Composite LPG cylinders

Appendix 1 – Criteria for cylinder inspection

If you have questions or need technical assistance, please contact:

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1 Types of damage of cylinders and casing

The pictures below (also see: Composite LPG Cylinders
Part 4 – Inspection and Maintenance, Table 1) are examples of the various types of damage that occur to cylinders and casing. (Please disregard the pen-marking on some of the pictures - for HERAG internal use). Please note that all evaluations are done from a safety standpoint only. The operator may have commercial and marketing issues leading to stronger reactions to the damaged than those described in the table.

IMPORTANT: IF REPLACING PROTECTIV CASING LOWER PART OR HANDLE, THE COMPOSITE EXPOSED DURING REMOVAL SHALL BE THOROUGLY INSPECTED BY TRAINED PERSONNEL.

	Damage on handle “skirt”, and lower part	Replace handle and casing lower part.
	Damage on handle “skirt”, and potentially casing lower part.	Replace handle and potentially casing lower part.

	Damage on casing lower part.	Replace casing lower part.
	Damage on handle “skirt”, typically beside the snap	Replace handle
	Damage on handle “skirt” and potentially casing lower part.	Replace handle and potentially casing lower part.

	Damage on handle “skirt” and potentially casing lower part.	Replace handle and casing lower part.
	Damage on handle “skirt” and casing lower part.	Replace handle and casing lower part.
	Ring and handle part broken ➔ impossible to replace ring	Replace ring and handle

	Crack on ring and handle part. Potentially rough handling. Photo courtesy of PrestaCylinders	Replace ring and handle.
	Ring and handle damaged Photo courtesy of PrestaCylinders	Replace ring and handle
	Impact on handle part of casing Photo courtesy of PrestaCylinders	Replace handle

	Impact on handle part and potentially casing lower part Photo courtesy of PrestaCylinders	Replace handle and casing lower part
	Impact on handle part and potentially casing lower part Photo courtesy of PrestaCylinders	Replace handle and casing lower part
	Composite damaged due to impact or abrasion. Casing lower part broken, potentially also snap on handle part. Photo courtesy of PrestaCylinders	Reject.

	Casing lower part broken because of composite un-even surface. Photo courtesy of PrestaCylinders	No action
	Damage to casing lower part. No visual impact on fibre. Photo courtesy of PrestaCylinders	Replace casing lower part.
	Damage to fibre and casing lower part. Photo courtesy of PrestaCylinders	Reject

	Casing lower part broken without any sign of impact Photo courtesy of PrestaCylinders	No action
	Casing lower part foot-ring deformed (no cracks in the bottom area casing or composite detected) Photo courtesy of PrestaCylinders	No action
	Casing lower part foot-ring deformed (no cracks in the bottom area casing or composite detected) Photo courtesy of PrestaCylinders	No action

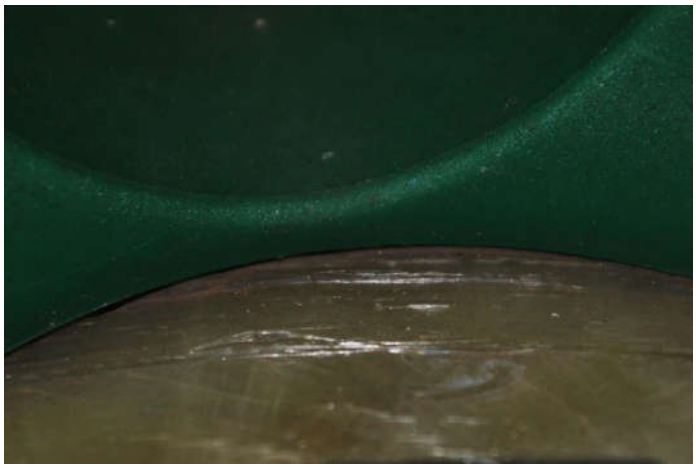
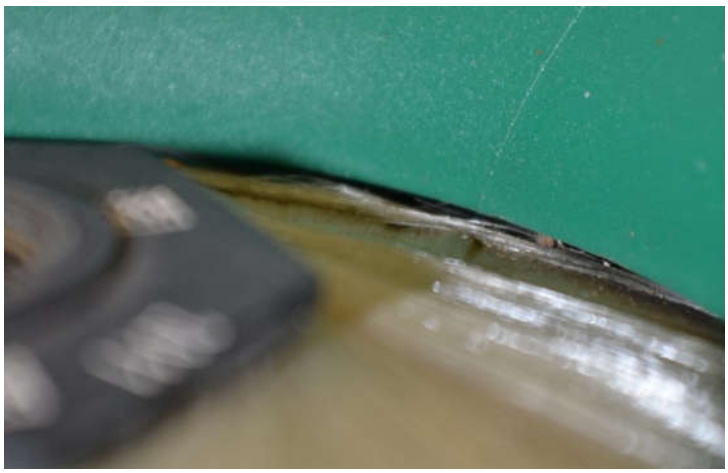
	Casing lower part foot-ring cracked Photo courtesy of PrestaCylinders	Replace casing lower part.
	Casing lower part foot-ring cracked	Replace casing lower part.
	Casing lower part foot-ring cracked	Replace casing lower part.

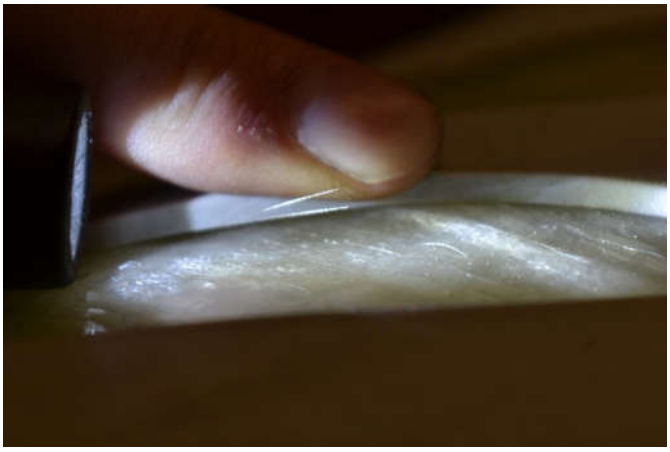
	Casing lower part foot-ring cracked	Replace casing lower part.
	Casing lower part foot-ring cracked	Replace casing lower part.
	Casing lower part cylindrical area damaged	Replace casing lower part.

	Impact on handle part of casing	Replace casing lower part.
	Casing lower part cylindrical area damaged	Replace casing lower part.
	Casing lower part cylindrical area damaged	Replace casing lower part.

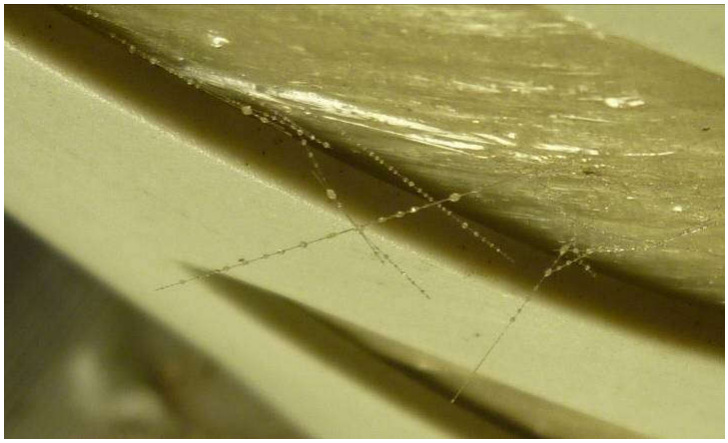
	Casing lower part cylindrical area damaged	Replace casing lower part.

	Fiber broken under flange (Comment: Resin may be broken to this level with no relevant effect on safety) Photo courtesy of PrestaCylinders	Fiber broken (or in doubt) ⇨ Reject Only limited resin crack *<50mm* = No action.
	Fiber broken under flange (Comment: Resin may be broken to this level with no relevant effect on safety) Photo courtesy of PrestaCylinders	Fiber broken (or in doubt) ⇨ Reject Only limited resin crack *<50mm* = No action.

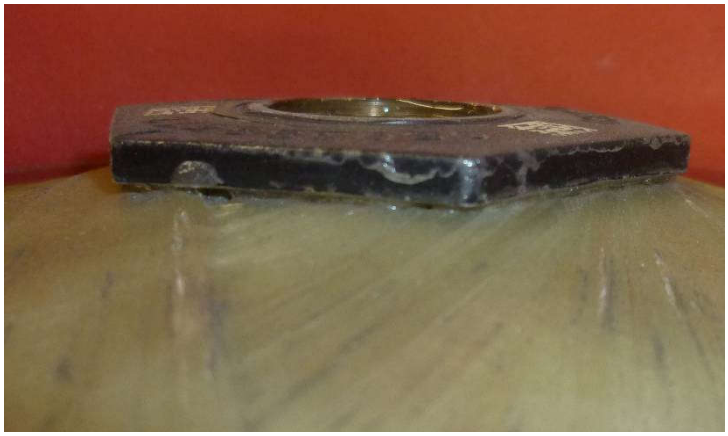
	Fiber peeled on top Photo courtesy of PrestaCylinders	*No action*
	Fiber peeled under plastic top part Photo courtesy of PrestaCylinders	No action
	Fiber peeled on vertical part (Comment: Not affecting cylinder behavior, Cutting the loose strand with a knife/scissors is recommended to avoid customers hurting themselves). Photo courtesy of PrestaCylinders	No action

	Fiber peeled on vertical part Photo courtesy of PrestaCylinders	No action
	Fiber peeled on vertical part Photo courtesy of PrestaCylinders	No action
	Fiber peeled on vertical part Photo courtesy of PrestaCylinders	No action

	Fiber peeled on vertical part Photo courtesy of PrestaCylinders	No action
	Fiber peeled on vertical part Photo courtesy of PrestaCylinders	No action
	Fiber peeled on vertical part Photo courtesy of PrestaCylinders	No action

	Fiber peeled on vertical part Photo courtesy of PrestaCylinders	No action
	Fiber peeled on lower part Photo courtesy of PrestaCylinders	No action
	Fiber broken under foot ring, not in combination with outer damage (Comment: an irregularity from production, not affecting safety. If in combination with signs of hard use or other damage, the cylinder shall be rejected) Photo courtesy of PrestaCylinders	No action

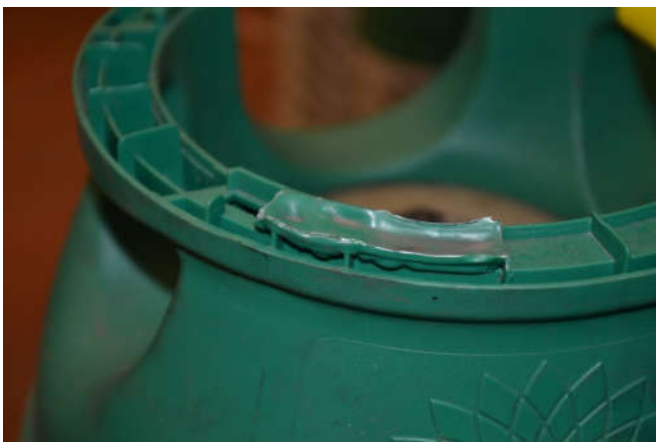
	Fiber scratched under foot ring Photo courtesy of PrestaCylinders	No action
	Fiber dried and brittle on flange Photo courtesy of PrestaCylinders	No action
	Fiber dried and brittle on centering piece Photo courtesy of PrestaCylinders	No action
	Waves on composite side wall from production. Photo courtesy of PrestaCylinders	No action

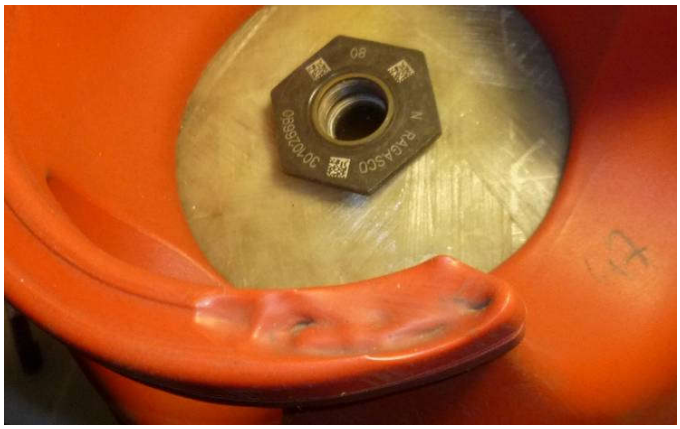
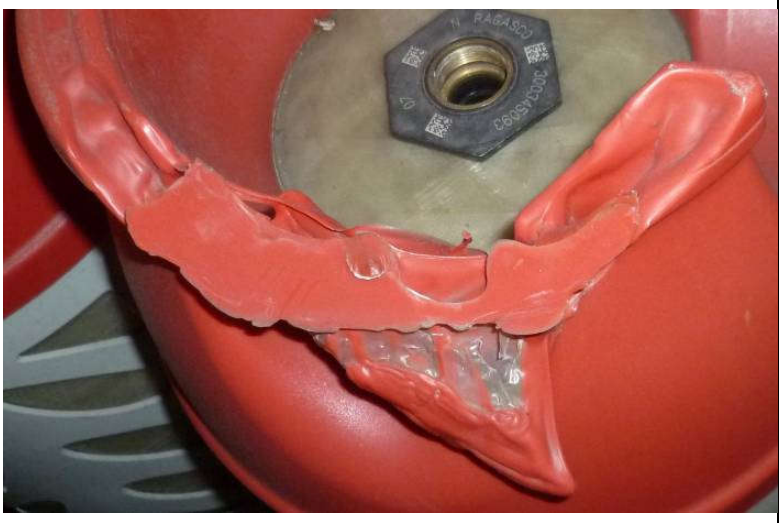
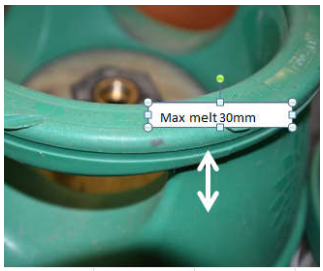
	Small edge from “fiber stop / end” during manufacturing Photo courtesy of PrestaCylinders	No action
	Hexagonal flange touching composite (normal) Photo courtesy of PrestaCylinders	No action
	Resin and laminate build up under boss is within the in the low side of the tolerance. Photo courtesy of PrestaCylinders	No action

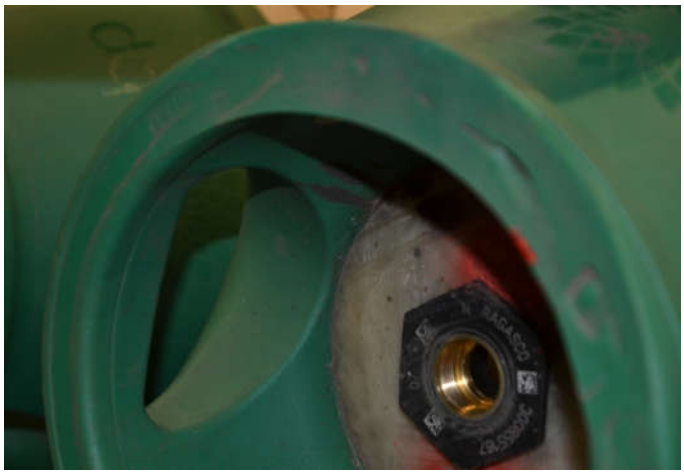
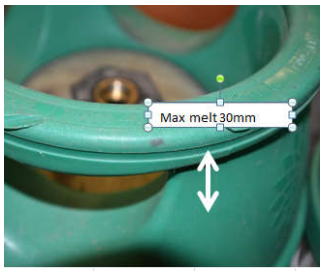
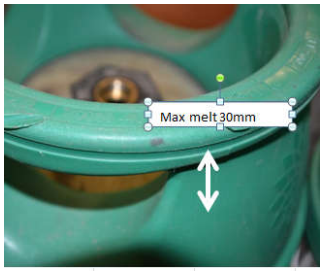
	Lack of surface resin on fiber (Comment: This low quality photo does not illustrate the situation well…)	No action
	Air to in the surface layer of composite, not into the lower layers. Photo courtesy of PrestaCylinders	*Area less than 60mm x 60mm* = No action.
	Some delamination, Not in combination with surface damage => no action. Photo courtesy of PrestaCylinders	No action

	Fiber tow standing somewhat out Photo courtesy of PrestaCylinders	No action
	Delamination, not in combination with signs of impact. Photo courtesy of PrestaCylinders	< 30% surface of cylinder = OK. >30% → reject
	Excess thickness of resin (normal). Photo courtesy of PrestaCylinders	No action

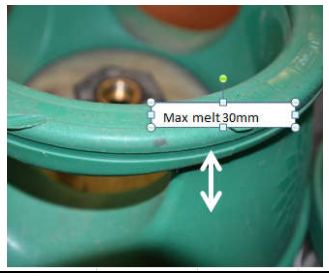
	Resin and laminate build up within the bottom is in the in the low side of the tolerance. Photo courtesy of PrestaCylinders	No action
	Fiber broken Photo courtesy of PrestaCylinders	Reject

	Ring and possibly handle melted / burned, but not lower than 15 mm from the interface between ring and handle. Photo courtesy of PrestaCylinders	Replace ring and possibly handle

	Ring melted / burned (Comment: Actual picture is from G1, replacement is not possible – only on cylinders with mechanical snap). Photo courtesy of PrestaCylinders	Replace ring
	Ring and possibly handle melted / burned, but not lower than 15 mm from the interface between ring and handle Photo courtesy of PrestaCylinders	Replace ring and possibly handle
	Ring and handle melted / burned lower than 30 mm from the interface between ring and handle. No sign of heat to boss or composite. Photo courtesy of PrestaCylinders 	Reject

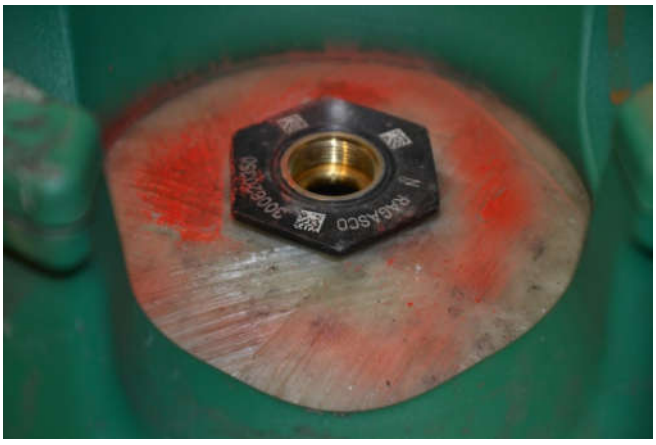
	Ring and handle part melted, no heat indication on boss or composite.  Photo courtesy of PrestaCylinders	Replace ring and handle.
 Photo courtesy of PrestaCylinders	Ring and handle melted / burned lower than 30 mm from the interface between ring and handle 	Reject
	Handle part of casing melted due direct exposure to hot object on small area. not close to snap/skirt, no marking damaged, no heat indication on boss or composite Photo courtesy of PrestaCylinders	*Replace handle*

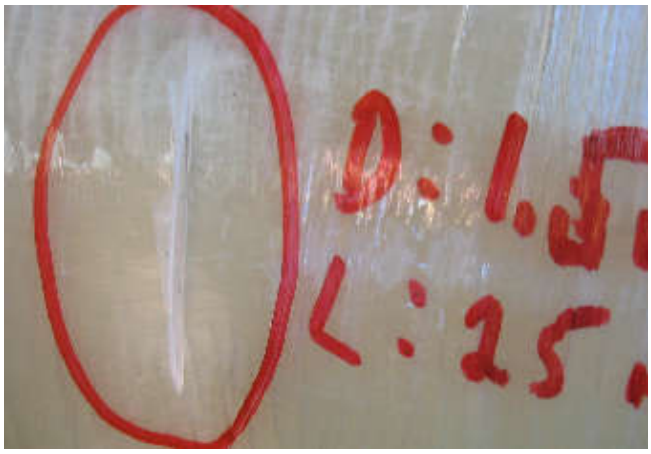
	Handle and casing lower part melted. Photo courtesy of PrestaCylinders	Reject.
	Handle and casing lower part melted. Photo courtesy of PrestaCylinders	Reject.
	Handle and casing lower part melted. Photo courtesy of PrestaCylinders	Reject.

	Casing lower part melted. 	Reject
	Ring and possibly handle melted, less than 30 mm below the interface between ring and handle. No indication of heat on boss and composite 	Replace handle
	Ring and handle melted.	Reject

	Moisture between fiber and casing, no signs of chemical degeneration (no resin soft spots or significant discoloring) Photo courtesy of PrestaCylinders	No action
	Rust on plastic Photo courtesy of PrestaCylinders	No action
	Glue from sticker or similar, on casing parts Photo courtesy of PrestaCylinders	No action

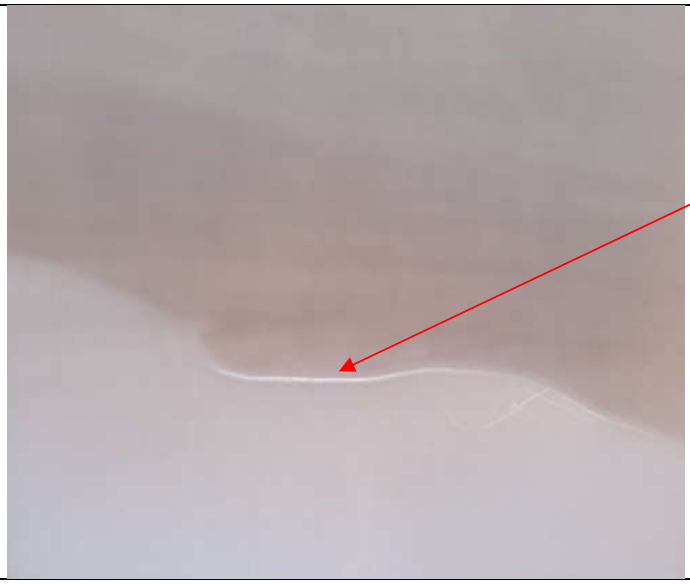
	Black dirt Photo courtesy of PrestaCylinders	Clean
	Grease and black dirt Photo courtesy of PrestaCylinders	Clean
	Grease Photo courtesy of PrestaCylinders	Clean

	Cement Photo courtesy of PrestaCylinders	Clean
	Lot of dirt Photo courtesy of PrestaCylinders	Clean
	Spray on top Photo courtesy of PrestaCylinders	No action

	Paint Photo courtesy of PrestaCylinders	No action
	Light spray Photo courtesy of PrestaCylinders	No action
	Cut fiber, more than one fibre tow. (Comment: See table in section 7 for details and limits).	Reject

	Damage from abrasion (Comment: See table in section 7 for details and limits).	Reject
	Impact damage in combination with delamination and surface defects.	Reject
	Impact damage in combination with delamination and surface defects.	Reject

	Delamination and no surface damage.	No action
	Intra-laminar delamination due to pressure cycling >12000 cycles to proof pressure If less than approximately 100 hairlines, it is acceptable.	Reject
	Intra-laminar delamination due to pressure cycling >12000 cycles to proof pressure. If less than approximately 100 hairlines, it is acceptable.	Reject

	Stretch-mark / white line in the liner at cylindrical / dome transition area (internal inspection). Usually in combination with partial lack of adhesion between liner and composite wrapping.	Reject
	Stretch-mark / white line in the liner at cylindrical / dome transition area (internal inspection). Usually in combination with partial lack of adhesion between liner and composite wrapping (whitish area in the picture).	Reject
	Crack in the liner at cylindrical / dome transition area (internal inspection).	Reject