

# Refinery applications with advanced mass transfer technology



# Excellence in refining technology

## Expertise and experience

Sulzer Chemtech is the process engineering and equipment manufacturing division of the international Sulzer Corporation, with its headquarters in Winterthur, Switzerland.

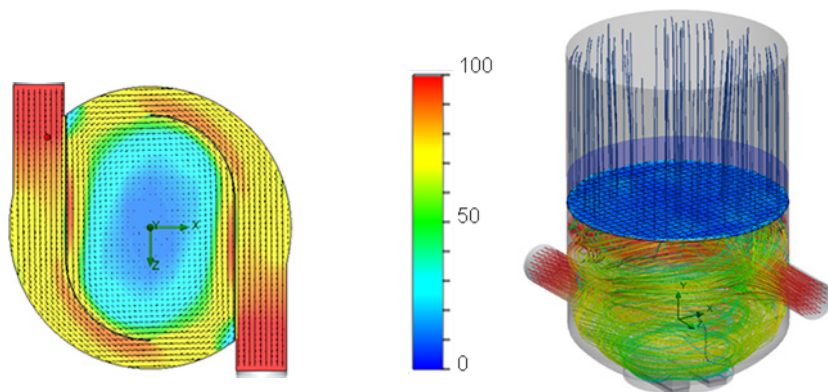
Areas of expertise include equipment and application know-how in separation and mixing technology. Products include trays, structured packing, and random packing for separation columns, internals for separators, fractional crystallization systems, and equipment for mixing and reaction processes.

## Leading in research and development

With tried-and-tested design procedures and innovative engineering solutions, Sulzer can meet the most challenging refinery objectives. Sulzer has the requisite personnel, experience and engineering capability to model and analyze mass and heat transfer phenomena in distillation, absorption, extraction, mixing, gas-liquid, and liquid-liquid separation. Our large test and pilot facilities have the capability to extensively test trays, packings, separators and tower internals to maximize performance and reliability.

## Computational Fluid Dynamics (CFD)

At Sulzer, CFD is extensively used for developing new products and optimizing the performance of the equipment being delivered (e.g. flash zones and wash sections).



Flow distribution in the flash zone and below the wash bed of a vacuum column 15300 mm ID

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Three-phase separator test facility



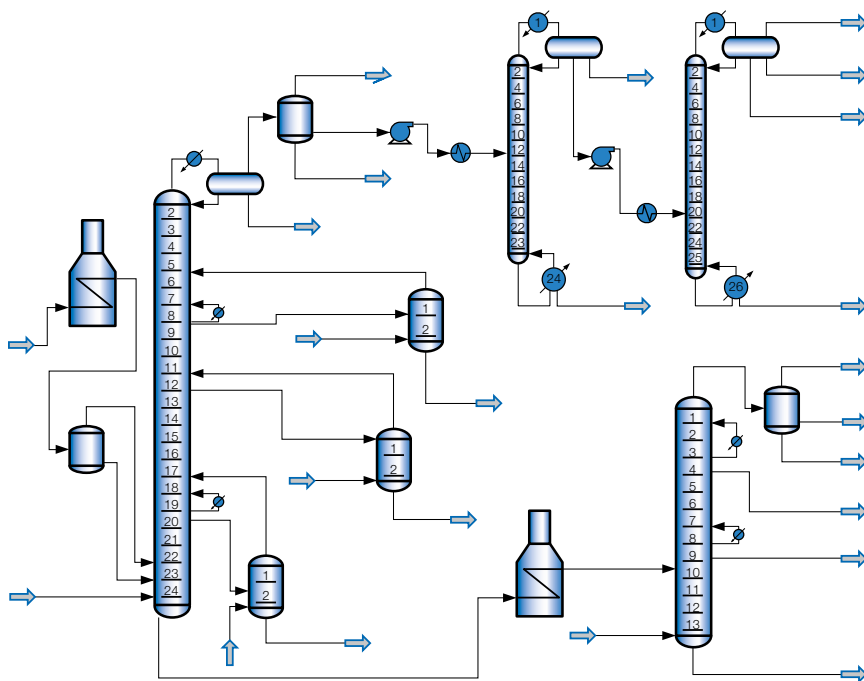
Pilot plant at Sulzer Chemtech



# Excellence in refining technology

## Process simulation

Sulzer Chemtech makes use of state-of-the-art simulation software. Process simulation experts can model new or revamped plant equipment, such as distillation columns, pumps, exchangers, valves, flash drums, fired heaters, piping, and fittings. Third-party thermodynamic packages are fine tuned for specific applications based on decades of experience at Sulzer Chemtech.



Process simulation model of a heat integrated crude and vacuum distillation unit

## Engineering services and products

For more than 50 years Sulzer Chemtech has provided innovative mass transfer components to the oil and gas, and petrochemical industries. Our company offers a wide range of products and engineering services.



Our team of experts optimizing the mass transfer components for a revamp of a crude and vacuum distillation unit to provide customers with maximum benefits while minimizing investment costs

## Engineering services

- Process simulation
- CFD study
- Feasibility study
- Basic engineering
- Detailed engineering
- Equipment design
- Installation at site
- Commissioning
- Start-up assistance
- Troubleshooting

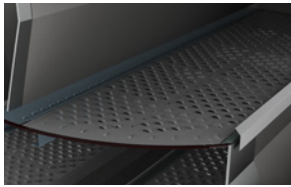
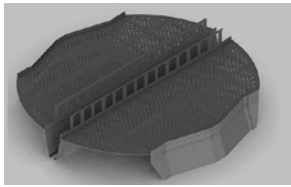

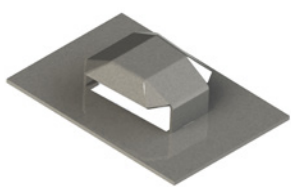




## Products

- Fractionation trays
- Structured packing
- Random packing
- Grids
- Distributors
- Static mixers
- Mist eliminators
- Coalescers




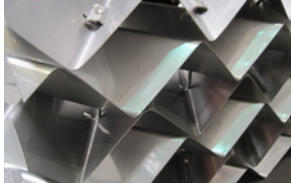


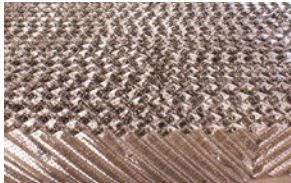
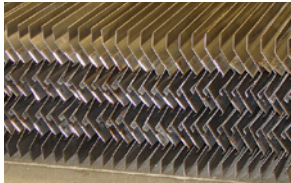
## FOR

- Crude oil distillation
- Vacuum distillation
- Lube oil fractionation
- Hydrotreating
- Fluid catalytic cracking
- Hydrocracking
- Coking
- Visbreaking
- Reforming
- Isomerization
- Alkylation
- Aromatics recovery
- Gas concentration
- Gas sweetening
- Liquid-liquid contactor
- Solvent deasphalting

# Innovative components

<p><b>VG AF™ Tray</b></p>	<p>High performance fractionation tray featuring enhanced fouling resistance and hydraulic capacity.</p>	
<p><b>UFMPlus™ VGPlus™ Tray</b></p>	<p>High performance fractionation tray featuring enhanced hydraulic capacity and separation efficiency.</p>	
<p><b>UFM™ Valve</b></p>	<p>Movable mini-valve featuring an innovative shape for maximum hydraulic capacity, separation efficiency, and the widest operating range.</p>	
<p><b>UFM™ AF XVG™ SVG™ Valve</b></p>	<p>High-performance fixed valves featuring a large opening and high lift for maximum fouling resistance.</p>	
<p><b>Shell HiFi™ Plus Tray</b></p>	<p>Multiple downcomer high performance fractionation tray suitable for high liquid loading applications.</p>	
<p><b>Shell ConSep™ Tray</b></p>	<p>Ultra system limit high performance fractionation tray suitable for debottlenecking columns which otherwise would require a larger vessel diameter.</p>	
<p><b>Shell Schoepentoeer Plus™</b></p>	<p>High-performance feed inlet distributor for mixed phases featuring devices that enhance bulk separation efficiency even at the highest feed inlet momentum.</p>	
<p><b>SMV™ Static Mixer</b></p>	<p>High-performance mixer that enables maximum homogeneous mixing with minimum pressure drop and robust design with no moving parts.</p>	

# Innovative components

<p>VEP Liquid Distributor</p>	<p>State-of-the-art trough type distributor with the highest drip point density for the maximum number of fractionation stages per unit of bed height.</p>	
<p>Mellapak™</p>	<p>High-performance structured packing that is particularly suitable for vacuum distillation and selective absorption.</p>	
<p>MellapakPlus™</p>	<p>The second generation of structured packing, featuring a geometric shape which drastically enhances the performance over standard Mellapak producing the highest number of theoretical stages per unit of pressure drop.</p>	
<p>MG40 AF Mellagrid™</p>	<p>High-performance grid featuring structured geometry for superior mechanical robustness and smooth surface for fouling resistance. High sheet thickness is used in corrosive environments.</p>	
<p>F-Grid™</p>	<p>Conventional type of grid suitable for fouling applications.</p>	
<p>NeXRing™ Nutter Ring™ I-Ring™</p>	<p>High-performance random packing suitable for sponge absorbers, amine contactors, and lube cuts aromatic extraction.</p>	
<p>SMV, SMVP Extraction Packing</p>	<p>High-performance structured packing suitable for liquid-liquid amine contactors and lube cuts aromatic extraction.</p>	
<p>Mellachevron™</p>	<p>High-performance mist eliminator suitable for heavy-duty applications.</p>	

# Enhanced mass transfer technology for heavy duty and fouling services in refinery

## Anti-fouling fractionation trays

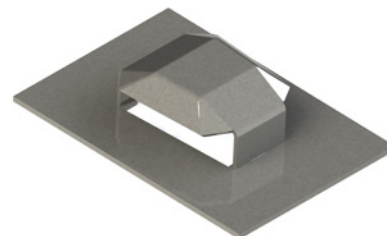
### UFM™ AF

UFM AF is the latest addition to our fixed valve portfolio. This enhanced valve is part of the UFMPlus tray family, developed specifically for fouling services.

UFM AF is a large valve with an umbrella shape which provides excellent fouling resistance especially in combination with the following anti-fouling features:

- Stepped outlet weirs
- Sloped outlet weirs
- Push valves

UFM AF is a premium anti-fouling valve with high hydraulic capacity and superior fractionation efficiency. It can be combined with enhanced downcomers to maximize capacity for a given tower diameter.



### VG AF™

VG AF trays are part of the VGPlus tray family and are particularly suitable for fouling applications.

Tray decks can be equipped with either SVG, our standard fouling resistant valve, or XVG, our extra large fixed valve developed particularly for severe fouling services. Push valves and enhanced outlet weirs are usually applied to minimize the fouling accumulation on the tray decks.

To maximize the mechanical resistance, even up to 14000 N/m<sup>2</sup> (2 psi), these trays can be equipped with the following features:

- Shear clips
- Through bolting panel connections
- Downcomer spreaders
- Explosion doors



2 Pass VG AF trays equipped with XVG valves, and Push valves for an Upgrader Main Fractionator



Extra Large XVG valve

# Enhanced mass transfer technology for heavy duty and fouling services in refinery

## Anti-fouling structured and random grids

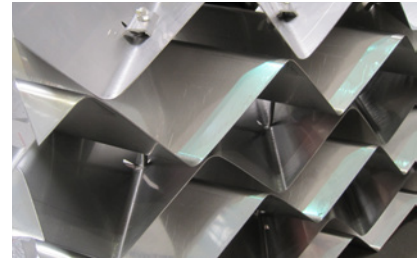
### Mellagrid and MG40 AF™

Mellagrid is a high performance grid featuring:

- Structured geometry for:
  - the highest de-entrainment efficiency
  - superior mechanical strength
  - good mass and heat transfer efficiency
- Smooth surface for:
  - the highest fouling resistance
  - minimum residence time
- Mellagrid can be manufactured with thick metal sheets when used in corrosive environments
- Mellagrid is suitable for cleaning via water and or steam jetting

MG40 AF is an evolution of standard Mellagrid, specifically developed to maximize the hydraulic capacity, fouling resistance and the mechanical robustness without compromising the de-entrainment efficiency.

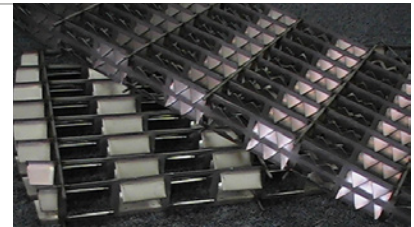
These grids can be delivered with tailor made support & hold down grids, and tie rods to further boost the mechanical resistance up to 14000 N/m<sup>2</sup> (2 psi).



MG40 AF™ high performance anti-fouling grids

### Nutter Grid and F-Grid

Nutter Grid and F-Grid are the conventional type of grids extensively used before the launch of the Structured Grids. They are mainly available upon Customer request



F-Grid

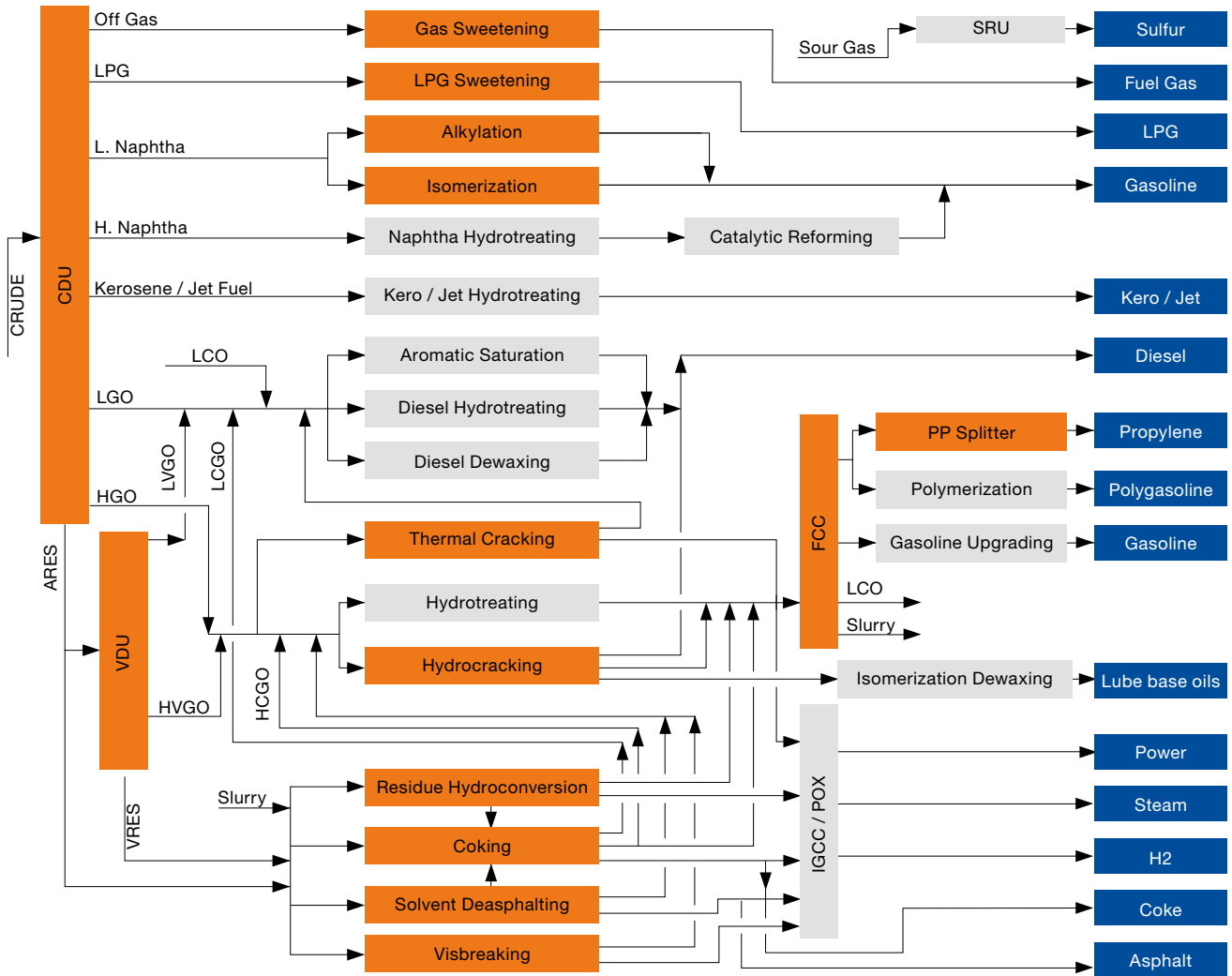
### VES liquid distributor

State-of-the-art trough type distributor suitable for high liquid loadings in fouling applications. It can handle solid particles without compromising the drip point density for a good distribution efficiency





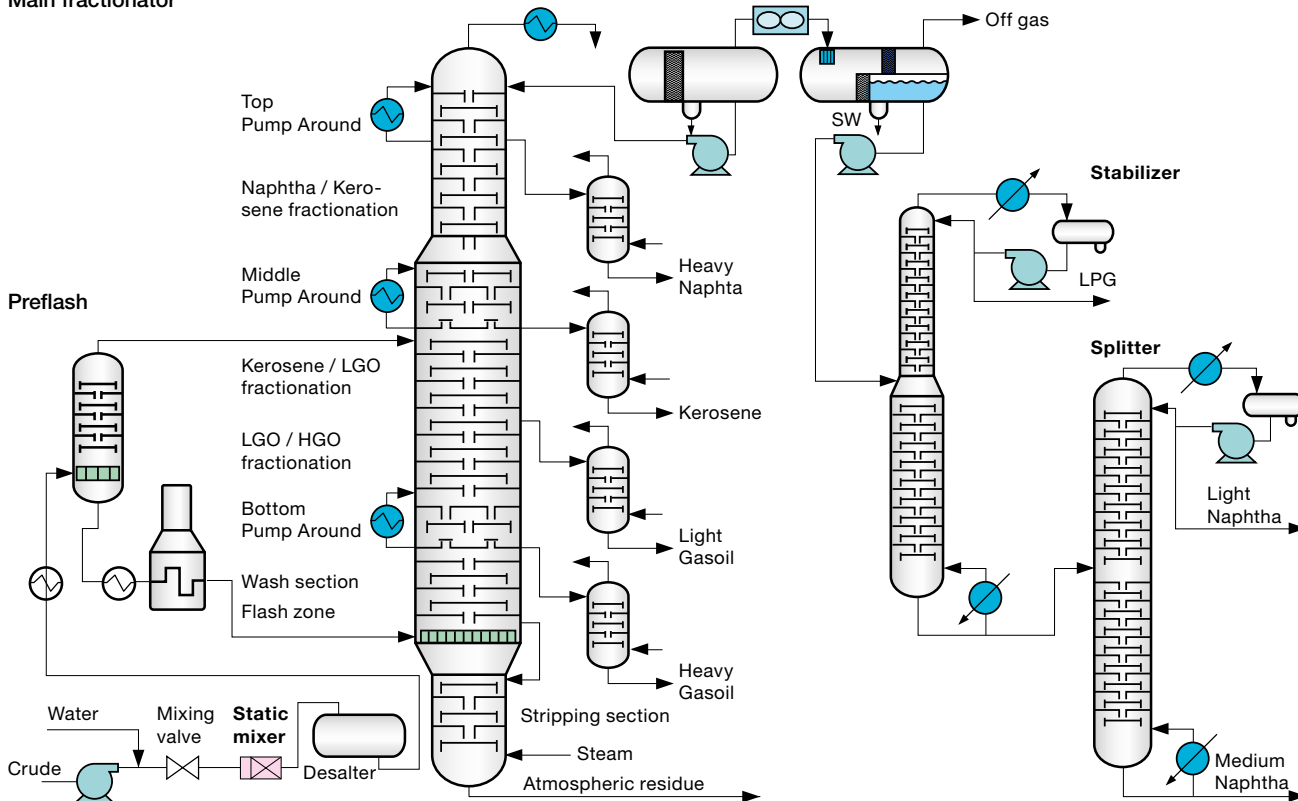
# Refinery flow chart





# Crude distillation unit

## Main fractionator



## CDU typical upgrading targets:

- Up to 30% additional capacity
- Up to 20% additional fractionation efficiency
- Up to 10% energy saving

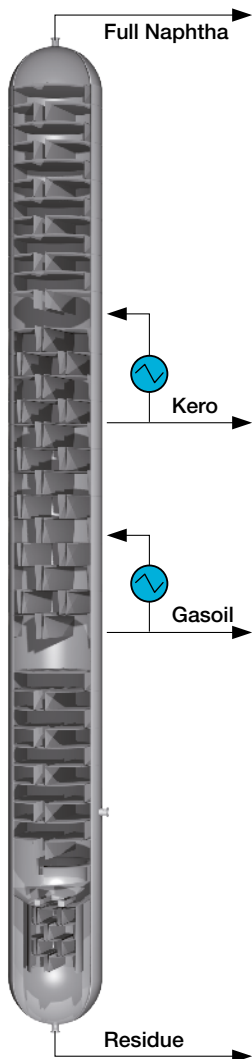


Shell Schoepentoeter Plus™: the advanced radial feed inlet vane device for the flash zone

## Mass transfer components best fit

Top section	VG AF trays, Mellagrid
Naphtha / Kero Kero / LGO LGO / HGO	VGPlus, UFMPlus trays
Middle PA Bottom PA	VG AF, VGPlus trays, Mellapak, MellapakPlus
Wash section	MellapakPlus, Mellapak VG AF, VGPlus trays
Flash zone	Shell Schoepentoeter Plus
Stripping section	VG AF, VGPlus trays, Shell HiFi Plus trays
Top receiver	Mellaplate coalescer, Mellachevron mist eliminator
Side strippers Preflash	VG AF, VGPlus trays
Stabilizer Splitter	VGPlus, UFMPlus trays Shell HiFi Plus trays

# CDU main fractionator upgrading



## Before revamp

Throughput: 160 KBPD

### Naphtha / Kerosene:

12 round valve trays  
760 mm tray spacing  
10 theoretical stages

### Top Pump Around:

5 round valve trays  
1070 mm tray spacing  
Duty: 26 MM Cal / h

### Kerosene / Gasoil:

5 round valve trays  
990 mm tray spacing  
3 theoretical stages

### Bottom Pump Around:

3 round valve trays  
990 mm tray spacing  
Duty: 10 MM Cal / h

### Wash Section:

10 round valve trays  
760 mm tray spacing  
5 theoretical stages

### Stripping Section:

5 Sieve trays  
610 mm tray spacing  
2 theoretical stages

## After revamp

Throughput: 180 KBPD

### Naphtha / Kerosene:

16 BDH valve trays  
510 mm tray spacing  
13 theoretical stages

### Top Pump Around:

Mellapak equipped with  
trough type liquid distributor  
Duty: 30 MM Cal / h

### Kerosene / Gasoil:

12 VGPlus trays  
500 mm tray spacing  
8 theoretical stages

### Bottom Pump Around:

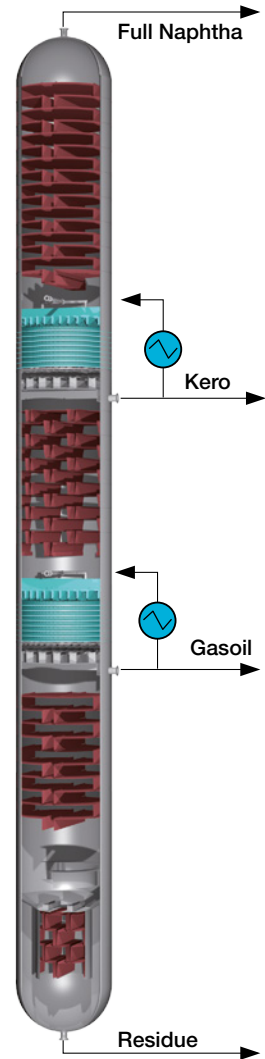
Mellapak equipped with  
trough type liquid distributor  
Duty: 12 MM Cal / h

### Wash Section:

10 MVG valve trays  
550 mm tray spacing  
5 theoretical Stages

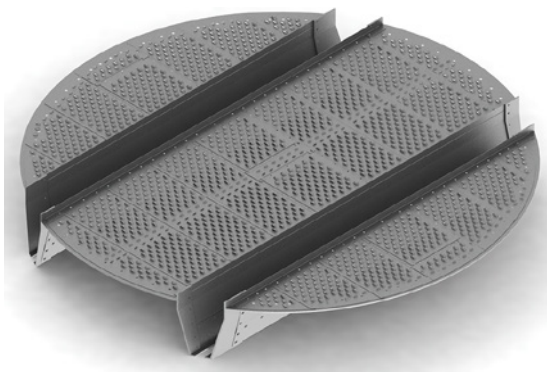
### Stripping Section:

5 MVG valve trays  
610 mm tray spacing  
over 2 theoretical stages

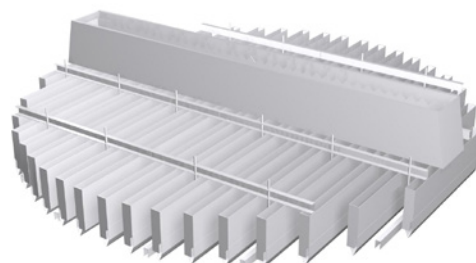


## Achievements:

- 10% additional capacity
- Sharper separation naphtha / kerosene
- Sharper separation kerosene / gasoil
- Gasoil suitable for low sulfur diesel production
- Less residue

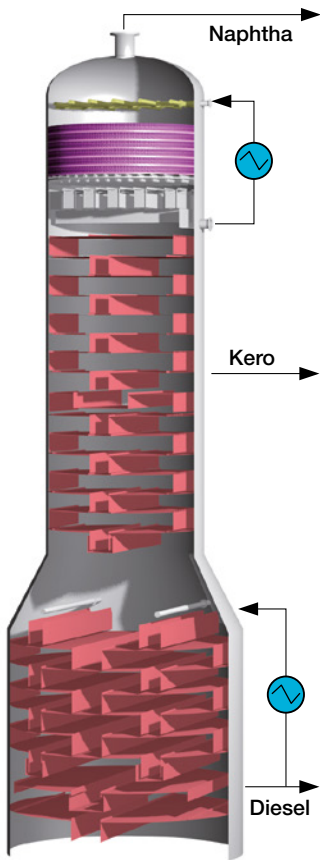


4-pass VGPlus high performance trays equipped with truncated downcomer, MVG, and push valves



VEH high-performance liquid distributor suitable for Pump Around sections

# CDU main fractionator upgrading

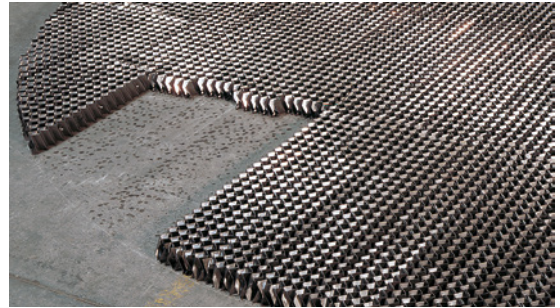


**Top Pump Around:**  
4 conventional trays replaced with Mellagrid in Alloy 59 to maximize capacity and improve corrosion resistance

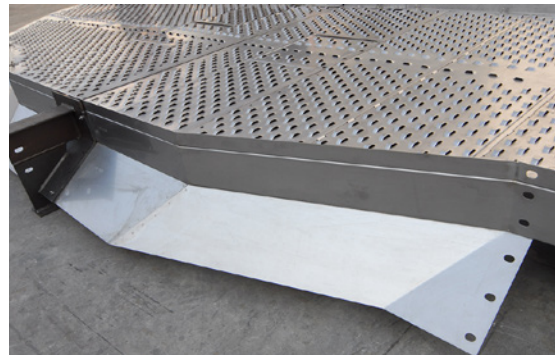
**Naphtha / Kerosene Section:**  
8 VGPlus trays retrofitting conventional trays to maximize capacity and improve the quality of the naphtha

**Kerosene / Diesel Section:**  
8 MVG trays retrofitting conventional trays to debottleneck the section

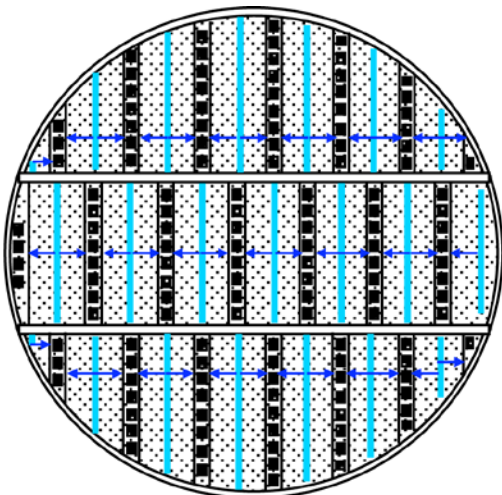
**Middle Pump Around:**  
4 MVG trays retrofitting conventional trays to debottleneck the section



Mellagrid: the high-performance structured grid at the top Pump Around



VGPlus high performance trays equipped with ModArc downcomer, MVG, and push valves



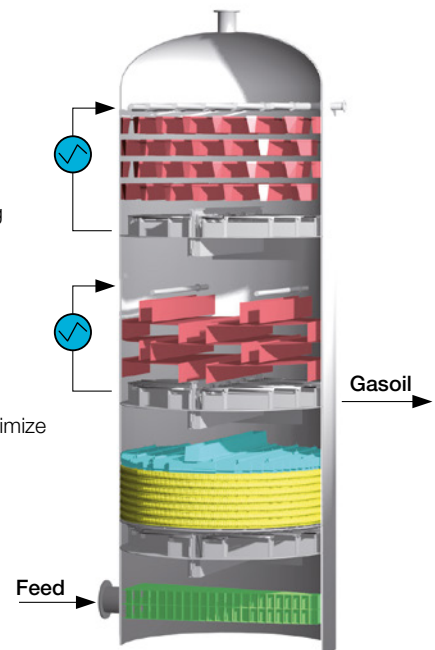
13-pass Shell HiFi Plus trays at the top Pump Around

**Top Pump Around:**  
13 pass HiFi Plus retrofitting  
4 pass conventional trays

**Bottom Pump Around:**  
4 pass conventional trays

**Wash section:**  
MellapakPlus retrofitting  
5 conventional trays to maximize gasoil yield and quality

**Flash zone:**  
Schoepentoeter



Upgrading a 400 KBPD CDU Main Fractionator



# Vacuum distillation unit

## Typical deep cut operating data:

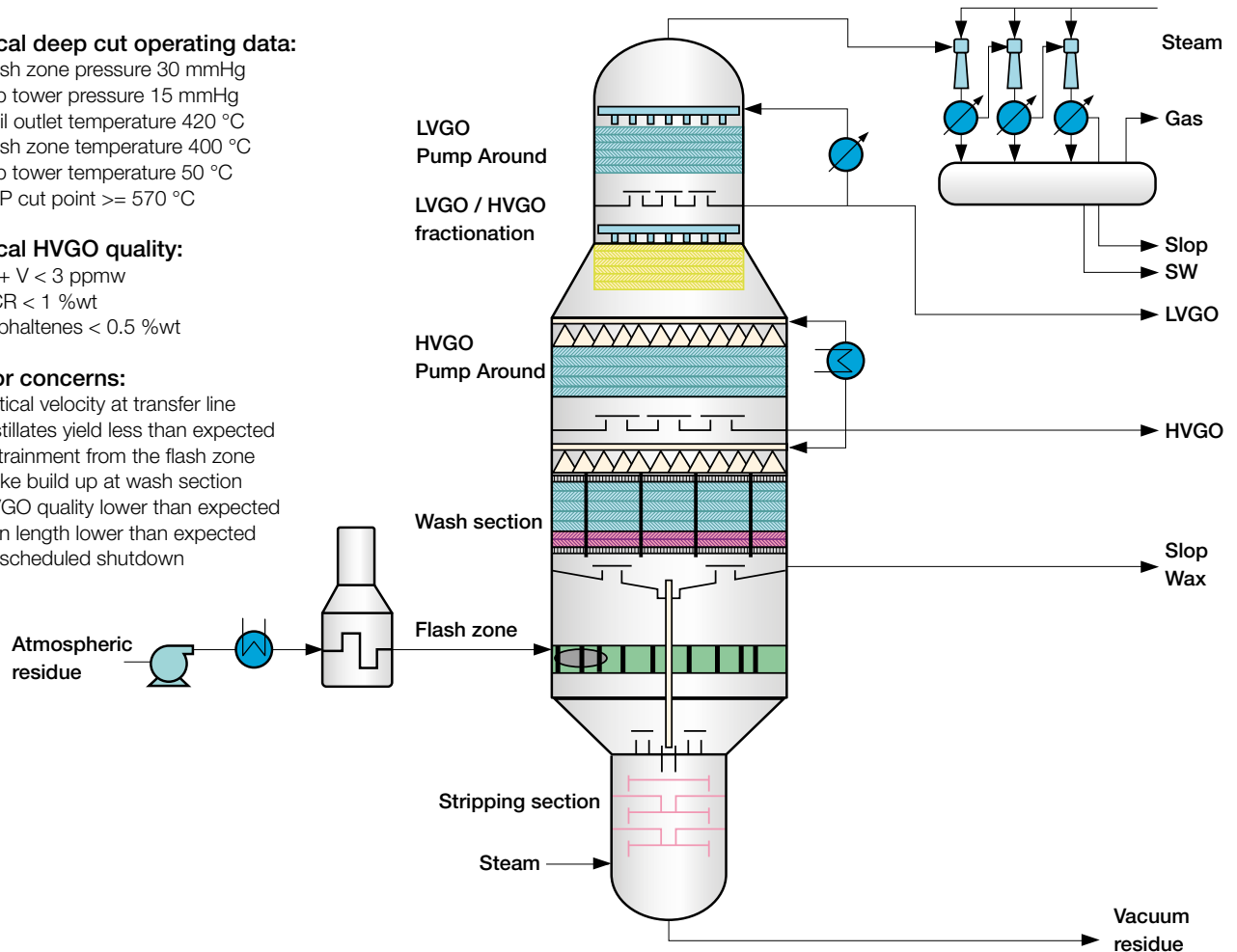
- Flash zone pressure 30 mmHg
- Top tower pressure 15 mmHg
- Coil outlet temperature 420 °C
- Flash zone temperature 400 °C
- Top tower temperature 50 °C
- TBP cut point  $\geq 570$  °C

## Typical HVGO quality:

- Ni + V < 3 ppmw
- CCR < 1 %wt
- Asphaltenes < 0.5 %wt

## Major concerns:

- Critical velocity at transfer line
- Distillates yield less than expected
- Entrainment from the flash zone
- Coke build up at wash section
- HVGO quality lower than expected
- Run length lower than expected
- Unscheduled shutdown



VG AF trays equipped with XVG valves for the stripping section

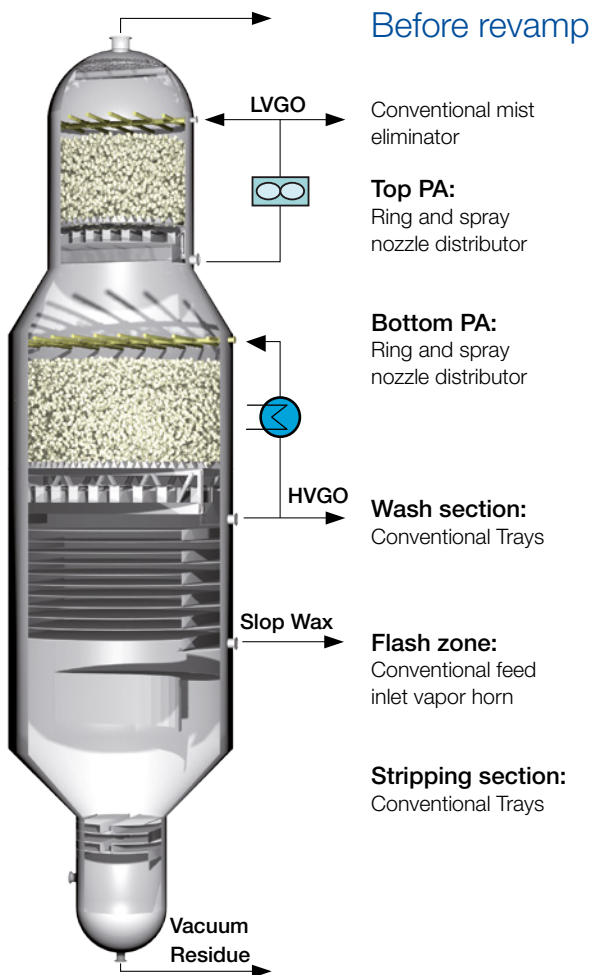


Mellagrid: high-performance structured grids for the wash section

## Mass transfer components best fit

LVGO PA	Mellapak, MellapakPlus, VEH gravity distributor
LVGO / HVGO	MellapakPlus, Mellapak, VEP gravity distributor
HVGO PA	Mellapak, MellapakPlus, VRD spray nozzles distributor
Wash section	Mellapak, MellapakPlus, MG40 AF, Mellagrid, F-Grid, VRD spray nozzles distributor, Support system to withstand uplift mechanical loadings
Flash zone	Advanced feed inlet vane device
Stripping section	VG AF trays

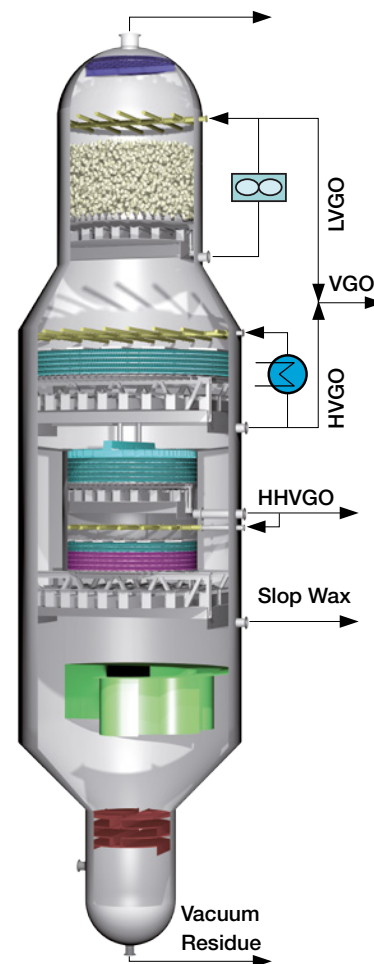
# Vacuum tower upgrading



## After revamp

Throughput: 80 KBPD

- Sulzer mist eliminator
- Top PA:** Reused Ring, new spray nozzle distributor
- Bottom PA:** Mellapak and spray nozzle distributor
- New HHVGO section:** Mellapak and trough type distributor
- Internal skirt**
- Wash section:** Mellapak, Mellagrid, and spray nozzle distributor
- Flash zone:** Advanced tangential feed inlet vanes device

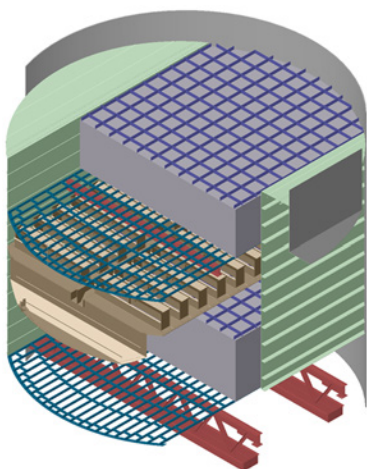


## Stripping section:

SVG Trays



SVG valves



Internal skirt used to fit the required mass transfer components while minimizing the need for new manways and/or process nozzles.

## Achievements

- Over 10% additional capacity
- Premium VGO quality to hydrocracker: CCR < 0.01 %wt
- Additional HHVGO side cut to FCC: Ni + V < 2 ppmw; CCR < 0.7 %wt
- Deeper cut point: 3 %wt on feed basis additional distillates recovery
- Heavier vacuum residue resulting in higher liquid yields at the coker plant

# Upgrading a vacuum tower and the heater's transfer line (before revamp)

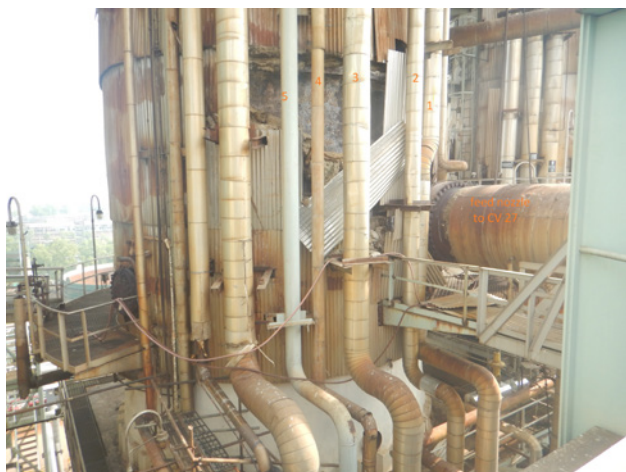
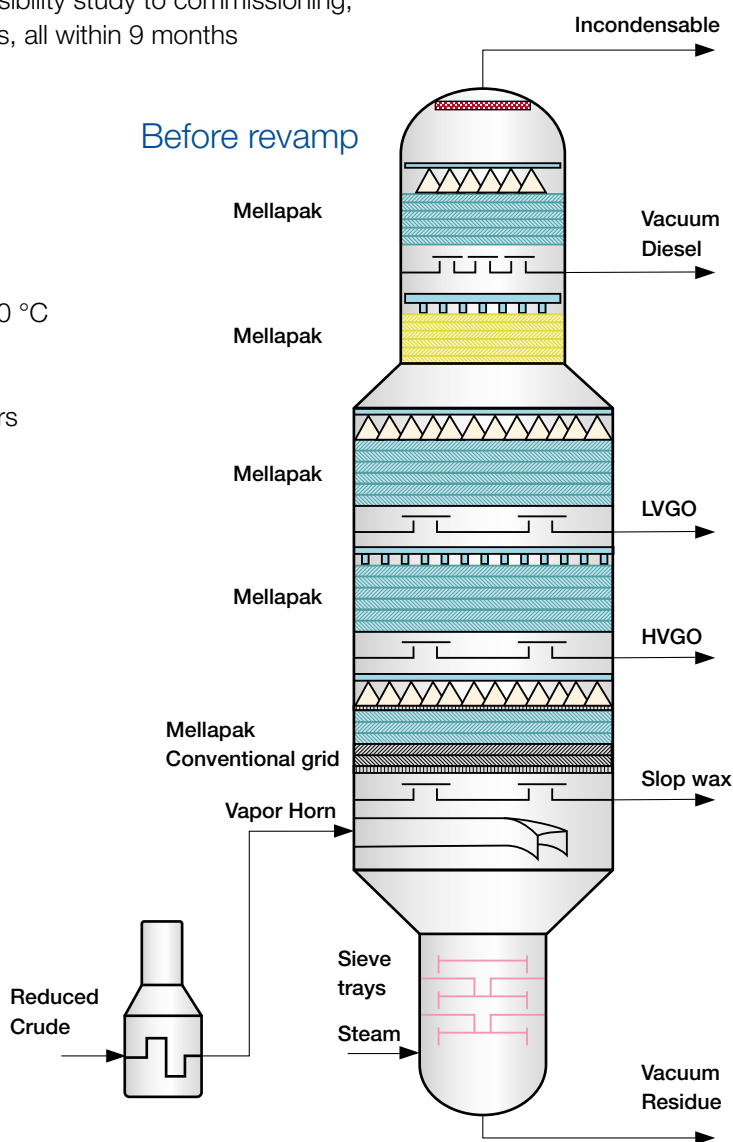
Sulzer serving as a single contractor from feasibility study to commissioning, start up, and witness of the revamping targets, all within 9 months

## Scope of the revamp

- Increase the robustness of the tower internals
- Increase the capacity by 11%
- Maximize the distillates yield
- Keep the products on spec:
  - 95 %Vol boiling point of Vacuum Diesel  $\leq 360$  °C
  - Ni + V in the VGO  $\leq 2$  ppmw
  - CCR in the VGO  $\leq 0.7$  % wt
- Stable and reliable operation for at least 5 years

## Scope of the study

- Process simulation
- Heat and Material balance
- Preheat Train and Pump Around circuits
- Fired Heater
- Transfer Line
- Vacuum column



Tangential feed inlet nozzle before revamp



Radial feed inlet nozzle after revamp



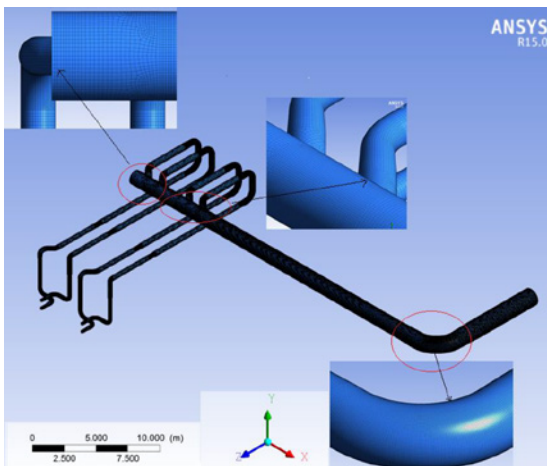
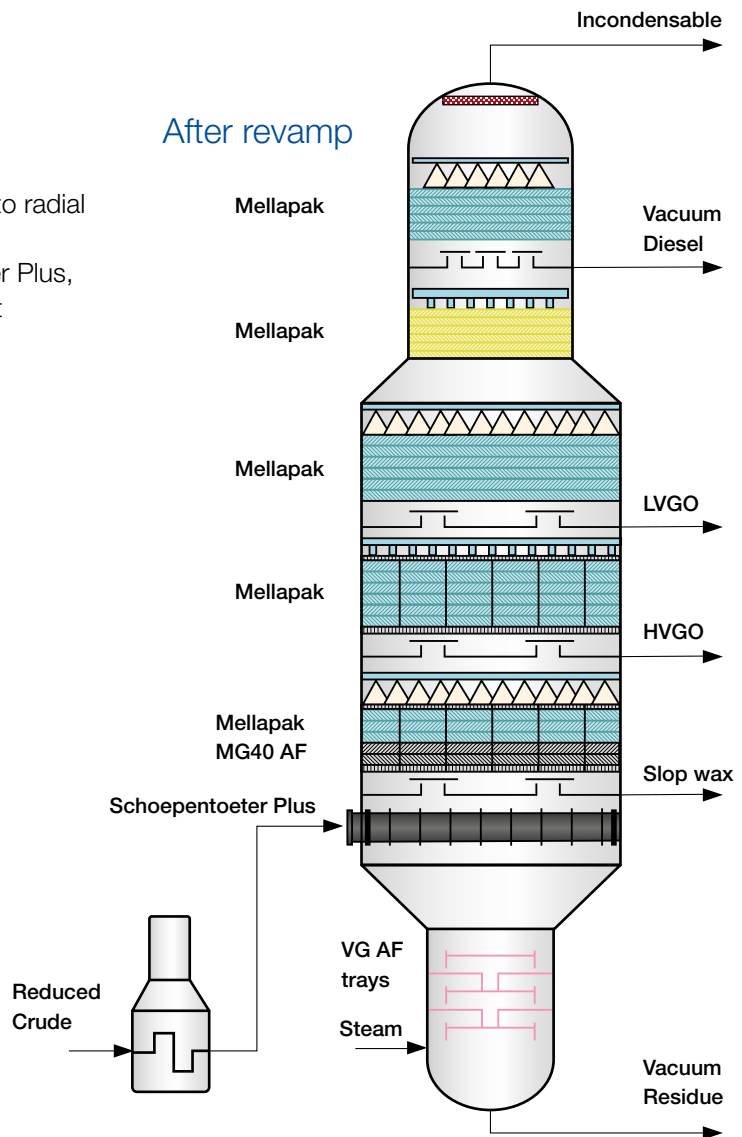
# Upgrading a vacuum tower and the heater's transfer line (after revamp)

## Scope of the supply

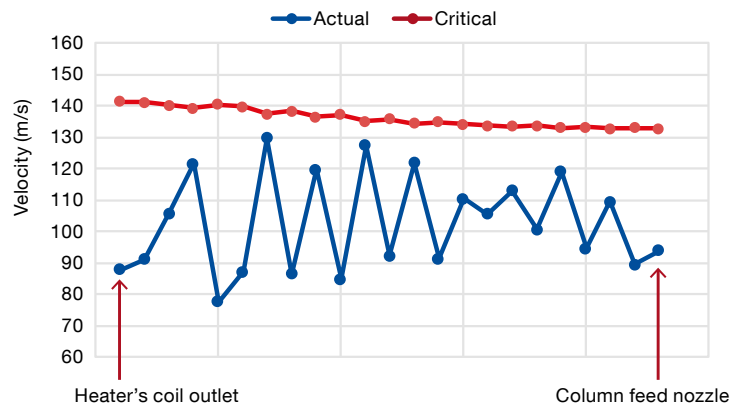
- New Feed inlet nozzle
- Relocation of the feed nozzle from tangential to radial
- Partial re-routing of the Transfer Line
- HVGO section, Wash section, Schoepentoeter Plus, and Stripping section designed for 2 PSI uplift
- Construction
- Commissioning
- Start up assistance

## Achievements:

- Throughput > 15 % wt
- Distillates yield > 0.5 % wt on feed bases
- Vacuum Diesel on Spec
- VGO on spec
- Minimized Vacuum Residue
- Run length significantly increased



CFD model of the Heater's Transfer Line



Velocity profile along with the Heater's Transfer Line

# Lube oil plant

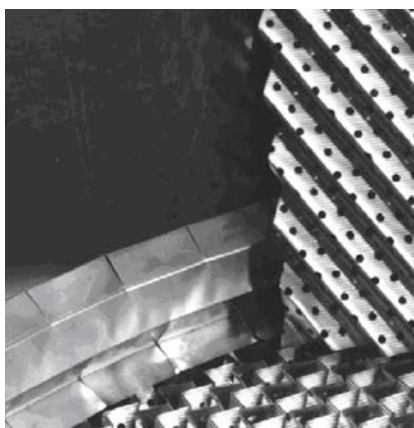
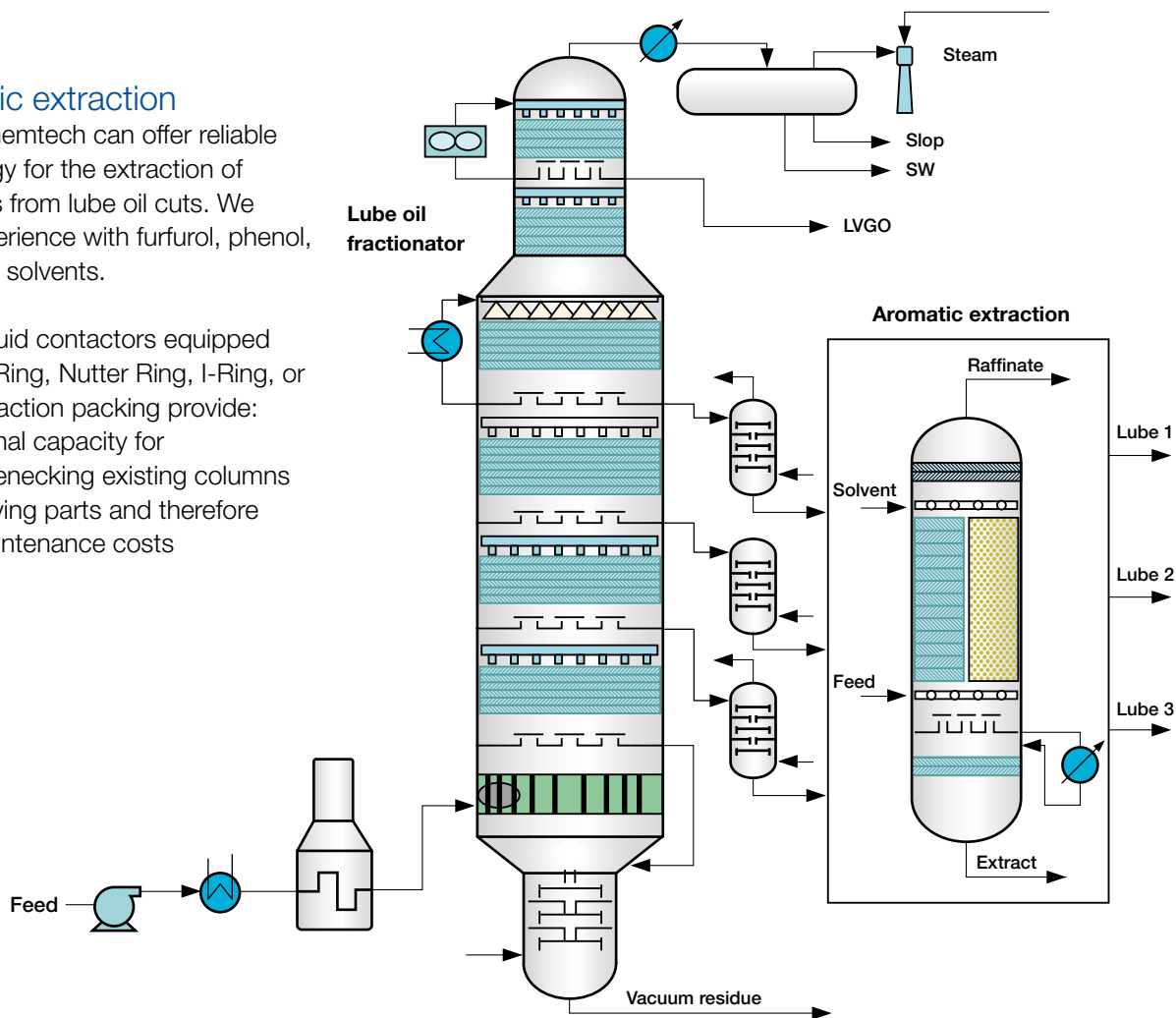
New product requirements in the lube oil market mean new challenges to refineries. Sulzer Chemtech has extensive lube oil experience with solutions for achieving specifications with more than 60 reference columns worldwide.

## Aromatic extraction

Sulzer Chemtech can offer reliable technology for the extraction of aromatics from lube oil cuts. We have experience with furfural, phenol, and NMP solvents.

Liquid-liquid contactors equipped with NeXRing, Nutter Ring, I-Ring, or SMV extraction packing provide:

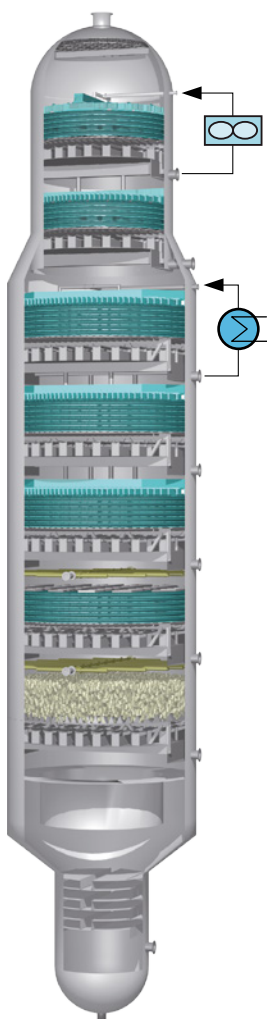
- Additional capacity for debottlenecking existing columns
- No moving parts and therefore low maintenance costs



High-efficiency Mellapak for lube vacuum tower

Features of Mellapak and MellapakPlus	Achievements
Low pressure drop	Maximum throughput and distillate recovery
High separation efficiency	Sharp fractionation with minimum operating cost
Several types of packing with high hydraulic flexibility	Wide operating range
Mechanical robustness	Reliable operation
Easy and fast installation	Low installation cost
Compact internals	Reduced tower dimensions

# Lube tower upgrading



## Before revamp

Throughput: 30 kBPD

Conventional mist eliminator

### LVGO Pump Around:

Mellapak  
VEP distributor

### LVGO / Lube 1:

Mellapak  
VEP distributor

### HVGO Pump Around:

Mellapak  
VEP distributor

### Lube 1 / Lube 2:

Mellapak  
VEP distributor

### Lube 2 / Lube 3:

Mellapak  
VEP distributor

### Lube 3 / Lube 4:

Mellapak  
Spray nozzle distributor

### Wash Section:

Ring  
Spray nozzle distributor

### Flash Zone:

Annular feed inlet device

### Stripping Section:

Conventional sieve trays

## After revamp

Throughput: 39 kBPD

Sulzer V-MISTER

### LVGO Pump Around:

High-capacity Mellapak  
VEP distributor

### LVGO / Lube 1:

Same arrangement

### HVGO Pump Around:

High-capacity Mellapak  
VEP distributor

### Lube 1 / Lube 2:

MellapakPlus  
VEP distributor

### Lube 2 / Lube 3:

MellapakPlus  
VEP distributor

### Lube 3 / Lube 4:

Same Mellapak, new  
VEP distributor

### Wash Section:

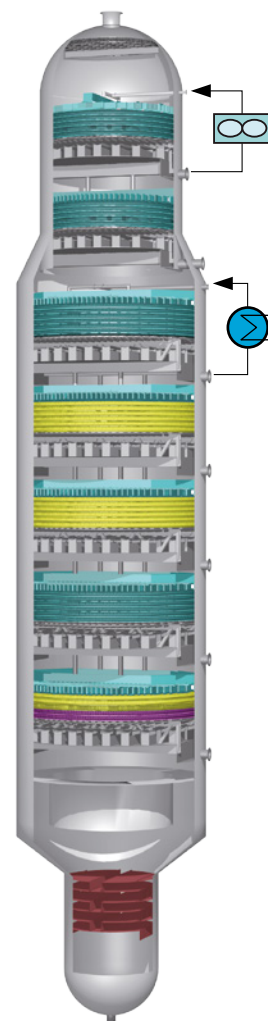
MellapakPlus, Mellagrid  
VEP distributor

### Flash Zone:

Reinforced annular feed inlet  
device

### Stripping Section:

SVG fixed valve trays



MellapakPlus for debottlenecking  
lube oil fractionator



Light Medium Heavy  
Lube oil samples after revamp

## Achievements:

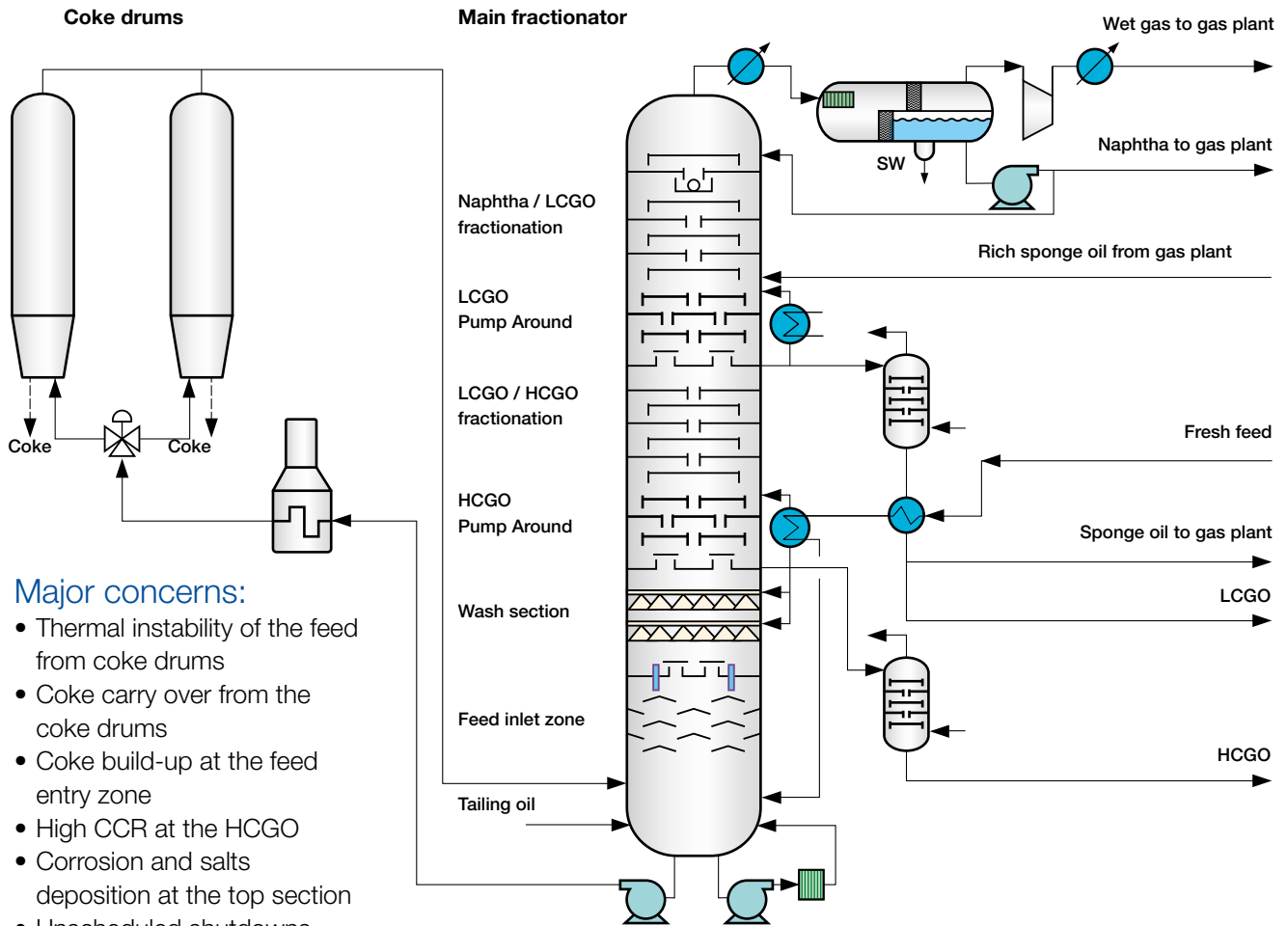
- Additional capacity: over 30%
- Additional lube yield: 0.5 %wt on feed base
- Premium quality lube cuts



VEP high-performance liquid distributor suitable for  
fractionation sections



# Coking unit

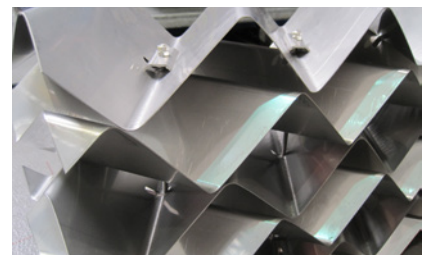


## Major concerns:

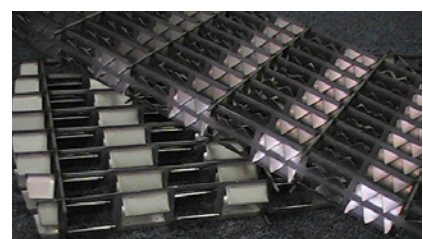
- Thermal instability of the feed from coke drums
- Coke carry over from the coke drums
- Coke build-up at the feed entry zone
- High CCR at the HCGO
- Corrosion and salts deposition at the top section
- Unscheduled shutdowns

## Mass transfer components best fit

Top section	VG AF trays
Naph / LCGO	VG AF, VGPlus trays, MellapakPlus
LCGO PA	VG AF trays, MellapakPlus
LCGO / HCGO	VG AF, VGPlus trays
HCGO PA	VG AF trays, MG40 AF, Mellagrid
Wash section	MG40 AF, Mellagrid, F-Grid
Feed inlet zone	Baffle trays
Top receiver	Mellaplate coalescer Mellachevron mist eliminator

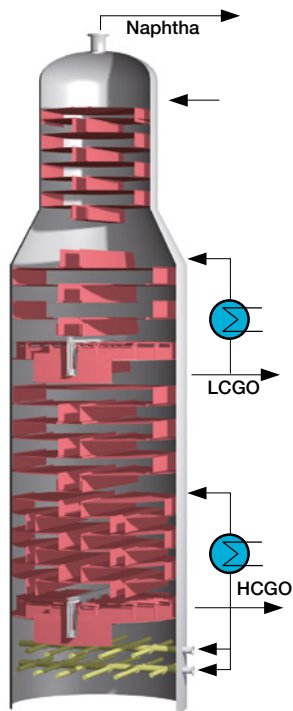


MG40 AF



F-Grid

# Coker main fractionator upgrading

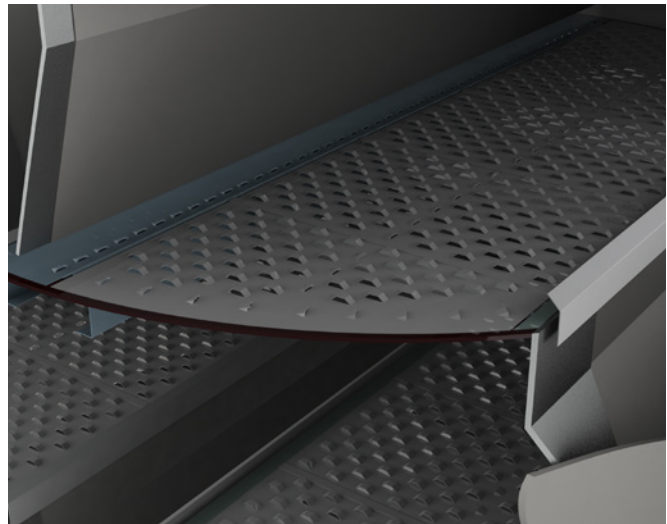


**Naphtha / LCGO**  
8 VG AF trays retrofitting conventional valve trays

**LCGO Pump Around:**  
4 VG AF trays retrofitting conventional valve trays  
**LCGO / HCGO:**  
6 VG AF trays retrofitting conventional trays

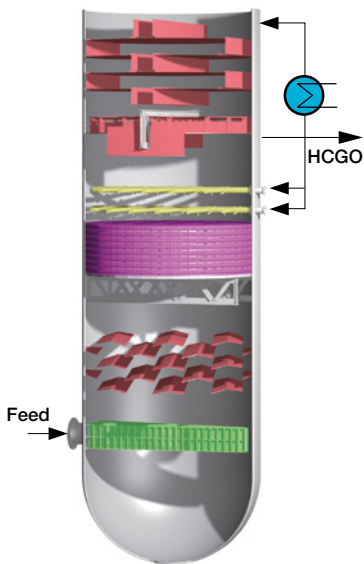
**HCGO Pump Around:**  
4VG AF trays retrofitting conventional trays

**Wash section:**  
New spray nozzle distributor



2-pass VG AF high-performance anti fouling trays equipped with MVG fixed valves, push valves, and stepped outlet weir

Upgrading a coker main fractionator to boost the capacity from 140 to 180 KBPD and increase the run length up to 5 years.



**HCGO Pump Around:**  
4 MVG trays retrofitting conventional trays

**Wash section:**  
New spray nozzles distributor  
Mellagrid retrofitting 5 fixed valves trays

**Feed inlet zone:**  
New 6 pass baffle trays

Existing Schoepentoeter cleaned & reused



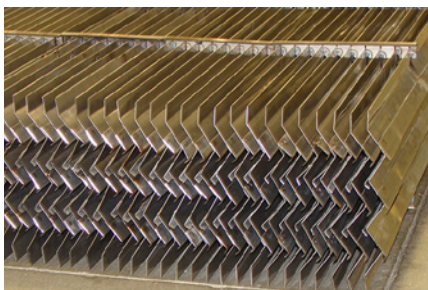
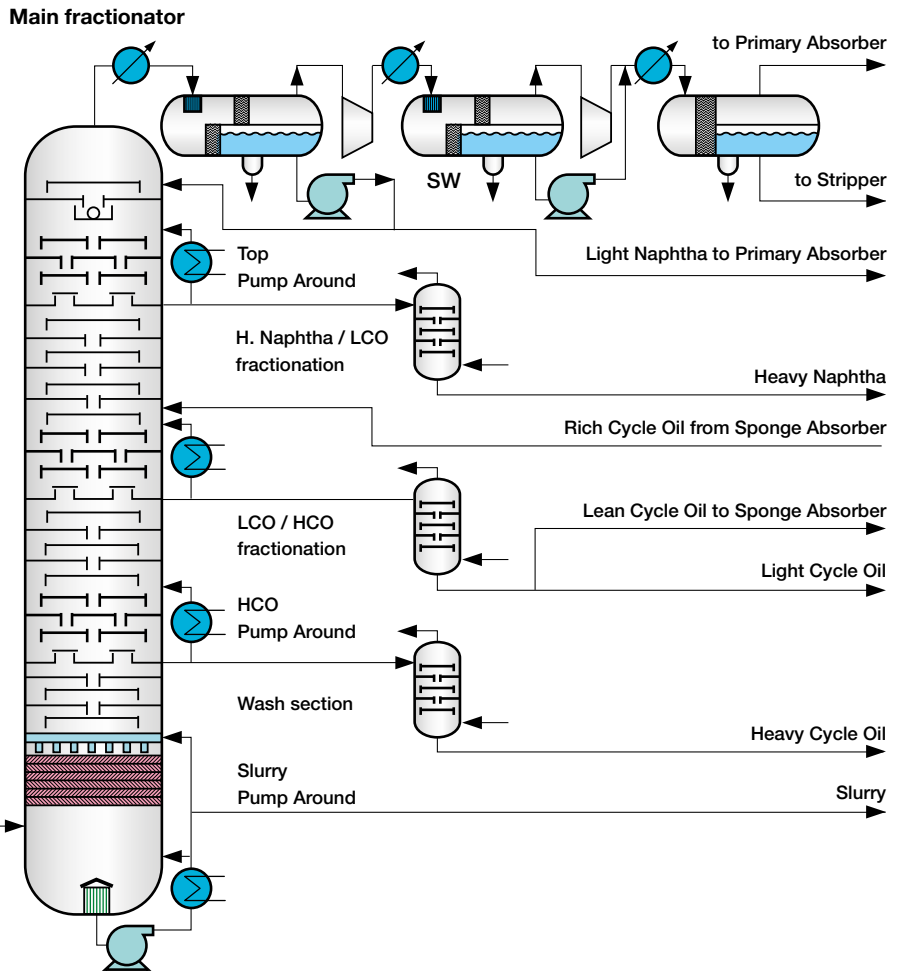
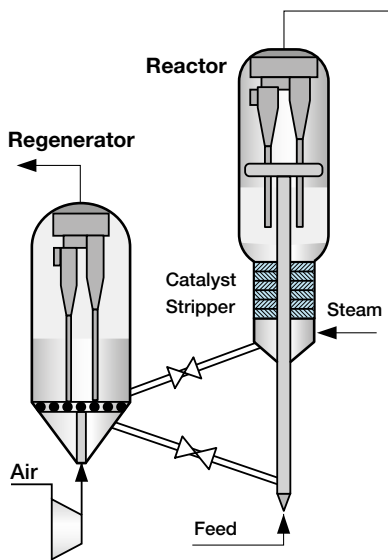
Mellagrid high-performance structured grid after 3 years operation, only small amount of coke at the bottom of the bed, washed in place and reused

Upgrading a coker main fractionator to double the capacity, increase the liquid yield, and reduce the CCR of the HCGO from 0.4 to 0.3 %wt

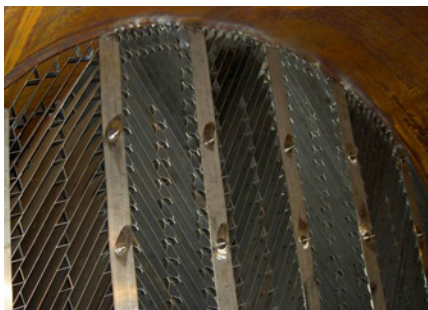
# Fluid catalytic cracking



SMV packing for the catalyst stripper



Mellachevron mist eliminator for the top receiver

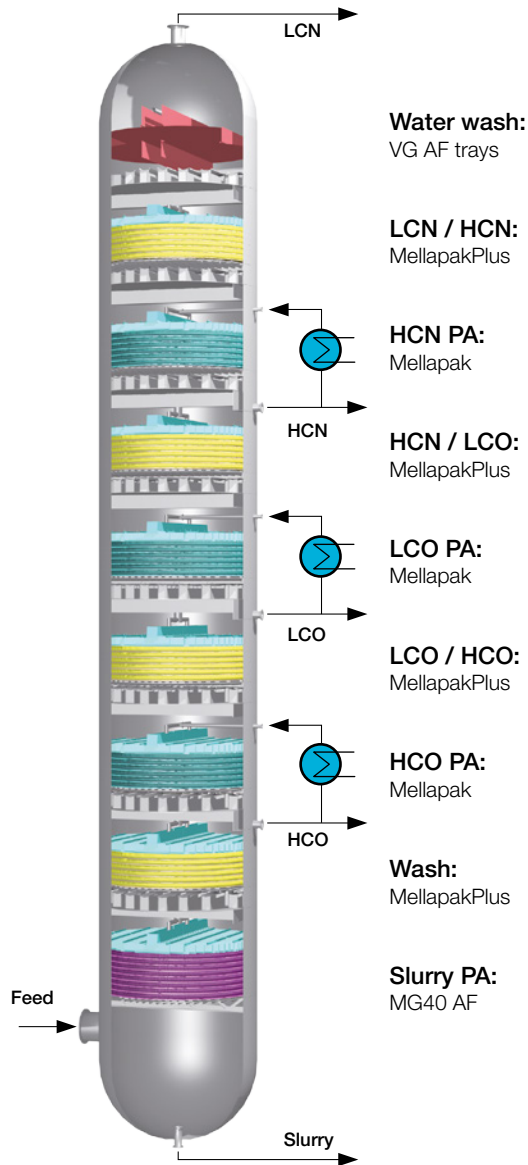


Mellaplate coalescer for the top receiver

## Mass transfer components best fit

Top section	VG AF trays, Mellagrid
Naph / LCO LCO / HCO	VGPlus, UFMPlus trays MellapakPlus, Mellapak
Top PA LCO PA HCO PA	VG AF, VGPlus trays MellapakPlus, Mellapak
Wash section	MellapakPlus, Mellapak VG AF trays
Slurry PA	MG40 AF, Mellagrid, F-Grid
Catalyst stripper	SMV packing
Top receiver	Mellaplate coalescer Mellachevron mist eliminator

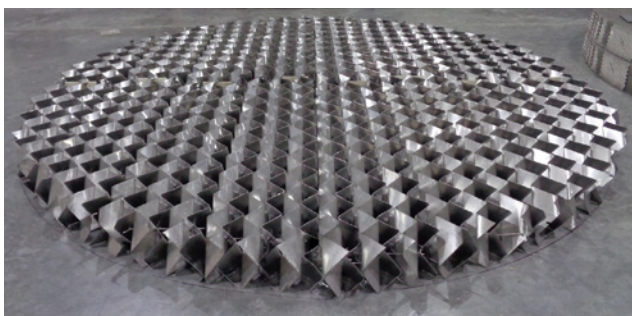
# State-of-the-art FCC main fractionator



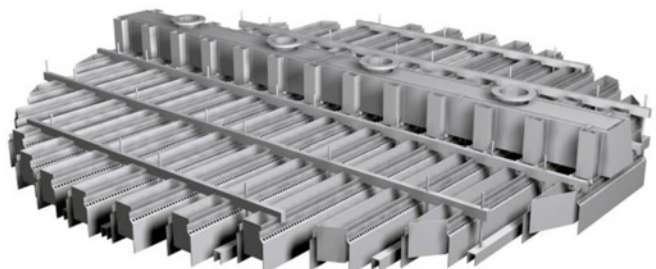
For large main fractionators, **structured packing** becomes a very attractive solution when compared to fractionation trays.

The low pressure drop across the tower allows the reactor to operate at minimum pressure with the highest conversion rate and distillates yield, while keeping the wet gas compressor and the air blower within a reasonable size.

- **MellapakPlus** in the fractionation sections further reduces the pressure drop while maintaining high separation efficiency. The top water wash section of the tower is often subject to corrosion and salt deposition.
- **VG AF trays** equipped with anti-fouling features and a properly designed draw-off tray are recommended. The high operating temperature and consequent-mechanical instability, the risk of coke build-up, and the catalyst debris carry-over, make the Slurry Pump Around the most critical section of the tower. Mass transfer components that are specifically developed for this section are essential:
- **VES**, the liquid distributor suitable for handling solid debris and coke particles.
- **MG40 AF**, the high performance grid that features structured geometry for superior mechanical robustness, and smooth surface for fouling resistance. It can often be cleaned with jet washing. Alternatively, a conventional type **F-grid** can be used.
- **Support and hold down grids** equipped with features to withstand uplift loadings.



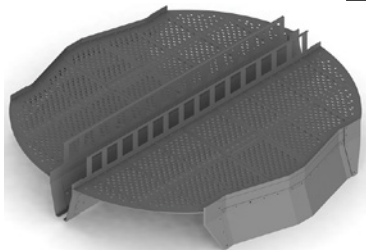
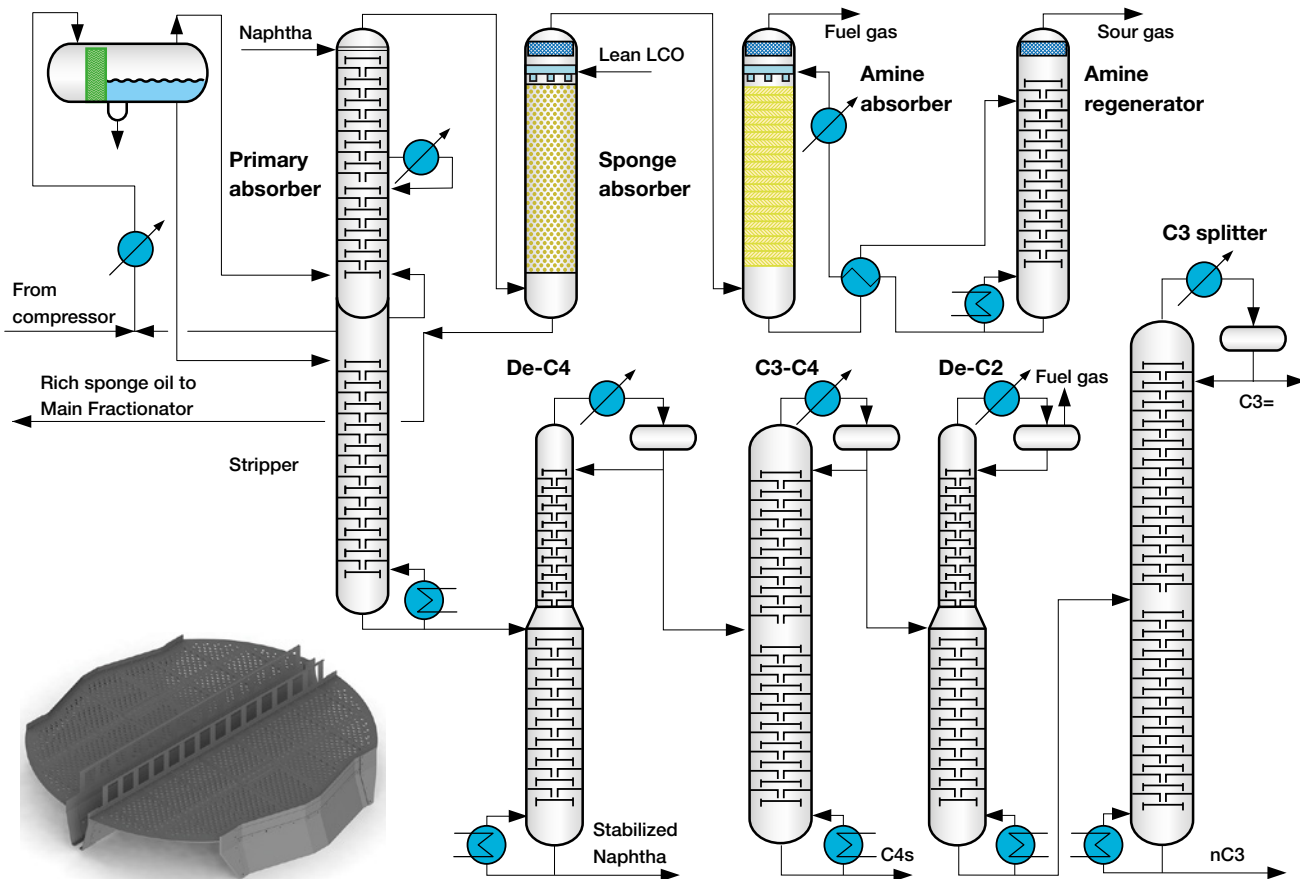
MG40 AF for the Slurry Pump Around



VES distributor for the Slurry Pump Around



# FCC Gas concentration unit



4-pass VGPlus tray



Sulzer Knitmesh™ V-MISTER enhanced performance mist eliminator



NeXRing

## Mass transfer components best fit

Sulzer Chemtech provides the widest range of high-performance mass transfer components to maximize LPG recovery, energy saving and throughput, while minimizing investment cost.

C3 Splitter	VGPlus, UFMPlus trays Shell HiFi Plus trays
De-C4, C3/C4, De-C2	VGPlus, UFMPlus trays Shell HiFi Plus, ConSep trays
Primary and Sponge Absorbers	VG AF trays, NeXRing Nutter Ring, I-Ring
Stripper	VG AF trays, NeXRing Nutter Ring, I-Ring
Amine Absorber and Regenerator	VG AF, HiFi Plus trays MellapakPlus, Mellapak, NeXRing, Nutter Ring, I-Ring

# LPG and gas sweetening

Sulzer Chemtech has extensive experience in designing amine absorbers and regenerators equipped with:

- Conventional trays featuring BDH movable valves or V-Grid fixed valves
- VGPlus and VG AF high performance trays
- Mellapak or MellapakPlus structured packing
- NeXRing, Nutter Ring, I-Ring random packing
- Mist eliminators

## Selective absorption

Mellapak or MellapakPlus is recommended for selective absorption of sour gas systems contaminated with CO<sub>2</sub>; the advantages are:

- High selectivity due to short residence time
- Minimum solvent requirement
- Minimum solvent regeneration cost
- Minimum investment cost
- Low pressure drop

## Tail gas treatment

For these units, operating at atmospheric pressure, Mellapak or MellapakPlus is strongly recommended for the quench tower and the H<sub>2</sub>S absorber to minimize pressure drop and energy consumption

## LPG sweetening

Liquid-liquid amine contactors incorporate the following customized internals:

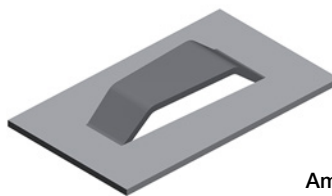
- SMV and SMVP extraction packing
- Coalescer packing
- NeXRing, Nutter Ring, I-Ring random packing
- VRXK distributor for the continuous phase
- VRXD distributor for the dispersed phase
- VSX disperser / support plate
- Shell HiFi extraction trays
- Sieve trays



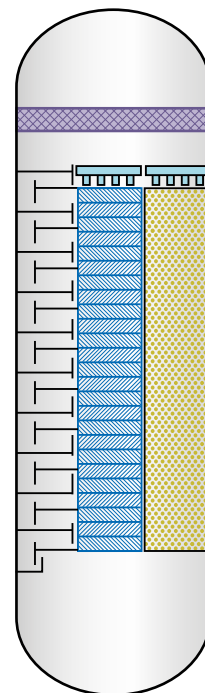
V-MISTER mist eliminator



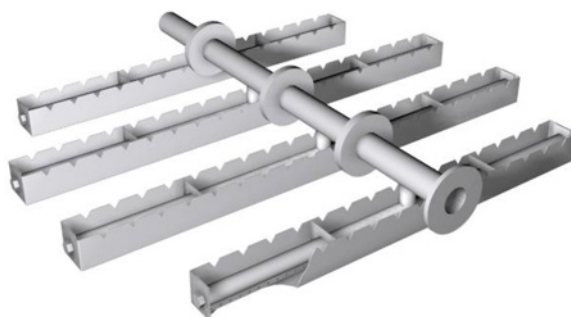
NeXRing



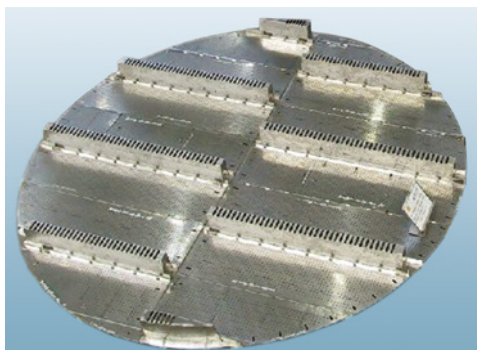
V-Grid fixed valve



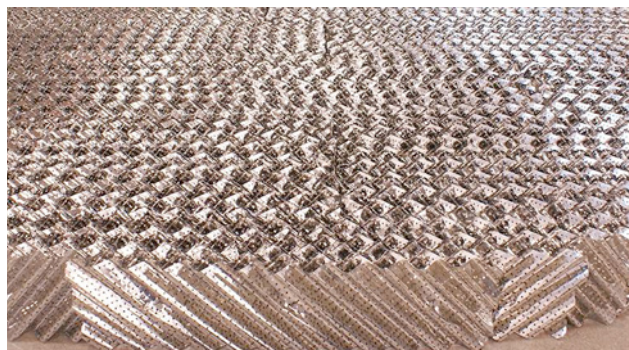
Amine absorbers and regenerators can be equipped with trays, structured or random packings



VRXK high-performance distributor for the continuous phase

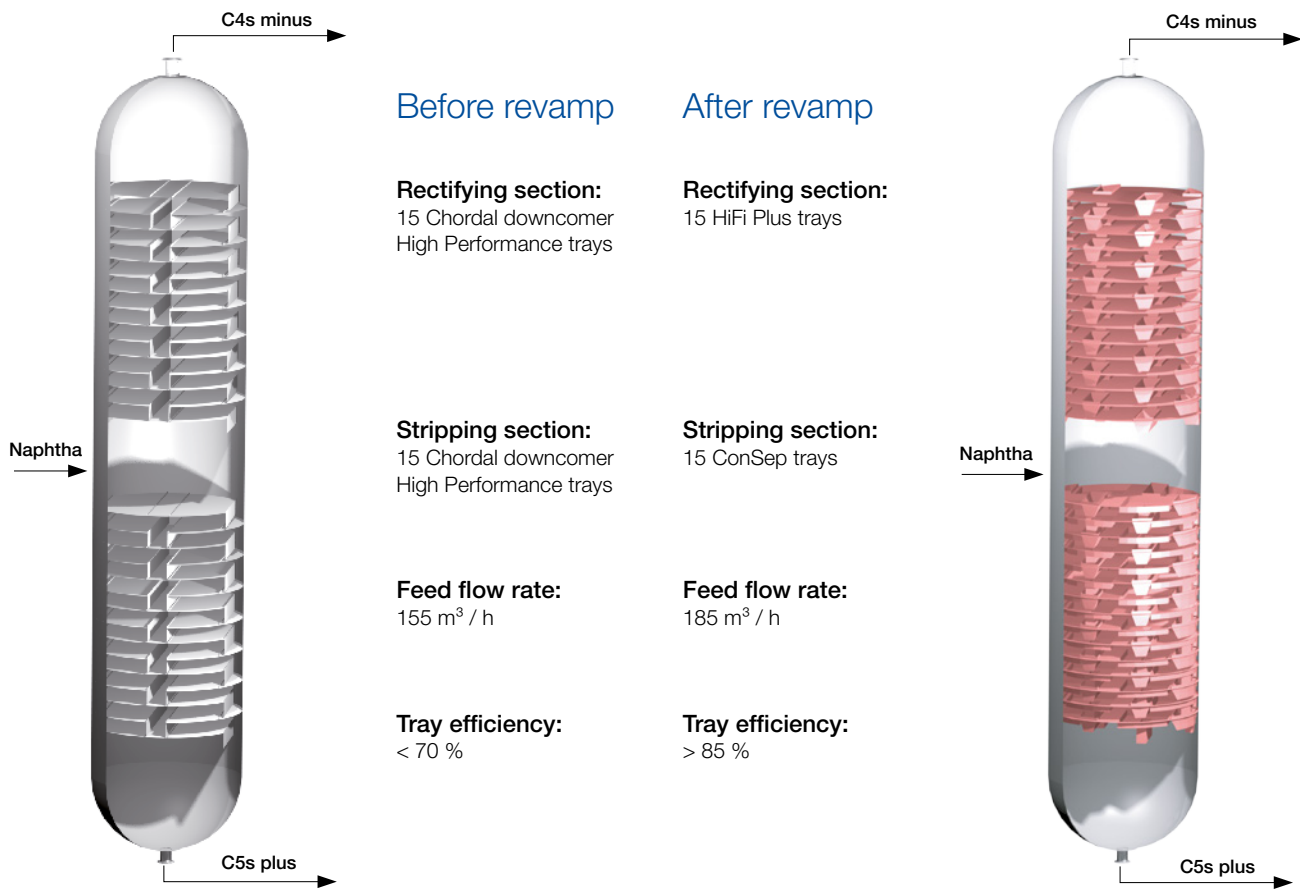


Shell HiFi extraction trays



SMV extraction packing

# Debutanizer upgrading



Shell HiFi Plus high-capacity tray equipped with MVG valves

## Achievements:

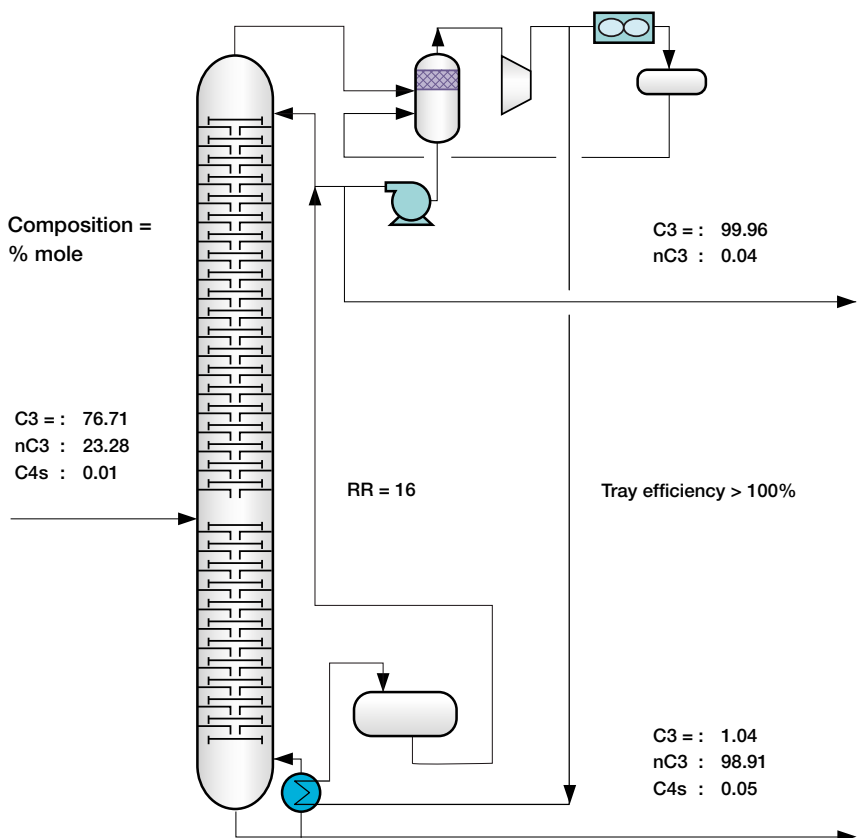
- 20% additional capacity
- 20% additional separation efficiency
- Naphtha and LPG on spec



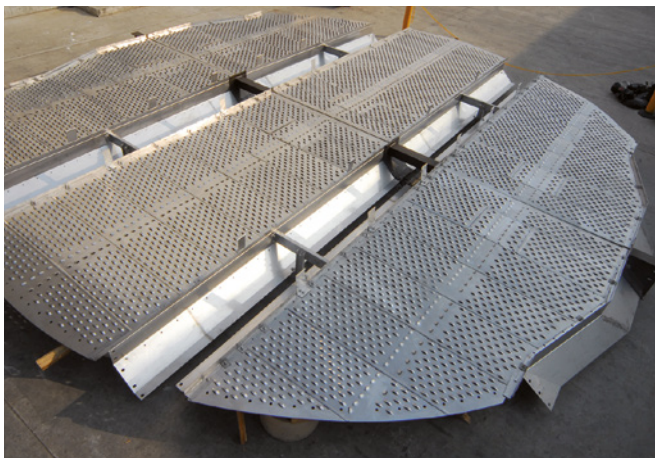
Shell ConSep tray: the ultra system limit high-capacity tray



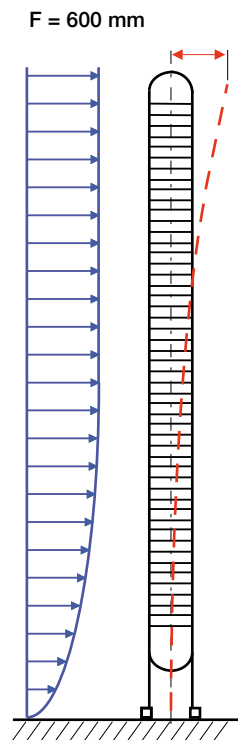
# State-of-the-art propylene-propane splitter



In a superfractionator, the wind deflection at the top section of the vessel is of great concern. This deflection can significantly impact the levelness of the trays, causing maldistribution with consequent loss of the separation efficiency. Sulzer Chemtech can provide tailor-made devices to prevent maldistribution, and enable maximum mass transfer efficiency.

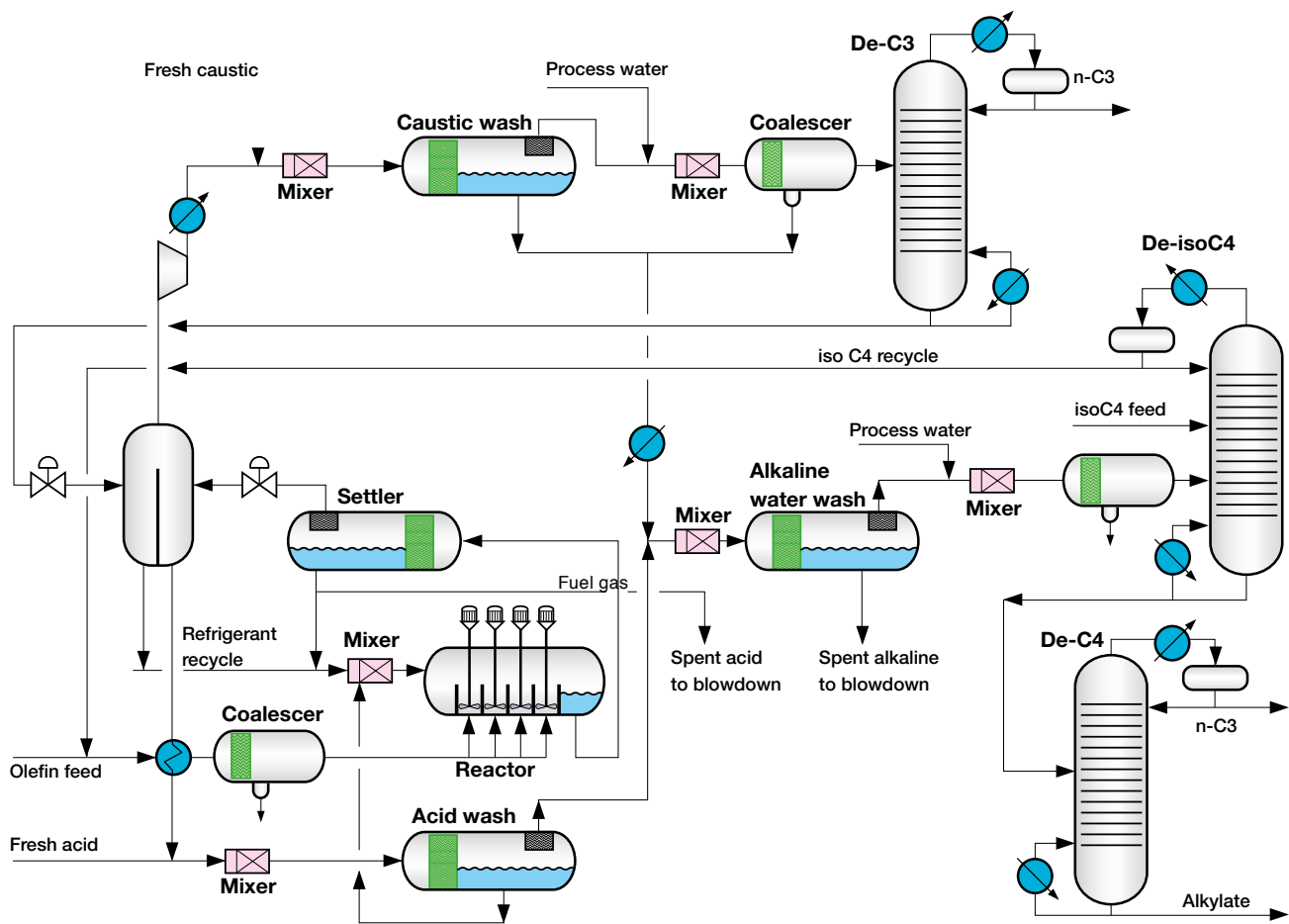


6-pass VGPlus high performance trays equipped with ModArc downcomer, MVG, and push valves, for a 8000 mm diameter PP splitter



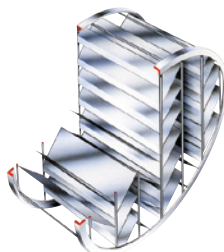


# Alkylation



## Sulzer separators

Sulzer DC Coalescer and Sulzer Mellaplate are the coalescers used in the acid settler, acid wash tank, alkaline wash tank, and in the caustic wash tank, to drastically reduce the required residence time for phase separation. This technology provides significant savings for new units and higher performance when debottlenecking existing units.



Mellaplate™ coalescer

## Sulzer static mixers

Sulzer SMV static mixers are used to improve the performance of the following equipment:

**Reactor:** to minimize the formation of undesired products.

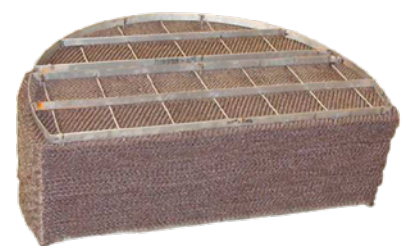
**Acid wash tank:** to maximize the extraction of the free acid and the alkyl / di-alkyl sulfates from the net effluent.

**Caustic wash tank:** to improve the removal of any traces of acidic components and protect the De-C3 from corrosion.

**Alkaline wash tank:** to improve the removal of any residual free acid and alkyl / di-alkyl sulfates and protect the De-isoC4 & De-C4 from corrosion.



SMV static mixer



DC Coalescer™

# Additional capabilities

## Turnaround Services

The Sulzer Chemtech Turnaround Services (TAS) team is known for its fast delivery and quality of the goods, its reliability, and customer oriented approach.

TAS is available 24 hours a day, 7 days a week, to provide customers with the best response time and premium quality service.

Our team can provide complete, around-the-clock support for your planned or emergency turnarounds. We offer material replacements with our complete line of products regardless of the original equipment manufacturer.

Our global manufacturing network allows us to bring our service and goods to you, day or night, in almost every country of the world.

## Tower Field Service

Sulzer Chemtech's Tower Field Service has the expertise and experience to ensure that projects are executed with the highest standards of safety, quality, and efficiency. Our extensive depth of technical strength and project and construction management skills assist the client in obtaining the process goals they desire, within the constraints of a shutdown or construction environment.

The challenge to complete multiple tower revamps and retrofits safely and on time is what Tower Field Service most prides itself on.

For tower revamps and retrofits, Tower Field Service can provide a streamlined solution to ensure minimal downtime. A systematic, practical approach for tower revamping projects is essential in obtaining a successful outcome.

These capabilities have been tested and proven in thousands of projects around the world.

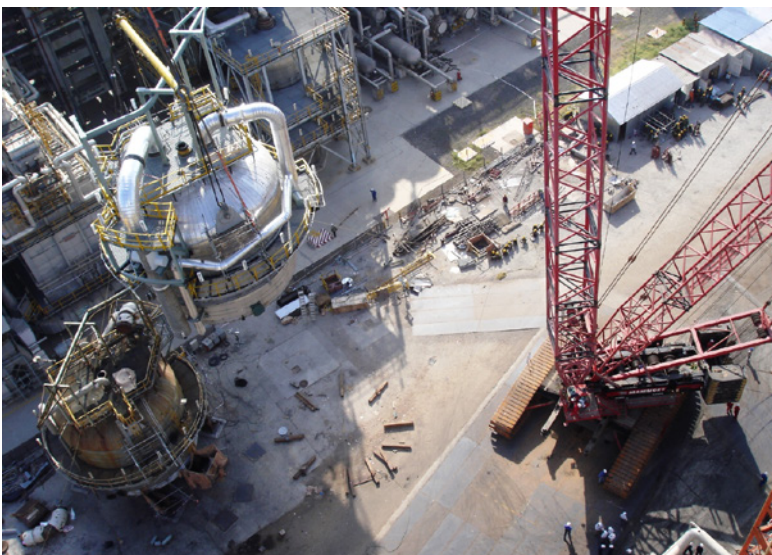
## Sulzer Pumps Equipment

Sulzer Pumps Equipment is a leading global supplier of reliable products and innovative pumping solutions for all industrial applications, including crude oil refining.

Sulzer Pumps Equipment combines more than 135 years of experience in pump research, development and manufacturing with a commitment to fully understand the needs of our customers. Our detailed process and application knowledge, combined with an in-depth understanding of market demand, keeps us consistently at the leading edge of technical development.

Some refining processes produce coke particles and chunks. If these particles are too large, they are trapped between impeller vanes and may reduce or stall flow.

The coke crusher breaks up coke particles, while maintaining pumping output. It is available for all refining pumps operating in severe fouling environments.



**BBS: Single Stage Between Bearing, typically used at high temperature, high flow and high head, that is typically found in residue and the bottom Pump Around of main fractionators**

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