

# HIGH DISPERSION (HD<sup>2</sup>) TRAY

Maximising liquid distribution and extending cycle length for fixed bed reactors

Shell Global Solutions



## AT A GLANCE

**Customer Driver:** Optimised production and efficiency; reliability; reduced WABT; streamlined maintenance

**Solution:** High Dispersion (HD<sup>2</sup>) distribution tray

**Value-delivered:** Nearly perfect (100%) utilisation of catalyst. Reduction of large radial temperature maldistribution. Boltless installation for easy cleaning and catalyst loading

**Proof point:** Total feed processed worldwide through HD<sup>2</sup> trays exceeds 1.2 million barrels per day over 300 operating units

High Dispersion (HD<sup>2</sup>) Trays provide unparalleled hydroprocessing performance with minimal investment.

As product specifications grow more stringent, production success depends on reactor internals that can outperform standard distribution tray technology. Conventional distribution trays, even advanced bubble cap designs, are notorious for low uniformity of vapour/liquid distribution as well as undesirable thermal maldistribution.

Shell Global Solution's latest High Dispersion (HD<sup>2</sup>) Trays have high feed rate flexibility and utilise more nozzles per area than the original HD trays, providing even better performance for hydroprocessing reactors needing optimisation.

### ABOUT THE TECHNOLOGY

As one of Shell's latest proprietary technologies, the HD<sup>2</sup> tray has benefited from extensive observation in the organisation's pressurised testing facilities, advanced computer simulations and over 20 years of operation in Shell and non-Shell refineries.

The substantially high-performance profile of the HD<sup>2</sup> tray makes it an essential component in any hydroprocessing reactor especially when paired with other Shell internals, such as the UFQ (Ultra Flat Quench). Even in retrofit applications HD<sup>2</sup> trays confer performance benefits by lowering start-of-run temperatures, decreasing catalyst deactivation and raising end-of-run WABT (Weighted Average Bed Temperature). They boast extremely low occurrence of stagnant zones and channeling as well as minimal susceptibility to tilt and fouling.

### TECHNOLOGY DESCRIPTION

Due to their excellent vapour/liquid and thermal distribution uniformity HD<sup>2</sup> trays function equally well as top distribution and interbed distribution trays ensuring full catalyst utilisation throughout the reactor. Also in contrast with conventional and bubble cap designs, which require a deep layer of inert distributive packing, HD<sup>2</sup> trays enable the volume of the reactor beds to be filled with active catalyst.

Unique nozzle design harnesses vapour momentum to create overlapping coverage, ensuring near-perfect wetting, even in severe fouling applications. And in addition to improved production performance, the mechanical configuration of each tray is engineered for easy boltless access, cleaning and catalyst loading, all of which improve turnaround time significantly.

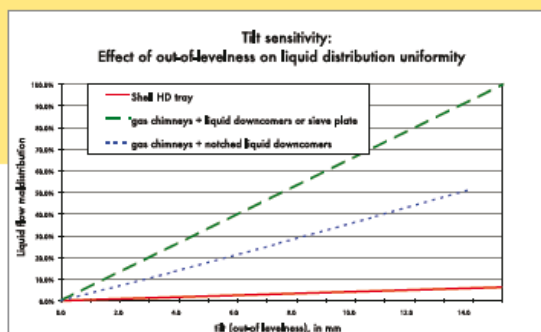


Figure 1: Low tilt sensitivity of Shell HD tray, in comparison to conventional trays

Because they function independent of pressure drop, HD<sup>2</sup> trays enable the reactor to operate efficiently at a wide range of feed rates, typically plus fifty percent to minus seventy-five percent (+50% to -70%). This is true for both liquid and gas feeds, although operation with gas feed only is also viable.

Along with the benefits of decreased maintenance time, lower WABTs (up to 5°C) translate into substantially longer run-lengths for reactors retrofitted with HD<sup>2</sup> trays as demonstrated in Figure 1.

## BUSINESS VALUE

Upcoming fuel trends demand new hydroprocessing methods. Shell Global Solutions is positioned to equip refiners to meet these trends using their proprietary reactor internals technology.

HD<sup>2</sup> trays can vastly improve refiners' cycle lengths through slower catalyst deactivation, lower inlet temperatures (as required for stringent product specifications), and improved thermal distribution. Documented case studies have demonstrated higher throughput capacity as well as the ability to process heavier feeds. Ultimately, Shell HD<sup>2</sup> trays offer optimized reactor performance while minimising your capital expenditure and investment costs.

## PROOF POINTS

This distillate Low-Sulphur diesel hydrotreater reactor scenario illustrates (Figure 2) the benefits of a Shell HD<sup>2</sup> tray internal. After being retrofitted with a High Dispersion Tray, reactor catalyst volume was increased by 30% compared to the original configuration. This enabled production of 50 ppm sulphur diesel without large revamp costs.

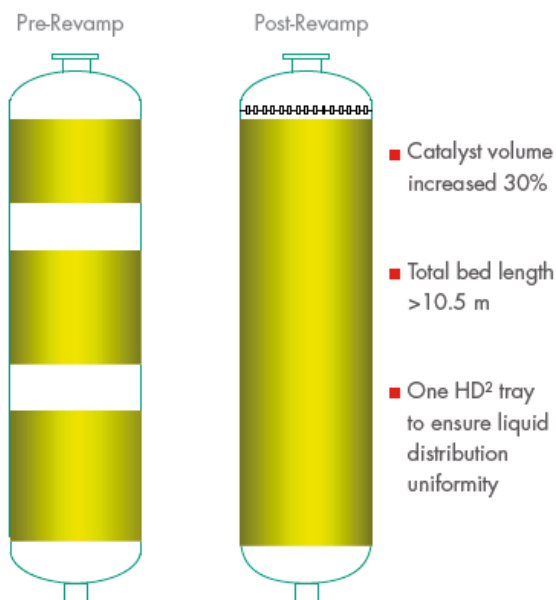


Figure 2: The combination of three catalyst beds into one 10.5m bed was only possible in this DHT reactor due to the exceptional performance of the HD<sup>2</sup> Tray.

## HAVE YOU CONSIDERED HOW YOU CAN

- Increase cycle length and throughput?
- Optimise catalyst usage?
- Increase production despite heavier feedstock?
- Develop new, quality products that meet clean fuel specifications?

For further information, please visit our website at [www.shell.com/global-solutions](http://www.shell.com/global-solutions)

Shell Global Solutions is a network of independent technology companies in the Shell Group. In this material, the expressions "the Shell Group" and "Shell Global Solutions" are sometimes used for convenience where reference is made to these companies in general, or where no useful purpose is served by identifying a particular company.

The information contained in this material is intended to be general in nature and must not be relied on as specific advice in connection with any decisions you may make. Shell Global Solutions is not liable for any action you may take as a result of your relying on such material or for any loss or damage suffered by you as a result of your taking this action. Furthermore, these materials do not in any way constitute an offer to provide specific services. Some services may not be available in certain countries or political subdivisions thereof.

Copyright © 2011 Shell Global Solutions International BV. All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical including by photocopy, recording or information storage and retrieval system, without permission in writing from Shell Global Solutions International BV.



Where getting away from it all  
means getting everything back.



Addiction is a chronic disease that destroys the vitality and joy that life has to offer. Enterhealth is non-traditional drug and alcohol treatment facility that uses the latest medical breakthroughs and evidence-based therapies to help your brain's neurological pathways to heal from substance abuse. Nestled in the rolling prairie just outside Dallas/Ft. Worth, Enterhealth cultivates an atmosphere of serenity and discretion for each of its residents.

Sometimes recovering your life means stepping back from it.

**Call 800-388-4601 or visit [www.enterhealth.com](http://www.enterhealth.com) to learn more.**

enterhealth

**A BETTER WAY**  
to recover.





## Discover for yourself Recover for your family

Addiction is a chronic disease that destroys the vitality and joy that life has to offer. Enterhealth is non-traditional drug and alcohol treatment facility that uses the latest medical breakthroughs and evidence-based therapies to help your brain's neurological pathways to heal from substance abuse. Nestled in the rolling prairie just outside Dallas/Ft. Worth, Enterhealth cultivates an atmosphere of serenity and discretion for each of its residents.

enterhealth

A BETTER WAY  
to recover.

Sometimes recovering your life means stepping back from it.  
Call 800-388-4601 or visit [www.enterhealth.com](http://www.enterhealth.com) to learn more.

# Uncover...

**Transparency** is a virtue among businesses and cultures alike, revealing the beginning of trust between partners.

Nested within each gesture of **openness** rests the opportunity for progress. Huawei is reinforcing a long-term commitment to the North American market with 8 research and development centers located across the continent.

As Huawei puts a face on its U.S. operations, we invite you to behold the unexpected.





# hidden splendor...

The people of Huawei give our company its exceptional edge. The heroic efforts of our employees power each technological **achievement**, while the satisfaction of our customers ignites a passion for innovation.

Our investments in the communities where our people live and work is more than a responsibility to build up new generations, it is a privilege that strengthens the **future** of our company.



# and inner truth.

At Huawei our core values of quality and  
**excellence** help us provide technology  
solutions to a global telecom community.

The success of our business requires  
relentless customer focus. It forms the  
center of what we do, because what's  
**inside** is most important.

**Uncover magnificence.**



## THE LEMONS AREN'T GETTING ANY SWEETER, JUST THE LEMONADE.

With the onset of increasingly sour crudes and global product demands growing more stringent, refiners ask how they can do more with less. Shell Global Solutions offers an integrated portfolio of technologies, covering everything from sulphur recovery and hydroprocessing to conversion and bottom-of-the-barrel technologies. We're helping refiners to squeeze the most out of their resources, and the results are sweeter than ever.

**Shell Global Solutions**







## A BETTER TWIST ON REFINING

Sour crudes present a challenge that no refiner can escape; but instead of swallowing the bitter pill, Shell has developed innovative ways to combat heavy contaminants and improve end products. Better yet, rather than rely on conventional outlets for sulphur by-products, Shell licenses a host of technologies to help refiners repurpose it as a value-added resource. This kind of unique approach to difficult crudes is helping refiners capitalise on their resources and do more with less. Quite the turn of events, don't you think?

**Shell Global Solutions**



## FROM SOUR TO SWEET— REFINING TRANSFORMED

The refining industry is facing some difficult prospects; while governments tighten regulations at the tailpipe and the production plant, crude sources are growing increasingly sour, or difficult to process. In order to sweeten these challenges, Shell Global Solutions leverages extensive refining experience to integrate advanced technologies exactly where operators need them. We believe this combination can yield some pretty satisfying results. **Are you ready for a taste?**

**Shell Global Solutions**





# THE SWEETEST REWARDS ARE THE TOUGHEST TO REACH

The distance between the quality of available crude sources and the quality of end-user products grows wider every day. The gap is seen most acutely at the refinery where environmental legislation, consumer demand and production metrics simultaneously raise the stakes. In response to these challenges, Shell Global Solutions collaborates with industry leaders, applying innovative technologies to help refiners achieve ambitious results. The rules of refining are changing. Are you ready to change with them?

**Shell Global Solutions**



We don't play with the big boys.  
We beat 'em with a stick.



TTS puts the power of logistics in your hands. The right technology can take a chaotic supply chain and channel the momentum into results for your company and your bottom line. At TTS we equip our agents with an unmatched technology platform and a logistics network that moves like a freight train and turns on a dime. Performance. Excellence. It's what we do.



*The **power** to move you*

Visit [www.tts-us.com](http://www.tts-us.com) or call 214.778.0800 to learn how TTS can put the logic back in your logistics.



# It's not you. It's your logistics provider.

TTS puts the power of logistics in your hands. The right technology can take a chaotic supply chain and channel the momentum into results for your company and your bottom line. At TTS, we equip our agents with an unmatched technology platform and a logistics network that moves like a freight train and turns on a dime. Performance. Excellence. It's what we do.

**Visit [www.tts-us.com](http://www.tts-us.com) or call David Miller at 214.226.2308 to learn how TTS can put the logic back in your logistics.**



*The power to move you*

