	158°F		
Nater Overheating Safe	ty Thermostat Setting	230•F	2304		
Combustion Prod. Overheating Safety Thermostat Setting			230%	230°F	
Heating Circuit Water Capacity			423 Galois	6.6 Gallons	
Primary Water Flow Rat	e (122/158°F)	254 Gal/i	343 Ga¥i		
Nater Pressure Drop (at nominal flow rate)			1.D MCE	1.8 MCE	
Power Absorbed (with b	ourner, without circulator)	0.2 kW	kW 0.2 kW		
Power Consumption		235 W	235 W		
Full Load Current		2.0 Amps FLA	2DAmps FLA		
Max. Fuse/Circuit Break	er Size	15 Am pe	15 Am ps		
Dimensions		Height	39.1*	39.1°	
		Width	23.7*	23.7*	
		Depth	27.5*	27.5	
Packaged Weight			322 bs.	369 bs.	
Pipe Connections	Water Heating Supply/Return		3/4*	3/4*	
	Domestic Hot Water or Second Heating Circuit		3/4*	3/4*	
	Condensate Drain	Condensate Drain		1-1/2"	
	Heating Water Drain	Heating Water Drain		1/2*	
	Air Bleed	Air Bleed		3/4*	
	Safety Pressure Relief Malue		34.	34*	

FCX Components

- Built in temperature controls provide heating comfort.
- Economical PP/PVC Vent System: sealed system brings in fresh air for combustion and allows flue gas to be vented safely outdoors either vertically or horizontally. Single wall PP options available.
- All burners equipped with fuel line heater to provide maximum efficiency.



- Expansion tank, mixing valve and circulation pump, built-in for ease of installation.
- 5. Stainless steel secondary heat exchanger to transfer any unused energy from the primary heat exchanger thus minimizing your fuel bills
- Steel primary heat exchanger for long life durability
- 7. High and low temp Connections

7



The FCX is a "plug and play" boiler with full functionality as a stand alone. But modern third party controls, such as cold-start, outdoor reset, and indoor feed back, can easily be interfaced with the system to provide additional flexibility and efficiency.



Typical Concentric Venting



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Concentric straight length

- Venting can be: Polypropylene or stainless steel

- Low Exhaust Heat
- Can be side wall vented

- Can Use existing chimney as chase with out having to be relined

-Concentric venting eliminates the need for combustion grills.



Concentric horizontal termination



Exhaust waste are fewer

Example of how low the vent tempts can be - environmentally safe.







Horizontal FCX Venting

Single wall installs can be over 50 ft. equivalent length.

90's = 3.28ft 45's = 1.6ft



FCX Venting (cont.)

FCX 22 - Long vent testing

Quote from test:

"For the venting configuration I used 7 3ft strait lengths, 2 1.5ft strait lengths, 2 90' elbows and a terminal."





FCX Venting (cont.)



3 Efficient (Riello shown) Burners



- 1. FCX22 .55 gph nozzle & air damper setting
- 2. FCX30 .70 gph nozzle & air damper setting
- 3. <u>https://www.youtube.com/watch?v=DFmHXgz_4dk</u> for burner assembly info.

3 Riello Burner (cont.)



- 1 Ollpump
- Z Control box
- 3 Reseibution with lock-out tamp
- Flange with insulating gasket.
- 5 Air danper adlusiments crew
- 6 Pumppressure adjustmentscrew

- 7 Bester correction
- 8 Fizme de le clor
- 9 Combusion head
- 10 Air Inteles (CF)
- 11 Molor



Built In Components:

- Created a more compact unit with a smaller foot print.
- Are internal allowing them to be insulated against sound transfer outside the unit. Creating a ultra quite unit while
- Pre-installed components allow for a quick and clean install saving TIME and MONEY \$\$\$\$.

5 Secondary Combustion Chamber



Stainless Steel Secondary





Turbulators – agitate exhaust flow in tubes.



6 Primary Combustion Chamber FCX30

S.S. "Knight Hood"





6 Primary Combustion Chamber FCX22





Correctly designed loads are a part of efficiency

BS Indirect Domestic Hot-Water Storage Tanks

The BS series of domestic hot-water storage tanks are among the world's finest products of this type. Their highquality, all stainless waterside construction and oversized heat exchanger combine to deliver lifetime performance at the very highest efficiency levels. The pleasing design, exceptional fit and finish make the BS Series a worldclass indirect tank.

Technical Specifications

Models		8525	B540	8550	8580
Nominal Storage	GAL.	25	40	50	80
Height	IN.	27.5	36.4	45.3	63
Diameter	IN,	23.6	23.6	23.6	23.6
All Pipe Connections	MPT	3/4"	3/4"	3/4"	3/4*
Max. DHW Pressure	PSI	100	100	100	100
Aquastat Range	۴F	68-176	68-176	68-176	68-176
Aquastat Differential	*F	10.8	10.8	10.8	10.8
Inspection Port Opening	IN.	3.9	3.9	3.9	3.9
Nominal Exchanger Power at 170°F. Av. Boiler Water Temperature	МВН	115	115	200	210
Nominal Preheat Time from 50°F to 140°F stored	MIN.	10	15	12	17
Continuous Output at 110°F	GPM	3.8	3.8	6.5	6.7
Nominal First Hour Draw at 70°F Rise	GAL.	250	260	430	465
Dry Weights	LBS.	71	86	121	159

Your Authorized FCX Dealer

Since the tank does not actually heat the water (the boiler does), the actual efficiency will be dependent upon the efficiency of the boiler. When the boiler used is the FCX, the efficiency should be 93 % plus.



- Sizes Available 25, 40, 50, & 80 Gallon
- Thermometer
- Aquastat
- 100% 316 L Stainless
 Steel
- Special connection for hot recirculation
- Built for low temperature boilers
- Comparison of recovery rates & Sizing
- Works on 130-140° water

Fitting FCX into Hydronic Systems

New Construction – design for low temp baseboard, radiant heat, or panel radiators.
Efficient indirects for domestic hot water.

➢ Retrofits

Opportunities & Limitations

- Factors affecting the need for higher temperatures poor insulation, bad windows, infiltration, few heat emitters i.e. copper finned baseboard
- Fuel savings occur even in non-condensing mode or applications.
- Existing ducted systems, furnaces or heat pumps.



8.3.2 - Connection to a heating circuit with a domestic hot water production system



Multiple Circulators



Utilizing Boiler Pump





General schematic for 3 heat emitter types (Radiant, Baseboard, & DHW) requiring both high and lower temperatures, and expected ΔT 's. The three-way zone value on the return will promote some condensing on the Baseboard circuit when the radiant circuit is not active, but will not contaminate the cooler return of the Radiant when active.

Important websites:

www.fcxboilers.com www.fcxalaska.com

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