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10.25 New ionization vacuum gauges with LaB6 emitter for long-time operation in Wendelstein 7-X

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We report on a potentially significant improvement in the design of vacuum gauges of the so-called ASDEX-type. Such gauges are in wide use in fusion experiments, but they nonetheless suffer from a relatively high failure rate when operated at high magnetic field strengths for long times. For example, in Wendelstein 7-X only 6 of 18 pressure gauges survived plasma operation in the operational phase 1.2a. This is therefore a significant concern for long-pulse, high-field experiments such as Wendelstein 7-X and ITER. The new design is much more robust. The improvement is to use a LaB6 crystal instead of a tungsten wire as the thermionic emitter of electrons in the gauge. Such a LaB6 prototype gauge was successfully operated for a total of 60 hours in B = 3.1 T, confirming the significantly improved robustness of the new design, and qualifying it for near-term operation in W7-X. With the LaB6 crystal, an order of magnitude reduction in heating current is achieved, relative to the tungsten filament based gauges, from 15-20 A to 1-2 A. This reduces the Lorenz forces by an order of magnitude also, presumably the reason for the much improved robustness. The new gauge design, results from test operation in a 3T magnat and the set-up of the new gauges on W7-X are described.

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