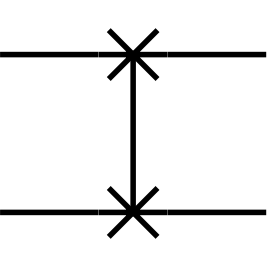

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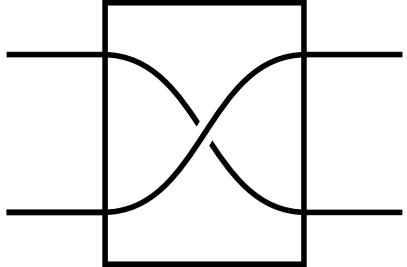

$\iff \quad \hat{S}^{0,1} = \sum_{j,k=0}^{d-1} |j\rangle\langle k| \otimes |k\rangle\langle j|$