Luxfer
Gas Cylinders

CYLINDER TYPE: 618/1/Q

TECHNICAL CHARACTERISTICS

1.1 Dimensions:

Water Capacity (min.)-	1.0	litres
Minimum Wall Thickness-	6.80	mm
Diameter (external)-	102	mm
Test Pressure -	300	bar
Length (approx.)-	240	mm
Weight (Approx. Empty) -	1.62	kg

1.2 Minimum Mechanical Properties:

0.2% Proof	280 N/mm^2
UTS	330 N/mm^2
Elongation	12%

1.3 Material:

Aluminium alloy AA6061 is an alloy containing magnesium and silicon in proportion to form magnesium silicide, thus making the alloy heat treatable. The alloy combines medium strength, good formability and machinability with excellent corrosion resistance.

1.4 Composition:

	WT/%		
	Min		**Max**
Silicon	0.40	-	0.8
Iron			0.7
Copper	0.15	-	0.40
Manganese			0.15
Magnesium	0.8	-	1.2
Chromium	0.04	-	0.35
Zinc			0.25
Titanium			0.15
Lead			0.0030*
Bismuth			0.0030*
Others {Each			0.05
{Total			0.15

* Limit set by Luxfer on Suppliers

1.5 Properties (Typical):

Temper Condition	**0.2% Proof N/mm^2**	**UTS N/mm^2**	**Elongation % (On $5.65\sqrt{S_o}$)**
T6	315	356	14.2

1.6 Physical Constants:

Specific gravity	2.7
Electrical conductivity	43.1% IACS
Modulus of elasticity	69 Gpa

1.7 Manufacturing Process:

Luxfer manufacture seamless aluminium alloy cylinders by cold impact extrusion. The open end of the shell formed by extrusion is subsequently closed by heading (hot formed in a die) to give the characteristic cylinder profile. Solution heat treatment, quenching into cold water and artificial ageing is carried out to develop the mechanical properties. This is followed by machining of the threads, stamping of marks and inscriptions, pressure testing, internal cleaning, full inspection, painting as required and packing.

SECTION TWO STRENGTH CALCULATIONS

2.1 Calculation of Minimum Wall Thickness:

Based on wall thickness equation from the EC Directive 84/526/EC :

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Use,
$$a = \frac{P_h \cdot D}{\frac{20 \cdot R}{4/3} + P_h}$$

Where,

a	=	Minimum Wall Thickness - (mm)
P_h	=	Hydraulic Test Pressure - (bar)
D	=	Nominal External Diameter of Cylinder - (mm)
R	=	Lesser of R_e or 0.85 R_m
R_e	=	0.2% proof stress of material - (N/mm^2)
R_m	=	Tensile strength of material - (N/mm^2)

For 618/1/Q

P_h	=	300	bar
D	=	102	mm
R_e	=	280	N/mm^2
R_m	=	330	N/mm^2
R	=	Lesser of 280 or 0.85 x 330 = 280.5	N/mm^2

$$a = \frac{300 \cdot 102}{\frac{20 \cdot 280}{4/3} + 300}$$

$\therefore$ a = 6.80 mm

This is the value of 6.80 mm shown on the cylinder drawing.

The minimum wall thickness of 6.80 mm is greater than $\left(\frac{D}{100}+1.5\text{mm}\right)$

Where D = External diameter.

i.e. min. wall of 618/1/Q is 6.80 mm $\left(\frac{D}{100}+1.5=2.52\text{ mm}\right)$

2.2 Hydraulic Burst Test

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The measured burst pressure (P_r) shall be not less than:

$$P_{rt}=\frac{20a\cdot R_m}{D-a}$$

Where; P_r = Actual burst pressure measured during testing - bar
P_{rt} = Calculated minimum theoretical burst pressure - bar
a = Calculated minimum wall thickness - mm
D = The nominal external diameter of the cylinder – mm
Rm = The minimum guaranteed tensile strength – N/mm^2

Applying to the 618/1/Q:

Where; a = 6.80 mm
D = 102 mm
Rm = 330 N/mm^2

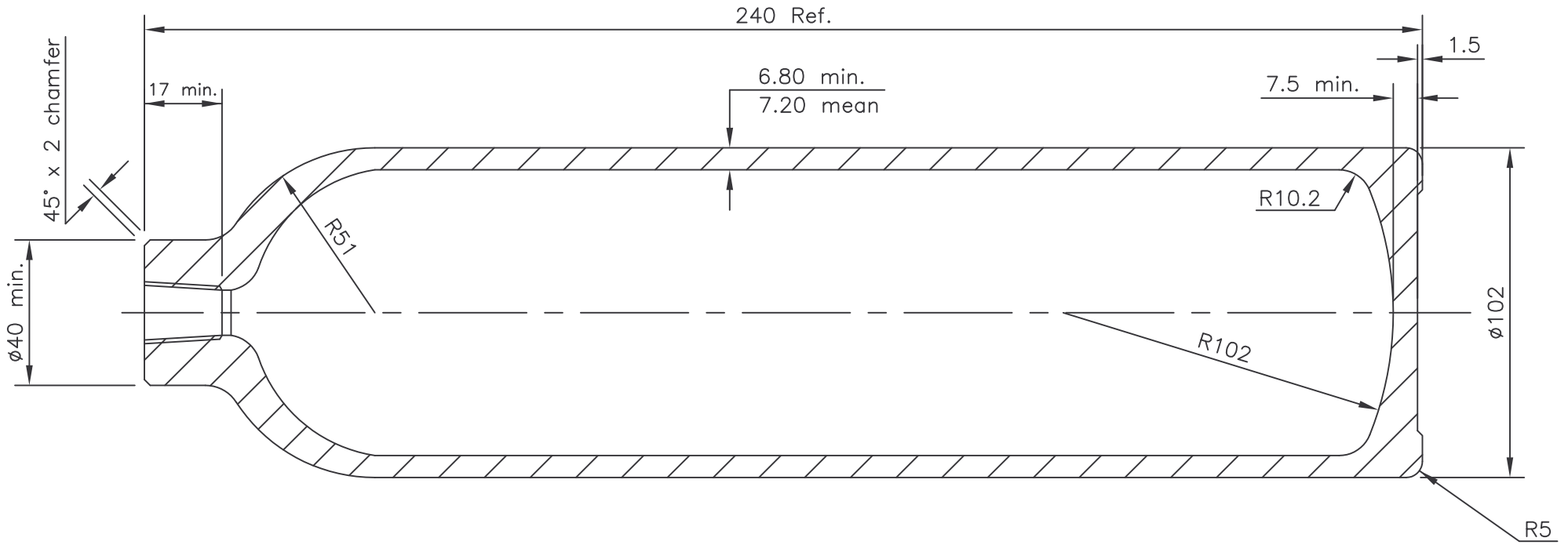
Then,

$$P_{rt}=\frac{20\cdot 6.80\cdot 330}{102-6.80}$$

∴ **P_{rt} = 472 bar**

Simon Nicholson
Senior Design Engineer

Luxfer Gas Cylinders Ltd.



MATERIAL: Aluminium Alloy AA6061 T6	WATER CAPACITY: 1.00L (min.)	CHARGING PRESSURE @15°C: 200 bar	CHECKED	A.S.N.	© LUXFER GAS CYLINDERS LTD. 2008 The copyright of this drawing belongs to Luxfer Gas Cylinders. It is supplied on the express terms that it is to be treated as confidential and is not to be copied or communicated to any other person. It is not to be used for the purpose of construction or manufacture unless expressly authorised for that purpose on each occasion that it is used.
UTS (min.): 330 N/mm²	EMPTY WEIGHT: 1.62 Kg (approx.)	———	DATE	08.January.08	
0.2% PROOF STRESS: 280 N/mm²	THREAD: 19.8 DIN 477	TEST PRESSURE: 300 bar	DESIGN: 84/526/EEC	ALL DIMENSIONS IN mm U.O.S.	TITLE: 1.0L PERMANENT GAS CYLINDER
ELONGATION: 5.65 √A (min.) 12%	FILLING RATIO: ———	BURST PRESSURE: 472 bar		APPROVAL No.: 84/526/EEC/UK19 APPROVAL MARK: E 2UK935UK	618/1/Q ISSUE 4 Taken From EEC Family Drawing 424/1/Q M5089

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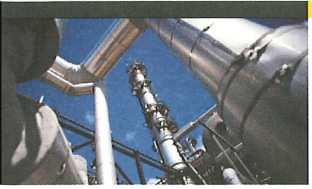

APRAGAZ

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NOTIFIED BODY TYPE APPROVAL CERTIFICATE

Issued in accordance with Pt. 1.8.7.2.4 (Renewal) of ADR 2021 agreement and following:
Directive 2010/35/EU *(TPED)*
Directives 2008/68/EC *(Annex 1)* & 2020/1833/EU

Certificate N°:
01/GB/231
Index 1 – Rev. 0

Manufacturer: *LUXFER GAS Cylinders Ltd.*
Colwick, Nottingham, NG4 2BH
ENGLAND

Concerned Equipment: *Seamless aluminium alloy refillable Gas Cylinders.*

Drawing n° 424/1/Q Issue 1

Test pressure: ***300*** *bar*
Diameter (out): ***102*** *mm*
Water Capacity: ***1.0*** *L*
Wall thickness min (Cylindrical part): ***6.8*** *mm*
Bottom thickness min (Central part): ***7.5*** *mm*

Concerned EC Directives & Standards used for this type approval (renewal):
TPED (2010/35/EU), ADR 2021 and Annex I, Parts 1 to 3 to 84/526/EEC

The conformity assessment of the concerned equipment will be performed in accordance with:

- Pt. 1.8.7.3 of ADR (Supervision of the manufacture)
- Pt. 1.8.7.4 of ADR (Initial inspection and tests)

This will be performed by a relevant body which can be either:

- A TPED - ADR notified / inspection body (**Xa**), *See Pt 6.2. of ADR, or*
- The in-house Inspection Service of the manufacturer (**IS**), *See Pt 6.2. of ADR.*

The manufacturer will be allowed to affix the ⚱ *mark followed by the appropriate notified body identification number to approved equipment under the conditions described in the chapter 3 of the TPED Directive (2010/35/EU).*

The Certificate is valid until 12th October 2031

Approval Date: ***29/10/2021***
Notified body identification n°: ***0029***
Notified body (Xa): APRAGAZ VZW/ASBL
Notified body reference / Technical file: *0110/F.1391*

Name: ***B. Nève ir***
Position: ***General Manager***
Signature:

Certificate of Registration

QUALITY MANAGEMENT SYSTEM - ISO 9001:2015

This is to certify that:

Luxfer Gas Cylinders Limited
Division of Luxfer Group Limited
Private Road 2
Colwick Industrial Estate
Nottingham
NG4 2BH
United Kingdom

Holds Certificate Number: FM 23214

and operates a Quality Management System which complies with the requirements of ISO 9001:2015 for the following scope:

The design, development, manufacture, assembly and supply of aluminium alloy seamless high pressure gas cylinders, medical gas therapy devices, alternative fuel devices, and associated products and aluminium cold impact extrusion to customer order and specification requirements appropriate to the destination country

For and on behalf of BSI:

Matt Page, Managing Director Assurance - UK & Ireland

Original Registration Date: 1993-02-15
Effective Date: 2022-05-19
Latest Revision Date: 2022-07-19
Expiry Date: 2025-05-18

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