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Lithium Loop and Purification System of DONES: Preliminary Design.

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The Demo-Oriented NEutron Source (DONES) is an essential irradiation facility for testing candidate materials for DEMO reactor and future fusion power plants. An intense flux of highly energetic neutrons is generated by the nuclear reactions of a 125mA beam of deuterons at 40MeV striking a liquid lithium target. The neutron flux achieves a damage rate of 8-10 dpa/fpy in a volume of about 0.3 l with a helium production rate of ~10-13 appm He/dpa. The main lithium loop and the related purification system have to generate a stable lithium jet at the target and guarantee: a high speed flow to evacuate the deposited heat (5 MW) and avoid boiling or significant evaporation of the lithium; a constant shape and thickness of the jet to assure a constant neutrons flux and prevent impingement of the beam on the back-plate, being the latter the surface just behind the jet; and an adequate level of chemical impurities solved in lithium. The preliminary design of the two systems is concluded. In this work, the lay-out of the loops, piping dimensioning, pressure drop evaluations, definitions of supports, piping stress analysis, and the design of the traps to remove the impurities are described in detail.

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