

**EXPERIMENTAL AND ANALYTICAL MODELING STUDIES OF STEAM
INJECTION WITH HYDROCARBON ADDITIVES TO ENHANCE RECOVERY
OF SAN ARDO HEAVY OIL**

A Thesis

by

ROLY SIMANGUNSONG

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE

August 2005

Major Subject: Petroleum Engineering

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August 2005

Major Subject: Petroleum Engineering

ABSTRACT

Experimental and Analytical Modeling Studies of Steam
Injection with Hydrocarbon Additives to Enhance Recovery of
San Ardo Heavy Oil. (August 2005)

Roly Simangunsong, B.S., Bandung Institute of Technology, Indonesia
Chair of Advisory Committee: Dr. Daulat D. Mamora

Experimental and analytical studies have been carried out to better understand production mechanisms of heavy oil under steam injection with propane and petroleum distillate as steam additives. The studies have been conducted for heavy oil from San Ardo field (12°API, 2800 cp at 53.3°C), under current reservoir conditions.

The experiments consist of injecting pure steam, steam-propane, and steam-petroleum distillate into a vertical cell containing a mixture of sand, water and San Ardo oil. The injection cell (68.58 cm long with an ID of 7.376 cm) is placed inside a vacuum jacket, set at the reservoir temperature of 53.3°C. Superheated steam at 230°C is injected at 5.5 ml/min (cold-water equivalent) simultaneously with propane or a petroleum distillate slug. The cell outlet pressure is maintained at 260 psig. Six runs were performed, two runs using pure steam, two steam-propane runs using 5:100 propane:steam mass ratio, and two steam-petroleum distillate runs using 5:100 petroleum distillate:steam mass ratio.

We develop a simplified analytical model that describes steam front advancement and oil production for the 1D displacement experiments. The model incorporates heat and material balance, fillup time and Darcy's law pertaining to the injection cell. The analytical model results are compared against the experimental data to verify the validity of the model.

The main results of the study are as follows. First, experimental results indicate that compared to pure steam injection, oil production was accelerated by 30% for 5:100 propane:steam injection and 38% for 5:100 petroleum distillate:steam injection

respectively. Second, steam injectivity with steam-propane and steam-petroleum distillate increases to 1.4 and 1.9 times respectively, compared with pure steam injection.

Third, steam front advancement and oil production data are in good agreement with results based on the new analytical model. The analytical model indicates that the oil production acceleration observed is due to oil viscosity reduction resulting from the addition of propane and petroleum distillate to the steam. Oil viscosity at the initial temperature with pure steam injection is 2281 cp, which is reduced to 261 cp with steam-propane injection and 227 cp with steam-petroleum distillate injection.

DEDICATION

This thesis is humbly dedicated to my parents, Wesley Simangunsong and Rospita Simanjuntak, who are both models of the person I hope to become, who have supported me with their boundless love and wisdom throughout my life, and who have rejoiced with me in the good times and encouraged me to move forward through the bad.

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I am also grateful to Drs. Maria A. Barrufet and Yalchin R. Efendiev for serving on my committee.

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My sincere thanks also go to my good friend, Zuher Syihab, who, possibly without realizing it, taught me that learning is more than just a grade.

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CHAPTER I

INTRODUCTION

The San Ardo field is located in the Central Coastal region of California, about 217 km (135 miles) roughly due west of Bakersfield. This giant oil field (OOIP in excess of 1 billion STB) contains heavy oil with oil gravity of 11^o-12^oAPI¹⁻³. The field has been steamflooded since 1968. The field contains two main heavy oil reservoirs³. The shallower Lombardi reservoir lies about 2100 ft with an average net pay thickness of 115 ft in the Main Area (40 ft in North Area), oil gravity of 11^oAPI and in-situ oil viscosity of 3000 cp. The deeper Aurignac reservoir lies at about 2350 ft with an average net pay thickness of 100 ft, oil gravity of 12^oAPI and in-situ oil viscosity of 300 cp.

In fields like San Ardo, where extra-heavy oil is produced, continuous steam injection or steam flooding has been used for years to improve recovery. Several mechanisms operate in steam injection, mainly oil viscosity reduction and steam distillation of the oil. When steam is injected into a reservoir, the resulting phase distribution forms five distinct zones. Each zone has different characteristics with respect to the distance from the injection well. The first zone -nearest to the injector- corresponds to the steam zone, where water in liquid and vapor phase and mainly residual oil are present. The light fractions of the oil are vaporized and condense ahead of the steam front creating a solvent bank, which comprises the second zone. The solvent bank is miscible with the oil, thereby reducing its interfacial tension and viscosity. The third zone consists of the hot water zone where steam and volatile oil condense upon contact with the cold matrix. As a result of oil viscosity reduction and displacement in the first three zones, an oil bank (fourth zone) is formed. The fifth zone (farthest away from the injector) is composed of the original oil.

Since it was first implemented, the principles of steam flooding have remained basically unchanged. In order to improve the process, investigations have been made to determine the viability of injecting steam along with other additives with the purpose of enhancing recovery. Additives like carbon dioxide and light hydrocarbons have been tested and showed to improve the recovery of heavy oils in the laboratory. However, the combined injection of steam and hydrocarbon additives (solvent) is often too costly and economically unattractive due to cost of the solvent. Therefore, the need exists to better understand the oil recovery mechanisms associated with steam-hydrocarbon injection (e.g. steam-propane) in order to possibly improve the technical and economical feasibility of these processes.

In the last five years, experimental and simulation studies⁴⁻¹⁹ have been carried out in the Ramey Laboratory of the Petroleum Engineering Department at Texas A&M University to investigate the effects of the combined injection of steam and propane on heavy oil recovery. These experiments have shown encouraging results, specifically accelerated oil recovery when compared to pure steam injection.

The proposed research is intended to obtain a more complete understanding of the production mechanisms involved in steam-propane and steam-petroleum distillate injection using crude oil from the San Ardo field. The first aspect of the research is to perform a series of experiments to evaluate the effect of propane and petroleum distillate as steam additives in production acceleration and recovery.

The second aspect of the research is to model analytically the reservoir temperature propagation and cumulative oil production during the experimental runs. The results of the analytical model will be compared against experimental data to verify the validity of the model. The model will be based on heat, material balance and Darcy's Law assuming one-dimensional displacement of oil by steam of steam with additives during the experimental runs.

1.1 Research Objectives

The main research objective is to evaluate the effect of propane and petroleum distillate as steam additives to enhance injectivity and to accelerate production of San Ardo oil. To achieve these objectives, steam-propane and steam-petroleum distillate displacement experiments will be conducted using propane:steam and petroleum distillate: steam mass ratio of 5:100.

The parameters to be recorded during the experiments include injection rate, injection and production pressures, cell temperatures, and produced volumes of liquids and gases. Density and viscosity measurements are carried out for the produced oil samples. Final oil recovery will be measured in addition to the production rates that will be compared between the different runs.

An analytical model of temperature propagation within the sand mix and cumulative oil production during the experimental runs will be developed. This model will be based on heat and material balance and Darcy's Law assuming one dimensional displacement of oil by steam in the injection cell. The results of the analytical model will be compared against data to verify the validity of the model.

CHAPTER II

LITERATURE REVIEW

Several studies have been carried out to test the effects of injecting steam along with other gaseous additives. In this section, a literature review covering previous experiences with the combined use of steam and gaseous additives will be presented.

Redford (1982)²¹ conducted experiments to study the effect of adding carbon dioxide, ethane and/or naphtha in combination with steam. His results showed that the addition of carbon dioxide or ethane improved the recovery. Further recovery was reached when naphtha was added.

Harding *et al.* (1983)²² presented both experimental and simulation results suggesting that the co-injection of carbon dioxide or flue gas with steam yielded higher recoveries when compared to pure steam injection.

Stone and Malcolm (1985)²³ performed several tests to study the benefits of injecting carbon dioxide along with steam. Higher production rates were obtained for the case of steam-carbon dioxide injection. Good agreement was found when comparing the experimental results with a numerical simulation also conducted in the study.

Stone and Ivory (1987)²⁴ carried out further investigations using the model from Stone and Malcolm.²² This time, experiments with CO₂ presoak and CO₂ co-injection with a solvent were conducted. They found that under certain conditions, carbon dioxide pre-soaking increased recovery above the conventional CO₂-steam injection.

Nasr *et al.* (1987)²⁵ presented results of experiments conducted to test the effects of injecting CO₂, N₂ and flue gas with steam. Both continuous and cyclic injections were tested. The addition of gases increased bitumen recovery. The use of CO₂ resulted in higher recoveries when compared to N₂ and flue gas.

Frauenfeld *et al.* (1988)²⁶ presented results showing that for oils without an initial gas content, co-injection of CO₂ with steam was capable of improving oil recovery over

that obtained with pure steam injection. On the other hand, when an initial non-zero gas saturation was present, co-injection of CO₂ was not beneficial.

Metwally (1990)²⁷ employed cores from the Lindbergh Field to investigate the effects of carbon dioxide and methane on the performance of steam processes. The experiments were carried out to determine the differences in performance of simultaneous injection of steam and a gaseous additive and an injection of a gas slug prior to steam injection. The results showed that injecting a CO₂ slug prior to the steam improved injectivity. However, the presence of a non-condensable gas with steam did not improve steam drive recovery and resulted in higher residual oil saturation compared to pure steam injection.

Gumrah and Okandan (1992)²⁸ performed linear and 3-D displacement experiments to evaluate the performance of CO₂ addition to steam on the recovery of 24°API, 12°API and 10.6°API oils. The 1D tests indicated that the oil recovery increased with increasing CO₂/steam ratios until an optimum value was reached. The addition of CO₂ did not produce a significant increase in the recovery of the lighter oil. However, for the heavier oils, the oil production rate was increased considerably.

Bagci and Gumrah (1998)²⁹ performed experiments with both linear and 3D models to investigate the effects of injecting methane and carbon dioxide along with steam in a 12.4°API heavy oil. The results showed that the use of CO₂ or CH₄ combined with steam yielded a higher incremental oil recovery than of with pure steam injection.

Butler and Mokrys (1991)³⁰ described a new recovery concept related to the steam-assisted gravity drainage (SAGD) process. The process was intended to be used in thin reservoirs, where the application of SAGD alone was uneconomical due to the high heat losses to the formations above and below the reservoir. The process, called VAPEX, used a solvent, such as propane, which could form a vapor-filled chamber within the reservoir. Vapor dissolves in the oil around the chamber and the resulting solution drains, driven by gravity, to a horizontal production well placed low in the formation. A well, located at the top of the reservoir, is used to inject steam and the solvent.

Additional work by Butler and Mokrys^{31,32,33} presented results of further investigations conducted on the VAPEX process. Their results showed that the process could be applied economically for heavy oil recovery. Additional advantages derived from VAPEX are a partial in situ deasphalting and a reduction of the content of heavy metals. The resulting oil can be lighter, of a higher quality and better suited for a direct refining.

Goite (1999)^{4,7} conducted several experiments to determine the influence of injecting steam with propane as an additive for 12.5°API from the Morichal field, Venezuela. Results showed that the optimal concentration by weight of propane lies somewhere in the region of 5%.

Ferguson (2000)^{5,7} continued Goite's experiments using a constant steam mass rate. Several tests were performed to determine the optimum propane:steam mass ratio. Acceleration of oil production was found in the steam-propane runs when compared to pure steam injection. The optimum propane:steam mass ratio appeared to be around 5:100. The acceleration in oil production was thought to be due to the dry distillation process in which the lighter oil fractions are vaporized and carried by propane. On contact with the colder part of the reservoir, the light fractions condense and are miscible with the oil, thus lowering the interfacial tension and decreasing the viscosity of the oil.

Tinns (2001)⁸ carried out steam-propane experiments using 5:100 propane:steam mass ratio on 21°API Kulin oil from Indonesia. The same effect of production acceleration was observed in these experiments. Viscosity and density measurements indicated an increase in API gravity and a reduction of viscosity of the produced oil. Furthermore, injectivity was improved with the addition of propane to the steam. A reduction in the maximum injection pressure from 85 psig to 78 psig was observed in the experiments.

Rivero (2002)^{9,10,15} conducted a series of experiments to evaluate the effect of additive on recovery of Hamaca heavy oil. The same effect of production acceleration was observed in these experiments. Improvement in steam injectivity of up to threefold was observed even with propane:steam mass ration as low as 2.5:100.

Plazas (2002)¹¹ conducted a series of experiments of steam distillation and steam-propane distillation on light crude oil (34.2°API) and intermediate crude oil (25.1°API). The results showed that the yield for steam-propane distillation is higher than steam distillation for the intermediate crude oil. On the other hand, propane seemed to have little effect on the light oil.

Hendroyono (2003)^{13,15} found acceleration in production with as little as 1.25:100 propane:steam mass ratio. Up to 30% acceleration with an apparent optimum ratio of 5:100 propane:steam was observed. Injectivity was reported to be three times higher than with pure steam injection.

Ramirez-Garnica (2004)¹⁶ performed distillation experiments on synthetic oil, showing that propane effectively reduces the boiling point of hydrocarbons. Thus, yields are higher with steam-propane, followed by that of pure steam injection, and lowest under dry distillation (with nitrogen).

Nesse (2004)¹⁷ found steam-propane injection accelerates the start of production for 21°API of Duri oil. The propane does not have the same effect when used with hot water, or water alternating steam. Pure steam injection accelerates oil production more than these two other methods.

CHAPTER III

EXPERIMENTAL APPARATUS AND PROCEDURE

3.1 Experimental Apparatus

The experimental set-up is comprised of five main parts: fluid injection system, injection cell, fluid production system, gas measurement system and data recording system. A schematic diagram of the apparatus is shown in **Fig. 3.1**.

3.1.1 Fluid Injection System

This system is comprised of a High Performance Liquid Chromatography (HPLC) pump, a steam generator, an ISCO syringe pump, one accumulator, and a petroleum distillate vessel. Distilled water is injected into the steam generator using the HPLC pump at a set rate. A backpressure regulator with a gauge is mounted directly after the pump to maintain its minimum required operating pressure of 1200 psig. At ambient temperature (75°F), saturated vapor pressure of propane is 135 psig. Therefore, the propane needs to be pressurized to about 600 psig before being introduced into the steam generator. Propane from the propane cylinder is flowed into the top of the accumulator above the piston. It is then pressurized by injecting water from an ISCO pump into the accumulator below the piston until the desired pressure (600 psig) is reached. At this desired pressure, usually after about two days, any propane within vapor phase will transform into liquid phase. The ISCO pump is then disconnected from the accumulator and nitrogen from a cylinder is connected to the accumulator to maintain the pressure at about 600 psig.

For steam-propane injection runs, liquid mass flow controller regulates the propane rate from the accumulator. The HPLC pump feeds water at a constant rate, which is mixed with propane and the mixture injected into the steam generator. The resulting mixture of propane and steam is then injected into the cell through an injection line around which is wrapped a band heater. The heater is used to prevent heat loss in the

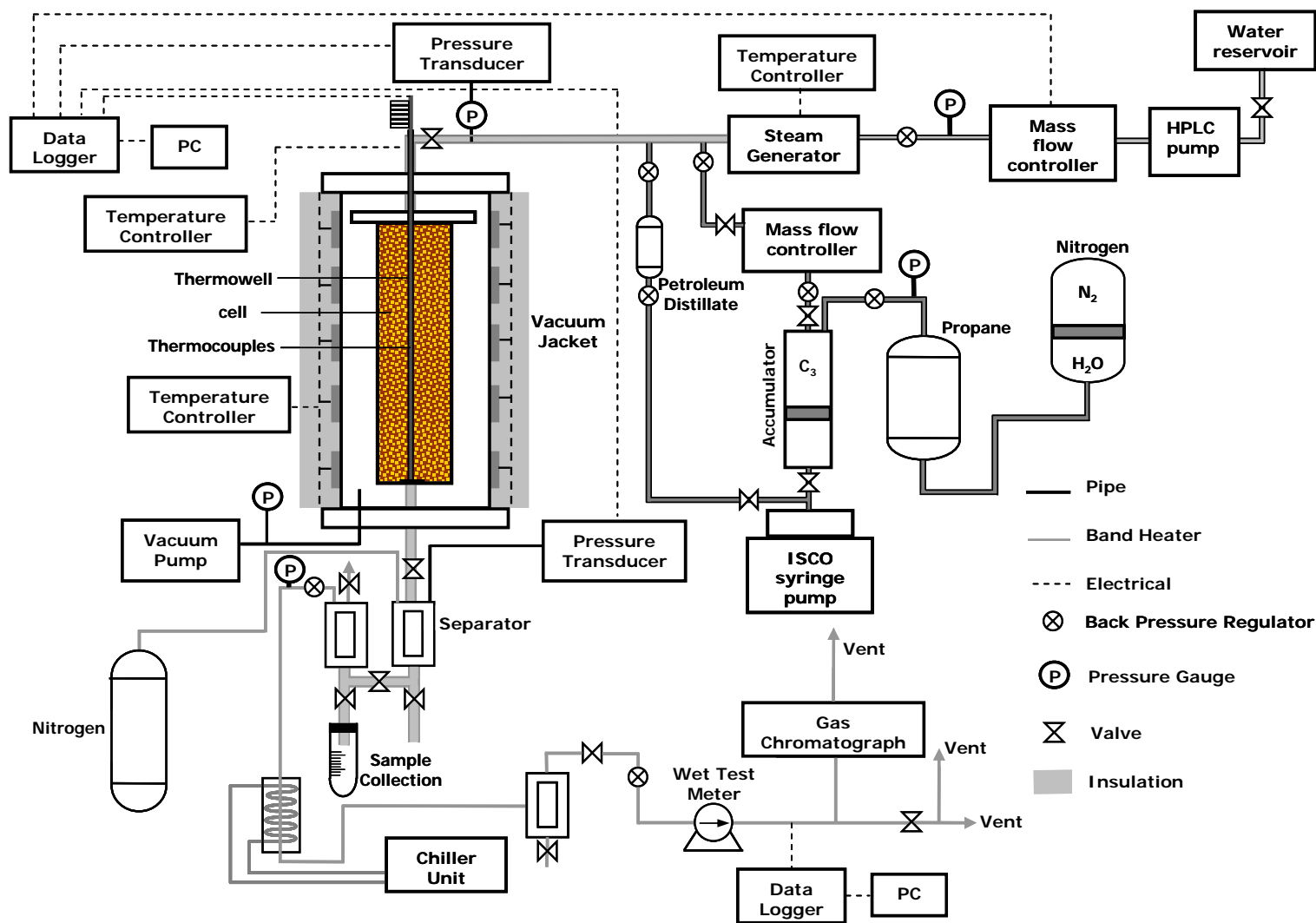


Fig. 3.1- Schematic diagram of experimental apparatus.

injection line. A temperature controller on the band heater is used to adjust the temperature of the injected fluid, effectively allowing the user to manipulate it all the way to the entry point of the cell.

For steam-petroleum distillate injection runs, 75 ml vertical steel vessel is mounted about six inches from the entry point of the cell. The vessel contains desired volume of petroleum distillate which will be displaced by water utilizing ISCO pump. The petroleum distillate is injected along with the steam into the cell at about 0.275 ml/min of injection rate resulting approximately thirteen minutes petroleum distillate injection period. The petroleum distillate slug thus moves ahead of the steam. This vessel is connected with the system using a T-connection with a valve that controls the petroleum distillate flow.

3.1.2 Injection Cell

The injection cell is a stainless steel cylinder (**Fig. 3.2**) with an internal diameter of 2.904 in. and a length of 27 in. It holds a mixture of sand, water and oil that have been carefully weighed and measured. For the purpose of measuring the temperature profile, a thermowell is placed along the longitudinal axis of the cell. Six thermocouples are placed in the thermowell. These thermocouples are spaced out at different intervals to monitor temperature propagation through the experiment (**Fig. 3.3**). At the bottom of the cell there is a sand screen preventing sand particles from being produced with the fluid. The cell is placed inside a larger diameter vacuum-heater jacket (**Fig. 3.4**). During experimental runs, the cell-vacuum jacket annulus is evacuated using an external vacuum pump. This helps reduce heat loss. After the cell has been placed inside the vacuum jacket, the temperature is set at desired level with a temperature controller. To ensure uniform temperature throughout the cell, this heater is left on for about 12 hours to stabilize the system at “reservoir temperature”.



Fig. 3.2-Photograph of injection cell (cell outlet at the left).

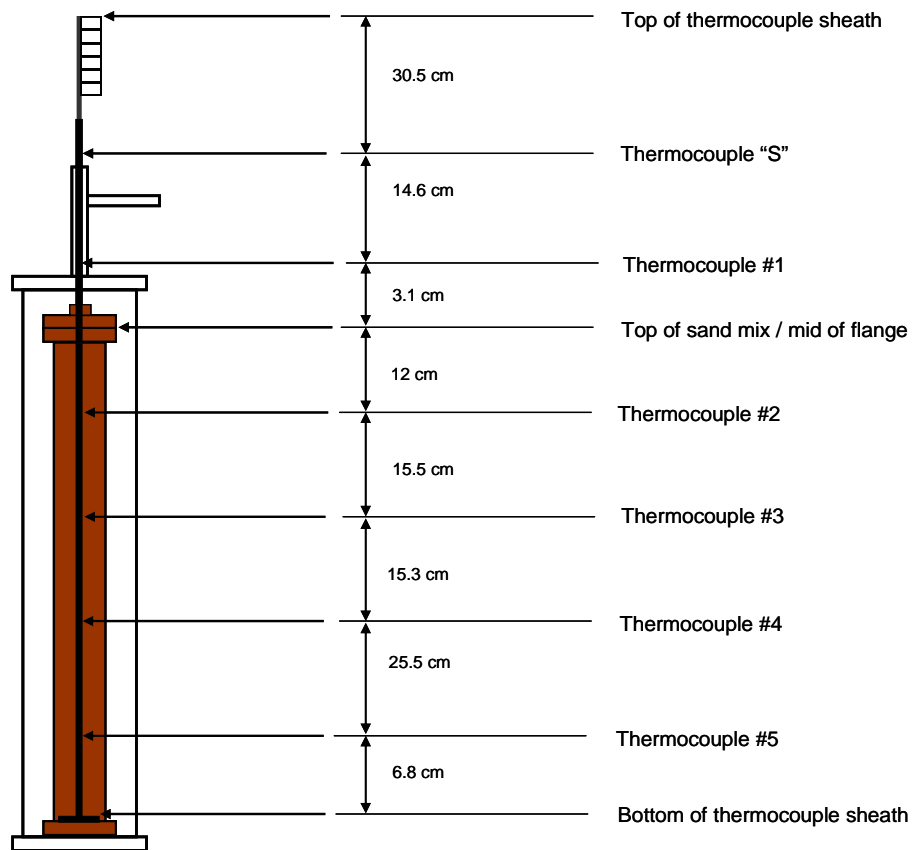


Fig. 3.3- Positions of the thermocouples in the injection cell.

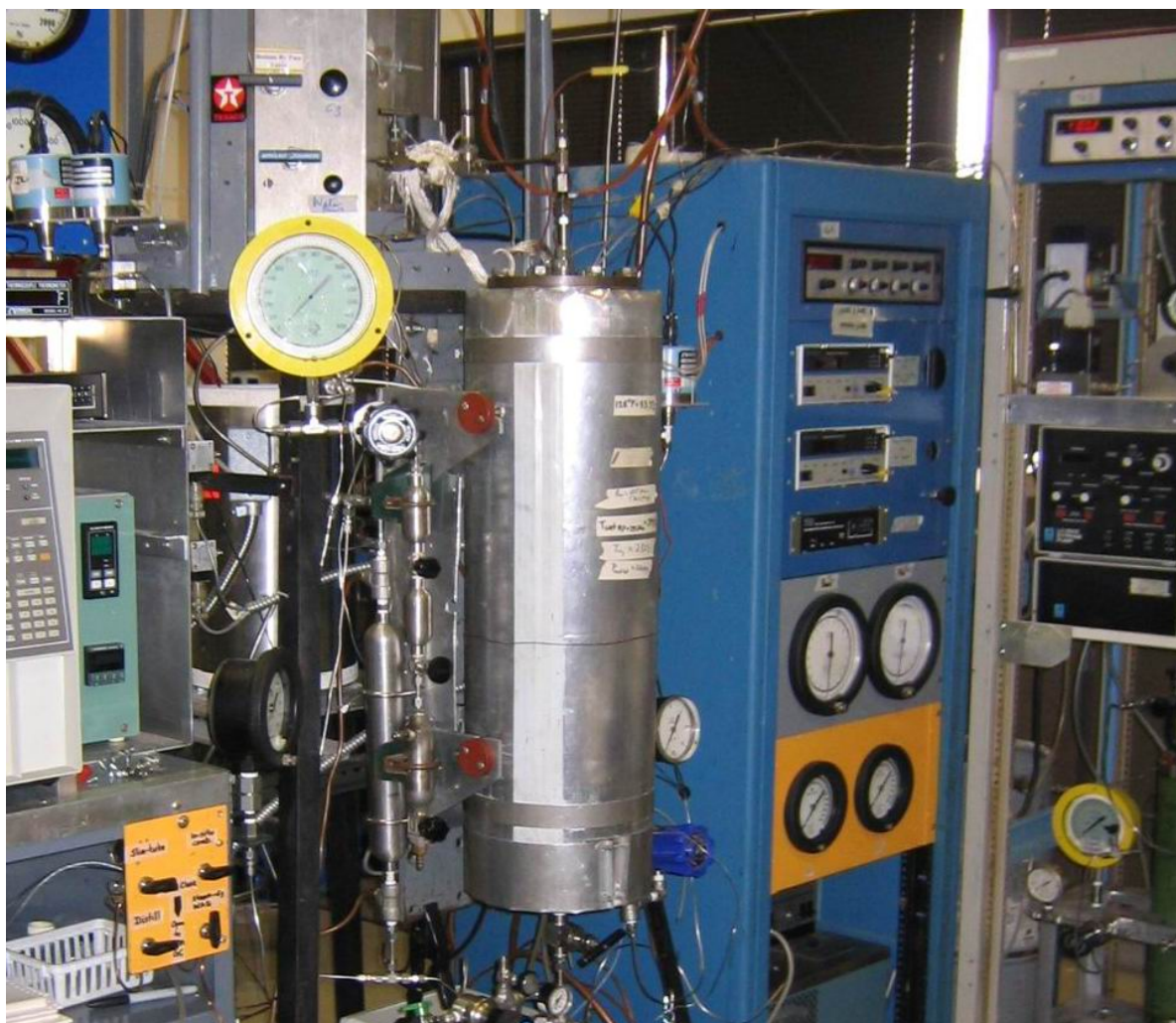


Fig. 3.4- Photograph of vacuum jacket.

3.1.3 Fluid Production System

The fluids leaving the cell are produced through a heated line, which is connected to a set of three separators and a condenser (**Fig. 3.5**). A band heater (set at 60°C) is wrapped around the production line from the cell bottom to the first separator. Two backpressure regulators are used. The first backpressure regulator (**Fig 3.6**) maintains the cell outlet pressure (with the help of nitrogen from a cylinder) at a constant predetermined level during the experiment (i.e. 260 psig). A second backpressure regulator maintains outlet pressure of the second separator at about 50 psig. Fluid from the first separator goes to the second separator where gas is separated from the liquid. Liquid samples are collected from the bottom of the second separator which maximizes liquid recovery. Gas from the top of the second separator is first cooled in the condenser. Cooling water for the condenser is provided by a chiller unit. To ensure no liquid carry-over in the gas stream, the gas passes through a third separator and then to the gas measurement system.

3.1.4 Gas Measurement System

Produced gasses from the third separator flow to a wet test meter, where the cumulative gas production rate is measured. A control valve is used to redirect a portion of the produced gas to a gas chromatograph (GC), which will be used to determine its composition. Before entering the GC (**Fig. 3.7**), the gas is passed through a silica packed cylinder to remove any moisture. An automatic gas sampler is installed in the gas chromatograph to inject the sample. All the gas sampling, injection and measurement operations are carried out automatically at predetermined intervals.

3.1.5 Data Measurement and Recording System

A data logger and a personal computer (**Fig. 3.8**) are used to record the following parameters: injection pressure, outlet pressure, propane injection rate, produced gas rate,

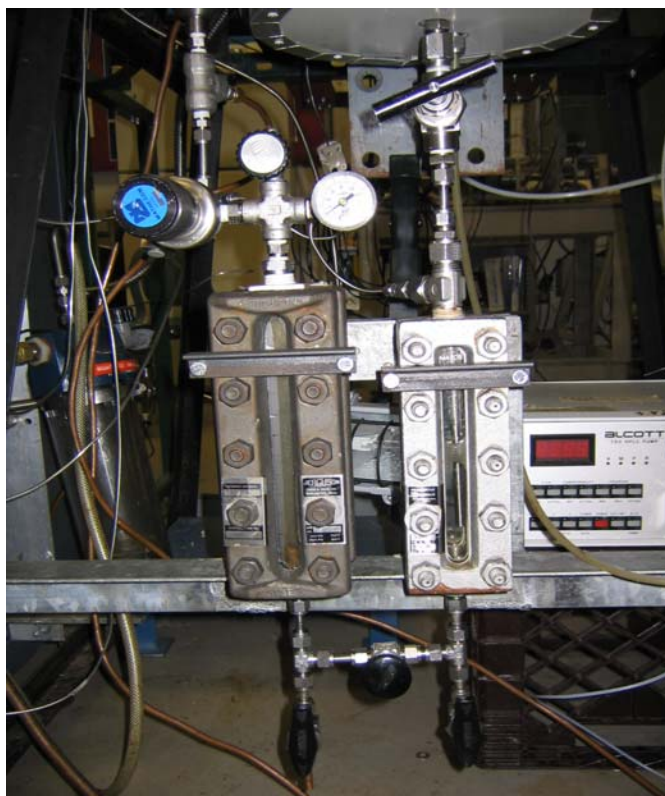


Fig. 3.5- Photograph of first separator (right) and second separator (left).



Fig. 3.6- Photograph of back pressure valve and wet test meter.



Fig. 3.7- Photograph of gas chromatograph.



Fig. 3.8- Photograph of data logger, personal computer and temperature controllers.

injection temperature and temperature profile along the longitudinal axis of the cell. The parameters are recorded at 30-second intervals.

A brief description of the main components of the apparatus follows.

1. HPLC pump

An *Alcott* High Performance Liquid Chromatograph pump supplies water to the steam generator at a very accurate rate (5.5 ml/min \pm 0.1 ml/min).

2. ISCO syringe pump.

An ISCO Precision High Pressure Syringe Pump supplies water to the first accumulator to pressurize the propane until the desired pressure. The pump is designed to work with aqueous and organic solvents. The pump injects water into a 950 ml accumulator, which contains the propane that will be compressed into liquid at the desired pressure.

3. Steam generator

An electric powered steam generator of 1000 watts maximum power, sustaining a maximum pressure of 2000 psig and a maximum temperature of 1200°F provides the steam necessary for the experiments.

4. Temperature controller

A dual-circuit temperature controller is used to maintain a constant temperature of the steam generator. Temperature controllers are also used to control temperature of the heating jacket, and band heater around the separator system.

5. Injection cell

The stainless steel cell measures 27 inches long with an inside diameter of 2.904 inches.

6. Accumulator

The accumulator contains a piston used to compress the propane (above piston) at the desired pressure by means of water injected (below piston) with the ISCO syringe pump.

7. Mass flow controller

Regulates the mass rate of propane injected into the steam generator.

8. Heating jacket

The heating jacket consists of 31.25 inches long, 5.6 inches inner diameter, 7.9 inches outer diameter, stainless steel cylinder with thermal insulation on the outside. Five steel band heaters are attached to the outer wall of the steel cylinder. The top and bottom are sealed by stainless steel flanges, which are insulated by two caps. The injection cell is placed within the heating jacket that is evacuated to minimize heat losses.

9. Vacuum pump

Establishes minus 29 inches mercury vacuum in the annulus between the heating jacket wall and the cell to minimize the heat losses.

10. Wet test meter

The wet test meter measures the volumetric flow of the produced gas from the first separator. It is equipped with a ten diode counter that enables automatic recording of produced gas rate.

11. Three stage separation and collection system

It is used to separate the produced gas from the produced liquid (water and oil). Nitrogen line for backpressure control is connected to the first separator, while a gas sampling lines is connected the outlet of the third separator.

12. A vessel for petroleum distillate

A vessel (inner volume of 153.77 ml) that contains petroleum distillate is mounted at about one foot to from the injection point. This vessel contains 66 ml of petroleum distillate at the top layer (equivalent to 5:100 petroleum distillate:steam mass ratio and assuming 4 hours of experimental run is conducted) and 87 of water (at the bottom layer, connected to the ISCO syringe pump). The petroleum distillate is injected along with the steam for steam-petroleum distillate runs.

13. Temperature controller

A dual-circuit temperature controller is used to maintain a constant temperature of the steam generator. Temperature controllers are also used to control temperature of the heating jacket, and band heater around the separator system.

14. Gas chromatograph

The gas chromatograph analyzes the composition of the gas samples collected in the first separator and the production outlet.

15. Data logger/recording system

Takes measurements and records pressure, temperature, produced and injection gas rates and propane injection rate data every 30 seconds.

A list of the principal components of the experiment setup can be observed in

Table 3.1.

Table 3.1- List of main components of the apparatus.

Water reservoir	4-liter plastic container
HPLC pump	Alcott 760 HPLC
Steam generator	Custom-made by Texaco. Max. pressure: 2000 psig. Max. temperature: 1200°F
Injection cell	Stainless steel tube. Length: 27 in. I.D.: 2.904 in.
Temperature controller	Digi-Sense. Model 2186-10A, 20 Amp peak
Temperature controller-band heater	VICI. Model ITCK10. 10 Amp max
Temperature controller-steam generator	Eurotherm Digital Controller. Model 808
Vacuum Pump	Welch director II, model 8811
Mass Flow Controller	Brooks. Model 5850E series. Max. flow 1000 cm ³ /min
Wet test meter	GCA/Precision Scientific, capacity 0.1 ft ³ per revolution.
Gas chromatographs (GC)	Hewlett Packard 5890 Series II

Table 3.1- Continued.

Data logger	Hewlett Packard data acquisition unit. Model 3497A with 44422A T-couple acquisition assembly.
Back-pressure regulator	Tescom Corporation. Max. pressure 500 psig (for nitrogen), 1500 psig for HPLC backpressure control.
Rheometer	Brookfield. Model DV-III with cone and plate assembly. (Fig. 3.9)
Chiller unit	Hasskriss Co. Model R100
Pressure transducer	Omega. Model PX 621. Max pressure 1000 psig.
Tubing	¼-in., 1/8-in. and 1/16-in. stainless steel tubing with Swagelok and Autoclave connections.
Control valves	Autoclave Engineers ¼-in. Withey ¼-in., 1/8-in.
Thermocouples	Omega JMQSS-020. Type J. Sheath diameter .020-in.
Gauges	HEISE, CM-105620 and CM-105618, Bourdon tube 403 ST-ST. Max. pressure 500 psig.
Temperature bath	GCA/Precision Scientific. Model TC 500. (Fig. 3.10)
Electronic balance	METTLER PM 4600 Delta Range. Capacity 10.45 kg.
Balance	OHAUS Heavy duty. Capacity 20 kg.
Thermometer	Kessler. ASTM 40C
Industrial sand	100 mesh supplied by Baker Oil Tools
San Ardo oil	Circa 12°API, 2800 cp at 50°C
Paint thinner	Commercial paint thinner
Nitrogen tank	Botco, Nitrogen compressed, 1500 psig.
Centrifuge	IEC HN-II Benchtop centrifuge, 0-3000 RPM (Fig. 3.11)

Figs. 3.9 – 3.12 show various components of the experimental apparatus, while **Fig. 3.13** shows the entire set up.

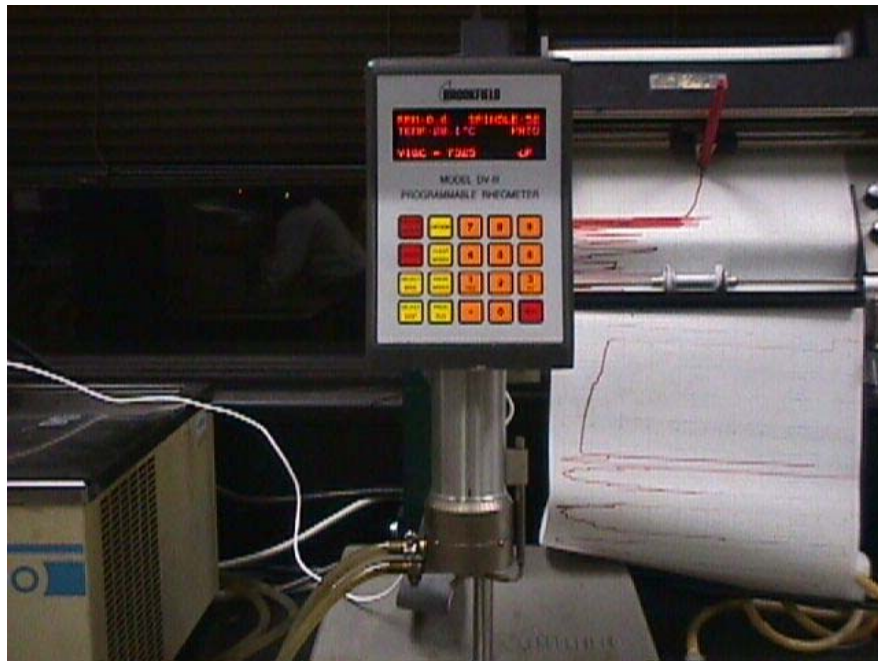


Fig. 3.9- Cone-plate rheometer.



Fig. 3.10- Water bath for viscometer.



Fig. 3.11- Photograph of insulated centrifuge with heater gun to keep samples warm.



Fig. 3.12- Water bath for heating samples.



Fig. 3.13- Photograph showing overview of experimental apparatus.

3.2 Experimental Procedure

The physical model consists of a cylindrical stainless steel cell, which is packed with a mixture of sand, oil and water. The mixture is prepared in a mixing bowl prior to the run with constant amounts of fluids and sand (see **Appendix A** for details). Because of the extra-heavy oil used, heating the mixture at about 53°C is required to assure homogeneity. A small amount of the mixture at a time is then manually tamped into the cell. By applying a mass balance between the initial amount of mixture and the remaining left after the tamping process, the exact amount of mixture inside the cell is

calculated. This information is used to compute the pore volume, fluid saturations and original oil in place (OOIP) as shown in **Appendix A**.

The cell is placed in the vacuum jacket where it is left overnight with a constant temperature of 53°C. Before the run starts, vacuum is applied on the annulus between the jacket and the cell to ensure minimal heat loss during the run.

The HPLC pump is set to feed a constant rate 5.5 ml/ min of water to the steam generator. Using a mass flowmeter, propane is injected at a fixed mass rate into the generator. The steam or propane-steam or petroleum distillate-steam mixture is first produced, bypassing the cell until superheated steam is obtained. Once the steam has reached the desired temperature (230°C), injection into the cell begins and the system pressure is set at a predetermined level (260 psig) using nitrogen and a backpressure valve. The mass rate of propane and petroleum distillate is set to the value corresponding to the propane:steam or petroleum distillate:steam mass ratio to be used.

The injection starts when the temperature of the steam reaches 230°C and the injection pressure reaches 260 psig.

Once the injection starts, the injection temperature is maintained throughout the run by means of a temperature controller connected to a band heater wrapped around the injection line. Production pressure is controlled by means of a backpressure valve, which regulates the nitrogen pressure to the first separator and subsequently to the bottom of the cell.

Sampling is carried out every three minutes by allowing the flow from the first separator to the second. Once the produced fluids pass from the first separator to the second, the valve that connects both separators is closed. Then, the fluids are collected from the bottom of the second separator in the sampling bottles to be treated and analyzed. This procedure ensures that the cell and the first separator are never open to atmospheric pressure. The gas produced from the first separator passes through a wet test meter where the cumulative volume is measured at 30-seconds intervals.

Gas samples from the fluid separator are collected automatically every five minutes by the means of an autosampler. These samples are then automatically analyzed using a GC.

San Ardo oil tends to smear the surface of the sample bottles. It was decided to add paint thinner to the produced fluids. The paint thinner decreases the interfacial tension and helps to create clear separation between oil and water in the sample bottles. This separation ensures correct measurement of the produced oil and water. The samples are spun for 30 minutes at 2300 RPM inside a centrifuge heated at 140°F (**Fig. 3.11**) to achieve a more accurate reading of the oil and water production. This procedure is applied only for one run out of two runs conducted in the same type of additive that is used along with the steam.

Given the very low sample volumes obtained, the oil density was measured using a 2 cm³ pycnometer. Viscosity was measured using a digital rheometer with a cone-plate assembly (**Fig. 3.9**). A heating bath (**Fig. 3.10**) maintained the sample temperature at 50°C during the viscosity measurements.

A data logger and a personal computer were used to record at 30-second intervals the following parameters: injection and cell temperatures; injection and production pressures; and gas injection and production rates. These values were displayed in real time and helped us maintain the injection temperature and production pressure at constant levels throughout the run.

CHAPTER IV

EXPERIMENTAL RESULTS

4.1 Overview

A total of six successful runs were carried out under steam injection, steam-propane injection, and steam-petroleum distillate injection. The runs were repeated to confirm the validity of the experiments and the consistency of the results. To allow fair comparison between these runs some parameters are kept constant for all experiments. The sand mix properties are also kept as constant as possible (**Table 4.1**).

The experimental runs conditions and additives used are as follows:

- Run 3 5:100 propane:steam mass ratio
- Run 4 pure steam
- Run 5 pure steam
- Run 6 5:100 propane:steam mass ratio
- Run 7 5:100 petroleum distillate:steam mass ratio
- Run 8 5:100 petroleum distillate:steam mass ratio

The following parameters were kept constant for all the runs:

- Steam injection temperature: 230°C
- Steam injection rate: 5.5 cm³/min cold water equivalent (CWE)
- First separator backpressure (production pressure): 260 psig
- Second separator backpressure (production pressure): 50 psig
- Vacuum jacket pressure: -29 in. mercury
- Initial cell temperature: 53.3°C

The raw data is presented in **Appendix A**. The calculations used to process the data are also showed in the appendix.

The properties of the sand mixture inside the cell for each run are shown in **Table 4.1**.

Table 4.1- Sand mix properties for Runs 3 to 8.

	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8
Porosity, %	41.8	41.2	41.1	42.1	41.2	42.5
Pore volume, cm³	1163.2	1164.7	1162.3	1164.4	1265.7	1261.8
Water volume inside cell, cm³	190.8	191.2	190.1	193.0	192.1	191.5
Oil volume inside cell (OOIP), cm³	860.3	861.5	862.8	860.3	863.9	860.7
Oil saturation, %	65.6	65.6	74.1	65.6	72.6	71.6
Water saturation, %	15.4	15.4	16.5	15.4	16.5	15.7
Air saturation, %	10.1	10.4	9.1	9.8	10.2	9.4

The data analyses and interpretations are presented individually for each run. In addition, a global comparison between the various cases is also made.

4.2 Run 3 (5:100 Propane:Steam Mass Ratio)

The temperature profiles for this run are shown in **Fig. 4.1**. The average steam injection temperature is 230°C and very little variation is observed throughout the run. **Figs. 4.2** and **4.3** show the cumulative volumes of oil and water versus time and pore volume of steam injected respectively. By the end of the run, when the amount of steam injected is around 95% of the pore volume, the oil recovery is 407.5 cm³ (47.3% of OOIP).

The oil and water rates are plotted both as a function of time and pore volume of steam injected (**Figs. 4.4** and **4.5**). The oil production rate peak is about 15 cm³/min and it lasts from 56 to 71 minutes. **Fig. 4.6** shows the temperature profiles inside the cell at 20-minute intervals. It can be observed that by 141 minutes the temperature of the whole cell reaches a value around 210°C.

The injection and production pressures are shown in **Fig. 4.7**. The differential pressure (injection pressure minus production pressure) is also plotted in **Fig. 4.7**. Production pressure is maintained at 260 psig during the whole run. On the other hand, the injection pressure started increasing at the beginning of the run to eventually decrease at around 77. The maximum differential pressure reached in this run was around 121 psig.

The oil viscosity and API gravity of the produced oil is shown in **Fig. 4.8**. The API gravity tends to increase with respect to time. Most of the values recorded were around the original API gravity of 12. The oil viscosity shows an increasing trend as time increases.

The compositional analysis of the gas produced after the third separator is plotted in **Fig. 4.9**. The cumulative gas volume produced after the third separator is presented in **Fig. 4.10**. **Fig. 4.11** shows the propane cumulative injection mass and propane cumulative mass production for the third separator. A total of 66 g propane is injected inside the cell and propane produced from the third separator is 4.43 g

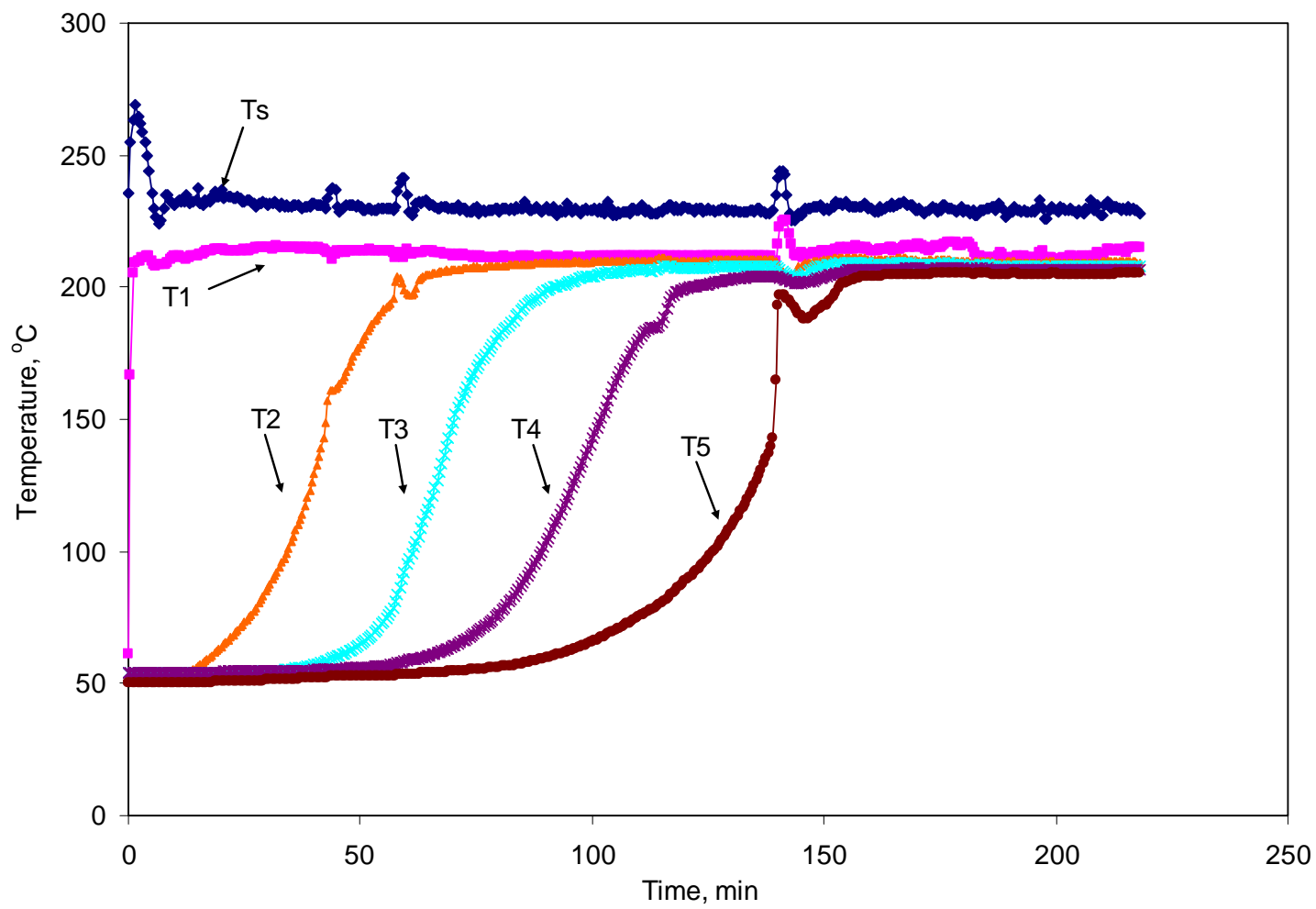


Fig. 4.1-Temperature profile versus time for Run 3 (5:100 propane:steam).

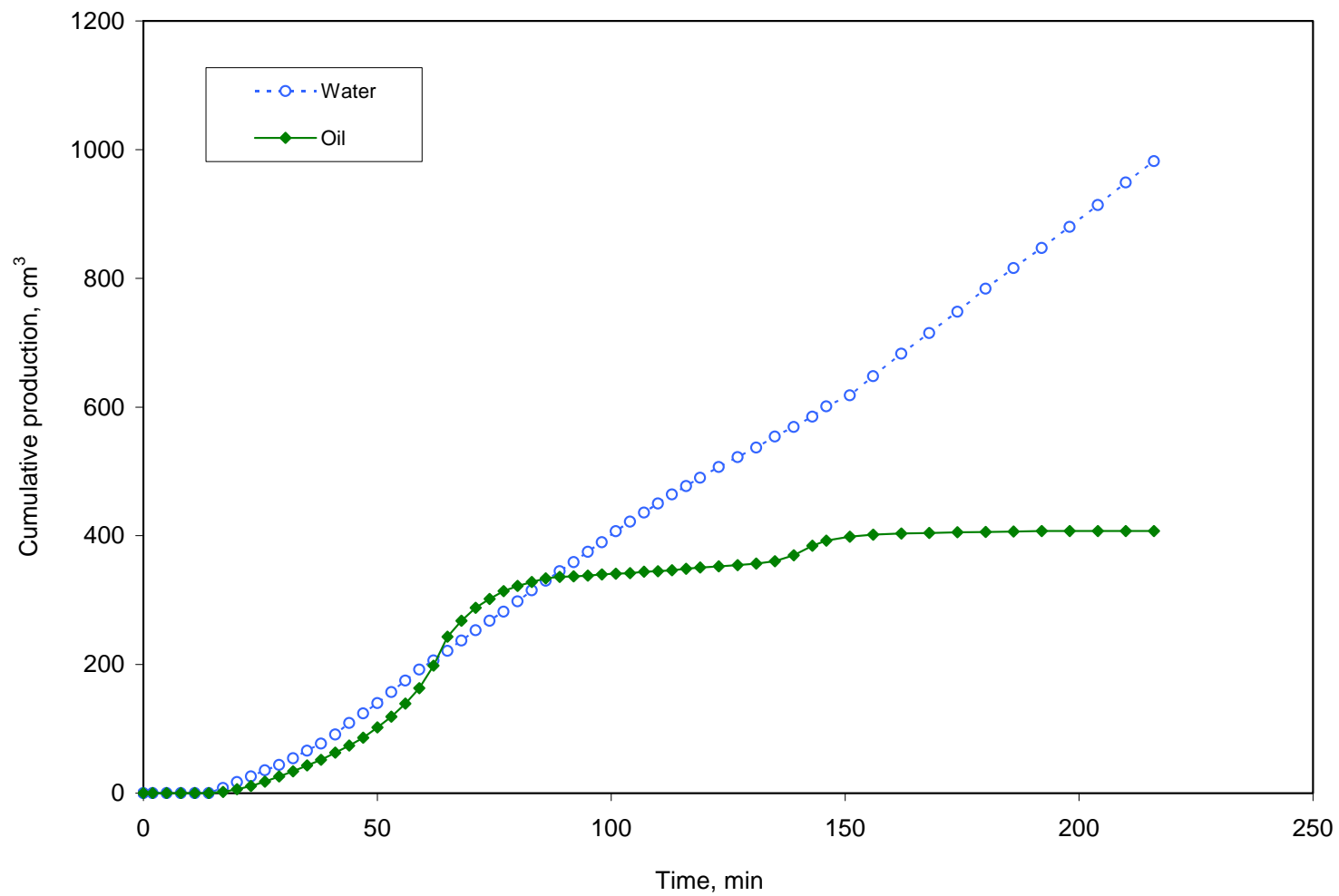


Fig. 4.2- Cumulative oil and water volumes versus time for Run 3 (5:100 propane:steam).

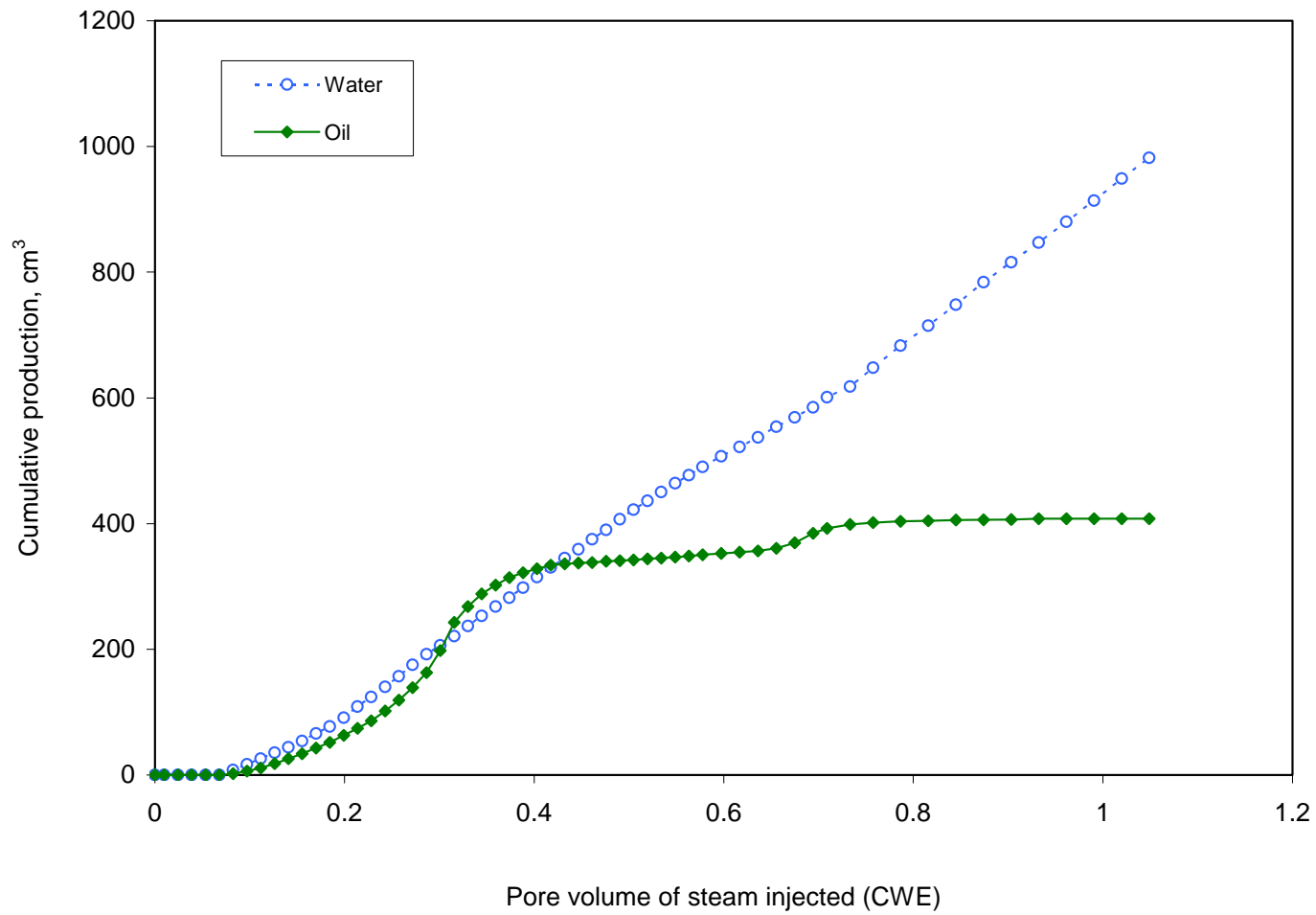


Fig. 4.3- Cumulative oil and water volumes versus pore volume of steam injected for Run 3 (5:100 propane:steam).

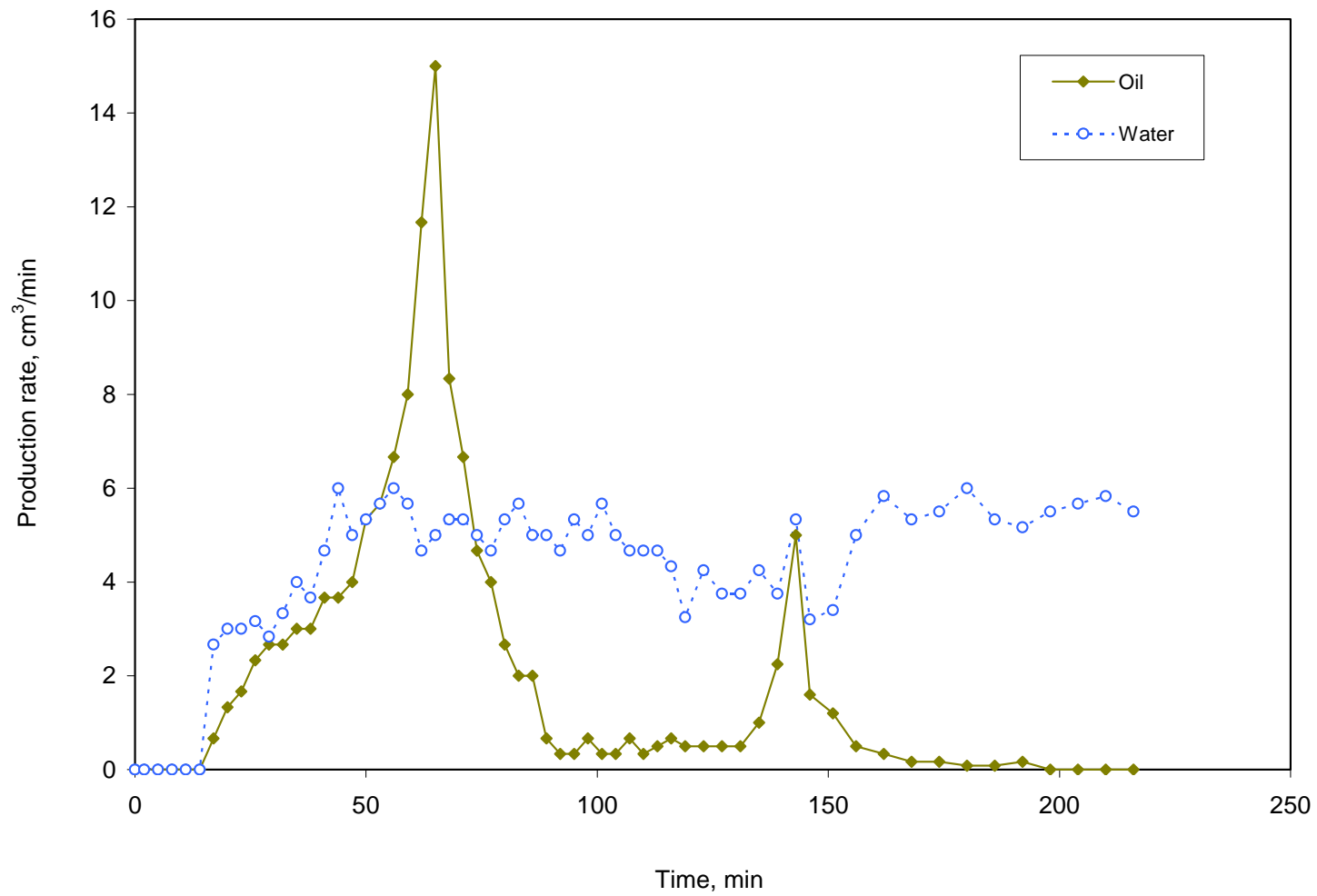


Fig. 4.4- Oil and water rates versus time for Run 3 (5:100 propane:steam).

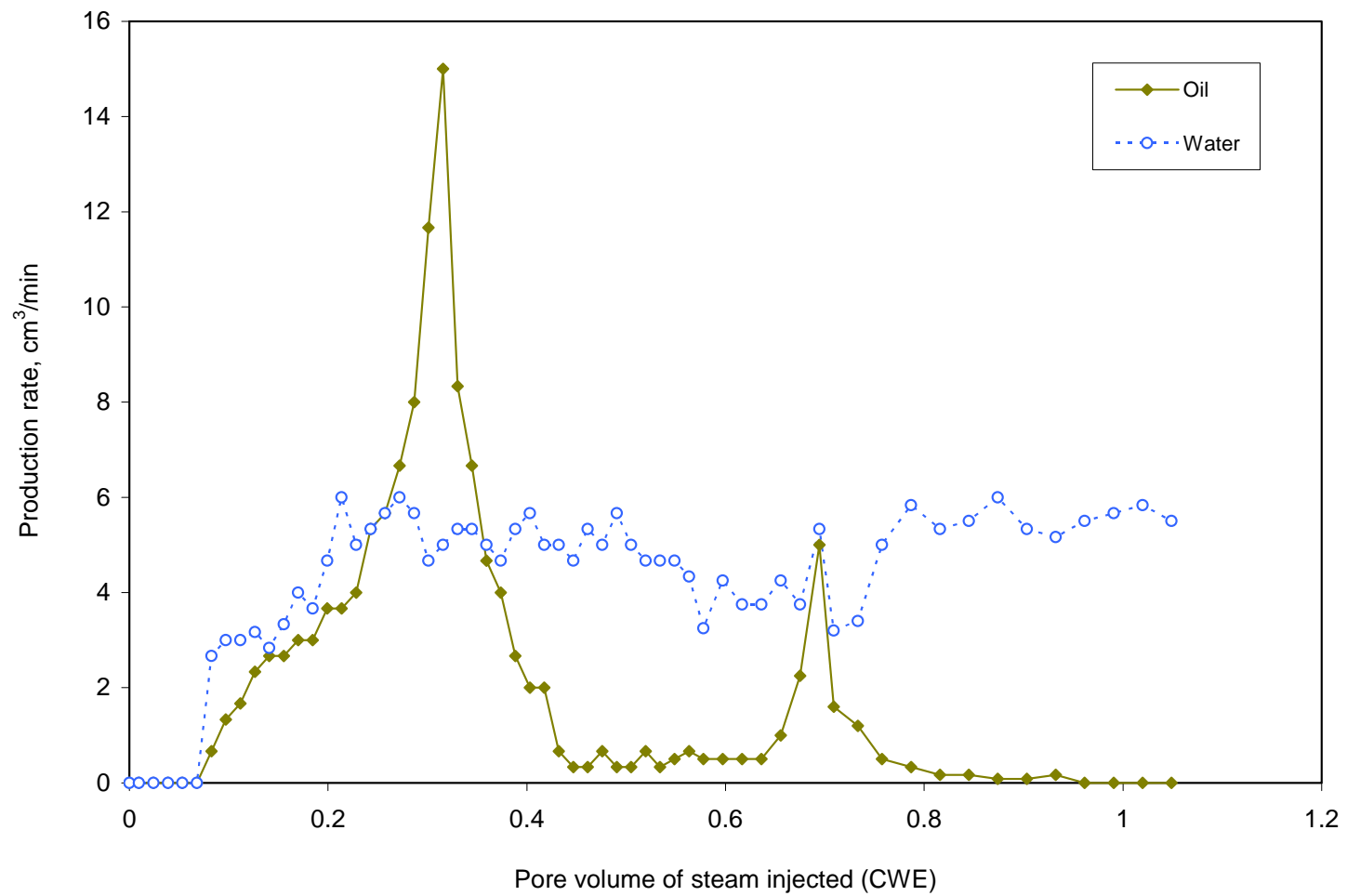


Fig. 4.5- Oil and water rates versus pore volume injected for Run 3 (5:100 propane:steam).

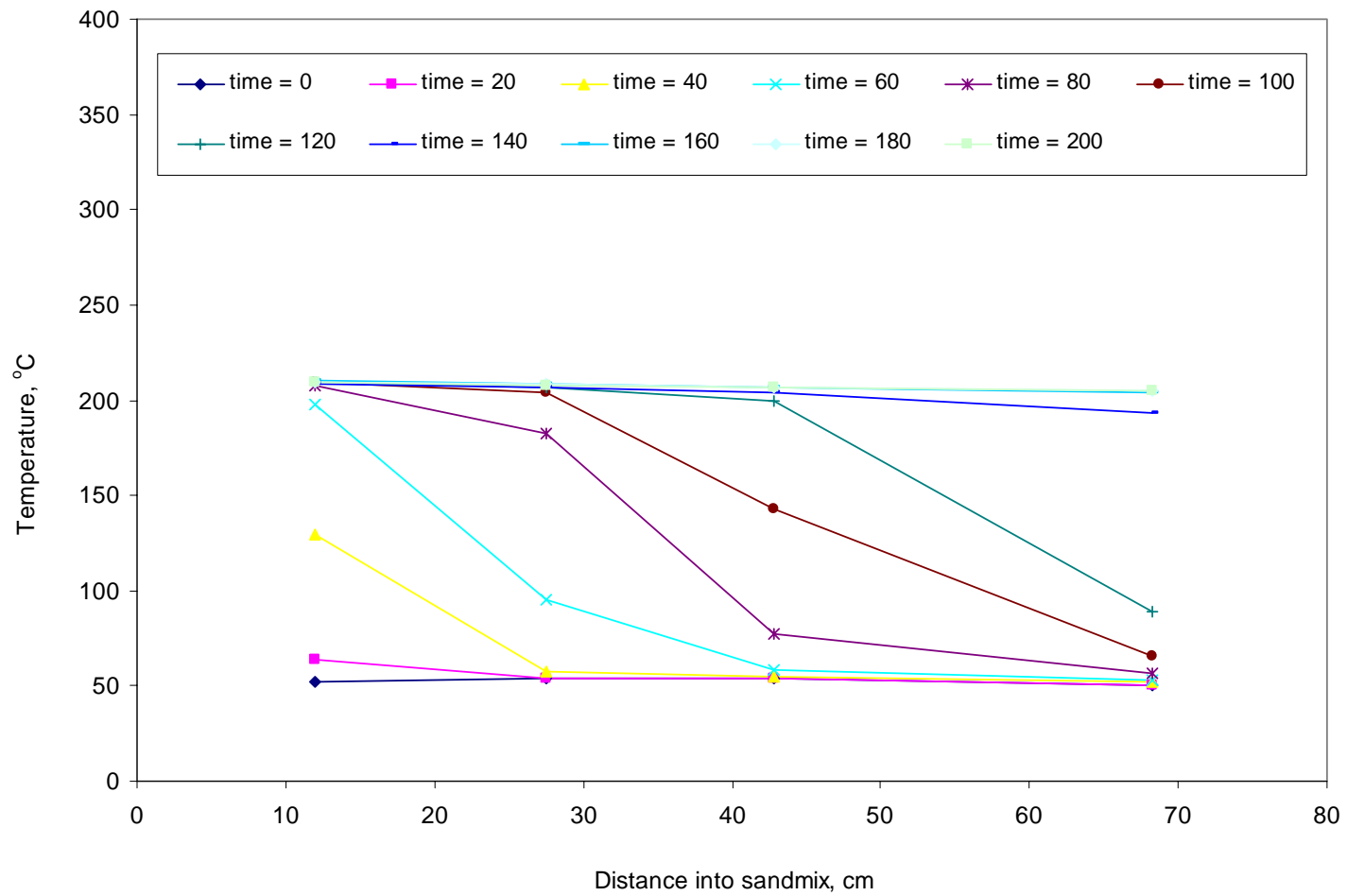


Fig. 4.6- Temperature profiles at 20-minute intervals – from t = 0 to t = 200 min – for Run 3 (5:100 propane:steam).

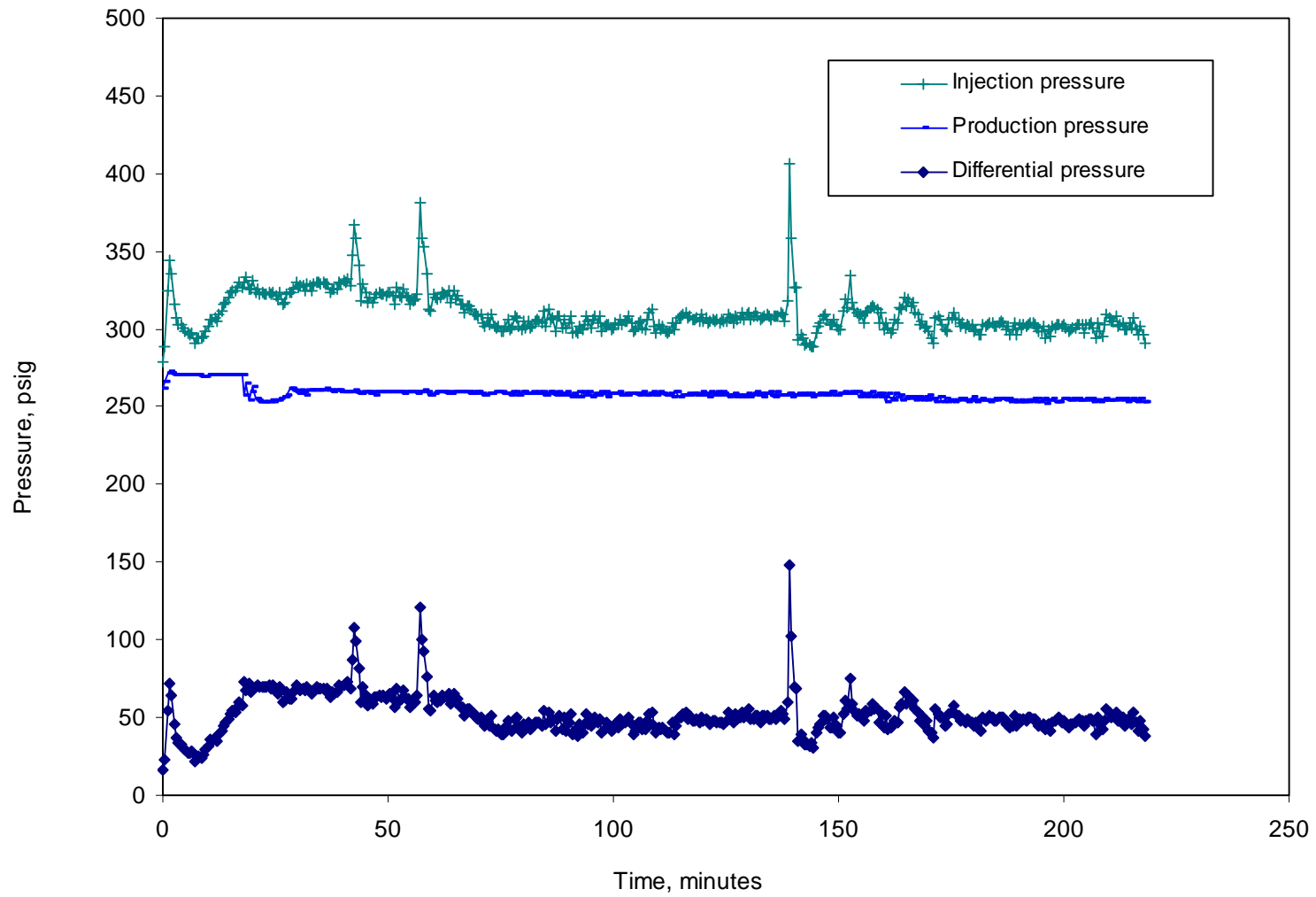


Fig. 4.7- Injection, production and differential pressures for Run 3 (5:100 propane:steam).

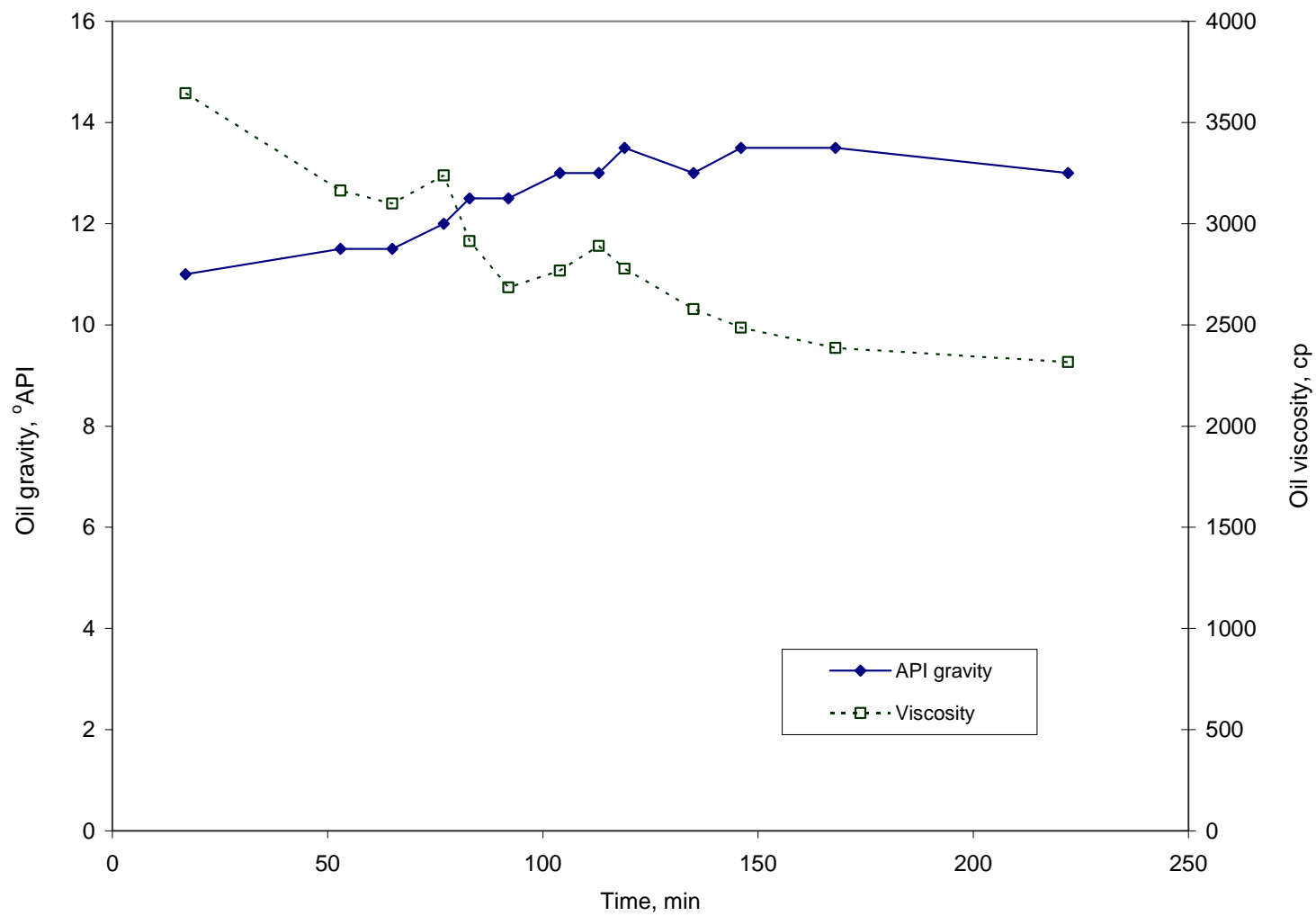


Fig. 4.8- Oil viscosity and API gravity for Run 3 (5:100 propane:steam).

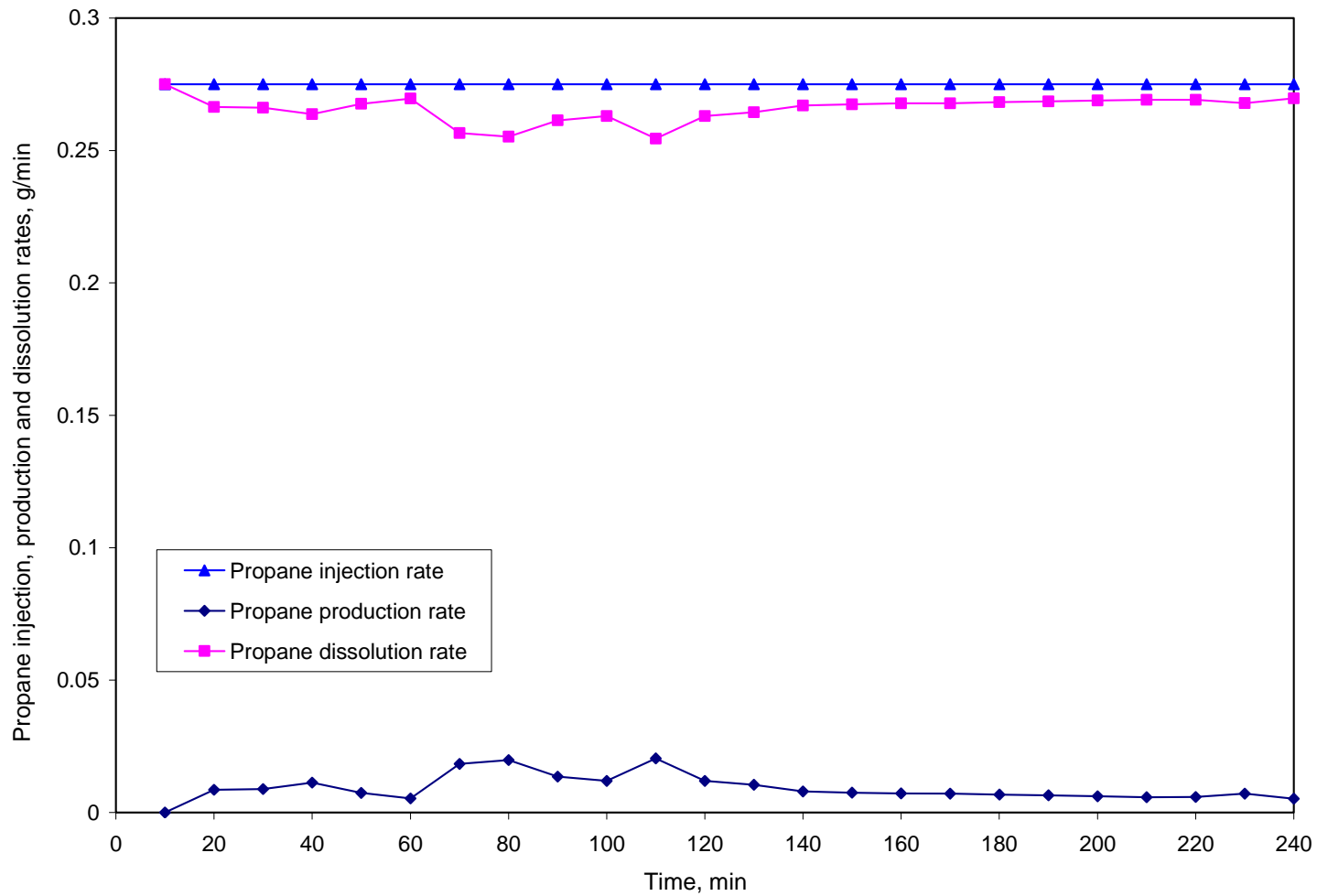


Fig. 4.9- Propane injection, production, and dissolution rates after the third separator for Run 3 (5:100 propane:steam).

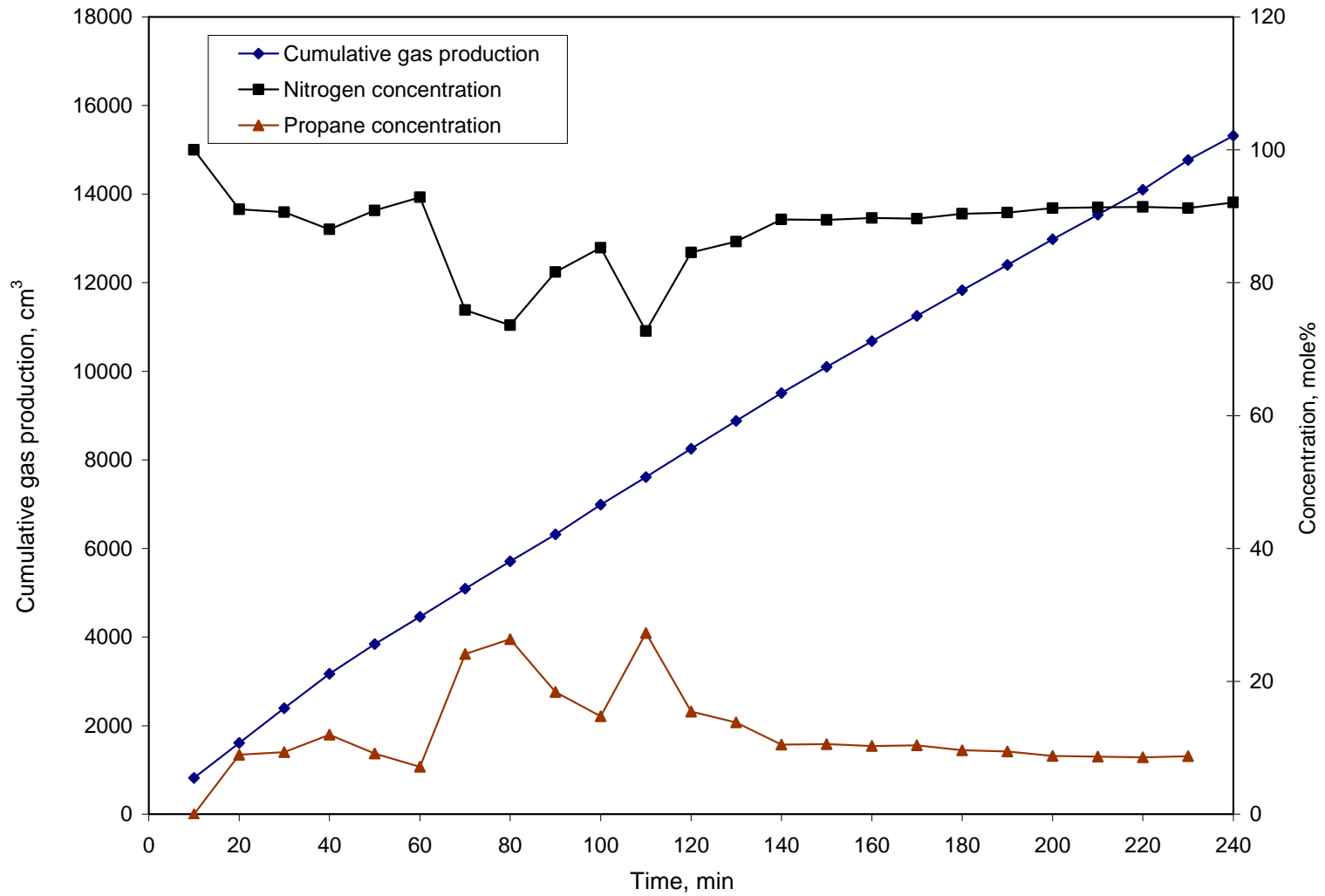


Fig. 4.10- Cumulative gas production and composition after the third separator for Run 3 (5:100 propane:steam).

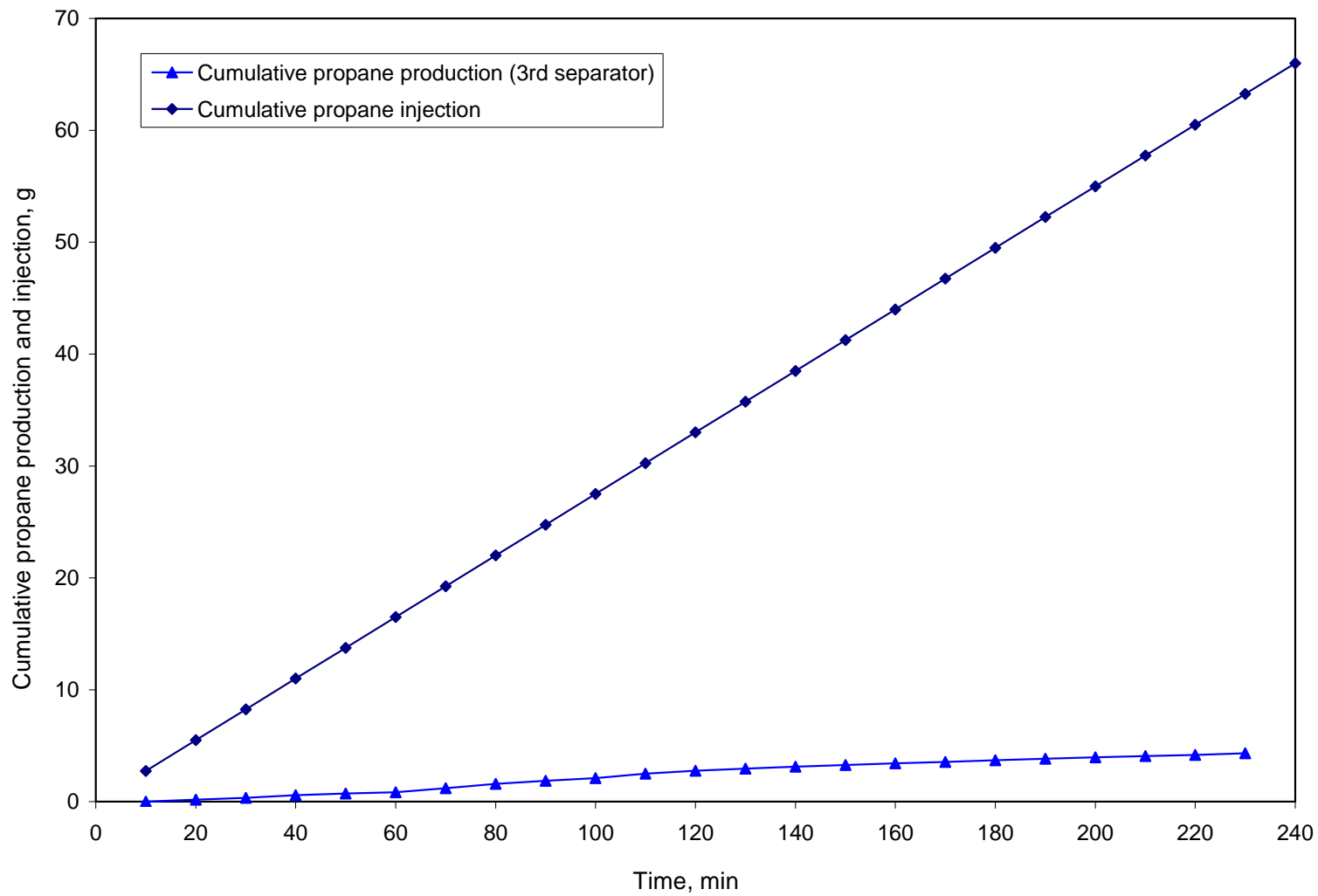


Fig. 4.11- Cumulative propane injection and production for Run 3 (5:100 propane:steam).

4.3 Run 4 (Pure Steam)

The temperature profiles for run 4 are shown in **Fig. 4.12**. The initial injection temperature is around 200 °C, however, the temperature quickly stabilizes to the preset level for all the runs (220°C). **Figs. 4.13** and **4.13** show the oil cumulative production plotted as a function of time and pore volume injected respectively. The final oil recovery at 273 minutes (132% of pore volume injected) was 394 cm³, which corresponds to 40.9% of OOIP.

The oil production rates vs. time and pore volume injected are plotted in **Figs. 4.15** and **4.16** respectively. The start of oil production occurs at 24 minutes, and the oil rate peak is 15 cm³/min. **Fig. 4.17** shows temperature profiles at 20-minute intervals. . It takes about 198 minutes for the whole cell to reach a more or less constant temperature of 210°C.

The injection, production and differential pressures are plotted in **Fig. 4.18**. The differential pressure peak is 31 psig. API gravity tends to increase as time increases (**Fig. 4.19**). Oil viscosity shows a decreasing trend with time. The viscosity values measured in run 4 shows significant upgrading as compared to the original oil viscosity.

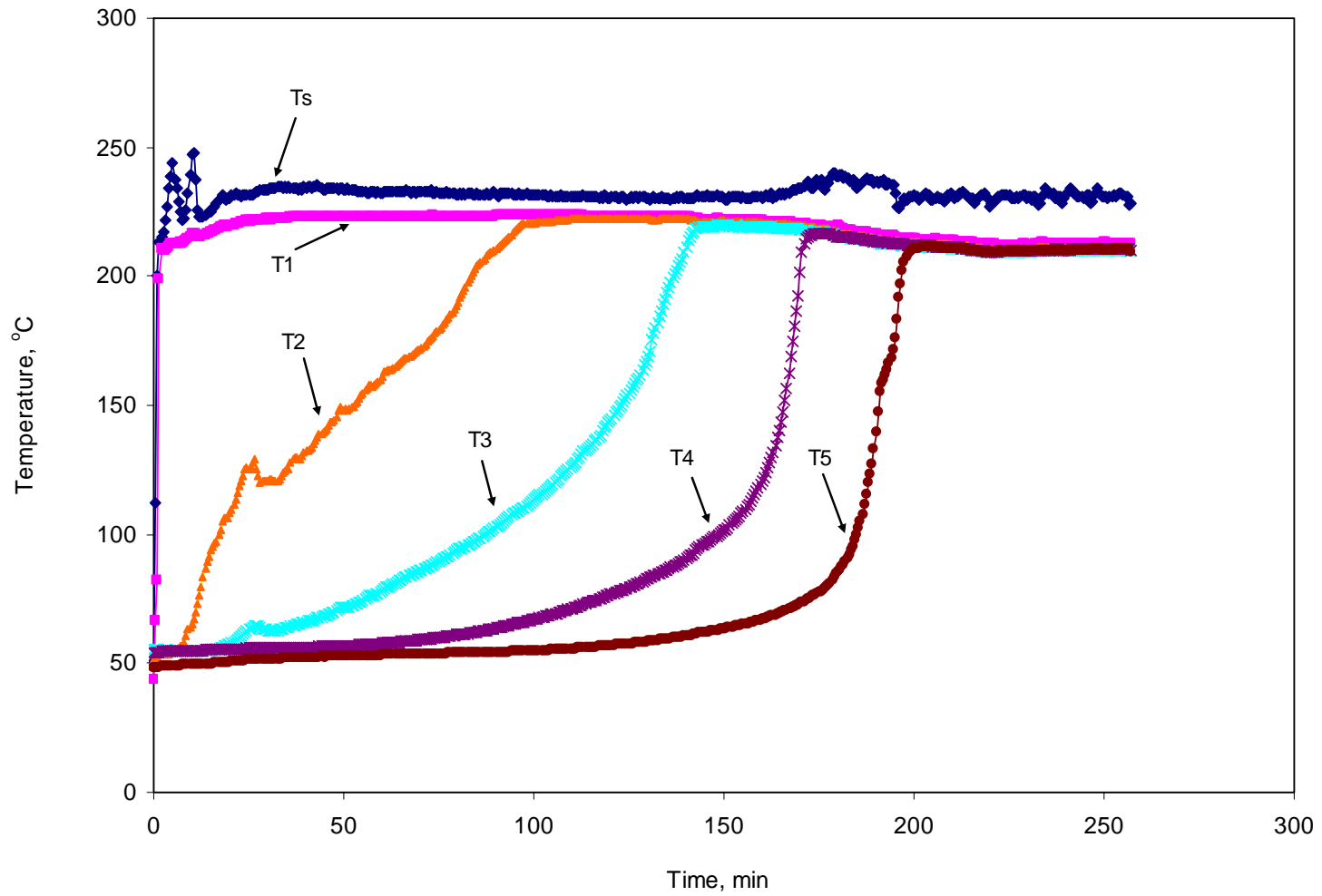


Fig. 4.12- Temperature profile versus time for Run 4 (pure steam).

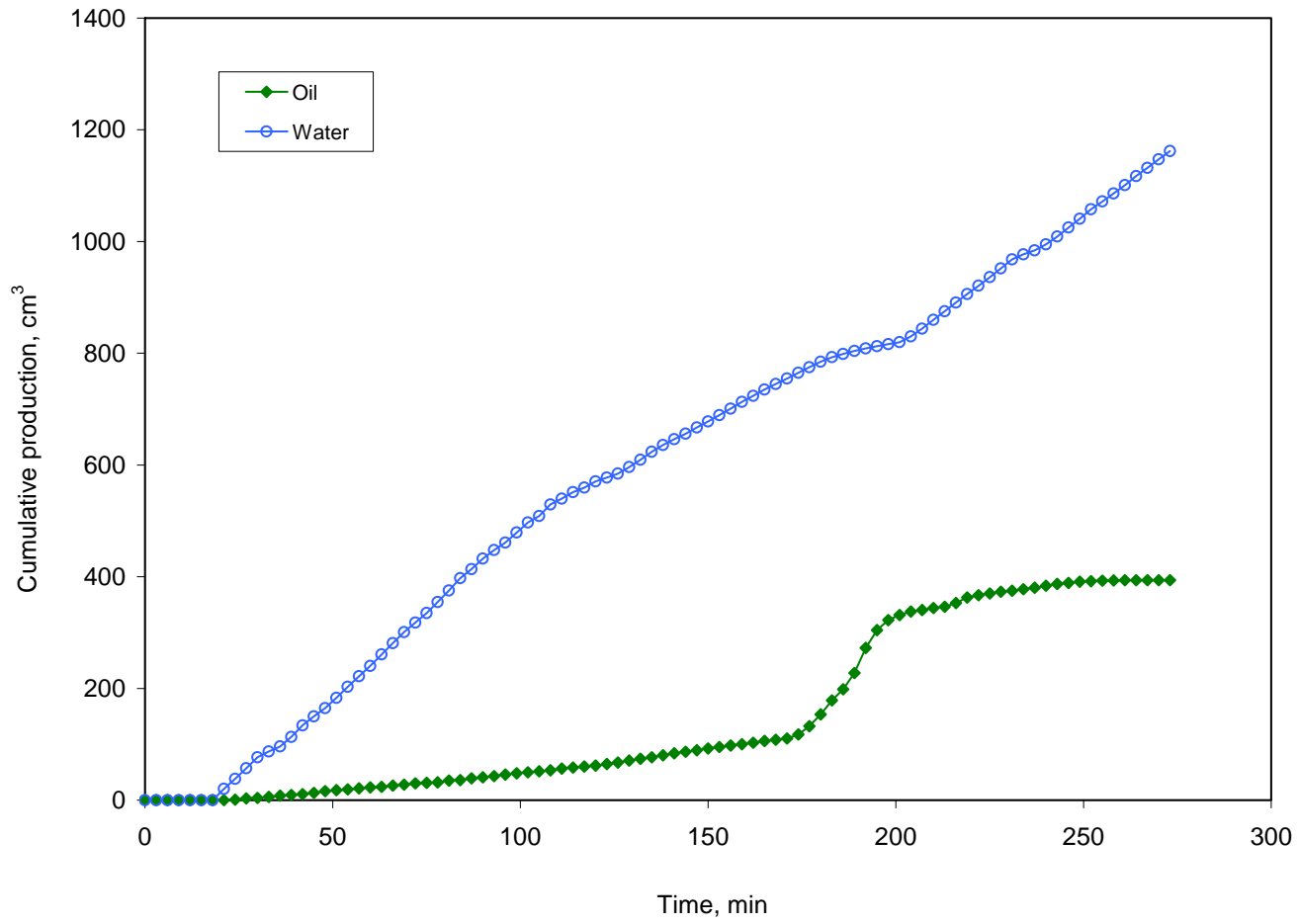


Fig. 4.13- Cumulative oil and water volumes versus time for Run 4 (pure steam).

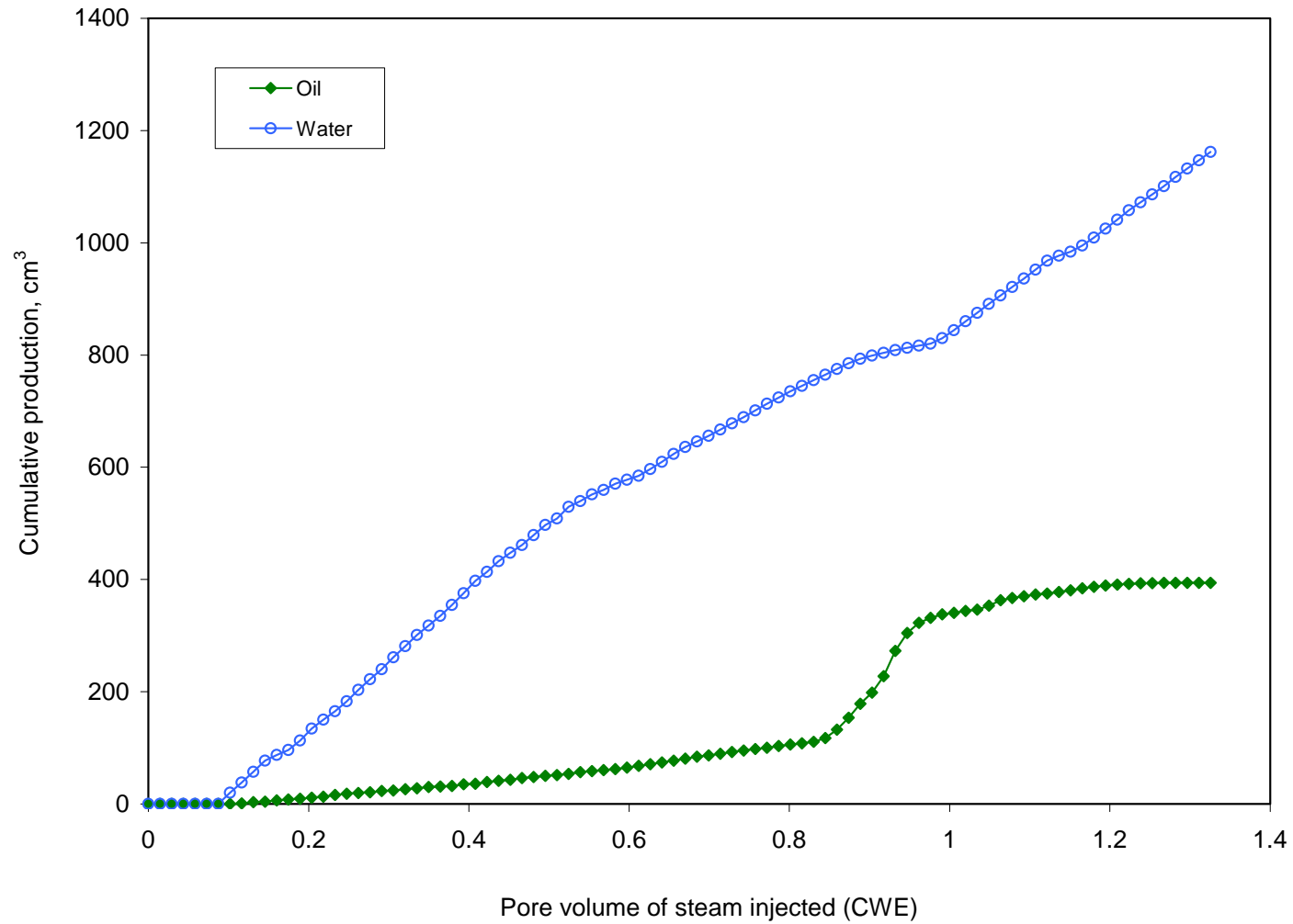


Fig. 4.14- Cumulative oil and water volumes versus pore volume injected for Run 4 (pure steam).

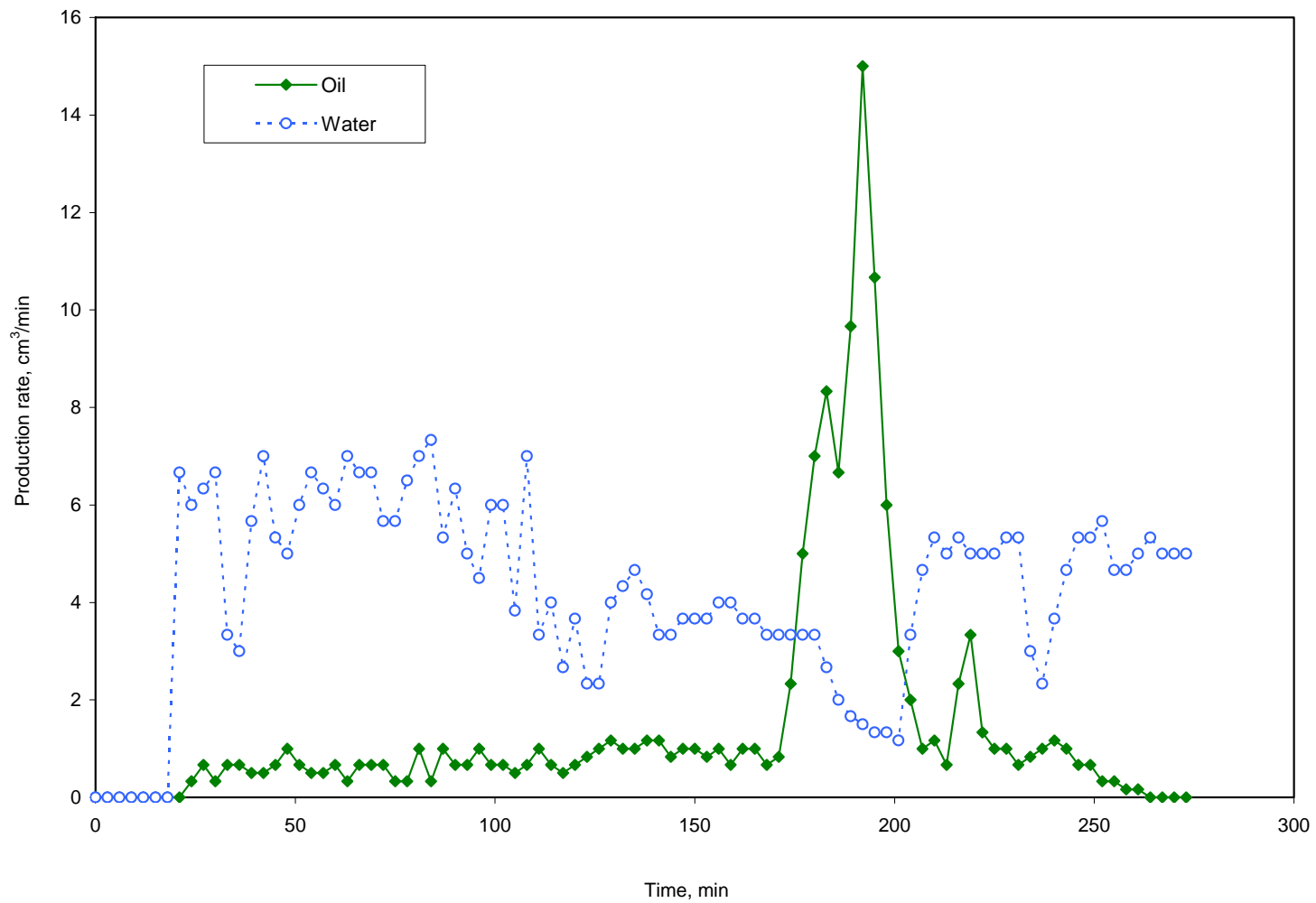


Fig. 4.15- Oil and water rates versus time for Run 4 (pure steam).

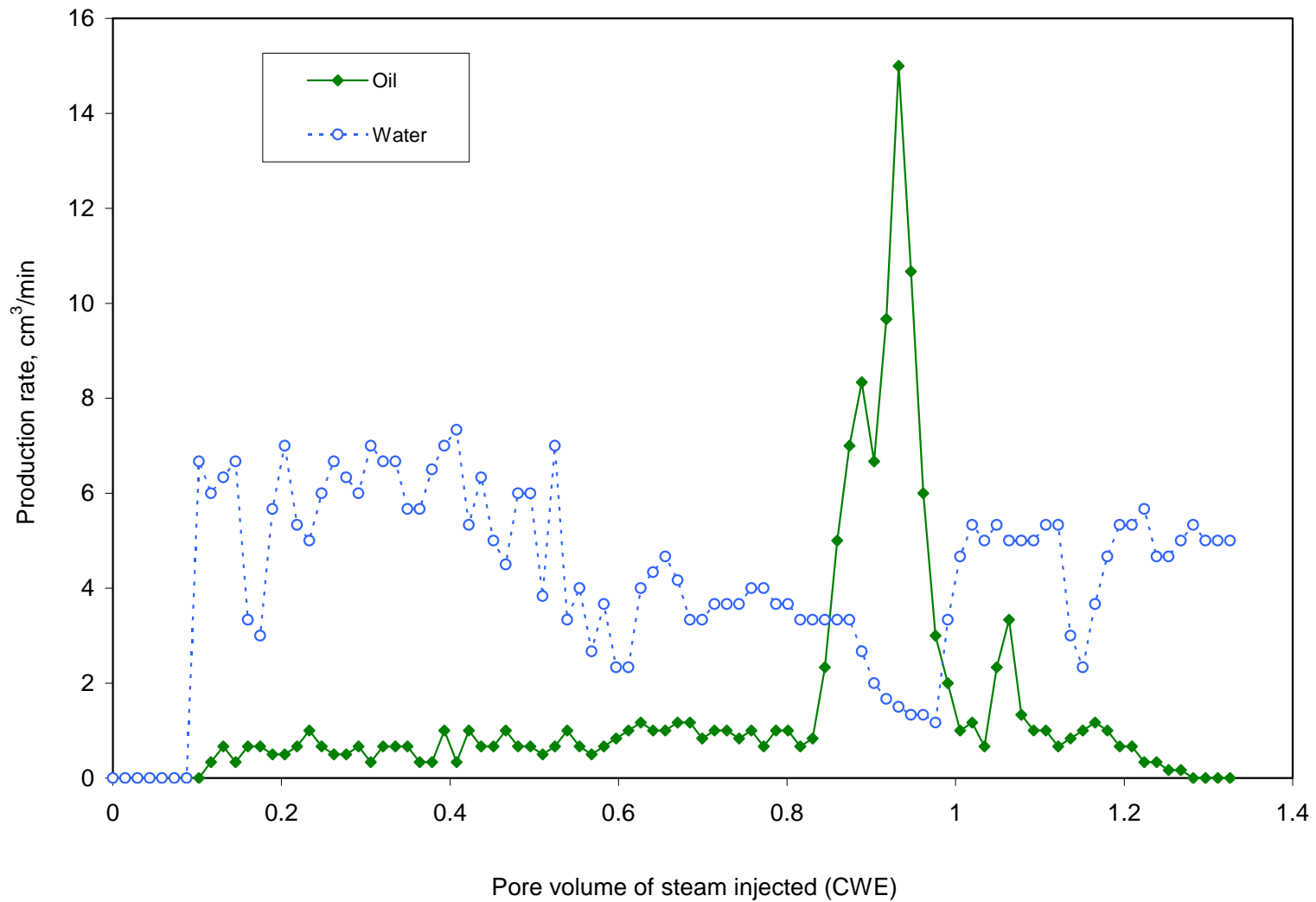


Fig. 4.16- Oil and water rates versus pore volume injected for Run 4 (pure steam).

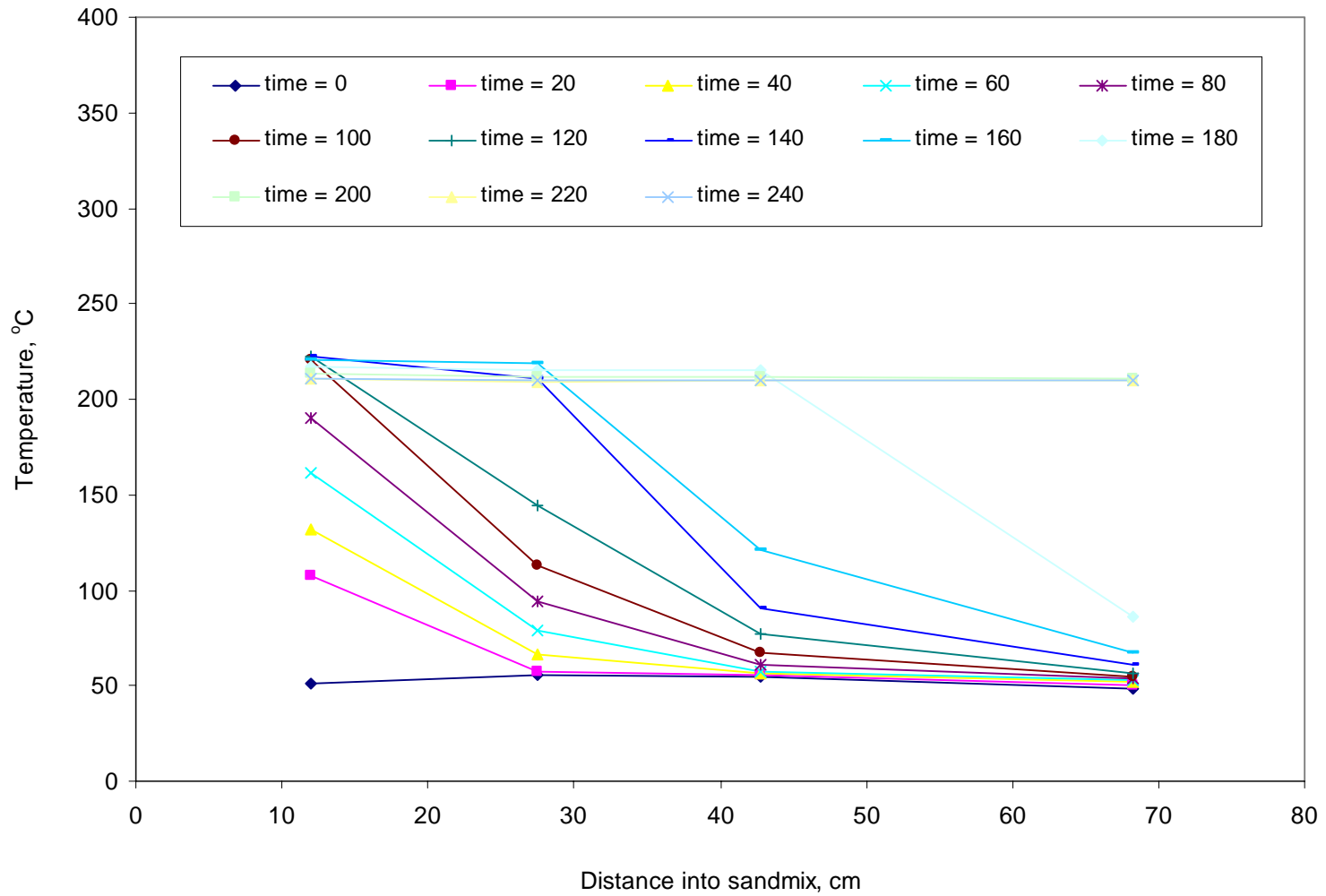


Fig. 4.17- Temperature profiles at 20-minute intervals – from t = 0 to t = 240 min – for Run 4 (pure steam).

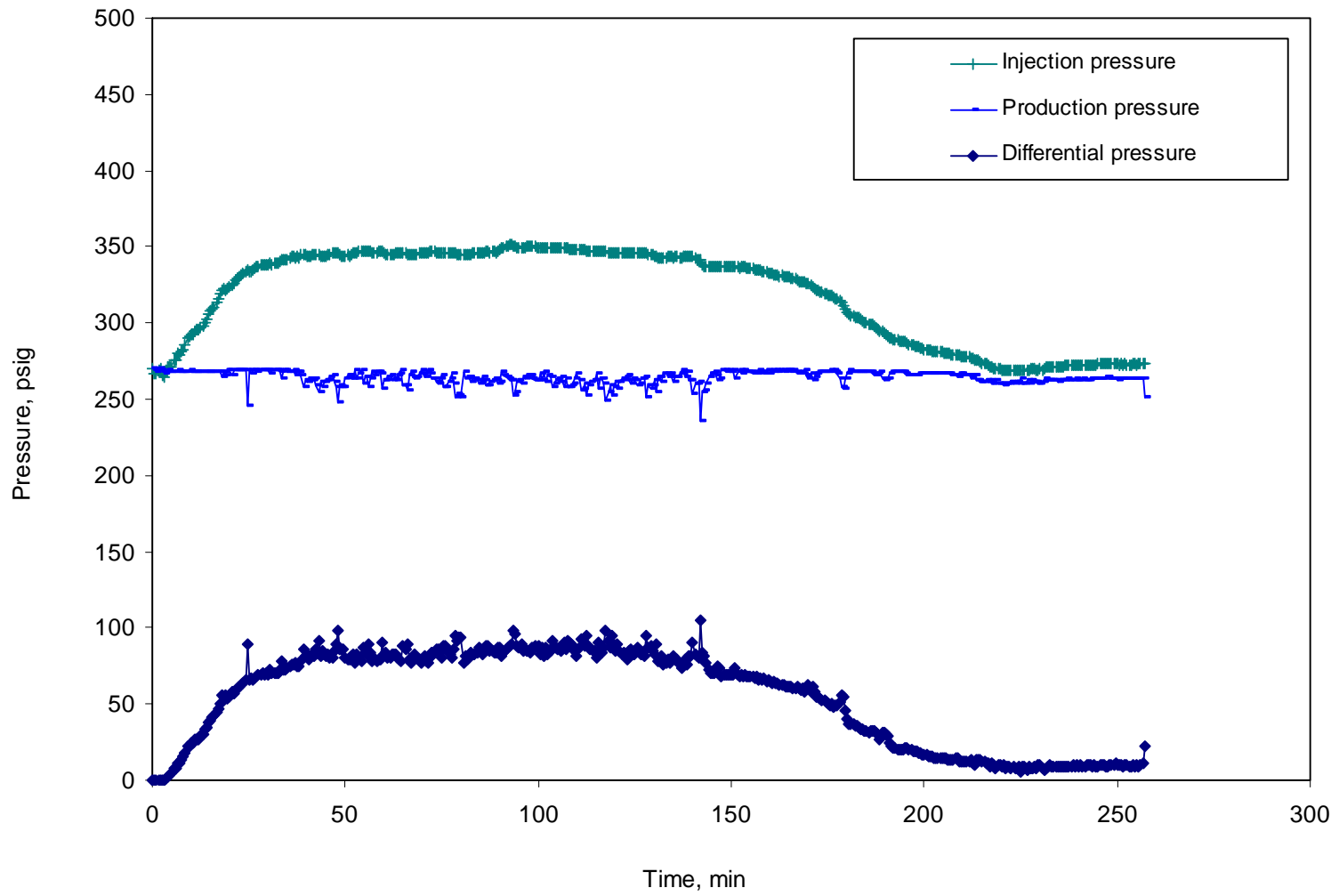


Fig. 4.18- Injection, production and differential pressures for Run 4 (pure steam).

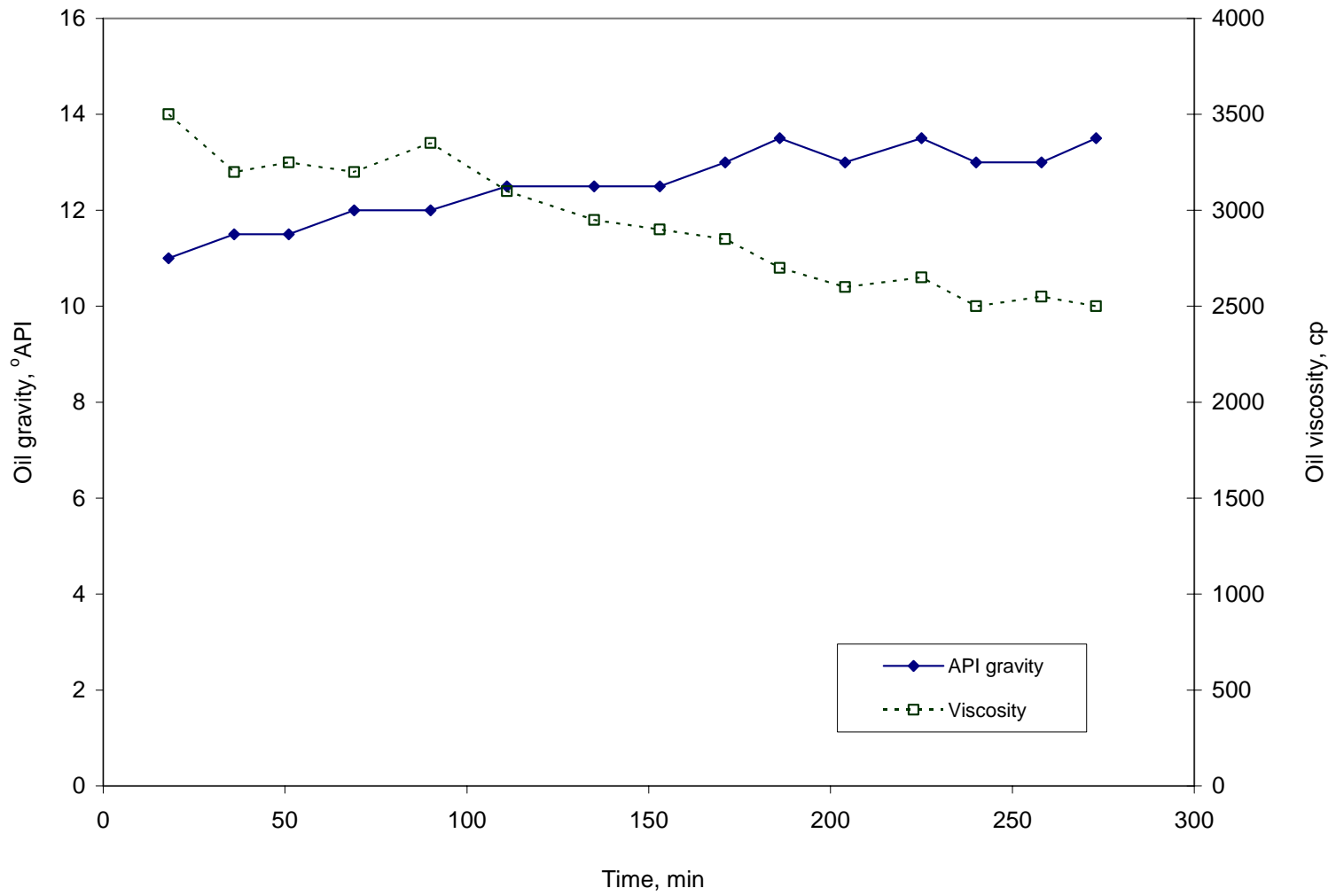


Fig. 4.19- Oil viscosity and API gravity for Run 4 (pure steam).

4.4 Run 5 (Pure Steam)

The temperature profile as a function of time is presented in **Fig. 4.20**. A constant injection temperature is observed throughout most of the run. Some fluctuation occurs at the beginning of the run, but after 15 minutes, it stabilizes at 220°C.

The cumulative oil and water volumes and pore volume injected versus time are depicted in **Figs. 4.21** and **4.22**. A recovery of 40.53% of OOIP is achieved by the end of the run. **Figs. 4.23** and **4.24** show the oil and water rates as a function of time and pore volume injected. In this run, most of the oil is produced at 177 and 277 minutes and the oil rate peak is around 15 cm³/min.

Fig 4.25 shows temperature profiles at 20-minute intervals. It can be noted that at 188 minutes, the temperature in the whole cell is stabilized around 210 °C. The injection and production pressure along with the differential pressure are shown in **Fig. 4.26**. The differential pressure peak is around 105 psig at 70 minutes and decreases when the oil start to be produced at 60 minutes or 0.25 pore volume steam injected (CWE) and stabilizes until 140 minutes and decreases rapidly the end of the run.

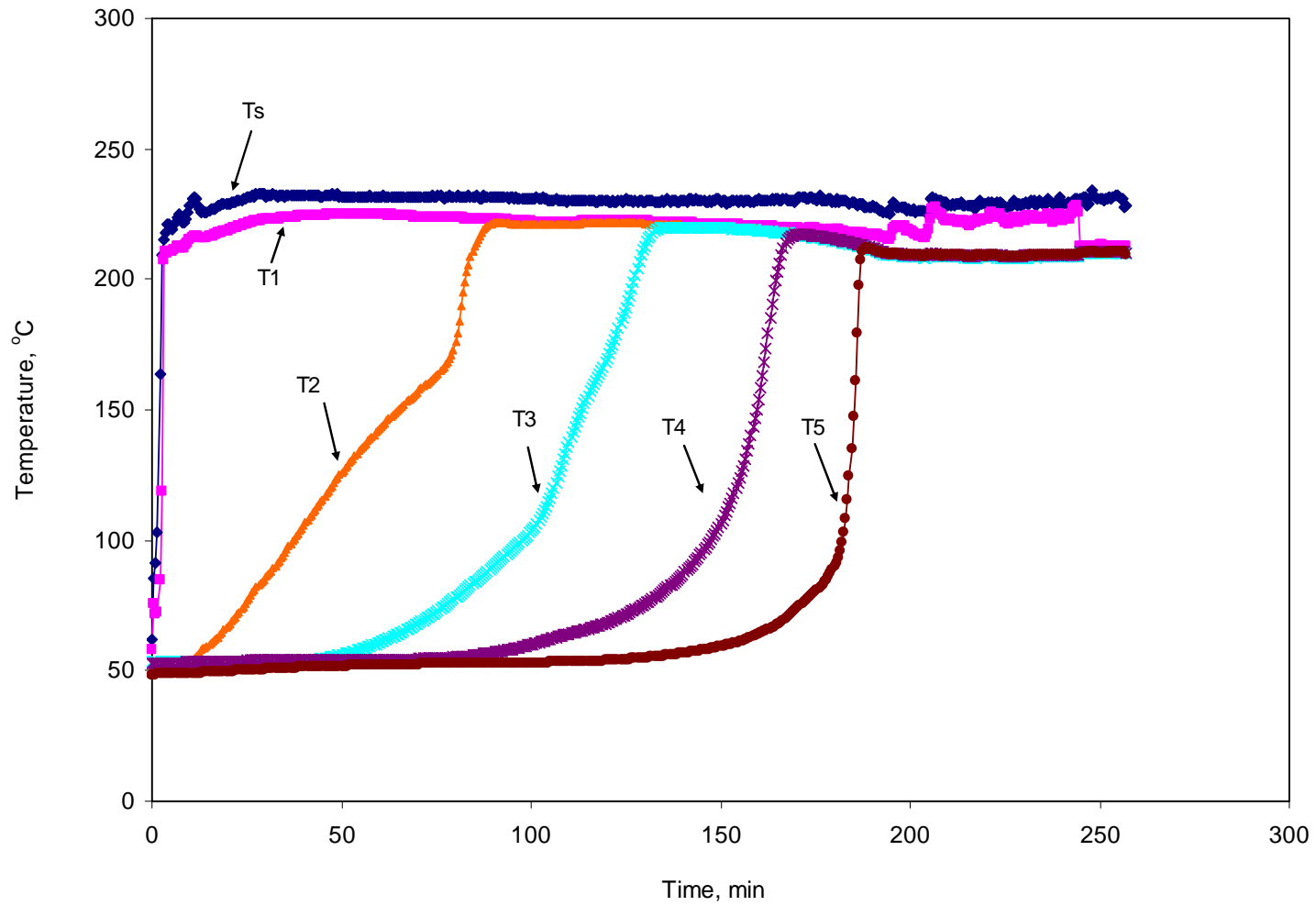


Fig. 4.20- Temperature profile versus time for Run 5 (pure steam).

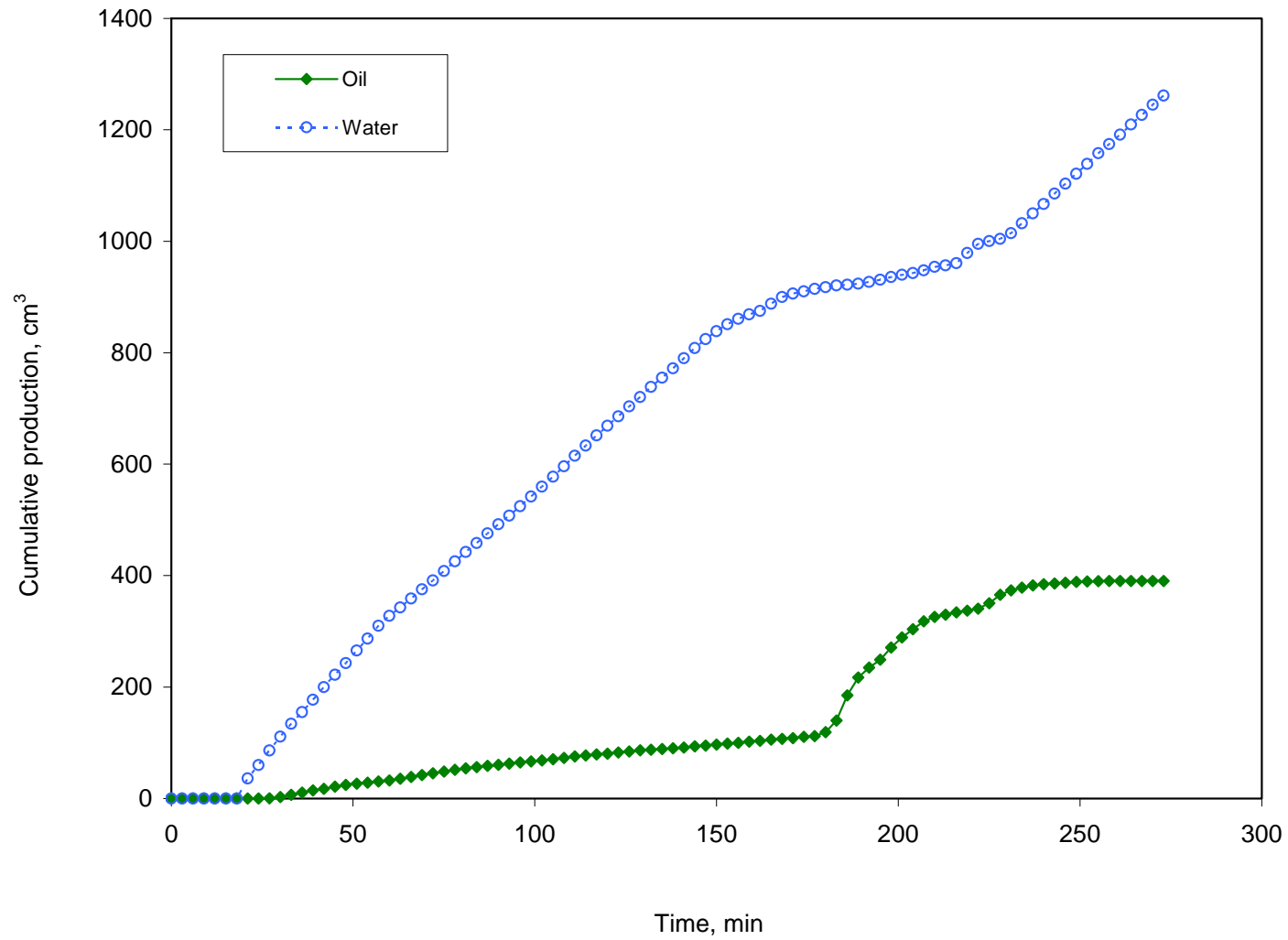


Fig. 4.21- Cumulative oil and water volumes versus time for Run 5 (pure steam).

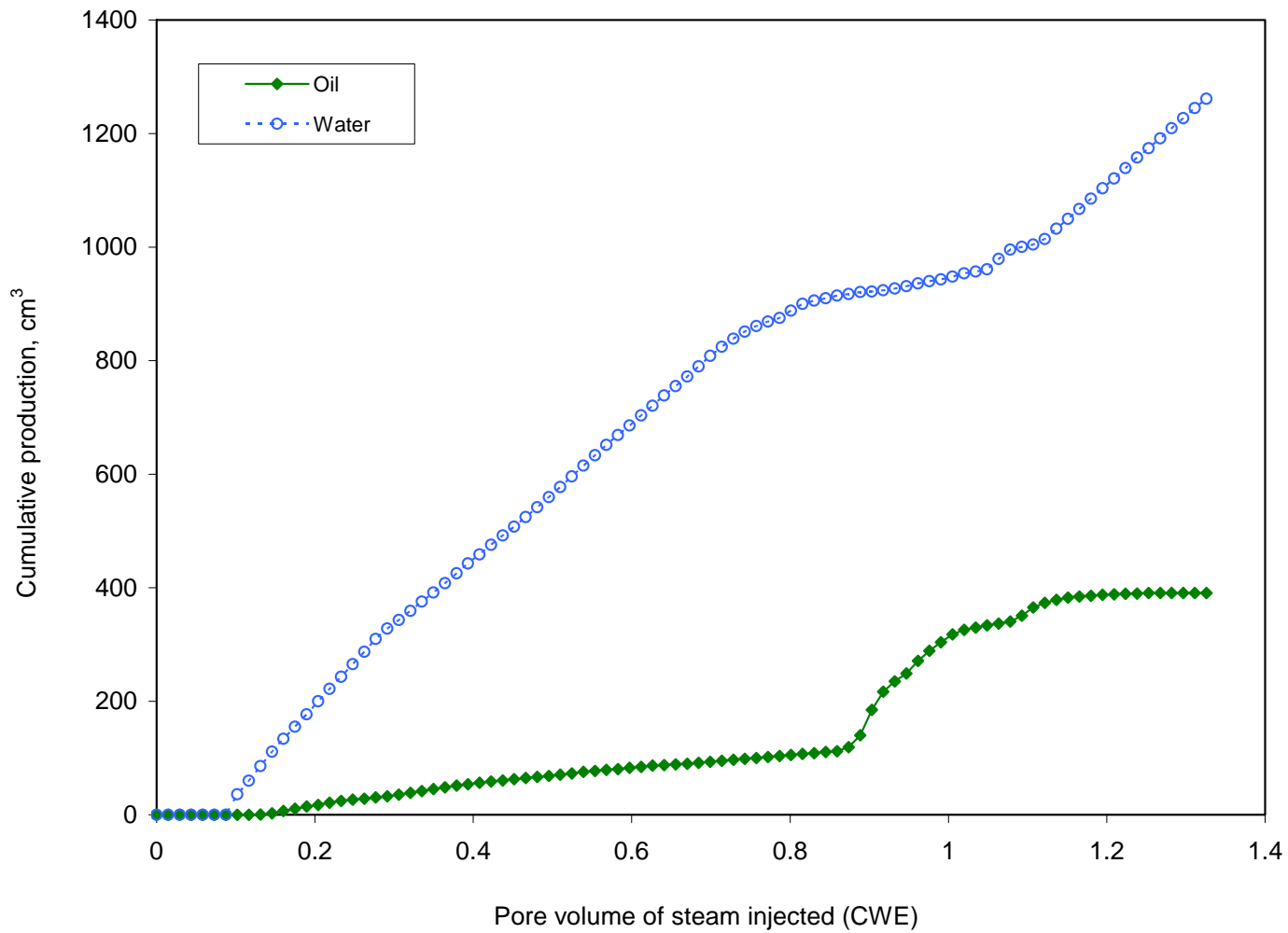


Fig. 4.22- Cumulative oil and water volumes versus pore volume of steam injected for Run 5 (pure steam).

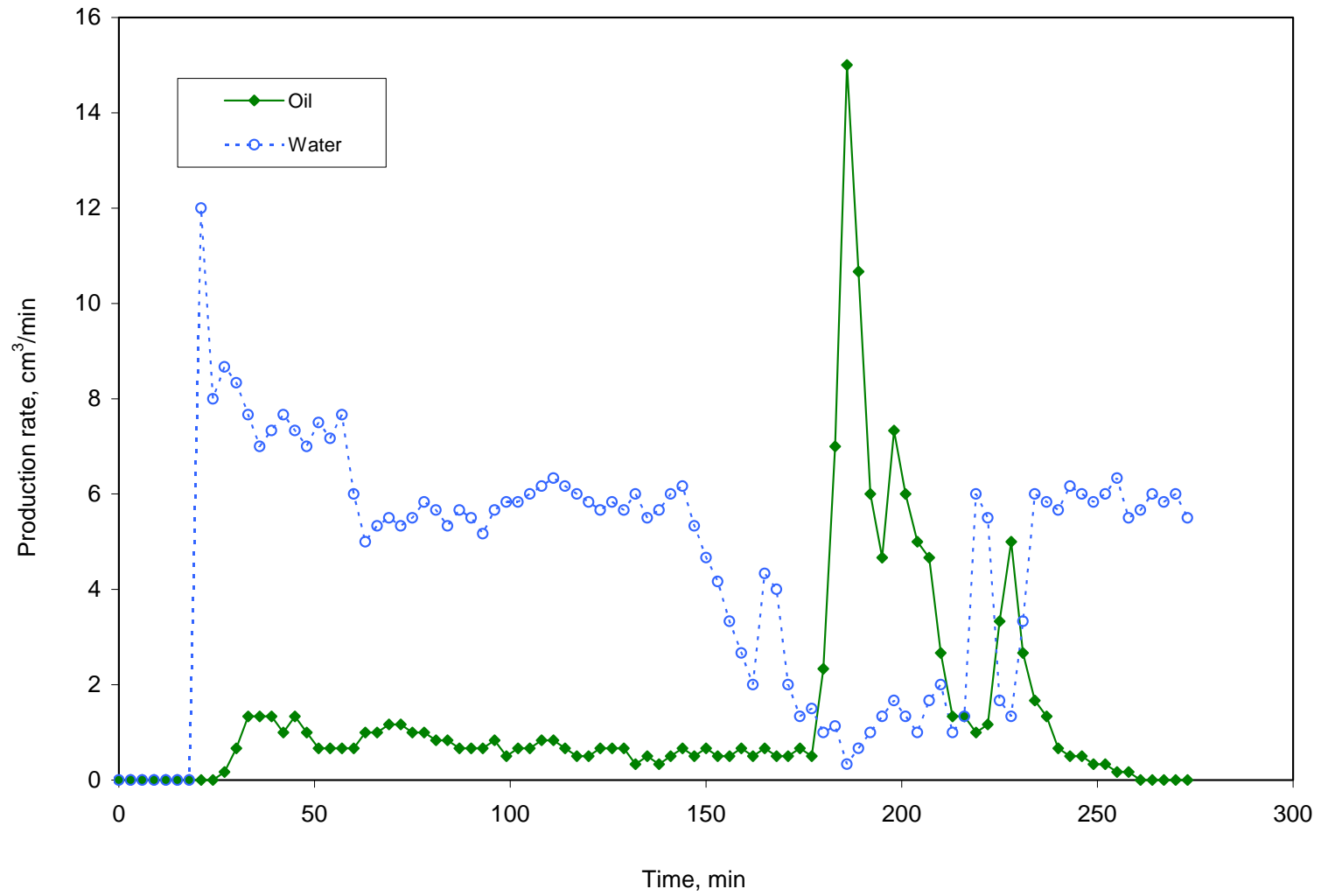


Fig. 4.23- Oil and water rates versus time for Run 5 (pure steam).

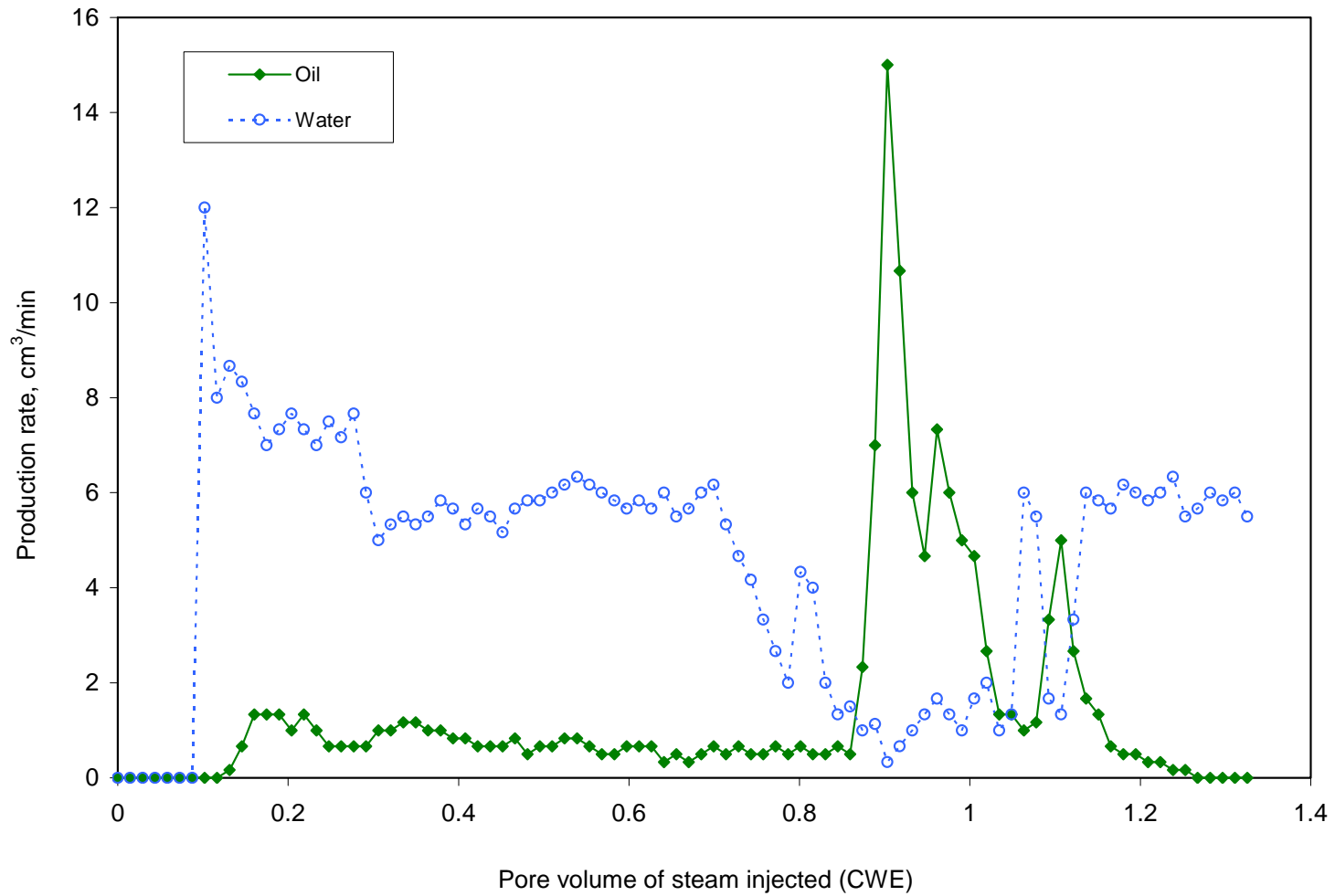


Fig. 4.24- Oil and water rates versus pore volume of steam injected for Run 5 (pure steam).

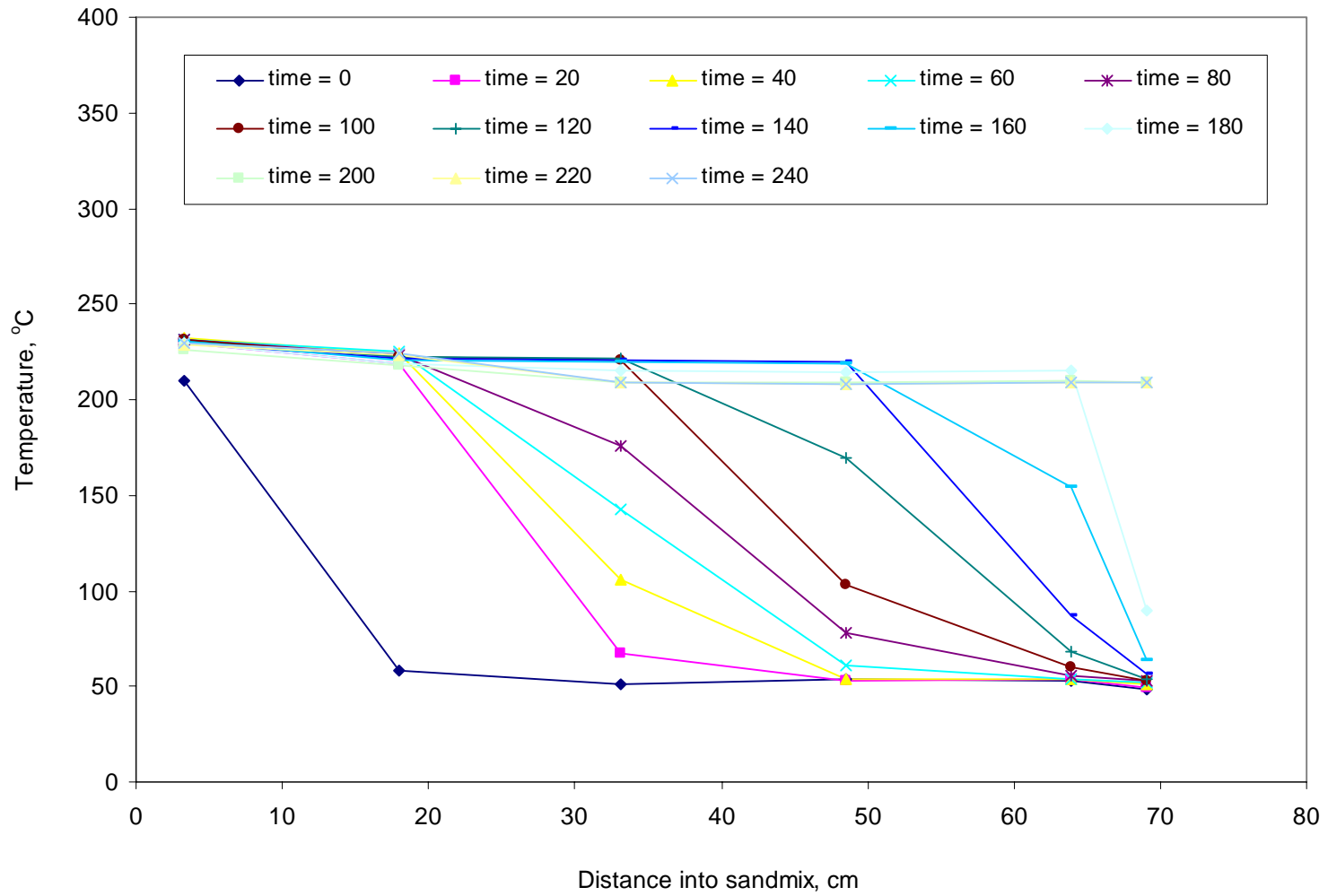


Fig. 4.25-Temperature profiles at 20-minute intervals – from t = 0 to t = 240 min – for Run 5 (pure steam).

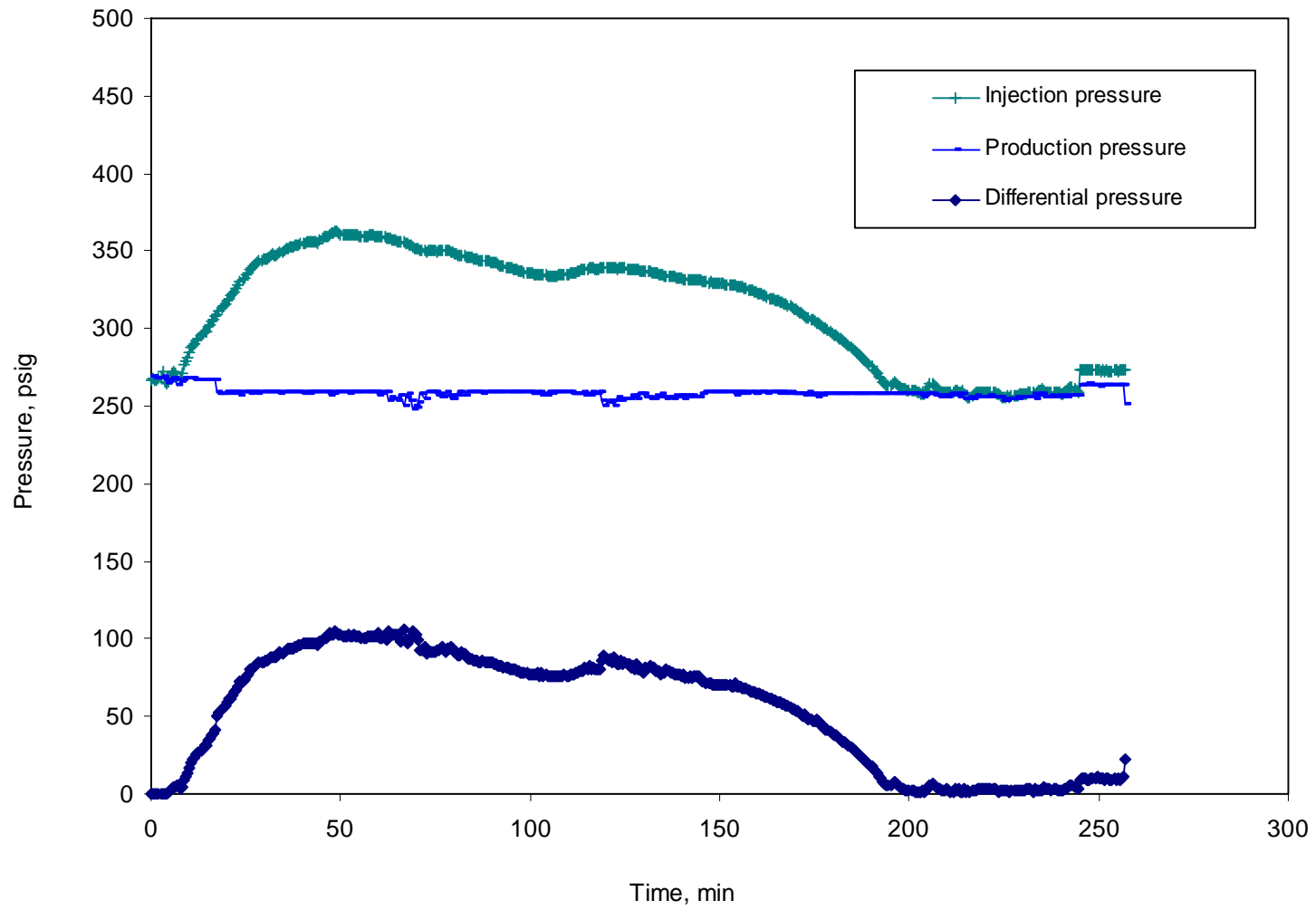


Fig. 4.26- Injection, production and differential pressures for Run 5 (pure steam).

4.5 Run 6 (5:100 Propane:Steam Mass Ratio)

This is a repeat run with the same conditions as run no. 3. The movement of the steam front can be followed in **Fig. 4.27**. The injection temperature is kept steady at 230°C throughout the run, and little fluctuation is observed.

The cumulative oil and water volumes, and pore volume injected plotted versus time are depicted in **Figs. 4.28** and **4.29**. Ultimate recovery at the end of the 216 minutes run is about 403.5 cm³, or 42% of OOIP, as can be seen in **Figs. 4.30** and **4.31** shows the oil and water production rates as a function of time. The first oil is produced after 17 minutes of injection, with a peak rate of about 15.33 cm³/min after 62 minutes.

Fig. 4.32 shows how the temperature propagation at 20 minute intervals for the different thermocouples. It takes about 100 minutes for the whole cell to reach a more or less constant temperature of 142°C.

The injection pressure, outlet pressure, and differential pressure are shown in **Fig. 4.33**. The outlet pressure is kept steady at 260 psig. As the oil bank is building up injection pressure increases, and as a result of that so does the differential pressure. From an initial differential pressure of close to zero it reaches highs of about 89 psig before oil production starts.

The compositional analysis of the gas produced after the third separator is plotted in **Fig. 4.34**. The cumulative gas volume produced after the third separator is presented in **Fig. 4.35**. **Fig. 4.36** shows the propane cumulative injection mass and propane cumulative mass production for the third separator. A total of 66 g propane is injected inside the cell and propane produced from the third separator is 4.63 g. The balance of the propane, 61.37 g, is produced at the second separator during sample collection.

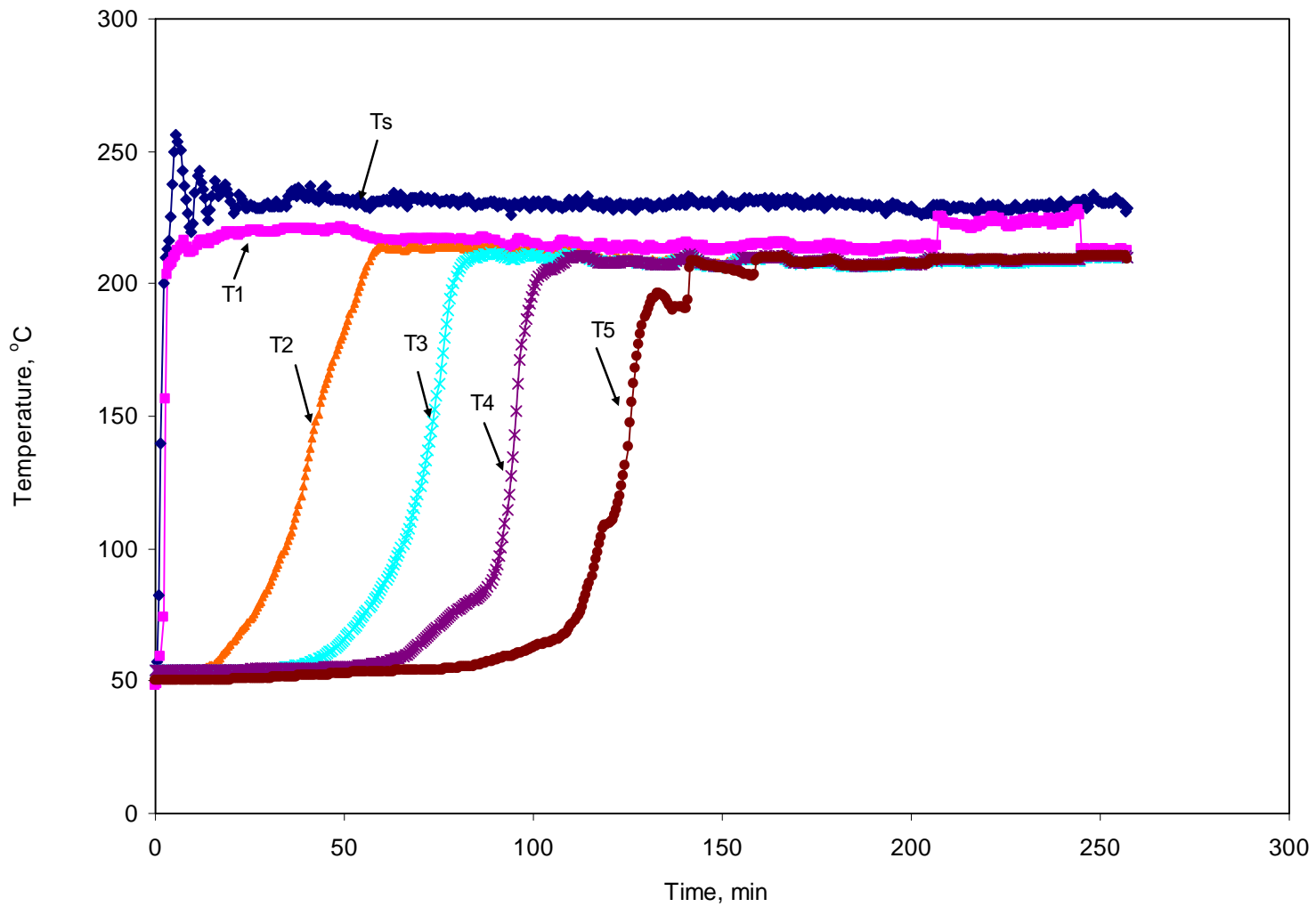


Fig. 4.27- Temperature profile versus time for Run 6 (5:100 propane:steam).

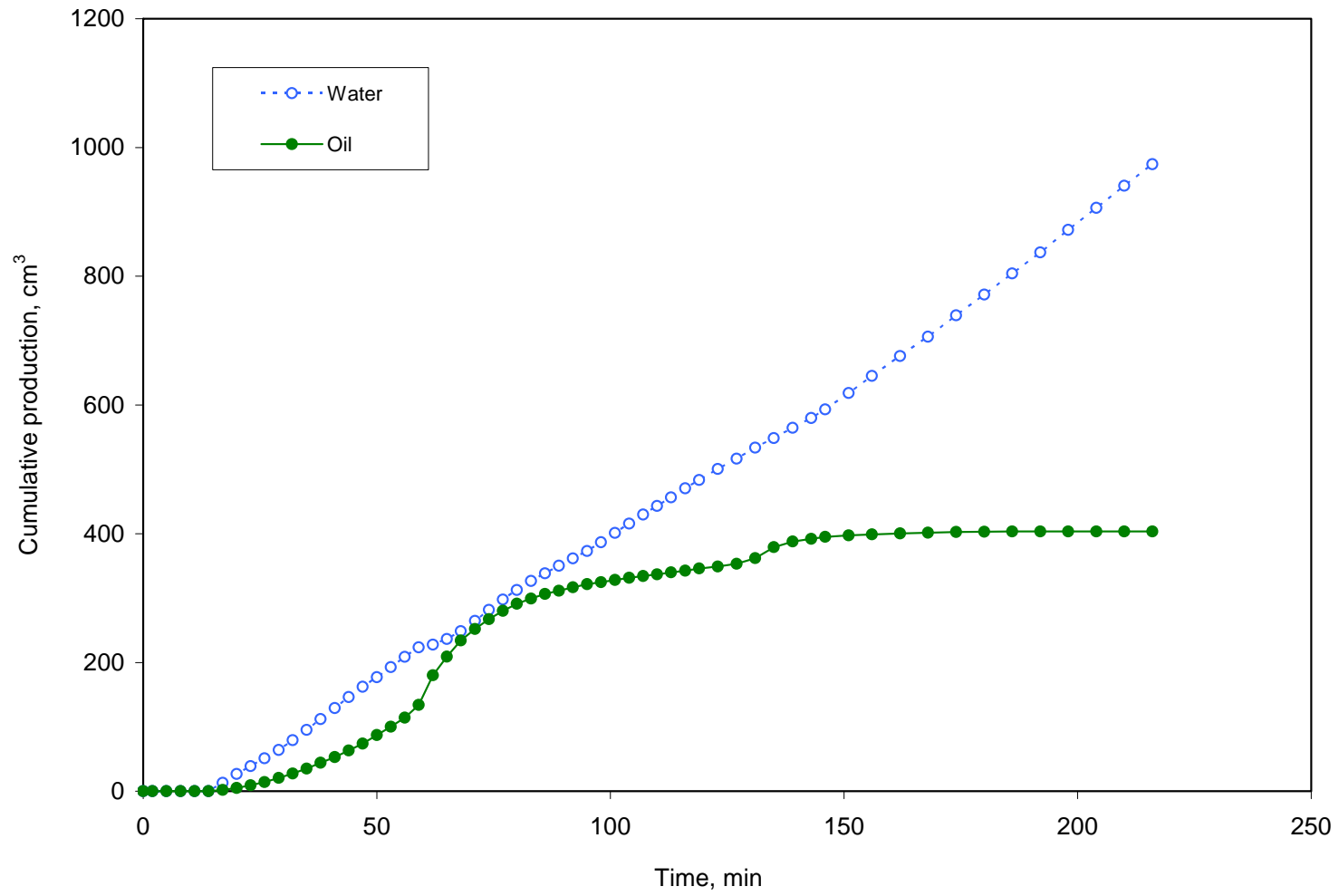


Fig. 4.28- Cumulative oil and water volumes versus time for Run 6 (5:100 propane:steam).

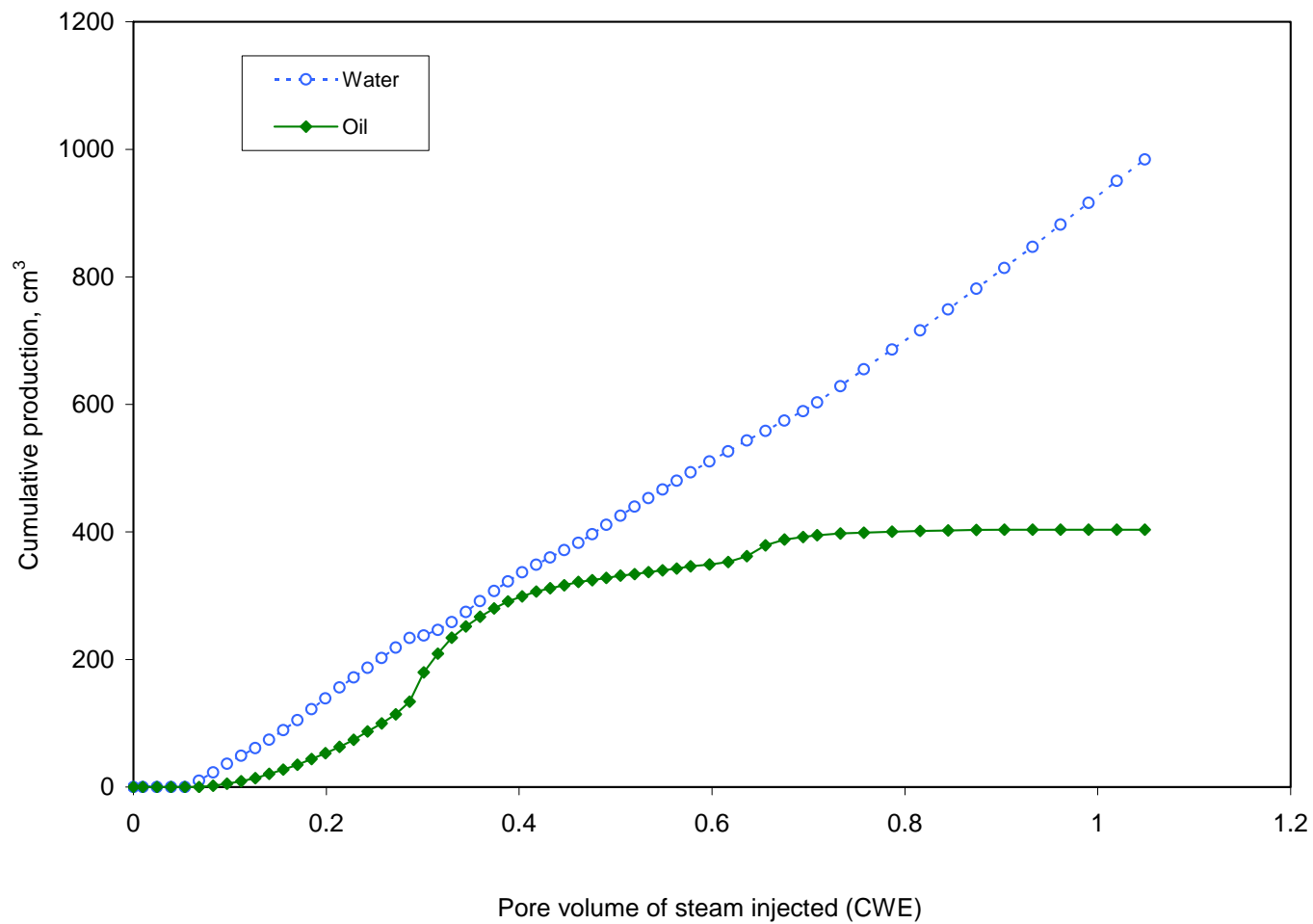


Fig. 4.29- Cumulative oil and water volumes versus pore volume of steam injected for Run 6 (5:100 propane:steam).

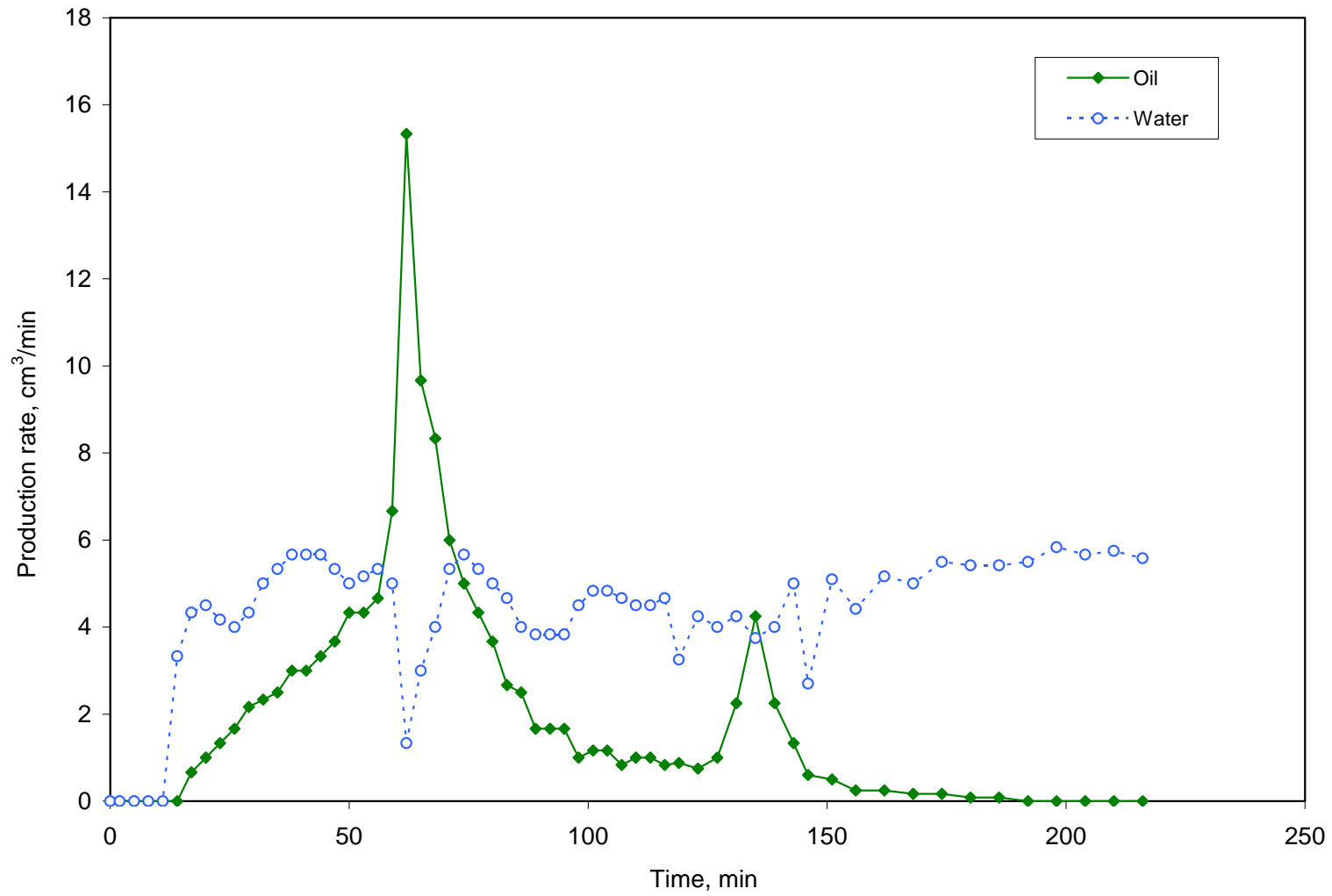


Fig. 4.30- Oil and water rates versus time for Run 6 (5:100 propane:steam).

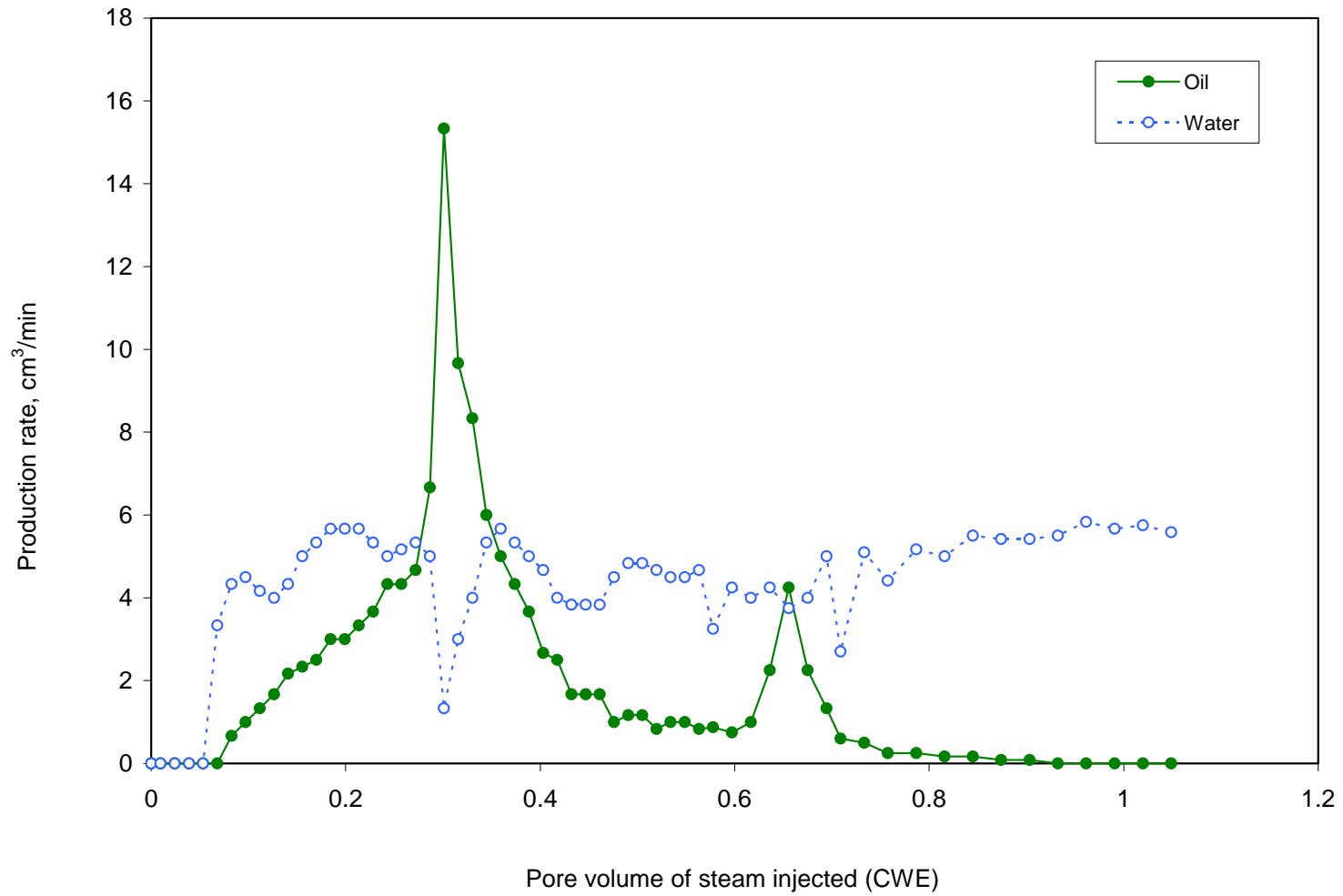


Fig. 4.31- Oil and water rates versus pore volume of steam injected for Run 6 (5:100 propane:steam).

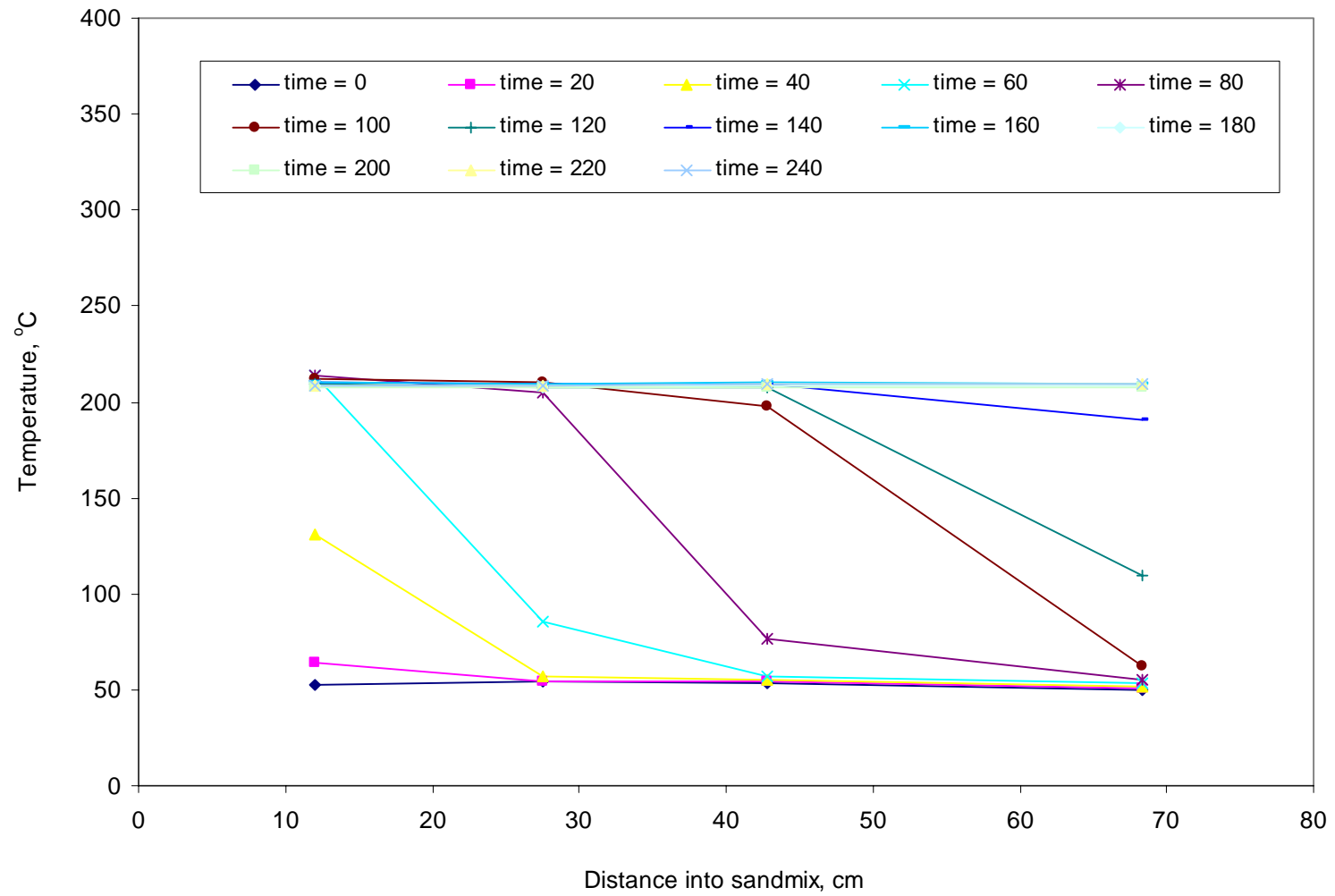


Fig. 4.32- Temperature profiles at 10-minute intervals – from t = 0 to t = 240 min – for Run 6 (5:100 propane:steam).

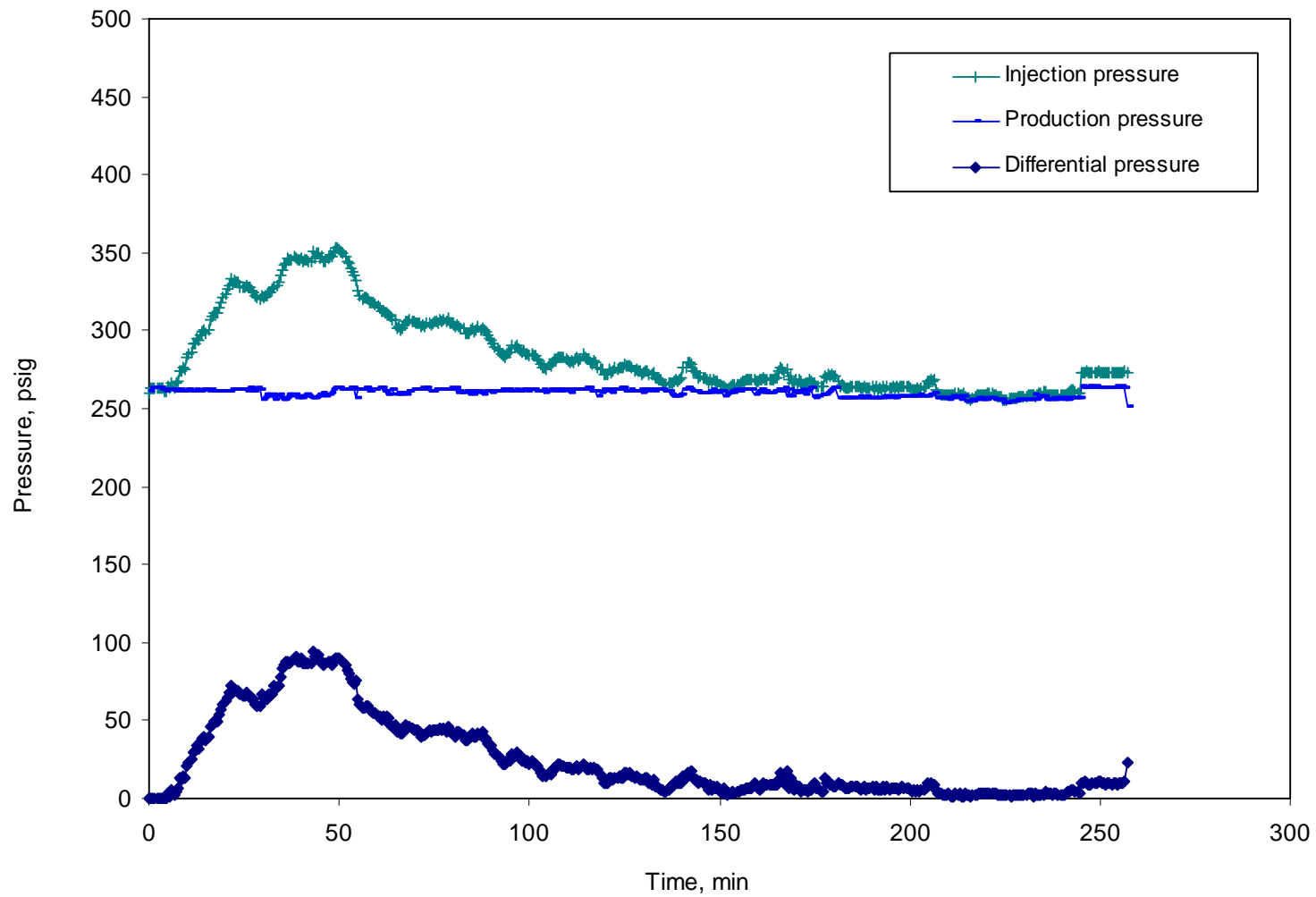


Fig. 4.33- Injection, production and differential pressures for Run 6 (5:100 propane:steam).

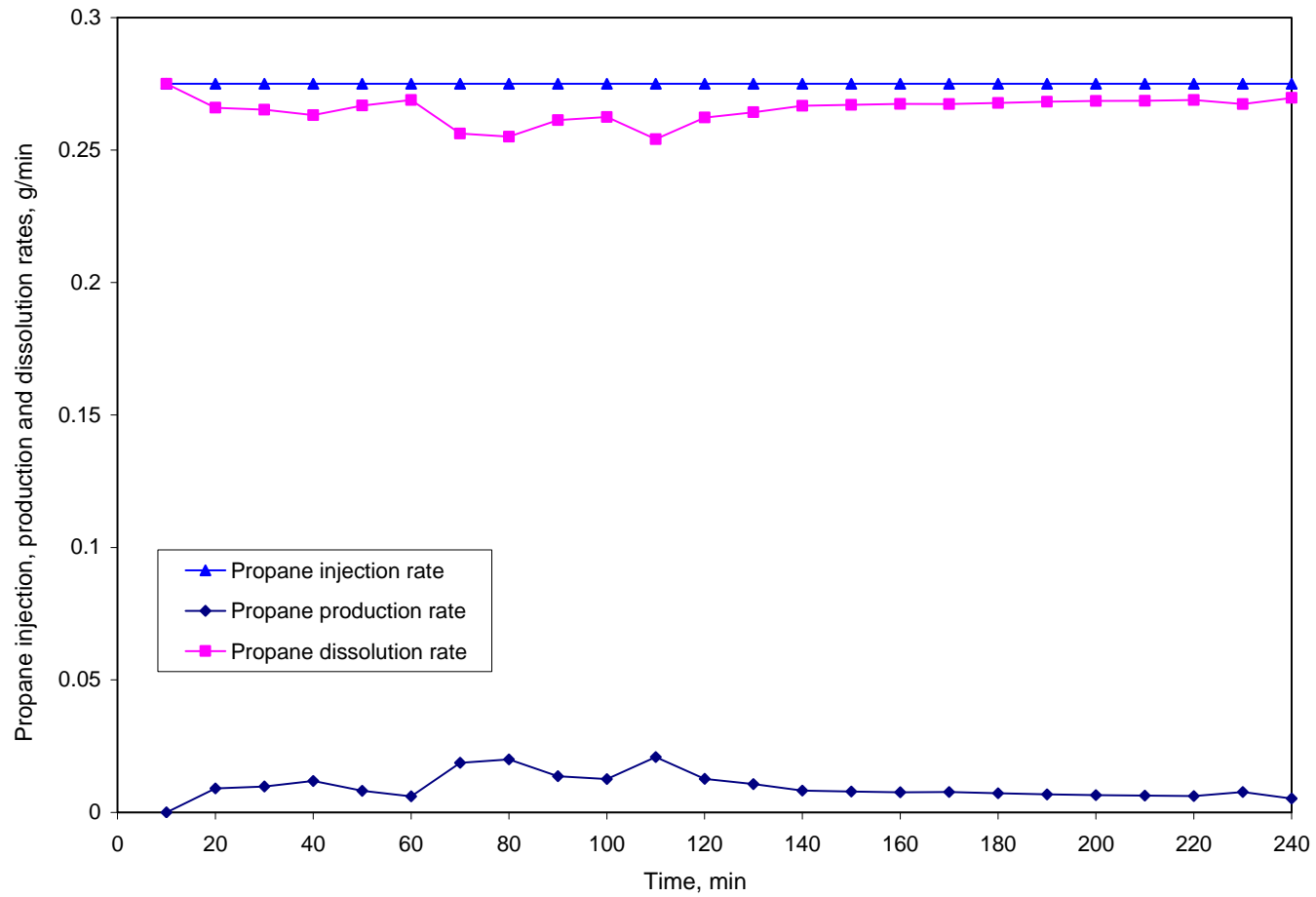


Fig. 4.34- Propane injection, production, and dissolution rates after the third separator for Run 6 (5:100 propane:steam).

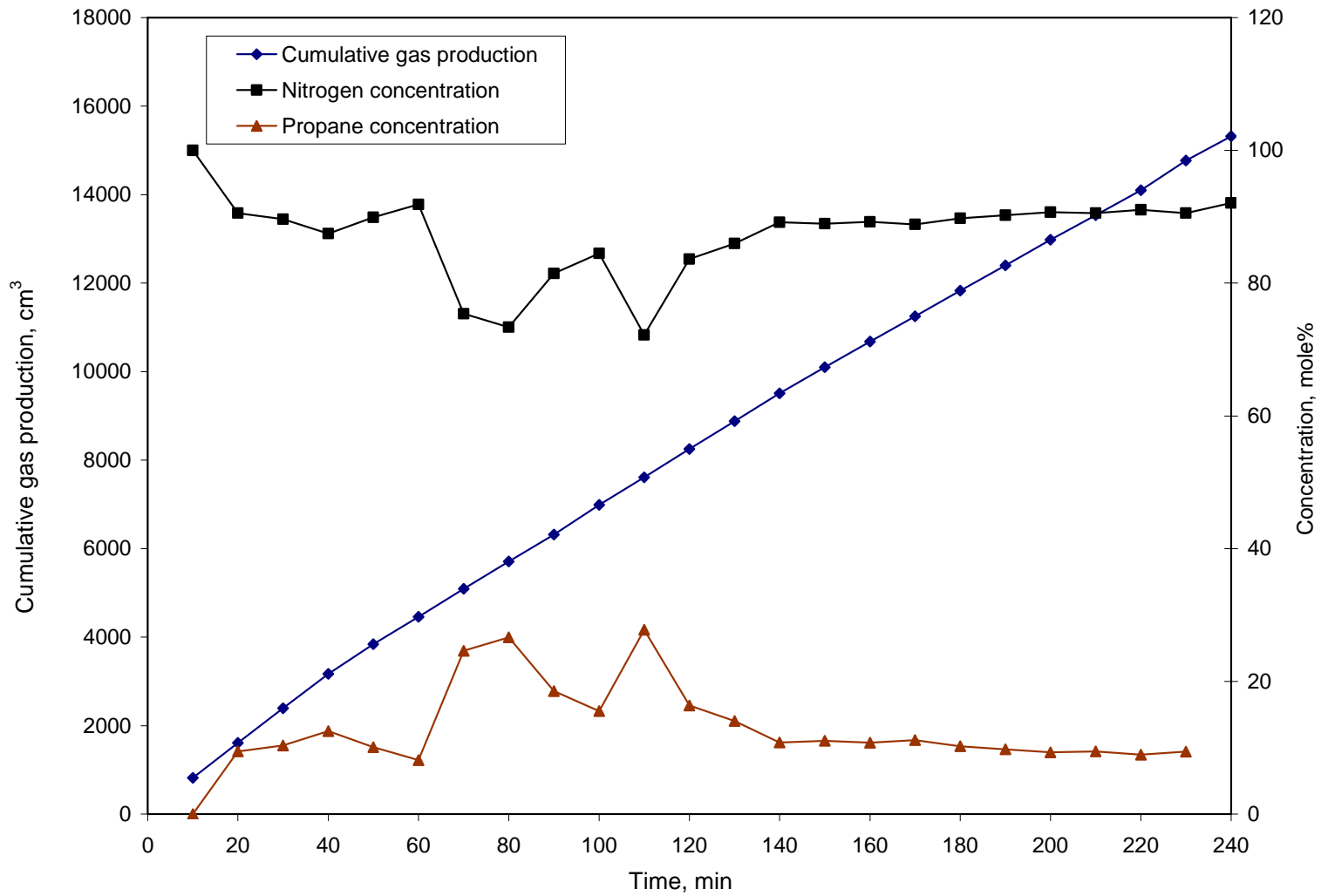


Fig. 4.35- Cumulative gas production and composition after the third separator for Run 6 (5:100 propane:steam).

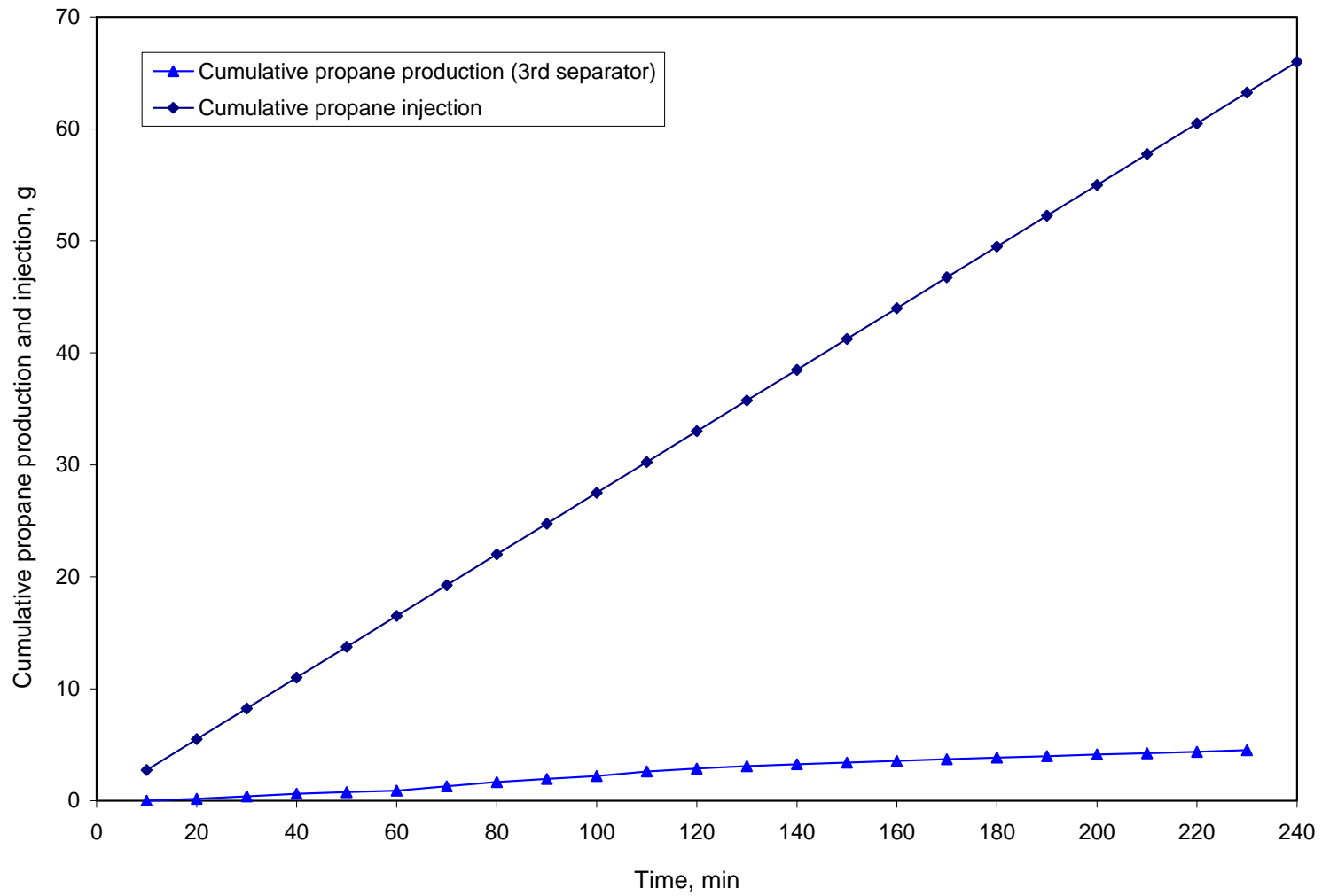


Fig. 4.36- Cumulative propane injection and production for Run 6 (5:100 propane:steam).

4.6 Run 7 (5:100 Petroleum Distillate:Steam Mass Ratio)

Fig. 4.37 shows the temperature profile within the cell. **Figs. 4.38** and **4.39** show the cumulative volumes of oil and water vs. time and pore volume of steam injected respectively. At the end of the run, the oil recovery is 441.5 cm^3 (45.8% of OOIP).

The oil and water rates are plotted both as a function of time and pore volume of steam injected (**Figs. 4.40** and **4.41**). Oil production rate peak is around $15 \text{ cm}^3/\text{min}$ and most of the oil is produced from 15 to 123 minutes. **Fig. 4.42** shows the temperature profiles inside the cell at 20-minute intervals. It can be observed that by 124 minutes the temperature of the whole cell reaches a value around 210°C .

The injection, production pressures and the differential pressure are depicted in **Fig. 4.44**. The injection pressure started increasing at the beginning of the run to eventually decrease at around 126 minutes. The maximum differential pressure reached in this run was around 70 psig.

The oil viscosity and API gravity of the produced oil are shown in **Fig. 4.45**. The API gravity shows an increasing trend. The oil viscosity shows a decreasing trend as time increases.

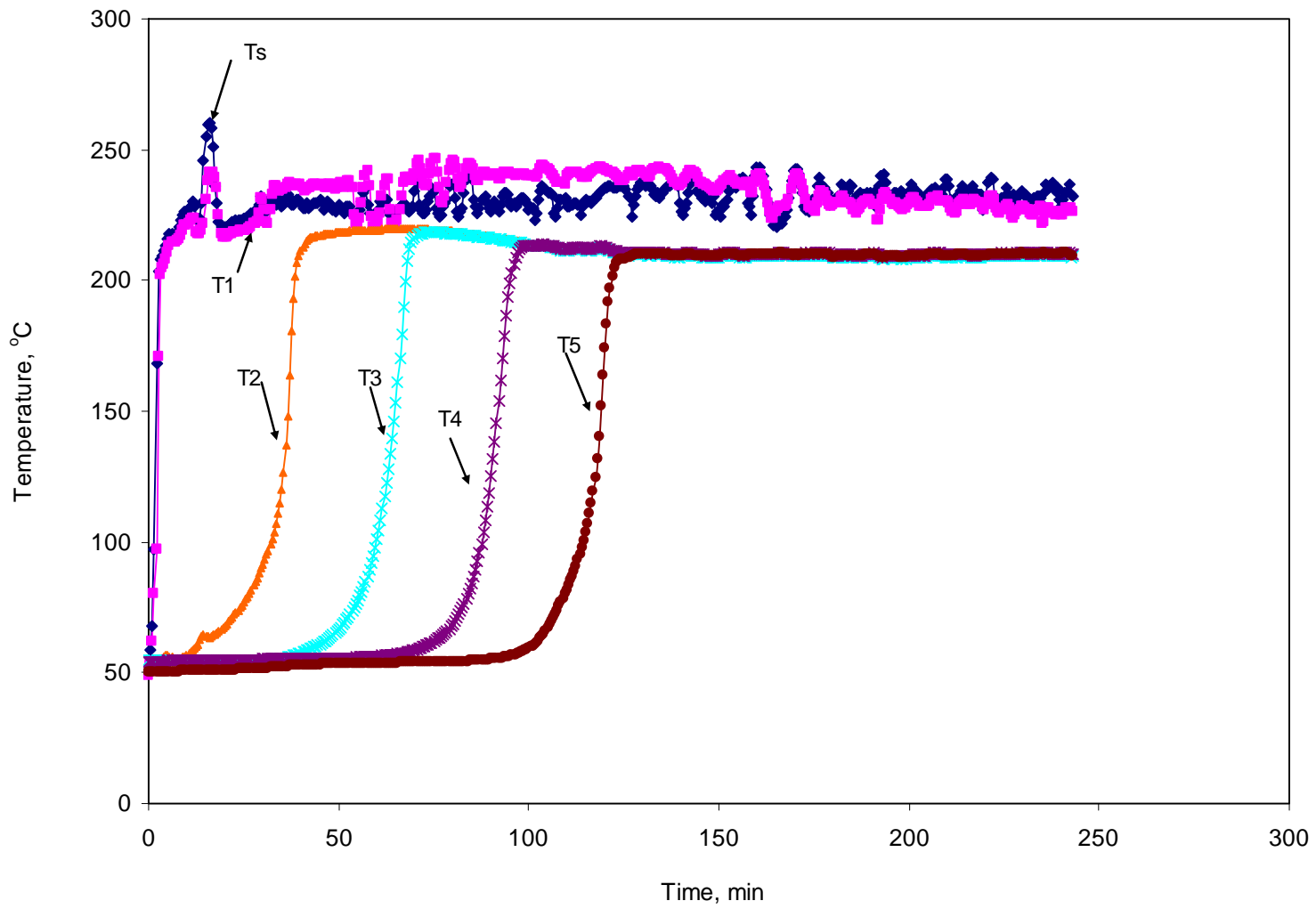


Fig. 4.37- Temperature profile versus time for Run 7 (5:100 petroleum distillate:steam).

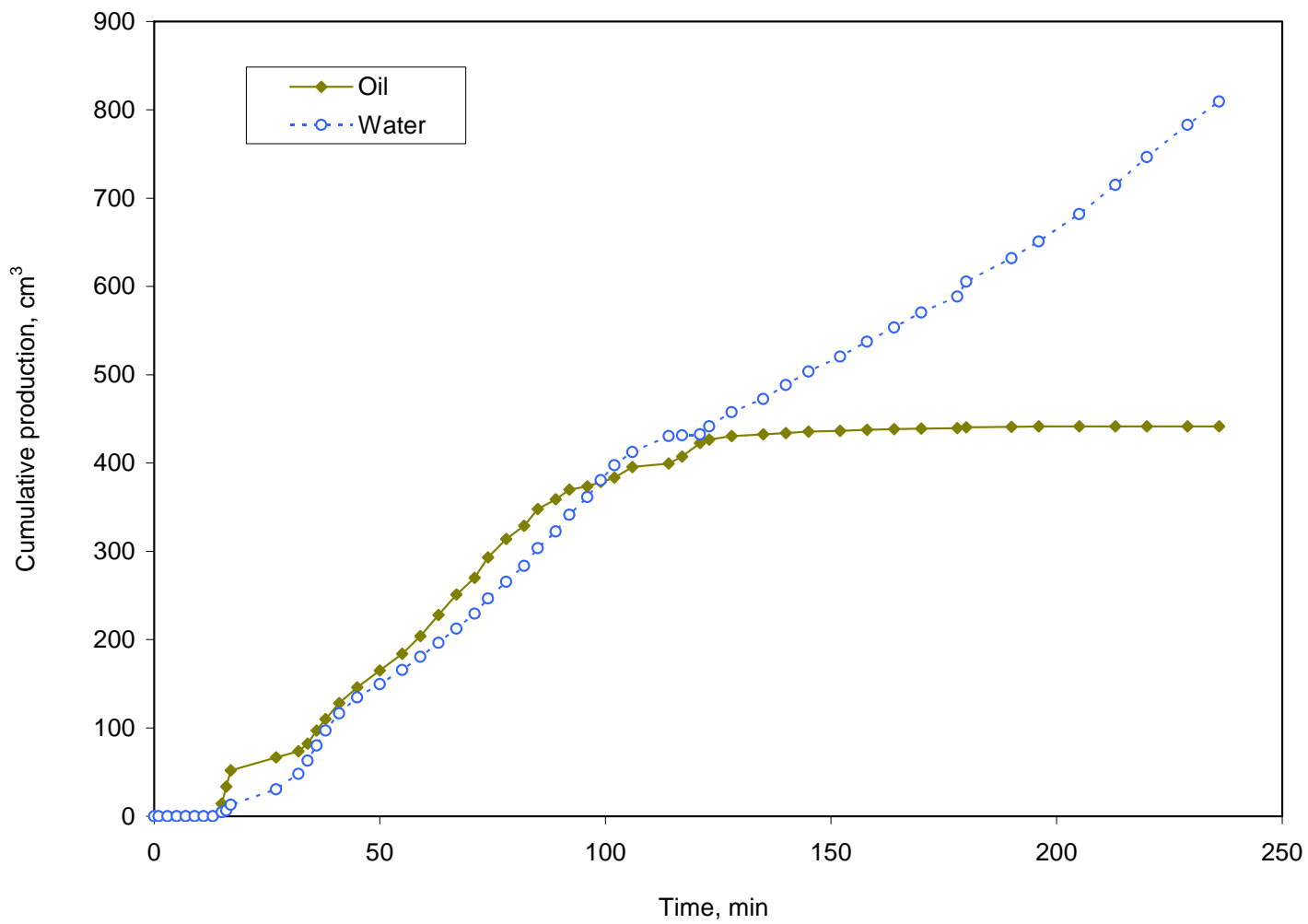


Fig. 4.38- Cumulative oil and water volumes versus time for Run 7 (5:100 petroleum distillate:steam).

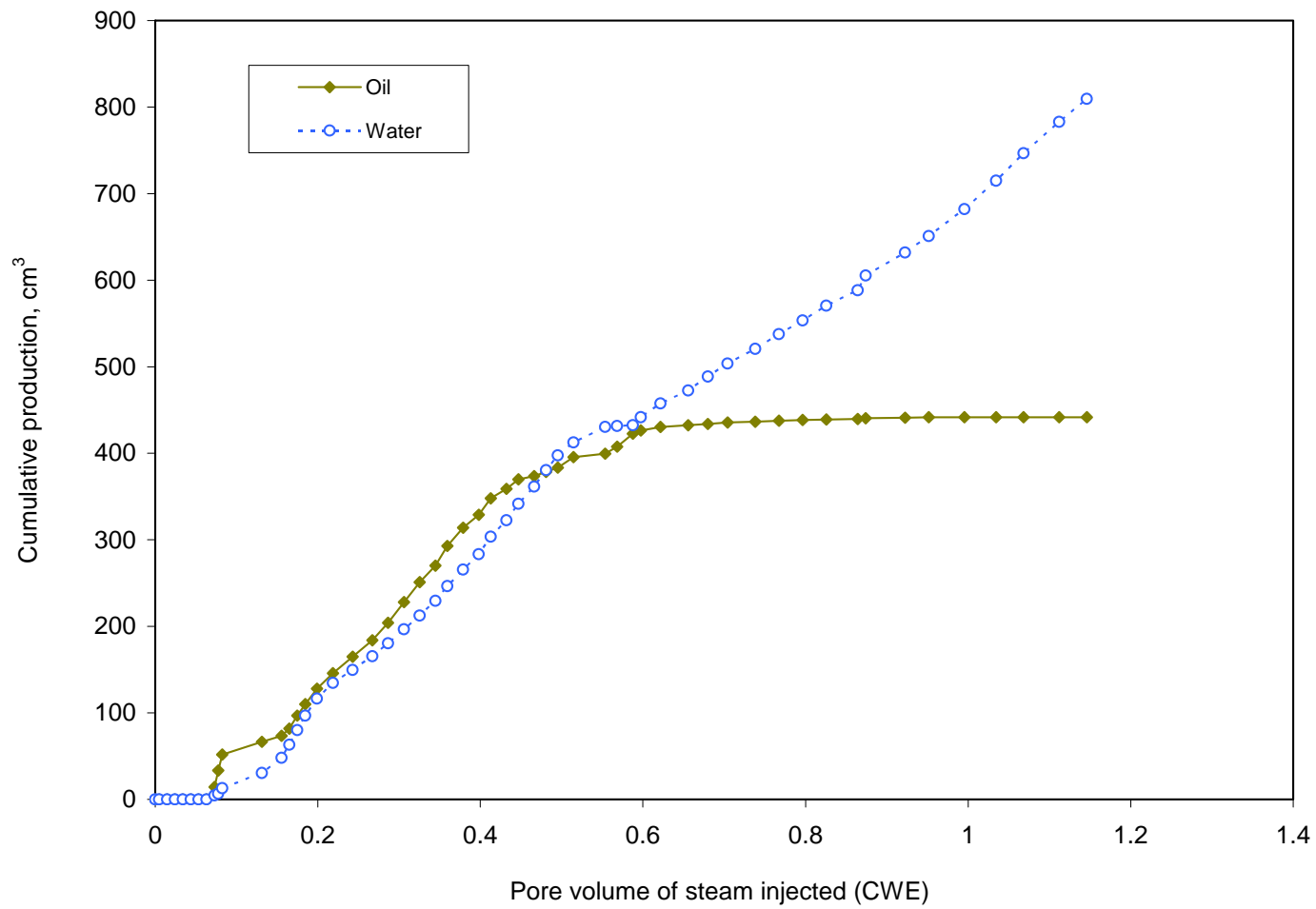


Fig. 4.39- Cumulative oil and water volumes versus pore volume of steam injected for Run 7 (5:100 petroleum distillate:steam).

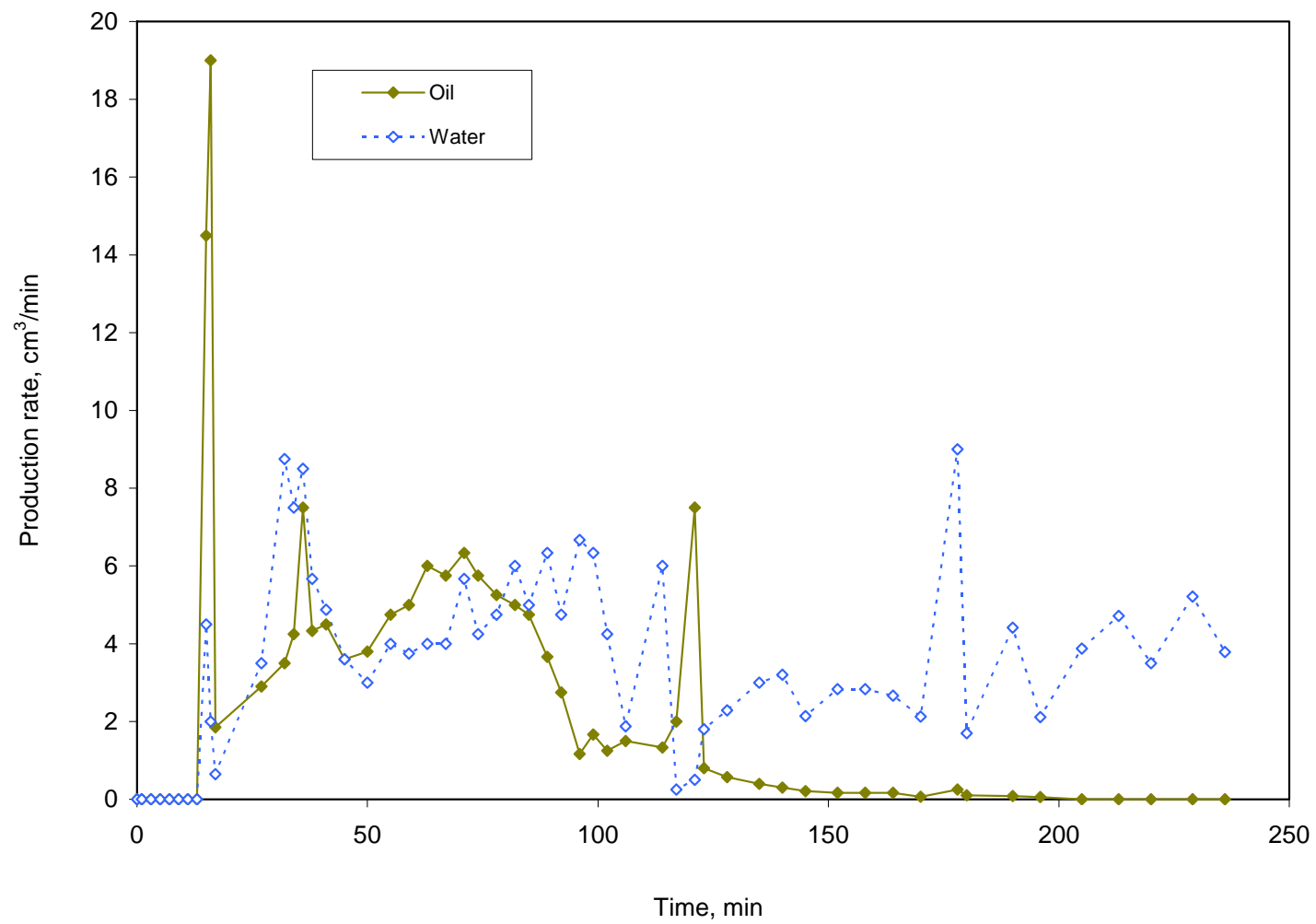


Fig. 4.40- Oil and water rates versus time for Run 7 (5:100 petroleum distillate:steam).

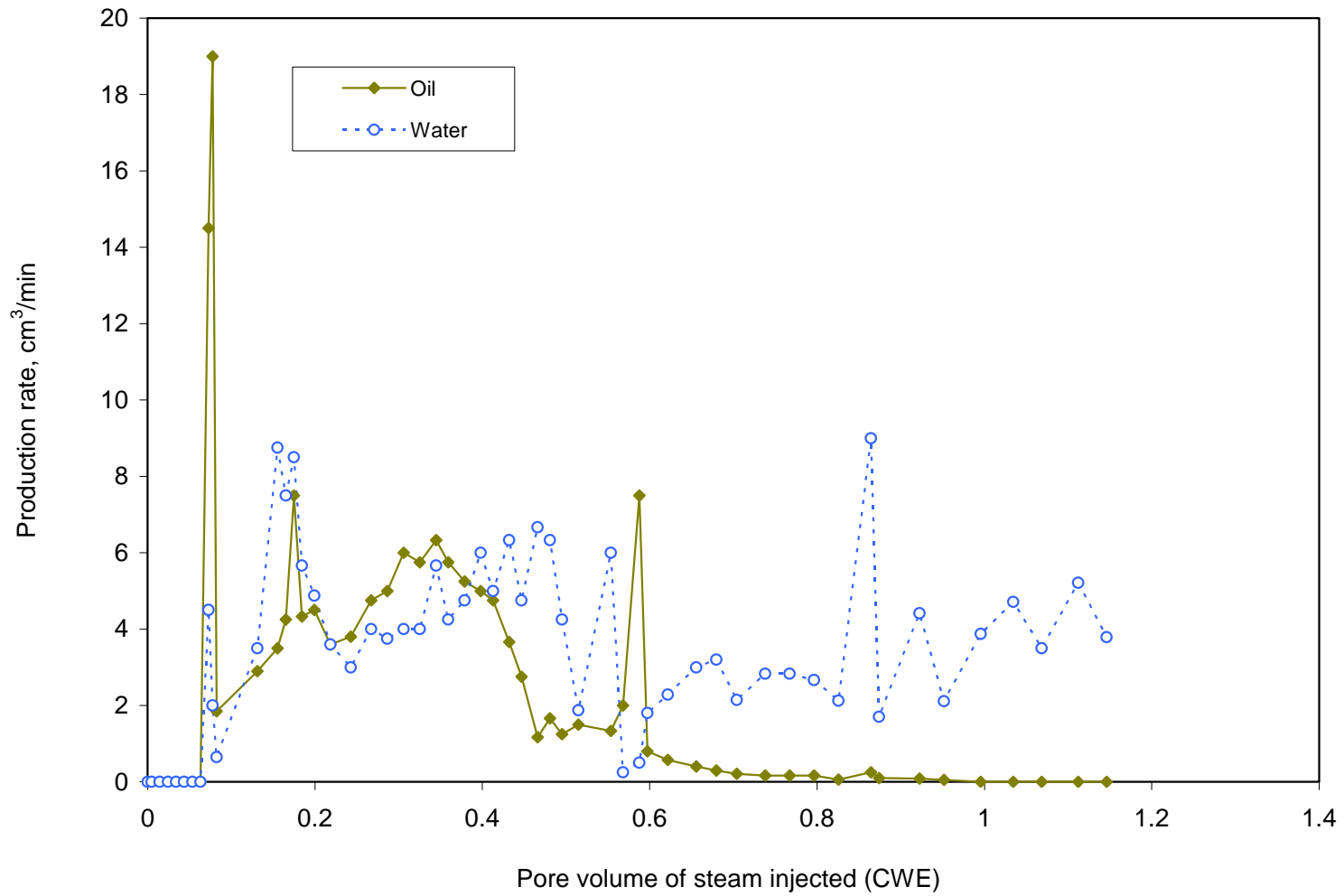


Fig. 4.41- Oil and water rates versus pore volume of steam injected for Run 7 (5:100 petroleum distillate:steam).

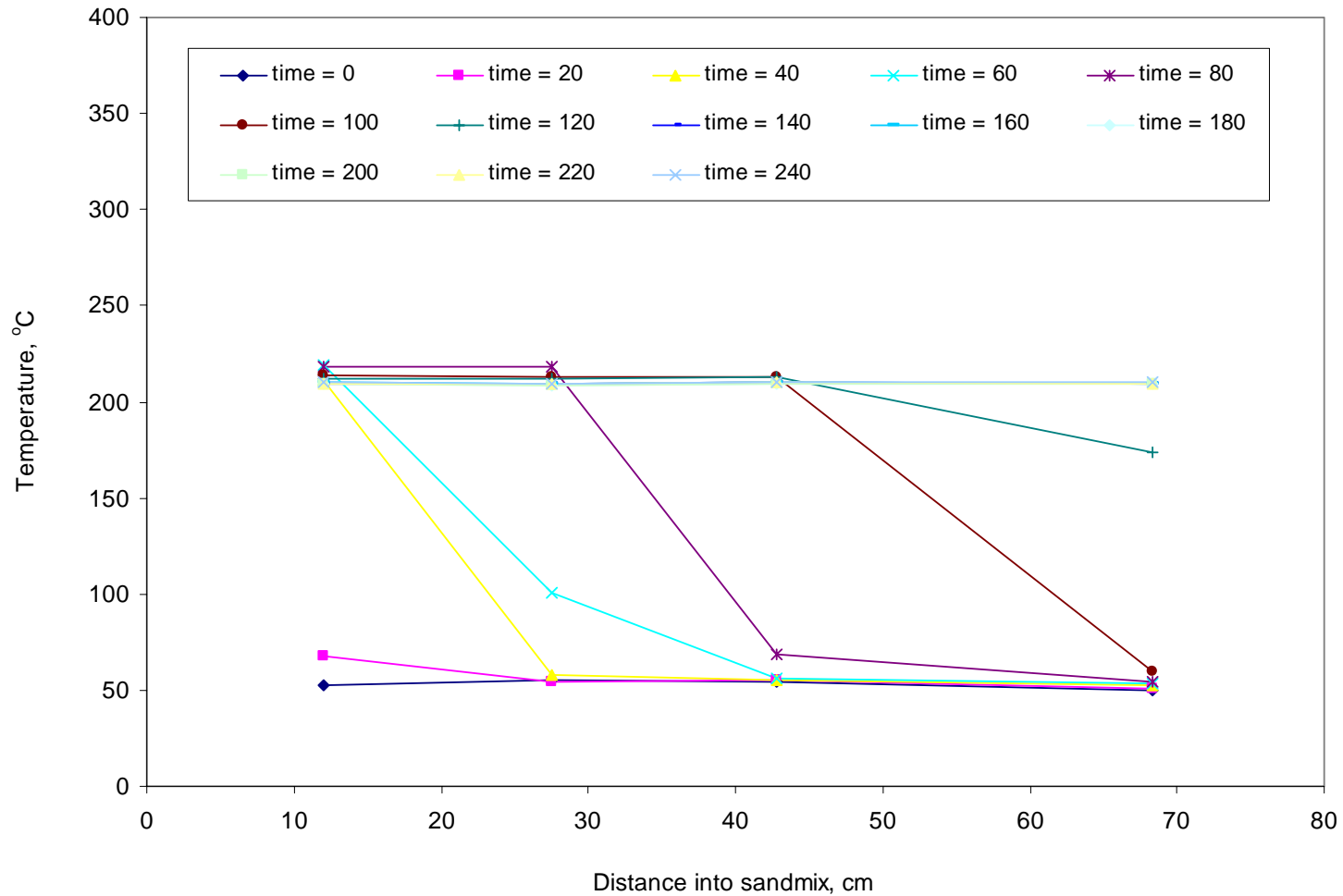


Fig. 4.42- Temperature profiles at 20-minute intervals – from t = 0 to t = 240 min – for Run 7 (5:100 petroleum distillate:steam).

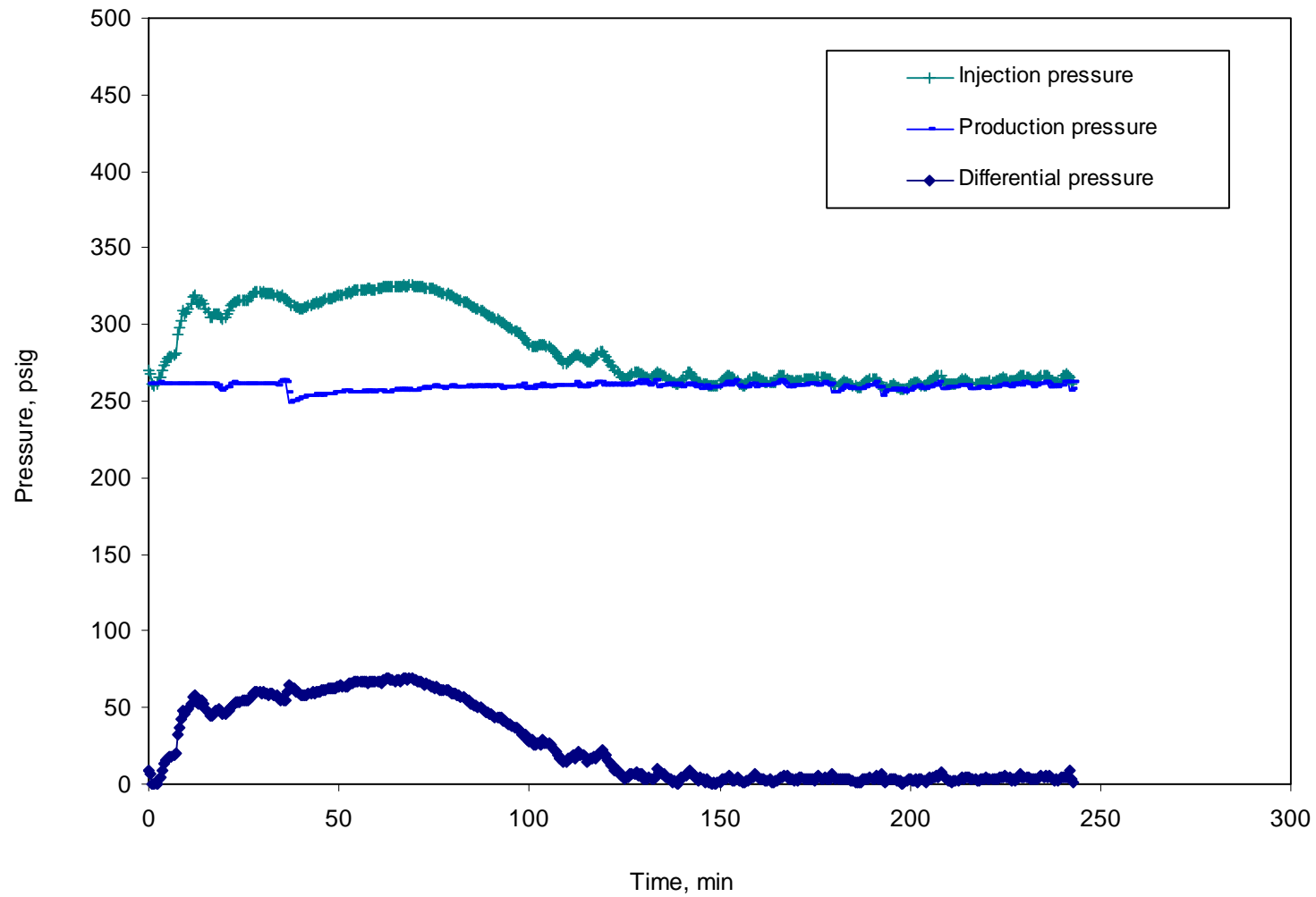


Fig. 4.43- Injection, production and differential pressures for Run 7 (5:100 petroleum distillate:steam).

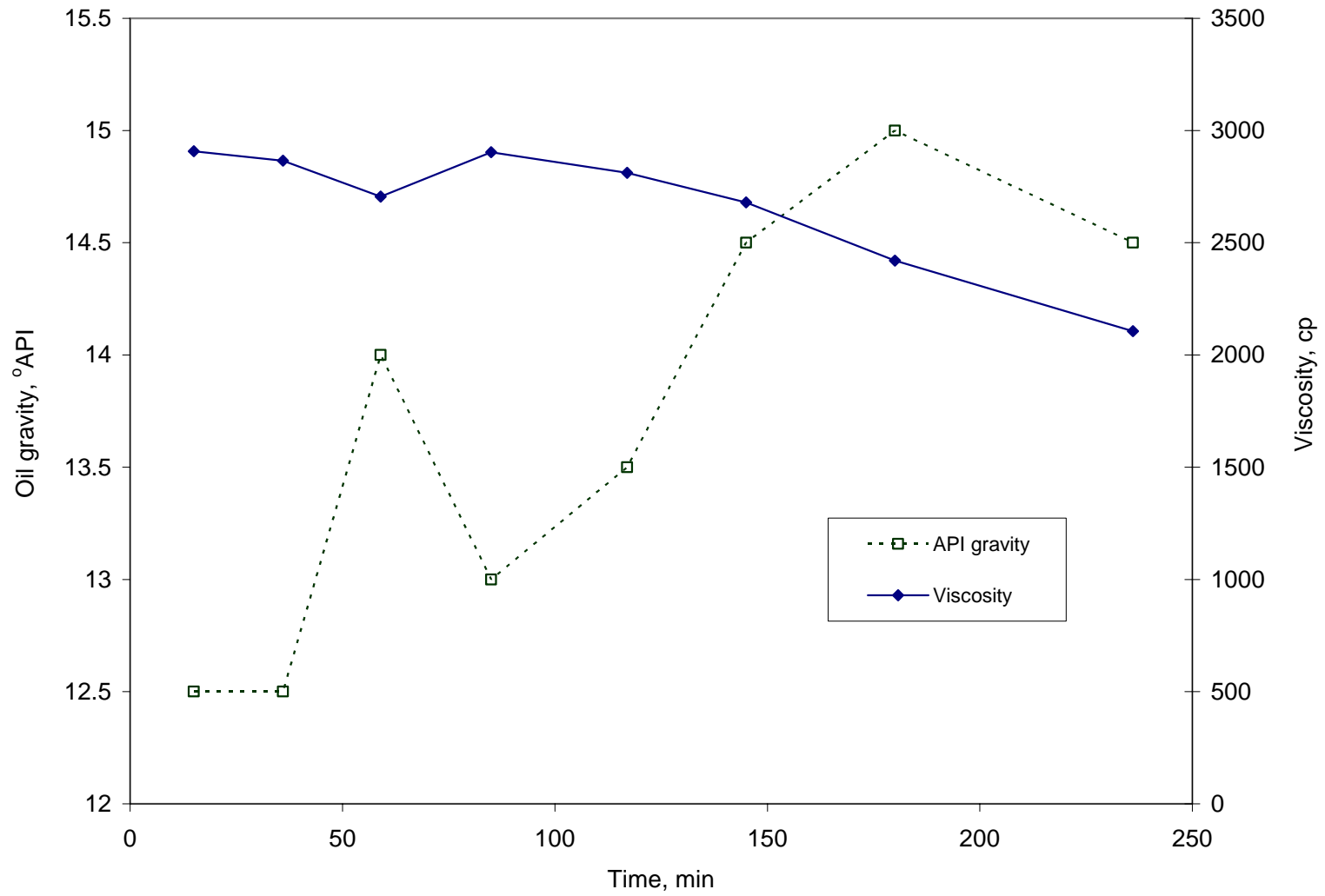


Fig. 4.44- Oil viscosity and API gravity for Run 7 (5:100 petroleum distillate:steam).

4.7 Run 8 (5:100 Petroleum Distillate:Steam Mass Ratio)

This is a repeat run with the same conditions as run no. 7. The injection temperature is kept steady at 230°C throughout the run and outlet pressure is set to be 260 psig.

The temperature profile within the cell is shown in **Fig. 4.45**. Some fluctuations are found in the injection temperature throughout the run. **Figs 4.46** and **4.47** show the cumulative oil and water production as a function of time and pore volume injected. At the end of the run, the oil recovery was 46.8% of OOIP.

The oil and water rates plotted versus time and pore volume injected are shown in **Figs. 4.48** and **4.49** respectively. Most of the oil is produced between 15 and 121 minutes, and the oil rate peak is 16 cm³/min.

Fig. 4.50 shows temperature profiles within the cell at twenty-minute intervals. The temperature in the entire cell is around 210°C at 132 minutes.

The injection and production pressures are shown in **Fig. 4.51**. The production pressure is maintained at 260 psig during the entire run. The differential pressure peaks at around 72 psig.

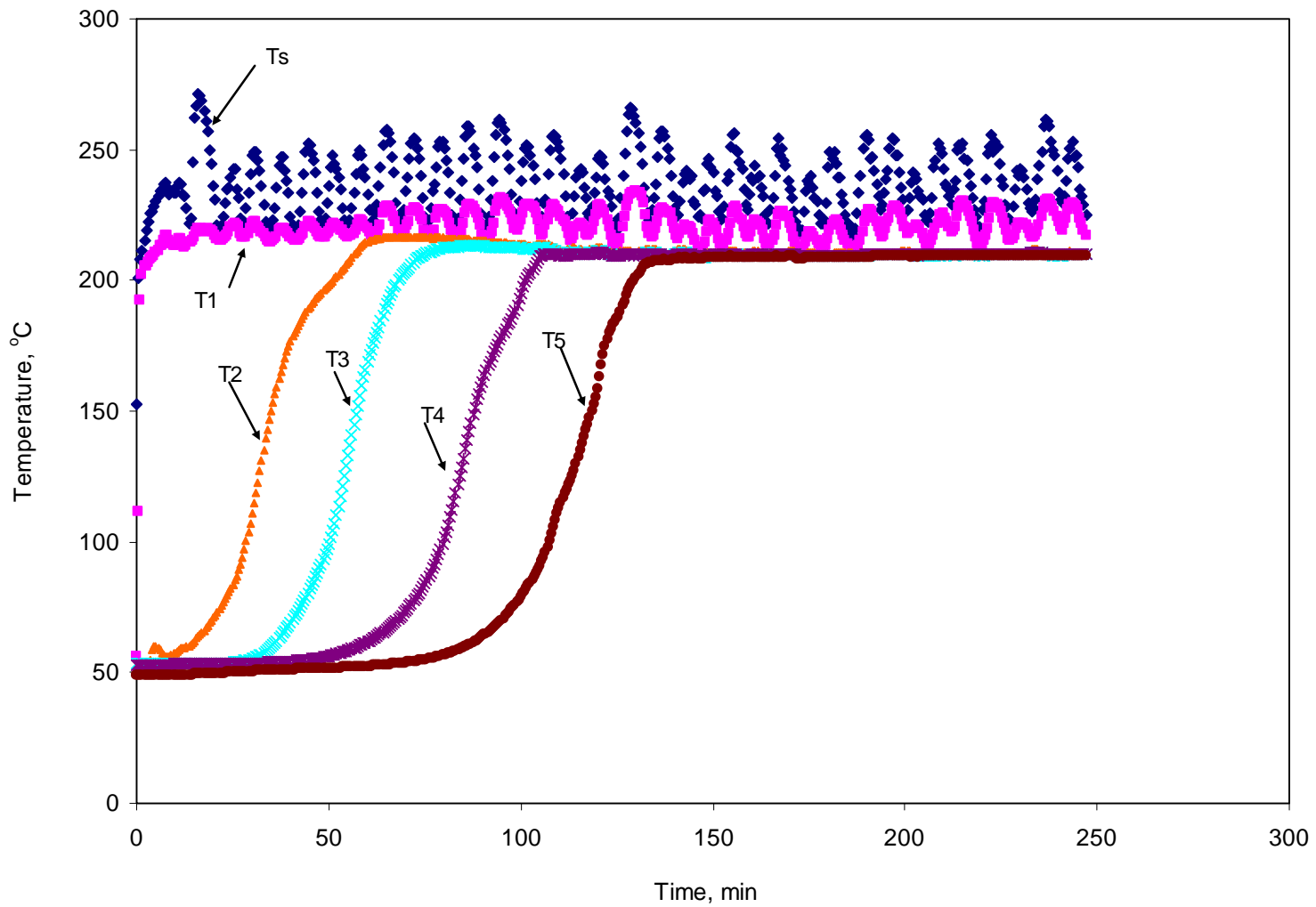


Fig. 4.45- Temperature profile versus time for Run 8 (5:100 petroleum distillate:steam).

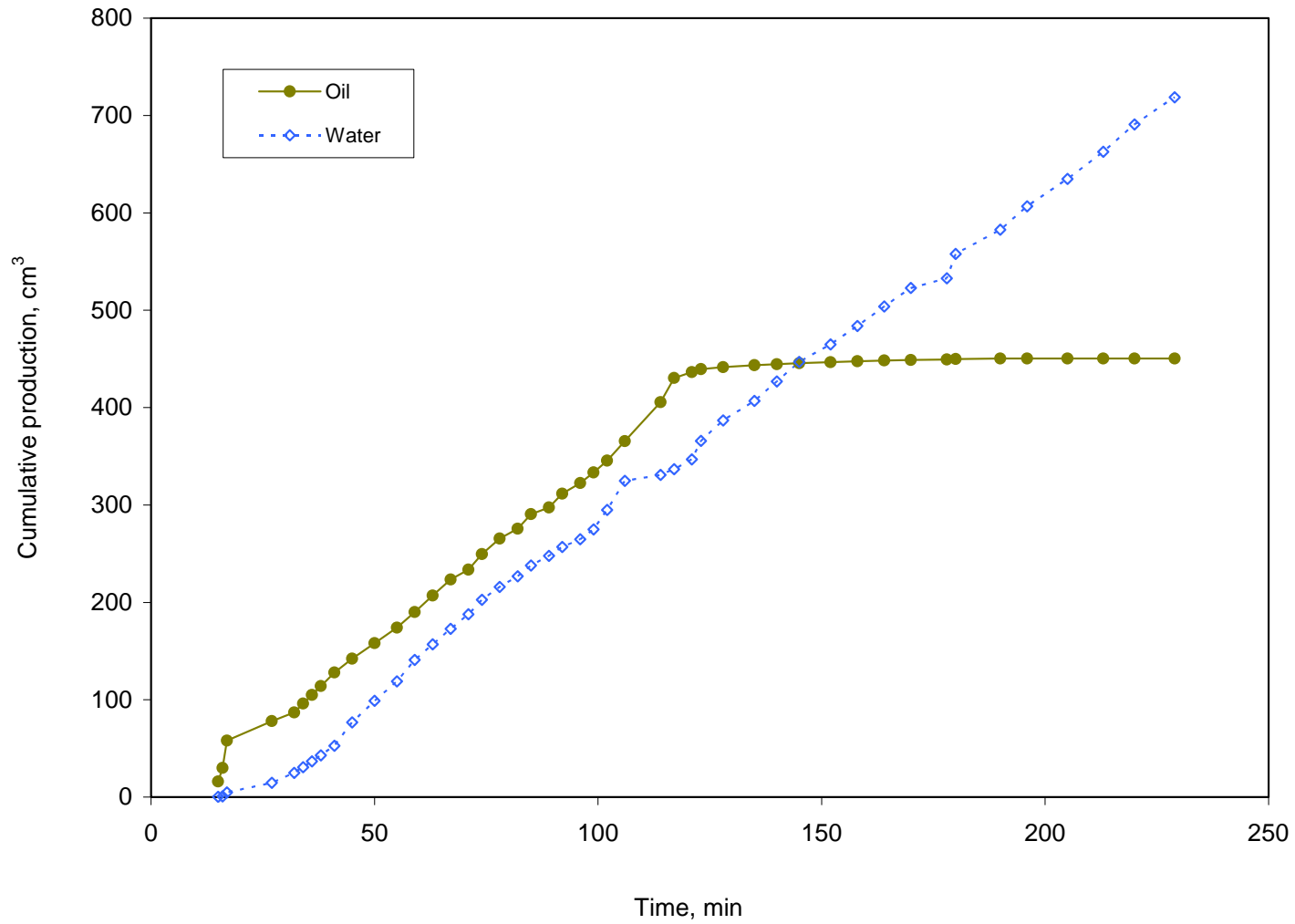


Fig. 4.46- Cumulative oil and water volumes versus time for Run 8 (5:100 petroleum distillate:steam).

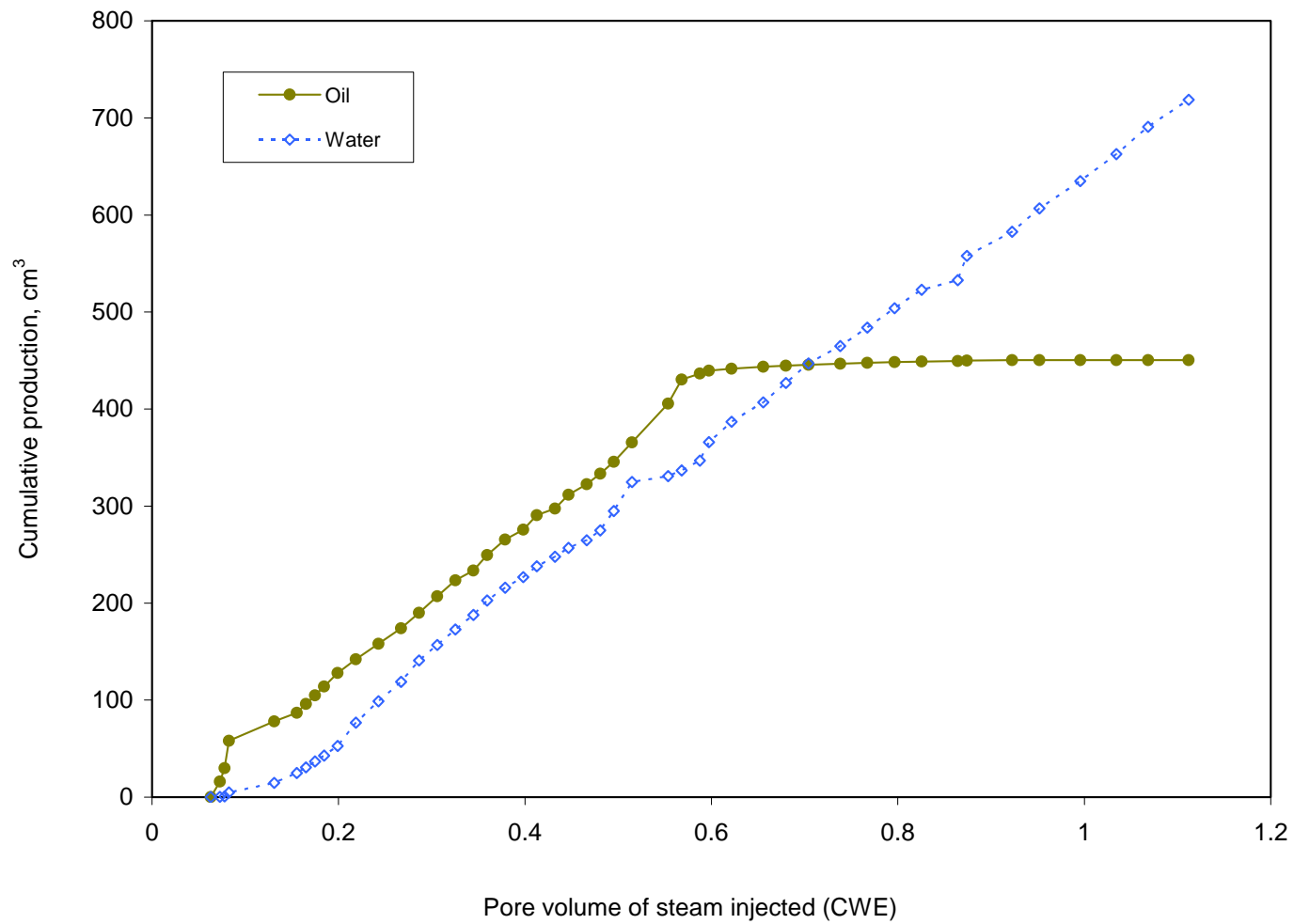


Fig. 4.47- Cumulative oil and water volumes vs. pore volume of steam injected for Run 8 (5:100 petroleum distillate:steam).

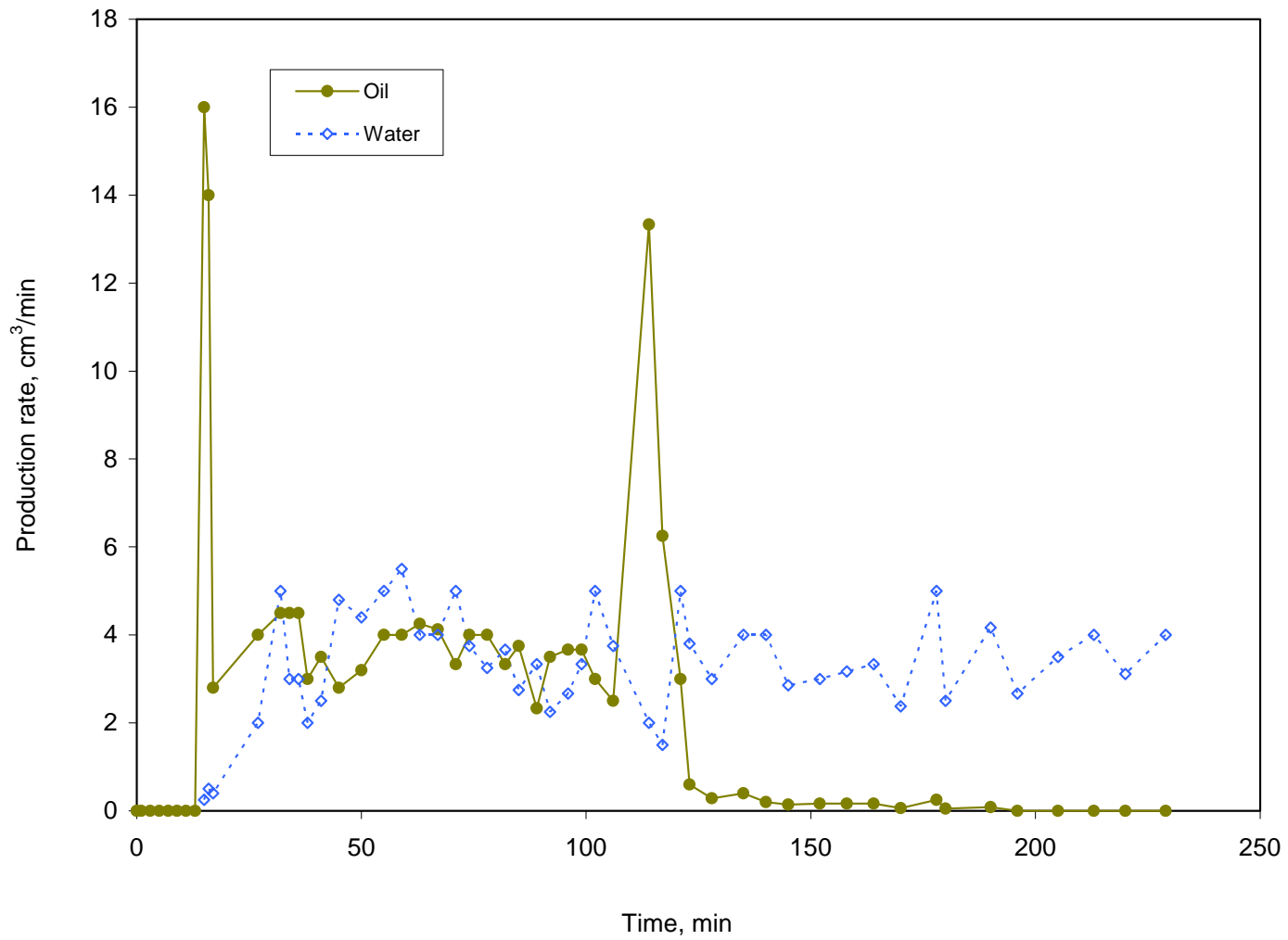


Fig. 4.48- Oil and water rates versus time for Run 8 (5:100 petroleum distillate:steam).

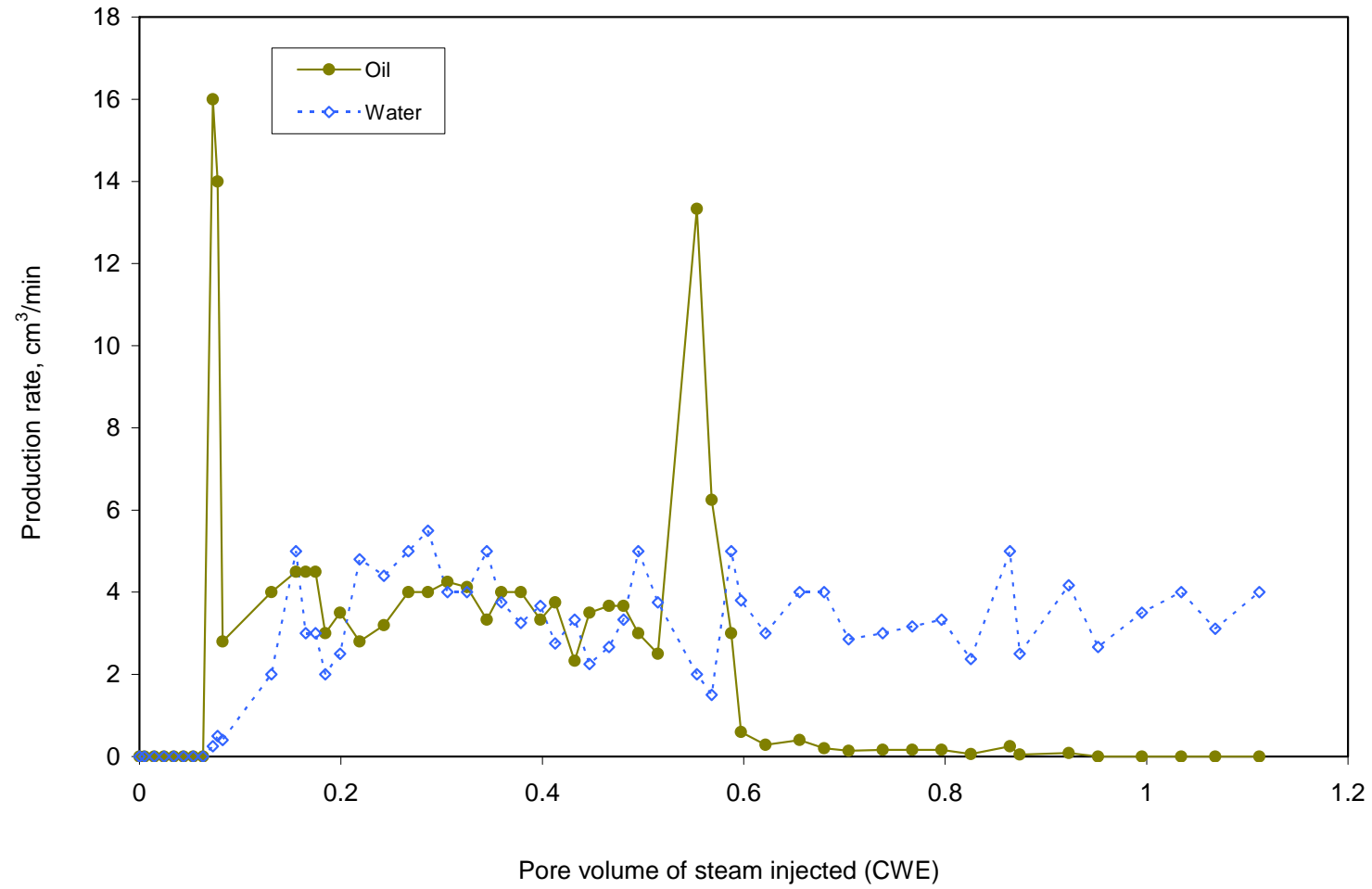


Fig. 4.49- Oil and water rates versus pore volume of steam injected for Run 8 (5:100 petroleum distillate:steam).

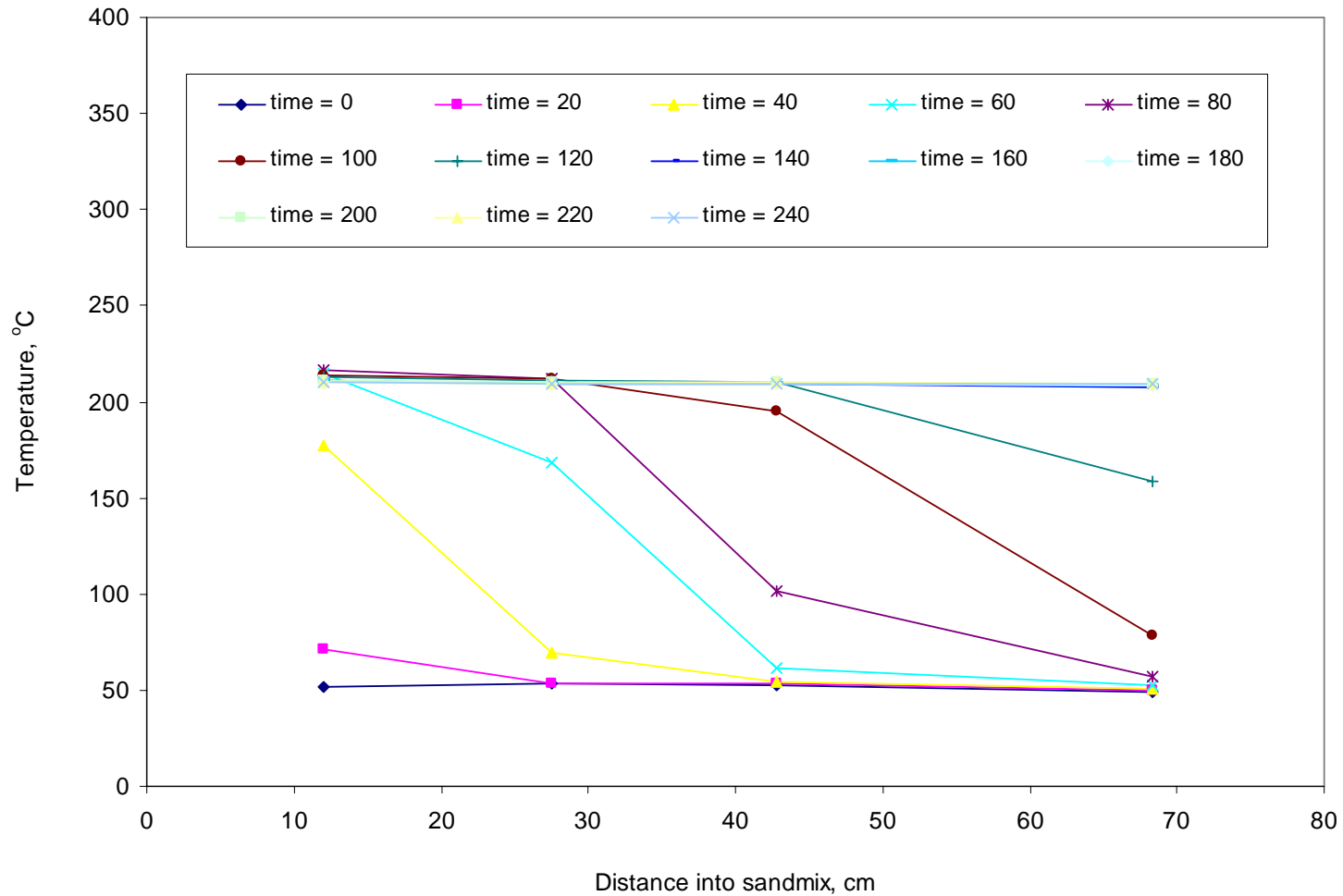


Fig. 4.50- Temperature profiles at 10-minute intervals – from t = 0 to t = 240 min – for Run 8 (5:100 petroleum distillate:steam).

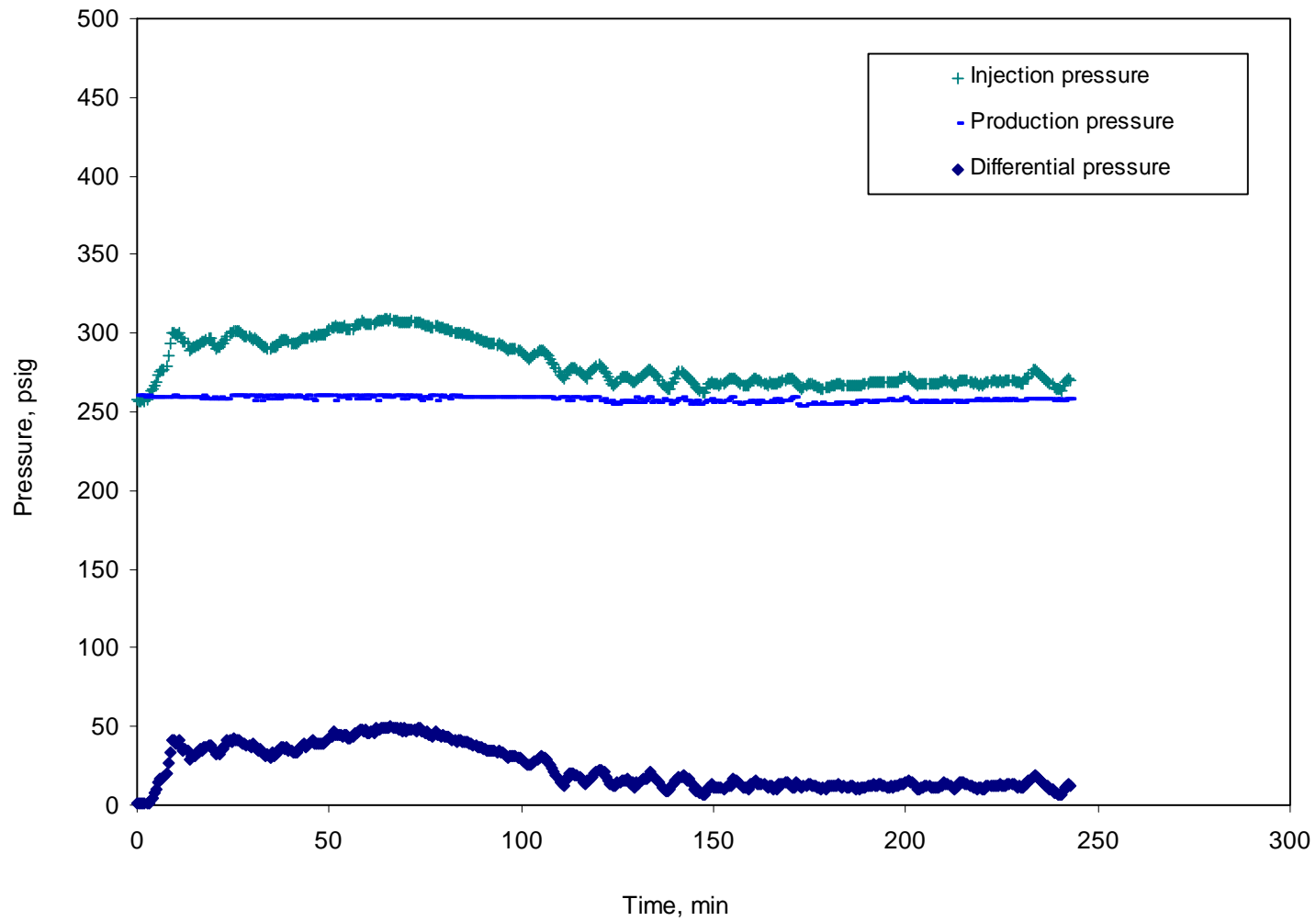


Fig. 4.51- Injection, production and differential pressures for Run 8 (5:100 petroleum distillate:steam).

4.8 Comparison and Discussion of Experimental Results

Figs. 4.52 and **4.53** show a plot of oil rate vs. time and pore volume of water injected respectively for all runs. It can be observed that oil production starts earlier in the steam-petroleum distillate runs, followed by steam- propane runs as compared to pure steam runs. On average, steam-petroleum distillate and steam-propane oil production starts 14 and 17 minutes respectively, while oil production starts at 24 minutes in pure steam runs (average), this represents an acceleration of using petroleum distillate and propane as additives of 34% and 46% respectively in terms of production time. **Fig. 4.54** shows each start of production runs. In **Fig. 4.53**, the oil rate is plotted vs. pore volume injected (CWE). For the steam-petroleum distillate and steam-propane runs, oil production starts when 7% and 9% (on average) respectively of the pore volume has been injected. On the other hand, the average pore volume injected before starting production in a pure steam run is 12.5%. The oil rate peaks of the steam-petroleum distillate are the tallest, followed by steam-propane and pure steam runs. And as a result, oil production in the steam-petroleum distillate runs last shorter as compared to steam-propane runs, followed by steam-propane runs that last shorter than pure steam runs.

Water rates (shown in **Figs. 4.55** and **5.56**) are not affected by the addition of propane and petroleum distillate. Although for one steam-petroleum distillate run (run 8), higher rates are found, but another steam-petroleum distillate run (run 8) does not indicate the same trend. Hence, suffice to say that the role of petroleum distillate in water production can not be established based on the observed experimental results. For all runs, water production starts around the same time (average of 14 minutes), then the rate fluctuates and finally decrease and stabilize around the water injection rate of 5.5 cm³/min, cold water equivalent.

The cumulative volume of oil produced is shown in **Figs. 4.57** and **4.58**. **Figs. 4.59** and **4.60** show the oil recovery as a percentage of Original Oil in Place. Recovery for the steam-petroleum distillate and steam-propane runs is on average 51% and 47% respectively while the average for the pure steam runs is 41%. By evaluating all runs, higher recoveries are found when petroleum distillate or propane is added. The effect of

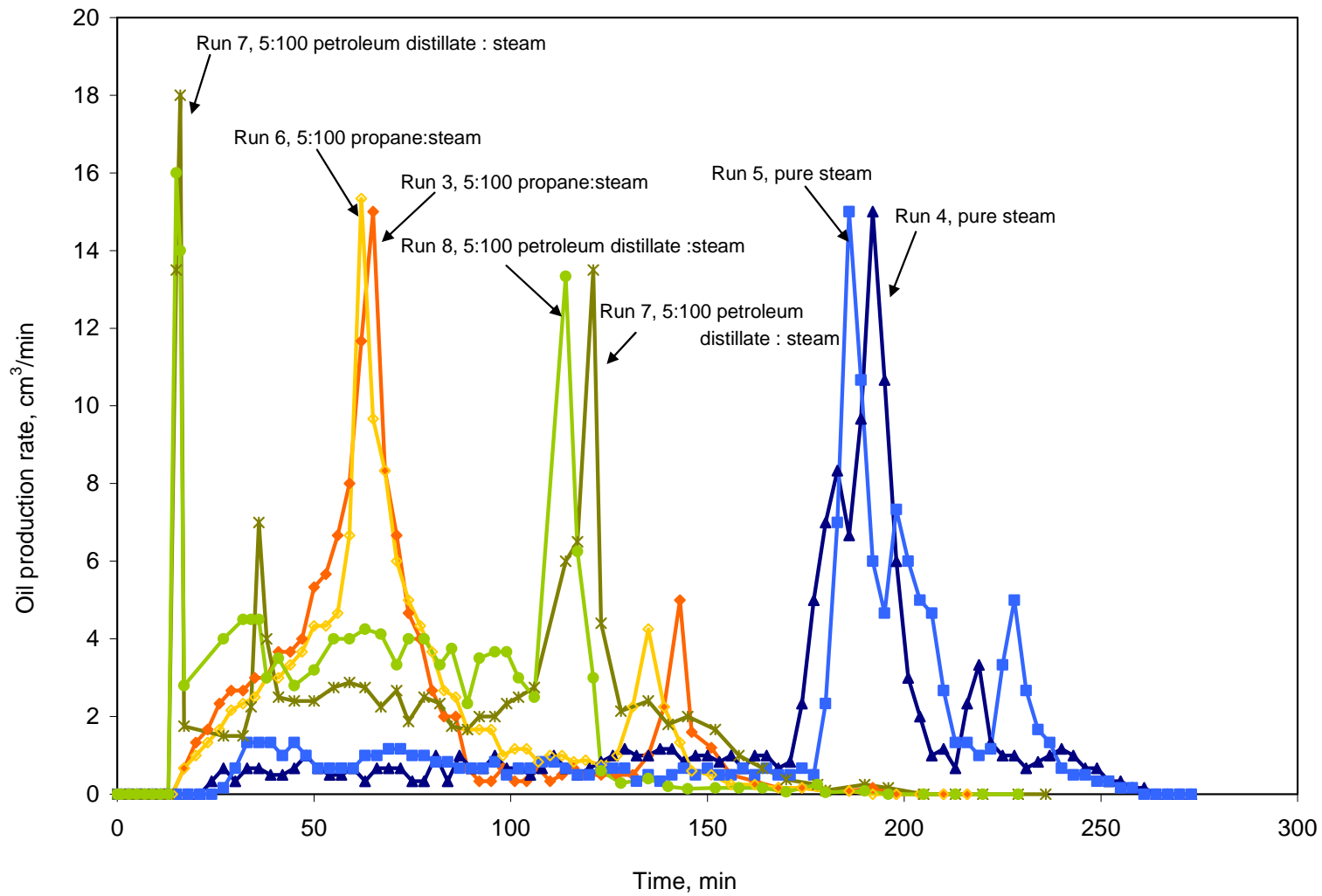


Fig. 4.52- Oil rates versus time for Runs 3 to 8.

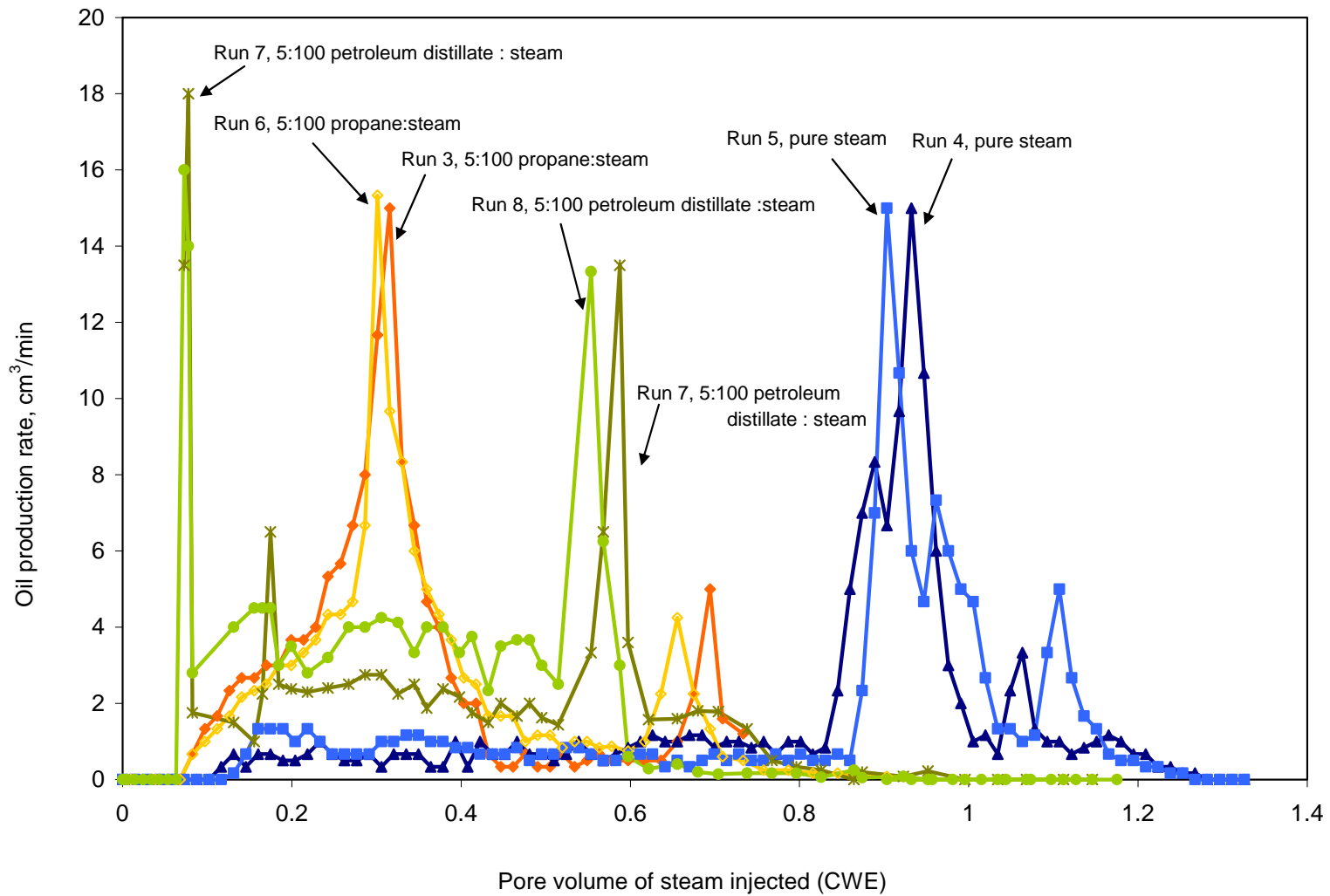


Fig. 4.53- Oil rates versus pore volume of steam injected (CWE) for Runs 3 to 8.

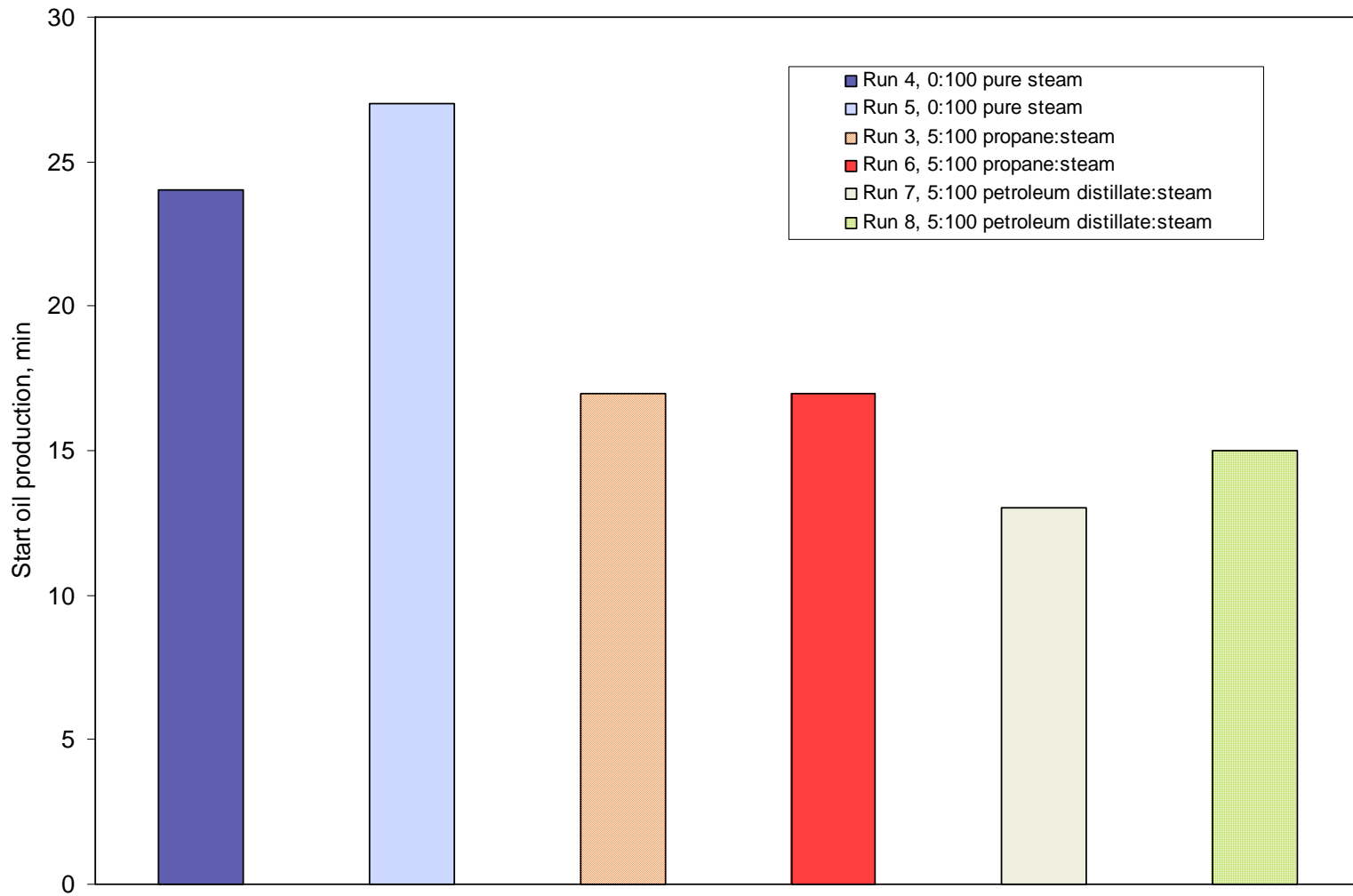


Fig. 4.54- Start of oil production.

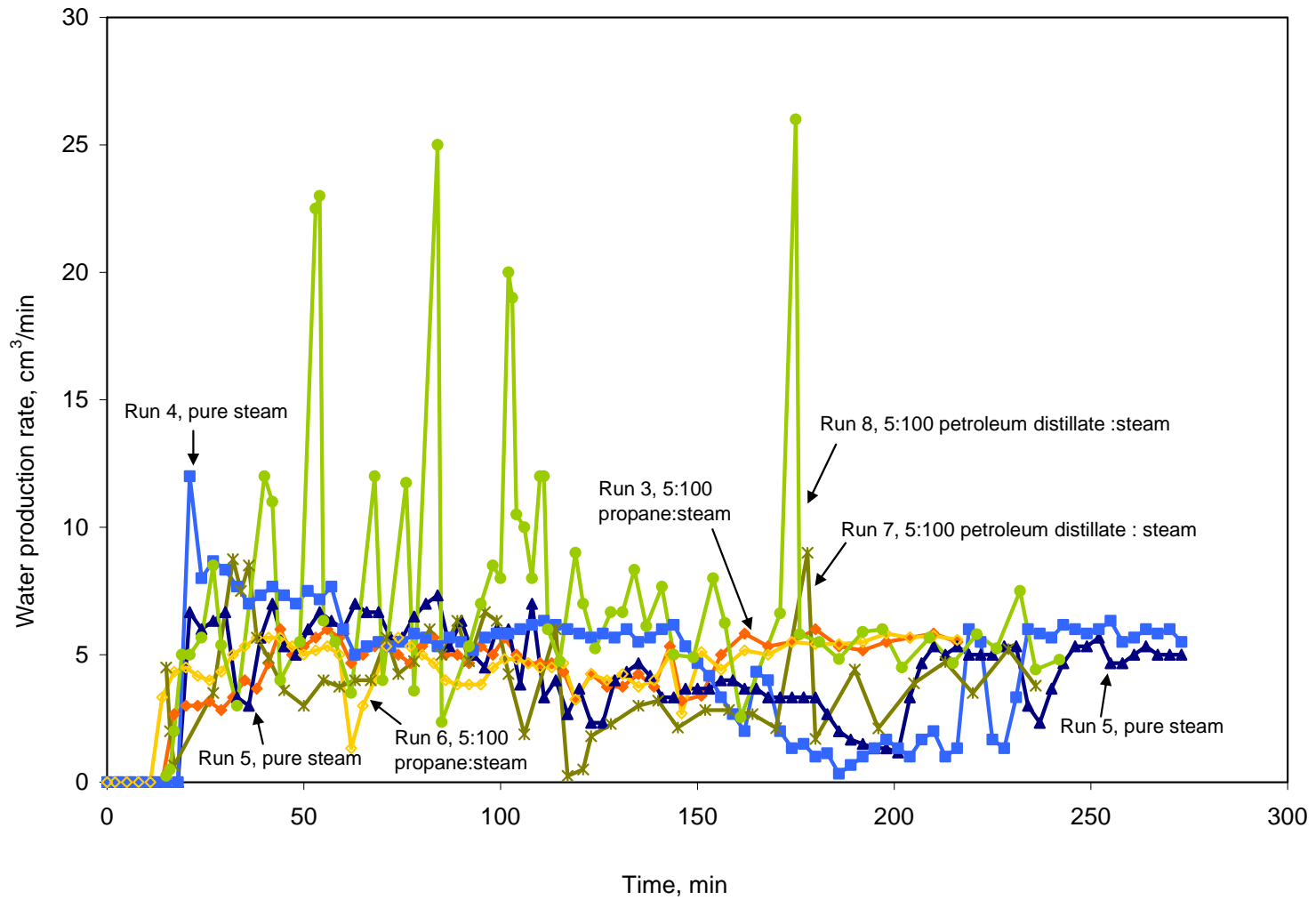


Fig. 4.55- Water rates versus time for Runs 3 to 8.

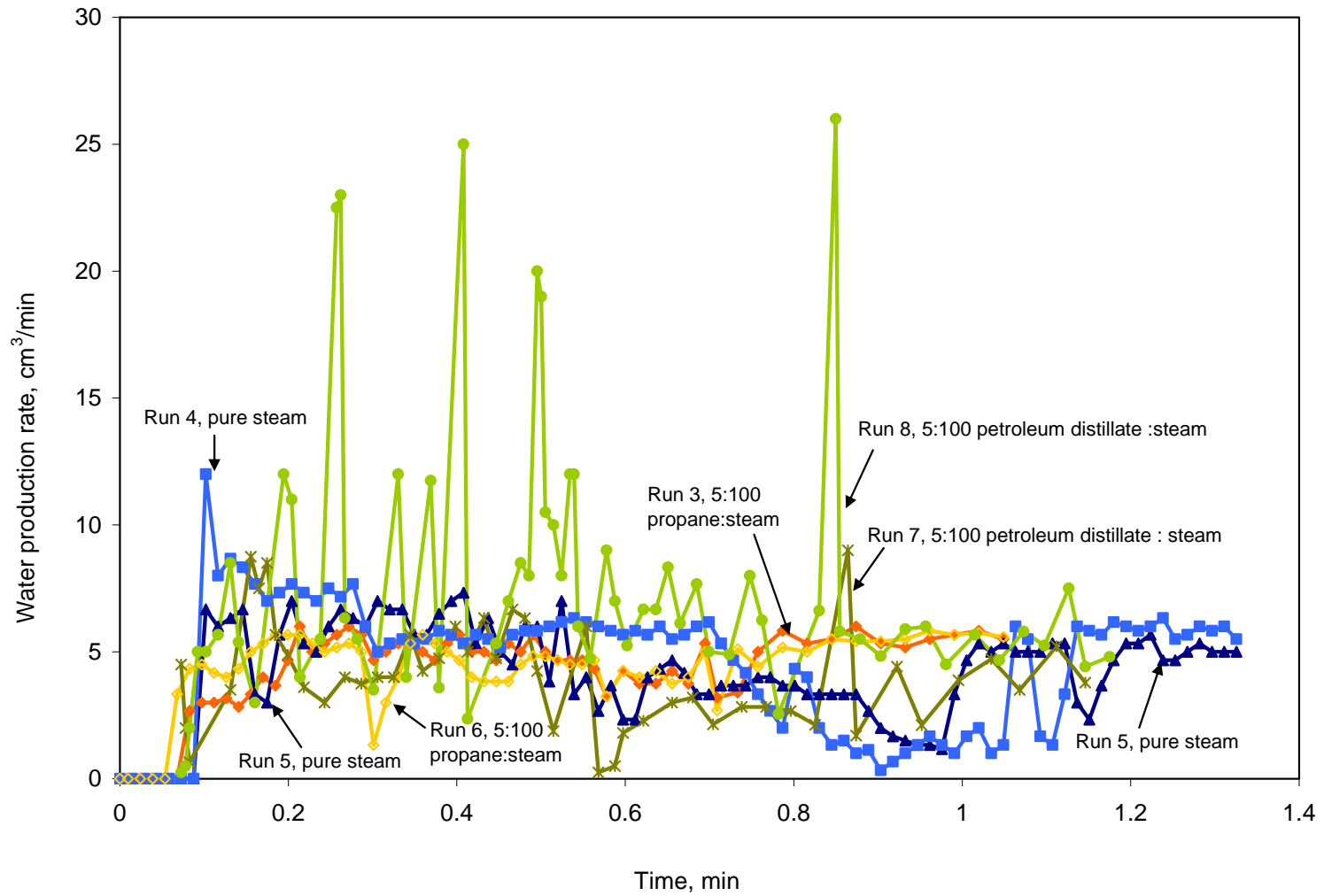


Fig. 4.56- Water rates versus pore volume of steam injected (CWE) for runs 3 to 8.

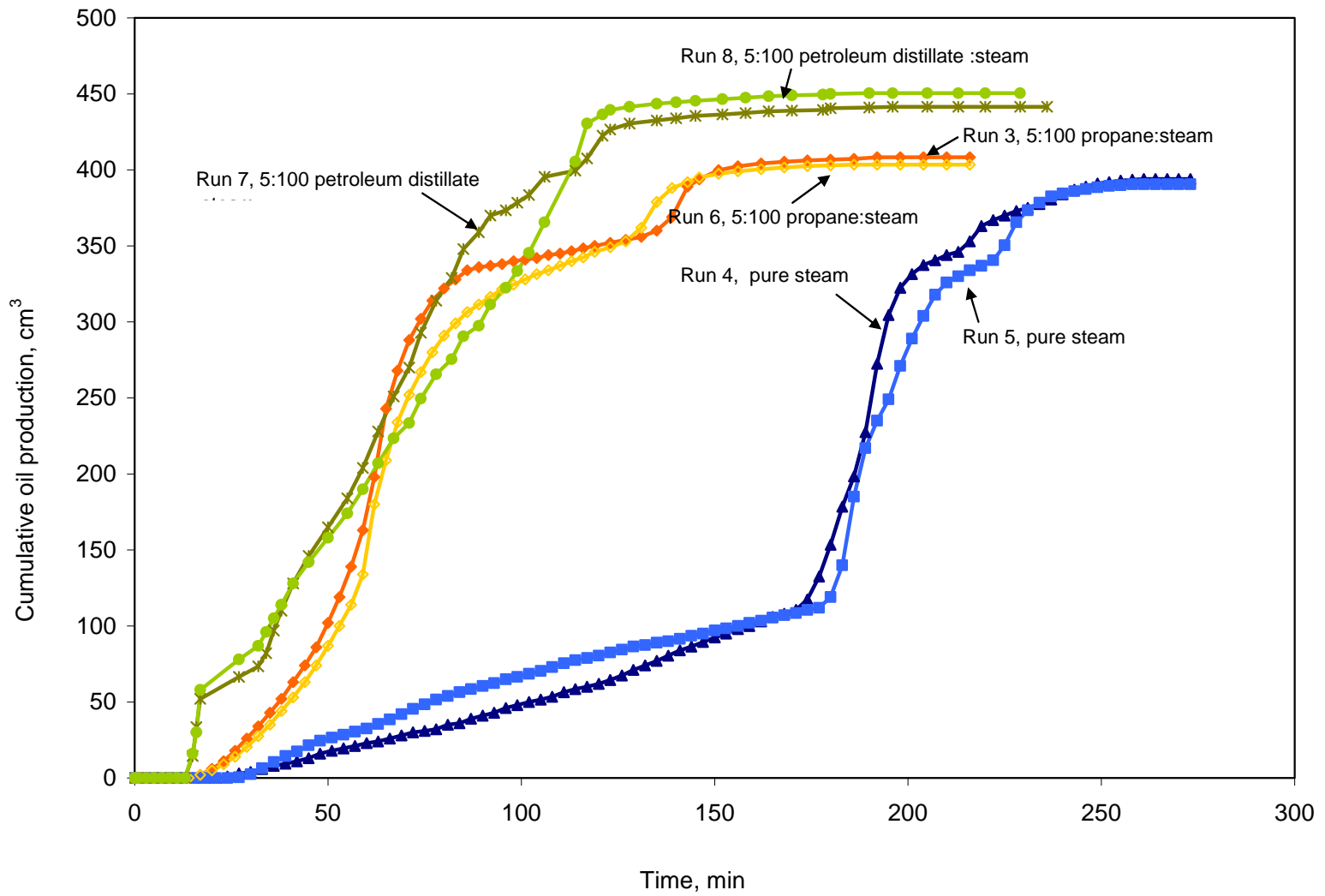


Fig. 4.57- Cumulative oil recovery versus time for Runs 3 to 8.

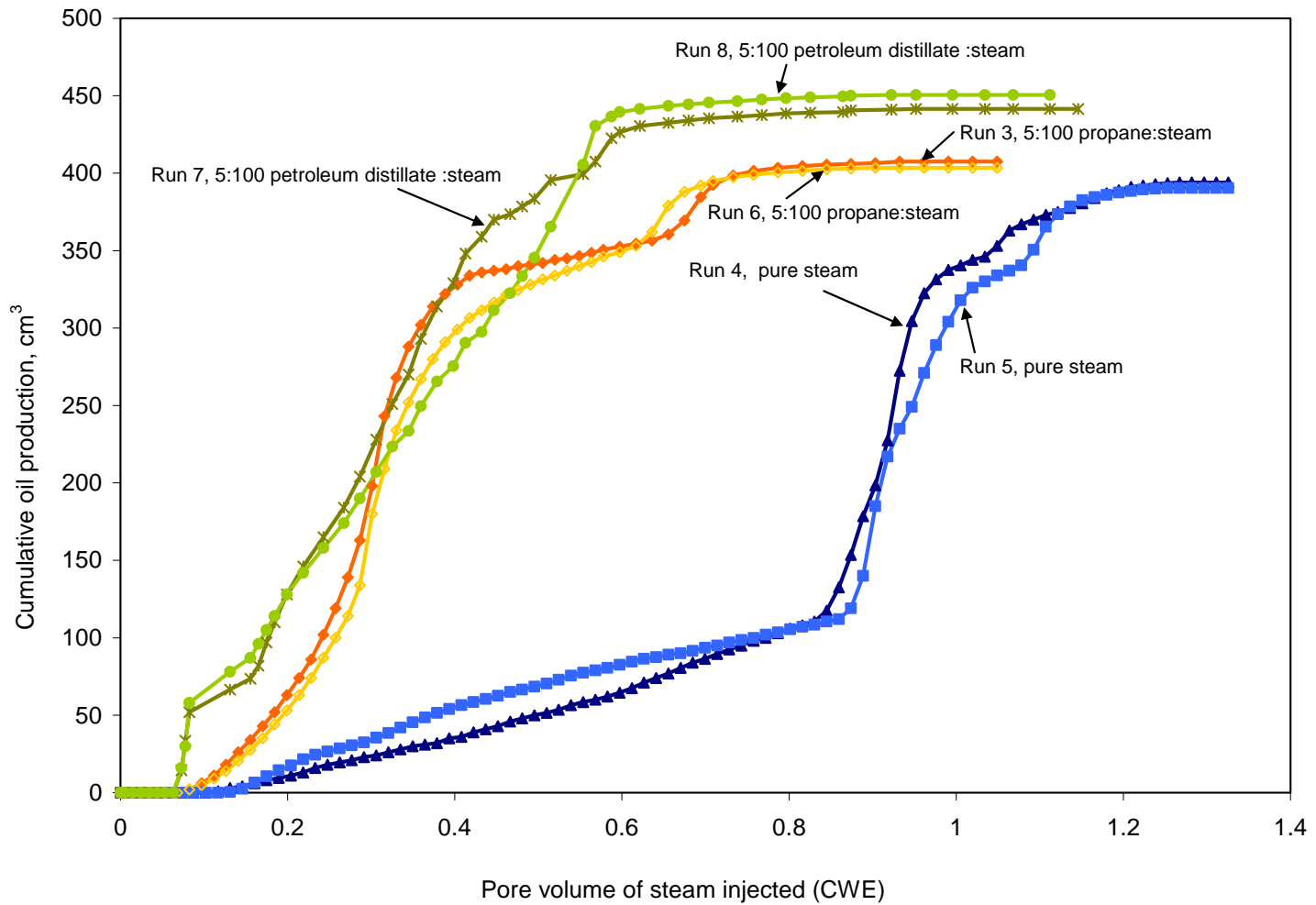


Fig. 4.58- Cumulative oil recovery versus pore volume of steam injected (CWE) for Runs 3 to 8.

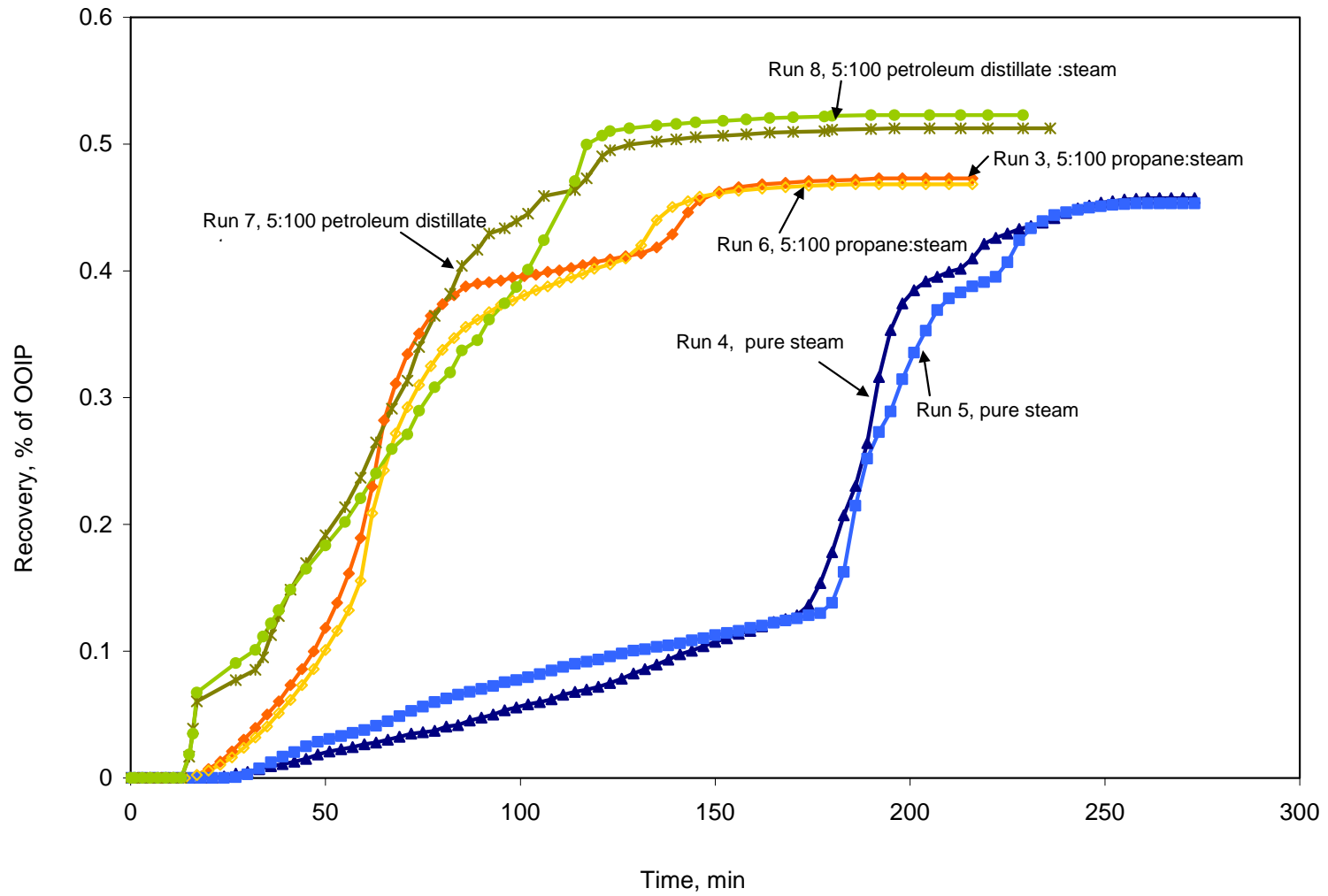


Fig. 4.59- Oil recovery versus time for Runs 3 to 8.

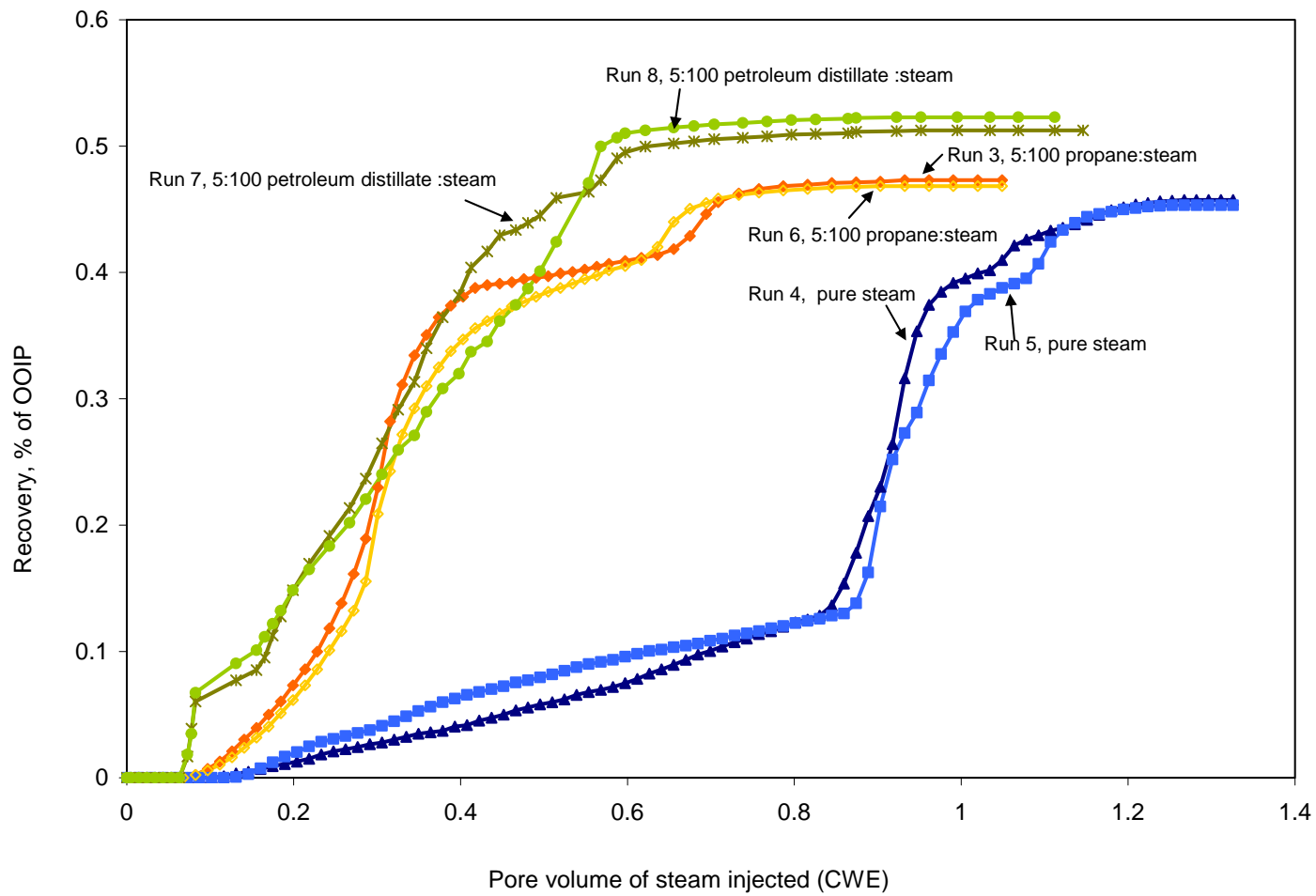


Fig. 4.60- Oil recovery versus pore volume of steam injected (CWE) for Runs 3 to 8.

petroleum distillate to enhance oil production has been recognized quite recently in the oil industry and supported by some the field experiences in heavy oil productions such one as described by Léauté⁴⁶.

Figs. 4.61 and 4.62 show the differential pressure as a function of time for all runs. The differential pressure is the difference between the injection and production pressure (production pressure is held constant at 260 psig). The injection pressure starts increasing just after the run begins. On average, the maximum differential pressure for the steam-petroleum distillate and steam-propane runs are 26 and 40 psig. In contrast, the pure steam runs have a maximum differential pressure (average) of 62 psig. Thus, petroleum distillate and propane as additives improve the injectivity by reducing the pressure differential to 150% and 240%.

Oil density, expressed as API gravity, is plotted in **Fig. 4.63**. Since only a small amount of oil was available in every sample, a pycnometer with a volume of 2 cm³ was used to obtain these density measurements. Given the size of the pycnometer, even a small measurement error is magnified causing the scattering observed in the plot. No specific trend was observed in the plots; however, API values for the steam-propane runs are in most cases higher than the corresponding value for the original oil (12°API). On the other hand, pure steam runs yielded API gravities equal to or slightly lower than the original API gravity.

Fig. 4.64 depicts the oil viscosity vs. time measured at 50°C. Though some scatter is present, all runs (pure steam, steam-propane and steam-petroleum distillate) show an increasing trend with time. Viscosity values for the steam-petroleum distillate and steam-propane runs are generally higher than those corresponding to the pure steam runs. Most of the viscosity values measured are below the original oil viscosity (2800 cp at 50°C). The steam front location for each run is plotted in **Fig. 4.65**. Five thermocouples were placed inside a thermowell within the cell. In this plot, the slope of the curve indicates the steam front velocity. The steam front is faster in the steam-propane runs, this may explain the fact that oil production starts earlier when petroleum distillate and propane are added.

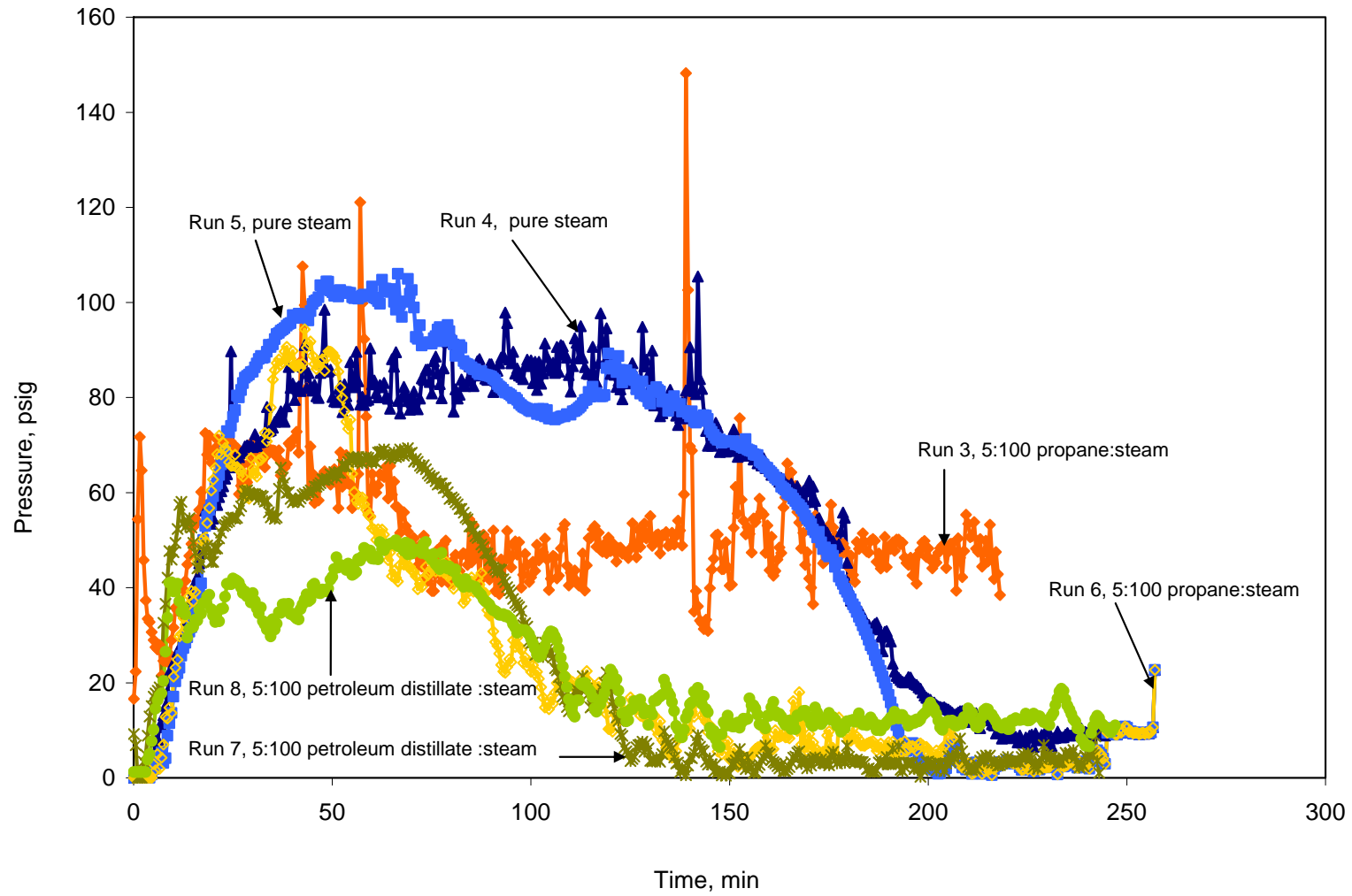


Fig. 4.61- Differential pressure versus time for Runs 3 to 8.

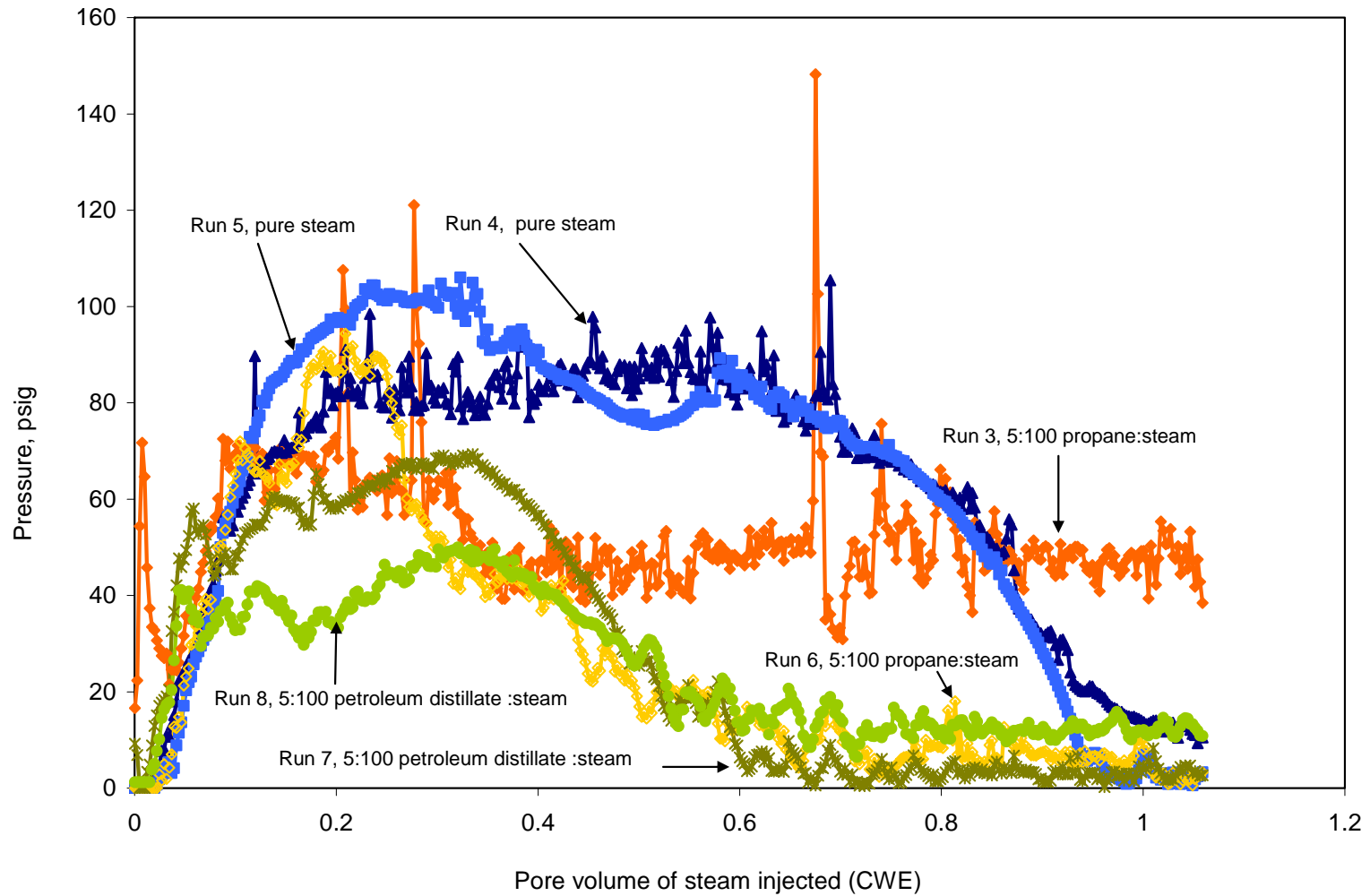


Fig. 4.62- Differential pressure versus pore volume of steam injected (CWE) for Runs 3 to 8.

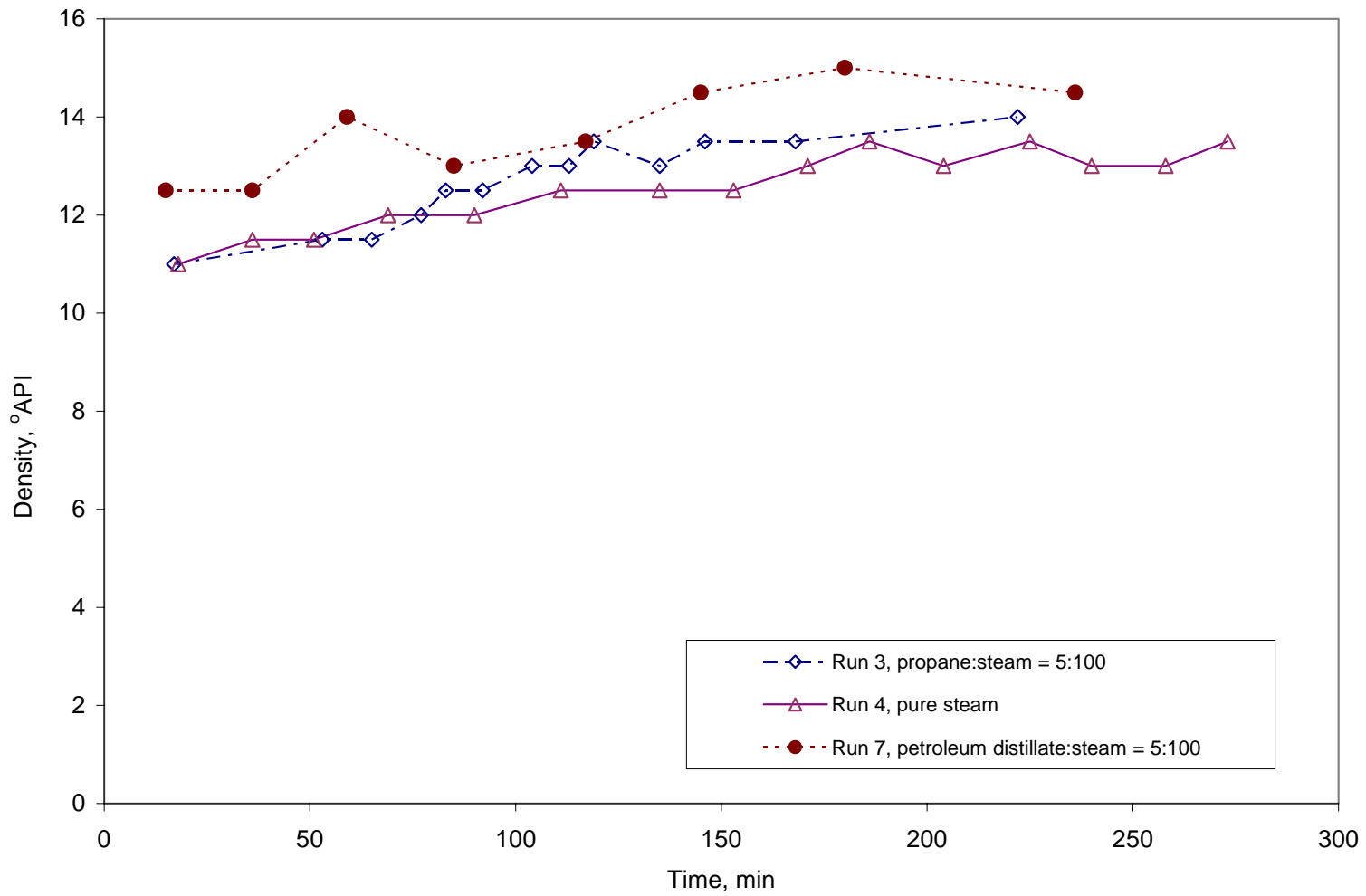


Fig. 4.63- Oil density (@50°C) vs. time for Runs 3 to 8.

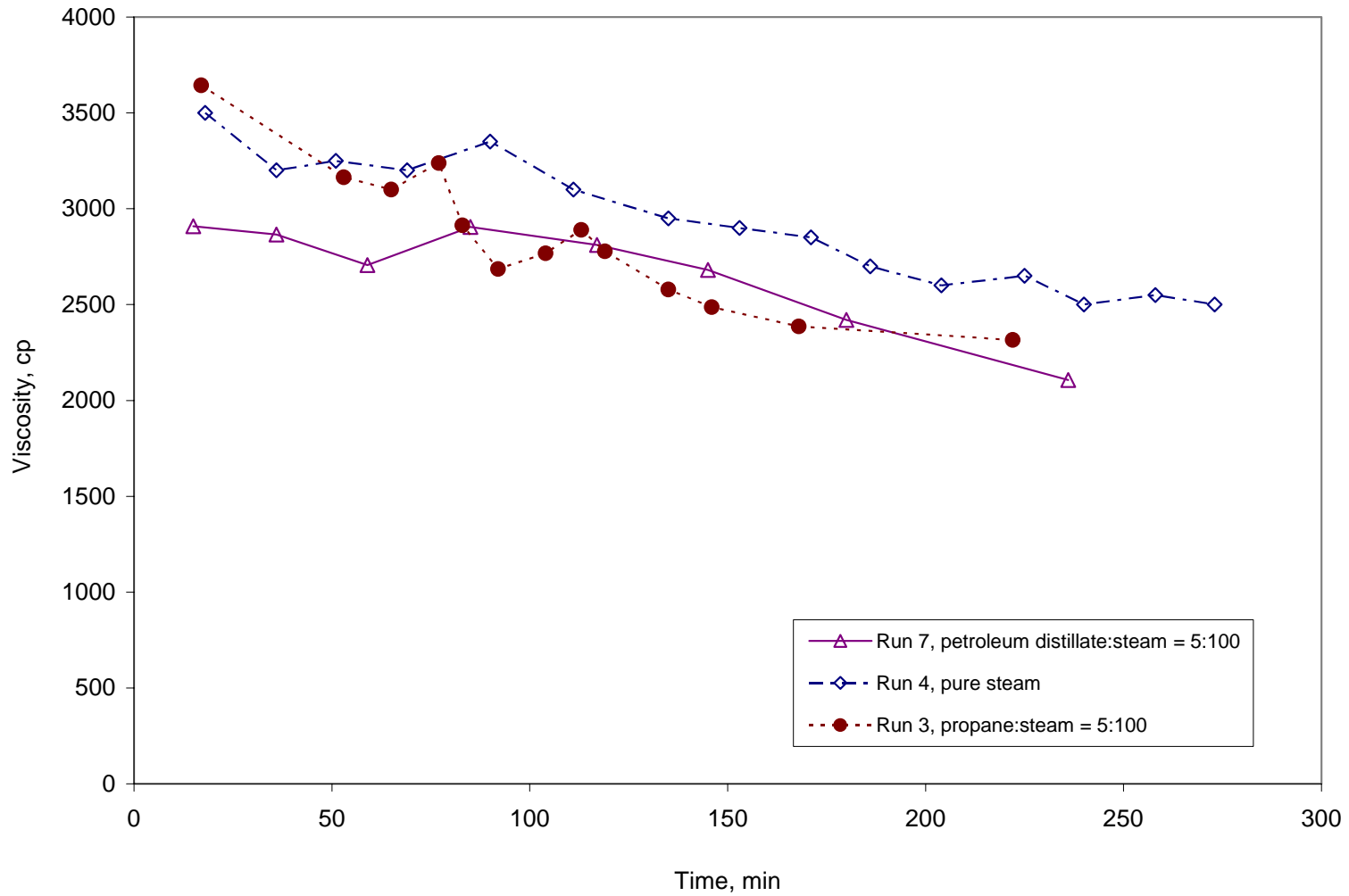


Fig. 4.64- Oil viscosity (@50°C) vs. time for Runs 3 to 8.

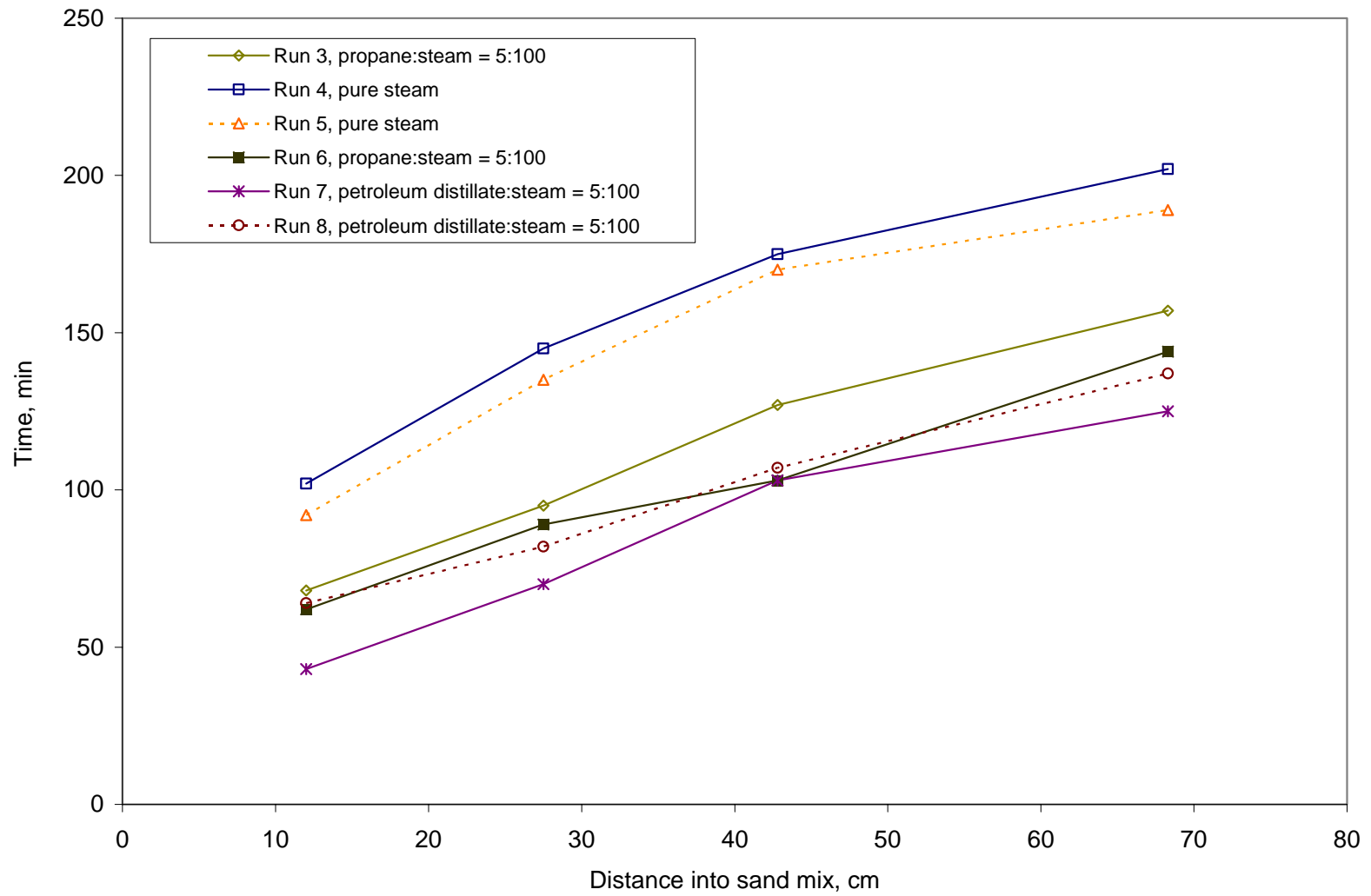


Fig. 4.65- Steam front location for Runs 3 to 8.

CHAPTER V

ANALYTICAL MODEL

5.1 Review of Analytical Models for Steamflooding

Analytical models have dealt with the basic problems of heat and mass transport in an oil reservoir. Analytical solutions are possible after many assumptions are made. The first study of heat transport within a reservoir due to hot fluid injection was presented by Lauwerier³⁵. Lauwerier considered the temperature decrease along the flow direction due to the heat loss to the adjacent strata. He derived the temperature distribution both in the reservoir and adjacent formation under several assumptions.

Marx and Langenheim³⁶ presented a model for estimating thermal invasion rate, cumulative heated area (Eq. 5.1) and theoretical economic limits for sustained heat injection at constant rate into an idealized reservoir.

$$R_h^2 = \frac{h_n M_s (f_{sdh} L_{vdh} + h_{fs} - h_{fr}) \xi_s}{4 \pi K_h (T_s - T_R) t_{inj} N_s}, \quad (5.1)$$

where

$$\xi_s = e^\tau \operatorname{erfc}(\sqrt{\tau}) + \frac{2}{\sqrt{\pi}} \sqrt{\tau} - 1, \quad (5.2)$$

$$\tau = \frac{4 K_h t_{inj}}{h_n (\rho C)_t}, \quad (5.3)$$

K_h = thermal conductivity of overburden, in Btu/ft-°F

h_n = reservoir thickness, ft

$(\rho C)_t$ = volumetric heat capacity of reservoir material, BTU/ft³

t_{inj} = injection time, D

h_{fs} = enthalpy of liquid water at T_R , BTU/lbm

τ = lag time, D

- T_s = steam temperature, in °F
 T_R = original reservoir temperature in °F
 α = the ratio of oil displaced from the steam zone below to that displaced from the steam zone itself
 M_s = the heat capacity of the steam zone, in Btu/ft³-°F
 L_{vdh} = heat of vaporization of water at reservoir pressure in Btu/lb
 f_{sdh} = downhole steam quality, fraction.

They assumed that the injected heat was retained by the formation within a constant temperature steam zone and lost to the overlying and the underlying strata by conduction and that there was no heat flow ahead of the steam front. The model has been found to be applicable to thick formations, high steam qualities, low pressures, and high steam injection rates. Ramey³⁷ extended the Marx-Langenheim work to permit a variable injection rate.

Willman et al.³⁸ presented an equation to estimate the heated radius, R_h (Eq. 5.5) for a constant injection rate, i_{st} :

$$R_h^2 = \frac{14.6 i_{st} L_{vdh}}{K_h (T_s - T_R)} \sqrt{\frac{\alpha}{\pi}} \left[\frac{\sqrt{t}}{2} - \frac{h_n}{8} \sqrt{\frac{\pi}{\alpha}} \frac{(\rho C_p)_t}{(\rho C_p)_{ob}} \ln \left[\frac{4}{h_n} \sqrt{\frac{\alpha}{\pi}} \frac{(\rho C_p)_{ob}}{(\rho C_p)_t} \sqrt{t} + 1 \right] \right]. \quad (5.4)$$

They also predicted the steam injection rate required for a constant volumetric rate of steam in radial flow reservoir as the following:

$$i_{st} = \frac{\pi R_h^2 (T_s - T_R)}{14.6 t L_{vdh}} \left[h_n (\rho C_p)_t + 4k_h \sqrt{\frac{t}{\pi\alpha}} \right], \quad (5.5)$$

where

K_h = thermal conductivity of overburden, in Btu/ft-°F

h_n = reservoir thickness, ft

$(\rho C)_t$ = volumetric heat capacity of reservoir material, BTU/ft³

t_{inj} = injection time, D

h_{fs} = enthalpy of liquid water at T_R , BTU/lbm

- T_s = steam temperature, in °F
 T_R = original reservoir temperature in °F
 α = the ratio of oil displaced from the steam zone below to that displaced from the steam zone itself
 M_s = the heat capacity of the steam zone, in Btu/ft³-°F
 L_{vdh} = heat of vaporization of water at reservoir pressure in Btu/lb
 f_{sdh} = downhole steam quality, fraction.

The concepts, assumptions, and restrictions of this model were similar to those of Marx and Langenheim. Mandl and Volek³⁹ improved upon these models by noting that at a critical time the latent heat content of the injected steam was not sufficient to supply heat loss and also raise rock ahead of the steam zone to the steam temperature. As a result, convective heat transfer at the steam front cannot be neglected. Prior to the critical time, they used the same equation as Marx and Langenheim. The Mandl-Volek equation for the steam volume after the critical time is

$$V_s = \frac{\dot{Q}_{inj} h_n^2 R_h^2 (\rho C_p)_t \alpha}{4 K_h^2 T_s} \left[\left\{ e^{t_D} \operatorname{erfc} \sqrt{t_D} + 2 \sqrt{\frac{t_D}{\pi}} - 1 \right\} - \sqrt{\frac{t_D - t_{cD}}{\pi}} \left\{ \frac{1}{1 + F_{hD}} + \frac{t_D - t_{cD}^{-3}}{3} e^{t_D} \operatorname{erfc} \sqrt{t_D} - \frac{t_D - t_{cD}}{(\pi t_D)^{1/3}} \right\} \right], \quad (5.6)$$

where

$$F_{hD} = \frac{f_{sdh} L_{vdh}}{C_w T_s}, \quad (5.7)$$

$$t_D = \frac{4 K_h (\rho C)_{ob} t}{h_n^2 (\rho C)_t^2}. \quad (5.8)$$

The dimensionless critical time (t_{cD}) for constant injection rate, temperature and steam quality was determined by solving the relation

$$e^{t_{cD}} \operatorname{erfc} \sqrt{t_{cD}} = \left[1 + \frac{f_{sdh} L_{vdh}}{C_w T_s} \right]^{-1} . \quad (5.9)$$

An important study of steam override was published by Van Lookeren⁴⁰. He presented an equation to estimate the laterally averaged steam zone thickness, h_{st} , on segregated flow principles

$$h_{st} = 0.5 h_n A_{RD} , \quad (5.10)$$

where

h_n = reservoir thickness, ft,

A_{RD} = shape factor for radial flow.

The treatment was similar to that isothermal, incompressible and immiscible displacement under segregated conditions presented by Dietz and Dake⁴¹. However, the conventional mobility ratio was used by Dietz while the equivalent ratio (pseudo mobility ratio) was used by Van Lookeren. An important discussion of the equivalent mobility ratio was presented by Prats⁴². The vertical conformance (A_{RD}) can be used to calculate the optimum steam injection rate. Van Lookeren showed that the vertical seep decreased with a decreased steam injection rate, increased pressure, or decreased steam quality.

5.2 Predictive Models for Steamflooding

The basic concepts developed in the studies mentioned have led to the development of various models to predict steamflooding performance. The models can be divided into two categories:

1. Frontal advance models: The steam-drive mechanism was modeled as a horizontal frontal displacement (**Fig. 5.1**). The steam zone was assumed to

grow horizontally and the tendency of the steam to finger beyond the front suppressed by condensation.

- 2. Vertical displacement or gravity override models: The problem of gravity override of the steam due to its low density has been recognized. The gravity override models (Fig. 5.2) assume principal direction of steam zone propagation is vertically downward.

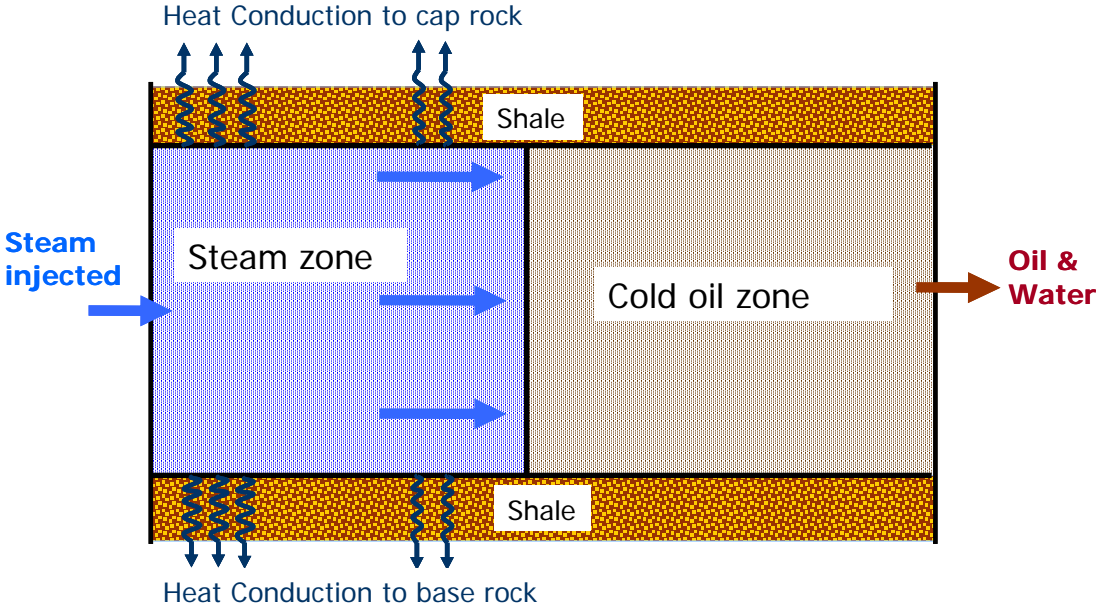


Fig. 5.1- Frontal Advanced Displacement (reproduced from Myhill and Stegemeier⁴⁰).

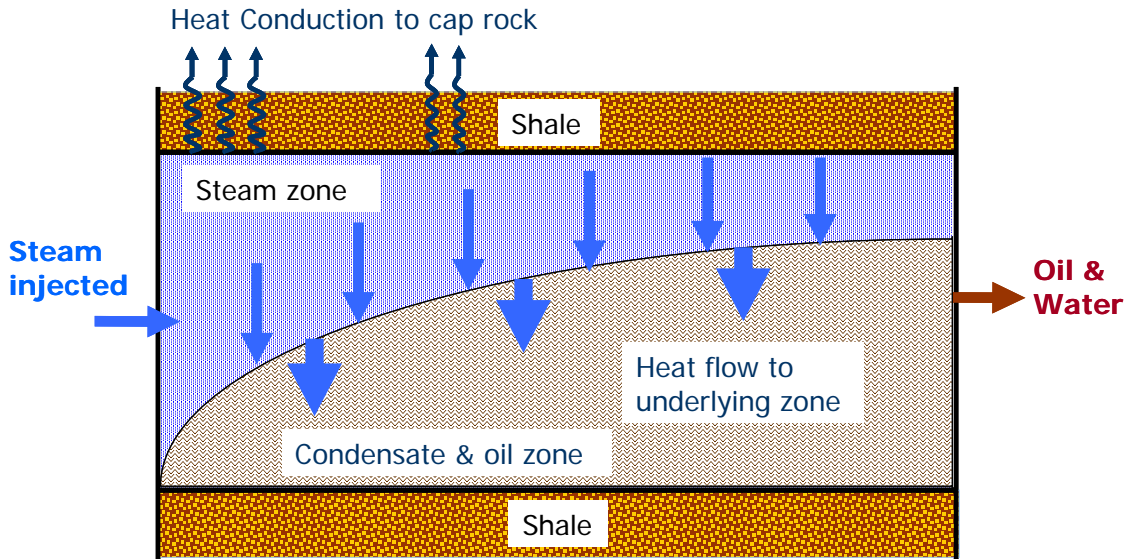


Fig. 5.2- Vertical or Gravity Override Displacement (reproduced from Neuman⁴²).

Because the frontal advance model developed by Mandl and Volek neglected the higher order terms for the steam zone volume calculation, Myhill and Stegemeier⁴³ modified the model based on the Prats solution to calculate the thermal efficiency after the critical time from the relation

$$E_{hs} = \frac{\sqrt{t_D}}{\sqrt{\pi} t_D} \left[\frac{\sqrt{t_D - t_{cD}}}{1 + F_{hD}} - \int_0^{t_{cD}} \frac{e^u \operatorname{erfc}\sqrt{u}}{\sqrt{t_D - u}} du \right], \quad (5.11)$$

where

t_D = dimensionless time,

t_{cD} = critical dimensionless time,

u = velocity of steam-oil interface, ft/sec.

This model assumes (a) a uniform oil concentration, formation thickness and constant petrophysical properties; (b) steam injection at constant pressure, rate and quality; and (c) no vertical temperature gradients. Jones (1981) noted that the Myhill-Stegemeier model often overestimates the oil production, especially in the early phase of

a project. One of the deficiencies of the Myhill-Stegemeier model is its prediction that the oil displaced by the steam zone is immediately produced.

Neuman⁴⁴ presented a gravity override model of steam drive which predicted the following:

1. Steam zone thickness, h_{st} and areal extent, A

$$h_{st} = \frac{4 k_h C_w (T_s - T_R)}{M_s L_{vdh}} \sqrt{\frac{t - \tau}{\pi \alpha}} \quad (5.12)$$

$$A = \frac{f_{sdh} (1 - f_p) \rho_w L_{vdh}}{K_h (T_s - T_R)} \sqrt{\frac{\alpha t}{\pi}} \quad (5.13)$$

where

$t - \tau$ = the time elapsed since steam first arrived where the steam zone thickness is to be calculated.

K_h = thermal conductivity of overburden, in Btu/ft-°F

T_s = steam temperature, in °F

T_R = original reservoir temperature in °F

α = the ratio of oil displaced from the steam zone below to that displaced from the steam zone itself.

M_s = the heat capacity of the steam zone, in Btu/ft³-°F.

L_{vdh} = heat of vaporization of water at reservoir pressure in Btu/lb

f_{sdh} = downhole steam quality, fraction

f_p = fraction of injected heat that is produced, fraction.

2. The volume of oil displaced from the steam zone and the heated reservoir beneath it.

$$V_o = \frac{(1 + f_b) \phi (S_{oi} - S_{ors}) f_{sdh} (1 - f_p) i_{st} \rho_w C_w t}{M_s}, \quad (5.14)$$

and $f_b = F \frac{T^* - T_R}{T_s - T_R}$ is obtained from Neuman's graphical solution.

3. The reduced injection rate (i_m) and the downhole steam quality that sustains the steam zone can be determined by solving Eq. 5.15.

$$i_m f_{dm} (1 - f_{pm}) = i_b f_{db} (1 - f_{pb}) \frac{2}{\pi} \tan^{-1} \left(\frac{t^*}{1 - t^*} \right). \quad (5.15)$$

The subscript "b" and "m" represent the injection conditions before and after the heat reduction and t^* is the time at which reduction is begun.

4. The additional oil displaced (V_{oT}) after steam injection is stopped is given by

$$V_{oT} = \frac{2 (T_{s1} - T_R) - (T_{s2} - T_R) V_o}{T_{s1} - T_R}, \quad (5.16)$$

where T_o is the oil displaced from Eq. 5.15 using t^* and subscript 1 and 2 refer to the conditions before and after steam injection is stopped. It is noted that Neuman did not suggest a way to evaluate the value of the fraction injected that is produced (f_p) in Eqs. 5.13 and 5.14. Thus, this value is an adjustable parameter.

Rhee and Doscher⁴⁵ also proposed that the principal direction of steam zone growth is vertically downward. They developed a semi-analytical predictive model based on this approach. The model includes some of the concept of Marx and Langenheim³⁴ and Van Lookeren³⁸. In the model, the heated zone volume and shape were calculated by a rigorous heat balance, the volume and composition were calculated by approximate enthalpy and material balances, and the results were combined with a fluid flow model similar to that of Higgins and Leighton (1960). Although the model showed good agreement with the available experimental data, it is not easy to use due to the sophisticated distillation mechanism and the fluid flow model used.

Jones⁴⁶ developed a simplified predictive model based on Van Lookeren's calculation for optimum steam injection rate and a modification of the Myhill and Stegemeier model for oil production rate. Empirical factors based upon field performance were included to simulate the oil production history at a given steam injection rate.

5.3 New Analytical Model for Injection with Steam Additives

The methods that have been previously discussed involved steam injection growth in radial direction and developed for three dimensional model. A one-dimensional model of steam front velocity and oil production under pure steam injection, and steam injection with additives (propane and petroleum distillate) has been developed to describe the experimental data. The model is used to predict the steam front advancement with respect to time. In this new model, the complex temperature and phase distribution profiles actually present in the cell during steam injection are approximated, as depicted in **Figs. 5.3 and 5.4**. **Fig. 5.3** depicts the new model.

The following simplifying assumptions are made in this present model:

- (1) The sand mix in the injection cell is homogenous.
- (2) The steam zone movement is piston-like outward from the injection point.
- (3) The sand mix temperature profile follows a one-step temperature distribution: steam temperature, T_s , from the injection point until the steam front, where it drops to the original reservoir temperature, T_o .
- (4) Heat loss to the adjacent formation is only by convection and radiation normal to the steam injection path direction.
- (5) Constant heat injection rate, H_s , BTU/D
- (6) Constant injected fluid phase throughout the production.
- (7) Pressure drop in the steam zone is negligible.

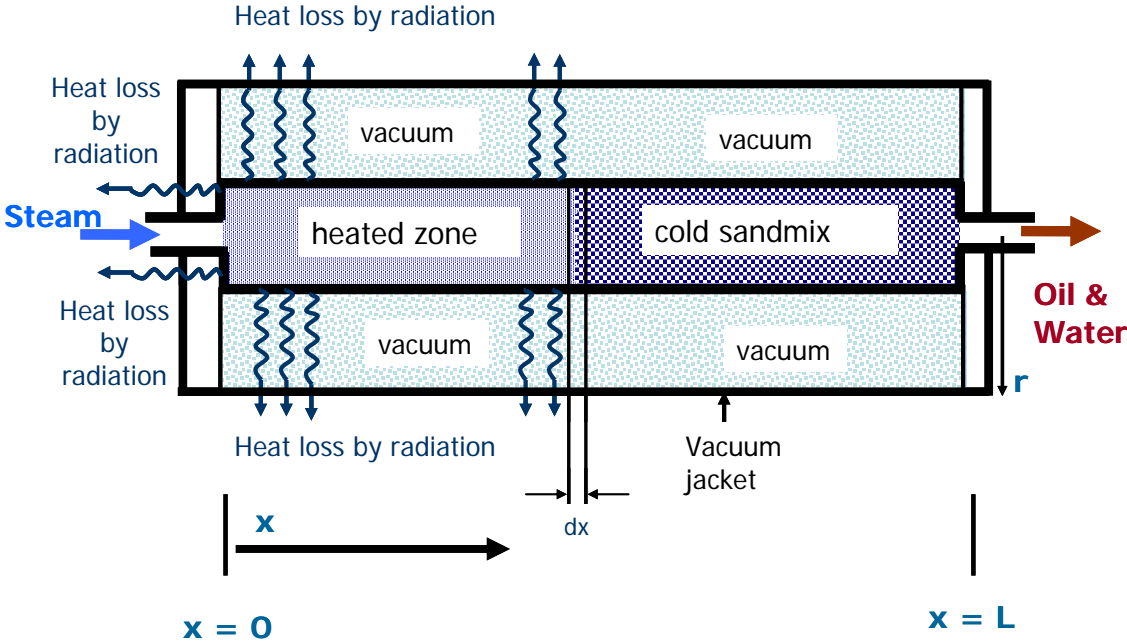


Fig. 5.3- One dimensional heat balance for 1D displacement experiments.

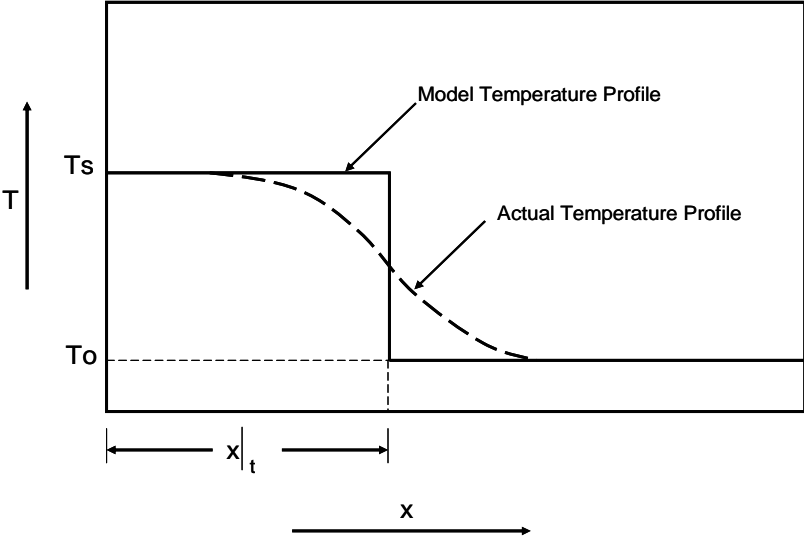


Fig. 5.4- Schematic diagram of model and actual temperature profiles in 1D displacement experiments.

The heat balance based on process as depicted in **Fig. 5.3.** can be expressed as the following:

$$\begin{aligned} &\text{Heat in} - \text{heat loss by radiation/convection} = \\ &\text{heat to raise temperature of element } dx \text{ of sandmix,} \end{aligned} \quad (5.17)$$

Evaluating the heat balance for time period dt gives:

$$\text{Heat in} = H_s dt, \quad (5.18)$$

$$\text{heat loss by radiation for outer wall of cell} = (2 \pi r (T_s - T_o)(x + L_{void})) U, \quad (5.19)$$

$$\text{heat loss by radiation for top flange} = (\pi r^2) U dt, \quad (5.20)$$

$$\begin{aligned} &\text{heat to raise temperature of element } dx \text{ of sandmix} = \\ &\quad \text{heat loss by radiation for outer wall of cell} + \\ &\quad \text{heat loss by radiation for top flange.} \end{aligned} \quad (5.21)$$

$$\text{Thus, } H_s dt - (2 \pi r (T_s - T_o)(x + L_{void}) + \pi r^2) U dt = \pi r^2 M_R (T_s - T_o) dx. \quad (5.22)$$

where:

U = overall coefficient of heat loss, in BTU/(ft-D-°F),

H_s = heat injected into the injection cell, in BTU/D,

L_{void} = length of void space in the top of sandmix (measured after the end of experiment run), cm,

$$M_R = (1 - \phi) C_r \rho_r + \phi S_o C_o \rho_o + \phi S_w C_w \rho_w. \quad (5.23)$$

Multiplying through Eq. 5.22 by $\frac{1}{dt}$ gives:

$$H_s - (2 \pi r (T_s - T_o)(x + L_{void}) + \pi r^2) U = \pi r^2 M_r (T_s - T_o) \frac{dx}{dt}. \quad (5.24)$$

Grouping variables which are independent upon time gives us:

$$A = H_s, \quad (5.25)$$

$$B = -2 \pi r (T_s - T_o) U, \quad (5.26)$$

$$C = -\pi r^2 U, \quad (5.27)$$

$$D = \pi r^2 M_R (T_s - T_o). \quad (5.28)$$

Hence Eq. 5.24 can be written as:

$$A + B (x + L_{void}) = D \frac{dx}{dt}. \quad (5.29)$$

Rearranging Eq. 5.29 gives us:

$$\frac{dx}{dt} = \frac{A + B (x + L_{void}) + C}{D}. \quad (5.30)$$

Rearranging Eq. 5.30 gives us:

$$dt = \frac{D dx}{A + B (x + L_{void}) + C}. \quad (5.31)$$

Integrating Eq. 5.31 gives:

$$t = \int_0^t dt = D \int_0^x \frac{dx}{A + B(x + L_{void}) + C}. \quad (5.32)$$

Assigning the limit of the integer in Eq. 5.32 yields:

$$t = D \ln [A + B (x + L_{void})] + E, \quad (5.33)$$

where E is a constant of integration.

Evaluating at the boundary condition:

$$t = 0 \text{ at } x = L_{\text{void}},$$

then Eq. 5.33 can be rearranged as:

$$E = -D \ln(A + 2B L_{\text{void}} + C). \quad (5.34)$$

Substituting Eq. 5.34 into Eq. 5.33 yields:

$$t = \frac{C}{B} \ln(A + Bx) - \frac{C}{B} \ln A. \quad (5.35)$$

Rearranging Eq. 5.35 gives:

$$\ln \left(\frac{A + B(x + L_{\text{void}}) + C}{A + 2B L_{\text{void}} + C} \right) = \frac{t}{D}. \quad (5.36)$$

Rearranging Eq. 5.36 gives:

$$A + B(x + L_{\text{void}}) + C = (A + 2B L_{\text{void}} + C) e^{t/D}. \quad (5.37)$$

Rearranging Eq. 5.37 gives:

$$x = \frac{(A + 2B L_{\text{void}} + C) e^{t/D} - (A + C)}{B} - L_{\text{void}}. \quad (5.38)$$

Substituting Eqs. 5.25 to 5.28 into 5.38 yields:

$$x = L_{void} + \frac{(H_s - \pi r^2 U) - [H_s - 4 \pi r (T_s - T_o) U L_{void} - \pi r^2 U] e^{t/\pi r^2 M_R (T_s - T_o)}}{2 \pi r (T_s - T_o) U}. \quad (5.39)$$

Although Eq. 5.24 can be derived and takes final form as expressed in Eq. 5.39, in calculation routine however, Eq. 5.24 is used by simply discretizing it. The analytical solution of Eq. 5.24 as expressed in Eq. 5.39 is restricted by a critical assumption which is constant injection temperature T_s (and H_s) throughout the entire run. It is decided to directly apply the Eq. 5.24 rather than Eq. 5.39 due to the fact that in reality, H_s (the amount heat injected to the cell) depends upon time, t . This causes Eq. 5.24 to be non-linear equation. The second reason is that the small time interval (30 seconds) recorded for the experimental run is sufficiently small to be used as dt . Thus, the interval time can be treated as dt , hence Eq. 5.24 can be used to solve for dx . The distance from the top of sand mix to the steam front, x , is then computed by performing summation of the elemental form of x , dx . Performing direct calculation by discretizing Eq. 5.24 avoids the numerical fail criteria. Furthermore, H_s can be computed independently using table lookup of steam table, and the injected fluid phase of the current time step can also be determined. The table lookup routine to obtain the value of H_s and current fluid phase involves interpolation programming procedure of large steam table. In applying Eq. 5.24, the backward difference scheme is used to obtain dt based on the experimental data. From Eq. 5.24, the following expression for x_j at time index j is used to calculate steam front location:

$$x_j = \sum_{i=1}^j \frac{\{H_{s_i} - [2 \pi r (T_{s_i} - T_o)(x_i + L_{void}) + \pi r^2] U - \pi r^2 M_R (T_{s_i} - T_o)\} (t_{i+1} - t_i)}{\pi r^2 M_R (T_{s_i} - T_o)}. \quad (5.40)$$

The total fill-up time ($t_{f_{total}}$) occurs during the experimental work is incorporated to the calculation using the analytical model. The total fill-up time comprises in two parts. The first part is due to the void space created during high pressure difference in the top part sand mix, $t_{f_{sandmix}}$. The void space is translated into time required for the steam

to travel from the mid of the flange to the top of the sand mix that has been pushed during the experimental run due to the high pressure difference mainly occurring during the early production time. Thus, $t_{fusandmix}$ can be expressed as the following:

$$t_{fusandmix} = \frac{V_{sandpack} \times \phi \times S_g'}{i_s}, \quad (5.41)$$

where:

$$S_g' = S_g \times \frac{P_{atm}}{P_{inj}} \times \frac{T_{inj}}{T_{atm}}. \quad (5.42)$$

The second part of the fill-up time is caused by the time required to warm up the top of the flange cap (t_{flange}). And t_{flange} is modeled using this following relation:

$$\int_0^t H_s dt = M_f (T_s - T_o), \quad (5.43)$$

where $M_f = \pi r_f^2 h_f \rho_f c_f$, then the total fill-up time is computed as:

$$t_{ftotal} = t_{fusandmix} + t_{flange}. \quad (5.44)$$

Steam front calculation is started in the total fill-up time.

The cumulative oil production can be calculated using two approaches. The first approach is to apply material balance (assuming a piston-like displacement occurs as steam is injected through the porous media) and the second approach is to apply Darcy's Law and manipulate it to obtain cumulative oil production.

The first approach is used by applying the steam front distance, x , to calculate, the cumulative oil production. The material balance equation that couples the present steam velocity model is explained in details as the following:

$$N_p = V_{swp} (S_{oi} - S_{or}), \quad (5.45)$$

where V_{swp} = area swept by steam and can be expressed as the following:

$$V_{swp} = \pi r^2 x \phi . \quad (5.46)$$

Substituting Eqs. 5.46 into 5.45 gives:

$$N_p = \pi r^2 \phi x (1 - S_{wc} - S_{gi} - S_{or}). \quad (5.47)$$

The distance of steam front from sand mix top, x , is obtained by using Eq. 5.16 hence we can directly predicted N_p .

The second approach is to use Darcy's Law such that N_p can be expressed as the following relationship:

$$N_p = J \int_0^t (p_i - p_o) dt , \quad (5.48)$$

numerically,

$$N_{p_j} = \sum_{i=1}^j J (p_i - p_o), \quad (5.49)$$

where J is productivity index and given by the following:

$$J = \frac{\pi r^2 k k_{ro}}{\mu_o (L - x - L_{void})} . \quad (5.50)$$

In the model, pressure drop in the steam zone is negligible and is only across the oil zone. Thus J is inversely proportional to μ_o , that is

$$J = \frac{C}{\mu_o (L - x - L_{void})}, \quad (5.51)$$

where C is a constant found by history-matching cumulative oil production for pure steam injection runs, knowing μ_o at initial cell temperature.

Combining Eqs. 5.49 and 5.51 gives us:

$$N_{pj} = C \sum_{i=1}^j \frac{(p_i - p_o)_i}{(L - x - L_{void})}. \quad (5.52)$$

Later, by applying both method to calculate N_p , it is decided to use Eq 5.52 (Darcy's Law approach) to model N_p with respect to time, t . The pseudo productivity index (C) is obtained by history-match the N_p calculated by analytical model with the N_p obtained from the experimental data. After the "matched" C is achieved, the same value of C will be used for the rest of cumulative oil production calculation under steam-propane and steam-petroleum distillate injection conditions. However, in order to obtain a good match for steam with additives runs, $\bar{\mu}_0$ is modified to get a match between analytical model and experimental results. **Fig. 5.5** depicts the flow chart of analytical model and experimental data history-matching process.

The analytical model requires a rather tedious computation, hence, a program written in Visual Basic is developed to generate the result of steam front advancement and cumulative oil production based on the analytical model, and display that composite plot of analytical model results and experimental data. The program and data input for the program is attached in **Appendices E** and **F** respectively.

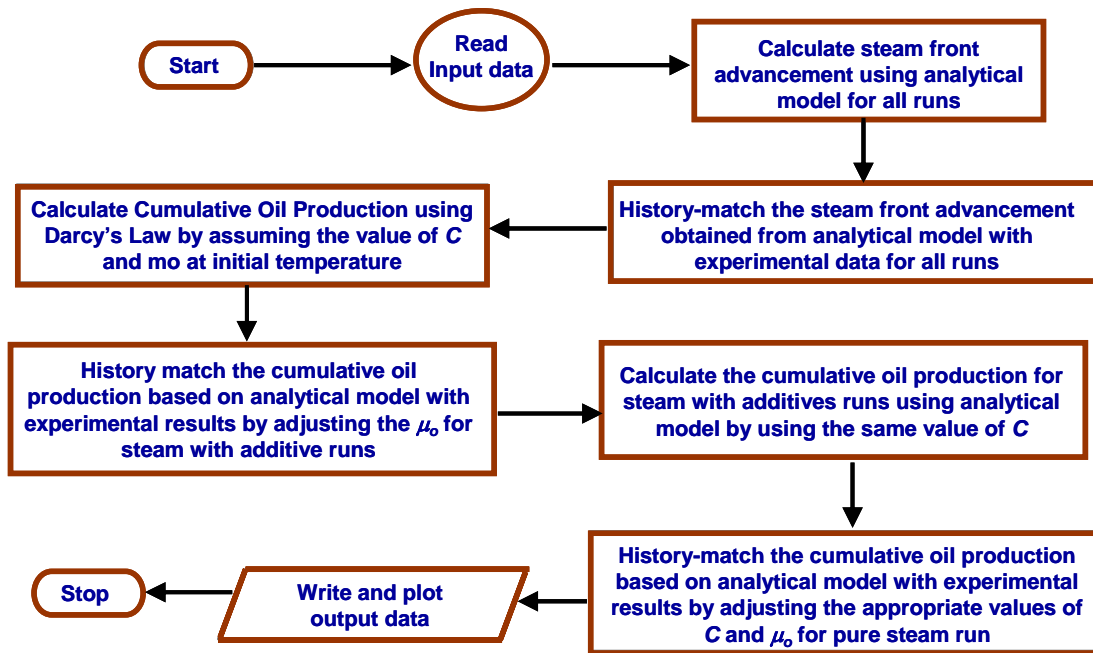


Fig. 5.5- Flow Chart of Analytical Model and Experimental Data History-Matching Process.

5.4 Comparison and Discussion of Experimental and Analytical Model Results

Figs. 5.6-5.7 shows plots of the distance of steam front from sand mix and cumulative oil production, respectively for each runs.

The steam front position for run 3 (propane:steam = 5:100) using analytical model shows an excellent agreement to analytical model, as depicted in **Fig. 5.6**. The analytical model trend for middle time tends to deviate and give higher prediction of steam front position as compared to experimental data. The cumulative oil production plot for both experimental and predictive analytical model for run 3 is shown in **Fig. 5.7**. The analytical model trend agrees with the experimental data for early and late time.

The experiments using pure steam (run 4 and 5) yield similar trends for steam front position. These results are expected since both runs are using pure steam, and performed in the same conditions. Cumulative oil production calculated using analytical

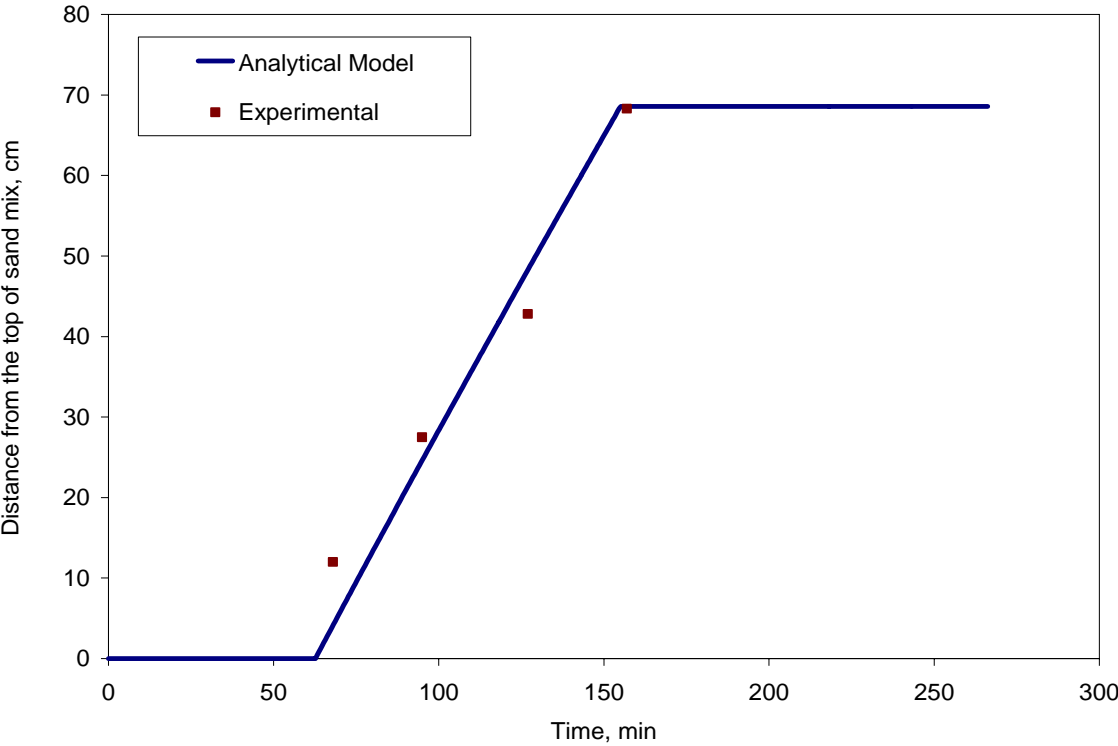


Fig. 5.6- Steam front position for Run 3 (propane:steam = 5:100).

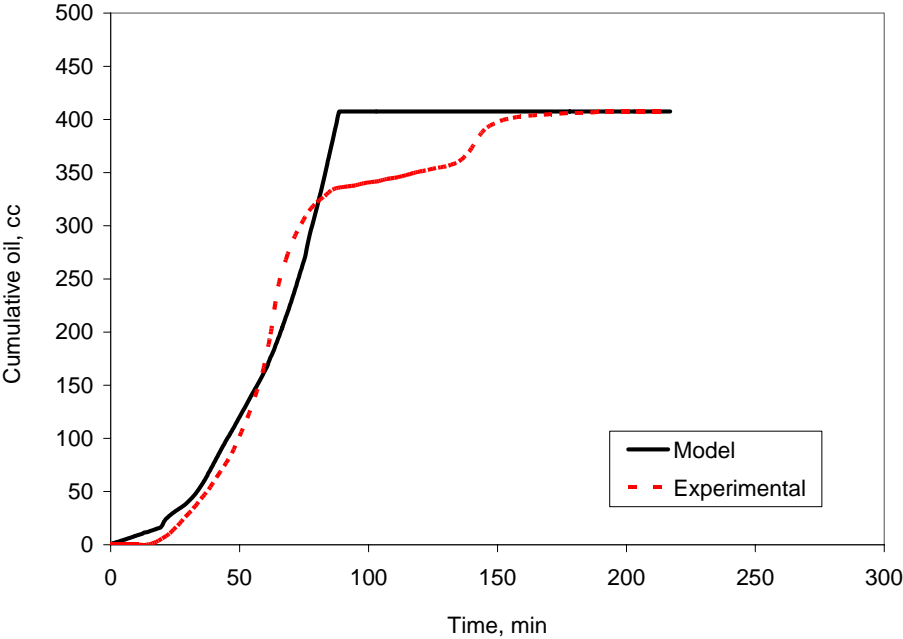


Fig. 5.7- Cumulative oil production for Run 3 (propane:steam = 5:100).

model and experimental data show excellent matches for the entire production time run no. 4 and 5. The plots are depicted in **Figs. 5.7-5.11**. In terms of steam front advancement, the analytical models for both runs yield 25% higher in average for those data in early production time. However, this overestimated trend of steam front position is vanishing at approximately 110 minutes of production time.

Run 6 (5:100 petroleum distillate:steam) is a repeat of run 3. As it is expected, the data for both analytical model and experimental runs show a similar trend for both runs. Both steam front advancement and cumulative oil production give an excellent match as depicted in **Figs. 5.12** and **5.13**.

The experiments runs utilizing petroleum distillate along with the steam (run 7 and 8) yield an excellent match for both steam front position and cumulative oil production profile. These results are expected since both runs are using petroleum distillate as an additive due both were performed using the same conditions. The plots are depicted in **Fig. 5.14-5.17**. In terms of steam front advancement, the analytical models for run 7 yield 12% higher in average for those data in early and middle production time. However, this overestimated trend of steam front position is vanishing at approximately 120 minutes of production time. For run 7, the analytical model shows an excellent of cumulative oil production as compared to experimental data. Run 8 gives yields 18% higher steam front advancement values compared to experimental data. Nevertheless, analytical model for cumulative oil production profile meets a good agreement with the experimental data for run 8.

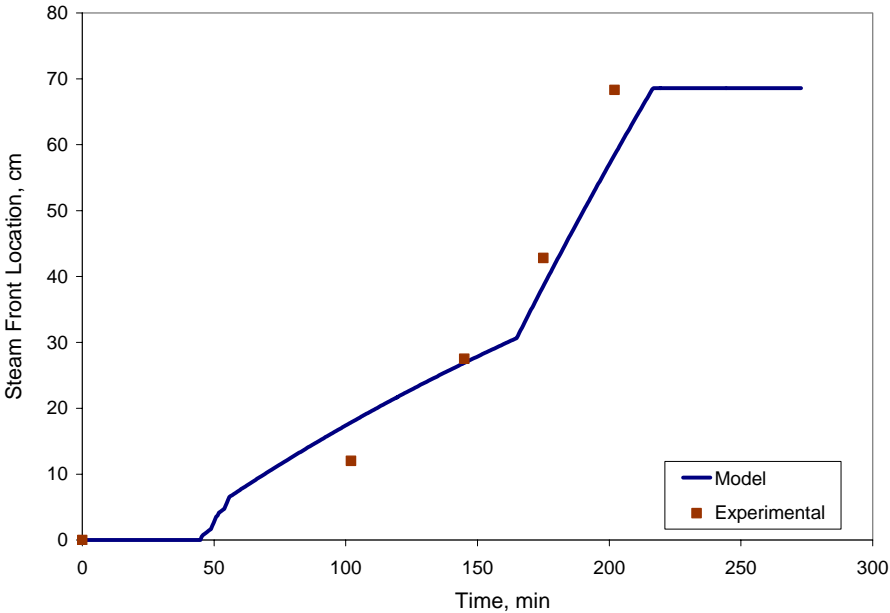


Fig. 5.8- Steam front position for Run 4 (pure steam).

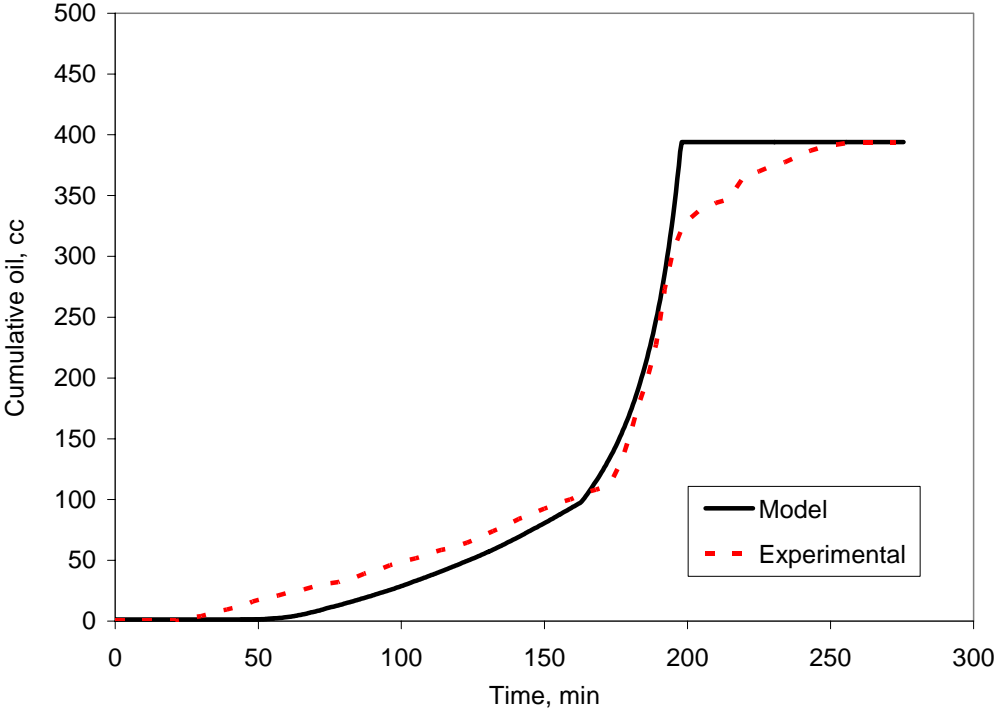


Fig. 5.9- Cumulative oil production for Run 4 (pure steam).

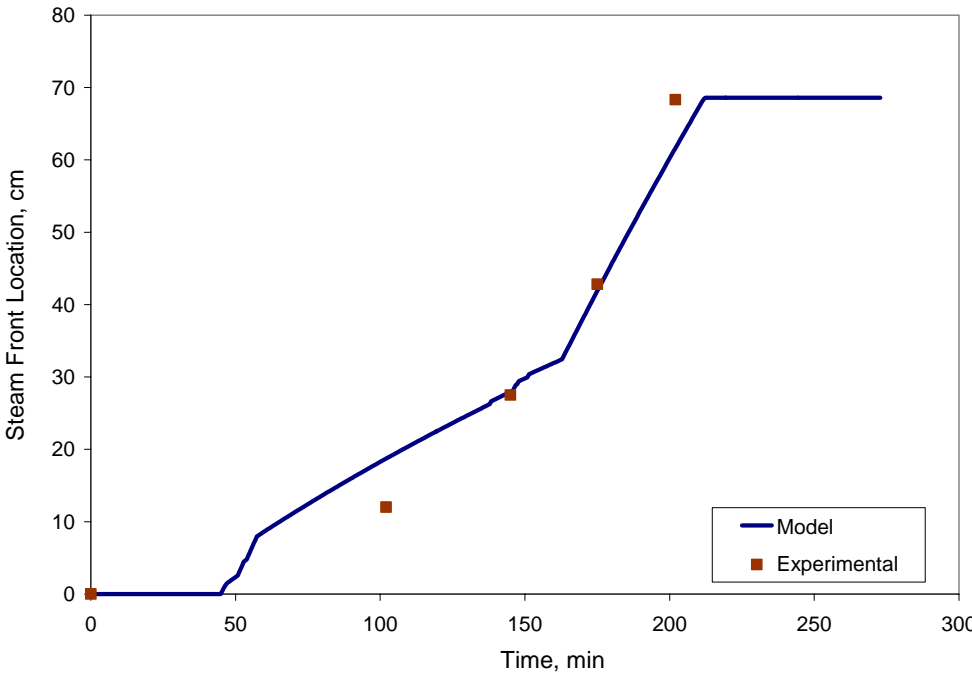


Fig. 5.10- Steam front position for Run 5 (pure steam).

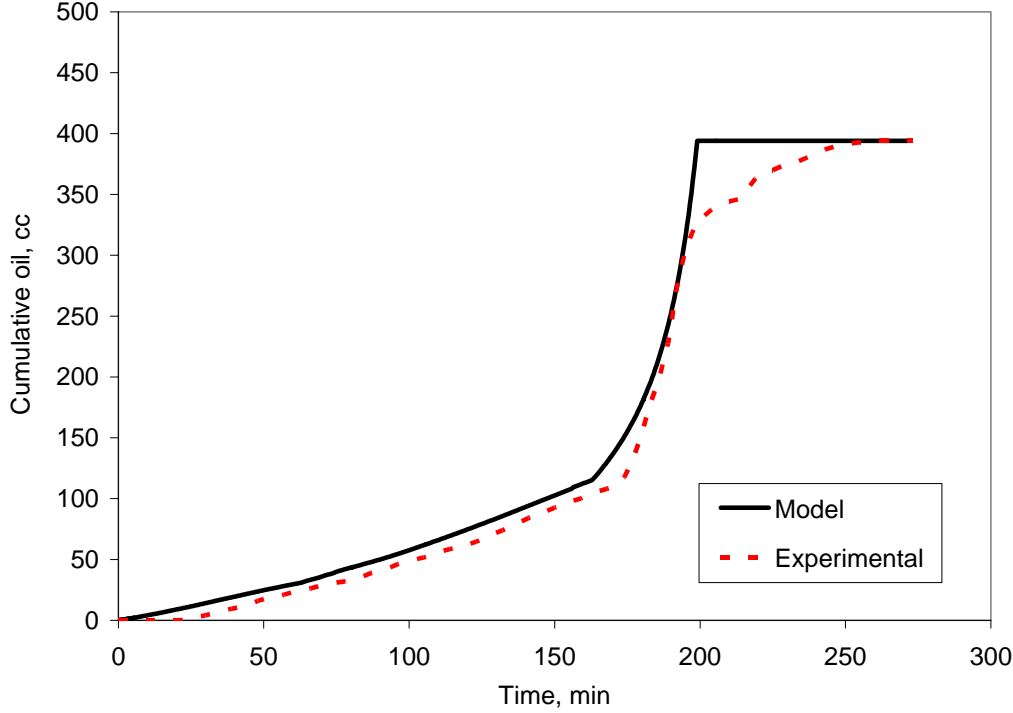


Fig. 5.11- Cumulative oil production for Run 5 (pure steam).

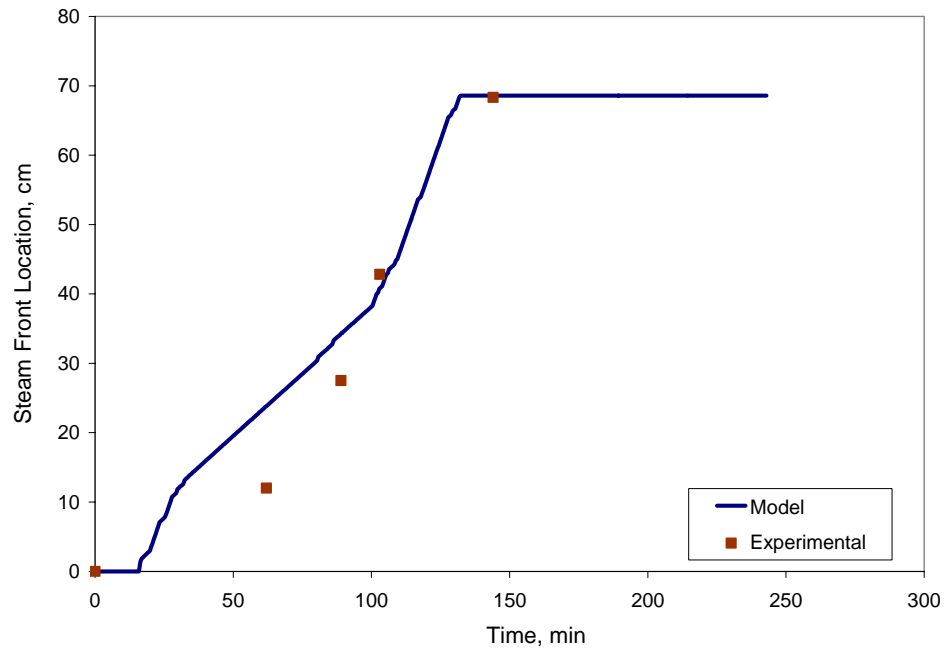


Fig. 5.12- Steam front position for Run 6 (propane:steam = 5:100).

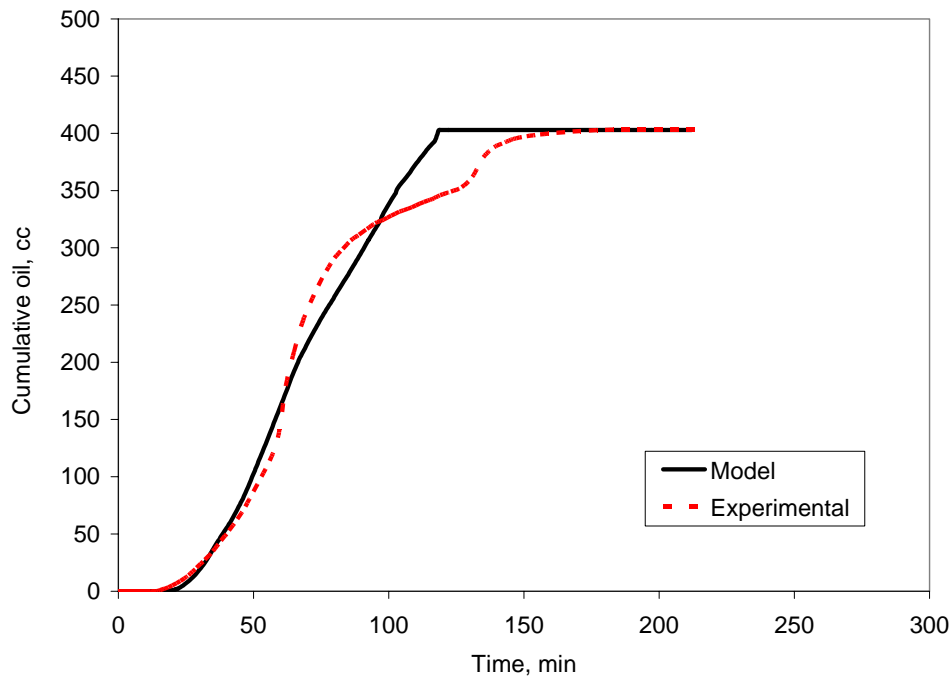


Fig. 5.13- Cumulative oil production for Run 6 (propane:steam = 5:100).

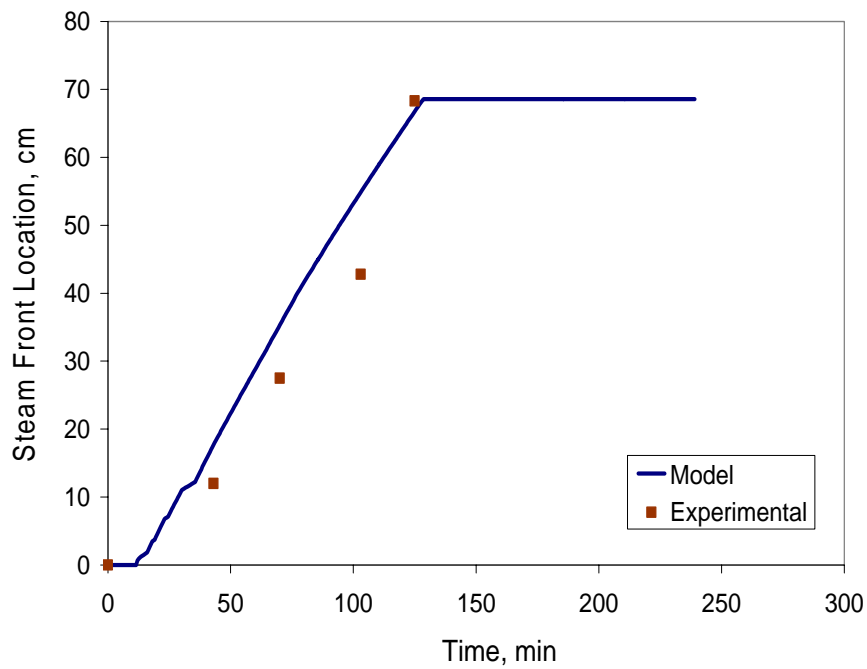


Fig. 5.14- Steam front position for Run 7 (petroleum distillate:steam = 5:100).

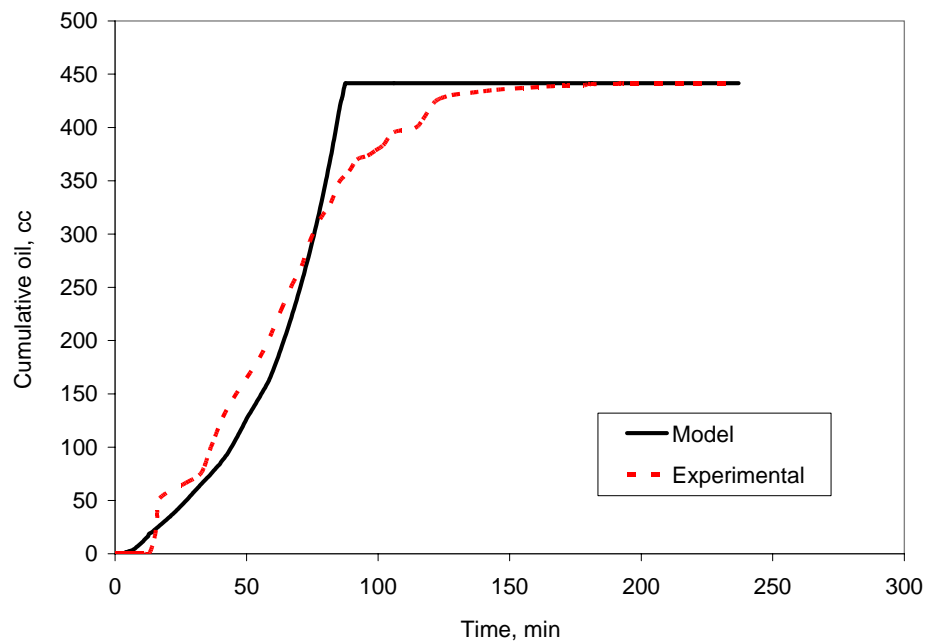


Fig. 5.15- Cumulative oil production for Run 7 (petroleum distillate:steam = 5:100).

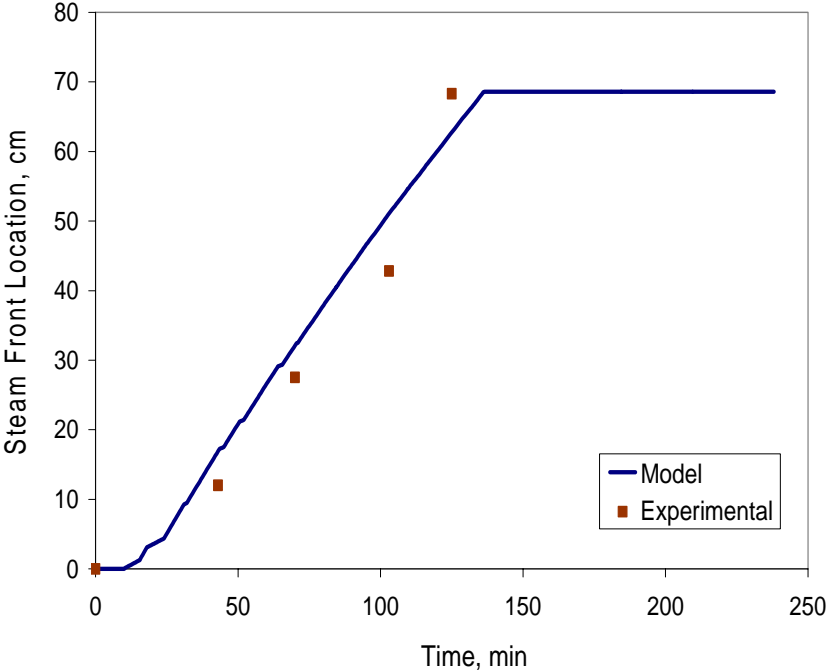


Fig. 5.16- Steam front position for Run 8 (petroleum distillate:steam = 5:100).

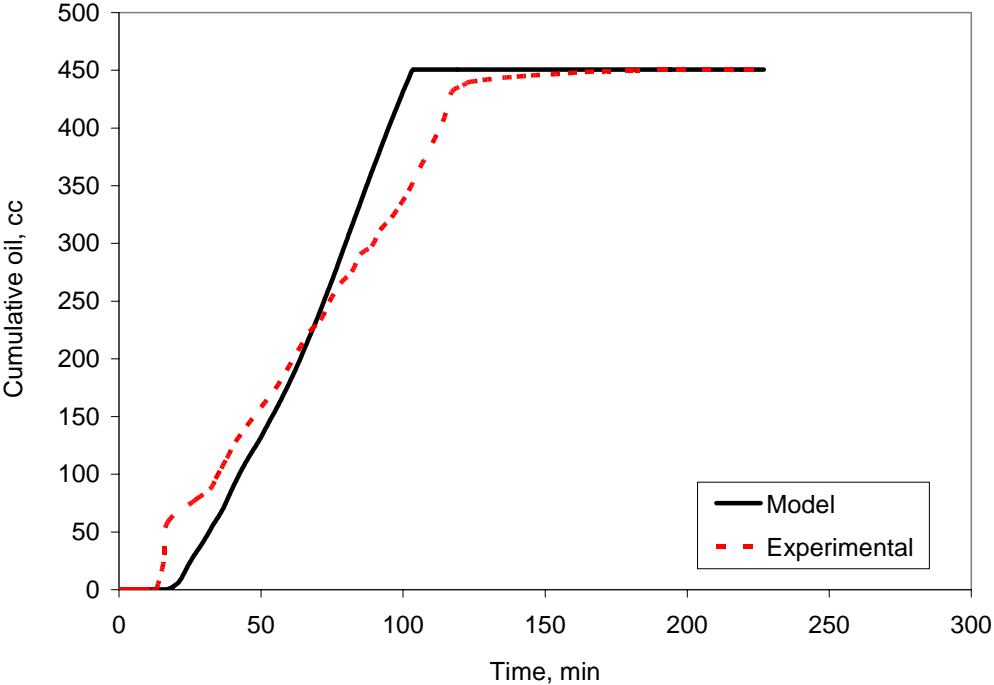


Fig. 5.17- Cumulative oil production for Run 8 (petroleum distillate:steam = 5:100).

CHAPTER VI

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

Six successful runs were performed to investigate the feasibility of using propane and petroleum distillate as steam additives to improve injectivity and accelerate oil recovery for San Ardo oil. The injection rate was kept constant at 5.5 ml/min (cold water equivalent), along with a constant backpressure of 260 psig. Propane:steam and petroleum distillate:steam mass ratios of 5:100 were used in the experiments.

An analytical model to describe steam front advancement and cumulative oil production with respect time was developed. The model is based on heat and material balance and Darcy's Law in one dimensional displacement of oil. The analytical model results and experimental data show very satisfactory history match, verifying validity of the new model.

6.2 Conclusions

1. The use of propane as an additive to steam resulted in injection pressures lower than those of pure steam injections. On average, the differential pressure for the steam propane runs is 69 psig. In contrast, the pure steam runs have a differential pressure (average) of 97 psig. This represents an increase of steam injectivity of up to 140% with steam-propane injection.
2. Improvement of injectivity is also found for runs using petroleum distillate as an additive to steam. The average differential pressure for the steam-petroleum distillate runs is 51 psig. This yields an increase of steam injectivity up to 190% with steam-petroleum distillate injection.
3. Ultimate oil recovery is found to be higher for experimental runs using petroleum distillate as an additive (51% OOIP) followed by propane as the additive (46% OOIP) compared to that with pure steam (41% OOIP).

4. Start of oil production is accelerated when propane and petroleum distillate is added to steam. Average start of oil production of 17 minutes and 14 minutes are observed in the steam-propane and steam-petroleum distillate runs respectively. On the other hand, the average start of oil production for the pure steam runs is 26 minutes.
5. API gravity of the produced oil in all runs tended to increase. For pure steam runs the API gravity increases from 12°API for the original oil to 13.5°API, followed by increases up to 14 and 14.5°API for steam-propane and steam-petroleum distillate runs respectively.
6. The produced oil viscosity decreased for all runs. For pure steam runs, oil viscosity decreases at 50°C from 2800 cp for the original oil to 2100 cp. The produced oil viscosity decreases to 2000 cp and 1800 cp for steam-propane and steam-petroleum distillate respectively.
7. The fastest steam front propagation occurs in steam-petroleum distillate runs, followed by steam-propane and pure steam injection runs. This fact can explain the acceleration in oil production that is observed when petroleum distillate and propane is added to steam. The analytical model of steam front propagation also indicates the same result.
8. The new analytical model of steam front propagation yields a good match with experimental data. The cumulative oil production prediction using the analytical model also gives a good history match. In the model, the average viscosity at initial cell temperature, 2281 cp, is reduced to 261 cp for steam propane runs and 227 cp for steam-petroleum distillate runs. This confirms that these steam additives are effective carrier gas.
9. Petroleum distillate is cheaper (116.6 cents per gallon) as compared to propane (128.6 cents per gallon)⁴⁵. Considering the same weight of additive that will be used during the experiment, injecting petroleum distillate as a slug is easier than injecting liquid propane. Thus, using petroleum distillate as an additive appears to be more economical than propane.

6.3 Recommendations

1. Repeat experiments, using another amount of petroleum distillate to decide the optimum ratio that gives the best oil rate and cumulative production.
2. In the analytical model, apply relative permeability data to accurately model the rate profile and effect of multiphase flow in porous media.
3. The use of petroleum distillate slug as an additive is promising in the sense that operationally it is easier to handle as compared to propane and may lead to more economical operations considering it is cheaper than propane.
4. It has been established that steam-petroleum distillate injection accelerates the oil production and slightly increases the oil recovery. In the field, injecting petroleum distillate continuously may lead to a better upgrading of oil production and yield a higher recovery.

NOMENCLATURE

A = cross sectional area, L^2

C_r = specific heat of rock, BTU/lb-°F

C_o = specific heat of oil, BTU/lb-°F

C_w = specific heat of water, BTU/lb-°F

dt = time interval, day

dx = incremental steam front distance, ft

ΔP = differential pressure, m/Lt²

f_{sdh} = steam quality, fraction

f_p = fraction of injected heat that is produced, fraction

ϕ = porosity, fraction

H_s = heat injected into the injection cell, BTU/D

I = injectivity, $L^3/m/Lt^2$

i_m = steam injection rate, BTU/lb

K = effective permeability, L^2

L_{void} = length of void space in the top of sandpack, cm

L = length of porous media, L^2

M_R = volumetric heat capacity of the reservoir, BTU/(ft³-°F)

μ = fluid viscosity, m/Lt

N_p = cumulative oil production, standard cm³

p_{atm} = pressure at atmospheric condition = 14.7 psia

ρ_r = rock grain density, lb/ft³

ρ_o = oil density, lb/ft³

ρ_w = water density, lb/ft³

T_{atm} = temperature at atmospheric condition = 460 + 70 = 530°R

p_i = injection pressure, psig

p_o = outlet pressure, psig

Q_{inj} = injection rate, L³/t

r = radius of the injected cell, ft

S_{wc} = water connate saturation, fraction

S_g = gas saturation, fraction

S_{gi} = initial gas saturation, fraction

T_s = injection temperature, °F

T_o = original reservoir temperature, °F

U = overall coefficient of heat loss, BTU/(ft-D-°F)

x = distance of steam front from the top of sand mix, ft

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APPENDIX A

CALCULATION OF FLUID SATURATIONS AND PORE VOLUME

The following is a sample calculation of the fluid saturations and pore volume inside the cell. The calculations are made for run 4.

1. Cell dimension:

diameter, $d = 7.376$ cm

height, $h = 66.08$ cm

Since the cell is cylindrical, the volume of the cell is:

$$V_{cell} = 2823.59 \text{ cm}^3$$

2. The total weight of mixture (W_{mix}):

Weight of sand, $W_{sand} = 5141$ g

Weight of water, $W_{water} = 226$ g

Weight of oil, $W_{oil} = 1000$ g

$$W_{mix} = W_{sand} + W_{water} + W_{oil}$$

$$W_{mix} = 5141 + 226 + 1000 \text{ g} = 6367 \text{ g}$$

3. The weight of mixture inside the cell, W_{mix} in cell

Weight of empty cell = 4339 g

Weight of cell with mixture inside = 9798 g

Weight of oil left over 24 hrs cell heating = 50 g

Weight of mixture inside the cell, $W_{mixcell} = 9798 - 4339 - 50 = 5409$ g

4. Since the mixture is homogenous, the proportions of sand, water and oil remain constant before and after packing. The amount of each component inside the cell is then calculated below:

$$\text{Weight of sand inside the cell, } W_{\text{sand}} = \frac{W_{\text{mixcell}}}{W_{\text{mix}}} W_{\text{sand}} = \frac{5409 \text{ g}}{6317 \text{ g}} \times 5141 \text{ g} = 4402 \text{ g}$$

$$\text{Weight of water inside the cell, } W_{\text{water}} = \frac{W_{\text{mixcell}}}{W_{\text{mix}}} W_{\text{water}} = \frac{5409 \text{ g}}{6317 \text{ g}} \times 226 \text{ g} = 192 \text{ g}$$

$$\text{Weight of oil inside the cell, } W_{\text{oil}} = \frac{W_{\text{mixcell}}}{W_{\text{mix}}} W_{\text{oil}} = \frac{5409 \text{ g}}{6317 \text{ g}} \times 1000 \text{ g} = 850 \text{ g}$$

5. The sand density, $\rho = 2.65 \text{ g/cm}^3$. Thus,

$$\text{Volume of sand inside the cell} = \frac{W_{\text{sandcell}}}{\rho_{\text{sand}}} = \frac{4402}{2.65} = 1661 \text{ g}$$

6. Porosity inside the cell is calculated as the following:

$$\phi = \frac{V_{\text{cell}} - V_{\text{sandcell}}}{V_{\text{cell}}} = \frac{2824 - 1661}{2824} = 0.4117$$

7. The original San Ardo oil has an oil gravity of 12°API which is equivalent 0.9861 g/cm^3 . Water and oil volumes inside the cell are calculated by:

$$V_{\text{watercell}} = \frac{W_{\text{watercell}}}{\rho_{\text{water}}} = \frac{192}{1} = 192 \text{ cm}^3$$

$$V_{\text{oilcell}} = \frac{W_{\text{oilcell}}}{\rho_{\text{oil}}} = \frac{862}{0.9862} = 862 \text{ cm}^3$$

8. The pore volume of the cell is calculated as the following:

$$V_{\text{pcell}} = V_{\text{cell}} \times \phi = 2824 \times 0.4117 = 1162 \text{ cm}^3$$

9. The saturation of oil (S_o) and water (S_w) are calculated as the following:

$$S_w = \frac{V_{\text{watercell}}}{V_{\text{pcell}}} = \frac{192}{1162} = 0.1652$$

$$S_o = \frac{V_{\text{oilcell}}}{V_{\text{pcell}}} = \frac{862}{1162} = 0.7411$$

10. The nitrogen saturation (S_g) is calculated as the following:

$$S_g = 1 - S_w - S_o = 1 - 0.1652 - 0.7411 = 0.0937$$

11. The nitrogen volume in cell is calculated as the following:

$$V_{aircell} = S_g \times V_{pcell} = 0.0937 \times 2824 = 109 \text{ cm}^3$$

12. The fill-up time, t_{fu} is calculated by:

Steam injection rate, $i_s = 5.5 \text{ cm}^3/\text{min}$

$$t_{fu} = \frac{\text{Air pore volume}}{i_s} = \frac{109}{5.5} = 19.8 \text{ min}$$

APPENDIX B

TEMPERATURE AND PRESSURE DATA

The data in the following table is:

T-steam: Steam injection temperature at 30.5 cm from the top of thermocouples sheat

T1 : Temperature at 45.1 cm from the top of thermocouples sheat

T2 : Temperature at 60.2 cm from the top of thermocouples sheat

T3 : Temperature at 75.7 cm from the top of thermocouples sheat

T4 : Temperature at 91 cm from the top of thermocouples sheat

T5 : Temperature at 116.5 cm from the top of thermocouples sheat

Pinj : Injection pressure

Pout : Production pressure

Qinj : Propane injection rate

Vw : water injection rate

TABLE B1. PRESSURE AND TEMPERATURE DATA FOR RUN 3 (PROPANE:STEAM = 5:100).

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
0.0512	235.59	60.89	52.06	53.90	53.87	49.92	278.55	261.93	0.2748	5.5347
0.5455	254.67	166.49	52.06	54.02	53.87	49.99	288.36	266.00	0.2757	5.5826
1.0453	263.17	205.57	52.10	54.12	53.97	50.04	325.14	270.74	0.2756	5.5617
1.5452	269.27	209.03	52.14	54.18	54.03	50.05	344.16	272.44	0.2748	5.5415
2.0440	264.85	210.19	52.16	54.22	54.05	50.03	335.65	270.98	0.2743	5.5314
2.5438	262.14	210.14	52.15	54.22	54.03	50.01	316.01	270.24	0.2760	5.5579
3.0447	258.76	210.86	52.09	54.18	54.03	50.01	307.27	269.93	0.2763	5.5705
3.5453	255.19	211.26	52.04	54.20	54.03	50.02	303.15	269.70	0.2763	5.5677
4.0452	249.87	211.79	52.09	54.21	54.05	50.04	302.49	269.73	0.2768	5.5338
4.5450	243.72	211.60	52.29	54.23	54.05	50.04	300.54	269.88	0.2774	5.5221

TABLE B1.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
5.0448	235.41	210.01	52.40	54.23	54.06	50.06	298.98	270.01	0.2756	5.5433
5.5455	229.93	208.65	52.42	54.27	54.06	50.04	297.30	269.82	0.2766	5.5828
6.0453	226.60	208.18	52.42	54.30	54.04	50.04	296.81	269.79	0.2770	5.5521
6.5452	224.27	208.42	52.46	54.30	54.06	50.04	297.68	269.76	0.2760	5.5337
7.0450	225.10	208.65	52.48	54.32	54.04	50.04	291.35	269.88	0.5374	5.5291
7.5448	229.91	208.86	52.48	54.31	54.04	50.02	294.53	269.91	0.2701	5.5744
8.0447	234.68	208.60	52.50	54.31	54.04	50.02	294.26	269.71	0.2760	5.5872
8.5453	235.12	209.31	52.55	54.29	54.06	50.02	294.03	269.56	0.2739	5.5738
9.0452	232.65	210.26	52.63	54.30	54.04	50.02	295.52	269.52	0.2761	5.5451
9.5450	231.67	210.92	52.73	54.25	54.04	50.02	298.58	269.58	0.2765	5.5413
10.0458	231.09	211.81	52.86	54.23	54.06	50.06	301.84	270.24	0.2766	5.5335
10.5447	232.67	212.01	53.03	54.23	54.08	50.08	306.28	270.52	0.2756	5.5965
11.0455	232.88	211.69	53.26	54.23	54.07	50.08	305.71	270.56	0.2766	5.5799
11.5453	232.31	211.44	53.50	54.21	54.07	50.06	307.17	270.50	0.2758	5.5428
12.0450	232.70	210.88	53.86	54.24	54.07	50.07	304.84	270.36	0.2763	5.5274
12.5448	235.26	210.66	54.28	54.24	54.09	50.05	309.70	270.11	0.2758	5.5316
13.0457	231.77	211.45	54.54	54.22	54.11	50.05	311.76	270.37	0.2761	5.5575
13.5455	232.44	211.86	54.98	54.22	54.18	50.07	315.41	270.54	0.2761	5.5484
14.0443	232.53	211.91	55.55	54.20	54.24	50.09	317.24	270.54	0.2764	5.5162
14.5452	232.98	211.77	56.13	54.18	54.27	50.08	319.75	270.54	0.2757	5.4871
15.0450	237.26	211.96	56.72	54.17	54.27	50.10	323.12	270.41	0.2747	5.5375
15.5457	232.08	212.55	57.23	54.15	54.27	50.08	324.67	270.33	0.2762	5.5236
16.0455	231.32	212.60	57.93	54.15	54.25	50.10	324.22	270.39	0.2760	5.5252
16.5453	232.97	213.01	58.63	54.13	54.24	50.11	326.68	270.33	0.2762	5.5343
17.0452	232.50	213.51	59.24	54.13	54.24	50.17	330.48	270.34	0.2758	5.5559
17.5440	232.43	213.67	60.01	54.14	54.26	50.34	327.19	269.98	0.2753	5.5800
18.0457	234.40	213.74	60.77	54.12	54.27	50.47	329.79	257.31	0.2759	5.5625
18.5447	236.17	214.58	61.60	54.10	54.31	50.56	332.88	264.90	0.2756	5.5428
19.0453	234.46	214.25	62.45	54.12	54.34	50.59	325.91	253.94	0.2759	5.5299
19.5452	234.53	214.20	63.28	54.08	54.38	50.63	325.66	259.36	0.2763	5.5556
20.0450	236.80	214.62	64.05	54.05	54.38	50.57	330.65	262.13	0.2761	5.5807
20.5448	233.81	214.19	64.80	54.05	54.41	50.55	324.04	254.73	0.2746	5.5627
21.0447	234.06	213.94	65.71	54.07	54.45	50.55	325.41	254.29	0.2749	5.5597
21.5453	234.07	213.86	66.55	54.05	54.46	50.54	322.64	253.12	0.2757	5.5270
22.0452	234.23	213.89	67.40	54.06	54.48	50.54	323.39	253.15	0.2754	5.5205
22.5450	233.67	213.87	68.26	54.06	54.51	50.57	322.33	252.75	0.2755	5.5539
23.0448	233.99	213.83	69.26	54.07	54.55	50.59	322.75	252.95	0.2727	5.5698
23.5455	234.42	213.90	70.29	54.07	54.58	50.66	323.37	252.38	0.2758	5.5568
24.0453	233.46	214.04	71.15	54.08	54.60	50.77	322.89	254.00	0.2753	5.5187
24.5452	232.40	214.05	72.20	54.10	54.59	50.79	323.53	252.86	0.2757	5.5382
25.0442	232.56	214.16	73.27	54.11	54.59	50.86	321.75	254.09	0.7071	5.5726
25.5448	233.33	214.03	74.26	54.15	54.60	50.87	319.48	254.08	0.1894	5.5913
26.0457	232.77	214.01	75.25	54.16	54.62	50.93	324.05	254.69	0.2778	5.5628
26.5453	232.26	214.27	76.19	54.20	54.60	50.98	315.99	256.32	0.2757	5.5313
27.0443	231.47	214.63	77.25	54.23	54.63	50.99	317.36	255.91	0.2756	5.5325
27.5450	230.73	214.77	78.68	54.28	54.61	51.05	322.84	256.83	0.2772	5.5568
28.0448	232.04	214.96	80.25	54.34	54.62	51.10	323.31	261.20	0.2758	5.5745
28.5457	231.69	214.87	81.83	54.39	54.64	51.13	323.37	261.22	0.2764	5.5481
29.0455	232.58	214.93	83.33	54.42	54.63	51.15	326.15	260.07	0.2764	5.5279
29.5453	231.70	214.96	84.71	54.47	54.63	51.22	329.88	259.54	0.7071	5.5243

TABLE B1.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
30.0450	231.25	215.09	86.18	54.55	54.66	51.27	326.76	258.38	0.3634	5.5693
30.5448	231.71	214.96	87.65	54.62	54.70	51.29	327.79	260.21	0.2780	5.5626
31.0457	231.44	214.59	89.32	54.71	54.73	51.38	327.80	259.12	0.2772	5.5440
31.5455	232.22	214.95	90.62	54.78	54.74	51.39	324.86	257.50	0.2773	5.5162
32.0453	231.75	215.41	91.94	54.83	54.74	51.47	329.15	259.90	0.2762	5.5296
32.5460	230.60	215.08	93.70	54.94	54.77	51.48	328.29	260.64	0.2753	5.5769
33.0440	231.49	215.24	95.63	55.03	54.81	51.53	325.16	259.86	0.2767	5.5700
33.5457	230.79	215.18	97.37	55.14	54.82	51.55	328.64	260.83	0.2758	5.5412
34.0445	231.00	215.21	99.29	55.23	54.83	51.60	329.77	260.51	0.2761	5.5153
34.5453	230.58	215.17	101.29	55.36	54.87	51.63	329.54	260.59	0.2764	5.5361
35.0452	230.33	215.10	103.40	55.49	54.86	51.68	329.50	260.64	0.2746	5.5467
35.5450	230.86	214.90	105.68	55.62	54.88	51.74	329.69	260.89	0.7068	5.5537
36.0457	231.22	214.75	107.84	55.77	54.93	51.79	328.72	261.20	0.2785	5.5409
36.5455	231.03	214.80	109.90	55.91	54.94	51.82	329.34	260.44	0.2762	5.5216
37.0453	230.54	214.68	111.87	56.04	54.96	51.88	323.51	259.92	0.2770	5.5453
37.5452	229.95	215.07	114.05	56.19	54.97	51.91	325.97	259.78	0.2772	5.5500
38.0440	230.43	214.78	117.03	56.33	54.97	51.94	325.45	260.21	0.2777	5.5079
38.5448	230.46	214.76	120.21	56.50	54.98	51.98	325.84	259.81	0.2761	5.4960
39.0447	230.76	214.47	123.25	56.70	55.01	52.05	330.18	259.85	0.2745	5.5389
39.5453	231.63	214.38	126.32	56.89	55.03	52.10	329.32	259.49	0.2760	5.5663
40.0452	231.52	214.80	129.42	57.09	55.06	52.13	330.80	259.67	0.2769	5.5452
40.5442	231.32	214.53	132.56	57.32	55.07	52.18	330.57	259.21	0.2762	5.5222
41.0448	231.06	214.72	135.69	57.54	55.13	52.24	331.92	259.10	0.2763	5.5509
41.5447	230.86	214.50	139.16	57.76	55.16	52.27	327.67	259.29	0.2773	5.5777
42.0453	231.18	214.46	142.82	58.00	55.20	52.32	347.01	259.46	0.7071	5.5878
42.5452	229.62	213.54	148.73	58.30	55.23	52.36	367.37	259.81	0.2491	5.5609
43.0450	233.91	212.86	157.28	58.85	55.28	52.39	358.66	259.24	0.2799	5.5264
43.5448	236.95	212.82	160.92	59.35	55.35	52.48	340.71	258.70	0.2776	5.5372
44.0465	237.55	210.79	161.08	59.65	55.40	52.51	317.97	258.39	0.2770	5.5678
44.5453	236.65	212.72	161.56	59.97	55.47	52.54	329.29	259.61	0.2752	5.5867
45.0443	230.77	213.56	162.37	60.38	55.51	52.58	323.32	259.35	0.2774	5.5503
45.5450	228.84	213.28	163.52	60.76	55.58	52.63	317.21	259.40	0.2766	5.5341
46.0448	229.98	213.44	164.65	61.13	55.65	52.68	319.97	257.87	0.2772	5.5386
46.5447	230.37	213.61	165.96	61.47	55.68	52.66	317.24	258.88	0.2772	5.5431
47.0455	231.27	213.41	167.74	61.80	55.75	52.65	319.96	256.90	0.2745	5.5622
47.5453	230.86	213.73	169.68	62.18	55.80	52.69	322.90	259.32	0.2747	5.5681
48.0450	231.19	213.56	171.76	62.59	55.82	52.70	323.75	259.31	0.2760	5.5259
48.5448	231.17	213.74	173.91	63.06	55.89	52.75	321.91	259.21	0.2770	5.5361
49.0457	230.52	213.77	175.43	63.58	55.92	52.77	322.71	258.82	0.2752	5.5448
49.5463	230.80	213.87	176.98	64.12	55.96	52.78	321.27	259.59	0.2766	5.5755
50.0453	230.19	213.90	178.59	64.74	55.99	52.81	323.42	259.46	0.2760	5.5713
50.5452	229.17	214.01	180.25	65.40	56.04	52.81	323.67	258.75	0.2735	5.5403
51.0450	229.27	213.96	181.54	66.09	56.09	52.84	321.12	259.01	0.2771	5.5339
51.5457	230.12	213.53	183.21	66.88	56.14	52.86	315.74	259.06	0.2756	5.5426
52.0463	230.10	214.13	184.49	67.69	56.22	52.87	327.31	258.83	0.2752	5.5892
52.5443	229.31	213.70	186.05	68.55	56.29	52.90	320.83	259.61	0.2756	5.5661
53.0452	229.45	213.86	187.12	69.49	56.38	52.90	320.80	258.76	0.2745	5.5290
53.5450	228.99	213.96	188.12	70.43	56.43	52.91	325.75	257.90	0.2776	5.5137
54.0448	229.69	213.61	189.32	71.44	56.52	52.95	320.85	258.94	0.2747	5.5561
54.5455	229.68	213.63	190.28	72.52	56.59	52.94	320.61	258.93	0.2761	5.5714

TABLE B1.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
55.0453	229.87	213.62	191.58	73.65	56.70	52.95	315.99	259.22	0.2760	5.5508
55.5452	229.92	213.62	192.42	74.84	56.79	52.99	318.56	258.97	0.2748	5.5360
56.0440	229.79	213.76	193.01	76.04	56.92	53.02	318.98	259.31	0.2762	5.5543
56.5448	230.06	213.75	193.92	77.22	57.03	53.02	322.45	258.57	0.2774	5.5565
57.0447	229.44	213.37	196.03	78.81	57.17	53.03	380.84	259.79	0.7069	5.5749
57.5453	230.17	211.29	202.16	81.11	57.40	53.04	358.65	258.81	0.2800	5.5556
58.0452	236.06	211.66	203.84	83.74	57.66	53.15	352.48	260.19	0.2760	5.5286
58.5450	239.44	213.27	203.66	86.56	57.86	53.19	335.00	259.03	0.2759	5.5181
59.0448	241.66	212.46	201.43	89.45	58.16	53.22	312.45	256.66	0.2811	5.5452
59.5455	241.35	211.33	199.12	92.23	58.46	53.29	311.96	256.98	0.2639	5.5602
60.0453	234.91	214.31	197.93	95.04	58.70	53.34	321.90	258.00	0.2754	5.5704
60.5452	228.52	213.21	196.80	97.33	58.92	53.43	320.77	259.27	0.2724	5.5226
61.0450	227.31	212.71	196.81	99.46	59.12	53.48	319.59	259.61	0.2765	5.5251
61.5440	229.44	212.83	197.56	101.49	59.31	53.55	320.72	259.21	0.2762	5.5520
62.0457	231.87	213.07	199.59	103.62	59.42	53.64	323.11	259.20	0.2755	5.5350
62.5445	232.56	213.16	202.56	105.76	59.51	53.71	322.84	259.26	0.2757	5.5175
63.0452	231.93	213.21	203.63	108.81	59.58	53.77	321.53	258.23	0.2762	5.5180
63.5450	232.16	213.29	204.20	111.50	59.76	53.80	324.45	259.05	0.2702	5.5669
64.0448	233.00	213.75	204.61	113.65	59.97	53.81	317.41	258.65	0.2769	5.5792
64.5457	232.56	213.98	204.85	115.85	60.24	53.83	324.79	259.19	0.2759	5.5766
65.0455	231.05	213.58	204.99	118.29	60.52	53.86	318.84	259.29	0.2766	5.5367
65.5453	231.01	213.58	205.22	121.00	60.84	53.93	321.43	259.13	0.2758	5.5396
66.0442	230.72	213.39	205.32	123.93	61.16	54.00	316.03	258.90	0.2769	5.5416
66.5440	230.04	213.17	205.51	127.03	61.50	54.08	315.87	259.01	0.2759	5.5731
67.0447	230.05	213.03	205.74	130.30	61.87	54.13	310.43	258.93	0.2760	5.5887
67.5455	230.28	213.02	205.86	133.54	62.20	54.20	314.75	258.83	0.2761	5.5607
68.0453	230.58	212.71	206.25	136.72	62.58	54.25	314.55	258.68	0.2759	5.5304
68.5452	230.30	212.49	206.43	139.97	62.95	54.32	312.28	259.34	0.2750	5.5366
69.0450	230.15	212.42	206.30	143.03	63.36	54.41	309.46	257.69	0.2760	5.5541
69.5457	229.93	212.32	206.43	146.06	63.77	54.46	309.02	259.09	0.2784	5.5834
70.0463	230.00	211.96	206.75	148.99	64.24	54.53	307.91	259.01	0.2757	5.5827
70.5453	229.98	212.11	206.87	151.72	64.67	54.60	309.04	258.63	0.2759	5.5304
71.0452	231.12	212.22	206.85	154.30	65.16	54.71	303.77	256.64	0.2766	5.5345
71.5450	229.29	211.82	206.90	156.57	65.64	54.80	302.02	257.33	0.2772	5.5576
72.0457	229.57	212.23	207.11	158.52	66.13	54.88	307.43	258.53	0.2764	5.5782
72.5455	229.82	211.86	207.30	160.43	66.63	54.93	302.70	258.28	0.2758	5.5683
73.0443	228.59	211.81	207.38	162.30	67.14	55.00	309.54	258.64	0.2748	5.5513
73.5452	228.29	211.69	207.51	164.21	67.66	55.09	301.22	258.84	0.2760	5.5161
74.0450	228.46	211.60	207.43	165.93	68.20	55.16	300.48	259.07	0.2754	5.5315
74.5448	229.80	211.13	207.66	167.60	68.80	55.25	301.77	259.14	0.2738	5.5437
75.0455	230.49	211.61	207.65	169.40	69.40	55.32	298.16	258.85	0.2746	5.5570
75.5453	227.89	211.08	207.47	170.74	70.00	55.41	297.98	258.69	0.2761	5.5589
76.0452	228.90	211.58	207.45	172.25	70.60	55.50	301.25	258.07	0.2760	5.5318
76.5442	229.04	211.38	207.42	173.46	71.23	55.57	306.34	258.37	0.2761	5.5548
77.0438	228.22	211.34	207.63	174.61	71.94	55.66	299.93	257.15	0.2763	5.5545
77.5455	228.89	211.10	207.73	175.81	72.67	55.75	300.49	259.23	0.2762	5.5943
78.0445	228.90	211.26	207.73	177.03	73.45	55.82	308.00	258.82	0.2854	5.5722
78.5452	229.15	211.38	207.78	178.42	74.26	55.95	306.90	256.98	0.2765	5.5451
79.0450	229.66	211.14	208.02	179.89	75.10	56.02	301.59	257.35	0.2758	5.5281
79.5448	229.98	211.42	208.09	181.23	76.01	56.13	299.62	258.84	0.2754	5.5420

TABLE B1.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
80.0457	228.27	211.27	207.96	182.05	76.93	56.24	304.64	259.23	0.2767	5.5812
80.5445	229.72	211.10	207.94	183.02	77.84	56.34	300.82	258.01	0.2757	5.5803
81.0452	229.68	211.50	207.95	183.98	78.81	56.47	305.32	258.41	0.2767	5.5369
81.5450	230.03	211.37	208.14	184.69	79.84	56.58	300.75	258.43	0.2754	5.5206
82.0448	229.37	211.38	208.35	185.57	80.85	56.69	302.24	258.77	0.2765	5.5579
82.5457	229.86	211.45	208.51	186.59	81.93	56.82	304.69	257.89	0.2763	5.5673
83.0455	229.37	211.35	208.61	187.57	83.03	56.96	306.44	259.17	0.2770	5.5269
83.5443	230.25	211.47	208.66	188.98	84.22	57.09	305.14	258.15	0.2773	5.5044
84.0450	229.72	211.25	208.69	190.19	85.48	57.26	303.75	258.99	0.2774	5.5632
84.5448	230.15	211.64	208.62	191.03	86.77	57.41	311.13	256.76	0.2757	5.5862
85.0447	229.73	211.10	208.84	192.01	88.10	57.59	301.92	256.58	0.2762	5.6105
85.5455	232.54	211.59	208.86	192.92	89.46	57.74	312.54	259.34	0.2757	5.6019
86.0453	230.67	211.48	208.83	193.62	90.85	57.92	305.57	259.22	0.2778	5.5675
86.5452	229.43	211.57	208.78	194.38	92.30	58.13	307.14	258.66	0.2765	5.5641
87.0450	229.37	211.31	208.90	194.77	93.76	58.31	298.89	257.46	0.2764	5.5624
87.5457	229.80	211.22	209.02	195.21	95.24	58.49	307.97	259.02	0.2757	5.5679
88.0463	230.54	211.32	209.10	195.94	96.82	58.72	308.24	257.11	0.2765	5.5767
88.5453	229.48	211.37	209.04	196.67	98.46	58.92	301.08	258.25	0.2765	5.5927
89.0442	228.57	211.31	209.02	197.47	100.07	59.14	306.58	256.69	0.2762	5.5955
89.5450	229.33	211.38	209.12	198.36	101.75	59.37	300.56	258.84	0.2764	5.5702
90.0467	230.18	211.52	209.14	198.82	103.43	59.62	304.30	257.40	0.2757	5.5519
90.5455	229.32	211.57	209.11	199.05	105.13	59.85	308.28	256.27	0.2761	5.5437
91.0453	229.44	210.95	209.27	199.51	106.86	60.13	296.98	257.71	0.2767	5.5673
91.5452	230.33	211.20	209.23	200.03	108.62	60.37	298.21	255.80	0.2757	5.5813
92.0440	229.43	211.23	209.12	200.33	110.46	60.63	297.43	258.81	0.2765	5.5879
92.5448	227.55	211.23	209.02	200.41	112.28	60.89	302.16	256.23	0.2770	5.5721
93.0455	229.48	211.38	209.22	200.64	114.19	61.17	299.64	259.17	0.2766	5.5370
93.5453	228.59	211.20	209.19	200.90	116.04	61.45	302.47	256.68	0.2755	5.5316
94.0452	228.77	211.30	209.28	201.13	117.95	61.71	308.60	256.70	0.2760	5.5772
94.5450	231.63	211.35	209.44	201.51	119.96	62.03	305.23	259.13	0.2768	5.5599
95.0438	230.71	211.56	209.43	201.99	121.94	62.32	300.29	256.00	0.2755	5.5615
95.5455	228.29	211.45	209.46	202.02	123.99	62.60	306.35	257.35	0.2758	5.5386
96.0445	229.34	211.39	209.60	202.26	125.90	62.92	307.97	258.27	0.2750	5.5320
96.5452	229.62	211.19	209.72	202.87	127.84	63.24	303.48	256.56	0.2772	5.5619
97.0450	228.73	211.26	209.58	203.42	129.84	63.59	308.67	259.12	0.2752	5.5665
97.5448	228.13	211.34	209.53	203.64	131.94	63.91	298.11	258.12	0.2760	5.5522
98.0457	229.32	211.12	209.49	203.78	134.03	64.26	301.79	259.09	0.2754	5.5030
98.5453	229.84	211.35	209.49	203.89	136.21	64.66	303.31	256.23	0.2760	5.5216
99.0452	229.23	211.19	209.47	204.13	138.37	65.01	302.61	257.88	0.2764	5.5707
99.5442	228.99	211.49	209.46	204.17	140.60	65.42	299.14	257.91	0.2774	5.5881
100.0448	229.31	211.20	209.60	204.22	142.67	65.78	300.69	258.55	0.2762	5.5953
100.5457	229.90	211.48	209.69	204.39	144.62	66.19	303.85	258.41	0.2759	5.5690
101.0455	228.76	211.42	209.79	204.51	146.56	66.60	302.74	259.22	0.2787	5.5501
101.5462	230.03	211.52	209.84	204.85	148.60	67.03	305.96	256.95	0.2764	5.5486
102.0450	228.77	211.48	209.78	205.13	150.59	67.44	302.77	257.01	0.2769	5.5643
102.5440	228.00	211.50	209.82	205.23	152.56	67.85	305.22	258.08	0.2759	5.6031
103.0447	230.97	211.24	209.96	205.52	154.80	68.32	304.88	257.45	0.2777	5.5712
103.5455	232.15	211.86	209.74	205.69	157.24	68.77	308.64	258.35	0.2753	5.5601
104.0453	229.87	211.72	209.70	205.54	159.70	69.21	304.06	258.11	0.2766	5.5397
104.5452	227.28	211.48	209.66	205.45	161.99	69.66	298.15	258.63	0.2751	5.5341

TABLE B1.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
105.0450	227.57	211.51	209.72	205.46	164.19	70.17	299.92	258.04	0.2759	5.5550
105.5457	228.67	211.58	209.79	205.58	166.04	70.62	304.15	257.44	0.2750	5.5684
106.0455	228.15	211.52	209.88	205.71	167.87	71.06	304.95	258.57	0.2758	5.5691
106.5443	228.70	211.61	209.89	205.83	169.56	71.55	300.84	258.89	0.2767	5.5445
107.0452	228.23	211.46	209.85	205.88	171.14	72.05	299.29	256.78	0.2762	5.5337
107.5450	228.62	211.60	209.92	206.04	172.74	72.48	305.86	257.60	0.2773	5.5528
108.0448	228.05	211.60	210.02	206.23	174.32	73.01	310.13	257.79	0.2761	5.5735
108.5455	229.98	211.68	210.07	206.49	175.89	73.49	312.62	259.22	0.2762	5.5805
109.0453	229.60	211.52	210.01	206.56	177.38	74.03	302.09	257.44	0.2778	5.5398
109.5452	228.95	211.34	209.98	206.63	179.10	74.57	297.45	257.00	0.2731	5.5341
110.0458	229.12	211.49	209.92	206.66	180.57	75.09	302.51	259.33	0.2789	5.5323
110.5448	230.96	211.72	209.91	206.66	181.66	75.65	299.98	257.91	0.2757	5.5739
111.0455	229.47	211.88	209.82	206.58	182.59	76.19	301.51	257.90	0.2751	5.5836
111.5453	228.74	211.70	209.82	206.45	183.52	76.72	298.89	257.55	0.2756	5.5547
112.0452	229.23	211.82	209.83	206.41	184.29	77.24	297.27	256.83	0.2753	5.5295
112.5458	227.92	211.90	209.86	206.30	184.57	77.72	298.94	258.41	0.2757	5.5147
113.0438	228.03	212.03	209.97	206.33	184.75	78.19	303.62	256.44	0.2755	5.5801
113.5455	228.18	212.00	210.27	206.55	184.90	78.69	299.02	259.62	0.2750	5.5626
114.0453	228.00	212.04	210.52	206.85	185.01	79.14	303.42	258.74	0.2757	5.5519
114.5443	228.71	211.87	210.92	207.33	185.33	79.70	306.94	256.51	0.2763	5.5375
115.0450	228.75	211.81	211.05	207.72	186.54	80.31	308.02	257.56	0.2758	5.5474
115.5448	229.57	211.61	210.90	207.62	188.76	80.98	309.28	257.00	0.2760	5.5737
116.0455	229.71	211.65	210.66	207.80	191.84	81.73	310.42	257.48	0.2762	5.5785
116.5453	230.92	211.36	210.46	207.81	194.60	82.56	306.79	258.20	0.2750	5.5532
117.0452	231.10	211.64	210.21	207.65	196.21	83.50	308.71	257.16	0.2756	5.5301
117.5450	229.30	211.44	210.13	207.47	197.28	84.39	306.29	258.38	0.2766	5.5163
118.0458	230.28	211.54	210.04	207.34	197.99	85.26	306.08	258.53	0.2767	5.5628
118.5457	229.44	211.54	209.97	207.25	198.42	86.08	306.66	257.46	0.2766	5.5969
119.0463	229.06	211.27	209.96	207.17	198.92	86.94	304.77	257.54	0.2747	5.5910
119.5443	230.24	211.57	209.91	207.11	199.24	87.74	309.31	258.81	0.2755	5.5778
120.0450	230.43	211.44	209.88	207.04	199.45	88.55	304.60	256.90	0.2756	5.5422
120.5448	229.62	211.62	209.88	207.02	199.70	89.39	307.68	258.32	0.2749	5.5499
121.0457	229.82	211.56	209.91	207.01	200.00	90.19	303.90	256.24	0.2746	5.5735
121.5455	229.38	211.47	209.93	207.03	200.16	91.06	304.57	259.08	0.2766	5.5744
122.0453	228.86	211.38	209.98	207.10	200.17	91.84	306.53	258.25	0.2738	5.5817
122.5442	229.68	211.50	209.98	207.18	200.36	92.77	305.02	256.63	0.2759	5.5455
123.0450	229.90	211.35	210.01	207.22	200.63	93.66	305.92	258.79	0.2755	5.5341
123.5447	229.89	211.64	209.99	207.30	200.74	94.60	304.34	257.00	0.2759	5.5411
124.0455	228.82	211.54	210.02	207.36	200.86	95.58	306.20	259.03	0.2755	5.5649
124.5453	229.37	211.67	210.06	207.41	200.98	96.55	304.96	258.71	0.2768	5.5804
125.0452	229.69	211.72	210.09	207.44	201.16	97.49	304.78	256.57	0.2760	5.5945
125.5450	229.47	211.75	210.16	207.49	201.55	98.55	309.38	255.84	0.2761	5.5953
126.0457	229.09	211.86	210.25	207.56	201.76	99.53	306.67	257.50	0.2764	5.5710
126.5455	228.48	211.76	210.32	207.65	201.99	100.62	304.27	257.90	0.2764	5.5412
127.0443	228.98	211.66	210.38	207.75	202.37	101.74	308.08	255.91	0.2757	5.5480
127.5452	228.89	211.89	210.40	207.79	202.44	102.87	306.03	257.46	0.2765	5.5745
128.0450	230.12	211.76	210.38	207.82	202.36	104.07	307.00	256.44	0.2764	5.5852
128.5448	229.69	211.85	210.38	207.84	202.59	105.33	310.64	257.17	0.2757	5.5862
129.0455	228.62	211.68	210.41	207.85	202.86	106.56	306.45	256.08	0.2765	5.5602
129.5453	229.38	211.99	210.41	207.89	203.04	107.85	309.26	257.91	0.2764	5.5035

TABLE B1.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
130.0462	229.13	211.88	210.41	207.89	203.11	109.18	310.95	255.91	0.2767	5.5308
130.5450	228.70	211.64	210.43	207.89	203.39	110.54	306.14	257.34	0.2768	5.5880
131.0448	229.17	211.84	210.36	207.92	203.36	111.92	307.87	258.40	0.2756	5.5690
131.5455	228.72	211.66	210.39	207.92	203.44	113.41	310.04	259.03	0.2762	5.5437
132.0453	228.86	211.64	210.39	207.95	203.55	114.92	308.68	257.48	0.2740	5.5555
132.5452	228.63	211.82	210.32	207.94	203.68	116.39	305.88	258.71	0.2760	5.5602
133.0450	228.84	211.55	210.30	207.92	203.71	118.12	306.74	255.66	0.2762	5.5735
133.5448	228.70	211.59	210.26	207.86	203.78	119.75	308.74	257.70	0.2756	5.6020
134.0455	229.36	211.80	210.23	207.85	203.96	121.45	309.77	258.11	0.2754	5.5873
134.5453	228.95	211.77	210.24	207.83	204.03	123.19	307.75	258.92	0.2759	5.5767
135.0443	228.50	211.75	210.24	207.81	204.09	124.93	306.19	257.19	0.2759	5.5399
135.5450	229.99	211.64	210.30	207.81	204.18	126.85	307.96	256.44	0.2754	5.5469
136.0448	229.95	211.93	210.26	207.83	204.09	128.85	308.08	259.01	0.2764	5.5793
136.5457	228.29	211.66	210.24	207.81	204.21	130.80	308.55	257.61	0.2759	5.5757
137.0455	228.29	211.68	210.26	207.83	204.39	132.95	310.94	256.85	0.2767	5.5777
137.5453	228.14	211.77	210.23	207.85	204.37	135.05	309.60	257.56	0.2756	5.5564
138.0460	228.04	211.43	210.21	207.83	204.38	137.18	305.39	256.54	0.2766	5.5284
138.5440	228.45	211.64	210.23	207.85	204.36	139.42	317.56	257.95	0.7069	5.5441
139.0457	229.11	208.80	210.70	208.19	204.00	142.83	406.27	258.02	0.7068	5.5724
139.5445	234.67	209.61	209.75	207.94	203.82	164.66	358.74	256.14	0.2455	5.5818
140.0453	241.32	216.62	208.16	207.10	203.92	193.37	327.23	257.49	0.2762	5.5891
140.5452	243.81	222.92	206.83	206.48	203.56	196.91	326.42	257.59	0.2762	5.5378
141.0440	244.10	224.36	205.82	205.85	203.17	197.17	293.03	258.08	0.2762	5.5329
141.5457	242.56	225.54	205.05	205.30	202.86	196.69	296.47	257.15	0.2746	5.5239
142.0445	234.69	225.04	204.53	204.82	202.56	195.99	294.50	258.41	0.2760	5.5673
142.5453	228.07	220.21	204.44	204.44	202.24	195.10	289.71	256.67	0.2762	5.5273
143.0442	225.64	216.13	204.95	204.12	201.96	194.08	290.69	258.20	0.2760	5.5144
143.5450	225.03	212.57	205.59	203.89	201.69	192.81	289.83	258.52	0.2762	5.5371
144.0448	226.80	211.99	206.69	203.79	201.50	191.46	288.96	255.69	0.2761	5.5617
144.5455	227.94	211.79	207.80	203.92	201.50	190.18	288.32	257.42	0.2760	5.5698
145.0453	227.49	212.96	208.25	204.30	201.70	189.02	297.30	257.42	0.2759	5.5792
145.5452	228.44	211.13	208.72	204.89	201.99	188.14	301.47	257.66	0.2759	5.5651
146.0450	229.68	211.66	209.04	205.52	202.10	187.80	304.15	258.04	0.2766	5.5301
146.5448	229.67	212.61	209.24	206.06	201.99	188.04	307.82	256.83	0.2764	5.5528
147.0455	229.63	212.75	209.44	206.44	202.07	188.56	309.23	258.06	0.2742	5.5747
147.5453	230.35	212.78	209.61	206.82	202.34	189.48	306.17	257.38	0.2761	5.5745
148.0452	230.41	213.05	209.79	207.25	202.76	190.49	302.74	258.85	0.2755	5.5958
148.5440	230.27	212.71	209.94	207.65	203.13	191.22	302.74	258.80	0.2758	5.5539
149.0438	231.02	212.91	210.06	207.92	203.53	191.85	306.30	256.72	0.2754	5.5411
149.5447	230.38	213.50	210.14	208.10	203.75	192.29	301.73	257.44	0.2771	5.5467
150.0453	229.39	213.72	210.20	208.23	203.92	192.94	299.09	258.70	0.2750	5.5592
150.5462	229.69	212.82	210.24	208.32	204.21	193.37	299.02	258.35	0.2751	5.5761
151.0450	229.02	213.16	210.28	208.40	204.50	194.13	311.65	259.06	0.7067	5.5641
151.5440	229.79	213.54	210.62	208.49	204.70	194.97	319.22	258.06	0.2638	5.5343
152.0447	230.35	213.81	211.14	208.68	204.95	196.07	313.75	258.15	0.2756	5.4985
152.5453	232.38	214.57	211.35	208.93	205.17	197.45	334.32	258.72	0.2763	5.5631
153.0452	231.93	214.43	211.31	209.20	205.26	199.43	316.48	257.97	0.2774	5.5801
153.5450	231.60	215.13	210.91	209.01	205.38	200.87	313.00	258.93	0.2746	5.5599
154.0448	231.21	214.69	210.84	208.85	205.63	201.44	310.16	258.95	0.2761	5.5298
154.5457	232.33	214.66	210.99	208.90	205.94	201.70	308.33	255.61	0.2761	5.4995

TABLE B1.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
155.0455	231.10	214.70	211.08	209.06	206.36	201.87	309.81	258.51	0.2754	5.5034
155.5443	230.62	214.65	211.14	209.17	206.56	202.19	304.18	256.78	0.2765	5.5587
156.0450	230.16	214.62	211.22	209.29	206.78	202.61	310.51	255.97	0.2768	5.5452
156.5448	230.34	214.34	211.21	209.31	206.80	203.05	312.09	258.26	0.2763	5.5165
157.0457	230.72	215.47	211.14	209.32	206.72	203.39	313.87	258.95	0.2760	5.5208
157.5455	230.53	215.19	211.06	209.27	206.73	203.74	314.58	255.84	0.2766	5.5470
158.0462	230.16	214.77	211.01	209.24	206.68	203.85	313.40	257.47	0.2758	5.5655
158.5452	231.96	214.58	210.84	209.17	206.68	203.93	313.16	257.78	0.4485	5.5727
159.0450	230.98	214.74	210.68	209.03	206.62	204.04	303.52	256.23	0.2760	5.5434
159.5457	229.82	214.07	210.51	208.92	206.61	204.10	310.78	257.69	0.2767	5.5415
160.0463	229.74	213.66	210.41	208.78	206.58	204.11	299.53	255.84	0.2753	5.5380
160.5453	229.40	213.81	210.14	208.57	206.57	204.15	303.93	253.20	0.2757	5.5723
161.0452	228.30	213.96	210.26	208.41	206.55	204.15	300.29	257.75	0.2762	5.5827
161.5440	228.45	213.91	210.43	208.49	206.72	204.18	297.87	254.37	0.2763	5.5671
162.0457	230.50	214.31	210.40	208.59	206.80	204.27	300.09	254.15	0.2760	5.5466
162.5447	229.38	214.64	210.28	208.60	206.75	204.37	306.34	257.88	0.2817	5.5277
163.0453	229.63	214.45	210.46	208.55	206.81	204.43	303.84	256.53	0.2752	5.5519
163.5452	230.50	214.28	210.65	208.75	206.94	204.49	313.54	256.69	0.2766	5.5473
164.0450	230.52	214.97	210.74	208.88	206.82	204.48	312.56	253.57	0.2756	5.5689
164.5438	231.77	215.21	210.73	208.93	206.71	204.56	320.69	254.60	0.2760	5.5466
165.0455	230.72	213.44	210.83	208.95	206.78	204.57	315.32	256.27	0.2759	5.5103
165.5453	231.31	214.11	210.85	209.03	206.81	204.50	318.94	254.69	0.2762	5.5407
166.0452	231.95	214.12	210.88	209.02	206.73	204.51	314.70	256.27	0.2762	5.5441
166.5450	231.72	214.30	210.92	208.99	206.81	204.55	317.39	256.01	0.2759	5.5722
167.0448	232.18	215.14	210.95	209.01	206.92	204.61	310.27	254.35	0.2759	5.5373
167.5455	231.66	215.53	210.92	209.04	206.98	204.71	309.89	256.22	0.2762	5.5044
168.0453	230.90	215.36	210.82	209.03	207.06	204.79	303.06	254.82	0.2764	5.5285
168.5452	231.05	215.25	210.61	208.96	207.07	204.83	304.98	253.48	0.2760	5.5686
169.0450	230.99	215.50	210.40	208.87	207.02	204.86	300.91	256.13	0.2753	5.5625
169.5440	229.19	215.32	210.25	208.75	207.03	204.94	301.75	254.31	0.2759	5.5310
170.0455	229.32	216.00	210.11	208.65	207.00	204.94	298.51	256.59	0.2755	5.4844
170.5463	229.86	216.08	209.96	208.53	207.01	204.93	294.47	254.49	0.2774	5.5227
171.0452	228.28	215.95	209.81	208.39	206.96	204.96	291.10	254.59	0.2757	5.5752
171.5450	227.93	215.17	209.76	208.31	206.93	204.96	307.49	252.35	0.2734	5.5653
172.0448	228.29	214.12	210.11	208.30	206.89	204.97	307.99	255.61	0.2768	5.5099
172.5457	229.36	213.45	210.21	208.45	206.93	205.00	305.85	255.89	0.2726	5.5284
173.0455	229.62	214.63	210.20	208.50	206.92	205.04	302.93	253.25	0.2758	5.5510
173.5453	230.29	215.11	210.19	208.50	206.97	205.05	299.88	254.77	0.2761	5.5765
174.0450	230.06	215.56	210.25	208.51	207.06	205.15	298.68	253.08	0.2763	5.5703
174.5448	228.85	215.34	210.47	208.56	207.18	205.23	305.78	253.62	0.2760	5.5571
175.0457	229.13	215.08	210.75	208.85	207.31	205.36	307.36	254.26	0.2766	5.5158
175.5455	231.28	215.94	210.74	209.11	207.39	205.55	310.07	252.62	0.2765	5.5469
176.0453	230.93	216.47	210.58	209.12	207.24	205.54	306.00	253.31	0.2755	5.5690
176.5452	229.55	217.00	210.39	209.02	207.37	205.51	305.84	254.85	0.2757	5.5780
177.0440	229.73	216.86	210.31	208.94	207.40	205.43	301.49	253.93	0.2758	5.5544
177.5457	230.03	216.76	210.07	208.82	207.31	205.38	304.30	255.08	0.2753	5.5340
178.0445	229.21	216.83	209.99	208.63	207.18	205.26	300.62	253.65	0.2762	5.5329
178.5453	228.36	216.73	209.94	208.50	207.15	205.24	302.49	253.24	0.2755	5.5594
179.0452	229.10	215.64	209.97	208.43	207.11	205.24	302.24	253.96	0.2767	5.5713
179.5450	230.20	215.69	209.91	208.39	207.06	205.20	302.82	255.66	0.2760	5.5544

TABLE B1.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
180.0457	228.69	216.57	209.83	208.31	206.98	205.16	298.26	254.07	0.7075	5.5277
180.5447	229.11	216.56	209.76	208.24	206.94	205.11	299.72	252.98	0.2638	5.5254
181.0453	229.26	216.98	209.61	208.14	206.91	205.12	296.39	253.74	0.2760	5.5477
181.5452	228.07	216.01	209.51	208.04	206.86	205.06	296.23	255.03	0.2768	5.5757
182.0450	229.42	215.25	209.45	207.89	206.80	205.03	303.18	253.57	0.2765	5.5611
182.5448	227.23	212.91	209.76	207.81	206.81	205.04	301.78	253.65	0.2764	5.5224
183.0447	226.97	211.58	210.06	208.09	206.99	205.15	302.34	253.28	0.2757	5.5115
183.5453	229.25	211.66	210.06	208.38	207.04	205.34	304.38	252.96	0.2762	5.5352
184.0452	229.40	211.27	209.98	208.46	206.92	205.36	303.50	253.93	0.2760	5.5376
184.5440	229.09	211.24	209.85	208.45	206.93	205.30	302.00	254.38	0.2763	5.5269
185.0448	229.51	211.36	209.75	208.37	206.98	205.17	301.76	254.35	0.2764	5.5184
185.5465	229.86	211.10	209.63	208.31	206.95	205.05	304.24	254.39	0.2758	5.5340
186.0445	230.51	211.09	209.59	208.21	206.88	204.97	305.02	254.80	0.2751	5.5498
186.5452	230.25	211.22	209.47	208.09	206.77	204.89	304.42	254.54	0.7076	5.5127
187.0450	229.31	210.66	209.40	207.97	206.68	204.82	299.42	253.99	0.2754	5.4948
187.5448	231.82	212.04	209.27	207.86	206.62	204.80	301.69	254.50	0.2759	5.5304
188.0455	230.45	213.06	209.17	207.71	206.54	204.77	296.55	252.52	0.2763	5.5346
188.5453	230.05	212.44	209.07	207.55	206.48	204.76	299.27	254.12	0.2765	5.5679
189.0452	226.53	210.91	209.35	207.43	206.45	204.80	303.62	252.93	0.2755	5.5124
189.5450	227.35	210.38	209.66	207.59	206.55	204.87	296.56	252.21	0.2758	5.5204
190.0458	228.80	210.96	209.64	207.84	206.65	205.02	302.40	253.78	0.2762	5.5401
190.5447	228.49	210.59	209.72	207.94	206.65	205.10	300.81	252.66	0.2763	5.5608
191.0455	230.56	211.21	209.65	208.04	206.63	205.09	302.36	252.83	0.2766	5.5696
191.5453	229.37	211.68	209.54	208.05	206.64	205.06	301.24	253.51	0.2767	5.5343
192.0450	229.04	211.24	209.49	208.00	206.61	204.98	302.93	252.84	0.2763	5.5311
192.5440	228.42	210.84	209.48	207.98	206.62	204.90	303.74	253.64	0.2765	5.5245
193.0457	229.39	211.69	209.42	207.93	206.57	204.87	304.46	255.29	0.2762	5.5439
193.5445	228.51	211.41	209.39	207.87	206.54	204.84	302.68	253.22	0.2753	5.5803
194.0453	228.85	211.08	209.38	207.84	206.53	204.82	301.14	254.78	0.2755	5.5681
194.5452	228.68	210.87	209.37	207.81	206.51	204.81	298.15	252.99	0.2764	5.5296
195.0450	229.14	210.87	209.34	207.77	206.48	204.82	298.89	254.09	0.7077	5.5195
195.5457	228.29	210.94	209.33	207.72	206.49	204.79	301.36	255.08	0.2568	5.5523
196.0455	230.18	211.38	209.29	207.73	206.46	204.78	294.62	252.05	0.2746	5.5645
196.5443	232.82	212.77	209.15	207.65	206.43	204.79	299.85	253.87	0.2762	5.5671
197.0452	229.73	213.46	209.05	207.55	206.37	204.79	294.93	254.05	0.2762	5.5274
197.5450	226.01	211.23	209.21	207.45	206.32	204.75	301.44	254.40	0.2758	5.5191
198.0457	225.90	210.36	209.61	207.57	206.48	204.85	300.30	252.42	0.2757	5.5569
198.5455	228.95	210.90	209.76	207.95	206.68	204.96	302.33	252.87	0.2761	5.5466
199.0453	230.48	210.97	209.68	208.12	206.64	205.13	303.06	253.24	0.2763	5.5414
199.5442	229.75	210.80	209.62	208.13	206.59	205.16	301.43	254.98	0.2753	5.5109
200.0450	229.42	210.79	209.53	208.08	206.62	205.10	302.89	254.62	0.2761	5.5314
200.5438	228.30	210.72	209.49	208.06	206.61	205.00	300.28	254.43	0.2767	5.5462
201.0455	230.53	210.70	209.41	207.99	206.65	204.91	297.96	253.90	0.2761	5.5304
201.5445	229.86	211.06	209.34	207.95	206.61	204.87	299.54	253.47	0.2762	5.4886
202.0452	228.93	210.50	209.37	207.85	206.58	204.84	300.20	254.91	0.2760	5.5052
202.5450	229.19	210.70	209.36	207.80	206.55	204.81	301.08	253.75	0.2768	5.5411
203.0448	229.95	211.89	209.37	207.77	206.52	204.80	302.84	254.56	0.2763	5.5783
203.5455	229.42	211.54	209.34	207.75	206.51	204.79	302.53	253.65	0.2760	5.5530
204.0453	228.54	211.32	209.35	207.74	206.50	204.78	302.63	254.21	0.2757	5.5133
204.5452	227.99	210.41	209.39	207.71	206.47	204.79	297.68	253.56	0.2754	5.5347

TABLE B1.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
205.0450	229.43	211.40	209.40	207.72	206.48	204.82	302.46	254.89	0.2765	5.5442
205.5440	228.79	211.66	209.39	207.76	206.51	204.83	302.77	253.55	0.2767	5.5660
206.0455	227.96	211.28	209.42	207.75	206.50	204.82	304.20	254.95	0.2756	5.5439
206.5445	229.70	211.28	209.40	207.76	206.47	204.82	300.22	252.56	0.2757	5.5321
207.0443	229.73	210.56	209.39	207.75	206.48	204.85	293.64	254.31	0.2754	5.5319
207.5450	232.73	211.87	209.17	207.76	206.47	204.87	304.21	253.87	0.2764	5.5514
208.0448	229.03	211.63	209.25	207.64	206.40	204.85	298.55	252.28	0.2760	5.5745
208.5457	230.22	211.19	209.35	207.70	206.45	204.82	295.56	253.37	0.2758	5.5663
209.0455	231.32	213.40	209.10	207.72	206.44	204.84	302.30	254.59	0.2759	5.5218
209.5453	227.13	211.72	209.36	207.55	206.35	204.82	308.88	253.53	0.2758	5.5133
210.0450	227.37	210.84	209.80	207.74	206.45	204.82	307.42	253.99	0.2755	5.5525
210.5440	230.93	212.62	209.81	208.02	206.57	204.96	304.47	253.85	0.2751	5.5744
211.0447	232.51	214.32	209.81	208.08	206.52	204.98	304.73	253.92	0.2760	5.5561
211.5445	231.78	214.67	209.78	208.10	206.56	204.99	308.39	254.60	0.2752	5.5221
212.0453	229.59	213.60	209.84	208.13	206.59	204.98	302.06	253.86	0.2756	5.4981
212.5452	230.46	213.63	209.87	208.19	206.69	205.02	302.33	254.80	0.2769	5.5386
213.0450	230.78	213.82	209.81	208.21	206.73	205.05	304.07	253.87	0.2728	5.5605
213.5465	229.65	214.49	209.72	208.17	206.74	205.07	299.12	254.70	0.2754	5.5569
214.0463	229.49	213.94	209.73	208.18	206.76	205.08	299.83	252.34	0.2758	5.4921
214.5453	229.79	214.03	209.69	208.15	206.77	205.09	304.15	254.29	0.2763	5.5095
215.0442	229.02	213.22	209.75	208.14	206.78	205.13	300.70	255.18	0.2764	5.5760
215.5450	230.37	214.25	209.75	208.18	206.84	205.15	307.01	253.79	0.2760	5.5602
216.0448	229.43	214.81	209.85	208.21	206.88	205.23	299.58	252.43	0.1692	5.5212
216.5465	230.05	214.76	209.79	208.23	206.92	205.22	296.32	254.49	0.0437	5.4878
217.0462	229.18	215.13	209.62	208.17	206.88	205.27	302.15	254.66	0.0435	5.5179
217.5460	228.97	214.83	209.52	208.07	206.87	205.24	295.86	253.04	0.0293	5.5193
218.0458	227.78	214.75	209.40	207.95	206.86	205.25	291.25	252.80	0.0334	5.5327

TABLE B2. PRESSURE AND TEMPERATURE DATA FOR RUN 4 (PURE STEAM).

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
0.0548	50.89	43.59	51.52	55.76	54.33	48.39	269.73	270.62	0.0007	5.5795
0.5473	112.28	66.55	51.04	55.68	54.28	48.43	266.31	268.42	0.0004	5.6026
1.0480	200.30	82.34	50.89	55.38	54.20	48.39	266.52	268.40	0.0006	5.5777
1.5478	213.00	198.82	51.60	55.25	54.42	48.57	269.22	269.78	0.0000	5.5862
2.0468	215.43	210.78	56.13	54.86	54.72	48.63	269.94	269.23	0.0004	5.5519
2.5475	217.22	210.23	54.71	55.07	54.65	48.67	265.57	267.45	0.0004	5.5429
3.0483	221.95	210.18	53.72	55.17	54.62	48.67	264.99	266.91	0.0009	5.5381
3.5482	227.00	210.54	53.40	55.15	54.68	48.72	268.50	267.34	0.0003	5.5346
4.0480	233.95	211.38	53.77	55.08	54.81	48.74	270.65	268.44	0.0003	5.5587
4.5477	238.87	212.42	54.34	55.06	54.87	48.72	271.22	268.41	0.0001	5.5885
5.0467	243.76	212.73	54.40	55.05	54.89	48.72	271.72	267.48	0.0005	5.5850
5.5473	237.60	212.71	54.86	55.03	54.94	48.80	275.47	267.70	0.0005	5.6024
6.0482	234.14	212.59	55.76	54.98	54.98	48.92	275.83	267.78	0.0000	5.5825
6.5480	228.81	212.92	56.25	54.98	55.02	49.12	279.96	269.02	0.0005	5.5691
7.0468	224.88	212.99	56.75	54.98	55.02	49.21	278.77	268.09	0.0004	5.5378
7.5477	222.05	212.90	56.51	54.99	55.01	49.26	280.85	267.70	0.0002	5.5479
8.0483	222.50	213.21	58.01	54.99	55.01	49.28	282.67	267.53	0.0008	5.5403
8.5482	225.49	213.63	60.72	54.95	55.03	49.36	285.47	267.46	0.0002	5.5353
9.0480	231.87	214.77	63.22	54.86	55.01	49.34	290.15	267.91	0.0006	5.5639
9.5487	239.08	215.37	63.72	54.87	54.94	49.27	290.95	268.47	0.0006	5.5710
10.0485	247.32	216.30	64.93	54.87	54.93	49.31	292.29	268.14	0.0003	5.5818
10.5483	247.51	216.64	67.09	54.83	54.95	49.31	292.54	268.21	0.0002	5.5610
11.0482	237.67	216.47	69.73	54.80	54.97	49.30	294.87	268.35	0.0002	5.5654
11.5480	225.78	215.65	73.33	54.78	54.99	49.32	295.64	268.34	0.0002	5.5492
12.0478	222.76	215.38	76.25	54.77	55.03	49.38	295.21	267.89	0.0001	5.5335
12.5467	222.87	215.46	79.42	54.73	55.06	49.42	297.05	267.64	0.0007	5.5455
13.0475	222.99	215.76	83.65	54.72	55.10	49.50	298.28	267.75	0.0007	5.5526
13.5482	223.68	216.09	86.59	54.72	55.14	49.56	300.71	267.68	0.0012	5.5676
14.0480	224.61	216.41	89.09	54.70	55.14	49.62	302.67	267.74	0.0005	5.5487
14.5470	225.24	216.76	91.31	54.72	55.14	49.70	305.39	267.75	0.0008	5.5475
15.0477	225.24	217.12	93.95	54.82	55.18	49.74	307.51	267.96	0.0000	5.5209
15.5475	226.23	217.39	95.15	54.96	55.23	49.82	309.10	267.95	0.0007	5.5555
16.0482	227.09	217.71	96.30	55.13	55.23	49.92	310.31	268.03	0.0004	5.5581
16.5480	227.94	218.04	97.34	55.31	55.25	49.98	313.22	268.11	0.0002	5.5532
17.0488	229.39	218.42	99.83	55.52	55.29	50.09	315.49	268.24	0.0005	5.5595
17.5477	230.43	218.87	101.91	55.81	55.31	50.19	318.70	268.38	0.0005	5.5823
18.0485	231.27	219.39	105.09	56.17	55.33	50.29	321.22	265.03	0.0005	5.6131
18.5483	229.94	219.48	106.06	56.57	55.36	50.41	322.00	267.64	0.0007	5.6155
19.0490	229.44	219.39	106.39	56.88	55.34	50.43	321.34	265.39	0.0008	5.5825
19.5470	229.91	219.40	106.53	57.15	55.36	50.49	322.08	268.64	0.0007	5.5606
20.0477	230.35	219.61	108.06	57.45	55.36	50.53	323.20	268.67	0.0002	5.5338
20.5475	231.79	219.88	109.89	57.82	55.37	50.55	324.41	265.84	0.0006	5.5364
21.0483	231.60	220.05	111.60	58.22	55.41	50.65	325.87	268.47	0.0005	5.5474
21.5482	231.97	220.23	113.78	58.68	55.43	50.73	327.75	268.68	0.0003	5.5602
22.0488	231.62	220.45	116.13	59.21	55.47	50.83	328.88	268.62	0.0004	5.5473
22.5468	231.62	220.67	118.42	59.80	55.51	50.93	329.97	268.62	0.0004	5.4950
23.0475	231.05	220.85	120.73	60.47	55.57	51.01	331.58	268.64	0.0003	5.4885
23.5483	231.74	221.03	122.77	61.19	55.61	51.07	332.53	268.66	0.0002	5.5136
24.0490	231.49	221.30	125.20	61.97	55.69	51.13	334.21	268.70	0.0003	5.5479
24.5470	231.76	221.43	125.57	62.75	55.77	51.24	334.75	245.05	0.0000	5.4969

TABLE B2.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
25.0478	231.37	221.46	124.99	63.15	55.87	51.36	334.12	268.79	0.0004	5.5000
25.5477	231.62	221.34	125.96	63.47	55.91	51.44	333.77	266.45	0.0005	5.5373
26.0483	231.84	221.47	128.14	63.97	55.99	51.52	335.11	268.92	0.0003	5.5239
26.5482	232.11	221.62	128.98	64.63	56.05	51.54	336.09	268.64	0.0008	5.4743
27.0480	232.65	221.69	124.93	64.80	56.13	51.66	336.51	268.17	0.0007	5.4822
27.5478	232.90	221.82	122.58	64.48	56.13	51.68	337.51	268.84	0.0007	5.5275
28.0477	233.21	221.95	120.30	63.69	56.07	51.68	338.25	268.57	0.0003	5.5166
28.5483	233.39	221.95	120.83	63.45	56.08	51.70	338.59	268.65	0.0005	5.4762
29.0482	233.48	222.06	120.80	63.24	56.04	51.76	338.61	268.86	0.0000	5.4984
29.5472	233.41	222.08	120.49	62.96	56.01	51.78	338.43	268.56	0.0000	5.5443
30.0478	233.61	222.08	120.82	62.87	55.97	51.79	338.02	268.46	0.0004	5.5207
30.5477	234.08	222.07	120.99	62.82	55.97	51.77	338.86	266.61	0.0011	5.4791
31.0483	234.37	222.05	121.05	62.84	56.00	51.79	338.65	268.84	0.0007	5.5104
31.5482	234.35	222.11	120.92	62.80	55.98	51.79	339.12	268.55	0.0005	5.5181
32.0480	234.25	222.24	120.47	62.81	55.98	51.80	339.15	268.47	0.0007	5.5687
32.5478	234.49	222.27	120.60	62.92	55.97	51.76	339.20	268.42	0.0005	5.5332
33.0477	234.56	222.38	121.33	62.96	55.97	51.78	340.46	268.41	0.0006	5.5177
33.5483	234.81	222.44	122.87	63.21	55.99	51.84	341.39	263.39	0.0006	5.5184
34.0482	234.30	222.51	123.75	63.52	56.01	51.87	341.66	268.75	0.0007	5.5306
34.5472	234.48	222.57	124.34	63.61	56.01	51.93	341.63	268.54	0.0006	5.5804
35.0478	234.21	222.64	125.02	63.73	56.04	51.95	341.94	268.29	0.0006	5.5587
35.5477	234.70	222.63	125.39	63.98	56.06	52.01	342.69	267.80	0.0007	5.5815
36.0485	234.38	222.79	128.04	64.32	56.10	52.05	343.45	268.04	0.0002	5.5679
36.5483	234.25	222.88	129.09	64.57	56.16	52.09	344.03	268.53	0.0006	5.5698
37.0480	234.35	222.91	129.64	64.78	56.14	52.11	343.16	266.07	0.0000	5.5662
37.5478	234.21	222.87	129.61	65.14	56.18	52.13	343.65	268.40	0.0005	5.5498
38.0477	233.74	222.77	129.39	65.22	56.20	52.17	343.07	268.16	0.0005	5.5416
38.5475	233.91	222.84	129.39	65.34	56.21	52.18	344.32	266.18	0.0006	5.5463
39.0483	233.64	222.92	130.51	65.59	56.23	52.20	344.47	258.03	0.0001	5.5553
39.5482	234.66	222.92	131.77	65.98	56.27	52.22	344.47	262.44	0.0005	5.5589
40.0480	234.36	223.03	132.08	66.16	56.27	52.24	344.07	261.15	0.0005	5.5626
40.5468	234.56	222.90	132.48	66.27	56.29	52.26	343.34	263.82	0.0001	5.5707
41.0475	234.56	222.89	133.11	66.31	56.30	52.28	344.05	262.10	0.0006	5.5815
41.5483	234.35	222.95	134.00	66.49	56.30	52.32	344.59	262.26	0.0003	5.5721
42.0482	234.89	222.98	135.08	66.75	56.32	52.36	344.80	263.44	0.0001	5.5476
42.5470	234.50	223.04	136.19	66.98	56.36	52.37	345.30	258.82	0.0003	5.5470
43.0478	235.54	223.02	137.92	67.57	56.40	52.45	345.23	254.21	0.0003	5.5464
43.5477	234.86	222.95	138.72	67.95	56.44	52.48	343.45	261.49	0.0003	5.5615
44.0492	234.25	222.90	139.05	67.99	56.46	52.51	343.50	258.36	0.0003	5.5552
44.5472	233.59	222.89	139.38	68.18	56.48	52.53	343.79	261.54	0.0004	5.5864
45.0480	233.72	222.89	140.10	68.37	56.50	52.49	343.82	262.36	0.0004	5.5762
45.5478	233.92	222.93	141.17	68.60	56.53	52.51	344.52	261.86	0.0002	5.5544
46.0477	233.89	223.09	142.35	68.98	56.55	52.53	345.03	264.79	0.0011	5.5610
46.5475	233.91	223.14	143.41	69.39	56.59	52.55	345.45	265.53	0.0004	5.5520
47.0482	234.12	223.18	143.75	69.70	56.65	52.60	346.39	261.20	0.0007	5.5417
47.5480	234.05	223.19	144.25	70.04	56.67	52.64	346.17	257.42	0.0009	5.5449
48.0478	234.06	223.21	145.54	70.53	56.73	52.68	346.19	247.71	0.0002	5.5504
48.5477	233.77	223.19	148.24	71.27	56.81	52.74	344.94	258.68	0.0007	5.5694
49.0475	234.24	223.00	149.11	71.42	56.85	52.76	343.60	258.10	0.0004	5.5815
49.5482	234.10	222.91	148.12	71.50	56.87	52.78	343.88	258.05	0.0004	5.5719

TABLE B2.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
50.0490	233.71	222.87	148.21	71.52	56.89	52.78	343.65	263.56	0.0004	5.5735
50.5478	233.78	222.88	148.54	71.52	56.89	52.76	344.33	265.15	0.0007	5.5509
51.0468	233.89	222.90	148.13	71.70	56.89	52.79	344.27	265.23	0.0009	5.5523
51.5475	233.80	223.13	148.60	71.85	56.89	52.77	345.24	263.45	0.0009	5.5542
52.0482	233.57	223.15	149.13	72.11	56.94	52.81	345.54	263.10	0.0003	5.5520
52.5480	233.47	223.14	149.47	72.42	56.96	52.81	345.76	268.85	0.0003	5.5550
53.0470	233.24	223.16	150.49	72.72	57.00	52.83	346.16	263.40	0.0006	5.5526
53.5477	232.88	223.25	151.63	73.12	57.06	52.87	346.77	266.48	0.0006	5.5697
54.0485	232.92	223.30	152.65	73.53	57.10	52.88	347.12	268.69	0.0011	5.5573
54.5483	232.83	223.34	153.79	74.01	57.16	52.92	347.51	260.08	0.0005	5.5644
55.0472	232.80	223.36	154.68	74.63	57.21	52.96	347.48	264.17	0.0004	5.5516
55.5478	232.80	223.29	155.82	75.08	57.29	52.98	347.08	264.94	0.0002	5.5372
56.0487	232.50	223.28	156.72	75.52	57.33	53.02	347.13	257.54	0.0002	5.5425
56.5475	232.25	223.24	157.61	75.99	57.41	53.04	346.93	263.49	0.0002	5.5407
57.0473	232.54	223.17	157.70	76.27	57.45	53.04	346.06	267.52	0.0002	5.5565
57.5482	232.84	223.27	157.20	76.46	57.47	53.06	346.34	266.18	0.0008	5.5452
58.0480	232.58	223.23	157.58	76.63	57.51	53.07	346.50	268.06	0.0000	5.5618
58.5477	232.28	223.27	158.27	76.86	57.57	53.09	346.70	267.34	0.0003	5.5739
59.0475	232.55	223.18	159.19	77.18	57.61	53.11	346.58	267.03	0.0004	5.5705
59.5483	232.41	223.33	159.82	77.62	57.67	53.13	347.16	256.83	0.0005	5.5772
60.0482	232.32	223.19	161.16	78.48	57.77	53.17	345.51	262.76	0.0011	5.5318
60.5480	232.53	223.12	162.77	78.93	57.87	53.21	345.30	261.72	0.0007	5.5169
61.0468	232.86	223.05	163.33	79.25	57.89	53.23	345.01	264.11	0.0002	5.5620
61.5477	232.59	223.05	163.39	79.57	57.93	53.23	345.20	265.13	0.0001	5.5497
62.0483	233.03	223.00	163.39	79.80	58.01	53.26	345.33	262.71	0.0001	5.5642
62.5482	232.94	223.09	163.73	80.20	58.07	53.28	345.28	263.11	0.0008	5.5815
63.0470	232.90	223.13	164.53	80.57	58.12	53.30	345.71	262.63	0.0002	5.5802
63.5478	232.66	223.11	165.18	80.99	58.16	53.30	345.68	265.49	0.0006	5.5856
64.0477	232.60	223.17	165.63	81.50	58.26	53.30	346.03	266.29	0.0011	5.5706
64.5493	233.07	223.24	166.35	81.87	58.30	53.32	346.37	268.73	0.0006	5.5721
65.0473	232.95	223.31	166.95	82.36	58.38	53.36	346.44	258.40	0.0006	5.5289
65.5480	232.98	223.17	167.57	83.02	58.49	53.38	345.66	259.19	0.0006	5.5345
66.0487	233.10	223.09	168.14	83.45	58.59	53.42	345.18	255.66	0.0009	5.5355
66.5467	233.53	223.03	168.56	83.79	58.69	53.43	344.63	265.35	0.0001	5.5536
67.0475	232.97	223.00	168.74	84.05	58.75	53.45	344.48	267.84	0.0008	5.5609
67.5482	232.46	223.06	168.91	84.24	58.79	53.45	344.98	264.85	0.0000	5.5695
68.0480	232.51	223.08	169.47	84.47	58.85	53.47	345.11	262.89	0.0010	5.5859
68.5470	232.51	223.11	170.17	84.90	58.93	53.51	345.15	264.24	0.0008	5.5761
69.0477	232.48	223.12	170.75	85.33	58.98	53.51	345.75	266.49	0.0008	5.5530
69.5483	232.98	223.21	171.33	85.65	59.04	53.52	345.87	268.43	0.0006	5.5366
70.0482	232.84	223.26	171.81	85.95	59.12	53.54	346.09	267.15	0.0003	5.5373
70.5480	232.86	223.21	172.34	86.22	59.22	53.54	345.87	264.60	0.0010	5.5555
71.0478	232.56	223.18	173.02	86.54	59.30	53.58	346.00	268.15	0.0008	5.5556
71.5468	232.51	223.22	173.80	86.89	59.35	53.58	346.13	268.59	0.0002	5.5820
72.0475	232.71	223.25	174.52	87.25	59.45	53.60	346.57	266.77	0.0006	5.5782
72.5483	232.87	223.29	175.54	87.66	59.53	53.60	347.14	263.13	0.0006	5.5635
73.0472	233.21	223.29	175.78	88.09	59.61	53.63	346.58	262.84	0.0005	5.5646
73.5478	232.37	223.37	176.73	88.28	59.71	53.67	346.53	260.71	0.0007	5.5502
74.0487	232.32	223.24	177.85	88.75	59.82	53.69	346.25	260.34	0.0007	5.5172
74.5475	232.63	223.21	178.55	89.18	59.92	53.71	346.15	262.89	0.0006	5.5162

TABLE B2.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
75.0483	232.29	223.19	179.34	89.50	59.98	53.69	346.05	265.21	0.0002	5.5511
75.5482	232.43	223.23	180.15	89.89	60.07	53.71	345.98	258.32	0.0002	5.5921
76.0480	232.41	223.30	181.18	90.41	60.19	53.75	346.11	257.52	0.0006	5.5849
76.5468	232.20	223.20	182.18	90.95	60.30	53.77	345.91	260.83	0.0006	5.5921
77.0475	232.63	223.15	183.05	91.29	60.40	53.77	345.81	262.99	0.0009	5.5707
77.5483	232.24	223.18	183.86	91.63	60.48	53.81	346.15	266.31	0.0009	5.5669
78.0482	231.92	223.26	184.92	91.91	60.55	53.82	346.06	259.92	0.0003	5.5432
78.5470	232.12	223.21	186.16	92.47	60.69	53.86	345.68	250.84	0.0003	5.5460
79.0478	232.28	223.12	187.33	93.31	60.86	53.86	345.04	253.40	0.0006	5.5503
79.5477	231.55	223.09	188.57	93.91	61.04	53.90	345.09	251.83	0.0002	5.5703
80.0483	231.70	223.16	189.91	94.24	61.17	53.94	344.70	251.40	0.0001	5.5788
80.5482	232.13	223.04	191.44	94.58	61.29	53.96	344.43	267.39	0.0003	5.5676
81.0480	231.77	222.98	192.73	94.86	61.35	53.98	344.57	262.88	0.0004	5.5898
81.5468	231.87	222.97	194.29	95.05	61.44	53.98	344.64	264.86	0.0006	5.5849
82.0477	231.65	223.10	195.67	95.33	61.52	53.99	344.85	264.24	0.0006	5.5405
82.5483	231.96	223.11	197.30	95.59	61.60	53.97	344.93	261.17	0.0011	5.5386
83.0482	232.05	223.10	198.93	95.93	61.67	53.99	345.44	262.89	0.0001	5.5337
83.5480	231.96	223.12	200.44	96.41	61.79	54.01	345.79	263.38	0.0006	5.5641
84.0478	231.68	223.17	201.55	96.88	61.92	54.03	345.89	262.44	0.0000	5.5683
84.5467	231.80	223.19	202.66	97.31	62.06	54.01	346.15	259.55	0.0001	5.5677
85.0493	231.89	223.26	203.97	97.85	62.19	54.05	346.15	261.06	0.0006	5.5805
85.5482	231.49	223.23	204.89	98.28	62.31	54.07	346.36	263.97	0.0006	5.5714
86.0480	231.20	223.25	205.55	98.76	62.44	54.10	346.51	261.87	0.0008	5.5811
86.5478	231.70	223.24	206.11	99.24	62.56	54.10	346.74	259.10	0.0003	5.5548
87.0468	231.74	223.24	207.00	99.87	62.73	54.12	346.56	258.50	0.0009	5.5370
87.5475	231.85	223.29	207.74	100.41	62.88	54.16	346.50	261.30	0.0000	5.5519
88.0482	231.53	223.33	208.55	100.90	63.03	54.18	347.03	262.21	0.0003	5.5473
88.5480	231.46	223.29	209.07	101.40	63.17	54.20	347.04	263.09	0.0001	5.5631
89.0470	232.05	223.26	209.44	101.86	63.32	54.20	346.36	262.66	0.0004	5.5707
89.5477	232.61	223.30	209.70	102.22	63.46	54.22	347.23	260.26	0.0004	5.5446
90.0485	231.45	223.37	210.57	102.75	63.59	54.24	347.68	260.67	0.0013	5.5702
90.5483	230.77	223.53	211.36	103.33	63.76	54.26	348.78	267.63	0.0003	5.5562
91.0480	231.98	223.62	212.08	103.90	63.91	54.30	349.68	266.14	0.0010	5.5679
91.5470	231.99	223.73	212.92	104.48	64.10	54.32	350.27	264.62	0.0004	5.5613
92.0477	232.33	223.77	213.53	105.02	64.24	54.34	350.50	263.31	0.0009	5.5724
92.5485	232.37	223.88	214.09	105.61	64.41	54.36	351.20	262.80	0.0005	5.5617
93.0483	232.21	223.97	214.50	106.22	64.56	54.39	351.30	262.41	0.0002	5.5514
93.5472	232.15	223.90	214.93	106.72	64.77	54.42	350.61	252.75	0.0002	5.5350
94.0480	232.30	223.79	215.61	107.31	65.04	54.46	350.21	254.56	0.0011	5.5483
94.5477	231.51	223.72	217.14	108.07	65.29	54.50	349.68	261.66	0.0002	5.5596
95.0467	231.28	223.69	217.76	108.35	65.44	54.54	349.69	262.50	0.0001	5.5498
95.5473	231.37	223.69	218.36	108.66	65.57	54.56	349.60	259.97	0.0006	5.5681
96.0482	232.27	223.73	219.02	109.09	65.69	54.60	349.62	264.58	0.0011	5.5886
96.5480	231.66	223.73	219.83	109.66	65.86	54.60	349.69	263.58	0.0006	5.5955
97.0478	231.68	223.68	220.15	110.09	66.01	54.64	349.89	265.25	0.0009	5.5953
97.5477	231.59	223.71	220.37	110.48	66.16	54.68	350.01	265.70	0.0004	5.5765
98.0483	232.08	223.77	220.53	110.98	66.32	54.68	349.99	266.11	0.0007	5.5675
98.5482	231.38	223.75	220.64	111.47	66.47	54.72	350.06	263.46	0.0002	5.5460
99.0480	231.49	223.75	220.69	112.07	66.66	54.76	350.01	262.06	0.0002	5.5396
99.5478	231.60	223.68	220.60	112.71	66.85	54.78	349.59	262.37	0.0007	5.5421

TABLE B2.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
100.0477	231.42	223.67	220.73	113.32	67.04	54.80	349.63	261.85	0.0004	5.5205
100.5483	231.62	223.69	220.75	113.91	67.23	54.84	349.48	266.46	0.0012	5.5666
101.0482	231.48	223.62	220.82	114.52	67.40	54.88	349.23	261.74	0.0002	5.5583
101.5480	231.44	223.60	220.95	115.11	67.59	54.90	349.16	267.56	0.0004	5.5941
102.0478	231.71	223.62	221.01	115.71	67.78	54.94	349.20	261.70	0.0003	5.5705
102.5477	231.62	223.60	221.11	116.34	67.99	54.98	349.03	266.12	0.0011	5.5761
103.0483	231.32	223.62	221.22	116.98	68.20	55.02	349.32	264.22	0.0011	5.5655
103.5492	230.96	223.59	221.24	117.54	68.39	55.04	348.91	257.54	0.0005	5.5539
104.0472	231.09	223.61	221.33	118.27	68.62	55.08	349.14	260.58	0.0010	5.5383
104.5478	231.22	223.57	221.39	118.99	68.82	55.12	348.84	262.30	0.0010	5.5385
105.0477	230.82	223.59	221.41	119.56	69.03	55.16	348.82	263.12	0.0010	5.5597
105.5493	231.00	223.57	221.57	120.24	69.22	55.20	348.84	261.52	0.0000	5.5764
106.0473	231.09	223.59	221.68	120.90	69.43	55.24	349.24	264.06	0.0002	5.5791
106.5480	231.17	223.56	221.70	121.54	69.66	55.30	348.82	258.21	0.0006	5.5809
107.0478	231.29	223.54	221.79	122.33	69.89	55.34	348.84	263.43	0.0001	5.5886
107.5468	231.04	223.54	221.93	122.99	70.11	55.36	348.86	257.82	0.0007	5.5393
108.0475	230.60	223.58	221.97	123.75	70.38	55.43	348.73	257.95	0.0009	5.5220
108.5483	230.98	223.55	222.01	124.57	70.63	55.49	348.44	259.36	0.0007	5.5090
109.0480	230.87	223.49	222.04	125.38	70.89	55.51	348.53	260.12	0.0006	5.5390
109.5470	231.01	223.57	222.15	126.02	71.10	55.57	348.31	263.60	0.0000	5.5873
110.0487	230.82	223.58	222.17	126.64	71.29	55.59	348.43	267.16	0.0005	5.5952
110.5475	231.02	223.55	222.23	127.25	71.50	55.65	348.52	261.93	0.0006	5.5914
111.0483	230.91	223.53	222.30	128.02	71.74	55.71	348.55	256.13	0.0008	5.5818
111.5482	231.09	223.44	222.30	128.87	72.03	55.77	348.33	256.80	0.0004	5.5633
112.0470	231.06	223.48	222.32	129.77	72.31	55.82	348.08	259.83	0.0007	5.5499
112.5477	231.07	223.50	222.32	130.83	72.67	55.90	347.61	252.61	0.0001	5.5431
113.0475	231.20	223.38	222.32	132.07	73.03	55.98	346.95	258.58	0.0009	5.5429
113.5483	230.91	223.32	222.38	132.67	73.29	56.03	347.30	260.92	0.0000	5.5402
114.0472	231.02	223.29	222.38	133.24	73.50	56.07	347.00	261.90	0.0002	5.5410
114.5480	230.79	223.33	222.36	133.84	73.69	56.13	346.85	261.92	0.0010	5.5812
115.0478	230.63	223.31	222.40	134.54	73.91	56.19	347.10	266.28	0.0002	5.5745
115.5467	230.74	223.31	222.43	135.21	74.14	56.23	347.16	256.48	0.0004	5.5766
116.0473	230.76	223.33	222.38	136.11	74.39	56.29	346.59	263.40	0.0004	5.5855
116.5482	230.99	223.33	222.42	136.91	74.63	56.35	346.95	263.73	0.0003	5.5835
117.0480	230.53	223.35	222.47	137.74	74.88	56.42	347.35	260.05	0.0002	5.5645
117.5468	230.65	223.35	222.47	138.55	75.12	56.48	347.11	249.40	0.0002	5.5677
118.0477	230.48	223.32	222.40	139.93	75.46	56.56	346.52	254.85	0.0005	5.5521
118.5483	231.35	223.21	222.35	141.33	75.86	56.63	345.97	258.58	0.0000	5.5577
119.0482	230.86	223.30	222.41	142.26	76.16	56.73	346.38	251.86	0.0010	5.5455
119.5472	230.48	223.30	222.41	143.18	76.44	56.81	346.35	257.48	0.0007	5.5655
120.0478	230.48	223.27	222.41	144.06	76.69	56.85	346.34	261.37	0.0009	5.5724
120.5477	230.68	223.23	222.39	145.00	76.95	56.92	346.11	257.04	0.0003	5.6136
121.0483	231.02	223.16	222.37	146.16	77.25	57.00	345.53	260.77	0.0006	5.6178
121.5482	230.63	223.18	222.34	147.18	77.53	57.08	345.72	263.51	0.0005	5.5914
122.0472	230.36	223.23	222.36	148.10	77.78	57.11	345.98	262.44	0.0008	5.6000
122.5478	230.32	223.25	222.37	149.12	78.04	57.19	346.00	264.29	0.0006	5.5818
123.0468	230.79	223.16	222.36	150.19	78.27	57.27	345.60	265.93	0.0005	5.5660
123.5475	230.81	223.18	222.38	151.31	78.55	57.31	346.06	261.75	0.0006	5.5368
124.0482	229.97	223.22	222.43	152.51	78.83	57.39	345.94	260.20	0.0006	5.5300
124.5480	229.88	223.22	222.41	153.68	79.13	57.46	345.98	263.01	0.0007	5.5408

TABLE B2.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
125.0478	230.52	223.24	222.42	154.64	79.40	57.54	345.82	262.70	0.0008	5.5567
125.5477	230.88	223.19	222.42	155.94	79.70	57.62	346.08	258.91	0.0008	5.5955
126.0475	230.19	223.17	222.42	157.28	80.03	57.69	345.63	260.56	0.0005	5.6132
126.5483	230.76	223.15	222.40	158.40	80.35	57.79	345.79	263.73	0.0005	5.5904
127.0480	230.90	223.15	222.38	159.52	80.67	57.85	345.72	263.46	0.0001	5.5906
127.5470	230.49	223.15	222.38	160.62	80.97	57.94	345.54	264.37	0.0009	5.5678
128.0477	230.55	223.19	222.40	161.76	81.29	58.02	345.82	250.97	0.0010	5.5448
128.5485	230.78	223.10	222.31	163.51	81.71	58.15	345.02	258.48	0.0008	5.5351
129.0483	230.98	223.03	222.24	165.35	82.14	58.25	344.84	256.89	0.0008	5.5416
129.5482	230.17	222.94	222.22	167.15	82.51	58.36	344.35	259.45	0.0003	5.5359
130.0480	230.30	222.96	222.19	169.00	82.85	58.44	344.17	261.85	0.0006	5.5833
130.5477	229.71	222.96	222.15	171.13	83.26	58.57	343.94	254.10	0.0002	5.5771
131.0475	230.07	222.82	221.99	175.21	83.75	58.67	342.88	264.56	0.0001	5.5856
131.5483	230.66	222.80	221.99	177.91	84.12	58.76	342.64	264.17	0.0003	5.5651
132.0482	230.14	222.75	222.05	179.99	84.38	58.84	342.91	261.00	0.0009	5.5414
132.5470	230.36	222.76	222.03	182.07	84.72	58.93	342.96	266.87	0.0008	5.5430
133.0478	230.23	222.82	222.08	184.39	85.00	59.03	343.11	266.42	0.0005	5.5457
133.5477	230.89	222.89	222.08	186.76	85.36	59.12	343.50	264.24	0.0007	5.5554
134.0483	230.44	222.91	222.16	189.19	85.69	59.24	343.66	266.43	0.0006	5.5532
134.5482	229.94	222.87	222.14	191.28	86.03	59.33	343.24	264.52	0.0006	5.5545
135.0470	230.39	222.87	222.10	193.53	86.40	59.41	343.17	261.58	0.0006	5.5936
135.5478	230.48	222.86	222.10	195.59	86.78	59.52	343.25	264.11	0.0014	5.5795
136.0485	229.68	222.78	222.12	197.92	87.13	59.62	343.26	264.32	0.0010	5.6032
136.5483	229.97	222.73	222.11	199.66	87.54	59.75	343.10	266.90	0.0001	5.5643
137.0473	230.36	222.75	222.11	200.93	87.92	59.85	342.88	268.69	0.0005	5.5341
137.5480	230.95	222.81	222.11	202.31	88.31	59.96	343.28	267.54	0.0002	5.5288
138.0468	230.16	222.88	222.18	203.94	88.74	60.06	343.34	264.40	0.0001	5.5386
138.5477	230.63	222.91	222.16	205.41	89.20	60.17	343.48	267.88	0.0005	5.5526
139.0483	231.02	222.93	222.20	206.64	89.65	60.29	343.78	262.34	0.0007	5.5699
139.5482	230.09	222.89	222.20	209.10	90.14	60.42	343.94	262.13	0.0006	5.5739
140.0480	230.06	222.84	222.16	211.08	90.64	60.55	343.43	252.85	0.0006	5.5691
140.5478	230.04	222.81	222.07	213.66	91.26	60.70	342.67	259.87	0.0004	5.5715
141.0468	230.40	222.74	221.97	215.49	91.78	60.84	341.97	260.59	0.0011	5.5309
141.5483	229.90	222.61	221.95	216.58	92.19	60.97	341.76	261.05	0.0008	5.5202
142.0482	230.09	222.56	221.86	217.26	92.65	61.10	341.36	235.92	0.0005	5.5350
142.5480	230.63	222.32	221.48	218.37	93.92	61.33	338.02	254.14	0.0008	5.5647
143.0478	231.47	222.22	221.34	218.80	94.59	61.54	337.60	255.77	0.0007	5.5787
143.5477	230.88	222.11	221.34	218.91	95.14	61.71	337.30	260.42	0.0000	5.6055
144.0493	230.79	222.06	221.32	219.05	95.66	61.82	336.99	264.01	0.0000	5.6076
144.5473	231.19	221.97	221.30	219.12	96.13	61.92	336.95	267.09	0.0003	5.6000
145.0480	231.01	221.93	221.30	219.19	96.56	62.05	336.87	266.30	0.0004	5.5997
145.5488	231.63	221.93	221.31	219.23	96.97	62.16	337.19	267.34	0.0005	5.5442
146.0468	230.67	221.91	221.32	219.27	97.39	62.28	337.37	265.08	0.0002	5.5265
146.5475	230.67	222.06	221.36	219.36	97.84	62.39	337.16	262.48	0.0001	5.5367
147.0483	230.76	222.06	221.38	219.39	98.34	62.54	337.28	263.58	0.0009	5.5493
147.5482	231.10	222.02	221.38	219.43	98.84	62.68	337.40	268.88	0.0006	5.5654
148.0480	231.75	222.11	221.36	219.46	99.29	62.81	337.33	268.62	0.0005	5.5879
148.5477	231.14	222.10	221.40	219.50	99.81	62.91	337.28	268.28	0.0004	5.5969
149.0475	230.71	222.04	221.42	219.56	100.33	63.04	337.34	268.70	0.0005	5.5933
149.5492	230.76	222.01	221.42	219.56	100.88	63.19	337.42	267.86	0.0005	5.5896

TABLE B2.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
150.0490	230.26	221.97	221.42	219.55	101.46	63.30	337.13	268.01	0.0005	5.5992
150.5480	229.76	221.94	221.36	219.54	102.01	63.46	337.25	268.51	0.0006	5.5708
151.0478	229.69	222.04	221.36	219.50	102.60	63.63	337.11	263.84	0.0004	5.5396
151.5477	230.67	221.97	221.33	219.34	103.44	63.80	336.75	267.82	0.0008	5.5132
152.0483	231.14	221.92	221.29	219.40	104.18	63.95	336.18	268.65	0.0006	5.5376
152.5482	230.85	221.87	221.29	219.45	104.88	64.10	336.78	267.13	0.0002	5.5802
153.0470	230.73	221.81	221.29	219.49	105.67	64.29	336.68	268.61	0.0006	5.6059
153.5478	230.75	221.83	221.28	219.47	106.41	64.42	336.52	267.69	0.0006	5.6014
154.0467	230.71	221.83	221.26	219.45	107.28	64.59	336.34	268.04	0.0006	5.5971
154.5483	230.26	221.85	221.22	219.43	108.13	64.76	335.95	268.16	0.0006	5.5965
155.0482	230.60	221.80	221.15	219.40	108.96	64.93	335.61	267.54	0.0007	5.6020
155.5470	230.23	221.72	221.12	219.33	109.85	65.10	335.46	267.17	0.0006	5.5838
156.0478	230.14	221.76	221.06	219.27	110.80	65.31	335.22	268.25	0.0003	5.5757
156.5477	230.21	221.69	221.01	219.27	111.78	65.48	334.78	266.79	0.0005	5.5507
157.0493	230.36	221.60	220.99	219.24	112.89	65.67	334.59	268.45	0.0006	5.5429
157.5473	231.11	221.57	220.94	219.22	113.96	65.88	334.32	267.62	0.0005	5.5538
158.0480	230.84	221.55	220.94	219.19	115.13	66.09	333.98	268.29	0.0005	5.5560
158.5488	230.81	221.51	220.91	219.15	116.46	66.32	333.67	266.45	0.0007	5.5632
159.0468	230.75	221.44	220.83	219.12	117.85	66.54	333.56	268.42	0.0002	5.5901
159.5475	230.80	221.42	220.78	219.08	119.25	66.77	333.03	267.12	0.0007	5.5895
160.0482	230.34	221.42	220.74	219.03	120.72	67.00	332.77	268.27	0.0005	5.5738
160.5480	230.66	221.34	220.71	218.99	122.26	67.22	332.45	268.70	0.0004	5.5730
161.0478	231.74	221.23	220.64	218.96	123.87	67.45	331.93	267.72	0.0006	5.5571
161.5477	230.80	221.19	220.60	218.90	125.68	67.69	331.61	268.44	0.0008	5.5264
162.0475	231.15	221.12	220.56	218.87	127.60	67.92	331.46	268.24	0.0006	5.5371
162.5483	231.93	221.18	220.50	218.81	129.72	68.17	330.79	268.48	0.0004	5.5374
163.0480	230.54	221.19	220.50	218.78	131.98	68.41	331.56	268.53	0.0006	5.5862
163.5478	230.72	221.18	220.48	218.78	134.48	68.70	330.56	267.81	0.0004	5.6230
164.0477	231.45	221.11	220.42	218.74	137.48	68.98	330.08	268.46	0.0004	5.6036
164.5467	232.22	221.04	220.35	218.73	140.50	69.26	330.24	268.63	0.0005	5.5910
165.0473	231.58	220.93	220.36	218.67	143.72	69.59	329.94	268.52	0.0005	5.5805
165.5482	232.12	221.11	220.30	218.64	147.22	69.85	329.63	267.80	0.0007	5.5803
166.0480	231.63	220.98	220.27	218.53	151.77	70.15	329.18	268.48	0.0009	5.5604
166.5468	231.90	220.84	220.18	218.53	156.72	70.47	328.75	268.22	0.0007	5.5438
167.0475	232.39	220.75	220.13	218.44	162.68	70.79	328.30	266.98	0.0002	5.5217
167.5483	233.05	220.77	220.04	218.34	168.84	71.17	327.45	267.14	0.0010	5.5457
168.0482	233.73	220.75	219.97	218.28	174.61	71.49	327.37	267.75	0.0010	5.5823
168.5470	233.29	220.65	219.93	218.27	180.33	71.83	326.92	266.65	0.0007	5.5898
169.0478	233.75	220.59	219.88	218.23	186.61	72.17	326.56	268.62	0.0009	5.5914
169.5477	234.09	220.60	219.83	218.20	192.38	72.53	326.24	265.48	0.0000	5.5975
170.0492	234.15	220.43	219.77	218.04	201.80	73.00	325.85	263.36	0.0006	5.5896
170.5482	234.02	220.36	219.63	217.89	209.30	73.55	324.83	266.81	0.0001	5.5654
171.0480	234.78	220.26	219.49	217.82	212.54	74.00	323.28	262.01	0.0003	5.5577
171.5478	235.50	220.21	219.35	217.66	214.30	74.41	322.80	264.53	0.0010	5.5326
172.0477	236.79	219.99	219.20	217.59	215.21	74.81	321.46	267.17	0.0009	5.5331
172.5493	235.43	219.96	219.13	217.49	215.86	75.19	321.89	267.31	0.0002	5.5306
173.0473	234.28	219.90	219.06	217.42	216.18	75.58	320.86	267.47	0.0003	5.5575
173.5480	234.41	219.87	218.96	217.35	216.40	76.00	320.31	267.94	0.0004	5.5576
174.0487	235.50	219.82	218.85	217.26	216.56	76.43	319.49	267.40	0.0003	5.5558
174.5467	237.08	219.83	218.76	217.19	216.61	76.86	318.91	267.32	0.0006	5.5582

TABLE B2.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
175.0475	236.86	219.73	218.67	217.10	216.65	77.31	318.41	267.76	0.0000	5.5307
175.5482	237.13	219.53	218.60	217.03	216.69	77.80	318.19	268.65	0.0007	5.5429
176.0480	234.30	219.30	218.55	216.96	216.69	78.37	317.63	267.94	0.0006	5.5446
176.5470	233.55	219.21	218.50	216.89	216.67	78.91	316.98	268.54	0.0004	5.5609
177.0477	235.40	219.30	218.39	216.80	216.62	79.49	316.26	267.57	0.0005	5.5616
177.5483	235.97	219.29	218.27	216.69	216.51	80.11	315.43	266.30	0.0003	5.5694
178.0482	238.21	219.29	218.14	216.55	216.42	80.83	314.81	262.97	0.0006	5.5526
178.5472	239.86	219.20	217.97	216.25	215.98	82.03	313.44	257.63	0.0007	5.5659
179.0478	240.04	219.22	217.73	215.96	215.77	83.24	311.92	257.24	0.0001	5.5661
179.5487	238.77	219.36	217.31	215.45	215.28	84.96	308.95	263.70	0.0004	5.5751
180.0485	239.01	219.51	216.93	215.36	215.37	85.73	307.03	267.20	0.0005	5.5747
180.5483	239.08	218.92	216.77	215.25	215.34	86.39	305.88	268.61	0.0011	5.5565
181.0472	239.35	218.69	216.63	215.16	215.29	87.12	305.01	267.95	0.0006	5.5540
181.5478	237.95	218.33	216.54	215.07	215.20	88.09	304.42	267.96	0.0002	5.5493
182.0477	238.96	217.92	216.43	214.99	215.13	89.24	303.88	267.88	0.0005	5.5485
182.5467	237.89	218.03	216.36	214.92	215.06	90.57	303.31	268.10	0.0004	5.5588
183.0473	237.05	217.87	216.28	214.85	214.99	91.97	303.07	268.05	0.0004	5.5677
183.5482	236.74	217.66	216.17	214.76	214.94	93.64	301.96	268.00	0.0000	5.5542
184.0480	237.08	217.46	216.06	214.67	214.85	95.52	301.34	267.94	0.0000	5.6053
184.5468	236.57	217.30	215.96	214.55	214.76	97.53	300.47	268.22	0.0005	5.5941
185.0475	233.93	217.12	215.89	214.46	214.62	99.74	300.31	268.16	0.0002	5.5777
185.5483	234.96	217.11	215.77	214.37	214.53	102.15	299.60	268.18	0.0010	5.5742
186.0482	235.71	217.45	215.75	214.30	214.46	104.72	299.54	267.64	0.0000	5.5627
186.5470	236.99	217.50	215.68	214.21	214.36	107.84	298.88	266.60	0.0003	5.5495
187.0478	237.70	217.35	215.54	214.07	214.21	111.48	298.05	265.44	0.0003	5.5450
187.5485	237.76	216.92	215.38	213.91	214.06	115.23	296.97	265.72	0.0011	5.5284
188.0483	237.44	216.72	215.19	213.74	213.86	119.71	295.98	266.31	0.0011	5.5431
188.5472	237.49	216.51	215.03	213.61	213.79	122.96	294.91	268.31	0.0001	5.5891
189.0480	237.16	216.48	214.94	213.51	213.69	127.04	294.26	263.56	0.0004	5.6024
189.5478	235.89	216.39	214.80	213.33	213.47	133.18	293.53	262.69	0.0005	5.5815
190.0485	236.62	216.37	214.64	213.17	213.31	139.37	292.61	262.85	0.0001	5.5933
190.5483	236.23	216.11	214.50	212.99	213.14	147.34	291.66	262.98	0.0005	5.5653
191.0492	236.52	215.93	214.34	212.84	213.00	154.98	290.57	266.56	0.0002	5.5696
191.5470	236.67	215.75	214.22	212.75	212.96	158.29	290.03	267.70	0.0005	5.5419
192.0478	237.21	215.74	214.11	212.73	212.97	159.79	289.33	267.92	0.0005	5.5306
192.5477	235.56	215.56	214.06	212.72	212.99	161.63	288.95	267.94	0.0000	5.5275
193.0493	235.76	215.99	213.99	212.66	212.93	163.80	288.61	268.01	0.0002	5.5378
193.5473	236.35	216.16	213.92	212.61	212.94	166.19	288.18	267.98	0.0000	5.5670
194.0480	235.58	216.09	213.87	212.60	212.90	168.55	288.01	267.95	0.0007	5.5594
194.5478	235.12	215.84	213.83	212.56	212.85	171.27	287.85	267.33	0.0004	5.5813
195.0468	231.88	215.41	213.78	212.50	212.78	175.88	287.61	266.45	0.0000	5.5692
195.5483	227.19	214.70	213.75	212.43	212.68	183.43	286.94	265.86	0.0002	5.5600
196.0473	226.28	214.47	213.61	212.32	212.57	191.43	286.13	265.94	0.0005	5.5458
196.5480	227.30	214.44	213.52	212.22	212.48	197.13	285.73	265.97	0.0005	5.5464
197.0478	228.33	214.47	213.45	212.13	212.40	202.37	285.28	265.77	0.0010	5.5577
197.5468	230.19	214.49	213.37	212.08	212.33	205.40	284.94	265.87	0.0008	5.5554
198.0485	229.73	214.30	213.32	211.99	212.28	207.41	284.78	266.07	0.0007	5.5372
198.5483	230.86	214.28	213.25	211.94	212.21	208.59	284.17	266.19	0.0002	5.5712
199.0480	231.04	214.54	213.18	211.87	212.16	209.35	283.58	266.25	0.0002	5.5932
199.5478	230.85	214.45	213.13	211.80	212.09	209.96	283.24	266.37	0.0003	5.6056

TABLE B2.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
200.0477	231.74	214.29	213.06	211.75	212.05	210.43	282.92	266.34	0.0001	5.5871
200.5475	231.08	214.31	212.99	211.70	212.00	210.68	282.74	266.34	0.0001	5.5834
201.0483	231.00	214.15	212.95	211.67	211.95	210.82	282.32	266.45	0.0003	5.5825
201.5472	229.75	214.08	212.94	211.60	211.88	210.93	282.25	266.45	0.0003	5.5588
202.0480	231.07	214.05	212.87	211.58	211.87	211.01	281.76	266.48	0.0004	5.5492
202.5468	231.43	214.00	212.80	211.51	211.82	211.06	281.47	266.47	0.0005	5.5286
203.0475	232.06	213.95	212.77	211.46	211.78	211.09	281.38	266.48	0.0005	5.5452
203.5483	231.26	213.92	212.74	211.45	211.72	211.09	281.05	266.33	0.0008	5.5488
204.0482	231.78	214.03	212.74	211.41	211.70	211.09	281.09	266.25	0.0004	5.5523
204.5480	229.26	213.89	212.69	211.36	211.65	211.07	280.94	266.38	0.0009	5.5629
205.0478	229.46	214.03	212.65	211.35	211.61	211.08	280.54	266.22	0.0009	5.5711
205.5467	230.20	214.27	212.60	211.26	211.56	211.03	280.32	266.29	0.0002	5.5822
206.0483	230.88	214.14	212.55	211.26	211.53	211.03	280.04	266.37	0.0002	5.5986
206.5472	230.42	213.93	212.50	211.21	211.48	211.02	279.65	266.36	0.0002	5.5857
207.0480	230.03	213.67	212.45	211.16	211.43	210.98	279.47	266.06	0.0001	5.5645
207.5478	229.87	213.69	212.42	211.11	211.38	210.93	279.48	265.74	0.0003	5.5378
208.0467	228.89	213.57	212.42	211.06	211.31	210.88	279.20	265.19	0.0003	5.5205
208.5483	229.48	213.52	212.37	211.03	211.30	210.87	278.95	264.92	0.0012	5.5455
209.0482	231.36	213.86	212.32	210.98	211.23	210.83	278.84	266.31	0.0001	5.5358
209.5480	231.94	214.13	212.29	210.94	211.21	210.84	278.30	266.27	0.0005	5.5520
210.0478	231.35	213.94	212.22	210.91	211.16	210.79	277.83	265.50	0.0005	5.5861
210.5477	230.01	213.65	212.19	210.84	211.08	210.72	277.82	266.09	0.0005	5.5880
211.0475	230.88	213.55	212.12	210.79	211.04	210.70	277.67	265.84	0.0005	5.5661
211.5482	231.15	213.37	212.10	210.76	211.01	210.71	277.51	265.70	0.0005	5.5871
212.0472	232.08	213.30	212.07	210.75	211.00	210.66	277.13	263.52	0.0004	5.5740
212.5478	231.96	213.17	211.97	210.62	210.82	210.50	276.74	265.59	0.0002	5.5542
213.0477	232.57	213.20	211.91	210.57	210.81	210.50	276.08	265.60	0.0001	5.5590
213.5483	231.37	213.06	211.79	210.47	210.70	210.36	275.81	261.91	0.0002	5.5287
214.0473	230.73	213.30	211.76	210.35	210.54	210.20	275.35	261.78	0.0002	5.5344
214.5490	230.18	213.07	211.60	210.19	210.35	210.01	274.48	261.37	0.0004	5.5363
215.0470	230.52	213.27	211.50	210.07	210.23	209.91	273.78	260.96	0.0001	5.5564
215.5477	230.08	213.08	211.39	209.96	210.14	209.84	273.31	261.22	0.0006	5.5736
216.0485	228.35	212.65	211.34	209.91	210.05	209.77	272.99	261.74	0.0000	5.5767
216.5483	229.32	212.63	211.24	209.82	210.02	209.72	272.28	261.24	0.0000	5.5403
217.0480	231.04	212.76	211.12	209.74	209.94	209.67	271.66	262.37	0.0002	5.5386
217.5478	231.83	212.75	211.03	209.65	209.85	209.58	271.07	259.75	0.0004	5.5334
218.0468	231.62	212.64	210.94	209.55	209.73	209.46	270.61	260.09	0.0004	5.5404
218.5475	232.09	212.56	210.82	209.48	209.70	209.46	269.96	261.72	0.0003	5.5335
219.0483	231.11	212.46	210.77	209.39	209.63	209.36	269.80	259.82	0.0003	5.5492
219.5482	230.18	212.30	210.72	209.34	209.58	209.34	269.57	259.83	0.0003	5.5498
220.0488	227.23	212.43	210.69	209.38	209.65	209.42	269.21	260.52	0.0004	5.5760
220.5477	228.52	212.34	210.64	209.35	209.62	209.39	268.83	258.86	0.0004	5.5850
221.0475	229.20	212.34	210.61	209.36	209.66	209.44	268.59	260.24	0.0003	5.5707
221.5483	230.42	212.13	210.59	209.34	209.66	209.47	268.58	260.15	0.0003	5.5649
222.0482	230.86	212.08	210.60	209.34	209.63	209.38	268.62	260.03	0.0003	5.5791
222.5470	230.88	212.05	210.58	209.42	209.85	209.71	268.48	261.05	0.0002	5.5405
223.0478	231.83	212.02	210.64	209.44	209.76	209.48	268.72	259.82	0.0002	5.5132
223.5477	231.71	212.07	210.62	209.43	209.78	209.60	268.70	261.31	0.0002	5.5243
224.0492	231.53	211.97	210.63	209.41	209.68	209.45	268.74	261.17	0.0002	5.5504
224.5472	231.48	211.87	210.58	209.43	209.79	209.54	268.50	260.04	0.0002	5.5863

TABLE B2.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
225.0480	231.22	212.16	210.58	209.47	209.96	209.78	268.58	263.36	0.0008	5.5872
225.5478	230.28	212.04	210.66	209.51	209.83	209.57	269.02	260.17	0.0008	5.5975
226.0477	230.06	212.02	210.68	209.46	209.84	209.62	269.25	260.17	0.0004	5.5927
226.5483	230.16	211.99	210.68	209.52	209.97	209.75	269.08	262.61	0.0000	5.5886
227.0482	231.07	212.19	210.79	209.60	209.90	209.63	269.51	260.20	0.0000	5.5579
227.5480	230.43	212.27	210.76	209.63	210.01	209.78	269.77	261.88	0.0001	5.5374
228.0478	230.78	212.23	210.80	209.50	209.80	209.59	269.71	261.44	0.0002	5.5335
228.5467	231.66	212.29	210.77	209.52	209.82	209.57	269.83	260.81	0.0007	5.5405
229.0475	231.43	212.33	210.72	209.52	209.93	209.72	269.20	261.03	0.0005	5.5374
229.5482	230.18	212.07	210.76	209.52	209.81	209.52	269.34	259.57	0.0001	5.5505
230.0480	231.11	212.10	210.76	209.56	209.85	209.53	270.07	259.94	0.0001	5.5605
230.5488	230.63	211.98	210.71	209.44	209.89	209.46	269.25	261.49	0.0000	5.5835
231.0477	229.76	211.95	210.77	209.62	210.07	209.89	269.88	263.23	0.0008	5.5678
231.5483	230.91	212.15	210.88	209.77	210.16	209.95	270.81	262.50	0.0005	5.5517
232.0482	230.93	212.51	210.96	209.74	210.11	209.97	270.73	262.33	0.0004	5.5632
232.5480	227.85	212.39	211.03	209.83	210.17	209.94	271.55	261.85	0.0002	5.5515
233.0478	228.20	212.72	211.02	209.71	210.01	209.80	271.04	262.25	0.0002	5.5505
233.5477	230.75	213.06	211.02	209.79	210.05	209.80	271.02	262.53	0.0009	5.5287
234.0485	231.48	213.06	211.02	209.70	209.93	209.75	270.97	262.44	0.0001	5.5298
234.5483	233.92	212.89	210.96	209.81	210.13	209.92	270.76	261.71	0.0001	5.5495
235.0480	232.89	212.84	211.01	209.81	210.14	209.90	271.26	261.86	0.0004	5.5727
235.5478	232.19	212.73	211.05	209.84	210.19	210.00	271.10	262.20	0.0004	5.5785
236.0477	232.21	212.76	211.04	209.87	210.23	210.00	271.42	262.50	0.0006	5.5812
236.5475	232.22	212.76	211.10	209.91	210.29	210.11	271.80	262.81	0.0006	5.5699
237.0483	230.14	212.71	211.17	209.99	210.35	210.15	271.98	263.00	0.0006	5.5597
237.5482	230.51	212.69	211.25	210.05	210.37	210.15	272.11	262.75	0.0004	5.5459
238.0480	231.08	212.64	211.21	210.00	210.37	210.17	271.97	262.66	0.0000	5.5333
238.5468	231.05	212.52	211.20	209.95	210.20	209.95	272.10	261.73	0.0005	5.5574
239.0475	228.04	212.35	211.22	209.95	210.25	210.06	272.57	263.22	0.0004	5.5392
239.5483	230.30	212.35	211.19	209.95	210.26	210.03	272.08	262.43	0.0004	5.5464
240.0482	232.17	212.46	211.17	209.96	210.31	210.14	271.81	262.36	0.0008	5.5852
240.5480	232.94	212.55	211.18	209.96	210.32	210.12	271.93	262.24	0.0008	5.5908
241.0478	234.08	212.65	211.16	209.96	210.30	210.12	271.99	263.09	0.0004	5.6025
241.5477	233.22	212.67	211.17	209.98	210.34	210.16	272.02	262.60	0.0004	5.5814
242.0483	232.00	212.60	211.21	210.02	210.38	210.17	272.25	262.64	0.0004	5.5731
242.5482	232.22	212.60	211.19	210.06	210.42	210.22	272.42	262.56	0.0005	5.5629
243.0480	230.61	212.79	211.23	210.05	210.41	210.21	272.66	262.91	0.0004	5.5458
243.5478	230.74	212.72	211.27	210.12	210.46	210.27	272.38	262.99	0.0004	5.5214
244.0485	230.93	212.90	211.29	210.11	210.45	210.29	272.77	263.25	0.0001	5.5300
244.5475	230.54	212.91	211.31	210.13	210.49	210.31	272.50	263.58	0.0001	5.5676
245.0482	230.77	212.78	211.30	210.15	210.51	210.31	273.20	263.76	0.0007	5.5945
245.5480	231.60	212.88	211.39	210.17	210.52	210.30	273.35	263.24	0.0007	5.5752
246.0478	231.60	212.88	211.38	210.18	210.48	210.27	273.37	262.92	0.0003	5.5735
246.5477	228.47	212.62	211.43	210.18	210.50	210.31	273.88	263.67	0.0006	5.6004
247.0483	228.91	212.49	211.42	210.26	210.60	210.40	273.37	264.23	0.0002	5.5806
247.5473	231.47	212.64	211.44	210.28	210.64	210.42	273.35	264.25	0.0002	5.5628
248.0480	233.89	212.72	211.45	210.25	210.57	210.34	273.39	263.39	0.0000	5.5453
248.5478	232.10	212.81	211.43	210.23	210.59	210.39	273.42	263.91	0.0005	5.5201
249.0467	231.73	212.83	211.44	210.27	210.58	210.36	273.24	263.34	0.0000	5.5063
249.5475	230.88	212.87	211.44	210.20	210.49	210.29	273.73	262.94	0.0000	5.5489

TABLE B2.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
250.0492	231.02	213.07	211.39	210.17	210.49	210.24	273.27	262.76	0.0005	5.5565
250.5472	230.58	213.02	211.32	210.14	210.48	210.23	272.70	263.05	0.0004	5.5953
251.0470	230.40	212.86	211.32	210.11	210.43	210.25	272.94	263.17	0.0002	5.5893
251.5477	230.57	212.63	211.26	210.09	210.41	210.22	272.57	263.28	0.0007	5.5928
252.0485	230.72	212.64	211.31	210.11	210.47	210.29	272.99	263.48	0.0001	5.5652
252.5482	231.35	212.50	211.28	210.15	210.53	210.35	272.80	263.31	0.0002	5.5712
253.0480	230.74	212.52	211.28	210.16	210.51	210.32	272.60	263.43	0.0002	5.5246
253.5488	231.44	212.47	211.31	210.16	210.52	210.36	272.86	263.48	0.0002	5.5234
254.0477	232.09	212.51	211.36	210.18	210.56	210.36	273.37	263.86	0.0007	5.5461
254.5475	231.91	212.51	211.37	210.20	210.54	210.36	272.88	263.64	0.0001	5.5620
255.0473	231.35	212.59	211.35	210.19	210.55	210.38	272.82	263.30	0.0000	5.5622
255.5482	230.65	212.82	211.39	210.21	210.55	210.39	273.12	263.78	0.0004	5.5535
256.0480	230.55	212.79	211.41	210.21	210.55	210.36	273.04	263.44	0.0005	5.5749
256.5477	227.43	212.42	211.45	210.23	210.56	210.38	273.69	263.06	0.0007	5.5879
257.0467	228.30	212.33	211.40	210.06	209.97	209.22	273.43	250.72	0.0001	3.1443

TABLE B3. PRESSURE AND TEMPERATURE DATA FOR RUN 5 (PURE STEAM).

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
0.0540	61.86	58.30	50.98	53.55	52.82	48.54	267.23	268.56	0.0001	5.4997
0.5483	85.13	75.46	50.96	53.57	52.79	48.56	267.75	269.04	0.0000	5.4933
1.0480	91.08	71.54	50.95	53.52	52.82	48.57	267.10	268.39	0.0001	5.5361
1.5478	103.11	72.18	50.84	53.49	52.80	48.61	267.29	268.24	0.0001	5.5041
2.0477	163.40	85.05	50.70	53.38	52.71	48.65	267.75	268.41	0.0008	5.4815
2.5475	209.47	118.91	50.68	53.33	52.72	48.66	268.57	268.19	0.0001	5.5066
3.0483	214.98	207.16	50.71	53.49	52.90	48.78	272.45	269.01	0.0003	5.5386
3.5490	217.64	210.39	50.71	53.49	52.96	48.79	266.01	266.39	0.0002	5.4895
4.0480	220.81	210.18	50.78	53.46	52.97	48.79	264.28	265.04	0.0006	5.4800
4.5477	221.12	210.42	50.76	53.49	52.99	48.82	266.13	265.49	0.0004	5.5217
5.0475	219.62	210.71	50.73	53.45	53.02	48.84	268.86	267.07	0.0005	5.5090
5.5483	218.95	210.93	50.74	53.36	53.02	48.85	270.65	267.73	0.0004	5.4872
6.0490	221.01	211.56	50.84	53.29	53.05	48.85	272.40	268.29	0.0004	5.5124
6.5480	223.88	212.36	50.88	53.28	53.03	48.88	271.39	266.74	0.0004	5.5225
7.0478	224.87	212.56	50.91	53.27	53.06	48.89	269.19	263.86	0.0004	5.4872
7.5477	223.84	212.04	50.93	53.31	53.06	48.87	268.54	265.43	0.0003	5.4801
8.0483	221.70	211.67	50.96	53.34	53.07	48.90	270.82	266.67	0.0008	5.5292
8.5482	221.92	212.11	51.00	53.36	53.10	48.92	276.66	267.82	0.0004	5.5266
9.0470	223.19	213.01	51.16	53.33	53.16	48.95	279.14	267.66	0.0006	5.4724
9.5478	225.42	213.95	51.47	53.30	53.26	48.94	281.32	267.67	0.0001	5.4950
10.0477	228.25	215.04	52.24	53.27	53.32	48.94	284.66	267.60	0.0002	5.5209
10.5483	230.71	215.59	53.43	53.24	53.37	48.95	287.83	267.55	0.0004	5.5095
11.0482	231.69	216.42	54.46	53.20	53.41	48.96	289.38	267.38	0.0004	5.4898
11.5480	231.14	216.26	55.34	53.19	53.42	48.96	290.31	267.18	0.0002	5.5231
12.0478	228.08	216.63	56.13	53.16	53.43	48.99	292.74	267.07	0.0004	5.5129
12.5477	227.23	216.15	57.01	53.11	53.45	49.09	293.95	266.68	0.0002	5.4804
13.0475	225.96	215.72	57.83	53.08	53.44	49.19	295.21	266.84	0.0001	5.4769
13.5482	226.06	215.84	58.38	53.06	53.48	49.27	296.34	266.83	0.0000	5.5087
14.0480	225.69	215.75	58.94	53.05	53.45	49.30	297.56	266.81	0.0004	5.5171
14.5470	225.89	215.90	59.50	53.02	53.46	49.32	298.50	266.85	0.0004	5.4759
15.0477	226.49	216.23	60.13	53.01	53.48	49.35	300.91	266.86	0.0001	5.4917
15.5483	226.96	216.44	60.67	53.00	53.49	49.39	302.25	266.73	0.0006	5.5286
16.0482	226.64	216.69	61.18	53.00	53.50	49.40	304.47	266.70	0.0000	5.5048
16.5490	227.15	216.93	61.74	52.99	53.50	49.45	306.03	266.90	0.0004	5.4899
17.0470	227.80	217.22	62.33	53.00	53.53	49.49	308.07	267.15	0.0005	5.5017
17.5477	228.04	217.53	62.93	52.98	53.54	49.55	308.99	258.96	0.0004	5.5361
18.0485	228.55	217.85	63.61	52.97	53.58	49.56	311.35	258.35	0.0001	5.4901
18.5483	228.73	218.05	64.68	52.94	53.61	49.63	313.19	258.26	0.0003	5.4856
19.0480	228.78	218.27	65.69	52.93	53.63	49.65	314.53	258.19	0.0002	5.5139
19.5470	229.04	218.53	66.22	52.94	53.66	49.72	316.14	258.78	0.0004	5.5187
20.0477	229.22	218.78	67.21	52.92	53.69	49.76	317.97	258.77	0.0002	5.4907
20.5475	229.03	219.01	67.99	52.91	53.69	49.81	319.51	258.11	0.0000	5.5084
21.0483	229.49	219.28	69.06	52.92	53.72	49.85	321.06	259.16	0.0004	5.5360
21.5482	229.47	219.52	69.74	52.91	53.75	49.88	322.73	259.04	0.0004	5.5097
22.0480	229.79	219.72	70.64	52.90	53.75	49.93	324.02	258.11	0.0004	5.4863
22.5487	230.15	220.02	71.66	52.88	53.76	49.99	326.13	258.88	0.0004	5.5299
23.0475	230.19	220.26	72.44	52.89	53.75	50.04	327.84	259.03	0.0004	5.5219
23.5483	230.07	220.59	73.61	52.86	53.79	50.12	330.01	257.12	0.0000	5.4812
24.0472	230.74	220.86	74.41	52.89	53.78	50.16	331.59	258.95	0.0004	5.4791
24.5480	231.09	221.10	75.62	52.90	53.79	50.23	333.14	259.15	0.0001	5.5167

TABLE B3.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
25.0468	231.37	221.36	76.75	52.88	53.81	50.27	334.96	259.04	0.0002	5.5074
25.5477	231.66	221.65	77.92	52.87	53.80	50.28	336.36	259.05	0.0005	5.4842
26.0483	231.79	221.80	78.91	52.88	53.81	50.31	338.17	257.75	0.0001	5.5057
26.5482	231.87	222.03	80.32	52.87	53.84	50.33	339.05	259.04	0.0004	5.5456
27.0480	231.83	222.25	81.15	52.90	53.85	50.34	340.49	258.94	0.0004	5.5083
27.5478	232.53	222.40	81.96	52.88	53.85	50.33	341.89	258.86	0.0004	5.5006
28.0477	232.82	222.53	82.72	52.89	53.88	50.40	342.23	258.06	0.0004	5.5261
28.5483	232.94	222.64	83.32	52.92	53.89	50.40	343.61	259.06	0.0000	5.5139
29.0473	232.98	222.78	84.01	52.93	53.90	50.49	343.92	259.07	0.0004	5.5029
29.5480	232.51	222.86	84.69	52.93	53.92	50.53	344.36	259.01	0.0004	5.4915
30.0478	231.30	222.77	85.80	52.94	53.91	50.58	344.38	258.96	0.0005	5.5210
30.5477	232.11	222.87	86.83	52.97	53.92	50.63	345.20	258.88	0.0004	5.5255
31.0483	231.97	223.04	87.51	52.99	53.95	50.67	346.11	258.97	0.0005	5.4836
31.5473	232.34	223.14	88.24	53.00	53.93	50.72	346.89	258.80	0.0001	5.5001
32.0480	232.70	223.25	89.20	53.03	53.94	50.76	347.72	259.04	0.0000	5.5303
32.5478	232.07	223.31	90.07	53.06	53.97	50.81	347.27	258.95	0.0003	5.4974
33.0468	231.64	223.21	91.12	53.08	53.98	50.84	347.33	258.90	0.0004	5.4816
33.5475	231.96	223.29	92.26	53.09	53.97	50.88	348.55	258.94	0.0004	5.4968
34.0482	231.96	223.37	93.16	53.14	53.99	50.93	349.09	258.02	0.0004	5.5200
34.5480	232.28	223.47	94.10	53.17	53.98	50.97	349.54	258.92	0.0004	5.5028
35.0470	231.69	223.53	95.04	53.21	53.99	50.98	350.05	258.90	0.0003	5.4629
35.5477	231.99	223.64	96.29	53.26	54.00	51.03	351.06	258.79	0.0004	5.5144
36.0485	232.01	223.79	97.61	53.28	53.99	51.04	352.06	258.75	0.0002	5.5136
36.5483	231.90	223.89	98.66	53.33	54.00	51.07	352.49	258.88	0.0006	5.4734
37.0480	232.23	223.90	99.62	53.40	54.01	51.09	352.87	258.85	0.0004	5.4931
37.5478	232.21	224.00	100.55	53.44	54.03	51.14	353.13	258.86	0.0001	5.5132
38.0477	232.19	223.99	101.52	53.49	54.02	51.17	353.44	258.87	0.0004	5.4743
38.5475	232.41	224.10	102.59	53.55	54.01	51.21	353.91	258.84	0.0004	5.4955
39.0483	232.47	224.15	103.57	53.62	54.04	51.26	354.25	258.80	0.0004	5.5345
39.5482	232.30	224.17	104.54	53.67	54.03	51.29	354.41	258.75	0.0004	5.4924
40.0480	232.49	224.25	105.73	53.75	54.04	51.31	355.15	257.82	0.0004	5.4671
40.5477	232.42	224.29	106.66	53.82	54.04	51.30	355.43	258.75	0.0004	5.4971
41.0467	232.27	224.34	107.73	53.90	54.03	51.35	355.63	258.80	0.0004	5.4924
41.5483	232.49	224.38	108.73	53.97	54.02	51.36	355.87	258.28	0.0005	5.4648
42.0482	232.38	224.35	109.66	54.05	54.05	51.38	356.01	258.82	0.0004	5.4927
42.5480	231.97	224.29	110.66	54.15	54.06	51.41	355.60	258.87	0.0004	5.5250
43.0478	232.34	224.32	111.78	54.22	54.05	51.44	355.98	258.66	0.0004	5.4792
43.5477	232.29	224.40	112.78	54.34	54.06	51.47	356.06	258.78	0.0002	5.4814
44.0483	232.25	224.33	113.56	54.43	54.07	51.48	354.98	258.76	0.0000	5.5127
44.5482	231.57	224.29	114.47	54.51	54.04	51.50	356.88	258.70	0.0003	5.5055
45.0470	231.49	224.56	115.71	54.65	54.05	51.53	358.37	258.70	0.0004	5.4799
45.5478	231.86	224.66	116.79	54.79	54.05	51.56	359.10	258.84	0.0001	5.5203
46.0477	232.06	224.76	117.80	54.92	54.06	51.59	359.27	258.78	0.0004	5.5114
46.5483	232.34	224.86	118.88	55.04	54.05	51.60	359.81	258.72	0.0004	5.4694
47.0473	232.42	224.90	119.91	55.16	54.06	51.63	360.70	257.12	0.0004	5.4856
47.5480	232.56	225.03	120.97	55.32	54.07	51.65	361.45	258.76	0.0002	5.5074
48.0478	232.49	225.10	121.85	55.47	54.06	51.66	361.23	258.30	0.0004	5.4953
48.5467	232.36	225.27	122.96	55.61	54.05	51.69	363.17	258.78	0.0004	5.4822
49.0475	232.53	225.26	124.00	55.79	54.08	51.72	363.00	258.66	0.0004	5.5064
49.5482	231.78	225.12	124.90	55.95	54.09	51.73	361.19	258.69	0.0002	5.5026

TABLE B3.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
50.0490	231.66	224.99	125.82	56.11	54.08	51.77	360.64	258.48	0.0004	5.4943
50.5478	231.58	224.94	126.76	56.29	54.08	51.80	360.16	258.76	0.0004	5.4721
51.0468	231.52	224.89	127.71	56.47	54.11	51.83	360.17	258.76	0.0002	5.5058
51.5475	231.44	224.87	128.63	56.67	54.10	51.84	359.98	258.75	0.0004	5.5139
52.0482	231.66	224.91	129.53	56.88	54.11	51.86	360.26	257.65	0.0004	5.4702
52.5490	231.60	224.95	130.43	57.06	54.14	51.89	360.69	258.75	0.0000	5.4765
53.0478	231.52	224.98	131.35	57.26	54.11	51.92	360.84	258.72	0.0002	5.4660
53.5477	231.49	224.97	132.31	57.50	54.12	51.93	360.80	258.59	0.0001	5.4402
54.0485	231.68	224.98	133.19	57.72	54.13	51.94	360.66	258.62	0.0001	5.4372
54.5483	231.54	224.93	134.06	57.93	54.13	51.98	360.61	258.63	0.0004	5.4340
55.0480	231.84	224.91	134.87	58.17	54.14	51.99	359.69	258.63	0.0004	5.4833
55.5478	231.63	224.86	135.64	58.39	54.13	52.00	359.57	258.71	0.0004	5.4540
56.0477	231.58	224.83	136.43	58.64	54.14	52.03	359.51	258.54	0.0004	5.4519
56.5467	231.61	224.82	137.24	58.86	54.15	52.06	359.39	258.62	0.0003	5.4934
57.0473	231.62	224.87	138.13	59.13	54.14	52.05	359.72	258.58	0.0002	5.4584
57.5482	231.89	224.89	138.91	59.39	54.15	52.09	360.05	258.61	0.0004	5.4361
58.0480	231.78	224.92	139.67	59.68	54.16	52.08	360.33	258.67	0.0004	5.4558
58.5468	231.70	224.91	140.44	59.96	54.17	52.11	360.14	258.66	0.0004	5.4788
59.0475	231.76	224.90	141.21	60.25	54.17	52.14	359.80	258.46	0.0004	5.4342
59.5483	231.44	224.93	142.00	60.54	54.20	52.15	359.93	258.61	0.0004	5.4440
60.0490	231.49	224.92	142.79	60.87	54.19	52.17	359.86	256.53	0.0002	5.4618
60.5480	231.64	224.85	143.58	61.18	54.20	52.20	359.61	258.64	0.0004	5.4581
61.0468	231.99	224.81	144.35	61.51	54.21	52.21	358.86	258.08	0.0004	5.4390
61.5477	231.65	224.80	145.10	61.81	54.22	52.22	358.95	258.65	0.0004	5.4610
62.0483	231.31	224.73	145.87	62.12	54.23	52.25	358.28	258.55	0.0002	5.4865
62.5482	231.44	224.67	146.62	62.43	54.21	52.27	358.37	253.61	0.0004	5.4644
63.0470	231.73	224.70	147.43	62.80	54.24	52.28	357.93	255.04	0.0004	5.4225
63.5478	231.76	224.61	148.20	63.16	54.25	52.29	357.24	254.36	0.0001	5.4549
64.0477	231.59	224.57	148.91	63.49	54.28	52.32	357.21	254.93	0.0004	5.4301
64.5483	231.61	224.58	149.59	63.84	54.27	52.33	357.03	254.85	0.0005	5.4212
65.0482	231.40	224.51	150.27	64.21	54.29	52.35	356.47	253.66	0.0001	5.4090
65.5480	231.48	224.48	150.93	64.54	54.30	52.36	356.34	256.20	0.0004	5.4444
66.0478	231.53	224.45	151.58	64.89	54.31	52.37	355.66	257.20	0.0005	5.4225
66.5477	231.57	224.43	152.26	65.25	54.32	52.40	355.65	249.63	0.0004	5.4147
67.0483	231.77	224.38	153.01	65.68	54.34	52.40	355.44	255.83	0.0004	5.3661
67.5482	231.67	224.30	153.63	66.04	54.35	52.43	354.60	257.63	0.0004	5.3930
68.0480	231.38	224.22	154.20	66.39	54.38	52.44	354.03	253.84	0.0004	5.3821
68.5470	231.48	224.14	154.82	66.78	54.41	52.45	353.31	253.18	0.0004	5.3663
69.0477	231.38	224.00	155.50	67.24	54.43	52.47	352.21	247.27	0.0004	5.3467
69.5483	231.72	223.90	156.19	67.68	54.44	52.48	351.43	249.58	0.0004	5.3735
70.0492	231.71	223.89	156.83	68.08	54.45	52.49	351.55	248.98	0.0004	5.3820
70.5480	231.56	223.86	157.53	68.54	54.48	52.50	351.05	252.12	0.0004	5.3700
71.0470	231.80	223.80	158.24	68.91	54.48	52.52	350.41	257.69	0.0005	5.3651
71.5477	231.49	223.75	158.88	69.33	54.51	52.53	349.95	257.62	0.0001	5.3703
72.0485	231.65	223.74	159.48	69.74	54.56	52.54	349.98	254.77	0.0004	5.3705
72.5483	231.39	223.64	160.08	70.20	54.57	52.55	349.64	258.74	0.0004	5.3650
73.0472	231.31	223.61	160.70	70.62	54.59	52.54	349.95	258.56	0.0004	5.3502
73.5478	231.76	223.72	161.36	71.11	54.61	52.56	350.30	258.73	0.0004	5.3434
74.0477	231.97	223.77	162.02	71.57	54.64	52.59	350.08	258.75	0.0000	5.3514
74.5475	231.61	223.70	162.66	72.05	54.67	52.60	350.28	258.71	0.0005	5.3460

TABLE B3.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
75.0483	231.59	223.69	163.35	72.57	54.73	52.58	349.96	258.62	0.0007	5.3452
75.5482	231.90	223.66	163.99	73.06	54.74	52.63	349.57	257.07	0.0004	5.3360
76.0480	231.96	223.76	164.75	73.58	54.80	52.64	350.57	257.68	0.0001	5.3283
76.5477	231.82	223.82	165.49	74.09	54.85	52.64	350.15	255.85	0.0004	5.3422
77.0475	230.99	223.66	166.37	74.59	54.88	52.65	350.26	255.49	0.0002	5.3192
77.5483	231.30	223.74	167.31	75.18	54.92	52.66	350.82	258.99	0.0004	5.2761
78.0482	231.79	223.77	168.27	75.73	54.97	52.68	350.16	256.51	0.0004	5.2220
78.5480	232.33	223.92	169.48	76.28	55.03	52.69	350.09	256.85	0.0004	5.2387
79.0478	231.60	223.78	171.16	76.83	55.07	52.72	349.75	254.49	0.0004	5.2561
79.5467	231.61	223.61	173.04	77.40	55.12	52.72	348.93	254.99	0.0000	5.2595
80.0483	231.71	223.59	175.87	78.01	55.18	52.73	348.39	256.47	0.0002	5.2653
80.5482	231.93	223.64	179.57	78.54	55.25	52.74	347.82	256.63	0.0003	5.2200
81.0470	231.84	223.50	184.05	79.09	55.31	52.72	347.50	258.75	0.0004	5.2246
81.5478	231.81	223.49	189.54	79.66	55.37	52.73	347.57	258.74	0.0003	5.2143
82.0477	231.62	223.44	195.12	80.26	55.44	52.73	347.34	256.34	0.0004	5.2625
82.5483	231.50	223.32	199.01	80.85	55.50	52.74	346.64	256.19	0.0010	5.2781
83.0473	231.81	223.36	202.73	81.42	55.58	52.75	346.33	258.69	0.0004	5.2337
83.5480	231.85	223.31	205.69	82.04	55.66	52.75	345.79	258.66	0.0004	5.2214
84.0468	231.36	223.18	208.48	82.63	55.75	52.78	345.69	258.71	0.0004	5.2462
84.5477	231.58	223.13	210.53	83.23	55.83	52.77	345.47	258.71	0.0004	5.2515
85.0483	231.62	223.10	212.29	83.86	55.93	52.77	345.02	258.66	0.0006	5.2419
85.5482	232.13	223.19	213.78	84.44	56.01	52.78	344.73	258.72	0.0002	5.2487
86.0490	231.58	223.02	215.20	85.06	56.09	52.79	344.55	258.67	0.0004	5.2475
86.5470	230.96	222.92	216.62	85.67	56.21	52.77	343.91	258.62	0.0004	5.2715
87.0477	231.11	222.89	217.88	86.29	56.30	52.78	343.47	258.60	0.0004	5.3139
87.5483	231.85	223.07	218.85	86.91	56.42	52.80	343.66	258.15	0.0002	5.2229
88.0482	231.60	222.95	219.86	87.55	56.50	52.79	343.47	258.58	0.0005	5.2207
88.5472	231.27	222.87	220.51	88.17	56.62	52.80	343.34	258.60	0.0004	5.2509
89.0478	231.45	222.91	220.87	88.81	56.74	52.80	343.32	258.64	0.0004	5.2613
89.5477	231.44	222.90	221.20	89.47	56.86	52.83	343.18	258.65	0.0005	5.2621
90.0493	231.53	222.80	221.44	90.11	56.97	52.83	342.95	258.58	0.0004	5.2858
90.5483	231.40	222.89	221.57	90.75	57.10	52.84	342.60	258.61	0.0003	5.2905
91.0472	231.56	222.86	221.63	91.41	57.22	52.84	342.22	258.58	0.0004	5.2978
91.5478	231.51	222.76	221.60	92.04	57.35	52.85	341.49	258.66	0.0006	5.2819
92.0477	231.30	222.73	221.55	92.64	57.49	52.87	340.86	258.54	0.0002	5.3064
92.5467	231.31	222.61	221.50	93.28	57.63	52.90	340.56	258.52	0.0004	5.3232
93.0473	231.47	222.66	221.45	93.90	57.75	52.92	340.23	258.60	0.0004	5.3180
93.5482	231.66	222.78	221.44	94.56	57.91	52.93	339.63	258.55	0.0002	5.3153
94.0480	231.13	222.59	221.44	95.21	58.06	52.91	339.51	258.49	0.0006	5.3424
94.5468	231.31	222.50	221.39	95.87	58.20	52.92	339.12	258.44	0.0005	5.3666
95.0475	231.26	222.45	221.34	96.50	58.36	52.94	338.84	258.43	0.0009	5.3752
95.5483	231.14	222.33	221.31	97.16	58.50	52.95	338.39	258.56	0.0000	5.3645
96.0482	231.38	222.43	221.26	97.79	58.67	52.95	338.41	258.52	0.0004	5.3666
96.5470	231.17	222.16	221.25	98.48	58.85	52.96	337.98	258.48	0.0003	5.4167
97.0478	231.14	222.18	221.20	99.16	59.00	52.96	337.36	258.55	0.0001	5.4625
97.5477	230.91	222.21	221.15	99.87	59.20	52.97	336.99	258.59	0.0001	5.5027
98.0483	230.93	222.12	221.12	100.56	59.35	52.97	336.57	258.54	0.0004	5.5300
98.5482	230.88	222.13	221.05	101.28	59.53	52.97	336.31	258.49	0.0005	5.5189
99.0480	230.90	222.06	221.02	101.99	59.70	52.98	336.11	258.47	0.0004	5.5406
99.5478	230.89	222.03	221.01	102.72	59.90	52.99	335.78	258.48	0.0004	5.5193

TABLE B3.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
100.0477	231.11	222.09	220.99	103.55	60.09	53.01	335.55	258.45	0.0005	5.5413
100.5483	230.83	221.98	220.98	104.39	60.31	53.01	335.39	257.98	0.0004	5.5172
101.0482	230.56	221.83	220.93	105.30	60.54	53.04	335.03	257.72	0.0008	5.5259
101.5480	231.28	222.06	220.92	106.28	60.73	53.06	335.02	258.49	0.0004	5.5062
102.0478	230.91	222.03	220.92	107.41	60.95	53.07	334.93	257.33	0.0002	5.5014
102.5477	230.59	221.96	220.89	108.64	61.14	53.09	334.85	258.51	0.0002	5.5140
103.0483	231.22	221.95	220.88	109.91	61.37	53.11	334.39	256.78	0.0004	5.5172
103.5482	230.67	221.85	220.86	111.36	61.60	53.10	334.32	258.27	0.0004	5.5154
104.0480	230.59	221.81	220.83	112.87	61.81	53.12	334.33	256.98	0.0006	5.5346
104.5478	230.41	221.78	220.84	114.55	62.05	53.15	334.06	258.49	0.0003	5.5267
105.0477	230.27	221.65	220.82	116.26	62.26	53.17	334.06	258.47	0.0009	5.5138
105.5483	230.33	221.79	220.81	118.08	62.49	53.19	333.85	258.23	0.0004	5.5592
106.0482	230.39	221.81	220.83	120.09	62.70	53.21	333.87	258.49	0.0006	5.5344
106.5472	230.75	221.89	220.85	122.18	62.88	53.22	334.10	258.46	0.0005	5.5488
107.0478	230.23	221.75	220.85	124.35	63.07	53.26	334.19	258.44	0.0003	5.5555
107.5468	230.10	221.58	220.89	126.56	63.24	53.26	334.40	258.41	0.0004	5.5704
108.0485	230.32	221.79	220.92	128.76	63.44	53.29	334.53	258.47	0.0007	5.5699
108.5483	230.00	221.69	220.97	131.14	63.63	53.33	334.49	258.45	0.0004	5.5555
109.0480	230.05	221.75	220.98	133.24	63.80	53.35	334.94	258.45	0.0001	5.5637
109.5478	229.86	221.70	221.02	135.41	64.00	53.36	334.83	258.39	0.0003	5.5665
110.0477	230.17	221.65	221.02	137.43	64.17	53.40	334.97	258.57	0.0003	5.5856
110.5475	230.08	221.87	221.08	139.49	64.36	53.40	335.48	258.42	0.0000	5.5766
111.0483	230.23	221.85	221.10	141.44	64.54	53.42	335.52	258.37	0.0010	5.6013
111.5482	230.25	221.94	221.14	143.28	64.73	53.45	335.80	258.35	0.0004	5.5938
112.0470	230.15	221.95	221.18	145.28	64.92	53.45	336.18	258.32	0.0007	5.6208
112.5477	230.08	221.99	221.23	147.11	65.10	53.47	336.54	258.36	0.0004	5.5889
113.0475	230.21	221.99	221.29	148.89	65.31	53.50	337.16	258.37	0.0004	5.5914
113.5483	230.34	222.08	221.42	150.65	65.48	53.52	337.77	258.30	0.0004	5.6143
114.0490	230.09	222.12	221.48	152.32	65.69	53.54	337.99	258.45	0.0004	5.5878
114.5488	229.90	222.18	221.54	153.97	65.92	53.58	338.27	257.09	0.0000	5.5976
115.0478	230.29	222.27	221.57	155.47	66.12	53.61	338.48	258.33	0.0004	5.4813
115.5477	230.19	222.33	221.61	156.98	66.33	53.61	338.76	256.49	0.0004	5.4915
116.0483	230.26	222.35	221.62	158.41	66.52	53.63	338.81	258.41	0.0001	5.4576
116.5482	230.09	222.43	221.62	159.76	66.73	53.66	338.85	257.92	0.0002	5.4852
117.0480	229.77	222.30	221.61	161.14	66.94	53.70	338.68	258.35	0.0007	5.4983
117.5478	229.88	222.25	221.61	162.41	67.17	53.70	338.64	258.37	0.0007	5.4881
118.0477	230.33	222.31	221.58	163.65	67.38	53.74	338.66	258.41	0.0002	5.4488
118.5483	230.24	222.35	221.60	165.06	67.61	53.76	338.93	258.45	0.0001	5.4984
119.0482	230.00	222.25	221.62	166.36	67.86	53.79	339.07	252.87	0.0001	5.5379
119.5472	230.18	222.23	221.62	167.99	68.11	53.83	338.89	249.65	0.0003	5.5028
120.0487	230.06	222.22	221.62	169.70	68.40	53.85	338.84	252.23	0.0005	5.4755
120.5477	229.88	222.17	221.61	171.48	68.70	53.93	338.93	252.89	0.0003	5.4974
121.0493	229.80	222.12	221.62	173.21	69.01	53.97	338.84	252.06	0.0007	5.5029
121.5473	230.23	222.35	221.64	175.02	69.31	54.01	339.16	253.85	0.0010	5.4903
122.0480	229.84	222.30	221.66	176.89	69.62	54.06	338.99	250.31	0.0009	5.4690
122.5478	229.88	222.34	221.64	178.79	69.94	54.10	338.87	253.09	0.0006	5.4675
123.0477	229.99	222.34	221.61	181.02	70.25	54.12	338.72	255.56	0.0013	5.5024
123.5483	229.94	222.42	221.61	183.00	70.57	54.16	338.81	254.89	0.0005	5.4843
124.0473	229.60	222.26	221.60	185.10	70.89	54.20	338.75	253.02	0.0004	5.4663
124.5480	230.25	222.41	221.62	187.24	71.23	54.26	338.82	254.90	0.0004	5.5051

TABLE B3.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
125.0478	230.57	222.46	221.64	189.40	71.62	54.34	338.91	254.02	0.0000	5.5167
125.5477	230.07	222.32	221.62	191.62	71.98	54.38	338.56	254.31	0.0004	5.4736
126.0485	230.18	222.24	221.59	193.63	72.34	54.44	338.42	254.78	0.0004	5.4795
126.5483	229.97	222.24	221.56	196.14	72.72	54.50	338.17	256.45	0.0004	5.5124
127.0480	229.89	222.19	221.56	198.89	73.10	54.57	338.06	255.10	0.0004	5.5244
127.5470	230.07	222.12	221.55	201.31	73.49	54.62	338.01	257.21	0.0001	5.4735
128.0477	229.88	222.18	221.52	204.01	73.89	54.67	338.01	254.65	0.0003	5.4938
128.5475	230.31	222.25	221.48	206.81	74.33	54.73	337.76	257.41	0.0002	5.5279
129.0483	229.99	222.11	221.47	209.33	74.74	54.79	337.48	257.26	0.0004	5.5042
129.5482	229.56	222.10	221.42	211.23	75.18	54.85	337.44	258.26	0.0004	5.4840
130.0480	229.89	222.15	221.40	212.70	75.61	54.91	337.05	258.37	0.0004	5.5113
130.5477	230.21	222.12	221.39	214.28	76.09	54.99	337.10	255.63	0.0006	5.5341
131.0467	230.02	222.14	221.39	215.70	76.54	55.07	336.95	255.82	0.0009	5.5236
131.5483	229.99	222.04	221.34	216.72	77.01	55.13	336.72	254.56	0.0004	5.4935
132.0472	230.02	222.02	221.32	217.53	77.54	55.22	336.37	254.83	0.0004	5.5002
132.5480	229.49	221.97	221.27	218.41	78.07	55.30	335.89	254.64	0.0005	5.5229
133.0478	229.40	221.81	221.20	219.00	78.58	55.38	335.71	256.57	0.0003	5.5129
133.5467	229.35	221.73	221.15	219.35	79.09	55.46	335.50	255.88	0.0005	5.4894
134.0473	229.60	221.73	221.12	219.51	79.63	55.52	334.83	255.63	0.0002	5.5045
134.5482	230.36	221.79	221.07	219.60	80.18	55.64	334.46	257.28	0.0006	5.5374
135.0480	229.88	221.75	221.05	219.69	80.76	55.73	334.56	255.95	0.0004	5.5104
135.5487	229.95	221.77	221.00	219.73	81.33	55.83	334.20	255.90	0.0000	5.4916
136.0477	230.56	221.86	220.99	219.77	81.91	55.91	334.20	253.96	0.0005	5.4853
136.5483	229.71	221.65	220.99	219.83	82.53	55.99	334.08	255.35	0.0006	5.5289
137.0473	229.92	221.69	220.94	219.83	83.13	56.08	333.70	255.38	0.0008	5.4993
137.5480	230.03	221.71	220.90	219.81	83.77	56.18	333.50	254.90	0.0004	5.4725
138.0478	230.41	221.62	220.87	219.81	84.39	56.30	333.21	256.16	0.0001	5.5033
138.5467	229.82	221.57	220.84	219.82	85.05	56.40	333.14	255.99	0.0007	5.5214
139.0483	229.74	221.63	220.78	219.78	85.66	56.47	332.85	255.82	0.0004	5.4922
139.5473	229.90	221.50	220.77	219.80	86.37	56.57	332.78	256.15	0.0005	5.4886
140.0480	229.92	221.54	220.72	219.79	87.05	56.69	332.23	256.23	0.0006	5.5022
140.5470	230.10	221.42	220.68	219.75	87.76	56.79	331.94	254.87	0.0004	5.5108
141.0477	229.82	221.33	220.63	219.74	88.47	56.88	331.78	256.75	0.0006	5.4850
141.5483	230.93	221.60	220.60	219.71	89.22	57.00	331.59	256.88	0.0004	5.4949
142.0482	230.66	221.51	220.62	219.74	89.99	57.10	331.53	255.61	0.0004	5.5261
142.5480	229.90	221.48	220.62	219.74	90.81	57.19	331.56	256.56	0.0002	5.5366
143.0478	229.90	221.41	220.61	219.75	91.65	57.33	331.68	255.76	0.0003	5.5067
143.5477	230.83	221.40	220.61	219.77	92.53	57.43	331.64	255.38	0.0011	5.4957
144.0485	230.26	221.34	220.59	219.77	93.46	57.54	331.43	255.24	0.0006	5.5177
144.5483	229.98	221.24	220.58	219.77	94.41	57.70	331.16	255.68	0.0004	5.5458
145.0480	230.19	221.35	220.58	219.76	95.36	57.79	331.08	257.72	0.0006	5.4918
145.5470	229.93	221.21	220.55	219.74	96.34	57.93	330.76	258.02	0.0009	5.4922
146.0477	229.44	221.12	220.49	219.72	97.33	58.06	330.68	258.60	0.0004	5.5158
146.5475	229.48	221.09	220.44	219.65	98.35	58.18	330.06	258.56	0.0005	5.5094
147.0483	230.07	221.09	220.39	219.62	99.37	58.31	329.73	258.63	0.0007	5.4805
147.5482	229.88	221.23	220.36	219.59	100.43	58.43	329.80	258.65	0.0001	5.4887
148.0470	230.13	221.27	220.30	219.55	101.51	58.56	329.10	258.60	0.0003	5.5429
148.5477	230.21	221.22	220.29	219.54	102.60	58.72	329.26	258.64	0.0003	5.5103
149.0475	230.57	221.20	220.29	219.52	103.79	58.86	329.30	258.47	0.0005	5.4696
149.5483	230.73	221.13	220.28	219.54	105.09	59.03	329.24	258.53	0.0004	5.4855

TABLE B3.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
150.0482	229.78	220.98	220.28	219.54	106.44	59.18	329.31	258.52	0.0004	5.5376
150.5470	230.09	221.07	220.26	219.55	107.84	59.34	329.24	258.55	0.0006	5.4932
151.0478	230.47	221.05	220.26	219.53	109.34	59.49	329.27	258.46	0.0004	5.4819
151.5477	228.82	220.84	220.25	219.55	110.94	59.70	328.62	258.50	0.0006	5.5069
152.0483	229.40	220.93	220.19	219.48	112.56	59.85	328.61	258.51	0.0012	5.5280
152.5482	229.85	220.91	220.18	219.46	114.28	60.04	328.36	258.44	0.0012	5.4961
153.0470	230.15	220.90	220.11	219.39	116.05	60.22	328.11	258.51	0.0004	5.4815
153.5478	230.41	220.92	220.09	219.38	117.88	60.43	327.85	258.45	0.0006	5.5251
154.0477	230.25	220.76	220.06	219.38	119.83	60.64	327.74	256.51	0.0005	5.5339
154.5483	229.84	220.81	220.05	219.35	121.89	60.85	327.55	258.45	0.0003	5.4762
155.0482	230.18	220.76	220.01	219.33	124.05	61.08	327.30	258.41	0.0007	5.4846
155.5470	230.25	220.57	219.94	219.23	126.34	61.31	327.10	258.37	0.0004	5.5116
156.0478	229.52	220.61	219.89	219.21	128.77	61.58	326.53	258.44	0.0004	5.4934
156.5477	230.10	220.59	219.86	219.18	131.35	61.82	326.38	258.44	0.0006	5.4710
157.0483	230.15	220.73	219.79	219.11	134.08	62.11	325.66	257.78	0.0004	5.4688
157.5482	230.13	220.61	219.73	219.05	136.96	62.40	325.12	258.43	0.0001	5.5217
158.0480	229.89	220.45	219.66	219.00	140.02	62.68	324.73	258.43	0.0004	5.5182
158.5470	229.89	220.47	219.59	218.91	143.20	63.00	324.27	258.42	0.0004	5.4682
159.0477	230.21	220.33	219.49	218.83	146.54	63.33	323.67	258.37	0.0005	5.4904
159.5483	230.27	220.31	219.44	218.78	150.13	63.65	323.42	258.23	0.0007	5.5101
160.0482	230.63	220.33	219.35	218.72	154.10	64.03	322.97	258.42	0.0006	5.4884
160.5480	229.91	220.18	219.30	218.65	158.38	64.38	322.62	258.41	0.0007	5.4676
161.0478	230.06	220.09	219.23	218.58	162.96	64.74	322.12	258.43	0.0001	5.5127
161.5477	230.35	220.07	219.16	218.51	167.97	65.08	321.58	258.43	0.0005	5.5089
162.0485	230.22	220.11	219.11	218.46	173.61	65.42	321.08	258.41	0.0004	5.4787
162.5483	230.10	220.20	219.00	218.37	179.27	65.74	320.61	257.80	0.0008	5.5037
163.0480	230.53	220.08	218.91	218.31	185.07	66.08	319.64	258.41	0.0001	5.5201
163.5478	230.75	220.15	218.84	218.20	190.57	66.43	319.28	258.40	0.0004	5.4789
164.0477	230.02	219.97	218.76	218.13	195.43	66.79	318.94	258.38	0.0004	5.4894
164.5475	230.57	219.96	218.69	218.06	199.39	67.17	318.27	258.41	0.0002	5.5104
165.0483	230.75	219.80	218.60	217.99	203.05	67.60	317.97	258.42	0.0000	5.4798
165.5472	230.52	219.87	218.55	217.94	206.25	68.13	317.75	258.35	0.0005	5.4890
166.0480	230.38	219.96	218.48	217.85	209.03	68.63	317.09	258.39	0.0004	5.5200
166.5477	230.76	220.06	218.41	217.80	211.68	69.14	316.62	258.40	0.0004	5.5455
167.0475	230.94	219.61	218.34	217.73	213.87	69.69	315.90	258.34	0.0006	5.5385
167.5483	230.44	219.52	218.25	217.62	215.05	70.37	315.75	258.42	0.0004	5.4994
168.0490	230.37	219.42	218.16	217.57	215.85	71.03	315.04	258.34	0.0004	5.5112
168.5480	230.30	219.36	218.08	217.48	216.43	71.71	314.53	258.39	0.0004	5.5242
169.0468	230.05	219.19	217.97	217.38	216.82	72.40	313.45	258.31	0.0004	5.5398
169.5477	229.86	219.26	217.86	217.27	217.11	73.12	312.81	258.30	0.0008	5.5290
170.0492	230.97	219.44	217.72	217.15	217.29	73.78	312.31	258.34	0.0010	5.4835
170.5482	231.70	219.48	217.62	217.04	217.35	74.46	311.31	257.97	0.0000	5.4989
171.0480	231.44	219.01	217.49	216.90	217.33	75.12	310.45	258.29	0.0003	5.5327
171.5478	231.26	219.21	217.37	216.80	217.30	75.74	309.76	258.14	0.0004	5.5155
172.0467	231.48	219.29	217.23	216.67	217.21	76.40	308.84	258.28	0.0002	5.4904
172.5483	231.19	219.16	217.11	216.53	217.10	77.02	308.04	256.32	0.0002	5.4827
173.0482	230.62	218.93	216.98	216.43	217.04	77.66	307.26	257.76	0.0006	5.5348
173.5488	231.64	219.63	216.86	216.30	216.91	78.25	306.55	258.44	0.0008	5.5320
174.0478	231.34	219.71	216.74	216.18	216.83	78.83	305.69	257.23	0.0003	5.4890
174.5477	230.84	219.91	216.63	216.08	216.72	79.43	305.33	258.37	0.0003	5.4925

TABLE B3.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
175.0475	231.03	219.50	216.53	215.99	216.63	80.01	304.62	258.08	0.0004	5.5204
175.5473	230.51	219.07	216.44	215.88	216.53	80.75	303.81	255.93	0.0005	5.5372
176.0480	232.00	219.25	216.28	215.76	216.42	81.46	303.12	256.43	0.0002	5.4958
176.5488	230.51	218.23	216.17	215.65	216.30	82.17	302.27	257.88	0.0006	5.5009
177.0468	230.14	217.80	216.03	215.53	216.21	82.94	301.43	256.23	0.0005	5.5573
177.5483	229.99	218.75	215.93	215.43	216.09	83.84	300.63	258.31	0.0008	5.5606
178.0482	230.19	218.61	215.78	215.25	215.96	84.83	299.79	258.27	0.0010	5.5446
178.5480	230.72	218.61	215.66	215.16	215.84	85.92	299.02	258.28	0.0004	5.4948
179.0478	231.00	219.08	215.50	215.00	215.70	87.13	298.00	258.24	0.0004	5.5031
179.5468	229.79	217.74	215.38	214.86	215.56	88.42	297.29	258.20	0.0005	5.5304
180.0493	229.68	218.41	215.24	214.72	215.43	89.93	296.29	258.16	0.0006	5.5095
180.5483	230.65	219.18	215.08	214.60	215.27	91.59	295.66	258.13	0.0004	5.4786
181.0480	229.60	219.02	214.95	214.47	215.17	93.53	294.63	258.17	0.0010	5.5022
181.5470	229.90	218.64	214.81	214.31	215.03	95.89	294.01	258.17	0.0005	5.5195
182.0477	230.08	218.00	214.69	214.19	214.89	99.01	293.01	258.14	0.0001	5.4887
182.5475	230.48	218.25	214.53	214.05	214.75	103.03	292.05	258.17	0.0004	5.4738
183.0483	230.36	217.66	214.39	213.89	214.60	108.43	291.21	258.14	0.0006	5.4932
183.5482	229.46	218.06	214.23	213.73	214.45	115.72	290.16	258.10	0.0003	5.5064
184.0470	229.14	217.67	214.05	213.57	214.27	124.34	289.20	258.10	0.0004	5.4842
184.5477	229.30	217.88	213.89	213.41	214.14	134.84	288.25	258.06	0.0003	5.4965
185.0475	229.32	217.98	213.70	213.21	213.95	147.16	287.10	258.09	0.0002	5.5246
185.5483	228.79	217.49	213.54	213.06	213.77	161.14	285.97	258.09	0.0006	5.5400
186.0482	228.45	217.69	213.36	212.88	213.58	179.21	285.12	258.05	0.0008	5.5222
186.5480	228.63	217.10	213.18	212.70	213.42	197.56	283.94	258.08	0.0009	5.4892
187.0468	228.87	216.82	212.97	212.51	213.24	207.10	282.75	258.03	0.0003	5.5249
187.5477	228.76	217.70	212.79	212.31	213.03	210.63	281.62	258.02	0.0008	5.5360
188.0483	227.79	217.14	212.62	212.12	212.83	211.54	280.48	257.97	0.0004	5.5202
188.5482	227.92	217.11	212.39	211.88	212.62	211.74	279.24	257.96	0.0012	5.4999
189.0488	227.78	217.29	212.17	211.69	212.41	211.69	277.89	257.90	0.0004	5.4778
189.5478	227.89	217.08	211.96	211.46	212.18	211.55	276.61	257.91	0.0003	5.5229
190.0477	227.96	216.35	211.71	211.23	211.96	211.37	275.29	257.88	0.0009	5.5433
190.5483	227.77	216.90	211.48	211.00	211.71	211.18	273.71	257.87	0.0001	5.5193
191.0482	227.50	216.85	211.21	210.73	211.46	210.96	272.28	257.88	0.0004	5.4993
191.5470	226.79	217.26	210.93	210.48	211.22	210.73	270.88	257.90	0.0005	5.5144
192.0478	226.38	216.59	210.64	210.18	210.95	210.50	268.94	257.85	0.0004	5.5444
192.5477	226.29	216.68	210.36	209.88	210.65	210.24	267.35	257.82	0.0007	5.5320
193.0483	225.95	216.07	210.06	209.61	210.36	209.99	265.44	257.75	0.0006	5.5039
193.5482	225.67	216.16	209.77	209.36	210.15	209.81	264.11	257.68	0.0004	5.5014
194.0480	225.42	215.09	209.62	209.22	209.97	209.69	263.54	257.66	0.0002	5.5117
194.5478	225.06	214.99	209.55	209.13	209.90	209.62	263.34	257.72	0.0004	5.5043
195.0477	227.43	216.63	209.58	209.17	209.90	209.65	263.78	257.75	0.0010	5.4913
195.5483	229.79	219.12	209.67	209.24	209.96	209.71	264.54	257.84	0.0004	5.4940
196.0482	228.92	219.95	209.78	209.32	210.00	209.76	265.20	257.89	0.0008	5.5471
196.5480	227.41	220.18	209.80	209.32	210.00	209.75	264.97	257.90	0.0005	5.5181
197.0478	227.43	220.09	209.68	209.20	209.91	209.63	263.80	257.72	0.0004	5.4943
197.5477	227.47	220.24	209.48	209.00	209.73	209.48	262.52	257.50	0.0012	5.4911
198.0485	227.42	219.61	209.29	208.88	209.61	209.40	261.48	257.74	0.0004	5.5306
198.5483	227.31	220.57	209.18	208.79	209.56	209.36	261.02	257.75	0.0005	5.5308
199.0480	226.53	218.63	209.11	208.76	209.51	209.35	260.63	257.87	0.0006	5.5058
199.5478	226.94	219.24	209.06	208.72	209.51	209.33	260.40	257.92	0.0008	5.4899

TABLE B3.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
200.0477	226.34	218.33	209.05	208.72	209.51	209.35	260.25	257.97	0.0008	5.5106
200.5475	226.46	218.64	209.03	208.71	209.50	209.35	260.11	257.92	0.0002	5.5262
201.0502	226.75	217.98	209.00	208.67	209.48	209.34	259.92	257.94	0.0005	5.5135
201.5490	225.86	217.46	208.96	208.67	209.48	209.32	259.61	257.96	0.0005	5.4986
202.0480	226.00	216.41	208.89	208.61	209.43	209.29	259.17	257.86	0.0006	5.4926
202.5468	226.42	216.39	208.80	208.54	209.40	209.23	258.69	257.83	0.0003	5.5258
203.0475	226.01	216.93	208.75	208.41	209.24	209.02	257.90	256.90	0.0006	5.5024
203.5483	226.33	215.57	208.54	208.25	209.08	208.92	257.28	255.21	0.0006	5.4781
204.0482	225.76	216.04	208.59	208.31	209.08	208.95	258.28	256.67	0.0007	5.4849
204.5470	225.35	217.08	208.81	208.51	209.24	209.13	259.97	257.95	0.0004	5.5375
205.0478	226.89	219.10	209.12	208.76	209.46	209.35	261.88	258.19	0.0003	5.5047
205.5477	230.60	222.79	209.48	209.05	209.74	209.57	264.14	258.32	0.0005	5.4871
206.0483	231.37	227.25	209.73	209.17	209.82	209.59	265.03	258.11	0.0004	5.5015
206.5482	230.56	227.72	209.61	209.07	209.73	209.46	263.23	257.20	0.0006	5.5221
207.0480	229.31	225.61	209.39	208.93	209.63	209.39	262.02	257.08	0.0002	5.5039
207.5478	229.96	225.27	209.07	208.59	209.32	209.07	260.07	256.45	0.0003	5.4928
208.0467	230.14	225.08	208.86	208.45	209.20	209.04	259.25	256.08	0.0003	5.5038
208.5483	229.73	224.18	208.74	208.38	209.17	209.02	258.55	256.41	0.0004	5.5442
209.0473	229.36	222.75	208.74	208.44	209.24	209.12	258.80	256.20	0.0012	5.5137
209.5480	229.32	222.45	208.76	208.42	209.21	209.08	258.58	256.86	0.0002	5.4846
210.0478	228.05	222.68	208.76	208.44	209.24	209.10	258.77	255.71	0.0006	5.4985
210.5477	228.13	223.01	208.76	208.44	209.26	209.12	258.83	257.05	0.0004	5.5276
211.0483	229.08	222.71	208.80	208.50	209.30	209.19	258.80	257.97	0.0004	5.4921
211.5482	228.26	222.37	208.82	208.55	209.38	209.27	259.24	258.19	0.0005	5.4592
212.0480	228.67	222.17	208.89	208.64	209.43	209.32	259.90	256.68	0.0002	5.4933
212.5478	228.98	221.94	208.95	208.66	209.49	209.34	259.76	257.80	0.0007	5.5274
213.0477	229.12	222.16	208.75	208.41	209.22	209.09	258.60	255.80	0.0005	5.5008
213.5475	229.47	221.80	208.72	208.51	209.33	209.12	259.00	258.18	0.0009	5.4825
214.0482	228.27	222.11	208.94	208.69	209.51	209.39	259.71	258.16	0.0004	5.4858
214.5480	228.45	222.18	208.76	208.33	209.14	208.83	257.53	254.48	0.0004	5.5287
215.0478	228.34	221.29	208.44	208.12	208.96	208.80	256.41	254.74	0.0002	5.5285
215.5468	228.43	220.67	208.34	208.05	208.86	208.73	256.09	254.33	0.0007	5.4851
216.0475	228.49	220.81	208.25	207.96	208.80	208.69	255.95	255.39	0.0004	5.4729
216.5483	227.97	221.53	208.29	208.03	208.88	208.79	256.30	254.49	0.0003	5.5007
217.0480	226.71	222.37	208.56	208.24	208.99	208.88	257.89	255.48	0.0008	5.4896
217.5478	227.60	221.64	208.65	208.35	209.11	209.04	258.79	256.22	0.0005	5.4701
218.0468	229.31	223.22	208.77	208.42	209.19	209.04	259.11	255.83	0.0005	5.5371
218.5475	230.27	222.29	208.80	208.47	209.24	209.12	258.98	256.07	0.0007	5.5258
219.0483	228.81	222.65	208.76	208.40	209.19	209.07	258.84	255.79	0.0000	5.4804
219.5482	228.70	223.33	208.75	208.37	209.16	209.00	259.04	255.65	0.0004	5.4884
220.0488	228.88	223.30	208.77	208.41	209.16	209.00	258.97	255.28	0.0004	5.4962
220.5477	229.31	223.17	208.80	208.44	209.23	209.09	259.37	256.04	0.0006	5.4575
221.0485	228.83	224.96	208.86	208.46	209.22	209.07	259.47	256.37	0.0004	5.4106
221.5483	229.53	225.61	208.84	208.47	209.22	209.08	259.38	256.40	0.0002	5.4142
222.0482	229.18	224.07	208.84	208.47	209.22	209.06	259.13	255.83	0.0003	5.4235
222.5480	228.96	223.52	208.77	208.42	209.20	209.10	258.66	255.75	0.0005	5.3977
223.0478	229.86	223.74	208.70	208.35	209.17	209.03	258.09	255.89	0.0005	5.3805
223.5477	229.42	224.96	208.58	208.26	209.10	208.98	257.53	255.87	0.0004	5.3764
224.0483	228.61	223.38	208.53	208.26	209.10	208.98	257.22	255.46	0.0002	5.3664
224.5482	227.54	223.35	208.35	208.01	208.85	208.66	255.83	253.18	0.0005	5.3153

TABLE B3.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
225.0470	227.60	221.92	208.16	207.89	208.73	208.62	255.28	253.53	0.0001	5.3522
225.5478	227.58	221.78	208.20	207.91	208.70	208.63	255.74	253.68	0.0001	5.3865
226.0477	227.60	221.37	208.25	207.98	208.79	208.68	256.18	254.21	0.0004	5.3563
226.5483	228.08	221.66	208.29	208.00	208.81	208.72	256.10	254.77	0.0004	5.4357
227.0482	228.23	222.38	208.34	208.02	208.85	208.74	256.55	254.18	0.0005	5.3871
227.5470	230.02	223.67	208.36	208.08	208.88	208.78	256.48	254.67	0.0005	5.5498
228.0478	228.52	223.06	208.39	208.10	208.89	208.78	256.79	255.10	0.0006	5.5414
228.5477	228.74	221.99	208.46	208.15	208.94	208.85	257.24	254.94	0.0001	5.4265
229.0483	228.18	223.44	208.53	208.21	209.00	208.87	257.81	255.58	0.0000	5.4533
229.5482	228.72	223.98	208.53	208.21	209.02	208.91	257.98	255.81	0.0006	5.6171
230.0480	228.89	223.19	208.61	208.31	209.07	208.97	257.91	255.66	0.0004	5.5951
230.5478	229.69	222.71	208.65	208.32	209.11	209.00	258.13	255.87	0.0005	5.4239
231.0468	229.09	224.09	208.67	208.34	209.15	209.01	258.37	255.24	0.0004	5.5074
231.5483	229.00	223.58	208.72	208.40	209.19	209.06	258.55	255.55	0.0004	5.5478
232.0473	230.15	224.01	208.74	208.42	209.21	209.08	258.93	255.57	0.0004	5.4782
232.5480	229.90	224.40	208.72	208.44	209.26	209.24	258.97	258.27	0.0004	5.3325
233.0478	228.47	223.19	208.73	208.32	209.10	208.92	258.19	255.01	0.0003	5.5892
233.5487	229.67	222.94	208.75	208.46	209.25	209.18	259.22	256.53	0.0004	5.4976
234.0485	229.96	223.23	208.89	208.62	209.43	209.36	259.78	257.44	0.0008	5.4795
234.5473	229.83	223.69	209.02	208.73	209.52	209.43	260.39	257.87	0.0005	5.4897
235.0480	229.16	223.11	209.09	208.81	209.61	209.52	260.93	258.22	0.0002	5.4954
235.5478	229.66	223.70	209.13	208.65	209.42	209.15	260.42	255.80	0.0002	5.4311
236.0487	228.86	223.54	208.85	208.43	209.22	209.04	258.97	255.45	0.0008	5.4550
236.5467	230.61	224.85	208.74	208.40	209.19	209.08	258.58	255.72	0.0002	5.5215
237.0473	229.67	224.35	208.73	208.42	209.21	209.10	258.71	255.70	0.0006	5.4379
237.5482	229.01	221.92	208.73	208.41	209.18	209.09	258.65	256.53	0.0000	5.4394
238.0480	228.77	223.92	208.75	208.43	209.21	209.09	258.78	255.35	0.0007	5.4884
238.5477	228.38	222.82	208.75	208.43	209.21	209.07	258.74	255.85	0.0007	5.4853
239.0467	230.32	223.10	208.75	208.45	209.25	209.11	258.75	256.17	0.0004	5.4581
239.5483	231.36	224.84	208.74	208.41	209.22	209.11	258.62	256.07	0.0005	5.4278
240.0482	229.52	224.47	208.72	208.41	209.26	209.13	258.32	255.77	0.0003	5.5517
240.5480	229.23	222.54	208.69	208.40	209.20	209.10	258.24	256.31	0.0004	5.4580
241.0478	228.93	223.29	208.71	208.42	209.22	209.12	258.71	255.31	0.0004	5.4402
241.5477	229.42	224.39	208.80	208.47	209.26	209.16	259.61	255.77	0.0004	5.4505
242.0483	228.97	223.31	208.98	208.62	209.35	209.23	260.89	256.24	0.0010	5.3722
242.5482	229.44	225.11	209.18	208.75	209.45	209.32	262.09	256.30	0.0006	5.4634
243.0470	230.23	226.68	209.29	208.84	209.54	209.38	262.25	256.95	0.0003	5.5427
243.5478	231.13	227.29	209.24	208.81	209.54	209.36	261.34	256.49	0.0002	5.4283
244.0477	230.88	228.05	209.04	208.68	209.45	209.27	260.36	256.33	0.0006	5.3558
244.5483	229.80	225.94	208.92	208.56	209.36	209.22	259.38	256.44	0.0002	5.3776
245.0482	230.77	212.78	211.30	210.15	210.51	210.31	273.20	263.76	0.0007	5.5945
245.5480	231.60	212.88	211.39	210.17	210.52	210.30	273.35	263.24	0.0004	5.5752
246.0478	231.60	212.88	211.38	210.18	210.48	210.27	273.37	262.92	0.0003	5.5735
246.5477	228.47	212.62	211.43	210.18	210.50	210.31	273.88	263.67	0.0006	5.6004
247.0483	228.91	212.49	211.42	210.26	210.60	210.40	273.37	264.23	0.0002	5.5806
247.5473	231.47	212.64	211.44	210.28	210.64	210.42	273.35	264.25	0.0004	5.5628
248.0480	233.89	212.72	211.45	210.25	210.57	210.34	273.39	263.39	0.0004	5.5453
248.5478	232.10	212.81	211.43	210.23	210.59	210.39	273.42	263.91	0.0005	5.5201
249.0467	231.73	212.83	211.44	210.27	210.58	210.36	273.24	263.34	0.0000	5.5063
249.5475	230.88	212.87	211.44	210.20	210.49	210.29	273.73	262.94	0.0004	5.5489

TABLE B3.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
250.0492	231.02	213.07	211.39	210.17	210.49	210.24	273.27	262.76	0.0005	5.5565
250.5472	230.58	213.02	211.32	210.14	210.48	210.23	272.70	263.05	0.0004	5.5953
251.0470	230.40	212.86	211.32	210.11	210.43	210.25	272.94	263.17	0.0002	5.5893
251.5477	230.57	212.63	211.26	210.09	210.41	210.22	272.57	263.28	0.0007	5.5928
252.0485	230.72	212.64	211.31	210.11	210.47	210.29	272.99	263.48	0.0001	5.5652
252.5482	231.35	212.50	211.28	210.15	210.53	210.35	272.80	263.31	0.0002	5.5712
253.0480	230.74	212.52	211.28	210.16	210.51	210.32	272.60	263.43	0.0004	5.5246
253.5488	231.44	212.47	211.31	210.16	210.52	210.36	272.86	263.48	0.0002	5.5234
254.0477	232.09	212.51	211.36	210.18	210.56	210.36	273.37	263.86	0.0007	5.5461
254.5475	231.91	212.51	211.37	210.20	210.54	210.36	272.88	263.64	0.0001	5.5620
255.0473	231.35	212.59	211.35	210.19	210.55	210.38	272.82	263.30	0.0004	5.5622
255.5482	230.65	212.82	211.39	210.21	210.55	210.39	273.12	263.78	0.0004	5.5535
256.0480	230.55	212.79	211.41	210.21	210.55	210.36	273.04	263.44	0.0005	5.5749
256.5477	227.43	212.42	211.45	210.23	210.56	210.38	273.69	263.06	0.0007	5.5879
257.0467	228.30	212.33	211.40	210.06	209.97	209.22	273.43	250.72	0.0001	3.1443

TABLE B4. PRESSURE AND TEMPERATURE DATA FOR RUN 6 (PROPANE:STEAM = 5:100).

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
0.0503	50.77	48.31	52.29	54.33	53.78	49.93	259.65	261.27	0.2756	5.5010
0.5447	57.30	48.81	52.32	54.32	53.78	49.94	263.01	263.18	0.2716	5.4737
1.0453	82.72	52.84	52.32	54.30	53.77	49.96	263.29	262.87	0.2766	5.5007
1.5452	139.56	59.09	52.33	54.21	53.74	50.04	262.69	262.83	0.2760	5.5306
2.0450	200.51	74.11	52.30	54.07	53.69	49.99	263.09	263.24	0.2762	5.5392
2.5448	209.59	156.71	52.32	54.15	53.67	50.07	263.12	262.94	0.2755	5.5114
3.0455	213.28	203.44	52.31	54.25	53.81	50.12	263.67	261.95	0.2756	5.4922
3.5453	216.62	206.65	52.28	54.25	53.89	50.16	263.39	262.37	0.2756	5.5264
4.0452	225.02	206.98	52.26	54.28	53.94	50.20	260.75	261.49	0.2763	5.5296
4.5442	237.24	208.02	52.23	54.25	53.92	50.15	261.32	261.53	0.2761	5.4929
5.0448	249.68	210.03	52.23	54.23	53.95	50.18	264.56	261.70	0.2757	5.4955
5.5447	256.01	210.70	52.26	54.22	53.95	50.20	263.17	261.59	0.2759	5.5136
6.0453	253.71	212.49	52.28	54.24	53.98	50.21	266.68	261.69	0.2758	5.5128
6.5452	250.70	213.82	52.34	54.23	53.98	50.23	263.16	261.27	0.2765	5.4696
7.0450	242.69	214.66	52.48	54.23	54.00	50.25	266.32	262.10	0.2760	5.5192
7.5448	236.85	216.07	52.56	54.22	53.99	50.24	267.91	260.92	0.2761	5.5279
8.0457	231.73	213.10	52.68	54.22	54.03	50.28	274.60	261.80	0.2755	5.5073
8.5453	226.51	213.52	52.76	54.21	54.04	50.29	273.74	261.27	0.2761	5.4869
9.0452	221.32	212.07	52.88	54.18	54.02	50.29	276.13	261.40	0.2763	5.5207
9.5450	219.79	211.86	53.02	54.14	54.03	50.28	275.00	261.38	0.2767	5.5420
10.0458	222.84	212.47	53.18	54.15	54.04	50.28	282.79	261.53	0.2763	5.4916
10.5457	234.30	212.69	53.39	54.15	54.02	50.29	284.67	261.54	0.2756	5.4883
11.0455	240.59	214.52	53.63	54.16	54.03	50.28	286.34	261.50	0.2767	5.5174
11.5453	242.93	215.37	53.90	54.16	54.03	50.30	291.26	261.50	0.2766	5.5246
12.0442	238.44	216.14	54.19	54.17	54.05	50.30	291.79	261.56	0.2759	5.4732
12.5448	235.46	216.04	54.46	54.17	54.04	50.31	294.95	261.36	0.2771	5.4967
13.0447	232.30	216.42	54.79	54.20	54.08	50.31	293.63	261.37	0.2755	5.5660
13.5445	227.24	215.82	55.13	54.18	54.09	50.32	297.64	261.49	0.2762	5.5188
14.0443	224.29	215.30	55.61	54.17	54.15	50.30	299.78	261.59	0.2757	5.4960
14.5452	228.11	215.33	56.00	54.17	54.19	50.33	300.91	261.62	0.2759	5.5242
15.0450	233.18	216.71	56.33	54.16	54.22	50.30	298.70	261.59	0.2766	5.5421
15.5465	238.86	216.59	56.84	54.16	54.22	50.30	300.56	261.45	0.2756	5.5179
16.0455	236.14	216.72	57.46	54.15	54.23	50.30	307.25	261.54	0.2760	5.4869
16.5443	232.94	217.81	58.18	54.17	54.23	50.35	308.86	261.48	0.2764	5.4921
17.0452	233.79	217.35	58.87	54.18	54.24	50.35	311.35	261.47	0.2763	5.5274
17.5450	234.67	218.56	59.56	54.18	54.26	50.45	311.55	261.25	0.2764	5.4902
18.0457	235.16	218.15	60.36	54.11	54.26	50.49	310.92	261.31	0.2761	5.4762
18.5455	237.67	218.01	61.16	54.12	54.27	50.48	314.86	261.26	0.2755	5.4960
19.0453	235.74	219.37	62.07	54.12	54.27	50.49	317.98	261.24	0.2764	5.5006
19.5452	233.61	219.07	62.95	54.11	54.28	50.49	321.62	261.17	0.2761	5.4739
20.0450	231.43	219.72	63.91	54.11	54.30	50.51	323.91	261.19	0.2757	5.4955
20.5448	226.76	218.67	64.90	54.11	54.30	50.54	326.36	261.17	0.2761	5.5275
21.0447	228.70	218.85	65.89	54.14	54.33	50.56	329.42	261.32	0.2762	5.5151
21.5453	228.29	219.34	67.04	54.12	54.31	50.58	333.67	261.65	0.7086	5.4908
22.0452	233.43	218.45	67.56	54.13	54.32	50.61	329.75	261.70	0.7085	5.5235
22.5450	233.26	218.83	68.65	54.15	54.36	50.63	332.40	261.90	0.7085	5.5263
23.0448	231.99	219.37	69.41	54.17	54.36	50.65	331.03	261.63	0.7085	5.4932
23.5455	230.67	219.53	70.21	54.21	54.37	50.71	331.07	262.43	0.7085	5.4863
24.0453	228.59	219.34	71.06	54.22	54.37	50.73	328.21	261.87	0.1816	5.5296
24.5462	228.79	219.49	72.10	54.22	54.37	50.76	328.17	262.56	0.1207	5.5305

TABLE B4.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
25.0450	229.93	220.01	73.10	54.24	54.40	50.80	328.29	262.58	0.7085	5.4931
25.5458	229.16	220.25	74.16	54.25	54.40	50.84	328.56	260.57	0.0717	5.4737
26.0465	229.45	220.25	75.25	54.25	54.39	50.85	328.02	262.62	0.2877	5.5171
26.5453	228.77	220.32	76.57	54.26	54.43	50.93	327.36	262.63	0.4451	5.5270
27.0452	228.72	220.11	77.68	54.28	54.41	50.93	326.03	261.46	0.3045	5.4829
27.5460	228.53	220.01	78.90	54.30	54.44	50.97	324.34	261.00	0.4162	5.4870
28.0448	228.51	219.83	80.09	54.30	54.44	51.01	322.90	262.29	0.3987	5.5207
28.5457	228.45	219.69	81.48	54.37	54.46	51.04	321.64	262.62	0.3519	5.4889
29.0455	229.61	219.55	82.77	54.39	54.47	51.06	320.30	261.60	0.3058	5.4755
29.5443	230.62	219.63	84.25	54.45	54.47	51.12	322.68	255.40	0.2727	5.5271
30.0450	229.30	219.51	85.97	54.47	54.45	51.12	321.63	256.63	0.2731	5.5407
30.5448	228.93	219.56	87.68	54.53	54.48	51.16	322.57	258.55	0.2678	5.4842
31.0457	229.16	219.69	89.23	54.61	54.48	51.23	322.55	259.19	0.2729	5.5032
31.5455	228.93	219.72	90.80	54.65	54.48	51.27	324.55	257.69	0.2599	5.5207
32.0453	231.01	219.77	92.51	54.75	54.49	51.31	325.09	258.21	0.2735	5.5299
32.5452	229.24	220.01	94.28	54.83	54.51	51.35	326.37	258.97	0.2759	5.4933
33.0450	228.92	220.19	96.01	54.91	54.51	51.39	328.02	255.49	0.2760	5.5078
33.5457	229.45	220.35	97.72	55.01	54.52	51.45	328.50	257.73	0.2757	5.5259
34.0455	230.24	220.63	99.38	55.11	54.54	51.49	330.76	258.47	0.2758	5.5206
34.5453	229.40	220.91	101.20	55.19	54.58	51.55	335.00	257.11	0.2751	5.4827
35.0452	233.36	220.88	103.18	55.32	54.58	51.61	339.24	255.46	0.2759	5.5001
35.5450	232.75	220.76	104.81	55.42	54.59	51.64	341.72	255.99	0.2757	5.5445
36.0448	235.23	220.89	106.53	55.50	54.59	51.66	343.74	256.50	0.2759	5.4807
36.5455	233.87	221.02	108.66	55.62	54.63	51.72	346.53	258.51	0.2759	5.4712
37.0453	235.83	220.97	111.11	55.74	54.67	51.78	345.82	258.90	0.2760	5.5149
37.5452	233.36	220.93	113.78	55.85	54.69	51.82	345.34	257.99	0.2760	5.5450
38.0450	236.39	220.86	116.76	55.99	54.70	51.84	348.03	258.37	0.2762	5.4976
38.5448	234.99	220.67	120.05	56.12	54.72	51.92	346.90	256.21	0.2755	5.5050
39.0455	232.90	220.64	123.65	56.28	54.76	51.98	345.31	257.56	0.2767	5.5250
39.5453	232.33	220.64	127.34	56.45	54.76	52.00	345.24	257.06	0.2753	5.5380
40.0452	233.59	220.27	130.89	56.68	54.80	52.06	345.99	256.25	0.2736	5.5017
40.5450	232.68	220.25	134.47	56.90	54.82	52.11	344.78	258.21	0.2555	5.4829
41.0448	236.85	220.33	137.86	57.14	54.85	52.15	344.88	258.25	0.2370	5.5286
41.5455	234.58	220.58	141.49	57.41	54.85	52.17	345.32	258.44	0.1410	5.5368
42.0445	232.29	220.44	144.64	57.72	54.85	52.19	343.98	257.73	0.2939	5.4963
42.5443	231.74	220.32	147.88	58.01	54.87	52.23	343.92	256.80	0.2731	5.5028
43.0450	231.11	220.32	150.75	58.32	54.90	52.22	351.39	257.04	0.7087	5.5446
43.5448	233.37	219.91	155.00	58.68	54.97	52.25	347.00	256.53	0.2741	5.5367
44.0457	235.86	220.22	157.63	59.08	55.00	52.30	349.41	258.07	0.2763	5.5097
44.5453	233.34	220.33	160.53	59.54	55.08	52.34	350.13	258.35	0.2763	5.4852
45.0452	237.03	219.22	162.48	59.99	55.12	52.38	346.82	258.05	0.2753	5.5497
45.5450	232.15	220.46	164.22	60.47	55.12	52.42	347.09	260.03	0.2750	5.5275
46.0440	232.97	220.42	166.22	60.97	55.14	52.46	344.69	258.71	0.2755	5.4842
46.5447	232.04	220.73	168.37	61.48	55.16	52.48	344.50	257.76	0.2757	5.5000
47.0445	232.05	220.66	170.87	61.97	55.15	52.50	346.43	258.77	0.2752	5.5175
47.5453	231.89	220.63	173.23	62.54	55.17	52.58	348.32	260.28	0.2752	5.5171
48.0450	231.66	220.56	175.21	63.15	55.19	52.64	348.09	262.50	0.2752	5.4943
48.5440	231.84	220.79	177.06	63.80	55.23	52.72	350.92	262.64	0.2753	5.5201
49.0457	232.02	221.14	178.70	64.50	55.27	52.84	352.57	262.86	0.2741	5.5192
49.5445	232.09	220.96	180.43	65.22	55.29	52.91	352.56	262.93	0.2753	5.5156

TABLE B4.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
50.0453	231.17	220.78	182.01	65.98	55.33	52.98	352.36	262.99	0.2755	5.4876
50.5452	231.83	220.46	184.13	66.77	55.37	53.00	350.63	261.92	0.2742	5.5084
51.0450	232.08	220.48	186.21	67.63	55.40	53.04	349.61	261.86	0.2748	5.5407
51.5457	230.69	220.45	188.33	68.46	55.47	53.08	347.52	262.08	0.2746	5.4974
52.0463	231.78	219.91	190.29	69.31	55.51	53.12	344.42	262.30	0.2750	5.4853
52.5453	231.41	219.97	192.44	70.20	55.57	53.18	342.71	262.74	0.2762	5.5191
53.0452	230.14	219.45	194.47	71.09	55.63	53.26	340.02	262.89	0.2712	5.5321
53.5450	232.22	219.17	196.92	71.95	55.71	53.32	337.99	263.07	0.2855	5.4585
54.0448	231.70	219.14	199.02	72.88	55.77	53.37	335.15	261.74	0.2661	5.4905
54.5455	230.58	218.51	201.01	73.82	55.87	53.45	332.02	256.71	0.2745	5.5278
55.0453	230.49	218.16	203.23	74.73	55.95	53.48	325.88	261.95	0.2745	5.5229
55.5452	228.97	218.09	205.01	75.67	56.04	53.50	322.67	262.53	0.2753	5.4898
56.0450	228.92	217.79	206.85	76.63	56.14	53.50	320.52	262.22	0.2758	5.5229
56.5448	228.37	217.47	208.72	77.61	56.24	53.50	320.78	263.17	0.2749	5.5402
57.0447	231.40	217.43	210.40	78.62	56.34	53.49	321.52	262.74	0.2752	5.5193
57.5453	231.26	217.27	211.82	79.69	56.47	53.49	320.35	261.36	0.2750	5.4730
58.0452	230.29	217.13	212.62	80.80	56.57	53.51	318.08	260.57	0.2748	5.5154
58.5442	230.83	217.01	213.22	81.91	56.71	53.51	318.13	261.75	0.2750	5.5410
59.0438	230.90	216.82	213.54	83.01	56.80	53.53	317.54	262.18	0.2739	5.5270
59.5447	231.05	216.60	213.61	84.17	56.94	53.54	317.36	262.45	0.2752	5.4975
60.0453	231.01	216.52	213.60	85.39	57.09	53.57	315.55	263.01	0.2749	5.5118
60.5452	231.61	216.14	213.51	86.68	57.21	53.60	315.20	262.99	0.2736	5.5348
61.0450	231.61	216.22	213.44	88.01	57.36	53.62	312.93	262.88	0.2747	5.4981
61.5448	231.02	216.18	213.37	89.37	57.50	53.62	312.98	260.72	0.2760	5.4861
62.0447	231.13	216.28	213.30	90.83	57.69	53.66	311.47	260.58	0.2747	5.4965
62.5445	232.62	216.55	213.29	92.36	57.88	53.72	311.45	259.22	0.2757	5.5130
63.0452	234.25	216.19	213.20	93.86	58.09	53.70	309.88	258.71	0.7087	5.5095
63.5450	232.05	216.46	213.15	95.41	58.32	53.76	309.57	261.89	0.2611	5.4903
64.0448	230.44	215.98	213.13	96.99	58.55	53.78	307.54	261.74	0.2787	5.5210
64.5447	231.20	215.46	213.15	98.62	58.84	53.80	306.54	259.16	0.2763	5.5258
65.0455	233.70	215.48	212.98	100.28	59.16	53.83	302.03	259.63	0.2745	5.4872
65.5453	232.35	216.15	212.73	101.93	59.49	53.85	302.45	258.89	0.2765	5.5038
66.0450	229.70	216.65	212.71	103.60	59.78	53.85	300.41	258.33	0.2758	5.5088
66.5448	229.48	215.95	213.38	105.43	60.14	53.83	301.19	259.87	0.2758	5.4837
67.0457	231.21	216.40	213.70	107.53	60.56	53.86	304.14	259.35	0.2759	5.4800
67.5455	232.32	216.94	213.72	109.95	61.07	53.84	305.56	258.63	0.2758	5.5406
68.0453	232.25	216.80	213.70	112.41	61.72	53.88	306.14	261.31	0.2753	5.5319
68.5442	232.70	216.66	213.69	114.95	62.44	53.90	307.42	261.49	0.2755	5.5151
69.0440	232.18	217.15	213.71	117.67	63.14	53.90	306.43	261.96	0.2754	5.4852
69.5457	231.77	216.54	213.60	120.62	63.82	53.94	306.15	261.77	0.2747	5.5119
70.0455	232.83	216.94	213.48	123.74	64.49	53.92	305.24	261.69	0.2763	5.5382
70.5453	231.13	216.63	213.38	126.89	65.13	53.97	305.31	261.98	0.2756	5.4684
71.0452	231.90	216.67	213.38	130.16	65.78	54.01	304.31	261.92	0.2749	5.4906
71.5450	231.94	217.14	213.38	133.56	66.42	54.03	302.26	262.61	0.2749	5.5333
72.0467	232.25	216.64	213.36	136.86	67.06	54.03	303.33	262.52	0.2749	5.5404
72.5447	231.91	216.89	213.38	140.33	67.69	54.05	303.05	262.89	0.2742	5.4957
73.0443	231.43	217.09	213.40	144.18	68.31	54.09	304.83	262.90	0.2752	5.5030
73.5452	231.61	216.97	213.57	148.30	68.97	54.13	305.14	260.74	0.2758	5.5455
74.0450	232.18	216.90	213.55	152.79	69.68	54.17	303.89	261.26	0.2757	5.5310
74.5438	231.54	216.72	213.55	157.62	70.36	54.23	304.88	261.39	0.2749	5.4803

TABLE B4.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
75.0447	230.38	216.76	213.66	162.49	70.98	54.27	305.67	261.68	0.2750	5.4999
75.5453	231.40	216.19	213.63	167.72	71.58	54.33	305.95	261.98	0.2749	5.5039
76.0462	231.05	216.80	213.63	173.50	72.22	54.39	305.33	261.91	0.2755	5.4998
76.5450	231.35	217.01	213.67	179.52	72.87	54.43	306.62	261.75	0.2752	5.4913
77.0438	231.75	216.77	213.67	184.99	73.51	54.49	305.58	262.09	0.2754	5.5432
77.5455	230.94	217.14	213.74	190.02	74.09	54.57	306.89	262.32	0.2755	5.5249
78.0453	230.44	216.95	213.78	194.18	74.73	54.64	305.56	262.32	0.2753	5.4889
78.5452	232.00	216.41	213.76	197.40	75.34	54.70	307.96	262.43	0.2750	5.5015
79.0450	231.72	216.47	213.80	200.22	75.92	54.78	305.16	262.70	0.2752	5.5389
79.5448	231.15	216.52	213.80	202.69	76.49	54.88	305.09	262.42	0.2755	5.5120
80.0457	230.11	216.58	213.73	204.55	77.01	54.96	304.20	262.57	0.2701	5.4742
80.5445	231.31	216.29	213.57	205.99	77.50	55.05	302.38	262.61	0.2750	5.5062
81.0452	231.10	216.78	213.45	207.17	77.97	55.11	303.20	260.20	0.2755	5.5267
81.5450	230.85	216.46	213.38	208.09	78.52	55.21	303.09	260.56	0.2746	5.5151
82.0448	232.16	216.55	213.40	208.62	79.03	55.27	301.82	259.92	0.2746	5.4808
82.5457	231.18	215.71	213.31	208.89	79.44	55.35	301.35	260.37	0.2748	5.5113
83.0455	232.54	215.91	213.05	209.29	79.84	55.42	297.85	261.05	0.2751	5.5358
83.5453	231.11	216.22	212.91	209.60	80.18	55.52	298.45	261.04	0.2747	5.5061
84.0450	229.84	216.09	212.87	209.79	80.57	55.62	298.61	258.59	0.2742	5.5042
84.5448	229.25	215.90	212.86	209.96	80.99	55.71	300.30	261.00	0.2759	5.5106
85.0457	230.15	215.51	213.06	210.10	81.42	55.87	301.31	259.13	0.2754	5.5341
85.5455	230.47	216.19	213.18	210.26	81.95	56.00	299.75	260.60	0.2755	5.5003
86.0453	229.99	216.71	213.33	210.43	82.49	56.21	299.98	259.97	0.2758	5.4845
86.5452	229.94	217.30	213.60	210.61	83.09	56.39	302.53	260.67	0.2755	5.5176
87.0450	230.32	217.41	213.83	210.93	83.77	56.58	300.96	260.30	0.2754	5.5389
87.5457	230.39	216.80	213.78	211.26	84.57	56.81	301.92	258.83	0.2752	5.4976
88.0455	230.20	216.97	213.75	211.46	85.55	57.04	300.15	261.25	0.2756	5.4950
88.5443	231.06	216.29	213.71	211.51	86.74	57.29	299.58	260.74	0.2756	5.5231
89.0452	230.49	215.93	213.50	211.48	88.14	57.55	296.75	261.50	0.2750	5.5461
89.5450	231.40	216.24	213.32	211.41	89.82	57.76	295.12	260.96	0.2736	5.4933
90.0457	230.11	216.44	213.07	211.27	91.91	57.99	294.18	259.85	0.2756	5.4769
90.5447	229.15	215.20	212.77	211.11	94.31	58.21	291.56	260.75	0.2737	5.5289
91.0443	230.65	214.62	212.41	210.91	97.19	58.42	289.48	260.90	0.2761	5.5554
91.5442	230.14	214.71	212.00	210.66	100.55	58.61	288.61	260.85	0.5224	5.5324
92.0450	230.21	214.05	211.63	210.41	104.57	58.76	287.05	260.93	0.4493	5.5169
92.5448	230.78	213.98	211.31	210.15	109.40	58.93	285.41	261.67	0.2822	5.5326
93.0465	228.99	213.74	211.04	209.88	114.86	59.07	283.95	261.55	0.2464	5.5466
93.5453	229.84	213.26	210.83	209.61	120.60	59.20	283.09	261.00	0.2663	5.5177
94.0443	225.79	214.07	210.83	209.45	127.23	59.37	285.14	261.86	0.2614	5.4827
94.5442	228.93	214.27	211.07	209.35	134.85	59.53	286.48	261.53	0.2781	5.5024
95.0448	230.42	214.49	211.18	209.37	142.90	59.74	285.66	261.29	0.2562	5.5204
95.5447	229.56	215.31	211.55	209.55	151.80	59.97	290.17	261.25	0.3173	5.4880
96.0453	229.88	216.23	212.00	209.78	162.26	60.24	289.20	261.69	0.2653	5.4913
96.5443	229.03	216.96	212.58	210.11	171.27	60.54	291.00	261.47	0.2577	5.5281
97.0450	230.46	216.07	212.76	210.52	177.35	60.83	288.80	261.14	0.2496	5.5377
97.5440	230.82	216.05	212.49	210.81	182.09	61.06	287.56	260.63	0.3234	5.5163
98.0457	230.12	215.91	212.40	210.88	186.78	61.32	285.91	261.75	0.2799	5.4883
98.5453	229.93	214.98	212.32	210.87	190.13	61.67	287.13	261.81	0.2598	5.5016
99.0452	228.80	215.25	212.12	210.87	192.73	61.97	285.26	261.83	0.2596	5.5337
99.5442	229.88	214.82	211.98	210.82	195.28	62.26	285.43	261.18	0.3226	5.5124

TABLE B4.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
100.0448	231.33	214.63	211.91	210.66	197.86	62.58	284.14	261.84	0.3184	5.4969
100.5447	230.08	214.94	211.75	210.55	199.72	62.90	285.27	261.59	0.2620	5.5023
101.0455	230.64	214.74	211.61	210.43	201.42	63.23	283.74	261.91	0.2512	5.5344
101.5443	231.19	214.42	211.40	210.25	202.66	63.53	283.54	261.26	0.3140	5.5250
102.0450	229.17	213.62	211.15	210.04	203.47	63.80	281.89	261.08	0.3177	5.4646
102.5448	229.51	213.17	210.93	209.82	204.26	63.99	280.33	261.27	0.2523	5.5107
103.0457	231.32	212.49	210.70	209.61	204.76	64.18	278.11	261.18	0.2499	5.5451
103.5455	231.02	212.92	210.42	209.43	205.17	64.39	276.86	262.07	0.2536	5.5104
104.0453	231.24	212.93	210.17	209.22	205.36	64.52	275.86	260.30	0.3099	5.4992
104.5452	229.79	213.88	210.13	209.03	205.52	64.66	275.38	260.93	0.3666	5.5209
105.0440	228.39	213.98	210.15	208.87	205.61	64.81	278.40	261.59	0.2936	5.5597
105.5457	229.58	213.90	210.76	208.94	205.97	65.09	277.33	261.74	0.2109	5.5236
106.0455	230.06	213.99	210.89	209.23	206.15	65.38	279.15	261.25	0.2236	5.4846
106.5453	229.08	214.08	210.84	209.53	206.44	65.76	281.63	261.70	0.2242	5.5056
107.0442	228.99	215.60	211.27	209.61	207.17	66.16	281.79	261.55	0.2803	5.5332
107.5450	228.62	216.02	211.88	209.86	207.91	66.69	283.36	260.99	0.2565	5.5292
108.0457	229.50	216.14	212.31	210.34	208.23	67.35	283.43	261.52	0.2733	5.4937
108.5465	229.37	215.77	212.35	210.76	208.83	67.90	282.65	261.41	0.2755	5.5123
109.0462	229.61	215.34	212.10	210.89	209.56	68.45	282.78	261.61	0.2817	5.5363
109.5452	231.54	215.43	212.14	210.90	210.01	69.36	281.47	261.56	0.2771	5.5190
110.0450	230.99	214.92	211.89	210.87	210.12	70.58	280.70	260.84	0.2752	5.4681
110.5448	229.50	215.15	211.68	210.77	210.18	71.70	279.49	259.34	0.2755	5.5140
111.0455	231.91	215.53	212.04	210.68	210.21	72.77	280.39	261.57	0.2833	5.5234
111.5453	229.90	215.05	211.72	210.73	210.18	73.79	280.01	261.60	0.2754	5.5135
112.0452	229.28	214.30	211.65	210.75	210.34	74.77	281.63	261.69	0.2756	5.4916
112.5440	229.24	213.67	211.45	210.70	210.50	76.22	282.74	262.03	0.2757	5.5275
113.0438	230.82	213.46	211.06	210.56	210.56	78.11	281.03	261.90	0.2755	5.5363
113.5455	230.31	213.34	210.67	210.33	210.49	80.18	281.92	262.21	0.2739	5.5159
114.0453	231.38	213.27	210.35	209.96	210.26	82.43	284.69	262.24	0.2757	5.4922
114.5452	232.92	213.75	210.12	209.58	209.96	84.73	283.02	262.71	0.2761	5.5071
115.0450	230.85	213.16	209.89	209.19	209.58	87.01	281.45	262.75	0.2756	5.5300
115.5448	230.08	213.38	209.64	208.85	209.21	89.32	281.57	262.89	0.2757	5.5146
116.0455	230.03	213.97	209.67	208.60	208.91	92.43	280.12	260.84	0.2758	5.4806
116.5453	229.60	213.31	209.96	208.30	208.48	95.84	278.97	260.59	0.2748	5.5214
117.0452	229.31	213.81	209.70	208.37	208.19	98.47	280.98	261.02	0.2757	5.5061
117.5450	230.68	214.92	209.81	208.37	208.00	101.55	279.72	261.24	0.2742	5.4585
118.0448	230.60	215.34	209.74	208.36	208.00	104.13	276.54	257.92	0.2764	5.4928
118.5447	228.55	214.96	209.49	208.25	207.89	107.75	275.05	259.61	0.2474	5.5360
119.0445	229.68	213.91	209.29	208.15	207.91	108.73	275.73	262.36	0.2708	5.5252
119.5453	231.08	213.73	209.11	208.13	207.97	108.97	272.25	261.98	0.2763	5.5079
120.0460	230.65	213.34	209.01	208.01	207.97	109.56	271.53	261.25	0.2759	5.4947
120.5448	228.48	212.71	208.89	207.94	207.92	110.17	271.55	261.84	0.2764	5.5461
121.0447	227.86	212.86	208.99	207.85	207.87	110.65	274.87	261.22	0.2756	5.5146
121.5455	228.31	213.90	209.57	207.89	207.85	112.90	273.06	260.05	0.2739	5.4827
122.0453	229.74	214.21	209.73	208.14	207.82	114.89	274.33	262.42	0.2755	5.4898
122.5452	229.60	212.94	209.59	208.59	207.87	116.97	276.02	262.38	0.2750	5.5274
123.0450	230.34	213.74	209.50	208.64	208.11	119.96	275.17	262.55	0.2753	5.5459
123.5457	228.48	213.12	209.54	208.54	208.45	123.39	276.79	262.72	0.2752	5.5088
124.0455	229.84	212.92	209.65	208.43	208.50	127.20	276.55	262.88	0.2755	5.4988
124.5453	229.64	213.62	209.83	208.49	208.51	131.64	276.66	263.07	0.2754	5.5161

TABLE B4.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
125.0452	229.61	214.27	209.89	208.58	208.42	138.43	278.17	261.25	0.2755	5.5095
125.5450	229.74	214.24	209.78	208.62	208.37	147.15	276.96	260.70	0.2748	5.4951
126.0457	229.42	214.15	209.60	208.57	208.40	155.26	277.02	261.44	0.2749	5.5080
126.5455	229.24	214.17	209.53	208.46	208.42	161.96	277.56	261.59	0.2750	5.5516
127.0453	228.04	213.27	209.44	208.33	208.37	167.98	276.02	261.44	0.2750	5.5519
127.5452	230.17	213.42	209.29	208.25	208.27	172.78	274.44	261.37	0.2750	5.5031
128.0450	229.80	213.37	209.13	208.14	208.16	177.21	274.87	260.68	0.2750	5.4943
128.5457	230.52	213.07	208.95	208.00	208.07	180.77	273.74	260.88	0.2754	5.5116
129.0455	229.79	213.23	208.81	207.88	207.99	184.34	273.71	261.59	0.2750	5.5146
129.5453	230.29	212.68	208.86	207.74	207.86	187.25	272.23	259.93	0.2754	5.4914
130.0452	230.38	212.91	208.74	207.61	207.74	188.83	273.49	261.77	0.2756	5.4956
130.5450	229.47	213.47	208.71	207.65	207.69	190.62	274.51	261.70	0.2690	5.5350
131.0438	229.92	214.18	208.87	207.58	207.60	192.58	273.87	260.69	0.2754	5.5440
131.5455	228.81	213.69	208.92	207.53	207.51	194.17	272.26	262.08	0.2753	5.4963
132.0445	229.44	213.53	208.77	207.64	207.48	194.59	271.40	262.24	0.7089	5.4971
132.5443	229.33	213.17	208.73	207.69	207.44	195.13	272.79	260.93	0.6741	5.5127
133.0450	229.87	213.16	208.72	207.55	207.42	196.54	270.05	262.09	0.6035	5.5239
133.5448	230.70	213.21	208.67	207.57	207.52	196.24	269.88	262.44	0.5530	5.4878
134.0447	229.11	212.80	208.63	207.56	207.49	195.85	268.75	262.39	0.5201	5.4818
134.5453	229.74	213.16	208.78	207.52	207.44	195.30	268.15	262.35	0.4827	5.5093
135.0452	229.42	213.15	209.03	207.47	207.40	194.53	266.98	261.93	0.4370	5.5072
135.5450	230.31	213.20	209.00	207.55	207.31	193.45	265.63	261.38	0.3893	5.5025
136.0448	229.65	213.10	209.30	207.75	207.26	192.11	265.69	261.18	0.3436	5.5155
136.5447	230.35	213.51	209.72	208.11	207.25	191.02	266.66	261.04	0.2970	5.5449
137.0445	231.77	214.17	209.84	208.72	207.27	189.97	266.64	258.64	0.2649	5.5356
137.5453	230.75	214.37	209.86	208.84	207.54	191.44	266.60	258.05	0.2605	5.4913
138.0442	229.71	213.37	209.85	208.92	208.68	191.42	267.14	258.09	0.2669	5.4939
138.5440	229.84	214.64	210.08	209.08	209.15	190.94	268.51	258.05	0.2555	5.5640
139.0457	231.65	215.00	210.15	209.17	209.33	191.01	268.09	257.84	0.2760	5.5124
139.5445	231.33	215.24	210.17	209.26	209.49	190.91	268.36	258.35	0.2765	5.4732
140.0462	230.04	214.10	210.26	209.41	209.76	190.50	269.41	259.10	0.2750	5.5264
140.5452	230.06	215.73	210.91	209.89	210.14	190.73	275.77	261.87	0.2756	5.5390
141.0450	232.89	214.87	210.77	210.36	210.77	193.76	276.22	263.39	0.2746	5.5140
141.5457	231.66	214.35	210.40	210.29	210.95	205.69	279.76	263.48	0.2752	5.4901
142.0455	232.42	214.23	209.92	209.65	210.33	208.79	279.08	262.24	0.2759	5.4811
142.5453	231.02	214.28	209.42	208.92	209.56	208.70	278.49	261.19	0.2748	5.5366
143.0452	230.56	213.82	209.02	208.27	208.92	208.31	274.12	260.92	0.2759	5.5237
143.5450	229.86	213.82	208.69	207.88	208.47	207.99	273.58	260.99	0.2757	5.4938
144.0457	230.38	214.20	208.56	207.54	208.04	207.67	272.92	261.17	0.2761	5.5049
144.5455	231.15	213.95	208.28	207.39	207.80	207.46	269.98	260.39	0.2753	5.5217
145.0453	230.44	214.46	207.91	207.26	207.62	207.23	271.21	260.16	0.2731	5.5274
145.5442	230.34	213.17	207.82	207.00	207.41	206.96	269.69	259.37	0.2759	5.4866
146.0450	230.64	213.10	207.70	206.75	207.25	206.80	269.21	259.59	0.2752	5.4966
146.5448	231.15	212.67	207.72	206.70	207.13	206.71	268.14	259.38	0.2746	5.5287
147.0455	230.45	212.89	207.70	206.72	207.04	206.66	266.83	261.30	0.2748	5.5491
147.5453	229.20	213.00	207.72	206.68	206.90	206.47	268.62	259.97	0.2761	5.5010
148.0452	230.65	212.72	207.79	206.74	206.90	206.40	266.82	261.88	0.7082	5.4835
148.5440	230.69	212.85	207.82	206.78	206.88	206.28	268.61	261.42	0.7089	5.5349
149.0448	231.23	212.61	207.82	206.74	206.85	206.14	267.38	261.22	0.7089	5.5142
149.5455	231.14	212.63	207.61	206.76	206.80	205.99	268.02	260.30	0.7089	5.4883

TABLE B4.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
150.0453	233.04	212.83	207.43	206.73	206.82	205.91	265.17	261.31	0.7089	5.4981
150.5452	230.93	213.10	207.27	206.68	206.84	205.82	264.34	260.61	0.7089	5.5453
151.0442	229.90	213.18	207.56	206.52	206.73	205.66	263.86	257.76	0.7089	5.5489
151.5440	230.18	213.41	208.51	206.31	206.65	205.52	263.11	259.26	0.7089	5.5279
152.0455	231.01	213.83	208.73	206.35	206.63	205.34	262.50	260.18	0.7089	5.5051
152.5453	230.17	213.43	209.07	206.99	206.58	205.20	263.22	259.83	0.7089	5.5130
153.0443	230.33	213.71	209.30	208.09	206.53	205.01	263.76	260.78	0.3743	5.5289
153.5460	229.96	213.78	209.45	208.66	206.48	204.78	264.83	260.34	0.0835	5.5202
154.0448	230.45	213.19	209.59	208.91	206.39	204.55	265.40	261.64	0.4481	5.5108
154.5457	229.14	213.18	209.72	208.97	207.13	204.44	265.42	261.39	0.4510	5.5236
155.0455	230.13	213.79	209.69	209.04	209.04	204.25	265.71	261.48	0.2803	5.5408
155.5453	231.55	213.88	209.78	209.24	209.64	203.89	266.83	261.88	0.2600	5.5434
156.0450	232.30	214.56	209.92	209.33	209.84	203.66	267.10	261.93	0.6457	5.4764
156.5458	231.41	214.31	210.03	209.39	209.89	203.48	267.97	261.94	0.1507	5.4920
157.0465	232.29	214.35	210.14	209.47	209.95	203.29	268.60	262.20	0.0350	5.5449
157.5455	231.73	214.80	210.20	209.50	210.00	203.11	268.37	261.88	0.1877	5.5389
158.0443	231.41	214.61	210.24	209.54	210.04	202.95	268.38	261.89	0.5007	5.5095
158.5452	231.31	214.72	210.24	209.56	210.10	203.51	268.30	261.91	0.7088	5.5076
159.0440	231.53	214.97	210.26	209.53	210.00	208.46	268.94	259.21	0.5666	5.5375
159.5447	231.35	214.95	210.21	209.46	209.92	209.23	268.05	259.55	0.3953	5.5314
160.0455	231.94	214.88	210.14	209.44	209.98	209.52	267.62	261.04	0.2653	5.4837
160.5443	231.75	215.26	210.14	209.56	210.13	209.71	268.10	262.30	0.2670	5.5080
161.0452	232.27	215.18	210.27	209.65	210.24	209.83	268.61	262.56	0.2686	5.5443
161.5440	229.62	214.96	210.40	209.76	210.29	209.79	270.09	260.06	0.2805	5.5390
162.0457	229.05	214.20	210.39	209.62	210.10	209.63	268.99	260.44	0.2170	5.5197
162.5455	231.26	214.70	210.30	209.62	210.14	209.73	268.64	260.02	0.2700	5.4877
163.0443	232.19	215.33	210.28	209.60	210.12	209.71	268.67	259.85	0.2743	5.5055
163.5452	231.42	215.87	210.30	209.57	210.09	209.70	268.60	259.51	0.2741	5.5091
164.0440	229.71	215.46	210.36	209.61	210.13	209.75	269.13	260.63	0.2749	5.4898
164.5438	229.94	215.25	210.40	209.68	210.18	209.81	269.72	261.15	0.2733	5.5009
165.0455	231.59	215.47	210.53	209.79	210.29	209.94	270.08	261.80	0.2585	5.5054
165.5453	230.92	215.68	210.87	210.03	210.44	210.06	274.43	262.07	0.2362	5.5493
166.0443	231.58	215.79	210.58	210.12	210.64	210.23	276.86	260.71	0.2136	5.5438
166.5450	231.28	215.54	210.09	209.44	209.96	209.58	275.23	261.15	0.2078	5.4935
167.0448	232.14	215.12	209.64	209.03	209.73	209.53	272.78	262.90	0.1892	5.4883
167.5447	230.82	214.44	209.13	208.64	209.30	208.96	275.67	257.68	0.1805	5.5172
168.0453	231.84	214.91	208.91	208.11	208.81	208.65	268.50	261.56	0.1697	5.5358
168.5452	229.59	214.12	208.84	207.93	208.49	208.16	270.42	257.53	0.1653	5.4964
169.0450	230.74	213.39	208.54	207.74	208.17	208.01	266.44	259.93	0.1594	5.5109
169.5448	232.15	213.88	208.38	207.79	208.19	207.97	266.75	261.10	0.1464	5.5350
170.0455	229.88	213.43	208.49	207.67	208.14	207.72	268.93	259.69	0.1358	5.5281
170.5463	231.01	213.40	208.62	207.58	208.07	207.73	265.75	259.56	0.1310	5.5188
171.0470	229.55	213.11	208.59	207.73	208.03	207.78	268.96	261.49	0.1254	5.5026
171.5460	229.39	213.67	208.97	208.00	208.16	207.82	267.29	262.36	0.1218	5.5238
172.0458	229.75	213.66	208.52	207.81	207.95	207.38	264.57	258.69	0.1183	5.5269
172.5465	230.23	213.86	208.86	207.90	208.22	207.54	266.63	261.23	0.1117	5.5165
173.0463	230.13	212.91	208.94	208.04	208.45	207.65	266.55	262.11	0.1097	5.5108
173.5470	229.51	213.32	209.03	208.39	208.55	207.74	268.15	262.68	0.1040	5.5082
174.0460	232.02	213.95	209.37	208.44	208.64	207.85	268.04	262.79	0.1015	5.5408
174.5458	230.57	213.99	209.05	208.37	208.50	207.64	266.40	257.48	0.0953	5.5128

TABLE B4.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
175.0465	230.07	213.37	209.06	208.02	208.43	207.71	266.60	256.81	0.0921	5.4943
175.5463	232.47	214.41	208.97	208.18	208.41	207.88	264.05	257.70	0.0896	5.5298
176.0472	231.81	213.71	208.56	208.25	208.61	208.02	263.93	257.63	0.0768	5.5553
176.5452	230.18	213.63	208.56	208.04	208.76	208.10	264.09	259.30	0.2172	5.5307
177.0450	228.86	213.33	208.99	207.96	208.73	208.26	263.91	259.11	0.2701	5.4983
177.5447	228.88	213.72	209.55	208.37	208.66	208.39	271.17	258.50	0.2737	5.4955
178.0455	231.11	214.98	209.54	209.02	209.05	208.48	269.73	259.84	0.3526	5.5071
178.5453	230.53	214.17	209.04	208.86	209.50	208.84	272.40	261.12	0.2553	5.5210
179.0452	231.67	214.80	208.93	208.43	209.27	209.13	270.80	261.59	0.2339	5.4865
179.5450	230.67	214.02	208.38	208.20	208.97	208.95	271.72	262.84	0.3158	5.4974
180.0457	229.70	213.27	208.17	207.92	208.76	208.71	270.87	263.01	0.2697	5.5386
180.5465	230.49	212.99	208.26	207.58	208.51	208.46	270.52	262.71	0.2297	5.5453
181.0443	230.92	214.33	208.35	207.17	207.87	207.69	267.37	257.02	0.2762	5.5063
181.5442	230.64	214.53	208.05	206.92	207.28	207.19	264.69	256.43	0.2493	5.4916
182.0450	230.32	213.75	207.68	206.94	207.09	206.89	265.05	256.33	0.2619	5.5152
182.5448	229.79	212.26	207.56	206.80	207.16	206.71	264.29	256.18	0.3102	5.5150
183.0447	229.61	213.07	207.42	206.72	207.18	206.74	263.49	256.69	0.2754	5.4752
183.5453	230.38	213.99	207.42	206.63	207.15	206.77	263.46	256.68	0.2754	5.5020
184.0452	230.35	213.18	207.44	206.56	207.06	206.74	263.35	256.59	0.2748	5.5102
184.5450	230.12	212.88	207.42	206.56	206.99	206.71	263.73	256.60	0.2752	5.5738
185.0448	230.05	213.26	207.42	206.57	206.92	206.60	263.95	256.62	0.2755	5.5311
185.5455	229.82	212.29	207.52	206.57	206.91	206.57	264.28	256.78	0.2742	5.4861
186.0453	229.57	212.66	207.54	206.61	206.93	206.50	264.56	256.85	0.2771	5.5163
186.5452	229.39	213.34	207.52	206.68	206.93	206.50	263.82	257.19	0.2743	5.5182
187.0450	230.26	212.75	207.49	206.70	206.97	206.45	262.66	256.99	0.2749	5.4785
187.5448	229.24	212.77	207.44	206.69	207.03	206.45	263.41	257.01	0.2762	5.4940
188.0455	229.54	212.43	207.58	206.67	207.06	206.49	263.94	256.76	0.2760	5.5232
188.5453	229.58	213.08	207.50	206.73	207.07	206.53	262.96	257.24	0.2744	5.5228
189.0452	229.48	212.58	207.61	206.73	207.03	206.55	262.77	256.54	0.2742	5.5034
189.5450	228.55	212.55	207.63	206.75	207.09	206.57	263.52	256.87	0.2740	5.4956
190.0448	229.21	212.08	207.58	206.79	207.09	206.57	263.87	256.38	0.2753	5.5389
190.5457	229.52	212.23	207.51	206.79	207.15	206.59	262.51	256.83	0.2788	5.5410
191.0455	229.09	212.88	207.53	206.76	207.17	206.61	263.99	256.40	0.2736	5.5140
191.5462	229.95	213.24	207.64	206.72	207.15	206.63	262.13	257.01	0.2758	5.4938
192.0450	228.95	212.34	207.57	206.78	207.15	206.69	262.65	256.79	0.2760	5.5004
192.5448	228.76	213.01	207.51	206.83	207.12	206.71	261.77	256.80	0.2749	5.5138
193.0457	226.78	213.78	207.93	206.80	207.14	206.68	264.42	257.16	0.2760	5.4998
193.5455	229.18	213.57	208.47	206.98	207.21	206.66	262.43	257.15	0.2745	5.4937
194.0453	229.39	213.18	207.97	207.63	207.22	206.64	264.70	256.98	0.2742	5.5346
194.5452	228.61	213.23	208.04	207.51	207.67	206.68	262.97	257.35	0.2761	5.5514
195.0450	230.47	213.50	208.30	207.33	207.96	206.74	263.27	257.18	0.2759	5.5568
195.5457	229.33	212.93	208.30	207.49	207.87	207.03	263.71	257.12	0.2747	5.5151
196.0455	229.92	213.80	208.32	207.59	207.89	207.37	263.37	256.69	0.2754	5.4843
196.5453	229.75	214.41	208.38	207.62	208.04	207.50	263.80	257.35	0.2754	5.5123
197.0452	229.28	214.46	208.18	207.57	208.06	207.59	263.33	257.63	0.2743	5.5099
197.5450	228.64	214.14	208.11	207.50	208.06	207.70	264.72	257.74	0.2753	5.4735
198.0457	228.25	214.02	207.95	207.38	208.01	207.72	264.48	257.22	0.2879	5.5119
198.5465	228.11	213.77	207.97	207.25	207.88	207.65	264.17	257.40	0.2501	5.5168
199.0453	227.80	213.52	208.01	207.11	207.74	207.54	263.90	257.55	0.2748	5.5199
199.5442	227.88	213.76	207.87	207.19	207.62	207.47	264.05	257.54	0.2972	5.4971

TABLE B4.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
200.0450	229.04	213.08	207.78	207.17	207.58	207.37	262.74	257.59	0.2379	5.4853
200.5448	227.95	212.99	207.75	207.05	207.57	207.24	261.92	257.35	0.2080	5.5148
201.0455	227.27	214.39	208.36	207.05	207.61	207.25	262.27	257.15	0.2748	5.4981
201.5453	227.31	213.91	208.48	207.23	207.55	207.18	262.25	258.06	0.2631	5.4658
202.0452	226.47	213.16	208.47	207.72	207.54	207.16	262.99	257.23	0.2752	5.5053
202.5450	225.96	214.09	208.81	207.84	207.59	207.13	262.52	258.32	0.2752	5.5434
203.0448	226.32	214.15	209.06	208.08	207.97	207.09	262.97	257.64	0.2757	5.5101
203.5455	226.73	214.58	209.26	208.46	208.29	207.04	263.56	257.73	0.2756	5.4907
204.0453	226.60	214.99	209.46	208.76	208.82	207.03	264.15	257.48	0.2757	5.4970
204.5452	226.75	214.22	209.78	209.00	209.32	207.12	267.55	257.64	0.2748	5.5132
205.0450	228.33	214.63	209.46	209.11	209.61	208.41	267.79	258.66	0.2750	5.5114
205.5448	226.86	213.64	209.05	208.73	209.52	209.29	268.86	258.68	0.2762	5.4878
206.0455	229.53	213.26	208.95	208.34	209.18	209.11	268.01	260.03	0.2756	5.5058
206.5453	229.68	214.16	208.77	208.21	208.90	208.86	268.36	259.76	0.2761	5.5316
207.0480	229.31	225.61	209.39	208.93	209.63	209.39	262.02	257.08	0.0002	5.5039
207.5478	229.96	225.27	209.07	208.59	209.32	209.07	260.07	256.45	0.0003	5.4928
208.0467	230.14	225.08	208.86	208.45	209.20	209.04	259.25	256.08	0.0003	5.5038
208.5483	229.73	224.18	208.74	208.38	209.17	209.02	258.55	256.41	0.0000	5.5442
209.0473	229.36	222.75	208.74	208.44	209.24	209.12	258.80	256.20	0.0012	5.5137
209.5480	229.32	222.45	208.76	208.42	209.21	209.08	258.58	256.86	0.0002	5.4846
210.0478	228.05	222.68	208.76	208.44	209.24	209.10	258.77	255.71	0.0006	5.4985
210.5477	228.13	223.01	208.76	208.44	209.26	209.12	258.83	257.05	0.0006	5.5276
211.0483	229.08	222.71	208.80	208.50	209.30	209.19	258.80	257.97	0.0006	5.4921
211.5482	228.26	222.37	208.82	208.55	209.38	209.27	259.24	258.19	0.0005	5.4592
212.0480	228.67	222.17	208.89	208.64	209.43	209.32	259.90	256.68	0.0002	5.4933
212.5478	228.98	221.94	208.95	208.66	209.49	209.34	259.76	257.80	0.0007	5.5274
213.0477	229.12	222.16	208.75	208.41	209.22	209.09	258.60	255.80	0.0005	5.5008
213.5475	229.47	221.80	208.72	208.51	209.33	209.12	259.00	258.18	0.0009	5.4825
214.0482	228.27	222.11	208.94	208.69	209.51	209.39	259.71	258.16	0.0004	5.4858
214.5480	228.45	222.18	208.76	208.33	209.14	208.83	257.53	254.48	0.0004	5.5287
215.0478	228.34	221.29	208.44	208.12	208.96	208.80	256.41	254.74	0.0002	5.5285
215.5468	228.43	220.67	208.34	208.05	208.86	208.73	256.09	254.33	0.0007	5.4851
216.0475	228.49	220.81	208.25	207.96	208.80	208.69	255.95	255.39	0.0000	5.4729
216.5483	227.97	221.53	208.29	208.03	208.88	208.79	256.30	254.49	0.0003	5.5007
217.0480	226.71	222.37	208.56	208.24	208.99	208.88	257.89	255.48	0.0008	5.4896
217.5478	227.60	221.64	208.65	208.35	209.11	209.04	258.79	256.22	0.0005	5.4701
218.0468	229.31	223.22	208.77	208.42	209.19	209.04	259.11	255.83	0.0005	5.5371
218.5475	230.27	222.29	208.80	208.47	209.24	209.12	258.98	256.07	0.0007	5.5258
219.0483	228.81	222.65	208.76	208.40	209.19	209.07	258.84	255.79	0.0000	5.4804
219.5482	228.70	223.33	208.75	208.37	209.16	209.00	259.04	255.65	0.0000	5.4884
220.0488	228.88	223.30	208.77	208.41	209.16	209.00	258.97	255.28	0.0000	5.4962
220.5477	229.31	223.17	208.80	208.44	209.23	209.09	259.37	256.04	0.0006	5.4575
221.0485	228.83	224.96	208.86	208.46	209.22	209.07	259.47	256.37	0.0004	5.4106
221.5483	229.53	225.61	208.84	208.47	209.22	209.08	259.38	256.40	0.0002	5.4142
222.0482	229.18	224.07	208.84	208.47	209.22	209.06	259.13	255.83	0.0003	5.4235
222.5480	228.96	223.52	208.77	208.42	209.20	209.10	258.66	255.75	0.0005	5.3977
223.0478	229.86	223.74	208.70	208.35	209.17	209.03	258.09	255.89	0.0005	5.3805
223.5477	229.42	224.96	208.58	208.26	209.10	208.98	257.53	255.87	0.0000	5.3764
224.0483	228.61	223.38	208.53	208.26	209.10	208.98	257.22	255.46	0.0002	5.3664

TABLE B4.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
224.5482	227.54	223.35	208.35	208.01	208.85	208.66	255.83	253.18	0.0005	5.3153
225.0470	227.60	221.92	208.16	207.89	208.73	208.62	255.28	253.53	0.0001	5.3522
225.5478	227.58	221.78	208.20	207.91	208.70	208.63	255.74	253.68	0.0001	5.3865
226.0477	227.60	221.37	208.25	207.98	208.79	208.68	256.18	254.21	0.0001	5.3563
226.5483	228.08	221.66	208.29	208.00	208.81	208.72	256.10	254.77	0.0001	5.4357
227.0482	228.23	222.38	208.34	208.02	208.85	208.74	256.55	254.18	0.0005	5.3871
227.5470	230.02	223.67	208.36	208.08	208.88	208.78	256.48	254.67	0.0005	5.5498
228.0478	228.52	223.06	208.39	208.10	208.89	208.78	256.79	255.10	0.0006	5.5414
228.5477	228.74	221.99	208.46	208.15	208.94	208.85	257.24	254.94	0.0001	5.4265
229.0483	228.18	223.44	208.53	208.21	209.00	208.87	257.81	255.58	0.0000	5.4533
229.5482	228.72	223.98	208.53	208.21	209.02	208.91	257.98	255.81	0.0006	5.6171
230.0480	228.89	223.19	208.61	208.31	209.07	208.97	257.91	255.66	0.0006	5.5951
230.5478	229.69	222.71	208.65	208.32	209.11	209.00	258.13	255.87	0.0006	5.4239
231.0468	229.09	224.09	208.67	208.34	209.15	209.01	258.37	255.24	0.0006	5.5074
231.5483	229.00	223.58	208.72	208.40	209.19	209.06	258.55	255.55	0.0006	5.5478
232.0473	230.15	224.01	208.74	208.42	209.21	209.08	258.93	255.57	0.0006	5.4782
232.5480	229.90	224.40	208.72	208.44	209.26	209.24	258.97	258.27	0.0004	5.3325
233.0478	228.47	223.19	208.73	208.32	209.10	208.92	258.19	255.01	0.0003	5.5892
233.5487	229.67	222.94	208.75	208.46	209.25	209.18	259.22	256.53	0.0004	5.4976
234.0485	229.96	223.23	208.89	208.62	209.43	209.36	259.78	257.44	0.0008	5.4795
234.5473	229.83	223.69	209.02	208.73	209.52	209.43	260.39	257.87	0.0005	5.4897
235.0480	229.16	223.11	209.09	208.81	209.61	209.52	260.93	258.22	0.0002	5.4954
235.5478	229.66	223.70	209.13	208.65	209.42	209.15	260.42	255.80	0.0002	5.4311
236.0487	228.86	223.54	208.85	208.63	209.22	209.04	258.97	255.45	0.0008	5.4550
236.5467	230.61	224.85	208.74	208.40	209.19	209.08	258.58	255.72	0.0002	5.5215
237.0473	229.67	224.35	208.73	208.42	209.21	209.10	258.71	255.70	0.0006	5.4379
237.5482	229.01	221.92	208.73	208.41	209.18	209.09	258.65	256.53	0.0000	5.4394
238.0480	228.77	223.92	208.75	208.43	209.21	209.09	258.78	255.35	0.0007	5.4884
238.5477	228.38	222.82	208.75	208.43	209.21	209.07	258.74	255.85	0.0007	5.4853
239.0467	230.32	223.10	208.75	208.45	209.25	209.11	258.75	256.17	0.0007	5.4581
239.5483	231.36	224.84	208.74	208.41	209.22	209.11	258.62	256.07	0.0007	5.4278
240.0482	229.52	224.47	208.72	208.41	209.26	209.13	258.32	255.77	0.0003	5.5517
240.5480	229.23	222.54	208.69	208.40	209.20	209.10	258.24	256.31	0.0003	5.4580
241.0478	228.93	223.29	208.71	208.42	209.22	209.12	258.71	255.31	0.0003	5.4402
241.5477	229.42	224.39	208.80	208.47	209.26	209.16	259.61	255.77	0.0003	5.4505
242.0483	228.97	223.31	208.98	208.62	209.35	209.23	260.89	256.24	0.0010	5.3722
242.5482	229.44	225.11	209.18	208.75	209.45	209.32	262.09	256.30	0.0006	5.4634
243.0470	230.23	226.68	209.29	208.84	209.54	209.38	262.25	256.95	0.0003	5.5427
243.5478	231.13	227.29	209.24	208.81	209.54	209.36	261.34	256.49	0.0002	5.4283
244.0477	230.88	228.05	209.04	208.68	209.45	209.27	260.36	256.33	0.0006	5.3558
244.5483	229.80	225.94	208.92	208.56	209.36	209.22	259.38	256.44	0.0002	5.3776
245.0482	230.77	212.78	211.30	210.15	210.51	210.31	273.20	263.76	0.0007	5.5945
245.5480	231.60	212.88	211.39	210.17	210.52	210.30	273.35	263.24	0.0007	5.5752
246.0478	231.60	212.88	211.38	210.18	210.48	210.27	273.37	262.92	0.0003	5.5735
246.5477	228.47	212.62	211.43	210.18	210.50	210.31	273.88	263.67	0.0006	5.6004
247.0483	228.91	212.49	211.42	210.26	210.60	210.40	273.37	264.23	0.0002	5.5806
247.5473	231.47	212.64	211.44	210.28	210.64	210.42	273.35	264.25	0.0002	5.5628
248.0480	233.89	212.72	211.45	210.25	210.57	210.34	273.39	263.39	0.0000	5.5453
248.5478	232.10	212.81	211.43	210.23	210.59	210.39	273.42	263.91	0.0005	5.5201
249.0467	231.73	212.83	211.44	210.27	210.58	210.36	273.24	263.34	0.0000	5.5063
249.5475	230.88	212.87	211.44	210.20	210.49	210.29	273.73	262.94	0.0000	5.5489

TABLE B4.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
250.0492	231.02	213.07	211.39	210.17	210.49	210.24	273.27	262.76	0.0005	5.5565
250.5472	230.58	213.02	211.32	210.14	210.48	210.23	272.70	263.05	0.0004	5.5953
251.0470	230.40	212.86	211.32	210.11	210.43	210.25	272.94	263.17	0.0002	5.5893
251.5477	230.57	212.63	211.26	210.09	210.41	210.22	272.57	263.28	0.0007	5.5928
252.0485	230.72	212.64	211.31	210.11	210.47	210.29	272.99	263.48	0.0001	5.5652
252.5482	231.35	212.50	211.28	210.15	210.53	210.35	272.80	263.31	0.0002	5.5712
253.0480	230.74	212.52	211.28	210.16	210.51	210.32	272.60	263.43	0.0002	5.5246
253.5488	231.44	212.47	211.31	210.16	210.52	210.36	272.86	263.48	0.0002	5.5234
254.0477	232.09	212.51	211.36	210.18	210.56	210.36	273.37	263.86	0.0007	5.5461
254.5475	231.91	212.51	211.37	210.20	210.54	210.36	272.88	263.64	0.0001	5.5620
255.0473	231.35	212.59	211.35	210.19	210.55	210.38	272.82	263.30	0.0000	5.5622
255.5482	230.65	212.82	211.39	210.21	210.55	210.39	273.12	263.78	0.0004	5.5535
256.0480	230.55	212.79	211.41	210.21	210.55	210.36	273.04	263.44	0.0005	5.5749
256.5477	227.43	212.42	211.45	210.23	210.56	210.38	273.69	263.06	0.0007	5.5879
257.0467	228.30	212.33	211.40	210.06	209.97	209.22	273.43	250.72	0.0001	3.1443

TABLE B5. PRESSURE AND TEMPERATURE DATA FOR RUN 7 (PETROLEUM DISTILLATE:STEAM = 5:100).

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
0.0530	50.91	48.62	52.60	54.96	54.31	50.18	270.44	261.21	0.0000	5.5097
0.5473	58.98	52.71	52.58	54.96	54.33	50.20	268.15	261.32	0.0000	5.5440
1.0480	68.01	61.98	52.60	54.94	54.31	50.20	260.61	261.36	0.0003	5.5006
1.5478	97.45	79.98	52.58	54.90	54.30	50.22	260.50	261.26	0.0003	5.4906
2.0468	168.34	97.43	52.58	54.79	54.20	50.26	260.93	261.33	0.0006	5.5337
2.5475	203.32	171.13	52.59	54.87	54.26	50.36	265.14	261.75	0.0004	5.5381
3.0483	208.03	202.29	53.98	54.85	54.36	50.38	265.92	261.02	0.0004	5.4981
3.5482	209.48	204.94	55.15	54.83	54.41	50.40	269.77	260.92	0.0004	5.5028
4.0480	211.08	206.19	56.24	54.81	54.43	50.41	273.95	261.07	0.0007	5.5213
4.5468	213.33	208.09	56.64	54.79	54.45	50.44	276.00	260.89	0.0003	5.5361
5.0475	215.79	210.61	56.56	54.78	54.47	50.46	277.95	260.88	0.0005	5.4972
5.5473	217.57	213.46	56.22	54.72	54.49	50.48	278.65	260.87	0.0005	5.4972
6.0482	218.02	214.39	55.80	54.70	54.49	50.50	279.17	260.85	0.0004	5.5408
6.5480	217.11	214.57	55.43	54.68	54.51	50.52	279.88	260.85	0.0002	5.5250
7.0478	216.72	214.48	55.16	54.70	54.53	50.52	281.20	260.84	0.0003	5.4863
7.5477	218.19	214.97	55.26	54.69	54.53	50.54	293.51	260.93	0.0001	5.5186
8.0483	220.69	216.00	55.45	54.69	54.57	50.54	297.46	260.89	0.0006	5.5468
8.5482	223.22	217.29	55.66	54.67	54.57	50.56	303.00	260.88	0.0000	5.5213
9.0480	225.08	219.42	55.92	54.69	54.63	50.56	308.62	260.91	0.0000	5.4908
9.5478	226.48	220.87	56.25	54.67	54.67	50.56	306.70	260.83	0.0004	5.5321
10.0477	226.50	221.04	56.70	54.67	54.69	50.56	308.29	260.83	0.0005	5.5376
10.5483	227.86	222.02	57.25	54.65	54.71	50.58	310.22	260.80	0.0004	5.5077
11.0492	228.47	223.13	57.82	54.65	54.73	50.58	313.13	260.80	0.0000	5.4947
11.5480	230.06	223.42	58.59	54.64	54.73	50.66	318.22	260.82	0.0004	5.5394
12.0478	228.11	223.65	59.44	54.62	54.75	50.66	318.86	260.81	0.0009	5.5360
12.5477	223.94	218.64	59.88	54.60	54.75	50.66	314.41	260.80	0.0006	5.4888
13.0483	223.26	218.00	60.84	54.58	54.75	50.68	313.54	260.78	0.0003	5.5042
13.5473	223.71	218.07	62.38	54.56	54.75	50.68	314.92	260.77	0.0007	5.5396
14.0480	229.82	219.08	63.91	54.53	54.79	50.72	315.37	260.79	0.0007	5.5247
14.5478	245.57	221.82	64.52	54.49	54.79	50.72	313.50	260.86	0.0007	5.4849
15.0468	254.74	231.12	63.97	54.47	54.83	50.74	310.16	260.77	0.0000	5.5252
15.5475	259.30	238.20	63.61	54.47	54.85	50.78	308.04	260.73	0.0003	5.5519
16.0482	260.24	241.25	63.58	54.46	54.84	50.80	304.80	260.71	0.0002	5.4928
16.5480	258.12	241.54	63.90	54.46	54.86	50.84	305.11	260.72	0.0005	5.5073
17.0470	251.19	241.07	64.34	54.46	54.86	50.88	306.56	261.27	0.0005	5.5362
17.5477	236.34	239.50	64.83	54.46	54.88	50.92	307.03	259.11	0.0002	5.5274
18.0485	229.77	235.72	65.38	54.46	54.90	50.94	307.11	259.59	0.0004	5.4811
18.5473	222.67	224.74	65.91	54.46	54.86	50.96	306.95	258.09	0.0004	5.4794
19.0480	220.72	217.55	66.46	54.46	54.86	50.96	304.50	257.05	0.0000	5.5302
19.5478	220.06	216.53	67.10	54.45	54.89	51.00	303.38	258.02	0.0000	5.5093
20.0487	220.18	216.43	67.90	54.43	54.91	51.04	304.42	259.01	0.0005	5.4805
20.5475	220.60	216.75	68.75	54.43	54.91	51.06	307.00	258.84	0.0003	5.5283
21.0483	221.17	217.29	69.63	54.43	54.93	51.10	309.70	261.45	0.0003	5.5241
21.5482	221.62	217.70	70.45	54.42	54.95	51.12	312.00	261.62	0.0003	5.4516
22.0470	222.11	218.08	71.30	54.42	54.93	51.15	313.29	261.73	0.0003	5.4856
22.5477	222.48	218.44	72.15	54.40	54.94	51.17	314.43	261.49	0.0000	5.5058
23.0475	222.74	218.69	72.96	54.41	54.96	51.19	314.75	261.58	0.0000	5.4798
23.5483	222.81	218.66	73.81	54.39	54.96	51.21	315.33	261.57	0.0000	5.5216
24.0482	223.08	218.86	74.77	54.41	54.98	51.23	315.56	261.57	0.0000	5.5700
24.5470	223.16	219.06	75.78	54.41	54.98	51.25	316.23	261.54	0.0000	5.5482

TABLE B5.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
25.0478	223.50	219.40	76.87	54.39	55.00	51.31	316.27	261.52	0.0001	5.5069
25.5477	223.63	219.31	78.02	54.42	54.99	51.33	316.00	261.49	0.0001	5.5136
26.0483	224.24	219.44	79.13	54.42	54.99	51.36	316.12	261.44	0.0003	5.5249
26.5482	224.31	219.91	80.31	54.42	55.01	51.40	317.64	261.42	0.0003	5.5491
27.0470	225.55	220.18	81.76	54.42	55.01	51.42	318.51	261.42	0.0005	5.5343
27.5478	226.23	221.58	83.22	54.43	55.03	51.48	320.73	261.39	0.0003	5.5023
28.0477	225.59	221.99	84.85	54.43	55.04	51.52	321.52	261.24	0.0003	5.5228
28.5483	227.08	222.33	86.38	54.45	55.06	51.56	321.72	261.24	0.0003	5.5430
29.0482	229.21	225.72	88.12	54.49	55.08	51.62	321.23	261.24	0.0001	5.5296
29.5480	232.11	231.74	89.80	54.53	55.08	51.66	320.79	261.21	0.0001	5.4966
30.0478	228.19	231.08	91.54	54.54	55.11	51.72	320.97	261.23	0.0001	5.5171
30.5485	226.82	227.11	93.14	54.58	55.11	51.74	320.84	261.19	0.0004	5.5319
31.0483	226.46	222.71	94.95	54.62	55.09	51.78	320.57	261.21	0.0003	5.5509
31.5473	229.42	221.89	96.77	54.68	55.10	51.81	319.80	261.21	0.0003	5.5012
32.0480	231.77	226.74	98.83	54.74	55.12	51.89	320.54	261.17	0.0003	5.4997
32.5478	232.80	233.15	101.11	54.80	55.14	51.93	320.38	261.19	0.0001	5.5176
33.0477	234.25	235.92	103.76	54.90	55.15	51.99	319.28	261.15	0.0006	5.5387
33.5483	228.88	235.88	107.04	55.00	55.17	52.05	318.68	260.42	0.0006	5.5242
34.0482	229.83	234.08	110.75	55.12	55.17	52.11	318.38	262.53	0.0006	5.4683
34.5480	230.82	234.01	114.97	55.25	55.19	52.19	318.27	263.46	0.0003	5.5386
35.0478	228.55	235.09	120.08	55.41	55.18	52.25	318.84	263.23	0.0003	5.5401
35.5477	228.84	234.57	126.54	55.56	55.18	52.33	317.48	263.00	0.0001	5.5138
36.0485	231.44	235.58	136.83	55.76	55.17	52.41	316.78	262.03	0.0001	5.4935
36.5473	232.64	236.67	148.28	55.97	55.19	52.49	315.86	255.07	0.0001	5.5204
37.0480	231.59	237.09	163.84	56.16	55.21	52.53	314.19	248.94	0.0002	5.5310
37.5478	228.77	236.65	180.79	56.38	55.22	52.56	312.99	249.87	0.0002	5.5004
38.0477	228.99	235.86	192.90	56.59	55.24	52.60	312.25	250.28	0.0002	5.4874
38.5475	229.97	236.35	201.50	56.82	55.26	52.62	311.49	251.54	0.0002	5.5267
39.0483	230.68	236.71	206.51	57.04	55.27	52.64	311.36	251.26	0.0002	5.4834
39.5482	230.72	236.41	209.51	57.29	55.29	52.69	310.66	251.99	0.0002	5.4811
40.0488	229.29	236.52	211.44	57.54	55.30	52.71	310.66	252.71	0.0002	5.5308
40.5477	227.70	235.13	212.93	57.82	55.32	52.75	310.77	252.28	0.0002	5.5523
41.0467	227.72	234.45	214.11	58.11	55.34	52.79	311.44	253.02	0.0002	5.5335
41.5473	229.28	234.99	214.98	58.44	55.36	52.84	311.79	253.75	0.0002	5.5039
42.0482	227.35	235.62	215.66	58.77	55.35	52.88	312.33	253.54	0.0002	5.5142
42.5480	228.14	235.13	216.22	59.09	55.37	52.92	312.79	253.32	0.0002	5.5501
43.0478	229.13	235.85	216.58	59.46	55.38	52.94	313.31	253.54	0.0002	5.5411
43.5477	229.60	236.69	216.78	59.79	55.38	52.99	313.59	254.17	0.0002	5.4973
44.0483	229.50	236.95	216.99	60.17	55.41	53.05	314.24	254.16	0.0002	5.5297
44.5482	229.50	235.81	217.15	60.55	55.41	53.09	314.07	253.58	0.0002	5.5291
45.0480	230.94	236.22	217.24	60.92	55.41	53.11	314.38	254.31	0.0002	5.5216
45.5478	229.90	236.66	217.43	61.34	55.44	53.17	315.08	253.80	0.0002	5.5072
46.0477	226.94	235.91	217.56	61.76	55.46	53.18	315.62	254.41	0.0002	5.5049
46.5483	228.25	235.16	217.74	62.26	55.47	53.22	316.56	254.97	0.0002	5.5248
47.0482	230.15	235.61	217.83	62.75	55.47	53.27	316.81	254.80	0.0002	5.5194
47.5480	229.55	236.89	217.98	63.27	55.49	53.29	317.39	254.59	0.0002	5.4521
48.0478	228.96	236.79	218.04	63.84	55.52	53.31	317.18	254.53	0.0002	5.4921
48.5477	226.74	236.29	218.13	64.43	55.52	53.36	318.02	255.06	0.0002	5.5455
49.0483	226.44	234.66	218.26	65.10	55.55	53.36	318.31	255.61	0.0002	5.5107
49.5473	227.68	235.13	218.36	65.78	55.57	53.38	319.10	255.25	0.0002	5.4960

TABLE B5.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
50.0480	228.78	236.46	218.42	66.52	55.58	53.39	319.15	255.55	0.0002	5.5452
50.5478	227.59	237.11	218.49	67.34	55.60	53.39	319.68	255.38	0.0001	5.5304
51.0477	226.98	236.04	218.53	68.21	55.62	53.40	319.65	256.52	0.0001	5.5268
51.5483	225.95	235.63	218.61	69.16	55.65	53.42	320.24	256.14	0.0001	5.4962
52.0482	228.53	236.30	218.70	70.18	55.67	53.43	320.55	256.40	0.0001	5.5157
52.5480	228.32	238.12	218.80	71.26	55.69	53.45	321.26	255.39	0.0001	5.5293
53.0478	227.97	237.84	218.82	72.43	55.72	53.48	320.76	255.30	0.0000	5.5107
53.5477	225.13	235.69	218.92	73.68	55.74	53.46	321.55	256.04	0.0000	5.5042
54.0475	224.59	224.77	218.99	75.00	55.73	53.47	322.15	255.72	0.0000	5.5009
54.5483	224.70	221.43	219.09	76.38	55.77	53.47	322.67	255.65	0.0000	5.5164
55.0480	225.61	220.47	219.13	77.84	55.76	53.48	322.49	255.15	0.0004	5.4749
55.5478	227.13	223.44	219.19	79.41	55.80	53.50	322.98	255.76	0.0000	5.4940
56.0468	230.49	229.73	219.19	81.08	55.85	53.51	322.87	256.29	0.0003	5.5415
56.5475	233.44	235.42	219.21	82.84	55.87	53.53	323.05	255.55	0.0003	5.5307
57.0483	235.08	240.00	219.25	84.81	55.93	53.53	323.08	256.49	0.0004	5.4911
57.5482	228.60	241.64	219.29	86.92	55.97	53.54	323.20	257.00	0.0002	5.4958
58.0470	225.74	236.11	219.32	89.26	56.04	53.55	323.55	256.48	0.0002	5.5478
58.5477	224.76	224.15	219.27	91.84	56.08	53.57	322.97	255.49	0.0002	5.5481
59.0475	224.62	220.63	219.24	94.67	56.12	53.59	323.08	255.83	0.0002	5.5011
59.5483	224.72	220.48	219.26	97.68	56.18	53.60	322.97	256.38	0.0002	5.4912
60.0482	225.24	220.84	219.28	100.95	56.25	53.62	323.17	256.42	0.0002	5.5088
60.5480	226.73	222.42	219.30	104.47	56.31	53.63	323.37	256.75	0.0002	5.5252
61.0478	230.10	225.61	219.36	108.39	56.37	53.67	323.40	257.12	0.0000	5.4925
61.5477	229.25	231.92	219.49	112.85	56.43	53.68	324.52	256.07	0.0000	5.4923
62.0483	230.61	236.31	219.55	117.68	56.48	53.70	324.70	256.13	0.0000	5.5017
62.5482	231.07	238.84	219.56	122.58	56.56	53.73	324.69	256.05	0.0000	5.4757
63.0470	226.38	238.81	219.58	127.87	56.64	53.75	324.97	255.89	0.0000	5.4823
63.5478	224.86	227.01	219.62	133.57	56.70	53.74	325.28	257.14	0.0000	5.5320
64.0477	224.87	221.54	219.59	139.45	56.78	53.74	324.88	256.97	0.0000	5.5210
64.5483	225.03	221.28	219.57	145.87	56.88	53.78	324.50	257.32	0.0000	5.4833
65.0482	225.52	221.66	219.54	153.26	56.98	53.79	324.62	256.92	0.0000	5.4976
65.5472	226.82	222.97	219.57	161.18	57.12	53.79	324.67	256.17	0.0000	5.5480
66.0478	228.00	227.05	219.59	170.22	57.22	53.82	324.76	257.28	0.0000	5.5125
66.5477	229.12	232.48	219.60	179.06	57.40	53.86	325.10	257.26	0.0000	5.4953
67.0483	229.57	237.43	219.67	189.66	57.53	53.87	325.38	256.30	0.0000	5.5127
67.5482	227.80	239.46	219.68	199.70	57.69	53.87	325.31	256.61	0.0000	5.5520
68.0472	227.09	239.18	219.63	207.40	57.87	53.90	325.05	257.26	0.0000	5.5140
68.5478	226.49	239.31	219.70	212.01	58.02	53.92	325.61	256.86	0.0004	5.4829
69.0477	226.73	238.56	219.73	214.32	58.26	53.93	325.80	256.45	0.0002	5.5244
69.5483	228.00	238.25	219.71	215.69	58.47	53.97	325.26	257.05	0.0002	5.5316
70.0482	234.08	240.76	219.68	216.55	58.70	53.97	325.13	256.75	0.0000	5.5167
70.5472	237.50	244.35	219.64	217.24	58.96	54.02	324.60	258.10	0.0001	5.4958
71.0478	228.61	245.74	219.62	217.69	59.21	54.06	324.40	257.33	0.0007	5.5080
71.5477	226.64	242.42	219.55	217.93	59.50	54.08	324.28	257.80	0.0003	5.5253
72.0485	225.70	239.17	219.56	218.13	59.77	54.11	324.26	258.62	0.0003	5.5218
72.5473	225.97	236.99	219.51	218.26	60.10	54.12	323.89	258.66	0.0003	5.4827
73.0480	226.68	236.26	219.52	218.39	60.46	54.14	324.04	258.29	0.0002	5.5307
73.5478	230.01	236.81	219.47	218.39	60.81	54.16	323.51	258.61	0.0010	5.5409
74.0468	232.04	240.50	219.44	218.43	61.19	54.19	323.38	259.34	0.0010	5.4706
74.5475	235.45	244.59	219.41	218.42	61.63	54.19	323.13	259.56	0.0010	5.4938

TABLE B5.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
75.0483	234.07	246.67	219.34	218.39	62.05	54.22	322.60	259.57	0.0000	5.5525
75.5482	227.81	246.23	219.27	218.36	62.51	54.22	322.09	258.92	0.0000	5.5592
76.0480	225.50	241.57	219.19	218.31	62.97	54.23	321.30	258.90	0.0000	5.5087
76.5477	224.61	235.11	219.10	218.26	63.49	54.23	320.97	259.27	0.0000	5.5093
77.0467	225.10	229.99	219.04	218.23	64.04	54.24	320.61	258.73	0.0002	5.5302
77.5483	228.06	229.24	218.95	218.16	64.65	54.24	320.15	258.21	0.0000	5.5337
78.0482	229.68	232.40	218.92	218.13	65.30	54.27	319.63	258.68	0.0000	5.5129
78.5480	230.95	237.12	218.89	218.12	66.02	54.31	319.77	258.73	0.0000	5.4853
79.0468	236.40	241.87	218.86	218.12	66.82	54.30	319.63	259.53	0.0000	5.5050
79.5477	236.75	244.87	218.81	218.08	67.69	54.30	318.91	260.25	0.0001	5.5044
80.0483	236.99	245.68	218.67	217.94	68.64	54.31	317.92	258.97	0.0001	5.5412
80.5472	231.31	245.20	218.57	217.85	69.70	54.33	317.21	258.60	0.0001	5.5301
81.0480	226.18	242.73	218.47	217.77	70.86	54.36	316.96	258.99	0.0001	5.5353
81.5478	224.34	238.56	218.38	217.72	72.12	54.36	316.25	258.74	0.0005	5.5246
82.0477	226.10	235.61	218.28	217.62	73.50	54.37	315.41	258.86	0.0005	5.4888
82.5483	227.42	236.49	218.21	217.55	74.97	54.37	315.27	258.70	0.0005	5.4916
83.0482	233.42	239.24	218.13	217.49	76.58	54.40	314.47	258.71	0.0000	5.5288
83.5480	238.73	242.85	218.06	217.42	78.29	54.40	314.32	259.57	0.0005	5.5412
84.0478	240.69	244.63	217.96	217.32	80.13	54.45	313.63	259.26	0.0000	5.4916
84.5477	240.39	244.71	217.84	217.23	82.14	54.47	312.58	259.68	0.0004	5.4917
85.0483	238.38	243.73	217.70	217.08	84.33	54.53	311.74	258.92	0.0004	5.5155
85.5473	230.60	242.44	217.62	217.01	86.73	54.56	311.24	259.37	0.0004	5.5184
86.0472	228.27	239.81	217.50	216.89	89.35	54.60	310.54	259.71	0.0004	5.4604
86.5478	225.40	237.88	217.43	216.82	92.29	54.66	310.04	259.59	0.0000	5.4762
87.0477	227.55	238.19	217.33	216.74	95.61	54.73	309.31	258.56	0.0000	5.5110
87.5483	230.62	239.90	217.23	216.64	99.32	54.77	308.65	259.55	0.0000	5.4699
88.0482	230.67	240.98	217.11	216.52	103.48	54.85	308.02	259.53	0.0000	5.5165
88.5480	231.99	241.12	216.99	216.43	108.08	54.91	307.25	259.89	0.0000	5.5480
89.0478	229.40	240.88	216.85	216.31	113.17	54.99	306.20	259.04	0.0001	5.5630
89.5468	227.38	240.26	216.75	216.21	118.91	55.05	305.68	259.96	0.0002	5.5047
90.0485	226.59	239.90	216.62	216.09	125.09	55.12	304.93	258.73	0.0002	5.4996
90.5483	228.26	239.94	216.50	215.99	131.64	55.20	304.26	260.03	0.0002	5.5238
91.0472	230.38	240.38	216.40	215.88	138.53	55.30	303.54	259.76	0.0000	5.5252
91.5478	227.92	240.71	216.30	215.78	145.69	55.40	303.29	260.00	0.0002	5.5150
92.0468	226.60	238.72	216.23	215.73	153.64	55.48	302.46	258.60	0.0002	5.4903
92.5475	228.89	238.82	216.11	215.61	161.90	55.60	301.70	257.96	0.0003	5.5136
93.0483	232.39	240.74	216.01	215.53	169.97	55.74	301.00	259.26	0.0002	5.5220
93.5482	233.56	241.57	215.89	215.39	178.64	55.86	300.18	259.03	0.0000	5.4810
94.0480	233.64	241.52	215.75	215.25	186.54	56.01	299.40	259.30	0.0000	5.4891
94.5477	232.91	241.29	215.61	215.11	193.43	56.15	298.43	258.98	0.0006	5.5282
95.0475	230.30	241.21	215.48	214.97	199.08	56.35	297.67	258.84	0.0003	5.5085
95.5483	228.22	240.96	215.34	214.85	203.02	56.54	297.06	259.44	0.0008	5.4672
96.0472	229.55	240.73	215.23	214.75	206.32	56.74	296.24	259.47	0.0008	5.5002
96.5480	228.52	240.29	215.17	214.68	208.80	56.95	295.85	259.52	0.0008	5.5352
97.0478	229.80	240.42	215.06	214.58	210.73	57.22	295.17	259.23	0.0008	5.5068
97.5485	230.68	240.77	214.91	214.43	211.97	57.49	294.23	259.16	0.0008	5.4936
98.0483	231.81	240.75	214.72	214.25	212.70	57.76	292.83	260.71	0.0008	5.5168
98.5472	231.80	240.70	214.51	214.06	213.06	58.11	291.65	259.14	0.0002	5.5424
99.0480	230.59	240.37	214.26	213.78	213.24	58.44	289.75	257.94	0.0002	5.5212
99.5478	229.87	240.09	213.96	213.50	213.28	58.84	288.24	259.46	0.0007	5.5016

TABLE B5.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
100.0485	226.67	239.88	213.73	213.29	213.25	59.27	286.95	258.60	0.0002	5.5011
100.5475	227.81	239.77	213.56	213.11	213.22	59.73	285.95	257.49	0.0002	5.5252
101.0482	227.65	240.03	213.44	213.01	213.19	60.26	285.62	259.79	0.0003	5.4865
101.5480	223.16	239.82	213.46	213.01	213.23	60.83	285.77	259.66	0.0002	5.4952
102.0468	225.94	239.37	213.47	213.04	213.31	61.48	286.09	258.91	0.0002	5.5208
102.5477	230.60	240.90	213.54	213.10	213.42	62.19	286.51	260.19	0.0001	5.5308
103.0483	234.26	242.91	213.62	213.21	213.53	62.99	287.04	261.64	0.0001	5.5195
103.5482	235.79	243.89	213.66	213.21	213.59	63.86	287.16	258.68	0.0002	5.5050
104.0480	235.34	243.91	213.63	213.18	213.59	64.87	286.84	259.89	0.0001	5.5159
104.5478	235.06	243.25	213.56	213.11	213.56	65.91	286.23	259.89	0.0009	5.5060
105.0477	233.17	242.47	213.44	213.01	213.48	67.07	285.56	259.24	0.0009	5.5065
105.5483	233.30	241.70	213.30	212.87	213.37	68.32	284.65	259.27	0.0004	5.4953
106.0482	232.53	240.67	213.13	212.72	213.24	69.65	283.41	260.39	0.0002	5.5147
106.5480	225.43	240.03	212.97	212.56	213.11	71.01	282.45	259.86	0.0006	5.5284
107.0478	224.43	238.51	212.73	212.37	212.92	72.44	280.90	259.72	0.0006	5.4849
107.5477	227.67	237.54	212.48	212.10	212.71	73.91	279.30	260.19	0.0006	5.5060
108.0485	230.58	237.19	212.20	211.84	212.47	75.42	277.66	260.57	0.0006	5.5335
108.5483	230.64	237.37	211.95	211.59	212.24	76.95	276.49	260.02	0.0006	5.5309
109.0490	230.95	237.31	211.72	211.37	212.05	78.49	275.07	260.18	0.0006	5.4930
109.5478	231.42	237.04	211.53	211.19	211.85	80.05	274.09	260.08	0.0006	5.4908
110.0487	228.14	239.98	211.68	211.34	211.91	81.70	276.09	259.71	0.0006	5.5455
110.5475	228.52	240.81	211.88	211.50	212.11	83.37	276.86	260.06	0.0006	5.5185
111.0483	229.14	241.21	212.06	211.71	212.28	85.11	278.11	260.02	0.0004	5.4810
111.5482	229.00	241.31	212.23	211.89	212.48	86.97	279.01	260.44	0.0004	5.5190
112.0470	229.59	241.38	212.38	212.02	212.63	88.86	279.75	262.71	0.0001	5.5443
112.5477	229.62	241.30	212.47	212.10	212.70	90.85	280.02	261.35	0.0006	5.5142
113.0475	229.10	241.00	212.47	212.12	212.73	92.96	279.89	258.52	0.0006	5.4842
113.5483	225.22	240.37	212.37	212.01	212.66	95.33	278.92	259.52	0.0006	5.5087
114.0482	228.18	239.57	212.21	211.86	212.52	97.87	277.87	259.11	0.0002	5.5319
114.5470	230.17	239.18	212.04	211.68	212.36	100.66	276.82	259.17	0.0004	5.4762
115.0468	230.95	239.13	211.88	211.53	212.22	103.74	275.91	261.10	0.0004	5.4833
115.5477	230.36	239.60	211.78	211.44	212.12	107.14	275.81	260.60	0.0004	5.5448
116.0483	230.49	240.50	211.80	211.45	212.12	110.82	276.15	259.83	0.0004	5.5414
116.5472	229.47	241.35	211.93	211.58	212.18	114.83	277.11	259.82	0.0004	5.5068
117.0480	230.61	241.89	212.10	211.74	212.35	119.36	278.37	260.72	0.0002	5.4915
117.5478	231.69	242.33	212.32	211.96	212.53	124.73	279.79	262.61	0.0002	5.5352
118.0477	233.00	242.73	212.55	212.18	212.75	131.57	281.16	262.60	0.0002	5.5298
118.5483	233.72	243.09	212.76	212.36	212.95	140.33	282.14	262.17	0.0002	5.4804
119.0482	234.21	243.08	212.80	212.40	212.97	151.67	281.85	259.71	0.0002	5.4797
119.5472	234.87	242.67	212.62	212.21	212.82	163.70	280.33	260.91	0.0002	5.5262
120.0478	235.52	242.39	212.36	211.95	212.57	173.87	278.72	260.15	0.0000	5.5407
120.5477	235.67	242.12	212.08	211.66	212.33	183.50	276.98	261.16	0.0001	5.4973
121.0483	235.92	241.79	211.79	211.36	212.04	191.47	275.27	260.58	0.0001	5.5117
121.5482	235.82	241.43	211.49	211.10	211.80	197.03	273.71	261.04	0.0002	5.5250
122.0480	235.59	241.13	211.25	210.85	211.55	201.55	272.09	260.10	0.0003	5.5325
122.5478	235.67	240.65	210.98	210.61	211.31	204.86	270.53	261.33	0.0002	5.4696
123.0477	235.62	239.92	210.68	210.34	211.08	206.60	269.04	260.23	0.0002	5.4941
123.5483	235.77	239.03	210.42	210.08	210.85	207.58	267.39	261.05	0.0004	5.5199
124.0482	235.77	238.16	210.16	209.85	210.62	207.88	265.99	260.40	0.0000	5.4989
124.5480	236.17	237.98	209.96	209.66	210.41	208.00	265.21	260.15	0.0004	5.4677

TABLE B5.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
125.0478	235.87	238.00	209.83	209.52	210.31	208.04	264.27	260.75	0.0001	5.5356
125.5477	234.94	238.37	209.74	209.42	210.19	208.17	264.08	260.13	0.0001	5.5285
126.0485	232.07	239.91	209.83	209.49	210.19	208.37	265.66	261.20	0.0002	5.4878
126.5483	231.35	241.47	210.09	209.77	210.45	208.87	266.72	260.29	0.0003	5.5038
127.0480	224.55	240.19	210.36	210.02	210.70	209.29	268.25	261.37	0.0001	5.5177
127.5478	228.87	239.93	210.49	210.15	210.83	209.61	268.76	261.78	0.0002	5.5364
128.0477	232.50	241.36	210.55	210.21	210.89	209.80	269.04	261.45	0.0002	5.4872
128.5475	234.47	242.10	210.54	210.20	210.89	209.95	268.87	263.37	0.0002	5.5026
129.0483	235.80	242.14	210.49	210.11	210.85	209.95	268.22	261.03	0.0003	5.5329
129.5472	237.11	241.74	210.37	210.03	210.76	209.96	267.48	261.30	0.0003	5.4993
130.0480	236.88	241.33	210.23	209.91	210.66	209.91	266.62	263.03	0.0003	5.4865
130.5477	236.32	240.63	210.07	209.77	210.54	209.84	265.82	262.42	0.0003	5.5243
131.0475	236.45	240.05	209.95	209.65	210.44	209.79	265.09	261.49	0.0006	5.5578
131.5483	236.51	239.37	209.83	209.54	210.33	209.72	264.53	260.28	0.0002	5.5184
132.0500	235.90	240.04	209.84	209.55	210.32	209.75	265.15	261.31	0.0002	5.4919
132.5470	234.78	241.94	210.07	209.77	210.47	209.95	266.65	263.26	0.0001	5.5026
133.0478	232.92	242.29	210.27	209.97	210.67	210.11	267.84	262.87	0.0003	5.5320
133.5477	232.17	242.51	210.44	210.08	210.71	209.92	268.42	258.68	0.0003	5.5024
134.0492	233.21	242.76	210.35	209.94	210.57	209.84	267.87	259.90	0.0006	5.4717
134.5472	231.50	243.04	210.30	209.91	210.52	209.82	267.55	260.26	0.0002	5.5211
135.0480	233.22	242.90	210.24	209.83	210.47	209.85	266.99	260.18	0.0002	5.5610
135.5478	234.68	242.72	210.14	209.74	210.42	209.85	266.28	260.06	0.0000	5.5482
136.0477	235.71	242.46	209.96	209.60	210.32	209.78	265.27	261.01	0.0002	5.4959
136.5493	235.91	241.98	209.81	209.48	210.23	209.75	264.37	261.33	0.0002	5.4899
137.0482	236.13	241.07	209.65	209.35	210.15	209.70	263.37	260.14	0.0002	5.5326
137.5480	236.49	239.95	209.51	209.24	210.05	209.65	262.72	261.53	0.0003	5.5118
138.0487	237.84	238.52	209.39	209.12	209.96	209.57	261.83	259.77	0.0000	5.4627
138.5467	237.23	237.66	209.27	209.02	209.88	209.52	261.45	259.81	0.0000	5.5087
139.0475	235.84	236.45	209.22	208.97	209.81	209.47	261.17	260.62	0.0002	5.5334
139.5482	229.32	235.90	209.24	208.99	209.80	209.47	262.72	260.17	0.0002	5.5058
140.0490	226.03	236.64	209.48	209.19	209.91	209.46	263.05	258.70	0.0002	5.4944
140.5478	225.31	237.38	209.63	209.31	210.02	209.65	264.36	260.25	0.0002	5.5181
141.0477	227.67	238.72	209.92	209.60	210.22	209.79	266.49	261.23	0.0002	5.5428
141.5483	229.72	239.39	210.30	209.91	210.50	209.98	268.58	260.77	0.0002	5.5204
142.0482	233.16	240.88	210.48	210.07	210.64	209.96	268.80	259.85	0.0001	5.4811
142.5480	236.66	241.75	210.33	209.93	210.59	210.02	267.42	260.86	0.0001	5.5236
143.0478	238.58	241.70	210.10	209.74	210.46	209.90	266.02	260.19	0.0001	5.5355
143.5477	239.25	241.40	209.83	209.44	210.14	209.53	264.11	258.52	0.0001	5.4888
144.0485	234.15	240.79	209.55	209.23	209.98	209.57	262.95	259.53	0.0001	5.4871
144.5483	234.13	239.24	209.43	209.15	209.93	209.59	262.57	259.82	0.0005	5.5075
145.0480	232.56	237.54	209.36	209.06	209.85	209.44	262.04	257.97	0.0002	5.5100
145.5478	231.78	237.08	209.23	208.94	209.73	209.35	261.33	258.51	0.0002	5.5031
146.0477	232.21	236.98	209.20	208.94	209.75	209.50	261.39	260.09	0.0002	5.5140
146.5475	230.14	236.95	209.17	208.86	209.63	209.24	260.72	257.90	0.0006	5.5373
147.0483	231.60	236.40	209.03	208.78	209.58	209.28	260.17	259.00	0.0007	5.5400
147.5482	233.37	235.61	208.98	208.73	209.57	209.28	259.79	258.46	0.0007	5.4682
148.0480	229.60	234.72	208.93	208.69	209.54	209.30	259.57	259.05	0.0007	5.4959
148.5477	232.13	233.94	208.91	208.68	209.54	209.27	259.62	258.54	0.0007	5.5393
149.0475	225.26	234.69	208.95	208.72	209.55	209.28	259.86	259.43	0.0007	5.5115
149.5483	226.25	234.18	208.98	208.76	209.60	209.35	260.15	259.02	0.0007	5.5130

TABLE B5.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
150.0490	226.15	235.05	209.11	208.87	209.68	209.43	261.24	260.31	0.0001	5.5114
150.5480	224.56	236.25	209.36	209.11	209.86	209.61	262.89	260.00	0.0001	5.5213
151.0478	228.61	236.95	209.64	209.37	210.12	209.83	264.41	261.36	0.0001	5.5293
151.5467	228.50	237.93	209.93	209.66	210.36	210.09	266.06	262.38	0.0001	5.4982
152.0483	230.66	238.49	210.15	209.86	210.56	210.22	267.05	262.61	0.0001	5.5105
152.5482	234.44	239.30	210.13	209.76	210.44	209.88	266.42	260.38	0.0001	5.5348
153.0480	235.97	239.86	210.01	209.67	210.39	209.98	265.91	261.69	0.0001	5.5253
153.5468	235.81	239.02	209.96	209.68	210.45	210.14	265.54	262.81	0.0001	5.4825
154.0477	237.52	238.33	209.90	209.61	210.40	210.00	264.86	263.04	0.0001	5.5531
154.5483	235.45	237.20	209.78	209.47	210.28	209.83	263.91	259.65	0.0001	5.5431
155.0482	238.12	236.51	209.39	209.04	209.83	209.40	261.50	259.00	0.0001	5.5150
155.5470	238.82	236.55	209.16	208.89	209.71	209.39	260.72	258.61	0.0001	5.4800
156.0478	239.19	236.46	209.05	208.80	209.63	209.36	260.26	259.25	0.0001	5.4999
156.5477	238.96	236.41	209.02	208.81	209.61	209.36	260.53	259.31	0.0001	5.5444
157.0483	237.46	237.49	209.17	208.94	209.73	209.48	261.58	259.40	0.0001	5.5117
157.5473	229.62	237.35	209.39	209.12	209.89	209.62	263.07	260.36	0.0001	5.4936
158.0480	227.94	235.84	209.63	209.34	210.06	209.74	264.35	260.61	0.0001	5.5264
158.5478	224.92	233.42	209.90	209.58	210.26	209.94	265.87	261.53	0.0001	5.5193
159.0485	232.42	233.27	210.01	209.64	210.28	209.71	266.06	259.29	0.0000	5.4683
159.5483	239.90	237.25	209.93	209.52	210.20	209.75	265.42	260.14	0.0000	5.4878
160.0482	243.15	240.16	209.85	209.49	210.18	209.76	264.81	259.81	0.0000	5.5532
160.5480	243.57	240.91	209.72	209.40	210.15	209.78	264.18	260.37	0.0000	5.5355
161.0478	239.41	239.95	209.62	209.33	210.12	209.80	263.61	260.28	0.0000	5.5040
161.5477	240.22	238.06	209.54	209.27	210.07	209.75	263.04	260.03	0.0000	5.4949
162.0485	235.43	235.87	209.45	209.20	210.02	209.74	262.52	260.07	0.0000	5.5109
162.5473	234.50	232.71	209.42	209.19	210.05	209.83	262.46	260.52	0.0000	5.5331
163.0480	229.49	229.78	209.41	209.23	210.14	209.80	262.60	259.79	0.0000	5.4636
163.5478	225.00	226.20	209.39	209.22	210.07	209.84	262.36	260.91	0.0000	5.4804
164.0468	225.65	223.65	209.38	209.20	210.06	209.88	262.37	261.02	0.0001	5.5277
164.5475	220.80	223.79	209.42	209.22	210.07	209.85	262.64	260.78	0.0001	5.5388
165.0483	220.16	226.61	209.68	209.44	210.20	209.96	264.59	262.32	0.0001	5.4867
165.5482	222.32	227.38	209.95	209.74	210.49	210.27	266.21	262.95	0.0001	5.4998
166.0480	221.87	228.41	210.15	209.88	210.62	210.33	267.16	262.94	0.0001	5.5167
166.5468	221.59	228.22	210.21	209.92	210.68	210.34	267.10	262.63	0.0001	5.5136
167.0475	224.05	228.26	210.16	209.89	210.66	210.29	266.64	261.38	0.0001	5.4782
167.5483	224.36	228.41	209.92	209.56	210.27	209.76	264.56	258.96	0.0001	5.5320
168.0482	227.16	228.89	209.60	209.29	210.05	209.69	263.12	260.20	0.0001	5.5245
168.5488	231.76	230.99	209.50	209.21	210.02	209.71	262.85	259.19	0.0001	5.4831
169.0468	237.75	234.63	209.50	209.21	210.04	209.77	262.91	259.63	0.0001	5.5001
169.5477	242.02	238.26	209.45	209.15	209.94	209.63	262.62	260.60	0.0001	5.5363
170.0483	242.85	240.16	209.49	209.22	210.01	209.80	263.27	259.67	0.0001	5.5374
170.5482	242.34	240.78	209.52	209.21	210.00	209.71	263.12	260.54	0.0001	5.4760
171.0480	240.96	240.14	209.58	209.31	210.06	209.66	263.59	259.64	0.0001	5.4801
171.5468	235.99	238.96	209.62	209.35	210.12	209.83	263.94	259.64	0.0004	5.5275
172.0477	233.71	236.69	209.68	209.41	210.16	209.87	264.21	260.49	0.0004	5.4894
172.5483	228.20	233.97	209.75	209.48	210.25	209.95	264.53	261.24	0.0004	5.4838
173.0482	226.95	230.59	209.79	209.54	210.33	210.02	264.62	260.74	0.0004	5.5033
173.5470	226.39	228.00	209.72	209.51	210.30	210.03	264.35	261.16	0.0004	5.5293
174.0478	228.66	227.52	209.76	209.53	210.34	210.05	264.47	261.46	0.0004	5.4808
174.5477	230.76	227.97	209.70	209.46	210.27	209.97	264.05	260.66	0.0004	5.4943

TABLE B5.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
175.0483	227.65	227.10	209.67	209.43	210.24	210.03	263.86	261.23	0.0000	5.5254
175.5482	228.98	226.42	209.76	209.53	210.33	210.03	265.26	260.46	0.0001	5.4891
176.0480	236.17	229.47	209.93	209.62	210.38	210.02	265.61	260.13	0.0001	5.4510
176.5488	239.26	232.45	209.86	209.57	210.36	210.13	265.25	261.57	0.0001	5.4825
177.0468	236.72	233.87	209.88	209.60	210.38	210.12	265.30	262.27	0.0001	5.5074
177.5475	235.63	233.68	209.89	209.58	210.34	209.98	265.12	260.79	0.0001	5.4848
178.0482	232.75	232.11	209.80	209.55	210.34	210.07	264.76	260.92	0.0001	5.5099
178.5480	233.31	230.09	209.72	209.47	210.27	209.97	264.22	260.50	0.0001	5.5298
179.0478	228.98	228.91	209.74	209.53	210.35	210.15	264.63	261.50	0.0001	5.4859
179.5468	230.58	228.18	209.59	209.19	209.93	209.16	262.57	255.83	0.0001	5.4756
180.0493	230.28	229.05	209.07	208.68	209.41	208.91	260.11	255.68	0.0001	5.5096
180.5483	229.84	229.61	208.86	208.54	209.29	208.95	259.71	255.96	0.0001	5.4979
181.0480	231.22	229.25	208.92	208.64	209.37	209.08	260.28	256.72	0.0001	5.4556
181.5470	232.48	229.83	209.07	208.80	209.54	209.29	261.32	258.11	0.0001	5.4970
182.0477	237.02	231.47	209.25	209.00	209.74	209.49	262.45	258.61	0.0001	5.5312
182.5475	236.34	232.28	209.42	209.13	209.90	209.63	262.98	259.55	0.0001	5.4780
183.0483	232.08	231.06	209.37	209.07	209.84	209.48	262.47	259.13	0.0001	5.4887
183.5482	234.36	229.55	209.27	209.02	209.80	209.52	261.83	258.51	0.0001	5.5190
184.0480	234.35	229.48	209.17	208.92	209.74	209.45	261.16	258.23	0.0001	5.4862
184.5477	236.70	229.38	209.06	208.85	209.71	209.49	260.64	258.82	0.0001	5.4800
185.0475	236.15	228.63	209.00	208.78	209.66	209.43	260.18	258.21	0.0001	5.5414
185.5483	229.16	227.11	208.88	208.66	209.52	209.29	259.49	258.12	0.0001	5.5252
186.0472	232.24	225.72	208.79	208.61	209.49	209.29	259.22	257.95	0.0001	5.4938
186.5480	232.78	226.64	208.76	208.60	209.46	209.28	259.16	257.91	0.0001	5.4893
187.0478	233.67	227.49	208.77	208.59	209.47	209.27	259.38	257.83	0.0001	5.5153
187.5467	232.78	229.18	209.06	208.84	209.61	209.42	261.65	258.42	0.0001	5.4903
188.0483	232.89	229.66	209.32	209.06	209.83	209.60	262.44	258.89	0.0001	5.4889
188.5482	231.67	230.14	209.43	209.18	209.95	209.71	263.39	260.58	0.0001	5.5135
189.0470	233.42	230.37	209.52	209.29	210.06	209.86	263.82	260.56	0.0001	5.5166
189.5478	233.08	230.83	209.67	209.46	210.23	209.97	264.61	260.21	0.0001	5.5140
190.0485	233.68	230.12	209.71	209.48	210.28	210.07	264.40	261.53	0.0001	5.4745
190.5483	233.29	229.17	209.75	209.55	210.38	210.18	264.79	261.94	0.0001	5.4914
191.0482	228.23	228.96	209.70	209.44	210.22	209.81	264.70	258.58	0.0001	5.5189
191.5480	230.02	223.20	209.40	209.10	209.91	209.57	262.09	258.93	0.0001	5.4867
192.0478	235.96	223.01	209.25	209.02	209.84	209.57	261.72	258.54	0.0001	5.4855
192.5477	240.17	226.86	209.06	208.70	209.47	208.74	259.95	253.32	0.0001	5.5611
193.0483	239.87	231.02	208.52	208.20	208.99	208.67	257.49	255.76	0.0001	5.5177
193.5473	240.90	232.93	208.47	208.24	209.03	208.83	257.88	256.45	0.0001	5.4661
194.0480	237.37	233.61	208.62	208.39	209.16	208.95	258.97	256.72	0.0001	5.4737
194.5478	233.17	232.35	208.79	208.54	209.31	209.08	259.89	256.80	0.0001	5.5271
195.0477	231.17	230.81	208.92	208.67	209.44	209.21	260.46	257.26	0.0001	5.4835
195.5483	230.44	229.60	209.02	208.78	209.57	209.32	261.08	258.02	0.0001	5.4871
196.0482	233.67	229.19	208.99	208.70	209.49	209.15	260.19	257.05	0.0001	5.5056
196.5472	233.53	229.68	208.85	208.58	209.40	209.13	259.35	257.53	0.0001	5.5296
197.0478	233.07	228.90	208.75	208.50	209.34	209.03	258.68	256.21	0.0001	5.4836
197.5477	232.18	228.42	208.61	208.39	209.23	209.00	258.21	256.19	0.0001	5.4871
198.0485	234.07	227.53	208.50	208.31	209.15	208.99	257.72	257.51	0.0001	5.4978
198.5473	233.52	227.25	208.47	208.28	209.14	208.90	257.57	255.99	0.0001	5.4763
199.0480	231.87	227.81	208.50	208.30	209.16	208.98	258.30	256.28	0.0001	5.4754
199.5478	233.33	229.03	208.84	208.63	209.40	209.20	260.22	256.88	0.0001	5.5446

TABLE B5.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
200.0477	233.41	229.68	208.99	208.76	209.55	209.30	260.84	257.41	0.0001	5.5326
200.5475	236.80	231.10	209.10	208.87	209.66	209.43	261.55	258.95	0.0001	5.4814
201.0483	235.48	231.63	209.22	208.98	209.79	209.56	262.00	259.44	0.0005	5.4868
201.5482	233.01	231.29	209.26	209.04	209.85	209.63	262.05	259.15	0.0005	5.5063
202.0480	234.34	230.24	209.23	209.01	209.84	209.66	261.79	260.21	0.0005	5.5178
202.5477	230.25	229.58	209.21	208.96	209.80	209.54	261.55	258.57	0.0005	5.4866
203.0475	232.52	227.96	209.00	208.77	209.61	209.33	260.34	257.26	0.0005	5.4923
203.5473	231.24	228.29	208.89	208.65	209.49	209.24	259.72	257.34	0.0005	5.5226
204.0472	232.48	228.51	208.89	208.71	209.55	209.43	260.32	258.97	0.0005	5.5432
204.5480	231.25	228.55	209.13	208.93	209.75	209.59	261.79	258.77	0.0005	5.4689
205.0478	230.52	228.50	209.37	209.15	209.94	209.71	263.20	258.73	0.0005	5.4753
205.5477	234.06	229.13	209.51	209.26	210.02	209.78	263.83	260.52	0.0005	5.5340
206.0483	234.49	230.85	209.68	209.47	210.22	210.00	265.05	260.48	0.0005	5.5360
206.5482	234.98	231.61	209.83	209.58	210.33	210.12	265.73	261.71	0.0005	5.4740
207.0470	235.61	231.73	209.96	209.67	210.43	210.09	266.24	260.59	0.0005	5.4850
207.5478	233.36	231.95	209.97	209.70	210.45	210.20	266.46	261.87	0.0005	5.5408
208.0477	231.09	230.50	210.01	209.74	210.47	209.97	266.33	258.08	0.0005	5.5207
208.5475	232.56	230.13	209.67	209.30	210.05	209.55	263.49	257.90	0.0005	5.4541
209.0482	235.76	229.99	209.32	209.03	209.86	209.55	262.02	258.01	0.0005	5.4949
209.5480	238.65	230.35	209.18	208.95	209.81	209.59	261.54	258.49	0.0005	5.5145
210.0487	238.65	230.36	209.13	208.92	209.78	209.58	261.10	258.86	0.0005	5.4949
210.5477	236.24	229.52	209.07	208.89	209.78	209.64	261.22	259.45	0.0005	5.4947
211.0475	230.80	227.72	209.03	208.89	209.77	209.63	260.71	259.04	0.0005	5.5295
211.5492	229.84	226.58	209.04	208.88	209.76	209.60	260.96	259.00	0.0005	5.5127
212.0480	230.86	225.80	209.08	208.90	209.76	209.60	261.08	259.26	0.0005	5.4778
212.5470	232.34	226.41	209.16	209.02	209.84	209.73	262.47	259.85	0.0005	5.4904
213.0477	232.36	229.09	209.47	209.27	210.08	209.92	263.88	260.28	0.0005	5.5365
213.5483	234.43	229.74	209.55	209.31	210.12	209.87	264.12	259.75	0.0005	5.5312
214.0482	236.12	230.37	209.57	209.34	210.14	209.91	263.93	260.49	0.0005	5.5064
214.5472	234.92	230.89	209.68	209.45	210.22	209.84	264.44	259.75	0.0005	5.4929
215.0478	232.19	230.27	209.56	209.33	210.13	209.85	263.94	259.69	0.0005	5.5337
215.5468	231.76	228.86	209.41	209.10	209.89	209.48	262.28	257.61	0.0005	5.4990
216.0485	233.04	229.06	209.14	208.86	209.68	209.39	261.14	258.01	0.0005	5.4873
216.5483	236.27	229.82	209.04	208.83	209.63	209.42	260.81	257.28	0.0005	5.4789
217.0480	234.34	230.60	209.03	208.79	209.64	209.42	260.94	257.80	0.0005	5.5374
217.5470	232.12	230.37	209.03	208.82	209.64	209.46	261.13	258.57	0.0005	5.5248
218.0477	231.68	229.87	209.07	208.86	209.70	209.49	261.27	258.58	0.0005	5.4868
218.5467	232.56	229.77	209.17	208.95	209.78	209.56	261.84	258.88	0.0005	5.4947
219.0473	233.13	229.74	209.21	209.01	209.80	209.59	262.02	258.72	0.0005	5.5357
219.5472	227.19	228.39	209.29	209.07	209.86	209.65	262.44	258.54	0.0005	5.5210
220.0480	230.83	226.85	209.29	209.10	209.90	209.65	262.55	258.17	0.0005	5.4884
220.5477	237.39	228.84	209.32	209.09	209.91	209.66	262.55	259.12	0.0005	5.4944
221.0475	237.88	231.48	209.36	209.14	209.95	209.72	262.84	259.48	0.0005	5.5212
221.5483	239.39	232.13	209.36	209.15	209.97	209.77	262.72	259.27	0.0005	5.5328
222.0482	238.75	232.15	209.33	209.14	209.96	209.78	262.67	259.22	0.0005	5.4798
222.5480	232.25	230.55	209.37	209.18	210.00	209.80	262.93	259.37	0.0005	5.4934
223.0478	229.43	227.74	209.43	209.25	210.08	209.88	263.48	260.25	0.0005	5.5172
223.5485	226.92	226.19	209.63	209.44	210.21	209.97	264.87	260.50	0.0005	5.4870
224.0483	230.26	225.85	209.69	209.46	210.23	210.00	264.79	259.87	0.0005	5.4809
224.5490	231.39	226.84	209.77	209.54	210.36	210.15	265.30	261.27	0.0005	5.5207

TABLE B5.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
225.0480	232.36	227.14	209.78	209.52	210.31	209.97	264.79	259.62	0.0002	5.5343
225.5468	235.47	227.96	209.62	209.37	210.19	209.91	264.00	259.57	0.0002	5.4993
226.0477	233.00	228.63	209.52	209.28	210.12	209.89	263.49	259.29	0.0002	5.4849
226.5483	231.23	227.40	209.43	209.26	210.10	209.97	263.07	260.80	0.0002	5.5117
227.0482	229.52	225.19	209.44	209.28	210.14	209.98	263.23	259.90	0.0002	5.5162
227.5480	232.87	223.49	209.43	209.27	210.14	210.00	263.03	261.11	0.0002	5.5048
228.0478	230.64	224.82	209.57	209.38	210.20	210.08	264.54	261.37	0.0002	5.5123
228.5477	231.74	226.26	209.76	209.53	210.33	210.08	265.61	261.69	0.0002	5.5295
229.0483	233.16	227.27	209.96	209.76	210.55	210.30	266.69	259.81	0.0002	5.5347
229.5482	233.99	228.19	210.02	209.79	210.57	210.36	266.96	262.41	0.0002	5.4915
230.0490	232.72	228.53	210.04	209.81	210.58	210.29	266.69	261.86	0.0002	5.4747
230.5478	232.58	227.53	209.89	209.62	210.44	210.15	265.46	261.12	0.0002	5.5375
231.0477	232.39	227.16	209.80	209.59	210.39	210.18	265.16	260.81	0.0002	5.5453
231.5483	230.18	226.83	209.72	209.50	210.36	210.13	264.64	260.77	0.0002	5.4952
232.0482	230.27	225.42	209.51	209.26	210.10	209.81	263.23	259.39	0.0002	5.4990
232.5480	231.12	224.76	209.37	209.17	210.05	209.87	262.91	259.76	0.0002	5.5150
233.0470	231.71	224.96	209.39	209.18	210.04	209.82	262.97	259.74	0.0002	5.5252
233.5477	232.17	226.22	209.49	209.29	210.11	209.97	264.47	261.09	0.0002	5.4758
234.0485	231.99	227.14	209.78	209.56	210.37	210.21	265.68	261.51	0.0002	5.5015
234.5473	231.37	228.00	209.89	209.64	210.41	210.16	266.48	261.22	0.0002	5.5195
235.0480	228.78	222.01	210.04	209.81	210.54	210.29	266.98	262.23	0.0002	5.5423
235.5478	233.17	222.23	210.06	209.83	210.60	210.37	266.86	261.72	0.0002	5.4898
236.0477	236.54	225.87	210.00	209.76	210.57	210.32	266.35	261.40	0.0002	5.4988
236.5475	236.14	227.54	209.88	209.64	210.43	210.06	265.25	259.40	0.0002	5.5346
237.0492	235.53	227.60	209.58	209.33	210.15	209.83	263.38	259.12	0.0002	5.5479
237.5472	237.17	226.19	209.35	209.15	210.01	209.85	262.46	259.49	0.0002	5.4937
238.0480	234.83	225.52	209.32	209.14	210.00	209.86	262.61	260.49	0.0002	5.4947
238.5477	234.15	225.07	209.32	209.15	210.02	209.84	262.40	259.33	0.0002	5.5263
239.0475	235.27	225.35	209.31	209.13	210.03	209.88	262.65	260.22	0.0002	5.5206
239.5483	231.03	225.98	209.55	209.37	210.18	210.03	264.75	260.14	0.0002	5.4765
240.0490	228.42	225.29	209.84	209.63	210.40	210.25	266.19	262.17	0.0002	5.4871
240.5488	231.07	224.74	210.04	209.83	210.60	210.42	267.23	262.21	0.0002	5.5337
241.0478	233.27	226.07	210.14	209.92	210.73	210.48	267.47	262.46	0.0002	5.5180
241.5477	233.24	227.36	210.14	209.93	210.73	210.48	267.13	262.39	0.0002	5.4927
242.0473	236.57	227.60	209.99	209.66	210.44	209.68	265.26	256.54	0.0002	5.4862
242.5482	232.85	227.69	209.31	208.99	209.81	209.49	261.70	258.15	0.0002	5.5286
243.0470	232.36	226.32	209.23	209.14	210.00	209.28	263.11	262.10	0.0002	0.3457

TABLE B6. PRESSURE AND TEMPERATURE DATA FOR RUN 8 (PETROLEUM DISTILLATE:STEAM = 5:100).

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, Psig	Qinj, g/min	Vw ml/min
0.0540	152.68	55.98	51.62	53.26	52.80	48.76	258.12	260.44	0.0010	5.5658
0.5483	201.09	111.52	51.59	53.21	52.70	48.74	256.93	259.90	0.0015	5.5138
1.0480	208.10	192.56	51.55	53.34	52.79	48.79	256.99	259.88	0.0015	5.5198
1.5470	211.47	202.24	51.56	53.37	52.84	48.82	257.88	260.27	0.0011	5.5610
2.0477	215.05	205.17	51.54	53.42	52.91	48.87	256.19	259.17	0.0016	5.5764
2.5475	219.03	205.54	51.53	53.38	52.94	48.86	257.81	259.74	0.0010	5.5619
3.0483	222.55	206.43	51.54	53.33	52.97	48.89	260.57	259.37	0.0009	5.5328
3.5482	225.37	207.73	54.87	53.35	52.97	48.91	263.02	259.20	0.0015	5.5274
4.0480	225.98	208.74	58.91	53.36	52.96	48.92	264.14	259.16	0.0008	5.5733
4.5468	227.94	209.51	60.30	53.33	52.97	48.91	266.86	259.16	0.0009	5.5729
5.0475	230.08	210.39	60.16	53.33	52.97	48.92	269.26	259.14	0.0016	5.5478
5.5483	232.23	211.39	59.53	53.26	52.98	48.94	273.74	259.20	0.0017	5.5103
6.0472	233.94	213.12	58.73	53.18	52.99	48.93	275.46	259.16	0.0016	5.5407
6.5480	234.70	213.56	57.60	53.17	52.96	48.92	276.41	259.16	0.0010	5.5643
7.0478	236.77	215.49	56.70	53.21	52.98	48.94	276.86	259.11	0.0013	5.5645
7.5477	237.65	217.02	56.11	53.22	53.01	48.93	279.54	259.17	0.0012	5.5417
8.0475	235.17	217.03	55.83	53.23	53.00	48.94	285.87	259.36	0.0013	5.5219
8.5482	232.89	215.32	55.96	53.22	53.03	48.95	293.11	259.43	0.0011	5.5291
9.0480	234.13	213.62	56.45	53.23	53.10	48.99	300.52	259.50	0.0016	5.5780
9.5468	233.32	213.40	57.07	53.25	53.21	49.00	300.62	259.50	0.0013	5.5643
10.0477	233.21	213.32	57.71	53.24	53.26	49.01	298.66	259.46	0.0013	5.5147
10.5483	235.98	214.30	58.27	53.23	53.31	49.00	298.67	259.38	0.0011	5.5093
11.0482	237.24	215.72	58.74	53.23	53.32	49.04	300.22	259.40	0.0012	5.5559
11.5480	236.84	215.59	59.03	53.24	53.33	49.03	296.47	259.36	0.0008	5.5774
12.0468	233.11	214.35	59.16	53.25	53.33	49.04	294.20	259.28	0.0018	5.5251
12.5477	232.39	212.90	59.51	53.26	53.34	49.09	295.06	259.28	0.0015	5.5209
13.0483	227.89	213.43	60.02	53.26	53.35	49.12	293.60	259.22	0.0016	5.5293
13.5482	221.81	214.40	60.13	53.27	53.37	49.14	288.73	259.26	0.0012	5.5527
14.0472	223.85	214.56	60.65	53.26	53.40	49.19	290.56	259.27	0.0008	5.5696
14.5478	245.41	215.11	61.42	53.26	53.41	49.22	290.90	259.23	0.0011	5.5227
15.0477	261.87	216.44	62.21	53.25	53.42	49.27	290.85	259.16	0.0008	5.5203
15.5483	266.45	218.48	63.15	53.22	53.42	49.26	292.38	259.13	0.0003	5.5359
16.0482	271.43	219.74	63.80	53.22	53.39	49.31	292.46	259.39	0.0009	5.5556
16.5480	270.72	219.22	64.48	53.21	53.42	49.36	293.41	258.07	0.0013	5.5370
17.0470	268.68	219.77	65.26	53.23	53.42	49.42	294.14	259.61	0.0010	5.5140
17.5477	264.86	218.76	66.05	53.24	53.43	49.47	295.16	258.42	0.0010	5.5270
18.0485	261.00	218.93	67.01	53.23	53.42	49.50	295.31	258.33	0.0006	5.5422
18.5492	256.67	219.84	68.06	53.26	53.45	49.53	296.44	258.35	0.0010	5.5490
19.0472	249.99	219.28	69.05	53.30	53.45	49.58	296.62	258.14	0.0012	5.5147
19.5478	244.28	218.92	70.05	53.29	53.46	49.61	293.98	258.49	0.0010	5.5094
20.0487	236.26	218.60	71.00	53.30	53.48	49.65	292.07	257.95	0.0003	5.5248
20.5475	231.04	217.04	71.99	53.36	53.49	49.68	290.70	257.94	0.0009	5.5628
21.0483	221.03	215.86	73.08	53.39	53.46	49.71	290.84	257.91	0.0007	5.5653
21.5482	220.13	214.98	74.32	53.42	53.50	49.73	291.56	258.65	0.0008	5.5115
22.0480	221.41	215.19	75.61	53.45	53.51	49.78	293.00	257.49	0.0016	5.5259
22.5468	224.43	215.63	76.84	53.51	53.51	49.83	293.93	258.29	0.0010	5.5362
23.0467	229.73	216.29	78.17	53.56	53.54	49.87	295.86	257.78	0.0000	5.5729
23.5483	234.67	217.19	79.46	53.59	53.53	49.92	298.17	257.36	0.0008	5.5539
24.0482	235.16	218.59	80.86	53.66	53.57	49.95	300.53	259.78	0.0011	5.5127
24.5480	239.64	220.37	82.16	53.73	53.58	50.02	300.59	259.91	0.0007	5.5281

TABLE B6.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
25.0468	242.54	220.92	83.62	53.83	53.58	50.06	301.55	259.62	0.0007	5.5637
25.5477	242.59	221.83	85.20	53.94	53.59	50.11	301.63	259.96	0.0004	5.5635
26.0483	235.04	221.16	87.05	54.03	53.61	50.16	301.17	259.74	0.0008	5.5289
26.5482	231.69	220.12	89.13	54.14	53.60	50.20	300.80	259.72	0.0001	5.5126
27.0480	223.90	217.65	91.50	54.25	53.62	50.23	299.77	259.77	0.0003	5.5254
27.5468	221.89	216.77	94.17	54.42	53.64	50.29	298.71	259.86	0.0013	5.5625
28.0477	222.37	216.39	97.12	54.54	53.65	50.32	298.50	259.28	0.0005	5.5477
28.5483	227.57	216.51	100.31	54.71	53.67	50.35	297.76	259.60	0.0003	5.5236
29.0492	233.78	217.57	103.73	54.90	53.66	50.41	297.98	259.89	0.0004	5.5078
29.5472	240.70	219.46	107.14	55.07	53.70	50.44	296.84	259.98	0.0004	5.5537
30.0478	248.03	221.53	110.87	55.29	53.70	50.50	295.81	256.99	0.0003	5.5636
30.5477	249.19	222.10	114.80	55.54	53.73	50.53	296.57	259.38	0.0007	5.5408
31.0483	249.07	222.37	118.82	55.80	53.73	50.57	295.42	259.78	0.0005	5.5092
31.5482	246.12	220.22	122.91	56.10	53.73	50.59	294.10	259.51	0.0004	5.5184
32.0472	241.98	219.82	127.02	56.44	53.73	50.62	293.04	257.23	0.0006	5.5621
32.5478	236.30	218.48	131.19	56.86	53.74	50.64	292.42	259.46	0.0007	5.5505
33.0477	228.70	217.53	135.29	57.35	53.78	50.69	291.70	259.47	0.0005	5.5285
33.5483	222.16	216.24	139.25	57.88	53.80	50.73	290.94	259.77	0.0003	5.5001
34.0473	219.34	214.90	143.03	58.49	53.81	50.77	290.21	257.57	0.0001	5.5321
34.5480	219.26	214.68	146.56	59.09	53.83	50.77	289.98	260.25	0.0001	5.5853
35.0478	220.03	214.80	149.97	59.81	53.89	50.80	290.77	257.43	0.0003	5.5493
35.5468	223.22	215.25	153.23	60.57	53.91	50.86	291.04	259.86	0.0002	5.5171
36.0493	227.83	215.82	156.35	61.34	53.94	50.90	291.37	258.99	0.0003	5.5164
36.5483	235.75	216.40	159.37	62.18	54.00	50.92	292.24	257.40	0.0003	5.5561
37.0480	243.92	218.92	162.33	63.05	54.02	50.95	294.57	259.92	0.0002	5.5587
37.5478	247.12	220.08	165.09	63.97	54.04	50.95	295.67	259.18	0.0001	5.5373
38.0477	246.92	220.08	167.81	64.94	54.07	50.97	295.95	259.42	0.0001	5.5309
38.5475	242.18	219.92	170.36	65.96	54.11	51.03	295.73	259.65	0.0003	5.5308
39.0483	238.15	218.67	172.79	67.00	54.17	51.07	295.53	258.97	0.0003	5.5520
39.5482	233.31	217.70	175.04	68.06	54.23	51.11	294.42	260.01	0.0003	5.5796
40.0480	224.47	216.72	176.98	69.15	54.29	51.13	293.37	258.83	0.0003	5.5599
40.5477	221.07	215.58	178.63	70.28	54.32	51.17	293.34	259.43	0.0006	5.5341
41.0475	219.87	215.18	180.11	71.43	54.40	51.19	293.16	259.66	0.0003	5.5364
41.5483	219.98	215.16	181.51	72.64	54.46	51.23	293.41	260.11	0.0003	5.5216
42.0482	221.23	215.35	182.80	73.88	54.52	51.25	294.35	258.88	0.0003	5.5680
42.5470	226.35	215.92	184.15	75.14	54.62	51.29	295.53	259.08	0.0001	5.5516
43.0478	233.20	216.91	185.41	76.46	54.69	51.33	296.48	259.02	0.0003	5.5325
43.5467	240.90	217.52	186.61	77.79	54.77	51.35	296.73	258.14	0.0003	5.5072
44.0473	249.08	220.49	187.74	79.14	54.87	51.37	296.99	259.84	0.0002	5.5400
44.5482	252.26	222.07	188.84	80.51	54.97	51.39	297.24	259.78	0.0003	5.5765
45.0488	252.05	222.50	189.90	81.96	55.06	51.41	297.81	257.34	0.0003	5.5880
45.5478	248.75	221.95	190.90	83.44	55.14	51.43	298.01	257.18	0.0003	5.5076
46.0477	245.72	220.62	191.84	84.97	55.24	51.45	298.84	259.65	0.0003	5.5112
46.5483	241.31	220.05	192.75	86.54	55.38	51.48	298.54	259.63	0.0003	5.5473
47.0482	233.64	218.41	193.54	88.17	55.49	51.50	298.86	260.06	0.0002	5.5534
47.5480	226.25	217.37	194.39	89.87	55.61	51.52	299.17	259.56	0.0002	5.5610
48.0478	222.85	216.80	195.23	91.58	55.74	51.54	299.26	259.80	0.0003	5.5133
48.5467	221.96	216.50	195.99	93.43	55.88	51.58	299.18	260.01	0.0004	5.5142
49.0475	223.70	216.70	196.76	95.31	56.04	51.60	299.60	259.82	0.0001	5.5615
49.5482	229.72	217.55	197.55	97.28	56.19	51.63	301.17	259.49	0.0003	5.5679

TABLE B6.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
50.0480	235.79	218.16	198.40	99.45	56.36	51.65	302.04	259.78	0.0001	5.5516
50.5478	243.50	219.72	199.14	101.79	56.54	51.69	303.52	259.60	0.0003	5.5277
51.0477	248.01	221.28	199.87	104.33	56.73	51.71	303.18	256.77	0.0001	5.5178
51.5483	244.26	221.77	200.61	107.20	56.93	51.76	304.15	259.90	0.0000	5.5411
52.0473	242.44	221.31	201.46	110.32	57.12	51.76	303.80	259.04	0.0003	5.5647
52.5480	239.43	220.20	202.36	113.67	57.34	51.80	304.00	259.36	0.0003	5.5503
53.0478	235.03	219.33	203.33	117.28	57.53	51.83	303.78	259.35	0.0003	5.5471
53.5477	227.39	218.85	204.15	121.10	57.76	51.87	303.22	259.51	0.0008	5.5103
54.0485	223.09	217.54	205.02	125.15	58.01	51.91	304.13	259.12	0.0003	5.5392
54.5483	221.54	216.92	205.90	129.25	58.26	51.93	302.60	257.84	0.0003	5.5585
55.0490	221.49	216.80	206.60	133.23	58.52	51.98	302.49	259.81	0.0003	5.5422
55.5470	222.79	216.92	207.41	136.90	58.77	52.02	302.52	259.58	0.0003	5.5001
56.0477	227.39	217.31	208.60	140.70	59.06	52.04	302.90	259.59	0.0000	5.5229
56.5475	233.48	217.89	209.84	144.68	59.35	52.07	304.22	258.20	0.0003	5.5652
57.0483	240.67	219.04	210.70	148.48	59.67	52.11	305.51	259.84	0.0001	5.5576
57.5482	247.92	221.21	211.58	152.16	60.00	52.15	305.83	259.36	0.0003	5.5365
58.0480	249.88	222.83	212.47	155.92	60.35	52.20	305.99	257.63	0.0003	5.5169
58.5477	247.88	222.83	213.42	159.56	60.69	52.24	307.83	259.79	0.0003	5.5260
59.0475	242.34	222.14	214.16	162.94	61.08	52.30	306.74	259.59	0.0003	5.5598
59.5473	239.17	220.55	214.45	165.86	61.44	52.33	306.07	258.26	0.0003	5.5595
60.0482	232.62	219.79	214.67	168.68	61.82	52.37	305.80	259.69	0.0001	5.5381
60.5480	226.81	218.48	214.98	171.38	62.23	52.43	305.85	259.83	0.0003	5.5123
61.0468	222.63	217.47	215.07	173.62	62.63	52.48	305.86	259.38	0.0002	5.5376
61.5477	223.01	217.47	215.36	176.06	63.07	52.52	305.80	259.87	0.0003	5.5607
62.0483	225.55	217.82	215.56	178.24	63.53	52.56	306.74	257.17	0.0003	5.5475
62.5482	228.72	218.34	215.80	180.19	63.99	52.65	307.71	259.62	0.0003	5.5157
63.0480	236.18	218.58	215.95	182.04	64.51	52.71	307.51	259.67	0.0003	5.5211
63.5487	243.11	220.93	216.17	184.31	65.00	52.77	308.56	259.86	0.0003	5.5462
64.0477	252.03	225.63	216.28	186.56	65.54	52.83	308.51	259.41	0.0002	5.5527
64.5483	256.75	227.82	216.34	188.91	66.07	52.90	308.74	259.56	0.0003	5.5510
65.0482	257.71	228.45	216.46	190.89	66.65	52.96	309.14	259.80	0.0003	5.5032
65.5480	256.39	228.15	216.43	192.60	67.22	53.04	308.51	259.15	0.0001	5.5228
66.0478	252.75	227.69	216.50	194.24	67.81	53.11	309.16	259.20	0.0003	5.5597
66.5477	247.23	226.25	216.40	195.69	68.44	53.19	308.28	259.56	0.0003	5.5465
67.0483	241.09	224.57	216.46	197.29	69.09	53.27	308.49	259.57	0.0003	5.5224
67.5473	229.43	222.41	216.49	198.37	69.77	53.33	308.35	259.61	0.0003	5.5074
68.0472	224.74	219.28	216.44	199.92	70.46	53.42	307.41	259.65	0.0003	5.5340
68.5478	222.89	217.89	216.36	201.11	71.18	53.48	307.17	257.69	0.0004	5.5462
69.0477	223.59	217.97	216.33	201.94	71.96	53.56	306.78	259.81	0.0004	5.5565
69.5483	226.82	218.00	216.44	203.05	72.75	53.65	306.93	257.89	0.0003	5.5075
70.0482	233.88	218.92	216.41	203.65	73.59	53.75	306.93	259.81	0.0002	5.5041
70.5480	239.09	220.78	216.47	204.32	74.46	53.83	307.33	259.52	0.0003	5.5545
71.0478	246.67	222.22	216.53	204.86	75.39	53.93	307.34	259.39	0.0004	5.5591
71.5477	252.50	226.36	216.59	205.98	76.31	54.05	307.56	259.59	0.0002	5.5300
72.0485	254.21	227.39	216.54	206.50	77.31	54.14	306.88	258.94	0.0003	5.5149
72.5473	253.39	227.50	216.51	208.05	78.32	54.26	306.89	259.63	0.0003	5.5279
73.0480	250.47	227.08	216.50	208.63	79.37	54.36	306.96	257.69	0.0003	5.5682
73.5478	246.51	226.01	216.44	208.94	80.46	54.48	306.40	256.81	0.0004	5.5288
74.0477	239.85	224.55	216.42	209.20	81.61	54.62	306.00	259.21	0.0004	5.5046
74.5475	231.45	222.73	216.34	209.47	82.82	54.74	305.67	258.84	0.0003	5.5059

TABLE B6.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
75.0483	224.23	219.23	216.37	210.07	84.12	54.88	305.04	259.17	0.0003	5.5251
75.5482	222.37	217.48	216.29	210.56	85.45	55.02	304.36	257.27	0.0003	5.5404
76.0480	223.22	217.47	216.22	210.51	86.84	55.16	304.43	259.52	0.0003	5.5367
76.5468	227.92	217.55	216.21	210.91	88.32	55.34	304.02	259.52	0.0003	5.4882
77.0475	234.21	218.24	216.13	211.21	89.87	55.50	303.42	259.54	0.0003	5.5189
77.5483	236.67	219.37	216.22	211.45	91.54	55.68	304.38	257.07	0.0003	5.5421
78.0472	243.43	223.69	216.28	211.77	93.31	55.88	304.29	259.55	0.0005	5.5539
78.5480	251.15	226.10	216.26	211.91	95.20	56.06	303.83	259.25	0.0003	5.5137
79.0478	253.12	227.04	216.21	212.07	97.19	56.25	303.74	259.69	0.0003	5.5055
79.5467	252.73	227.21	216.23	212.33	99.29	56.47	303.73	259.28	0.0002	5.5461
80.0483	250.66	226.32	216.14	212.32	101.58	56.69	302.88	259.21	0.0001	5.5654
80.5482	245.91	225.56	216.11	212.47	104.00	56.94	302.46	259.05	0.0003	5.5236
81.0480	241.20	224.15	216.04	212.59	106.61	57.17	302.07	258.24	0.0003	5.5101
81.5478	233.61	221.49	215.96	212.76	109.40	57.43	301.57	259.70	0.0003	5.5275
82.0477	224.91	219.22	215.86	212.76	112.34	57.68	300.80	259.66	0.0003	5.5506
82.5483	222.04	217.07	215.80	212.82	115.47	57.96	300.17	258.97	0.0003	5.5478
83.0482	221.98	216.64	215.71	212.80	118.68	58.23	299.82	259.68	0.0003	5.5177
83.5472	223.54	216.83	215.74	212.91	121.87	58.52	300.50	258.71	0.0000	5.5125
84.0468	230.62	217.23	215.74	213.02	125.25	58.85	299.87	258.95	0.0003	5.5497
84.5477	237.95	218.20	215.72	212.96	128.60	59.16	299.61	259.41	0.0003	5.5509
85.0483	246.35	222.01	215.72	212.99	131.99	59.48	299.77	259.38	0.0002	5.5332
85.5492	254.68	225.93	215.71	213.14	135.40	59.85	299.51	259.35	0.0003	5.5050
86.0472	258.66	228.07	215.67	213.18	138.78	60.21	299.41	259.24	0.0003	5.5178
86.5478	258.87	229.17	215.62	213.15	142.15	60.58	298.73	259.44	0.0004	5.5367
87.0477	257.11	229.14	215.52	213.21	145.42	60.97	298.31	259.48	0.0003	5.5363
87.5483	250.73	228.34	215.46	213.15	148.53	61.37	297.79	259.36	0.0003	5.5108
88.0473	247.83	227.06	215.34	213.16	151.54	61.82	296.94	259.38	0.0003	5.5173
88.5480	242.96	225.73	215.26	213.09	154.26	62.26	296.43	259.30	0.0003	5.5518
89.0478	234.62	223.80	215.25	213.08	156.80	62.72	296.16	259.31	0.0003	5.5502
89.5477	225.47	220.84	215.16	213.07	159.12	63.22	295.71	259.28	0.0003	5.5151
90.0485	221.65	217.36	215.07	213.04	161.31	63.74	294.83	259.14	0.0003	5.4956
90.5473	220.57	215.84	214.95	212.94	163.45	64.26	294.34	259.12	0.0002	5.5451
91.0480	221.04	215.64	214.92	212.90	165.47	64.80	294.27	259.20	0.0003	5.5320
91.5478	224.66	215.63	214.87	212.91	167.37	65.37	293.85	259.10	0.0003	5.5159
92.0477	230.99	216.63	214.81	212.84	169.20	65.98	293.37	259.10	0.0004	5.5035
92.5467	238.09	218.25	214.82	212.88	171.00	66.60	293.32	259.06	0.0003	5.5297
93.0473	247.26	221.98	214.81	212.89	172.60	67.23	293.43	259.01	0.0001	5.5391
93.5482	255.51	226.09	214.76	212.86	174.15	67.88	292.96	259.01	0.0007	5.5341
94.0480	260.37	229.21	214.73	212.86	175.72	68.57	293.08	258.96	0.0003	5.4975
94.5477	261.54	230.89	214.67	212.81	177.26	69.25	292.57	258.90	0.0003	5.5034
95.0475	260.13	231.49	214.62	212.78	178.77	69.99	292.23	258.93	0.0003	5.5389
95.5483	257.66	231.10	214.52	212.74	180.27	70.76	291.23	258.92	0.0003	5.5454
96.0490	253.97	229.89	214.35	212.60	181.63	71.54	290.47	258.89	0.0001	5.4982
96.5470	247.93	228.45	214.20	212.50	182.94	72.34	289.33	258.86	0.0003	5.5087
97.0478	242.39	226.95	214.17	212.45	184.15	73.15	289.77	258.82	0.0000	5.5372
97.5477	232.80	225.51	214.22	212.46	185.38	74.03	289.91	258.75	0.0003	5.5459
98.0473	226.07	222.94	214.21	212.49	186.86	74.92	289.70	258.72	0.0003	5.5244
98.5482	223.14	219.47	214.21	212.50	188.43	75.86	289.82	258.77	0.0002	5.5035
99.0480	225.32	218.87	214.18	212.50	190.25	76.83	289.37	258.68	0.0003	5.5273
99.5468	230.27	221.12	214.12	212.44	192.78	77.82	288.97	258.77S	0.0002	5.5478

TABLE B6.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
100.0477	237.73	223.35	214.01	212.36	195.17	78.84	287.92	258.70	0.0003	5.5229
100.5483	244.92	225.84	213.89	212.26	197.65	79.91	286.97	258.67	0.0003	5.4991
101.0482	250.56	228.00	213.68	212.11	199.33	80.99	285.67	258.56	0.0000	5.5339
101.5480	251.99	228.87	213.48	211.92	201.11	82.08	284.41	258.52	0.0003	5.5446
102.0478	250.85	229.00	213.34	211.80	202.28	83.20	283.98	258.59	0.0003	5.5266
102.5477	248.13	228.79	213.29	211.72	203.00	84.36	284.23	258.58	0.0002	5.5142
103.0483	244.17	228.48	213.37	211.78	204.10	85.55	285.21	258.50	0.0003	5.5278
103.5482	238.37	227.57	213.54	211.89	205.24	86.81	286.28	258.55	0.0003	5.5482
104.0480	229.44	225.54	213.80	212.10	206.50	88.12	287.84	258.61	0.0002	5.5257
104.5470	224.28	223.04	214.00	212.29	208.05	89.51	288.71	258.63	0.0001	5.4989
105.0477	221.64	219.18	214.14	212.42	209.13	90.95	289.41	258.61	0.0009	5.5041
105.5483	224.13	217.24	214.16	212.50	209.67	92.50	289.18	258.58	0.0002	5.5486
106.0482	229.37	217.88	214.10	212.47	210.00	94.17	288.30	258.57	0.0000	5.5404
106.5480	231.13	220.89	214.00	212.37	210.28	96.00	287.38	258.49	0.0001	5.4912
107.0470	240.97	223.01	213.72	212.18	210.30	98.05	285.63	258.44	0.0003	5.5120
107.5477	249.80	225.67	213.42	211.94	210.26	100.33	283.71	258.47	0.0003	5.5272
108.0485	254.71	227.95	213.11	211.68	210.14	102.86	281.73	258.33	0.0003	5.5389
108.5483	255.85	228.85	212.76	211.40	210.08	105.50	279.64	258.34	0.0003	5.5150
109.0472	255.13	228.38	212.38	211.09	209.92	108.11	277.42	258.35	0.0003	5.5009
109.5478	253.25	227.27	211.99	210.79	209.75	110.64	275.15	258.65	0.0004	5.5281
110.0487	250.46	226.03	211.66	210.50	209.66	112.93	273.37	258.70	0.0003	5.5520
110.5475	246.61	224.55	211.36	210.25	209.50	115.02	271.95	258.56	0.0001	5.5194
111.0483	240.95	223.18	211.23	210.10	209.38	116.94	271.23	258.42	0.0003	5.5044
111.5482	232.18	222.17	211.32	210.09	209.36	118.58	273.44	257.20	0.0004	5.5219
112.0470	224.15	220.60	211.73	210.37	209.58	120.17	275.50	259.19	0.0006	5.5388
112.5477	219.95	218.10	212.00	210.62	209.80	121.84	276.88	257.04	0.0001	5.5477
113.0475	219.83	215.07	212.24	210.83	209.95	123.52	278.24	258.70	0.0003	5.4981
113.5483	225.62	215.61	212.36	210.96	210.16	125.36	278.39	258.39	0.0003	5.5021
114.0482	232.25	217.37	212.35	210.99	210.22	127.43	277.92	258.84	0.0003	5.5246
114.5470	239.14	220.28	212.26	210.94	210.26	129.72	277.32	258.69	0.0001	5.5406
115.0478	241.82	221.36	212.07	210.82	210.21	132.30	275.67	257.56	0.0002	5.5225
115.5477	242.61	221.71	211.85	210.65	210.13	135.01	274.62	257.67	0.0005	5.4923
116.0483	241.39	221.27	211.63	210.46	209.98	137.75	273.17	258.58	0.0003	5.5166
116.5482	235.66	220.17	211.42	210.27	209.88	140.32	272.24	258.34	0.0003	5.5496
117.0480	231.37	218.05	211.30	210.16	209.80	142.74	271.67	256.54	0.0003	5.5386
117.5478	225.84	217.43	211.58	210.27	209.81	145.05	274.40	258.91	0.0004	5.4761
118.0477	224.35	217.80	211.78	210.44	209.94	147.42	275.47	258.81	0.0003	5.5165
118.5483	228.06	219.32	212.01	210.63	210.11	149.82	276.93	259.10	0.0008	5.5452
119.0473	233.60	222.54	212.28	210.85	210.30	152.38	278.44	258.90	0.0003	5.5458
119.5480	239.52	225.32	212.51	211.04	210.45	155.30	279.53	258.79	0.0001	5.4986
120.0478	246.70	228.19	212.62	211.17	210.60	158.56	279.87	257.14	0.0003	5.4972
120.5477	248.07	229.11	212.57	211.16	210.53	162.86	279.27	257.20	0.0007	5.5135
121.0483	246.95	228.53	212.40	211.01	210.45	167.35	277.82	258.17	0.0002	5.5448
121.5473	244.68	227.17	212.12	210.80	210.33	171.21	276.01	255.34	0.0003	5.5126
122.0480	238.91	225.43	211.81	210.57	210.16	174.54	274.07	255.70	0.0007	5.5056
122.5488	234.41	222.95	211.48	210.28	209.97	177.43	272.06	256.03	0.0003	5.5386
123.0468	232.43	220.23	211.11	210.00	209.80	179.72	269.96	256.38	0.0003	5.5659
123.5483	228.07	216.93	210.79	209.74	209.61	181.52	268.09	254.40	0.0003	5.5248
124.0492	221.20	214.74	210.51	209.51	209.40	183.03	266.66	254.80	0.0004	5.4910
124.5480	217.43	212.11	210.45	209.38	209.29	184.03	267.80	255.67	0.0001	5.5180

TABLE B6.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
125.0470	219.30	211.66	210.69	209.51	209.33	184.99	268.98	254.63	0.0003	5.5389
125.5477	224.00	212.85	210.95	209.70	209.46	186.11	270.81	256.43	0.0007	5.5377
126.0485	231.79	216.15	211.19	209.88	209.65	187.93	271.89	255.80	0.0005	5.4846
126.5492	240.31	220.14	211.34	210.05	209.80	190.21	272.44	256.43	0.0002	5.4959
127.0480	248.49	224.05	211.40	210.13	209.90	191.92	272.41	256.36	0.0003	5.5271
127.5488	256.99	228.00	211.34	210.14	209.92	194.45	271.87	255.40	0.0005	5.5477
128.0477	263.59	231.09	211.20	210.04	209.86	196.31	270.88	256.04	0.0003	5.5194
128.5475	265.80	232.85	211.03	209.88	209.78	197.78	269.95	256.47	0.0003	5.4895
129.0483	265.23	233.50	210.87	209.80	209.73	198.88	269.33	255.29	0.0003	5.5176
129.5482	263.15	233.70	210.85	209.72	209.66	199.80	269.53	258.42	0.0003	5.5463
130.0480	259.94	233.89	210.89	209.76	209.69	200.65	269.96	255.79	0.0006	5.5298
130.5468	256.03	233.59	210.99	209.82	209.72	201.93	270.69	257.38	0.0001	5.5087
131.0475	250.94	233.26	211.17	209.96	209.81	202.98	272.09	255.91	0.0002	5.5294
131.5483	244.24	232.26	211.39	210.12	209.91	204.04	273.43	257.20	0.0003	5.5441
132.0482	235.41	229.85	211.62	210.31	210.02	205.33	274.73	257.90	0.0003	5.5506
132.5480	230.58	224.69	211.82	210.50	210.14	205.86	275.61	258.57	0.0006	5.5026
133.0478	225.59	220.11	211.97	210.63	210.25	206.40	276.45	258.97	0.0006	5.5071
133.5485	222.72	217.92	212.07	210.69	210.26	206.72	276.66	256.01	0.0000	5.5417
134.0483	226.77	216.39	212.02	210.66	210.21	207.01	275.89	256.50	0.0001	5.5554
134.5482	231.40	217.43	211.88	210.54	210.15	207.30	274.85	256.90	0.0000	5.5177
135.0470	236.76	219.48	211.66	210.41	210.09	207.56	273.50	256.23	0.0003	5.5015
135.5478	247.18	222.64	211.42	210.22	210.00	207.59	271.93	256.03	0.0003	5.5265
136.0477	254.17	225.78	211.12	209.99	209.87	207.67	270.16	256.13	0.0004	5.5329
136.5483	256.82	227.22	210.81	209.77	209.75	207.69	268.35	257.43	0.0000	5.5582
137.0473	256.66	227.31	210.51	209.51	209.58	207.65	266.76	256.56	0.0001	5.5037
137.5480	254.78	227.25	210.30	209.33	209.46	207.72	265.76	257.22	0.0003	5.5025
138.0468	250.27	226.47	210.08	209.20	209.38	207.64	264.84	256.35	0.0003	5.5359
138.5477	246.36	225.87	210.01	209.08	209.22	207.56	264.70	254.58	0.0002	5.5481
139.0483	240.11	225.97	210.47	209.32	209.29	207.57	268.24	255.73	0.0004	5.5073
139.5482	232.20	222.52	210.65	209.49	209.43	207.79	269.24	255.58	0.0003	5.5059
140.0480	227.84	219.61	210.98	209.75	209.62	207.97	271.59	256.16	0.0004	5.5249
140.5470	224.61	217.36	211.44	210.09	209.86	208.11	274.21	258.37	0.0004	5.5828
141.0477	225.26	216.15	211.84	210.42	210.06	208.20	276.10	257.97	0.0003	5.5308
141.5483	230.17	217.73	212.00	210.61	210.22	208.37	276.22	258.71	0.0003	5.5166
142.0482	237.40	219.06	211.89	210.62	210.26	208.34	275.07	256.14	0.0003	5.5063
142.5472	240.36	221.09	211.71	210.48	210.21	208.44	273.83	256.35	0.0000	5.5423
143.0478	241.66	220.40	211.54	210.36	210.18	208.61	272.82	257.25	0.0002	5.5497
143.5477	240.55	220.68	211.32	210.23	210.03	208.26	271.58	254.37	0.0003	5.5152
144.0493	238.73	220.13	211.07	209.95	209.82	208.34	270.04	255.62	0.0001	5.4877
144.5473	239.89	219.67	210.81	209.78	209.70	208.25	268.68	254.87	0.0003	5.5130
145.0480	230.17	217.64	210.59	209.59	209.59	208.35	267.32	256.79	0.0003	5.5240
145.5470	228.83	215.23	210.33	209.41	209.54	208.43	265.71	256.62	0.0003	5.5207
146.0477	224.19	212.79	210.14	209.28	209.42	208.17	264.43	254.56	0.0003	5.4810
146.5475	225.05	211.47	209.86	209.05	209.25	208.23	263.07	254.95	0.0003	5.5190
147.0483	223.72	211.65	209.74	208.95	209.18	208.27	262.72	255.97	0.0003	5.5446
147.5482	234.02	212.81	209.69	208.90	209.21	208.35	262.64	256.19	0.0003	5.5287
148.0480	234.69	214.46	209.81	208.93	209.23	208.41	265.68	256.50	0.0005	5.4967
148.5468	244.80	218.76	210.39	209.35	209.47	208.56	267.88	256.23	0.0003	5.4972
149.0475	246.84	222.46	210.63	209.61	209.68	208.64	268.39	257.47	0.0003	5.5194
149.5483	243.26	223.30	210.67	209.69	209.74	208.56	268.73	255.63	0.0003	5.5392

TABLE B6.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
150.0490	240.99	221.82	210.66	209.66	209.67	208.55	268.30	256.64	0.0003	5.5125
150.5480	234.42	220.58	210.61	209.63	209.73	208.75	268.00	257.20	0.0003	5.4907
151.0468	232.15	218.85	210.53	209.62	209.72	208.72	267.38	256.62	0.0003	5.5316
151.5477	226.53	215.96	210.43	209.55	209.75	208.78	266.98	255.59	0.0003	5.5477
152.0483	223.25	213.73	210.45	209.54	209.61	208.56	267.35	255.73	0.0003	5.4984
152.5472	223.42	212.89	210.50	209.51	209.60	208.63	267.61	257.10	0.0005	5.5004
153.0480	228.31	213.33	210.61	209.61	209.70	208.71	268.49	256.92	0.0003	5.5308
153.5487	237.81	215.31	210.78	209.74	209.79	208.84	269.87	257.43	0.0004	5.5532
154.0477	240.76	217.71	210.98	209.91	209.92	208.98	270.81	258.51	0.0001	5.5211
154.5483	251.25	221.48	211.13	210.06	210.09	209.14	271.40	259.01	0.0007	5.5009
155.0482	255.91	225.70	211.23	210.10	209.92	208.58	271.75	255.06	0.0001	5.5049
155.5480	256.03	227.79	211.14	210.00	209.87	208.71	270.99	255.72	0.0003	5.5408
156.0478	250.09	228.19	211.04	209.93	209.81	208.59	270.56	255.30	0.0003	5.5285
156.5477	249.31	226.82	210.85	209.78	209.67	208.45	269.12	254.52	0.0001	5.4973
157.0483	245.26	223.67	210.66	209.63	209.59	208.48	268.00	254.74	0.0003	5.4992
157.5482	242.70	223.00	210.45	209.51	209.54	208.56	266.74	255.46	0.0004	5.5347
158.0480	234.84	220.14	210.34	209.41	209.51	208.62	266.29	255.29	0.0003	5.5475
158.5478	229.23	217.52	210.31	209.38	209.52	208.62	266.52	255.42	0.0001	5.4986
159.0477	227.19	216.34	210.35	209.40	209.49	208.60	266.89	256.54	0.0002	5.5097
159.5475	232.84	216.69	210.57	209.51	209.55	208.65	268.51	255.47	0.0003	5.5293
160.0482	239.03	218.70	210.81	209.68	209.68	208.79	269.78	256.74	0.0003	5.5466
160.5480	237.78	220.89	211.01	209.88	209.85	208.86	270.84	256.03	0.0003	5.5238
161.0488	243.71	222.74	211.07	209.96	209.84	208.69	270.79	254.84	0.0003	5.4990
161.5477	239.19	222.62	211.04	209.93	209.83	208.77	270.59	256.69	0.0003	5.5226
162.0493	240.32	222.05	210.94	209.90	209.83	208.83	269.78	256.79	0.0003	5.5274
162.5473	235.49	221.20	210.84	209.84	209.84	208.84	269.21	255.79	0.0003	5.5085
163.0480	231.97	218.97	210.70	209.74	209.72	208.73	268.30	255.42	0.0004	5.4828
163.5478	225.24	216.01	210.57	209.64	209.65	208.67	267.62	255.81	0.0003	5.5017
164.0477	221.90	213.72	210.45	209.54	209.62	208.71	267.14	256.00	0.0005	5.5186
164.5467	221.69	212.92	210.49	209.52	209.61	208.81	268.45	256.53	0.0001	5.5199
165.0473	226.98	213.86	210.61	209.62	209.67	208.87	268.05	256.02	0.0000	5.5072
165.5482	231.77	215.39	210.61	209.62	209.61	208.61	268.13	257.87	0.0005	5.4963
166.0470	239.73	217.33	210.63	209.65	209.70	208.93	268.24	256.84	0.0001	5.5279
166.5477	250.39	221.41	210.64	209.71	209.85	209.14	268.38	258.19	0.0003	5.5477
167.0475	254.32	224.68	210.72	209.79	209.93	209.02	268.91	255.76	0.0003	5.5158
167.5483	247.78	226.42	210.78	209.74	209.74	208.79	269.52	256.54	0.0003	5.4920
168.0472	250.69	226.50	210.80	209.76	209.78	208.87	269.57	256.28	0.0006	5.5127
168.5480	246.16	226.61	210.90	209.84	209.84	208.95	270.33	256.29	0.0003	5.5274
169.0487	243.80	224.38	210.97	209.92	209.92	209.02	270.73	256.64	0.0001	5.5229
169.5467	238.35	224.06	211.09	210.01	210.00	209.10	271.08	258.00	0.0003	5.4909
170.0483	234.83	221.42	211.09	210.09	210.07	209.20	270.96	258.53	0.0003	5.5022
170.5472	231.36	219.53	211.08	210.11	210.19	209.40	270.67	259.40	0.0003	5.5506
171.0480	226.41	216.51	210.98	210.09	210.21	209.44	270.08	259.21	0.0003	5.5165
171.5478	222.71	214.31	210.84	209.93	209.86	208.55	268.79	254.00	0.0003	5.4926
172.0477	220.37	212.67	210.56	209.51	209.34	208.25	266.91	253.13	0.0003	5.5108
172.5483	217.55	211.48	210.25	209.22	209.14	208.15	265.32	253.35	0.0003	5.5446
173.0482	218.97	211.49	210.04	209.07	209.09	208.34	264.54	253.29	0.0003	5.5491
173.5470	226.53	212.17	210.11	209.08	209.11	208.34	265.62	253.76	0.0003	5.5131
174.0468	233.86	214.40	210.26	209.19	209.19	208.38	266.27	253.94	0.0005	5.4922
174.5477	238.11	216.53	210.41	209.30	209.27	208.46	267.40	254.56	0.0000	5.5305

TABLE B6.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
175.0483	237.02	218.47	210.51	209.40	209.33	208.47	267.91	254.26	0.0000	5.5345
175.5482	239.75	218.57	210.53	209.46	209.40	208.56	267.62	255.42	0.0004	5.5035
176.0472	235.28	217.89	210.48	209.44	209.43	208.57	267.22	254.42	0.0003	5.5045
176.5478	231.56	216.82	210.38	209.40	209.43	208.59	266.41	254.11	0.0003	5.5274
177.0477	229.97	215.09	210.24	209.31	209.40	208.62	265.69	254.70	0.0003	5.5475
177.5483	225.25	213.60	210.14	209.25	209.32	208.50	265.22	253.95	0.0005	5.5140
178.0482	241.46	212.39	210.02	209.15	209.31	208.64	264.92	255.27	0.0003	5.4849
178.5480	221.61	211.93	210.03	209.15	209.28	208.62	264.89	254.24	0.0003	5.5174
179.0470	223.30	212.38	210.09	209.19	209.30	208.62	265.46	255.02	0.0003	5.5424
179.5477	229.89	213.32	210.20	209.25	209.36	208.66	265.78	253.93	0.0003	5.5240
180.0485	243.19	215.74	210.23	209.29	209.40	208.70	266.14	254.25	0.0003	5.5080
180.5483	249.38	219.05	210.28	209.32	209.43	208.69	266.24	254.20	0.0002	5.4988
181.0480	246.50	220.89	210.31	209.34	209.41	208.70	266.50	254.31	0.0003	5.5391
181.5488	249.07	222.18	210.35	209.36	209.45	208.70	267.16	255.37	0.0003	5.5418
182.0477	244.34	222.92	210.46	209.46	209.53	208.82	267.60	255.54	0.0001	5.4808
182.5475	239.29	222.42	210.45	209.50	209.56	208.77	267.55	254.01	0.0006	5.4975
183.0483	239.31	220.83	210.47	209.47	209.52	208.76	267.31	255.24	0.0002	5.5253
183.5490	232.98	219.26	210.42	209.48	209.55	208.83	267.27	256.11	0.0005	5.5369
184.0480	229.60	217.50	210.41	209.48	209.59	208.87	267.03	255.15	0.0003	5.4910
184.5477	224.97	214.98	210.40	209.49	209.59	208.90	267.07	255.98	0.0004	5.4937
185.0467	222.04	213.61	210.39	209.49	209.60	208.88	266.97	255.57	0.0002	5.5404
185.5473	219.52	212.32	210.36	209.50	209.61	208.75	266.79	254.11	0.0000	5.5459
186.0482	217.20	211.29	210.34	209.41	209.50	208.75	266.53	254.57	0.0003	5.5066
186.5480	217.28	211.10	210.30	209.40	209.51	208.85	266.38	255.29	0.0000	5.4982
187.0478	219.70	211.22	210.32	209.43	209.55	208.89	266.46	256.46	0.0004	5.5282
187.5467	225.56	211.94	210.29	209.41	209.56	208.87	266.24	255.21	0.0004	5.5629
188.0483	233.51	213.05	210.26	209.38	209.56	208.92	266.24	256.29	0.0002	5.5144
188.5482	239.77	215.24	210.34	209.44	209.59	208.96	266.93	256.17	0.0003	5.4687
189.0480	250.23	218.52	210.41	209.50	209.64	209.00	267.45	256.48	0.0003	5.5212
189.5478	255.07	222.23	210.51	209.58	209.70	209.02	267.81	256.19	0.0001	5.5543
190.0477	255.65	225.19	210.55	209.60	209.71	209.01	268.23	256.13	0.0003	5.5201
190.5483	253.80	226.86	210.65	209.66	209.72	208.98	268.65	255.96	0.0003	5.4746
191.0473	246.29	226.72	210.69	209.68	209.72	208.95	269.08	256.77	0.0004	5.5091
191.5480	247.07	226.39	210.75	209.73	209.78	209.01	269.31	255.44	0.0003	5.5354
192.0478	241.76	223.96	210.77	209.79	209.82	209.05	269.31	256.63	0.0003	5.5053
192.5467	236.96	222.64	210.77	209.79	209.84	209.11	269.38	256.88	0.0003	5.4942
193.0475	231.94	220.44	210.78	209.83	209.87	209.10	269.49	256.29	0.0003	5.5128
193.5482	227.18	218.64	210.79	209.84	209.89	209.10	269.37	256.17	0.0004	5.5480
194.0480	228.60	216.82	210.76	209.82	209.86	209.13	269.05	256.77	0.0002	5.5374
194.5478	233.19	217.19	210.71	209.79	209.90	209.15	268.69	256.53	0.0003	5.4948
195.0468	238.84	219.87	210.64	209.73	209.89	209.19	268.45	257.51	0.0003	5.4994
195.5483	241.80	222.69	210.66	209.75	209.89	209.25	269.02	257.76	0.0003	5.5276
196.0482	250.74	223.84	210.72	209.83	209.94	209.26	268.76	256.83	0.0003	5.5391
196.5480	254.46	226.87	210.66	209.78	209.92	209.26	268.48	256.95	0.0003	5.4963
197.0470	253.91	228.40	210.61	209.77	209.94	209.14	268.42	256.15	0.0000	5.4970
197.5477	247.74	228.28	210.67	209.74	209.84	209.16	269.04	257.18	0.0001	5.5184
198.0485	248.03	227.75	210.73	209.79	209.92	209.22	269.32	257.07	0.0003	5.5406
198.5483	241.44	227.21	210.89	209.92	209.98	209.33	270.96	257.89	0.0001	5.5007
199.0480	235.74	225.46	211.06	210.05	210.09	209.34	271.61	258.11	0.0001	5.4748
199.5478	231.13	223.34	211.17	210.19	210.19	209.45	272.39	258.57	0.0003	5.5402

TABLE B6.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
200.0477	225.91	220.12	211.30	210.30	210.28	209.47	272.80	257.82	0.0003	5.5421
200.5475	226.90	217.68	211.31	210.25	210.13	209.14	272.31	256.51	0.0003	5.4962
201.0483	231.45	218.54	211.17	210.11	210.01	209.07	271.08	256.09	0.0001	5.4882
201.5482	237.54	219.92	210.96	209.97	209.94	209.01	269.91	255.42	0.0001	5.5157
202.0470	241.54	219.88	210.77	209.82	209.83	209.03	268.71	255.26	0.0002	5.5408
202.5477	240.44	220.09	210.52	209.66	209.77	209.04	267.43	255.40	0.0004	5.5143
203.0475	238.65	220.98	210.35	209.54	209.70	209.04	266.66	256.09	0.0003	5.4705
203.5483	234.12	220.50	210.33	209.49	209.64	208.97	267.30	257.23	0.0005	5.5134
204.0472	232.05	219.48	210.48	209.61	209.73	209.12	268.34	256.79	0.0003	5.5525
204.5470	231.00	217.97	210.56	209.65	209.75	209.11	268.01	256.54	0.0003	5.5259
205.0468	224.68	216.02	210.55	209.69	209.83	209.15	268.08	256.08	0.0003	5.5016
205.5477	223.06	213.95	210.57	209.67	209.78	209.03	267.97	256.18	0.0003	5.5239
206.0483	222.39	213.55	210.54	209.63	209.72	209.04	267.77	255.72	0.0003	5.5240
206.5482	225.70	214.07	210.51	209.61	209.74	209.09	267.64	256.47	0.0003	5.5391
207.0480	231.42	215.16	210.51	209.64	209.74	209.08	267.92	256.98	0.0003	5.4917
207.5478	243.55	217.50	210.52	209.64	209.77	209.07	267.59	256.03	0.0000	5.5122
208.0477	245.93	220.06	210.47	209.61	209.79	209.13	267.48	255.78	0.0003	5.5317
208.5475	252.18	221.98	210.42	209.60	209.76	209.10	267.41	256.10	0.0001	5.5603
209.0482	250.55	224.72	210.46	209.60	209.76	209.06	268.44	255.64	0.0003	5.5275
209.5480	248.51	224.98	210.65	209.68	209.77	209.14	269.47	256.98	0.0001	5.4927
210.0478	242.31	225.54	210.85	209.84	209.88	209.15	270.16	255.58	0.0003	5.5051
210.5477	236.66	223.99	210.85	209.88	209.94	209.17	269.97	256.34	0.0003	5.5340
211.0483	235.22	222.47	210.78	209.87	209.94	209.19	269.46	255.74	0.0003	5.5389
211.5482	232.48	220.47	210.70	209.82	209.93	209.16	268.68	256.77	0.0004	5.4863
212.0480	229.23	218.54	210.58	209.74	209.88	209.18	267.99	257.21	0.0006	5.4912
212.5478	234.95	218.85	210.46	209.65	209.85	209.20	267.25	256.67	0.0003	5.5352
213.0468	238.12	220.43	210.39	209.57	209.76	209.10	267.21	255.99	0.0007	5.5555
213.5475	249.53	224.23	210.65	209.72	209.84	209.18	269.18	256.39	0.0004	5.5055
214.0482	251.85	227.81	210.78	209.81	209.88	209.13	269.70	255.56	0.0008	5.4849
214.5480	250.20	229.72	210.85	209.87	209.92	209.17	270.25	255.77	0.0003	5.5038
215.0478	252.56	230.10	210.89	209.91	209.96	209.18	270.28	255.88	0.0000	5.5529
215.5477	246.43	230.05	210.88	209.91	209.99	209.23	270.24	256.90	0.0002	5.5334
216.0485	246.00	228.41	210.87	209.94	210.03	209.26	269.88	256.61	0.0003	5.5186
216.5483	240.86	226.46	210.80	209.91	209.99	209.26	269.25	256.73	0.0000	5.5014
217.0480	235.92	224.42	210.68	209.82	209.95	209.27	268.61	256.72	0.0003	5.5141
217.5478	231.45	222.37	210.59	209.77	209.91	209.23	268.06	257.15	0.0003	5.5210
218.0477	226.98	219.39	210.58	209.72	209.88	209.27	268.48	257.68	0.0001	5.5126
218.5467	224.53	216.69	210.52	209.69	209.89	209.28	267.84	257.30	0.0004	5.4916
219.0483	220.68	213.88	210.47	209.68	209.89	209.28	267.15	256.44	0.0003	5.5276
219.5482	220.44	212.74	210.45	209.65	209.84	209.18	267.61	256.21	0.0003	5.5398
220.0480	226.89	213.43	210.44	209.63	209.85	209.31	267.20	256.98	0.0004	5.4959
220.5477	230.17	214.94	210.50	209.67	209.91	209.30	267.69	257.42	0.0001	5.4908
221.0475	238.73	217.16	210.56	209.71	209.91	209.27	268.49	256.37	0.0003	5.5238
221.5483	248.17	219.81	210.65	209.77	209.95	209.31	268.63	256.69	0.0002	5.5556
222.0482	251.05	223.93	210.67	209.81	209.94	209.21	269.03	256.49	0.0004	5.5141
222.5470	255.74	227.52	210.73	209.82	210.00	209.41	269.61	257.37	0.0003	5.4975
223.0478	249.44	229.46	210.81	209.91	210.02	209.36	269.75	257.62	0.0003	5.5156
223.5477	252.89	229.32	210.77	209.92	210.02	209.36	269.46	257.24	0.0006	5.5435
224.0492	251.06	228.94	210.76	209.87	210.03	209.31	269.31	256.78	0.0006	5.5384
224.5472	244.59	227.79	210.76	209.89	210.03	209.32	269.91	256.44	0.0003	5.4862

TABLE B6.- CONTINUED.

Time, min	T-steam °C	T1, °C	T2, °C	T3, °C	T4, °C	T5, °C	Pinj, psig	Pout, psig	Qinj, g/min	Vw ml/min
225.0480	238.41	226.14	226.14	209.91	210.03	209.34	269.53	257.48	0.0002	5.4903
225.5487	235.94	223.75	223.75	209.90	210.04	209.38	268.96	256.86	0.0005	5.5359
226.0477	229.18	221.61	221.61	209.88	210.03	209.36	269.89	257.43	0.0003	5.5183
226.5475	228.55	219.12	219.12	209.98	210.07	209.39	270.29	256.80	0.0003	5.4989
227.0482	223.74	216.17	216.17	210.02	210.07	209.35	270.46	257.35	0.0003	5.4951
227.5480	223.33	215.28	215.28	210.02	210.09	209.40	270.37	257.41	0.0003	5.5045
228.0468	228.25	215.77	215.77	210.03	210.11	209.36	269.88	256.94	0.0003	5.5355
228.5467	234.84	217.39	217.39	209.96	210.05	209.26	269.24	256.85	0.0003	5.4903
229.0475	242.03	219.61	219.61	209.85	210.01	209.34	268.53	256.83	0.0003	5.4963
229.5482	239.85	221.65	221.65	209.80	210.00	209.36	268.47	256.60	0.0000	5.5278
230.0480	242.43	221.55	221.55	209.77	209.99	209.34	267.94	256.62	0.0003	5.5606
230.5478	241.86	221.20	221.20	209.72	209.94	209.28	267.62	256.53	0.0004	5.5207
231.0477	239.39	221.97	221.97	209.89	210.03	209.42	270.71	257.71	0.0006	5.4887
231.5483	234.54	221.24	221.24	210.05	210.11	209.39	271.16	257.53	0.0003	5.4923
232.0482	229.26	219.53	219.53	210.20	210.20	209.45	272.72	257.42	0.0003	5.5400
232.5480	227.62	218.13	218.13	210.40	210.33	209.52	274.81	258.14	0.0004	5.5217
233.0470	226.18	216.55	216.55	210.68	210.51	209.62	276.41	258.27	0.0003	5.4930
233.5477	227.66	216.21	216.21	210.86	210.64	209.66	277.02	258.31	0.0004	5.4925
234.0485	230.73	217.00	217.00	210.84	210.65	209.57	276.11	257.87	0.0004	5.5209
234.5483	238.90	218.49	218.49	210.70	210.58	209.59	274.46	257.98	0.0003	5.5346
235.0472	243.60	220.80	220.80	210.51	210.48	209.55	272.96	257.79	0.0001	5.4972
235.5478	249.33	224.15	224.15	210.34	210.37	209.51	271.92	257.57	0.0003	5.4940
236.0477	258.63	227.74	227.74	210.20	210.29	209.50	270.84	257.45	0.0004	5.5229
236.5467	261.37	230.16	230.16	210.06	210.20	209.47	269.93	257.61	0.0000	5.5472
237.0473	260.98	231.11	231.11	209.94	210.15	209.45	269.15	257.31	0.0003	5.5013
237.5482	258.81	231.06	231.06	209.83	210.08	209.46	268.25	257.87	0.0001	5.4886
238.0480	252.78	230.24	230.24	209.71	210.02	209.43	267.38	257.11	0.0003	5.5209
238.5468	249.46	228.19	228.19	209.59	209.95	209.41	265.85	257.63	0.0001	5.5296
239.0475	247.78	226.45	226.45	209.45	209.84	209.36	264.76	257.15	0.0009	5.5218
239.5483	242.00	224.04	224.04	209.33	209.79	209.42	264.46	257.72	0.0005	5.4968
240.0490	233.34	222.41	222.41	209.32	209.76	209.37	264.09	257.22	0.0002	5.5021
240.5480	230.78	220.11	220.11	209.25	209.71	209.30	263.85	257.24	0.0000	5.5560
241.0487	229.51	219.02	219.02	209.32	209.75	209.38	266.66	257.25	0.0006	5.5195
241.5477	232.25	221.78	221.78	209.68	209.95	209.51	268.76	257.92	0.0004	5.4839
242.0483	238.33	223.63	223.63	209.92	210.10	209.47	270.02	257.71	0.0003	5.5106
242.5482	246.65	226.93	226.93	210.05	210.21	209.55	271.02	257.98	0.0005	5.5424
243.0470	250.33	228.76	228.76	210.12	210.25	209.59	270.57	258.00	0.0003	5.5144
243.5478	253.07	229.49	229.49	210.06	210.27	209.59	269.79	258.36	0.0002	5.4775
244.0477	246.91	228.74	228.74	209.99	210.19	209.54	268.99	257.91	0.0004	5.4913
244.5483	247.82	228.16	228.16	209.87	210.14	209.53	268.55	257.91	0.0005	5.5330
245.0473	242.98	226.66	226.66	209.82	210.07	209.48	268.11	257.70	0.0003	5.5385
245.5480	234.58	223.87	223.87	209.78	210.05	209.46	267.57	257.65	0.0003	5.4990
246.0478	232.22	221.56	221.56	209.68	210.00	209.45	267.10	257.53	0.0003	5.4992
246.5477	228.66	219.15	219.15	209.74	209.99	209.42	267.77	257.62	0.0002	5.5256
247.0483	224.70	217.18	217.18	209.74	210.01	209.44	268.35	257.32	0.0004	5.5494

APPENDIX C

PRODUCTION DATA

TABLE C1. PRODUCTION DATA FOR RUN 3.

Sample Number	Sampling Time, min	Vol. Oil, cm ³	Vol. Water, cm ³	Vol. Total, cm ³	Cum. Oil, cm ³	Cum. Water, cm ³	Oil Rate, cm ³	Water Rate, cm ³	Pore Vol. Injected, fraction	Oil Recovery, %
1	17	2	8	10	2	8	0.6667	2.6667	0.0826	0.0021
2	20	4	9	13	6	17	1.3333	3.0000	0.0971	0.0062
3	23	5	9	14	11	26	1.6667	3.0000	0.1117	0.0114
4	26	7	9.5	16.5	18	35.5	2.3333	3.1667	0.1263	0.0187
5	29	8	8.5	16.5	26	44	2.6667	2.8333	0.1408	0.0270
6	32	8	10	18	34	54	2.6667	3.3333	0.1554	0.0353
7	35	9	12	21	43	66	3.0000	4.0000	0.1700	0.0446
8	38	9	11	20	52	77	3.0000	3.6667	0.1845	0.0540
9	41	11	14	25	63	91	3.6667	4.6667	0.1991	0.0654
10	44	11	18	29	74	109	3.6667	6.0000	0.2137	0.0768
11	47	12	15	27	86	124	4.0000	5.0000	0.2282	0.0893
12	50	16	16	32	102	140	5.3333	5.3333	0.2428	0.1059
13	53	17	17	34	119	157	5.6667	5.6667	0.2574	0.1235
14	56	20	18	38	139	175	6.6667	6.0000	0.2719	0.1443
15	59	24	17	41	163	192	8.0000	5.6667	0.2865	0.1692
16	62	35	14	49	198	206	11.6667	4.6667	0.3011	0.2055
17	65	45	15	60	243	221	15.0000	5.0000	0.3156	0.2522
18	68	25	16	41	268	237	8.3333	5.3333	0.3302	0.2782
19	71	20	16	36	288	253	6.6667	5.3333	0.3448	0.2989
20	74	14	15	29	302	268	4.6667	5.0000	0.3593	0.3135
21	77	12	14	26	314	282	4.0000	4.6667	0.3739	0.3259
22	80	8	16	24	322	298	2.6667	5.3333	0.3885	0.3342
23	83	6	17	23	328	315	2.0000	5.6667	0.4030	0.3405
24	86	6	15	21	334	330	2.0000	5.0000	0.4176	0.3467
25	89	2	15	17	336	345	0.6667	5.0000	0.4322	0.3488
26	92	1	14	15	337	359	0.3333	4.6667	0.4467	0.3498
27	95	1	16	17	338	375	0.3333	5.3333	0.4613	0.3508
28	98	2	15	17	340	390	0.6667	5.0000	0.4759	0.3529
29	101	1	17	18	341	407	0.3333	5.6667	0.4905	0.3540
30	104	1	15	16	342	422	0.3333	5.0000	0.5050	0.3550
31	107	2	14	16	344	436	0.6667	4.6667	0.5196	0.3571
32	110	1	14	15	345	450	0.3333	4.6667	0.5342	0.3581
33	113	1.5	14	15.5	346.5	464	0.5000	4.6667	0.5487	0.3597
34	116	2	13	15	348.5	477	0.6667	4.3333	0.5633	0.3617
35	119	2	13	15	350.5	490	0.5000	3.2500	0.5779	0.3638
36	123	2	17	19	352.5	507	0.5000	4.2500	0.5973	0.3659
37	127	2	15	17	354.5	522	0.5000	3.7500	0.6167	0.3680
38	131	2	15	17	356.5	537	0.5000	3.7500	0.6361	0.3700
39	135	4	17	21	360.5	554	1.0000	4.2500	0.6556	0.3742
40	139	9	15	24	369.5	569	2.2500	3.7500	0.6750	0.3835

TABLE C1. -CONTINUED.

Sample Number	Sampling Time, min	Vol. Oil, cm ³	Vol. Water, cm ³	Vol. Total, cm ³	Cum. Oil, cm ³	Cum. Water, cm ³	Oil Rate, cm ³	Water Rate, cm ³	Pore Vol. Injected, fraction	Oil Recovery, %
41	143	15	16	31	384.5	585	5.0000	5.3333	0.6944	0.3991
42	146	8	16	24	392.5	601	1.6000	3.2000	0.7090	0.4074
43	151	6	17	23	398.5	618	1.2000	3.4000	0.7333	0.4136
44	156	3	30	33	401.5	648	0.5000	5.0000	0.7575	0.4168
45	162	2	35	37	403.5	683	0.3333	5.8333	0.7867	0.4188
46	168	1	32	33	404.5	715	0.1667	5.3333	0.8158	0.4199
47	174	1	33	34	405.5	748	0.1667	5.5000	0.8449	0.4209
48	180	0.5	36	36.5	406	784	0.0833	6.0000	0.8741	0.4214
49	186	0.5	32	32.5	406.5	816	0.0833	5.3333	0.9032	0.4219
50	192	1	31	32	407.5	847	0.1667	5.1667	0.9323	0.4230
51	198	0	33	33	407.5	880	0.0000	5.5000	0.9615	0.4230
52	204	0	34	34	407.5	914	0.0000	5.6667	0.9906	0.4230
53	210	0	35	35	407.5	949	0.0000	5.8333	1.0198	0.4230
54	216	0	33	33	407.5	982	0.0000	5.5000	1.0489	0.4230

TABLE C2. PRODUCTION DATA FOR RUN 4.

Sample Number	Sampling Time, min	Vol. Oil, cm ³	Vol. Water, cm ³	Vol. Total, cm ³	Cum. Oil, cm ³	Cum. Water, cm ³	Oil Rate, cm ³	Water Rate, cm ³	Pore Vol. Injected, fraction	Oil Recovery, %
1	21	0	20	20	0	20	0.0000	6.6667	0.1020	0.0000
2	24	1	18	19	1	38	0.3333	6.0000	0.1165	0.0010
3	27	2	19	21	3	57	0.6667	6.3333	0.1311	0.0031
4	30	1	20	21	4	77	0.3333	6.6667	0.1457	0.0042
5	33	2	10	12	6	87	0.6667	3.3333	0.1602	0.0062
6	36	2	9	11	8	96	0.6667	3.0000	0.1748	0.0083
7	39	1.5	17	18.5	9.5	113	0.5000	5.6667	0.1894	0.0099
8	42	1.5	21	22.5	11	134	0.5000	7.0000	0.2040	0.0114
9	45	2	16	18	13	150	0.6667	5.3333	0.2185	0.0135
10	48	3	15	18	16	165	1.0000	5.0000	0.2331	0.0166
11	51	2	18	20	18	183	0.6667	6.0000	0.2477	0.0187
12	54	1.5	20	21.5	19.5	203	0.5000	6.6667	0.2622	0.0202
13	57	1.5	19	20.5	21	222	0.5000	6.3333	0.2768	0.0218
14	60	2	18	20	23	240	0.6667	6.0000	0.2914	0.0239
15	63	1	21	22	24	261	0.3333	7.0000	0.3059	0.0249
16	66	2	20	22	26	281	0.6667	6.6667	0.3205	0.0270
17	69	2	20	22	28	301	0.6667	6.6667	0.3351	0.0291
18	72	2	17	19	30	318	0.6667	5.6667	0.3496	0.0311
19	75	1	17	18	31	335	0.3333	5.6667	0.3642	0.0322
20	78	1	19.5	20.5	32	354.5	0.3333	6.5000	0.3788	0.0332
21	81	3	21	24	35	375.5	1.0000	7.0000	0.3933	0.0363
22	84	1	22	23	36	397.5	0.3333	7.3333	0.4079	0.0374
23	87	3	16	19	39	413.5	1.0000	5.3333	0.4225	0.0405
24	90	2	19	21	41	432.5	0.6667	6.3333	0.4370	0.0426
25	93	2	15	17	43	447.5	0.6667	5.0000	0.4516	0.0446
26	96	3	13.5	16.5	46	461	1.0000	4.5000	0.4662	0.0477
27	99	2	18	20	48	479	0.6667	6.0000	0.4807	0.0498
28	102	2	18	20	50	497	0.6667	6.0000	0.4953	0.0519
29	105	1.5	11.5	13	51.5	508.5	0.5000	3.8333	0.5099	0.0535
30	108	2	21	23	53.5	529.5	0.6667	7.0000	0.5244	0.0555
31	111	3	10	13	56.5	539.5	1.0000	3.3333	0.5390	0.0586
32	114	2	12	14	58.5	551.5	0.6667	4.0000	0.5536	0.0607
33	117	1.5	8	9.5	60	559.5	0.5000	2.6667	0.5681	0.0623
34	120	2	11	13	62	570.5	0.6667	3.6667	0.5827	0.0644
35	123	2.5	7	9.5	64.5	577.5	0.8333	2.3333	0.5973	0.0670
36	126	3	7	10	67.5	584.5	1.0000	2.3333	0.6119	0.0701
37	129	3.5	12	15.5	71	596.5	1.1667	4.0000	0.6264	0.0737
38	132	3	13	16	74	609.5	1.0000	4.3333	0.6410	0.0768
39	135	3	14	17	77	623.5	1.0000	4.6667	0.6556	0.0799
40	138	3.5	12.5	16	80.5	636	1.1667	4.1667	0.6701	0.0836
41	141	3.5	10	13.5	84	646	1.1667	3.3333	0.6847	0.0872
42	144	2.5	10	12.5	86.5	656	0.8333	3.3333	0.6993	0.0898
43	147	3	11	14	89.5	667	1.0000	3.6667	0.7138	0.0929
44	150	3	11	14	92.5	678	1.0000	3.6667	0.7284	0.0960
45	153	2.5	11	13.5	95	689	0.8333	3.6667	0.7430	0.0986
46	156	3	12	15	98	701	1.0000	4.0000	0.7575	0.1017
47	159	2	12	14	100	713	0.6667	4.0000	0.7721	0.1038
48	162	3	11	14	103	724	1.0000	3.6667	0.7867	0.1069
49	165	3	11	14	106	735	1.0000	3.6667	0.8012	0.1100
50	168	2	10	12	108	745	0.6667	3.3333	0.8158	0.1121

TABLE C2. -CONTINUED.

Sample Number	Sampling Time, min	Vol. Oil, cm ³	Vol. Water, cm ³	Vol. Total, cm ³	Cum. Oil, cm ³	Cum. Water, cm ³	Oil Rate, cm ³	Water Rate, cm ³	Pore Vol. Injected, fraction	Oil Recovery, %
51	171	2.5	10	12.5	110.5	755	0.8333	3.3333	0.8304	0.1147
52	174	7	10	17	117.5	765	2.3333	3.3333	0.8449	0.1220
53	177	15	10	25	132.5	775	5.0000	3.3333	0.8595	0.1375
54	180	21	10	31	153.5	785	7.0000	3.3333	0.8741	0.1593
55	183	25	8	33	178.5	793	8.3333	2.6667	0.8886	0.1853
56	186	20	6	26	198.5	799	6.6667	2.0000	0.9032	0.2060
57	189	29	5	34	227.5	804	9.6667	1.6667	0.9178	0.2361
58	192	45	4.5	49.5	272.5	808.5	15.0000	1.5000	0.9323	0.2829
59	195	32	4	36	304.5	812.5	10.6667	1.3333	0.9469	0.3161
60	198	18	4	22	322.5	816.5	6.0000	1.3333	0.9615	0.3348
61	201	9	3.5	12.5	331.5	820	3.0000	1.1667	0.9760	0.3441
62	204	6	10	16	337.5	830	2.0000	3.3333	0.9906	0.3503
63	207	3	14	17	340.5	844	1.0000	4.6667	1.0052	0.3534
64	210	3.5	16	19.5	344	860	1.1667	5.3333	1.0198	0.3571
65	213	2	15	17	346	875	0.6667	5.0000	1.0343	0.3591
66	216	7	16	23	353	891	2.3333	5.3333	1.0489	0.3664
67	219	10	15	25	363	906	3.3333	5.0000	1.0635	0.3768
68	222	4	15	19	367	921	1.3333	5.0000	1.0780	0.3809
69	225	3	15	18	370	936	1.0000	5.0000	1.0926	0.3841
70	228	3	16	19	373	952	1.0000	5.3333	1.1072	0.3872
71	231	2	16	18	375	968	0.6667	5.3333	1.1217	0.3893
72	234	2.5	9	11.5	377.5	977	0.8333	3.0000	1.1363	0.3918
73	237	3	7	10	380.5	984	1.0000	2.3333	1.1509	0.3950
74	240	3.5	11	14.5	384	995	1.1667	3.6667	1.1654	0.3986
75	243	3	14	17	387	1009	1.0000	4.6667	1.1800	0.4017
76	246	2	16	18	389	1025	0.6667	5.3333	1.1946	0.4038
77	249	2	16	18	391	1041	0.6667	5.3333	1.2091	0.4059
78	252	1	17	18	392	1058	0.3333	5.6667	1.2237	0.4069
79	255	1	14	15	393	1072	0.3333	4.6667	1.2383	0.4079
80	258	0.5	14	14.5	393.5	1086	0.1667	4.6667	1.2528	0.4085
81	261	0.5	15	15.5	394	1101	0.1667	5.0000	1.2674	0.4090
82	264	0	16	16	394	1117	0.0000	5.3333	1.2820	0.4090
83	267	0	15	15	394	1132	0.0000	5.0000	1.2965	0.4090
84	270	0	15	15	394	1147	0.0000	5.0000	1.3111	0.4090
85	273	0	15	15	394	1162	0.0000	5.0000	1.3257	0.4090

TABLE C3. PRODUCTION DATA FOR RUN 5.

Sample Number	Sampling Time, min	Vol. Oil, cm ³	Vol. Water, cm ³	Vol. Total, cm ³	Cum. Oil, cm ³	Cum. Water, cm ³	Oil Rate, cm ³	Water Rate, cm ³	Pore Vol. Injected, fraction	Oil Recovery, %
1	21	0	36	36	0	36	0.0000	12.0000	0.1020	0.0000
2	24	0	24	24	0	60	0.0000	8.0000	0.1165	0.0000
3	27	0.5	26	26.5	0.5	86	0.1667	8.6667	0.1311	0.0005
4	30	2	25	27	2.5	111	0.6667	8.3333	0.1457	0.0026
5	33	4	23	27	6.5	134	1.3333	7.6667	0.1602	0.0067
6	36	4	21	25	10.5	155	1.3333	7.0000	0.1748	0.0109
7	39	4	22	26	14.5	177	1.3333	7.3333	0.1894	0.0151
8	42	3	23	26	17.5	200	1.0000	7.6667	0.2040	0.0182
9	45	4	22	26	21.5	222	1.3333	7.3333	0.2185	0.0223
10	48	3	21	24	24.5	243	1.0000	7.0000	0.2331	0.0254
11	51	2	22.5	24.5	26.5	265.5	0.6667	7.5000	0.2477	0.0275
12	54	2	21.5	23.5	28.5	287	0.6667	7.1667	0.2622	0.0296
13	57	2	23	25	30.5	310	0.6667	7.6667	0.2768	0.0317
14	60	2	18	20	32.5	328	0.6667	6.0000	0.2914	0.0337
15	63	3	15	18	35.5	343	1.0000	5.0000	0.3059	0.0368
16	66	3	16	19	38.5	359	1.0000	5.3333	0.3205	0.0400
17	69	3.5	16.5	20	42	375.5	1.1667	5.5000	0.3351	0.0436
18	72	3.5	16	19.5	45.5	391.5	1.1667	5.3333	0.3496	0.0472
19	75	3	16.5	19.5	48.5	408	1.0000	5.5000	0.3642	0.0503
20	78	3	17.5	20.5	51.5	425.5	1.0000	5.8333	0.3788	0.0535
21	81	2.5	17	19.5	54	442.5	0.8333	5.6667	0.3933	0.0561
22	84	2.5	16	18.5	56.5	458.5	0.8333	5.3333	0.4079	0.0586
23	87	2	17	19	58.5	475.5	0.6667	5.6667	0.4225	0.0607
24	90	2	16.5	18.5	60.5	492	0.6667	5.5000	0.4370	0.0628
25	93	2	15.5	17.5	62.5	507.5	0.6667	5.1667	0.4516	0.0649
26	96	2.5	17	19.5	65	524.5	0.8333	5.6667	0.4662	0.0675
27	99	1.5	17.5	19	66.5	542	0.5000	5.8333	0.4807	0.0690
28	102	2	17.5	19.5	68.5	559.5	0.6667	5.8333	0.4953	0.0711
29	105	2	18	20	70.5	577.5	0.6667	6.0000	0.5099	0.0732
30	108	2.5	18.5	21	73	596	0.8333	6.1667	0.5244	0.0758
31	111	2.5	19	21.5	75.5	615	0.8333	6.3333	0.5390	0.0784
32	114	2	18.5	20.5	77.5	633.5	0.6667	6.1667	0.5536	0.0804
33	117	1.5	18	19.5	79	651.5	0.5000	6.0000	0.5681	0.0820
34	120	1.5	17.5	19	80.5	669	0.5000	5.8333	0.5827	0.0836
35	123	2	17	19	82.5	686	0.6667	5.6667	0.5973	0.0856
36	126	2	17.5	19.5	84.5	703.5	0.6667	5.8333	0.6119	0.0877
37	129	2	17	19	86.5	720.5	0.6667	5.6667	0.6264	0.0898
38	132	1	18	19	87.5	738.5	0.3333	6.0000	0.6410	0.0908
39	135	1.5	16.5	18	89	755	0.5000	5.5000	0.6556	0.0924
40	138	1	17	18	90	772	0.3333	5.6667	0.6701	0.0934
41	141	1.5	18	19.5	91.5	790	0.5000	6.0000	0.6847	0.0950
42	144	2	18.5	20.5	93.5	808.5	0.6667	6.1667	0.6993	0.0971
43	147	1.5	16	17.5	95	824.5	0.5000	5.3333	0.7138	0.0986
44	150	2	14	16	97	838.5	0.6667	4.6667	0.7284	0.1007
45	153	1.5	12.5	14	98.5	851	0.5000	4.1667	0.7430	0.1022
46	156	1.5	10	11.5	100	861	0.5000	3.3333	0.7575	0.1038
47	159	2	8	10	102	869	0.6667	2.6667	0.7721	0.1059
48	162	1.5	6	7.5	103.5	875	0.5000	2.0000	0.7867	0.1074
49	165	2	13	15	105.5	888	0.6667	4.3333	0.8012	0.1095
50	168	1.5	12	13.5	107	900	0.5000	4.0000	0.8158	0.1111

TABLE C3. -CONTINUED.

Sample Number	Sampling Time, min	Vol. Oil, cm ³	Vol. Water, cm ³	Vol. Total, cm ³	Cum. Oil, cm ³	Cum. Water, cm ³	Oil Rate, cm ³	Water Rate, cm ³	Pore Vol. Injected, fraction	Oil Recovery, %
51	171	1.5	6	7.5	108.5	906	0.5000	2.0000	0.8304	0.1126
52	174	2	4	6	110.5	910	0.6667	1.3333	0.8449	0.1147
53	177	1.5	4.5	6	112	914.5	0.5000	1.5000	0.8595	0.1163
54	180	7	3	10	119	917.5	2.3333	1.0000	0.8741	0.1235
55	183	21	3.4	24.4	140	920.9	7.0000	1.1333	0.8886	0.1453
56	186	45	1	46	185	921.9	15.0000	0.3333	0.9032	0.1920
57	189	32	2	34	217	923.9	10.6667	0.6667	0.9178	0.2252
58	192	18	3	21	235	926.9	6.0000	1.0000	0.9323	0.2439
59	195	14	4	18	249	930.9	4.6667	1.3333	0.9469	0.2585
60	198	22	5	27	271	935.9	7.3333	1.6667	0.9615	0.2813
61	201	18	4	22	289	939.9	6.0000	1.3333	0.9760	0.3000
62	204	15	3	18	304	942.9	5.0000	1.0000	0.9906	0.3156
63	207	14	5	19	318	947.9	4.6667	1.6667	1.0052	0.3301
64	210	8	6	14	326	953.9	2.6667	2.0000	1.0198	0.3384
65	213	4	3	7	330	956.9	1.3333	1.0000	1.0343	0.3425
66	216	4	4	8	334	960.9	1.3333	1.3333	1.0489	0.3467
67	219	3	18	21	337	978.9	1.0000	6.0000	1.0635	0.3498
68	222	3.5	16.5	20	340.5	995.4	1.1667	5.5000	1.0780	0.3534
69	225	10	5	15	350.5	1000.4	3.3333	1.6667	1.0926	0.3638
70	228	15	4	19	365.5	1004.4	5.0000	1.3333	1.1072	0.3794
71	231	8	10	18	373.5	1014.4	2.6667	3.3333	1.1217	0.3877
72	234	5	18	23	378.5	1032.4	1.6667	6.0000	1.1363	0.3929
73	237	4	17.5	21.5	382.5	1049.9	1.3333	5.8333	1.1509	0.3970
74	240	2	17	19	384.5	1066.9	0.6667	5.6667	1.1654	0.3991
75	243	1.5	18.5	20	386	1085.4	0.5000	6.1667	1.1800	0.4007
76	246	1.5	18	19.5	387.5	1103.4	0.5000	6.0000	1.1946	0.4022
77	249	1	17.5	18.5	388.5	1120.9	0.3333	5.8333	1.2091	0.4033
78	252	1	18	19	389.5	1138.9	0.3333	6.0000	1.2237	0.4043
79	255	0.5	19	19.5	390	1157.9	0.1667	6.3333	1.2383	0.4048
80	258	0.5	16.5	17	390.5	1174.4	0.1667	5.5000	1.2528	0.4053
81	261	0	17	17	390.5	1191.4	0.0000	5.6667	1.2674	0.4053
82	264	0	18	18	390.5	1209.4	0.0000	6.0000	1.2820	0.4053
83	267	0	17.5	17.5	390.5	1226.9	0.0000	5.8333	1.2965	0.4053
84	270	0	18	18	390.5	1244.9	0.0000	6.0000	1.3111	0.4053
85	273	0	16.5	16.5	390.5	1261.4	0.0000	5.5000	1.3257	0.4053

TABLE C4. PRODUCTION DATA FOR RUN 6.

Sample Number	Sampling Time, min	Vol. Oil, cm ³	Vol. Water, cm ³	Vol. Total, cm ³	Cum. Oil, cm ³	Cum. Water, cm ³	Oil Rate, cm ³	Water Rate, cm ³	Pore Vol. Injected, fraction	Oil Recovery, %
1	14	0	10	10	0	0	0.0000	3.3333	0.0680	0.0000
2	17	2	13	15	2	13	0.6667	4.3333	0.0826	0.0021
3	20	3	13.5	16.5	5	26.5	1.0000	4.5000	0.0971	0.0052
4	23	4	12.5	16.5	9	39	1.3333	4.1667	0.1117	0.0093
5	26	5	12	17	14	51	1.6667	4.0000	0.1263	0.0145
6	29	6.5	13	19.5	20.5	64	2.1667	4.3333	0.1408	0.0213
7	32	7	15	22	27.5	79	2.3333	5.0000	0.1554	0.0285
8	35	7.5	16	23.5	35	95	2.5000	5.3333	0.1700	0.0363
9	38	9	17	26	44	112	3.0000	5.6667	0.1845	0.0457
10	41	9	17	26	53	129	3.0000	5.6667	0.1991	0.0550
11	44	10	17	27	63	146	3.3333	5.6667	0.2137	0.0654
12	47	11	16	27	74	162	3.6667	5.3333	0.2282	0.0768
13	50	13	15	28	87	177	4.3333	5.0000	0.2428	0.0903
14	53	13	15.5	28.5	100	192.5	4.3333	5.1667	0.2574	0.1038
15	56	14	16	30	114	208.5	4.6667	5.3333	0.2719	0.1183
16	59	20	15	35	134	223.5	6.6667	5.0000	0.2865	0.1391
17	62	46	4	50	180	227.5	15.3333	1.3333	0.3011	0.1868
18	65	29	9	38	209	236.5	9.6667	3.0000	0.3156	0.2169
19	68	25	12	37	234	248.5	8.3333	4.0000	0.3302	0.2429
20	71	18	16	34	252	264.5	6.0000	5.3333	0.3448	0.2616
21	74	15	17	32	267	281.5	5.0000	5.6667	0.3593	0.2771
22	77	13	16	29	280	297.5	4.3333	5.3333	0.3739	0.2906
23	80	11	15	26	291	312.5	3.6667	5.0000	0.3885	0.3021
24	83	8	14	22	299	326.5	2.6667	4.6667	0.4030	0.3104
25	86	7.5	12	19.5	306.5	338.5	2.5000	4.0000	0.4176	0.3181
26	89	5	11.5	16.5	311.5	350	1.6667	3.8333	0.4322	0.3233
27	92	5	11.5	16.5	316.5	361.5	1.6667	3.8333	0.4467	0.3285
28	95	5	11.5	16.5	321.5	373	1.6667	3.8333	0.4613	0.3337
29	98	3	13.5	16.5	324.5	386.5	1.0000	4.5000	0.4759	0.3368
30	101	3.5	14.5	18	328	401	1.1667	4.8333	0.4905	0.3405
31	104	3.5	14.5	18	331.5	415.5	1.1667	4.8333	0.5050	0.3441
32	107	2.5	14	16.5	334	429.5	0.8333	4.6667	0.5196	0.3467
32	110	3	13.5	16.5	337	443	1.0000	4.5000	0.5342	0.3498
33	113	3	13.5	16.5	340	456.5	1.0000	4.5000	0.5487	0.3529
34	116	2.5	14	16.5	342.5	470.5	0.8333	4.6667	0.5633	0.3555
35	119	3.5	13	16.5	346	483.5	0.8750	3.2500	0.5779	0.3591
36	123	3	17	20	349	500.5	0.7500	4.2500	0.5973	0.3623
37	127	4	16	20	353	516.5	1.0000	4.0000	0.6167	0.3664
38	131	9	17	26	362	533.5	2.2500	4.2500	0.6361	0.3758
39	135	17	15	32	379	548.5	4.2500	3.7500	0.6556	0.3934
40	139	9	16	25	388	564.5	2.2500	4.0000	0.6750	0.4027

TABLE C4. -CONTINUED.

Sample Number	Sampling Time, min	Vol. Oil, cm ³	Vol. Water, cm ³	Vol. Total, cm ³	Cum. Oil, cm ³	Cum. Water, cm ³	Oil Rate, cm ³	Water Rate, cm ³	Pore Vol. Injected, fraction	Oil Recovery, %
41	143	4	15	19	392	579.5	1.3333	5.0000	0.6944	0.4069
42	146	3	13.5	16.5	395	593	0.6000	2.7000	0.7090	0.4100
43	151	2.5	25.5	28	397.5	618.5	0.5000	5.1000	0.7333	0.4126
44	156	1.5	26.5	28	399	645	0.2500	4.4167	0.7575	0.4142
45	162	1.5	31	32.5	400.5	676	0.2500	5.1667	0.7867	0.4157
46	168	1	30	31	401.5	706	0.1667	5.0000	0.8158	0.4168
47	174	1	33	34	402.5	739	0.1667	5.5000	0.8449	0.4178
48	180	0.5	32.5	33	403	771.5	0.0833	5.4167	0.8741	0.4183
49	186	0.5	32.5	33	403.5	804	0.0833	5.4167	0.9032	0.4188
50	192	0	33	33	403.5	837	0.0000	5.5000	0.9323	0.4188
51	198	0	35	35	403.5	872	0.0000	5.8333	0.9615	0.4188
52	204	0	34	34	403.5	906	0.0000	5.6667	0.9906	0.4188
53	210	0	34.5	34.5	403.5	940.5	0.0000	5.7500	1.0198	0.4188
54	216	0	33.5	33.5	403.5	974	0.0000	5.5833	1.0489	0.41

TABLE C5. PRODUCTION DATA FOR RUN 7.

Sample Number	Sampling Time, min	Vol. Oil, cm ³	Vol. Water, cm ³	Vol. Total, cm ³	Cum. Oil, cm ³	Cum. Water, cm ³	Oil Rate, cm ³	Water Rate, cm ³	Pore Vol. Injected, fraction	Oil Recovery, %
1	15	14.5	4.5	19	14.5	4.5	14.5000	4.5000	0.0728	0.0151
2	16	19	2	21	33.5	6.5	19.0000	2.0000	0.0777	0.0348
3	17	18.5	6.5	25	52	13	1.8500	0.6500	0.0826	0.0540
4	27	14.5	17.5	32	66.5	30.5	2.9000	3.5000	0.1311	0.0690
5	32	7	17.5	24.5	73.5	48	3.5000	8.7500	0.1554	0.0763
6	34	8.5	15	23.5	82	63	4.2500	7.5000	0.1651	0.0851
7	36	15	17	32	97	80	7.5000	8.5000	0.1748	0.1007
8	38	13	17	30	110	97	4.3333	5.6667	0.1845	0.1142
9	41	18	19.5	37.5	128	116.5	4.5000	4.8750	0.1991	0.1329
10	45	18	18	36	146	134.5	3.6000	3.6000	0.2185	0.1515
11	50	19	15	34	165	149.5	3.8000	3.0000	0.2428	0.1713
12	55	19	16	35	184	165.5	4.7500	4.0000	0.2671	0.1910
13	59	20	15	35	204	180.5	5.0000	3.7500	0.2865	0.2118
14	63	24	16	40	228	196.5	6.0000	4.0000	0.3059	0.2367
15	67	23	16	39	251	212.5	5.7500	4.0000	0.3253	0.2605
16	71	19	17	36	270	229.5	6.3333	5.6667	0.3448	0.2803
17	74	23	17	40	293	246.5	5.7500	4.2500	0.3593	0.3041
18	78	21	19	40	314	265.5	5.2500	4.7500	0.3788	0.3259
19	82	15	18	33	329	283.5	5.0000	6.0000	0.3982	0.3415
20	85	19	20	39	348	303.5	4.7500	5.0000	0.4128	0.3612
21	89	11	19	30	359	322.5	3.6667	6.3333	0.4322	0.3726
22	92	11	19	30	370	341.5	2.7500	4.7500	0.4467	0.3841
23	96	3.5	20	23.5	373.5	361.5	1.1667	6.6667	0.4662	0.3877
24	99	5	19	24	378.5	380.5	1.6667	6.3333	0.4807	0.3929
25	102	5	17	22	383.5	397.5	1.2500	4.2500	0.4953	0.3981
26	106	12	15	27	395.5	412.5	1.5000	1.8750	0.5147	0.4105
27	114	4	18	22	399.5	430.5	1.3333	6.0000	0.5536	0.4147
28	117	8	1	9	407.5	431.5	2.0000	0.2500	0.5681	0.4230
29	121	15	1	16	422.5	432.5	7.5000	0.5000	0.5876	0.4386
30	123	4	9	13	426.5	441.5	0.8000	1.8000	0.5973	0.4427
31	128	4	16	20	430.5	457.5	0.5714	2.2857	0.6216	0.4469
32	135	2	15	17	432.5	472.5	0.4000	3.0000	0.6556	0.4489
33	140	1.5	16	17.5	434	488.5	0.3000	3.2000	0.6798	0.4505
34	145	1.5	15	16.5	435.5	503.5	0.2143	2.1429	0.7041	0.4520
35	152	1	17	18	436.5	520.5	0.1667	2.8333	0.7381	0.4531
36	158	1	17	18	437.5	537.5	0.1667	2.8333	0.7672	0.4541
37	164	1	16	17	438.5	553.5	0.1667	2.6667	0.7964	0.4552
38	170	0.5	17	17.5	439	570.5	0.0625	2.1250	0.8255	0.4557
39	178	0.5	18	18.5	439.5	588.5	0.2500	9.0000	0.8644	0.4562
40	180	1	17	18	440.5	605.5	0.1000	1.7000	0.8741	0.4572
41	190	0.5	26.5	27	441	632	0.0833	4.4167	0.9226	0.4578
42	196	0.5	19	19.5	441.5	651	0.0556	2.1111	0.9518	0.4583
43	205	0	31	31	441.5	682	0.0000	3.8750	0.9955	0.4583
44	213	0	33	33	441.5	715	0.0000	4.7143	1.0343	0.4583
45	220	0	31.5	31.5	441.5	746.5	0.0000	3.5000	1.0683	0.4583
46	229	0	36.5	36.5	441.5	783	0.0000	5.2143	1.1120	0.4583
47	236	0	26.5	26.5	441.5	809.5	0.0000	3.7857	1.1460	0.4583

TABLE C6. PRODUCTION DATA FOR RUN 8.

Sample Number	Sampling Time, min	Vol. Oil, cm ³	Vol. Water, cm ³	Vol. Total, cm ³	Cum. Oil, cm ³	Cum. Water, cm ³	Oil Rate, cm ³	Water Rate, cm ³	Pore Vol. Injected, fraction	Oil Recovery, %
1	15	16	0.25	16.25	16	0.25	16.0000	0.2500	0.0728	0.0166
2	16	14	0.5	14.5	30	0.75	14.0000	0.5000	0.0777	0.0311
3	17	28	4	32	58	4.75	2.8000	0.4000	0.0826	0.0602
4	27	20	10	30	78	14.75	4.0000	2.0000	0.1311	0.0810
5	32	9	10	19	87	24.75	4.5000	5.0000	0.1554	0.0903
6	34	9	6	15	96	30.75	4.5000	3.0000	0.1651	0.0996
7	36	9	6	15	105	36.75	4.5000	3.0000	0.1748	0.1090
8	38	9	6	15	114	42.75	3.0000	2.0000	0.1845	0.1183
9	41	14	10	24	128	52.75	3.5000	2.5000	0.1991	0.1329
10	45	14	24	38	142	76.75	2.8000	4.8000	0.2185	0.1474
11	50	16	22	38	158	98.75	3.2000	4.4000	0.2428	0.1640
12	55	16	20	36	174	118.75	4.0000	5.0000	0.2671	0.1806
13	59	16	22	38	190	140.75	4.0000	5.5000	0.2865	0.1972
14	63	17	16	33	207	156.75	4.2500	4.0000	0.3059	0.2149
15	67	16.5	16	32.5	223.5	172.75	4.1250	4.0000	0.3253	0.2320
16	71	10	15	25	233.5	187.75	3.3333	5.0000	0.3448	0.2424
17	74	16	15	31	249.5	202.75	4.0000	3.7500	0.3593	0.2590
18	78	16	13	29	265.5	215.75	4.0000	3.2500	0.3788	0.2756
19	82	10	11	21	275.5	226.75	3.3333	3.6667	0.3982	0.2860
20	85	15	11	26	290.5	237.75	3.7500	2.7500	0.4128	0.3015
21	89	7	10	17	297.5	247.75	2.3333	3.3333	0.4322	0.3088
22	92	14	9	23	311.5	256.75	3.5000	2.2500	0.4467	0.3233
23	96	11	8	19	322.5	264.75	3.6667	2.6667	0.4662	0.3348
24	99	11	10	21	333.5	274.75	3.6667	3.3333	0.4807	0.3462
25	102	12	20	32	345.5	294.75	3.0000	5.0000	0.4953	0.3586
26	106	20	30	50	365.5	324.75	2.5000	3.7500	0.5147	0.3794
27	114	40	6	46	405.5	330.75	13.3333	2.0000	0.5536	0.4209
28	117	25	6	31	430.5	336.75	6.2500	1.5000	0.5681	0.4469
29	121	6	10	16	436.5	346.75	3.0000	5.0000	0.5876	0.4531
30	123	3	19	22	439.5	365.75	0.6000	3.8000	0.5973	0.4562
31	128	2	21	23	441.5	386.75	0.2857	3.0000	0.6216	0.4583
32	135	2	20	22	443.5	406.75	0.4000	4.0000	0.6556	0.4604
33	140	1	20	21	444.5	426.75	0.2000	4.0000	0.6798	0.4614
34	145	1	20	21	445.5	446.75	0.1429	2.8571	0.7041	0.4624
35	152	1	18	19	446.5	464.75	0.1667	3.0000	0.7381	0.4635
36	158	1	19	20	447.5	483.75	0.1667	3.1667	0.7672	0.4645
37	164	1	20	21	448.5	503.75	0.1667	3.3333	0.7964	0.4655
38	170	0.5	19	19.5	449	522.75	0.0625	2.3750	0.8255	0.4661
39	178	0.5	10	10.5	449.5	532.75	0.2500	5.0000	0.8644	0.4666
40	180	0.5	25	25.5	450	557.75	0.0500	2.5000	0.8741	0.4671
41	190	0.5	25	25.5	450.5	582.75	0.0833	4.1667	0.9226	0.4676
42	196	0	24	24	450.5	606.75	0.0000	2.6667	0.9518	0.4676
43	205	0	28	28	450.5	634.75	0.0000	3.5000	0.9955	0.4676
44	213	0	28	28	450.5	662.75	0.0000	4.0000	1.0343	0.4676
45	220	0	28	28	450.5	690.75	0.0000	3.1111	1.0683	0.4676
46	229	0	28	28	450.5	718.75	0.0000	4.0000	1.1120	0.4676

APPENDIX D

DENSITY AND VISCOSITY DATA

TABLE D1. DENSITY AND VISCOSITY (AT 50°C) OF THE PRODUCED OIL FOR RUN 3

Time, Min	Sample Number	Density, °API	Viscosity, cp
17	14	11	3644
53	17	11.5	3164
65	20	11.5	3100
77	23	12	3238
83	26	12.5	2914
92	29	12.5	2685
104	32	13	2768
113	35	13	2890
119	38	13.5	2778
135	41	13	2578
146	43	13.5	2486
168	46	13.5	2386
222	49	13	2316

Table D2. Density and viscosity (at 50°C) of the produced oil for run 4

Time, Min	Sample Number	Density, °API	Viscosity, cp
18	1	11	3500
36	5	11.5	3200
51	9	11.5	3250
69	13	12	3200
90	17	12	3350
111	21	12.5	3100
135	25	12.5	2950
153	29	12.5	2900
171	33	13	2850
186	37	13.5	2700
204	41	13	2600
225	45	13.5	2650
240	49	13	2500
258	53	13	2550
273	57	13.5	2500

TABLE D3. DENSITY AND VISCOSITY (AT 50°C) OF THE PRODUCED OIL FOR RUN 7

Time, Min	Sample Number	Viscosity, cp	Density, °API
15	1	2908	12.5
36	4	2866	12.5
59	7	2706	14
85	10	2904	13
117	13	2812	13.5
145	20	2680	14.5
180	30	2420	15
236	40	2106	14.5

APPENDIX E

VISUAL BASIC SOURCE CODE FOR STEAM FRONT ADVANCEMENT AND CUMULATIVE OIL PRODUCTION CALCULATION BASED ON ONE DIMENSIONAL ANALYTICAL MODEL

```
Public Type data3Col
    logtime As Variant: Pinj As Variant: Ts As Variant: Pout As Variant
End Type
Public LogData() As data3Col
```

```
Public fileToOpen As Variant
```

```
Public Type FieldUnit
    Dlogtime As Double: Pinj As Double: KelTs As Double
    FahTs As Double: TabHs As Double: Psat As Double
    Tsat As Double: phase As String: fTabHs As Double
    HsRate As Double: xconv As Double: dx As Double
    x As Double: Np As Double: int_delP As Double
End Type
Public EqInput() As FieldUnit
```

```
Public Type data2Col
    stime As Variant: cumoil As Variant
End Type
Public ProdData() As data2Col
```

```
Public Type dataTherm
    ttime As Variant: propagation As Variant
End Type
Public ThermData() As dataTherm
```

```
Public Type Shifted
    Dtime As Double: Mtime As Double: x As Double: Np As Double
End Type
Public Plot() As Shifted
```

```
Public Type fill_up
    Dtime As Double: Mtime As Double: VoidLength As Double
End Type
Public FillUp As fill_up
```

```
Dim xaxis() As Double, yaxis() As Double
Public arEnd As Double, arProd As Double
```

```
Sub ModelingAcc()
```

```
    Dim i As Integer, iw As Double
    Dim j As Integer
    Dim rad As Double, Lcell As Double, Tcell As Double
    Dim Co As Double, por As Double, voidL As Double
    Dim mratio As Double, tfu_total As Double, Mr As Double
    Dim U As Double, tmod As Double
    Const PI As Double = 3.14159265358979
```

```
With Sheets("Main")
    rad = .Range("F11"): Lcell = .Range("F12")
    Tcell = .Range("F13"): Co = .Range("F17")
    por = .Range("F22"): So = .Range("F23")
End With
```

```

Sor = .Range("F24"): voidL = .Range("F28")
mratio = .Range("F31"): iw = .Range("F32")
tfu_total = .Range("F33"): Mr = .Range("F41")
a_mass_ratio = .Range("F34")
Hv_a = .Range("F35"): Lv_a = .Range("F36")
const_pi = .Range("F37"): visc_o = .Range("F38")
U = .Range("F42"): tmod = .Range("F43")
End With

tNp = Sheets("Sheet3").Range("B5")
a_rate = CalcARate(iw, a_mass_ratio)
iw = iw * 0.002204623 * 24 * 60 'cc/min --> lb/D
Tcell = ConvToFah(Tcell)
FillUp.Dtime = ConvDayToMin(tfu_total)
FillUp.Mtime = tfu_total
FillUp.VoidLength = ConvCmtoFt(voidL) 'cm --> ft
rad = ConvCmtoFt(rad) 'cm --> ft
Lcell = ConvCmtoFt(Lcell) 'cm --> ft
const_prod = PI * rad ^ 2 * por * (So - Sor)

Call ReadLogData
i = UBound(LogData): NoLogData = i
ReDim EqInput(1 To i): ReDim Plot(0 To i)
Plot(0).Dtime = 0: Plot(0).Mtime = 0: Plot(0).x = 0

Call DeleteChart
For j = 1 To i

    Plot(j).Mtime = LogData(j).logtime + FillUp.Mtime
    Plot(j).Dtime = ConvToDay(Plot(j).Mtime)

    If Plot(j).Mtime > tmod Then
        EqInput(j).phase = "Steam"
    End If

    EqInput(j).Dlogtime = ConvToDay(LogData(j).logtime)
    EqInput(j).Pinj = ConvToBar(LogData(j).Pinj)
    EqInput(j).KelTs = ConvToKel(LogData(j).Ts)
    EqInput(j).FahTs = ConvToFah(LogData(j).Ts)
    EqInput(j).Psat = Waterprop.VAPP(EqInput(j).KelTs)
    EqInput(j).Tsat = Waterprop.BOILP(EqInput(j).Pinj)
    If Plot(j).Mtime > tmod Then
        EqInput(j).phase = "Steam"
    Else
        EqInput(j).phase = FindPhase(EqInput(j).KelTs, EqInput(j).Tsat)
    End If
    If EqInput(j).phase = "Steam" Then
        EqInput(j).TabHs = Waterprop.HSUB2(Waterprop.BOILP(EqInput(j).Pinj), _
            EqInput(j).Pinj)
    Else 'EqInput(j).phase = "Hot Water" Then
        EqInput(j).TabHs = Waterprop.HSUB1(EqInput(j).KelTs, EqInput(j).Pinj)
    End If
    EqInput(j).fTabHs = ConvToBtuPerLb(EqInput(j).TabHs)
    EqInput(j).HsRate = EqInput(j).fTabHs * iw

    If j = 1 Then
        tbef = 0
    Else
        tbef = Plot(j - 1).Dtime
    End If
    tcur = Plot(j).Dtime

    If j = 1 Then
        EqInput(j).xconv = 0
        EqInput(j).dx = 0
        EqInput(j).x = 0

```

```

EqInput(j).Np = 0
EqInput(j).int_delP = 0

Else
  TabTs = Waterprop.BOILP(EqInput(j).Pinj)
  TabTs = ConvKelToFah(TabTs)
  EqInput(j).xconv = calc_x_conv(Co, mratio, iw, TabTs, Tcell, tcur, tbf)
  EqInput(j).dx = calc_dx(EqInput(j).HsRate, EqInput(j - 1).Dlogtime, _
    EqInput(j).Dlogtime, rad, EqInput(j - 1).x, _
    FillUp.VoidLength, U, EqInput(j).FahTs, Tcell, _
    Mr, EqInput(j).xconv)
  EqInput(j).x = EqInput(j - 1).x + EqInput(j).dx

  'To encounter discontinuities
  If EqInput(j).x < 0 Then
    EqInput(j).x = 0
  End If

  'EqInput(j).Np = const_prod * EqInput(j).x

  EqInput(j).int_delP = calc_int_delP(Plot(j - 1).Mtime, Plot(j).Mtime, _
    LogData(j).Pout, LogData(j).Pinj, EqInput(j - 1).int_delP)
  EqInput(j).Np = calc_Np(const_pi, visc_o, EqInput(j).int_delP)

  If EqInput(j).Np < 0 Then
    EqInput(j).Np = 0
  End If

  'catch the proper maximum Np
  If EqInput(j).x < Lcell Then
    flat = j
  End If

  'adjust steam front according to length of cell
  If EqInput(j).x > Lcell Then
    EqInput(j).x = Lcell
  ' EqInput(j).Np = EqInput(flat).Np
  End If

  Plot(j).x = ConvFtToCm(EqInput(j).x)
  Plot(j).Np = EqInput(j).Np

  'catch the array number at the last Np according to production data
  If Plot(j).Mtime < tNp Then
    arEnd = j
  End If

End If
Next

Sheets("Sheet3").Range("A6:B6").ClearContents
Sheets("Sheet3").Range("A6") = "Last array at last production time: "
Sheets("Sheet3").Range("B6") = arEnd
arProd = Sheets("Sheet3").Range("B2")

'Send steam front model calculated data to sheet
ReDim xaxis(0 To NoLogData): ReDim yaxis(0 To NoLogData)
For j = 0 To NoLogData
  xaxis(j) = Plot(j).Mtime: yaxis(j) = Plot(j).x
Next
Call WriteToSheetXModel(xaxis, yaxis)

'Send Np model calculated data to sheet
ReDim xaxis(0 To NoLogData): ReDim yaxis(0 To NoLogData)
For j = 0 To NoLogData
  xaxis(j) = Plot(j).Mtime: yaxis(j) = Plot(j).Np

```

```

Next
Call WriteToSheetNpModel(xaxis, yaxis)

'Create double plots
Call CreatePlot

End Sub

Function calc_int_delP(t1, t2, P1, P2, int_delP1) As Double
    If delta_p < 0 Then delta_p = 0
    delta_p = P2 - P1
    delta_t = t2 - t1
    calc_int_delP = delta_t * delta_p + int_delP1
End Function

Function calc_Np(ProdIndex, mu, int_dP)
    calc_Np = ProdIndex / mu * int_dP
End Function

Function calc_dx(ByVal Hs As Double, ByVal t1 As Double, ByVal t2 As Double, _
    ByVal r As Double, ByVal x1 As Double, ByVal xfu As Double, _
    ByVal U As Double, ByVal Ts As Double, ByVal Tinit As Double, _
    ByVal Mr As Double, ByVal xconv As Double) As Double

    Const PI As Double = 3.141592654
    Dim a As Double, b As Double, c As Double
    a = Hs * (t2 - t1)
    b = (2 * PI * r * (x1 + xfu) + PI * r ^ 2) * U * (Ts - Tinit) * (t2 - t1)
    c = PI * r ^ 2 * Mr * (Ts - Tinit)
    calc_dx = (a - b - xconv) / c
End Function

Function CalcARate(ByVal iw, ByVal a_percent)
    CalcARate = 0.002204623 * 24 * 60 * a_percent * iw
End Function

Function ConvCubftToCubcm(ByVal a As Double)
    ConvCubftToCubcm = a * (2.54 * 12) ^ 3
End Function

Function ConvDayToMin(ByVal a As Double) As Double
    ConvDayToMin = convtomin * 24 * 60
End Function

Function ConvCmtoFt(ByVal a As Double) As Double
    ConvCmtoFt = a / (2.54 * 12)
End Function
Function ConvFtToCm(ByVal a As Double) As Double
    ConvFtToCm = a * 2.54 * 12
End Function

Function ConvKelToFah(ByVal a As Double) As Double
    ConvKelToFah = a - 273.15
    ConvKelToFah = (ConvKelToFah - 32) * 9 / 5
End Function
Function calc_x_conv(Co, m_ratio, w_mass_rate, Ts, Tinit, t2, t1) As Double
    calc_x_conv = (Co * m_ratio * w_mass_rate) * (Ts - Tinit) * (t2 - t1)
End Function
Function FindPhase(ByVal a As Double, ByVal b As Double) As String
    If a > b Then
        FindPhase = "Steam"
    Else
        FindPhase = "Hot Water"
    End If
End Function

```

```

Function ConvToDay(ByVal a As Double) As Double
    ConvToDay = a / (24 * 60)
End Function
Function ConvToBar(ByVal a As Double) As Double
    ConvToBar = (a + 14.7) * 0.0689476
End Function
Function ConvToFah(ByVal a As Double) As Double
    ConvToFah = 9 / 5 * a + 32
End Function
Function ConvToKel(ByVal a As Double) As Double
    ConvToKel = 273.15 + a
End Function
Function ConvToBtuPerLb(ByVal a As Double) As Double
    '1 kilojoule = 0.9478171 Btu
    '1 kilogram = 2.2046226 pound
    ConvToBtuPerLb = a * 0.9478171 / 2.2046226
End Function

Public Sub Test()
    MsgBox "XXXX"
End Sub

Sub DeleteChart()
    With Sheets("Main")
        ActiveSheet.ChartObjects().Delete
    End With
End Sub

Sub CreatePlot()
    Call CreateChart
    Call CreateChart2
End Sub

Public Sub OpenDataExample()

    Dim dinput As Double
    On Error Resume Next

    this_file_path = ActiveWorkbook.Path
    this_file_HD_dir = Left(this_file_path, 1)
    ChDrive this_file_HD_dir: ChDir this_file_path
    fileToOpen = Application.GetOpenFilename("Input Files (*.dat), *.dat")

    If fileToOpen = False Then
        MsgBox "You haven't selected any input file"
        Exit Sub
    End If

    'Source data path and write them in "Sheet3" sheet
    With Sheets("Sheet3")
        .Range("A1") = "Data path: "
        .Range("B1") = fileToOpen
    End With

    'Read production properties data and write them in "Main" sheet
    Open fileToOpen For Input As #1
    Do While Not EOF(1)
        Input #1, inputdata

        If inputdata = "run_no" Then
            Line Input #1, inputdata
            Sheets("Main").Range("F5") = inputdata
        End If

        If inputdata = "additive" Then
            Line Input #1, inputdata

```



```
Sheets("Main").Range("F6") = inputdata  
End If
```

```
If inputdata = "researcher" Then  
Input #1, inputdata  
Sheets("Main").Range("F7") = inputdata  
End If
```

```
If inputdata = "cell_radius" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F11") = dinput  
End If
```

```
If inputdata = "cell_length" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F12") = dinput  
End If
```

```
If inputdata = "tcell" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F13") = dinput  
End If
```

```
If inputdata = "Cs" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F16") = dinput  
End If
```

```
If inputdata = "Co" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F17") = dinput  
End If
```

```
If inputdata = "Cw" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F18") = dinput  
End If
```

```
If inputdata = "dens_sand" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F19") = dinput  
End If
```

```
If inputdata = "dens_oil" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
  
Sheets("Main").Range("F20") = dinput  
End If
```

```
If inputdata = "dens_water" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F21") = dinput  
End If
```

```
If inputdata = "por" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)
```

```
Sheets("Main").Range("F22") = dinput  
End If
```

```
If inputdata = "Soi" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F23") = dinput  
End If
```

```
If inputdata = "Sor" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F24") = dinput  
End If
```

```
If inputdata = "Sgi" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F25") = dinput  
End If
```

```
If inputdata = "Swc" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F26") = dinput  
End If
```

```
If inputdata = "porvol" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F27") = dinput  
End If
```

```
If inputdata = "void_length" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F28") = dinput  
End If
```

```
If inputdata = "o_w_ratio" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F31") = dinput  
End If
```

```
If inputdata = "iw" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F32") = dinput  
End If
```

```
If inputdata = "tfu_total" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F33") = dinput  
End If
```

```
If inputdata = "ratio" Then  
Input #1, inputdata  
dinput = CDBl(inputdata)  
Sheets("Main").Range("F34") = dinput  
End If
```

```
If inputdata = "Hv_enthalphy" Then  
Input #1, inputdata
```

```

    dinput = CDBl(inputdata)
    Sheets("Main").Range("F35") = dinput
End If

If inputdata = "Lv_enthalphy" Then
    Input #1, inputdata
    dinput = CDBl(inputdata)
    Sheets("Main").Range("F36") = dinput
End If

If inputdata = "PI" Then
    Input #1, inputdata
    dinput = CDBl(inputdata)
    Sheets("Main").Range("F37") = dinput
End If

If inputdata = "Oil_visc" Then
    Input #1, inputdata
    dinput = CDBl(inputdata)
    Sheets("Main").Range("F38") = dinput
End If

If inputdata = "res_heat_capacity" Then
    Input #1, inputdata
    dinput = CDBl(inputdata)
    Sheets("Main").Range("F41") = dinput
End If

If inputdata = "heat_loss_coeff" Then
    Input #1, inputdata
    dinput = CDBl(inputdata)
    Sheets("Main").Range("F42") = dinput
End If

If inputdata = "t_phase" Then
    Input #1, inputdata
    dinput = CDBl(inputdata)
    Sheets("Main").Range("F43") = dinput
End If

Loop
Close #1

'read production data and write them in "Sheet2" sheet
Open fileToOpen For Input As #1
i = 1
kprod = False
Do While Not EOF(1)
    If kprod = False Then
        Input #1, inputdata
    End If

    If inputdata = "Production_Data_Tabulation" Then
        kprod = True
    End If

    If kprod = True Then
        ReDim Preserve ProdData(1 To i)
        With ProdData(i)
            Input #1, .stime, .cumoil
        End With
        i = i + 1
        If ProdData(i - 1).stime = "/" Or ProdData(i - 1).cumoil = "/" Then
            Exit Do
        End If
    End If

```

```

End If

Loop
no_prod = i - 2
ReDim Preserve ProdData(1 To no_prod)
Close #1

ReDim xaxis(0 To no_prod): ReDim yaxis(0 To no_prod)
For j = 1 To no_prod
xaxis(j) = ProdData(j).stime: yaxis(j) = ProdData(j).cumoil
Next
Sheets("Sheet3").Range("A2:B2").ClearContents
Sheets("Sheet3").Range("A5:B5").ClearContents
Sheets("Sheet3").Range("B2") = no_prod
Sheets("Sheet3").Range("B5") = ProdData(no_prod).stime
Sheets("Sheet3").Range("A2") = "No. of prod. data: "
Sheets("Sheet3").Range("A5") = "Last production time: "
Call WriteToSheetProd(xaxis, yaxis)

'read thermocouples data and write them in "Sheet2" sheet
Open fileToOpen For Input As #1
i = 1
kprod = False
Do While Not EOF(1)
If kprod = False Then
Input #1, inputdata
End If

If inputdata = "Thermo_Tabulation" Then
kprod = True
End If

If kprod = True Then
ReDim Preserve ThermData(1 To i)
With ThermData(i)
Input #1, .ttime, .propagation
End With
i = i + 1
If ThermData(i - 1).ttime = "/" Or ThermData(i - 1).propagation = "/" Then
Exit Do
End If
End If

Loop
no_therm = i - 2
ReDim Preserve ThermData(1 To no_therm)
Close #1

ReDim xaxis(0 To no_therm): ReDim yaxis(0 To no_therm)
For j = 1 To no_therm
xaxis(j) = ThermData(j).ttime: yaxis(j) = ThermData(j).propagation
Next
Sheets("Sheet3").Range("A3:B3").ClearContents
Sheets("Sheet3").Range("B3") = no_therm
Sheets("Sheet3").Range("A3") = "No. of thermocouples data: "
Call WriteToSheetTherm(xaxis, yaxis)

'Read Log Data and write them in "Sheet4" sheet
Open fileToOpen For Input As #1
i = 1
kprod = False
Do While Not EOF(1)
If kprod = False Then

```

```

    Input #1, inputdata
End If

If inputdata = "Log_Data_Tabulation" Then
    kprod = True
End If

If kprod = True Then
    ReDim Preserve LogData(1 To i)
    With LogData(i)
        Input #1, .logtime, .Ts, .Pinj, .Pout
    End With
    i = i + 1
    If LogData(i - 1).logtime = "/" Or _
        LogData(i - 1).Ts = "/" Or _
        LogData(i - 1).Pinj = "/" Or _
        LogData(i - 1).Pout = "/" Then
        Exit Do
    End If
End If

Loop
no_log = i - 2
ReDim Preserve LogData(1 To no_log)
Close #1

ReDim xaxis(1 To no_log)
ReDim yaxis(1 To no_log)
ReDim zaxis(1 To no_log)
ReDim xxaxis(1 To no_log)

For j = 1 To no_log
    xaxis(j) = LogData(j).logtime
    yaxis(j) = LogData(j).Ts
    zaxis(j) = LogData(j).Pinj
    xxaxis(j) = LogData(j).Pout
Next

Sheets("Sheet3").Range("A4:B4").ClearContents
Sheets("Sheet3").Range("B4") = no_log
Sheets("Sheet3").Range("A4") = "No. of log data: "
Call WriteToSheetLog(xaxis, yaxis, zaxis, xxaxis)

End Sub
Public Sub WriteToSheetProd(x1, y1)
    m = UBound(x1)
    With Sheets("Sheet2")
        .Range("B1:C20000").ClearContents
        .Cells(2, 2) = "Time"
        .Cells(3, 2) = "minutes"
        .Cells(2, 3) = "Cum Oil"
        .Cells(3, 3) = "cc"
    End With

    For n = 0 To m
        With Sheets("Sheet2")
            x1(n) = CDBl(x1(n)): y1(n) = CDBl(y1(n))
            .Cells(n + 3, 2).Value = x1(n)
            .Cells(n + 3, 3).Value = y1(n)
        End With
    Next
End Sub

Public Sub WriteToSheetXModel(x1, y1)
    m = UBound(x1)
    With Sheets("Sheet2")

```

```

.Range("E1:F20000").ClearContents
.Cells(2, 5) = "Time"
.Cells(3, 5) = "minutes"
.Cells(2, 6) = "Model Steam Front Position"
.Cells(3, 6) = "cm"
End With

For n = 0 To m
  With Sheets("Sheet2")
    x1(n) = CDBl(x1(n)): y1(n) = CDBl(y1(n))
    .Cells(n + 4, 5).Value = x1(n)
    .Cells(n + 4, 6).Value = y1(n)

  End With
Next
End Sub

Public Sub WriteToSheetNpModel(x1, y1)
  m = UBound(x1)
  With Sheets("Sheet2")
    .Range("K1:L20000").ClearContents
    .Cells(2, 11) = "Time"
    .Cells(3, 11) = "minutes"
    .Cells(2, 12) = "Np model"
    .Cells(3, 12) = "ft^3"
  End With

  For n = 0 To m
    With Sheets("Sheet2")
      x1(n) = CDBl(x1(n)): y1(n) = CDBl(y1(n))
      .Cells(n + 4, 11).Value = x1(n)
      .Cells(n + 4, 12).Value = y1(n)

    End With
  Next
End Sub

Public Sub WriteToSheetTherm(x1, y1)
  m = UBound(x1)
  With Sheets("Sheet2")
    .Range("H1:I20000").ClearContents
    .Cells(2, 8) = "Time"
    .Cells(3, 8) = "minutes"
    .Cells(2, 9) = "Thermocouples Steam Front Position"
    .Cells(3, 9) = "cm"
  End With

  For n = 0 To m
    With Sheets("Sheet2")
      x1(n) = CDBl(x1(n)): y1(n) = CDBl(y1(n))
      .Cells(n + 4, 8).Value = x1(n)
      .Cells(n + 4, 9).Value = y1(n)

    End With
  Next
End Sub

Public Sub WriteToSheetLog(x1, y1, z1, xx1)

  m = UBound(x1)
  With Sheets("Sheet2")
    .Range("N1:O20000").ClearContents
    .Cells(2, 14) = "Time"
    .Cells(3, 14) = "minutes"
    .Cells(2, 15) = "T inj."

```

```
.Cells(3, 15) = "oC"
.Cells(2, 16) = "P inj."
.Cells(3, 16) = "psig"
.Cells(2, 17) = "P out"
.Cells(3, 17) = "psig"
```

```
End With
```

```
For n = 1 To m
  With Sheets("Sheet2")
    x1(n) = CDBl(x1(n)): y1(n) = CDBl(y1(n))
    z1(n) = CDBl(z1(n)): xx1(n) = CDBl(xx1(n))
    .Cells(n + 4, 14).Value = x1(n)
    .Cells(n + 4, 15).Value = y1(n)
    .Cells(n + 4, 16).Value = z1(n)
    .Cells(n + 4, 17).Value = xx1(n)
```

```
End With
```

```
Next
```

```
With Sheets("Sheet4")
  .Range("B1:E20000").ClearContents
  .Cells(2, 2) = "Time"
  .Cells(3, 2) = "minutes"
  .Cells(2, 3) = "T inj."
  .Cells(3, 3) = "oC"
  .Cells(2, 4) = "P inj."
  .Cells(3, 4) = "psig"
  .Cells(2, 5) = "P out"
  .Cells(3, 5) = "psig"
```

```
End With
```

```
For n = 1 To m
  With Sheets("Sheet4")
    x1(n) = CDBl(x1(n)): y1(n) = CDBl(y1(n))
    z1(n) = CDBl(z1(n)): xx1(n) = CDBl(xx1(n))

    .Cells(n + 4, 2).Value = x1(n)
    .Cells(n + 4, 3).Value = y1(n)
    .Cells(n + 4, 4).Value = z1(n)
    .Cells(n + 4, 5).Value = xx1(n)
```

```
End With
```

```
Next
```

```
End Sub
```

```
Public Sub ReadLogData()
```

```
Dim i As Integer
Dim filename As String
m = Sheets("Sheet3").Range("B4")
ReDim Preserve LogData(1 To m)
For i = 1 To m
  With Sheets("Sheet4")
    LogData(i).logtime = .Cells(i + 4, 2).Value
    LogData(i).Ts = .Cells(i + 4, 3).Value
    LogData(i).Pinj = .Cells(i + 4, 4).Value
    LogData(i).Pout = .Cells(i + 4, 5).Value
```

```
End With
```

```
Next
```

```
End Sub
```

```
Public Sub ErrorHandling()
```

```

contact = "This is not a bug-free program!!!" & Chr(13) & _
          "For bug-reporting, please contact Roly Simangunsong at:" & Chr(13) & _
          "rasimangunsong@yahoo.com "
Msg = "Error # " & Str(Err.Number) & " was generated by " _
      & Err.Source & Chr(13) & _
      "Error is caused by: " & Err.Description & Chr(13) & _
      contact & Chr(13)
MsgBox Msg, , "Error", Err.HelpFile, Err.HelpContext
End Sub

```

Option Base 1

Function ETAF(T, V)

```

' *****
' * Viscosity of water *
' * up to 800 °C and 1000 bar *
' * T in K, V in m*3/kg *
' * ETAF IN E-6 kg/(m s) *
' *****

```

```

Dim AK(4), BK(6, 5)
AK(1) = 0.0181583
AK(2) = 0.0177624
AK(3) = 0.0105287
AK(4) = -0.0036744
BK(1, 1) = 0.501938
BK(2, 1) = 0.162888
BK(3, 1) = -0.130356
BK(4, 1) = 0.907919
BK(5, 1) = -0.551119
BK(6, 1) = 0.146543
BK(1, 2) = 0.235622
BK(2, 2) = 0.789393
BK(3, 2) = 0.673665
BK(4, 2) = 1.207552
BK(5, 2) = 0.0670665
BK(6, 2) = -0.084337
BK(1, 3) = -0.274637
BK(2, 3) = -0.743539
BK(3, 3) = -0.959456
BK(4, 3) = -0.687343
BK(5, 3) = -0.497089
BK(6, 3) = 0.195286
BK(1, 4) = 0.145831
BK(2, 4) = 0.263129
BK(3, 4) = 0.347247
BK(4, 4) = 0.213486
BK(5, 4) = 0.100754
BK(6, 4) = -0.032932
BK(1, 5) = -0.0270448
BK(2, 5) = -0.0253093
BK(3, 5) = -0.0267758
BK(4, 5) = -0.0822904
BK(5, 5) = 0.0602253
BK(6, 5) = -0.0202595

```

```

TUM = 647.27 / T
VUM = 0.003147 / V

```

```

Sum = 0
For i = 1 To 4
  Sum = Sum + AK(i) * TUM ^ (i - 1)
Next i
ETA0 = Sqr(1 / TUM) / Sum

```



```

Sum = 0
For i = 1 To 6
For j = 1 To 5
Sum = Sum + BK(i, j) * (TUM - 1) ^ (i - 1) * (VUM - 1) ^ (j - 1)
Next j
Next i
ETAF = ETA0 * Exp(VUM * Sum)
End Function

Function TCON(T, V)
' *****
' * Thermal conductivity of water *
' * up to 1500 °C and 3000 bar *
' * T in K, V in m³/kg *
' * TCON in W/(K m) *
' *****
Dim AK(4), BK(3), BG(2), DK(4), CG(6)
AK(1) = 0.0102811
AK(2) = 0.0299621
AK(3) = 0.0156146
AK(4) = -0.00422464
BK(1) = -0.39707
BK(2) = 0.400302
BK(3) = 1.06
BG(1) = -0.171587
BG(2) = 2.39219
DK(1) = 0.0701309
DK(2) = 0.011852
DK(3) = 0.00169937
DK(4) = -1.02
CG(1) = 0.642857
CG(2) = -4.11717
CG(3) = -6.17937
CG(4) = 0.00308976
CG(5) = 0.0822994
CG(6) = 10.0932

RHO = 1 / V
TR = T / 647.3
RHOR = RHO / 317.7

Sum = 0
For i = 1 To 4
Sum = Sum + AK(i) * TR ^ (i - 1)
Next i
ALAM0 = Sqr(TR) * Sum

HI = RHOR + BG(2)
ALAMQ = BK(1) + BK(2) * RHOR + BK(3) * Exp(BG(1) * HI * HI)

DTR = Abs(TR - 1) + CG(4)
Q = 2 + CG(5) * DTR ^ (-0.6)
r = Q * TR + 1
If TR < 1 Then S = CG(6) * DTR ^ (-0.6)
If TR >= 1 Then S = 1 / DTR

DL1 = (DK(1) * (1# / TR) ^ 10 + DK(2)) * RHOR ^ 1.8
DL2 = CG(1) * (1# - RHOR ^ 2.8)
DL3 = DK(3) * S * RHOR ^ Q
DL4 = Q / r * (1# - RHOR ^ r)
DL41 = CG(2) * TR ^ 1.5 + CG(3) * (1# / RHOR) ^ 5
If Abs(DL41) <= 700 Then DL5 = DK(4) * Exp(DL41)
If Abs(DL41) > 700 Then DL5 = 0
DLAM = DL1 * Exp(DL2) + DL3 * Exp(DL4) + DL5
TCON = ALAM0 + ALAMQ + DLAM

```

End Function

Function VSUB1(T, P)

```

' *****
' * Vsub1 in m^3/kg
' * Temperature range: 273.16 K < T < 623.15 K
' * Pressure range P < 1000 BAR
' * Temperatur T in K
' * p in bar
' *****

```

Dim AK(12), AG(12)

Tc = 647.3

Pc = 221.2

Vc = 0.00317

AK(1) = 0.8438375405

AK(2) = 0.0005362162162

AK(3) = 1.72

AK(4) = 0.07342278489

AK(5) = 0.0497585887

AK(6) = 0.65371543

AK(7) = 0.00000115

AK(8) = 0.000015108

AK(9) = 0.14188

AK(10) = 7.002753165

AK(11) = 0.0002995284926

AK(12) = 0.204

AG(1) = 7.982692717

AG(2) = -0.02616571843

AG(3) = 0.00152241179

AG(4) = 0.02284279054

AG(5) = 242.1647003

AG(6) = 1.269716088E-10

AG(7) = 2.074838328E-07

AG(8) = 2.17402035E-08

AG(9) = 1.105710498E-09

AG(10) = 12.93441934

AG(11) = 0.00001308119072

AG(12) = 6.047626338E-14

TR = T / Tc

PR = P / Pc

Y = 1 - AK(1) * TR * TR - AK(2) / TR ^ 6

y1 = 6 * AK(2) / TR ^ 7 - 2 * AK(1) * TR

Z = Y + Sqr(AK(3) * Y * Y - 2 * AK(4) * TR + 2 * AK(5) * PR)

S1 = AG(1) * AK(5) / Z ^ (5 / 17)

S2 = AG(2) + AG(3) * TR + AG(4) * TR * TR + AG(5) * (AK(6) - TR) ^ 10 + AG(6) / (AK(7) + TR ^ 19)

S3 = (AG(7) + 2 * AG(8) * PR + 3 * AG(9) * PR * PR) / (AK(8) + TR ^ 11)

S4 = AG(10) * TR ^ 18 * (AK(9) + TR * TR) * ((-3) / (AK(10) + PR) ^ 4 + AK(11))

S5 = 3 * AG(11) * (AK(12) - TR) * PR * PR

S6 = 4 * AG(12) * PR ^ 3 / TR ^ 20

VR = S1 + S2 - S3 - S4 + S5 + S6

VSUB1 = VR * Vc

End Function

Function HSUB1(T, P)

```

' *****
' * Hsub1 in kJ/kg
' * Temperature range in : 273.16 K < T < 623.15 K
' * Pressure range: P < 1000 BAR
' * Temperature T in K
' * p in bar
' *****

```

```

, *****
,
Dim AK(12), AG(12), AGA(11)
Tc = 647.3
Pc = 221.2
Hc = 70.1204
,
AK(1) = 0.8438375405
AK(2) = 0.0005362162162
AK(3) = 1.72
AK(4) = 0.07342278489
AK(5) = 0.0497585887
AK(6) = 0.65371543
AK(7) = 0.00000115
AK(8) = 0.000015108
AK(9) = 0.14188
AK(10) = 7.002753165
AK(11) = 0.0002995284926
AK(12) = 0.204
AG(1) = 7.982692717
AG(2) = -0.02616571843
AG(3) = 0.00152241179
AG(4) = 0.02284279054
AG(5) = 242.1647003
AG(6) = 1.269716088E-10
AG(7) = 2.074838328E-07
AG(8) = 2.17402035E-08
AG(9) = 1.105710498E-09
AG(10) = 12.93441934
AG(11) = 0.00001308119072
AG(12) = 6.047626338E-14
AGA(1) = 6824.687741
AGA(2) = -542.2063673
AGA(3) = -20966.66205
AGA(4) = 39412.86787
AGA(5) = -67332.77739
AGA(6) = 99023.81028
AGA(7) = -109391.1774
AGA(8) = 85908.41667
AGA(9) = -45111.68742
AGA(10) = 14181.38926
AGA(11) = -2017.271113
,
TR = T / Tc
PR = P / Pc
,
Y = 1 - AK(1) * TR * TR - AK(2) / TR ^ 6
y1 = 6 * AK(2) / TR ^ 7 - 2 * AK(1) * TR
Z = Y + Sqr(AK(3) * Y * Y - 2 * AK(4) * TR + 2 * AK(5) * PR)
,
H1 = AGA(1) * TR
H2 = 0
For i = 1 To 10
  I1 = i + 1
  H2 = H2 + (i - 2) * AGA(I1) * TR ^ (i - 1)
Next i
H3 = AG(1) * (Z * (17 * (Z / 29 - Y / 12) + 5 * TR * y1 / 12) + AK(4) * TR - (AK(3) - 1) * TR * Y * y1) / Z ^ (5 / 17)
H4 = (AG(2) - AG(4) * TR * TR + AG(5) * (9 * TR + AK(6)) * (AK(6) - TR) ^ 9 + AG(6) * (20 * TR ^ 19 + AK(7)) / (AK(7) +
TR ^ 19) ^ 2) * PR
H5 = (12 * TR ^ 11 + AK(8)) / (AK(8) + TR ^ 11) ^ 2 * (AG(7) * PR + AG(8) * PR * PR + AG(9) * PR ^ 3)
H6 = AG(10) * TR ^ 18 * (17# * AK(9) + 19# * TR * TR) * ((AK(10) + PR) ^ (-3) + AK(11) * PR)
H7 = AG(11) * AK(12) * PR ^ 3
H8 = 21 * AG(12) * PR ^ 4 / TR ^ 20
HR = H1 - H2 + H3 + H4 - H5 + H6 + H7 + H8
HSUB1 = HR * Hc
,

```

End Function

Function vsub2(T, P)

```
' *****
' * Vsub2 in m^3/kg *
' * Temperature range in: 273.16 K < T < 1073.15 K *
' * Pressure range in : 0 < P < SAETTIGUNGSDRUCK *
' * Temperature T in K *
' * Pressure p in bar *
' *****
```

Dim NA(8), NZ(8, 3), NL(3), NX(3, 2), BG(8, 3), BK(3, 2), B9(7)

Tc = 647.3

Pc = 221.2

Vc = 0.00317

NA(1) = 2

NA(2) = 3

NA(3) = 2

NA(4) = 2

NA(5) = 3

NA(6) = 2

NA(7) = 2

NA(8) = 2

NZ(1, 1) = 13

NZ(2, 1) = 18

NZ(3, 1) = 18

NZ(4, 1) = 25

NZ(5, 1) = 32

NZ(6, 1) = 12

NZ(7, 1) = 24

NZ(8, 1) = 24

NZ(1, 2) = 3

NZ(2, 2) = 2

NZ(3, 2) = 10

NZ(4, 2) = 14

NZ(5, 2) = 28

NZ(6, 2) = 11

NZ(7, 2) = 18

NZ(8, 2) = 14

NZ(1, 3) = 0

NZ(2, 3) = 1

NZ(3, 3) = 0

NZ(4, 3) = 0

NZ(5, 3) = 24

NZ(6, 3) = 0

NZ(7, 3) = 0

NZ(8, 3) = 0

NL(1) = 1

NL(2) = 1

NL(3) = 2

NX(1, 1) = 14

NX(2, 1) = 19

NX(3, 1) = 54

NX(1, 2) = 0

NX(2, 2) = 0

NX(3, 2) = 27

BG(1, 1) = 0.06670375918

BG(2, 1) = 0.08390104328

BG(3, 1) = 0.4520918904

BG(4, 1) = -0.5975336707

BG(5, 1) = 0.5958051609

BG(6, 1) = 0.1190610271

BG(7, 1) = 0.1683998803

BG(8, 1) = 0.006552390126

BG(1, 2) = 1.388983801

```

BG(2, 2) = 0.02614670893
BG(3, 2) = 0.1069036614
BG(4, 2) = -0.08847535804
BG(5, 2) = -0.5159303373
BG(6, 2) = -0.09867174132
BG(7, 2) = -0.05809438001
BG(8, 2) = 0.0005710218649
BG(1, 3) = 0
BG(2, 3) = -0.03373439453
BG(3, 3) = 0
BG(4, 3) = 0
BG(5, 3) = 0.2075021122
BG(6, 3) = 0
BG(7, 3) = 0
BG(8, 3) = 0
BK(1, 1) = 0.4006073948
BK(2, 1) = 0.08636081627
BK(3, 1) = -0.8532322921
BK(1, 2) = 0
BK(2, 2) = 0
BK(3, 2) = 0.3460208861
B9(1) = 193.6587558
B9(2) = -1388.522425
B9(3) = 4126.607219
B9(4) = -6508.211677
B9(5) = 5745.984054
B9(6) = -2693.088365
B9(7) = 523.5718623
RII = 4.260321148
BKA = 0.7633333333
,
TR = T / Tc
PR = P / Pc
,
x = Exp(BKA * (1 - TR))
PRL = BL(TR)
DPRL = DBL(TR)
,
S1 = RII * TR / PR
,
S2 = 0
For i = 1 To 5
  S2A = 0
  NAB = NA(i)
  For IA = 1 To NAB
    S2A = S2A + BG(i, IA) * x ^ NZ(i, IA)
  Next IA
S2 = S2 + i * PR ^ (i - 1) * S2A
Next i
,
S3 = 0
For i = 6 To 8
  LAM = i - 5
  S3A = 0
  NAB = NA(i)
  For IA = 1 To NAB
    S3A = S3A + BG(i, IA) * x ^ NZ(i, IA)
  Next IA
S3ZAE = (i - 2) * PR ^ (1 - i) * S3A
S3B = 0
NAC = NL(LAM)
For IB = 1 To NAC
  S3B = S3B + BK(LAM, IB) * x ^ NX(LAM, IB)
Next IB
S3HI = PR ^ (2 - i) + S3B
S3NEN = S3HI * S3HI

```

```

    S3 = S3 + S3ZAE / S3NEN
Next i
,
S4 = 0
For i = 1 To 7
    S4 = S4 + B9(i) * x ^ (i - 1)
Next i
S4 = 11# * (PR / PRL) ^ 10 * S4

VR = S1 - S2 - S3 + S4
vsub2 = VR * Vc
End Function
,
Function HSUB2(T, P)
' *****
' * Enthalpy Hsub2 in kJ/kg *
' * Temperature range in: 273.16 K < T < 1073.15 K *
' * Temperature T in K *
' * p in bar *
' *****
,
Dim NA(8), NZ(8, 3), NL(3), NX(3, 2), BGA(6), BG(8, 3), BK(3, 2), B9(7)
Tc = 647.3
Pc = 221.2
Hc = 70.1204
,
NA(1) = 2
NA(2) = 3
NA(3) = 2
NA(4) = 2
NA(5) = 3
NA(6) = 2
NA(7) = 2
NA(8) = 2
NZ(1, 1) = 13
NZ(2, 1) = 18
NZ(3, 1) = 18
NZ(4, 1) = 25
NZ(5, 1) = 32
NZ(6, 1) = 12
NZ(7, 1) = 24
NZ(8, 1) = 24
NZ(1, 2) = 3
NZ(2, 2) = 2
NZ(3, 2) = 10
NZ(4, 2) = 14
NZ(5, 2) = 28
NZ(6, 2) = 11
NZ(7, 2) = 18
NZ(8, 2) = 14
NZ(1, 3) = 0
NZ(2, 3) = 1
NZ(3, 3) = 0
NZ(4, 3) = 0
NZ(5, 3) = 24
NZ(6, 3) = 0
NZ(7, 3) = 0
NZ(8, 3) = 0
NL(1) = 1
NL(2) = 1
NL(3) = 2
NX(1, 1) = 14
NX(2, 1) = 19
NX(3, 1) = 54
NX(1, 2) = 0

```

```

NX(2, 2) = 0
NX(3, 2) = 27
BGA(1) = 16.83599274
BGA(2) = 28.56067796
BGA(3) = -54.38923329
BGA(4) = 0.4330662834
BGA(5) = -0.6547711697
BGA(6) = 0.08565182058
BG(1, 1) = 0.06670375918
BG(2, 1) = 0.08390104328
BG(3, 1) = 0.4520918904
BG(4, 1) = -0.5975336707
BG(5, 1) = 0.5958051609
BG(6, 1) = 0.1190610271
BG(7, 1) = 0.1683998803
BG(8, 1) = 0.006552390126
BG(1, 2) = 1.388983801
BG(2, 2) = 0.02614670893
BG(3, 2) = 0.1069036614
BG(4, 2) = -0.08847535804
BG(5, 2) = -0.5159303373
BG(6, 2) = -0.09867174132
BG(7, 2) = -0.05809438001
BG(8, 2) = 0.0005710218649
BG(1, 3) = 0
BG(2, 3) = -0.03373439453
BG(3, 3) = 0
BG(4, 3) = 0
BG(5, 3) = 0.2075021122
BG(6, 3) = 0
BG(7, 3) = 0
BG(8, 3) = 0
BK(1, 1) = 0.4006073948
BK(2, 1) = 0.08636081627
BK(3, 1) = -0.8532322921
BK(1, 2) = 0
BK(2, 2) = 0
BK(3, 2) = 0.3460208861
B9(1) = 193.6587558
B9(2) = -1388.522425
B9(3) = 4126.607219
B9(4) = -6508.211677
B9(5) = 5745.984054
B9(6) = -2693.088365
B9(7) = 523.5718623
BKA = 0.7633333333

```

```

TR = T / Tc
PR = P / Pc

```

```

x = Exp(BKA * (1 - TR))
PRL = BL(TR)
DPRL = DBL(TR)

```

```

H1 = BGA(1) * TR
H2 = 0
For i = 2 To 6
  H2 = H2 + BGA(i) * (i - 3) * TR ^ (i - 2)
Next i
H3 = 0
For i = 1 To 5
  H3A = 0
  NAA = NA(i)
  For IA = 1 To NAA
    H3A = H3A + (BG(i, IA) * (1# + NZ(i, IA) * BKA * TR)) * (x ^ NZ(i, IA))
  Next IA

```

```

    H3 = H3 + PR ^ i * H3A
Next i
H4 = 0
For i = 6 To 8
    H4A = 0
    H4B = 0
    LAM = i - 5
    NAB = NL(LAM)
    For IB = 1 To NAB
        H4B = H4B + NX(LAM, IB) * BK(LAM, IB) * x ^ NX(LAM, IB)
    Next IB
    H4C = 0
    For IC = 1 To NAB
        H4C = H4C + BK(LAM, IC) * x ^ NX(LAM, IC)
    Next IC
    HIL1 = PR ^ (2 - i) + H4C
    NAC = NA(i)
    For IA = 1 To NAC
        H4A = H4A + BG(i, IA) * x ^ NZ(i, IA) * (1# + NZ(i, IA) * BKA * TR - BKA * TR * H4B / HIL1)
    Next IA
    H4 = H4 + H4A / HIL1
Next i
H5A = 0
For i = 1 To 7
    H5A = H5A + (1 + TR * (10 * DPRL / PRL + (i - 1) * BKA)) * B9(i) * x ^ (i - 1)
Next i
H5 = PR * (PR / PRL) ^ 10 * H5A
HR = H1 - H2 - H3 - H4 + H5
H5UB2 = HR * Hc
,
End Function

Function BL(TR)

    Dim L(3)
    L(1) = 15.74373327
    L(2) = -34.17061978
    L(3) = 19.31380707
,
    BL = L(1) + L(2) * TR + L(3) * TR * TR
End Function

Function DBL(TR)
    Dim L(2)
    L(1) = -34.17061978
    L(2) = 19.31380707
    DBL = L(1) + 2 * L(2) * TR
End Function

Function BOILP(P)
' *****
' * Pressure range: 0.01 bar < P < 220 bar *
' * P in bar *
' * BOILP in K *
' *****
Tunt = 280.15
Tob = 646.85
Tm = 0.5 * (Tunt + Tob)
Punt = VAPP(Tunt)
Pob = VAPP(Tob)
Pm = VAPP(Tm)
Dpunt = Punt - P
Dpob = Pob - P
Dpm = Pm - P
If (Dpunt * Dpob) > 0 Then GoTo Bereich:
For i = 1 To 10000

```



```

If (Dpm * Dpunt) < 0 Then
  Tob = Tm
  Pob = Pm
  Dpob = Dpm
Else
  Tunt = Tm
  Punt = Pm
  Dpunt = Dpm
End If
Tm = 0.5 * (Tunt + Tob)
BOILP = Tm
If (Tm - Tunt) < 0.0005 Then GoTo Ende:
Pm = VAPP(Tm)
Dpm = Pm - P
Next i
Bereich: BOILP = -1
Ende:
End Function

Function VAPP(T)
' *****
' * T in K *
' * VAPP in bar *
' *****
'
Dim AK(12), BK(4), Tz(12)
Tc = 647.3
Pc = 221.2
'
AK(1) = -4.0596821
AK(2) = 5.1322555
AK(3) = -1.1842407
AK(4) = 0.11779592
AK(5) = -0.005157642
AK(6) = -0.0014689537
AK(7) = 0.00053622818
AK(8) = 0.00012455399
AK(9) = -0.000049154288
AK(10) = 0.000046302565
AK(11) = 0.000015301334
AK(12) = -0.00002095453
BK(1) = 2
BK(2) = 0.95
BK(3) = 1.45220717
BK(4) = -0.84878953
'
TR = T / Tc
'
If TR < 0.421 Or TR > 1.658 Then GoTo Bereich:
U = (BK(1) * (1 / TR - BK(2)) ^ 0.4 - BK(3)) / BK(4)
Tz(1) = 1
Tz(2) = U
For i = 3 To 12
  Tz(i) = 2 * U * Tz(i - 1) - Tz(i - 2)
Next i
Sum = 0
For i = 1 To 12
  Sum = Sum + AK(i) * Tz(i)
Next i
PR = Exp(Sum)
VAPP = PR * Pc
GoTo Ende:
Bereich: VAPP = -1
Ende:
End Function

```

```

Function HCAP(T, P, IAG)
' *****
' * HCAP IN KJ/(KG*K) *
' * T = TEMP. in K; P in bar *
' * IAG = 1: FLUESSIG; IAG = 2: DAMPF *
' *****

Tc = 647.3
Pc = 221.2
Vc = 0.00317

t1 = T - 0.5
t2 = T + 0.5
If IAG = 1 Then
    H1 = HSUB1(t1, P)
    H2 = HSUB1(t2, P)
Else
    H1 = HSUB2(t1, P)
    H2 = HSUB2(t2, P)
End If
HCAP = (H2 - H1)
End Function

Public Sub OpenDataExample()

Dim dinput As Double
On Error Resume Next

this_file_path = ActiveWorkbook.Path
this_file_HD_dir = Left(this_file_path, 1)
ChDrive this_file_HD_dir: ChDir this_file_path
fileToOpen = Application.GetOpenFilename("Input Files (*.dat), *.dat")

If fileToOpen = False Then
    MsgBox "You haven't selected any input file"
    Exit Sub
End If

'Source data path and write them in "Sheet3" sheet
With Sheets("Sheet3")
    .Range("A1") = "Data path: "
    .Range("B1") = fileToOpen
End With

'Read production properties data and write them in "Main" sheet
Open fileToOpen For Input As #1
Do While Not EOF(1)
    Input #1, inputdata

    If inputdata = "run_no" Then
        Line Input #1, inputdata
        Sheets("Main").Range("F5") = inputdata
    End If

    If inputdata = "additive" Then
        Line Input #1, inputdata
        Sheets("Main").Range("F6") = inputdata
    End If

    If inputdata = "researcher" Then
        Input #1, inputdata
        Sheets("Main").Range("F7") = inputdata
    End If

    If inputdata = "cell_radius" Then

```

```
Input #1, inputdata
dinput = CDbl(inputdata)
Sheets("Main").Range("F11") = dinput
End If
```

```
If inputdata = "cell_length" Then
Input #1, inputdata
dinput = CDbl(inputdata)
Sheets("Main").Range("F12") = dinput
End If
```

```
If inputdata = "tcell" Then
Input #1, inputdata
dinput = CDbl(inputdata)
Sheets("Main").Range("F13") = dinput
End If
```

```
If inputdata = "Cs" Then
Input #1, inputdata
dinput = CDbl(inputdata)
Sheets("Main").Range("F16") = dinput
End If
```

```
If inputdata = "Co" Then
Input #1, inputdata
dinput = CDbl(inputdata)
Sheets("Main").Range("F17") = dinput
End If
```

```
If inputdata = "Cw" Then
Input #1, inputdata
dinput = CDbl(inputdata)
Sheets("Main").Range("F18") = dinput
End If
```

```
If inputdata = "dens_sand" Then
Input #1, inputdata
dinput = CDbl(inputdata)
Sheets("Main").Range("F19") = dinput
End If
```

```
If inputdata = "dens_oil" Then
Input #1, inputdata
dinput = CDbl(inputdata)

Sheets("Main").Range("F20") = dinput
End If
```

```
If inputdata = "dens_water" Then
Input #1, inputdata
dinput = CDbl(inputdata)
Sheets("Main").Range("F21") = dinput
End If
```

```
If inputdata = "por" Then
Input #1, inputdata
dinput = CDbl(inputdata)
Sheets("Main").Range("F22") = dinput
End If
```

```
If inputdata = "Soi" Then
Input #1, inputdata
dinput = CDbl(inputdata)
Sheets("Main").Range("F23") = dinput
End If
```

```
If inputdata = "Sor" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F24") = dinput
End If
```

```
If inputdata = "Sgi" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F25") = dinput
End If
```

```
If inputdata = "Swc" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F26") = dinput
End If
```

```
If inputdata = "porvol" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F27") = dinput
End If
```

```
If inputdata = "void_length" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F28") = dinput
End If
```

```
If inputdata = "o_w_ratio" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F31") = dinput
End If
```

```
If inputdata = "iw" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F32") = dinput
End If
```

```
If inputdata = "tfu_total" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F33") = dinput
End If
```

```
If inputdata = "ratio" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F34") = dinput
End If
```

```
If inputdata = "Hv_enthalphy" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F35") = dinput
End If
```

```
If inputdata = "Lv_enthalphy" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F36") = dinput
End If
```

```

If inputdata = "PI" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F37") = dinput
End If

If inputdata = "Oil_visc" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F38") = dinput
End If

If inputdata = "res_heat_capacity" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F41") = dinput
End If

If inputdata = "heat_loss_coeff" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F42") = dinput
End If

If inputdata = "t_phase" Then
  Input #1, inputdata
  dinput = CDBl(inputdata)
  Sheets("Main").Range("F43") = dinput
End If

Loop
Close #1

'read production data and write them in "Sheet2" sheet
Open fileToOpen For Input As #1
i = 1
kprod = False
Do While Not EOF(1)
  If kprod = False Then
    Input #1, inputdata
  End If

  If inputdata = "Production_Data_Tabulation" Then
    kprod = True
  End If

  If kprod = True Then
    ReDim Preserve ProdData(1 To i)
    With ProdData(i)
      Input #1, .stime, .cumoil
    End With
    i = i + 1
    If ProdData(i - 1).stime = "/" Or ProdData(i - 1).cumoil = "/" Then
      Exit Do
    End If
  End If
End If

Loop
no_prod = i - 2
ReDim Preserve ProdData(1 To no_prod)
Close #1

ReDim xaxis(0 To no_prod): ReDim yaxis(0 To no_prod)
For j = 1 To no_prod

```

```

    xaxis(j) = ProdData(j).stime: yaxis(j) = ProdData(j).cumoil
Next
Sheets("Sheet3").Range("A2:B2").ClearContents
Sheets("Sheet3").Range("A5:B5").ClearContents
Sheets("Sheet3").Range("B2") = no_prod
Sheets("Sheet3").Range("B5") = ProdData(no_prod).stime
Sheets("Sheet3").Range("A2") = "No. of prod. data: "
Sheets("Sheet3").Range("A5") = "Last production time: "
Call WriteToSheetProd(xaxis, yaxis)

'read thermocouples data and write them in "Sheet2" sheet
Open fileToOpen For Input As #1
i = 1
kprod = False
Do While Not EOF(1)
    If kprod = False Then
        Input #1, inputdata
    End If

    If inputdata = "Thermo_Tabulation" Then
        kprod = True
    End If

    If kprod = True Then
        ReDim Preserve ThermData(1 To i)
        With ThermData(i)
            Input #1, .ttime, .propagation
        End With
        i = i + 1
        If ThermData(i - 1).ttime = "/" Or ThermData(i - 1).propagation = "/" Then
            Exit Do
        End If
    End If

Loop
no_therm = i - 2
ReDim Preserve ThermData(1 To no_therm)
Close #1

ReDim xaxis(0 To no_therm): ReDim yaxis(0 To no_therm)
For j = 1 To no_therm
    xaxis(j) = ThermData(j).ttime: yaxis(j) = ThermData(j).propagation
Next
Sheets("Sheet3").Range("A3:B3").ClearContents
Sheets("Sheet3").Range("B3") = no_therm
Sheets("Sheet3").Range("A3") = "No. of thermocouples data: "
Call WriteToSheetTherm(xaxis, yaxis)

'Read Log Data and write them in "Sheet4" sheet
Open fileToOpen For Input As #1
i = 1
kprod = False
Do While Not EOF(1)
    If kprod = False Then
        Input #1, inputdata
    End If

    If inputdata = "Log_Data_Tabulation" Then
        kprod = True
    End If

    If kprod = True Then
        ReDim Preserve LogData(1 To i)

```

```

With LogData(i)
  Input #1, .logtime, .Ts, .Pinj, .Pout
End With
i = i + 1
If LogData(i - 1).logtime = "/" Or _
  LogData(i - 1).Ts = "/" Or _
  LogData(i - 1).Pinj = "/" Or _
  LogData(i - 1).Pout = "/" Then
  Exit Do
End If
End If

Loop
no_log = i - 2
ReDim Preserve LogData(1 To no_log)
Close #1

ReDim xaxis(1 To no_log)
ReDim yaxis(1 To no_log)
ReDim zaxis(1 To no_log)
ReDim xxaxis(1 To no_log)

For j = 1 To no_log
  xaxis(j) = LogData(j).logtime
  yaxis(j) = LogData(j).Ts
  zaxis(j) = LogData(j).Pinj
  xxaxis(j) = LogData(j).Pout
Next

Sheets("Sheet3").Range("A4:B4").ClearContents
Sheets("Sheet3").Range("B4") = no_log
Sheets("Sheet3").Range("A4") = "No. of log data: "
Call WriteToSheetLog(xaxis, yaxis, zaxis, xxaxis)

End Sub
Public Sub WriteToSheetProd(x1, y1)
  m = UBound(x1)
  With Sheets("Sheet2")
    .Range("B1:C20000").ClearContents
    .Cells(2, 2) = "Time"
    .Cells(3, 2) = "minutes"
    .Cells(2, 3) = "Cum Oil"
    .Cells(3, 3) = "cc"
  End With

  For n = 0 To m
    With Sheets("Sheet2")
      x1(n) = CDBl(x1(n)): y1(n) = CDBl(y1(n))
      .Cells(n + 3, 2).Value = x1(n)
      .Cells(n + 3, 3).Value = y1(n)
    End With
  Next
End Sub

Public Sub WriteToSheetXModel(x1, y1)
  m = UBound(x1)
  With Sheets("Sheet2")
    .Range("E1:F20000").ClearContents
    .Cells(2, 5) = "Time"
    .Cells(3, 5) = "minutes"
    .Cells(2, 6) = "Model Steam Front Position"
    .Cells(3, 6) = "cm"
  End With

  For n = 0 To m
    With Sheets("Sheet2")

```

```

        x1(n) = CDBl(x1(n)): y1(n) = CDBl(y1(n))
        .Cells(n + 4, 5).Value = x1(n)
        .Cells(n + 4, 6).Value = y1(n)

    End With
Next
End Sub

Public Sub WriteToSheetNpModel(x1, y1)
    m = UBound(x1)
    With Sheets("Sheet2")
        .Range("K1:L20000").ClearContents
        .Cells(2, 11) = "Time"
        .Cells(3, 11) = "minutes"
        .Cells(2, 12) = "Np model"
        .Cells(3, 12) = "ft^3"
    End With

    For n = 0 To m
        With Sheets("Sheet2")
            x1(n) = CDBl(x1(n)): y1(n) = CDBl(y1(n))
            .Cells(n + 4, 11).Value = x1(n)
            .Cells(n + 4, 12).Value = y1(n)

        End With
    Next

End Sub

Public Sub WriteToSheetTherm(x1, y1)
    m = UBound(x1)
    With Sheets("Sheet2")
        .Range("H1:I20000").ClearContents
        .Cells(2, 8) = "Time"
        .Cells(3, 8) = "minutes"
        .Cells(2, 9) = "Thermocouples Steam Front Position"
        .Cells(3, 9) = "cm"
    End With

    For n = 0 To m
        With Sheets("Sheet2")
            x1(n) = CDBl(x1(n)): y1(n) = CDBl(y1(n))
            .Cells(n + 4, 8).Value = x1(n)
            .Cells(n + 4, 9).Value = y1(n)

        End With
    Next

End Sub

Public Sub WriteToSheetLog(x1, y1, z1, xx1)

    m = UBound(x1)
    With Sheets("Sheet2")
        .Range("N1:O20000").ClearContents
        .Cells(2, 14) = "Time"
        .Cells(3, 14) = "minutes"
        .Cells(2, 15) = "T inj."
        .Cells(3, 15) = "oC"
        .Cells(2, 16) = "P inj."
        .Cells(3, 16) = "psig"
        .Cells(2, 17) = "P out"
        .Cells(3, 17) = "psig"

    End With

    For n = 1 To m

```



```

With Sheets("Sheet2")
    x1(n) = CDb1(x1(n)): y1(n) = CDb1(y1(n))
    z1(n) = CDb1(z1(n)): xx1(n) = CDb1(xx1(n))
    .Cells(n + 4, 14).Value = x1(n)
    .Cells(n + 4, 15).Value = y1(n)
    .Cells(n + 4, 16).Value = z1(n)
    .Cells(n + 4, 17).Value = xx1(n)

End With
Next

With Sheets("Sheet4")
.Range("B1:E20000").ClearContents
.Cells(2, 2) = "Time"
.Cells(3, 2) = "minutes"
.Cells(2, 3) = "T inj."
.Cells(3, 3) = "oC"
.Cells(2, 4) = "P inj."
.Cells(3, 4) = "psig"
.Cells(2, 5) = "P out"
.Cells(3, 5) = "psig"

End With

For n = 1 To m
    With Sheets("Sheet4")
        x1(n) = CDb1(x1(n)): y1(n) = CDb1(y1(n))
        z1(n) = CDb1(z1(n)): xx1(n) = CDb1(xx1(n))
        .Cells(n + 4, 2).Value = x1(n)
        .Cells(n + 4, 3).Value = y1(n)
        .Cells(n + 4, 4).Value = z1(n)
        .Cells(n + 4, 5).Value = xx1(n)
    End With
Next
End Sub

Public Sub ReadLogData()
    Dim i As Integer
    Dim filename As String
    m = Sheets("Sheet3").Range("B4")
    ReDim Preserve LogData(1 To m)
    For i = 1 To m
        With Sheets("Sheet4")
            LogData(i).logtime = .Cells(i + 4, 2).Value
            LogData(i).Ts = .Cells(i + 4, 3).Value
            LogData(i).Pinj = .Cells(i + 4, 4).Value
            LogData(i).Pout = .Cells(i + 4, 5).Value
        End With
    Next
End Sub

Public Sub ErrorHandling()
    contact = "This is not a bug-free program!!!" & Chr(13) & _
        "For bug-reporting, please contact Roly Simangunsong at:" & Chr(13) & _
        "rasimangunsong@yahoo.com "
    Msg = "Error # " & Str(Err.Number) & " was generated by " & _
        & Err.Source & Chr(13) & _
        "Error is caused by: " & Err.Description & Chr(13) & _
        contact & Chr(13)
    MsgBox Msg, , "Error", Err.HelpFile, Err.HelpContext
End Sub

```

APPENDIX F**DATA INPUT FOR STEAM FRONT ADVANCEMENT AND
CUMULATIVE OIL PRODUCTION BASED ON ONE DIMENSIONAL
ANALYTICAL MODEL PROGRAM****Run 3 (steam-propane case)**

run_no
3

additive
propane

experiment_date
05/21/2005

researcher
Roly Simangunsong

cell_radius
3.688

cell_length
68.58

tcell
54

Cs
0.21

Co
0.5

Cw
1

dens_sand
167

dens_oil
62

dens_water
62.4

por
0.411690173

Soi
0.726148715592812

Sor
0.390594349450943

Sgi

0.0936861640173443

Swc

0.16516512

porvol

1162.444515

void_length

2.58

o_w_ratio

0.2

iw

5.5

tfu_total

14.8

ratio

0.05

Hv_enthalpy

0.358262377

Lv_enthalpy

182.8470859

PI

7.4

Oil_visc

108

res_heat_capacity

28

heat_loss_coeff

1

t_phase

163

-- Time, minutes Cumulative Oil, cc
Production_Data_Tabulation

0	0
2	0
5	0
8	0
11	0
14	0
17	2
20	5
23	9
26	14
29	20.5
32	27.5
35	35
38	44
41	53
44	63
47	74
50	87
53	100
56	114

59	134
62	180
65	209
68	234
71	252
74	267
77	280
80	291
83	299
86	306.5
89	311.5
92	316.5
95	321.5
98	324.5
101	328
104	331.5
107	334
110	337
113	340
116	342.5
119	346
123	349
127	353
131	362
135	379
139	388
143	392
146	395
151	397.5
156	399
162	400.5
168	401.5
174	402.5
180	403
186	403.5
192	403.5
198	403.5
204	403.5
210	403.5
216	403.5 /

-- time, min x, from top of flange, cm

Thermo_Tabulation

62	12
89	27.5
103	42.8
144	68.3 /

-- Time, minutes	Tinj, oC	Pinj,psig	Pout,psig
Log_Data_Tabulation			
0.05033333	48.31	259.65	261.27
0.5446666	48.81	263.01	263.18
1.045333	52.84	263.29	262.87
1.545167	59.09	262.69	262.83
2.045	74.11	263.09	263.24
2.544833	156.71	263.12	262.94
3.0455	203.44	263.67	261.95
3.545333	206.65	263.39	262.37
4.045167	206.98	260.75	261.49
4.544167	208.02	261.32	261.53
5.044833	210.03	264.56	261.7
5.544667	210.7	263.17	261.59
6.045333	212.49	266.68	261.69
6.545166	213.82	263.16	261.27
7.045	214.66	266.32	262.1

7.544833	216.07	267.91	260.92
8.045667	213.1	274.6	261.8
8.545333	213.52	273.74	261.27
9.045167	212.07	276.13	261.4
9.545	211.86	275	261.38
10.04583	212.47	282.79	261.53
10.54567	212.69	284.67	261.54
11.0455	214.52	286.34	261.5
11.54533	215.37	291.26	261.5
12.04417	216.14	291.79	261.56
12.54483	216.04	294.95	261.36
13.04467	216.42	293.63	261.37
13.5445	215.82	297.64	261.49
14.04433	215.3	299.78	261.59
14.54517	215.33	300.91	261.62
15.045	216.71	298.7	261.59
15.5465	216.59	300.56	261.45
16.0455	216.72	307.25	261.54
16.54433	217.81	308.86	261.48
17.04517	217.35	311.35	261.47
17.545	218.56	311.55	261.25
18.04567	218.15	310.92	261.31
18.5455	218.01	314.86	261.26
19.04533	219.37	317.98	261.24
19.54517	219.07	321.62	261.17
20.045	219.72	323.91	261.19
20.54483	218.67	326.36	261.17
21.04467	218.85	329.42	261.32
21.54533	219.34	333.67	261.65
22.04517	218.45	329.75	261.7
22.545	218.83	332.4	261.9
23.04483	219.37	331.03	261.63
23.5455	219.53	331.07	262.43
24.04533	219.34	328.21	261.87
24.54617	219.49	328.17	262.56
25.045	220.01	328.29	262.58
25.54583	220.25	328.56	260.57
26.0465	220.25	328.02	262.62
26.54533	220.32	327.36	262.63
27.04517	220.11	326.03	261.46
27.546	220.01	324.34	261
28.04483	219.83	322.9	262.29
28.54567	219.69	321.64	262.62
29.0455	219.55	320.3	261.6
29.54433	219.63	322.68	255.4
30.045	219.51	321.63	256.63
30.54483	219.56	322.57	258.55
31.04567	219.69	322.55	259.19
31.5455	219.72	324.55	257.69
32.04533	219.77	325.09	258.21
32.54517	220.01	326.37	258.97
33.045	220.19	328.02	255.49
33.54567	220.35	328.5	257.73
34.0455	220.63	330.76	258.47
34.54533	220.91	335	257.11
35.04517	220.88	339.24	255.46
35.545	220.76	341.72	255.99
36.04483	220.89	343.74	256.5
36.5455	221.02	346.53	258.51
37.04533	220.97	345.82	258.9
37.54517	220.93	345.34	257.99
38.045	220.86	348.03	258.37
38.54483	220.67	346.9	256.21
39.0455	220.64	345.31	257.56
39.54533	220.64	345.24	257.06
40.04517	220.27	345.99	256.25

40.545	220.25	344.78	258.21
41.04483	220.33	344.88	258.25
41.5455	220.58	345.32	258.44
42.0445	220.44	343.98	257.73
42.54433	220.32	343.92	256.8
43.045	220.32	351.39	257.04
43.54483	219.91	347	256.53
44.04567	220.22	349.41	258.07
44.54533	220.33	350.13	258.35
45.04517	219.22	346.82	258.05
45.545	220.46	347.09	260.03
46.044	220.42	344.69	258.71
46.54467	220.73	344.5	257.76
47.0445	220.66	346.43	258.77
47.54533	220.63	348.32	260.28
48.045	220.56	348.09	262.5
48.544	220.79	350.92	262.64
49.04567	221.14	352.57	262.86
49.5445	220.96	352.56	262.93
50.04533	220.78	352.36	262.99
50.54517	220.46	350.63	261.92
51.045	220.48	349.61	261.86
51.54567	220.45	347.52	262.08
52.04633	219.91	344.42	262.3
52.54533	219.97	342.71	262.74
53.04517	219.45	340.02	262.89
53.545	219.17	337.99	263.07
54.04483	219.14	335.15	261.74
54.5455	218.51	332.02	256.71
55.04533	218.16	325.88	261.95
55.54517	218.09	322.67	262.53
56.045	217.79	320.52	262.22
56.54483	217.47	320.78	263.17
57.04467	217.43	321.52	262.74
57.54533	217.27	320.35	261.36
58.04517	217.13	318.08	260.57
58.54417	217.01	318.13	261.75
59.04383	216.82	317.54	262.18
59.54467	216.6	317.36	262.45
60.04533	216.52	315.55	263.01
60.54517	216.14	315.2	262.99
61.045	216.22	312.93	262.88
61.54483	216.18	312.98	260.72
62.04467	216.28	311.47	260.58
62.5445	216.55	311.45	259.22
63.04517	216.19	309.88	258.71
63.545	216.46	309.57	261.89
64.04483	215.98	307.54	261.74
64.54466	215.46	306.54	259.16
65.0455	215.48	302.03	259.63
65.54533	216.15	302.45	258.89
66.045	216.65	300.41	258.33
66.54483	215.95	301.19	259.87
67.04567	216.4	304.14	259.35
67.5455	216.94	305.56	258.63
68.04533	216.8	306.14	261.31
68.54417	216.66	307.42	261.49
69.044	217.15	306.43	261.96
69.54567	216.54	306.15	261.77
70.0455	216.94	305.24	261.69
70.54533	216.63	305.31	261.98
71.04517	216.67	304.31	261.92
71.54501	217.14	302.26	262.61
72.04666	216.64	303.33	262.52
72.54467	216.89	303.05	262.89
73.04433	217.09	304.83	262.9

73.54517	216.97	305.14	260.74
74.04501	216.9	303.89	261.26
74.54383	216.72	304.88	261.39
75.04467	216.76	305.67	261.68
75.54533	216.19	305.95	261.98
76.04617	216.8	305.33	261.91
76.54501	217.01	306.62	261.75
77.04383	216.77	305.58	262.09
77.5455	217.14	306.89	262.32
78.04533	216.95	305.56	262.32
78.54517	216.41	307.96	262.43
79.04501	216.47	305.16	262.7
79.54483	216.52	305.09	262.42
80.04567	216.58	304.2	262.57
80.5445	216.29	302.38	262.61
81.04517	216.78	303.2	260.2
81.54501	216.46	303.09	260.56
82.04483	216.55	301.82	259.92
82.54567	215.71	301.35	260.37
83.0455	215.91	297.85	261.05
83.54533	216.22	298.45	261.04
84.04501	216.09	298.61	258.59
84.54483	215.9	300.3	261
85.04567	215.51	301.31	259.13
85.5455	216.19	299.75	260.6
86.04533	216.71	299.98	259.97
86.54517	217.3	302.53	260.67
87.04501	217.41	300.96	260.3
87.54567	216.8	301.92	258.83
88.0455	216.97	300.15	261.25
88.54433	216.29	299.58	260.74
89.04517	215.93	296.75	261.5
89.54501	216.24	295.12	260.96
90.04567	216.44	294.18	259.85
90.54467	215.2	291.56	260.75
91.04433	214.62	289.48	260.9
91.54417	214.71	288.61	260.85
92.04501	214.05	287.05	260.93
92.54483	213.98	285.41	261.67
93.0465	213.74	283.95	261.55
93.54533	213.26	283.09	261
94.04433	214.07	285.14	261.86
94.54417	214.27	286.48	261.53
95.04483	214.49	285.66	261.29
95.54467	215.31	290.17	261.25
96.04533	216.23	289.2	261.69
96.54433	216.96	291	261.47
97.04501	216.07	288.8	261.14
97.544	216.05	287.56	260.63
98.04567	215.91	285.91	261.75
98.54533	214.98	287.13	261.81
99.04517	215.25	285.26	261.83
99.54417	214.82	285.43	261.18
100.0448	214.63	284.14	261.84
100.5447	214.94	285.27	261.59
101.0455	214.74	283.74	261.91
101.5443	214.42	283.54	261.26
102.045	213.62	281.89	261.08
102.5448	213.17	280.33	261.27
103.0457	212.49	278.11	261.18
103.5455	212.92	276.86	262.07
104.0453	212.93	275.86	260.3
104.5452	213.88	275.38	260.93
105.044	213.98	278.4	261.59
105.5457	213.9	277.33	261.74
106.0455	213.99	279.15	261.25

106.5453	214.08	281.63	261.7
107.0442	215.6	281.79	261.55
107.545	216.02	283.36	260.99
108.0457	216.14	283.43	261.52
108.5465	215.77	282.65	261.41
109.0462	215.34	282.78	261.61
109.5452	215.43	281.47	261.56
110.045	214.92	280.7	260.84
110.5448	215.15	279.49	259.34
111.0455	215.53	280.39	261.57
111.5453	215.05	280.01	261.6
112.0452	214.3	281.63	261.69
112.544	213.67	282.74	262.03
113.0438	213.46	281.03	261.9
113.5455	213.34	281.92	262.21
114.0453	213.27	284.69	262.24
114.5452	213.75	283.02	262.71
115.045	213.16	281.45	262.75
115.5448	213.38	281.57	262.89
116.0455	213.97	280.12	260.84
116.5453	213.31	278.97	260.59
117.0452	213.81	280.98	261.02
117.545	214.92	279.72	261.24
118.0448	215.34	276.54	257.92
118.5447	214.96	275.05	259.61
119.0445	213.91	275.73	262.36
119.5453	213.73	272.25	261.98
120.046	213.34	271.53	261.25
120.5448	212.71	271.55	261.84
121.0447	212.86	274.87	261.22
121.5455	213.9	273.06	260.05
122.0453	214.21	274.33	262.42
122.5452	212.94	276.02	262.38
123.045	213.74	275.17	262.55
123.5457	213.12	276.79	262.72
124.0455	212.92	276.55	262.88
124.5453	213.62	276.66	263.07
125.0452	214.27	278.17	261.25
125.545	214.24	276.96	260.7
126.0457	214.15	277.02	261.44
126.5455	214.17	277.56	261.59
127.0453	213.27	276.02	261.44
127.5452	213.42	274.44	261.37
128.045	213.37	274.87	260.68
128.5457	213.07	273.74	260.88
129.0455	213.23	273.71	261.59
129.5453	212.68	272.23	259.93
130.0452	212.91	273.49	261.77
130.545	213.47	274.51	261.7
131.0438	214.18	273.87	260.69
131.5455	213.69	272.26	262.08
132.0445	213.53	271.4	262.24
132.5443	213.17	272.79	260.93
133.045	213.16	270.05	262.09
133.5448	213.21	269.88	262.44
134.0447	212.8	268.75	262.39
134.5453	213.16	268.15	262.35
135.0452	213.15	266.98	261.93
135.545	213.2	265.63	261.38
136.0448	213.1	265.69	261.18
136.5447	213.51	266.66	261.04
137.0445	214.17	266.64	258.64
137.5453	214.37	266.6	258.05
138.0442	213.37	267.14	258.09
138.544	214.64	268.51	258.05
139.0457	215	268.09	257.84

139.5445	215.24	268.36	258.35
140.0462	214.1	269.41	259.1
140.5452	215.73	275.77	261.87
141.045	214.87	276.22	263.39
141.5457	214.35	279.76	263.48
142.0455	214.23	279.08	262.24
142.5453	214.28	278.49	261.19
143.0452	213.82	274.12	260.92
143.545	213.82	273.58	260.99
144.0457	214.2	272.92	261.17
144.5455	213.95	269.98	260.39
145.0453	214.46	271.21	260.16
145.5442	213.17	269.69	259.37
146.045	213.1	269.21	259.59
146.5448	212.67	268.14	259.38
147.0455	212.89	266.83	261.3
147.5453	213	268.62	259.97
148.0452	212.72	266.82	261.88
148.544	212.85	268.61	261.42
149.0448	212.61	267.38	261.22
149.5455	212.63	268.02	260.3
150.0453	212.83	265.17	261.31
150.5452	213.1	264.34	260.61
151.0442	213.18	263.86	257.76
151.544	213.41	263.11	259.26
152.0455	213.83	262.5	260.18
152.5453	213.43	263.22	259.83
153.0443	213.71	263.76	260.78
153.546	213.78	264.83	260.34
154.0448	213.19	265.4	261.64
154.5457	213.18	265.42	261.39
155.0455	213.79	265.71	261.48
155.5453	213.88	266.83	261.88
156.045	214.56	267.1	261.93
156.5458	214.31	267.97	261.94
157.0465	214.35	268.6	262.2
157.5455	214.8	268.37	261.88
158.0443	214.61	268.38	261.89
158.5452	214.72	268.3	261.91
159.044	214.97	268.94	259.21
159.5447	214.95	268.05	259.55
160.0455	214.88	267.62	261.04
160.5443	215.26	268.1	262.3
161.0452	215.18	268.61	262.56
161.544	214.96	270.09	260.06
162.0457	214.2	268.99	260.44
162.5455	214.7	268.64	260.02
163.0443	215.33	268.67	259.85
163.5452	215.87	268.6	259.51
164.044	215.46	269.13	260.63
164.5438	215.25	269.72	261.15
165.0455	215.47	270.08	261.8
165.5453	215.68	274.43	262.07
166.0443	215.79	276.86	260.71
166.545	215.54	275.23	261.15
167.0448	215.12	272.78	262.9
167.5447	214.44	275.67	257.68
168.0453	214.91	268.5	261.56
168.5452	214.12	270.42	257.53
169.045	213.39	266.44	259.93
169.5448	213.88	266.75	261.1
170.0455	213.43	268.93	259.69
170.5463	213.4	265.75	259.56
171.047	213.11	268.96	261.49
171.546	213.67	267.29	262.36
172.0458	213.66	264.57	258.69

172.5465	213.86	266.63	261.23
173.0463	212.91	266.55	262.11
173.547	213.32	268.15	262.68
174.046	213.95	268.04	262.79
174.5458	213.99	266.4	257.48
175.0465	213.37	266.6	256.81
175.5463	214.41	264.05	257.7
176.0472	213.71	263.93	257.63
176.5452	213.63	264.09	259.3
177.045	213.33	263.91	259.11
177.5447	213.72	271.17	258.5
178.0455	214.98	269.73	259.84
178.5453	214.17	272.4	261.12
179.0452	214.8	270.8	261.59
179.545	214.02	271.72	262.84
180.0457	213.27	270.87	263.01
180.5465	212.99	270.52	262.71
181.0443	214.33	267.37	257.02
181.5442	214.53	264.69	256.43
182.045	213.75	265.05	256.33
182.5448	212.26	264.29	256.18
183.0447	213.07	263.49	256.69
183.5453	213.99	263.46	256.68
184.0452	213.18	263.35	256.59
184.545	212.88	263.73	256.6
185.0448	213.26	263.95	256.62
185.5455	212.29	264.28	256.78
186.0453	212.66	264.56	256.85
186.5452	213.34	263.82	257.19
187.045	212.75	262.66	256.99
187.5448	212.77	263.41	257.01
188.0455	212.43	263.94	256.76
188.5453	213.08	262.96	257.24
189.0452	212.58	262.77	256.54
189.545	212.55	263.52	256.87
190.0448	212.08	263.87	256.38
190.5457	212.23	262.51	256.83
191.0455	212.88	263.99	256.4
191.5462	213.24	262.13	257.01
192.045	212.34	262.65	256.79
192.5448	213.01	261.77	256.8
193.0457	213.78	264.42	257.16
193.5455	213.57	262.43	257.15
194.0453	213.18	264.7	256.98
194.5452	213.23	262.97	257.35
195.045	213.5	263.27	257.18
195.5457	212.93	263.71	257.12
196.0455	213.8	263.37	256.69
196.5453	214.41	263.8	257.35
197.0452	214.46	263.33	257.63
197.545	214.14	264.72	257.74
198.0457	214.02	264.48	257.22
198.5465	213.77	264.17	257.4
199.0453	213.52	263.9	257.55
199.5442	213.76	264.05	257.54
200.045	213.08	262.74	257.59
200.5448	212.99	261.92	257.35
201.0455	214.39	262.27	257.15
201.5453	213.91	262.25	258.06
202.0452	213.16	262.99	257.23
202.545	214.09	262.52	258.32
203.0448	214.15	262.97	257.64
203.5455	214.58	263.56	257.73
204.0453	214.99	264.15	257.48
204.5452	214.22	267.55	257.64
205.045	214.63	267.79	258.66

205.5448	213.64	268.86	258.68
206.0455	213.26	268.01	260.03
206.5453	214.16	268.36	259.76
207.048	225.61	262.02	257.08
207.5478	225.27	260.07	256.45
208.0467	225.08	259.25	256.08
208.5483	224.18	258.55	256.41
209.0473	222.75	258.8	256.2
209.548	222.45	258.58	256.86
210.0478	222.68	258.77	255.71
210.5477	223.01	258.83	257.05
211.0483	222.71	258.8	257.97
211.5482	222.37	259.24	258.19
212.048	222.17	259.9	256.68
212.5478	221.94	259.76	257.8
213.0477	222.16	258.6	255.8
213.5475	221.8	259	258.18
214.0482	222.11	259.71	258.16
214.548	222.18	257.53	254.48
215.0478	221.29	256.41	254.74
215.5468	220.67	256.09	254.33
216.0475	220.81	255.95	255.39
216.5483	221.53	256.3	254.49
217.048	222.37	257.89	255.48
217.5478	221.64	258.79	256.22
218.0468	223.22	259.11	255.83
218.5475	222.29	258.98	256.07
219.0483	222.65	258.84	255.79
219.5482	223.33	259.04	255.65
220.0488	223.3	258.97	255.28
220.5477	223.17	259.37	256.04
221.0485	224.96	259.47	256.37
221.5483	225.61	259.38	256.4
222.0482	224.07	259.13	255.83
222.548	223.52	258.66	255.75
223.0478	223.74	258.09	255.89
223.5477	224.96	257.53	255.87
224.0483	223.38	257.22	255.46
224.5482	223.35	255.83	253.18
225.047	221.92	255.28	253.53
225.5478	221.78	255.74	253.68
226.0477	221.37	256.18	254.21
226.5483	221.66	256.1	254.77
227.0482	222.38	256.55	254.18
227.547	223.67	256.48	254.67
228.0478	223.06	256.79	255.1
228.5477	221.99	257.24	254.94
229.0483	223.44	257.81	255.58
229.5482	223.98	257.98	255.81
230.048	223.19	257.91	255.66
230.5478	222.71	258.13	255.87
231.0468	224.09	258.37	255.24
231.5483	223.58	258.55	255.55
232.0473	224.01	258.93	255.57
232.548	224.4	258.97	258.27
233.0478	223.19	258.19	255.01
233.5487	222.94	259.22	256.53
234.0485	223.23	259.78	257.44
234.5473	223.69	260.39	257.87
235.048	223.11	260.93	258.22
235.5478	223.7	260.42	255.8
236.0487	223.54	258.97	255.45
236.5467	224.85	258.58	255.72
237.0473	224.35	258.71	255.7
237.5482	221.92	258.65	256.53
238.048	223.92	258.78	255.35

238.5477	222.82	258.74	255.85
239.0467	223.1	258.75	256.17
239.5483	224.84	258.62	256.07
240.0482	224.47	258.32	255.77
240.548	222.54	258.24	256.31
241.0478	223.29	258.71	255.31
241.5477	224.39	259.61	255.77
242.0483	223.31	260.89	256.24
242.5482	225.11	262.09	256.3
243.047	226.68	262.25	256.95
243.5478	227.29	261.34	256.49
244.0477	228.05	260.36	256.33
244.5483	225.94	259.38	256.44
245.0482	212.78	273.2	263.76
245.548	212.88	273.35	263.24
246.0478	212.88	273.37	262.92
246.5477	212.62	273.88	263.67
247.0483	212.49	273.37	264.23
247.5473	212.64	273.35	264.25
248.048	212.72	273.39	263.39
248.5478	212.81	273.42	263.91
249.0467	212.83	273.24	263.34
249.5475	212.87	273.73	262.94
250.0492	213.07	273.27	262.76
250.5472	213.02	272.7	263.05
251.047	212.86	272.94	263.17
251.5477	212.63	272.57	263.28
252.0485	212.64	272.99	263.48
252.5482	212.5	272.8	263.31
253.048	212.52	272.6	263.43
253.5488	212.47	272.86	263.48
254.0477	212.51	273.37	263.86
254.5475	212.51	272.88	263.64
255.0473	212.59	272.82	263.3
255.5482	212.82	273.12	263.78
256.048	212.79	273.04	263.44
256.5477	212.42	273.69	263.06
257.0467	212.33	273.43	250.72 /

Run 4 (pure steam case)

run_no
4

additive
none

experiment_date
05/20/2005

researcher
Roly Simangunsong

cell_radius
3.688

cell_length
68.58

tcell
54

Cs
0.21

Co
0.5

Cw
1

dens_sand
167

dens_oil
62

dens_water
62.4

por
0.411690173

Soi
0.741148716

Sor
0.415

Sgi
0.093686164

Swc
0.16516512

porvol
1162.444515

void_length
2.58

o_w_ratio
0.2

iw
5.5

tfu_total
44.8

ratio
0

Hv_enthalphy
0

Lv_enthalphy
0

PI
7.8

Oil_visc
280

res_heat_capacity
34.33456123

heat_loss_coeff
10

t_phase
165

-- Time, minutes	Cumulative Oil, cc
0	0
3	0
6	0
9	0
12	0
15	0
18	0
21	0
24	1
27	3
30	4
33	6
36	8
39	9.5
42	11
45	13
48	16
51	18
54	19.5
57	21
60	23
63	24
66	26
69	28
72	30
75	31
78	32
81	35
84	36
87	39
90	41
93	43
96	46
99	48
102	50
105	51.5
108	53.5
111	56.5
114	58.5
117	60
120	62
123	64.5
126	67.5
129	71
132	74
135	77
138	80.5
141	84
144	86.5
147	89.5
150	92.5
153	95
156	98
159	100
162	103
165	106
168	108
171	110.5
174	117.5
177	132.5
180	153.5

183	178.5
186	198.5
189	227.5
192	272.5
195	304.5
198	322.5
201	331.5
204	337.5
207	340.5
210	344
213	346
216	353
219	363
222	367
225	370
228	373
231	375
234	377.5
237	380.5
240	384
243	387
246	389
249	391
252	392
255	393
258	393.5
261	394
264	394
267	394
270	394
273	394 /

-- time, min	x, from top of flange, cm
Thermo_Tabulation	
102	12
145	27.5
175	42.8
202	68.3 /

--Time,min	Tinj, oC	Pinj, psig	Poutlet, psig
Log_Data_Tabulation			
0.0548	43.59	269.73	271.000
0.5473334	66.55	266.31	268.000
1.048	82.34	266.52	268.000
1.547833	198.82	269.22	270.000
2.046833	210.78	269.94	269.000
2.5475	210.23	265.57	267.000
3.048333	210.18	264.99	267.000
3.548167	210.54	268.5	267.000
4.048	211.38	270.65	268.000
4.547667	212.42	271.22	268.000
5.046667	212.73	271.72	267.000
5.547333	212.71	275.47	268.000
6.048167	212.59	275.83	268.000
6.548	212.92	279.96	269.000
7.046834	212.99	278.77	268.000
7.547667	212.9	280.85	268.000
8.048333	213.21	282.67	268.000
8.548167	213.63	285.47	267.000
9.048	214.77	290.15	268.000
9.548666	215.37	290.95	268.000
10.0485	216.3	292.29	268.000
10.54833	216.64	292.54	268.000
11.04817	216.47	294.87	268.000

11.548	215.65	295.64	268.000
12.04783	215.38	295.21	268.000
12.54667	215.46	297.05	268.000
13.0475	215.76	298.28	268.000
13.54817	216.09	300.71	268.000
14.048	216.41	302.67	268.000
14.547	216.76	305.39	268.000
15.04767	217.12	307.51	268.000
15.5475	217.39	309.1	268.000
16.04817	217.71	310.31	268.000
16.548	218.04	313.22	268.000
17.04883	218.42	315.49	268.000
17.54767	218.87	318.7	268.000
18.0485	219.39	321.22	265.000
18.54833	219.48	322	268.000
19.049	219.39	321.34	265.000
19.547	219.4	322.08	269.000
20.04767	219.61	323.2	269.000
20.5475	219.88	324.41	266.000
21.04833	220.05	325.87	268.000
21.54817	220.23	327.75	269.000
22.04883	220.45	328.88	269.000
22.54683	220.67	329.97	269.000
23.0475	220.85	331.58	269.000
23.54833	221.03	332.53	269.000
24.049	221.3	334.21	269.000
24.547	221.43	334.75	245.000
25.04783	221.46	334.12	269.000
25.54767	221.34	333.77	266.000
26.04833	221.47	335.11	269.000
26.54817	221.62	336.09	269.000
27.048	221.69	336.51	268.000
27.54783	221.82	337.51	269.000
28.04767	221.95	338.25	269.000
28.54833	221.95	338.59	269.000
29.04817	222.06	338.61	269.000
29.54717	222.08	338.43	269.000
30.04783	222.08	338.02	268.000
30.54767	222.07	338.86	267.000
31.04833	222.05	338.65	269.000
31.54817	222.11	339.12	269.000
32.048	222.24	339.15	268.000
32.54783	222.27	339.2	268.000
33.04766	222.38	340.46	268.000
33.54833	222.44	341.39	263.000
34.04817	222.51	341.66	269.000
34.54717	222.57	341.63	269.000
35.04784	222.64	341.94	268.000
35.54767	222.63	342.69	268.000
36.0485	222.79	343.45	268.000
36.54833	222.88	344.03	269.000
37.048	222.91	343.16	266.000
37.54784	222.87	343.65	268.000
38.04767	222.77	343.07	268.000
38.5475	222.84	344.32	266.000
39.04833	222.92	344.47	258.000
39.54816	222.92	344.47	262.000
40.048	223.03	344.07	261.000
40.54683	222.9	343.34	264.000
41.0475	222.89	344.05	262.000
41.54833	222.95	344.59	262.000
42.04816	222.98	344.8	263.000
42.547	223.04	345.3	259.000
43.04784	223.02	345.23	254.000
43.54767	222.95	343.45	261.000
44.04917	222.9	343.5	258.000

44.54717	222.89	343.79	262.000
45.048	222.89	343.82	262.000
45.54784	222.93	344.52	262.000
46.04767	223.09	345.03	265.000
46.5475	223.14	345.45	266.000
47.04816	223.18	346.39	261.000
47.548	223.19	346.17	257.000
48.04784	223.21	346.19	248.000
48.54767	223.19	344.94	259.000
49.0475	223	343.6	258.000
49.54816	222.91	343.88	258.000
50.049	222.87	343.65	264.000
50.54784	222.88	344.33	265.000
51.04683	222.9	344.27	265.000
51.5475	223.13	345.24	263.000
52.04816	223.15	345.54	263.000
52.548	223.14	345.76	269.000
53.047	223.16	346.16	263.000
53.54767	223.25	346.77	266.000
54.0485	223.3	347.12	269.000
54.54833	223.34	347.51	260.080
55.04717	223.36	347.48	264.000
55.54784	223.29	347.08	265.000
56.04866	223.28	347.13	258.000
56.5475	223.24	346.93	263.000
57.04734	223.17	346.06	268.000
57.54816	223.27	346.34	266.000
58.048	223.23	346.5	268.000
58.54767	223.27	346.7	267.000
59.0475	223.18	346.58	267.000
59.54833	223.33	347.16	257.000
60.04816	223.19	345.51	263.000
60.548	223.12	345.3	262.000
61.04683	223.05	345.01	264.000
61.54767	223.05	345.2	265.000
62.04833	223	345.33	263.000
62.54816	223.09	345.28	263.000
63.047	223.13	345.71	263.000
63.54784	223.11	345.68	265.000
64.04767	223.17	346.03	266.000
64.54933	223.24	346.37	269.000
65.04733	223.31	346.44	258.000
65.548	223.17	345.66	259.000
66.04867	223.09	345.18	256.000
66.54667	223.03	344.63	265.000
67.0475	223	344.48	268.000
67.54816	223.06	344.98	265.000
68.048	223.08	345.11	263.000
68.547	223.11	345.15	264.000
69.04766	223.12	345.75	266.000
69.54833	223.21	345.87	268.000
70.04817	223.26	346.09	267.000
70.548	223.21	345.87	265.000
71.04784	223.18	346	268.000
71.54684	223.22	346.13	269.000
72.0475	223.25	346.57	267.000
72.54833	223.29	347.14	263.000
73.04716	223.29	346.58	263.000
73.54784	223.37	346.53	261.000
74.04867	223.24	346.25	260.000
74.5475	223.21	346.15	263.000
75.04833	223.19	346.05	265.000
75.54817	223.23	345.98	258.000
76.048	223.3	346.11	258.000
76.54684	223.2	345.91	261.000
77.0475	223.15	345.81	263.000

77.54833	223.18	346.15	266.000
78.04817	223.26	346.06	260.000
78.547	223.21	345.68	251.000
79.04784	223.12	345.04	253.000
79.54766	223.09	345.09	252.000
80.04833	223.16	344.7	251.000
80.54817	223.04	344.43	267.000
81.048	222.98	344.57	263.000
81.54684	222.97	344.64	265.000
82.04766	223.1	344.85	264.000
82.54833	223.11	344.93	261.000
83.04817	223.1	345.44	263.000
83.548	223.12	345.79	263.000
84.04784	223.17	345.89	262.000
84.54666	223.19	346.15	260.000
85.04933	223.26	346.15	261.000
85.54817	223.23	346.36	264.000
86.048	223.25	346.51	262.000
86.54784	223.24	346.74	259.000
87.04684	223.24	346.56	259.000
87.5475	223.29	346.5	261.000
88.04817	223.33	347.03	262.000
88.548	223.29	347.04	263.000
89.047	223.26	346.36	263.000
89.54766	223.3	347.23	260.000
90.0485	223.37	347.68	261.000
90.54833	223.53	348.78	268.000
91.048	223.62	349.68	266.000
91.547	223.73	350.27	265.000
92.04766	223.77	350.5	263.000
92.5485	223.88	351.2	263.000
93.04833	223.97	351.3	262.000
93.54716	223.9	350.61	253.000
94.048	223.79	350.21	255.000
94.54766	223.72	349.68	262.000
95.04666	223.69	349.69	263.000
95.54733	223.69	349.6	260.000
96.04817	223.73	349.62	265.000
96.548	223.73	349.69	264.000
97.04784	223.68	349.89	265.000
97.54766	223.71	350.01	266.000
98.04833	223.77	349.99	266.000
98.54817	223.75	350.06	263.000
99.048	223.75	350.01	262.000
99.54784	223.68	349.59	262.000
100.0477	223.67	349.63	262.000
100.5483	223.69	349.48	266.000
101.0482	223.62	349.23	262.000
101.548	223.6	349.16	268.000
102.0478	223.62	349.2	262.000
102.5477	223.6	349.03	266.000
103.0483	223.62	349.32	264.000
103.5492	223.59	348.91	258.000
104.0472	223.61	349.14	261.000
104.5478	223.57	348.84	262.000
105.0477	223.59	348.82	263.000
105.5493	223.57	348.84	262.000
106.0473	223.59	349.24	264.000
106.548	223.56	348.82	258.000
107.0478	223.54	348.84	263.000
107.5468	223.54	348.86	258.000
108.0475	223.58	348.73	258.000
108.5483	223.55	348.44	259.000
109.048	223.49	348.53	260.000
109.547	223.57	348.31	264.000
110.0487	223.58	348.43	267.000

110.5475	223.55	348.52	262.000
111.0483	223.53	348.55	256.000
111.5482	223.44	348.33	257.000
112.047	223.48	348.08	260.000
112.5477	223.5	347.61	253.000
113.0475	223.38	346.95	259.000
113.5483	223.32	347.3	261.000
114.0472	223.29	347	262.000
114.548	223.33	346.85	262.000
115.0478	223.31	347.1	266.000
115.5467	223.31	347.16	256.000
116.0473	223.33	346.59	263.000
116.5482	223.33	346.95	264.000
117.048	223.35	347.35	260.000
117.5468	223.35	347.11	249.000
118.0477	223.32	346.52	255.000
118.5483	223.21	345.97	259.000
119.0482	223.3	346.38	252.000
119.5472	223.3	346.35	257.000
120.0478	223.27	346.34	261.000
120.5477	223.23	346.11	257.000
121.0483	223.16	345.53	261.000
121.5482	223.18	345.72	264.000
122.0472	223.23	345.98	262.000
122.5478	223.25	346	264.000
123.0468	223.16	345.6	266.000
123.5475	223.18	346.06	262.000
124.0482	223.22	345.94	260.000
124.548	223.22	345.98	263.000
125.0478	223.24	345.82	263.000
125.5477	223.19	346.08	259.000
126.0475	223.17	345.63	261.000
126.5483	223.15	345.79	264.000
127.048	223.15	345.72	263.000
127.547	223.15	345.54	264.000
128.0477	223.19	345.82	251.000
128.5485	223.1	345.02	258.000
129.0483	223.03	344.84	257.000
129.5482	222.94	344.35	259.000
130.048	222.96	344.17	262.000
130.5477	222.96	343.94	254.000
131.0475	222.82	342.88	265.000
131.5483	222.8	342.64	264.000
132.0482	222.75	342.91	261.000
132.547	222.76	342.96	267.000
133.0478	222.82	343.11	266.000
133.5477	222.89	343.5	264.000
134.0483	222.91	343.66	266.000
134.5482	222.87	343.24	265.000
135.047	222.87	343.17	262.000
135.5478	222.86	343.25	264.000
136.0485	222.78	343.26	264.000
136.5483	222.73	343.1	267.000
137.0473	222.75	342.88	269.000
137.548	222.81	343.28	268.000
138.0468	222.88	343.34	264.000
138.5477	222.91	343.48	268.000
139.0483	222.93	343.78	262.000
139.5482	222.89	343.94	262.000
140.048	222.84	343.43	253.000
140.5478	222.81	342.67	260.000
141.0468	222.74	341.97	261.000
141.5483	222.61	341.76	261.000
142.0482	222.56	341.36	236.000
142.548	222.32	338.02	254.000
143.0478	222.22	337.6	256.000

143.5477	222.11	337.3	260.000
144.0493	222.06	336.99	264.000
144.5473	221.97	336.95	267.000
145.048	221.93	336.87	266.000
145.5488	221.93	337.19	267.000
146.0468	221.91	337.37	265.000
146.5475	222.06	337.16	262.000
147.0483	222.06	337.28	264.000
147.5482	222.02	337.4	269.000
148.048	222.11	337.33	269.000
148.5477	222.1	337.28	268.000
149.0475	222.04	337.34	269.000
149.5492	222.01	337.42	268.000
150.049	221.97	337.13	268.000
150.548	221.94	337.25	269.000
151.0478	222.04	337.11	264.000
151.5477	221.97	336.75	268.000
152.0483	221.92	336.18	269.000
152.5482	221.87	336.78	267.000
153.047	221.81	336.68	269.000
153.5478	221.83	336.52	268.000
154.0467	221.83	336.34	268.000
154.5483	221.85	335.95	268.000
155.0482	221.8	335.61	268.000
155.547	221.72	335.46	267.000
156.0478	221.76	335.22	268.000
156.5477	221.69	334.78	267.000
157.0493	221.6	334.59	268.000
157.5473	221.57	334.32	268.000
158.048	221.55	333.98	268.000
158.5488	221.51	333.67	266.000
159.0468	221.44	333.56	268.000
159.5475	221.42	333.03	267.000
160.0482	221.42	332.77	268.000
160.548	221.34	332.45	269.000
161.0478	221.23	331.93	268.000
161.5477	221.19	331.61	268.000
162.0475	221.12	331.46	268.000
162.5483	221.18	330.79	268.000
163.048	221.19	331.56	269.000
163.5478	221.18	330.56	268.000
164.0477	221.11	330.08	268.000
164.5467	221.04	330.24	269.000
165.0473	220.93	329.94	269.000
165.5482	221.11	329.63	268.000
166.048	220.98	329.18	268.000
166.5468	220.84	328.75	268.000
167.0475	220.75	328.3	267.000
167.5483	220.77	327.45	267.000
168.0482	220.75	327.37	268.000
168.547	220.65	326.92	267.000
169.0478	220.59	326.56	269.000
169.5477	220.6	326.24	265.000
170.0492	220.43	325.85	263.000
170.5482	220.36	324.83	267.000
171.048	220.26	323.28	262.000
171.5478	220.21	322.8	265.000
172.0477	219.99	321.46	267.000
172.5493	219.96	321.89	267.000
173.0473	219.9	320.86	267.000
173.548	219.87	320.31	268.000
174.0487	219.82	319.49	267.000
174.5467	219.83	318.91	267.000
175.0475	219.73	318.41	268.000
175.5482	219.53	318.19	269.000
176.048	219.3	317.63	268.000

176.547	219.21	316.98	269.000
177.0477	219.3	316.26	268.000
177.5483	219.29	315.43	266.000
178.0482	219.29	314.81	263.000
178.5472	219.2	313.44	258.000
179.0478	219.22	311.92	257.000
179.5487	219.36	308.95	264.000
180.0485	219.51	307.03	267.000
180.5483	218.92	305.88	269.000
181.0472	218.69	305.01	268.000
181.5478	218.33	304.42	268.000
182.0477	217.92	303.88	268.000
182.5467	218.03	303.31	268.000
183.0473	217.87	303.07	268.000
183.5482	217.66	301.96	268.000
184.048	217.46	301.34	268.000
184.5468	217.3	300.47	268.000
185.0475	217.12	300.31	268.000
185.5483	217.11	299.6	268.000
186.0482	217.45	299.54	268.000
186.547	217.5	298.88	267.000
187.0478	217.35	298.05	265.000
187.5485	216.92	296.97	266.000
188.0483	216.72	295.98	266.000
188.5472	216.51	294.91	268.000
189.048	216.48	294.26	264.000
189.5478	216.39	293.53	263.000
190.0485	216.37	292.61	263.000
190.5483	216.11	291.66	263.000
191.0492	215.93	290.57	267.000
191.547	215.75	290.03	268.000
192.0478	215.74	289.33	268.000
192.5477	215.56	288.95	268.000
193.0493	215.99	288.61	268.000
193.5473	216.16	288.18	268.000
194.048	216.09	288.01	268.000
194.5478	215.84	287.85	267.000
195.0468	215.41	287.61	266.000
195.5483	214.7	286.94	266.000
196.0473	214.47	286.13	266.000
196.548	214.44	285.73	266.000
197.0478	214.47	285.28	266.000
197.5468	214.49	284.94	266.000
198.0485	214.3	284.78	266.000
198.5483	214.28	284.17	266.000
199.048	214.54	283.58	266.000
199.5478	214.45	283.24	266.000
200.0477	214.29	282.92	266.000
200.5475	214.31	282.74	266.000
201.0483	214.15	282.32	266.000
201.5472	214.08	282.25	266.000
202.048	214.05	281.76	266.000
202.5468	214	281.47	266.000
203.0475	213.95	281.38	266.000
203.5483	213.92	281.05	266.000
204.0482	214.03	281.09	266.000
204.548	213.89	280.94	266.000
205.0478	214.03	280.54	266.000
205.5467	214.27	280.32	266.000
206.0483	214.14	280.04	266.000
206.5472	213.93	279.65	266.000
207.048	213.67	279.47	266.000
207.5478	213.69	279.48	266.000
208.0467	213.57	279.2	265.000
208.5483	213.52	278.95	265.000
209.0482	213.86	278.84	266.000

209.548	214.13	278.3	266.000
210.0478	213.94	277.83	266.000
210.5477	213.65	277.82	266.000
211.0475	213.55	277.67	266.000
211.5482	213.37	277.51	266.000
212.0472	213.3	277.13	264.000
212.5478	213.17	276.74	266.000
213.0477	213.2	276.08	266.000
213.5483	213.06	275.81	262.000
214.0473	213.3	275.35	262.000
214.549	213.07	274.48	261.000
215.047	213.27	273.78	261.000
215.5477	213.08	273.31	261.000
216.0485	212.65	272.99	262.000
216.5483	212.63	272.28	261.000
217.048	212.76	271.66	262.000
217.5478	212.75	271.07	260.000
218.0468	212.64	270.61	260.000
218.5475	212.56	269.96	262.000
219.0483	212.46	269.8	260.000
219.5482	212.3	269.57	260.000
220.0488	212.43	269.21	261.000
220.5477	212.34	268.83	259.000
221.0475	212.34	268.59	260.000
221.5483	212.13	268.58	260.000
222.0482	212.08	268.62	260.000
222.547	212.05	268.48	261.000
223.0478	212.02	268.72	260.000
223.5477	212.07	268.7	261.000
224.0492	211.97	268.74	261.000
224.5472	211.87	268.5	260.000
225.048	212.16	268.58	263.000
225.5478	212.04	269.02	260.000
226.0477	212.02	269.25	260.000
226.5483	211.99	269.08	263.000
227.0482	212.19	269.51	260.000
227.548	212.27	269.77	262.000
228.0478	212.23	269.71	261.000
228.5467	212.29	269.83	261.000
229.0475	212.33	269.2	261.000
229.5482	212.07	269.34	260.000
230.048	212.1	270.07	260.000
230.5488	211.98	269.25	261.000
231.0477	211.95	269.88	263.000
231.5483	212.15	270.81	263.000
232.0482	212.51	270.73	262.000
232.548	212.39	271.55	262.000
233.0478	212.72	271.04	262.000
233.5477	213.06	271.02	263.000
234.0485	213.06	270.97	262.000
234.5483	212.89	270.76	262.000
235.048	212.84	271.26	262.000
235.5478	212.73	271.1	262.000
236.0477	212.76	271.42	263.000
236.5475	212.76	271.8	263.000
237.0483	212.71	271.98	263.000
237.5482	212.69	272.11	263.000
238.048	212.64	271.97	263.000
238.5468	212.52	272.1	262.000
239.0475	212.35	272.57	263.000
239.5483	212.35	272.08	262.000
240.0482	212.46	271.81	262.000
240.548	212.55	271.93	262.000
241.0478	212.65	271.99	263.000
241.5477	212.67	272.02	263.000
242.0483	212.6	272.25	263.000

242.5482	212.6	272.42	263.000
243.048	212.79	272.66	263.000
243.5478	212.72	272.38	263.000
244.0485	212.9	272.77	263.000
244.5475	212.91	272.5	264.000
245.0482	212.78	273.2	264.000
245.548	212.88	273.35	263.000
246.0478	212.88	273.37	263.000
246.5477	212.62	273.88	264.000
247.0483	212.49	273.37	264.000
247.5473	212.64	273.35	264.000
248.048	212.72	273.39	263.000
248.5478	212.81	273.42	264.000
249.0467	212.83	273.24	263.000
249.5475	212.87	273.73	263.000
250.0492	213.07	273.27	263.000
250.5472	213.02	272.7	263.000
251.047	212.86	272.94	263.000
251.5477	212.63	272.57	263.000
252.0485	212.64	272.99	263.000
252.5482	212.5	272.8	263.000
253.048	212.52	272.6	263.000
253.5488	212.47	272.86	263.000
254.0477	212.51	273.37	264.000
254.5475	212.51	272.88	264.000
255.0473	212.59	272.82	263.000
255.5482	212.82	273.12	264.000
256.048	212.79	273.04	263.000
256.5477	212.42	273.69	263.000
257.0467	212.33	273.43	251.000 /

Run 5 (pure steam case)

run_no
5

additive
none

experiment_date
05/21/2005

researcher
Roly Simangunsong

cell_radius
3.688

cell_length
68.58

tcell
54

Cs
0.21

Co
0.5

Cw
1

dens_sand

167

dens_oil
62dens_water
62.4por
0.411690173Soi
0.741148716Sor
0.415Sgi
0.0936861640173443Swc
0.16516512porvol
1162.444515void_length
2.58o_w_ratio
0.2iw
5.5tfu_total
44.8ratio
0Hv_enthalphy
0Lv_enthalphy
0PI
7.8Oil_visc
276res_heat_capacity
34.33456123heat_loss_coeff
10t_phase
163

-- Time, minutes	Cumulative Oil, cc
0	0
3	0

6	0
9	0
12	0
15	0
18	0
21	0
24	0
27	0.5
30	2.5
33	6.5
36	10.5
39	14.5
42	17.5
45	21.5
48	24.5
51	26.5
54	28.5
57	30.5
60	32.5
63	35.5
66	38.5
69	42
72	45.5
75	48.5
78	51.5
81	54
84	56.5
87	58.5
90	60.5
93	62.5
96	65
99	66.5
102	68.5
105	70.5
108	73
111	75.5
114	77.5
117	79
120	80.5
123	82.5
126	84.5
129	86.5
132	87.5
135	89
138	90
141	91.5
144	93.5
147	95
150	97
153	98.5
156	100
159	102
162	103.5
165	105.5
168	107
171	108.5
174	110.5
177	112
180	119
183	140
186	185
189	217
192	235
195	249
198	271
201	289

204	304
207	318
210	326
213	330
216	334
219	337
222	340.5
225	350.5
228	365.5
231	373.5
234	378.5
237	382.5
240	384.5
243	386
246	387.5
249	388.5
252	389.5
255	390
258	390.5
261	390.5
264	390.5
267	390.5
270	390.5
273	390.5 /

-- time, min	x, from top of flange, cm
Thermo_Tabulation	
102	12
145	27.5
175	42.8
202	68.3 /

-- Time, minutes	Pinj,psig	Tinj, oC	
Log_Data_Tabulation			
0.054	58.3	267.23	268.56
0.5483333	75.46	267.75	269.04
1.048	71.54	267.1	268.39
1.547833	72.18	267.29	268.24
2.047667	85.05	267.75	268.41
2.5475	118.91	268.57	268.19
3.048333	207.16	272.45	269.01
3.549	210.39	266.01	266.39
4.048	210.18	264.28	265.04
4.547667	210.42	266.13	265.49
5.0475	210.71	268.86	267.07
5.548333	210.93	270.65	267.73
6.049	211.56	272.4	268.29
6.548	212.36	271.39	266.74
7.047833	212.56	269.19	263.86
7.547667	212.04	268.54	265.43
8.048333	211.67	270.82	266.67
8.548167	212.11	276.66	267.82
9.047	213.01	279.14	267.66
9.547833	213.95	281.32	267.67
10.04767	215.04	284.66	267.6
10.54833	215.59	287.83	267.55
11.04817	216.42	289.38	267.38
11.548	216.26	290.31	267.18
12.04783	216.63	292.74	267.07
12.54767	216.15	293.95	266.68
13.0475	215.72	295.21	266.84
13.54817	215.84	296.34	266.83
14.048	215.75	297.56	266.81
14.547	215.9	298.5	266.85
15.04767	216.23	300.91	266.86

15.54833	216.44	302.25	266.73
16.04817	216.69	304.47	266.7
16.549	216.93	306.03	266.9
17.047	217.22	308.07	267.15
17.54767	217.53	308.99	258.96
18.0485	217.85	311.35	258.35
18.54833	218.05	313.19	258.26
19.048	218.27	314.53	258.19
19.547	218.53	316.14	258.78
20.04767	218.78	317.97	258.77
20.5475	219.01	319.51	258.11
21.04833	219.28	321.06	259.16
21.54817	219.52	322.73	259.04
22.048	219.72	324.02	258.11
22.54867	220.02	326.13	258.88
23.0475	220.26	327.84	259.03
23.54833	220.59	330.01	257.12
24.04717	220.86	331.59	258.95
24.548	221.1	333.14	259.15
25.04683	221.36	334.96	259.04
25.54767	221.65	336.36	259.05
26.04833	221.8	338.17	257.75
26.54817	222.03	339.05	259.04
27.048	222.25	340.49	258.94
27.54783	222.4	341.89	258.86
28.04767	222.53	342.23	258.06
28.54833	222.64	343.61	259.06
29.04733	222.78	343.92	259.07
29.548	222.86	344.36	259.01
30.04783	222.77	344.38	258.96
30.54767	222.87	345.2	258.88
31.04833	223.04	346.11	258.97
31.54733	223.14	346.89	258.8
32.048	223.25	347.72	259.04
32.54783	223.31	347.27	258.95
33.04683	223.21	347.33	258.9
33.5475	223.29	348.55	258.94
34.04817	223.37	349.09	258.02
34.548	223.47	349.54	258.92
35.047	223.53	350.05	258.9
35.54767	223.64	351.06	258.79
36.0485	223.79	352.06	258.75
36.54833	223.89	352.49	258.88
37.048	223.9	352.87	258.85
37.54784	224	353.13	258.86
38.04767	223.99	353.44	258.87
38.5475	224.1	353.91	258.84
39.04833	224.15	354.25	258.8
39.54816	224.17	354.41	258.75
40.048	224.25	355.15	257.82
40.54767	224.29	355.43	258.75
41.04667	224.34	355.63	258.8
41.54833	224.38	355.87	258.28
42.04816	224.35	356.01	258.82
42.548	224.29	355.6	258.87
43.04784	224.32	355.98	258.66
43.54767	224.4	356.06	258.78
44.04833	224.33	354.98	258.76
44.54816	224.29	356.88	258.7
45.047	224.56	358.37	258.7
45.54784	224.66	359.1	258.84
46.04767	224.76	359.27	258.78
46.54833	224.86	359.81	258.72
47.04734	224.9	360.7	257.12
47.548	225.03	361.45	258.76
48.04784	225.1	361.23	258.3

48.54667	225.27	363.17	258.78
49.0475	225.26	363	258.66
49.54816	225.12	361.19	258.69
50.049	224.99	360.64	258.48
50.54784	224.94	360.16	258.76
51.04683	224.89	360.17	258.76
51.5475	224.87	359.98	258.75
52.04816	224.91	360.26	257.65
52.549	224.95	360.69	258.75
53.04784	224.98	360.84	258.72
53.54767	224.97	360.8	258.59
54.0485	224.98	360.66	258.62
54.54833	224.93	360.61	258.63
55.048	224.91	359.69	258.63
55.54784	224.86	359.57	258.71
56.04767	224.83	359.51	258.54
56.54667	224.82	359.39	258.62
57.04734	224.87	359.72	258.58
57.54816	224.89	360.05	258.61
58.048	224.92	360.33	258.67
58.54683	224.91	360.14	258.66
59.0475	224.9	359.8	258.46
59.54833	224.93	359.93	258.61
60.049	224.92	359.86	256.53
60.548	224.85	359.61	258.64
61.04683	224.81	358.86	258.08
61.54767	224.8	358.95	258.65
62.04833	224.73	358.28	258.55
62.54816	224.67	358.37	253.61
63.047	224.7	357.93	255.04
63.54784	224.61	357.24	254.36
64.04767	224.57	357.21	254.93
64.54833	224.58	357.03	254.85
65.04816	224.51	356.47	253.66
65.548	224.48	356.34	256.2
66.04784	224.45	355.66	257.2
66.54767	224.43	355.65	249.63
67.04833	224.38	355.44	255.83
67.54816	224.3	354.6	257.63
68.048	224.22	354.03	253.84
68.547	224.14	353.31	253.18
69.04766	224	352.21	247.27
69.54833	223.9	351.43	249.58
70.04917	223.89	351.55	248.98
70.548	223.86	351.05	252.12
71.047	223.8	350.41	257.69
71.54766	223.75	349.95	257.62
72.0485	223.74	349.98	254.77
72.54833	223.64	349.64	258.74
73.04716	223.61	349.95	258.56
73.54784	223.72	350.3	258.73
74.04766	223.77	350.08	258.75
74.5475	223.7	350.28	258.71
75.04833	223.69	349.96	258.62
75.54817	223.66	349.57	257.07
76.048	223.76	350.57	257.68
76.54766	223.82	350.15	255.85
77.0475	223.66	350.26	255.49
77.54833	223.74	350.82	258.99
78.04817	223.77	350.16	256.51
78.548	223.92	350.09	256.85
79.04784	223.78	349.75	254.49
79.54666	223.61	348.93	254.99
80.04833	223.59	348.39	256.47
80.54817	223.64	347.82	256.63
81.047	223.5	347.5	258.75

81.54784	223.49	347.57	258.74
82.04766	223.44	347.34	256.34
82.54833	223.32	346.64	256.19
83.04733	223.36	346.33	258.69
83.548	223.31	345.79	258.66
84.04684	223.18	345.69	258.71
84.54766	223.13	345.47	258.71
85.04833	223.1	345.02	258.66
85.54817	223.19	344.73	258.72
86.049	223.02	344.55	258.67
86.547	222.92	343.91	258.62
87.04766	222.89	343.47	258.6
87.54833	223.07	343.66	258.15
88.04817	222.95	343.47	258.58
88.54716	222.87	343.34	258.6
89.04784	222.91	343.32	258.64
89.54766	222.9	343.18	258.65
90.04933	222.8	342.95	258.58
90.54833	222.89	342.6	258.61
91.04716	222.86	342.22	258.58
91.54784	222.76	341.49	258.66
92.04766	222.73	340.86	258.54
92.54666	222.61	340.56	258.52
93.04733	222.66	340.23	258.6
93.54817	222.78	339.63	258.55
94.048	222.59	339.51	258.49
94.54684	222.5	339.12	258.44
95.0475	222.45	338.84	258.43
95.54833	222.33	338.39	258.56
96.04817	222.43	338.41	258.52
96.547	222.16	337.98	258.48
97.04784	222.18	337.36	258.55
97.54766	222.21	336.99	258.59
98.04833	222.12	336.57	258.54
98.54817	222.13	336.31	258.49
99.048	222.06	336.11	258.47
99.54784	222.03	335.78	258.48
100.0477	222.09	335.55	258.45
100.5483	221.98	335.39	257.98
101.0482	221.83	335.03	257.72
101.548	222.06	335.02	258.49
102.0478	222.03	334.93	257.33
102.5477	221.96	334.85	258.51
103.0483	221.95	334.39	256.78
103.5482	221.85	334.32	258.27
104.048	221.81	334.33	256.98
104.5478	221.78	334.06	258.49
105.0477	221.65	334.06	258.47
105.5483	221.79	333.85	258.23
106.0482	221.81	333.87	258.49
106.5472	221.89	334.1	258.46
107.0478	221.75	334.19	258.44
107.5468	221.58	334.4	258.41
108.0485	221.79	334.53	258.47
108.5483	221.69	334.49	258.45
109.048	221.75	334.94	258.45
109.5478	221.7	334.83	258.39
110.0477	221.65	334.97	258.57
110.5475	221.87	335.48	258.42
111.0483	221.85	335.52	258.37
111.5482	221.94	335.8	258.35
112.047	221.95	336.18	258.32
112.5477	221.99	336.54	258.36
113.0475	221.99	337.16	258.37
113.5483	222.08	337.77	258.3
114.049	222.12	337.99	258.45

114.5488	222.18	338.27	257.09
115.0478	222.27	338.48	258.33
115.5477	222.33	338.76	256.49
116.0483	222.35	338.81	258.41
116.5482	222.43	338.85	257.92
117.048	222.3	338.68	258.35
117.5478	222.25	338.64	258.37
118.0477	222.31	338.66	258.41
118.5483	222.35	338.93	258.45
119.0482	222.25	339.07	252.87
119.5472	222.23	338.89	249.65
120.0487	222.22	338.84	252.23
120.5477	222.17	338.93	252.89
121.0493	222.12	338.84	252.06
121.5473	222.35	339.16	253.85
122.048	222.3	338.99	250.31
122.5478	222.34	338.87	253.09
123.0477	222.34	338.72	255.56
123.5483	222.42	338.81	254.89
124.0473	222.26	338.75	253.02
124.548	222.41	338.82	254.9
125.0478	222.46	338.91	254.02
125.5477	222.32	338.56	254.31
126.0485	222.24	338.42	254.78
126.5483	222.24	338.17	256.45
127.048	222.19	338.06	255.1
127.547	222.12	338.01	257.21
128.0477	222.18	338.01	254.65
128.5475	222.25	337.76	257.41
129.0483	222.11	337.48	257.26
129.5482	222.1	337.44	258.26
130.048	222.15	337.05	258.37
130.5477	222.12	337.1	255.63
131.0467	222.14	336.95	255.82
131.5483	222.04	336.72	254.56
132.0472	222.02	336.37	254.83
132.548	221.97	335.89	254.64
133.0478	221.81	335.71	256.57
133.5467	221.73	335.5	255.88
134.0473	221.73	334.83	255.63
134.5482	221.79	334.46	257.28
135.048	221.75	334.56	255.95
135.5487	221.77	334.2	255.9
136.0477	221.86	334.2	253.96
136.5483	221.65	334.08	255.35
137.0473	221.69	333.7	255.38
137.548	221.71	333.5	254.9
138.0478	221.62	333.21	256.16
138.5467	221.57	333.14	255.99
139.0483	221.63	332.85	255.82
139.5473	221.5	332.78	256.15
140.048	221.54	332.23	256.23
140.547	221.42	331.94	254.87
141.0477	221.33	331.78	256.75
141.5483	221.6	331.59	256.88
142.0482	221.51	331.53	255.61
142.548	221.48	331.56	256.56
143.0478	221.41	331.68	255.76
143.5477	221.4	331.64	255.38
144.0485	221.34	331.43	255.24
144.5483	221.24	331.16	255.68
145.048	221.35	331.08	257.72
145.547	221.21	330.76	258.02
146.0477	221.12	330.68	258.6
146.5475	221.09	330.06	258.56
147.0483	221.09	329.73	258.63

147.5482	221.23	329.8	258.65
148.047	221.27	329.1	258.6
148.5477	221.22	329.26	258.64
149.0475	221.2	329.3	258.47
149.5483	221.13	329.24	258.53
150.0482	220.98	329.31	258.52
150.547	221.07	329.24	258.55
151.0478	221.05	329.27	258.46
151.5477	220.84	328.62	258.5
152.0483	220.93	328.61	258.51
152.5482	220.91	328.36	258.44
153.047	220.9	328.11	258.51
153.5478	220.92	327.85	258.45
154.0477	220.76	327.74	256.51
154.5483	220.81	327.55	258.45
155.0482	220.76	327.3	258.41
155.547	220.57	327.1	258.37
156.0478	220.61	326.53	258.44
156.5477	220.59	326.38	258.44
157.0483	220.73	325.66	257.78
157.5482	220.61	325.12	258.43
158.048	220.45	324.73	258.43
158.547	220.47	324.27	258.42
159.0477	220.33	323.67	258.37
159.5483	220.31	323.42	258.23
160.0482	220.33	322.97	258.42
160.548	220.18	322.62	258.41
161.0478	220.09	322.12	258.43
161.5477	220.07	321.58	258.43
162.0485	220.11	321.08	258.41
162.5483	220.2	320.61	257.8
163.048	220.08	319.64	258.41
163.5478	220.15	319.28	258.4
164.0477	219.97	318.94	258.38
164.5475	219.96	318.27	258.41
165.0483	219.8	317.97	258.42
165.5472	219.87	317.75	258.35
166.048	219.96	317.09	258.39
166.5477	220.06	316.62	258.4
167.0475	219.61	315.9	258.34
167.5483	219.52	315.75	258.42
168.049	219.42	315.04	258.34
168.548	219.36	314.53	258.39
169.0468	219.19	313.45	258.31
169.5477	219.26	312.81	258.3
170.0492	219.44	312.31	258.34
170.5482	219.48	311.31	257.97
171.048	219.01	310.45	258.29
171.5478	219.21	309.76	258.14
172.0467	219.29	308.84	258.28
172.5483	219.16	308.04	256.32
173.0482	218.93	307.26	257.76
173.5488	219.63	306.55	258.44
174.0478	219.71	305.69	257.23
174.5477	219.91	305.33	258.37
175.0475	219.5	304.62	258.08
175.5473	219.07	303.81	255.93
176.048	219.25	303.12	256.43
176.5488	218.23	302.27	257.88
177.0468	217.8	301.43	256.23
177.5483	218.75	300.63	258.31
178.0482	218.61	299.79	258.27
178.548	218.61	299.02	258.28
179.0478	219.08	298	258.24
179.5468	217.74	297.29	258.2
180.0493	218.41	296.29	258.16

180.5483	219.18	295.66	258.13
181.048	219.02	294.63	258.17
181.547	218.64	294.01	258.17
182.0477	218	293.01	258.14
182.5475	218.25	292.05	258.17
183.0483	217.66	291.21	258.14
183.5482	218.06	290.16	258.1
184.047	217.67	289.2	258.1
184.5477	217.88	288.25	258.06
185.0475	217.98	287.1	258.09
185.5483	217.49	285.97	258.09
186.0482	217.69	285.12	258.05
186.548	217.1	283.94	258.08
187.0468	216.82	282.75	258.03
187.5477	217.7	281.62	258.02
188.0483	217.14	280.48	257.97
188.5482	217.11	279.24	257.96
189.0488	217.29	277.89	257.9
189.5478	217.08	276.61	257.91
190.0477	216.35	275.29	257.88
190.5483	216.9	273.71	257.87
191.0482	216.85	272.28	257.88
191.547	217.26	270.88	257.9
192.0478	216.59	268.94	257.85
192.5477	216.68	267.35	257.82
193.0483	216.07	265.44	257.75
193.5482	216.16	264.11	257.68
194.048	215.09	263.54	257.66
194.5478	214.99	263.34	257.72
195.0477	216.63	263.78	257.75
195.5483	219.12	264.54	257.84
196.0482	219.95	265.2	257.89
196.548	220.18	264.97	257.9
197.0478	220.09	263.8	257.72
197.5477	220.24	262.52	257.5
198.0485	219.61	261.48	257.74
198.5483	220.57	261.02	257.75
199.048	218.63	260.63	257.87
199.5478	219.24	260.4	257.92
200.0477	218.33	260.25	257.97
200.5475	218.64	260.11	257.92
201.0502	217.98	259.92	257.94
201.549	217.46	259.61	257.96
202.048	216.41	259.17	257.86
202.5468	216.39	258.69	257.83
203.0475	216.93	257.9	256.9
203.5483	215.57	257.28	255.21
204.0482	216.04	258.28	256.67
204.547	217.08	259.97	257.95
205.0478	219.1	261.88	258.19
205.5477	222.79	264.14	258.32
206.0483	227.25	265.03	258.11
206.5482	227.72	263.23	257.2
207.048	225.61	262.02	257.08
207.5478	225.27	260.07	256.45
208.0467	225.08	259.25	256.08
208.5483	224.18	258.55	256.41
209.0473	222.75	258.8	256.2
209.548	222.45	258.58	256.86
210.0478	222.68	258.77	255.71
210.5477	223.01	258.83	257.05
211.0483	222.71	258.8	257.97
211.5482	222.37	259.24	258.19
212.048	222.17	259.9	256.68
212.5478	221.94	259.76	257.8
213.0477	222.16	258.6	255.8

213.5475	221.8	259	258.18
214.0482	222.11	259.71	258.16
214.548	222.18	257.53	254.48
215.0478	221.29	256.41	254.74
215.5468	220.67	256.09	254.33
216.0475	220.81	255.95	255.39
216.5483	221.53	256.3	254.49
217.048	222.37	257.89	255.48
217.5478	221.64	258.79	256.22
218.0468	223.22	259.11	255.83
218.5475	222.29	258.98	256.07
219.0483	222.65	258.84	255.79
219.5482	223.33	259.04	255.65
220.0488	223.3	258.97	255.28
220.5477	223.17	259.37	256.04
221.0485	224.96	259.47	256.37
221.5483	225.61	259.38	256.4
222.0482	224.07	259.13	255.83
222.548	223.52	258.66	255.75
223.0478	223.74	258.09	255.89
223.5477	224.96	257.53	255.87
224.0483	223.38	257.22	255.46
224.5482	223.35	255.83	253.18
225.047	221.92	255.28	253.53
225.5478	221.78	255.74	253.68
226.0477	221.37	256.18	254.21
226.5483	221.66	256.1	254.77
227.0482	222.38	256.55	254.18
227.547	223.67	256.48	254.67
228.0478	223.06	256.79	255.1
228.5477	221.99	257.24	254.94
229.0483	223.44	257.81	255.58
229.5482	223.98	257.98	255.81
230.048	223.19	257.91	255.66
230.5478	222.71	258.13	255.87
231.0468	224.09	258.37	255.24
231.5483	223.58	258.55	255.55
232.0473	224.01	258.93	255.57
232.548	224.4	258.97	258.27
233.0478	223.19	258.19	255.01
233.5487	222.94	259.22	256.53
234.0485	223.23	259.78	257.44
234.5473	223.69	260.39	257.87
235.048	223.11	260.93	258.22
235.5478	223.7	260.42	255.8
236.0487	223.54	258.97	255.45
236.5467	224.85	258.58	255.72
237.0473	224.35	258.71	255.7
237.5482	221.92	258.65	256.53
238.048	223.92	258.78	255.35
238.5477	222.82	258.74	255.85
239.0467	223.1	258.75	256.17
239.5483	224.84	258.62	256.07
240.0482	224.47	258.32	255.77
240.548	222.54	258.24	256.31
241.0478	223.29	258.71	255.31
241.5477	224.39	259.61	255.77
242.0483	223.31	260.89	256.24
242.5482	225.11	262.09	256.3
243.047	226.68	262.25	256.95
243.5478	227.29	261.34	256.49
244.0477	228.05	260.36	256.33
244.5483	225.94	259.38	256.44
245.0482	212.78	273.2	263.76
245.548	212.88	273.35	263.24
246.0478	212.88	273.37	262.92

246.5477	212.62	273.88	263.67
247.0483	212.49	273.37	264.23
247.5473	212.64	273.35	264.25
248.048	212.72	273.39	263.39
248.5478	212.81	273.42	263.91
249.0467	212.83	273.24	263.34
249.5475	212.87	273.73	262.94
250.0492	213.07	273.27	262.76
250.5472	213.02	272.7	263.05
251.047	212.86	272.94	263.17
251.5477	212.63	272.57	263.28
252.0485	212.64	272.99	263.48
252.5482	212.5	272.8	263.31
253.048	212.52	272.6	263.43
253.5488	212.47	272.86	263.48
254.0477	212.51	273.37	263.86
254.5475	212.51	272.88	263.64
255.0473	212.59	272.82	263.3
255.5482	212.82	273.12	263.78
256.048	212.79	273.04	263.44
256.5477	212.42	273.69	263.06
257.0467	212.33	273.43	250.72 /

Run 6 (steam-propane case)

run_no
6

additive
propane

experiment_date
05/21/2005

researcher
Roly Simangunsong

cell_radius
3.688

cell_length
68.58

tcell
54

Cs
0.21

Co
0.5

Cw
1

dens_sand
167

dens_oil
62

dens_water
62.4

por
0.411690173

Soi
0.726148715592812

Sor
0.390594349450943

Sgi
0.0936861640173443

Swc
0.16516512

porvol
1162.444515

void_length
2.58

o_w_ratio
0.2

iw
5.5

tfu_total
14.8

ratio
0.05

Hv_enthalpy
0.358262377

Lv_enthalpy
182.8470859

res_heat_capacity
28

heat_loss_coeff
1

t_phase
163

-- Time, minutes Cumulative Oil, cc
Production_Data_Tabulation

0	0
2	0
5	0
8	0
11	0
14	0
17	2
20	5
23	9
26	14
29	20.5
32	27.5
35	35
38	44
41	53
44	63
47	74
50	87

53	100
56	114
59	134
62	180
65	209
68	234
71	252
74	267
77	280
80	291
83	299
86	306.5
89	311.5
92	316.5
95	321.5
98	324.5
101	328
104	331.5
107	334
110	337
113	340
116	342.5
119	346
123	349
127	353
131	362
135	379
139	388
143	392
146	395
151	397.5
156	399
162	400.5
168	401.5
174	402.5
180	403
186	403.5
192	403.5
198	403.5
204	403.5
210	403.5
216	403.5 /

-- time, min	x, from top of flange, cm
Thermo_Tabulation	
62	12
89	27.5
103	42.8
144	68.3 /

-- Time, minutes	Tinj, oC	Pinj,psig	Pout,psig
Log_Data_Tabulation			
0.05033333	48.31	259.65	261.27
0.54466666	48.81	263.01	263.18
1.045333	52.84	263.29	262.87
1.545167	59.09	262.69	262.83
2.045	74.11	263.09	263.24
2.544833	156.71	263.12	262.94
3.0455	203.44	263.67	261.95
3.545333	206.65	263.39	262.37
4.045167	206.98	260.75	261.49
4.544167	208.02	261.32	261.53
5.044833	210.03	264.56	261.7
5.544667	210.7	263.17	261.59
6.045333	212.49	266.68	261.69

6.545166	213.82	263.16	261.27
7.045	214.66	266.32	262.1
7.544833	216.07	267.91	260.92
8.045667	213.1	274.6	261.8
8.545333	213.52	273.74	261.27
9.045167	212.07	276.13	261.4
9.545	211.86	275	261.38
10.04583	212.47	282.79	261.53
10.54567	212.69	284.67	261.54
11.0455	214.52	286.34	261.5
11.54533	215.37	291.26	261.5
12.04417	216.14	291.79	261.56
12.54483	216.04	294.95	261.36
13.04467	216.42	293.63	261.37
13.5445	215.82	297.64	261.49
14.04433	215.3	299.78	261.59
14.54517	215.33	300.91	261.62
15.045	216.71	298.7	261.59
15.5465	216.59	300.56	261.45
16.0455	216.72	307.25	261.54
16.54433	217.81	308.86	261.48
17.04517	217.35	311.35	261.47
17.545	218.56	311.55	261.25
18.04567	218.15	310.92	261.31
18.5455	218.01	314.86	261.26
19.04533	219.37	317.98	261.24
19.54517	219.07	321.62	261.17
20.045	219.72	323.91	261.19
20.54483	218.67	326.36	261.17
21.04467	218.85	329.42	261.32
21.54533	219.34	333.67	261.65
22.04517	218.45	329.75	261.7
22.545	218.83	332.4	261.9
23.04483	219.37	331.03	261.63
23.5455	219.53	331.07	262.43
24.04533	219.34	328.21	261.87
24.54617	219.49	328.17	262.56
25.045	220.01	328.29	262.58
25.54583	220.25	328.56	260.57
26.0465	220.25	328.02	262.62
26.54533	220.32	327.36	262.63
27.04517	220.11	326.03	261.46
27.546	220.01	324.34	261
28.04483	219.83	322.9	262.29
28.54567	219.69	321.64	262.62
29.0455	219.55	320.3	261.6
29.54433	219.63	322.68	255.4
30.045	219.51	321.63	256.63
30.54483	219.56	322.57	258.55
31.04567	219.69	322.55	259.19
31.5455	219.72	324.55	257.69
32.04533	219.77	325.09	258.21
32.54517	220.01	326.37	258.97
33.045	220.19	328.02	255.49
33.54567	220.35	328.5	257.73
34.0455	220.63	330.76	258.47
34.54533	220.91	335	257.11
35.04517	220.88	339.24	255.46
35.545	220.76	341.72	255.99
36.04483	220.89	343.74	256.5
36.5455	221.02	346.53	258.51
37.04533	220.97	345.82	258.9
37.54517	220.93	345.34	257.99
38.045	220.86	348.03	258.37
38.54483	220.67	346.9	256.21
39.0455	220.64	345.31	257.56

39.54533	220.64	345.24	257.06
40.04517	220.27	345.99	256.25
40.545	220.25	344.78	258.21
41.04483	220.33	344.88	258.25
41.5455	220.58	345.32	258.44
42.0445	220.44	343.98	257.73
42.54433	220.32	343.92	256.8
43.045	220.32	351.39	257.04
43.54483	219.91	347	256.53
44.04567	220.22	349.41	258.07
44.54533	220.33	350.13	258.35
45.04517	219.22	346.82	258.05
45.545	220.46	347.09	260.03
46.044	220.42	344.69	258.71
46.54467	220.73	344.5	257.76
47.0445	220.66	346.43	258.77
47.54533	220.63	348.32	260.28
48.045	220.56	348.09	262.5
48.544	220.79	350.92	262.64
49.04567	221.14	352.57	262.86
49.5445	220.96	352.56	262.93
50.04533	220.78	352.36	262.99
50.54517	220.46	350.63	261.92
51.045	220.48	349.61	261.86
51.54567	220.45	347.52	262.08
52.04633	219.91	344.42	262.3
52.54533	219.97	342.71	262.74
53.04517	219.45	340.02	262.89
53.545	219.17	337.99	263.07
54.04483	219.14	335.15	261.74
54.5455	218.51	332.02	256.71
55.04533	218.16	325.88	261.95
55.54517	218.09	322.67	262.53
56.045	217.79	320.52	262.22
56.54483	217.47	320.78	263.17
57.04467	217.43	321.52	262.74
57.54533	217.27	320.35	261.36
58.04517	217.13	318.08	260.57
58.54417	217.01	318.13	261.75
59.04383	216.82	317.54	262.18
59.54467	216.6	317.36	262.45
60.04533	216.52	315.55	263.01
60.54517	216.14	315.2	262.99
61.045	216.22	312.93	262.88
61.54483	216.18	312.98	260.72
62.04467	216.28	311.47	260.58
62.5445	216.55	311.45	259.22
63.04517	216.19	309.88	258.71
63.545	216.46	309.57	261.89
64.04483	215.98	307.54	261.74
64.54466	215.46	306.54	259.16
65.0455	215.48	302.03	259.63
65.54533	216.15	302.45	258.89
66.045	216.65	300.41	258.33
66.54483	215.95	301.19	259.87
67.04567	216.4	304.14	259.35
67.5455	216.94	305.56	258.63
68.04533	216.8	306.14	261.31
68.54417	216.66	307.42	261.49
69.044	217.15	306.43	261.96
69.54567	216.54	306.15	261.77
70.0455	216.94	305.24	261.69
70.54533	216.63	305.31	261.98
71.04517	216.67	304.31	261.92
71.54501	217.14	302.26	262.61
72.04666	216.64	303.33	262.52

72.54467	216.89	303.05	262.89
73.04433	217.09	304.83	262.9
73.54517	216.97	305.14	260.74
74.04501	216.9	303.89	261.26
74.54383	216.72	304.88	261.39
75.04467	216.76	305.67	261.68
75.54533	216.19	305.95	261.98
76.04617	216.8	305.33	261.91
76.54501	217.01	306.62	261.75
77.04383	216.77	305.58	262.09
77.5455	217.14	306.89	262.32
78.04533	216.95	305.56	262.32
78.54517	216.41	307.96	262.43
79.04501	216.47	305.16	262.7
79.54483	216.52	305.09	262.42
80.04567	216.58	304.2	262.57
80.5445	216.29	302.38	262.61
81.04517	216.78	303.2	260.2
81.54501	216.46	303.09	260.56
82.04483	216.55	301.82	259.92
82.54567	215.71	301.35	260.37
83.0455	215.91	297.85	261.05
83.54533	216.22	298.45	261.04
84.04501	216.09	298.61	258.59
84.54483	215.9	300.3	261
85.04567	215.51	301.31	259.13
85.5455	216.19	299.75	260.6
86.04533	216.71	299.98	259.97
86.54517	217.3	302.53	260.67
87.04501	217.41	300.96	260.3
87.54567	216.8	301.92	258.83
88.0455	216.97	300.15	261.25
88.54433	216.29	299.58	260.74
89.04517	215.93	296.75	261.5
89.54501	216.24	295.12	260.96
90.04567	216.44	294.18	259.85
90.54467	215.2	291.56	260.75
91.04433	214.62	289.48	260.9
91.54417	214.71	288.61	260.85
92.04501	214.05	287.05	260.93
92.54483	213.98	285.41	261.67
93.0465	213.74	283.95	261.55
93.54533	213.26	283.09	261
94.04433	214.07	285.14	261.86
94.54417	214.27	286.48	261.53
95.04483	214.49	285.66	261.29
95.54467	215.31	290.17	261.25
96.04533	216.23	289.2	261.69
96.54433	216.96	291	261.47
97.04501	216.07	288.8	261.14
97.544	216.05	287.56	260.63
98.04567	215.91	285.91	261.75
98.54533	214.98	287.13	261.81
99.04517	215.25	285.26	261.83
99.54417	214.82	285.43	261.18
100.0448	214.63	284.14	261.84
100.5447	214.94	285.27	261.59
101.0455	214.74	283.74	261.91
101.5443	214.42	283.54	261.26
102.045	213.62	281.89	261.08
102.5448	213.17	280.33	261.27
103.0457	212.49	278.11	261.18
103.5455	212.92	276.86	262.07
104.0453	212.93	275.86	260.3
104.5452	213.88	275.38	260.93
105.044	213.98	278.4	261.59

105.5457	213.9	277.33	261.74
106.0455	213.99	279.15	261.25
106.5453	214.08	281.63	261.7
107.0442	215.6	281.79	261.55
107.545	216.02	283.36	260.99
108.0457	216.14	283.43	261.52
108.5465	215.77	282.65	261.41
109.0462	215.34	282.78	261.61
109.5452	215.43	281.47	261.56
110.045	214.92	280.7	260.84
110.5448	215.15	279.49	259.34
111.0455	215.53	280.39	261.57
111.5453	215.05	280.01	261.6
112.0452	214.3	281.63	261.69
112.544	213.67	282.74	262.03
113.0438	213.46	281.03	261.9
113.5455	213.34	281.92	262.21
114.0453	213.27	284.69	262.24
114.5452	213.75	283.02	262.71
115.045	213.16	281.45	262.75
115.5448	213.38	281.57	262.89
116.0455	213.97	280.12	260.84
116.5453	213.31	278.97	260.59
117.0452	213.81	280.98	261.02
117.545	214.92	279.72	261.24
118.0448	215.34	276.54	257.92
118.5447	214.96	275.05	259.61
119.0445	213.91	275.73	262.36
119.5453	213.73	272.25	261.98
120.046	213.34	271.53	261.25
120.5448	212.71	271.55	261.84
121.0447	212.86	274.87	261.22
121.5455	213.9	273.06	260.05
122.0453	214.21	274.33	262.42
122.5452	212.94	276.02	262.38
123.045	213.74	275.17	262.55
123.5457	213.12	276.79	262.72
124.0455	212.92	276.55	262.88
124.5453	213.62	276.66	263.07
125.0452	214.27	278.17	261.25
125.545	214.24	276.96	260.7
126.0457	214.15	277.02	261.44
126.5455	214.17	277.56	261.59
127.0453	213.27	276.02	261.44
127.5452	213.42	274.44	261.37
128.045	213.37	274.87	260.68
128.5457	213.07	273.74	260.88
129.0455	213.23	273.71	261.59
129.5453	212.68	272.23	259.93
130.0452	212.91	273.49	261.77
130.545	213.47	274.51	261.7
131.0438	214.18	273.87	260.69
131.5455	213.69	272.26	262.08
132.0445	213.53	271.4	262.24
132.5443	213.17	272.79	260.93
133.045	213.16	270.05	262.09
133.5448	213.21	269.88	262.44
134.0447	212.8	268.75	262.39
134.5453	213.16	268.15	262.35
135.0452	213.15	266.98	261.93
135.545	213.2	265.63	261.38
136.0448	213.1	265.69	261.18
136.5447	213.51	266.66	261.04
137.0445	214.17	266.64	258.64
137.5453	214.37	266.6	258.05
138.0442	213.37	267.14	258.09

138.544	214.64	268.51	258.05
139.0457	215	268.09	257.84
139.5445	215.24	268.36	258.35
140.0462	214.1	269.41	259.1
140.5452	215.73	275.77	261.87
141.045	214.87	276.22	263.39
141.5457	214.35	279.76	263.48
142.0455	214.23	279.08	262.24
142.5453	214.28	278.49	261.19
143.0452	213.82	274.12	260.92
143.545	213.82	273.58	260.99
144.0457	214.2	272.92	261.17
144.5455	213.95	269.98	260.39
145.0453	214.46	271.21	260.16
145.5442	213.17	269.69	259.37
146.045	213.1	269.21	259.59
146.5448	212.67	268.14	259.38
147.0455	212.89	266.83	261.3
147.5453	213	268.62	259.97
148.0452	212.72	266.82	261.88
148.544	212.85	268.61	261.42
149.0448	212.61	267.38	261.22
149.5455	212.63	268.02	260.3
150.0453	212.83	265.17	261.31
150.5452	213.1	264.34	260.61
151.0442	213.18	263.86	257.76
151.544	213.41	263.11	259.26
152.0455	213.83	262.5	260.18
152.5453	213.43	263.22	259.83
153.0443	213.71	263.76	260.78
153.546	213.78	264.83	260.34
154.0448	213.19	265.4	261.64
154.5457	213.18	265.42	261.39
155.0455	213.79	265.71	261.48
155.5453	213.88	266.83	261.88
156.045	214.56	267.1	261.93
156.5458	214.31	267.97	261.94
157.0465	214.35	268.6	262.2
157.5455	214.8	268.37	261.88
158.0443	214.61	268.38	261.89
158.5452	214.72	268.3	261.91
159.044	214.97	268.94	259.21
159.5447	214.95	268.05	259.55
160.0455	214.88	267.62	261.04
160.5443	215.26	268.1	262.3
161.0452	215.18	268.61	262.56
161.544	214.96	270.09	260.06
162.0457	214.2	268.99	260.44
162.5455	214.7	268.64	260.02
163.0443	215.33	268.67	259.85
163.5452	215.87	268.6	259.51
164.044	215.46	269.13	260.63
164.5438	215.25	269.72	261.15
165.0455	215.47	270.08	261.8
165.5453	215.68	274.43	262.07
166.0443	215.79	276.86	260.71
166.545	215.54	275.23	261.15
167.0448	215.12	272.78	262.9
167.5447	214.44	275.67	257.68
168.0453	214.91	268.5	261.56
168.5452	214.12	270.42	257.53
169.045	213.39	266.44	259.93
169.5448	213.88	266.75	261.1
170.0455	213.43	268.93	259.69
170.5463	213.4	265.75	259.56
171.047	213.11	268.96	261.49

171.546	213.67	267.29	262.36
172.0458	213.66	264.57	258.69
172.5465	213.86	266.63	261.23
173.0463	212.91	266.55	262.11
173.547	213.32	268.15	262.68
174.046	213.95	268.04	262.79
174.5458	213.99	266.4	257.48
175.0465	213.37	266.6	256.81
175.5463	214.41	264.05	257.7
176.0472	213.71	263.93	257.63
176.5452	213.63	264.09	259.3
177.045	213.33	263.91	259.11
177.5447	213.72	271.17	258.5
178.0455	214.98	269.73	259.84
178.5453	214.17	272.4	261.12
179.0452	214.8	270.8	261.59
179.545	214.02	271.72	262.84
180.0457	213.27	270.87	263.01
180.5465	212.99	270.52	262.71
181.0443	214.33	267.37	257.02
181.5442	214.53	264.69	256.43
182.045	213.75	265.05	256.33
182.5448	212.26	264.29	256.18
183.0447	213.07	263.49	256.69
183.5453	213.99	263.46	256.68
184.0452	213.18	263.35	256.59
184.545	212.88	263.73	256.6
185.0448	213.26	263.95	256.62
185.5455	212.29	264.28	256.78
186.0453	212.66	264.56	256.85
186.5452	213.34	263.82	257.19
187.045	212.75	262.66	256.99
187.5448	212.77	263.41	257.01
188.0455	212.43	263.94	256.76
188.5453	213.08	262.96	257.24
189.0452	212.58	262.77	256.54
189.545	212.55	263.52	256.87
190.0448	212.08	263.87	256.38
190.5457	212.23	262.51	256.83
191.0455	212.88	263.99	256.4
191.5462	213.24	262.13	257.01
192.045	212.34	262.65	256.79
192.5448	213.01	261.77	256.8
193.0457	213.78	264.42	257.16
193.5455	213.57	262.43	257.15
194.0453	213.18	264.7	256.98
194.5452	213.23	262.97	257.35
195.045	213.5	263.27	257.18
195.5457	212.93	263.71	257.12
196.0455	213.8	263.37	256.69
196.5453	214.41	263.8	257.35
197.0452	214.46	263.33	257.63
197.545	214.14	264.72	257.74
198.0457	214.02	264.48	257.22
198.5465	213.77	264.17	257.4
199.0453	213.52	263.9	257.55
199.5442	213.76	264.05	257.54
200.045	213.08	262.74	257.59
200.5448	212.99	261.92	257.35
201.0455	214.39	262.27	257.15
201.5453	213.91	262.25	258.06
202.0452	213.16	262.99	257.23
202.545	214.09	262.52	258.32
203.0448	214.15	262.97	257.64
203.5455	214.58	263.56	257.73
204.0453	214.99	264.15	257.48

204.5452	214.22	267.55	257.64
205.045	214.63	267.79	258.66
205.5448	213.64	268.86	258.68
206.0455	213.26	268.01	260.03
206.5453	214.16	268.36	259.76
207.048	225.61	262.02	257.08
207.5478	225.27	260.07	256.45
208.0467	225.08	259.25	256.08
208.5483	224.18	258.55	256.41
209.0473	222.75	258.8	256.2
209.548	222.45	258.58	256.86
210.0478	222.68	258.77	255.71
210.5477	223.01	258.83	257.05
211.0483	222.71	258.8	257.97
211.5482	222.37	259.24	258.19
212.048	222.17	259.9	256.68
212.5478	221.94	259.76	257.8
213.0477	222.16	258.6	255.8
213.5475	221.8	259	258.18
214.0482	222.11	259.71	258.16
214.548	222.18	257.53	254.48
215.0478	221.29	256.41	254.74
215.5468	220.67	256.09	254.33
216.0475	220.81	255.95	255.39
216.5483	221.53	256.3	254.49
217.048	222.37	257.89	255.48
217.5478	221.64	258.79	256.22
218.0468	223.22	259.11	255.83
218.5475	222.29	258.98	256.07
219.0483	222.65	258.84	255.79
219.5482	223.33	259.04	255.65
220.0488	223.3	258.97	255.28
220.5477	223.17	259.37	256.04
221.0485	224.96	259.47	256.37
221.5483	225.61	259.38	256.4
222.0482	224.07	259.13	255.83
222.548	223.52	258.66	255.75
223.0478	223.74	258.09	255.89
223.5477	224.96	257.53	255.87
224.0483	223.38	257.22	255.46
224.5482	223.35	255.83	253.18
225.047	221.92	255.28	253.53
225.5478	221.78	255.74	253.68
226.0477	221.37	256.18	254.21
226.5483	221.66	256.1	254.77
227.0482	222.38	256.55	254.18
227.547	223.67	256.48	254.67
228.0478	223.06	256.79	255.1
228.5477	221.99	257.24	254.94
229.0483	223.44	257.81	255.58
229.5482	223.98	257.98	255.81
230.048	223.19	257.91	255.66
230.5478	222.71	258.13	255.87
231.0468	224.09	258.37	255.24
231.5483	223.58	258.55	255.55
232.0473	224.01	258.93	255.57
232.548	224.4	258.97	258.27
233.0478	223.19	258.19	255.01
233.5487	222.94	259.22	256.53
234.0485	223.23	259.78	257.44
234.5473	223.69	260.39	257.87
235.048	223.11	260.93	258.22
235.5478	223.7	260.42	255.8
236.0487	223.54	258.97	255.45
236.5467	224.85	258.58	255.72
237.0473	224.35	258.71	255.7

237.5482	221.92	258.65	256.53
238.048	223.92	258.78	255.35
238.5477	222.82	258.74	255.85
239.0467	223.1	258.75	256.17
239.5483	224.84	258.62	256.07
240.0482	224.47	258.32	255.77
240.548	222.54	258.24	256.31
241.0478	223.29	258.71	255.31
241.5477	224.39	259.61	255.77
242.0483	223.31	260.89	256.24
242.5482	225.11	262.09	256.3
243.047	226.68	262.25	256.95
243.5478	227.29	261.34	256.49
244.0477	228.05	260.36	256.33
244.5483	225.94	259.38	256.44
245.0482	212.78	273.2	263.76
245.548	212.88	273.35	263.24
246.0478	212.88	273.37	262.92
246.5477	212.62	273.88	263.67
247.0483	212.49	273.37	264.23
247.5473	212.64	273.35	264.25
248.048	212.72	273.39	263.39
248.5478	212.81	273.42	263.91
249.0467	212.83	273.24	263.34
249.5475	212.87	273.73	262.94
250.0492	213.07	273.27	262.76
250.5472	213.02	272.7	263.05
251.047	212.86	272.94	263.17
251.5477	212.63	272.57	263.28
252.0485	212.64	272.99	263.48
252.5482	212.5	272.8	263.31
253.048	212.52	272.6	263.43
253.5488	212.47	272.86	263.48
254.0477	212.51	273.37	263.86
254.5475	212.51	272.88	263.64
255.0473	212.59	272.82	263.3
255.5482	212.82	273.12	263.78
256.048	212.79	273.04	263.44
256.5477	212.42	273.69	263.06
257.0467	212.33	273.43	250.72 /

Run 7 (steam-petroleum distillate case)

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7

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petroleum_distillate

experiment_date
05/21/2005

researcher
Roly Simangunsong

cell_radius
3.688

cell_length
68.58

tcell
54

Cs
0.21

Co
0.5

Cw
1

dens_sand
167

dens_oil
62

dens_water
62.4

por
0.411690173

Soi
0.726148715592812

Sor
0.390594349450943

Sgi
0.0936861640173443

Swc
0.16516512

porvol
1162.444515

void_length
2.58

o_w_ratio
0.2

iw
5.5

tfu_total
8

ratio
0.05

Hv_enthalphy
0.5466

Lv_enthalphy
185.466

PI
6.95

Oil_visc
95

res_heat_capacity
34.00

heat_loss_coeff
15

t_phase
40

-- Time, minutes Cumulative Oil, cc

Production_Data_Tabulation

0	0
1	0
3	0
5	0
7	0
9	0
11	0
13	0
15	14.5
16	33.5
17	52
27	66.5
32	73.5
34	82
36	97
38	110
41	128
45	146
50	165
55	184
59	204
63	228
67	251
71	270
74	293
78	314
82	329
85	348
89	359
92	370
96	373.5
99	378.5
102	383.5
106	395.5
114	399.5
117	407.5
121	422.5
123	426.5
128	430.5
135	432.5
140	434
145	435.5
152	436.5
158	437.5
164	438.5
170	439
178	439.5
180	440.5
190	441
196	441.5
205	441.5
213	441.5
220	441.5
229	441.5
236	441.5 /

-- time, min x, from top of flange, cm
Thermo_Tabulation

43	12
70	27.5
103	42.8
125	68.3 /

-- Time, minutes	Tinj, oC	Pinj,psig	Pout,psig
Log_Data_Tabulation			
0.053	48.62	270.44	261.21
0.5473	52.71	268.15	261.32
1.048	61.98	260.61	261.36
1.5478	79.98	260.50	261.26
2.0468	97.43	260.93	261.33
2.5475	171.13	265.14	261.75
3.0483	202.29	265.92	261.02
3.5482	204.94	269.77	260.92
4.048	206.19	273.95	261.07
4.5468	208.09	276.00	260.89
5.0475	210.61	277.95	260.88
5.5473	213.46	278.65	260.87
6.0482	214.39	279.17	260.85
6.548	214.57	279.88	260.85
7.0478	214.48	281.20	260.84
7.5477	214.97	293.51	260.93
8.0483	216.00	297.46	260.89
8.5482	217.29	303.00	260.88
9.048	219.42	308.62	260.91
9.5478	220.87	306.70	260.83
10.0477	221.04	308.29	260.83
10.5483	222.02	310.22	260.80
11.0492	223.13	313.13	260.80
11.548	223.42	318.22	260.82
12.0478	223.65	318.86	260.81
12.5477	218.64	314.41	260.80
13.0483	218.00	313.54	260.78
13.5473	218.07	314.92	260.77
14.048	219.08	315.37	260.79
14.5478	221.82	313.50	260.86
15.0468	231.12	310.16	260.77
15.5475	238.20	308.04	260.73
16.0482	241.25	304.80	260.71
16.548	241.54	305.11	260.72
17.047	241.07	306.56	261.27
17.5477	239.50	307.03	259.11
18.0485	235.72	307.11	259.59
18.5473	224.74	306.95	258.09
19.048	217.55	304.50	257.05
19.5478	216.53	303.38	258.02
20.0487	216.43	304.42	259.01
20.5475	216.75	307.00	258.84
21.0483	217.29	309.70	261.45
21.5482	217.70	312.00	261.62
22.047	218.08	313.29	261.73
22.5477	218.44	314.43	261.49
23.0475	218.69	314.75	261.58
23.5483	218.66	315.33	261.57
24.0482	218.86	315.56	261.57
24.547	219.06	316.23	261.54
25.0478	219.40	316.27	261.52
25.5477	219.31	316.00	261.49
26.0483	219.44	316.12	261.44
26.5482	219.91	317.64	261.42
27.047	220.18	318.51	261.42
27.5478	221.58	320.73	261.39
28.0477	221.99	321.52	261.24
28.5483	222.33	321.72	261.24

29.0482	225.72	321.23	261.24
29.548	231.74	320.79	261.21
30.0478	231.08	320.97	261.23
30.5485	227.11	320.84	261.19
31.0483	222.71	320.57	261.21
31.5473	221.89	319.80	261.21
32.048	226.74	320.54	261.17
32.5478	233.15	320.38	261.19
33.0477	235.92	319.28	261.15
33.5483	235.88	318.68	260.42
34.0482	234.08	318.38	262.53
34.548	234.01	318.27	263.46
35.0478	235.09	318.84	263.23
35.5477	234.57	317.48	263.00
36.0485	235.58	316.78	262.03
36.5473	236.67	315.86	255.07
37.048	237.09	314.19	248.94
37.5478	236.65	312.99	249.87
38.0477	235.86	312.25	250.28
38.5475	236.35	311.49	251.54
39.0483	236.71	311.36	251.26
39.5482	236.41	310.66	251.99
40.0488	236.52	310.66	252.71
40.5477	235.13	310.77	252.28
41.0467	234.45	311.44	253.02
41.5473	234.99	311.79	253.75
42.0482	235.62	312.33	253.54
42.548	235.13	312.79	253.32
43.0478	235.85	313.31	253.54
43.5477	236.69	313.59	254.17
44.0483	236.95	314.24	254.16
44.5482	235.81	314.07	253.58
45.048	236.22	314.38	254.31
45.5478	236.66	315.08	253.80
46.0477	235.91	315.62	254.41
46.5483	235.16	316.56	254.97
47.0482	235.61	316.81	254.80
47.548	236.89	317.39	254.59
48.0478	236.79	317.18	254.53
48.5477	236.29	318.02	255.06
49.0483	234.66	318.31	255.61
49.5473	235.13	319.10	255.25
50.048	236.46	319.15	255.55
50.5478	237.11	319.68	255.38
51.0477	236.04	319.65	256.52
51.5483	235.63	320.24	256.14
52.0482	236.30	320.55	256.40
52.548	238.12	321.26	255.39
53.0478	237.84	320.76	255.30
53.5477	235.69	321.55	256.04
54.0475	224.77	322.15	255.72
54.5483	221.43	322.67	255.65
55.048	220.47	322.49	255.15
55.5478	223.44	322.98	255.76
56.0468	229.73	322.87	256.29
56.5475	235.42	323.05	255.55
57.0483	240.00	323.08	256.49
57.5482	241.64	323.20	257.00
58.047	236.11	323.55	256.48
58.5477	224.15	322.97	255.49
59.0475	220.63	323.08	255.83
59.5483	220.48	322.97	256.38
60.0482	220.84	323.17	256.42
60.548	222.42	323.37	256.75
61.0478	225.61	323.40	257.12
61.5477	231.92	324.52	256.07

62.0483	236.31	324.70	256.13
62.5482	238.84	324.69	256.05
63.047	238.81	324.97	255.89
63.5478	227.01	325.28	257.14
64.0477	221.54	324.88	256.97
64.5483	221.28	324.50	257.32
65.0482	221.66	324.62	256.92
65.5472	222.97	324.67	256.17
66.0478	227.05	324.76	257.28
66.5477	232.48	325.10	257.26
67.0483	237.43	325.38	256.30
67.5482	239.46	325.31	256.61
68.0472	239.18	325.05	257.26
68.5478	239.31	325.61	256.86
69.0477	238.56	325.80	256.45
69.5483	238.25	325.26	257.05
70.0482	240.76	325.13	256.75
70.5472	244.35	324.60	258.10
71.0478	245.74	324.40	257.33
71.5477	242.42	324.28	257.80
72.0485	239.17	324.26	258.62
72.5473	236.99	323.89	258.66
73.048	236.26	324.04	258.29
73.5478	236.81	323.51	258.61
74.0468	240.50	323.38	259.34
74.5475	244.59	323.13	259.56
75.0483	246.67	322.60	259.57
75.5482	246.23	322.09	258.92
76.048	241.57	321.30	258.90
76.5477	235.11	320.97	259.27
77.0467	229.99	320.61	258.73
77.5483	229.24	320.15	258.21
78.0482	232.40	319.63	258.68
78.548	237.12	319.77	258.73
79.0468	241.87	319.63	259.53
79.5477	244.87	318.91	260.25
80.0483	245.68	317.92	258.97
80.5472	245.20	317.21	258.60
81.048	242.73	316.96	258.99
81.5478	238.56	316.25	258.74
82.0477	235.61	315.41	258.86
82.5483	236.49	315.27	258.70
83.0482	239.24	314.47	258.71
83.548	242.85	314.32	259.57
84.0478	244.63	313.63	259.26
84.5477	244.71	312.58	259.68
85.0483	243.73	311.74	258.92
85.5473	242.44	311.24	259.37
86.0472	239.81	310.54	259.71
86.5478	237.88	310.04	259.59
87.0477	238.19	309.31	258.56
87.5483	239.90	308.65	259.55
88.0482	240.98	308.02	259.53
88.548	241.12	307.25	259.89
89.0478	240.88	306.20	259.04
89.5468	240.26	305.68	259.96
90.0485	239.90	304.93	258.73
90.5483	239.94	304.26	260.03
91.0472	240.38	303.54	259.76
91.5478	240.71	303.29	260.00
92.0468	238.72	302.46	258.60
92.5475	238.82	301.70	257.96
93.0483	240.74	301.00	259.26
93.5482	241.57	300.18	259.03
94.048	241.52	299.40	259.30
94.5477	241.29	298.43	258.98

95.0475	241.21	297.67	258.84
95.5483	240.96	297.06	259.44
96.0472	240.73	296.24	259.47
96.548	240.29	295.85	259.52
97.0478	240.42	295.17	259.23
97.5485	240.77	294.23	259.16
98.0483	240.75	292.83	260.71
98.5472	240.70	291.65	259.14
99.048	240.37	289.75	257.94
99.5478	240.09	288.24	259.46
100.0485	239.88	286.95	258.60
100.5475	239.77	285.95	257.49
101.0482	240.03	285.62	259.79
101.548	239.82	285.77	259.66
102.0468	239.37	286.09	258.91
102.5477	240.90	286.51	260.19
103.0483	242.91	287.04	261.64
103.5482	243.89	287.16	258.68
104.048	243.91	286.84	259.89
104.5478	243.25	286.23	259.89
105.0477	242.47	285.56	259.24
105.5483	241.70	284.65	259.27
106.0482	240.67	283.41	260.39
106.548	240.03	282.45	259.86
107.0478	238.51	280.90	259.72
107.5477	237.54	279.30	260.19
108.0485	237.19	277.66	260.57
108.5483	237.37	276.49	260.02
109.049	237.31	275.07	260.18
109.5478	237.04	274.09	260.08
110.0487	239.98	276.09	259.71
110.5475	240.81	276.86	260.06
111.0483	241.21	278.11	260.02
111.5482	241.31	279.01	260.44
112.047	241.38	279.75	262.71
112.5477	241.30	280.02	261.35
113.0475	241.00	279.89	258.52
113.5483	240.37	278.92	259.52
114.0482	239.57	277.87	259.11
114.547	239.18	276.82	259.17
115.0468	239.13	275.91	261.10
115.5477	239.60	275.81	260.60
116.0483	240.50	276.15	259.83
116.5472	241.35	277.11	259.82
117.048	241.89	278.37	260.72
117.5478	242.33	279.79	262.61
118.0477	242.73	281.16	262.60
118.5483	243.09	282.14	262.17
119.0482	243.08	281.85	259.71
119.5472	242.67	280.33	260.91
120.0478	242.39	278.72	260.15
120.5477	242.12	276.98	261.16
121.0483	241.79	275.27	260.58
121.5482	241.43	273.71	261.04
122.048	241.13	272.09	260.10
122.5478	240.65	270.53	261.33
123.0477	239.92	269.04	260.23
123.5483	239.03	267.39	261.05
124.0482	238.16	265.99	260.40
124.548	237.98	265.21	260.15
125.0478	238.00	264.27	260.75
125.5477	238.37	264.08	260.13
126.0485	239.91	265.66	261.20
126.5483	241.47	266.72	260.29
127.048	240.19	268.25	261.37
127.5478	239.93	268.76	261.78

128.0477	241.36	269.04	261.45
128.5475	242.10	268.87	263.37
129.0483	242.14	268.22	261.03
129.5472	241.74	267.48	261.30
130.048	241.33	266.62	263.03
130.5477	240.63	265.82	262.42
131.0475	240.05	265.09	261.49
131.5483	239.37	264.53	260.28
132.05	240.04	265.15	261.31
132.547	241.94	266.65	263.26
133.0478	242.29	267.84	262.87
133.5477	242.51	268.42	258.68
134.0492	242.76	267.87	259.90
134.5472	243.04	267.55	260.26
135.048	242.90	266.99	260.18
135.5478	242.72	266.28	260.06
136.0477	242.46	265.27	261.01
136.5493	241.98	264.37	261.33
137.0482	241.07	263.37	260.14
137.548	239.95	262.72	261.53
138.0487	238.52	261.83	259.77
138.5467	237.66	261.45	259.81
139.0475	236.45	261.17	260.62
139.5482	235.90	262.72	260.17
140.049	236.64	263.05	258.70
140.5478	237.38	264.36	260.25
141.0477	238.72	266.49	261.23
141.5483	239.39	268.58	260.77
142.0482	240.88	268.80	259.85
142.548	241.75	267.42	260.86
143.0478	241.70	266.02	260.19
143.5477	241.40	264.11	258.52
144.0485	240.79	262.95	259.53
144.5483	239.24	262.57	259.82
145.048	237.54	262.04	257.97
145.5478	237.08	261.33	258.51
146.0477	236.98	261.39	260.09
146.5475	236.95	260.72	257.90
147.0483	236.40	260.17	259.00
147.5482	235.61	259.79	258.46
148.048	234.72	259.57	259.05
148.5477	233.94	259.62	258.54
149.0475	234.69	259.86	259.43
149.5483	234.18	260.15	259.02
150.049	235.05	261.24	260.31
150.548	236.25	262.89	260.00
151.0478	236.95	264.41	261.36
151.5467	237.93	266.06	262.38
152.0483	238.49	267.05	262.61
152.5482	239.30	266.42	260.38
153.048	239.86	265.91	261.69
153.5468	239.02	265.54	262.81
154.0477	238.33	264.86	263.04
154.5483	237.20	263.91	259.65
155.0482	236.51	261.50	259.00
155.547	236.55	260.72	258.61
156.0478	236.46	260.26	259.25
156.5477	236.41	260.53	259.31
157.0483	237.49	261.58	259.40
157.5473	237.35	263.07	260.36
158.048	235.84	264.35	260.61
158.5478	233.42	265.87	261.53
159.0485	233.27	266.06	259.29
159.5483	237.25	265.42	260.14
160.0482	240.16	264.81	259.81
160.548	240.91	264.18	260.37

161.0478	239.95	263.61	260.28
161.5477	238.06	263.04	260.03
162.0485	235.87	262.52	260.07
162.5473	232.71	262.46	260.52
163.048	229.78	262.60	259.79
163.5478	226.20	262.36	260.91
164.0468	223.65	262.37	261.02
164.5475	223.79	262.64	260.78
165.0483	226.61	264.59	262.32
165.5482	227.38	266.21	262.95
166.048	228.41	267.16	262.94
166.5468	228.22	267.10	262.63
167.0475	228.26	266.64	261.38
167.5483	228.41	264.56	258.96
168.0482	228.89	263.12	260.20
168.5488	230.99	262.85	259.19
169.0468	234.63	262.91	259.63
169.5477	238.26	262.62	260.60
170.0483	240.16	263.27	259.67
170.5482	240.78	263.12	260.54
171.048	240.14	263.59	259.64
171.5468	238.96	263.94	259.64
172.0477	236.69	264.21	260.49
172.5483	233.97	264.53	261.24
173.0482	230.59	264.62	260.74
173.547	228.00	264.35	261.16
174.0478	227.52	264.47	261.46
174.5477	227.97	264.05	260.66
175.0483	227.10	263.86	261.23
175.5482	226.42	265.26	260.46
176.048	229.47	265.61	260.13
176.5488	232.45	265.25	261.57
177.0468	233.87	265.30	262.27
177.5475	233.68	265.12	260.79
178.0482	232.11	264.76	260.92
178.548	230.09	264.22	260.50
179.0478	228.91	264.63	261.50
179.5468	228.18	262.57	255.83
180.0493	229.05	260.11	255.68
180.5483	229.61	259.71	255.96
181.048	229.25	260.28	256.72
181.547	229.83	261.32	258.11
182.0477	231.47	262.45	258.61
182.5475	232.28	262.98	259.55
183.0483	231.06	262.47	259.13
183.5482	229.55	261.83	258.51
184.048	229.48	261.16	258.23
184.5477	229.38	260.64	258.82
185.0475	228.63	260.18	258.21
185.5483	227.11	259.49	258.12
186.0472	225.72	259.22	257.95
186.548	226.64	259.16	257.91
187.0478	227.49	259.38	257.83
187.5467	229.18	261.65	258.42
188.0483	229.66	262.44	258.89
188.5482	230.14	263.39	260.58
189.047	230.37	263.82	260.56
189.5478	230.83	264.61	260.21
190.0485	230.12	264.40	261.53
190.5483	229.17	264.79	261.94
191.0482	228.96	264.70	258.58
191.548	223.20	262.09	258.93
192.0478	223.01	261.72	258.54
192.5477	226.86	259.95	253.32
193.0483	231.02	257.49	255.76
193.5473	232.93	257.88	256.45

194.048	233.61	258.97	256.72
194.5478	232.35	259.89	256.80
195.0477	230.81	260.46	257.26
195.5483	229.60	261.08	258.02
196.0482	229.19	260.19	257.05
196.5472	229.68	259.35	257.53
197.0478	228.90	258.68	256.21
197.5477	228.42	258.21	256.19
198.0485	227.53	257.72	257.51
198.5473	227.25	257.57	255.99
199.048	227.81	258.30	256.28
199.5478	229.03	260.22	256.88
200.0477	229.68	260.84	257.41
200.5475	231.10	261.55	258.95
201.0483	231.63	262.00	259.44
201.5482	231.29	262.05	259.15
202.048	230.24	261.79	260.21
202.5477	229.58	261.55	258.57
203.0475	227.96	260.34	257.26
203.5473	228.29	259.72	257.34
204.0472	228.51	260.32	258.97
204.548	228.55	261.79	258.77
205.0478	228.50	263.20	258.73
205.5477	229.13	263.83	260.52
206.0483	230.85	265.05	260.48
206.5482	231.61	265.73	261.71
207.047	231.73	266.24	260.59
207.5478	231.95	266.46	261.87
208.0477	230.50	266.33	258.08
208.5475	230.13	263.49	257.90
209.0482	229.99	262.02	258.01
209.548	230.35	261.54	258.49
210.0487	230.36	261.10	258.86
210.5477	229.52	261.22	259.45
211.0475	227.72	260.71	259.04
211.5492	226.58	260.96	259.00
212.048	225.80	261.08	259.26
212.547	226.41	262.47	259.85
213.0477	229.09	263.88	260.28
213.5483	229.74	264.12	259.75
214.0482	230.37	263.93	260.49
214.5472	230.89	264.44	259.75
215.0478	230.27	263.94	259.69
215.5468	228.86	262.28	257.61
216.0485	229.06	261.14	258.01
216.5483	229.82	260.81	257.28
217.048	230.60	260.94	257.80
217.547	230.37	261.13	258.57
218.0477	229.87	261.27	258.58
218.5467	229.77	261.84	258.88
219.0473	229.74	262.02	258.72
219.5472	228.39	262.44	258.54
220.048	226.85	262.55	258.17
220.5477	228.84	262.55	259.12
221.0475	231.48	262.84	259.48
221.5483	232.13	262.72	259.27
222.0482	232.15	262.67	259.22
222.548	230.55	262.93	259.37
223.0478	227.74	263.48	260.25
223.5485	226.19	264.87	260.50
224.0483	225.85	264.79	259.87
224.549	226.84	265.30	261.27
225.048	227.14	264.79	259.62
225.5468	227.96	264.00	259.57
226.0477	228.63	263.49	259.29
226.5483	227.40	263.07	260.80

227.0482	225.19	263.23	259.90
227.548	223.49	263.03	261.11
228.0478	224.82	264.54	261.37
228.5477	226.26	265.61	261.69
229.0483	227.27	266.69	259.81
229.5482	228.19	266.96	262.41
230.049	228.53	266.69	261.86
230.5478	227.53	265.46	261.12
231.0477	227.16	265.16	260.81
231.5483	226.83	264.64	260.77
232.0482	225.42	263.23	259.39
232.548	224.76	262.91	259.76
233.047	224.96	262.97	259.74
233.5477	226.22	264.47	261.09
234.0485	227.14	265.68	261.51
234.5473	228.00	266.48	261.22
235.048	222.01	266.98	262.23
235.5478	222.23	266.86	261.72
236.0477	225.87	266.35	261.40
236.5475	227.54	265.25	259.40
237.0492	227.60	263.38	259.12
237.5472	226.19	262.46	259.49
238.048	225.52	262.61	260.49
238.5477	225.07	262.40	259.33
239.0475	225.35	262.65	260.22
239.5483	225.98	264.75	260.14
240.049	225.29	266.19	262.17
240.5488	224.74	267.23	262.21
241.0478	226.07	267.47	262.46
241.5477	227.36	267.13	262.39
242.0473	227.60	265.26	256.54
242.5482	227.69	261.70	258.15
243.047	226.32	263.11	262.10 /

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