

# Zeolite Dusting

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Dusting is a sign of zeolite degradation. A fine white or gray "dust" appears in or on mufflers, filters, or pressure fittings. In some cases the "dust" will coat surfaces surrounding these fittings. This is especially obvious if dust is found in enclosed areas not subject to atmospheric conditions such as inside the PSA control box.

Dusting is caused by the breakdown of zeolite pellets. The pellets consist of zeolite microparticles joined in a binder. These pellets are generally small spheres approximately 3mm in diameter, although size can vary depending on application. When these pellets break down the microparticles of zeolite and powder from the degraded binder can escape out the sieve beds.



There are generally two causes of dusting: liquid water damage and mechanical erosion. The zeolite can readily adsorb and desorb water vapor; however, liquid water will irrevocably damage zeolite. If liquid water contacts the zeolite pellets, the liquid water will break down the binder in the zeolite pellet. The pellet disintegrates and the zeolite and binder powder are blown out through the muffler during the exhaust cycle.

Unless the plant house was in a flood the liquid water is due to a failure in the aftercooler or air dryer. This can be as simple as clogged condensate drain, or it can be a problem with the air dryer's refrigeration circuit.

Mechanical erosion is caused by the repeated movement of zeolite particles against one another during the PSA cycle. There are two main causes of mechanical erosion: bad packing and high inlet pressure.

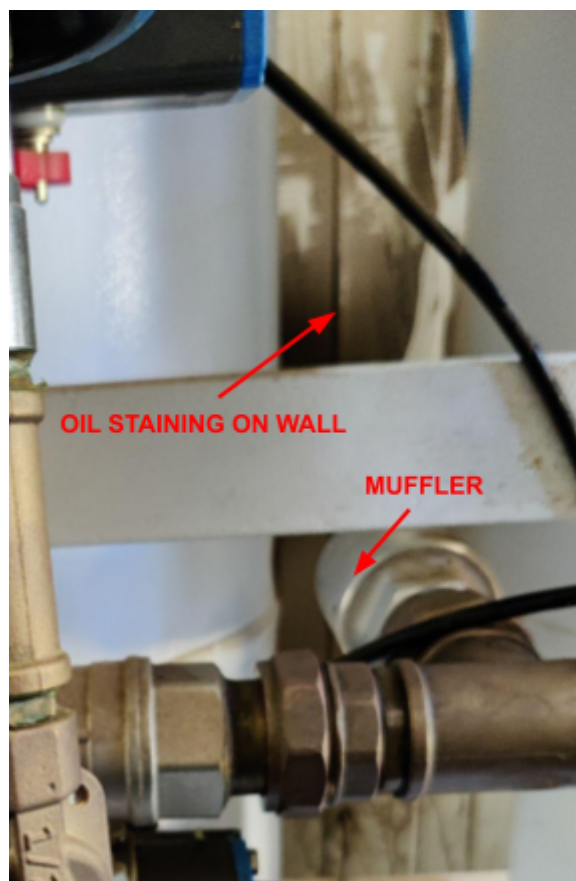
When the sieve beds are constructed, the zeolite is "packed," to keep the zeolite from moving against one another. Packing is generally done by vibrating the vessel or hitting the vessel or hitting it with a hammer while filling it. This causes the pellets to settle tightly against one another, taking up less volume. If the zeolite pellets are not sufficiently packed then the repeated changes in air flow direction move the pellets against one another causing erosion. Problems in packing generally present as dusting in the early life of the sieve bed or shortly it is refilled. While some dusting is expected as zeolite ages, this is generally after several years of continuous use.

Some manufacturers will ship their beds with some additional zeolite to be put into the sieve after an initial "break in" period. This zeolite is used to occupy the empty space at the top of the sieve bed form should the zeolite settle. It is important to follow the manufacturer's instructions.

Additionally, using too high of an inlet pressure into the sieve bed can cause movement as well. Here the high pressure air entering the bed from the bottom of the sieve bed does not flow through the zeolite quickly enough and a large pressure difference forms between the bottom and top of the sieve bed. The bulk of the zeolite can be pushed up into any empty space in the top of the sieve bed causing lots of movement. This type of movement is audible as a "thump," and should be corrected immediately.

#### **OIL DAMAGE:**

If oil from the screw compressor is carried over into the zeolite beds it will contaminate the zeolite. The zeolite that comes in contact with oil will no longer be able to adsorb nitrogen and will not be able to contribute to oxygen production. As more zeolite is exposed to oil the purity in PSA will drop. The only option is for the zeolite to be replaced. Oil carryover to sieve bed is caused by failure in the oil separator, or by using the wrong type of oil.



Oil carryover is generally first observed in the inline filters before the PSA. Once oil has reached the zeolite, an oily film is often found around the muffler.