Abstract: The flow and heat transfer characteristics of confined jet array impingement with crossflow is investigated. Discrete impingement pressure measurements are used to obtain the jet orifice discharge flow coefficient. Digital particle image velocimetry (DPIV) and flow visualization are used to determine the flow characteristics. Two thermal boundary conditions at the impinging surface are presented: an isothermal surface, and a uniform heat flux, where thermocouple and thermochromic liquid crystal methods were used, respectively, to determine the local heat transfer coefficient. Two nozzle geometries are studied, circular and cusped ellipse. Based on the interaction with the jet impingement at the surface, the crossflow is shown to influence the heat transfer results. The two thermal boundary conditions differ in overall heat transfer correlation with the jet Reynolds number. Detailed velocity data show that the flow development from the cusped ellipse nozzle affects the wall region flow more than the circular nozzle, as influenced by the crossflow interactions. The overall heat transfer for the uniform heat flux boundary condition is found to increase for the cusped ellipse orifice.