

Energetic and exergetic analysis of a steam turbine power plant in an existing phosphoric acid factory

Khair Tahar

Energetic and exergetic analysis is performed on a Steam Turbine Power Plant used in a Phosphoric Acid Factory. The power plant is mainly constituted by two steam turbine cycles STGI, STGII and a turbo-blower group Tb-Bl. Mass, energy and exergy balances are established on the main compounds of the plant. A numerical code is established using EES software to perform the calculations required for the analysis considering real variation ranges of the operating parameters such as pressure, temperature and mass flow rate. The effects of these parameters on the system performances are investigated. The minimum irreversibility rates are obtained for the condensers (0.5 MW), the deaerators (0.4 MW) and the blower (1.5 MW) followed by the pumps and steam turbines. The heat exchangers present an irreversibility rate of about 5 MW. The maximum energy efficiency is obtained for the blower followed by the heat exchangers, the deaerator and STGII. The exergy efficiency obtained for the heat exchanger, the steam turbine generator, the deaerator and the blower are 88 %, 74 %, 72 % and 66 % respectively. The exergy efficiency of STGI is analyzed taking into account the condensate flow rate. For mass flow rates through the condenser of 12, 18 and 20 t/h. The optimum HP steam flow rates feeding the turbine, leading to the maximum exergetic efficiency are 49, 51 and 56 t/h respectively. For the back pressure steam turbine STGII a maximum exergetic efficiency of about 75.5 % is obtained with a flow of 73 t/h.

Biography

Dr. Khair Tahar is an Associate Professor in the Department of Chemical Engineering, Faculty of Engineering, Alexandria University, Egypt. He received his B.Sc. in Chemical Engineering from Alexandria University in 1985, his M.Sc. in Chemical Engineering from Alexandria University in 1988, and his Ph.D. in Chemical Engineering from Alexandria University in 1992. He worked as an Assistant Lecturer from 1985 to 1988, as an Assistant Professor from 1988 to 1992, and as an Associate Professor from 1992 to the present. He has published more than 100 scientific papers in international journals and conferences. He is also a member of the International Association of Chemical Engineers (IChemE) and the American Nuclear Society (ANS). His research interests are in the field of process optimization, energy integration, and exergy analysis.

Notes: