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Engineer: CMB **No.:** DI00037
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Introduction to ISO 15848-1:

ISO 15848-1:2015 is a standard that evaluates how well valve seals prevent fugitive emissions. The standard tests valve stem seals and body seals for leakage (measured in concentration or a leak rate) and categorizes valves into different "tightness classes" based on how well a valve performed through a series of tests (endurance classes) at different temperatures and pressures (temperature classes). These classes are determined based on the test fluid used, the amount of cycles the valve undergoes, the temperature the test, and how a valve is identified (isolating or control valve). Isolating valves can be tested to 2500 cycles, while control valves can be tested to 100,000 cycles. Methane and Helium are both allowed as test fluids, and the standard does not allow for any correlations between them. Below are the different tightness classes (Table 1 and Table 3 for stem seals, Table 2 and Table 4 for body seals), temperature classes (Table 5), and endurance classes (Figure 1 and Figure 2) as defined by the standard (ISO,1).

Class	Measured leak rate (mass flow)	Measured leak rate (mass flow)	Measured leak rate (volumic flow)	Remarks
	$mg*s^{-1}*m^{-1}$ stem perimeter (for information)	$mg*s^{-1}*mm^{-1}$ stem diameter through stem seal system	$mbar*l*s^{-1}$*per mm stem diameter through stem seal system	
AH[a]	≤ 10-5	$\leq 3.14*10^{-8}$	$\leq 1.78*10^{-7}$	Typically achieved with bellow seals or equivalent stem (shaft) sealing system for quarter turn valves
BH[b]	≤ 10-4	$\leq 3.14*10^{-7}$	$\leq 1.78*10^{-6}$	Typically achieved with PTFE based packings or elastomeric seals
CH[b]	≤ 10-2	$\leq 3.14*10^{-5}$	$\leq 1.78*10^{-4}$	Typically achieved with flexible graphite based packings
a Measured by the vacuum method as defined in Annex A of ISO 15848-1				
b Measured by the total leak rate measurement method (vacuum or bagging) as defined by Annex A of ISO 15848-1				

Table 1- Tightness classes for stem (or shaft) seals with helium

Measured leakage ppmv
≤ 50
Note: Measured by the sniffing method as defined in Annex B

Table 2- Leakage from body seals with helium

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

Table 3- Tightness classes for stem (or shaft) seals with methane

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

Table 4- Leakage from body seals with methane

(t-196 °C)	(t-46 °C)	(tRT)	(t200 °C)	(t400 °C)
-196 °C	-46 °C	Room Temperature, °C	200 °C	400 °C

Table 5- Temperature classes

Notes on temperature classes (ISO,1):

- **Test at -196 °C:** qualifies the valve in the range -196 °C up to RT
- **Test at -46 °C:** qualifies the valve in the range -46 °C up to RT
- **Test at RT:** qualifies the valve in the range -29 °C up to 40 °C
- **Test at 200 °C:** qualifies the valve in the range RT up to 200 °C
- **Test at 400 °C:** qualifies the valve in the range RT up to 400 °C
- To qualify a valve from -46 °C to 200 °C, two tests are needed: test at -46 °C and test at 200 °C

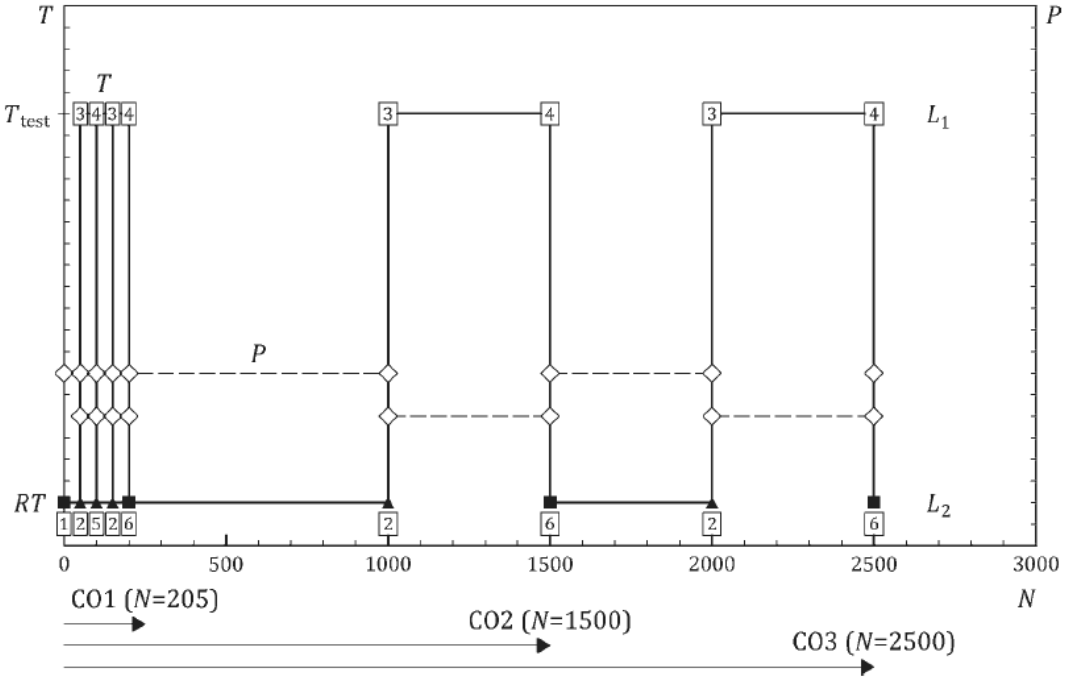

Figure 1- Mechanical-cycle classes for isolating valves (endurance Classes CO2 and CO3)

Note: This figure is Figure 5 in ISO 15848-1 standard

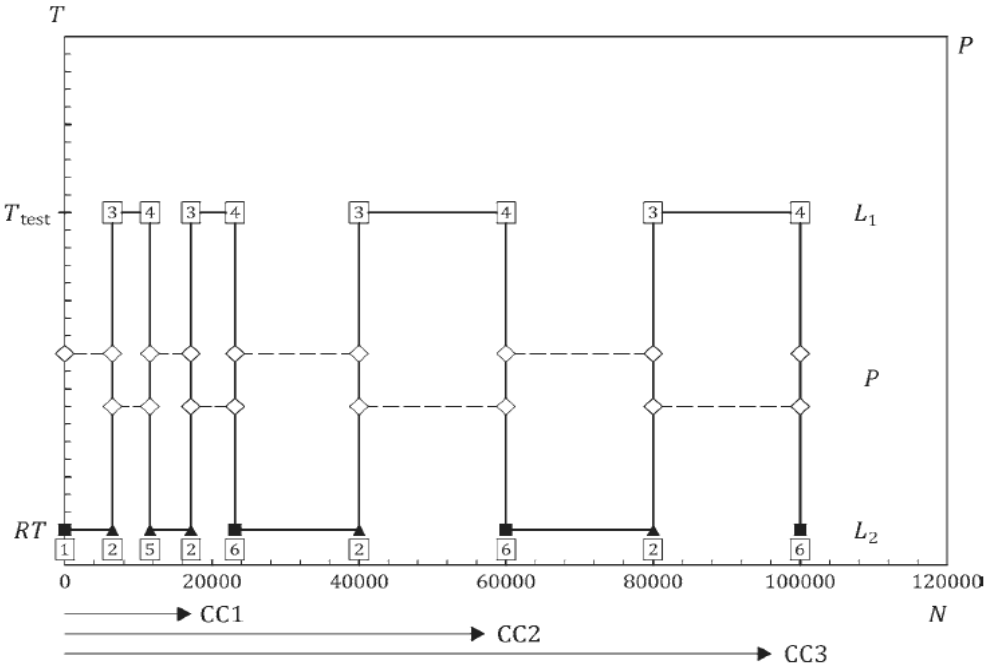

Figure 2- Mechanical-cycle classes for control valves

Note: This figure is Figure 6 in ISO 15848-1 standard

Key for Figures 1 and 2: (ISO,1)

T_{test}- test temperature, °C
L_1- measurement of leakage of stem seal
L_2- measurement of leakage of body seal
N- number of mechanical cycles
P- test fluid pressure
Numbers 1 through 6 (please refer to ISO 15848-1 for more detailed descriptions of these tests):

1- Preliminary tests at the room temperature (defined as -29 °C to 40 °C; defined in test report)
2- Mechanical cycle test at the room temperature
3- Static test at the selected test temperature
4- Mechanical cycle test at the selected test temperature
5- Intermediate static test at the room temperature
6- Final test at the room temperature

Marking and Identification of Qualified Valves

Valves that have passed ISO 15848-1 testing can have marking added to the valves to indicate their class designations. Information on the marking includes tightness class, endurance class, number of stem seal adjustments (SSA), temperature class, and test pressure. See an example below in Figure 3:

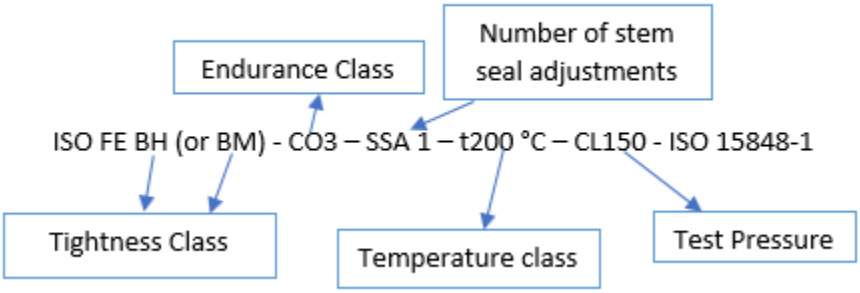

Figure 3- Class Designation Example

Extension of Qualification to Untested Valves

Section 8 of ISO 15848-1 describes conditions that need to be met for untested valves to be qualified using a different valve. These conditions include using the same materials, class rating is equal or lower, if the stem diameter of the untested valve is half to twice the tested valve, etc. (ISO,1)

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A-T Controls, Inc. Certified ISO 15848-1: 2015 Valves

Valves that have passed ISO 15848-1 testing or have been qualified per Section 8 of ISO 15848-1 are shown in the table below:

Valve	Class Designation
1/2" - 1" F90 or FD9-F1 Series	ISO FE BH - CO3 - SSA 2 - t200C - CL150 - ISO 15848-1
1-1/2" - 2-1/2" F90 or FD9-F1 Series	ISO FE BH - CO3 - SSA 1 - t200C - CL150 - ISO 15848-1
3" - 4 F90 or 3" - 6" FD9-F1 Series	ISO FE BH - CO3 - SSA 0 - t200C - CL150 - ISO 15848-1
1/4" - 4" F88 Series	ISO FE BH - CO3 - SSA 0 - t(RT) - CL600 - ISO 15848-1
FD9-F3 and 1/2" - 1-1/2" FD9-F6 Series	ISO FE BH - CO2 - SSA 0 - t200C - CL600 - ISO 15848-1
2” FD9-F6 Series	ISO FE CH - CO3 - SSA 0 - t200C - ANSI Class 600 - ISO 15848-1
F9R Series	ISO FE BH - CO3 - SSA 0 - t200C - CL300 - ISO 15848-1

Table 6- A-T Controls, Inc Certified ISO 15848-1:2015 Valves

Certificate Links on Website

https://a-tcontrols.com/resources/#certifications

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ISO 15848-2 Testing

ISO 15848-2 testing uses helium for production testing of valves that have already passed ISO 15848-1 testing. The allowable leakage rate of stem seals is also characterized in tightness classes (shown in Table 7 below), and the allowable leakage from body seals (shown in Table 8 below) (ISO,2). A-T Controls, Inc. can provide ISO 15848-2 testing with test reports at our Cincinnati facility. Valves are identified with a tag that indicates the unique test for each valve.

Class	Measured leakage ppmv	Remarks
A	≤ 50	Typically achieved with bellow seals or equivalent stem (shaft) sealing system for quarter turn valves
B	≤ 100	Typically achieved with PTFE based packings or elastomeric seals
C	≤ 200	Typically achieved with flexible graphite-based packings
NOTE: Measured by the vacuum method as defined in Annex A of ISO 15848-1		

Table 7- Tightness classes for stem seals

Note: this table is Table 1 in ISO 15848-2

Measured Leakage ppmv
≤ 50
Note: Measured by the sniffing method as defined in ISO 15848-1 Annex B

Table 8- Leakage from body seals

Sources

1. International Standards Organization. (2015). *Industrial Valves –Measurement, test and qualification procedures for fugitive emissions—Part 1: Classification system and qualification procedures for type testing of valves.* (ISO 15848-1 1st Edition). Geneva, Switerland: ISO.

2. International Standards Organization. (2015). *Industrial Valves –Measurement, test and qualification procedures for fugitive emissions—Part 2: Production acceptance test of valves.* (ISO 15848-2 2nd Edition). Geneva, Switerland: ISO.