Airbag for the closing of pipelines on explosions and leakages

This paper is a result of international effort aimed at the construction of a device for quick closing of pipelines in the case of explosion propagation and/or chemical leakage. Such a problem exists in industries where flammable substances are transported by pipelines. The basic solution principle was the idea to use airbags similar to those utilized in cars. Two pipeline applications were taken into consideration: a low-pressure module able to suppress explosion propagation and a high-pressure module to stop leakages from, e.g., natural gas pipeline capable to be used for duct diameters up to 0.6 m, pressures up to 5 MPa and reaction times of 50 ms. It was necessary to construct a new airbag, capable of withstanding up to 10 bar pressure. The choice of material was critical to ensure sufficient strength and chemical resistance while retaining impermeability. CFD modeling of the bag deployment into a pipe flow and analysis of the bag shapes was also completed. Two gas generators were constructed and tested with novel propellant materials. Different airbag models were tested to evaluate their effectiveness. Risk analysis approach was applied to evaluate the safety and economic benefits of the new technology in different fields of application. (C) 2007 Elsevier Ltd. All rights reserved.

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