

# **HPH<sup>®</sup>-Bell Type Annealing Furnaces and Explosion Prevention and Protection Directives ATEX**

## **Consequences for Operators and Manufacturers**



**THERMPROCESS Symposium 2007**

**Dr. Michal Buryan, Janus Drewniok; LOI Thermprocess GmbH**

**Dr. Wolfgang Mundel; TÜV-NORD**

# FAQ – frequently asked questions

- 1) *What is ATEX, what is regulated by ATEX?*
- 2) *What kind of explosion prevention and protection does exist?*
- 3) *How are potentially explosive atmospheres and zones defined ?*
- 4) *What directives are the HPH<sup>®</sup> - bell type annealing plants liable to?*
- 5) *Can potentially explosive atmospheres occur during operation with the HPH<sup>®</sup> - bell type annealing plant?*
- 6) *Have devices and components of the HPH<sup>®</sup> - bell type annealing plants to be of explosion-proof design (“ignition-sources-free”)?*



# **ATEX – Atmosphères Explosibles**

*The mnemonic ATEX stands for two EU directives:*

**94/9/EG – ATEX 95** – *formerly known as ATEX 100a*

- *Directive for placing on the market of devices, equipment components and protective systems intended for use in potentially explosive atmospheres*
- *this regards **the Manufacturer***

**1999/92/EG – ATEX 137** – *formerly known as ATEX 118a*

- *Directive for safe operation of devices and plants in potentially explosive atmospheres*
- *this regards **the Operator***



# The context between ATEX 95 and ATEX 137



Manufacturer

**ATEX 95**

*The product shall be designed that due its intended use an explosive atmosphere cannot be ignite.*

*Definition of the **level of protection** due to the term „**category of equipment**“*

*Operation manual*



*Study of the market*



Operator

**ATEX 137**

***Safe** using of explosion-proof products in potentially explosive atmospheres.*

*Definition of the **probability of the existence** due to the terms „**potentially explosive atmosphere**“ and „**zone**“*



# Explosion protection of products

*2 EU-directives regulate preferentially the explosion protection of products:*

## ***Directive 94/9/EG – ATEX 95***

*- regulates the safety requirements on products intended for use in potentially explosive atmospheres*

## ***Directive 2006/42/EG – Machinery directive (actual release)***

*- regulates the safety requirements on machines, also of such machines, if there e.g. inwardly explosion hazards can occur*



# Explosion protection of employees

*2 EU-directives regulate preferentially the explosion protection of workers in the shop:*

## ***Directive 1999/92/EG – ATEX 137***

*- regulates the protection of workers, who are at risk due to the explosive atmosphere (i.e. in atmospheric conditions in potentially explosive atmospheres)*

## ***Directive 98/24/EG***

*- regulates et al. the protection of workers, who are at risk due to the potentially explosive mixtures (i.e. mixtures out of atmospheric conditions)*



← → × ↻ 🏠 🔍 ⭐ 🌱 📧 🖨️ 📄 📁 👤

Important legal notice

 **Enterprise and Industry** English

European Commission > Enterprise & Industry > Industry Sectors > Equipment intended for use in potentially Explosive Atmospheres (ATEX) > ATEX standardization [Contact](#) | [Search](#)

[What's new?](#) | [Site map](#) | [Index](#) | [Information](#) | [FAQ](#) | [About this site](#)

## EQUIPMENT INTENDED FOR USE IN POTENTIALLY EXPLOSIVE ATMOSPHERES (ATEX)

### ATEX STANDARDIZATION

Overview

**Relevant information**

**Legislation**  
Directive 94/9/EC  
[How to apply the Directive](#)

**Standardization**  
**[ATEX standardization](#)**

**Contact points**  
[Notified Bodies](#)  
[Working structure](#)  
[Who is who](#)

**International**  
[International development](#)

[Archive](#)


[List of ATEX harmonised standards](#)  
Last publication: *Official Journal C 180, 20.7.2006, p. 6-12:* [cs](#) [da](#) [de](#) [et](#) [el](#) [en](#) [es](#) [fi](#) [fr](#) [it](#) [lv](#) [lt](#) [hu](#) [nl](#) [pl](#) [pt](#) [sk](#) [sl](#) [sv](#) 

[New Approach standardisation in the European internal market](#)

▲  
Last update: 29/09/2006

**Source: <http://ec.europa.eu/enterprise/atex/stand.htm>**

LOI Thermprocess GmbH, Essen, Germany



# Explosive atmosphere

- Ø **Mixture** of flammable gases, vapors, mists or dusts **with air**
- Ø in atmospheric conditions (approx. -20 to 60 °C and 80 to 110 kPa)
- Ø where the combustion process after the ignition will spread to the entire unburned mixture



# Potentially explosive atmosphere (hazardous places)

- ∅ *spatially* determined area, where an explosive atmosphere with **defined probability** can occur
- ∅ is divided into **zones** according to the ATEX 137 based on **probability** (time duration and frequency of occurrence)
- ∅ the definition of the zone is the **basis** for the realization of the explosion protection measure called „**prevention of ignition sources**“



# Zones classifications according to ATEX 137

| <b>Classifying potentially explosive atmospheres into zones (“zoning”)</b> |   |  |  |
|--|---|--|--|
| <b>Gases</b>   | <b>Zone 0</b> is a place in which an explosive atmosphere consisting of a mixture with...<br><b>is present continuously or for long time periods or frequently.</b> | <b>Zone 1</b> is a place in which an explosive atmosphere consisting of a mixture with...<br><b>is likely to occur in normal operation occasionally.</b> | <b>Zone 2</b> is a place in which an explosive atmosphere consisting of...<br><b>is not likely to occur in normal operation but, if it does occur, will persist for a short period only.</b> |
| <b>Dusts</b>   | <b>Zone 20</b> definition similar   | <b>Zone 21</b> definition similar  | <b>Zone 22</b> definition similar  |



# Equipment in explosive atmosphere

## **Equipment groups**

- Ø *Group I equipment – Equipment to use in mines and opencast mining*
- Ø *Group II equipment– Equipment to use in other regions*

## **Categories**

- Ø *Category 1 (very high safety)*
- Ø *Category 2 (high safety)*
- Ø *Category 3 (safety in normal operation)*



## Equipment categories in group II

| <i>Level of protection according to ATEX 95</i> |  |
|---|--|
| <b>1G</b>                                       | <i>Equipment designed to ensure a very high level of protection, even in the event of an expected malfunction or rare malfunction.</i> |
| <b>2G</b>                                       | <i>Equipment designed to ensure a high level of protection, even in the event of an expected malfunction.</i>                          |
| <b>3G</b>                                       | <i>Equipment ensuring a normal level of protection.</i>  |

*Additional character: G for gases, D for dusts  
definition of the degree of protection for dusts are similar*



# Equipment choice for explosive atmospheres

| <i>Explosive atmosphere</i> | <i>Degree of protection to be applied</i>   |
|-----------------------------|---|
| <i>Zone 0</i>               | <i>1G (very high safety)</i>  |
| <i>Zone 1</i>               | <i>2G or 1G (high respectively very high safety)</i>                                      |
| <i>Zone 2</i>               | <i>3G or 2G or 1G (safety in normal operation and high respectively very high safety)</i> |



# Philosophy of explosion protection

## 1) **Prevention of explosive atmospheres**

*e.g. due to the design and adequate processing (e.g. the HPH® - bell type annealing plants)*

## 2) **Prevention of ignition sources by using explosion-proof equipment (free of ignition-sources)**

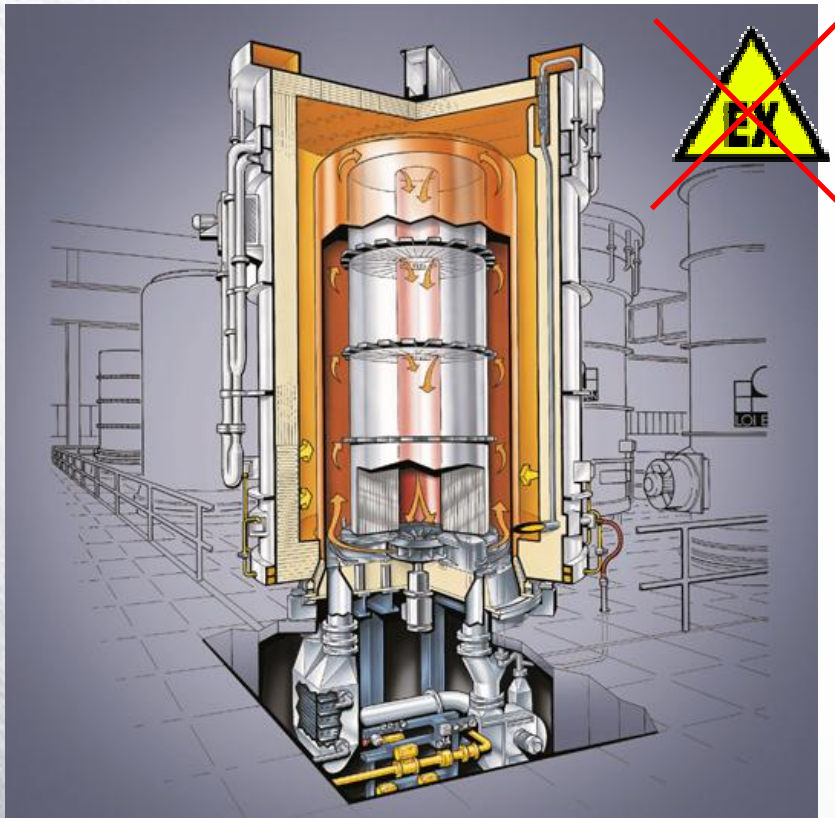
*Types of protection e.g.:*

- pressure-tight encapsulation*
- non sparking*
- overpressure encapsulation*
- intrinsically safe, etc.*



# HPH<sup>®</sup>- annealing plant and explosive atmosphere

*The HPH<sup>®</sup> is **not intended to use** in potentially explosive atmospheres, because its hot surface is a **ignition source!***



*The bell type annealing plant and its equipment shall be in such wise designed and operated, that a **potentially explosive atmospheres must not occur!** If that is fulfilled, no other explosion-proof measures are necessary.*



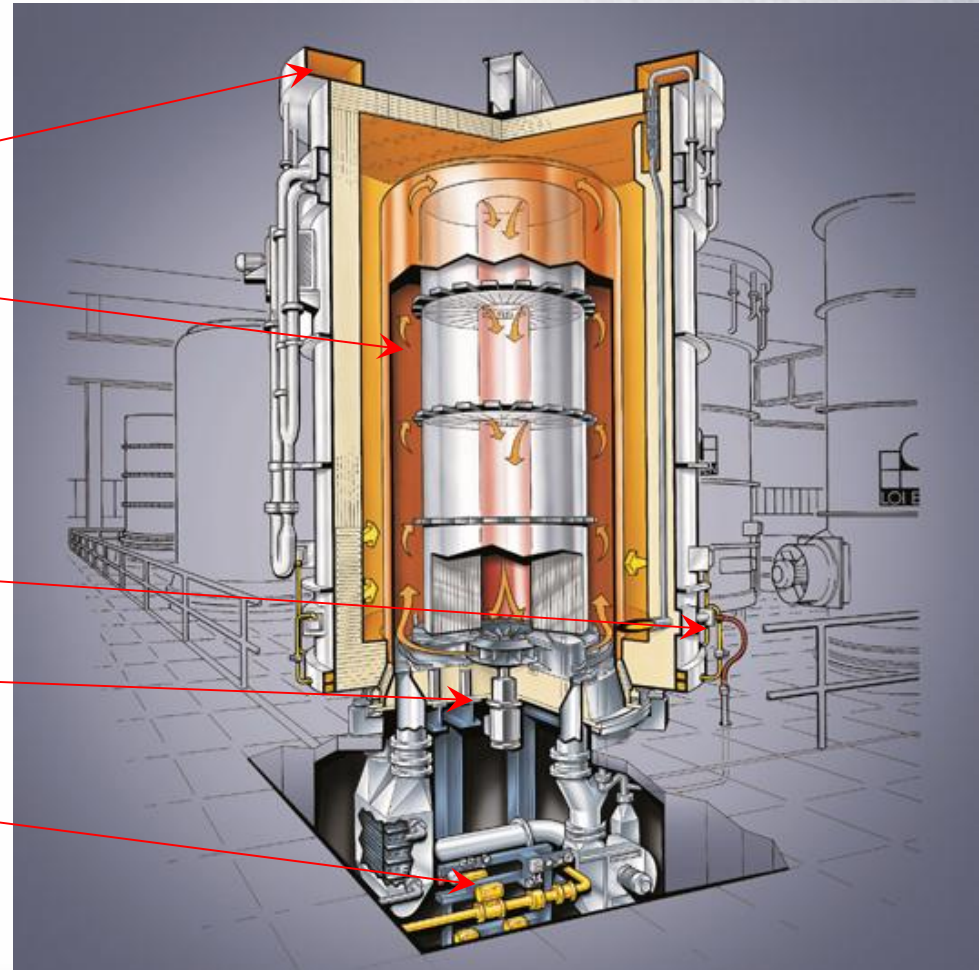
# Assessing the risk of the HPH® - annealing plant

## **Atmospheres:**

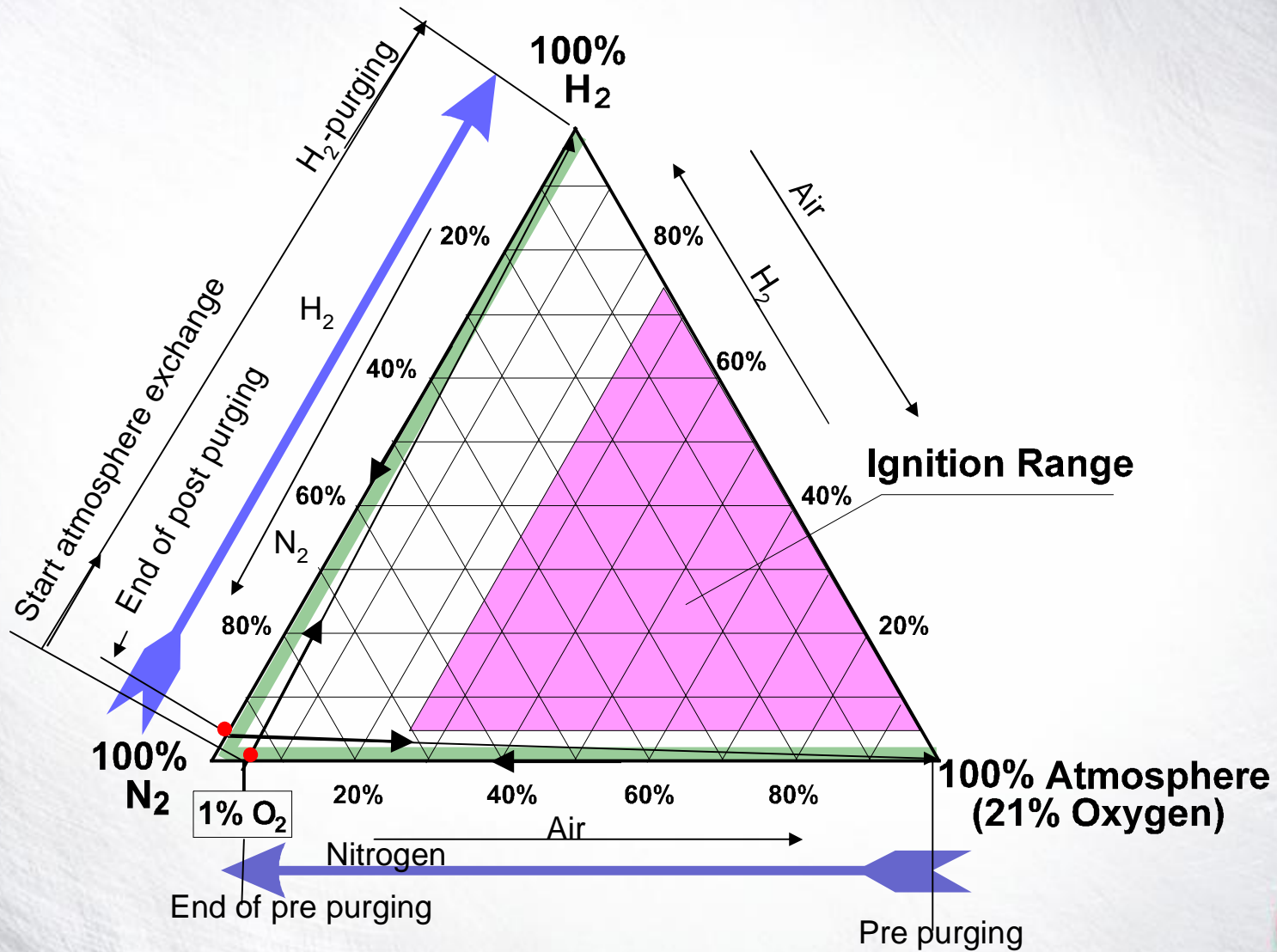
- Waste gas, maybe unburned
- Hydrogen

## **Areas to be analyzed:**

- Gas couplings
- Motor of base fan
- Valve stand
- Over roof outlet piping
- etc.

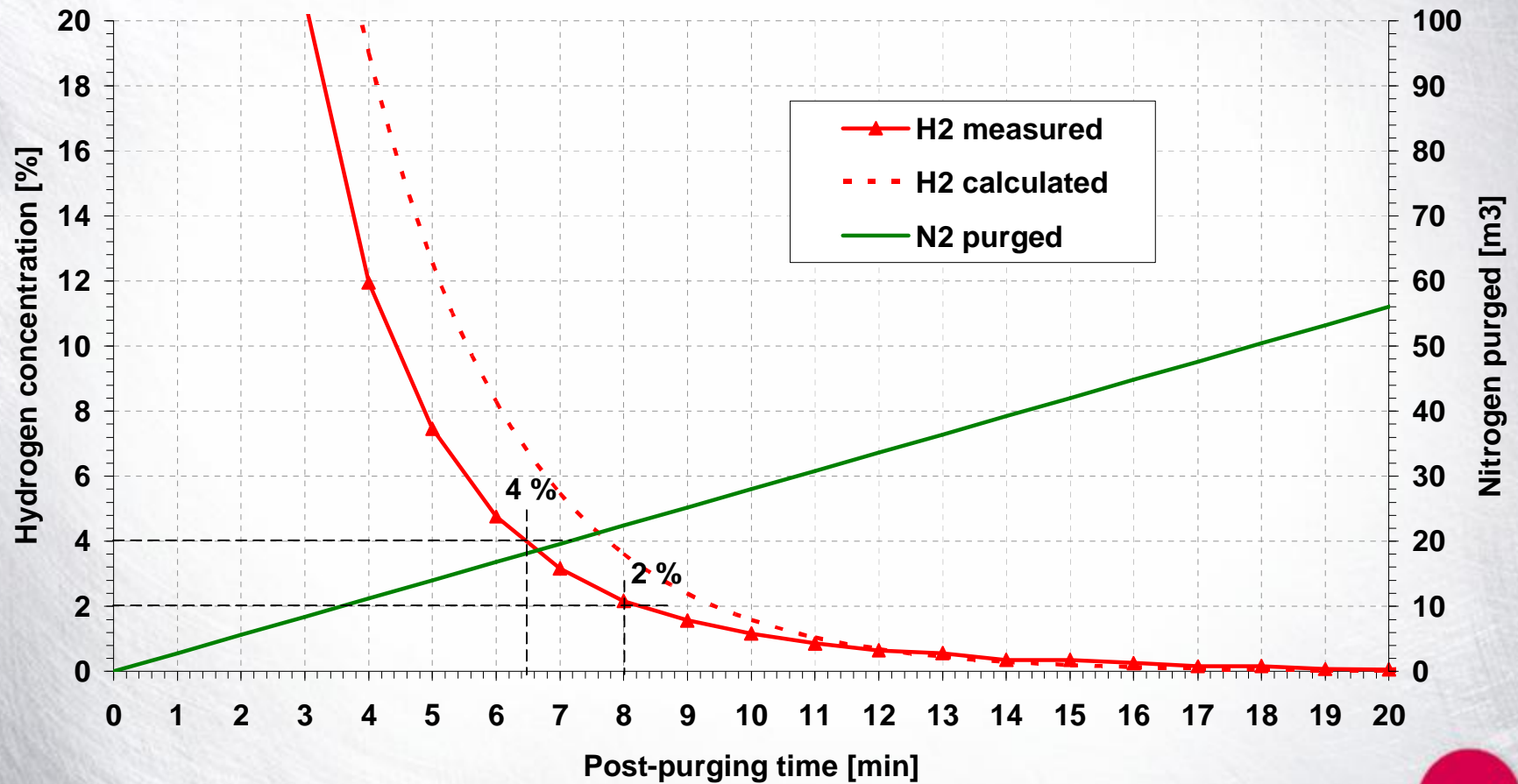


# Hydrogen as annealing atmosphere



# Safe post purging at power failure

Post-purging of hydrogen, base fan stopped  
nitrogen flow 165 m<sup>3</sup>/h, temperature 285 °C



# Technical tightness

*Is regulated e.g. by the German technical rules TRB 600 (Technische Regeln Druckbehälter – technical rules for pressure vessels):*

## *Article 5.4:*

*The pressure vessels as well as their equipment including all piping connected are still technical tight, if:*

- ∅ They are due to their design permanent tight (incapable for separation connections)*
- ∅ Their technical tightness is warranted by **monitoring** and maintenance*



# Technical tightness

***Application of the TRB 600 in explosion prevention:***

***Article 5.3:***

*If pressure vessels including all capable and incapable for separation connections are **technically tight**, there is **no fire, explosion or health hazard** in the surrounding atmosphere.*

*The technical tightness of the HPH<sup>®</sup> - bell type annealing plant is warranted by a periodical automatic monitoring including:*

- Ø Cold tightness test**
- Ø Hot tightness test**
- Ø Continuous leakage monitoring**



# Explosion protection on motor of base fan

**Prevention of explosive atmosphere by:**

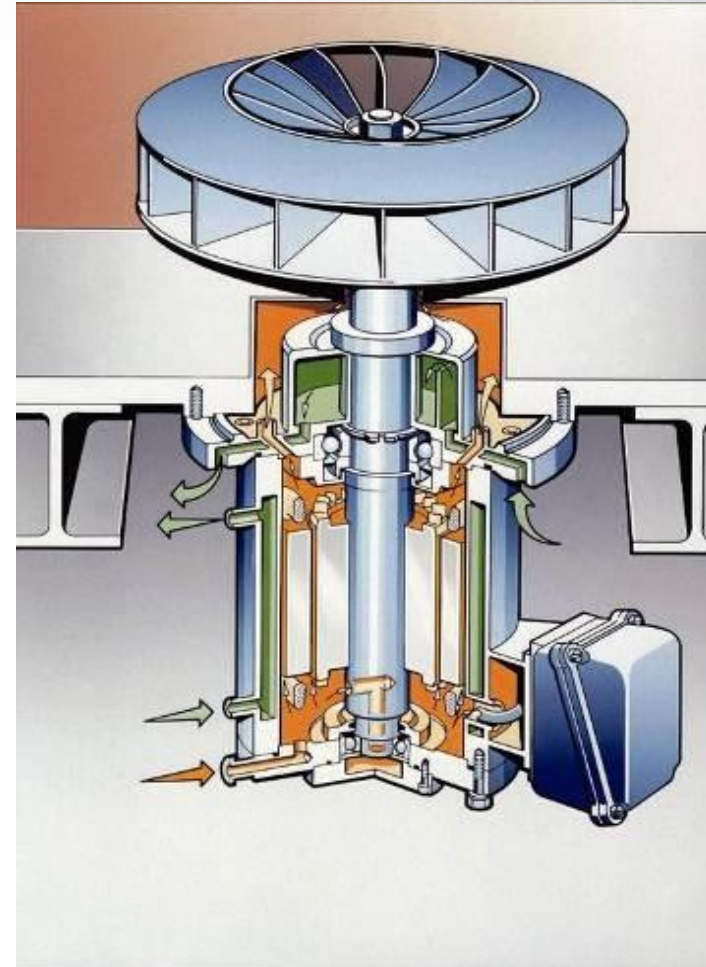
- $N_2$ ,  $H_2$  – purging
- $N_2$  – cross purging (new)

**No explosion-proof measure necessary!**

*Nevertheless at the customer request explosion-proof:*

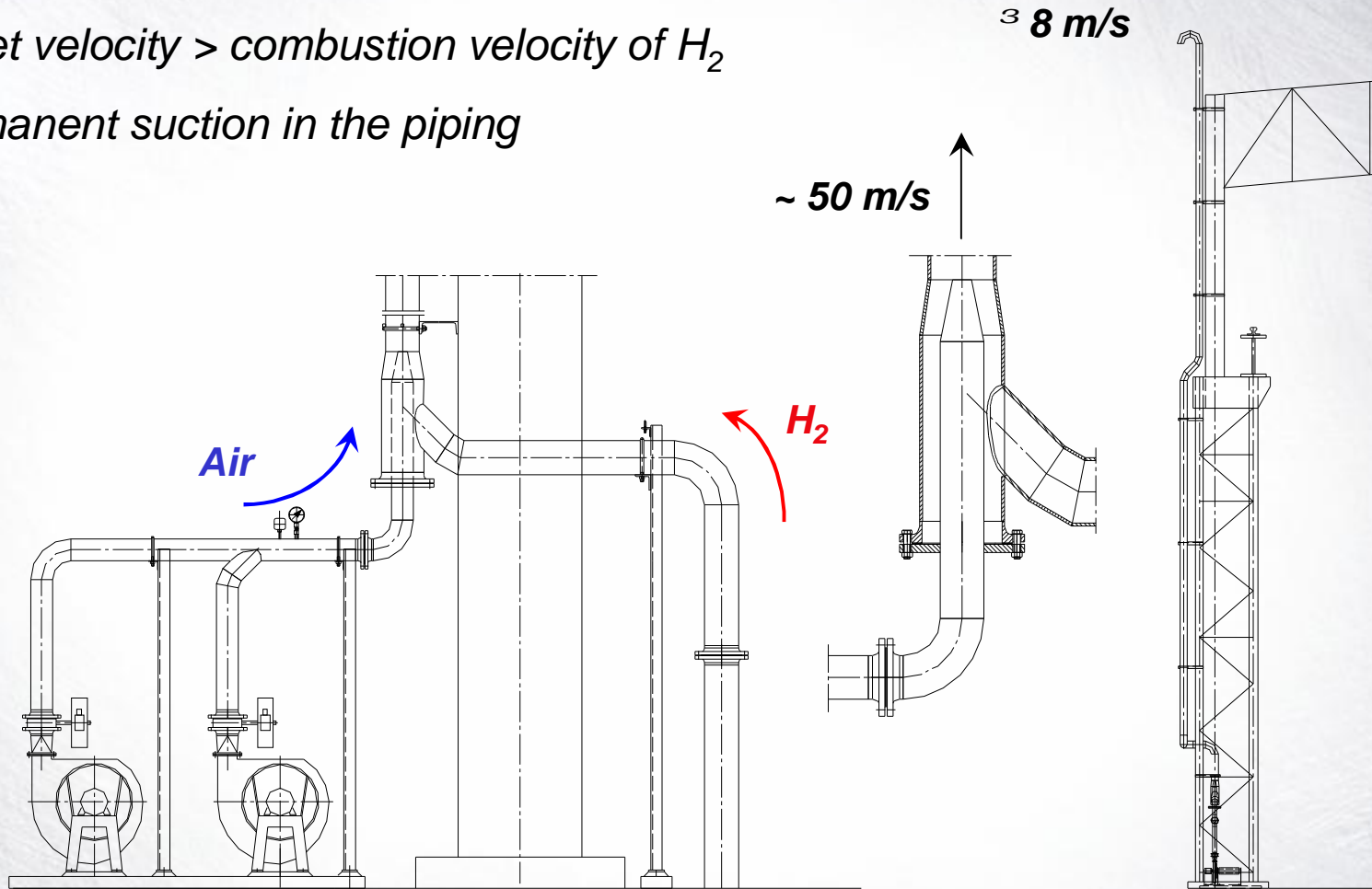
*Declaration of conformity:*

CE  II 3G EEx nA II T3



# Injector in the over roof outlet piping

- outlet velocity > combustion velocity of  $H_2$
- permanent suction in the piping



# Over roof outlet piping

*In the area of the ending of the over roof piping can occur a **potentially explosive atmosphere of zone 2.***

## Consequence:

*No equipment with ignition sources allowed. Only use of explosion-proof equipment in this area.*

## Designation according to ATEX 137:

*Potentially explosive atmosphere around the outlet piping on the roof are generally **not marked**. If the hazardous area contacts the roof or if its lower part is **less than approx. 3 m** above roof, the hazardous place should be marked at the **access to the roof**.*



# Summary

***Diverse items of written comment of TÜV-NORD (former RWTÜV):***

*With respect to **explosion prevention and protection** the HPH<sup>®</sup> - bell type annealing plant of the described design is subject to the requirements of the **Directive 2006/42/EC (Machinery Directive)**, and it has been designed.*

*Since an explosive atmosphere has been prevented in the area around the furnace by design means and an explosive atmosphere due to third sources is excluded, the **Explosion Safety Directive (Directive 94/9/EC, ATEX 95)** is by definition not applicable.*

***Explosion-proof design of devices and components of the HPH<sup>®</sup> - bell type annealing plant is therefore not necessary.***

