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## **ECMA POSITION PAPER NO 05/009 ISSUE 06/2005**

### **RECOMMENDATIONS FOR THE DETERMINATION OF PERIODIC INSPECTION INTERVALS FOR COMPOSITE CYLINDERS AND A PROCEDURE FOR THEIR PROLONGATION**

#### **Introduction**

According to the requirements of ADR/RID chapter 4.1.4.1, packing instruction P200, Nr.(9), the intervals for periodic inspections for composite cylinders have to be determined by the competent authority of the Contracting Party to ADR/RID.

In Europe individual countries specify different intervals for composite cylinders. In order to harmonize the determination of periodic inspection intervals Europe wide, this paper is proposed as a guideline for competent authorities when choosing these intervals.

Additionally this paper gives a procedure involving extra testing which can be carried out after the initial service period, for increasing the inspection period for a particular cylinder type should deterioration not have occurred during the initial period.

#### **Principles for the determination of periodic inspection intervals**

Composite cylinders shall not receive inspection intervals longer than those stipulated in ADR/RID Packing Instruction P200 for monolithic steel/aluminium cylinders according to the gas classification codes.

The appropriate inspection intervals which shall be applied to various types of composite cylinders shall be specified by the Competent Authority who is in charge of the design approval in accordance with Table 1.

Where two figures are shown in the table for a particular design of cylinder the shorter interval shall be applied to newly developed designs. If no verification of the behaviour of these new designs has been demonstrated by the manufacturer, then the shorter periodic interval shall continue to be applied. However, if it can be demonstrated that a particular design has given acceptable service during the initial period, this design may move to longer inspection interval if the procedures outlined in this document are followed. After successful completion of the additional testing outlined, the extended intervals may apply to those cylinder types and also to newly produced cylinders of designs with equivalent liner/fibre/matrix systems.

Table 1

Cylinder Type Material combination	Hoop wrapped cylinders to EN 12257		Fully wrapped cylinders with load sharing liner to EN12245		Fully wrapped cylinders with non-load sharing liners or linerless cylinders to EN 12245			
	Steel	Aluminium- alloys	Steel	Aluminium- alloys	Steel	Alu	Plastic	without liner
<b>Fibre material</b>	<b>Inspection intervals in years (for gases of classification code 1A, 1O, 1F, 2A, 2O and 2F) <sup>4)</sup></b>							
<b>Glass-limited life</b>	5	5	5	5	3 / 5 <sup>2)</sup>	3 / 5 <sup>2)</sup>	3 / 5 <sup>2)</sup>	3 / 5 <sup>2)</sup>
Glass-unlimited life	5	5	5	5	5 / 10 <sup>2)</sup>	5 / 10 <sup>2)</sup>	5/10 <sup>2)3)</sup>	5 / 10 <sup>2)3)</sup>
<b>Aramide limited life</b>	5	5	5	5	5	5	5	5
Aramide unlimited life	5 / 10 <sup>1)</sup>	5 / 10 <sup>1)</sup>	5 / 10 <sup>2)</sup>	5 / 10 <sup>2)</sup>	5 / 10 <sup>2)</sup>	5 / 10 <sup>2)</sup>	5/10 <sup>2)3)</sup>	5 / 10 <sup>2)3)</sup>
<b>Carbon limited life</b>	5	5	5 / 10 <sup>2)</sup>	5 / 10 <sup>2)</sup>	5	5	5	5
Carbon unlimited life	5 / 10 <sup>1)</sup>	5 / 10 <sup>1)</sup>	5 / 10 <sup>2)</sup>	5 / 10 <sup>2)</sup>	5/ 10 <sup>2)3)</sup>	5/ 10 <sup>2)3)</sup>	5/10 <sup>2)3)</sup>	5 / 10 <sup>2)3)</sup>

Footnotes:

- 1) To apply these extended intervals the manufacturer has to demonstrate that after 5 years in service, should there be a failure in the fibre wrapping, the liner is able to withstand the maximum permissible pressure at maximum service temperature without failure. The manufacturer shall also demonstrate that there is no evidence of deterioration of the matrix material when exposed to normal service conditions.
- 2) To apply these extended intervals the manufacturer has to verify after 3 or 5 years in service, whichever is the initial interval, that there is no evidence of deterioration of the cylinder quality behaviour when exposed to normal service conditions. For plastic lined and linerless composite cylinders this includes verification of permeation, ageing and post-curing.
- 3) These intervals may apply to cylinders with non-load sharing liners or linerless composite cylinders having a test pressure less than 30bar or less.
- 4) For all other gases stipulated in ADR/RID chapter 4.1.4.1, packing instruction P200, Nr.(9), a) and b) the maximum inspection interval according to clause 2.1 shall not exceed 5 years.

General Note. To ensure safe use of all gas cylinders it is imperative that appropriate prefill inspection procedures are carried out

**Procedure for prolonging periodic inspection intervals for composite cylinders**

Following the initial inspection period and positive results from the first periodic inspection, the manufacturer may apply for an extended periodic inspection interval for composite cylinder designs which have demonstrated successful service.

After having passed the periodic inspection according to the relevant standard/regulation the following tests shall be carried out by an authorised inspection body on at least 20 cylinders, preferably originating from the same production batch.

Provided the results of the periodic inspection show satisfactory results the following qualification procedure to gain extended periodic inspection intervals for further service shall be performed:

- (i) Ambient pressure cycling tests on two cylinders in accordance with EN 12245 or EN12257 as applicable. The number of cycles required without failure shall be the same as that used during the original type approval, minus 250 cycles per service year.
- (ii) Hydraulic burst tests on two cylinders (Test No.5 - in accordance with EN 12245 or EN12257 as applicable). The acceptance criteria for these tests shall be the same as for new cylinders.
- (iii) For composite cylinder designs with non-load sharing plastic liners or linerless cylinder designs a permeability test (Test No. 14 to EN12245) on one cylinder. The acceptance criteria for these tests shall be the same as for new cylinders.
- (iv) For composite cylinder designs with non-load sharing plastic liners or linerless cylinder designs a torque test (Test No. 15 to EN12245) on one cylinder. The acceptance criteria for these tests shall be the same as for new cylinders.

The test results of the above tests shall be compared with the prototype testing results. If the results do show a significant deterioration (less than 90% of values determined during prototype testing) further investigation shall be carried out to find the root cause of the difference. Otherwise a supporting test report to prolong the initially determined intervals shall be issued and forwarded to the competent authority.

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