HPA
HYDROPROCESSING ASSOCIATES

REACTOR SERVICES

- ***Reactor Turnkey Services***
  - *Project Planning*
  - *Blinds to Blinds*
- ***Catalyst Services***
  - *Catalyst Change Out & Inert Entry*
    - ✓ *Vessel Unloading*
    - ✓ *Catalyst Screening*
    - ✓ *Vessel Loading (HYDROPAC®)*
- ***Mechanical Services***
  - *QA/QC Inspection Services*
  - *Bolt Tensioning*
  - *Vessel Repairs & Retrofits*
    - ✓ *'R' Stamp for all vessel repairs (ASME)*
- ***Cleaning for Inspection***
  - *Abrasive Wet-Blasting*
    - ✓ *The CleanerBlast™ Machine*
  - *Hydro-blasting*
    - ✓ *Advanced Exchanger Cleaning*

HYDROPAC®
CATALYST DENSE LOADING SPECIALIST

Hydroprocessing Associates, LLC
6016 Highway 63
Moss Point, MS 39563
Phone: +1-228-475-2971
sales@hpa-usa.com
www.hpa-usa.com

HPA (S) Pte Ltd
10 Chia Ping Rd
Singapore 619978
Phone: +65-92965477
admin@hpa.sg
www.hpa.sg

Catalyst Loading

Catalyst loading may be done in either of two ways: Sock loading or dense loading.

Sock loading is the simpler loading method, which requires both less equipment and less operator training. Catalyst is delivered to the bed being loaded, through a flexible sock and is spread and raked to a level condition during loading. Sock loaded catalyst forms a more open bed structure, has both a lower density and lower initial start-of-run (SOR) pressure drop. Over the course of a run, the sock-loaded bed tends to slump to a more dense structure. At end-of-run (EOR), a sock loaded bed will often have a pressure drop equal to that of a dense loaded bed.

Problems Caused by Sock Loading

When catalyst is loaded by sock loading, less catalyst is loaded into the bed. The bed density is not uniform, causing possible 'Hot Spots' and 'Channeling'. Channeling will severely shorten the catalyst life. Poor distribution of catalyst can lead to coke formation.

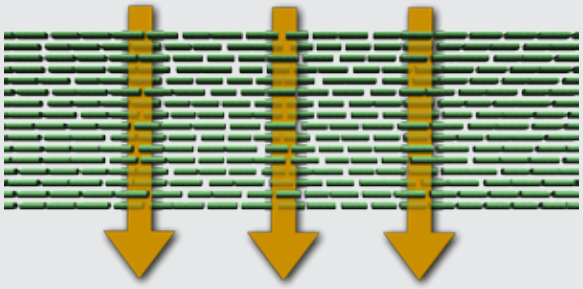
Dense Loading

The dense loading method fills a reactor with less open volume in the catalyst beds. The basic principal is to allow the individual catalyst particles to free-fall to the bed where they bounce around settling in their lowest energy state. This means that the particles fall onto their long axis and form a horizontal mat with the long dimension of the particles aligned with the bed diameter.

Benefits From Good Dense Loading

- Maximum performance from the catalyst
- More catalyst loaded per bed
- Even distribution of flow
- Prevents channelling
- No need for a technician to walk over the catalyst during loading
- Catalyst grains get to lay flat optimising reaction/activity
- Less chance of 'Hot Spots'

Good Dense Loading



The particle orientation does not effect oil flow. The orientation is horizontal, parallel to reactor radius, and perpendicular to oil flow.

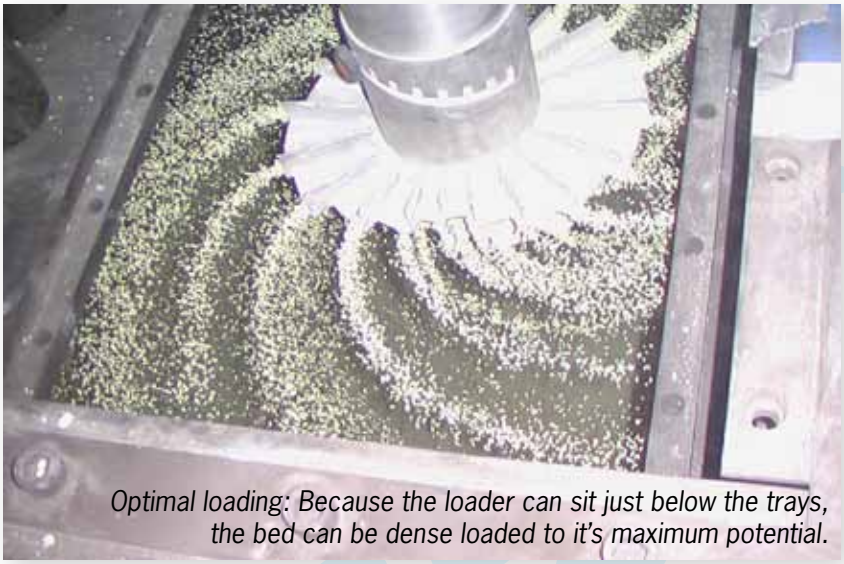
Bad Dense Loading

Angled Dense Loading | *Concave Dense Loading* | *Convex Dense Loading*

The HYDROPAC®

Hydroprocessing Associates (HPA) offers a catalyst dense loading method called HYDROPAC® loading. HYDROPAC® technology allows the sprinkling of catalyst in a continually uniform pattern at a rate slow enough to let each particle settle, but fast enough for acceptable loading time.There are several dense loading technologies on the market but few, if any, that can match the HYDROPAC® in design.

Using the right catalyst dense loading method is critical to the run and life of a catalyst bed. HYDROPAC® was designed by Chevron and further developed by HPA to create the Ultimate Dense Loading machine.



Optimal loading: Because the loader can sit just below the trays, the bed can be dense loaded to it's maximum potential.

HYDROPAC® sprinkles catalyst in a continually uniform pattern at a rate slow enough to let each particle settle, but fast enough for acceptable loading time. It loads the catalyst bed consist-ently even from start to finish.

HYDROPAC®, sitting just six inches below the trays when load-ing, is able to rotate in both directions, and can load around transfer pipes and vertical thermocouples. The rotation can be changed whenever the loading rate requires it, depending on the diameter of the reactor to drums loaded. HYDROPAC® does not create excessive dust and does not cause attrition to the catalyst.

HYDROPAC® in comparison to other loading methods

HYDROPAC® has many advantages compared to other dense loading methods. HYDROPAC® packs the catalyst tighter and more uniform, resulting in better reactant flow distribution in the trickle flow regime as used in hydro-processing. Catalyst beds do not sag or change flow patterns during the course of a run. More catalyst is loaded into each bed because of the higher loading density, re-sulting in longer runs. The direction of rotation is reversible, which is important for loading around transfer tubes to avoid shadowing.

The HYDROPAC® can load the catalyst bed higher due to its unique design, positioned 6" below the distributor tray. The unique design allows the bed profile to be viewed continuously from the trays manway. There are no whips obstructing the drop-lights when lowered to inspect the bed profile during loading. HYDROPAC® has no centre shaft obstruction to the centre of the bed when loading, critical to achieve maximum uniformity of the catalyst particles, to lay horizontal across the entire bed as the catalyst is loaded.

	HYDROPAC®	Competitor 1	Competitor 2	Competitor 3
Rotating	✓	✓	✓	✗
Can load without excess dust	✓	✓	✓	✗
Can load around transfer tubes	✓	✓	✗	✗
Bed profile can be viewed while loading	✓	✗	✓	✓
Can load without obstruction to centre of catalyst bed	✓	✗	✗	✗
Can load to maximum height beneath distributor tray	✓	✗	✗	✓

HYDROPAC® comes with a computer program to estimate the loading parameters and times.

Loading rates depend on the diameter of the reactor: The bigger the faster, normally eight to nine metric tons per hour. RDS Units and HCU about twelve 1800 lb bags per hour. We do not recommend any faster for the crane could have trouble keeping up. Also, the catalyst could start to free fall down the 6" loading pipe.

HPA will give the same guarantee our competi-tors can give. Subject to HPA and client lab test of catalyst on site before loading.

- ISO 9001 & OHSAS 18001 Accredited
- ISNetworld and PICS Compliant