



# Catalytic Condensation Process for Motor Fuel

## Refining

### Introduction

Since the 1930s, the UOP Catalytic Condensation process has been important for gasoline production, and UOP continues to design and license new units. Catalytic Condensation is an alternative to an alkylation unit for gasoline production. It is much less expensive than alkylation and does not require *i*-C<sub>4</sub>. UOP Catalytic Condensation process units are simple to operate and require minimum staffing. The solid phosphoric acid (SPA) catalyst used is non-corrosive, which permits extensive use of carbon steel throughout the unit. The catalyst is available from UOP.

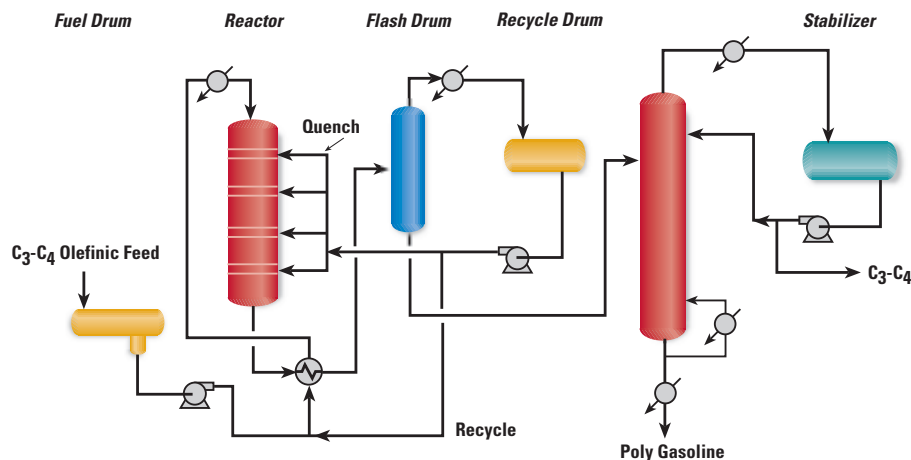
The UOP Catalytic Condensation process is also used for higher olefin production (heptenes, nonenes, tetramer) and aromatic derivatives (cumene, cymene).

### Process description

A flow diagram is shown in Figure 1. The olefin-rich feed to the UOP Catalytic Condensation process unit is charged to a reactor feed surge drum. Propane and/or butane diluent is recycled to the feed surge drum. The combined feed is preheated by exchange with the reactor effluent and charged to the reactor, where polymerization takes place. Control of the heat release in the reactor is accomplished both by feed dilution and by quenching between the catalyst beds in the reactor.

The reactor effluent, cooled in exchange with the combined feed, is directed to a flash drum where the flash vapor is condensed and the condensate cooled. Some of the condensate is recycled for use as feed

Figure 1 ■ UOP Catalytic Condensation Process for Motor Fuel Production



diluent and quench. Flash drum liquid flows to the stabilizer, where the polymer gasoline product at the desired Reid vapor pressure (RVP) and the LPG product are produced. The LPG may be sent to a C<sub>3</sub>-C<sub>4</sub> splitter, depending on the refiner's needs. The propane product can be made to the HD-5 specification required in many regions of the world.

### Yields

Polymer gasoline yields depend primarily on olefin concentration in the feed:

<u>Fresh Feed Olefin Concentration, wt-%</u>	<u>Poly Gasoline Yield on Olefins, wt-%</u>
50%	89%
70%	95%
90%	99%

The desired product distillation and desired catalyst life can be optimized by adjusting the operating conditions and controlling feedstock contaminants.

## Product Properties-Gasoline Operation

	Primary Feed Component		
	C <sub>3</sub>	C <sub>3</sub> -C <sub>4</sub>	C <sub>4</sub>
Specific Gravity	0.739	0.738	0.738
°API	60	60	60
ASTM °F (°C)			
IBP	135 (57)	200 (93)	144 (62)
10%	238 (114)	213 (101)	217 (103)
30%	269 (132)	228 (109)	235 (113)
50%	286 (141)	246 (119)	246 (119)
70%	304 (151)	278 (137)	261 (127)
90%	375 (191)	334 (168)	357 (181)
EP	425 (218)	412 (211)	420 (216)
C <sub>5</sub> <sup>+</sup> RON	93	96	99
C <sub>5</sub> <sup>+</sup> MON	82	83	84
C <sub>5</sub> <sup>+</sup> RVP, psi	2	2	2

## Investment costs

Investment costs were evaluated for the following cases:

Feed olefin	C <sub>3</sub> /C <sub>4</sub>	C <sub>4</sub>
Poly gasoline, bpsd	4,300	3,300
Poly gasoline, T/D	504	387
ISBL* EEC \$MM	14.5	12.0

\*Inside battery limits,

Basis: U.S. Gulf Coast installation, 2nd quarter, 1996.

## Experience

The UOP Catalytic Condensation process was commercialized in 1935. Since that time UOP has licensed and designed more than 200 units worldwide for the production of transportation fuels. About 100 additional units have been designed for petrochemicals, including the production of alkyl-aromatics and olefin oligomers, such as heptenes, octenes, nonenes, and tetramers. UOP has designed more than 30 units for tetramer production.

## For more information

For more information, contact your local UOP representative or our Des Plaines sales office:

e-mail: [info@uop.com](mailto:info@uop.com)  
 fax: +1-847-391-2253  
 phone: +1-847-391-2000

## UOP LLC

25 East Algonquin Road  
 Des Plaines, IL 60017-5017  
 U.S.A.  
[www.uop.com](http://www.uop.com)

© 2007 UOP LLC. All rights reserved.  
 The information in this document should not be construed as a representation for which UOP assumes legal responsibility, or an authorization or recommendation to practice a patented invention without a license.  
 UOP 4523-46 1107

