

Preparatory Studies for Eco-design Requirements of Energy-using Products

Lot 24: Professional Washing Machines, Dryers and Dishwashers

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Part: Washing Machines and Dryers

Task 1: Definition

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For reasons of better readability, two Task 1 reports were prepared.

The report at hand covers ***professional washing machines and dryers***.

The Task 1 report on *professional dishwashers*
is published separately.

For the benefit of the environment, this document has been optimised for
double-sided printing.

Part: Professional Washing Machines and Dryers

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1 Introduction

1.1 General objective of the preparatory study

Many aspects of energy-using products (EuPs) have a negative impact on the environment (emissions to air including greenhouse gases, to soil, recycling, water consumption...). In line with the Integrated Product Policy (which promotes the principle that requirements on the environmental performance of products should address all environmental aspects during the complete lifecycle of the product), the Commission decided in August 2003 to propose an integrated framework for setting “eco-design” requirements for EuPs (including energy efficiency requirements) while avoiding fragmentation of the market.

By adopting Directive 2009/125/EC¹, the European Parliament and the Council have granted a mandate to the Commission, assisted by a committee and after consultation of the stakeholders forum, to regulate the environmental characteristics of energy-using products (except vehicles) through adopting implementing measures (e.g. decisions, regulations or directives) laying down eco-design requirements for particular EuPs.

First step in considering whether and which eco-design requirements should be set for a particular product is a preparatory study identifying and recommending ways to improve at the design phase the environmental performance of the product throughout its lifecycle.

Preparatory studies should provide the necessary information to prepare for the next phases (carried out by the Commission) and in particular the impact assessment, the consultation of the Forum and the possible draft implementing measure.

Each product specific preparatory study follows a defined methodology especially developed for the European Commission (Methodology Study for the Eco-design of Energy-using Products (MEEuP)²). The MEEuP approach covers the following tasks:

- Task 1: Definition,
- Task 2: Economic and market data,
- Task 3: Consumer behaviour and local infrastructure,
- Task 4: Technical analysis of existing products,
- Task 5: Definition of base case,
- Task 6: Technical analysis of best available technology (BAT),
- Task 7: Improvement potential,
- Task 8: Scenario-, policy-, impact- and sensitivity analysis.

¹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:285:0010:0035:EN:PDF>

² http://ec.europa.eu/energy/efficiency/studies/doc/ecodesign/2005_11_28_methodology_report.pdf

1.2 Objective of Task 1

Within Task 1, the product category and system boundaries of the ‘playing field’ for eco-design shall be defined. This is important for a realistic definition of design options and improvement potential and is also relevant in the context of technically defining any implementing legislation or voluntary measures (if any).

Subtask 1.1 – Product category and performance assessment

The following classification schemes and documents shall be analysed to define the product categories for Lot 24:

- Prodcom category or categories (Eurostat);
- Categories according to EN- or ISO-standard(s);
- Labelling categories (EU Energy Label or Eco-label), if not defined by the above.

Categorisation will often be linked to the assessment of the primary product performance parameters (the “functional unit”). If needed, a further segmentation can be applied on the basis of secondary product performance parameters, referring to functional performance characteristics but not to technology.

Subtask 1.2 – Test Standards

Subtask 1.2 will identify and shortly describe the harmonised test standards and additional sector-specific directions for product-testing regarding the test procedures for:

- the primary and secondary functional performance parameters mentioned above;
- resources used (energy, water, detergent etc.) and emissions (NO_x, CO, particulate matter) during product life;
- safety (gas, oil, electricity, EMC, stability of the product etc.);
- noise and vibrations (if applicable);
- other product-specific test procedures.

Apart from mentioning these standards, including a short description, it should also be reported which new standards are being developed, which problems exist (e.g. regarding tolerances etc.) and which alternatives are being developed. Furthermore, the (ongoing) work on an eco-design standard, mandated by the European Commission to standardisation bodies, shall be considered.

Subtask 1.3 – Existing legislation

Task 1.3 should identify the relevant legislation for the product. This task can be subdivided in three parts:

Subtask 1.3.1 – Legislation and Agreements at European Community level

Apart from the obvious environmental directives (RoHS, WEEE, Packaging directive), relevant regulations could be such on building (e.g. developed under the Performance of Buildings Directive), on health and labour conditions (e.g. for air conditioners, copiers), minimum efficiency directives (boilers, refrigerators, ballasts etc.), regulations on product liability, safety, EMC etc. Also, EU Voluntary Agreements and already existing eco-design standards (e.g. ECMA, EIA) for the sector or related sectors need to be identified. And finally, especially in a business-to-business context, it needs to be described which quality requirements (e.g. “proven design”, maximum failure rate) are customary.

Subtask 1.3.2 – Legislation at Member State level

This section deals with the subjects as above, but for legislation that has been indicated as being relevant for the Member States.

Subtask 1.3.3 – Third Country Legislation

Again, this section deals with the subjects as above, but for legislation and measures in Third Countries (extra-EU) that have been indicated by stakeholders (NGOs, industry, consumers) as being relevant for the product group.

2 Product category and performance assessment

2.1 Scope of Task 1 report, part ‘Professional washing machines and dryers’

Objective of this task is to present and discuss the definition and scope of the product family “Lot 24: Professional washing machines, dryers and dishwashers”.

In previous preparatory studies on household appliances, washing machines and dishwashers have been jointly discussed as “wet appliances” within Lot 14, whereas laundry dryers have been dealt with in a different study (Lot 16). In Lot 24, we consider dryers as one module of the whole laundry process and therefore integrate the discussion on washing machines and dryers, whereas the research on professional dishwashers will be presented separately.

For reasons of better readability two Lot 24 reports are prepared. The report at hand covers professional washing machines and dryers. The report on professional dishwashers is published separately.

2.2 The professional laundry process

2.2.1 Wet-cleaning process

The entire washing and drying process, e.g. in a commercial laundry, consists of several steps which are depicted in the following figure³ and specified subsequently.

³ Own figure on the basis of BDEW-brochure “Erdgas in Wäschereien” (natural gas in laundries) 2007, www.bdew.de; and Electrolux Laundry Know How, www.laundrysystems.electrolux.com/Files/Laundryknowhow/HTML/71-0-1.htm

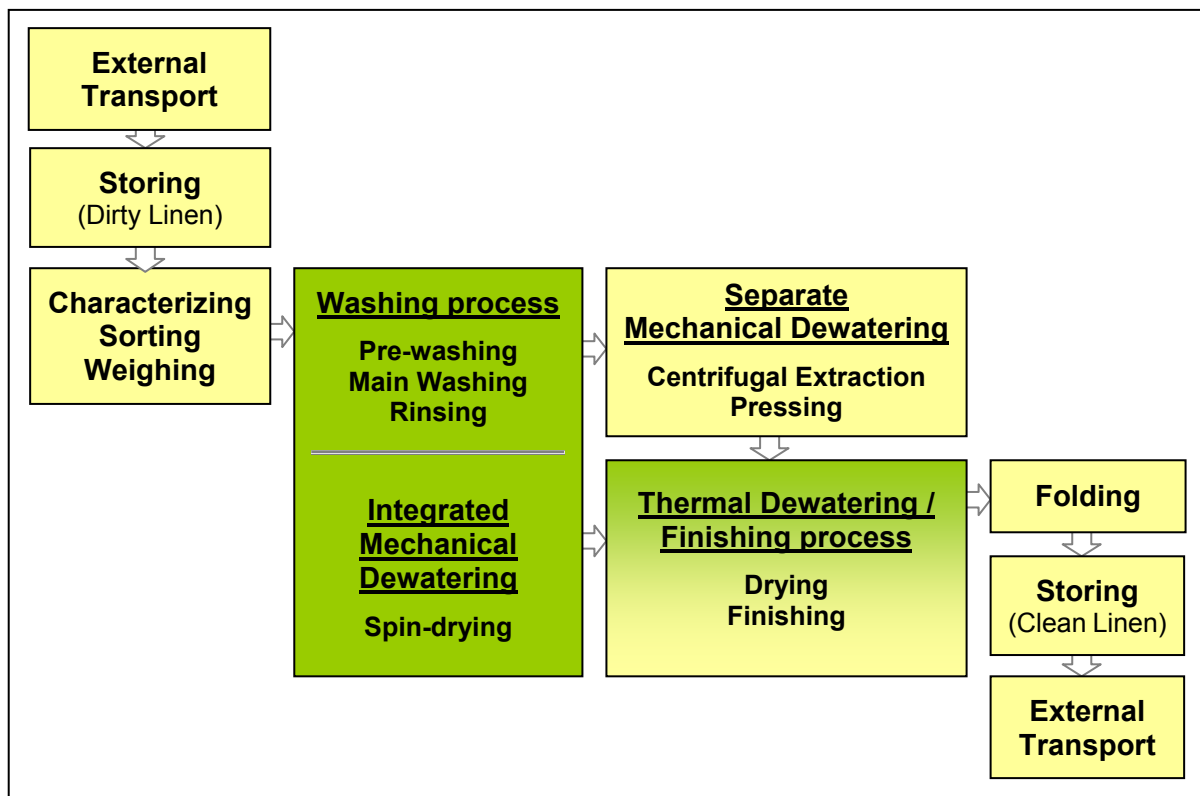


Figure 1 Different steps of a professional laundry process

- **Sorting:** Before loading a washing machine, laundry has to be sorted to avoid failures in the washing process. This can be done according to the different types of textiles (characterised by washing symbols in the garment labelling, textile materials, and colour of the laundry), and/or according to the type of dirt and degree of soiling.
- **Washing:** The purpose of washing laundry is to loosen dirt from the textile fibres and to rinse it off by using water as solvent. Depending on the laundry type and the degree of soiling, professional washing machines often provide a large number of different either adjustable or pre-defined washing programmes. They vary e.g. in terms of using pre-washing, the number of rinsing cycles, the temperature or the programme duration.
- **Dewatering:** After the laundry has been washed, it has to be dewatered to achieve a faster drying process at a later stage. This can be realised either by mechanical or thermal energy at different stages in the laundry process.
 - **Mechanical dewatering** can be done by different appliances:
 - Spin-dryer being integrated in the washing machine (“washer-extractor”).
 - Separate hydro-extractor or pressing appliances.
 - Squeeze press: Machine for the mechanical extraction of moisture from textile fabrics by the application of pressure.

- Centrifugal extraction machine = spin-extractor: Machine containing a perforated cage to and from which successive loads is transferred and within which the loads are subjected to a centrifugal force due to the rotation of the cage for the purpose of extracting moisture.
 - **Thermal dewatering / drying:** After mechanically dewatering the linen, the remaining moisture has to be evaporated to fully dry the laundry. Functions to be delivered by these processes are to dry, to soften and/or flatten as well as to stretch the fabrics. Depending on the type of textile, thermal evaporation of the remaining moisture is done in a tumble dryer, flatwork ironer, utility press or garment finisher.
 - Drying by rotating or tilting tumble dryers: They are used to dry garments, mostly for terry garments. The water evaporates due to the high temperature caused by hot air injected through the perforated shell of the drum.
 - **Finishing** by ironing, pressing or garment finishing: irons and presses generally have the same function: To soften and flatten the damp⁴ fabric, as well as to remove creases. At the same time, the fabric is dried.
 - Ironing: This process is performed by contact drying and calendaring of flat linen. The flat pieces are led, either manually or automatically by a feeding machine, between the rotating rolls and stable heated beds of the ironer. The evaporated water is vacuumed out through the perforation holes on the rolls. Due to the rotation the flat linen pieces are conveyed further into the machine.
 - Pressing: This process is used for most garments like shirts, overall, coats etc. A piece of garment is steamed and dried between two pressing plates. The steam and evaporated water are removed by an integrated suction system.
 - Garment finishers: Garments have to be de-wrinkled and re-shaped. This process is called “conditioning”. While domestic washing will normally utilise an iron to finish shirts and the like, for industrial purposes this process is performed with several kinds of steam air finishers. To soften the fabric, steam is injected either directly into the garment or into the bag on which the garments are dressed. After that, hot air inflates the bag which presses the garment from the inside while also drying the fabric.
 - **Folding:** The linen can be folded by hand, or automatically using a folding machine. Small and big pieces of flat linen, once ironed, are length and cross folded by synchronised units.

⁴ Depending on the efficiency of the mechanical dewatering by laundry machinery (e.g. spin-extractor), the material of the textiles and the type of following finishing, fabrics have a residual moisture of about 20 to 40%.

- **Storing:** The finished and folded laundry is stacked on shelves or hung on garment racks or similar. Before using the linen, the textiles have to re-absorb a certain amount of moisture to smooth out creases.

Within the different steps of an entire laundry process as described above, professional washing machines and dryers – the formal focus of Lot 24 according to the technical specifications of Tender No TREN/D3/91-2007 – only come into operation within the sub-processes washing and dewatering. The processes storing, sorting and folding will be out of the scope of this study.

Further, according to Porter et al. (1984),⁵ “drying” generally refers to the ‘removal of a liquid from a solid by evaporation. Mechanical methods for separating a liquid from a solid are generally not considered as drying, although they often precede a drying operation, since it is less expensive and frequently easier to use mechanical methods than to use thermal methods’. Thus, only the technical washing and thermal drying processes, including the spinning phase, and the machines used for these are within the scope of the preparatory study at hand. Further, systems for softening the water⁶ by reducing the concentration of calcium, magnesium, and other ions in hard water, are not in the scope of the study as they are not part of the laundry machinery but separate processes. Machines which are or can be equipped with a separate water treatment system, such as tanks for water recovery or waste water systems, will be introduced in Task 6.

In the professional context, a variety of items may be cleaned by a professional washing machine or dried by a professional dryer, e.g. clothes, shoes, tablecloths, napkins, hand towel rolls, towels, bed clothes, pillows, mattress toppers, sleeping bags, surgical scrubs, mats, mops, etc.. Their shape and material must be suitable for wet-cleaning or drying by machine.

In our study, we will use the term “laundry” as superordinated term for these different kinds of items to be washed and dried in a professional washing machine or dryer.

2.2.2 Dry-cleaning process

In the Commission Regulation with regard to eco-design requirements for household washing machines,⁷ washing machines are defined as a “machine which cleans and rinses tex-

⁵ Porter, H.F.; Schurr, G.A.; Wells, D.F.; Semrau, K.T.; Solids Drying and Gas-Solid Systems; in: Perry's Chemical Engineers' Handbook; Perry, R.H. and Green, D.W. (Eds.); 6th Edition, McGraw-Hill, New York, 1984

⁶ "Hardness ions" can cause a variety of undesired effects including interfering with the action of soaps, the build up of limescale, which can foul plumbing, and galvanic corrosion (source: Stephen Lower (July 2007). "Hard water and water softening" (<http://www.chem1.com/CQ/hardwater.html>). Water-softening appliances depend on an ion-exchange resin or reverse osmosis in which hardness ions are exchanged for sodium ions.

⁷ COMMISSION REGULATION (EU) No 1015/2010 of 10 November 2010 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for household washing machines. Official Journal of the European Union L 293/21 from 11.11.2010.

tiles using water [...]”. However, the removal of stain from laundry could not only be realised by water-using wet-cleaning machinery, but also in a dry-cleaning process. While water can be chemically classified as a polar solvent, dry-cleaning uses non-aqueous non-polar, mostly organic solvents like perchlorethylene (perchlor), hydrocarbon, cyclosiloxane, or CO₂ instead of water in contrast.

The most important reason for dry-cleaning instead of washing textiles is that some materials, especially wool, are very sensitive to water; their fibres swell and get deformed by water in combination with heat (felting or shrinkage). Dry-cleaning provides shape permanence: Folds and pleats are not damaged; flatwork like linen or tablecloth keeps its stiffness. Furthermore, the risk of discolouration is normally negligible. Another reason for using different processes is that wet- and dry-cleaning each remove different types of stain. While dry-cleaning is better for removing grease, ink, oil, or paint, water-based stains are best removed in a washing process.

Besides the different cleaning agent (non-aqueous non-polar solvents versus water), there are significant differences in the machine technology (for example, in contrast to washing machines, dry-cleaning machines operate with a completely closed circuit regarding the solvent). Furthermore, dry-cleaning machines are fabricated by different manufacturers and cover a different market segment.

For an extensive description of the dry-cleaning process and equipment, see Annex 7.3.1 of this document; a detailed market analysis for dry-cleaning machinery is annexed to Task 2.

2.3 Detergents for professional washing machines and dryers

Laundry detergents for professional use mean products intended for laundering textiles in water by professional users like institutional or industrial users and other large-scale consumers. Generally, various types of professional textile detergents exist – acid or alkaline.

The following constituent substances occur: Surfactants, alkalines, bleaching agents, enzymes, fillers, colour protection agents, colour complexing agents, preservatives, anticorrosion compounds, optical brighteners, fragrance, protective colloids and foam inhibitors.

Various auxiliary products are also available, such as pre-wash agents, stain removers, anti-static agents, fabric conditioners, softeners, washing strengtheners, wash enhancers for heavily soiled laundry (for example work clothes), special detergents for laundering delicates, proofing agents for water-repellent textiles, mop detergents, detergents for microfibers, bleaches, and rinsing agents.

The product group covers complete powders and liquid detergents as well as multi-component systems. A multi-component system is a detergent system based on components used to build up a complete detergent, a stock solution or a laundering programme for automatic dosing. This system incorporates basic detergents plus a number of auxiliary products.

Professional textile detergents are dosed both manually and automatically. Achieving the correct dosage is essential, as is maintaining the dosage devices so that they function efficiently and provide the optimum dose (Nordic Ecolabelling 2009)⁸.

2.4 Delimitation of professional washing machines and dryers

Washing machines and laundry dryers have already been object of research in previous preparatory studies,⁹ however focussing on domestic appliances (Lot 14: Domestic Washing Machines and Dishwashers; Lot 16: Laundry Dryers). Nevertheless, the following general definition for washing machines of Lot 14 and laundry dryers of Lot 16 can also be applied to professional laundry machinery:

“Washing machines are defined as machines which clean and rinses textiles using water which also have a spin extraction function.” (Lot 14)

“Tumble dryers are defined as machines in which textiles are dried by tumbling in a rotating drum through which heated air is passed.” (Lot 16)

Lot 24 focuses on professional appliances. They are used to clean, rinse and dry textiles in commercial customer and market segments.

Professional washing machines and dryers are always connected to the mains (electricity used for motor and electronics). The heating of the water or air can be realised by electricity or by other alternative energy sources like steam or gas. Professional washing machines may or may not have a specific drying operation at the end of the washing phase of a washing program resulting in different kinds of machinery (washing machines, washer extractors, washer dryers, for details cf. Section 2.5.5.1):

In the following the basic differences between professional and household washing machines and dryers are described to properly define the scope of this preparatory study on professional appliances.

2.4.1 Eco-design regulations on household washing machines and dryers

The Commission Regulation¹⁰ with regard to eco-design requirements for household washing machines provides the following definition: “household washing machine means a [...] machine [...] which is designed to be used principally for non-professional purposes.” This

⁸ Swan labelling of laundry detergents for professional use. Background document for ecolabelling. Consultative proposal – 16 March 2009. http://www.ecolabel.no/sfiles/60/20/1/file/Bakgr_TekstilvaskeProf_ENG.pdf

⁹ Further information: www.ecowet-domestic.org and www.ecodryers.org/, sighted on 12 January 2010

¹⁰ COMMISSION REGULATION (EU) No 1015/2010 of 10 November 2010 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for household washing machines. Official Journal of the European Union L 293/21 from 11.11.2010.

distinction on basis of the intended use of a machine equates the Machinery Directive (cf. next section). The draft Commission implementing Regulation with regard to eco-design requirements for household tumble dryers, defines a household tumble dryer as an appliance in which textiles are dried by tumbling in a rotating drum, through which heated air is passed and which is designed to be used principally for non-professional purposes.”

2.4.2 Distinction according to Machinery Directive

A possible general differentiation gives the amended version of the Machinery Directive 2006/42/EC¹¹, in force since 29th December 2009. It clarifies the borderline between machinery for household and for professional use in order to provide greater legal certainty. Whereas for the latter machinery the scope of the Machinery Directive applies, in Article 1 (2) k ‘household appliances intended for domestic use’ are explicitly excluded therefrom. They belong to low voltage electrical and electronic machinery with an electrical supply within the voltage limits of the Low Voltage Directive (between 50 and 1000 V for alternating current or between 75 and 1500 V for direct current) and therefore must fulfil the safety objectives of the Low Voltage Directive 2006/95/EC¹².

Concerning the exclusion of household appliances respectively intended for domestic use from the scope of this study, the following clarifications are given in the ‘*Guide to application of the Machinery Directive 2006/42/EC*’¹³:

- The expression ‘household appliances’ designates equipment intended for house-keeping functions such as washing, cleaning, heating, cooling, cooking, etc. Examples of household appliances include washing machines, dishwashers, vacuum cleaners and machinery for food preparation and cooking.
- The exclusion concerns appliances ‘intended for domestic use’, in other words, intended for use by private persons (consumers) in the home environment. Thus appliances for the housekeeping functions mentioned above that are intended for commercial or industrial use are not excluded from the scope of the Machinery Directive.

While it is possible for a private consumer to acquire and operate an appliance intended for commercial use or for a commerce to acquire an appliance intended for domestic use, the criterion to be taken into account for determining the ‘intended use’ is the use intended and stated by the manufacturer of the appliance in his product information or his Declaration of

¹¹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006L0042:20091215:EN:PDF>

¹² <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:374:0010:0019:EN:PDF>

¹³ Ian Fraser (General Editor): Guide to application of the Machinery Directive 2006/42/EC. Brussels, 1st Edition December 2009; revised by 2nd edition from June 2010
http://ec.europa.eu/enterprise/sectors/mechanical/files/machinery/guide_application_directive_2006-42-ec-2nd_edit_6-2010_en.pdf sighted at 15.02.2011

Conformity (DoC). Evidently, this statement must accurately reflect the foreseeable use of the product.¹⁴

In general, the design and construction of machinery must take account of the intended use. Recital 15 of the Machinery Directive stresses that the machinery manufacturer must consider whether the machinery is intended to be used by a professional or a non-professional operator or is intended to provide a service to consumers. Annex I of the Directive describes essential health and safety requirements relating to the design and construction of machinery, i.e. of appliances for commercial or industrial use.

In summary, the machinery directive provides a legal principle to distinguish between devices for usage in households on the one side and professional use on the other side on the basis of the intended use of the machinery as declared by the manufacturer.

2.4.3 Definition of professional washing machines and dryers within Lot 24

To date, there is no official or standardised definition or delimitation between the terms professional, commercial, and industrial. CENELEC TC59X¹⁵ proposed that the term “commercial” shall be used in connection with *market and market segments*. The term “professional”, however, shall be used in connection with *equipment* designed for use in commercial segments.

In our study, we will follow this distinction and apply the term “professional” as super-ordinated term for washing and drying appliances used in commercial and / or industrial market segments. However, please note that for example in existing standards, the term commercial or industrial might be used based on another approach (cf. Section 3)¹⁶. Therefore, an accurate delimitation and standardised definition of industrial equipment or market segments in comparison to other professional appliances would still be necessary.

On the basis of the Eco-design Regulation on household washing machines and the draft Eco-design Regulation on household dryers and the Machinery Directive, within Lot 24 we define professional washing machines and dryers as follows:

¹⁴ I.c., page 54/337

¹⁵ CENELEC TC59X settled a Sub Working Group 1.12 (CLC/TC59X/SWG1.12 which decided to clarify their understanding of the terms commercial, professional, industrial, and to decide which of them are inside the scope of SWG 1.12 on one of their next meetings (cf. Section 3.1.3).

¹⁶ For example, “industrial” laundry machinery is covered by ISO 9398 (definitions and testing of capacity and consumption characteristics) and by ISO 10472 (safety requirements). In this context, however, the term “industrial” also covers semi-professional and professional machines, e.g. quite small appliances with a capacity of 6 kg.

‘Professional washing machine’ means a machine which cleans and rinses laundry like clothes, tablecloths, bedclothes, towels, and other textiles or items by using water, chemical, mechanical, and thermal means; which might also have a spin extraction or drying function and which is designed to be used principally for commercial and industrial purposes as stated by the manufacturer.

‘Professional dryer’ means a machine which dries laundry like clothes, tablecloths, bedclothes, towels, and other textiles or items by thermally removing the moisture (evaporation) and which is designed to be used principally for commercial and industrial purposes as stated by the manufacturer.

2.4.4 Distinction according to functional performance and technological differences

With regard to functional performance and technological differences, the boundary between household and professional use is fluent. There is a semi-professional context, where some requirements of the household and some of the professional context apply.

In *private households*, a washing machine and/or dryer usually runs on average 220 cycles per year, i.e. more than 4 times per week.¹⁷ Household washing machines have cycle times of up to 3 hours. They are designed to clean various kinds of textiles (e.g. cotton, wool, synthetics, or silk). Besides some specific programmes for sensitive textiles, they usually have programmes for general use.

In the *professional context*, the specific requirements according to space or type of laundry differ considerably compared to household use, leading to a variety of different types of professional washing machines and dryers varying in e.g. size and capacity (weight of laundry to be cleaned per cycle). Compared to household use, usually a higher load of laundry has to be washed and dried in professional washing machines and dryers. Besides larger capacities, professional washing machines and dryers are also operated more often (in case of machines where the different steps of the washing or drying process are conducted consecutively in time and the textiles stay in the same position during the whole programme) or for longer times (in case of pass-through or tunnel appliances¹⁸). Moreover, in the professional context the programmes are required to be faster than in private households.

¹⁷ Total number of standard washing cycles per year as used in the “Method for calculating the Energy Efficiency Index, Washing Efficiency Index, water consumption and remaining moisture content” in the COMMISSION REGULATION (EU) No 1015/2010 of 10 November 2010 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for household washing machines. Official Journal of the European Union L 293/21 from 11.11.2010

¹⁸ Appliances where the different steps of the washing or drying process are allocated to several individual treatment zones, i.e. the textiles are transported through these zones, which are constructed as chambers, with openings in the transport direction. They are operated continuously within a certain period of time.

Sometimes only one specific type of laundry has to be washed and dried or there is enough space and needed capacity to use several washing machines and/or dryers in parallel, resulting in much more specialised appliances compared to household use. In speciality laundry (SL), for example, dust mats or functional garments (fire and rescue service) have to be cleaned, in health care laundry (HCL), high hygiene standards have to be met. Therefore, special appliances or programmes are used.

Further differences between appliances for household and professional use are:

- The rated capacity (professional washing machines and dryers are available with higher rated capacity and three phases connectivity (400 V));
- The detergent dosage (mainly manual dosing of cleaning agent in case of household washing machines, versus mainly automatic detergent dosage in case of professional washing machines; only few exemptions, e.g. automatic dosing in high-end household washing machines or manual dosing in launderettes);
- The distribution channels (professional appliances are sold directly by the manufacturers or via specialized trade);
- The price (professional appliances usually have a higher price than household washing machines and dryers).

Delimitation between household and professional appliances

The Product-Life Institute (1989)¹⁹ analysed the possible product-life extension of large appliances on the basis of a household and a (semi-)professional washing machine, providing the following distinctions.

¹⁹ <http://product-life.org/en/archive/case-studies/washing-machines>, sighted at 14 January 2010

Table 1 Delimitation between household and (semi-) professional washing machines (own compilation according to Product-Life Institute (1989))

	Household washing machines	(Semi-) professional
Target group	Private households	Communal laundries, small on-premises laundries and self-service laundromats
Functions / design	Household washing machine or fully automatic washing machine for use in private households. Washing at 30-90/95°C, rinsing, and spinning.	Semi-professional washing machines are automatic washing and spinning machines that, like household washing machines, wash, rinse, and spin dry laundry; they have a similar capacity of 5 to about 7 kg of laundry, a much shorter washing time, and a slightly larger washing drum.
Wear parts	The motor, bearings, and timer (programming switches) in a household washing machine are designed to have a certain theoretical technical life. On the other hand, lack of maintenance by the user (regular cleaning of the filter, for example, and cleaning out the detergent) or improper use (using too little detergent may in the case of hard water cause calcification of the heating elements) may cause breakdowns.	Semi-professional and professional machines are built more robustly and often have no filter. They are sturdy and easy to maintain.
Useful life	The mathematical average, calculated from the total inventory and replacement sales, is about 10 years ²⁰ . The household washing machine is designed for a theoretical technical life of at least 2 500 washing cycles with a full programme at 90/95°C, or 3 500 cycles at 60°C.	Semi-professional machines reach up to 15 000 hours, depending on the manufacturer. Professional machines reach 30 000 operating hours or more.
Distribution	Household washing machines are distributed via wholesalers and retailers, as well as via mail order and cash-and-carry outlets.	Semi-professional and professional washing machines are distributed via specialized retailers and specialized factory advisors.

Distinction between appliances in commercial and industrial market segments

On the other hand, some professional appliances are explicitly marketed or indicated as ‘industrial’ machinery. However, there is no clear and approved delimitation or definition.

The screening of manufacturers’ range of products provided no clarification. The following table exemplifies the product divisions of Girbau, a manufacturer of professional laundry equipment.²¹ Girbau explicitly differentiates between ‘commercial’ and a ‘heavy duty’²² laundry division. However, it is noticeable that washer extractors, drying tumblers and flatwork ironers are offered in both divisions, though partly with different functional performance parameters.

²⁰ More recent sources like ErP preparatory study Lot 14 on household washing machines identified an average lifetime of 15 years.

²¹ <http://www.girbau.de/grup/home>, sighted on 11 February 2010

²² Heavy duty is mainly corresponding to the term industrial

Table 2 Product classification according to the commercial and the heavy duty laundry division at Girbau

Commercial laundry division	Heavy duty laundry division
Washer extractor (9-120 kg)	Batch washer (tunnel washing machine)
Drying tumblers (7-77 kg)	Batch dryer
Barrier Washer (15-84 kg)	Water extraction press
Flatwork ironers (wall type)	Conveyor system
Finishing items (Form finishing, ironing table, utility press)	Barrier Washer
	Flatwork ironers line

PRODCOM and the European Customs Classification statistics do not provide a separate definition for industrial laundry appliances (see Sections 2.5.1 and 2.5.2).

There are two ISO standard series (ISO 9398 and ISO 10472) explicitly being in force for 'industrial laundry machines'.²³ According to the definition of ISO 10472,

“Industrial laundry machinery are machines used for the purpose of washing, extracting, drying or finishing of flat and shaped textile items in an industrial laundry. This definition includes machines intended for use in hotels, hospitals, nursing homes, prisons and similar premises.”

For some of the product categories covered by ISO 9398 and ISO 10472 on industrial laundry machinery, minimum capacities are given:

- ISO 9398, Part 2: Batch drying tumblers. Details: Batch drying tumblers whose net usable cage volume is greater than 160 dm³ (litres). This equals an approximate capacity of 6 to 7 kg dry linen.
- ISO 9398, Part 4: Washer-extractors: Details: Washer-extractors whose net usable cage volume is greater than 60 dm³ (litres). This equals an approximate capacity of 6 kg dry linen.
- ISO 10472, Part 2: Washing machines and washer extractors. Scope: This part of ISO 10472 covers, together with common requirements in part 1, most significant hazards associated with washing machines and washer-extractors of all configurations with a net usable cage volume > 60 l. This equals an approximate capacity of 6 kg dry linen.
- ISO 10472, Part 4: Air dryers. Scope: This part of ISO 10472 covers, together with common requirements in part 1, most significant hazards associated with air dryers, and in particular with tumble dryers with a net usable cage volume >160 l. This equals an approximate capacity of 6 to 7 kg dry linen.

²³ The Technical Committee of the International Organisation for Standardisation ISO/TC 72 generally deals with 'textile machinery and accessories'. TC 72 consists of seven subcommittees (SC). In the context of this study, the subcommittee SC 5 (industrial laundry and dry-cleaning machinery) is of particular interest.

The term “industrial” gives the impression of covering mainly heavy duty appliances; however, there are also commercial market segments like hotels, hospitals etc. in the general definition of industrial machinery, as well as the quite small capacities being in the scope of ISO 10472.

According to personal information by the Convenor of TC27/SC5/WG3, the issue of a distinguishing line between commercial and industrial machinery within the standard series EN ISO 10472-x has been discussed several times over the past years by working group CEN/TC 214/WG3 "Safety requirements for industrial laundering machinery". Finally, the working group came to the conclusion that it is not possible to define a clear, technically justifiable line between these sectors, neither from the point of view of manufacturers nor from the point of view of customers. Neither data regarding the size of the company (e.g. number of employees), the amount of the laundry treated daily, nor any data regarding the operational mode or the type of the machinery has been considered as suitable for the purposes of differentiating between the commercial and industrial appliances. There is always a transitional area with companies (customers) either being "commercial" or "industrial"; both types of commercial and industrial machines can perform heavy duty tasks for the same customer.

The members of the German VDMA (Verband Deutscher Maschinen- und Anlagenbau e.V.; German Engineering Federation) – working group “Garment and Leather Technology” subsume under “industrial machinery” mainly heavy duty appliances (i.e. tunnel washing machines, heavy duty dryers, heavy duty washer extractors) which are designed customer (operator) specific (see also stakeholder feedback, Section 7.1). From their view, industrial laundry equipment is mostly integrated in a comprehensive system of different laundry processes. Therefore, improvements on a single-product basis might not lead to an overall improvement of energy consumption. An environmental improvement could rather only be made on a system basis, i.e. considering all connected equipment (e.g. overall energy management, recovery management etc.). Moreover, heavy duty/industrial machines can not be operated by laymen but only by trained operators.

In our study, as described in Section 2.4.3, we will apply the term “professional” as superordinated term for washing and drying appliances used in commercial and/or industrial market segments. Table 3 gives an overview of a possible delimitation between household, semi-professional and professional washing machines and dryers.²⁴

²⁴ The information is gained from the previous sections, secondary literature and product portfolios of several manufacturers (see Section 6): Girbau, Ipsy, Miele, Primus, Electrolux, Kannegiesser

Table 3 Main product characteristics of domestic, semi-professional and professional washing machines and dryers

Group	Domestic washing machines and dryers	Semi-professional washing machines and dryers	Professional washing machines and dryers
Target group / Applications	Private households	<ul style="list-style-type: none"> ▪ Coin & Card laundry (CCL) ▪ Apartment Household Laundry (AHL) ▪ Hospitality Laundry (HPL) 	<ul style="list-style-type: none"> ▪ Coin & Card laundry (CCL) ▪ Apartment Household Laundry (AHL) ▪ Hospitality Laundry (HPL); Health Care Laundry (HCL) ▪ Commercial Industrial Laundry (CIL) ▪ Speciality Laundry (SP)
Operating principle	Discontinuous operation in cycles	Discontinuous operation in cycles	Discontinuous operation in cycles or continuous operation
Typical load capacities	4–10 kg	< 7kg	Washing machines: 8–120 kg (commercial use) up to 400 kg (industrial use) Dryers: 8–77 kg (commercial use) n.a. (industrial use)
Programme options	Mostly fix programmes (some high end electronic household washing machines are partly programmable)	Partly programmable	Fully programmable + operated
Detergent dosage	Most often manual detergent dosing	Manual or automatic detergent dosing	Automatic detergent dosing
Drying time	60–150 minutes	30–60 minutes	40-60 min (commercial use) 20 min (industrial use)
Power supply, heating system	Normal rated capacity	Normal or high rated capacity	Usually high rated capacity and three phases (400 V) connection; partly additionally other energy sources (heat, steam)
Life time in cycles	2 500–4 000	10 000–15 000	<30 000 (commercial use) >30 000 cycles / 40 000 hours (industrial use)
Product dimensions	Typical dimension: height x width x depth 850 x 600 x 600 mm	Typical dimension: height x width x depth 850 x 600 x 600 mm	Dimensions are very variable depending on amount / type of textiles to be washed and dried and spatial possibilities.

The table shows that there are only minor differences between household and semi-professional washing machines and dryers (main differences are the shorter running times of the programmes, the possibility to connect to higher load in case of semi-professional washing machines and dryers and the longer life times in cycles). However, there are significant differences between household and semi-professional appliances on the one hand and professional ones on the other hand.

After this general delimitation of professional laundry machines, the following sections describe the individual professional products in more details.

2.5 Classification of professional washing machines and dryers

2.5.1 The European PRODCOM classification²⁵

PRODCOM is a system for the collection and dissemination of statistics on the production of manufactured goods. It is based on a product classification called the Prodcom List of the European Community²⁶ which consists of about 4 500 headings relating to manufactured products. The products are detailed on an 8-digit level; digits 1 to 4 refer to the NACE classification in which the producing enterprise is normally classified. In 2008, the NACE codes have been revised; the following table lists both code classifications.

Table 4 Extract from PRODCOM lists 2008 and 2007 (Source: Eurostat)

Code since 2008	Code 2007	Description
28.94	29.54	Manufacture of machinery for textile, apparel and leather production
28.94.21	29.54.21	Machinery for washing, cleaning, wringing, ironing, pressing, dyeing, reeling and the like of textile yarn and fabrics; machinery for finishing of felt
28.94.21.30	29.54.21.30	Ironing machines and presses (including fusing presses; excluding calendering machines)
28.94.21.50	29.54.21.50	Washing, bleaching or dyeing machines (including wringers and mangles, shaker-tumblers; excluding household or laundry-type washing machines)
28.94.21.70	29.54.21.70	Machines for reeling, unreeling, folding, cutting or pinking textile fabrics
28.94.21.80	29.54.21.83	Machines used in the manufacture of linoleum or other floor coverings for applying the paste to the base fabric or other support
	29.54.21.85	Machines for dressing, finishing, wringing, drying, coating or impregnating textile yarns, fabrics or made up textile articles
28.94.22	29.54.22	Laundry-type washing machines; dry-cleaning machines; drying machines, with a capacity > 10 kg
28.94.22.30	29.54.22.30	Household or laundry-type washing machines of a dry linen capacity > 10 kg (including machines that both wash and dry)
28.94.22.70	29.54.22.70	Drying machines, of a dry linen capacity > 10 kg
28.94.23	29.56.21	Centrifugal clothes-dryers
28.94.23.00	29.56.21.00	Centrifugal clothes-dryers
28.94.52	29.54.42	Parts of machinery for other production of textiles and apparel and for the working of leather
28.94.52.10	29.54.42.10	Parts for household or laundry-type washing machines (including for those that both wash and dry)

²⁵ <http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/introduction>

²⁶ <http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/introduction>

From a practical point of view and against the overall aim of the preparatory study, the table shows that PRODCOM categorisations will be too rough to provide a basis for defining a clear scope of professional washing machines and dryers. For example, among the washing machines or dryers there is no further differentiation with regard to capacity or other functional performance parameters.

2.5.2 The European Customs Classification

The *Harmonized Commodity Description and Coding System (HS)* of tariff nomenclature is an internationally standardized system of names and numbers for classifying traded products developed and maintained by the World Customs Organization (WCO). The HS Nomenclature comprises about 5 000 commodity groups. The HS is a six-digit nomenclature. The first four digits are referred to as the heading. The first six digits are known as a subheading. Individual countries may extend a HS number to eight or ten digits for customs or export purposes. On the basis of the Harmonized System nomenclature, there is further comprised the *Combined nomenclature (CN)*²⁷ which is used to classify goods when being declared to customs in the Community. Each CN subdivision has an eight digit code number, the CN code, followed by a description. The CN also include preliminary provisions, additional section or chapter notes and footnotes relating to CN subdivisions.

Table 5 Classification of washing machines and dryers according to the HS-Classification (Source: World Customs Organisation²⁸)

Code	Description
8419	Machinery, plant or laboratory equipment, whether or not electrically heated (excluding furnaces, ovens and other equipment of heading 8514), for the treatment of materials by a process involving a change of temperature such as heating, cooking, roasting, distilling, rectifying, sterilising, pasteurising, steaming, drying, evaporating, vaporising, condensing or cooling, other than machinery or plant of a kind used for domestic purposes; instantaneous or storage water heaters, non-electric
8419.3x	Dryers
8419.39	Other
8420	Calendering or other rolling machines, other than for metals or glass, and cylinders therefore
8420.10	Calendering or other rolling machines
8420.10.10	Of a kind used in the textile industry
8420.91 / 8420.99	Parts: Cylinders / Other

²⁷ http://ec.europa.eu/taxation_customs/customs/customs_duties/tariff_aspects/combined_nomenclature/index_en.htm

²⁸ Source: www.wcoomd.org/files/1.%20Public%20files/PDFandDocuments/HarmonizedSystem/2007/1684_2007E.pdf

Code	Description
8421	Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases
8421.1x	Centrifuges, including centrifugal dryers
8421.12	Clothes dryers
8450	Household or laundry-type washing machines, including machines which both wash and dry
8450.1x	Machines, each of a dry linen capacity not exceeding 10 kg
8450.11	Fully-automatic machines
8450.11.11	<i>Each of a dry linen capacity not exceeding 6 kg</i>
8450.11.11	Front-loading machines
8450.11.19	Top-loading machines
8450.11.90	<i>Each of a dry linen capacity exceeding 6 kg but not exceeding 10 kg</i>
8450.12	Other machines, with built-in centrifugal dryer
8450.19	Other
8450.20	Machines, each of a dry linen capacity exceeding 10 kg
8450.90	Parts
8451	Machinery (other than machines of heading 8450) for washing, cleaning, wringing, drying, ironing, pressing (including fusing presses), bleaching, dyeing, dressing, finishing, coating or impregnating textile yarns, fabrics or made-up textile articles and machines for applying the paste to the base fabric or other support used in the manufacture of floor coverings such as linoleum; machines for reeling, unreeling, folding, cutting or pinking textile fabrics
8451.21	Drying machines, each of a dry linen capacity not exceeding 10 kg
8451.21.10	<i>Each of a dry linen capacity not exceeding 6 kg</i>
8451.21.90	<i>Each of a dry linen capacity exceeding 6 kg but not exceeding 10 kg</i>
8451.29	Other
8451.30	Ironing machines and presses (including fusing presses)
8451.30.00	Electrically heated, of a power...
8451.30.10	<i>...not exceeding 2 500 W</i>
8451.30.30	<i>...exceeding 2 500 W</i>
8451.30.80	Other
8451.40	Washing, bleaching or dyeing machines
8451.50	Machines for reeling, unreeling, folding, cutting or pinking textile fabrics
8451.80	Other machinery
8451.80.30	Machines for dressing or finishing
8451.80.80	Other
8451.90	Parts

The European Customs Classification will be too rough to provide a basis for defining a clear scope of professional washing machines and dryers. For example, there is no further differentiation with regard to capacity or other functional performance parameters; some relevant categories like tumble dryers and batch system dryers are merged into the category “Other”.

2.5.3 The International Patent Classification

The International Patent Classification (IPC) is a hierarchical patent classification system created under the Strasbourg Agreement (1971) and updated on a regular basis by a Committee of Experts, consisting of representatives of the Contracting States of that Agreement and observers from other organisations, such as the European Patent Office. The Strasbourg Agreement is one of a number of treaties administered by the World Intellectual Property Organization (WIPO). Patent publications from all of the Contracting States (and also most others) are each assigned at least one classification term, indicating the subject to which the invention relates, and may also be assigned further classification and indexing terms to give further details of the contents.

Each classification term consists of a symbol, such as A01B 1/00. The first letter is the "section symbol" consisting of a letter from A to H.²⁹ This is followed by a two digit number to give a "class symbol". The second letter indicates the "subclass" which is then followed by a 1 to 3 digit "group number", an oblique stroke and a number of at least two digits representing a "main group" or "subgroup".³⁰

Table 6 Classification of washing machines and dryers according to International Patent Classification

D06F	LAUNDERING, DRYING, IRONING, PRESSING OR FOLDING TEXTILE ARTICLES (apparatus for blocking, pressing, steaming, or stretching hats A42C; treating textile materials by liquids, gases or vapours D06B; chemical matters, see D06L, D06M)
	Note(s) This subclass covers: domestic or laundry dry-cleaning apparatus using volatile solvents; domestic laundry, or tailors' ironing or other hot-pressing of clothes, linen, or other textile articles. This subclass does not cover apparatus for wringing, washing, dry-cleaning, ironing, or other hot-pressing of textiles in manufacturing operations, which is covered by subclasses D06B, D06C.
Washing; Rinsing; Dry-cleaning	
D06F 9/00	Brushing-type washing machines
D06F 11/00	Washing machines using rollers, e.g. of the mangle type
D06F 13/00	Washing machines having receptacles, stationary for washing purposes, with agitators therein contacting the articles being washed (plungers or the like adapted for removable mounting on receptacles D06F 5/04; washing devices adapted to be used independently of any particular receptacle D06F 7/00)
D06F 15/00	Washing machines having beating, rubbing, or squeezing means in receptacles stationary for washing purposes (plungers or the like adapted for removable mounting on receptacles D06F 5/04; mangle-type washing machines D06F 11/00)

²⁹ A: Human Necessities; B: Performing Operations, Transporting; C: Chemistry, Metallurgy; D: Textiles, Paper; E: Fixed Constructions; F: Mechanical Engineering, Lighting, Heating, Weapons; G: Physics; H: Electricity

³⁰ Sources: http://www.wipo.int/export/sites/www/classifications/ipc/en/guide/guide_ipc_2009.pdf, http://en.wikipedia.org/wiki/International_Patent_Classification,

D06F 17/00	Washing machines having receptacles, stationary for washing purposes, wherein the washing action is effected solely by circulation or agitation of the washing liquid (washing devices adapted to be used independently of any particular receptacle D06F 7/00; using vibrations for washing purposes D06F 19/00)
D06F 18/00	Washing machines having receptacles, stationary for washing purposes, and having further drying means (details concerning drying only D06F 58/00) [3]
D06F 19/00	Washing machines using vibrations for washing purposes (devices of the vibrator type adapted to be used independently of any particular receptacle D06F 7/04)
D06F 21/00	Washing machines with receptacles, e.g. perforated, having a rotary movement, e.g. oscillatory movement (with receptacles serving both for washing and centrifugally draining D06F 23/00, D06F 25/00; with receptacles moving bodily about an axis D06F 27/00; programme control aspects D06F 33/00)
D06F 23/00	Washing machines with receptacles, e.g. perforated, having a rotary movement, e.g. oscillatory movement, the receptacle serving both for washing and centrifugally draining (with further drying means D06F 25/00; programme control aspects D06F 33/00)
D06F 25/00	Washing machines with receptacles, e.g. perforated, having a rotary movement, e.g. oscillatory movement, the receptacle serving both for washing and centrifugally draining and having further drying means, e.g. using hot air (programme-control aspects D06F 33/00; details concerning drying only D06F 58/00)
D06F 27/00	Washing machines with receptacles moving bodily, e.g. reciprocating, swinging
D06F 29/00	Combinations of a washing machine with other separate apparatus in a common frame or the like, e.g. with rinsing apparatus
D06F 31/00	Washing installations comprising an assembly of several washing machines or washing units, e.g. continuous flow assemblies
D06F 33/00	Controlling a series of operations in washing machines, e.g. programme-control arrangements for washing and drying cycles (D06F 31/00 takes precedence)
D06F 35/00	Washing machines, apparatus, or methods not otherwise provided for
D06F 39/00	Details of washing machines in so far as such details are not special to washing machines of groups D06F 21/00-D06F 25/00 or to any particular type of washing machine defined in groups D06F 9/00-D06F 19/00 or D06F 27/00
D06F 39/02	. Devices for adding soap or other washing agents
D06F 39/04	. Heating arrangements
D06F 39/06	. Arrangements for preventing or destroying scum
D06F 39/08	. Liquid supply or discharge arrangements (supplying liquid detergent D06F 39/02)
D06F 39/10	. Filtering arrangements
D06F 39/12	. Casings; Tubs
D06F 41/00	Rinsing apparatus
D06F 43/00	Dry-cleaning apparatus using volatile solvents (D06F 9/00-D06F 41/00 take precedence)
D06F 43/02	. having one rotary cleaning receptacle only
D06F 43/04	. having more than one rotary cleaning receptacle
D06F 43/06	. wherein the articles to be cleaned are passed through a cleaning chamber or bath
D06F 43/08	. Associated apparatus for handling and recovering the solvents (separate apparatus for purifying dry-cleaning solvents B01D)
Expelling water from the linen; Smoothing by cold rolling	
D06F 45/00	Wringing machines with two or more co-operating rollers; Similar cold-smoothing apparatus
D06F 47/00	Apparatus of the press type for expelling water from the linen
D06F 49/00	Domestic or similar spin-dryers not suitable for industrial use (centrifuges in general B04B)
D06F 51/00	Apparatus for expelling or draining water from the linen, not provided for in groups D06F 45/00-D06F 49/00

Drying; Airing	
D06F 57/00	Supporting means, other than simple clothes-lines, for linen or garments to be dried or aired (in combination with means for heating or positive air circulation D06F 58/00, F26B; adapted to retain the shape of particular articles being dried D06F 59/00; clothing hangers, e.g. suit hangers, A47G 25/14)
D06F 57/02	. mounted on pillar, e.g. rotatable
D06F 57/06	. comprising vertical members connected by horizontal bars
D06F 57/08	. Folding stands (D06F 57/06 takes precedence)
D06F 58/00	Domestic laundry dryers (drying in general F26B)
D06F 58/02	. having dryer drums rotating about a horizontal axis
D06F 58/10	. Drying cabinets or drying chambers having heating or ventilating means
D06F 58/16	. having heatable surfaces for contacting the laundry (D06F 59/00 takes precedence)
D06F 58/18	. Detachable or door-mounted drying arrangements for washing machines
D06F 58/20	. General details of domestic laundry dryers (D06F 59/00 takes precedence)
D06F 59/00	Supports adapted to retain the shape of particular articles being dried, e.g. incorporating heating means
D06F 60/00	Drying not provided for in groups D06F 53/00-D06F 59/00
Ironing; Pressing	
D06F 61/00	Ironing machines using two or more co-operating pressing rollers
D06F 63/00	Ironing machines having a roller or rollers co-acting with a fixed or moving flat bed or table (coverings or pads D06F 83/00)
D06F 65/00	Ironing machines with rollers rotating against curved surfaces
D06F 67/00	Details of ironing machines provided for in groups D06F 61/00, D06F 63/00, or D06F 65/00 (coverings or pads for ironing or pressing members D06F 83/00)
D06F 67/02	. Rollers; Heating arrangements therefore
D06F 67/04	. Arrangements for feeding or spreading the linen
D06F 67/06	. Means for stripping the linen from the rollers
D06F 67/08	. Beds; Heating arrangements therefore
D06F 67/10	. Driving arrangements
D06F 69/00	Ironing machines not otherwise provided for
D06F 69/02	. using endless or other ironing or pressing belts or aprons
D06F 69/04	. with relatively-sliding flat surfaces
D06F 71/00	Apparatus for hot-pressing clothes, linen, or other textile articles, i.e. wherein there is substantially no relative movement between pressing element and article while pressure is being applied to the article; Similar machines for cold-pressing clothes, linen or other textile articles (smoothing by cold rolling between two or more co-operating rollers D06F 45/00; devices, for household use, for cold-pressing garments A47G)
D06F 73/00	Apparatus for smoothing or removing creases from garments or other textile articles by formers, cores, stretchers, or internal frames, with the application of heat or steam (stretchers for drying purposes D06F 59/00; combined with external pressure means D06F 71/00; stretchers for use with presses D06F 71/40; dress forms for the tailoring trade A41H; garment stretchers without the application of heat A47G 25/00)
D06F 81/00	Ironing boards (coverings or pads therefore D06F 83/00; combined with tables, mounted in kitchen cabinets A47B; tables in general A47B; combined with ladders E06C)

Other laundry apparatus or systems	
D06F 87/00	Apparatus for moistening or otherwise conditioning the article to be ironed or pressed (apparatus for smoothing or removing creases from garments or other textile articles by formers, cores, stretchers or internal frames, with the application of heat or steam D06F 73/00)
D06F 89/00	Apparatus for folding textile articles with or without stapling
D06F 93/00	Counting, sorting, or marking arrangements specially adapted for laundry purposes
D06F 95/00	Laundry systems or arrangements of apparatus or machines; Mobile laundries (D06F 31/00 takes precedence; laundries as buildings E04H)

The comparison with the former statistical product classification schemes European PRODCOM and Customs classification clearly shows that the IPC scheme offers the most detailed graduation by product design and applications.³¹ For example, items D06F 39/00 to D06F 39/12 being parts of professional washing machines are supplementary parts even not supplied by manufacturers of washing machines but by different suppliers (e.g. devices for adding soap or other washing agents are produced by special manufacturers of dosing equipment). The IPC classification provides an overview of the diversity of professional laundry appliances. It distinguishes for example ten different subclasses for washing machines (D06F 13/00 – D06F 27/00).

2.5.4 Categories according to standards and labelling

The U.S. ENERGY STAR (cf. Section 4.3.1) distinguishes the following categorisations of professional washing machines (there are no ENERGY STAR requirements for professional dryers): front and top loader clothes washers with capacities of greater than 1.6 ft³ (45.3 litres)³².

There are two ISO standards for professional or industrial washing machines and dryers: ISO 9398: Specifications for industrial laundry machines – definitions and testing of capacity and consumption characteristics, and ISO 10472: Safety requirements. Both standards provide different product categories according to the function they offer (for details, see Chapters 3.1.1 and 3.2.1). ISO 9398 distinguishes four different categories of professional washing machines and dryers:

- Washer extractors
- Washing tunnels
- Batch drying tumblers
- Flatwork ironing machines

The following table provides an overview of product categories being in the scope of ISO 10472.

³¹ Further subcategories: cf. <http://depatinet.dpma.de/ipc/> => IPC symbol "D06F"

³² 1 cubic foot (ft³) equates 28.32 litres

Table 7 Classification of washing machines and dryers according to ISO 10472

Washing machines and washer extractors > 60 litres (ISO 10472-2) with definitions for the following sub-categories:	
Washing machine	Washing machine: Machines performing only those operations required for washing textiles.
Washer extractor	Machines which combines the functions of textile washing and moisture extraction by centrifugal action.
Fixed washer-extractor	Washer-extractor in which the drum is rigidly mounted in the frame.
Suspended washer-extractor	Washer-extractor in which the drum is not rigidly connected to the frame but is secured by means of a vibration-reducing system.
Tilting washer-extractor	Fixed or suspended washer-extractor in which the drum tilts during loading and/or unloading.
Drawer-type washer-extractor	Fixed or suspended washer-extractor in which two half-cages slide horizontally out from the frame, in the low position for loading and the high position for unloading.
Top-loading, vertical axis washer-extractor	Washer-extractor in which the plane of the loading door is at a right angle to the vertical axis of the rotation of the cage.
Front-loading machine	Washing machine or washer-extractor in which the plane of the loading door is at a right angle to the horizontal axis of rotation of the cage.
Side-loading machine	Washing machine or washer-extractor in which the plane of the loading door is parallel to the horizontal axis of rotation of the cage.
Barrier machine	Washing machine or washer-extractor without direct contact between the loading and unloading positions (e.g. separated by a wall).
Aseptic machine	Washing machine or washer-extractor used for processing infected work.
Washing tunnel lines including component machines (ISO 10472-3) with definitions for the following sub-categories	
Washing tunnel line	Complete integrated systems of linked machines for the washing, moisture extraction and drying or disentangling of discrete batches of textile fabric, including all necessary equipment for supply of water, steam, gas, electricity and chemicals.
Continuous tunnel washing machine	Machines designed to wash items in successive loads as a continuous process. NOTE: These machines may consist of one cage rotating around a longitudinal axis and subdivided into separate compartments, or several cages or several machines linked by means of a transfer system.
Squeeze press	Machine for the mechanical extraction of moisture from textile fabrics by the application of pressure (component machine within a washing tunnel line) Note: It is designed to receive loads of textile material automatically from a tunnel washing machine and to remove moisture by applying pressure (e.g. by a flexible membrane). Such a machine may with one or two pressure stations where the pressure may be applied hydraulically, mechanically or pneumatically
Centrifugal extraction machine	Machine containing a perforated cage to and from which successive loads are transferred and within which the loads are subjected to a centrifugal force due to the rotation of the cage the purpose of extracting moisture (component machine within a washing tunnel line)
Automatic transfer tumble dryer	Machine for moisture extraction from a load of damp textile material by tumbling in a rotating cage in an atmosphere of hot air (component machine within a washing tunnel line).

Air dryers > 160 litres (ISO 10472-4) with definitions for the following sub-categories	
Tumble dryer	Machine for moisture extraction from a load of damp textile material by tumbling in a rotating cage in an atmosphere of hot air produced by the tumble dryer.
Front-loaded tumble dryer	Tumble dryer in which the plane of the loading door is at a right angle to the axis of rotation of the cage.
Pass-through tumble dryer	Tumble dryer having the loading and unloading doors on opposite sides.
Tilting tumble dryer	Tumble dryer, which tilts for loading and/or unloading.
Automatic tilting tumble dryer	Tilting tumble dryer with the tilting motion to load and unload, and opening and closing doors, under automatic (not manual) control.
Tunnel finisher	Machine for the drying and finishing of shaped garments within which damp garments arranged on hangers are loaded onto an overhead conveyor for transport through the machine in an atmosphere of high humidity followed by an atmosphere of hot dry air produced by the tunnel finisher.
Cabinet dryer	Heated cabinet within which shaped garments are suspended on hangers for the purpose of drying, without being conveyed during the drying cycle.
Flatwork ironers, feeders and folders (ISO 10472-5) with definitions for the following sub-categories	
Bed ironer	Machine for the ironing of flatwork generally providing a heated bed against which the work is pressed by one or several fabric-covered roller(s).
Cylinder ironer	Machine for the ironing of flatwork in which the work to be treated is drawn against one or more heated cylinder(s) where it is held by means of an appropriate system, for example by bands.
Flatwork feeding machine	Machine, into which operator(s) load damp unfinished flatwork items, that presents the items, tensioned and spread to the feed-bands of an ironer or to a folding machine.
Flatwork folding machine	Machine generally fitted in conjunction with an ironer which will automatically fold flatwork items. NOTE: This machine is also used for folding blankets, polyester sheets and similar items.
Folding machine for small pieces	Machine for automatically folding towels, pillow cases and similar items.
Multi-function	machine which combines feeding, ironing and folding in one unit
Ironing and fusing presses (ISO 10472-6) with definitions for the following sub-categories	
Ironing press	Machine for the smoothing or shaping of fabric items by pressing them between two components, at least one of which is heated and, if required, equipped with a steaming device.
Fusing press	Machine for the fusing of two textile layers by pressing them between two components, at least one of which is heated to a temperature such that the coating of one layer becomes adhesive.
Scissor press	Ironing or fusing press whose head is moved on a circular path or a combination of circular and linear paths against a stationary buck.
Cabinet press	Machine into which a garment is placed on a vertical buck (or former) which is moved to a position between two or more vertical press heads which move horizontally to press the garment against the buck. NOTE: A cabinet press may have one or more vertical bucks which travel horizontally such that the entire equipment may be operated by two or more operators in concert.
Drawer press	Ironing or fusing press whose horizontal buck is moved on a horizontal linear path under the head, then the buck (or head) is pressed against the head (or buck) on a vertical, linear path.
Rotary press	Press in which the loading, unloading and pressing operations are assigned to different positions of the movement of a turntable carrying the bucks.

Upstroke press	Press comprising an upper head and a lower buck, upon which the fabric item is prepared, after which the action of the press raises the lower buck to the press head either mechanically or pneumatically.
Multiple-buck press	Press similar to a rotary press in which the bucks can travel in a straight path.

From a practical point of view and considering the overall aim of the preparatory study, the table shows that ISO categorisation provides a good basis for defining a categorisation of professional washing machines and dryers within Lot 24.

As highlighted in the previous section, it has to be noted that in this context, the term “industrial” includes also rather small semi-professional and professional machines. There is no further differentiation between washing machines or dryers with regard to professional / commercial and industrial equipment, e.g. capacity or other functional performance parameters (see also Sections 2.4.3 and 0).

2.5.5 Functional performance classification

Product definitions in international standards already give a differentiated overview of the variety of professional laundry appliances on the market (see Section 2.5.4). In this section, professional washing machines and dryers are further classified according to functional performance parameters.

2.5.5.1 Functional performance classification of professional washing machines

To better understand the differences between the above described categories, first of all an overview of the primary and secondary functions and important framework requirements of professional washing machines is given. Then the main properties to distinguish between the different categories within professional washing machines are described in a more detailed way.³³ Finally, seven product categories were identified as a result of this analysis of functions and the respective properties of professional washing machines.

Primary and secondary functions of professional washing machines

In general, the *primary function* of a washing machine is to clean and rinse textiles by using water as solvent (washing function). The washing machine may also have an integrated means for extracting excess water from the textiles (spinning/dewatering function). Apart from these functions, important requirements of customers for professional washing machines are:

³³ This further product information is gathered from secondary literature and the product portfolios of several manufacturers.

- Low energy, water and detergent consumption, and
- high hygiene performance.

In contrast to household washing machines there are some framework requirements for professional washing machines that have to be taken into account and that vary to a great extent for different customer groups:

- High capacities and shorter running cycles;
- amount of laundry to be cleaned;
- types of fabrics to be cleaned, and
- spatial / infrastructural requirements.

These framework requirements might be very different depending on the respective application; they are the main reason for a range of different product categories for professional washing machines on the market compared to e.g. washing machines for the household use which are quite similar regarding the principal design (i.e. mainly free-standing or built-in front loaders with capacities of 4 to 10 kilograms of laundry and spin speeds between 1 200 and 1 800 rpm).

Main properties of professional washing machines

Based on Table 7 (“Classification of washing machines and dryers according to ISO 10472”), the following main properties can be used to distinguish between the categories of professional washing machines (see next section).

- Machines combining the functions of textile washing and moisture extraction by centrifugal action (**washer extractors**);
 - Washer extractor without direct contact between the loading and unloading positions e.g. separated by a wall (**barrier washers**);
- Machines combining the functions of textile washing and moisture extraction by evaporation (**washer dryers**);
- Machines designed to wash items in successive loads as a continuous process (**tunnel washing machines**).

Within washer extractors there is a great variety regarding further functional performance parameters. For example, ISO 10472-2 classifies the following sub-categories:

Table 8 Sub-categories of washer extractors according to ISO 10472-2

Technical and construction characteristics	Sub-categories of washer extractors
A) Connection of the drum	<p>A.1 Fixed washer-extractor: Washer-extractor in which the drum is rigidly mounted in the frame.</p> <p>A.2 Suspended washer-extractor: Washer-extractor in which the drum is not rigidly connected to the frame but is secured by means of a vibration-reducing system.</p>
B) System for the support of loading and/or unloading	<p>B.1 Tilting washer-extractor: Fixed or suspended washer-extractor in which the drum tilts during loading and/or unloading.</p> <p>B.2 Drawer-type washer-extractor: Fixed or suspended washer-extractor in which two half-cages slide horizontally out from the frame, in the low position for loading and the high position for unloading.</p>
C) Type of loading	<p>C.1 Top-loading, vertical axis washer-extractor: Washer-extractor in which the plane of the loading door is at a right angle to the vertical axis of the rotation of the cage.</p> <p>C.2 Front-loading machine: Washer-extractor in which the plane of the loading door is at a right angle to the horizontal axis of rotation of the cage.</p> <p>C.3 Side-loading machine: Washer-extractor in which the plane of the loading door is parallel to the horizontal axis of rotation of the cage.</p>
D) Machines for special hygiene requirements	<p>D.1 Barrier machine: Washer-extractor without direct contact between the loading and unloading positions (e.g. separated by a wall).</p> <p>D.2 Aseptic machine: Washer-extractor used for processing infected work.</p>

Additionally, further technical parameters of professional washer extractors were gathered from secondary literature and product portfolios of several manufacturers:

- **Extraction speed / spin speed / g-factor:** The residual moisture of laundry is depending on the spin speed and the drum diameter thus resulting in the G-force³⁴ of washer extractors. The residual moisture of the laundry coming from the washing process has an effect on the energy consumption required for the subsequent thermal drying process.
- **Load capacities** of washer extractors: The typical range is between 6 and 120 kilograms. Furthermore, some washer extractors come with load capacities of e.g. 200, 230, 240, 270 and 280 kilograms. Beyond that, at least one manufacturer even offers 300 kg machines for work wear garments, respectively 400 kg machines for dust mats.³⁵

Some examples for spin speeds and the associated G-forces, as well as other design and technical parameters (different spin speeds as normal, fast and high spin) of washer extractors are summarised in the following table.

³⁴ G-force (gravitational force):..The g-factor is a measure of centrifugal force which has a significant effect on laundry during spinning. G equates to 9.81 m/s² (acceleration as a result of the pull of gravity) (Source: Miele professional)

³⁵ Source: <http://www.kannegiesser.de/900.0.html?&L=1>, sighted on 26 January 2010

Table 9 Overview of design parameters of washer extractors

	Washer extractors, product examples
Capacities	6-400 kg per cycle
Technical parameters	Extraction speed / G-force: 415-550 rpm / 80-90 (normal spin ³⁶) 600-700 rpm / 150 (fast spin) 700-1 250 rpm / 250-475 (high spin)
Washing programmes	Up to 99 different washing programmes
Construction options	Front / side / top loaders; barrier wall / non barrier wall
Heating options*	<ul style="list-style-type: none"> ▪ Electric heating, ▪ Hot water (boiler fed), ▪ Steam (direct steam injection / indirect steam heating) or thermo oil ▪ Combo-version: direct steam heating being switchable to electric heating ▪ Gas

* heating the water for the washing process

Regarding the purposes of EuP Lot 24, the different capacities have proved as most dominating parameter influencing the categorisation of machines within washing machines with integrated moisture extraction by centrifugal action (so called “washer extractors”). Therefore, a further differentiation into sub-categories based on capacities has been chosen. The respective capacity ranges have been derived from current market categorisations as well as from stakeholder feedback during the course of this study.

Categories of professional washing machines used in Lot 24

The following table gives a summarizing overview of the professional washing machine categories which will be used as input for the following tasks:

³⁶ Source: <http://www.ipso.be/products/category.asp?pageid=2&c=1>

Table 10 Overview of the scope of professional washing machines categories within Lot 24

Washing machine category	Load capacity ³⁷	Water heating options	Programme options and operating principle	Type of loading
WM1: Semi-professional washer extractor	up to 7 kg	Electric	Fix programmes, manual programme, automat, Hot and cold water connection	Manual, front / loading
WM2 Professional washer extractor, <15 kg	up to 15 kg	Electric, hot water, steam (direct or indirect), combo: direct steam and electric, gas	Partly programmable Manual programme automat, Hot and cold water connection	Manual, front / side loading
WM3 Professional washer extractor, 15-40 kg	15-40 kg	Electric, hot water, steam (direct or indirect), combo: direct steam and electric, gas	Partly programmable Manual programme automat, Hot and cold water connection	Manual, front / side loading
WM4 Professional washer extractor, >40 kg	40-400 kg	Electric (only with maximal 62 kg batch size, hot water, steam (direct or indirect), combo: direct steam and electric, gas	Partly programmable / fully programmable, manual programme automat, Hot and cold water connection for most applications with a large variety of additional equipment	Front / side / top loading manual or automatic top, loading and tilt unloading
WM5 Professional washer dryer	15/33 kg ³⁸ (up to 240 dm ³)	Electric	Partly programmable, Washing and drying in one machine, no re-loading, used also as regular dryer or washer	Manual, front loading
WM6 Professional barrier washer	15-240 kg	Electric (only with maximal 62 kg batch size), Steam (direct or indirect), gas	Fully programmable, ensure highest hygienic standards, barrier wall, doors on opposites sides	Front / side loading; manual or automatic top, loading and tilt unloading
WM7 Washing tunnel machine	250-4 000 kg/h Number of compartments (5-20); length (4.7-18 m)	Steam (or thermo oil, gas	Fully programmable + operated, batch (by items) continuous washing, laundry pass each compartment	Automatically, conveyor, pass through, bottom or centre transfer

³⁷ The product capacity of professional washing machines is usually given in kilograms instead of volume. A differentiation based on volumes would not be clear as it may vary depending on the kind of the textiles. The load capacity depends on the drum volume and the filling ratio; the latter in turn depends on the density of the laundry to be washed.

³⁸ Washing / Drying capacity

2.5.5.2 Functional performance classification of professional dryers

Product definitions in international standards already give a differentiated overview of the variety of professional dryers on the market (see Section 2.5.4). In this section, we will categorize the comprehensive list of definitions in a more structured way according to functional performance parameters provided by standards. Additionally, the main properties to distinguish between the different categories of professional dryers are described in a more detailed way. This further product information is gathered from secondary literature and the product portfolios of several manufacturers.³⁹

Primary and secondary functions of professional dryers

The *primary function* of a (professional) laundry dryer is to thermally remove moisture from laundry, generally shortly after it has been cleaned in a washing machine (drying efficiency).

Porter et al. (1984)⁴⁰ provide a classification of dryers used in chemical technology dividing them into direct and indirect dryers, based on the method of heat transfer:

- **Direct dryers:** Heat transfer for drying is accomplished by direct contact between the wet solid and hot gases. The vaporized liquid is carried away by the drying medium; i.e. the hot gases. Direct dryers might also be termed *convection* dryers.
- **Indirect dryers:** Heat for drying is transferred to the wet material by conduction through a solid retaining wall, usually metallic. The vaporized liquid is removed independently of the heating medium. Rate of drying depends on the contacting of the wet material with hot surfaces. Indirect dryers are also termed *conduction* or contact dryers.

Apart from drying, important requirements of customers for professional dryers are

- energy efficiency,
- wear resistance,
- finishing, calendering (by ironing, pressing or garment finishing).

Some dewatering machines, however, combine both the functions calendering (i.e. flattening) and drying, e.g. garment finishers, flatwork ironing machines, or presses. From customers' perspective and according to stakeholders, the primary function of these appliances is the removal of creases and, in case of finishers, the relaxing of the textiles, including desired changes of the surface structure. Drying is only a secondary or even less important function.

³⁹ Sources (see Section 6): Girbau, Ipson, Miele, Primus, Stahl, Kannegiesser; <http://tunnelfinisher.com/>, sighted on 23 February 2010

⁴⁰ Porter, H.F.; Schurr, G.A.; Wells, D.F.; Semrau, K.T.; Solids Drying and Gas-Solid Systems; in: Perry's Chemical Engineers' Handbook; Perry, R.H. and Green, D.W. (Eds.); 6th Edition, McGraw-Hill, New York, 1984.

Main properties of professional dryers

Based on the classification of dryers by Porter et al. (1984) as well as additional literature research, the following main properties can be used to distinguish between the categories of professional dryers (see next section: “Categories of professional dryers used in Lot 24”).

Table 11 General classification of dryers

Method of heat transfer	Direct heat transfer		Indirect heat transfer	
Primary function	Removal of moisture	Removal of creases, relaxing of textiles	Removal of creases	Removal of creases
Product categories	Air dryer	Finisher	Flatwork ironers	Ironing and fusing presses
Product sub-categories	<ul style="list-style-type: none"> ▪ Tumble dryers ▪ Cabinet dryers 	Steam air finisher Tunnel finisher		

For the purposes of Lot 24 only those products were classified as dryers falling under the scope of the study which use a direct method for heat transfer and for which the removal of moisture is the primary function (i.e. air dryers). Nevertheless, for the benefit of completeness, the further listed appliances are described in the Annex, Section 7.3.

From ISO 10473, following sub-categories for air dryers can be derived:

- **Cabinet dryers** are heated cabinets within which shaped garments are suspended on hangers for the purpose of drying, without being conveyed during the drying cycle.
- **Tumble dryers** are machines for moisture extraction from a load of damp textile material by tumbling in a rotating cage in an atmosphere of hot air produced by the tumble dryer.

Within tumble dryers there is a great variety regarding further functional performance parameters. For example, ISO 10472-4 classifies the following sub-categories:

Table 12 Sub-categories and definitions of tumble dryers according to ISO 10472-4

Technical/construction characteristics	Sub-categories of tumble dryers
A) Type of loading	<p>A.1 Front-loaded tumble dryer: Tumble dryer in which the plane of the loading door is at a right angle to the axis of rotation of the cage.</p> <p>A.2 Pass-through tumble dryer: Tumble dryer having the loading and unloading doors on opposite sides.</p>
B) System for the support of loading and/or unloading	<p>B.1 Tilting tumble dryer: Tumble dryer, which tilts for loading and/or unloading.</p> <p>B.2 Automatic tilting tumble dryer: Tilting tumble dryer with the tilting motion to load and unload, and opening and closing doors, under automatic (not manual) control.</p>

Additionally, the following further technical characteristics of professional tumble dryers were derived from literature as well as product portfolios of several manufacturers:

- *Air-vented tumble dryers:* They continuously draw in the cool, dry, ambient air around them and heat it by an electrical heating (electric, steam, gas) element before passing it through the moist laundry in the tumbler. The resulting hot, humid air is simply vented outside to make room for more dry air to continue the drying process. Therefore they require an external duct out to open air (open system). Variant:
- *Condenser tumble dryers:* They also pass air which is heated by an electrical heating element through the load. However, instead of exhausting this air, the dryer uses a heat exchanger to cool the air and condense the water vapour into either a drain pipe or a collection tank. Afterwards, this air is run through the loop again. The heat exchanger typically uses ambient air as its coolant, therefore the heat produced by the dryer will go into the immediate surroundings instead of the outside, increasing the room temperature slightly. They do not require an external duct but they do need fresh air ventilation to operate effectively. Condenser dryers represent an appropriate solution in circumstances where no form of external ventilation is available. Variant:

Finally, regarding the purposes of EuP Lot 24, the different capacities have proved as further dominating parameter influencing the categorisation of machines within tumble dryers. Therefore, a further differentiation into sub-categories based on capacities has been chosen. The respective capacity ranges have been derived from current market categorisations as well as from stakeholder feedback during the course of this study.

Categories of professional dryers used in Lot 24

The following table gives a summarizing overview of the professional dryer categories which will be used as input for the following tasks:

Table 13 Overview of the scope of professional dryer categories within Lot 24

Dryer category	Load capacity ⁴¹	Drying control	Heating options	Type of loading	Further design options
D1 Semi-professional dryer, condenser	<8 kg	Temperature or time control, residual moisture controlled	Electric, heat pump	Front loading	Substructures
D2 Semi-professional dryer, air vented	<8 kg	Temperature or time control, separate heat and cool down timers, residual moisture control	Electric, steam, gas	Front loading	Drum interior lighting

⁴¹ Load capacity depends on the drum volume and the filling factor (the filling factor for typically professional dryer is from 1:18 to 1:25)

Dryer category	Load capacity ⁴¹	Drying control	Heating options	Type of loading	Further design options
D3 Professional cabinet dryer	3-30 kg	Humidity sensor Overheat protection	Electric, steam, heat pump	Hangers, Front loading	Drain for excessive water drippings, bar for hangers, pull-out hangers, glove rack and hanger rod on door, shoe rack, combination of heat and steam injection
D4 Professional tumble dryer <15 kg	<15 kg	Temperature or time control, separate heat and cool down timers, residual moisture controlled, heat recycling	Electric, steam, gas, heat pump	Front loading Stacker tumbler loading	Air recycling, reverse action, New Air Control system, central air intake, large-surface fluff filter, all kinds of linen, heat exchanger, condensing unit
D5 Professional tumble dryer 15-40 kg	15-40 kg	Temperature or time control, separate heat and cool down timers, residual moisture controlled, heat recycling	Steam, gas, heat pump	Front loading	Air recycling, reverse action, New Air Control system, central air intake, large-surface fluff filter, all kinds of linen, heat exchanger, condensing unit
D6 Professional tumble dryer >40 kg	>40 kg	Temperature or time control, separate heat and cool down timers, residual moisture controlled, heat recycling	Steam, gas, heat pump	Front loading	Air recycling, reverse action, New Air Control system, central air intake, large-surface fluff filter, all kinds of linen, heat exchanger, condensing unit
D7 Pass-through (transfer) tumble dryer	40-240 kg	Temperature or time control, heat and cool down timers, residual moisture controlled, heat recycling	Electric, steam, gas, hot oil	Automatically, loading and unloading doors on opposite sides	Automatic lint cleaning system and infra touch, all kinds of linen

2.5.6 Classification according to market/customer segments

Professional washing machines and dryers are used in a large range of applications. In this section, we give an overview of the variety of customer segments and corresponding types of laundry on the basis of an analysis compiled from product information and personal information by manufactures.⁴²

Different market areas have unique requirements that are fulfilled with help of tailored solutions, such as options, changeable programmes etc. Thus, the professional laundry equipment could be categorized in following main customer segments:

⁴² Source see Section 6: by Miele Professional, Electrolux Professional, <http://www.commerciallaundryequipment.girbau.com/segments>

- **Coin & Card Laundry (CCL):** laundrette, camping, student dorms, real estate etc. and **Apartment Household Laundry (AHL):** household, real estate, old people's homes etc; the users are not the owners and therefore safety and easy handling are the most important issues.
- **Hospitality Laundry (HPL):** hotels, restaurants, quick service restaurants etc.
- **Healthcare Laundry (HCL):**
 - **Healthcare Nursing Home (HN)** with hygiene demands.
 - **Healthcare Hospital (HH)** with very high hygiene demands
- **Commercial Industrial Laundry (CIL):** service providers, textile rent cleaning, small or heavy duty laundries etc.
- **Speciality Laundry (SP)** including high-tech industries (mops, functional garments like fire and rescue service or offshore, pharmaceutical and electronic factories).
- Others: airlines, convenience stores, work camps, military establishments, car repair shops, farms, prisons, leisure and sports, etc.

The type of laundry and degree of contamination (e.g. fat, protein, oil, blood etc.) in commercial and industrial laundries differ greatly. The following main types of laundry are identified:

- Apartment household textiles;
- Work wear – all types;
- Hotel and restaurant linen, towels, roller towels;
- Healthcare linen, clean room linen (special hygienic requirements);
- Special laundry (e.g. dust mats, mops, wipers, terry cloth, microfiber, laminated fabric);
- High visibility garments, functional garments (e.g. firemen etc.);

Depending on the particular type of laundry and specific treatment requirements (e.g. hygienic requirements in the sanitary field, preservation of the protective function of fire protection suits etc.), different product and programme solutions exist.

3 Test standards of professional washing machines and dryers

This subtask aims to specify the relevant test standards for professional washing machines and dryers concerning test procedures for functional performance parameters, resource use, safety and hygiene as well as noise and vibration and (if any) other specific test procedures. A short overview of existing test standards is given, including household standards whose scope has currently been modified to 'household and similar electrical appliances' thus including standardisation work on professional machines.

3.1 Performance

3.1.1 ISO 9398 (International)

ISO 9398 Specifications for industrial laundry machines – Definitions and testing of capacity and consumption characteristics

- ISO 9398-1:2003 Specifications for industrial laundry machines – Definitions and testing of capacity and consumption characteristics, Part 1: Flatwork ironing machines

Part 1 defines the characteristics of flatwork ironing machines and gives the usual test methods for determining these characteristics with regard to machine capacity power consumption and hourly productivity. It is applicable for use as a reference in the drafting of purchasing orders for flatwork ironing machines having a contact surface area greater than 0.25 m². It does not cover safety requirements (see ISO 10472-5).

The energy consumption of a flatwork ironing machine is defined as the number of kilojoules or kilowatt hours of steam, gas, electricity or heat-transport fluid energy required for flat-ironing one test load having a residual moisture level on discharge from the flatwork ironing machine.

- ISO 9398-2:2003 Specifications for industrial laundry machines – Definitions and testing of capacity and consumption characteristics, Part 2: Batch drying tumblers

Part 2 defines the characteristics of a batch drying tumbler and gives the usual test methods for these characteristics with regard to machine capacity, power consumption and productivity. It is applicable for use as a reference in the drafting of purchasing orders for batch drying tumblers whose net usable cage volume is greater than 160 dm³ (litres) (corresponding 6 kg to 7 kg dry linen capacity). It does not cover safety requirements (see ISO 10472-4).

The energy consumption of batch drying tumblers is defined as the number of kilojoules or kilowatt hours of steam, gas, electricity or heat-transport fluid energy required for the drying of a test load to obtain residual moisture content after drying.

- ISO 9398-3:2003 Specifications for industrial laundry machines – Definitions and testing of capacity and consumption characteristics, Part 3: Washing tunnels

Part 3 defines the characteristics of washing tunnels and gives test methods for determining machine power consumption and hourly productivity. It is applicable for use as a reference in the drafting of purchasing orders for washing tunnels. It does not cover safety requirements (see ISO 10472-3).

The energy consumption of a washing tunnel is defined as the number of kilojoules or kilowatt hours of steam, gas, electricity or heat-transport fluid energy required for the washing of one test load in machine operating at its nominal capacity during one cycle.

- ISO 9398-4:2003 Specifications for industrial laundry machines – Definitions and testing of capacity and consumption characteristics, Part 4: Washer-extractors

Part 4 defines the characteristics of washer-extractors and gives test methods for these characteristics with regard to machine capacity, power and water consumption, and hourly productivity. Parameters are measured in three specified programmes (programmable timers needed); no measurement method for the washing and rinsing performance is available in the test standard (e.g. no types of soiling are given), see also Table 14. The energy for the test shall be supplied by steam, gas, electricity or heat-transport fluid, as specified by the manufacturer. The standard is applicable for use as a reference in the drafting of purchasing orders for washer-extractors whose net usable cage volume is greater than 60 dm³ (litres). It does not cover safety requirements (see ISO 10472-2).

The energy consumption of a washer-extractor is defined as the number of kilojoules or kilowatt hours of steam, gas, electricity or heat-transport fluid energy required during washing and extraction of a test load in machine operating at its nominal capacity during the time corresponding to three different described cycles.

These four standards for professional laundry machinery define the measurement method for the energy and water consumption; the standards do not include the washing and rinsing performance measurement and are thus not used by most manufacturers.⁴³

Instead, manufacturers use internal test procedures which allow direct comparison between models of similar performance characteristic. These are not suitable for a performance classification of professional washing machines and dryers due to insufficient reproducibility; however, manufacturers feed their experiences into the work on the development of new performance standards for professional laundry machines (sub working group CLC/TC59X/SWG1.12 of CENELEC TC59X, see Section 3.1.3).

3.1.2 IEC and European harmonised standards EN 60456 and EN 61121

EN 60456:2005 Clothes washing machines for household use – Methods for measuring the performance (IEC 60456:2010)

This standard deals with methods for measuring the performance of clothes washing machines for household use, with or without heating devices and for cold and/or hot water supply. Also included are appliances for water extraction by centrifugal force and appliances for both washing and drying textiles (called washer-dryers) with respect to their washing per-

⁴³ See also Section 3.1.5); according to Electrolux professional, Kannegiesser, Miele professional

formance. The object is to state and define the principal performance characteristics of household electric washing machines and spin extractors and to describe the standard methods for the measuring of the performance.

EN 61121:2005 Tumble dryers for household use – Methods for measuring the performance (IEC 61121:2005)

This international standard is applicable to household electric tumble dryers of the automatic and non-automatic type, with or without a cold water supply and incorporating a heating device. The object is to state and define the principal performance characteristics of household electric tumble dryers of interest to users and to describe standard methods for measuring the performance.

These two standards are the main harmonised international standards regarding the performance measurement of washing machines and tumble dryers for *household use*. They are valid for electric mains-operated household washing machines and tumble dryers. The standards are used to measure the information required by Commission Directives 95/12/EC and 95/13/EC implementing Council Directive 92/75/EEC with regard to energy labelling of household washing machines and tumble dryers. In summary these standards define the general test conditions and specific test methods for the following information:

- Household washing machines:
 - Washing performance, rinsing performance, spin extraction performance
 - Energy consumption, water consumption, programme time, and
 - Shrinkage during the wool wash programme
- Household tumble dryers:
 - Drying performance, condensation efficiency (for condenser dryers)
 - Energy consumption, programme time, and
 - Evenness of drying.

For measuring each of the information, the same programme has to be used.

Since adoption of IEC 60456 and 61121, the standards have repeatedly been amended and modified, currently IEC 60436 edition 5.0 from 11.02.2010 and IEC 61121 edition 3.1 consolidated with amendment 1 from 21.07.2005 being in effect.

3.1.3 Work on development of new performance standards for professional laundry machines

In 2009, CENELEC TC59X settled two Sub Working Groups with the scope to develop performance standards for laundry machines for commercial use (CLC/TC59X/SWG1.12) and for dishwashing machines for commercial use (CLC/TC59X/SWG2.1).

Scope of SWG 1.12 is to develop performance standards for laundry machines (washing machines and tumble dryers) for commercial use based on current and coming versions of household standards EN60456 and EN 61121.

The constitutional meeting of this sub-working group has taken place in November 2009.⁴⁴ For the members of SWG 1.12 it is evident that the content from EN 60456 and EN 61121 has to be revised and in some cases totally changed in order to fulfil the requirements for professional appliances. Discussions were held on the scope of a new standard for professional laundry machines and possible equipment and variants that might not be covered by the developed standards.⁴⁵ Further, members of SWG 1.12 provided a definition of the terms “commercial” and “professional” (cf. Section 2.4.3) and proposed that a possible standard for professional laundry machinery should follow market segments instead of machine size.⁴⁶

Work is still in progress.

3.1.4 Further used or adopted performance testing methods

In the context of the modification of the scope of EN 60456, the Danish Technological Institute (DTI) already performed examples of test methods and programmes for professional washing machines. The energy and water consumption as well as washing and rinsing performance of professional washing machines have been measured for different programmes, temperatures and loads. The data have been measured following the test standard EN 60456. Data sheets of the tests are available on the web site belonging to the Danish Energy Association⁴⁷.

3.1.5 Conclusion: Comparison of different performance standards

The following tables show the differences between the several standard conditions defined in the European measurement methods to evaluate the consumption and the performance of appliances.

Currently, there is no commonly applied performance measurement standard for professional washing machines and dryers in Europe. ISO 9398 series for professional laundry machinery defines a measurement method for the energy and water consumption; however, does not include a performance measurement (washing and spin extraction performance for washing machines, drying performance and condensation efficiency for dryers). IEC/EN standards

⁴⁴ Source: input by CENELEC

⁴⁵ See Annex, Section 7.2 (Reflections and concerns of CENELEC/TC59X/SWG 1.12 regarding the outcome of performance standards for commercial laundry machines)

⁴⁶ Presentation “CENELEC 59X SWG 1:12 - Proposal about definitions and way of direction for future standards for Professional laundry equipment” at the LOT 24 stakeholder meeting from 01.10.2010, downloadable at <http://www.ecowet-commercial.org/meetings.php>

⁴⁷ Source: <http://faellesvaskeri.dk>

60456 and 61121 currently only apply for washing machines and dryers for household use. They might be the basis for performance standards for professional appliances, however, the condition parameters and measurement methods have to be adapted accordingly - a work that is still ongoing within CENELEC TC59X/SWG1.12.

Washing machines

Table 14 Consumer behaviour and differences may be identified with the standard conditions for washing machines

General test condition parameters	Household test standard conditions EN 60456 (IEC 60456) in coming Eco-design version	Test conditions for professional machines as performed at Danish Technological Institute	Industrial standard conditions (ISO 9398-4)
Number of cycle per week	220/52	~20-40 (1000-2000 cycles per year)	Not defined
Number of loads	One load divided in parts	One load divided in parts	Two identical loads
Loading of washing machine	As described in EN 60456	As in EN 60456	Nominal capacity
Type of fabrics	Cotton base load (for energy label testing)	Cotton base load as EN 60456	Decatized white cotton sheets (mass per unit area of (140 ± 20) g/m ² and dimensions of (240 ± 20) cm x (180 ± 20) cm)
Washing programme (Length, temperature, load size)	60°C cotton programme at full load; 60°C cotton programme at half load; 40°C cotton programme at half load. All with standard detergent A* All with standard soiled test strips	60°C cotton programme at full load; 60°C cotton programme at half load; 40°C cotton programme at half load. All with standard detergent A* All with standard soiled test strips 30°C cotton programme, 60% load, with low temperature detergent and standard soiled test strips 40°C cotton programme, 20% load for consumption measurement with small load	Test cycle A: 76 min (detergent A) Test cycle B: 43 min (detergent B) Test cycle C: 22 min (detergent B)
Other specification	Reference machine for measuring: washing performance	Reference machine for measuring: washing performance and rinsing performance	Not defined
Location of the washer extractor: Ambient temperatures and humidity Conditioning of cotton load: Ambient temperatures and humidity as in ISO standard	Ambient temperature: (23 ± 2) °C Ambient temperature: (20 ± 2) °C Ambient humidity: (65 ± 5) %RH	Ambient temperature: (23 ± 2) °C Ambient temperature: (20 ± 2) °C Ambient humidity: (65 ± 5) %RH	Ambient temperature: 24 ± 6 °C Ambient humidity: 50 ± 10 %

General test condition parameters	Household test standard conditions EN 60456 (IEC 60456) in coming Eco-design version	Test conditions for professional machines as performed at Danish Technological Institute	Industrial standard conditions (ISO 9398-4)
Types of soiling	Mineral oil/carbon black, blood, chocolate and milk, red wine	Mineral oil/carbon black, blood, chocolate and milk, red wine	Not included
Behaviour at the end of the washing programme:	Measurement of power consumption in low power modes	In future probably: Measurement of power consumption in low power modes	Not included
Load ratio	Rated capacity in kg dry cotton declared by the manufacturer	Rated capacity in kg dry cotton declared by the manufacturer	1:10
Condition of the machine	Installation according to the manufacturer's instructions if not specially described in the standard.	Installation according to the manufacturer's instructions if not specially described in the standard.	Installation according to the manufacturer's instructions, and it shall be clean
Type of energy heating	Electricity 230V±1% or 400V±1%, 50 Hz ±1%	Electricity 230V±1% or 400V±1%, 50 Hz ±1%	By steam, gas, electricity or heat transport fluid, as specified by manufacturer
Water conditions	Cold water (15 ± 2) °C Hot water (60 ± 2) °C Hardness (2.5 ± 0.2) mmol/l Pressure (240 ± 50) kPa	Cold water (15 ± 2) °C Hot water (60 ± 2) °C Hardness (2.5 ± 0.2) mmol/l Pressure (240 ± 50) kPa	17 ± 3°C (For tropical countries, a temperature of 25 ± 5°C for the rinse water is allowed)
Standard foresees the following measurements			
Washing performance	X	X	Not possible
Spin extraction performance	X	X	X
Rinsing performance	Not used in label test	X	
Temperature		X	
Energy, water and programme time	X	X	X

Table 15 Consumer behaviour and differences may be identified with the standard conditions for dryers

General test condition parameters	Household test standard conditions EN 61121 (IEC 61121) in coming Eco-design version	Possible test conditions for professional machines in ongoing project at Danish Technological Institute	Standard conditions (ISO 9398-2)
Number of cycle per week	160/52	~20-40 (1000-2000 cycles per year)	Not defined
Number of loads	One load divided in parts	One load divided in parts	Two identical loads
Loading of dryer	As described in EN61121	As described in EN61121	Nominal capacity
Type of fabrics	Cotton load (for energy label testing)	Cotton load as EN 61121	Decatized cotton towels (mass per unit area of (420 ± 25) g/m ² and dimensions of (90 ± 10) cm x (60 ± 10) cm)
Drying programme (Length, temperature, load size)	Cotton programme at full load; Cotton programme at half load; Programme continues until 0% humidity reached (for energy label testing)	Max temperature cotton programme at full load; Max temperature cotton programme at half load; And probably: Reduced temperature cotton programme at half load. Reduced temperature cotton programme at 20% load for consumption measurement with small load Programme continues until 0% humidity reached	Not defined
Remaining humidity after spin (=nominal initial moisture content)	Cotton $(60 \pm 1)\%$ (for energy label testing)	Cotton $(60 \pm 1)\%$ or $(50 \pm 1)\%$	$55 \pm 1\%$
Location of the washer extractor: Ambient temperatures and humidity Conditioning of cotton load: Ambient temperatures and humidity as in ISO standard	Ambient temperature: $(23 \pm 2)^{\circ}\text{C}$ Ambient humidity: $(55 \pm 5)\%\text{RH}$ Ambient temperature: $(20 \pm 2)^{\circ}\text{C}$ Ambient humidity: $(65 \pm 5)\%\text{RH}$	Ambient temperature: $(23 \pm 2)^{\circ}\text{C}$ Ambient humidity: $(55 \pm 5)\%\text{RH}$ Ambient temperature: $(20 \pm 2)^{\circ}\text{C}$ Ambient humidity: $(65 \pm 5)\%\text{RH}$	Ambient temperature: $24 \pm 6^{\circ}\text{C}$ Ambient humidity: $50 \pm 10\%$
Behaviour at the end of the drying programme:	Measurement of power consumption in low power modes	In future probably: Measurement of power consumption in low power modes	Not included
Load ratio	Rated capacity in kg dry cotton declared by the manufacturer	Rated capacity in kg dry cotton declared by the manufacturer	1:25

General test condition parameters	Household test standard conditions EN 61121 (IEC 61121) in coming Eco-design version	Possible test conditions for professional machines in ongoing project at Danish Technological Institute	Standard conditions (ISO 9398-2)
Condition of the machine	Installation according to the manufacture's instructions if not specially described in the standard.	Installation according to the manufacture's instructions if not specially described in the standard.	Installation according to the manufacture's instructions and it shall be clean
Other specification			Not defined
Type of energy heating	Electricity 230V±1% or 400V±1%, 50 Hz ±1%	Electricity 230V±1% or 400V±1%, 50 Hz ±1% and probably gas	By steam, gas, electricity or heat transport fluid, as specified by the manufacture
Temperature of rinse water before extraction	Water (15 ± 2) °C Hardness (2.5 ± 0.2) mmol/l Conductivity (75 ± 15) mS/m	Water (15 ± 2) °C Hardness (2.5 ± 0.2) mmol/l Conductivity (75 ± 15) mS/m	17 ± 3°C (For tropical countries, a temperature of 25 ± 5°C is allowed)
	Standard foresees the following measurements		
Drying temperature		X	
Condensation efficiency	X	X	
Equality of drying	Not for label test		
Initial moisture content	X	X	
Final moisture content	X	X	
Energy and programme time	X	X	X

3.2 Safety

3.2.1 ISO 10472 (International)

ISO 10472 Safety requirements for industrial laundry machinery

- ISO 10472-1:1997 Safety requirements for industrial laundry machinery, Part 1: Common requirements (see also EN ISO 10472-1:2008; DIN EN ISO 10472-1 with publication date 10/2009).

The individual parts of ISO 10472 identify all significant hazards (mechanical, electrical, thermal hazards, hazards generated by noise; hazards associated with materials and substances processed, used or exhausted by machinery; hazards due to neglect of ergonomic principles in machine design; failure of energy supply, breakdown of machin-

ery parts and other malfunction; hazards arising during maintenance and/or elimination of process faults) associated with laundry machinery designed for use in industrial laundry premises, which includes hotels, hospitals, nursing homes, prisons and similar premises, as well as machines designed for use in self-service establishments subject to the minimum capacities stated in the separate parts of ISO 10472. Dry-cleaning presses and garment presses are also included.

- ISO 10472-2:1997 Safety requirements for industrial laundry machinery, Part 2: Washing machines and washer-extractors (see also EN ISO 10472-2:2008; DIN EN ISO 10472-2 with publication date 10/2009)

This part of ISO 10472 covers, together with ISO 10472-1, most significant hazards associated with washing machines and washer-extractors of all configurations having a net usable cage volume > 60 l (i.e. capacity of 6 kg of dry linen). This part of ISO 10472 does not cover particular hazards for drawer-type washer-extractors as well the hazards caused by processing work may create an explosive or flammable atmosphere inside the machine. Furthermore, it does not apply to ancillary equipment, e.g. chemical supply pumps, steam valves and supply pipe work, vent systems, work feed systems and discharge systems and ducting to the atmosphere.

- ISO 10472-3:1997 Safety requirements for industrial laundry machinery, Part 3: Washing tunnel lines including component machines (see also EN ISO 10472-3:2008; DIN EN ISO 10472-3 with publication date 10/2009)

This part of ISO 10472 covers, together with ISO 10472-1, most significant hazards associated with washing tunnel lines including component machines such as:

- continuous tunnel washing machines;
- squeeze presses or centrifugal extraction machines;
- transfer conveyor systems;
- automatic transfer tumblers;
- loading or unloading system interfaces;
- access platform and ladders.

This part of ISO 10472 does not cover particular hazards for continuous stand-alone washing lines for endless towels as well the hazards caused by processing work may create an explosive or flammable atmosphere inside the machine.

- ISO 10472-4:1997 Safety requirements for industrial laundry machinery, Part 4: Air dryers (EN ISO 10472-4:2008; DIN EN ISO 10472-4 with publication date 09/2009)

This part of ISO 10472 covers, together with ISO 10472-1, most significant hazards associated with air dryers, and in particular with tumble dryers having a net usable cage volume > 160 l (i.e. capacity of 6 to 7 kg of dry linen) and tunnel finishers including as-

sociated conveyors and cabinet dryers. This part of ISO 10472 does not apply to ancillary equipment.

- ISO 10472-5:1997 Safety requirements for industrial laundry machinery, Part 5: Flatwork ironers, feeders and folders (see also EN ISO 10472-5:2008; DIN EN ISO 10472-5 with publication date 09/2009)

This part of ISO 10472 covers, together with ISO 10472-1, most significant hazards associated with flatwork ironers, feeders and folders, such as:

- cylinder and bed ironers for flatwork finishing having a contact area (for bed ironers under pressure) > 0.25 m²;
 - flatwork feeding machines for the automatic feeding of flatwork into bed or cylinder ironers, or directly to folders;
 - flatwork folding machines for the automatic folding of flatwork in association with cylinder and bed ironers;
 - folding machines for the automatic folding of small pieces (excluding endless towels);
 - multi-function machines.
- ISO 10472-6:1997 Safety requirements for industrial laundry machinery, Part 6: Ironing and fusing presses (see also EN ISO 10472-6:2008; DIN EN ISO 10472-6 with publication date 10/2009)

This part of ISO 10472 covers, together with ISO 10472-1, most significant hazards associated with ironing and fusing presses used in the laundry, garment and dry-cleaning industry, and in particular:

- scissor presses;
- cabinet presses;
- drawer presses;
- rotary presses (carousel) and other presses with multiple bucks.

These standards give the most relevant product definitions of all sources identified providing a first basis for conclusion of the products classification (see Section 2.4). The ISO standards 10472 are also widely used by manufacturers.

3.2.2 IEC 60335 (International)

IEC 60335 Household and similar electrical appliances – Safety

- IEC 60335-1: Household and similar electrical appliances – Safety, Part 1: General requirements

The Standard covers safety issues of household and similar electrical appliances. Part 1 defines general elements and is common to all electric motor appliances. Product specific issues are addressed in the Part 2-series. The relevant Standards of Part 2 for professional washing machines and dryers are listed in the following.

- IEC 60335-2: Household and similar electrical appliances – Safety, Part 2
 - IEC 60335-2-4:2008: Household and similar electrical appliances – Safety, Part 2-4: Particular requirements for spin extractors

Deals with the safety of spin extractors incorporated in washing machines that have separate containers for washing and spin extraction for household and similar purposes that have a capacity not exceeding 10 kg of dry cloth and a drum peripheral speed not exceeding 50 m/s, their rated voltages being not more than 250 V for single-phase appliances and 480 V for other appliances.
 - IEC 60335-2-7:2008: Household and similar electrical appliances – Safety, Part 2-7: Particular requirements for washing machines

Deals with the safety of electric washing machines for household and similar use, that are intended for washing clothes and textiles, their rated voltage being not more than 250 V for single-phase appliances and 480 V for other appliances. This standard also deals with the safety of electric washing machines for household and similar use employing an electrolyte instead of detergent. Additional requirements for these appliances are given in Annex CC of the standard.
 - IEC 60335-2-11:2008: Household and similar electrical appliances – Safety, Part 2-11: Particular requirements for tumble dryers

Deals with the safety of electric tumble dryers intended for household and similar purposes, their rated voltage being not more than 250 V for single-phase appliances and 480 V for other appliances. This standard also applies to the drying function of washing machines having a drying cycle, as well as the safety of tumble dryers that use a refrigerating system incorporating sealed motor-compressors, for drying textile material. These appliances may use flammable refrigerants.
 - IEC 60335-2-43:2008 Household and similar electrical appliances – Safety, Part 2-43: Particular requirements for clothes dryers and towel rails

Deals with the safety of electric clothes dryers for drying textiles on racks located in a warm airflow and to electric towel rails, for household and similar purposes,

their rated voltage being not more than 250 V. Appliances not intended for normal household use but that nevertheless may be a source of danger to the public, such as appliances intended to be used by laymen in shops, in light industry and on farms, are within the scope of this standard.

- IEC 60335-2-44:2008 Household and similar electrical appliances – Safety, Part 2-44: Particular requirements for ironers

This International Standard deals with the safety of electric ironers for household and similar purposes, their rated voltage being not more than 250 V for single-phase appliances and 480 V for other appliances. Appliances not intended for normal household use but which nevertheless may be a source of danger to the public, such as appliances intended to be used by laymen in shops, in light industry and on farms, are within the scope of this standard. Examples of appliances within the scope of this standard are ironing presses for one-person operation; mangles; rotary ironers for one-person operation; trouser presses.

- IEC 60335-2-85:2008 Household and similar electrical appliances – Safety, Part 2-85: Particular requirements for fabric steamers

Deals with the safety of electric fabric steamers intended for household and similar purposes, their rated voltage being not more than 250 V. Appliances not intended for normal household use, such as appliances to be used by laymen in laundries and dry cleaners, are within the scope of this standard.

3.2.3 IEC 60204

IEC 60204-1:2005 Safety of machinery – Electrical equipment of machines – Part 1: General requirements

This part of IEC 60204 applies to the application of electrical, electronic and programmable electronic equipment and systems to machines not portable by hand while working, including a group of machines working together in a co-ordinated manner. This standard is applicable to the electrical equipment or parts of the electrical equipment that operate with nominal supply voltages not exceeding 1 000 V for alternating current (a.c.) and not exceeding 1 500 V for direct current (d.c.), and with nominal supply frequencies not exceeding 200 Hz.

The standard provides requirements and recommendations relating to the electrical equipment of machines so as to promote: safety of persons and property; consistency of control response; – ease of maintenance.

According to the Convenor of TC27/SC5/WG3 all machines constructed in accordance with the standard series EN 10472, in combination with EN 60204-1, fall into the industrial sector. All machines constructed in accordance with EN 60335-1, in combination with the machine-specific parts of this standard series, fall into the commercial/professional sector. EN ISO 10472-1 points this fact out in 5.2: "The electrical equipment of machines shall be designed in accordance with EN 60204-1 ... or IEC 60335 ..., depending on the intended use of the machine." This normative specification, which refers to the different scopes of the before-mentioned standards, results in a clear distinction of the industrial sector.

3.2.4 BGR 500 (German)

BGR 500 (Berufsgenossenschaftliche Regeln für Sicherheit und Gesundheit bei der Arbeit) – Chapter 2.6 provides safety regulations for the operation of laundries.

3.2.5 UL 1206 / 1240 / 2157 / 2158 (USA / Canada)

UL 1206 Electric Commercial Clothes-Washing Equipment (USA / Canada)

These requirements cover electric commercial, industrial, and institutional clothes-washing equipment intended for use in accordance with the National Electrical Code. Equipment covered by this Standard is not intended for use by the general public, but only by trained or supervised personnel. These requirements do not cover clothes dryers, coin-operated clothes washing appliances, flatirons, ironing machines, water heaters, water softeners, dry-cleaning machines, garment-finishing machines, appliances employing wringer mechanisms, or other equipment covered by requirements separate from this standard.

UL 1240 Electric Commercial Clothes-Drying Equipment (USA / Canada)

These requirements cover electric commercial, industrial, and institutional clothes-drying equipment intended for use in accordance with the National Electrical Code, NFPA 70. Equipment covered by this Standard is not intended for use by the general public, but only by trained or supervised personnel. These requirements do not cover coin-operated clothes-drying equipment, flatirons, ironing machines, water heaters, water softeners, dry-cleaning machines, garment-finishing machines, clothes washers, or other equipment covered by requirements separate from this standard.

UL 2157 Electric Clothes Washing Machines and Extractors (USA / Canada)

This Standard applies to electric clothes washing machines and extractors intended to be used in nonhazardous locations in accordance with the Canadian Electrical Code, Part I (CEC), and the (U.S.) National Electrical Code (NEC), on circuits having a nominal voltage not exceeding 600 V. Note: Wherever practical, for convenience, the term "appliance" has been used in lieu of "clothes washer" or "machine". This standard applies to both cord-

connected and permanently connected appliances. The appliances covered by this standard are intended for use by the general public not specifically trained in the use of the appliance, regardless of the mode by which its operation is initiated.

They are for use in household and commercial purposes, including appliances provided with coin-, ticket-, or card-operated mechanisms, wringer washers, tumbler, agitator and spinner machines, combination washer-dryers, and extractors of the centrifugal type. This Standard does not apply to industrial and institutional type appliances. Industrial or institutional appliances are covered under the scope of Electric Commercial Clothes-Washing Equipment, UL 1206.

UL 2158 Electric Clothes Dryers (USA / Canada)

This standard applies to electric clothes dryers intended to be used in nonhazardous locations in accordance with the Canadian Electrical Code, Part I (CEC), and the (U.S.) National Electrical Code (NEC), on circuits having a nominal voltage not exceeding 600 Note: Wherever practical, for convenience, the term "appliance" has been used in lieu of "clothes dryer" or "machine".

This standard applies to both cord-connected and permanently connected appliances. The appliances covered by this standard are intended for use by the general public not specifically trained in the use of the appliance, regardless of the mode by which its operation is initiated. They are for use in households and for commercial purposes, including appliances provided with coin-, ticket-, or card-operated mechanisms, and combination washer-dryers. This standard does not apply to industrial and institutional type appliances. Industrial or institutional appliances are covered under the scope of Electric Commercial Clothes-Drying Equipment, UL 1240.

Test standards for household equipment around the world are mostly based on EN standards (which in turn are mostly based on IEC standards) whereas in North America (USA/CANADA) they are based on UL-standards. The UL-standards are usually slightly modified to suit local conditions and set requirements in the areas of construction, safety and mainly for on hardware issues. These standards provide no relevant product definitions for providing a good basis for a product classification.

3.3 Hygiene

Laundry from medical services (e.g. operation material, bed linen or work wear of nurses) as well as laundry from food businesses underlies several regulations for its hygienic treatment. The soiled textiles delivered to the laundries are contaminated with a multitude of microorganisms.

The aim of reprocessing is for example to decontaminate the textiles in a disinfecting process (= to reduce microorganisms in a way that there is no more risk of infection) and protect it against recontamination (re-soiling with microorganisms) until they go back to the customers. According to the field of application, different requirements exist for the processing (washing, drying and finishing) and microbiological quality of the textiles. However, not only the textiles but also the surroundings within and the personnel of the laundry services have to fulfil hygienic regimentations. Objective for the appropriate handling of textiles from medical services is to avoid infectious diseases and to minimise the risk of infections, respectively. Objective for the handling of textiles from food businesses is to avoid any harmful impact on the food caused by inappropriate work wear.

3.3.1 IFS – International Food Standard (International)

The IFS Food (version 5 which is applicable since 1st January 2008) is a standard for auditing retailer and wholesaler branded food product suppliers and only concerns food processing companies or companies that pack loose food products. The IFS Food can only be used when a product is “processed” or when there is a hazard for product contamination during the primary packing.⁴⁸ The food processing industry generally requires evidence of hygienic harmless-ness of the processed textiles from laundry services. Version 5 of the International Food Standard contains requirements regarding the hygiene of textiles.

3.3.2 EN 13795 (European)

EN 13795 Surgical drapes, gowns and clean air suits, used as medical devices, for patients, clinical staff and equipment

- EN 13795-1+A1 2009-07: Surgical drapes, gowns and clean air suits, used as medical devices, for patients, clinical staff and equipment, Part 1: General requirements for manufacturers, processors and products
- EN 13795-2+A1 2009-07: Surgical drapes, gowns and clean air suits, used as medical devices for patients, clinical staff and equipment, Part 2: Test methods
- EN 13795-3+A1 2009-07: Surgical drapes, gowns and clean air suits, used as medical devices for patients, clinical staff and equipment, Part 3: Performance requirements and performance levels

⁴⁸ Source: <http://www.ifs-certification.com/>, sighted on 12 January 2010

3.3.3 EN 14065 (European)

EN 14065 Textiles – Laundry processed textiles – Biocontamination control system

This European standard describes a system for Risk Analysis and Biocontamination Control (so-called RABC system) during the processing of textiles in laundries. Prevention of microbiological contamination is of significant importance in all steps of the reprocessing of textiles. The so-called RABC system ensures that a pre-agreed level of microbiological quality will be set to match the needs of the intended use.

The RABC-System is a hygiene- and quality-management-system respectively, with risk analysis, comparable to the HACCP concept for the food area. According to the worldwide approved HACCP concept (developed 1959 and published 1971), the EN 14065 was developed.⁴⁹

3.3.4 DIN 10524 (German)

DIN 10524 Lebensmittelhygiene – Arbeitsbekleidung in Lebensmittelbetrieben (Food hygiene – Work wear in food business, German)

Work wear in food businesses have to fulfil hygienic requirements during their whole expected useful life. According to DIN 10524, the textiles have to be treatable under the conditions of a professional laundry service, i.e. being able to wash, disinfect and finish. The DIN standard describes the hygienic requirements for work wear in food businesses. Further, it provides details for the selection, treatment and cleaning of the work wear.

3.3.5 RKI-Guidelines (German)

Guidelines for hospital hygiene and prevention of infectious diseases (Robert Koch Institute, Germany)⁵⁰

The guidelines comprise hygienic requirements for textiles of medical service institutions, for the laundry, the washing process, and requirements for giving away textiles to professional laundry services.

⁴⁹ Source: <http://rabc-wfk.com/module6/index.php?lang=eng>

⁵⁰ Richtlinie für Krankenhaushygiene und Infektionsprävention: Anforderungen der Hygiene an die Wäsche aus Einrichtungen des Gesundheitsdienstes, die Wäscherei und den Waschvorgang und Bedingungen für die Vergabe von Wäsche an gewerbliche Wäschereien.
http://www.rki.de/clin_091/nn_201414/DE/Content/Infekt/Krankenhaushygiene/Kommission/Downloads/Altanl_Rili,templateId=raw,property=publicationFile.pdf/Altanl_Rili.pdf

3.4 Noise

3.4.1 IEC 60704 (International)

IEC 60704:1997 Household and similar electrical appliances – Test code for the determination of airborne acoustical noise

- IEC 60704-1: Household and similar electrical appliances – Test code for the determination of airborne acoustical noise, Part 1: General requirements
Applies to the methods of determination of airborne acoustical noise emitted by household and similar electrical appliances supplied from mains or from batteries.
- IEC 60704-2-4 Ed. 2.0 b:2001: Household and similar electrical appliances – Test code for the determination of airborne acoustical noise, Part 2-4: Particular requirements for washing machines and spin extractors
These particular requirements apply to single unit electric washing machines, the washing and spinning function of combined appliances for household and similar use, and to spin extractors.
- IEC 60704-2-6 2005: Household and similar electrical appliances – Test code for the determination of airborne acoustical noise, Part 2-6: Particular requirements for tumble dryers
Applies to the methods of determination of airborne acoustical noise emitted by tumble dryers for household and similar use. This standard applies to single unit electric tumble dryers intended for placing on the floor against a wall, for building in or placing under a counter, a kitchen work-top or under a sink, for wall-mounting or for mounting on a counter. For the purpose of this standard, washer-dryer combinations, when operated as a dryer, are considered as a tumble dryer.

3.4.2 ISO 3744 (International)

ISO 3744:2010 Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane

ISO 3744:2010 specifies methods for determining the sound power level or sound energy level of a noise source from sound pressure levels measured on a surface enveloping the noise source (machinery or equipment) in an environment that approximates to an acoustic free field near one or more reflecting planes. The sound power level (or, in the case of noise bursts or transient noise emission, the sound energy level) produced by the noise source, in frequency bands or with frequency A-weighting applied, is calculated using those measurements. The methods specified in ISO 3744:2010 are suitable for all types of noise (steady, non-steady, fluctuating, isolated bursts of sound energy, etc.) defined in ISO 12001.

ISO 3744:2010 is applicable to all types and sizes of noise source (e.g. stationary or slowly moving plant, installation, machine, component or sub-assembly), provided the conditions for the measurements can be met.

The test environments that are applicable for measurements made in accordance with ISO 3744:2010 can be located indoors or outdoors, with one or more sound-reflecting planes present on or near which the noise source under test is mounted. The ideal environment is a completely open space with no bounding or reflecting surfaces other than the reflecting plane(s) (such as that provided by a qualified hemi-anechoic chamber), but procedures are given for applying corrections (within limits that are specified) in the case of environments that are less than ideal.

Information is given on the uncertainty of the sound power levels and sound energy levels determined in accordance with ISO 3744:2010, for measurements made in limited bands of frequency and with frequency A-weighting applied. The uncertainty conforms to ISO 12001:1996, accuracy grade 2 (engineering grade).

3.4.3 ISO 3746 (International)

ISO 3746:2010 Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Survey method using an enveloping measurement surface over a reflecting plane

ISO 3746:2010 specifies methods for determining the sound power level or sound energy level of a noise source from sound pressure levels measured on a surface enveloping a noise source (machinery or equipment) in a test environment for which requirements are given. The sound power level (or, in the case of noise bursts or transient noise emission, the sound energy level) produced by the noise source with frequency A-weighting applied is calculated using those measurements. The methods specified in ISO 3746:2010 are suitable for all types of noise (steady, non-steady, fluctuating, isolated bursts of sound energy, etc.) defined in ISO 12001. ISO 3746:2010 is applicable to all types and sizes of noise source (e.g. stationary or slowly moving plant, installation, machine, component or sub-assembly), provided the conditions for the measurements can be met.

The test environments that are applicable for measurements made in accordance with ISO 3746:2010 can be located indoors or outdoors, with one or more sound-reflecting planes present on or near which the noise source under test is mounted.

Information is given on the uncertainty of the sound power levels and sound energy levels determined in accordance with ISO 3746:2010, for measurements made with frequency A-weighting applied. The uncertainty conforms to that of ISO 12001:1996, accuracy grade 3 (survey grade).

3.4.4 ISO 4871 (International)

ISO 4871:1996 Acoustics – Declaration and verification of noise emission values of machinery and equipment

Gives information on the declaration of noise emission values, describes acoustical information to be presented in technical documents and specifies a method for verifying the noise emission declaration.

3.4.5 ISO 9614 (International)

ISO 9614-2:1996 Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 2: Measurement by scanning

Specifies a method for measuring the component of sound intensity normal to a measurement surface which is chosen so as to enclose the noise source(s) of which the sound power level is to be determined.

3.4.6 ISO 11204 (International)

ISO 11204:2010 Acoustics – Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions applying accurate environmental corrections

ISO 11204:2010 specifies a method for determining the emission sound pressure levels of machinery or equipment, at a work station and at other specified positions nearby, in any environment which meets certain qualification requirements. A work station is occupied by an operator and may be located in open space, in the room where the source under test operates, in a cab fixed to the source under test, or in an enclosure remote from the source under test. One or more specified positions may be located in the vicinity of a work station, or in the vicinity of an attended or unattended machine. Such positions are sometimes referred to as bystander positions. Emission sound pressure levels are determined as A-weighted levels. Additionally, levels in frequency bands and C-weighted peak emission sound pressure levels can be determined in accordance with ISO 11204:2010, if required.

A method is given for determining a local environmental correction (subject to a specified limiting maximum value) to be applied to the measured sound pressure levels to exclude the effects of reflections from reflecting surfaces other than the plane on which the source under test is placed. This correction is based upon the mean sound pressure level on a measurement surface, the sound pressure level measured at a specified position, and either an environmental correction or the equivalent absorption area of the test room.

With the method specified in ISO 11204:2010 results of accuracy grade 2 (engineering grade) or accuracy grade 3 (survey grade) are obtained. Corrections are applied for background noise and, as described above, for the acoustic environment. Instructions are given

for the mounting and operation of the source under test and for the choice of microphone positions for the work station and for other specified positions. One purpose of the measurements is to permit comparison of the performance of different units of a given family of machines, under defined environmental conditions and standardized mounting and operating conditions.

The method specified in ISO 11204:2010 is suitable for all types of noise (steady, non-steady, fluctuating, isolated bursts of sound energy, etc.) defined in ISO 12001. The method specified in ISO 11204:2010 is applicable to all types and sizes of noise sources.

The type of test environment influences the accuracy of the determination of emission sound pressure levels. ISO 11204:2010 is applicable to an indoor or outdoor environment with one or more reflecting planes present, meeting specified requirements. These requirements on the room are less strict than those of ISO 11201, in particular regarding the acoustical quality of the environment. ISO 11204:2010 is applicable to work stations and other specified positions where emission sound pressure levels are to be determined.

Appropriate positions where measurements may be made include the following: a) work station located in the vicinity of the source under test; this is the case for many industrial machines and domestic appliances; b) work station within a cab which is an integral part of the source under test; this is the case for many industrial trucks and earth-moving machines; c) work station within a partial or total enclosure (or behind a screen) supplied by the manufacturer as an integral part of the source under test; d) work station partially or totally enclosed by the source under test – this situation may be encountered with some large industrial machines; e) bystander positions occupied by individuals not responsible for the operation of the source under test, but who may be in its immediate vicinity, either occasionally or continuously; f) other specified positions, not necessarily work stations or bystander positions.

The work station may also lie on a specified path along which an operator moves.

3.5 Electromagnetic fields / Electromagnetic compatibility (EMC)

3.5.1 IEC 62233 (International)

IEC 62233:2005 Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure

Deals with electromagnetic fields up to 300 GHz and defines methods for evaluating the electric field strength and magnetic flux density around household and similar electrical appliances, including the conditions during testing as well as measuring distances and positions. Appliances may incorporate motors, heating elements or their combination, may contain electric or electronic circuitry, and may be powered by the mains, by batteries, or by any other electrical power source. Appliances include such equipment as household electrical

appliances, electric tools and electric toys. Appliances not intended for normal household use but which nevertheless may be approached by the public, or may be used by laymen, are within the scope of this standard. This standard includes specific elements to assess human exposure:

- definition of sensor,
- definition of measuring methods,
- definition of operating mode for appliance under test,
- definition of measuring distance and position

The measurement methods specified are valid from 10 Hz to 400 kHz. In the frequency range above 400 kHz and below 10 Hz appliances in the scope of this standard are deemed to comply without testing unless otherwise specified in IEC 60335 series.

3.5.2 IEC 61000 (International)

IEC 61000 Electromagnetic compatibility

- IEC 61000-3-2 ed3.2 Consol. with am1&2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
- IEC 61000-3-3 ed2.0: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection

3.5.3 EN 50366 (European)

EN 50366:2003 Household and similar electrical appliances – Electromagnetic fields – Methods for evaluation and measurement

Several test methods by which the magnetic field emissions from products can be compared to the general public restrictions and levels over the frequency range of 10Hz to 400 kHz.

3.5.4 EN 55014 (European)

EN 55014 Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus

- EN 55014-1:2007 Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus, Part 1: Emission (IEC/CISPR 14-1:2005)
- EN 55014-2:2009 Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus, Part 2: Immunity – Product family standard (IEC/CISPR 14-2:1997 + A1:2001 + A2:2008)

3.6 Gas

3.6.1 EN 12752 (European)

EN 12752 Gas-fired type B tumble dryers of nominal heat input not exceeding 20 kW

- EN 12752-1:1999 Gas-fired type B tumble dryers of nominal heat input not exceeding 20 kW – Part 1: Safety
- EN 12752-2:1999 Gas-fired type B tumble dryers of nominal heat input not exceeding 20 kW – Part 2: Rational use of energy

3.6.2 DIN 30682 (Germany)

DIN 30682:1982 Gas-appliances for laundry-machinery

3.6.3 NF G45-106 (France)

NF G45-106 1997 Laundry equipment: Drying and ironing machine, rotating dryers, spinner-washers, with atmospheric burners of output not exceeding 120 kW using gaseous fuels

Provides product definitions, an equipment classification and specifications for construction characteristics, operating and performance testing of gas laundry equipment.

4 Existing legislation and environmental labelling

Aim of this work package is to identify the relevant existing legislation for professional washing machines and dryers subdivided in four parts:

- Legislation and Agreements at European Community level,
- Legislation at Member State level,
- Third Country Legislation,
- Environmental Labelling.

A short overview of existing legislation and environmental labelling is given, also including legislation on household appliances whose scope has currently been modified to 'household and similar electrical appliances' thus including professional machines.

4.1 European legislation

4.1.1 Machinery Directive (MD) 2006/42/EC (replacing 98/37/EC)

The new Machinery Directive 2006/42/EC⁵¹ is a revised version of Directive 98/37/EC, and is applicable since 29th December 2009. The Directive has the dual aim of harmonising the health and safety requirements applicable to machinery, while ensuring the free circulation of machinery on the Community market. Machinery is defined as an assembly, fitted with or intended to be fitted with a drive system other than directly applied human or animal effort, consisting of linked parts or components, at least one of which moves, and which are joined together for a specific application.

The manufacturer or his authorised representative shall ensure that a risk assessment is carried out for the machinery which he wishes to place on the market. For this purpose, he should determine which are the essential health and safety requirements applicable to his machinery and in respect of which he must take measures. The CE marking should be fully recognised as being the only marking which guarantees that machinery conforms to the requirements of this Directive. All other markings which are likely to mislead third parties as to the meaning or the form of the CE marking, or both, are prohibited.

One of the objectives of the revision of the Machinery Directive was to clarify the borderline between the scope of the Machinery Directive (MD) and the Low Voltage Directive (LVD) 2006/95/EC⁵² (formerly Directive 73/23/EEC as amended) in order to provide greater legal certainty. Article 1 (2) (k) lists the categories of low voltage electrical and electronic machinery that are excluded from the scope of the Machinery Directive, amongst others 'household appliances intended for domestic use'. When such machinery has an electrical supply within the voltage limits of the Low Voltage Directive (between 50 and 1000 V for alternating current or between 75 and 1500 V for direct current), it must fulfil the safety objectives of the LVD instead. For machinery beyond these voltage limits the requirements of the Machinery Directive apply.

The Machinery Directive applies to all professional washing machine and dryer categories being in the scope of Lot 24 (for the borderline between machinery for household and professional use, see also Section 2.4). The requirements of the Directive are sufficient to cover all health and safety aspects related to those appliances.

⁵¹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006L0042:20091215:EN:PDF>

⁵² <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:374:0010:0019:EN:PDF>

4.1.2 Low Voltage Directive (LVD) 2006/95/EC

The Low Voltage Directive (LVD) 2006/95/EC⁵³ (formerly Directive 73/23/EEC as amended) seeks to ensure that electrical equipment within certain voltage limits both provides a high level of protection for European citizens and enjoys a Single Market in the European Union.

The Directive requires electrical equipment to have protection against hazards that could arise from within the electrical equipment itself or from external influences. The directive covers all risks arising from the use of electrical equipment, including mechanical, chemical (such as, in particular, emission of aggressive substances). The LVD also covers noise and vibration, and ergonomic aspects which could cause hazards within the scope of the Directive. The LVD covers electrical equipment designed for use with a voltage rating of between 50 V and 1000 V for alternating current and between 75 V and 1500 V for direct current. It should be noted that these voltage ratings refer to the voltage of the electrical input or output, not to voltages that may appear inside the equipment.

Since 29th December 2009 (revision of the Machinery Directive, see also Sections 2.4 and 4.1.1), washing machines and dryers being stated by the manufacturer for professional use in the Declaration of Conformity, do clearly not fall under the Low Voltage Directive any more.

4.1.3 Electromagnetic Compatibility (EMC) 2004/108/EC

Directive 2004/108/EC⁵⁴ on the approximation of the laws of Member States regulates the electromagnetic compatibility (EMC) of both apparatus and fixed installations. The Directive applies to most electrical and electronic apparatuses including professional washing machines and dryers, which are finished products and systems that include electrical and electronic equipment that may generate or be affected by electromagnetic disturbance.

The main objective of the EMC Directive, thus, is to regulate the compatibility of equipment regarding EMC. In order to achieve this objective, provisions have been put in place so that equipment needs to comply with the requirements of the EMC Directive when it is placed on the market and/or taken into service. On the one hand it has to be ensured that the electromagnetic emissions of this equipment in its intended use do not disturb radio and telecommunication as well as other equipment. On the other hand the Directive also governs the immunity of such equipment to interference and seeks to ensure that this equipment is not disturbed by radio emissions normally present used as intended.

⁵³ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:374:0010:0019:EN:PDF>

⁵⁴ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:390:0024:0037:en:PDF>

4.1.4 Restriction of Hazardous Substances Directive (RoHS) 2002/95/EC

The Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2002/95/EC⁵⁵ (commonly referred to as the Restriction of Hazardous Substances Directive or RoHS) restricts the use of six hazardous substances in the manufacture of various types of electronic and electrical equipment (EEE).

The restrictions apply to EEE belonging to several categories as set out in Annex I A to Directive 2002/96/EC (WEEE). One of the categories of Annex I A falling under the RoHS Directive is category 1 “Large Household Appliances”, covering inter alia washing machines, clothes dryers and dish washing machines.

According to the Commission's "Frequently Asked Questions on Directive 2002/95/EC on the Restriction of the Use of certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) and Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE)"⁵⁶ professional equipment, like professional washing machines, dryers and dishwashers, is covered by the RoHS Directive.

Article 5(1) (b) of the Directive provides that materials and components can be exempted from the substance restrictions contained in Article 4(1) if their elimination or substitution via design changes or materials and components which do not require any of the materials or substances referred to therein is technically or scientifically impracticable, or where the negative environmental, health and/or consumer safety impacts caused by substitution outweigh the environmental, health and/or consumer safety benefits thereof.

Currently, there are 39 exemptions listed in the Annex of the RoHS Directive. In the course of Task 4 (Technical analysis of existing products) we will evaluate whether there are existing exemptions which are of importance for the scope of Lot 24 “Professional washing machines, dryers and dishwashers”.

Currently (status January 2011), the Commission proposal for a recast of the RoHS Directive is in the co-decision adoption procedure by the Council and the European Parliament (EP). The Parliament voted on a text in November 2010 confirming the first reading agreement with the Council on the revised legislation. It is now needed to be formally adopted by the Council. The new Directive will enter into force 20 days after its publication in the Official Journal of the European Union. Member States will then have 18 months to transpose it into national law. Until then, the existing RoHS Directive (Directive 2002/95/EC) continues to apply.

⁵⁵ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:037:0019:0023:EN:PDF>

⁵⁶ http://ec.europa.eu/environment/waste/weee/pdf/faq_weee.pdf, FAQ 1.8 “Do the WEEE and the RoHS Directives apply to electrical and electronic products for professional use?” Answer: “The RoHS Directive does not differentiate between households or professional EEE, so products for professional use are covered by the RoHS Directive.”

The revised Directive aims to improve implementation and enforcement and introduces greater coherence with other EU legislation, such as REACH and the new legislative framework for the marketing of products. Main elements include:⁵⁷

- “The extension of the scope to all electrical and electronic equipment, including medical devices and monitoring and control instruments.
- Electrical and electronic equipment that was outside the scope of the current RoHS Directive but which will be covered by the revised Directive, does not need to comply with the requirements during a transitional period of 8 years, giving producers time to adapt;
- A lighter and more effective mechanism for reviewing or amending the list of banned substances is introduced, enabling further substances to be considered on the basis of scientific evidence and specific criteria, and in line with REACH. Changes may then be made through comitology;
- The rules for granting exemptions from the substance ban are further streamlined to provide legal certainty for the economic operators and to ensure coherence with REACH;
- Important definitions are clarified to ensure the directive is applied in a harmonised manner throughout the EU.
- Better enforcement of the Directive at national level will be achieved through alignment with the marketing of products legislative package.”

Should these changes come into force in the near future manufacturers would need to verify whether they still comply with the requirements of the Directive, inter alia:

- If, for example, products were considered out of scope until now, they might be covered by the revision which would possibly entail need for substitution and / or exemption requests.
- In that case, companies will need to link their efforts in respect with REACH to those under the context of RoHS.

4.1.5 Waste Electrical and Electronic Equipment Directive (WEEE) 2002/96/EC

The Waste Electrical and Electronic Equipment Directive (WEEE Directive) is the European Community Directive 2002/96/EC⁵⁸ regulating the collection, treatment, recycling and disposal of WEEE as well the financial provisions for this waste stream’s treatment which, together with the RoHS Directive 2002/95/EC (cf. Section 4.1.4), came into force in February 2003. The Directive assigns the responsibility for the management of waste electrical and electronic equipment to the manufacturers of such equipment.

⁵⁷ <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/1596&format=HTML>

⁵⁸ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:037:0024:0038:EN:PDF>

The Directive applies to the product categories set out in Annex I A that includes “Large household appliances”. Article 5 differentiates between WEEE from private households and WEEE from other than private households. According to the Commission's "Frequently Asked Questions on Directive 2002/95/EC on the Restriction of the Use of certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) and Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE)"⁵⁹ professional equipment, like professional washing machines, dryers and dishwashers, is covered by the WEEE Directive⁶⁰.

For WEEE from other than private households, Article 5 (3) points out that “Member States shall ensure that producers or third parties acting on their behalf provide for the collection of such waste.” Also Article 9 on financing applies to WEEE from users other than private households. Article 9 (1) sets out that “Member States shall ensure that [...] the financing of the costs for the collection, treatment, recovery and environmentally sound disposal of WEEE from users other than private households from products put on the market after 13 August 2005 is to be provided for by producers.” Article 9 (2) points out, however, that “producers and users other than private households may, without prejudice to this Directive, conclude agreements stipulating other financing methods.”

In parallel to the revision of the RoHS Directive, the WEEE Directive is currently also being revised under the co-decision procedure (status January 2011). The WEEE revision however is progressing at a much slower pace. The European Commission initially wanted to link the RoHS revision to discussions on a strengthening of the WEEE directive, but the Council wanted to keep the two dossiers separate. A parliament first reading vote on the WEEE revision is scheduled for February 2011, and the council will not issue its position until after the vote has taken place. Legislators are thus aiming for a second reading agreement late 2011.

The main issues are the possible shift of burden for reaching collection targets to EEE manufacturers as well as new collection targets that are adapted to country specificities and in relation to the number of products placed on the market. “Currently, the majority of member states are resisting a proposal by the European Commission, backed by the European Parliament's environment committee, to set a 65% collection rate for waste from electrical and

⁵⁹ http://ec.europa.eu/environment/waste/weee/pdf/faq_weee.pdf, FAQ 1.8 “Do the WEEE and the RoHS Directives apply to electrical and electronic products for professional use?” Answer: “The WEEE Directive contains provisions that cover WEEE from households and WEEE from users other than private households. WEEE from private households means WEEE which comes from private households and from commercial, industrial, institutional and other sources which, because of its nature and quantity, is similar to that from private households. WEEE from other users than private households can then be all WEEE that is not defined as WEEE from private households. Financing provisions in respect of WEEE from private households are laid down in Article 8 while Article 9 covers WEEE from users other than private households. In addition, Article 10(3) does not specifically limit the marking obligation to electrical and electronic equipment (EEE) for private households because in some cases it is difficult to distinguish between households and professional electrical and electronic equipment. Therefore, the marking obligation also applies to EEE for professional use.”

⁶⁰ However, e.g. in Germany the general requirements set out in article 9 (1) of WEEE were not yet incorporated into national legislation (ElektroG).

electronic equipment (WEEE) by 2016. According to a progress report from the Council of Ministers, the Belgian presidency has proposed a phased approach according to which a 45% target would be set four years after the rules' entry into force, followed by a 65% target two years later. A majority of delegations favour this approach though some still want a longer transition period, according to the report.”⁶¹

Also the scope of the Directive shall be clarified as currently the scope of the WEEE directive is unclear, e.g. types of appliances shall be categorized as household (B2C – business to consumer) and non-household appliances (B2B – business to business). “Twelve countries support giving the WEEE directive an open scope as demanded by the environment committee. Twelve other states want to limit the law's scope to specific products. As a compromise Belgium suggested a narrow definition of what constitutes EEE equipment, which would limit the number of products falling into an open scope. Other issues of disagreement remain, for example whether a producer of electrical and electronic equipment should be defined at national or EU level and whether the cost of managing WEEE should be displayed on product labels.”⁶¹

Should these changes come into force, industry would be forced to make sure that they control the waste stream more than they do now in order to meet the (more demanding) collection and recycling targets.

4.1.6 Biocide Directive 98/8/EC

This Directive⁶² concerns: (a) the authorisation and the placing on the market for use of biocidal products within the Member States; (b) the mutual recognition of authorisations within the Community; and (c) the establishment at Community level of a positive list of active substances which may be used in biocidal products.

Biocidal products are defined as active substances and preparations containing one or more active substances, put up in the form in which they are supplied to the user, intended to destroy, deter, render harmless, prevent the action of, or otherwise exert a controlling effect on any harmful organism by chemical or biological means.

The guidance document for the Biocidal Products Directive (BPD)⁶³ provides the following explanations:

- Human hygiene biocidal products: Detergents and cleaning products (auxiliary aids for washing processes like fabric conditioners are included) intended to have a biocidal activity (reliably controlling micro-organisms like fungi and bacteria) are biocidal products.

⁶¹ <http://www.endseurope.com/25218?referrer=channel%2Dwaste>

⁶² <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1998:123:0001:0063:EN:PDF>

⁶³ Source: Guidance document agreed between the Commission services and the competent authorities of the Member States for the Biocidal Products Directive 98/8/EC (Doc-Biocides-2002/04-Rev3; 31.10.2003); <http://ec.europa.eu/environment/biocides/pdf/definitions.pdf>

The Commission services and all Member States except Austria agreed to the following clarification: When associated with cleaning products, the word 'hygiene' can be used without immediately causing the product to fall under the scope of the BPD as long as no reference (words, pictures, etc.) to antimicrobial or disinfecting action is made.

- Private area and public health area disinfectants and other biocidal products: Detergents containing in-can preservatives, but not intended to have biocidal effects, are not in the scope of BPD. However, detergents containing a biocidal active substance, *intended to have biocidal effects under conditions of use, with or without biocidal claim*, should be regarded as biocidal products. The definition of a biocidal product in Directive 98/8/EC is that it is "intended" as such and does not necessitate a claim to be made. However, it is reasonable to expect that an intended biocidal action would be reflected in a relevant claim. In the absence of such a claim, on the label or elsewhere, some other relevant matter in the context in which the product is presented beyond its formulation (e.g. presentation of the product, use instruction etc.) would be needed to justify a conclusion that it was 'intended' to be biocidal. The current wording reflects the definition. In case of a divergence of views concerning a particular product between the authorities and the person responsible for placing the product on the market, it is up to the latter to demonstrate that no biocidal effect was intended.

Currently, the approval procedure for biocidal active substances of the product types 1 to 4 (related to disinfectants) is ongoing. Active substances being approved in the EU will be listed in Annex 1 of the BPD in the coming years. Only after that, national product approvals in the Member States will be starting, i.e. the disinfectants with biocidal active substances will be approved at national level according to the BPD. Meanwhile transitional agreements apply.

Both the professional laundry (e.g. in health care laundry) and the dishwashing sector use biocidal detergent systems to achieve a certain level of hygiene; thus being affected by the Biocidal Products Directive. In the washing and drying process, hygienic requirements are usually met by a predefined level of process temperatures, however depending on the use of detergents with or without disinfection components of the detergents.

4.1.7 Gas Appliances Directive (GAD) Directive 2009/142/EC

The Directive regulates appliances burning gaseous fuels used for cooking, heating, hot water production, refrigeration, lighting or washing with (where applicable) a normal water temperature not exceeding 105°C. The GAD applies to all gas heated and combined gas-heated applications. Although the Directive mainly covers common consumer and commercial products, so-called fittings are comprised, too. Appliances specifically designed for use in industrial processes carried out on industrial premises are excluded.

The GAD has been subject to a recent codification which is a process of incorporating a legislative act and all its amendments into a single new act. The new codified version is referred to as Directive 2009/142/EC and came into force on 4 January 2010. From this date, any references to the repealed Directive 90/396/EEC⁶⁴ shall be construed as references to Directive 2009/142/EC.

4.1.8 Water Framework Directive (WFD) 2000/60/EC

The Water Framework Directive⁶⁵ establishes a legal framework to protect and restore clean water across Europe and ensure its long-term, sustainable use. The directive establishes an innovative approach for water management based on river basins, the natural geographical and hydrological units, and it sets specific deadlines for Member States to protect aquatic ecosystems. The directive addresses inland surface waters, transitional waters, coastal waters and groundwater, and it establishes innovative principles for water management, including public participation in planning and economic approaches, including the recovery of the cost of water services.

Inter alia, the Water Framework Directive introduces two key economic principles. First, it calls on water users – such as industries, farmers and households – to pay for the full costs of the water services they receive. Second, the directive calls on Member States to use economic analysis in the management of their water resources and to assess both the cost-effectiveness and overall costs of alternatives when making key decisions. Under the directive the recovery of costs refers to several elements. The prices users pay for water should cover the operational and maintenance costs of its supply and treatment and the costs invested in infrastructure. The directive goes further and requires that prices paid by users also cover environmental and resource costs. This is a key step towards implementing the economic principle that polluters and users should pay for the natural resources they use and the damage they create.

Further, Articles 4, 10, 11 and 16 and Annexes V, VIII, IX and X of the Directive address chemical pollution. By targeting priority substances, the Water Framework Directive focuses on individual pollutants or groups of pollutants that present significant risk to or via the aquatic environment. The substances are identified through rigorous risk assessments, which involve examining scientific evidence of the hazardous properties of the substances, their contamination of European waters, and other factors such as volumes used. Among the 33 chemicals categorised as priority substances, 13 are designated as priority hazardous substances due to their persistence, bioaccumulation and toxicity. The European Commission will review this list every four years, to allow for the inclusion of additional substances of

⁶⁴ <http://eur-lex.europa.eu/LexUriServ/site/en/consleg/1990/L/01990L0396-19930802-en.pdf>

⁶⁵ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2000:327:0001:0072:EN:PDF>
http://ec.europa.eu/environment/water/participation/notes_en.htm

concern. The Water Framework Directive seeks to progressively reduce emissions, discharges and losses of priority substances to waters. Priority hazardous substances are to be phased out completely within 20 years.

None of the 33 listed priority substances is expected to be in detergents used for professional laundry and dishwashing processes. Amongst the 13 substances being designated as priority hazardous substances, EDTA⁶⁶ is still used in detergents. In Germany, for example, since 1991 several industrial associations (e.g. IKW and IHO⁶⁷) have voluntarily committed to abandon the use of EDTA to a large extent. Thus, in Germany EDTA is only found in few specialised detergent products of the industrial and institutional (I&I) sector.

In general, the WFD prescribes the creation of incentives for an efficient use of water resources and focuses on improvement of sustainability of production.

4.1.9 Commission Regulation (EC) No. 648/2004 – Detergents

Detergents have to fulfil the requirements laid down by Regulation (EC) No. 648/2004 on detergents.⁶⁸ This regulation establishes rules designed to achieve the free movement of detergents and surfactants for detergents in the internal market while, at the same time, ensuring a high degree of protection of the environment and human health. For this purpose, this Regulation harmonises the following rules for the placing on the market of detergents and of surfactants for detergents:

- the biodegradability of surfactants in detergents;
- restrictions or bans on surfactants on grounds of biodegradability;
- the additional labelling⁶⁹ of detergents, including fragrance allergens; and
- the information that manufacturers must hold at the disposal of the Member States competent authorities and medical personnel.

⁶⁶ EDTA (ethylene-diamino-tetra-acetate): A class of synthetic, phosphate-alternative compounds used to reduce calcium and magnesium hardness in water. EDTA is also used to prevent bleaching agents from becoming active before they're immersed in water and as a foaming stabilizer.

⁶⁷ IKW: Industrieverband Körperpflege- und Waschmittel; IHO: Industrieverband Hygiene und Oberflächenschutz

⁶⁸ For the purpose of Regulation (EC) No. 648/2004 'detergents' means any substance or mixture containing soaps and/or other surfactants intended for washing and cleaning processes. Detergents may be in any form (liquid, powder, paste, bar, cake, moulded piece, shape, etc.) and marketed for or used in household, or institutional or industrial purposes. Other products to be considered as detergents are: 'Auxiliary washing mixture', 'Laundry fabric-softener', 'Cleaning mixture', 'Other cleaning and washing mixtures', intended for any other washing and cleaning processes.

⁶⁹ The Detergent Regulation sets the requirement for more specific detergent package labelling on issues including the ingredient datasheet, the number of standard washing machine loads and the enterprise's contact details. The labelling requirements vary depending on whether the product is sold to the general public or for use in the industrial sector only. Specific provisions regarding labelling are laid down in Annex VII to the Regulation. In addition, the packaging of detergents regarded as biocides, such as disinfectants, will be required to have special biocidal product labelling following a transitional period.

4.1.10 Commission Regulation (EC) No. 842/2006 – Fluorinated GHG

The objective of this Regulation⁷⁰ is to contain, prevent and thereby reduce emissions of the fluorinated greenhouse gases covered by the Kyoto Protocol. Annex I to this Regulation contains a list of the fluorinated greenhouse gases currently covered by this Regulation, together with their global warming potentials.

Fluorinated gases are powerful greenhouse gases with global warming potentials many times that of natural greenhouse gases such as carbon dioxide. They also tend to remain much longer in the atmosphere than natural greenhouse gases. Because of this, they are included in the basket of gases controlled by the Kyoto Protocol and Parties to the Protocol that have an emissions target are required to control and reduce emissions of Fluorinated gases. Fluorinated gases are man made substances and Regulation 842/2006 defines them as follows: fluorinated greenhouse gases' means hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆) as listed in Annex I of the Regulation.

This Regulation addresses the containment, use, recovery and destruction of the fluorinated greenhouse gases listed in Annex I; the labelling and disposal of products and equipment containing those gases; the reporting of information on those gases; the control of uses and the placing on the market prohibitions of the products and equipment; and the training and certification of personnel and companies involved in activities provided for by this Regulation. For professional washing machines and dryers, this Regulation applies in those cases when the appliances are equipped with heat pumps containing refrigerants.

4.1.11 Commission Regulation (EC) No. 1275/2008 – Standby

The Regulation⁷¹ sets out eco-design requirements for standby and off mode electric power consumption. The application is limited to products corresponding to household and office equipment intended for use in the domestic environment. 'Electrical and electronic household and office equipment' is defined as energy-using products which:

- a) are made commercially available as a single functional unit and are intended for the end-user;
- b) fall under the list of energy-using products of Annex I of the Directive (inter alia washing machines and dryers);
- c) are dependent on energy input from the mains power source in order to work as intended; and
- d) are designed for use with a nominal voltage rating of 250 V or below, also when marketed for non-household or non-office use.

⁷⁰ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:161:0001:0011:EN:PDF>

⁷¹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:339:0045:0052:EN:PDF>

The Standby Directive only covers appliances being in the scope of the Low Voltage Directive (LVD). As professional washing machines and dryers do not fall under the LVD but under the Machinery Directive (see Sections 2.4.2 and 4.1.1), they are also not covered by the scope of the Standby Regulation.

4.1.12 European labelling

There is no EU-wide mandatory measure regarding the efficiency of professional washing machines and dryers.

4.2 Legislation at member state level

No legislation at member state level regarding professional washing machines and dryers has been found. Regarding labelling, there are environmental labels for textile respectively wet-cleaning services in Germany and Norway.

German RAL-UZ 104 for Wet Cleaning Services

In cooperation with the Federal Minister for the Environment, Nature Conservation and Nuclear Safety, the Federal Environmental Agency and considering the results of the expert hearings conducted by RAL gGmbH, the Environmental Label Jury has set up these Basic Criteria for the Award of the Environmental Label for Wet Cleaning Services (2009)⁷². They apply to wet cleaning services for the treatment of personal textile or leather outerwear and home textiles which use water as only solvent for the cleaning process.

- The following instrumental requirements must be fulfilled:
 - The special wet-cleaning washing machine must have a minimum drum volume of 100 litres.
 - The wet-cleaning machine must have a programmable control system, a temperature control device as well as a dosing device for the washing agents.
 - Dryers used for the wet-cleaning process must be equipped with a temperature limiting and a time-limiting device as well as with a humidity measurement device.
- Requirements for Water and Energy Consumption:
 - Normal outerware with easily removable soiling: the water consumption of wet cleaning systems must not exceed 12 litres per kg of cleaned goods.
 - For washing and drying programmes the energy consumption of **all-electric wet cleaning systems for heating purposes** must not exceed 0.5 kWh of electric current per kg of goods to be cleaned and 0.2 kWh of electric current per kg of goods to be cleaned for driving and auxiliary units.

⁷² http://www.blauer-engel.de/en/products_brands/vergabegrundlage.php?id=21

- For washing and drying programmes the energy consumption of **steam-heated wet cleaning systems** must not exceed 0.7 kg of steam per kg of goods to be cleaned and 0.2 kWh of electric current per kg of goods to be cleaned for driving and auxiliary units.
- All other units used for drying purposes shall be named together with the energy consumption data (kWh per kg of cleaned goods).
- Requirements for Cleaning Agents:
 - Solvents: Cleaning must be done without the addition of organic solvents to the bathes (pre-cleaning, main cleaning and rinsing bath).
 - Exclusion of certain ingredients
- Requirements for Waste Water

German RAL⁷³ Quality Certification Marks for Household and Commercial Linen (RAL-GZ 992/1 – edition of 1953); for Hospital Linen (RAL-GZ 992/2 – edition of 1986); and for Linen from Food Processing Businesses (RAL-GZ 992/3 – edition of 1998)⁷⁴

The RAL Quality Certification Marks RAL-GZ 992/1, RAL-GZ 992/2 and RAL-GZ 992/3 are awarded to the commercial laundries that form the German Certification Association for Professional Textile Services on the basis of standardised quality and control specifications.

Criteria for obtaining the quality label include a membership of the commercial laundry in the quality mark association as well as compliance with the specifications contained in the quality label's quality and inspection provisions:

- General framework conditions, such as a structural separation between "clean" and "non-clean" areas.
- Implementation of a quality management system.
- Microbiological values which must be adhered to. As part of an audit, so-called bio-indicators are used as an additional instrument in hygiene inspections; they run through the laundering process and are used to prove that the selected laundry method achieves the specified disinfectant performance.

⁷³ RAL, the German Institute for Quality Assurance and Certification, was established in 1925 as a joint initiative by private businesses and the government of the day. Initially, its task was to standardise precise technical terms and conditions of sale in the interests of rationalisation. Today, RAL is the recognised institution for efficient and reliable labelling of products and services of all kinds. RAL Quality Certification Marks are voluntary regulatory measures used by business and are free of any kind of state influence. A comprehensive system of regular self-monitoring and neutral external monitoring helps to ensure that the quality prescribed by the relevant quality specifications is maintained.

⁷⁴ Sources: www.waeschereien.de; http://www.hohenstein.de/ximages/1354434_ggralgz992.pdf, sighted on 08 January 2010

- Regular in-house and external audits. The in-house testing of the finished laundry includes the following criteria: cleanliness, degree of whiteness, dryness, smoothness, effectiveness of finishing treatment, quality of laying out and folding, odour and packaging. In particular, dry linen, mangle linen and shaped items are tested separately. The external monitoring covers the washing processes and the whole operation of the company including hygiene.
- Inspection of results from in-house and external audits by external experts and adjustment to specified values.

Nordic Ecolabelling of Textile Services

Criteria document version 2.0 from 27 April 2010,⁷⁵ valid from 15 December 2009 to 31 December 2012 defines the following:

Scope: The criteria for textile services are a combination of the criteria that formerly applied to hand towel rolls and laundries. The product group encompasses the full range of textile services and a licence may be awarded to individual production units or multiple units that form part of a chain/group of companies. Each unit must fulfil the requirements. In the case of hand towel rolls, the Nordic Ecolabel may be awarded for the laundry in its entirety or solely to those areas of the laundry operations that apply to hand towel rolls. The criteria do not encompass production units doing only dry cleaning. Such units may apply according to the criteria alternative dry cleaning.

Specification of textile categories: The separate groups of textiles to be washed have special requirements that shall be complied with in order to obtain the license. The requirements on ecolabelling include the following distinct categories of textiles:

⁷⁵ <http://www.svanen.se/Templates/Criteria/CriteriaGetFile.aspx?fileID=114261001>

Table 16 Different groups of textiles according to Nordic Ecolabelling of Laundries

No.	Textile category	Details
1	Work clothes industrial / kitchen / butchering and equivalent use. Kitchen textiles (cloths and towels)	Clothing, such as work clothes for mechanical industrial work, offshore industry, outdoor military clothes and bags, the foodstuffs industry, the medical industry and the like, as well as clothing for butchers, cooks and the like. Kitchen clothes, floor clothes, cooks whites, kitchen towels and the like for restaurants and institutional kitchens etc. These textiles are often characterised by their heavy degree of soiling and may be difficult to clean.
2	Work clothes, institutions / retail / service. Private clothes from households / institutions; shoes	Clothing for use in service industries, retail outlets, hotels, hospitals, nursing homes and other institutions. Indoor military textiles. Private clothes typically from citizens not able to do their own laundry. All kinds of shoes (typical for industrial use) sent to laundering. The category will usually be work clothes with a somewhat smaller degree of soiling than in the previous category and furthermore shoes and light soiled private clothes which requires special sorting and handling in smaller scale machines.
3	Hotels	Bed clothes and towelling from hotels and other overnight accommodation. Often this will involve lightly soiled textiles since they will often have been in limited use before being sent off for laundering.
4	Restaurants	Tablecloths, napkins and the like for use in restaurants, industrial kitchens etc. This will often be textiles with a medium degree of soiling. Although the stains in question may frequently require relaundering.
5	Hospitals/nursing homes	Textiles from hospitals and nursing homes and similar institutions including bed-clothes, contour sheets, surgical scrubs, barrier sheets and patient clothing, but excluding the work wear of personnel and the category "comforters and pillows". Although there will be a wider degree of variation in soiling, on average it can be viewed as of medium intensity.
6	Comforters and pillows	Comforters, pillows, sleeping bags and mattress toppers from for example hospitals, nursing homes, hotels, summer houses, ski lodges and the like. The volume per kilo of these textiles will often be high, which makes for a lower degree of filling. Moreover, it is difficult to remove water from these textiles before drying, which in turn means that the tumble drying process consumes more energy.
7	Mats for offshore industry and mops	Mats used in the heavily soiled offshore industry and mops used for cleaning purposes. Often very heavily soiled, but do not need to be completely clean. Frequently treated after laundering in order to secure enhanced soil retention or other properties.
8	Other mats	Mats for entrance ways and the like for capturing dirt and water. Often heavily soiled, but do not need to be completely clean. Frequently treated after laundering in order to secure enhanced soil retention properties.
9	Textile hand towel rolls	Cotton cloth hand towel rolls for hand drying in toilets and the like.
10	Industrial wiping cloths	Textile cloths for drying in for example the graphic and mechanical industries. Will often be heavily polluted cloths containing traces of printers ink, oils, metal filings
11	Dry cleaning	All textiles that are dry-cleaned internally and/or externally including private clothing. These will typically be delicate textiles not capable of withstanding washing.
12	Other	Textiles that are not encompassed by the above categories and that generally make up a small proportion of the textiles laundered by the laundries.

Ecolabelling criteria for the laundries⁷⁶:

- Energy requirements;
- Requirements on the emission of climate gases;
- Requirements on water consumption;
- Requirements on transport;
- Requirements on laundry chemicals;
- Requirements on constituent substances.

The document describes further requirements on finished washable textiles, on waste water discharge, on waste treatment and collection system and on packaging. Finally, there are requirements on quality control of the laundry, authority requirements for working security, health and environment, requirements on the environmental- and quality assurance as well as marketing criteria to be fulfilled.

4.3 Third country legislation

4.3.1 USA

The Energy Policy Act of 1992 set standards for certain commercial equipment and set schedules requiring the U.S. Department of Energy (DOE) to make, review, and update standards. DOE currently is active in standards development for a range of commercial products. While professional clothes washers are in the scope of the US Energy Conservation Standard,⁷⁷ professional dryers are not yet.

Energy Conservation Standards for [...] Certain Commercial and Industrial Equipment (Commercial Clothes Washers)

“Energy Conservation Standards for Certain Consumer Products (Dishwashers, Dehumidifiers, Microwave Ovens, and Electric and Gas Kitchen Ranges and Ovens) and for Certain Commercial and Industrial Equipment (Commercial Clothes Washers); Final Rule, Federal Register, 75 FR 1122, January 8, 2010”⁷⁸

The U.S. Department of Energy's Appliances and Commercial Equipment Standards Program develops test procedures and minimum efficiency standards for residential appliances and commercial equipment.

⁷⁶ Note: the requirements refer to the whole textile service, not to individual laundry appliances.

⁷⁷ http://www1.eere.energy.gov/buildings/appliance_standards/commercial_products.html

⁷⁸ http://www1.eere.energy.gov/buildings/appliance_standards/commercial/clothes_washers.html; sighted on 7 September 2010

The Energy Policy and Conservation Act (EPCA) (42 USC 6295 (e)), as amended, requires the U.S. Department of Energy (DOE) to determine whether amended, more stringent standards would be technologically feasible and economically justified. Commercial clothes washers were originally included in the final rule for residential dishwashers, dehumidifiers, and cooking products, and commercial clothes washers. However, DOE needed to conduct supplemental rulemaking analyses to complete the rulemaking. As a result, the standards for commercial clothes washers are under development in a separate rulemaking through a supplemental notice of proposed rulemaking and final rule.

Any such amended energy conservation standard must be designed to “achieve the maximum improvement in energy efficiency. Furthermore, any new or amended standard must result in significant conservation of energy.”

Table 17 shows the amended standard levels that DOE is adopting currently. These standards will apply to all commercial clothes washers manufactured for sale in the United States, or imported to the United States, on or after January 8, 2013.

Table 17 Amended energy conservation standards for commercial cloth washers

Criteria/Product Type	Amended energy conservation standards
Top-loading commercial clothes washers	1.60 Modified Energy Factor (MEF) 8.5 Water Factor (WF)
Front-loading commercial clothes washers.	2.00 Modified Energy Factor (WF) 5.5 Water Factor (WF)

Furthermore, California's Appliance Efficiency Regulations were established in 1976 in response to a legislative mandate to reduce California's energy consumption. The regulations are updated periodically to allow consideration and possible incorporation of new energy efficiency technologies and methods. The 2009 Appliance Efficiency Regulations, (California Code of Regulations, Title 20, Sections 1601 through 1608)⁷⁹ effective August 9, 2009, were adopted by the California Energy Commission (CEC) on December 3, 2008, and approved by the California Office of Administrative Law on July 10, 2009. The Appliance Efficiency Regulations include standards for both federally-regulated appliances and non-federally-regulated appliances.

While for dryers, the Californian Appliance Efficiency Regulations only include appliances that are federally-regulated consumer products, commercial clothes washers do fall under the scope.

- Definition: “Commercial clothes washer” is defined as a soft mount front-loading or soft mount top-loading clothes washer with clothes container compartment no greater than

⁷⁹ Source: <http://www.energy.ca.gov/2009publications/CEC-400-2009-013/CEC-400-2009-013.PDF>

3.5 ft³ (99 litres) for horizontal axis clothes washers, or no greater than 4.0 ft³ (113 litres) for vertical-axis clothes washers,⁸⁰ that is designed for use in:

- applications where the occupants of more than one household will be using it, such as multi-family housing common areas and coin laundries; or
- other commercial applications.
- Test method: For commercial clothes washers, the test method 10 CFR Section 430.23(j) (Appendix J1 to Subpart B of Part 430) (2008) applies; however being a test programme for consumer products.⁸¹
- Energy and water efficiency standards: Commercial clothes washers manufactured on or after January 1, 2007 shall have a modified energy factor of at least 1.26 and a water consumption factor of not more than 9.5.

ENERGY STAR Label Commercial Clothes Washers

ENERGY STAR is a joint programme of the U.S. Environmental Protection Agency and the U.S. Department of Energy. Criteria for energy labelling:⁸²

- Types: front-loading washer or a top-loading washer.
- Volume: Tub capacity of the clothes washer in cubic feet.⁸³
- Energy requirements
 - kWh/year: This is the estimated annual energy use of the washer under typical conditions. It is based on an annual usage of 392 loads per year, or around 8 loads per week. Actual energy consumption will vary depending on the amount of laundry done, the size of the loads, and the temperature settings used. This figure is calculated according to the Department of Energy test procedure, Code of Federal Regulations, Title 10, Section 430. It incorporates the estimated energy consumed by the washer and also the energy needed to heat the water with an electric water heater. Households with a gas water heater will use significantly fewer kilowatt hours but will consume gas to heat the same water.
 - Modified Energy Factor (MEF): MEF is the official energy efficiency metric used to compare relative efficiencies of different clothes washers. MEF considers the en-

⁸⁰ One cubic foot (ft³) equates 28.32 litres

⁸¹ PART 430: Energy conservation program for consumer products. Appendix J1 to Subpart B of Part 430: Uniform Test Method for Measuring the Energy Consumption of Automatic and Semi-Automatic Clothes Washers. For more details, cf.

<http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=6e467fb0b172d3508a249d20c47da096&rgn=div9&view=text&node=10:3.0.1.4.16.2.9.7.17&idno=10>

⁸² http://www.energystar.gov/index.cfm?c=clotheswash.pr_crit_clothes_washers

⁸³ 1 cubic feet: 1 ft³ = 28.317 litres

ergy used to run the washer, heat the water, and run the dryer. The higher the MEF, the more efficient the clothes washer. ENERGY STAR qualified clothes washers must have a minimum MEF of 2.0. The minimum Federal standard requirement for clothes washers is an MEF of 1.26 (see above).

- Water requirements
 - Water Factor (WF): a measurement of water efficiency that is calculated as gallons⁸⁴ of water used per cubic foot⁸³ of capacity. A clothes washer which needs 30 gallons (113.5 litres) per cycle and which has a tub volume of 3.0 cubic feet (85 litres), for example, will produce a water factor of 10.0. The lower the WF, the more efficient the clothes washer. ENERGY STAR qualified clothes washers must have a maximum WF of 6.0.
 - Annual Water Use (Gallons per year): estimated annual water use of the washer under typical conditions. It is based on an annual usage of 392 loads per year, or around 8 loads per week. Actual water consumption will vary depending on the amount of laundry done.

Table 18 The ENERGY STAR criteria for clothes washers

Criteria/Product Type	Current criteria levels (as of January 1, 2011)	Former criteria levels (as of July 1, 2009)
ENERGY STAR top and front loading	MEF >= 2.0 WF <= 6.0	MEF >= 1.8 WF <= 7.5
Federal Standard top and front loading	MEF >= 1.26 WF <= 9.5	MEF >= 1.26 WF <= 9.5

MEF = modified energy factor, WF = water factor (gallons per cycle per cubic foot)

Since 1 January 2011, the above listed revision has come into force. According to the "Commercial Clothes Washers Qualified Product List" posted on January 20, 2011, around 40 commercial clothes washers have qualified for the ENERGY STAR.⁸⁵

The ENERGY STAR Program Requirements Product Specification for Clothes Washers are based on the test method 10 CFR 430, Subpart B, Appendix J1 (Electronic Code of Federal Regulations), however being a test programme for consumer products.⁸⁶

⁸⁴ 1 US gallon = 3.78 litres

⁸⁵ http://www.energystar.gov/ia/products/prod_lists/comm_washers_prod_list.xls

⁸⁶ PART 430: Energy conservation program for consumer products. Appendix J1 to Subpart B of Part 430: Uniform Test Method for Measuring the Energy Consumption of Automatic and Semi-Automatic Clothes Washers. For more details cf. <http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=6e467fb0b172d3508a249d20c47da096&rgn=div9&view=text&node=10:3.0.1.4.16.2.9.7.17&idno=10>

4.3.2 Canada

Regulations under the Energy Efficiency Act,⁸⁷ in effect since 1995, set minimum energy-performance levels for a number of energy-using products such as appliances, lighting, and heating and air-conditioning products. Broadening and strengthening the Act means that 80 percent of the energy used in homes and businesses will soon be regulated. Over time, the set of planned new regulations will tighten requirements for 10 products such as residential dishwashers, and will address about 20 currently unregulated products including commercial clothes washers. However, the latest amendment 11 and 12 bulletins published did not yet cover this product group.

ENERGY STAR Canada for commercial clothes washers

Natural Resources Canada's (NRCan's) Office of Energy Efficiency (OEE) promotes the international ENERGY STAR symbol in Canada and monitors its use.⁸⁸ This also applies for the Energy Star label for the following categories of commercial clothes washers:

Coin- or card operated, soft-mount front-loading and top loading clothes washers with a tub not greater than 99.3 litres (approx. 9 kg) for front-loading washers or not greater than 113 litres (approx. 11 kg) for top-loading washers, designated for use in applications where the occupants of more than one household will be using it, such as a multi-family housing common areas and coin-laundries, hotels, or in other commercial applications.

4.3.3 Australia

A wide range of products are regulated for energy efficiency in Australia. Also, new products are continually being considered for regulation or other types of programs in order to improve energy efficiency. Other than for commercial refrigeration appliances, professional washing machines or dryers do not fall under the (considered) scope of the Australian energy efficiency regulation so far.⁸⁹

4.3.4 China

The China Standard Certification Center (CSC),⁹⁰ formerly known as China Certification Center for Energy Conservation Products (CECP), was officially founded in October 1998, by the former China State Economic and Trade Commission (SETC) with an approval from the former State Bureau of Quality and Technical Supervision. CSC has been administrated by China National Institute of Standardization. Over the past several years, CSC has continuously introduced various product certification programs to promote the use of energy

⁸⁷ Source: http://oee.nrcan.gc.ca/regulations/home_page.cfm

⁸⁸ <http://oee.nrcan.gc.ca/residential/business/manufacturers/commercial-products.cfm?attr=12>

⁸⁹ Source: <http://www.energyrating.gov.au/considered.html>

⁹⁰ <http://www.cecp.org.cn/english/index.asp>

conservation, water conservation and environmental-friendly products and equipment. In addition to lighting products, CSC's energy conservation certification programs now cover over other 35 product categories, for example home appliances, electronic, industrial, office equipments, building materials, etc. To date, more than 2 000 individual products from approximately 250 manufacturers have participated in the certification program. However, no information on professional washing machines and dryers has been found.

4.3.5 Russia

No information on Russian regulations with regard to professional washing machines and dryers has been found.

4.3.6 Thailand

Thai Green Label TGL-17-98 Laundry services and dry cleaning services (1998)

Laundry services use a large volume of water thus discharging waste water to the environment. Additionally, some chemicals and nutrients from slow or non biodegradable detergents accumulate in the environment causing water and soil pollution. The criteria for laundry services require to have limited water consumption and use high quality detergents which will reduce wastewater load to the environment.

- Category Definition: This category includes only laundry service in registered shops, hotels and hospitals.
- Green Label Requirements: To be authorized to carry the Green label, a product must meet both the general requirements and the specific requirement listed below:
 - General Requirements: The service process, transportation and disposal must follow to the requirements of all applicable governmental acts and regulation such as Public Health Act, Factory Act etc.
 - Product Specific Requirements: Laundry Services
 - must not use water exceeding 30 litres per washing cycle per 1 kg dry cloth;
 - must have a plan to reuse hangers;
 - must ensure that in industrial service, the chemicals used underlie a suitable storage and handling system;
 - must use Green Label laundry detergent or detergents that meet the requirements of Green Label laundry detergent regarding aerobical and anaerobical biodegradability, pH values, and phosphate content. Furthermore, there are requirements regarding forbidden substances / unused chemicals in the detergents.

5 Conclusions: Scope of the study

5.1 Professional washing machines

Within Lot 24 we define professional washing machines as follows (cf. Section 2.4.3):

‘Professional washing machine’ means a machine which cleans and rinses laundry like clothes, tablecloths, bedclothes, towels, and other textiles or items by using water, chemical, mechanical, and thermal means; which might also have a spin extraction or drying function and which is designed to be used principally for commercial and industrial purposes as stated by the manufacturer in the Declaration of Conformity (DoC).

The delimitation of professional washing machines to those for household use is determined from the ‘intended use’ (domestic or commercial / industrial use) as declared by the manufacturer in the product information or the Declaration of Conformity (cf. Section 2.4.2).

Besides this formal distinction, professional and household washing machines can be distinguished by functional performance and technological differences resulting from different requirements regarding the washing process. Professional washing machines need to take into account important framework requirements (shorter running cycles, high throughput, amount and type of laundry, spatial requirements) to fulfil their primary function (to clean and rinse a certain amount of laundry). Reflecting these framework requirements and taking into account functional and technological differences, professional washing machines can be categorised into the following seven categories (cf Section 2.5.5.1):

- WM1: Semi-professional washer extractor
- WM2: Professional washer extractor, <15 kg
- WM3: Professional washer extractor, 15-40 kg
- WM4: Professional washer extractor, >40 kg
- WM5: Professional washer dryer
- WM6: Professional barrier washer
- WM7: Washing tunnel machine;

Due to the following reasons dry-cleaning machines will fall out of the scope of Lot 24 on professional washing machines:

- In the Eco-design regulation on household washing machines, such appliances are defined as "an automatic washing machine which cleans and rinses textiles using water which also has a spin extraction function and which is designed to be used principally for non-professional purposes". Thus, washing machines use water for cleaning and

rinsing textiles. Dry cleaning machines, on the other hand, use other solvents for cleaning textiles.

- Dry-cleaning machines do not perform the same function as washing machines. Especially with regard to water-soluble stains, the performance is worse than washing machines. On the other hand, for some types of textiles it is not possible to wash them (i.e. in a washing machine) but only to dry-clean them.
- Dry-cleaning machines are clearly different to washing machines with regard to technology, as outlined in this working paper. It would therefore not be possible to describe a dry-cleaning machine as a washing machine in order to circumvent regulation.
- Dry-cleaning machines are not manufactured by washing machine manufacturers and vice versa.
- Dry-cleaning machines cover a different market segment (chemical dry-cleaning businesses as opposed to professional laundry services or on-premise laundry).
- The number of dry-cleaning machines produced is much smaller than the aggregated figure for other laundry equipment considered in the project; for details, please refer to the annex of Task 2 report).

5.2 Professional dryers

Within Lot 24 we define professional dryers as follows (cf. Section 2.4.3):

‘Professional dryer’ means a machine which dries laundry like clothes, tablecloths, bedclothes, towels, and other textiles or items by thermally removing the moisture (evaporation) and which is designed to be used principally for commercial and industrial purposes as stated by the manufacturer in the Declaration of Conformity (DoC).

The delimitation of professional dryers to those for household use is determined from the ‘intended use’ (domestic or commercial / industrial use) as declared by the manufacturer in the product information or the Declaration of Conformity (cf. Section 2.4.2).

Besides this formal distinction, professional and household dryers can be distinguished by functional performance and technological differences resulting from different requirements regarding the drying process. Professional dryers need to take into account important framework requirements (shorter running cycles, high throughput, amount and type of laundry, spatial requirements) to fulfil their primary function (to dry a certain amount of laundry). Reflecting these framework requirements and taking into account functional and technological differences, professional dryers can be categorised into the following seven categories (cf Section 2.5.5.2):

- D1: Semi-professional dryer, condenser
- D2: Semi-professional dryer, air vented
- D3: Professional cabinet dryer
- D4: Professional tumble dryer, <15 kg
- D5: Professional tumble dryer, 15-40 kg
- D6: Professional tumble dryer, >40 kg
- D7: Pass-through (transfer) tumble dryer

According to the above definition of dryers thermally removing the moisture by evaporation, those appliances using only mechanical energy for dewatering will fall out of the scope of Lot 24 on professional dryers.

- Separate hydro-extractor or pressing appliances are set up mainly for further processing behind tunnel washing systems. It is the most widely used method for dewatering the batch tunnel washing machines. Within the tunnel washing system, many individual machines are one behind the other. Each of the individual machines fulfils a certain individual function of the washing and rinsing process. Finally, a centrifugal-extractor or water press is supplied at the end.
- However, washing machines with *integrated* mechanical dewatering modules (e.g. washer extractors) fall under the scope of Lot 24. Effects and impacts caused by products of the other outlined processes still might be indirectly assessed within the whole system analysis.

According to Porter et al. (1985), some appliances meet the definition of dryers, however using an indirect method of heat transfer. Thus, their primary function is not drying of the textiles but the removal of creases. Within Lot 24, we will narrow the scope to direct dryers using heated dry air as medium for the heat and humidity transfer (convection principle, drying as primary function). Hence, the following indirect dryers (conduction principle, drying as secondary function) will fall out of the scope of Lot 24:

- Professional ironing tables,
- Ironing and fusing presses, and
- Flatwork ironers.

Further, there are other appliances using the convection principle for drying; however their primary function is not the drying of textiles but the removal of creases by calendaring and relaxing the textiles. Therefore, the following appliances will fall out of the scope of Lot 24:

- Steam air finisher,
- Tunnel finisher.

The laundry appliances being excluded from the scope of Lot 24 are briefly described in the Annex, Section 7.3.

6 Sources

For the categorisation of product types, numerous internet pages and product brochures of manufacturers and industry associations have been analysed:

Table 19 Manufacturers' internet pages being screened within EuP Lot 24

Manufacturer	Internet page
Allied Armstrong	http://www.laundry.ie/
American Dryer Corp. (ADC)	http://amdry.com/products/index.asp
ASKO	http://www.askousa.com/
Broadbent	http://www.broadbent-laundry-systems.co.uk/
Campitel	http://www.campitel.it/english/cat1/main_en.htm
Cissell (Alliance Laundry Systems)	http://www.cissell.com/products/
Continental Girbau	http://www.continentalgirbau.com/products
Danube	http://www.danube-international.com/
Electrolux Professional	http://www.laundrysystems.electrolux.de/
Fimas	http://www.fimassrl.it/en/prodotti-per-lavanderie.asp
Girbau	http://www.commerciallaundryequipment.girbau.com/lc/home http://www.laundryequipment.girbau.com/gi/home
GMP	http://www.gmp.it/enindex.php
Hamony Business	http://www.harmonybusiness.co.uk/Products.html
Hoffman	http://www.hoffman-newyorker.com/products.htm
Hornung GmbH INDUPRESS	http://www.indupress.com / http://tunnelfinisher.com
Huebsch	http://www.huebsch.com/products/
Imesa	http://www.imesa.it/eng/prodotti.php
Ipsos	http://www.ipsos.be/products/main.asp?pagelid=2
IWM Industrial Washing Machines	http://www.indwash.co.uk/products/
Jensen	http://www.jensen-group.com/products.html
Kannegiesser	http://www.kannegiesser.de/wet.0.html?&L=5
Lavamac	http://www.lavamac.eu/
Maytag	http://www.maytag.com/catalog/all_products.jsp
Miele Professional	http://www.miele-professional.com
Milnor	http://www.milnor.com/category.asp?retid=153
Podab	http://www.podab.se/English_Products_DXNI-827429_.aspx
Primus	http://www.primuslaundry.com/products.aspx?lang=EN&swf=products
Schulthess	http://www.schulthess.ch/en/products.html
Staber	http://www.staber.com/
Stahl Wäschereimaschinen	http://stahl-waeschereimaschinen.de/pages/en/products/overview-of-all-products.php?lang=EN
Unimac	http://www.unimac.com/intl/products/products.asp
Warwick	http://www.warwickdryers.co.uk/
Whirlpool commercial	http://www.coinop.com/products/default.asp?type=1

Further valuable sources have been

- The Electrolux Laundry Know-How provides basic knowledge on the washing process, from sorting the laundry to storing it. This includes knowledge about the quality of water and detergents, and information about common washing methods as well as the finishing process.
<http://www.laundrysystems.electrolux.com/Files/Laundryknowhow/HTML/71-0-1.htm>
- Training Modules on the Sustainability of Industrial Laundering Processes – E-learning tool for trainees and employees in laundries. The EU financed Leonardo da Vinci laundry sustainability Internet page comprises six training modules providing basic knowledge about sustainable processing in industrial laundries. Project partners: wfk Forschungsinstitut für Reinigungstechnologie e.V. (D); European Textile Services Ass. (E.T.S.A.) (BE); University of Maribor (SI); Textile Testing Institute (TZU) (CZ); Politechnika Lodzka Katedra (PL); International Committee of Textile Care (CINET) (NL); Herbert Kannegiesser GmbH (D); Unitechnika S.A. (PL); Christeyns (GB).
<http://www.laundry-sustainability.eu/en/>
- Expertly guided on-site visits at
Miele (Germany), Kannegiesser (Germany); Electrolux Professional (Sweden); Central laundry of the University Medical Centre Freiburg (Germany), laundrettes
- Personal information by
 - CENELEC/TC59X, SWG 1.12
 - Danish Technological Institute DTI
 - Electrolux Professional
 - Girbau
 - Miele Professional
 - Primus
 - Schulthess
 - VDMA
 - Kannegiesser,
 - Jensen,
 - Veith
 - SEIBT&Kapp
 - Xeros Ltd.

7 Annex

7.1 Questions to the stakeholders for Task 1

Existing legislation

- Which existing legislation at EU-Member States-Level is being used / observed for professional washing machines and dryers? (please specify between EU Member States)
- Which existing legislation in "third countries" (USA, Australia, Asia etc.) is being used / observed for professional washing machines and dryers? (please specify between States)

General questions regarding ISO 9398

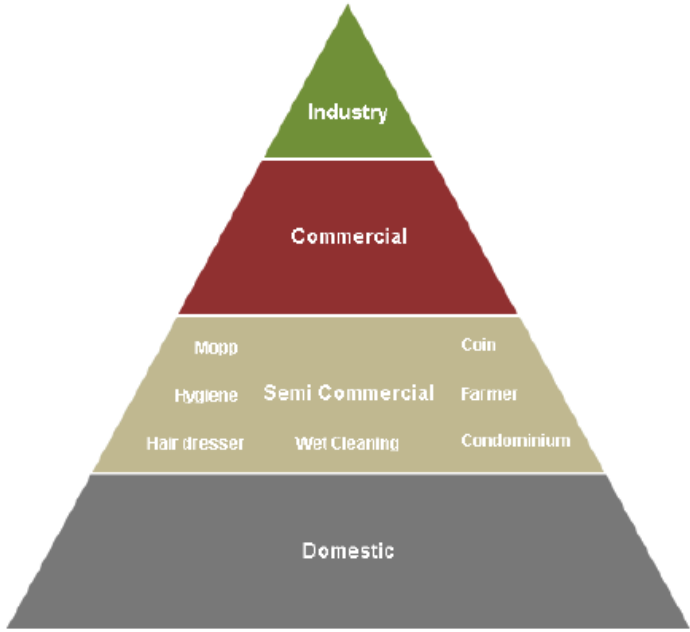
- Are you using those ISO 9398 for measurements?
- For what purpose are the results of the measurements according to the standard used? (i.e. advertising, engineering etc.)?
- Why is there no standard for washing machines (without extraction)? See ISO 10472: washing machines and washer-extractors are combined.

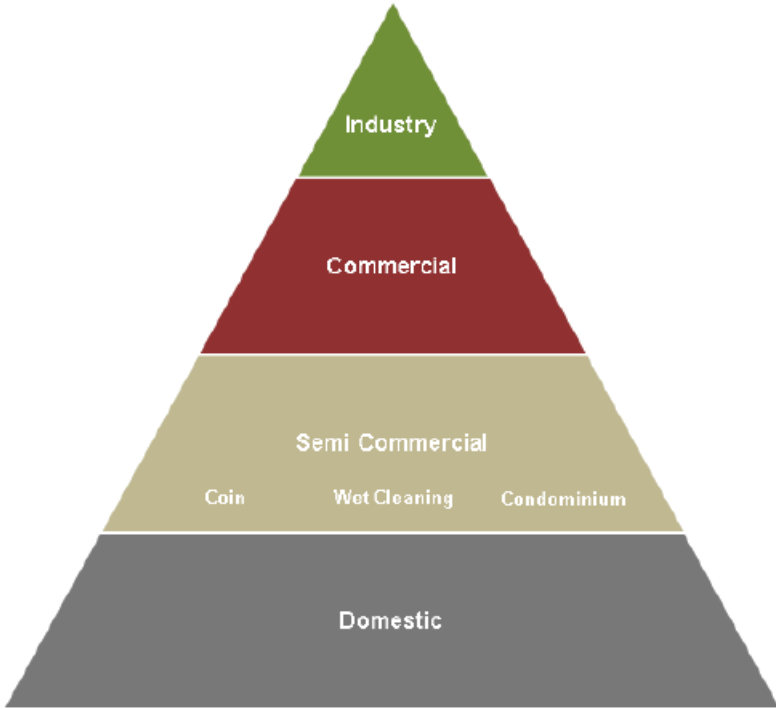
General questions regarding ISO 10472

- What is the purpose of the standards? (i.e. in which context are the standards used?)
Mainly development of new products or also advertising etc.?
- Is compliance to ISO 10472 mandatory?
- Are you contributing in the ISO committee TC 72/SC 5 "Industrial laundry and dry-cleaning machinery and accessories?"

7.2 Stakeholder feedback to draft versions of Task 1

Please note that the feedback refers to prior versions of Task 1 report; thus the indicated numerations of chapters, tables, figures or pages might have changed.

Feedback		Comment																																																		
Miele Professional																																																				
	<p>The difference between the Professional products, semi-commercial products, commercial products plus industrial products is not clarified as it should be. This should be done before the different topics are getting discussed and sorted out.</p> <p>We suggest a differentiation like in following pictures:</p> <div style="display: flex; align-items: center;"> <div style="flex: 1;"> <p style="text-align: center;">WASHER</p>  </div> <div style="flex: 2;"> <table border="1" data-bbox="1124 564 1951 1246"> <thead> <tr> <th>Life cycle</th> <th>Wash time 60°C CW</th> <th>Heating device</th> <th>Capacity</th> <th>Drum volume</th> <th>Filling ratio</th> <th>Electrical connection</th> <th>G-Force</th> <th>Spinn speed</th> <th>Standards/ Norm</th> </tr> </thead> <tbody> <tr> <td>30.000 h</td> <td>~ 45 - 60 min.</td> <td>Steam Gas</td> <td>> 40 kg</td> <td>> 400 l</td> <td>1:12 1:10</td> <td>3 phase 380 V</td> <td>300 - 500</td> <td>400 - 1000</td> <td>DIN ISO 9398- ↓ ROHS Machinery Guideline (2006/42/EG)</td> </tr> <tr> <td>30.000 h</td> <td>~ 45 - 60 min.</td> <td>Steam Gas EL</td> <td>8-40 kg</td> <td>80 - 400 l</td> <td>1:10 1:3</td> <td>3 phase 380 V - * 1 phase 230 V 25+ Amps</td> <td>80 - 540</td> <td>400 - 1200</td> <td>DIN ISO 9398- ↓ ROHS Machinery Guideline (2006/42/EG)</td> </tr> <tr> <td>20-25.000 h</td> <td>~ 45 - 60 min.</td> <td>EL</td> <td>5-8 kg</td> <td>50 - 80 l</td> <td>1:10 1:3</td> <td>3 phase 380 V - * 1 phase 230 V 20+ Amps</td> <td>200 - 540</td> <td>600 - 1200</td> <td>DIN ISO 9398- ↓ ROHS Machinery Guideline (2006/42/EG)</td> </tr> <tr> <td>~ 7.500 h</td> <td>~ 90 - 120 min.</td> <td>EL</td> <td>4,5-10 kg</td> <td>45 - 100 l</td> <td>1:9 1:7</td> <td>1 phase 220 V 10 Amps</td> <td></td> <td>800 - 1600</td> <td>ROHS</td> </tr> </tbody> </table> <p style="text-align: right; font-size: small;">* OFF Shore > 440V</p> </div> </div>	Life cycle	Wash time 60°C CW	Heating device	Capacity	Drum volume	Filling ratio	Electrical connection	G-Force	Spinn speed	Standards/ Norm	30.000 h	~ 45 - 60 min.	Steam Gas	> 40 kg	> 400 l	1:12 1:10	3 phase 380 V	300 - 500	400 - 1000	DIN ISO 9398- ↓ ROHS Machinery Guideline (2006/42/EG)	30.000 h	~ 45 - 60 min.	Steam Gas EL	8-40 kg	80 - 400 l	1:10 1:3	3 phase 380 V - * 1 phase 230 V 25+ Amps	80 - 540	400 - 1200	DIN ISO 9398- ↓ ROHS Machinery Guideline (2006/42/EG)	20-25.000 h	~ 45 - 60 min.	EL	5-8 kg	50 - 80 l	1:10 1:3	3 phase 380 V - * 1 phase 230 V 20+ Amps	200 - 540	600 - 1200	DIN ISO 9398- ↓ ROHS Machinery Guideline (2006/42/EG)	~ 7.500 h	~ 90 - 120 min.	EL	4,5-10 kg	45 - 100 l	1:9 1:7	1 phase 220 V 10 Amps		800 - 1600	ROHS	<p>Noted</p>
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Feedback									Comment																																													
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Feedback		Comment
	<p>For a common understanding a glossary would be very helpful (e.g. batch drying tumblers, batch dryers, drying tumblers, wash extractors, batch washers...).</p> <p>In table 2 on page 10 we see a major difference to the product definition in the market. Under the headline commercial dryers is also mentioned a washer extractor. From our point of view this washer extractor has nothing to do with commercial dryers.</p> <p>On page 14 in the box is mentioned in the last line ...be used for non-professional purposes > the professional washing machine is designed for professional purposes!</p> <p>On page 32 in table 10 is a differentiation regarding the spin speeds. In the market different manufacturers have defined different parameters (rpm) for those different spin levels. It would be better to show them all or even better to define the average. The table shows only the values of one manufacturer.</p> <p>Generally we agree on chapter 4.1, except that industrial appliances should be excluded too (based on the definition).</p> <p>In chapter 4.2 we agree basically on the products, except re the continuous tunnel washing machines and washing tunnel lines. We also would exclude direct continuous dryers.</p>	
VDMA - Garment and Leather Technology, 10 May 2010		
<p>10. Mai 2010</p> <p>VDMA – Bekleidungs- und Ledertechnik</p>	<p>Maschinen unter der Rubrik „Professional washing machines“ und „Professional dryers“ fallen in den Bereich der industriellen Anwendung und sollten aus dem Lot 24 herausgenommen werden.</p> <p>Begründung:</p> <p>Der Einsatz der Maschinen im industriellen Bereich, ist durch ein sehr breites Anwendungsspektrum und sehr unterschiedlicher Verfahrenstechnik gekennzeichnet. Außerdem sind viele Maschinen individuell auf Kundenwunsch zugeschnitten.</p> <p>Eine einheitliche Festlegung bzw. Vorgabe von Grenzwerten beim Verbrauch, ist daher aus Sicht der Verfasser, nicht möglich.</p> <p>Die Verbrauchswerte ergeben sich im Schwerpunkt, durch sehr unterschiedliche Verfahrenstechniken, für die einzelnen Produktgruppen. Teilweise unterliegen insbesondere Waschverfahren zusätzlich länderspezifischen Vorschriften wie Hygienevorschriften etc.</p> <p>Beispiele Artikelsortiment:</p> <ul style="list-style-type: none"> • Hospitalwäsche • Hotelwäsche • Berufsbekleidung • Altenheim Oberbekleidung • Reinigungsartikel (Wischbezüge, Schmutzmatten) • usw. <p>Daraus resultierende Einflüsse auf die differenzierten Behandlungsverfahren:</p>	<p>Noted and added to the relevant section in the report.</p>

Feedback		Comment
	<ul style="list-style-type: none"> • Waschtemperaturen (40–90°C) • Behandlungszeiten • Waschmechanik • Wassereinsatz • Chemieeinsatz • Trockentemperaturen und -zeiten <p>Geräte und Anlagen zum Finishen von Kleidung werden, ebenso wenig wie Bügeleisen, nicht zum Zweck des Trocknens eingesetzt. Hauptzweck ist das Glätten und Entspannen des Textils, einschließlich gewünschter Veränderung der Struktur an der Oberfläche. Hierbei kann, je nach zu behandelndem Textil, eine gewisse Befeuchtung (mit Dampf) sinnvoll sein, ist aber nicht generell nötig.</p> <p>Allein die zu behandelnden Produkte sind extrem vielfältig und reichen von BHs, Poloshirts, Pullovern, Business-Hemden und Anzügen über Kfz-Türverkleidungen bis hin zu kompletten Autositzen. Dazu wird teilweise Dampf benötigt, aber nicht generell. Meist wird die Feuchtigkeit während des Finishprozesses ausgetragen, aber nicht grundsätzlich. Insbesondere bei Nutzung von industriellen Tunnelfinishern ist häufig sogar der Erhalt einer Restfeuchte gewünscht, um das Ende des Finishvorganges auf einen Zeitpunkt nach der Endmontage des zuvor gefinishten Bauteils zu legen.</p> <p>Das Trocknen von Produkten ist also keinesfalls die Hauptaufgabe von Finishern, somit ist die Zuordnung von Finishern in die Gerätekategorie "Trockner" nicht nachvollziehbar.</p> <p>Generell werden professionell genutzte Geräte, ähnlich wie Geräte aus dem Haushaltsbereich, in Serienfertigung, zumindest in Kleinserienfertigung, hergestellt.</p> <p>Ein großes Angebot vergleichbarer Geräte durch eine große Anzahl von Herstellern bedingt meist eine rationelle Serienbauweise von mehr oder weniger standardisierten Geräten. Dagegen werden industriell genutzte Geräte bzw. Anlagen in Einzelanfertigung, in vielen Details eingehend auf die speziellen Bedürfnisse der Kunden, hergestellt.</p> <p>Wir sprechen hier von Maschinen- und Anlagenbau. Dabei wird jede Anlage individuell nach teils sehr spezifischen Vorgaben der Kunden konzipiert und gebaut.</p> <p>Natürlich wiederholen sind die Grundfunktionen meist, die Gewichtung der verschiedenen Teilfunktionen ist aber immer wieder unterschiedlich. Aus diesem Grund ist die Definition eines zu testenden Standards unserer Meinung nach nicht sinnvoll, da es keinen repräsentativen Standard gibt.</p> <p>Diese Vielfalt der beschriebenen Einflussfaktoren und deren Kombinationsmöglichkeiten, haben zu der bereits erwähnten Schlussfolgerung geführt, dass allgemein gültige und verbindliche Grenzwerte für Maschinen- und Anlagen im industriellen Einsatz nicht festgelegt werden können.</p>	
	<p>Electrolux Laundry Systems, 20. July 2010</p>	
	<p>LOT 24 Task 1, Comments from Electrolux Laundry Systems</p> <p>Definitions</p> <p>For instance:</p>	<p>Noted and Added to the relevant sec-</p>

Feedback		Comment
	<ul style="list-style-type: none"> ▪ Professional Washing Machines ▪ Professional Dryers ▪ Commercial Appliances ▪ Professional Laundry ▪ Semi-Commercial / Semi-Professional ▪ Industrial Laundry <p>Even though they are discussed a lot in the report, I miss clear definitions.</p> <p>I suggest that you use the word Professional only for Equipment and use the word Commercial only for different Markets (that professional equipment typically are sold to), see examples below.</p> <p>How to categorize</p> <p>I would like to underline that relevant market/customer categories should preferably be clearly defined here, for re-use in the following tasks.</p> <p>Capacity, such as max load weight or drum volume or similar, is not a relevant way of categorizing professional wash equipment.</p> <p>Different market areas have unique requirements that are fulfilled with help of tailored solutions, such as options, changeable programmes etc.</p> <p>Electrolux Laundry Systems normally mention the following markets that also could be used for categorizing:</p> <ul style="list-style-type: none"> ▪ Commercial Laundries ▪ They require superior performing equipment with high throughput and minimal faults. ▪ Dry Cleaners ▪ LagoonTM is a wet cleaning process that also satisfies these unique customer needs, i.e delicate garments. ▪ Surface Cleaning ▪ Efficient floor cleaning calls for proper mop washer extractors with controlled rest moisture. ▪ Health Care ▪ In hospitals and similar health care establishments, there are very high hygiene demands. Cross-contamination must be avoided. ▪ Hotels ▪ Typically linen and towels in hotels are only slightly dirty. The guests shall feel the cleanliness of the linen and the towels. ▪ Minimum of wear is essential. ▪ Restaurants ▪ In professional kitchens with greasily laundry you have high hygiene demands. ▪ Self-Service Laundries 	<p>tion in the report.</p>

Feedback		Comment
	<ul style="list-style-type: none"> ▪ Such as Apartment House Laundries, Launderettes (coin operated), ▪ Camping Laundries (coin operated) and Leisure/Sports Laundries, where the users are not the same as the owners and therefore safety and easy to use are the most important issues. ▪ Work wear ▪ Tailored solutions developed to guarantee the functions of specific types of work clothing, rather it be the extreme safety requirements ▪ in a fireman's heat suit, or "only" the need to look crisp and neat in a uniform. <p>The professional wash equipment are requested to have</p> <ul style="list-style-type: none"> ▪ High capacity, meaning; ▪ Clean laundry kg/hour & footprint with <ul style="list-style-type: none"> - good enough clearness - minimum wear and tear ▪ Reliability, meaning: ▪ Long lifetime and minimum of maintenance <ul style="list-style-type: none"> - 10-15 years and 30 000 cycles ▪ Cost effective, meaning: ▪ Quick processes (typical wash cycle 30 minutes) ▪ Low energy consumption (thanks to quick process) ▪ Low water consumption ▪ Low detergent consumption ▪ Low maintenance cost ▪ Programmable machines ▪ Very much in cooperation with detergent suppliers. <p>Chapter 1.3 Delimitation of professional washing machines and dryers</p> <p>Already here the scope becomes unclear if not the above mentioned definitions are made.</p> <p>Table 2, second column, page 10</p> <p>Is 'Washer extractors' really a Commercial Dryer?</p> <p>Second paragraph (framed) page 14</p> <ol style="list-style-type: none"> 1. Also add a definition of dryers 2. Last line. Replace 'non-professional purpose' with 'professional purpose' 	

Feedback			Comment
	<p>Chapter 2 Test standards on Professional washing machines and dryers</p> <p>WRAS missing</p> <p>The following WRAS std could also be worth mention due to very high local demands in England to follow it.</p> <p>BS 6920-2.1:2000+A3:2008 Suitability of non-metallic products for use in contact with water intended for human consumption with regards to their effect on the quality of the water.</p> <p>Chapter 3.1 European Directives</p> <p>Gas Directive missing</p> <p>Gas Directive 90/396/EEC is valid for gas heated tumble dryers and combined gas-heated washer-dryers and must be fulfilled</p>		
JRC IPTS			
<p>Draft Revised Task 1 Professional Washing Machines and Dryers Report</p>	<p>The Revised Draft Task 1 report makes a better impression than its first version. Previous comments of ours have been taken into account and additional information has been supplied. Nevertheless, important issues on the scope of the study need further elaboration.</p> <p>Especially we would like to draw the attention to the exclusion from the scope of the Professional dry-cleaning machines. This does not seem to be well justified at this stage.</p> <p>In particular, we would like to draw attention to the following: In the revised Task 1:</p> <ol style="list-style-type: none"> 1. There is still no definition for professional dryers. 2. The scope is restricted to professional laundry processes. This restriction needs to be substantiated. 3. Professional dry-cleaning is excluded from the scope of this study. This does not seem to be well justified at this stage. On the contrary we consider that there are reasons for including dry-cleaning products in the scope of the study (please see below in section specific comments). 		<p>Noted and added in Section 1.5</p>

Letters from VDMA



Garment and Leather
Technology Association

**Extended VDMA comment on Preparatory Studies for Eco-Design Requirements of Energy-using Products
Lot 24: Professional washing machines, dryers and dishwashers (Tender No. TREN/D3/91-2007)
Draft Version Task 1 Report, washing machines and dryers**

An in-depth discussion among the representatives of the companies Jensen, Veit, Seibt + Kapp and Kannegiesser present at the VDMA meeting on 16th June 2010 in Frankfurt/Main led to the conclusion that the field of application of machines falling within the category of "Professional washing machines" and "Professional dryers" is in the industrial sector and that, thus, these machines should be excluded from Lot 24.

Reason:

The use of the machines in the industrial sector is characterized by a very broad application spectrum and very diverse techniques. Furthermore, many machines are customized to meet the individual customers' needs.

A significant characteristic of the "industrial" machines is the fact that the process parameters in the treatment process can be freely chosen and set by the user. Since the process parameters have considerable causal influence on the (energy) consumption of a machine, it is the opinion of the authors that no consistent specifications or requirements regarding any limit values are possible.

The consumption values result mainly from the techniques which vary considerably from product group to product group. Additionally, it is particularly the washing procedures which are partly subject to country-specific regulations such as hygiene regulations.

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Examples of the range of articles:

- hospital laundry
- hotel laundry
- professional clothing
- outerwear for nursing homes
- cleaning articles (mop covers, dirt mats)
- etc.

Resulting influences on the different treatment procedures:

- washing temperatures (40–90) °C
- treatment durations
- washing mechanics
- water consumption
- chemicals consumption
- drying temperatures and durations

This variety of the described influential factors and their possible combinations have led to the conclusion, already mentioned above, that it is not possible to specify universally applicable and mandatory limit values for machines and plants for industrial use.

In the following you will find an overview regarding the distinction between household use, on the one hand, and industrial use, on the other hand, as well as a comparison between the main distinctive features which have an influence on the validity of the measurement quantities. You will also find examples for dependencies of parameterizations within the framework of an industrial treatment process.

1. Comparison: Household/Trade — Industry/Professional

	Household/Trade	Industry/Professional
Field of application	machines used in private households or household-oriented fields	machines used in industry or industry-oriented fields
Fields	private household; coin-operated laundries;	commercial laundries; industrial laundries;

	restaurants and diners/snack bars; pensions and small hotel businesses	larger hotel businesses
Laundry load	< 4 tons/week	> 4 tons/week

2. Distinctive features

	Household/Trade	Industry/Professional
Influentiability of consumption	consumption is defined by a <u>hard-coded</u> parameterization of the treatment programmes	consumption is defined by the <u>freely parameterizable</u> treatment programmes
Free parameterization (set) of the treatment programmes	not possible; limited selection, e.g., temperature and programme	possible settings: <ul style="list-style-type: none"> • time • type of treatment and process sequence • temperature • amount of water (litres/kg) • detergent dosage • dosing of different finishing chemicals for different programme steps • treatment duration • residual moisture
Supply of media (e.g. steam)	individual machine	centralized supply of media (e.g. centralized steam generator)
Treatment process	usually completed following the end of the process inside the machine (e.g. complete drying = subsequent manual folding)	usually part of a continuous treatment process (e.g. complete drying = subsequent mechanical folding, sorting, packaging)
Requirements for operation	no special requirements; can be operated by laypersons	can only be operated by people with special training and additional schooling by manufacturers and detergent engineers
Number of items on the market/year	> 200 000	< 10 000

3. Examples for the process-related dependencies in the industrial/professional sector

- a) Finishing process in the tunnel finisher as a function of the washing and dewatering process

Process chain: Treatment of articles made of blended fabrics

	Washing process	Dewatering	Finishing process
Influential factors	<ul style="list-style-type: none"> • no cool-down process • warm rinsing 	<ul style="list-style-type: none"> • high pressing power • warm dewatering 	in order to meet the demands for quality, considerably more sprayed steam is required to remove the intense creases in the fabric
Result	+ reduced water consumption	+ high dewatering performance + little residual moisture – intense creasing	– high energy consumption due to higher steam consumption

Summary: Negative example for increased energy consumption within one process chain despite reductions having been obtained with individual machines.

b) Finishing process in the ironer line as a function of the drying process

Process chain: Treatment of flatwork, cotton fabric

	Washing process	Dewatering	Ironing process
Influential factors	<ul style="list-style-type: none"> • no cool-down process • warm rinsing 	<ul style="list-style-type: none"> • high pressing power • warm dewatering 	<ul style="list-style-type: none"> • low amount of water to be evaporated • high throughput speed
Result	+ reduced water consumption	+ high dewatering performance + little residual moisture	+ lower energy consumption because of lower amount of water to be evaporated from the fabric + high ironing performance + no quality loss

Summary: Positive example for lower energy consumption over the whole process chain due to improved dewatering.

Munich, 25th June 2010



Garment and Leather
Technology Association

**VDMA comment on Preparatory Studies for Eco-Design Requirements of Energy-using Products
Lot 24: Professional washing machines, dryers and dishwashers (Tender No. TREN/D3/91-2007)**

According to our opinion, the industrial sector should be excluded from implementation measure Lot 24.

In our view, the industrial sector includes the following product groups stated in the Öko-Institut's study report as of January 2011:

- professional washer extractors (WM 3 and WM 4) whose capacity exceeds 25 kg
- professional air tumble dryers (D 6) whose capacity exceeds 25 kg
- washing tunnel machines (WM 7)
- pass-through (transfer) tumble dryers (D 7)
- professional barrier washers (WM 6)

As far as the professional washer extractors (WM 3 and WM 4) and the professional air tumble dryers (D 6) are concerned, we think that the study performer has drawn an artificial line which does not represent reality. So far, the Öko-Institut has not provided any justification either as to why this 40 kg limit has been chosen.

We think that, in order to represent reality, the line should be drawn at 25 kg. Practical experience gained by the users themselves has shown that this a logical limit value. Machines with nominal loads exceeding 25 kg are primarily used in industrial laundries since here large amounts of laundry are treated. Furthermore, the general number of these larger machines is low and lies far below the guideline value given in the Eco-Design Directive.

An industrial washing range is usually composed of a washing tunnel (WM 7) or a professional barrier washer (WM 6), respectively, and the pass-through (transfer) tumble dryer (D 7) and is used exclusively in the industrial sector. We believe that these products should be excluded from Lot 24 as industrial washing ranges are:

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- used exclusively in the industrial sector;
- constructed in an order-related way and according to the customers' requirements, resulting in the fact that each machine or plant, respectively, has its unique characteristics. Thus, no standard limit values regarding the consumption can be specified since the consumption-related values result mainly from the process technologies, washing procedures, country-specific regulations and hygiene-related provisions which all exhibit considerable variations;
- sold in low annual numbers which lie considerably below the guideline value given in the Eco-Design Directive.

There are further reasons speaking in favour of completely excluding the industrial sector from implementation measure Lot 24:

- According to Mr. Almstrom of CENELEC is also of the opinion that the industrial sector should be excluded from implementation measure Lot 24.
- In the sector of industrial laundry machines and plants, far less than 10 000 units are produced per year. Thus, the annual production of these machines and plants is far below the guideline value of 200,000 units per year given in the Eco-Design Directive (see Directive 2009/125/EC, Article 15 (2 a)).
- As a result of the order-related construction of industrial laundry machines and plants we do not see a basis for developing homogenous and relevant test methods which could be used to specify standardized values.
- In general it has to be said that, as far as highly automated industrial laundries are concerned, the energy savings potential needs absolutely to be taken into consideration in order to be able to meet today's and tomorrow's high market demands. For this reason, there is an inevitable demand for machines which are ever more energy and environmentally efficient. In order to be able to achieve positive saving results, however, these machines have always to be considered within the overall context of the treatment process rather than on an individual basis (see extended VDMA comment of 25th June 2010).

We do not see any benefits in standardized provisions — combined with labelling — with regard to environmental and energy efficiency.

7th February 2011

Reflections and concerns of CENELEC/TC59X/SWG 1.12 regarding the outcome of performance standards for commercial laundry machines, from 2010-11-11

Introduction

CENELEC TC 59X “Performance of household and similar electrical appliances” is the body responsible for providing harmonized standards in support of European legislation. TC59X settled a Sub Working Group 1:12 (CLC/TC59X/SWG1.12) with the scope to develop Performance standards for laundry machines for commercial use. Since this SWG was created in 2009 it already has started the development of such standards.

Target

The standards under development shall be developed in such a way that they will be the harmonized standards for performance tests for commercial laundry machines if regulations based on recommendations within the Lot 24 work and measures taken by the Commission will come to force.

Reflections and concerns

After the initial meetings held within the SWG 1.12 we want to communicate to the Commission and to the Lot 24 consultant the reflections made during these SWG meetings being held to date. SWG1.12 is confident that it can develop performance standards for commercial washing machines and commercial tumble dryers based on current and coming versions of household standards EN60456 and EN 61121. It is evident that the content from EN 60456 and EN 61121 must be revised and in some cases totally changed in order to fulfill the demand for the new commercial standards.

Limitations of the standards

SWG1.12 also realize that it is not possible to create performance standards for washing machines and tumble dryers within the commercial area covering all kind of technical solutions, sizes or heating alternatives. SWG 1.12 can foresee that following equipment and variants can not be covered by the developed standards:

- Continuous batch washers and transfer dryers due to their size and completely different design.
- Equipment that is imbedded in larger production lines and where the total energy efficiency shall be measured and not the single components
- Gas heated washing machines and heat fluid heated washing machines due to the low number of machines produced.
- Washing machines and tumble dryers intended for use in applications where other requirements than energy have a priority. Such applications include:

- Hygienic processes where disinfection/sanitation levels must be achieved such as hospital processes and mop cleaning processes.
- Processes including safety issues as cleaning of fireman dresses.
- Technical processes where special features are essential like clean room washing machines and dryers.
- It is also doubtful if performance standards for steam heated washing machines and gas and steam heated tumble dryers can be developed as test methods including steam and gas do not exist in present performance standards. The development of such test methods will take considerable time and a reliable time frame for such standards can not be given. Furthermore to our knowledge no independent laboratory and no test laboratory at any manufacturer can perform such tests within the controlled conditions needed for such a standard. Installing the measurement instruments needed in the laboratories will create investments not justified in relation to the number of such washing/drying equipment being produced.

Customized energy saving solutions

In the commercial sector there also exist many energy saving solutions that are a mix of single laundry equipment and central customized saving solutions. Often these solutions are more energy efficient than the single equipment of best technology. One example: In a laundrette (coin store) a number of tumble dryers can be connected to a central heat recovery unit or there can be heat recovery units on each dryer. A central unit can be more energy efficient. If as a result of the Lot 24 studies a measure will be implemented giving a penalty or a score regarding the energy efficiency of the dryers, the units connected to the central unit must not have such a penalty compared with the dryers with internal recovery systems even if they as single units are less energy efficient.

Uncertainty

SWG1.12 must clearly state that data generated from any performance standard will include an uncertainty interval that can not be ignored.

Standard EN 60456 has reduced the allowable tolerances as far as it is possible within practical limits but still the uncertainty of the result is as wide as or wider than one performance class. In the new commercial standards the equipment under test will have a greater variety in design and/or a wider size span and will also generate data with an uncertainty. The test conditions in the commercial standards can not be more stringent than in EN 60456 or EN 61121 and will more likely need to have larger test tolerances for some parameters. This will generate uncertainty levels as high as or higher than the existing performance standards.

If the LOT 24 recommends and the Commission implements measures including performance the uncertainty levels must be taken into consideration.

7.3 Further laundry appliances being out of scope from Lot 24

The following laundry appliances have been excluded from the scope of Lot 24 (cf. Section 5). For completeness, however, they are shortly described in the following sections.

7.3.1 Dry-Cleaning – description of the process and equipment

The contractors of EuP Lot 24 – Professional washing machines, dryers and dishwashers (TREN/D3/91-2007-Lot 24-SI2.521728) Öko-Institut e.V. and Bio Intelligence Service were asked by the European Commission (DG TREN) to present a short working paper on dry-cleaning machines in order to help decide whether these machines can be excluded from the scope of this Lot. In this section, the process and equipment of dry-cleaning are described; a detailed market analysis for dry-cleaning machinery is annexed to Task 2 report. The conclusions with regard to the scope are listed in Section 2.2.2.

In the draft Commission Regulation with regard to eco-design requirements for household washing machines,⁹¹ such machines are defined as a “machine which cleans and rinses textiles using water [...]”. This means that washing machines remove stains from laundry with water, detergents, thermal and mechanical energy.

Water can be chemically classified as a polar solvent. In contrast, dry-cleaning uses non-aqueous non-polar, mostly organic solvents like perchlorethylene (perchlor), hydrocarbon, cyclosiloxane, or CO₂ instead of water.

The most important reason for dry-cleaning instead of washing textiles is that some materials, especially wool, are very sensitive to water; their fibres swell and get deformed by water in combination with heat (felting or shrinkage). Dry-cleaning provides shape permanence: Folds and pleats are not damaged; flatwork like linen or tablecloth keeps its stiffness. Furthermore, the risk of discolouration is normally negligible. Another reason for using different processes is that wet- and dry-cleaning each remove different types of stains. While dry-cleaning is better for removing grease, ink, oil, or paint, water-based stains are best removed in a washing process.

Dry-cleaning typically works as follows:⁹²

- Workers in dry-cleaning facilities usually treat spots by hand before placing garments in the machines.
- Liquid solvents, detergents, and sometimes a small amount of water are added to the machines.

⁹¹ http://www.eup-network.de/fileadmin/user_upload/Produktgruppen/Lots/Working_Documents/Lot_14/v2_WM-Ecodesign_Regulation_02-03-10.doc

⁹² <http://www.epa.gov/dfe/pubs/garment/ctsa/factsheet/ctsafaq.htm#2>

- The machines then agitate clothes in a manner similar to a washing machine to remove dirt, oil and stains.
- Once clean, the clothes are dried either in the same machine or transferred manually to a separate dryer, then pressed and shaped.
- Used solvent is distilled so it can be purified. Distillation separates the solvent from waste residues such as detergents, dye, dirt and oil, so the solvent can be reused. In addition to distillation, most machines also use filters to clean the used solvent.
- After the purification process, filters which contain the solvent in very small amounts and certain solvent residues must be managed and disposed of as hazardous waste. They have to be sent to special facilities for recycling or incineration.

The dry-cleaning process described above demonstrates that – besides the different cleaning agent (water versus non-aqueous non-polar solvents) – there are also significant differences in the machine technology in comparison to wet-cleaning.

Generally, there are two basic types of dry cleaning machines: transfer and dry-to-dry.

Transfer machines accomplish washing and drying in separate machines. The laundry is transferred by a worker from the washer/extractor unit to the dryer unit. Dry-to-dry machines are single units that wash, extract and dry the articles in the same cylinder in a single machine. The articles enter and exit the machine dry.

The following two figures describe the simplified process flows for a transfer- and a dry-to-dry machine in order to show some of the major equipment components.⁹³

⁹³ Source: US EPA (Ed.): Cleaner Technologies Substitutes Assessment: Professional Fabricare Processes. EPA 744-B-98-001. Washington, 1998, p.5

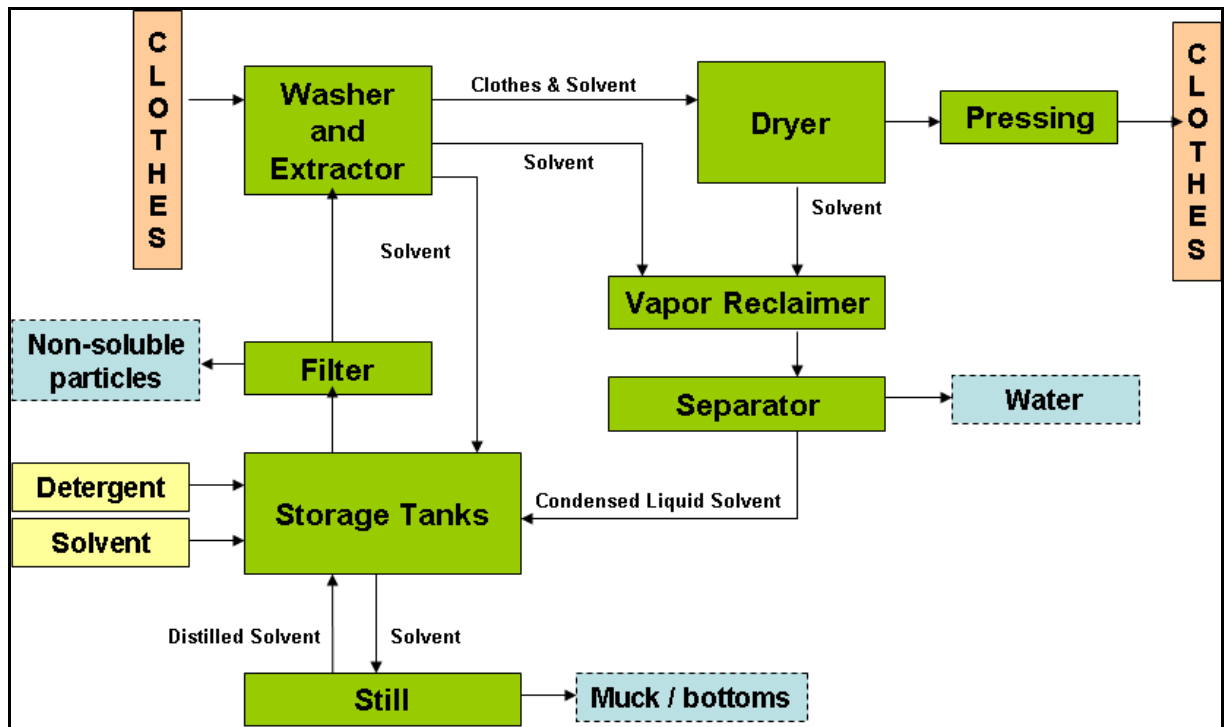


Figure 2 Simplified Process Flow Diagram for Transfer Machinery

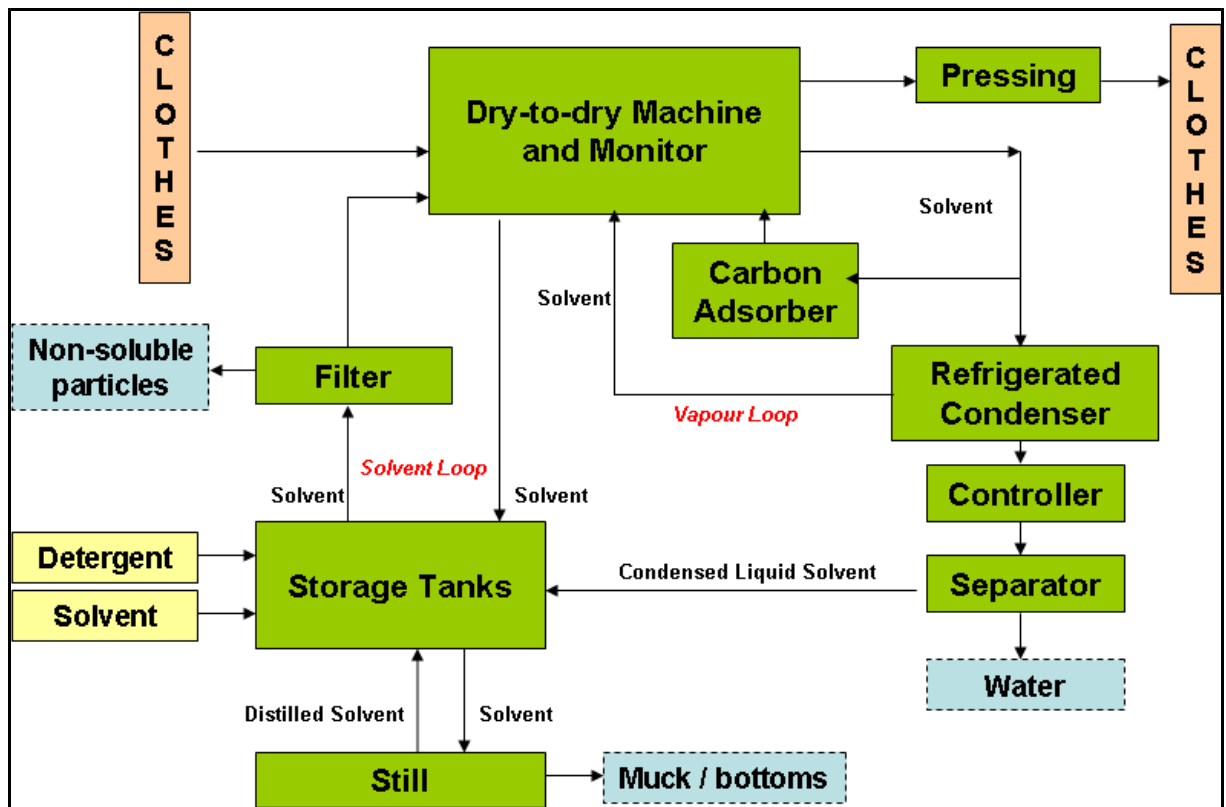


Figure 3 Simplified Process Flow Diagram for Dry-to-dry Machinery

In contrast to washing machines, dry-cleaning machines operate with a completely closed circuit regarding the solvent. Furthermore, the following equipment components considerably differentiate dry-cleaning machines from washing machines:

- Storage tanks for the solvent.
- Vacuum distillation unit ('still'): Most dry-cleaners use distillation to keep the solvent clean enough to avoid odours and the darkening of articles. Without distillation, oils, soils, dyes, detergents and other solvent-soluble impurities would build up in the solvent.
- Different kinds of filters: Filtration of non-soluble particles out of the solvent while in use. Some sorts of filters can be regenerated after each load of clothes; other filters have to be removed from the facility after usage as hazardous waste.
- Carbon adsorber / refrigerated condenser / separator: The carbon adsorber adsorbs the solvent from the aeration stream. Once it reaches its adsorbing capacity, the solvent is usually removed (desorbed) from the adsorber by passing steam through the device. Steam containing solvent exits from the adsorber and is routed to a condenser, which liquefies the solvent and water vapours. The liquid solvent and water mixture from the condenser is routed to the water separator. The solvent is recovered and recycled back through the machine.

Finally, in comparison to washing machines different legislation applies to dry-cleaning machines: The European Solvent Emissions Directive 1999/13/EC regulates emissions of volatile organic compounds (VOCs) due to the use of organic solvents in certain activities and installations. Dry cleaning falls within the scope of the Directive, i.e. any industrial or commercial activity using VOCs in an installation to clean garments, furnishing and similar consumer goods with the exception of the manual removal of stains and spots in the textile and clothing industry.

7.3.2 Dryers with direct heat transfer (drying as secondary function)

7.3.2.1 Finisher

Steam air finisher

Garments like shirts, trousers, jackets, coats etc. have to be de-wrinkled and re-shaped. This process is called conditioning and is performed with different types of steam air finishers.

Variants:

- Form finisher / multi finisher: The machine supports the garment by the shoulders, and pulls it over a nylon bag (a human dummy figure made of a material designed to retain heated air). The clamped hem is "tensioned" by mechanical devices. At the same time, vertical tension is applied to the fabric. By this process of both hem and vertical ten-

sioning, the garments regain their original dimension and appearance. Finally, very hot air inflates the bag which presses the garment from the inside and dries it at the same time.

- **Shirt Finisher:** Shirt finishing equipment is designed especially for laundries with a high turnover of shirts. The machines can either be electric or steam-heated. In principle, the functionality is comparable to that of a form finisher.
- **Trouser finisher:** This machine expands the waistband and clamps the hems of the garment. Steam is injected to soften the fabric. Then, very hot air inflates the garment which gives it a pressed appearance while also drying the fabric, only leaving creases to be pressed.
- **Rotor cabinet:** Rotor or rotary finishing cabinets provide the combined possibility to condition jackets *and* trousers. They are fitted with a rotary door. On the one side is a "shoulder device", along with a bag that works in the same way as the form finisher's. On the other side of the door, a "trouser device" supports the waist of the trousers. Manual clamps are fitted to the hems, and treatment is much the same as for the trouser finisher.

Tunnel finisher

According to ISO 10472-4: Machine for the drying and finishing of shaped garments within which damp garments arranged on hangers are loaded onto an overhead conveyor for transport through the machine in an atmosphere of high humidity followed by an atmosphere of hot dry air produced by the tunnel finisher. A conveyor system transports the garments (e.g. blouses, shirts, dresses, coats, trousers etc.) through different chambers of the tunnel finisher. In the first modules, the materials are softened with a measured and well-directed amount of sprayed steam to remove tensions. In the next step, the garments are gently stretched. Influencing factors hereby are a combination of air and steam, as well as their temperature and speed passing along the goods from top to bottom. Final drying happens in the last module, as the air that is drawn in is largely unsaturated. It cools down the outgoing articles. At the same time, the incoming cool air is heated up by the heated garments. The last chamber therefore operates effectively like a heat exchanger.

7.3.3 Dryers with indirect heat transfer (drying as secondary function)

7.3.3.1 Flatwork ironers

According to ISO 10472-5: Machine for the ironing of flatwork. Flatwork is a textile article (e.g. a bed sheet) which can be satisfactorily dried and smoothed by being passed through a flatwork ironing machine.

Ironing in the professional context fulfils the same purpose as a domestic hand iron. The heat of heavy steam-heated rollers removes residual water (drying the fabric), and the pressure removes creases. Textiles that are ironed are mostly flat, and are therefore called flatwork. This applies to “wet work” items, such as bed sheets, pillow cases, serviettes, or tablecloths. Professional ironers can be designed with either through- or return-feed. Through-feeding means that the linen is fed into the ironer on one side, and out on the other. The return-feed model saves space as the linen is fed both into and out of the ironer on the same side. Further, multi-function machines combine feeding, ironing and folding in one unit.

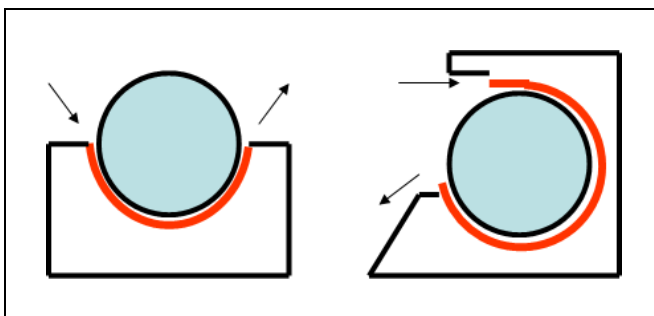


Figure 4 Functionality of a through-feed and a return-feed ironer

Types of flatwork ironers:

Bed ironers (chest ironers)

- Small bed ironers, also called chest ironers, are used in small installations and are generally designed with return-feed. The types of linen to be chest ironed are typically table clothes, serviettes, and pillowcases. The textiles are placed on a feeding table. By means of a rotating padded roll, the linen is moderately pressed against a heated fixed chest. The moisture in the linen is heated and turned into steam which “de-tensions” the fibres of the textile so that they are reshaped. The textiles are processed, and fed out to a collection table in front of the ironer. Small bed ironers can be operated manually by three or four operators who feed and fold the sheets by hand. In this case, the capacity achieved is 15-20 metres/min.
- Large bed ironers are suitable for laundries with high capacity requirements; they generally are of the through-fed type. This type of ironer is available with more than one roller, and the diameter of the roller varies. The capacity is increased by adding rollers, the efficiency by using special feeders, folders and stackers. The sheet is clamped to a feeding machine by one or more operators. The feeder automatically stretches and positions the sheet which is then fed through the rollers at quite a high speed. The capacity ranges up to 20-40 metres/min, depending on the size of the rollers and the degree of automation in the feeding and folding process. When the sheet has passed through, it is folded length- and crosswise. Finally, it is stacked in an automatic stacker unit.

Cylinder ironers

Cylinder ironers, also called roll heated flatwork ironers, are used to iron linen such as bed textiles and large tablecloths. The textiles are placed on a feeding belt. The continuously running belts feed the textiles into a heated rotating cylinder where the linen is ironed and dried. The finished textiles are fed out on a discharge belt behind the ironer or on a collection tray in the front.

7.3.3.2 Ironing and fusing presses

According to ISO 10472-6, the following definitions apply:

- *Ironing press*: Machine for the smoothing or shaping of fabric items by pressing them between two components, at least one of which is heated and, if required, equipped with a steaming device.
- *Fusing press*: Machine for the fusing of two textile layers by pressing them between two components, at least one of which is heated to a temperature such that the coating of one layer becomes adhesive.