



Re-sell of OMO (pilot) plant



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GENERAL PLANT INFORMATION

The offered process facility (further called pilot plant) was designed and built for production of **Methanol to Olefins (MTO)** having a capacity of 3 ton per day. The process is quite similar to FCC, equipped with riser reactors, regenerator, in which the formed coke on the recycled catalyst is burning.

This demo/pilot plant is designed and built according to Shell's DEP, with extensive instrumentations, flexibility for modification and ability to detect and resolve any problem that might arise in production scale plant.

This demo plant is for outdoor installation, assembled in modular galvanized steel structure, ATEX compliance, and having control system based on Honeywell process control, separate safety system (ESD), HMI, and Data logging.

The plant owner, Shell Technology Center Amsterdam (STCA), has decided to stop further development of this technology and we, Frimach / SECUNDUS, offering this demo plant for sale. Our offered plant is for client use, therefore, not for a specific process and no guarantee for conversion performance.

At present, the plant is at storage, consisting of disassembled structures, control and power distribution container and well-stored computers, server and full manufacturing documents.

APPLICATION SUMMARY

The offered plant can be used for any process that should be conducted in riser reactor in demo scale. Material of construction of reactors and most of other wetted parts are SS-304, SS316L and the high temperature parts from alloy 625.

Possible applications are:

Catalyst test and process studies and optimization of: MTO, FCC, catalytic selective oxidation, catalytic cracking/conversion of bio-waste; catalytic dehydrogenation of hydrocarbons.

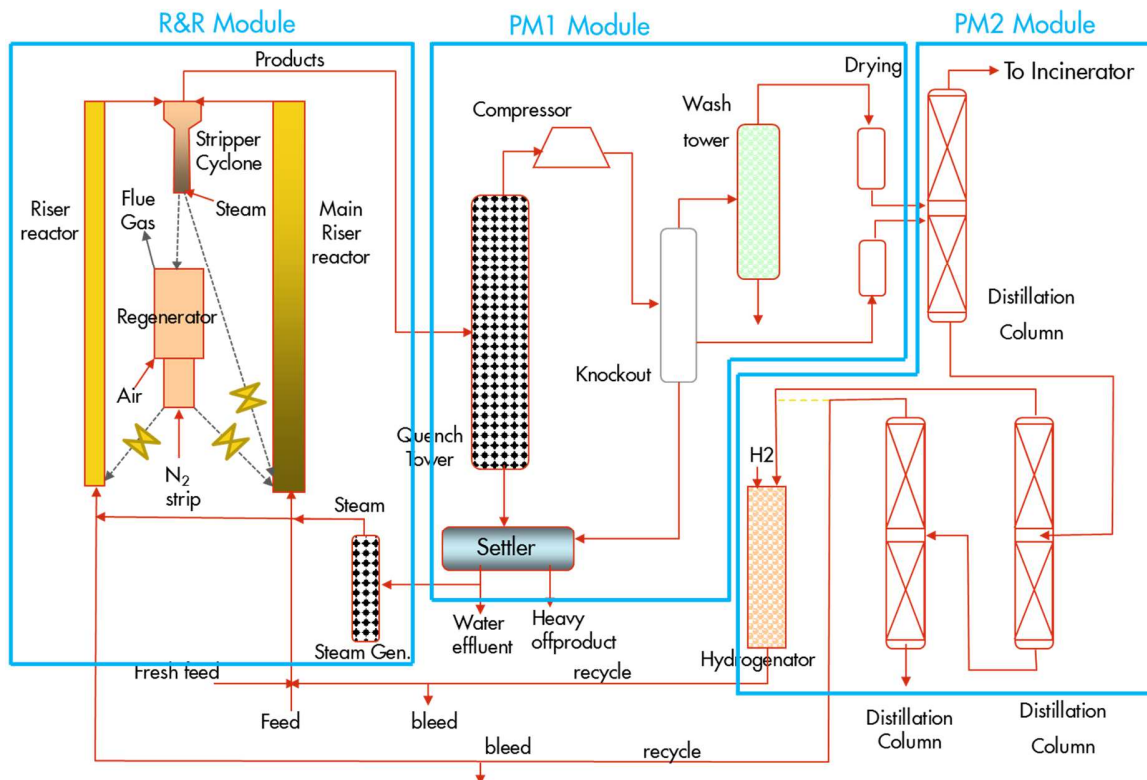
SPECIFICATION SUMMARY

- Main riser reactor R-210: total length 23302 mm; upper part 6" sch 80 (ID 146 mm); catalyst flux at normal operating conditions 5,8 kg/m².s; operating temperature 590 – 610 °C; design 710 °C
- Second riser R-220: total length 23243 mm; upper part 3" sch 80 (ID 74 mm); catalyst flux at normal operating condition 32,6 kg/m².s. operating temperature 610 – 623 °C; design 710 °C
- Regenerator R-230: total volume 0.72 m³; operating temperature 630 °C; design 710 °C.
- Fixed bed reactor for hydrogenation of C4 –C5, R-601: 15 l, Operating press. 20 - 40 barg; Operating temp. 200 °C
- Compressor package X-401: 2 stage; 0.4 – 20 barg; 217 kg/h, medium H₂ & N₂; SS-316
- Dryer package removing water from HCX-451: 619 L gas; Operating: 20 barg; 20 – 170 °C;

- Water cooler package X-911: 36564 kg/h; 307 kW cooling; operating temp. 33 – 25 °C
- Water chiller package X-912: 19,6 kW cooling, operating temp. -7 °C up-to -12 °C
- Fresh catalyst vessel V-260: 450 kg catalyst
- Catalyst addition vessel V-254: 10 kg catalyst
- E-catalyst receiving vessel V-262: 360 kg catalyst
- Bisulfite wash column C-450: 132 L; operating press. & temp.: 5 barg; 53 – 103 °C
- Depropanizer column C-501: 376 L; operating press. & temp. :10 barg; 15 – 87 °C
- Debutanizer column C-551: 362 L; operating press. & temp.: 5 barg; 53 – 103 °C
- Depentanizer column C-561: 161 L; operating press. & temp.: 1 barg; 55 -125 °C

The pilot plant is built up from 4 process modules and an incinerator

1. Feed and Reactor and Regeneration unit - R&R (section 2000);
2. Catalyst handling - CH (section 2500);
3. Process module 1 – PM1 (section 3000, 4000, 4500);
4. Process module 2 – PM2 (section 5000 and 6000);
5. Incinerator (section 9000). This module is working independently & it is for sale separately



1. Feed and Reactor and Regeneration unit (R&R)

This process module consists of a feed preparation and two riser reactors and a regeneration section.

The reactor, comprising riser reactors, to convert methanol to a mixture of lower olefins (ethylene and propylene), higher olefins (butanes, pentanes, etc.), water (the main by product) and minor by-products as well as coke, which is deposited on the catalyst. Effluent of reactors after passing cyclone and stripping of the catalyst, are sent to product separation section, Module 1.

The stripped deactivated catalyst is charged to a regenerator vessel where the coke is removed by hot combustion in air. The regenerated catalyst is returned to the reactors and the gas stream containing combustion products is sent to the incinerator. Main equipment items in this module are the riser reactors, cyclones/stripper and the catalyst regenerator.

2. Catalyst Handling (CH)

This module was used for the handling of fresh and E-catalyst. Its main equipment's consist of a storage vessel for the fresh catalyst, a catalyst addition vessel and a vessel for collecting of whole catalyst inventory for shutdown or before charging different/new catalyst.

3. Process Module 1 (PM1)

Reactor product from the reactor section is fed to a quench tower where heavier (C6+) hydrocarbons are removed via a water quench and leave at the bottom of the quench tower from which they are further separated and cleaned. A two-stage compressor is employed to compress the gaseous overhead stream of the reactor after the quench. Thereafter, washing section is installed to further clean and dry the gaseous stream and one more column to remove bisulfite. In product separation section using distillation columns, the products are further separated into lighter and heavier components.

4. Process Module 2 (PM 2)

In this process module the products are further cleaned and separated by employing distillation towers. Main equipment items of this module are distillation and a hydrogenation reactor. The hydrogenation reactor is a fixed bed reactor, which contained heterogeneous catalyst.

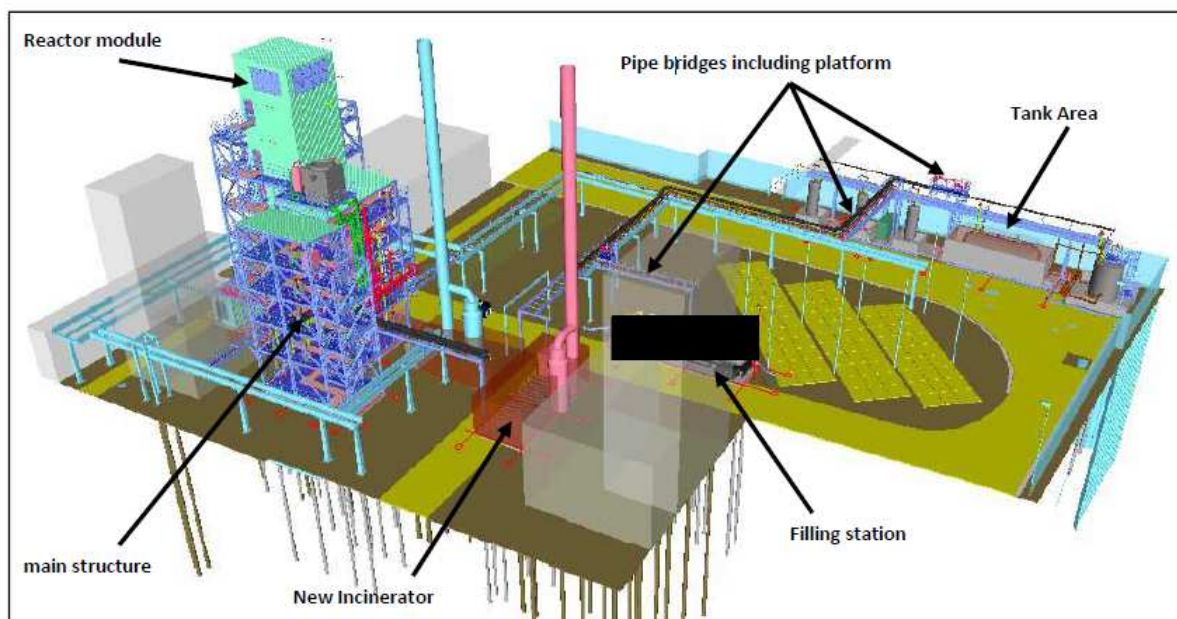


Plant top layout, indicated location of modules

PLANT OVERVIEW

The OMO Integrated Pilot Plant was located at Shell Technology Center Amsterdam (STCA) and mainly consists of:

- ~~Tank area and filling station~~ (demolished and cleared end of 2018, not in scope);
- Reactor unit (section 2000);
- Catalyst handling (section 2500);
- Process module 1 (section 3000, 4000, 4500);
- Process module 2 (section 5000 and 6000);
- Incinerator (section 9000);





Picture of the plant structure front side

The pipe racks that connected the pilot plant with the utilities and handles feed and product streams for the above mentioned pilot plant as well as the Sub-station for electrical power supply switching container are not part of scope of supply.

RE-SELL BACKGROUND

The OMO plant had been mothballed since 2015 relative shortly after commissioning of the plant. Decision to sell and remove the plant was made to make way for new projects in the outside plot of STCA.

Dismantling is executed in Q3 2019 and is plant is stored on a temporary site in Beverwijk. The main structures /modules and associated equipment and piping are removed from site.

The olefin-assisted Methanol to Olefins (OMO) process is being developed by Shell to enable the conversion of methanol to ethylene and propylene. . Ethylene and propylene are bulk chemicals that can be turned into various high value derivatives. As the missing link in a gas-to-derivatives value chain, OMO enables the monetization of natural gas through the production of these derivatives.

The OMO IPP was built back in 2013 to de-risk the commercial process. The intention was to demonstrate various parts of the process fits together (i.e. by closing recycles) and that the required product quality can be obtained.

The main focus of design was on:

- Closing the C4 recycle
- Providing a continuous reactor-regenerator system
- Enabling scale up of the reactor to commercial scale
- Inclusion of other critical product process steps such as the bisulphite wash and C4 hydrogenation

The plant was in operation since 2014 for almost a year or so before decision was taken to mothball the unit on commercial grounds in 2015. It is dismantled and stored for sale in Q3 2019 by Mammoet. Mammoet is offering their services for re-installation to the buyer.



<https://www.mammoet.com/>

The other features of OMO-IPP demo plant are:

- Designed for process development
- Wide flexibility in parameter adjustment
- Designed for flexibility and easy of modification
- Extensive process instrumentation and data acquisition

COMMERCIAL CONDITIONS

A Scope of supply

- R&R, Moule 1, Module 2 structures including packages
- DCS , ES & power distribution container
- HMI computers and monitors & computer for plant maintenance
- Full hard copies and digital files of manufacturing documents

B Delivery

- Generally delivery terms: Ex-works , “as-is”,
- Plant Modules, Beverwijk The Netherlands. (stored at deep water quay)
- Control container, computers & documentations: Drachten, The Netherlands
- Incinerator: Drachten, The Netherlands

C Payment condition

- Payment prior to pick-up.

D Additional documents

- The following documents are attached.
 - P&ID
 - Single line electrical drawing
 - Bill of Materials (equipment)
 - General arrangement drawing

E Full plant technical construction file.

Detailed information is available on request.

When plant is sold to buyer, the full technical construction file is transferred to the buyer (on request), available in hardcopy and digitally.

Also full 3D plant file and software available, for identification of parts, finding parts and trouble shooting.

F Genuine manufacturer support. <https://www.spie-nl.com/>

Spie is the genuine manufacturer of this plant and offers its support and services for re-installation and/ or modification of the plant.

G. Trade Control Limitations.

To comply with international Export and Trade Control Laws, we need to inform and express to you the buyer that some of the technology or components involved in this OMO plant as being offered are from United States origin and regarding that International Export and Trade Control Laws and related limitations are or might be applicable, also regarding restricted jurisdiction and restricted parties.

For your information the following definitions might be applicable and will be part of the purchase contract

Definitions:

RESTRICTED JURISDICTION: countries or states that are subject to comprehensive trade sanctions or embargoes (as may be amended by the relevant AUTHORITIES from time to time).

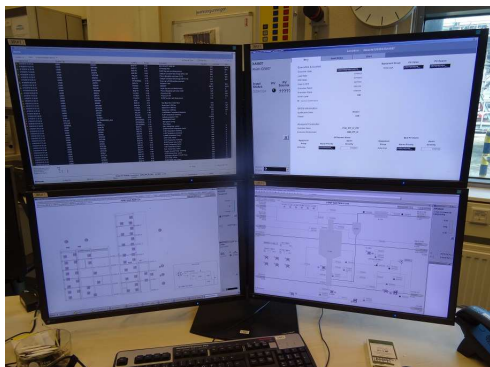
RESTRICTED PARTY: (a) any person targeted by national, regional, or multilateral trade or economic sanctions under applicable laws; (b) any person designated on the United Nations Financial Sanctions Lists, European Union (EU) or EU Member State Consolidated Lists, US Department of the Treasury Office of Foreign Assets Control Lists, US State Department Non-proliferation Sanctions Lists, or US Department of Commerce Denied Persons List, in force from time to time; or (c) any affiliates of such persons; and (d) any person acting on behalf of a person referred to in the foregoing.

TRADE CONTROL LAWS: all applicable laws concerning the import, export, or re-export of goods, software, or technology, or their direct product, including: (a) applicable customs regulations, Council Regulation (EC) No. 428/2009; (b) any sanction regulations issued by the Council of the European Union; (c) the International Traffic in Arms Regulations ("ITAR"); (d) the Export Administration Regulations ("EAR"); and (e) the regulations and orders issued or administered by the US Department of the Treasury, Office of Foreign Assets Control in relation to export control, anti-boycott, and trade sanctions matters.

PLC controllers and software (from US origin)



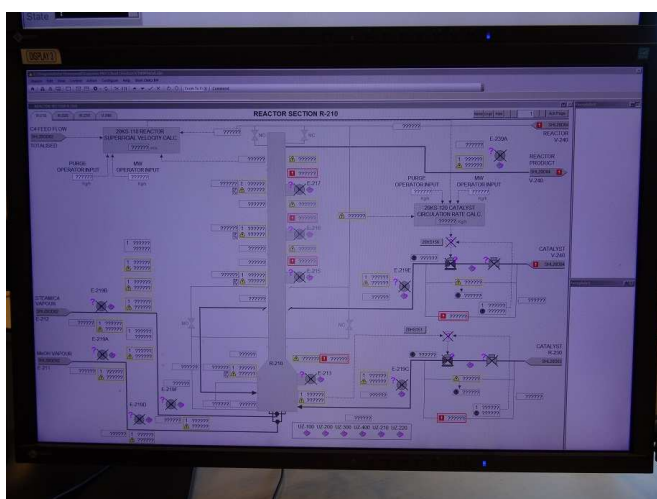
ADDITIONAL PICTURES



HMI monitors



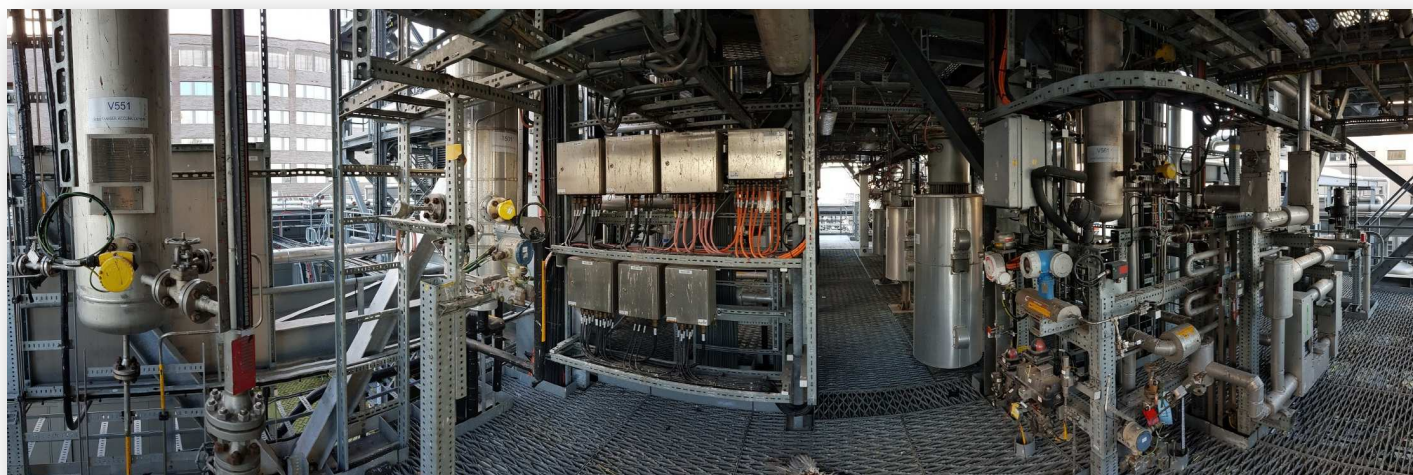
HMI computers



HMI screen: reactor



Control interface & power distribution cabinet



Panorama view inside

Outside overview



Miscellaneous 1



Miscellaneous 2

