

# Chemical Dry Cleaning

## EU and German Requirements – 2nd BImSchV

Reference: Böwe

## Installation of Annex IIa No 11 of VOC Directive 1999/13/EC (Annex VII , part 2, No 8 of IE Directive)

**All chemical dry cleaning installations have to comply to the VOC requirements - there is **no solvent consumption threshold**.**

### **Annex VII part 1:**

Any industrial or commercial activity using volatile organic compounds 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.**

### **Requirements according to Annex VII, part 2, No 11:**

- **Total emission limit value**, expressed in mass of solvent emitted Perc kilogramme of product cleaned and dried: **20 g/kg textile**
- **Emission limit values in point 2 of Part 4 of IE Directive** (Art. 5 (8) VOC Directive) **does not apply** for this activity (**20 mg/m<sup>3</sup> or 100 g/h for substances/mixtures with hazard statements H341 or H351 – former: R40/R68**)

## Dry cleaning machines with **refrigerant and adsorption technique**:

At the end of the drying the solvent containing air is conducted to an adsorption unit after the air cooler.

Solvent adsorption in closed circle!

Solvent consumption: < 1% referred to permitted filling quantity of textile good [kg]

**VOC total emission limit** value of 20 g Perc/kg textile good **can be complied** by this technique (< 10 g Perc/kg textile good)!

Residual Perc content in drying air after the end of the drying process in machine space:  $\leq 2$  g Perc/m<sup>3</sup>

## One charge adsorption units:

- After each charge a regeneration takes place -> for each cleaning charge an unloaded carbon adsorber is available
- Desorption e.g. with hot air - > no contact water!

# Requirements to dry cleaning installations with Perc als cleaning solvent in Germany: 2. BImSchV

§ 2 (2): Trichloroethylene and Dichloromethane are not allowed to be used in chemical dry cleaning

-> Only Perc is accepted from volatile halogenated hydrocarbons

§ 4 (1) and (2): Requirements for air emission reduction:

Closed installations:

-> § 4 (1) relevant

Installations with suction and discharge into the atmosphere:

-> § 4 (2) relevant

## **§ 4 (1) Compliance § 4 Abs. 1, Nr. 1: closed installations:**

In drying air at the exit of drum area during rotating drum, running ventilation and closed loading door:

Residual solvent concentration at end of the cleaning charge:  $\leq 2 \text{ g/m}^3$  at a

Perc temperature of the textile good of  $\geq 35 \text{ }^\circ\text{C}$  at a air flow rate of minimum

2 to  $\leq 5 \text{ m}^3$  per kg loading weight and hour

### Solution:

Use of a combination of cleaning machines with refrigerant and integrated adsorption technique

Closed system

## § 4 (2) in combination with § 10 monitoring openings:

With the begin of the cleaning process the loading door must be locked automatically until the **emission mass concentration of 2 g/m<sup>3</sup>** is not exceeded as a result of running measurement.

### Solution: installation of a Perc monitoring instrument

At the end of the charge the measurement of the emission limit is carried out.

If the monitoring value is not under the limit value after a given time:

- > Machine turns to operation mode „disorder“
- > post-drying necessary

## § 4 (1): Closed machines: Air flow rate during measurement:

During the drying: cleaning machines are working with higher air flow rates to take away as much solvent as possible from textile goods

Only during measurement phase:

-> air flow is reduced to required air flow rate from 2 – 5

$\text{m}^3/\text{kg}/\text{h}$

### **§ 4 (3) Use of regenerative filter for cleaning of liquid solvent**

### **§ 4 (4) Ventilation of working rooms:**

Ventilation of working rooms only by ventilation equipment with extraction of ambient air.

Capturing and extraction of VOC at site of formation (areas of machines, storage of cleaned textile good, pressing tables, steaming machines, discharge of machines)

### **§ 4 (6) Chemical dry cleaning machines may only be operated in presence of competent service staff**



## **§ 13 Handling of volatile halogenated organic carbons:**

### § 13 (1):

Carrying-out of emission reduction measures during filling or discharge of solvents:

- Extraction of displaced waste gas and feeding to an active carbon adsorber
- Application of gas balancing technique

### § 13 (2):

Residues containing volatile halogenated VOC may only taken from cleaning machines by using of a closed system

### § 13 (3):

Volatile halogenated VOC or other residues may only be stored, transferred and handled in closed containers.

## **Emission-free disposal of distillates:**

Automatically process controlled closed system

Goal: As less Perc in sludge:

1. Distillation of Perc
2. After reaching the shut-off temperature:  
pumping the distillation residue with sludge  
pumped to the distillate container. By using the  
spraying technique when entering the container:  
-> evaporation of solvent -> reduction of solvent  
content in residue
3. Direct addition of vapour
4. After cooling: Pumping down of sludge into a  
container for disposal -> displaced solvent  
containing gas is fed back to distillation unit by  
gas balance technique

**Reference. Böwe  
Textile Cleaning**

## **§ 15 General provision:**

Operation of chemical dry cleaning machines only permitted if the entry of halogenated hydrocarbons

1. into a room designed for human use and not belonging to the installation or

2. into an adjacent installation in which food pursuant to Article 1 of the Act on Food and Consumer Products) are produced, treated, brought into circulation, consumed or stored,

is limited according to the state-of-the-art technology.

In case of an ambient air in such rooms of  $> 0.1 \text{ mg/m}^3$   
(mean value over 7 days):

-> Within 6 month measures to ensure an ambient air concentration of  $\leq 0.1 \text{ mg/m}^3$

## **Solution: Prevention measures against frequent opening of the cleaning machines**

Safety control switch at maintenance openings:

### **Goal:**

Openings of machine should be reduced to a minimum

->Opening for maintenance of flue/needle filter as well as the door of distillation container equipped with a safety control switch.

->Machine can not be taken into operation if the openings are not closed.

## **§ 11 Self-control:**

Documentation on:

- Input quantities of Perc
- Quantities disposed to an external recycling or disposal company
- Operation hours
- Measures for maintenance

Blowing-off machines with active carbon adsorption units:

Daily control of active carbon adsorber documented in a written way (exception: in case of continuous measurements or automatically shut-off).

Control measurement should take place about 2 Minutes after beginning of blowing-off

## Maintenance and inspection work

**Germany:** An **annually expert check** is obligatory (due to occupational health legislation)

- Situation of total installation, parts and equipment
- Changes of safety devices
- Completeness and efficiency of safety devices
- Concordance of technical data of machine with data of manufacturer
- Last conformity certificate
- Check on leakages
- Test run

## **§ 12 Inspection:**

Emission measurements by an authorized institute earliest 3 month and latest 6 month after taking into operations

In case of installations with a solvent filling volume > 50 l or in case of blowing-off installations with an active carbon adsorber for waste gas cleaning: Annually emission measurements by a licensed monitoring institute (exception: not by continuous measurements: here annual calibration and functioning check)

Three individual measurements minimum

Period:

- a) In case of determination in drum or take away area: 30 seconds
- b) In case of determination of waste gas during sucking-off phase: 30 minutes

Condition: Result of each individual measurement  $\leq$  emission limit value

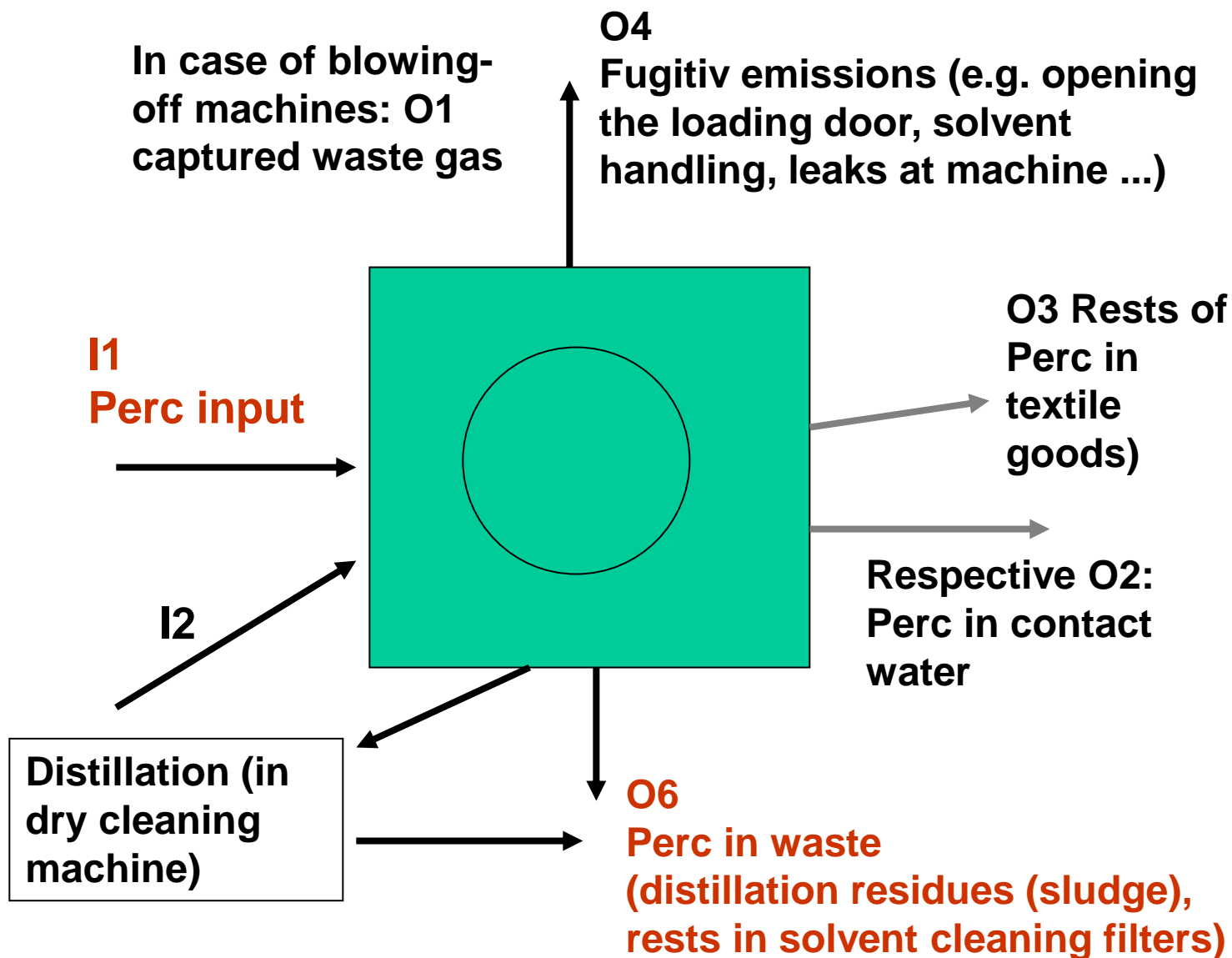
Elaboration of a monitoring report (to be stored 3 years + copy to authority)



## EU Chapter V IED: Requirement for annual solvent mass balances

**Assessment on compliance to VOC Directive**

**Verification of total emission limit values of 20 g Perc/kg textile required by solvent mass balance**



The **total emissions E** are calculated according to VOC Directive as (time period is always one year):

$$E = F + O1$$

F are the fugitive Emissions.

The **fugitive Emissions F** are calculated by

$$F = I1 - O1 - O5 - O6 - O7 - O8$$

In case of closed-circuit drying machines the term is simplified (O1, O5, O7, O8 are all =0)

$$E = I1 - O6$$

The total emission value E is calculated by

Total Emission Value [g VOC of the time period / kg cleaned product of the time period] =

$$E \text{ [kg]} * 1000 / (\text{Weight of cleaned product [kg]})$$

By using a closed circuit machine with integral refrigerated condenser following emission values can be achieved [Vito 2008]:

Air: 16 g/kg

Waste: 4 g/kg

Water: 4 mg/kg.

## For elaboration of an annual solvent mass balance:

Operator has to introduce a documentation system:

- Weighing the textiles
- Documentation of annual solvent input I1
- Determination of solvent content in waste
- Documentation of annual output of waste O6
- If contact water is considered as waste O6:  
Determination of solvent content in contact water  
Documentation of annual output of contact water

## Alternatives to “solvent mass balance”:

**General binding requirements according to application of certain techniques of cleaning machines instead of emission limit values – see German 2nd BImSchV!:**

- Closed circuit machine
- Integral refrigerated condensor
- Internal activated carbon filter
- Solvent concentration in drum at end of drying process:  $< 2 \text{ mg/m}^3$
- Regularly maintenance and inspection according to operation instructions of manufacturer
- No calculation of consumption, mass of textile, nor solvent in waste

# Simplification!

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