Catalyst Handling Guidelines – Dry Catalysts

1. Packaging and Shipping

LyondellBasell Avant catalyst is packaged and shipped as a dry, free-flowing powder under a nitrogen pressure of about 0.3 barg at 20 °C. Catalyst is packaged in 88 and 170 litre steel drums (type I and II, refer Figure 1) which are painted blue. The maximum allowed working pressure (MAWP) is 0.3 barg.

Hazardous contents, hexane and titanium chlorides are identified with flammable solid and corrosive labels.

2. Storage and Handling

The drums of catalyst can be stored in an ordinary chemical warehouse. They should be kept in an upright position and hermetically sealed, well labelled and in a dry, well-ventilated area far away from water or steam. Storage temperatures should be less than 50°C (preferably 10°C to 30°C) to maintain product quality.

The catalyst should be stored away from sources of ignition. Under normal conditions there is no risk of flammability, but the presence of hydrocarbon solvent used in connection with these catalysts may provide flammable vapours.

Because of its sensitivity to oxygen and water, the catalyst should always be blanketed with nitrogen. Nitrogen with less than 10 ppm oxygen and a dew point of less than -70°C is recommended. It should never be exposed to even small amounts of air, as this can lead to deactivation of the catalyst.

3. Safety equipment

The catalyst is not pyrophoric, but when exposed to air or water it emits irritating hydrochloric acid fumes. Any minor leaks should be immediately decomposed with plenty of water.

When the catalyst contacts human skin it reacts with moisture on the body and can cause burns. Personal protection recommended when handling the catalyst includes protective goggles, gloves, shoes, apron and filter mask for hydrochloric acid. Gloves need to be chemically and mechanically resistant and should comply with norms EN374 and EN388, or equivalent.

Safety showers and eye wash fountains should be readily accessible in all areas where these catalysts are stored.

In case of inhalation, immediately take the patient outdoors and seek medical attention. In case of contact with skin or eyes, wash carefully with tap water.

For other and more detailed safety information please refer to the catalyst MSDS.

4. Drum Unloading

The guidelines below apply to a typical facility and of course must be adapted to the customer’s particular plant configuration and operating practices.

The product is supplied in drums pressurized with nitrogen to 0.3 barg at 20° C. After packaging, the drum pressure depends on the external temperature: it ranges from 0.05 barg at −20°C up to 0.95 barg at 55°C (refer Figure 2). This means that the real pressure inside the drum when received by the customer, can be higher or lower (but never null) in relation to the original 0.3 barg depending on the external temperature.

Before using a LyondellBasell product, customers and other users should make their own independent determination that the product is suitable for the intended use. They should also ensure that they can use the LyondellBasell product safely and legally (Material Safety Data Sheets are available on request). This document does not constitute a warranty, express or implied, including a warranty of merchantability or fitness for a particular purpose. No one is authorized to make such warranties or assume any liabilities on behalf of LyondellBasell except in a writing signed by an authorized LyondellBasell employee. Unless otherwise agreed in writing, the exclusive remedy for all claims is replacement of the product or refund of the purchase price at LyondellBasell’s option, and in no event shall LyondellBasell be liable for special, consequential, incidental, punitive or exemplary damages.
A pressure manometer (14) is installed on the ball valve (13) in each drum. The lid (9) of the drum is gas-proof (by gasket (10)), if a gas leakage takes place on top of the drum, the lid should be bulging.

All the unloading operations, especially the connection of the couplings, have to be done very carefully to avoid any exposure of the catalyst to air.

- It is recommended to connect an earth clamp to the drum before and during unloading.
- Remove the seal, open the lid clamp (11) and take off the lid (9).
- Check the pressure of the drum using the manometer (14) by opening the ball valve (13). If there is no overpressure the drum, with the internal seal still on, can be returned to LyondellBasell. If the manometer reveals a slight over pressure the seal can be removed.
- Check the gross weight of the drum.
- Keeping the drum in its normal vertical position, remove the plastic cap on the flange hole (4) and connect the threaded connector together with a ball valve to the flange. Where applicable, it is suggested to do a pressure check and a nitrogen purge between the placed valve and the slide valve (6) of the drum. (It is important that the threaded connector with ball valve is clean and dry before being connected to the flange.)
- In some cases, the thread of the drum, after removal of the plastic cap, can show a small amount of white deposit, being zinc oxide. This deposit is harmless for the quality of the catalyst. A dry cloth, possibly wetted with a small amount of oil, can be used to wipe the thread clean, before connecting the threaded connector.
- Close the ball valve (13) and remove the manometer (14) from the drum.
- Connect a small hose directly to the vent valve (13) and depressurize the catalyst drum into a small oil-filled container until the bubbling stops. In this way any possible catalyst powder carryover will be contained. If you are using a nitrogen injector, remove the small hose and then insert the nitrogen injector into the drum via the vent valve. Do not connect the low pressure nitrogen system at this time. If you are not using a nitrogen injector, close the vent valve and remove the small hose.
- While maintaining the above-mentioned conditions, loosen the four bolts (7) that tighten the flange coupling (4-5) on the top of the cone. The four bolts (7) are tightened with a force of 120 N/m max. An appropriate torque wrench is recommended to use. Check if the slide valve can be moved freely sideways and then open the slide (6) carefully. Next, tighten the loosened bolts and ensure that the vent valve or nitrogen injector valve are closed.
- Place the sling belt around the drum and clamp it so the drum can be turned upside-down. Using a hoist, lift the drum and turn it upside-down and hoist the drum to the catalyst dispersion vessel. Connect the drum to the nozzle of the dispersion vessel. Connect the drum to the nozzle of the dispersion vessel. Open and close the purging valves to eliminate the air in the connection. Then open the valves to unload the catalyst. Where applicable, connect the low pressure to the nitrogen injector and open its valve to facilitate the catalyst unloading. Use of a vibrator is allowed for ZN GF2A, Z 501, and Z 509-1 catalysts. The vibrating device is not recommended for spherical form catalysts, as it can cause particle breakage.
- At the end of the operation, disconnect the earth clamp and weigh the empty drum to check the net weight of the discharged product.
Catalyst Handling Guidelines – Dry Catalysts

- It is not recommended to empty cognizant the drum partially.
- It is very important that the weight is determined before and after the catalyst unloading, in order to ensure that all the catalyst has been discharged. Otherwise the drum unloading has to be repeated by discharging the remaining catalyst in order to avoid problems during drum disposal. LyondellBasell determines the tare weight of the drum with the lid (9), lid clamp (11), bolts (7), and manometer (14) included.

5. Drum Disposal

If a catalyst drum is not completely empty (i.e. still contains residual catalyst solids) it must first be unloaded in a suitable catalyst destruction unit. The emptied drum must first be cleaned and made inert before disposal.

Customers should make their own independent determination to ensure the following disposal guidelines are also in accordance with their local and state laws.

Before the disposal of the drum, the following actions must be taken (refer Figure 3):

- Place the drum near a process sewer.
- Remove the drum cover A.
- Slowly open purging valve B.
- When the drum is depressurised, loosen the four bolts tightening gate C.
- Remove gate C. Afterwards, close purging valve B.
- Pour about 100 g of sodium carbonate into the drum to neutralize the wash water.
- Screw the dip line into the threaded flange.
- Purge wash water through line D. The water will react with any residual catalyst producing small quantities of HCl. This wash water will exit from line E and must be absorbed in water.
- If the residual catalyst is not completely destroyed and therefore the wash water contains solids particles, these must be removed in a suitable treatment unit to reduce the COD (Chemical Oxygen Demand) to legal limits.
- The treatment unit is typically a system for separation of solids and floating particles (i.e. filtration) and by a biological treatment.
- Continue purging with wash water until clean water exits line E. At that moment the drum is cleaned and neutralized.
- Turn off wash water and take out the cleaning dip line.
- Empty the water from the drum and check if it is clean. Due to the heavy weight of the filled drum, water may need to be pumped out or a hoist may be required to unload the drum.
- Use a hose to blow steam into the drum for about 20 minutes.
- Empty the condensed water from the drum.
- Remove any paper labels, including the LyondellBasell logo, from the drum.
- The drum can now be sent for disposal.

Before using a LyondellBasell product, customers and other users should make their own independent determination that the product is suitable for the intended use. They should also ensure that they can use the LyondellBasell product safely and legally (Material Safety Data Sheets are available on request). This document does not constitute a warranty, express or implied, including a warranty of merchantability or fitness for a particular purpose. No one is authorized to make such warranties or assume any liabilities on behalf of LyondellBasell except in a writing signed by an authorized LyondellBasell employee. Unless otherwise agreed in writing, the exclusive remedy for all claims is replacement of the product or refund of the purchase price at LyondellBasell’s option, and in no event shall LyondellBasell be liable for special, consequential, incidental, punitive or exemplary damages.
Before using a LyondellBasell product, customers and other users should make their own independent determination that the product is suitable for the intended use. They should also ensure that they can use the LyondellBasell product safely and legally (Material Safety Data Sheets are available on request). This document does not constitute a warranty, express or implied, including a warranty of merchantability or fitness for a particular purpose. No one is authorized to make such warranties or assume any liabilities on behalf of LyondellBasell except in a writing signed by an authorized LyondellBasell employee. Unless otherwise agreed in writing, the exclusive remedy for all claims is replacement of the product or refund of the purchase price at LyondellBasell’s option, and in no event shall LyondellBasell be liable for special, consequential, incidental, punitive or exemplary damages.
Before using a LyondellBasell product, customers and other users should make their own independent determination that the product is suitable for the intended use. They should also ensure that they can use the LyondellBasell product safely and legally (Material Safety Data Sheets are available on request). This document does not constitute a warranty, express or implied, including a warranty of merchantability or fitness for a particular purpose. No one is authorized to make such warranties or assume any liabilities on behalf of LyondellBasell except in a writing signed by an authorized LyondellBasell employee. Unless otherwise agreed in writing, the exclusive remedy for all claims is replacement of the product or refund of the purchase price at LyondellBasell’s option, and in no event shall LyondellBasell be liable for special, consequential, incidental, punitive or exemplary damages.
Catalyst Handling Guidelines – Dry Catalysts

Before using a LyondellBasell product, customers and other users should make their own independent determination that the product is suitable for the intended use. They should also ensure that they can use the LyondellBasell product safely and legally (Material Safety Data Sheets are available on request). This document does not constitute a warranty, express or implied, including a warranty of merchantability or fitness for a particular purpose. No one is authorized to make such warranties or assume any liabilities on behalf of LyondellBasell except in a writing signed by an authorized LyondellBasell employee. Unless otherwise agreed in writing, the exclusive remedy for all claims is replacement of the product or refund of the purchase price at LyondellBasell’s option, and in no event shall LyondellBasell be liable for special, consequential, incidental, punitive or exemplary damages.