Flight-Type Dishmachine Replacement—Field Evaluation Report

Frontier Energy Report # 1850172.000-R0
December 2018

Prepared by:
Angelo Karas
Denis Livchak
Frontier Energy

Prepared for:
Pacific Gas and Electric Company

Test Site:
Marriott Hotel - San Ramon

Food Service Technology Center Background

The information in this report is based on data generated in the field in commercial foodservice facilities by Frontier Energy who operate the Food Service Technology Center. Dedicated to the advancement of the foodservice industry, Frontier Energy is the industry leader in commercial kitchen energy and water efficiency and appliance performance testing for 30 years. They have developed over 35 Standard Test Methods for evaluating commercial kitchen appliance and system performance as well as pioneering lab and field research with cooking appliances, kitchen ventilation systems, hot water systems and dishroom equipment.

Policy on the Use of Frontier Energy Field Test Results and Other Related Information

Frontier Energy does not endorse products or services from any specific manufacturer or service provider. Frontier Energy is *strongly* committed to testing foodservice equipment using the best available scientific techniques and instrumentation. Frontier Energy is neutral as to fuel and energy source. It does not, in any way, encourage or promote the use of any fuel or energy source nor does it endorse any of the equipment tested by Frontier Energy. Frontier Energy test results are made available to the public through technical research reports and publications and are protected under U.S. and international copyright laws.

Disclaimer

Copyright 2018 Frontier Energy. All rights reserved. Reproduction or distribution of the whole or any part of the contents of this document without written permission of Frontier Energy is prohibited. Results relate only to item(s) tested. Frontier Energy nor any of their employees make any warranty, expressed or implied, or assume any legal liability of responsibility for the accuracy, completeness, or usefulness of any data, information, method, product or process disclosed in this document, or represents that its use will not infringe any privately-owned rights, including but not limited to, patents, trademarks, or copyrights. Reference to specific products or manufacturers is not an endorsement of that product or manufacturer by Frontier Energy. In no event will Frontier Energy be liable for any special, incidental, consequential, indirect, or similar damages, including but not limited to lost profits, lost market share, lost savings, lost data, increased cost of production, or any other damages arising out of the use of the data or the interpretation of the data presented in this report.

Acknowledgments

Frontier Energy appreciates the funding partners that supported this project including Pacific Gas and Electric Company and Meiko USA, Inc. Further appreciation is extended to the San Ramon Marriott Hotel and their foodservice, maintenance and engineering staff for accommodating us on our on-site visits and correspondences.

Legal Notice

This report was prepared by Frontier Energy at the Food Service Technology Center whose operations are sponsored by the California Public Utilities Commission (CPUC). It does not necessarily represent the views of the CPUC, its employees, or the State of California. The CPUC, the State of California, its employees, contractors, and subcontractors make no warranty, express or implied, and assume no legal liability for the information in this report; nor does any party represent that the use of this information will not infringe upon privately owned rights. This report has not been approved or disapproved by the CPUC nor has the CPUC passed upon the accuracy or adequacy of the information in this report.

Revision History

Revision Num.	Date	Description	Author(s)
0	December 2018	Final Report	A. Karas; D. Livchak

Executive Summary

This project involved field monitoring of baseline and replacement flight-type (rackless) conveyor dishmachines at The Marriott Hotel in San Ramon, California. The scope included the installation of instrumentation to monitor and log water and energy use of the preexisting, past-generation flight conveyor dishmachine, and the subsequent monitoring of the replacement latest-generation, high-efficiency machine equipped with exhaust air heat recovery. Data points included water flow, electricity use, hot/cold-water supply temperature, and dishmachine sanitizing rinse time. Each machine was monitoring for a period of over one month, and the resultant data sets were compiled to calculate daily water and energy use, and annual savings estimates.

As a function of a more efficient, final rinse system with a lower flowrate, the replacement machine used 63% less total water and 84% less hot water, resulting in an 84% reduction in gas energy consumption. Electrical energy use was reduced by 19%, and the estimated peak demand was reduced by 36%, from 70 kW to 45 kW. The measured average daily gas, electric and water consumption was extrapolated for a 365 day-per-year operation and calculated for the following utility costs: $1.00 per therm; $0.12 per kWh; $5.08 per CCF for water and $8.64 per CCF for sewer. The chemical cost estimate for the replacement machine was extrapolated based on the previous-year chemical cost information given for the baseline machine. This cost was then normalized to a cost-per-gallon of dishmachine water use value—based on the estimated annual water use calculated from the baseline machine monitoring data. Table ES-1 summarizes the annual usage and savings estimates.

Table ES-1. Annual Usage and Operating Cost Savings

	Baseline	Replacement	Difference	% Difference	Cost Savings*
Hot Water Use (gal/yr)	604,688	94,980	509,708	84%	*Included Below*
Water Heating Gas Use (therms/yr)	6,476	1,017	5,459	84%	$5,459
Dishmachine Energy Use (kWh/yr)	207,757	168,013	39,744	19%	$4,769
Dishmachine Water Use (CCF/yr)	808	301	507	63%	$6,956
Estimated Chemical Cost	$9,443	$3,515	$5,928	63%	$5,928
				Total Annual Savings	**$23,112**

** Calculated using $1.00 per therm; $0.12 per kWh; $5.08 per CCF for water and $8.64 per CCF for sewer*

Introduction

This project involved field monitoring of baseline and replacement flight (rackless) conveyor dishmachines installed at The Marriott Hotel in San Ramon, California to accurately estimate annual gas, electric and water usage and savings. Factors that affect utility consumption of dishmachines such as machine throughput, maintenance/condition and dishroom staff operational practices can be quite variable, thereby making it difficult or nearly impossible to predict utility consumption without at least some form of installed metering equipment. Because these large, workhorse flight-conveyor dishmachines can be very utility-intensive, they can demonstrate great savings potential. The segments of the food service sector that are often equipped with flight conveyer dishmachines are large full-service restaurants, commercial cafeterias, hospitals, hotels with dining and banquet facilities, nursing homes, colleges, universities, K-12 central kitchens, and correctional facilities.

The project scope included the installation of instrumentation to monitor and log water and energy use of the preexisting, past-generation flight conveyor dishmachine, and then the subsequent monitoring of the replacement latest-generation, high-efficiency machine equipped with exhaust air heat recovery. Data points including water flow, electricity use, hot-water supply temperature, and dishmachine sanitizing rinse time were collected at five-second intervals and stored with a time stamp in the memory of a data acquisition system (DAQ). Resultant data sets were compiled to calculate daily water and energy use. Further description and specifications of the instrumentation can be found in the Methodology section of the Appendix. Baseline (preexisting) dishmachine monitoring commenced in December 2016, and the replacement dishmachine monitoring commenced in July 2018 shortly after the machine replacement.

Site Overview

The Marriott Hotel central kitchen is the sole kitchen in the facility and prepares food for the hotel restaurant, catered events, and room service. The dishroom is equipped with a flight conveyor dishmachine that is used to process most of the facility's wares. The hotel incorporates two undercounter dishmachines located in other areas and used primarily for fine glassware. Although there is a separate back-of-house ware-washing area with compartment sinks, much of the medium- and larger-size back-of-house wares get processed through the flight conveyor dishmachine.

Figure 1 shows the dishtable and pre-rinse area opposite the flight dishmachine with a variety of wares including dishes and many back-of-house items such as mixing bowls, hotel pans and sheet pans.

Figure 1. Hotel Dishtable with Assorted Wares

During monitoring, the dishmachine operating span, i.e., the time first turned on in the morning to the time turned off at night, ranged between 16 and 22 hours per day and averaged 19 hours per day. Active wash time ranged between 4 and 13 hours per day and averaged approximately 8 hours per day. All the domestic hot water (DHW) for the kitchen and dishroom was provided by a gas boiler. Cold city water was supplied at 65°F to the boiler and arrived at the dishwasher hot inlet at 145°F. For the gas heating energy use calculations, it was assumed that the delivery efficiency of the water heating system to the dishwasher was 70% and that there was a 10°F line loss between the boiler and the dishwasher, equating to a boiler outlet temperature of 155°F. The dishmachine uses electric tank heaters to maintain proper tank water temperature and incorporates an internal electric booster heater to supply the final rinse water at or above 180°F.

Baseline Dishmachine

Setup

The preexisting dishmachine (Figure 2) at the Marriott hotel was a +15-year-old standard (without heat recovery) flight-type machine. It consisted of a pre-wash section, a power wash section, and a power/final rinse section—each with a separate tank and pump. The machine's total tank capacity was 120 gallons. Water was supplied solely by the building domestic hot water (DHW) system. This water was used for tank fills and top-offs and supplied the electric booster heater used to heat the final sanitizing rinse. The NSF rated final rinse water consumption rate for the baseline machine was 132 gph or 2.2 gpm. The rinse sensing/timing technology in this model used an optic sensor at the load end of the conveyor to identify wares entering the machine (anywhere across the conveyor) and then cycled the final rinse water flow accordingly as the wares crossed through the final rinse section before the machine exit. The machine cavity was directly ventilated over the rinse section with a single duct operating at an exhaust airflow rate of 750 cfm.

Figure 2. Baseline Dishmachine

Results

The baseline dishmachine was monitored for over a month for water and energy consumption. The active wash time (time the conveyor was moving, with wash pumps on) averaged 7.5 hours per day, and the final rinse time (activated by the optic sensor system) averaged 6.0 hours per day, which translates to a 20% final rinse water use reduction. Figure 3 shows the daily wash times and rinse times for the baseline machine during the monitoring period.

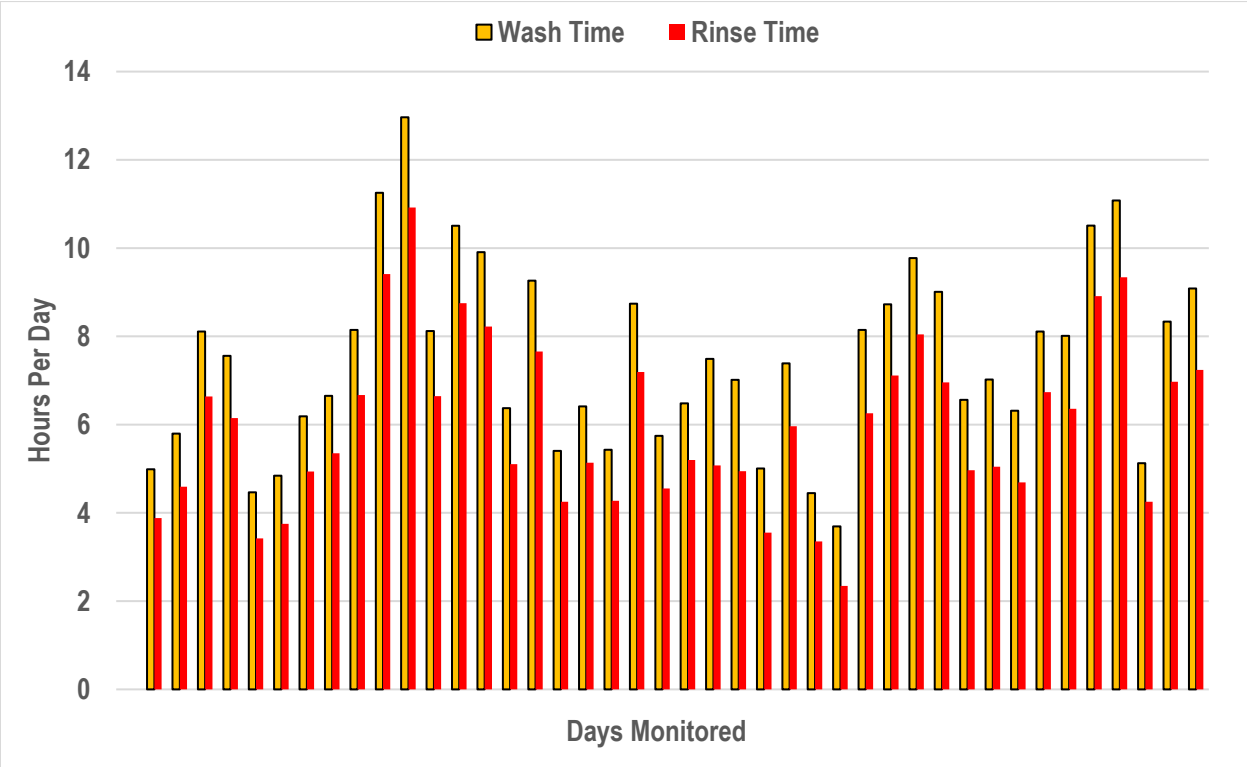


Figure 3. Baseline Machine Wash Time and Rinse Time

A typical-day water consumption profile is shown in Figure 4, using a selected day with water and energy consumption approximating the overall average.

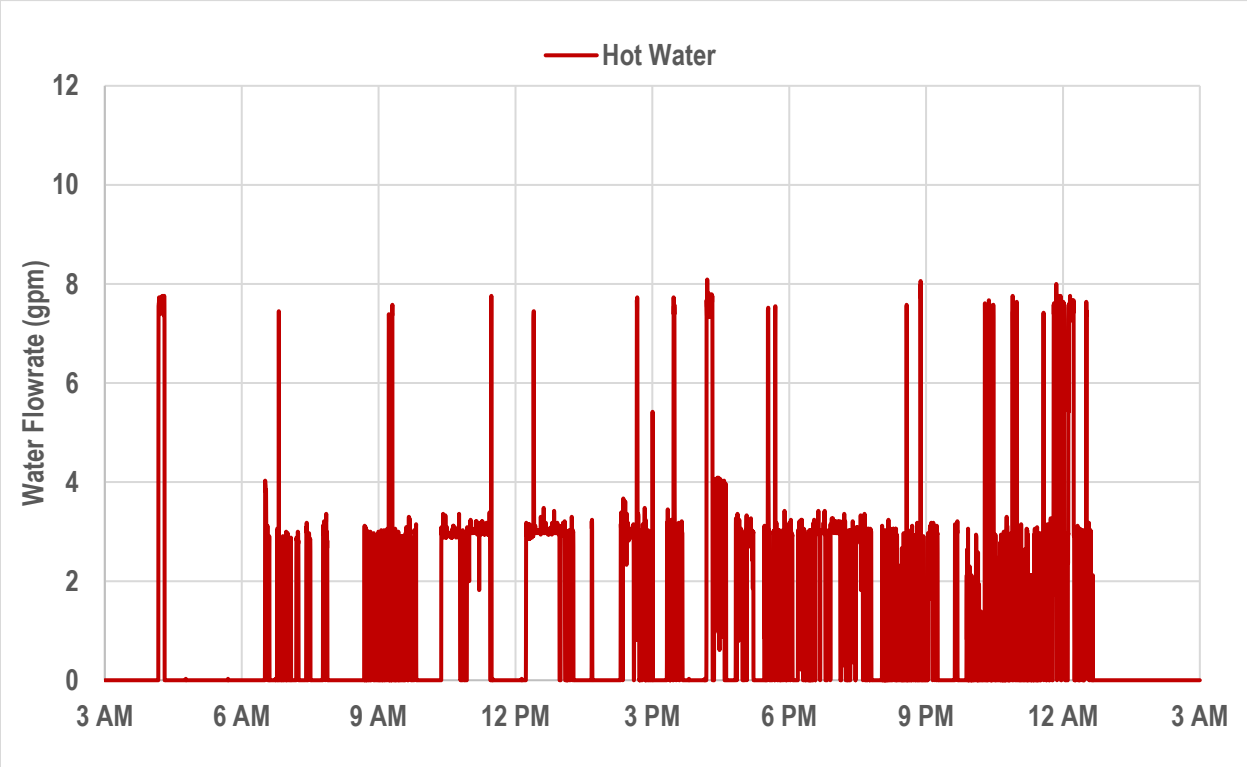


Figure 4. Baseline Machine Water Consumption Profile

The measured rinse flowrate of 2.8 gpm was 27% higher than the manufacturer-specified flowrate of 2.2 gpm. This was because the final-rinse line pressure regulator setting was increased, reportedly to increase the final sanitization temperature of the wares (which is not an uncommon practice with older dishmachines). On the profile graph, these rinse flow periods represent the bulk of the flow, while the higher flow periods (spikes) at around 7.5 gpm represent fills and tank top-offs.

Figure 5 on the following page shows the daily water consumption throughout the baseline monitoring period, during which the machine consumed an average of 1,657 gal of water per day—all of which was hot water from the DHW system. It is suspected that the anomalous days with water consumption above 3,000 gal were likely due to a tank water level sensor malfunction, though this did not significantly affect the average. Also, later data collected after the official monitoring period indicated higher average water consumption in the order of 1,800 gal per day—probably due to increased business and throughput as the winter period waned. Thus, the lower representative official average tends to yield a more conservative savings estimate.

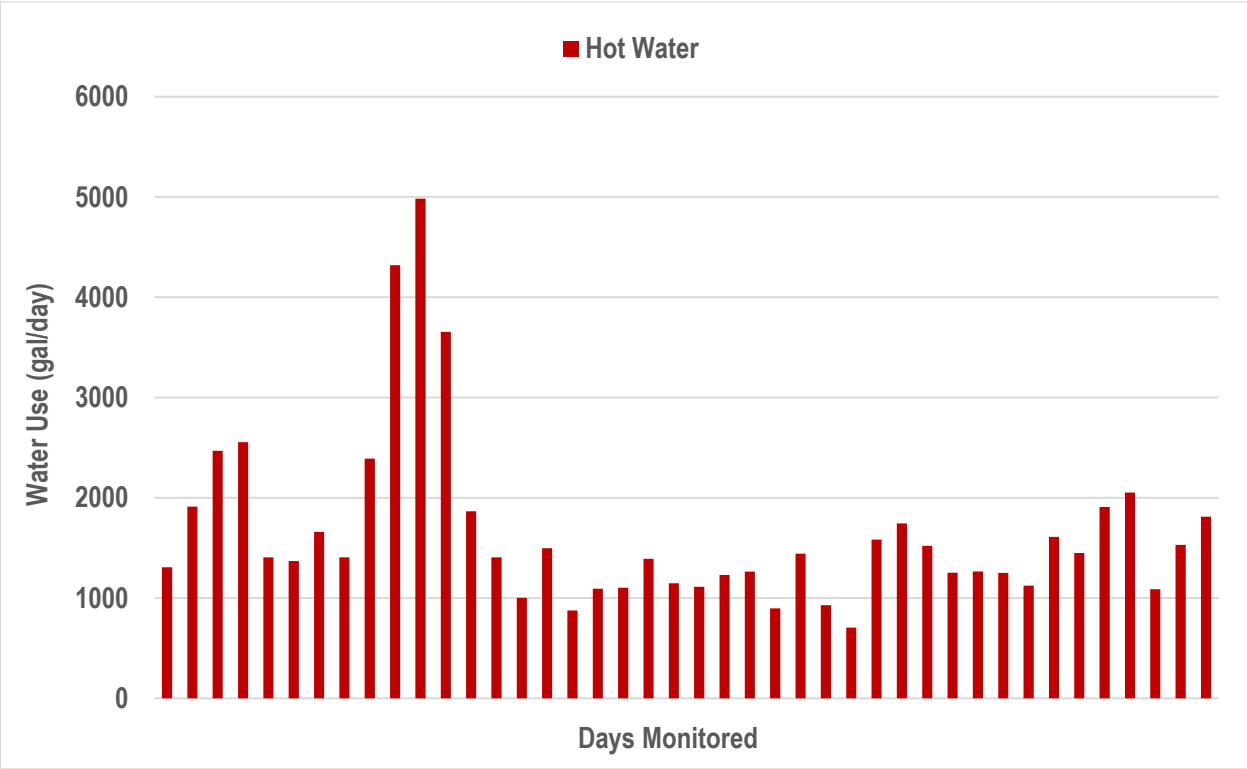


Figure 5. Baseline Machine Daily Water Consumption

With an average of 2.1 fills per day and a 120-gal total tank capacity, the tank fill/refill water component (not including top-offs) represented 15% of the water usage and thusly 15% of the water heater gas energy usage. Using a nominal DHW system delivery efficiency of 70%, the energy impact on the boiler was calculated to be 17.7 therms per day. The electrical consumption of the machine including the booster heater was 569 kWh per day. This energy total excludes ventilation energy, and any air conditioning energy used to offset the heat load to the space generated by the machine. Table 1 summarizes the results from the baseline machine.

Table 1. Baseline Machine Usage

Wash Time (h/day)	7.48
Cold Water Consumption (gal/day)	0
Hot Water Consumption (gal/day)	1,657
Water Heater Gas Use (therms/day)	17.7
Dishmachine Energy Use (kWh/day)	569

Replacement Dishmachine

Setup

The replacement dishmachine (Figure 6) at the Marriott hotel is a latest generation flight-type exhaust-air heat recovery model. The dishmachine consists of a pre-wash section, a power wash section, and a power/final rinse section with a separate tank and pump in each. The NSF final rinse water consumption rating is 56.8 gph or 0.95 gpm. Final rinse water is pumped and therefore not subject to flowrate alterations via a rinse line pressure regulator. The replacement machine has a smaller total tank capacity of 76 gallons. It also includes a 4.5-kW blower/dryer section. A blower/dryer was not included on the baseline machine but was opted for by the hotel operations staff for the replacement machine to improve final rinse quality, for example by reducing or eliminating water spots. Ventilation is accomplished with a canopy hood operating with an airflow rate of 750 cfm and installed over the load end of the machine, which is where the exhaust exits.

Figure 6. Replacement Dishmachine

While the baseline dishmachine was supplied exclusively with hot water from the DHW system, the replacement machine uses both hot and cold (City) water supplies. Hot water is used only for tank fills and top-offs, while the primary operating water supply to the machine during operation is cold water, which is initially heated through an exhaust air heat exchanger. The hot air from within the machine cavity is drawn through the heat exchanger to preheat the incoming cold water before this water is then passed to the internal electric booster heater. The rinse sensing/timing technology of the replacement machine uses three optical sensors that point downward across the conveyor above the load end and detect whether wares enter the machine in any of the three corresponding rinse sectors (lanes). The controls accordingly shut off the final rinse water flow to any of the three corresponding final rinse circuits at the other end of the machine whenever no wares are detected. The default state is to start the wash cycle with all three final rinse circuits on until an empty lane is detected before shutting any single rinse circuit off. Thus, the reported wash and rinse times for the replacement machine are effectively the same while the rinse flow proportion (equivalent rinse time) varies depending on the conveyor loading pattern.

Results

After installation and proper commissioning, the replacement dishmachine was also monitored over a period of one month. The average wash and rinse time for the replacement machine was 8.1 hours per day, and the equivalent rinse time, accounting for the optic system rinse reduction, was 5.8 hours per day. This equates to a 29% rinse water use reduction, which resulted from efficient loading by the dishroom staff to keep at least one lane unused when full throughput capacity loading was unnecessary. Figure 7 shows the daily wash/rinse times and equivalent rinse times through the monitoring period.

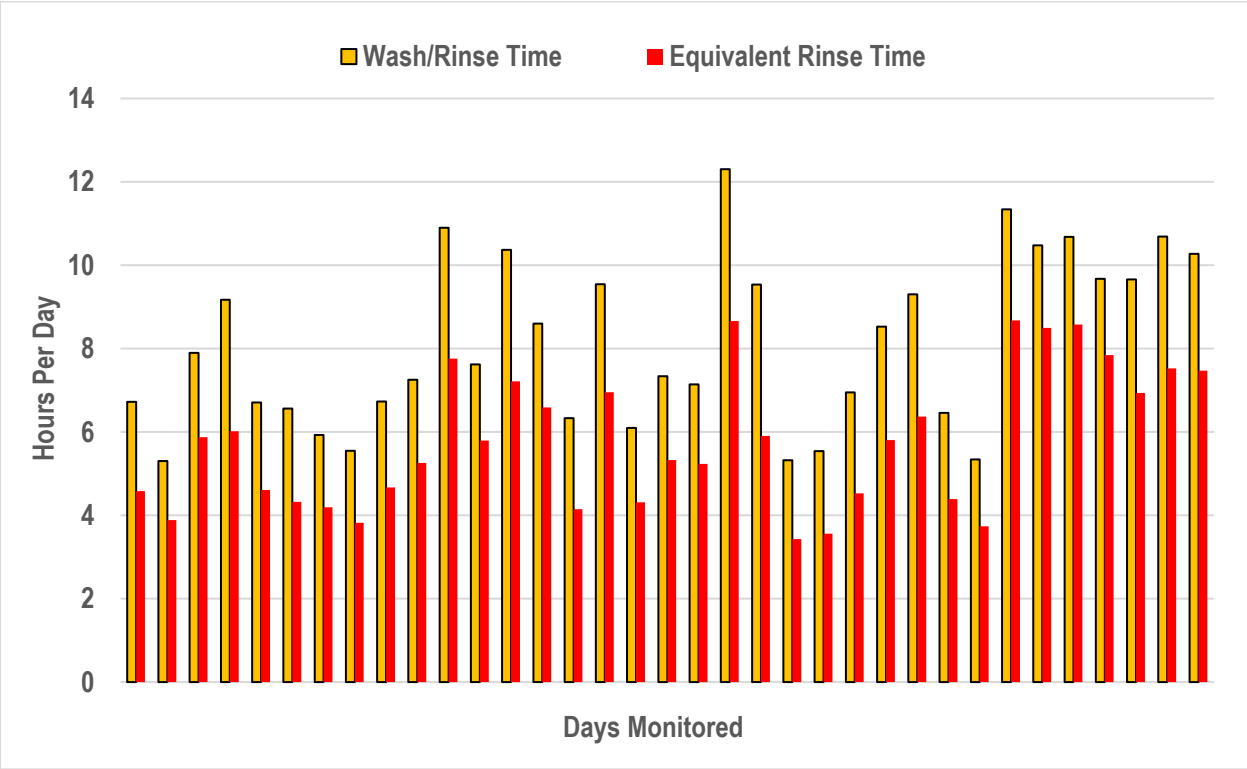


Figure 7. Replacement Machine Wash/Rinse Time and Equivalent Rinse Time

The staff drained and filled the replacement machine an average of 2 times per day during the monitoring period, and including tank top-offs, this resulted in an average DHW consumption of 260 gal per day. The machine also consumed 357 gal of cold water per day to supply the fresh water rinse, which was heated ultimately to the 180°F minimum final rinse temperature by a combination of energy recovery and the electric booster heater. Figure 8 shows the daily water consumption of the replacement machine through the monitoring period, and Figure 9 shows a typical day profile. The profile shows the rinse flow (blue) and the hot water fills and tank top-offs (red) throughout the day. The average measured rinse water consumption rate of 1.03 gpm was very close to the NSF rating of 0.95 gpm.

It was discovered that the frequent top-offs were mostly a result of flat placement of sheet pans and large serving trays on the conveyor belt causing water to transfer from one tank to another during washing (deflecting across the wares), resulting in a top-off with hot water into the deficient tank. This was the largest contributing factor for water consumption and would also depend on whether dishroom staff members would load the sheet pans and trays on edge as opposed to flat on the conveyor. Therefore, the days with the most water use occurred on the hotel's reported heaviest service days with large meetings and banquets that involved the use of many sheet pans and serving trays.

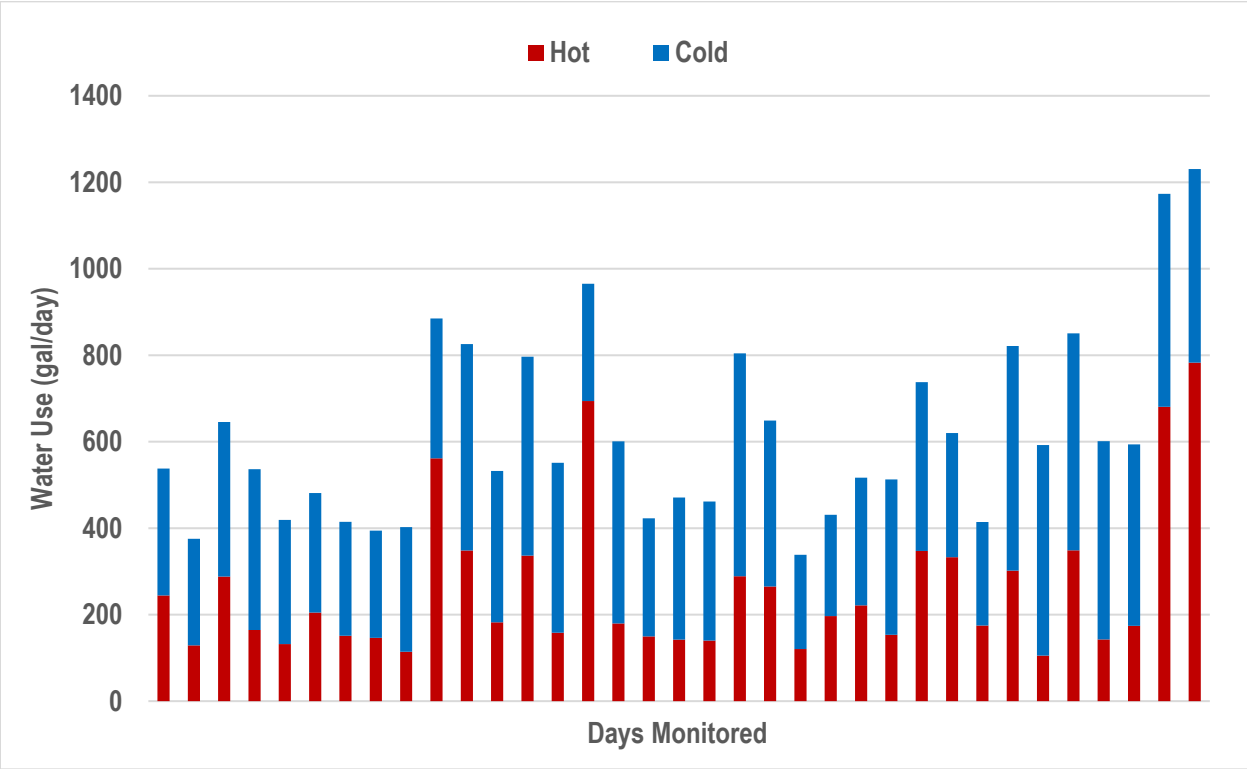


Figure 8. Replacement Machine Daily Water Consumption

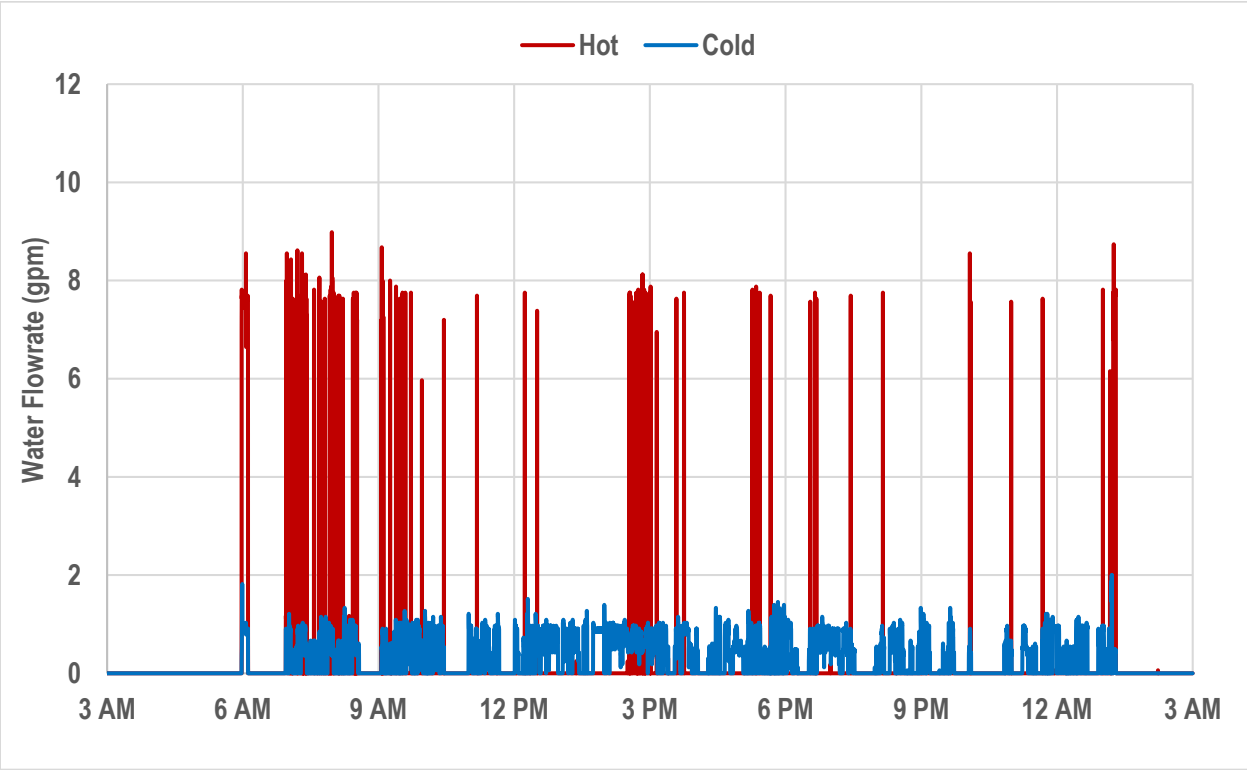


Figure 9. Replacement Machine Water Consumption Profile

The average daily energy consumption was 460 kWh per day, which included the 4.5-kW blower/dryer energy. Based on the 8.1 h rinse time, the blower/dryer consumed an estimated 36.5 kWh per day. Table 2 summarizes the results from the replacement machine.

Table 2. Replacement Machine Usage

Wash Time (h/day)	8.11
Cold Water Consumption (gal/day)	357
Hot Water Consumption (gal/day)	260
Water Heater Gas Use (therms/day)	2.8
Dishmachine Electrical Energy (kWh/day)	460

Comparative Results

Dishmachine replacement resulted in significant hot water savings of 1,396 gal per day, resulting in an estimated water heating gas savings of 15 therms per day at the boiler. The exhaust air heat recovery featured on the replacement machine allowed the use of a cold-water supply for the final rinse water component. Although the booster heater was required to provide a higher temperature rise (from the booster supplied with ~110°F by the heat recovery system as compared to the 140°F baseline machine DHW booster supply), and the replacement machine had the addition of the 4.5-kW blower/dryer (accounting for 36.5 kWh/day), the replacement machine still used 109 kWh/day less than the baseline machine. This was primarily due to the lower rinse flowrate of the replacement machine, which significantly reduced the energy demand of the internal booster heater. Table 3 summarizes the energy savings associated with the flight-type dishmachine replacement. Based on the wash times recorded during the monitoring periods, it is assumed that the overall usage (throughput of wares) between the two machines was similar, and the slightly higher wash time (0.63 h/day) for the replacement machine would tend to make the savings estimate conservative.

Table 3. Replacement Machine Savings

	Baseline	Replacement	Difference
Wash Time (h/day)	7.48	8.11	+0.63
Cold Water Use (gal/day)	0	357	+357
Hot Water Use (gal/day)	1,657	260	1,396
Water Heating Gas Use (therms/day)	17.7	2.8	15.0
Dishmachine Energy Use (kWh/day)	569	460	109
Peak Demand (kW)	70	45	25

In addition to the 109-kWh/day electrical energy reduction, the replacement machine demonstrated a significant peak demand reduction as well. Figures 10 and 11 show the 15-minute moving average demand profiles (for a duration of five days) for the baseline and replacement machines respectively. The graphically-estimated nominal peak demand values for each were 70 kW and 45 kW respectively, equating to a 25-kW peak demand reduction.

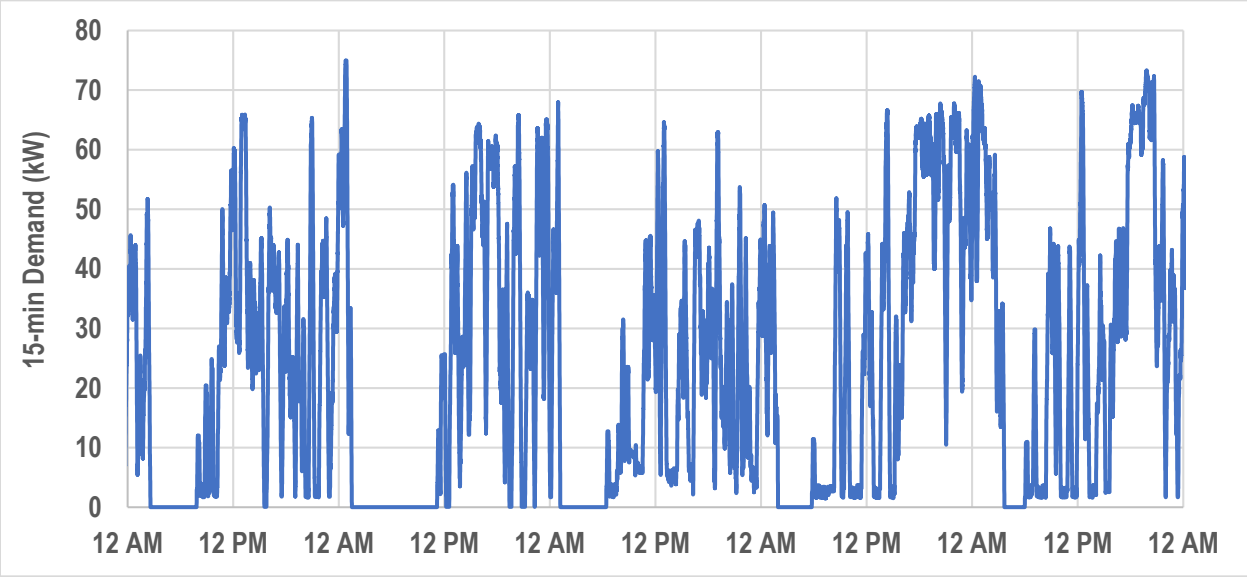


Figure 10. Baseline Machine Demand Profile

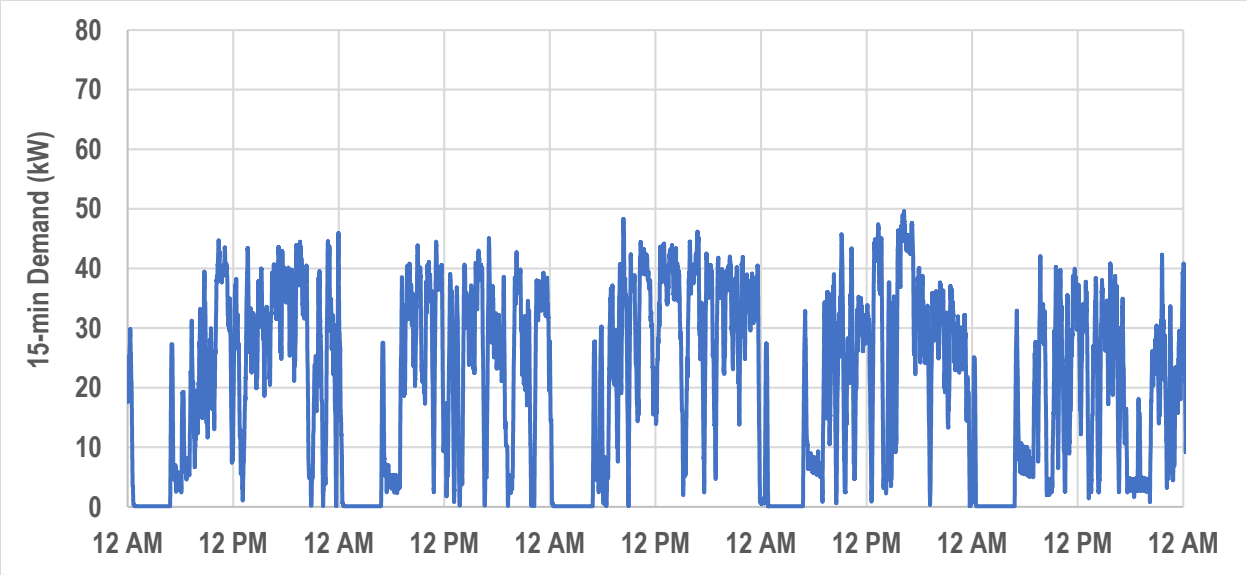


Figure 11. Replacement Machine Demand Profile

All the average daily gas, electric and water consumption values were extrapolated for a 365 day-per-year operation and calculated for the following utility costs: $1.00 per therm; $0.12 per kWh; $5.08 per CCF for water and $8.64 per CCF for sewer. Peak demand reduction cost savings were not included. In addition to the water and energy components, dishwasher chemical costs are a significant contributor to the dishroom operating costs. The hotel's chemical costs for washing and rinsing agents from a major national chemical provider were $9,443 in 2016. The average chemical cost was $26/day, which can be normalized to $0.0156 per gallon of water use—using the baseline machine average total daily water consumption. This cost-per-gallon value was applied to the replacement machine case to estimate its annual chemical cost. Table 4 summarizes the annual usage and savings estimates.

Table 4. Replacement Machine Operating Costs

	Baseline	Replacement	Difference	% Difference	Cost Savings*
Hot Water Use (gal/yr)	604,688	94,980	509,708	84%	*Included Below*
Water Heating Gas Use (therms/yr)	6,476	1,017	5,459	84%	$5,459
Dishmachine Energy Use (kWh/yr)	207,757	168,013	39,744	19%	$4,769
Dishmachine Water Use (CCF/yr)	808	301	507	63%	$6,956
Estimated Chemical Cost per Year	$9,443	$3,515	$5,928	63%	$5,928
				Total Annual Savings	**$23,112**

** Calculated using $1.00 per therm; $0.12 per kWh; $5.08 per CCF for water and $8.64 per CCF for sewer*

References

Delagah, A., Fisher, D., 2010. Characterizing the Energy Efficiency Potential of Gas-Fired Commercial Water Heating Equipment in Foodservice Facilities. California Energy Commission, PIER Energy Technologies Program. CEC 500-2013-050. October. http://www.energy.ca.gov/2013publications/CEC-500-2013-050/CEC-500-2013-050.pdf

Delagah, Amin. 2015. *Conveyor Dishwasher Performance Field Evaluation Report*. Los Angeles, CA: The Metropolitan Water District of Southern California. FSTC Report Number P20004-R0. http://bewaterwise.com/icp_projects.html

Delagah, A., Davis, R., Slater, M., Karas, A. 2017. Results from 20 Field Monitoring Projects on Rack and Flight Conveyor Dishwashers in Commercial Kitchens. Atlanta, GA: American Society of Heating, Air-Conditioning and Refrigeration Engineers (ASHRAE). January Conference Paper.

Johnson, F. Delagah, A., Karas, A. 2018. Presidio of Monterey Belas Hall Dishroom Replacement Monitoring Project. Des Plains, IL: Gas Technology Institute, Department of Defense. (Upcoming Publication)

Slater, M., Delagah, A., Karas, A., Davis, R. 2017. Energy Efficient Flight Conveyor Dishwashers. San Francisco, CA: Pacific Gas and Electric Company, Emerging Technologies Program. Emerging Technologies Report Number ET16PGE1971. https://www.etcc-ca.com/reports/energy-efficient-flight-conveyor-dishwashers

Appendix
Methodology

Data Acquisition and Instrumentation Setup

The FE team installed instrumentation and data logging equipment to record the dishmachine water and energy use. Electrical power metering equipment was installed to measure all electrical use of the dishmachine including the tank heaters, pump motors, booster heater and controls.

Utility-grade water meters were placed on the water inlets. The water meters provided pulse outputs (per unit of measure) to the data logger. Water meter data was logged at five-second intervals and stored with a corresponding time stamp in logger memory. The water temperature was monitored with a thermocouple attached to the inlet piping and connected to the data logger. Based on the delivered temperature data, a nominal water heater outlet temperature was estimated to account for line losses.

Figure 1. Data logger and cell modem

The instrumentation setup included a rinse solenoid valve sensor to measure the fresh-water rinse time. The baseline dishmachine rinse solenoid was instrumented with an independent on/off logger (that senses magnetic field) placed directly on the rinse solenoid body, and the replacement dishmachine solenoid was monitored from a connection to the solenoid control relay to the main data logger. Additionally, the three rinse section solenoids of the replacement machine were individually monitored to determine rinse water use reduction.

Instrumentation Specifications

Water Meters

Badger Recordall Model 25, with 198.3 pulses/gal output, accuracy 1.5% of reading, flow range of 0.25 to 15 gpm (Figure 2). www.badgermeter.com

Figure 2. Badger Recordall

Power Metering

Dent Instruments ELITEpro XC portable power data logger, single- and three-phase capability, accuracy ±1% (Figure 3). www.dentinstruments.com

Figure 3. DENT ELITEpro XC

Dent Instruments mini hinged split-core current transformers, 20A and 50A, low voltage 0.333 Vac out, accuracy ±1%.

Continental Control Systems Acuu-CT split-core current transformers, CTL-0750 Opt C0.6, 20A and 50A, low voltage 0.333 Vac out, accuracy ±0.5%. www.ccontrolsys.com

Dataloggers

DataTaker DT80, ten isolated analog inputs and twelve pulse counter inputs (Figure 4). www.datataker.com

Figure 4. DataTaker DT-80

Motor On/Off Loggers

HOBO UX90-004M Motor On/Off Logger timestamp log the nearest second. (Figure 5). www.onsetcomp.com

Figure 5. HOBO UX90-004M

Replacement Machine Specification Sheet

MEIKO

The clean solution

M-iQ

B-M74 SERIES

HOT WATER SANITIZING MULTIPLE-TANK FLIGHT TYPE WAREWASHERS

Special Features:

- **Industry-leading low water, energy and chemical consumption**
  At less than 57 gallons (216 liters) per hour, M-iQ is one of the most efficient dishwashers in the world. Advanced technologies further reduce energy and detergent use.
- **M-iQ Filter Technology**
  Each tank features a multiple stage filtration process that first collects food soil, then flushes it out of the tank completely in high-pressure cycles. This improves performance, eases cleanup and reduces detergent consumption by up to 50%.
- **M-iQ Airflow Management**
  M-iQ features an advanced, fully integrated airflow system that retains and redirects hot air within the machine. This improves heating efficiency and reduces exhaust emissions.
- **M-iQ Tank Management**
  Each tank is equipped with a M-iQ Filter system. Water levels are monitored and controlled intelligently and automatically. M-iQ automatically diverts water within the machine to maintain optimum level control and soil distribution.
- **M-iQ Washing Dynamics**
  M-iQ employs a higher-pressure wash for improved soil removal and reduced water consumption. Water flow has been modeled using computational fluid dynamics. Water, energy and chemical consumption are all dramatically reduced.
- **M-iQ Energy Management**
  M-iQ incorporates a 3-stage energy control system, as well as a variable-output "smart" booster heater, for optimal energy balance. The system dynamically adjusts to changes in heating distribution for minimal energy consumption.
- **M-iQ Control System**
  M-iQ features a *CC Touch* glass touch screen with a high resolution color display. Screen information is customized based on the machine's operating mode for fast, intuitive operation. Kitchen management, dishroom staff and service personnel can quickly call up customized information, or save data to the controller's built-in memory.
- **M-iQ Intuitive Cleaning**
  M-iQ features an automatic cleaning mode. Assisted by the soil removal capabilities of the M-iQ Filter, this dramatically reduces cleanup time. Areas that require regular manual cleaning are marked in blue for less wasted effort by the staff.

This dishwasher is compliant with the Reduction of Lead in Drinking Water Act (2011) amendment to the Safe Drinking Water Act (SDWA).

ENERGY STAR NSF ETL LISTED US U.S. GREEN BUILDING COUNCIL MEMBER

Standard Features:

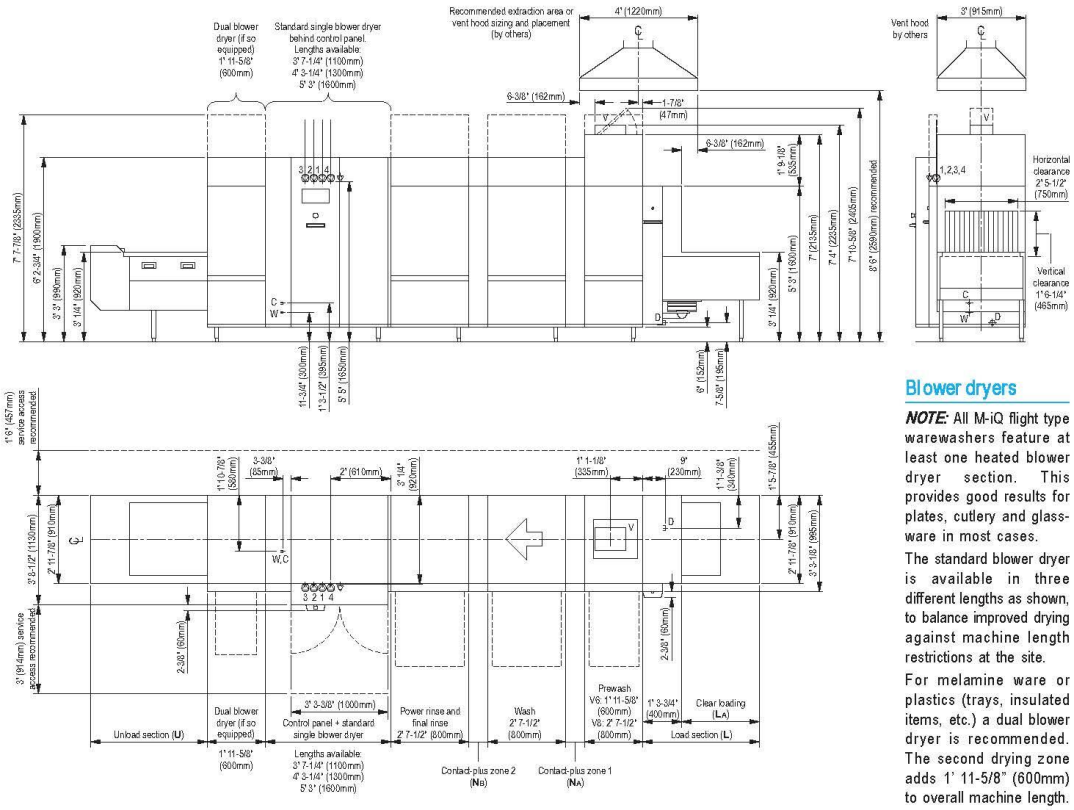
- ENERGY STAR Qualified
- True two-tank washing perfomance consisting of:
  - Wash chamber with 3 HP (2.2 kW) pump motor
  - Power rinse chamber with 1 HP (0.75 kW) pump motor
- Pumped final rinse with 3/4 HP (0.55 kW) pump motor
- Integral heated blower dryer, in choice of three different lengths, with 2/3 HP (0.5 kW) motor
- Choice of prewash sections:
  - **B-M74 V6 N** P8:** 1' 11-5/8" (600mm) prewash with 1 HP (0.75 kW) pump, conveyor speed 6.0' (1.8m)/min., 56.2 gals. (212.7 liters)/hr.
  - **B-M74 V8 N** P8:** 2' 7-1/2" (800mm) prewash with 3 HP (2.2 kW) pump, conveyor speed 6.5' (2.0m)/min., 56.8 gals. (215.0 liters)/hr.
- Conveyor width 29-1/2" (750mm); passing height 15-3/4" (400mm); accommodates standard 18 x 26" sheet pans
- 304-series stainless steel construction
- Fully automatic operation. Prewash, wash, power rinse and final rinse are activated only when ware is present
- Front-sloping tanks for complete drainage and easier cleaning. Automatic rinsedown/drain feature is accessed from control panel to eliminate manual drain levers
- Double-wall insulated construction on front, top and back improves operator safety, conserves heating energy, and reduces noise and heat loss into the dishroom. Insulation is fully waterproofed to eliminate heavy doors and unsanitary waterlogging
- Standard lifting doors are full-width for each chamber, including the blower drying zone, for improved access
- Pumps are vertically-mounted to be self-draining and easily removed for servicing. Pumps include safety alert feature to inform the operator of a leaking pump seal

Optional Features:

- GreenEye™ - An integrated system that includes:
  - Green Coach™ - interactive lights that suggest optimal loading pattern "lanes" on the belt, increasing efficiency
  - GreenFilter™ - a dedicated hydrocyclone separator in the power rinse tank continuously and actively removes even the finest soil particles, for improved washing and reduced detergent consumption
  - M-iQ Synergies - promoting optimum teamwork between the operator and the machine
- Hinged doors
- Drain water tempering
- Flanged, bolt-down feet
- Single-point electrical connection (electrically-heated machines only; standard on steam-heated machines)

Page 1 • M-iQ Flight - B-M74 Series • Updated 10-16 • MEIKO • 1349 Heil Quaker Blvd. • LaVergne, TN 37086 • (800) 55-MEIKO • *www.meiko.us* • *sales@meiko.us*

M-iQ Flight - B-M74 Series - Electric heat, right to left



Blower dryers

NOTE: All M-iQ flight type warewashers feature at least one heated blower dryer section. This provides good results for plates, cutlery and glassware in most cases.

The standard blower dryer is available in three different lengths as shown, to balance improved drying against machine length restrictions at the site.

For melamine ware or plastics (trays, insulated items, etc.) a dual blower dryer is recommended. The second drying zone adds 1' 11-5/8" (600mm) to overall machine length.

Load sections (L)	Clear loading (LA)
3' 3-3/8" (1000mm)	1' 11-5/8" (600mm)
3' 11-1/4" (1200mm)	2' 7-1/2" (800mm)
4' 7-1/8" (1400mm)	3' 3-3/8" (1000mm)
5' 3" (1600mm)	3' 11-1/4" (1200mm)
5' 10-7/8" (1800mm)	4' 7-1/8" (1400mm)
6' 6-3/4" (2000mm)	5' 3" (1600mm)
7' 2-5/8" (2200mm)	5' 10-7/8" (1800mm)
7' 10-1/2" (2400mm)	6' 6-3/4" (2000mm)
8' 6-3/8" (2600mm)	7' 2-5/8" (2200mm)
9' 2-1/4" (2800mm)	7' 10-1/2" (2400mm)
9' 10-1/8" (3000mm)	8' 6-3/8" (2600mm)

NOTE: Load sections with a lowered loading height of 2' 7-1/2" (800mm) are available for specific applications, such as when the loading area is underneath a table or tray conveyor. Consult MEIKO for details.

Recommended load sections:

- Single worker loading items while standing at the end of the machine - **L** = 3' 11-1/4" (1200mm)
- Two workers loading items, each standing on one side of the machine - **L** = 4' 7-1/8" (1400mm)
- Large items placed flat on the belt (totes, containers, etc.) - **LA** = 2' (600mm) longer than the item
- Operations with special delivery systems and/or multiple workers loading items may require extended load sections. Consult MEIKO for assistance.

Contact-plus 1 (NA)	Contact-plus 2 (NB)	Model number code
None	7-7/8" (200mm)	B-M74 V? **N02** P8
7-7/8" (200mm)	7-7/8" (200mm)	B-M74 V? **N22** P8
11-7/8" (300mm)	11-7/8" (300mm)	B-M74 V? **N33** P8
1' 3-3/4" (400mm)	1' 3-3/4" (400mm)	B-M74 V? **N44** P8
1' 7-5/8" (500mm)	1' 7-5/8" (500mm)	B-M74 V? **N55** P8
1' 11-5/8" (600mm)	1' 11-5/8" (600mm)	B-M74 V? **N66** P8
2' 7-1/2" (800mm)	2' 7-1/2" (800mm)	B-M74 V? **N88** P8
3' 3-3/8" (1000mm)	3' 3-3/8" (1000mm)	B-M74 V? **N1010** P8

NOTE: As ware proceeds through the machine and closer to the final rinse, the water contacting the ware becomes warmer and cleaner. Large items and flat items (particularly sheet pans, trays, totes, etc.) can carry over cooler, soiled water forward in the machine. The contact-plus zone provides a landing area for this water, allowing it to return to the previous tank. This reduces detergent consumption and tank heating energy use.

Wider contact-plus zones also provide a surface that may be used to front-mount detergent or rinse aid systems.

Recommended contact-plus zone configurations:

- For machines washing plates/glasswares - **N02**
- For machines washing a typical ware mix - cafeteria trays and some sheet pans in addition to plates and glasswares - **N22**
- For machines washing a high proportion of sheet pans - **N33**
- For machines washing large containers - **N44** or larger, depending on the size of the container
- For machines with front-mounted detergent and rinse aid dispensers - **N33** or larger, depending on the size of the dispensing systems

Unload sections (U)
2' 7-1/2" (800mm)
3' 3-3/8" (1000mm)
3' 11-1/4" (1200mm)
4' 7-1/8" (1400mm)
5' 3" (1600mm)
5' 10-7/8" (1800mm)
6' 6-3/4" (2000mm)
7' 2-5/8" (2200mm)
7' 10-1/2" (2400mm)
8' 6-3/8" (2600mm)
9' 2-1/4" (2800mm)
9' 10-1/8" (3000mm)

Recommended unload sections:

- Typical ware mix, limited space available - **U** = 3' 11-1/4" (1200mm)
- Typical ware mix, more space available - **U** = 4' 7-1/8" (1400mm) or longer for improved drying
- Large items placed flat on the belt (totes, containers, etc.) - **U** = at least 1' (300mm) longer than *twice* the length of the item

M-iQ Flight - B-M74 Series - Utility legend

Electrical connection(s)
- Electrically-heated machines have four (4) connections, routed from above.
- Steam-heated machines have one (1) connection, routed from below.
- Incoming leads must be appropriately sized for electrical supply. Individual circuit breaker/disconnects strongly recommended (provided by others).
- Ampacity shown on utility chart, p. 7

Equipotential ground connection

D Drain connection
- Connection to 2" (50mm) OD horizontal drain outlet (HDPE piping).
- Indirect routing to 4" (100mm) floor drain recommended. Pipe to be connected to 2" (50mm) OD line (or 1-1/2" pipe) via no-hub. Additional piping to drain to be supplied by others.

W Water, warm (initial fill connection)
- Connection 1/2" NPT
- Temp. 110-140°F (43-60°C). 140°F (60°C) recommended to reduce start-up time
- Recommended hardness 1-3 grains/U.S. gal.
- Volume shown on utility chart, p. 7

C Water, cold (final rinse connection)
- Connection 1/2" NPT
- Temp. cold as available. 50°F/10°C recommended to reduce steam emissions
- Recommended hardness 1-3 grains/U.S. gal.
- Consumption shown on utility chart, p. 7

V Vent connection
- Machine vent is powered, intended for indirect vent connection
- Extraction area detailed on drawings (pages 2-5) and utility chart (p. 7)
- Exhaust volume shown on utility chart, p. 7

S Steam connection (steam-heated machines only)
- Connection 1-1/2" NPT
- Constant steam pressure is REQUIRED (pressure to be specified at time of order). If pressure is below minimum shown, consult factory. If pressure is above maximum shown, use of a regulator is REQUIRED (supplied by others).
- Pressure ranges (specify at time of order):
  - 7-14 PSI (0.51-1.0 bars)
  - 15-22 PSI (1.1-1.5 bars)
  - 23-29 PSI (1.6-2.0 bars)
- Consumption shown on utility chart, p. 7

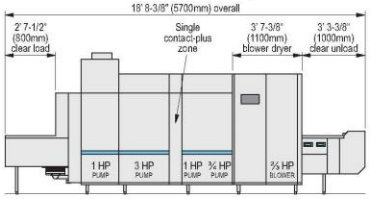
CR Condensate return connection (steam-heated machines only)
- Connection 1" NPT
- Condensate return line must be pressure-free

M-iQ Flight - B-M74 Series - Standard MTS Configurations

MEIKO M-iQ series dishwashers are available in a wide variety of configurations. The "MTS" configurations shown below are pre-configured machines optimized for common applications. Non-standard configurations are possible, as shown on the preceding pages. Consult MEIKO for assistance with machine selection.

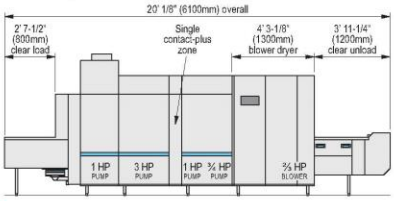
MTS918: M-iQ B-M74 V6 N02 P8

Overall length 18' 8-3/8' (5700mm). Fits footprint of many older "short" machines. Useful when extremely limited space is available.



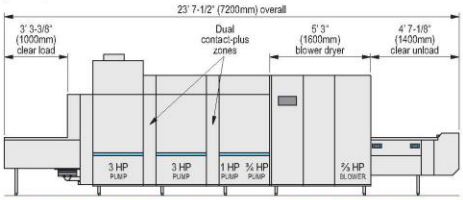
MTS1: M-iQ B-M74 V6 N02 P8

Overall length 20' 1/8" (6100mm). Most useful for trayless cafeterias or when limited space is available.



MTS2: M-iQ B-M74 V8 N22 P8

Overall length 23' 7-1/2" (7200mm)
General purpose - useful for cafeterias with large numbers of trays, hospitals, limited numbers of sheet pans.



M-iQ Flight - B-M74 Series - Optional GreenEye™ System

The optional GreenEye™ system dynamically combines the efforts of the operator and the machine to take dishwashing performance to a whole new level. The system includes:

Green Coach™

Three interactive lights suggest optimal loading pattern "lanes" for the operator. Water is delivered only to the lanes where dishware is actually loaded, reducing the consumption of water, energy, and chemicals.

GreenFilter™

In addition to the standard M-iQ Filter, a dedicated hydrocyclone separator is positioned in the power rinse tank. As the final wash tank, the warmer, cleaner water in this tank is the most important for effective dishwashing. The GreenFilter™ continuously and actively removes even the finest soil particles from this tank, improving washing effectiveness while reducing detergent consumption.

M-iQ Synergies

By promoting optimum teamwork between the operator and the machine, GreenEye™ creates synergies that extend beyond the machine to encompass the entire dishroom area, maximizing washing effectiveness while minimizing operating costs.

M-iQ Flight - B-M74 Series - Technical Specifications

Operating Capacities and Conveyor Specifications (NSF Rated)

	*B-M74 V6 N** P8*	*B-M74 V8 N** P8*
Conveyor belt speed (max.)	6.0' (1.8m)/min.	6.5' (2.0m)/min.
Dishes per hour (max.)[1]	9,995	10,828
Water consumption/hr. (max)	56.2 gal. (212.7 liters)	56.8 gal. (215.0 liters)
Horizontal clearance	2' 5-1/2" (750mm)	2' 5-1/2" (750mm)
Vertical clearance	1' 6-1/4" (465mm)	1' 6-1/4" (465mm)
Minimum peg spacing	2-1/8" (54mm)	2-1/8" (54mm)

[1] *Maximum dishes per hour as calculated with NSF formula* (120 x CS x CW / PD), *where* CS *= conveyor speed in ft/min,* CW *= conveyor width in inches and* PD *= peg distance in inches. This formula assumes full belt utilization regardless of conveyor speed or ware size. This loading generally cannot be achieved under actual operating conditions. For assistance with ware throughput calculations and machine selection, contact MEIKO at* **sales@meiko.us**.

[2] *Heat load shown is for dishwasher only and does not include heat emitted by ware exiting the machine. Heat emitted by ware is site-specific and outside the scope of this spec sheet. For assistance, contact MEIKO at* **sales@meiko.us**.

Venting Specifications

	With standard loading sections (load height 3' 1/4" / 920mm)	*With lowered loading sections (load height 2' 7-1/2" (800mm)*
Machine exhaust	155 CFM (263m³/h)	155 CFM (263m³/h)
Recommended room air	345 CFM (586m³/h)	445 CFM (756m³/h)
Recommended total	500 CFM (850m³/h)	600 CFM (1019m³/h)
Recommended extraction area	3' (900mm) W x 4' (1220mm) L	3' (900mm) W x 5' (1520mm) L

Machine heat load[2]	*Sensible*	*Latent*	*Total*
@ 208V/60Hz/3Ph	19,108 BTU/hr (5.6 kW)	9,554 BTU/hr (2.8 kW)	28,662 BTU/hr (8.4 kW)
Per add'l blwr dryer	+ 1,024 BTU (0.3 kW)	+ 341 BTU (0.1 kW)	+ 1,365 BTU (0.4 kW)
@ 230V/60Hz/3Ph	18,426 BTU/hr (5.4 kW)	9,213 BTU/hr (2.7 kW)	27,639 BTU/hr (8.1 kW)
Per add'l blwr dryer	+ 1,024 BTU (0.3 kW)	+ 682 BTU (0.2 kW)	+ 1,706 BTU (0.5 kW)
@ 460V/60Hz/3Ph	19,449 BTU/hr (5.7 kW)	9,554 BTU/hr (2.8 kW)	29,003 BTU/hr (8.5 kW)
Per add'l blwr dryer	+ 1,365 BTU (0.4 kW)	+ 1,024 BTU (0.3 kW)	+ 2,389 BTU (0.7 kW)

Water and Drain Specifications

Minimum water temperatures:

- Prewash tank ..... No minimum - 110-140°F (43-60°C) typical
- Wash tank ..... 150°F (66°C)
- Power rinse ..... 162°F (72°C)
- Final rinse ..... 180°F (82°C)

Incoming water temperatures:

- Initial fill line ..... 110°-140°F (43°-60°C)
- Final rinse line ..... Cold as available, 50°F (10°C) recommended

Incoming water line sizes:

- Initial fill line ..... 1/2" NPT
- Final rinse line ..... 1/2" NPT

	*B-M74 V6 N** P8*	*B-M74 V8 N** P8*
Initial fill	67.6 gal. (276.0 liters)	76.1 gal. (288.0 liters)
Consumption at 100% cap.	56.2 gal. (212.7 liters)/hr	56.8 gal. (215.0 liters)/hr

Recommended water hardness ..... 1-3 grains/gal

Drain specifications:

- Connection (standard) ..... 2" (50mm) OD
- Connection (with no-hub) ..... 1-1/2" pipe
- Recommended floor drain (min.) ..... 4" (100mm)
- Maximum drain flow rate ..... 40 gals. (151.5 liters) per minute

Machine Electrical Specifications

	208 V/60 Hz/3 Ph				*230 V/60 Hz/3 Ph*				*460 V/60 Hz/3 Ph*			
	TB1	TB2	TB3	TB4	TB1	TB2	TB3	TB4	TB1	TB2	TB3	TB4
Electric tank heat, B-M74 V6 N** P8	29.15 A	94.33 A	9.00 A	52.50 A	29.05 A	84.60 A	7.50 A	45.60 A	19.91 A	43.50 A	5.00 A	23.70 A
Electric tank heat, B-M74 V8 N** P8	35.25 A	94.33 A	9.00 A	52.50 A	35.15 A	84.60 A	7.50 A	45.60 A	23.06 A	43.50 A	5.00 A	23.70 A
Steam tank heat/elec. blower dryer, B-M74 V6 N** P8	45.11 A	--	--	--	42.59 A	--	--	--	27.19 A	--	--	--
Steam tank heat/steam blower dryer, B-M74 V6 N** P8	36.11 A	--	--	--	35.09 A	--	--	--	22.19 A	--	--	--
Steam tank heat/elec. blower dryer, B-M74 V8 N** P8	51.21 A	--	--	--	48.69 A	--	--	--	30.34 A	--	--	--
Steam tank heat/steam blower dryer, B-M74 V8 N** P8	42.21 A	--	--	--	41.19 A	--	--	--	25.34 A	--	--	--
Per additional elec. blower dryer section (electric machine)	+ 2.25 A	--	+9.00 A	--	+ 2.25 A	--	+ 7.50 A	--	+ 1.30 A	--	+ 5.00 A	--
Per additional elec. blower dryer section (steam machine)	+ 11.25 A	--	--	--	+ 9.75 A	--	--	--	+ 6.30 A	--	--	--
Per additional steam blower dryer section	+ 2.25 A	--	--	--	+ 2.25 A	--	--	--	+ 1.30 A	--	--	--

Component Electrical Specifications

Prewash pump motor, B-M74 V6 N** P8 ..... 1.0 hp (0.75 kW)
Prewash pump motor, B-M74 V8 N** P8 ..... 3.0 hp (2.20 kW)
Wash pump motor ..... 3.0 hp (2.20 kW)
Power rinse pump motor ..... 1.0 hp (0.75 kW)
Final rinse pump motor ..... 0.75 hp (0.55 kW)
Vent motor ..... 0.17 hp (0.13 kW)
Conveyor motor ..... 0.34 hp (0.25 kW)
Blower dryer motor (each) ..... 0.67 hp (0.50 kW)
Loading deck flushing pump ..... 0.134 hp (0.10 kW)
M-iQ Filter pump, prewash ..... 0.134 hp (0.10 kW)
M-iQ Filter pump, wash ..... 0.134 hp (0.10 kW)
M-iQ Filter pump, power rinse ..... 0.134 hp (0.10 kW)
Control system, 208V/60Hz/3Ph or 230V/60Hz/3Ph ..... 0.48 kW
Control system, 460V/60Hz/3Ph ..... 3.30 kW

Electric Heating Elements (electrically-heated units only)

	208 V/60 Hz/3 Ph	*230 V/60 Hz/3 Ph*	*460 V/60 Hz/3 Ph*
Wash tank heat	14.88 kW	15.52 kW	15.40 kW
Power rinse tank heat	19.12 kW	18.18 kW	19.20 kW
Booster heater (max.)[1]	18.90 kW	18.30 kW	18.90 kW
Blower dryer heat (each)	3.20 kW	3.00 kW	4.00 kW

[1] *Maximum heater output shown. Incoming cold water is pre-heated by heat captured from machine exhaust air prior to being heated to sanitizing 180°F (82°C) by booster heater. Booster heater incorporates variable output and is automatically regulated to ensure proper final rinse temperature, regardless of incoming water temperature or machine operating status (startup, operation, idle).*

Typical booster output at operating temperature:

- B-M74 V6 N** P8 ..... 7.025 kW
- B-M74 V8 N** P8 ..... 7.100 kW

Steam Specifications (steam-heated units only)

Steam supply connection ..... 1-1/2" NPT
Condensate return connection ..... 1" NPT
Steam supply pressure (must be specified):
7-14 PSI (0.51-1.0 bars) 15-22 PSI (1-1-1.5 bars) 23-29 PSI (1.6-2.0 bars)

Steam consumption (max.):

- Machine with electric blower dryer ..... 195 lbs/hr (56.47 kW)
- Machine with steam heated blower dryer ..... 206 lbs/hr (59.66 kW)
- Per additional steam blower dryer section ..... + 11 lbs/hr (3.20 kW)

Note: All specifications are subject to change without notice based on MEIKO's dedicated product improvement program.

Equipment Specification: M-iQ B-M74 V__ N__ __ P8 - Item No. _____

Unit will be a:

___ **MEIKO M-iQ B-M74 V6 N__ __ P8** multiple tank flight type rackless conveyor dishmachine, consisting of a load section, 1' 11-5/8" (600mm) prewash compartment with 1 hp (0.75 kW) pump motor, 2' 7-1/2" (800mm) wash compartment with 3 hp (2.2 kW) pump motor, contact-plus zone between wash and rinse sections, 2' 7-1/2" (800mm) combination rinse compartment (with 1 hp /0.75 kW power rinse pump motor and 3/4 hp / 0.55 kW final rinse pump motor), 5' 3" (1600mm) combination control panel / heated blower drying zone, and a clear, level unloading area. Unit will be NSF rated at a maximum conveyor belt speed of 6.0' (1.8m)/minute. Final rinse water consumption will not exceed a maximum of 56.2 U.S. gal. (212.7 liters)/hour.

___ **MEIKO M-iQ B-M74 V8 N__ __ P8** multiple tank flight type rackless conveyor dishmachine, consisting of a load section, 2' 7-1/2" (800mm) prewash compartment with 3 hp (2.2 kW) pump motor, 2' 7-1/2" (800mm) wash compartment with 3 hp (2.2 kW) pump motor, contact-plus zone between wash and rinse sections, 2' 7-1/2" (800mm) combination rinse compartment (with 1 hp / 0.75 kW power rinse pump motor and 3/4 hp / 0.55 kW final rinse pump motor), 5' 3" (1600mm) combination control panel / heated blower drying zone, and a clear, level unloading area. Unit will be NSF rated at a maximum conveyor belt speed of 6.5' (2.0m)/minute. Final rinse water consumption will not exceed a maximum of 56.8 U.S. gal. (215.0 liters)/hour.

Unit will be NSF and ETL listed. Unit will have a conveyor belt width of 29-1/2" (750mm) and a conveyor peg spacing of 2-1/8" (54mm).

Unit will utilize an internal booster heater to maintain a minimum 180°F (82°C) minimum fresh water sanitizing rinse. Wash tank temperature will be automatically maintained at a minimum temperature of 150°F (66°C). Power rinse tank temperature will be automatically maintained at a minimum temperature of 162°F (72°C).

All tank, final rinse and blower dryer heating will be accomplished by:

___ Electric heaters ___ Steam coil heaters *

* *NOTE: Some steam-heated machine configurations use electrically-heated blower dryers. Consult MEIKO for additional information.*

If steam, specify pressure:

___ 7-14 PSI (0.51-1.0 bars) ___ 15-22 PSI (1.1-1.5 bars) ___ 23-29 PSI (1.6-2.0 bars)

Operating voltage will be:

___ 208V/60Hz/3Ph ___ 230V/60Hz/3Ph ___ 460V/60 Hz/3 Ph

Direction of operation will be:

___ Left to right ___ Right to left

Unit will be equipped with the following blower dryer system:

✔ Standard heated blower dryer for drying of dishes, crockery and silverware, with a 0.67 hp blower dryer motor. Drying tunnel length will be (check one):

___ 3' 7-1/4" (1100mm) ___ 4' 3-1/4" (1300mm) ___ 5' 3" (1600mm)

___ Dual adjacent heated blower dryers for complete drying of all dishes, crockery and silverware, and improved drying of plastic trays. Additional drying tunnel will feature a 0.67 hp blower dryer motor and will be 1' 11-5/8" (600mm) in length.

Unit will feature a glass touch screen control panel and display. Display will provide customized information based on the machine operating mode, including tank and final rinse temperatures and selection of three different operating speeds. Display will provide service diagnostic information, automatic logging of operating history, and the ability for the operator to enter manual log entries for later retrieval.

Unit will feature a single-point drain connection and single-point indirect ventilation connections. Steam-heated machines will feature a single-point electrical connection.

Unit will have the following standard features:

Operating Features

Unit will feature fully automatic operation. Ware placed on the belt and entering machine will activate water flow and pump operation. Ware sensing will be by mechanical limit arm for reliable operation under exposure to steam and water droplets. Final rinse activates only when ware is located in the machine to conserve water, chemicals and heating energy. Pumped final rinse provides consistent results and water consumption regardless of variations in supply water pressure. Waste Air Heat Recovery System reclaims waste heat generated by the machine as free energy to preheat the incoming rinse water, reducing energy consumption and allowing hot-water sanitizing from a cold water supply (minimum 50°F / 10°C). Water will be delivered from Waste Air Heat Recovery System exchanger to an internal booster heater to provide the required rise for a minimum 180°F (82°C) sanitizing final rinse. Booster heater will incorporate variable output and will be automatically regulated to ensure optimum performance regardless of incoming water temperature or machine operating status (startup, operation, idle).

Unit will feature fully automatic operation with one-touch selection of three different conveyor speeds. Unit will feature a main control panel on the front of the machine to include a push-pull emergency stop switch, and separate start-stop controls at each end of the machine for operator convenience. Main control panel will be a glass touch screen display providing access to temperature displays, machine status, service diagnostics and machine logs as well as operating controls. Display will be capable of displaying information in multiple selectable languages to include English, French, Spanish and German.

Construction Features

Conveyor will be 29-1/2" (750mm) in width, and will accommodate flat trays, dishes, 18x26" (460x660mm) sheet pans, and standard 20x20" (500x500mm) dishracks. Clearance height for ware within the machine will be 1' 6-1/4" (465mm). Unless optional lowered load end is selected, conveyor loading and unloading height will be 3' 1/4" (920mm) A.F.F. (+/- 1/2" / 12mm from adjustable legs), and conveyor will maintain level height throughout machine without gradients for easier loading/unloading and ware stability.

Unit will feature double-wall, insulated stainless steel construction on front, top and rear panels to retain heat inside the machine, conserve energy and provide a cool-to-the-touch exterior. Prewash, wash and power rinse manifolds will be internally mounted to ensure a cool-to-the-touch rear panel, and will be spaced from rear wall of tank for easier cleaning.

Tank drains will feature magnetic switches to prevent operation if drain plug is not in place. Tank pump motors will be vertically-installed for easier serviceability and self-draining. Motors will include a safety switch to automatically signal the operator if a leaking pump seal is detected.

Wash arms of unit will be mounted in easily-removed assemblies, and will feature concave, slotted nozzles to minimize clogging. All prewash, wash, power rinse and final rinse arms will be of stainless steel construction. Final rinse nozzles to feature individual, screw-in stainless steel orifices for durability and simple cleaning. Front-sloping wash tanks will be of all 304-series stainless steel construction.

Cleaning Features

Load section of unit will include an interval-based cascade of water to push food soil directly into a single, front-accessible scrap tray. Prewash, wash and power rinse tanks will each feature a multi-stage filtration system with multiple, nesting scrap screens. Food soil will be collected and sorted by nested scrap screens and flushed into the drain line using a dedicated 0.134 hp M-iQ Filter active filtration pump. Active M-iQ filtration will completely eliminate the need to manually remove and empty scrap baskets during operation. Upon shutdown, unit will use water already inside the machine, as well as a minimal amount of fresh water, for an assisted cleaning mode to reduce the need for manual cleaning. All components of unit that require regular manual cleaning will be marked in a blue accent color for easy identification. Prewash, wash and power rinse arm end caps will be tethered to arms with braided stainless steel wire to prevent loss during cleaning.

Efficiency Features

Unit will feature a single-point vent connection. Heat will be drawn the length of the machine to the load end vent for superior temperature distribution, reduced air emissions and reduced energy consumption. Load end vent will incorporate a MEIKO Waste Air Heat Recovery System heat exchanger to preheat incoming final rinse water and cool exhaust air, permitting final rinse operation using a cold water supply. Unit will employ active soil filtration and removal in each tank to reduce detergent consumption by up to 50%.

Unit will have the following optional features:

___ GreenEye™ system, including GreenCoach™ operator feedback system with selective three-lane final rinse activation, and GreenFilter™ power rinse tank hydrocyclone separator for continuous and active soil removal

___ Drain water tempering - reduces drain water below 140°F (60°C)

___ Single-point electrical connection (electrically-heated machines only)

___ Flanged, bolt-down feet

Unit will include the following doors:

___ Standard spring-loaded lifting doors extending the full width of each applicable section (prewash, wash, power + final rinse, blower dryer). All doors will feature dual-wall, insulated construction, and door safety switches to prevent operation while in the open position.

___ Hinged doors extending the full width of each applicable section (prewash, wash, power + final rinse, blower dryer). All doors will feature dual-wall, insulated construction, and door safety switches to prevent operation while in the open position. Tanks and sections 2' (600mm) in length or shorter will feature a single door. Longer tanks and sections will feature dual doors.

Unit will have the following contact-plus zones:

Contact-plus zones between prewash and wash sections (optional) and between wash and rinse sections (standard) minimize cool/soiled water carryover between tanks, which reduces heating energy and detergent consumption.

Between prewash and wash sections (first digit after "N" in model number)

___ 0: None (standard) ___ 2: 7-7/8" (200mm) ___ 3: 11-7/8" (300mm)
___ 4: 15-3/4" (400mm) ___ 5: 19-5/8" (500mm) ___ 6: 23-5/8" (600mm)
___ 8: 31-1/2" (800mm) ___ 10: 39-3/8" (1000mm)

Between wash and rinse sections (second digit after "N" in model number)

___ 2: 7-7/8" (200mm, standard) ___ 3: 11-7/8" (300mm)
___ 4: 15-3/4" (400mm) ___ 5: 19-5/8" (500mm) ___ 6: 23-5/8" (600mm)
___ 8: 31-1/2" (800mm) ___ 10: 39-3/8" (1000mm)