

## Pilot Plants

# Bench Scale Short Contact Time Riser Test (SCT-RT) Unit

360<sup>®</sup>  
KAS

*The method to measure performance of catalytic cracking (FCC) catalysts in a small-scale fluidised bed test unit with short contact times of 1 to 3 seconds.*

Decisions on catalyst selection are often supported by performance results from lab-scale simulation. Hereto both realistic deactivation of the fresh Fluid Catalytic Cracking (FCC) catalyst and performance measurement of this catalyst needs to take place in lab-scale units that are able to mimic commercial operation closely.

To evaluate the performance of a deactivated FCC catalyst, a short injection time of about one second and adiabatic operation is necessary to simulate the behaviour of a commercial riser. This technology was pioneered by Albemarle<sup>®</sup> and is brought to market by 360°KAS since 2006 in the form of our bench scale Short Contact Time Riser Test Unit (SCT-RT).



*SCT-RT unit before shipment to Hindustan Petroleum Corporation Limited (HPCL), R&D centre in India.*

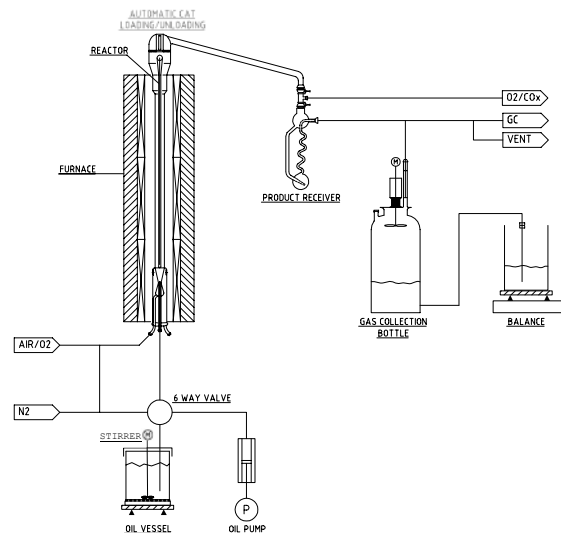
The 360°KAS Short Contact Time Riser Test unit has proven to be the most cost effective way to test the performance of FCC catalysts at realistic feed and vapour contact times.

## Functional Design

In the SCT-RT unit pre-heated oil is injected into a fluidised bed of hot FCC catalyst particles. The unique reactor design provides an optimal mixing and cracking at very short and realistic contact times, followed by fast disengagement of cracked products and the stripping of the formed products.

The SCT-RT unit is supplied with the following process modules:

- Gas feed delivery module for N<sub>2</sub> and N<sub>2</sub>/O<sub>2</sub> (Instrument Air).
- Heated liquid hydrocarbon feed supply module with injection system.
- Reactor module.
- Product treatment module (condenser).
- Closed chilled water cooling system.
- Gas collection of produced gases.
- Liquid product collection.
- Optional In-situ coke burning



*Typical arrangement of a single Short Contact Riser Test (SCT-RT) Unit.*

## Feedstock Characteristics

Specific Gravity at 15 °C	0.86 – 0.98
API	13.0 – 32.0
CCR	Up to 10 wt%
Aniline point	58 – 110 °C
Boiling range	Up to 740 °C
Accuracy at single CTO conversion	72.2 ± 0.9 wt% (with a feedstock having a specific gravity of 0.92 and a CCR of 3.4 wt%)

The system is built into a ventilated enclosure with polycarbonate sheets for use in safe area. Provision for forced ventilation is foreseen at the top of the unit. This is required to provide a safe environment when using hazardous and flammable gases and liquids. 360°KAS supplies the SCT-RT unit in accordance with the following technical specifications:

The reactor is constructed of inert Quartz glass instead of steel for the following main reasons:

- Exclusion of Nickel influence and other metal parts especially at high temperatures (700-900 °C).
- Fluidisation process inside the reactor can be monitored and afterwards proper emptying of the reactor can be visually checked.

The E-cat used to feed the SCT-RT unit can be prepared with our Cyclic Deactivation Unit. With this Albemarle<sup>®</sup> developed unit a resembling equilibrium catalyst (E-cat) can be prepared at laboratory scale. For more information, see our dedicated 360°KAS Cyclic Deactivation (CD) Unit product sheet.

### Short Contact Time – Riser Unit

Type of Reactor	Fast Fluidised Plug Flow
Catalyst Intake (dependent on the cat-to-oil ratio)	Min 12 g Max 24 g
Feed injection time:	1.00 sec.; adjustable up to 3 sec.
Fluidising Medium	Nitrogen
Capacity	Up to 6 tests per 8 hours
Type of control	Sequence control and temperature control PLC/ PC
Gas flow control	Instrument-based
HMI & Data Acquisition	In Touch – Wonderware
Approximate Dimensions	2940 x 970 x 2100 (WxDxH in mm)

### Short Contact Time – Utilities

Power	220-230/380-400 VAC, 50/60Hz, 3-phase + neutral, 32A (other voltages are possible upon request)
Instrument Air	5 - 7 Barg, HC free, dew point < -30°C, max consumption 2 L/h
Nitrogen	bottle or clean supply network, 20-200 barg, min 6 barg, 99.99% purity, max consumption: 60Nl/hr during test run

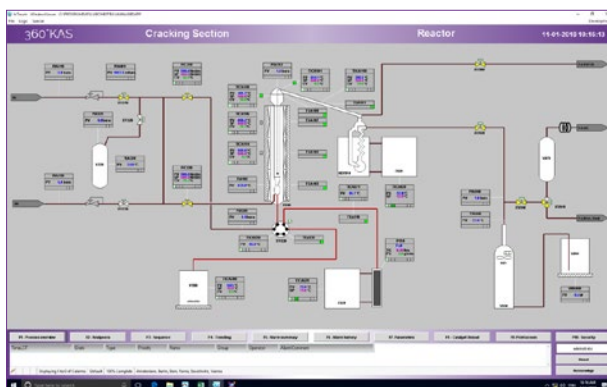
## Control System

The SCT-RT unit is delivered as a fully computer controlled system with all necessary monitoring and control functions, safety and alarm management and data acquisition including historical trending.

In the control system the following components can be distinguished:

- One control cabinet with PLC for injection sequence control.
- Power distribution with main switch.
- One common SCADA PC to act as HMI and screen to display operational data and settings.

The PC based data acquisition system is equipped with a printer (optional). Logged data will be for example: reactor pressure, reactor temperature, inlet flow and outlet gas volume.



The process overview screen shows the controls (flows, valve openings, pressures, temperatures) of the SCT-RT unit.

Two types of data collection are provided:

- Continuous I/O process data logging for graphic trends on the SCADA PC.
- Experiment snapshot I/O process data logging for data reporting and detailed analysis. This data will be available in CSV-file.

## Options

The following options can be quoted upon request:

- Interface with your local LIMS and prepare/write custom made reports.
- Uninterrupted Power Supply (UPS).
- An automatic catalyst loading hopper and condenser system to execute 6 consequent runs,
- Laboratory equipment such as glass work, calciner, catalyst sieves and weighing scales.
- In-Situ coking burning including an analytical equipment such as an FTIR analyser for emission monitoring of exhaust gases.
- Services such as site installation, installation supervision, commissioning, start-up and training.
- Annual maintenance.
- Spare parts for 2 year operation.
- Extended warranty.



The SCT-RT unit can be outfitted with an automatic catalyst loading hopper and condenser system. The operator can program six runs. The six catalyst hoppers are connected to a general catalyst unloading system. The six condenser system is designed in such way that the unit K-factor will not depend on the condenser selection.

The following Pilot Plant product sheets are available:

- Cyclic Deactivation (CD) Unit
- Short Contact Time – Riser Test (SCT-RT) Unit
- Hot Attrition Test (HAT) Unit



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