# ABSTRAK

Kebutuhan air panas di semua kalangan masyarakat sudah tidak bisa dipungkiri lagi. Baik di skala rumah tangga, rumah sakit, perhotelan, tempat rekreasi, maupun bidang industri memerlukan air panas untuk menunjang aktivitasnya. Tujuan penelitian ini adalah : (a) Merancang dan membuat pemanas air sederhana yang bertenaga gas LPG, (b) Mengetahui hubungan debit aliran air dengan temperatur air keluar *water heater*, (c) Menghitung kalor yang diterima air dari *water heater* (d) Menghitung kalor yang diberikan gas LPG, (e) Mengetahui hubungan debit air dengan efisiensi *water heater*.

Penelitian ini dilaksanakan di Laboratorium Progran Studi Teknik Mesin Sanata Dharma. *Water heater* yang dibuat memiliki dimensi tinggi 37 cm, diameter tabung paling luar 34 cm, diameter tabung tengah 26 cm, diameter tabung paling dalam 9 cm, 640 lubang udara pada tabung terluar, panjang pipa 10 meter, diameter dalam pipa 1,27 cm, dan 8 buah sirip dari pipa tembaga dengan diameter dalam sirip 1,27 cm. Variasi dilakukan pada besarnya pembukaan gas buang, yaitu sebesar 10 putaran (1 cm), 20 putaran (2 cm), dan 30 putaran (3 cm).

Hasil proses penelitian didapatkan bahwa (a)*water heater* dapat dirancang dan dibuat dengan baik dan hasilnya mampu bersaing dengan *water heater* yang ada di pasaran, serta mempunyai kemampuan menghasilkan air panas untuk keperluan mandi air hangat (berkisar antara suhu 36$^o$C – 40$^o$C) pada debit 15 liter/menit – 20 liter/menit dengan efisiensi antara 50%-55% serta konsumsi gas sebesar 1,5 kg/jam. (b) Hasil terbaik hubungan antara debit air dengan temperatur air yang keluar dari *water heater* dinyatakan dengan persamaan : $T_o = 106{,}0m^{-0{,}34.}$ (m dalam liter/menit dan $T_o$ dalam $^o$C). (c) Hasil terbaik hubungan antara debit air dengan laju aliran kalor yang diterima air dinyatakan dengan persamaan : $q_{air} = -0{,}729m^2 + 30{,}47m + 12096$ (m dalam liter/menit dan $q_{air}$ dalam watt). (d) Hasil terbaik hubungan antara debit air dengan efisiensi *water heater* yaitu pada suhu mandi 36$^o$C dengan efisiensi 54,4% hingga 40$^o$C dengan efisiensi 55%, yang dinyatakan dengan persamaan : $\eta = -0{,}026m^2 + 0{,}760m + 46{,}96$ (m dalam liter/menit dan $\eta$ dalam %). (e) Kalor yang diberikan gas LPG pada pembukaan tutup gas buang setinggi 2 cm sebesar 21,755 kW.

Kata kunci : *water heater*, *tankless water heater*, pemanas air tenaga gas, *gas water heater*, LPG.

# ABSTRACT

Needs for hot water in all levels of society cannot be denied any longer. Whether it be in the household, hospital, hotels, resorts, and industry require hot water to keep their wheels running. The purpose of this study were: (a) Design and make a simple LPG powered water heater, (b) Knowing the relationship with the water flow rate of water out the water heater temperature, (c) Calculate the heat transfered from the water heater to the water (d) Calculate the heat supplied by LPG gas (e) Knowing the relationship between the water debit and the water heater efficiency.

This research was conducted at the Laboratory of Mechanical Engineering Study Program, Sanata Dharma University. The water heater has a dimension of 37 cm in height, 34 cm outer tube diameter, 26 cm central tube diameter, 9 cm inner tube diameter, 640 air vents on the outer tube, 10 meters in length of pipe, 1.27 cm inner pipe diameter, 8 fins made of copper pipe with an inside diameter of 1.27 cm. The variation is on the opening of the exhaust gases, amounting to 10 rounds as high as 1 cm, 20 rounds as high as 2 cm, and 30 rounds as high as 3 cm

Results of the study indicated that (a) the water heater can be designed and manufactured well and the results are competitive enough with existing water heater in the market, and it had the ability to produce hot water ranging from $36^o$ C – $40^oC$ for bathing purposes, discharging at 15 liters / minute - 20 liters / minute with efficiency between 50% -55% and gas consumption of 1.5 kg / hour. (b) The best results between the discharge and temperature of the water coming out from the water heater is expressed using the equation: $T_o$ = 106.0m - 0, 34. (m in liters / min and $T_o$ in $^oC$). (c) The best result of the relations between discharge of water to the rate of flow of heat received water expressed with an equation : $q_{air} = -0{,}729m^2 + 30{,}47m + 12096$ (m in liters/minute and $q_{air}$ in watt) (d) The best result of the relation between a discharge of water with water efficiency of water heater that is at the temperature of $36^oC$ with efficiency 54,4 % to $40^oC$ efficiency of 55 %, expressed with an equation : $\eta = -0{,}026m^2 + 0{,}760m + 46{,}96$ (m in liters/minute and $\eta$ in %) (e) Heat engine given by LPG at the opening of the exhaust gases as high as 2 cm as much as 21,755 kW.

Keywords : *water heater*, *tankless water heater*, pemanas air tenaga gas, *gas water heater*, LPG.