Caesium hydrogen sulfate (CsHSO₄) and caesium dihydrogen phosphate (CsH₂PO₄) are solid acids that undergo superprotonic phase-transitions at about 140 and 230 °C, respectively. As a result, the proton conductivity is increased by several orders of magnitude. However, the practical operational temperature range is narrow due to decomposition of the high-conductivity phases. For CsHSO₄, it is known that this window can be extended to lower temperatures by addition of carefully selected N-heterocycles. The present work investigates if the same approach can be used to extend the practical operating temperature range of CsH₂PO₄ as well. Binary mixtures of CsH₂PO₄ with 1,2,4-triazole, benzimidazole or imidazole were prepared by means of mechanochemical synthesis. Mixtures based on CsHSO₄ were prepared as a basis for a comparative discussion. It was found that CsHSO₄ formed organic-inorganic salts, while CsH₂PO₄ formed heterogeneous mixtures with the N-heterocycles due to its weaker acidity. At a N-heterocycle content of 30 mol%, enhanced proton conductivity was observed for both solid acids at temperatures below their superprotonic phase transitions.