

# INDUSTRIAL LAUNDRY AND DRY CLEANING

**up to 3 times more sustainable compared to  
household washing and drying**

## TKT

TKT is the Dutch technical knowledge centre for the textile care industry, for both the dry cleaning industry and the laundry industry. TKT initiates and coordinates technical and sustainable innovation projects for the Dutch and the International textile care industry. TKT is imbedded in international and networks and has extensive expertise about technological aspects of cleaning and washing such as (amongst others) sustainability of cleaning, alternative cleaning processes, energy saving, hygiene of cleaning and washing, life cycle assessments, environmental legislation for dry cleaners & laundries, textile functionalities and their relationship to washing processes. There are many ongoing projects about these aspects. Additionally, practical knowledge is transferred to the companies in the form of online educational material, both on a national and on an international level. TKT is closely affiliated to the Dutch national associations FTN (laundry) and Netex (dry cleaning), as well as the umbrella association CINET (the international committee of professional textile care).

## Introduction

In this project, a sustainability comparison has been made to evaluate household washing of work wear and industrial washing of work wear. The project aims to establish the difference in sustainability between household washing and industrial washing of work wear. The reason for this project is the fact that a lot of work wear is washed at home by the employees; even when a service contract exists between the employer and an industrial launderer. The project is executed by TKT and TNO Industry & Technique, in cooperation with an FTN user group.

To be able to draw a comparison, it is important to define the right basis of assessment. The comparison includes corporate clothing from hospitals and work wear from the industry sector. Moreover, the standards, on which the comparison is drawn, must be defined. For corporate clothing from hospitals, the Certex hygiene requirements are used. Certex is a Dutch quality system that requires a germ reduction of factor 10<sup>6</sup> (Log 6). A literature study has been executed to establish the household washing conditions necessary to meet these Certex requirements, and the consumption of energy that these conditions entail. The results have been compared with the energy consumption of an industrial washing- and drying process necessary to achieve the same results.

For work wear from the industry sector, the comparison is based on stain removal. The degree of stain removal from relevant stain cloths in an industrial laundering process, as well as the household washing conditions necessary to match this degree of stain removal, have been experimentally determined. Also here, the consumptions of energy in both processes have been compared.

## Energy consumption household washing

In 2007, Faberi executed a study regarding household washing behavior of consumers(1). Parameters like energy consumption, washing temperatures and degree of loading, as they occur in practice, have been investigated in this report. To determine the consumer behaviour regarding household dryers, a report of MilieuCentraal (Environment Central) from 2008 has been used(2). This report states which percentage of the households possesses a dryer, how frequently this dryer is used and what this entails with regard to energy consumption. On basis of these two sources, it is possible to determine the energy consumption per kg laundry for washing and drying in a household situation. In table 1, a summary of this information has been provided for two situations: on basis of average dryer possession in the Netherlands (63%) on the right side, and on basis of 100% dryer possession in the middle.

**Table 1. Summary energy consumption in household washing situation**

Energy consumption:	Washing machine and dryer present		Average dryer possession in the Netherlands	
	(kWh/kg)	(MJ/kg)	(kWh/kg)	(MJ/kg)
40°C	0,95	8,6	0,69	6,2
60°C	1,08	9,7	0,82	7,4
92°C	1,30	11,7	1,03	9,4

## Sustainability comparison corporate clothing hospitals

In 2003, Professor Terpstra from Wageningen University studied the relationship between household washing conditions and the achieved level of hygiene(3). He concluded that in order to reach the Certex required level of disinfection (Log 6), it is necessary to make use of a washing temperature of 90 degrees, in combination with a bleach containing powder detergent. To make sure that remaining germs do not immediately increase in numbers after washing, it is necessary to mechanically dry the laundry immediately after the washing process. The energy consumption necessary to meet Certex hygiene standards in a household situation therefore adds up to 11,7 MJ/kg, as shown in table 1.

To determine the sustainability of the industrial process that meets the Certex requirements, the process characteristics are as follows: washing tunnel with washing process for white laundry; 75°C, heat regeneration and pressurized dewatering. This washing process has an energy consumption of 0,30 kg steam and 0,065 kWh electricity per kg laundry. A subsequent industrial full drying process with gas dryer or gas finisher consumes 0,063 m<sup>3</sup> natural gas and 0,065 kWh electricity per kg laundry. The total energy consumption of characterized industrial washing and drying, converted to MJ/kg, comprises then 4,1 MJ/kg. This industrial process therefore is almost 300% more energy efficient than the household washing process.

Corporate clothing of medical personnel, health care providers and medical auxiliaries in hospitals is required to meet the regulations of the working group infection prevention (WIP). As a result of the increasing use of liquid solvents and washing with low temperatures, the household washing conditions necessary to meet the Certex requirements, prescribed by the working group infection prevention, are these days most uncommon. In addition, household situations do not provide for separate clean and unclean routes, creating a reasonable risk of re-contamination via laundry basket and hands. For normal laundry this does not constitute a problem. For hospital corporate clothing however, this can lead to great risks. All things considered, it is recommended to prohibit household washing of corporate clothing of health care providers.

## Sustainability comparison work wear industry

When it comes to work wear in the industry sector, stain removal is of main importance. To be able to compare stain removal in household and industry washing, stain cloths were examined containing oil/pigment, food (protein/fat/carbohydrate/coloring additives), bleachable filth and protein/blood. These stain cloths were washed in a standardized household washing process with bleach holding washing powder, according to ISO 6330 5, -2A and -1A. The same stain cloths have been washed industrially on 55° and 85° degrees in open end machines. Image 1 displays the average stain removal. The higher the value, the better the stain removal.

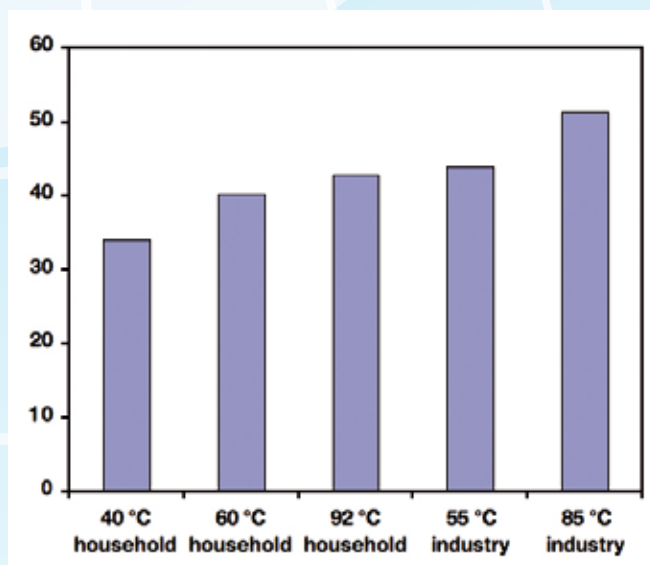


Image 1. – Comparison stain removal household washing and industrial washing

The image shows clearly that the only household washing process that nearly measures up to the results of a 55 degrees industrial process, is the 92 degrees household washing process using bleach holding powder. A 85 degrees industrial process cannot be matched in a household process at all. We can now examine what this means for the difference in energy consumption. It has been determined that an industrial washing process of 55 degrees, using an open end machine with steam heating and spin drying, consumes 0,47 kg steam per kg and 0,074 kWh electricity/kg. Full drying in a gas dryer or gas finisher consumes 0,063 m<sup>3</sup> natural gas/kg laundry. Converted to MJ/kg, the energy consumption of an industrial washing and drying process together is 4,7 MJ/kg. The energy consumption of a washing and drying process at home, considering an average dryer possession, is 9,4 MJ/kg. Treating work clothing from the industry sector at home therefore creates twice as much environmental impact per kg laundry, compared to the industrial process. It can be expected that heavy overalls, which will dry only slowly on the clothesline and cannot be missed for long, will be dried in the dryer more often than the 63% dryer possession suggests. However, of this there is no data available. This means that the above mentioned factor 2 is the absolute lower limit. Should we use data corresponding to 100% dryer use at home, more likely as a result of the longer drying times using the clothesline, the difference in sustainability will be almost a factor 3.

Furthermore, we can assume that in practice, the household washing process necessary for the desired results will not often take place. This means the stain removal will be mostly insufficient (see image 1). In time, the stains will then become irremovable. This will possibly result in premature dismissal of work wear, which also is undesirable from an environmental perspective. All things considered, also industrial work wear is better off treated by a professional textile service partner.

## Conclusion

Household washing consumes considerably more energy than industrial washing. When the same level of stain removal from industrial work wear is reached with a household washing machine, the impact on the environment is at least twice as high, compared to industrial washing. Where household treatment of corporate clothing in health care facilities must comply with Certex hygiene standards, the environmental impact is even three times higher, compared to industrial treatment.

It has become clear that the industrial achievements with industrial work wear as well as with corporate clothing can only be matched at home by a washing process at 90 degrees with bleach containing powder detergent. In practice this will not often occur, due to the tendency to wash at continuously lower levels of temperature and with bleach-free liquid detergent. Stains in industrial work wear will not be sufficiently removed and in time will become irremovable. Often dangerous bacteria in corporate clothing will also be insufficiently removed. In addition, re-contamination of dry laundry cannot be prevented as efficiently at home, as it can in an industrial situation specifically designed for this purpose. This contradicts the working group infection prevention regulations and brings danger to the household itself.

## References:

- 1) Faberi, S., Presutto, M., et al., Preparatory studies for eco-design requirements of EuP's, LOT14: domestic washing machines & dishwashers, final report tasks 3-5, 2007
- 2) Groeneveld, P., Wasdrogers, brondocument nr.003 van Milieu Centraal, Utrecht, versie 3.0, 16 oktober 2008, pp. 1-23
- 3) Terpstra, P.M.J., et al., Hygienic properties of textile laundering in Europe, Proceedings of the WFK 41st International Detergency Conference, 2003, pp.72-79.