

Can a water pump explode?

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The answer must be “yes” or we wouldn’t have a subject for this *Beacon*! The centrifugal pumps in the pictures are all water pumps which 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 – boiler feed water 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 could not flow through the pump, all of the energy which 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 would 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 (a boiling liquid expanding vapor explosion - BLEVE). The severity and damage will be 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 a non-hazardous fluid like water can result in 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 operating procedures and checklists.
- ➔ Some pumps are started automatically – for example 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 running while 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 similar incident.

Don't let your pumps run while blocked in!

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