# ISO 15848-1: comparison with new fugitive emission standards

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Cetim

# Project overview

- ISO 15848-1 is published since March 2006: “Classification system and qualification procedures for type testing of valves”
  - End of DIS Enquiry (23/06/2014). Result of votes: approved.
  - FDIS Enquiry (November 2014 - January 2015). Result of votes: approved.
  - Publication of ISO 15848-1 rev 2 : June 2015

- Test program at Cetim
  - Study of ISO 15848-1 changes
  - Study of a valve performance (with the same packing) using various existing fugitive emission standards

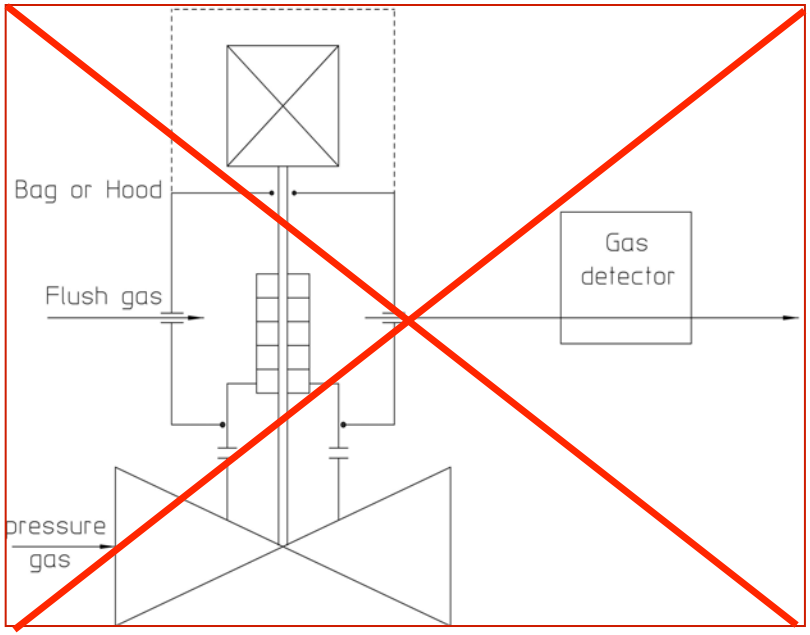
# ISO 15848-1 (March 2006)

- Type of valve
  - ON/OFF
  - Control
- Source of emission
  - Stem seal system
  - Body-bonnet seal
- Test fluid
  - Helium
  - Methane

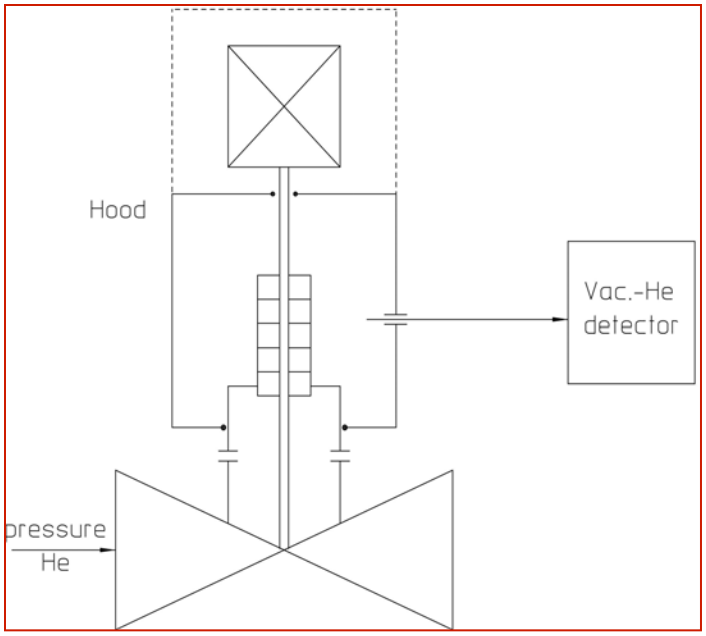
- Test pressure
  - Pressure class (P/T rating)
- Fugitive emission measurement
  - Global method (stem seal)
  - Sniffing (body-bonnet seal)
- Performance class
  - Tightness class
  - Endurance class
  - Temperature class

# ISO 15848-1 (March 2006) – Global methods

- **Flushing**




- **Vacuum method**

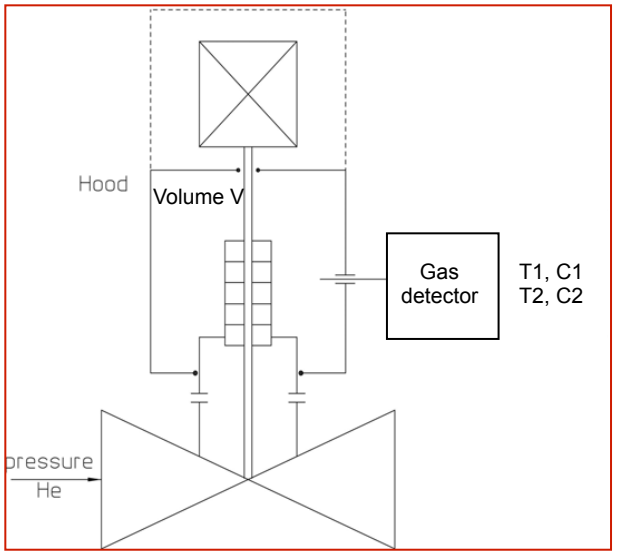



**Global methods are quantitative, reliable, reproducible**

**Difficult to perform, often need adaptation of the valve**

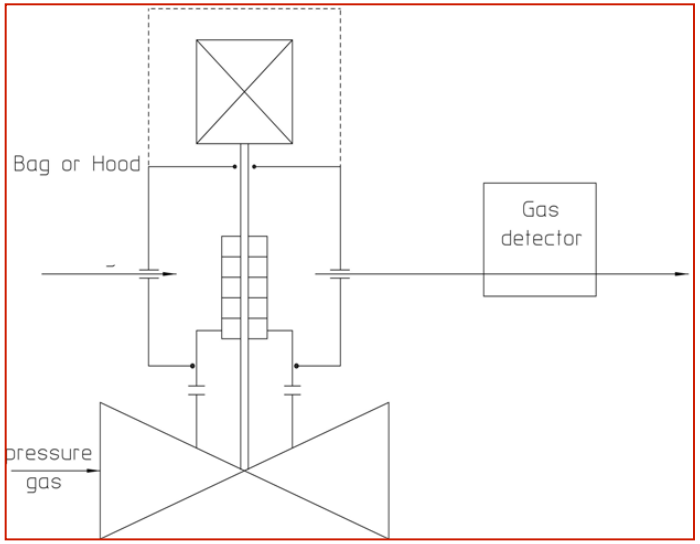
# New global methods

- **Accumulation (EN 13185)**

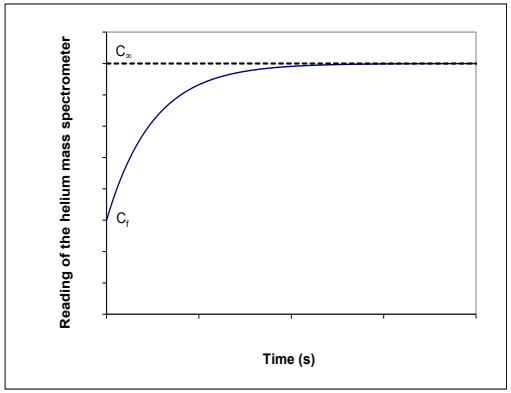



$$Q_l = \frac{(C_2 - C_1) \times V}{(t_2 - t_1)}$$

- **« Suck through Method »**



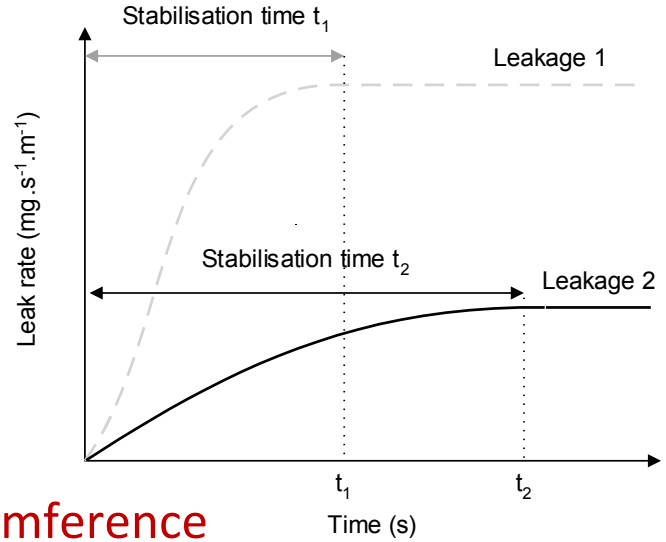

$$Q_l = \frac{(C_\infty - C_f) \times Q_p}{(1 - C_f)}$$



# ISO 15848-1 (March 2006) – Tightness classes

- Helium and methane
  - Stem seal system

| Leak rate – Global measurement $mg.s^{-1}.m^{-1}$ | |
|---|---|
| AH & AM | $10^{-6}$ |
| BH & BM | $10^{-4}$ |
| CH & CM | $10^{-2}$ |




H : Helium $mg.s^{-1}.m^{-1}$ per meter of stem circumference

M : Methane

  - Body-bonnet seal

| Leakage – Sniffing (local measurement) ppmv | |
|---|---|
| Helium | ≤ 50 |
| Methane | ≤ 50 |

# ISO 15848-1 (March 2006) – Tightness classes

- Helium
  - Stem seal system

| Class | Measured leak rate (mass flow) | Measured leak rate (mass flow) | Measured leak rate (volumic flow) | Remarks |
|---|---|---|---|---|
| | $mg.s^{-1}.m^{-1}$ stem perimeter | $mg.s^{-1}.mm^{-1}$ stem diameter through stem seal system | $mbar.l.s^{-1}$ per mm stem diameter through stem seal system | |
| AH [a] | $\leq 10^{-5}$ | $\leq 3{,}14\ 10^{-8}$ | $\leq 1{,}78 \cdot 10^{-7}$ | Typically achieved with bellow seals or equivalent stem (shaft) sealing system for quarter turn valves |
| BH [b] | $\leq 10^{-4}$ | $\leq 3{,}14\ 10^{-7}$ | $\leq 1{,}78 \cdot 10^{-6}$ | Typically achieved with PTFE based packings or elastomeric seals |
| CH [b] | $\leq 10^{-2}$ | $\leq 3{,}14\ 10^{-5}$ | $\leq 1{,}78 \cdot 10^{-4}$ | Typically achieved with flexible graphite based packings |

[a] Measured by the vacuum method as defined in Annex A.

[b] Measured by the total leak rate measurement method (vacuum or bagging) as defined in Annex A.

New unit

Vaccum

+ accumulation & suck through

  - Body seal

| Measured leakage ppmv |
|---|
| ≤ 50 |
| NOTE Measured by the sniffing method as defined in Annex B. |

# ISO 15848-1 (March 2006) – Tightness classes

- Methane
  - Stem seal system

| Class | Measured leakage (sniffing method as described in Annex B) ppmv |
|---|---|
| AM | ≤ 50 |
| BM | ≤ 100 |
| CM | ≤ 500 |

  - Body seal

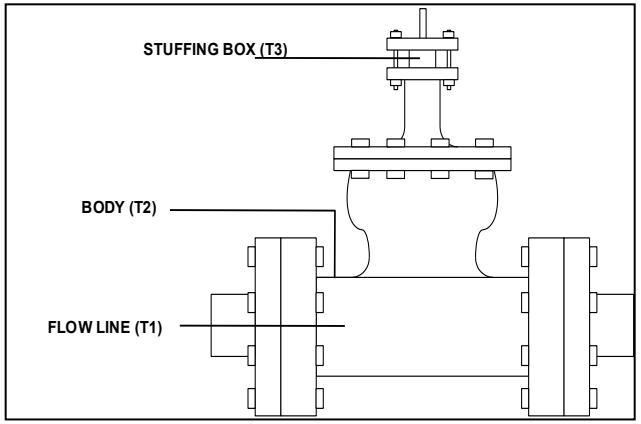
| Measured leakage (sniffing method as described in Annex B) ppmv |
|---|
| ≤ 50 |

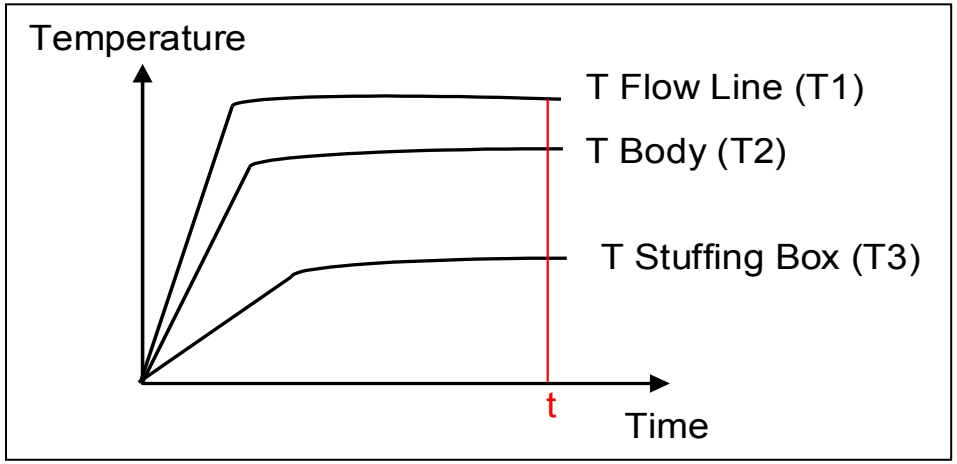
  - § 6.2.4 There is no correlation intended between measurements of total leak rate as described in Annex A and local sniffed concentration as described in Annex B.

# ISO 15848-1 (March 2006) – Temperature classes

| (t-196) | (t-46°C) | (tRT) | (t200°C) | (t400°C) |
|---|---|---|---|---|
| - 196°C | -46° C | Room temperature °C | 200° C | 400° C |

- Reference flow line temperature

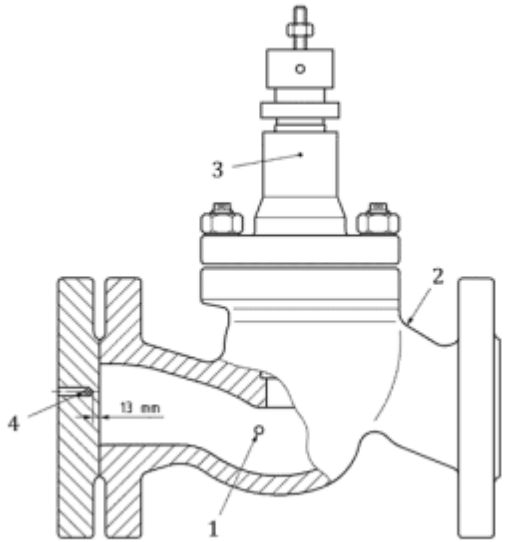


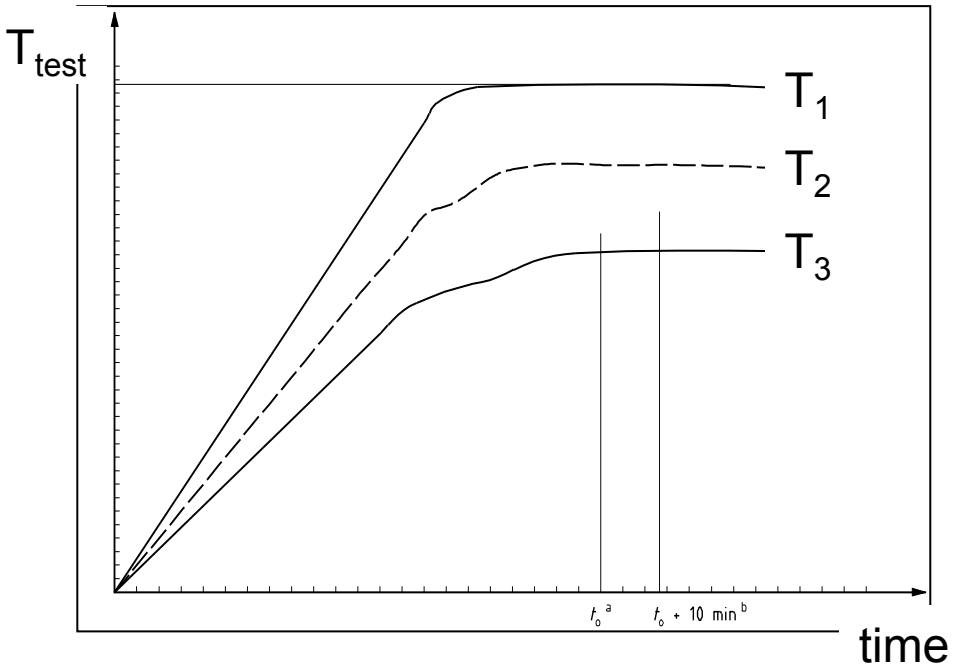



# ISO 15848-1 (March 2006) – Temperature classes

| (t-196 °C) | (t-46 °C) | (tRT) | (t200 °C) | (t400 °C) |
|---|---|---|---|---|
| – 196 °C | – 46 °C | Room temperature, °C | 200 °C | 400 °C |

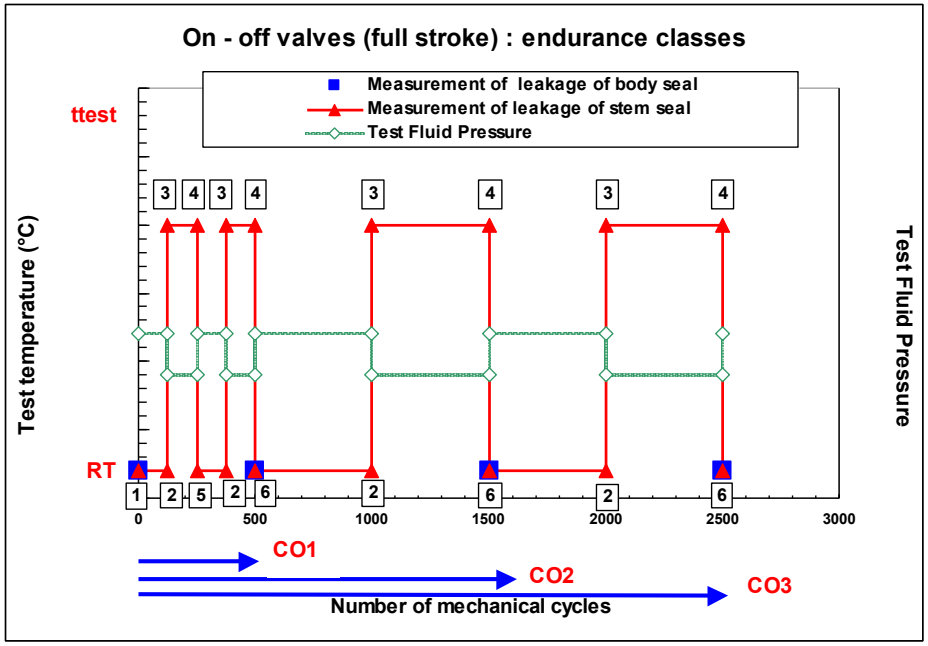
- Temperature reference at location 1 (flow line)

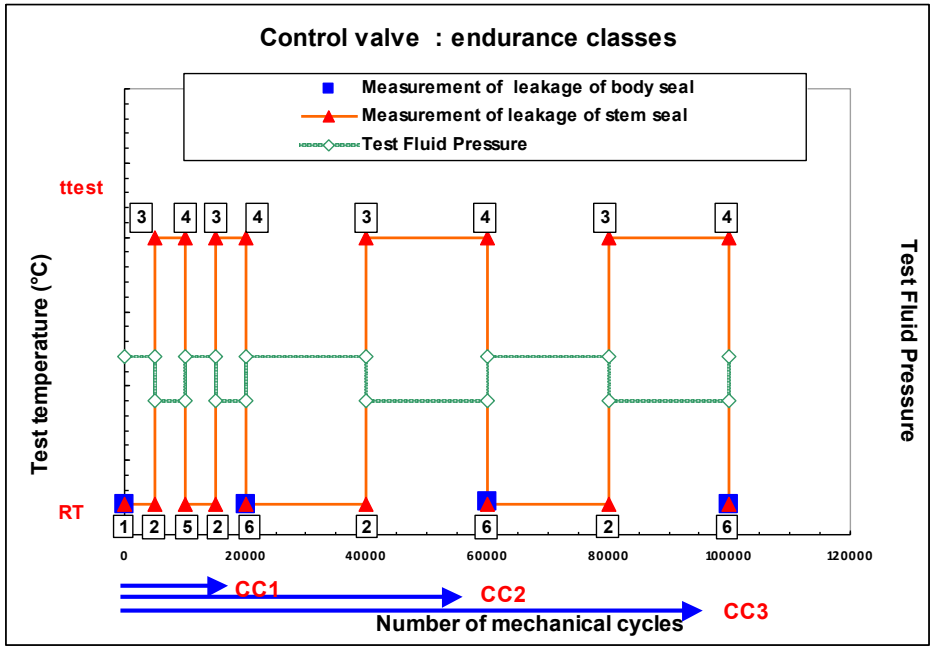



- Optional thermocouple: location 4 may be used instead of location 1

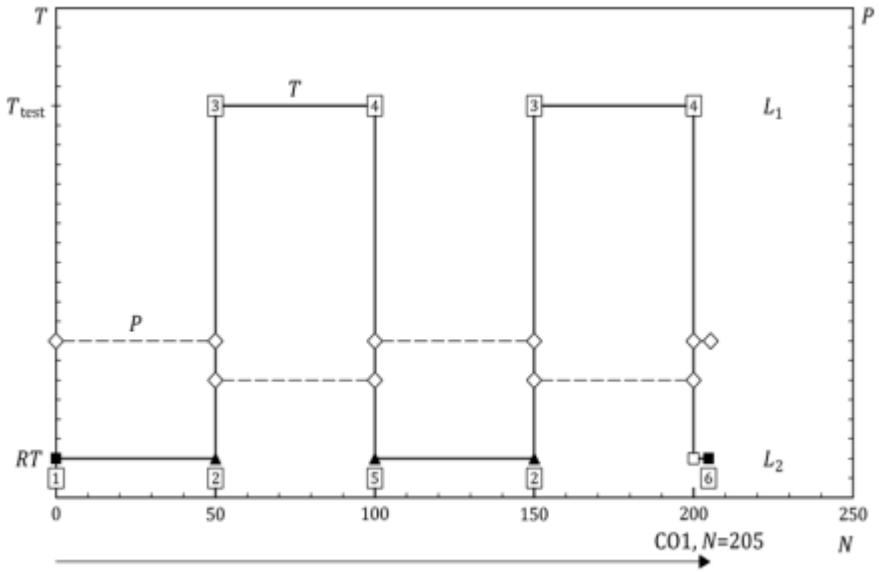
# ISO 15848-1 (March 2006) – Endurance classes

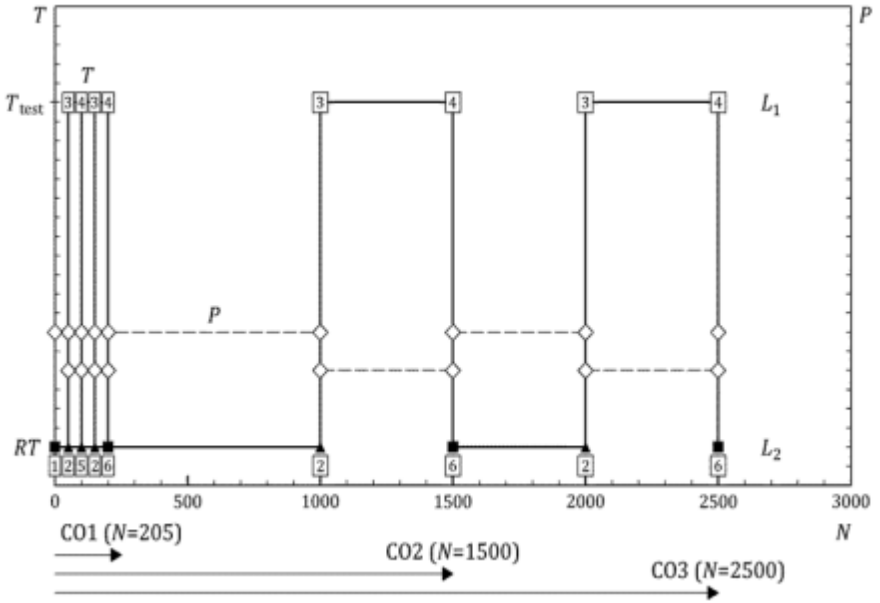



- Mechanical cycles + Thermal cycles
- Nature and number of cycles are different for ON/OFF and Control Valves

# ISO 15848-1 (March 2006) – Endurance classes




- CO1: 2 thermal cycles + 205 mechanical cycles
- CO2 et CO3 unchanged

**Publication of EN ISO 15848-1 and 2 : June 2015**

# ISO 15848-1:Testing facilities

## 03/2014 : ISO 17025 Certification by French Committee COFRAC

- Validation of High Quality Measurements

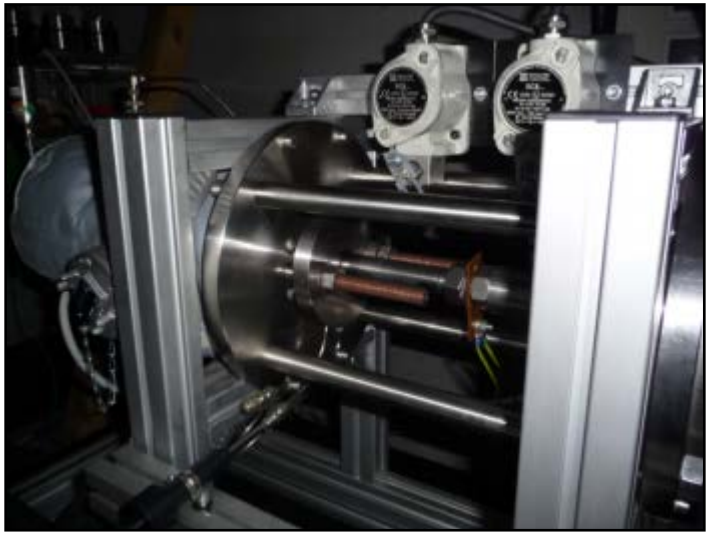

- Test capacity:
  - 18'' (15 tonnes)
  - 450 bar
  - -150°C to 450°C

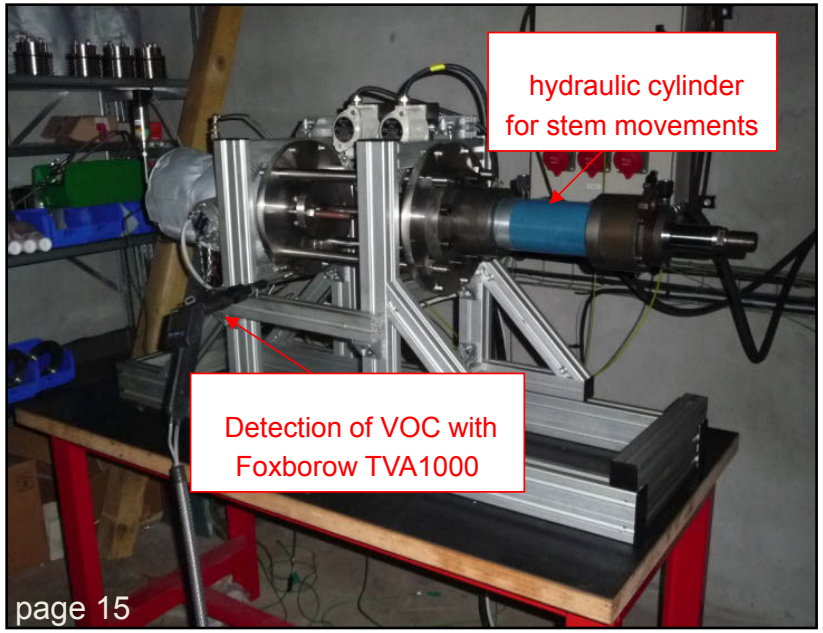
# Study of ISO 15848-1 changes

- Work program with French Valve Manufacturers
  - Instrumentation of a valve (API 600, 4''Cl300) to perform helium and methane measurements with various methods (vacuum, accumulation, suck through, sniffing)
  - Graphite based packings
    - ISO 15848-1 helium and $CH_4$ → influence of test fluid and method
    - API 624 helium and $CH_4$ → influence of test fluid and sniffing

# Study of ISO 15848-1 changes

- Work program
  - Test on API 622 bench with the same packings
    - API 622 according API622 and API624
      - To compare API622 and API624
      - To compare test on valve and test on bench





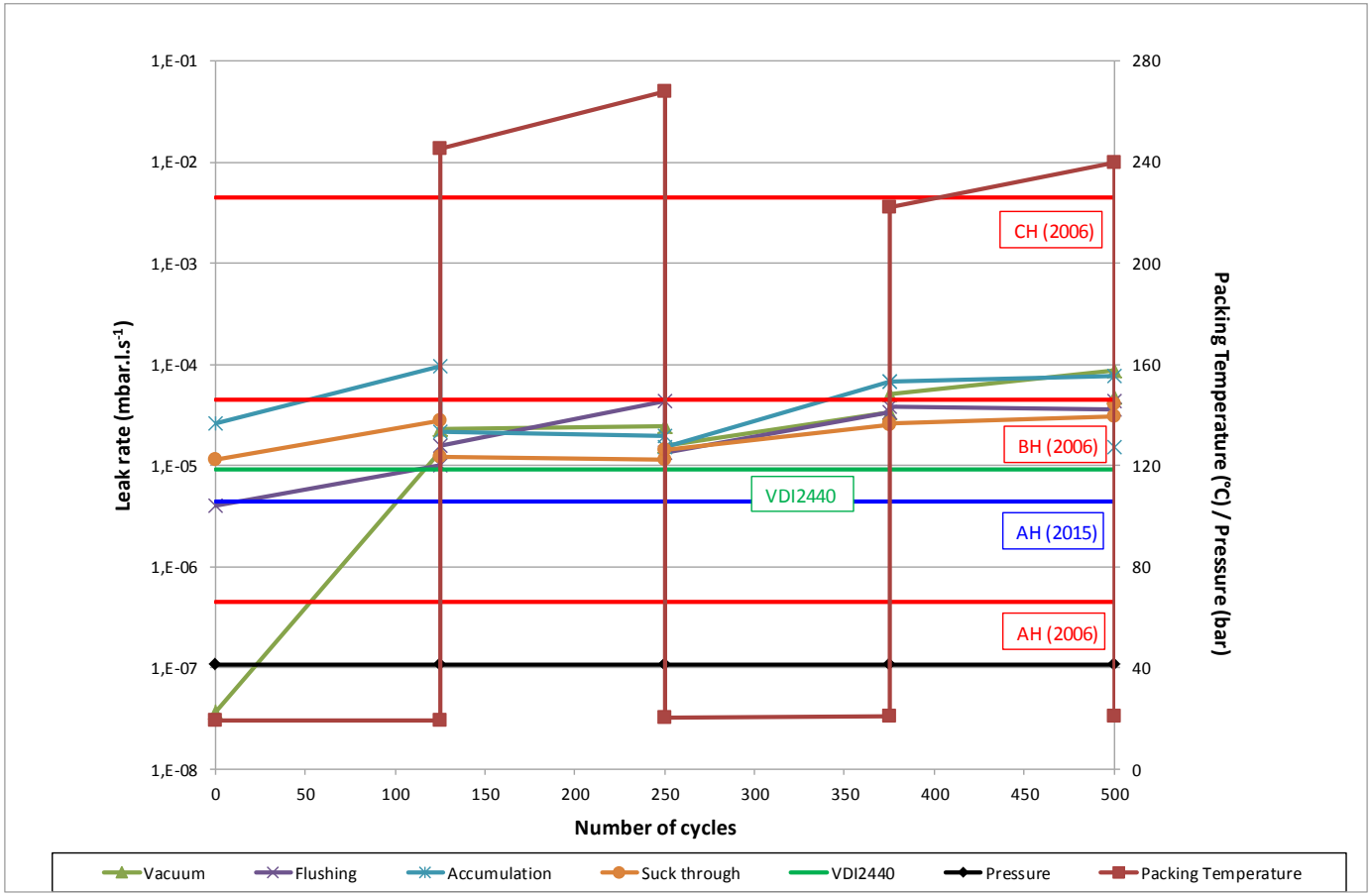
# Current status

- Progress from the previous work

| Step | Description | Status |
|---|---|---|
| 1 | Instrumentation of a valve (Atex heating system, ...) | ✓ |
| 2 | Helium test according to ISO 15848-1 | ✓ |
| | Methane test according to ISO 15848-1 | in progress |
| 3 | Helium test according to API624 | ✓ |
| | Methane test according to API624 | in progress |
| 4 | Methane test according to API622 | ✓ |
| | Methane test according to API624 | ✓ |
| 5 | Helium test according to API641 | in progress |
| | Methane test according to API641 | in progress |

# Study of ISO 15848-1 changes

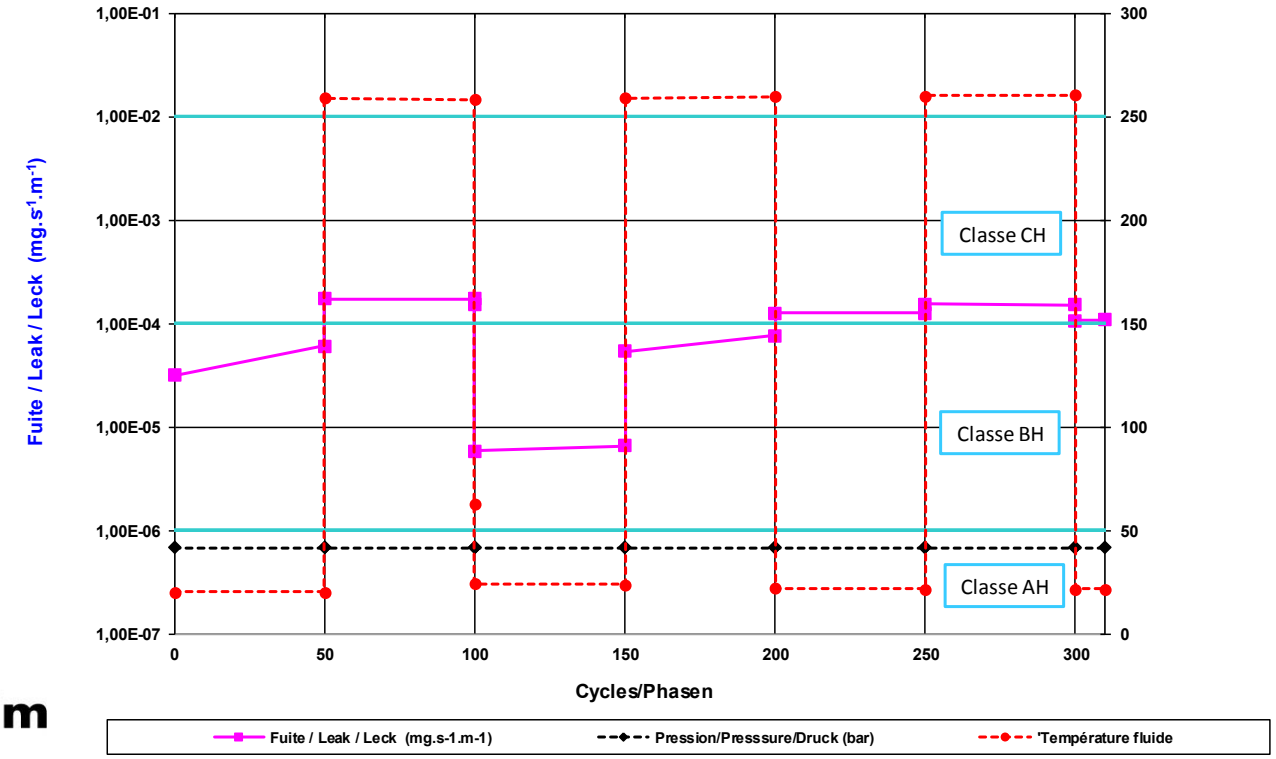
- Some results (CO1; 260°C - SSS; 41,4 bar)




– good agreement between the methods
– Vacuum method is well adapted for class AH

# Study of ISO 15848-1 changes

- Some results (API624; Helium; 260°C - SSS; 41,4 bar)




– Decrease of the leak rate during the first return at ambient temperature

– Leak rate close to those measured with ISO 15848-1

# Conclusion and scopes

- Conclusion
  - Second revision of EN ISO 15848-1 will be published in June of 2015
  - ISO 15848-1 main changes are the following
    - leak rate at the stem seal (Table 1) is expressed in **mbar.l.s$^{-1}$ per mm stem diameter**;
    - flushing method is replaced by **accumulation or suck through method** to measure leak rate from stem seal with Helium (Annex A);
    - leakage **with methane** is measured **by sniffing**; leakage is expressed **in ppmv**;
    - for tightness Class AH, **leak rate ≤ 1,78·10-7** (10-5 mg.s-1.m-1) → *TA Luft;*
    - tightness classes (Table 3): **AM ≤ 50 ppmv; BM ≤ 100 ppmv; CM ≤ 500 ppmv**;
    - there is **no correlation** intended between helium (Class AH, Class BH, Class CH) and methane tightness classes (Class AM, BM and Class CM);
    - minimum number of mechanical cycles required for isolating valves: **205 cycles** (instead of 500) with two thermal cycles.

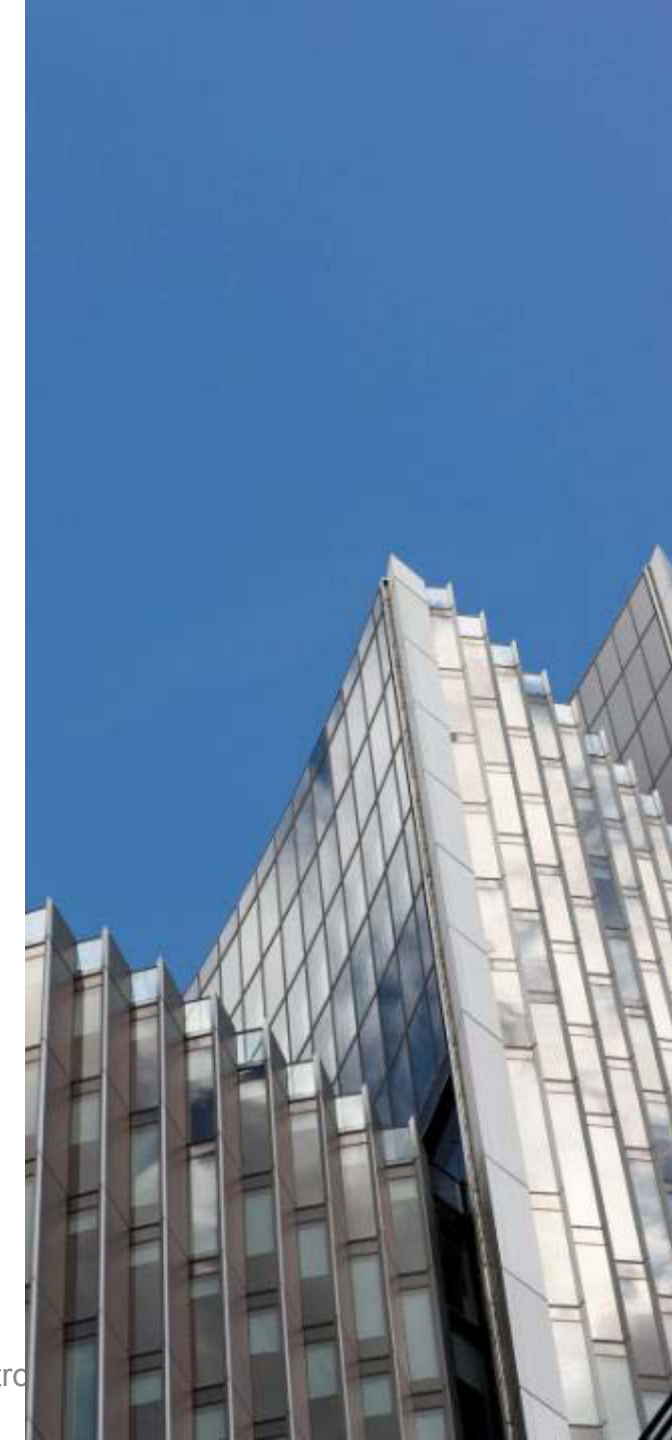
# Conclusion and scopes

- Looking forwad
  - A study is in progress
    - To evaluate impact of ISO 15848-1 changes (e.g. new possible leak rate measurements, comparison with VDI2440-TA Luft…)
    - To develop Test Rigs using methane as test fluid (API 622, API624, API641…)
    - To compare ISO 15848-1 with other procedures with various parameters
      - Test fluid
      - Thermal cycles
      - Mechanical cycles
      - Leakage measurement methods
  - Continuous evolution of test capacities of the Sealing Technology Lab to answer all kind of specific demand and ISO or API valve sealing system characterization

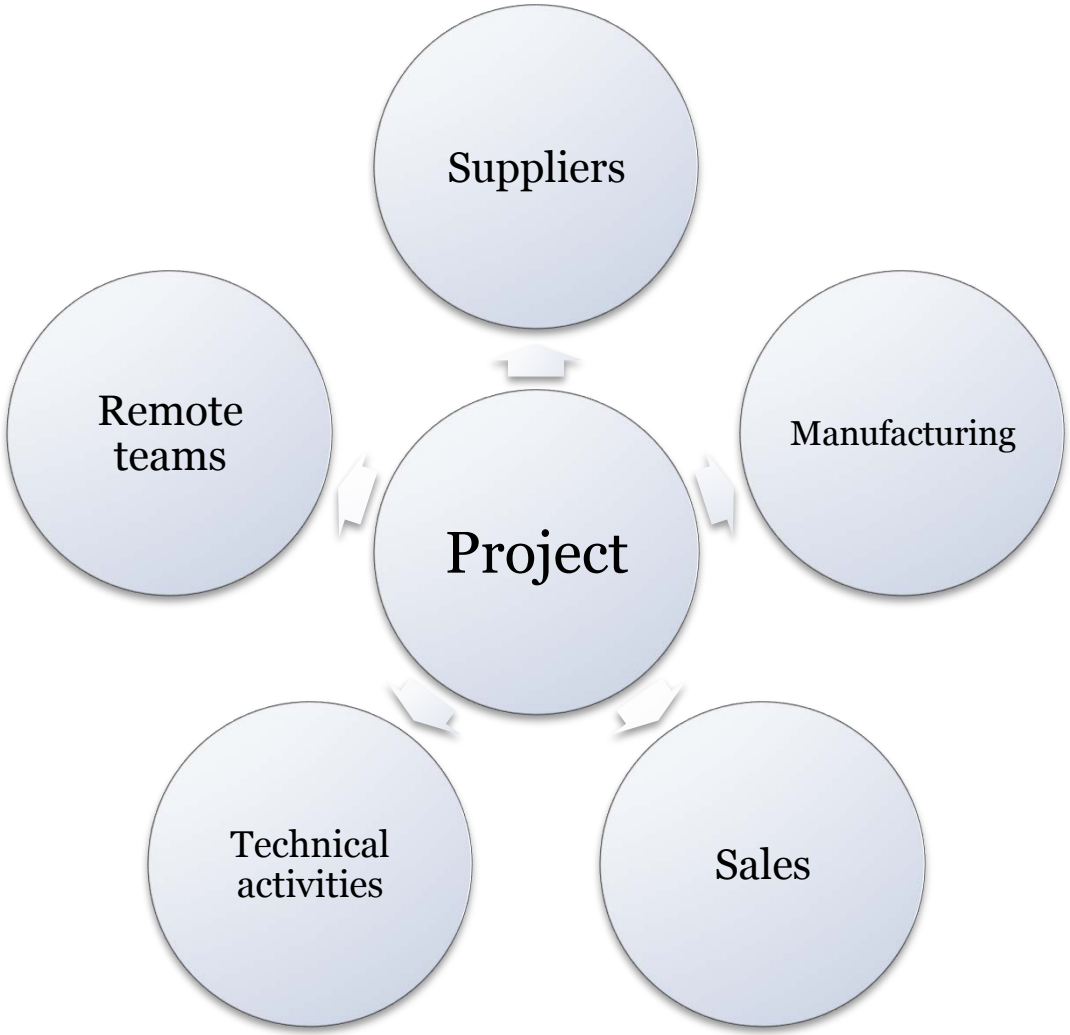
*Acknowledgements to French Valve Manufacturers & to Profluid*

# Looking forward

- Expiry of the next item
- Expected results
- Risks and known issues
  - Expected time for the analysis of these issues
- Actions and measures immediately following



# Dependencies and resources




# Addendum

# Addendum

- Budget
- Design documents
- Marketing plan
- Additional documents
- Contact information