The hydro-pneumatic accumulator is broadly used in heavy industry as leaking compensator. Lately, much interest has been developed to study the component as energy storage. The important element in the selection of accumulator is performance. Hence, research was conducted to examine the use of thermal process condition and its impingement on the accumulator as an energy store. For charging process, the performance is influenced by the thermal process because it involves temperature change and heat transfer. Both processes are producing a different performance. The storage system is planned to be adapted in the dual hybrid driveline. A simulation study has been conducted by using Automation Studio software which focusses on two different processes called isothermal and adiabatic. The process has involved a schematic design, functional testing, parameter setting, and pretense. The result has shown that the thermal process affected the fluid power parameters such as power, effective storage capacity, and temperature differentials. The isothermal process produced higher effective volume compared to adiabatic process, stored higher power and had lower temperature differentials. Regarding charging speed, the adiabatic was faster. However, it was a lack of storage capacity.