



# Compablocs recover energy at Canadian refinery

Shell refinery at Sarnia, Ontario, Canada

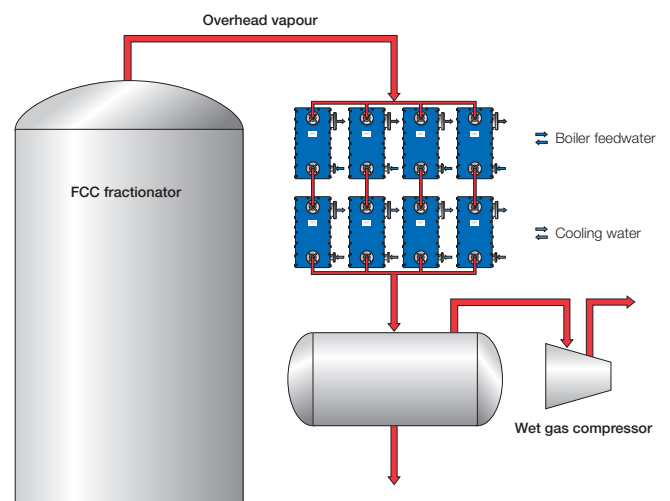


Energy savings were the reason for adopting Compablocs as condensers at the Shell refinery at Sarnia.

Shell is one of the largest integrated petroleum companies in Canada. To recover heat into boiler feedwater in order to offload the system, Shell replaced the shell-and-tube condensers at its refinery in Sarnia, Ontario with eight Alfa Laval Compabloc condensers. The new Compablocs are used as overhead condensers for overhead vapour stream from the main fractionator in the fluidized catalytic cracking unit (FCCU), where the main product is gasoline.

The original plan was to upgrade the metals used in the existing shell-and-tube exchangers in an attempt to reduce the effects of corrosion in the tube bundles, caused by bisulphides, chlorides and cyanides present in the overhead vapour. However, the new Compabloc condensers are made of Hastelloy C276®, a material that completely eliminates the corrosion problems previously encountered.

The eight Compablocs replaced the proposed eight shell-and-tube heat exchangers for condensing the overhead vapour at 132–138°C (270–280°F) using raw river water. The total condensing flow normally amounts to 23 MW (78 MMBtu/hr).



## Maximum heat recovery

The main objective in installing the new Compablocs at the Shell Sarnia refinery was to recover a significant portion of the heat in the FCCU - approximately 13.5 MW (46 MMBTU/hr) - into the treated cold water flow used as make-up water for the steam plant. Recovering this heat means that the steam plant still has additional capacity to meet any future increase in demand.

"The shell-and-tube design wasn't feasible because we couldn't come up with a configuration that would have delivered the required heat recovery and respect the very low pressure drop constraint imposed by other process requirements," says Dr Erich Wonchala, head engineer, catalytic reforming and heat integration at the Sarnia refinery. In addition, the existing structure in which the exchangers were to be installed did not permit a heavy shell-and-tube installation, which would not only have taken up considerable space, but would also have resulted in high installation costs.

There are eight Compabloc exchangers arranged in four parallel series of two. The top four units recover heat to the boiler feedwater system, while the bottom four are trim coolers using process cooling water.

The overhead vapour enters the top four Compablocs at 141°C (286°F) and is condensed and cooled down to finally exit the four bottom trim coolers at 29°C (84°F). The boiler feedwater that passes through the top four Compablocs is



Four of the eight Compabloc condensers.

heated to 128°C (262°F). Each Compabloc is mounted vertically with condensation taking place in horizontal channels arranged in two passes on the condensing side. This multi-pass arrangement results in efficient condensing and cooling at small temperature approach between the two media. This is the key to the economical recovery of the large amount of energy from the condensing stream.

The Compabloc units have been in continuous operation since they were commissioned in the middle of 2002. According to Dr Wonchala, the main reason for starting this project was to save energy. Compabloc condensers provided the most economical solution for using advanced alloys to avoid corrosion and to achieve the degree of heat recovery that Shell was looking for.

### Key facts about Compabloc

The Compabloc is a high-efficiency all-welded compact heat exchanger designed for aggressive or hazardous process duties. Compablocs are available in six sizes, with heat transfer areas ranging between 0.7 to 320 m<sup>2</sup> (7 to 3,450 sq ft).

The heat transfer area is made up of a pack of corrugated plates welded alternately to form the media channels. This plate pack is supported by an upper and lower head and four side panels, which accommodate the connections. The 100% welded plate pack extends design operating limits and provides improved reliability. Because there are no interplate gaskets, compatibility concerns are eliminated, and maintenance and operating costs are reduced. Access for inspection and cleaning is fast and easy.

### Plate materials

Stainless steel 316L, 304L, 317L, 904L  
Avesta 254 SMO, AL6XN  
Titanium, Pd-stabilized titanium  
Alloy C276, C22, B2, C-2000

### Specifications

Design pressure min/max:	Vacuum/35 bar(g) (500 psig)
Design temperature min/max:	-30/350°C (-20/660°F)
Connections:	ANSI or DIN flanged
Codes of construction:	PED, ASME (with or without U-stamp), AS1210 and other codes.

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