EBMUD Commercial Guidebook:
Laundries and Dry Cleaning Operations

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LAUNDRIES AND DRY CLEANING OPERATIONS

This chapter will provide an overview of the standards and water use characteristics of laundry equipment, including water saving technologies such as water reuse, recycling, and ozone.

A Typical Laundromat

Photo by Ryan McGuire from Pixabay

Commercial laundry operations cover a range of applications from laundromats and common laundry-rooms in apartment buildings, to on-premises laundries for institutions and commercial operations, such as hotels, nursing homes, hospitals, athletic facilities, and prisons. Industrial laundries offer services for the same set of on-premises users, as well as uniform, diaper, and linen services. Dry-cleaning establishments often have on-premises laundry equipment as well. The U.S. laundry facilities and dry-cleaning services market size is expected to reach USD 14.4 billion by 2028. It is estimated to grow at a compound annual growth rate (CAGR) of 4% from 2021 to 2028.[1]

The first equipment standards were enacted at the state level in California with the Warren-Alquist Act in 1974.[2] At the national level, the Energy Policy and Conservation Act (EPCA) was enacted in 1975, and established a federal program consisting of test procedures, labeling, and energy targets for consumer products. EPCA was amended in 1979 and the Department of Energy (DOE) was directed to establish energy conservation standards for consumer products.[3] Federal energy efficiency requirements established for covered products under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards.[4]

Table 10-1[5] summarizes the size of various types of entities that have commercial or industrial laundries or use industrial laundries for cleaning their fabrics.

TABLE 10-1: US and California Laundry and Dry-Cleaning Market

	NUMBER OF ENTITIES	
	USA	California
HOTELS AND MOTELS	132,228	5,596
LAUNDROMATS	18,304	2,275
INDUSTRIAL LAUNDRIES	2,538	468
DRY CLEANERS	30,723	1,910

1 *https://www.businesswire.com/news/home/20210630005665/en/US-Laundry-Facilities-Dry-Cleaning-Services-Market-2021-2028-Coin-operated-Retail-LaundryDry-Clean-Services-CorporateIndustrial-Laundry-Services*

2 *https://database.aceee.org/state/appliance-standards-summary*

3 *https://www.energy.gov/eere/buildings/history-and-impacts#:~:text=At%20the%20national%20level%2C%20the,energy%20targets%20for%20consumer%20products.*

4 *https://www.federalregister.gov/documents/2021/12/20/2021-27461/energy-conservation-program-energy-conservation-standards-for-commercial-clothes-washers#citation-3-p71842*

5 *https://www.dreambigtravelfarblog.com/blog/hotel-industry-statistics, https://www.ibisworld.com/industry-statistics/number-of-businesses/laundromats-united-states, https://www.ibisworld.com/industry-statistics/number-of-businesses/industrial-laundry-linen-supply-unitedstates, https://www.ibisworld.com/us/industry/california/dry-cleaners/14979*

Clothes-washing equipment used at commercial and industrial laundry operations include:

- Top-loading washers
- Front-loading washers
- Tunnel washers
- Washer extractors

Common Terminology

- **Coin/card operated** – A clothes washer used in laundromats, hotels, dormitories and other self-help laundry services. The washer and dryer use coins or a card for payment
- **Hard mount** – A clothes washer bolted to the floor to overcome centrifugal force during the spin cycle.
- **Soft mount** – A clothes washer that is stabilized by weight to overcome centrifugal force during the spin cycle and not bolted to the floor
- **Industrial Laundries** – Very large laundry facilities taking in volumes of laundry ranging from company uniforms to hospital and institutional laundry to heavily soiled wipe rags and fabrics.
- **Integrated Water Factor (IWF)** - The gallons of water used per cubic foot of volume (volumetric capacity of the clothes washer container) for one load. Common units in gallons per cubic foot per cycle (load).
- **Modified Energy Factor (MEF)** – The quotient of the volumetric capacity of the clothes container, C, divided by the total clothes washer energy consumption per cycle (load), including energy used to run the equipment, energy used to heat the water, and the energy used to dry the clothes. Common units in cubic feet per total kilowatt hours to wash and dry the clothes.
- **Multi load washer** – A clothes washer found in laundromats and similar facilities. Standard washers have drum capacity of 2.0 to 4.0 cubic feet while multi-load washer have capacities up to, and possibly exceeding, 9.0 cubic feet.[6]
- **On-premises system** – Laundry equipment for over 40 and up to 700 pounds of laundry per load used by hotels and other larger commercial and institutional operations. Unlike residential equipment, these washers have a wide range of settings for wash time, volume of water and types of chemicals that are fed. Route operators typically help program this equipment.
- **Route operator** – A representative, often of the chemical company, that supplies the laundry with detergent and other chemicals and is the one who sets the clothes washer for each type of fabric washes (chemicals fed, and the time, water use and chemical use for each type of fabric washed). Route operators are an integral component in effective water conservation programs.

Equipment Standards

Manufacturers have been required to comply with the DOE energy conservation standards for clothes washers since 1988.

However, it wasn't until 2005 with the passage of the Energy Policy Act (EPAct), which amended the EPCA, that commercial clothes washer (CCW) soft-mount machines with a horizontal axis and 3.5 cubic feet of volume and top-loading machines with 4.0 cubic feet of volume were regulated for the first time.

Manufacturers have been required to comply with the DOE energy conservation standards for CCWs since 2007.

EPAct established standards for CCWs and directed DOE to conduct two rulemakings to determine whether the established standards should be amended. DOE completed the first of these rulemakings by publishing a final rule on January 8, 2010 that amended energy conservation standards for CCWs manufactured on or after January 8, 2013.

DOE's most recent energy and water conservation standards for CCWs were published in the February 2024 Final Rule, which applied to CCWs manufactured on or after January 1, 2018.[7]

The standards listed in Table 10-2 are applicable as of June 13, 2024.

"Relative to the prior standards, which took effect in 2013, the new standards represent energy savings of 15% and 18% for top-loading and front-loading washers, respectively. The standards also reduce the water consumption of front-loaders by 20%, while the maximum water use of top-loaders remained essentially unchanged. MEF is expressed in terms of cubic feet of

6 For example, the Maytag Rigid Mount MYR65Pd has a capacity of 9.25 cubic feet: *https://www.whirlpool.com/content/dam/global/maytag/commercial-laundry/commercial-washer/spec-sheets/Maytag_MultiLoadWasher_Vended_1Page_Rigid_SpecSheet.pdf*

7 *https://www.federalregister.gov/documents/2021/12/20/2021-27461/energy-conservation-program-energy-conservation-standards-for-commercial-clothes-washers#citation-3-p71842*

TABLE 10-2: Federal Energy Conservation Standards for Commercial Clothes Washers Manufactured On or After January 1, 2018

EQUIPMENT CLASS	MINIMUM MODIFIED ENERGY FACTOR ("MEF") - CUBIC FEET ("FT 3")/KILOWATT-HOUR ("KWH")/CYCLE	MAXIMUM INTEGRATED WATER FACTOR ("IWF") - GALLONS ("GAL")/FT 3/ CYCLE)
TOP-LOADING	1.35	8.8
FRONT-LOADING	2.00	4.1

TABLE 10-3: EPA Energy Star Integrated Water Factor for Clothes Washers

PRODUCT TYPE	CURRENT CRITERIA LEVELS (AS OF APRIL 22, 2021)
ENERGY STAR Residential Clothes Washers, Front-loading (> 2.5 cu-ft)	**IMEF ≥ 2.76** **IWF ≤ 3.2**
ENERGY STAR Residential Clothes Washers, Top-loading (> 2.5 cu-ft)	**IMEF ≥ 2.06** **IWF ≤ 4.3**
ENERGY STAR Residential Clothes Washers (≤ 2.5 cu-ft)	**IMEF ≥ 2.07** **IWF ≤ 4.2**
ENERGY STAR COMMERCIAL Clothes Washers	**MEFJ2 ≥ 2.20** **IWF ≤ 4.0**
ENERGY STAR Combination All-in-One Washer-Dryer	**Meets IMEF, IWF and the current ENERGY STAR requirements for clothes dryers (except the time requirements) for the closest product type**

washer capacity per kWh of energy consumed per cycle. MEF incorporates machine electrical energy consumption, hot water energy consumption, and the energy required to remove the remaining moisture in the clothes. IWF is expressed in terms of gallons of water consumed per cubic foot of washer capacity. A higher MEF indicates better energy efficiency, while a lower IWF indicates better water efficiency" (Appliance Standards Awareness Project).

The US Environmental Protection Agency Energy Star Program also has energy and water use standards for residential and commercial clothes washers. The maximum integrated water factor to be Energy Star certified for a commercial clothes washer is 4.0 and the EPA only certifies washers up to 8.0 cubic feet of capacity.[8] The Energy Star Program does not certify top loading clothes washers because they are both energy and water inefficient. As demonstrated in Table 10-3, the Federal DOE standards for commercial clothes washers are much less stringent than the US EPA Energy Star standards.

The Energy Star database[9] lists all certified clothes washers meeting their commercial washer standards.

Commercial Laundries

An Array of Front-Loading Machines at a Commercial Laundry Facility

Commercial clothes washers are defined as soft-mounted (not bolted to the floor) front-loading or top-loading clothes washers that are no more than 3.5 cubic feet for front loaders, no more than 4.0 cubic feet for top loaders, and used in applications in which the occupants of more than one household will be using the clothes washer, such as multi-family housing common areas, coin laundries, or other commercial applications. According to the Alliance for Water Efficiency (AWE), while in-home machines average only 6 to 8 loads per week, common area machines often wash 20 to 50 loads per week per clothes washer. Single load washer capacity is under 20 pounds but multi load washers can wash up to more than 50 pounds.[10] The volume capacity of laundromat equipment ranges from 1.7 to over 12 cubic feet.

According to the Alliance for Water Efficiency, most coin-op washers are vertical-axis and have a Water Factor (WF) rating of 9.5 to 12; using 32 to 38 gallons per load (132.5 L to 170.29 L) (lower WF rating equates to less water use). Newer water efficient models have a WF rating of 4 to 8; using as little as 15 gallons per load (56.8 L).[11]

Top-load, soft-mount washers previously dominated the market; however, commercial front load washers are starting to be used more frequently in laundromats. Front loading machines are more efficient than top loading machines because the horizonal configuration allows for more room to put clothes in and less water is required to cover the clothes. Instead of using an agitator or impeller, a front-load washer cycles the clothes through a minimal amount of water and detergent by rotating the drum in different directions. Gravity drops the clothing in the water repeatedly throughout the cleaning process. A host of specialty cycles ensure effective and energy-efficient washing, according to Energy Star.

Significantly greater energy and water savings could be achieved if all commercial clothes washers met the efficiency levels of front-loading machines. Under the current CCW equipment standards, a top-loading washer can consume almost 50% more energy and more than twice as much water as a front-loading washer with the same cubic feet capacity (US Department of Energy).

Commercial multi-load washers can exceed capacities of 80 pounds per load as compared with less than 20 for conventional equipment. Standards for multi-load equipment and single-load hard-mount equipment were not included in the EPCA. Multi-load equipment

8 *https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Version%208.1%20Clothes%20Washer%20Final%20Specificaiton%20-%20Partner%20Commitments%20and%20Eligibility%20Criteria.pdf*

9 *https://www.energystar.gov/productfinder/product/certified-commercial-clothes-washers/results*

10, 11 *https://www.allianceforwaterefficiency.org/resources/topic/laundromats-and-common-area-laundry-facilities*

is essentially the same as the equipment used by commercial on-premises and industrial laundries. Multi-load equipment is designed with many possible settings and cycles to accommodate a range of washing requirements with large variations in water use. The manufacturer or equipment provider must preset the controls for the washing requirement prior to installation to avoid excessive water use.

As water and wastewater rates increase throughout the country, it is to the benefit of laundromat owners to rent or buy machines that are efficient to minimize utility costs. Water efficiency also helps increase energy savings as the need for hot water is reduced.

Many laundromats lease their machines and, to achieve water savings, the laundromat owner must work with the clothes washer leasing agent to rent and maintain higher efficiency equipment.

Example of an On-Premises Laundry Facility

On-Premises Laundries

On-premises laundries (OPL) use washer-extractors are identical to the multi-load equipment used in laundromats, except they have no coin boxes and can be much larger. Load capacities range from 25 to as much as 1,000 pounds. Washer-extractors are designed to wash everything from relatively clean hotel towels and bedding to heavily soiled items from nursing homes and commercial kitchens. All equipment in this category uses a horizontal configuration and is, therefore, relatively efficient. Examples of OPL applications include prisons, jails, hotels, hospitals, athletic facilities, food and beverage manufacturers, and uniform washing for businesses and military.

TABLE 10-4: On-Premises Laundry Production in Common Operations

TYPE OF OPERATION	POUNDS/PERSON/DAY	POUNDS/ROOM/DAY
HOSPITALS		**25**
NURSING HOMES		**25**
MOTELS		**23**
HOTELS		**36**
UNIVERSITY DORMS	**20**	
JAILS	**10**	
PRISONS	**12**	

Source: (Riesenberger and Koeller)

A typical washer extractor uses 3-4 gallons of water per pound of fabric, and in the most efficient of the machines, only 2.5 gallons of water is needed per pound of fabric.[12] Some washer extractors have recycling features built in that allow the water to be reused.[13] Because the items being washed vary greatly, the equipment needs to be adjustable. A study for the California Water Efficiency Partnership[14] illustrates these points.

Table 10-4 shows the amount of laundry produced by each of the most common OPL operations and laundry characteristics based upon degree of soiling.

The level of soiling strongly influences the amount of water required, because of the number of cycles needed to wash the items and the corresponding water levels needed for each cycle. Unlike residential and coin/card type laundry equipment, OPL equipment has the possibility of many settings including time of wash, temperature, volume of water in the washer, and the types of fabric. This makes the volume of water used susceptible to how the equipment is set up to operate, but also gives the benefit of being able to use the minimal amount of water, energy, and chemicals. Sorting laundry items and using the correct setting can save significant amounts of water.

Industrial Laundries

A Commercial Dry-Cleaning Facility

Industrial laundries comprise a special subset of commercial laundries. These are very large operations that typically offer services to institutional users such as hospitals and prisons and commercial enterprises such as hotels and restaurants. They often offer uniform and linen leasing, cleaning, and related functions. Industrial laundries use horizontal washer extractors identical to those used by OPL operations and large volume equipment called tunnel washers. Tunnel washers are commonly found in operations processing over 1,500 pounds of laundry an hour.

G. A. Braun Inc. in Syracuse, N.Y., states that tunnel washers have achieved water usage rates as low as 0.3-0.4 gallons per pound. This is opposed to 2.0 to 3.5 gallons per pound of laundry for other on-premises systems.[15] A tunnel washer works just like a front-loading machine but can wash loads 30 times larger than an average laundry machine. Tunnel washers are very expensive and typically not justified unless the laundry is washing 800 pounds of laundry an hour or more.[16]

Dry Cleaning

The dry-cleaning process uses a chemical agent to clean clothing instead of water (unless the operation uses a "wet cleaning" method). Typically, clothes are added into a drum machine with a chemical agent and sometimes other detergents, spun to remove the agent, then tumbled with hot air. Dry cleaning operations are phasing out the use of perchloroethylene (perc) as a dry-cleaning agent due to air-quality and carcinogenic concerns.

In the 2008 EBMUD Guidebook, there were three technologies that were considered to replace perc dry-cleaning operations:

- Supercritical or liquid carbon-dioxide (CO2) technologies
- Silicon-based compounds
- Wet-cleaning methods, similar to front-loading washers

Carbon dioxide and silicon based technologies nearly eliminate water use so long as air cooling is used in the process-fluid operations. Silicon based technology can be used in some existing dry-cleaning equipment that currently uses perchloroethylene. Pressurized (liquid) CO2 and detergent can be circulated through specialized equipment to remove dirt from clothes with no water.

12 *https://www.milnor.com/technical-knowledge-base/washer-extractors/general-information-4/water-usage/*
13 *https://unimac.com/products/unimac-washer-extractors/*
14 *https://calwep.org/wp-content/uploads/2021/03/On-Premise-Laundries-PBMP-2005.pdf*
15 American Laundry News, December 2018, *https://americanlaundrynews.com/articles/efficient-flexible-tunnel-washers*
16 *https://www.milnor.com/technical-knowledge-base/*

Detail from a Commercial Dry Cleaning Facility

Photo by Waldemar on Unsplash

The wet cleaning method uses washer equipment almost identical to normal horizontal washers and uses water in the process. Volumes per cubic foot are lower than those for conventional washer operations.

More technologies[17] have been developed to replace perchloroethylene. Although some of these technologies are less toxic than perc and promoted as a "safe, green or environmentally friendly" alternative, some of these solvents are still flammable, volatile, and hazardous:

- n-Propyl bromide (nPB)
- Cyclic volatile methyl siloxane decamethylcyclopentasiloxane (D5)
- Propylene glycol ethers
- High-flash hydrocarbons
- Acetals (butane (butylal))

Water Reuse, Recycling and Ozone Systems

Water reuse, recycling, ozone, and low water laundry systems using developing technologies such as reusable polymer spheres, can reduce water use and wastewater volumes. These technologies can also reduce pretreatment costs and energy use.

A simple recycle and reuse laundry system recovers the discharge from the final rinse in a multi-cycle operation for use in the first flush or first rinse of the next cycle. More complex systems can recover more than 85% of the water for reuse. Simple laundry systems rarely incorporate any type of treatment, since the final rinse water tends to be very clean. These systems are limited to a 10 to 35% savings (Laundry Today, 2005).

However, to achieve consistently higher recovery rates, used wash water must be treated to some extent before reuse.

Ecolab's Aquamiser and the Aqua 360 systems are examples that have been around for more than a decade. Water is filtered to remove lint and dirt, then reheated and sent for reuse. Still other systems process wash water to the point that it can be recycled for use in all cycles of the washing process. These systems can recycle up to 90% of wastewater.

Other laundry companies have included water saving technologies such wastewater recycling, water storage, water softeners, and reverse osmosis with the goal of reducing water consumption and wastewater costs. These technologies are more likely to be used in industrial laundry operations than in a local commercial laundromat.

A Commercial Dry-Cleaning Facility

17 *https://www.ftc.gov/sites/default/files/documents/public_comments/16-cfr-part-423-trade-regulation-rule-care-labeling-textile-wearing-apparel-and-certain-piece-goods-.r511915-00054%C2%A0/00054-85206.pdf*

While using ozone in the laundry process is providing to be an environmentally friendly way to reduce energy usage in the commercial laundry washing process, potential water savings as a result of the technology are inconsistent. One US Department of Energy report found a 60%reduction in hot water energy requirements. However, the same report notes that water usage can vary from site to site, and that unlike energy savings, water savings are not ensured by the installation of an ozone system.[18]

Recommendations

General

- Choose the most water efficient equipment available
  - Look for the EPA Energy Star rating
  - Choose machines with a high Integrated Modified Energy Factor (IMEF) and a low Integrated Water Factor (IWF)
  - Consider systems with water reuse, water recycle, and/or ozone capabilities
- Retrofit laundromats with multi-load units
- Install sub- or flowmeters [include link to/page for metering chapter] on the cold-water line, including a meter for the feed to the facility boiler (water heater).
  - Monitoring means faster identification of issues, as well as volumetric tracking
  - Sub- or flowmeters should be read daily or connected to the facility dashboard
  - Schedule routine equipment leak checks and maintenance/upgrades
  - Ensure that steam and hot water systems are insulated and operating properly

Operational

- Choose tunnel washers where laundry volume is large enough (tunnel washers are the most water and energy efficient systems)
  - Choose tunnel systems using less than 0.6 gallons per pound of laundry
  - Perform regular review of the tunnel washer computer control system to minimize water, energy, and chemical use
- Choose equipment with a broad range of possible wash settings
  - Work with a route operator to formulate settings for the types of items to be washed so that the setting use will minimize energy, chemical, and water use
  - Wash clothes in cold water using cold-water detergents whenever possible
- Ensure that staff are trained and that there is proper signage to separate laundry by the washing setting needed.
- Post energy and water use data for employees to see and award increased water and energy efficiency

Laundromats

- Single-load hard-mount laundromat or other coin- and card-operated machines should have a WF of 8.0 or less.
- Multi-load coin and card operated machines must have an IWF of 8.8 or less and be installed with proper settings to achieve the required IWF
- Post signage encouraging customers to wash and dry full loads
- For small loads, encourage customers to use the appropriate water-level setting
- Purchase single-load soft-mount washers with a WF of 3.8 or less
- Encourage the use of non-wet dry-cleaning
- Use dry lint collection systems with appropriate fire suppression systems that only activate when there is an actual fire risk

18 *https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/Ozone_Tech_Demo_Flyer_508.pdf*

Resources

1. EPA, Best Management Practices
   https://www.epa.gov/watersense/best-management-practices
2. Consortium for Energy Efficiency (CEE)
   https://cee1.org/content/about
3. Energy Star, Commercial Clothes Washers
   https://www.energystar.gov/products/commercial_clothes_washers
4. US Department of Energy, Appliances and Equipment Standards Rulemakings and Notices
   https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=68&action=viewlive
5. Riesenberger, James, and Koeller, John. November 2005. Evaluation of Potential Best Management Practices - On-Premise Laundries
   https://calwep.org/wp-content/uploads/2021/03/On-Premise-Laundries-PBMP-2005.pdf
6. San Diego Water Authority, Water Management, Inc., Western Policy Research, and Koeller and Company. 2006 Report on the Monitoring and Assessment of Water Savings from the Coin-Operated Multi-Load Clothes Washers Voucher Initiative Program.
7. 2021 Appliance Standards Awareness Project, Commercial Clothes Washers
   https://appliance-standards.org/product/commercial-clothes-washers
8. Alliance Laundry Systems LLC, UniMac, High-Performance Industrial Washer Extractors
   https://unimac.com/products/unimac-washer-extractors/
9. Alliance for Water Efficiency, Laundromats and Common Area Laundry Facilities
   https://www.allianceforwaterefficiency.org/resources/topic/laundromats-and-common-area-laundry-facilities
10. Next Generation Standards: How the National Energy Efficiency Standards Program Can Continue to Drive Energy, Economic, and Environmental Benefits 2016
    https://appliance-standards.org/sites/default/files/Next%20Gen%20Report%20Final_1.pdf
11. Danamark, Optimize Water And Energy Usage In Hotel Laundry Machines
    https://danamark.com/resources/improving-water-footprint-laundry-machines/
12. Pellerin Milnor Corporation, Technical Knowledge Base
    https://www.milnor.com/technical-knowledge-base/
13. SAHF – Stewards of Affordable Housing for the Future, Efficiency Opportunities in Multi-Family Common Area Laundry Facilities
    https://assets.ctfassets.net/ntcn17ss1ow9/3wb7I1yXahjWP8boavk13q/af77171dbe757aaa377230ae6ecdb932/efficiency-common-laundry-areas-sahf-20170327.pdf
14. T&L Equipment Company, Common Commercial Washing Equipment, http://www.washcycle.com/four-generic-types-washing-equipment/
15. Coin-Operated Clothes Washers in Laundromats and Multifamily Buildings: Assessment of Water Conservation Potential
    https://calwep.org/wp-content/uploads/2021/03/Coin_Operated-Clothes-Washers-PBMP-2012.pdf
16. Code of Federal Regulations Title 10, Chaoter II, Subpart D, Part 431, § 431.156 Energy and water conservation standards and effective dates
    https://www.ecfr.gov/current/title-10/chapter-II/subchapter-D/part-431/subpart-I
17. Pacific Gas and Energy, Support for Small and Medium Businesses
    https://www.pge.com/en_US/small-medium-business/save-energy-and-money/rebates-and-incentives/product-rebates.page
18. American Laundry News. May 21, 2020. Maximizing Pounds Per Operator Hour: 7 suggested steps to help improve laundry operation's PPOH
    https://americanlaundrynews.com/articles/maximizing-pounds-operator-hour

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