Gas cleaning for fluid catalytic cracking plants in refineries

Emission Control by GEA Bischoff
GEA Bischoff Customised Gas Cleaning Systems for fluid catalytic cracking (FCC) Units

Refineries vary by complexity; more complex refineries have more secondary conversion capability, meaning they can produce different types of petroleum products.

Fluid catalytic cracking, a type of secondary unit operation, is mainly producing additional lighter oil fractions out of the crude oil.

One of our most important activities in the refinery industry is gas cleaning for FCC units. GEA Bischoff technologies combine engineering process engineering, environmental aspects and energy savings. Taken this into account, GEA Bischoff offers clean air solutions while keeping the CAPEX/OPEX low.

With this extensive portfolio and a long experience of 100 years, we can handle the challenges posed by your specific production process.

GEA builds electrostatic precipitator absorber (EP-Absorber), electrostatic precipitator (ESP) and selective catalytic reduction (SCR) plants.

Electrostatic Precipitator Absorber

FEATURES OF GEA EP-ABSORBER FOR FCC

- Low pressure drop over EP-Absorber:
  - Removal of particulate/aerosols by electrostatic forces vs. pressure drop (venturi systems)
  - No additional booster fan
  - Less energy consumption
  - No boiler reinforcements for increased operating pressure
- Lower emissions compared to conventional SO2-Scrubbers
- No brownish trailing SO3 plume
- Scrubber nozzles with hollow cone to avoid clogging
- Easy nozzle maintenance and replacement during operation
- Heavy duty discharge electrodes for long run times
- Redundant high quality T/R sets and Controllers
- Redundant pumps
- Specific effluent treatment according to client’s needs

Example FCC gas cleaning: CITGO refinery, Lemont (USA)

Optimized spray arrangement
Uniform flux density
Hollow cone nozzles to avoid clogging
Easy maintenance and replacement during operation

EP-Absorber with soda ash reagent storage, pump house and control building.
Reference example: Tesoro Corporation, Tesoro (USA)
FEATUR ES OF GEA DRY ESP FOR FCC

- Even flow distribution achieved by specially designed gas distribution walls that are proven by CFD modelling.
- Use of optimised collecting electrode type ZT24.
- Electrode rapping with reliable and robust tumbling hammer system superior to magnetic/top rapping.
- Reliable Insulator design for long-term operation.
- High Voltage supply with TR sets and Controllers.
- No Ammonia injection needed.
- Comprehensive experience in ESP design and project execution for FCC units.

ADVANTAGES OF GEA EP-ABSORBER

<table>
<thead>
<tr>
<th>FCC scrubbing system can be designed for</th>
<th>GEA EP-Absorber</th>
<th>Conventional FCC scrubbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO₂</td>
<td>equal emissions</td>
<td>base</td>
</tr>
<tr>
<td>SO₃ (H₂SO₄ aerosol)</td>
<td>lower emissions</td>
<td>base</td>
</tr>
<tr>
<td>SOx (SO₂+SO₃)</td>
<td>lower emissions</td>
<td>base</td>
</tr>
<tr>
<td>Water droplets</td>
<td>lower emissions</td>
<td>base</td>
</tr>
<tr>
<td>Catalyst fines</td>
<td>lower emissions</td>
<td>base</td>
</tr>
<tr>
<td>NH₃ (Amonium aerosols)</td>
<td>lower emissions</td>
<td>base</td>
</tr>
<tr>
<td>Pressure drop (e.g. for CO boilers)</td>
<td>lower</td>
<td>base</td>
</tr>
<tr>
<td>Required pressure for scrubbing nozzles</td>
<td>lower</td>
<td>base</td>
</tr>
</tbody>
</table>

Reference example: Total MIDER Refinery, Leuna (Germany)

Installation of a three-field ESP... 
... later addition of a fourth field to meet more stringent regulatory requirements.
FEATURES OF GEA SCR FOR FCC

- No catalyst fouling due to optimised inlet temperature
- Minimised Ammonia slip
- CAPEX and OPEX considerably lower than other DeNOx systems such as Ozone generation – where additional health and safety aspects have to be considered.

SELECTIVE CATALYTIC REDUCTION (SCR) NOx removal 90 – 99 % ≤ 75 mg/Nm³

Dry Electrostatic Precipitator Dust removal > 98 % ≤ 20 mg/Nm³

EP Absorber Dust removal > 98 % ≤ 20 mg/Nm³
SO₂ removal 90 – 99 % ≤ 75 mg/Nm³
SO₃ removal > 98 % ≤ 20 mg/Nm³

LET US KNOW INLET CONDITIONS AND THE ALLOWABLE CLEAN GAS EMISSIONS:

YOU ARE WELCOME TO VISIT OUR REFERENCE PLANTS.

ANY OTHER REQUIREMENTS OR QUESTIONS?
We live our values.
Excellence • Passion • Integrity • Responsibility • GEA-versity

GEA Group is a global engineering company with multi-billion euro sales and operations in more than 50 countries. Founded in 1881, the company is one of the largest providers of innovative equipment and process technology. GEA Group is listed in the STOXX® Europe 600 Index.

GEA Process Engineering
Business Unit GEA Emission Control

GEA Bischoff GmbH
Ruhrallee 311
45136 Essen, Germany
Phone: +49 201 8948 0
E-Mail: gea-bischoff@gea.com
www.geabischoff.com

GEA Process Engineering A/S
Gladisaxevej 305
2860 Sæborg, Denmark
Phone: +45 3954 5454
E-Mail: niro@niro.dk

GEA Finland Oy
Homotie 19
00560 Helsinki, Finland
Mobile: +358 (0)10 322 11 00

GEA Process Engineering Inc.
9165 Rumsey Road
Columbia, MD 21045, USA
Phone: +1 410 997 8700

GEA Process Engineering China Ltd
Room 1405, CITIC Building, No. 19 Jian Guo Men Wai Street
Chao Yang District
Beijing, 100004, China
Phone: +86 10 8526 2025

GEA Process Engineering (Pty) Ltd.
286 16th Road
1685 Midrand, South Africa
Phone: +27 11 805 6910
Mobile: +27 72 479 9019

GEA Process Engineering SAS
23 Quai de Paludate
33 000 Bordeaux, France
Phone: +33 5 5795 9566

GEA Process Engineering S.p.A.
Centro Direzionale Milano 2
20090 Segrate (Mi), Italy
Phone: +39 02 2101 0611

GEA Process Engineering (India) pvt LTD
Coral Square, 3rd floor
Vijay Garden Naka
Ghoodbunder Road
Thane (W) 400 607, India
Phone: +91 98 3006 9550

GEA Process Engineering, ООО
ГЭА Процессный инжиниринг
Semenovsky Val st. 6, bldg. 1
105094 Moscow, Russia
Phone: +7 495 787 2020

GEA Engenharia de Processos e Sis. Ind. Ltda.
Prédio 4 D2, 1 Floor, Office 2
13051-750 Campinas, SP, Brazil
Phone: +55 19 3725 3001

www.gea.com