

1. GENERAL

This document is a short version and an extract from the “Instruction for filling and periodic inspection” for the Hexagon Ragasco composite LPG cylinders, adjusted to fit specific US requirements.

The cylinders from Hexagon Ragasco being used in the US are approved in accordance with Special Permit 12706, which also presents in which way retesting shall be done.

2. SCOPE

This document describes the procedure for requalification and covers also acceptance/rejection criteria for mechanical, material and heat damage on the VIKING CYLINDERS® and/or casing.

This document does not cover all aspects on e.g. filling instructions/prefill checkpoints or markings on the cylinder or the valve. For any such points, or other inspection points not covered by this standard, please refer to following documents:

DOT SP 12706

0147230-812 – COMPLET, RAGASCO LPG Composite Cylinders, Instruction for filling and periodic inspection

Only facilities approved by DOT are authorized to perform requalification on composite cylinders manufactured by Hexagon Ragasco. Information on how to become approved can be obtained by contacting our North America office through northamerica@hexagonragasco.com.

3. PROCEDURE FOR REQUALIFICATION

Before commencing with requalification it shall be established whether a cylinder is due for requalification or not. This is done by inspecting the markings on the cylinder. Both production date and any previous requalification marks shall be identified.

3.1 WHEN SHOULD A CYLINDER BE RETESTED

There are two options on requalification

1. Perform requalification every 10 years, performing visual inspection AND hydraulic pressure testing
2. Perform requalification every 5 years, performing ONLY visual inspection and NO hydraulic pressure testing.

To establish whether a cylinder is due for requalification it has to be established how long it has been since its last inspection, be it either at production (initial testing) or at a previous requalification. Check marking on the casing, see **Picture 3.1.2a** for the date of manufacture, and then for any instance of requalification marking, see **Picture 3.1.2b**.



Picture 3.1.2a – Marking at the front of the casing shows when the cylinder was produced. Marking format is month, year, MMY. Circled in red.



Picture 3.1.2b – Example of requalification label epoxied to cylinder. Contains RIN/VIN and Month & Year of test.

3.2 PROCEDURE, STEP-BY-STEP, SHORT VERSION

Below step-by-step lists considers cylinders already identified as being subject to requalification.

3.2.1 VISUAL INSPECTION ONLY

1. Note cylinder ID number in a file
2. Inspect entire cylinder surface for damage from
 - a. Impact damage – e.g. areas with local damage such as cracks in combination with delamination etc.
 - b. Chemical attack – e.g. discoloration or local damage due to dissolution of material etc.
 - c. Fire or heat damage – e.g. charring, soot, deformed casing etc.
 - d. Abrasion damage – e.g. areas with material abraded away etc.
 - e. Cuts or gouges – e.g. damages from cuts or severe local abrasion
3. Note result from visual inspection in the file
4. Apply sticker with information on next inspection date and inspection facility, format MM|IAXX|YY, where XX stands for the Inspection Agency ID no.
5. Cover the sticker with resin, i.e. epoxy or polyester.
6. Note in the file that the cylinder has been inspected.

3.3 ACCEPTANCE AND REJECTION CRITERIA

Type of damage	Description	Rejection if
Abrasion damage or damage from cuts.	<p>Abrasion damage caused by wearing, grinding or rubbing material away by friction.</p> <p>Cuts or gouges caused by contact with sharp objects in such a way as to cut into the composite, reducing its thickness at that point,</p>	<p>Casing damage:</p> <ul style="list-style-type: none"> Any small and large damage to the upper casing “skirt” typical $>20\text{mm}^2$, depending on depth and mode Cuts/cracks to the lower casing base Abrasion / cut through casing Total length of non-penetration cuts $>50\%$ diameter of the cylinder Total damaged area maximum diameter is more than 50 % of the diameter of the cylinder (note 1) <p>See Figure 1</p> <p>Composite damage:</p> <ul style="list-style-type: none"> Any cut or otherwise damaged fibre <p>See Figure 2</p> <p>Note 1: the maximum diameter of the damage area is the diameter of the smallest circle that includes the damaged area. Note 2: Intra-laminar hairline cracks (between fibres, typically on the circumference after proof testing) are allowed if not in combination with impact damage. Note 3: Scratches that do not sever a fibre are not included in the above.</p>
Delamination and impact damage	<p>Impact damage may appear as hairline cracks in the resin or delamination or cuts of the composite material.</p> <p>It may also appear as a whitish patch like a blister or air bubble beneath the surface.</p>	<ul style="list-style-type: none"> Any delamination in combination with surface damage, Cut fibres. Delamination covering more than 50 % of the cylinder. <p>See Figure 3</p> <p>Note 4. Areas with no adhesion between liner and over wrap shall not be regarded as delaminated. Note 5. Inter-laminar delamination is separation of layers of strands. Intra-laminar delamination is separation between strands within the same layer.</p>
Chemical damage	Chemical attack appearing as the dissolution of the resin matrix surrounding the fibres, where the cylinder is sticky. [text removed]	The cylinder shall be rendered unserviceable.

Heat/fire damage of the casing or composite	Heat or fire damage evident by discolouration, scarring or burning of the composite overwrap, casing, labels and non-metallic components of the valve.	Visible damage from heat and/or fire. Cylinders with this type of damage shall be rendered unserviceable. See Figure 4 .
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SHORT GUIDE TO RETESTING COMPOSITE LPG CYLINDERS
01 July 2013



Figure 1a — Damage on casing “skirt”— not acceptable



Figure 1b — Damage on casing base – not acceptable



Figure 1c — Damage on casing cylindrical area – not acceptable

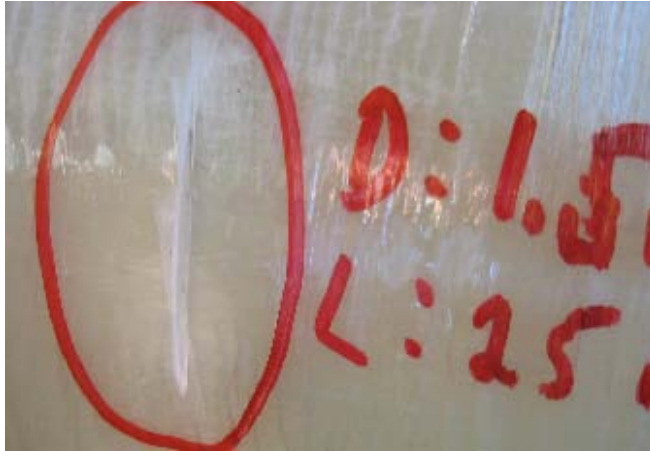


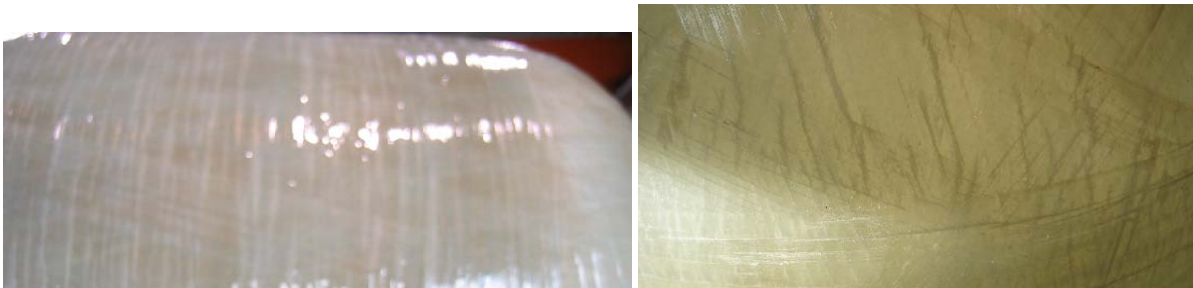
Figure 2 — Damage from abrasion and cuts— not accepted



Figure 3a — Impact damage in combination with delamination and surface defects – not acceptable



Figure 3b — Delamination and no surface damage - acceptable



**Figure 3c — Intra-laminar lamination due to pressure cycling >12000 cycles to proof pressure
- not acceptable damage, even though burst pressure is still above 90 bars.
If less than approximately 100 hairlines, it is acceptable.**



Figure 4 — Heat damage. This type of damage is not acceptable in any form