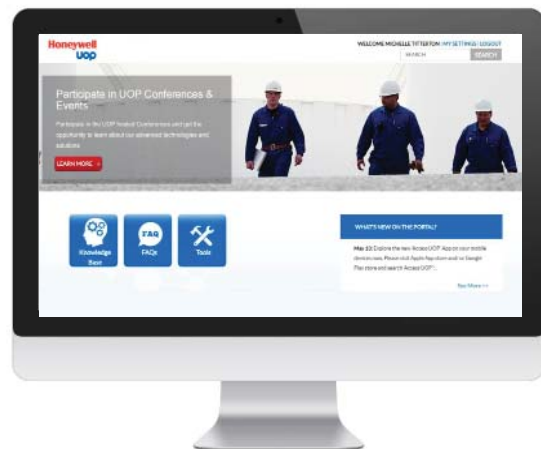


## Customer Portal

The Honeywell UOP portal offers information on products and services pertinent to our customers and partners. The portal also offers site-specific support and tools that will help you manage and operate your Honeywell UOP processes.

Login at **[www.accessuop.com](http://www.accessuop.com)**.



### Learn More

For more information about Honeywell UOP's portfolio of hydrocracking catalysts, please contact your Honeywell UOP representative or visit **[www.uop.com](http://www.uop.com)**.

### UOP LLC, A Honeywell Company

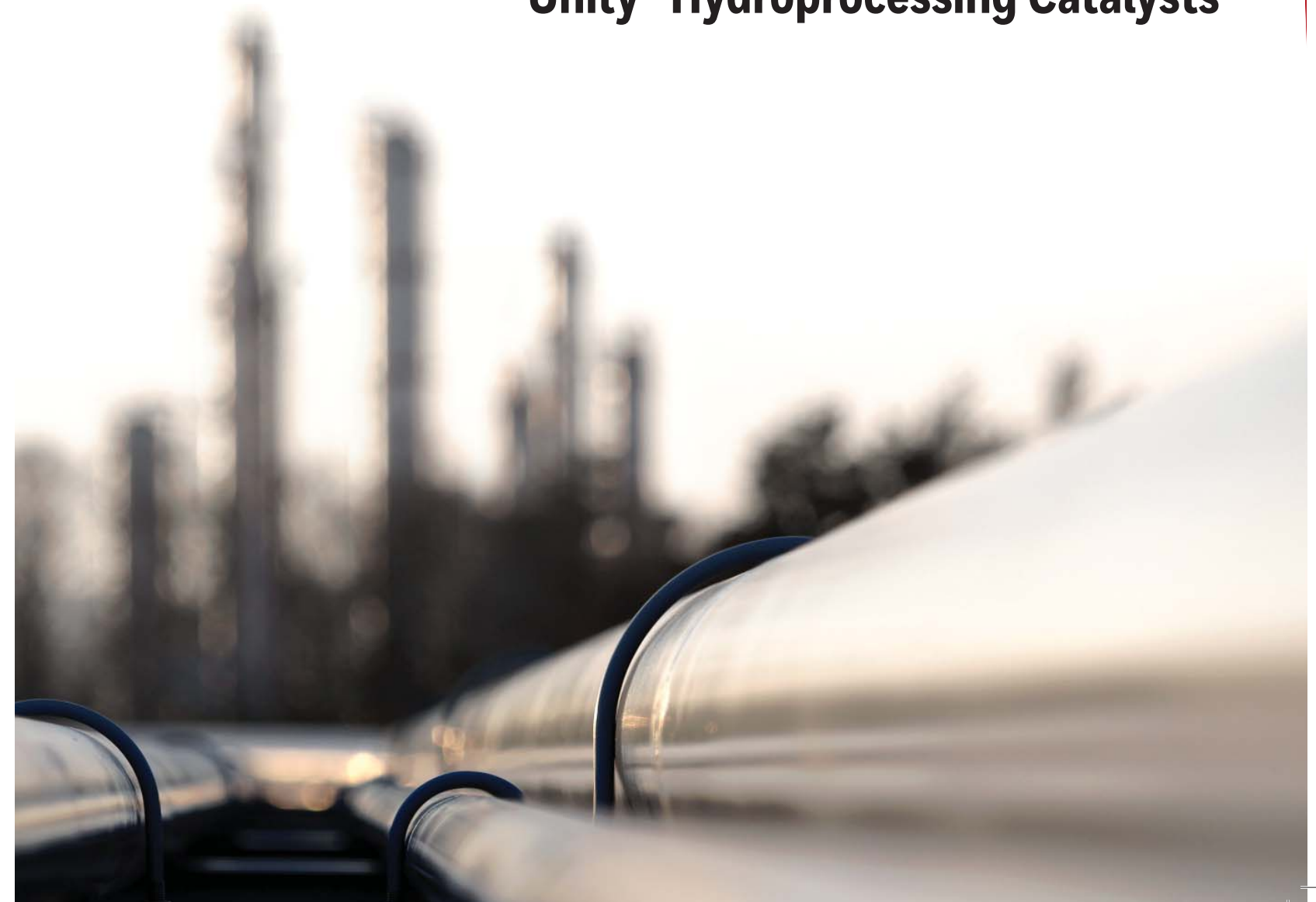
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August 2016

Complete Catalyst and Equipment Solutions  
**Unity™ Hydroprocessing Catalysts**





## A Unified Approach

Honeywell UOP's vast lineup is called Unity™ Hydroprocessing catalysts because we bring a unified approach, delivering complete catalyst, equipment, licensing and technical support solutions for hydrotreating, pretreat and hydrocracking. You can utilize Honeywell UOP as a one-stop-shop for complete end-to-end solutions, or you can simply utilize us as a leading supplier of top-quality catalysts. Either way, Honeywell UOP delivers value. This value starts with our ability to provide a consistent supply of great-performing catalysts.



**Unity In Action:** From technical experts working together with you to catalysts that optimize unit performance, you get it all with Honeywell UOP. Our commitment to serving customers with quality products, expert support, and new technologies is stronger than ever.

**Meet All Your Needs With Honeywell UOP**

## Boost Performance With Uniflow™ Hydroprocessing Reactor Internals

Using innovative vapor/liquid tray technology to provide optimized flow distribution, Honeywell UOP Uniflow reactor internals deliver significant performance gains over a wide range of operating conditions and provides you with:

- Improved product quality and/or yields
- Longer catalyst cycle length
- Improved reliability and safety with reduced potential for temperature instability
- Reduced turnaround time due to ease of access and maintenance
- Resistance to fouling due to large flow openings and sufficient space for any scale accumulation



Modeling and Engineering Support The Uniflow design has been validated by cold flow testing in a commercial scale column installed at Honeywell UOP's research and development facility.

### Revamp Delivers Major Revenue Increase

Struggling to meet the growing demand for transportation fuels, a major refinery in the EMEA region wished to increase crude capacity from 100 to 160 kbPSD. They had limited plot space and needed to minimize downtime in order to maintain production while the upgrade was in progress. They turned to Honeywell UOP for help.

Rather than attempt to expand the facility in the limited area, Honeywell UOP conducted a feasibility study that showed the capacity goals could be met through a revamp of the reactor internals. The existing Unicracking unit

was revamped from single-stage to two-stage. Plus, utilizing the latest catalytic solutions and HPNA management, the revamp reduced gasoline production and improved diesel production to achieve the goals.

The improved reactor performance delivered outstanding results. The refinery now produces 245,000 tons of LPG, 1.3 million tons of gasoline, and 3.2 million tons of diesel oil. Overall, the facility is expected to increase revenue by 30% — showing the true power of a reactor internals revamp.



## Get Peak Reactor Performance With Crystaphase®

Advanced catalysts are just the beginning. For years, Honeywell UOP has partnered with Crystaphase to boost unit performance. Combining our catalyst and system experience with their unmatched expertise in foulant mitigation, we deliver unprecedented efficiency, stability, and profitability by eliminating impediments to catalyst performance. Soluble and insoluble compounds are removed from feedstocks, thereby improving productivity and profitability.

Let Honeywell UOP with Crystaphase unleash your reactor's performance. You'll improve your reactor's safety and stability, protect your catalyst investment, and run longer at higher throughput for greater profitability.



100<sup>+</sup>  
YEARS

**Industry Experience.** With more than 100 years of experience in the refining industry and 50 years in hydroprocessing, we have the proven technical expertise for optimizing your operations.

## Proven Solutions. Global Expertise.

Honeywell UOP inaugurated the use of catalysts in the refining industry in 1931, and today is recognized as the leading developer of advanced catalysts for the refining industry. Honeywell UOP has leveraged its 100 years of leadership in catalyst research and development and process technology to develop more than a dozen new hydrotreating catalysts and a full portfolio of hydrocracking catalysts.

Because Unity Hydroprocessing Catalysts are universally compatible, you can use them in whatever system you have — you don't need UOP equipment to get the performance benefits of our catalysts.

### Tailored Performance

Because Unity Hydroprocessing Catalysts are developed and manufactured in-house, each catalyst is designed to help achieve the desired performance results you want from your unit. The in-house manufacturing also helps deliver quality as well as a shorter response time to help ensure that you always have the supply you need.

In addition, Honeywell UOP's diverse catalyst portfolio gives you a wide range of catalyst loading options to help get the performance you desire.



# Unity™ Hydroprocessing Catalysts – A Unified Portfolio

## Hydrotreating

The benefits of advanced hydrotreating catalysts include the ability to take advantage of heavier and opportunity crudes. We offer cost effective systems to help you meet the tighter environmental regulations on fuel quality. The right catalyst and grading selection for your hydrotreating unit will extend cycle life while processing of heavier and contaminated feed stocks.

| UNITY HYDROTREATING |          |            |              |          |            |                  |                        |
|---------------------|----------|------------|--------------|----------|------------|------------------|------------------------|
| DEMETALLIZATION     |          |            | CLEAN FUELS  |          |            | PRETREAT         |                        |
| Si DEMET            | As DEMET | Ni/V DEMET | FCC GASOLINE | NAPHTHA  | DISTILLATE | FCC VGO PRETREAT | HYDROCRACKING PRETREAT |
| HYT-9110            | UF-75    | HYT-8109   | HYT-2018     | HYT-1118 | HYT-6119   | HYT-5119         | HYT-6119               |
| HYT-9119            | UF-80    | HYT-8119   | HYT-2117     | HYT-1119 | HYT-6219   |                  | HYT-6219               |
|                     |          |            | HYT-2118     | HYT-9129 | HYT-4118   |                  |                        |
|                     |          |            | HYT-2119     |          |            |                  |                        |



**Global Supplier.** Through worldwide technical support and a global supply chain, Honeywell UOP is fully committed to serving the world market. Plus, even if you don't currently use Honeywell UOP equipment, you can still get the performance benefits of our catalysts.



## Improving Diesel Yields With Difficult Feeds

A Middle East refiner operating a Honeywell UOP Unionfining™ unit that processed heavy diesel feedstock to produce ultra low-sulfur diesel was interested in converting excess light vacuum gas oil to diesel. The refiner approached Honeywell UOP to find a solution to decrease diesel ASTM D-86 T95% and reduce diesel cloud point using this heavier feed.

Honeywell UOP completed a pilot plant program and found that reducing T95 could be accomplished using a hydrocracking catalyst, as more selective hydrocracking catalysts retain more diesel at the target T95. HC-120 uncracking catalyst was loaded to provide the best combination of activity to match the hydrotreating temperature, significant T95 reduction, highest diesel retention, good cold flow properties and low hydrogen consumption. Later, a second pilot plant program was undertaken to help improve diesel yield and meet T95 and cloud point targets using an improved catalyst loading technique. By stack-loading HC-320 and HC-120, the refiner experienced 2 Wt% higher diesel yield and 6° C higher activity for the same cloud point reduction. Stacked loading also provided higher volume swell and saturation compared to the previous HC-120 catalyst loading.

## Operating Issues Eased Through Pretreating

Challenging feedstocks, high conversion targets and more stringent fuel specifications were creating production challenges for hydrocracking operations in China. Honeywell UOP Unity hydrotreating and hydrocracking catalysts helped solve the issues. In one unit, Unity HYT-6219 pretreat catalyst was used to process a more challenging feed that design with a higher level of coker gas oil. The choice of Unity HC-185 is delivering the desired yields of distillate. The unit is performing well and is making diesel with less than 10 wt ppm sulfur.

The second unit is a two-stage configuration with a larger capacity targeting maximum heavy naphtha production for petrochemicals. HYT-6119 pretreat catalyst helped handle operating upsets while continuing to remove sulfur and nitrogen to stabilize the unit and improve its performance. Meanwhile, HC-140 and HC-150 can be used together to help improve yields of heavy naphtha.



# Unity Hydroprocessing Catalysts In Action

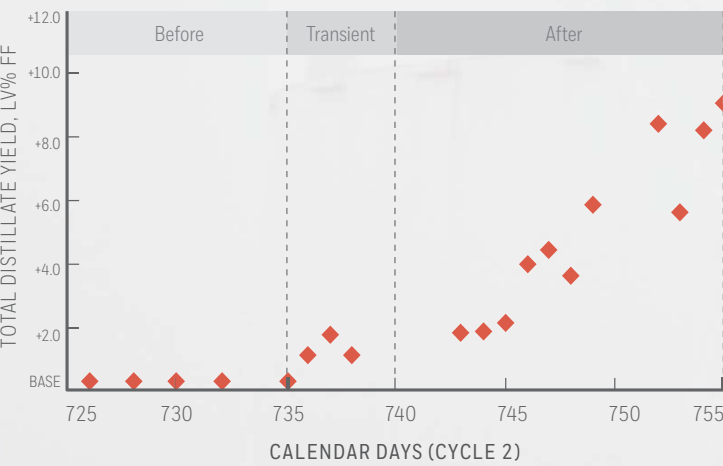
## Case studies from the field

### Increasing Yield and Cycle Length

When a refiner processing highly refractory nitrogen-containing vacuum gas oil (VGO) feed in two-stage operations was unable to meet cycle length targets, they turned to Honeywell UOP.

Working with Honeywell UOP technical experts and data from pilot plant results, the refiner selected first-stage pretreat catalyst HC-T, first-stage cracking catalyst HC-43, and max distillate catalyst DHC-32 in the second stage. After the reload, there was no pressure drop issue as in previous cycles and operation was extremely smooth over the entire cycle. The second stage catalyst system outperformed the previous cycle and has maintained the same relative stability. As a result, distillate yield increased by 6-8 vol% while improving cycle length. (See figures below)

Process enhancement impact on distallate yields



### Meeting Tight Product Specifications

Refiners under pressure to meet increasingly stringent product specifications, including improved cetane and smoke point, are turning to Honeywell UOP’s HC-470 hydrocracking catalyst.

HC-470 can be used in a variety of flow schemes to help produce maximum yields of distillate or naphtha products. Designed to improve yields and saturation, HC-470 not only provides excellent hydrogenation and higher diesel cetane, but also provides higher selectivity toward distillates. It provides better nitrogen tolerance and stability, balancing the cycle length between treating and cracking catalysts to improve overall benefits. The result is higher volume swell, better cold flow properties, lower light ends production, and longer cycle lengths to help meet the refiner’s specific objectives.

Comparison of Catalyst Performance

(cycle 1 vs. cycle 2 reload)

| DESCRIPTION      | UNITS  | CYCLE 1 | CYCLE 2   |
|------------------|--------|---------|-----------|
| Naphtha Yield    | vol%   | Base    | Base+3.10 |
| Distillate Yield | vol%   | Base    | Base+1.75 |
| Cycle Length     | Months | 36      | 47        |

**Customized Solution.** Honeywell UOP can tailor your catalyst solution to meet your unit’s key performance needs — whether your goal is diesel, middle distillate or naphtha. Our catalysts have been loaded into two-stage, single-stage and recycle operations around the world, and Honeywell UOP pretreatment catalysts can unify your entire solution.



### Hydrocracking

Honeywell UOP is the world’s leading supplier of hydrocracking catalysts. Our catalysts are universal — regardless of the equipment or type of hydrocracking technology you’re using, you’ll get the optimal catalysts for your hydrocracking operation.

| UNITY HYDROCRACKING      |                  |            |          |         |
|--------------------------|------------------|------------|----------|---------|
| - ACTIVITY +             |                  |            |          |         |
| MAX DIESEL AND 2ND STAGE | DIESEL AND LUBES | DISTILLATE | FLEXIBLE | NAPHTHA |
| HC-205                   | HC-115           | DHC-32     | DHC-41   | HC-24   |
| HC-310                   | HC-410           | DHC-39     | HC-43    | HC-26   |
| HC-320                   |                  | HC-120     | HC-140   | HC-29   |
| HC-325                   |                  | HC-130     | HC-150   | HC-185  |
|                          |                  | HC-425     | HC-470   |         |
|                          |                  | HC-520     |          |         |



# Ever-Growing Hydrotreating Portfolio

Honeywell UOP offers a broad range of advanced hydrotreating catalysts and technologies to help reduce sulfur, nitrogen and aromatics while enhancing cetane, density and smoke point. Some of our latest hydrocracking pretreat catalysts include:

HYT  
6119

**High performance catalyst for the removal of sulfur and nitrogen.**

- Builds on success of UOP HDN-1 and HC-K catalysts
- Standard regeneration methods can be applied for reuse within the refinery to help reduce catalyst lifecycle costs
- High pore diameter and volume for stability and long catalyst life

HYT  
6219

**State-of-the-art, high-activity catalyst that provides excellent desulfurization, denitrogenation, and hydrogenation.**

- Designed for challenging feedstocks, including distillates, VGO, heavy coker gas oils, DAO, and more
- Achieves longer operating cycles and improves sulfur and nitrogen reduction in hydrocracking pretreat and ultra-low sulfur diesel units
- Enhanced dispersion of metals results in higher activity and increased stability
- Rejuvenation demonstrated up to 95% of fresh catalyst activity

HYT  
8109

**State-of-the-art demetallization catalyst with high capacity for nickel and vanadium uptake.**

- First-stage demetallization catalyst utilized to protect downstream catalysts from deactivation due to metal contamination
- Provides both moderate HDS activity and HDM selectivity with a low bulk density

HYT  
8119

**Advanced demetallization catalyst with high capacity for nickel and vanadium uptake.**

- Protects downstream catalysts against deactivation from metal contamination while providing good HDS activity
- Provides excellent demetallization with good HDS at competitive fill costs

# The Hydrocracking Innovation Continues

Unity Hydroprocessing Catalysts offers a complete hydrocracking portfolio. Because we're heavily invested in the success of our customers, we never stop innovating. Some of our latest catalysts include:

HC  
320

**Specifically designed for operation in the 2nd stage of a two-stage flow scheme to improve diesel yield.**

- High-selectivity catalyst that can also be used in diesel single stage operations
- Superior activity and stability
- Used to produce jet A-1/kerosene, diesel, ethylene cracker feed, and high-quality lube oil base stocks

HC  
410

**Excellent hydrogenation for lube oil production.**

- Higher activity and diesel yield than previous generation
- Higher UCO dewaxed VI for higher grade lube base oils
- Highest saturation of products

HC  
425

**Improves distillate production in single and two-stage units.**

- Improves product quality when processing heavier feeds
- Extra distillate yields as compared to HC-120
- Enhanced metal formulation and support

HC  
470

**Used to improve yields of middle distillate or naphtha products.**

- Produces distillates with improved cold flow properties
- Specific metals content results in lower deactivation rates and longer cycle lengths
- Primarily used to produce naphtha, jet A-1/kerosene, and diesel

HC  
520

**New high-distillate selective catalyst.**

- New support technology
- Alternative metals

**Pilot Plant Testing:** We help meet your exact needs by testing our catalysts and catalyst combinations with different feedstocks at our Riverside, Illinois and India facilities.

