



CYLINDERS SERVICE LIFE

NGV GLOBAL / ACT EXPO LONG BEACH CONVENTION CENTER 2014

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STANDARDS

COMPARISON TABLE OF RULES FOR A STEEL CYLINDER

REQUIREMENTS	IRAM 2526:2005	ISO 4705:1983-D	NZS 5454	NGV2 – T1	ISO 11439 – T1
SAMPLE APPROVAL OF EACH LOT	Traction, Resilience, Bending or crushing. Burst	Traction, Resilience, Bending or crushing. Burst	Traction, Resilience, Bending or crushing. Hardness cycled + Burst	Traction. Resilience. Hardness Burst Cycled. Painting U.S.	Traction. Resilience. Hardness Burst Cycled. Painting U.S
SERVICE LIFE	NO	NO	NO	25 years max	20 years max
OVERVIEW NON-DESTRUCTIVE TESTING (FLOWS).	NO	NO	YES	YES	YES
CYLINDER INTERNAL PROTECTION (Corrosion)	NO	NO	YES	YES	YES
TEST FIRE	NO	NO	NO	YES	YES
PERMEANT TEST	NO	NO	NO	YES	YES
METHOD OF DETERMINATION OF CRITICAL AREAS OF FATIGUE	NO	NO	NO	YES	YES
DETERMINATION OF FAILURE FOR NON-DESTRUCTIVE TESTING.	NO	NO	NO	YES	YES
RELIEF DEVICE AND PROTECTION FOUNDATION	NO	NO	NO	YES	YES
TEST LOSS BEFORE BREAK	NO	NO	NO	YES	YES

COMPARISON BETWEEN REQUIRED CONDITIONS FOR STANDARD ISO 11439 AND NGV2 ABOUT CYCLING TESTS FOR CYLINDERS.

REQUIREMENTS	ISO 11439:2000	NGV2:2000	DELTA
	ECE R 110		
MINIMUM NUMBER OF CYCLES FOR EACH YEAR OF DESIGN LIFE	1.000	750	33%
MINIMUM QUANTITY OF CYCLES REQUIRED FOR THE STANDARD	15.000	11.250	33%
MINIMUM LIFE REQUIRED	15 years	15 years	0
PRESSURE RANGE INTO WHICH CYLINDERS SHOULD BE CYCLED IN PERIODICAL TESTS (BATCH TESTS)	20 – 260 bar(1)	26 – 259 bar(2)	—
	(Maximum Cycles Rate 10 cycles/min)	(Maximum Cycles Rate 10 cycles/min) Point 12.5.2.1	
	Point A-13.		
MAX. LIFE SERVICE	20	25	-20%

*“...A consideration in the design of CNG cylinders is the number of pressure cycles a cylinder may experience from filling operations. CNG cylinders will experience a significantly greater number of pressure cycles than cylinders used in industrial service. Repeated pressurization cycles will eventually result in the growth of fatigue cracks in metal cylinders and liners. A **“worst-case” pressure cycle life was defined as 1000 pressure cycles per year of life, i.e. 15000 pressure cycles for a 15-year-design life. In the development of ISO 11439 some traditionalists wanted an excessive pressure cycle life requirement applied to the performance testing of designs (“But we have always done it that way!”); for example, requiring a 15-year design to provide a minimum 30000 pressure cycles in performance tests...”** **

* Craig Webster , ISO Bulletin, February 2001

STANDARDS USED

- IRAM 2526 Edition: 1972 / 1992 / 1997 and 2005
- ISO 4705 Edition: 1983;
- CAN/CSA B399 / DOT 3 AA;
- ANSI/IAS NGV2 Edition: 1992 / 2007;
- EB 926A; DM12/09/1925;
- CTC 3AA; ANNCC / IGMC;
- NBR 12790 A; BS 5045 - Pat1 – 1983;
- NZS 5454: 1989
- COVENIN 3226

MOST OF THE MENTIONED STANDARDS DO NOT ESTABLISH

- Maximum service life of the cylinder.**
- Degree of cleaning of the raw material (steel and aluminum).**
- Chemical composition of the gas.**
- Determination of the maximum size of admissible defect.**
- Design based on the LBB principle.**
- Bonfire Test**
- Penetration Test**
- Extreme temperatures test**

GNC SYSTEM IN ARGENTINA



- **The state regulates and audits (ENARGAS)**
 - Administrative regulation of all Technical activities.
 - Regulation of Rules of application.
 - Strong controls and severe penalties on those who deviate from the system.
- **The system is based on subjects defined by local regulations.**
 - Control Agencies.
 - Audit and certify all the subjects of the system.
 - Parts manufacturers.
 - Conversion Equipment Producers.
 - Approves separate parts from different manufacturers ensuring that works in conjunction.
 - Installation Workshops.
 - Assemble CNG equipment.
 - Performs annual reviews of the installed equipment, enabling an additional year of service.
- **Filling Stations.**
- **Technical Professionals.**
 - Support the actions of the subjects of the system.
- **The subjects of the system, have joint responsibility.**
- **The cylinders are reviewed every 5 years. (CRPC)**
 - According to statistics INFLEX CRPC, 0.7% of the cylinders are rejected / condemned by technical problems. (2003 - 2008; 37122 reviews)
 - After the expiration of five years, the vehicle can not load GNC.
- **Computer system that traces the history of CNG equipment once installed.**
 - Annual review of the entire set of pieces of equipment that enables another year CNG load.
 - Cylinder certified reviews.
 - Vehicle data.
 - Owner's details

MANUFACTURERS WHOSE CYLINDERS WERE INSTALLED IN ARGENTINA

- ARGENTOIL SA
- CHERTERFIELD
- CILBRAS
- EUROCIL
- IMZ
- KIOSHI COMPRESIÓN
- KALVANCO
- MAT INCENDIO
- SARAVIA
- EKC
- MESCO GAS
- TAYLOR WHARTON
- NORRIS
- JP
- JMAR
- BOGAP
- ANSI
- CIDEGAS
- FABER
- GIFEL
- IMPROCIL
- LUIS PASQUINELLI e Hijos
- ECOTEMP
- PISL
- SITEA
- SIMMEL
- WORTHINGTON
- NI INDUSTRIES
- ITMAR
- DALMINE
- TEXCOM

MANUFACTURERS WHOSE CYLINDERS WERE INSTALLED IN ARGENTINA THAT DISAPPEARED

- IMZ (Italia)
- BOGAP (Italia)
- SITEA (Argentina)
- SARAVIA (Argentina)
- KALVANCO (Argentina)
- PISL (Argentina)
- CHESTERFIELD (Inglaterra)
- SIMMEL
- ITMAR
- JMAR
- NI INDUSTRIES
- ANSI (Argentina)
- ECOTEMP (Rusia)
- BRUNSWICK (Usa)

This loss of responsible of the system, leaves users stranded in case of accident, and is also the cause of disappearance of any of them, either by an accident resulting from a failure of their products

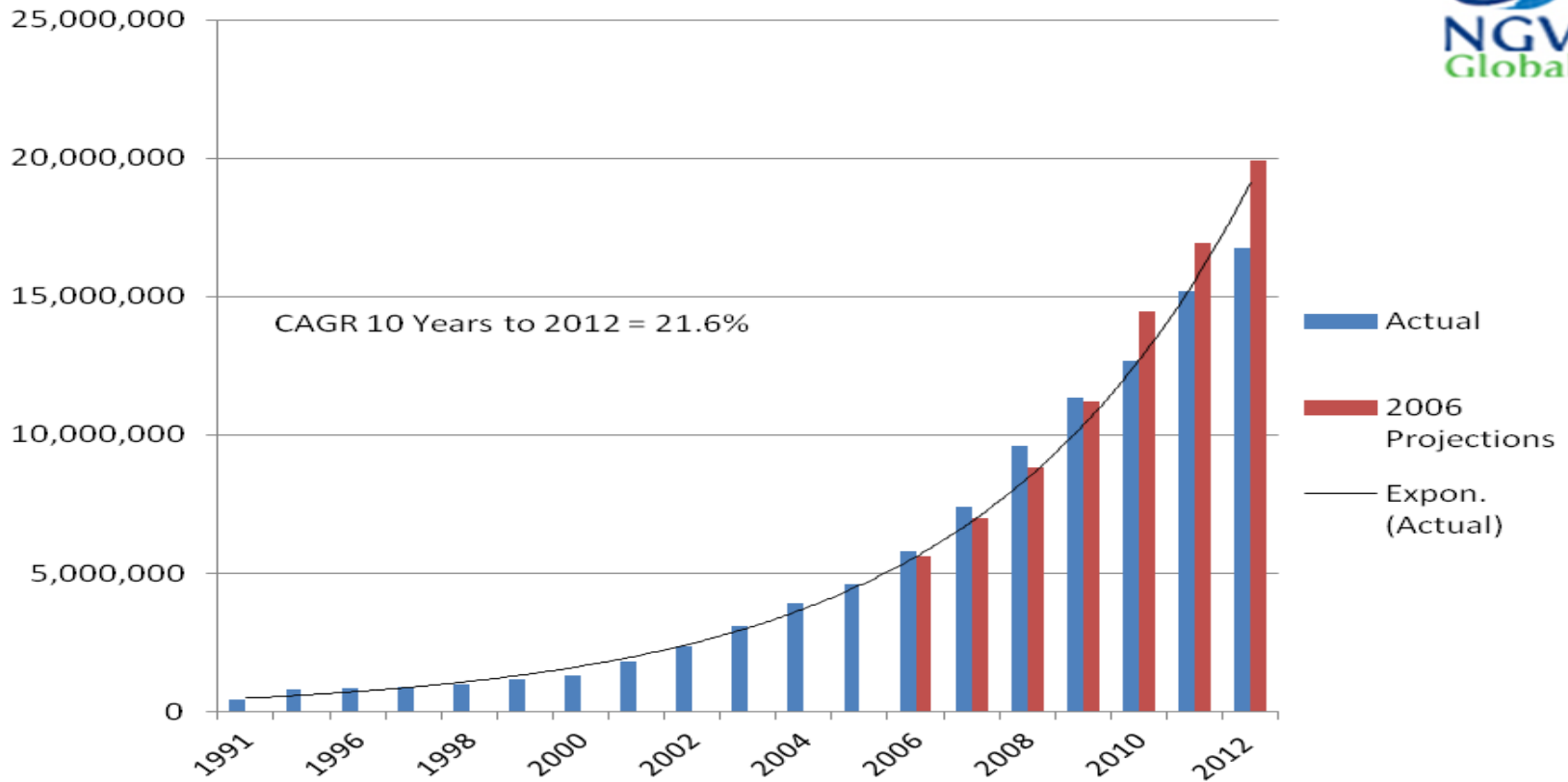
CYLINDERS IN SERVICE

- More than 17.000.000 of vehicles in the world use a NGV system. The 15 % of this amount is placed in Argentina.
- Particularly in Argentina with 30 years of historical NGV application system, this one is built on cylinders from 31 different manufacturers, of which today there only remain open about 16 manufacturers.
- This lack of presence generates a loss of people responsible and then the undercover of actual customers of this product against quality problems or incidents.
- It's necessary to explain that some of them disappeared due to incidents that came from the failures in their products
- Those responsible disappears of the system, but also traceability is lost.

TOTAL VEHICLES WORLDWIDE



Total Natural Gas Vehicles (Worldwide) 1991 - 2012



CONCLUSIONS

- **THERE IS NO DESTRUCTIVE METHOD THAT GUARANTEES WITH ABSOLUTE CERTAINTY THE USEFUL LIFE IN THE INSPECTION AFTER THE PRODUCTION.**
- **THIS LEADS TO BE CAUTIOUS, MINDFUL OF INHERENT RISK.**
- **AS IT INCREASES THE LOAD CYCLES, FATIGUE CAN CAUSE CRACKS THAT COULD SPREAD CAUSING A BURST.**
- **THIS IS WHY IT'S A MUST TO SET USEFUL LIFE TO THOSE CYLINDERS PRODUCED UNDER PREVIOUS STANDARDS WHICH DO NOT FORESEEN THIS, BECAUSE THE PARK AGING WILL BECOME AN EXPONENTIAL GROWTH OF ACCIDENTS THEREFORE “RESTRICTIVE CHARACTER” MUST BE APPLIED.**

ACCIDENTS

- <http://www.infobae.com/2014/01/16/1537499-le-exploto-el-auto-cuando-cargaba-gnc-perdio-las-piernas-y-esta-grave-estado>
- NGV cylinder blast injures pump worker.
- Eight vehicles badly damaged in explosion.
- A *old* substandard compressed natural gas (CNG) cylinder in a bus exploded at a PTT gas station in Samut Prakan yesterday, wounding a staff member and damaging seven other vehicles.



- THANK YOU!
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