

Can a Water Pump Explode?



The answer must be yes, or we would not have a Beacon on this subject. The centrifugal pumps in the pictures are all water pumps that exploded. The explosions did not occur because of any contamination or chemical reaction with something that was not supposed to be in the pump. In fact, explosions like this have happened with very pure water in boiler feedwater pumps, condensate pumps, and deionized water pumps.

How did these explosions happen? The pumps were operated for some period of time with both the pump suction and discharge valves closed. Because water cannot flow through the pump, all of the energy that normally goes into pumping is instead converted to heat. When water is heated, it expands, generating hydrostatic pressure inside the pump. This may be enough pressure to cause the pump to fail — perhaps the seal might fail, or the pump casing might rupture. These explosions may cause significant damage or injuries because of the built-up energy. However, if the water exceeds its boiling point before the pump fails, a more energetic explosion may occur, because the released superheated water will rapidly boil and expand, producing a boiling-liquid, expanding-vapor explosion, or BLEVE. The severity and damage caused by such a BLEVE is similar to a steam boiler explosion.

This type of explosion can happen with any fluid if a pump is operated with suction and discharge valves closed. If an explosion with a nonhazardous fluid like water can cause the damage shown in the pictures, think how much more severe the damage might be if the fluid is flammable; the released material could catch fire. If the fluid is toxic or corrosive, people near the pump could be severely injured by the released material.

What Can You Do?

- Before starting any pump, check that all valves are in the correct position. Be sure that the valves in the intended flow path are open, and other valves, such as drains and vents, are closed.
- If you are starting a pump from a remote location such as a control room, be sure that the pump is ready for operation. If you are not sure, go to the pump and check it, or have somebody else check it.
- Make sure that key steps important for safe operation of pumps, including all valve positions, are included in your plant's operating procedures and checklists.
- Some pumps are started automatically — such as by a process control computer or a level instrument to automatically empty a tank when it is filled. Make sure that all of the valves are in the correct positions when putting these pumps into automatic operation, for example, after maintenance.
- Some pumps have instrumentation installed to prevent operation while they are blocked in — for example, low-flow, high-temperature, or high-pressure interlocks. Be sure that these safety systems are properly maintained and tested.

See the October 2002 Process Safety Beacon for a discussion of a similar incident.

Don't let your pumps run while blocked in!

AIChE © 2013. All rights reserved. Reproduction for non-commercial, educational purposes is encouraged. However, reproduction for the purpose of resale by anyone other than CCPS is strictly prohibited. Contact us at ccps_beacon@aiche.org or 646-495-1371.

The Beacon is usually available in Afrikaans, Arabic, Chinese, Czech, Danish, Dutch, English, French, German, Greek, Gujarati, Hebrew, Hindi, Hungarian, Italian, Japanese, Korean, Malay, Marathi, Norwegian, Persian, Polish, Portuguese, Romanian, Russian, Spanish, Swedish, Telugu, Thai, Turkish, and Vietnamese.

Circle 103 on p. 63 for a free electronic subscription to the Beacon.