epd-norway
Global Program Operator

Environmental Product Declaration

In accordance with ISO 14025

HEXAGON RAGASCO

The Norwegian EPD Foundation

Owner of the declaration:
Hexagon Ragasco AS

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-3714-2656-EN

Registration number:
NEPD-3714-2656-EN

Issue date: 26.09.2022
Valid to: 26.09.2027

ver-280524

Product name

Composite LPG cylinder 24,5 l

Manufacturer

Hexagon Ragasco AS

General information

Product:
Hexagon Ragasco composite LPG cylinder, 24,5 L

Program Holder:
The Norwegian EPD Foundation
Post Box 5250 Majorstuen, 0303 Oslo, Norway
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Declaration Number:
NEPD-3714-2656-EN

This declaration is based on Product Category Rules:
NPCR 023: Packaging products and services v1.1 (2021)

Statements:

The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturer, life cycle assessment data and evidence.

Declared unit:
1 Composite LPG cylinder with a capacity of 24,5 L

Functional unit:
One delivery of 10 kg of propane gas with a Hexagon Ragasco composite LPG cylinder, 24,5L with an expected lifetime of 60 deliveries over 30 years, cradle-to-grave.

Verification:
Independent verification of the declaration and data, according to ISO14025:2010

internal ☐ external ■

Julie Lyslo Skullestad, Aase Teknikk AS
(Independent verifier approved by EPD Norway)

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Manufacturer:
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Phone: +47 61 15 16 00
e-mail: info@hexagonragasco.com

Place of production:
Raufoss, Norway

Management system:
ISO 9001:2015, ISO 14001:2015 ISO 50001:2018

Organisation no:
878612752

Issue date:
26.09.2022

Valid to:
26.09.2027

Year of study:
2019

Comparability:
EPDs from other programmes than the Norwegian EPD Foundation may not be comparable.

The EPD has been worked out by:
Alexander Borg

asplan viak

approved

(Manager of EPD Norway)

Product

Product description
Hexagon Ragasco is the largest global manufacturer of composite LPG (Liquified Petroleum Gas, i.e., propane/butane mixes) cylinders.

The company has over the last 22 years developed and operated a fully automated manufacturing plant in Raufoss, Norway, with an annual production capacity of 2 million cylinders. Since the year 2000, the company has sold over 20 million cylinders in approx. 100 countries. The cylinders are fully compatible with Bio- LPG, also called renewable LPG.

The Hexagon Ragasco cylinders are designed in compliance with international T4 composite cylinder standards like EN 12245, EN 14427, ISO 11119-3, TC SU 5931 and special permit DOT-SP 12706. The products have unique benefits which give environmental advantages in all phases of their lifetime:

- **Lightweight:** reduced product weight by approx. 50% compared to steel cylinders, resulting in reduced raw material consumption, reduced carbon emissions during transportation and reduced material for end-of-life handling.
- **Rust-free materials:** prolonged lifetime in high humidity climates, eliminates the need for refurbishment as required for steel cylinders and which generates toxic residues such as paints and chemicals.
- **Durability:** durable cylinders with proven lifetime of 22 years (and counting). The first cylinders produced in the year 2000 are still in the value chain in Norway and Finland.

In addition, the products have enhanced safety as they do not BLEVE[1] if exposed to a fire.

Hexagon Ragasco offers casing spare parts to customers to ensure the longest possible lifetime of the products in their value chain.

Based on the use of Norwegian hydroelectric power and Lean Manufacturing principles, Hexagon Ragasco manufactures in compliance with international industry-, environmental- and energy standards such as ISO 9001, ISO 14001 and ISO 50001.

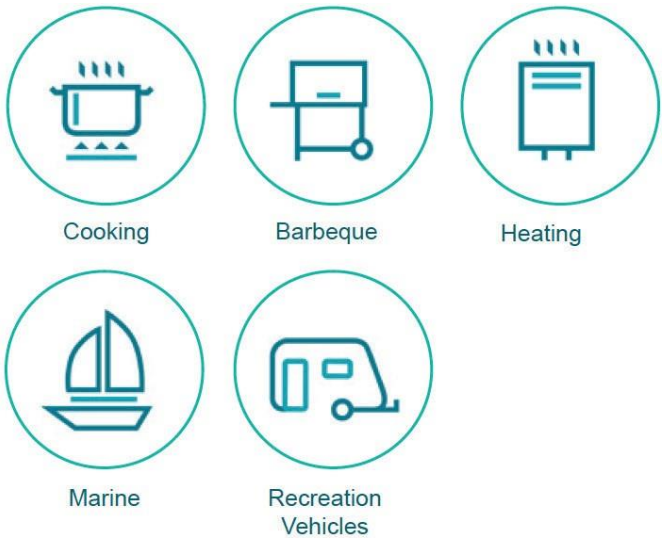
Since 2000 the company has re-used its own liner waste directly in production. Hexagon Ragasco continuously invests in more environmentally-friendly processes in production, such as incineration facility, energy recovery systems, water cleaning systems, grinders for thermoplastics, etc. The company also investigates new circular solutions for end-of-life of the composite cylinders through several funded R&D projects with strategic partners. Focus is put on product- and technology innovations covering the whole value chain to secure a sustainable business for customers and stakeholders, including lifetime prediction and real-life ageing in several climatic regions in the world.

Hexagon Ragasco performed their first Life Cycle Assessment (LCA) in 2015, while this EPD is now based on updated 2019 production figures. Hexagon Ragasco published an EPD for the product stage (A1-A4) in 2021, and this EPD is an update of the existing EPD, now covering cradle-to-grave.

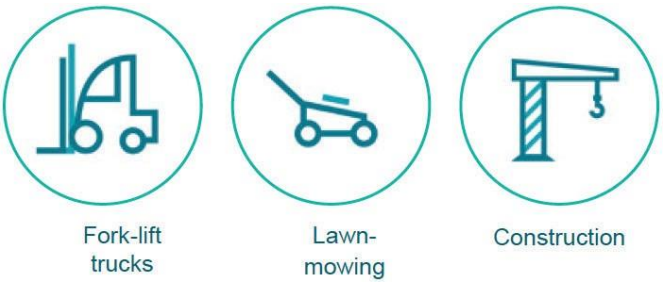
Hexagon Ragasco will use LCA as a strategic calculator/tool for future technological development and sourcing. It will also give the company the possibility to further improve the product's environmental carbon footprint in the value chain, including the use phase, end-of-life phase and into new circular products.

LPG is a transition fuel for cleaner cooking, replacing wood, charcoal, kerosene, and other highly polluting energy sources in large parts of the world. The use of LPG eliminates the soot and particles released through combustion and thereby improves the air quality and the health of millions of people around the world. As an example, since 2016, Hexagon Ragasco has sold 1 million cylinders to Bangladesh which has potentially helped avoid emissions of approx. 137,000 metric tons of CO_2 equivalents by replacing highly polluting and dangerous fuels.

Hexagon Ragasco composite cylinders are in use across a wide range of domestic and leisure applications:



As well as industrial applications:



[1] Boiling Liquid Expansion Vapour Explosion

Hexagon Ragasco products

Product specification
All manufacturing processes are done in-house and are fully automated, starting with the raw materials through to the completed cylinders on pallet ready for shipment.

Hexagon Ragasco manufacturing facility (above and below)

Manufacturing process
Hexagon Ragasco composite cylinders

Components

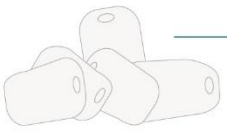
Thermoplastics

Glass fiber

Chemicals

Brass insert

Valves

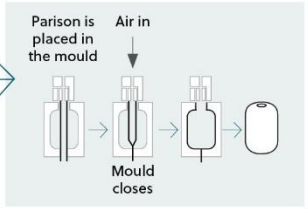


Grinded liner scrap

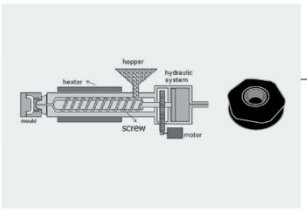
Transport to our plant

Raufoss, Norway

Production

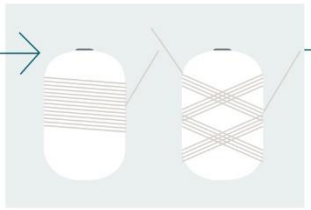


Blow moulding of liner

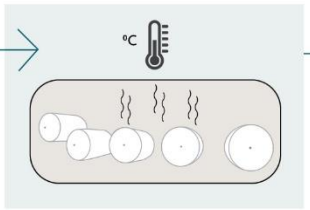


Injection moulding of boss

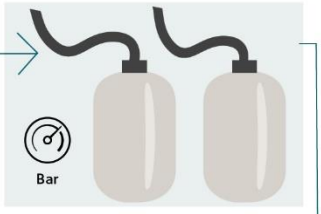
Welding of boss to liner



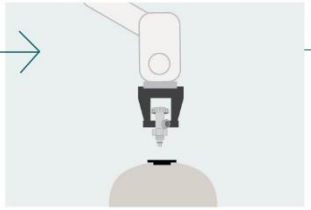
Filament winding



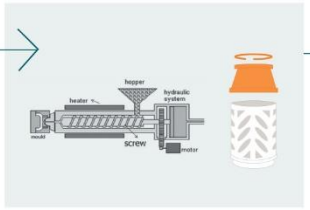
Curing of pressure vessel



Pressure test



Assembly of valve



Injection moulding of casing

Branding

Assembly of parts

Palletizing

Transport to port

Technical Specifications

The EPD is declared for a 24,5 L container. The GWP-total value for additional cylinder sizes is given at the end of the EPD document

						
SPECIFICATIONS[1]	12,5 L	18,2 L	24,5 L	26,2 L	27,4 L	33,5 L
Propane Capacity (kg)	5	7,5	10	10,7	11,2	14
Butane Capacity (kg)	6	8,5	12	12,8	13,4	16,5
Empty weight[2] (kg)	3,4	4,1	5	5,1	5,3	6,3
Water content (L)	12,5	18,2	24,5	26,2	27,4	33,5
Height (mm)	384	468	571	595	622	715
Diameter (mm)	305	305	305	305	305	305

[1.] All values are nominal. [2.] Without a valve
Hexagon Ragasco cylinders can be delivered with a wide variety of different valves for different uses with vapor or liquid outtake.

Materials	Kg	%
Vessel excl. Brass (insert and valve)	3,63	62,9
Casing parts	1,62	28,1
Valve System Brass (incl. insert)	0,52	9,2
Sum	5,77	100
Disposable pallet	0,27	
Packaging film	0,03	
Sum with packaging	6,06	

Technical data:

Propane capacity:	10 kg
Butane capacity:	12 kg
Water content:	24,5 l
Height:	571 mm
Diameter:	305 mm

Technical standards:
The LPG Cylinders are produced to the following technical standards: ISO 11119-3, EN 12245, EN 14427.

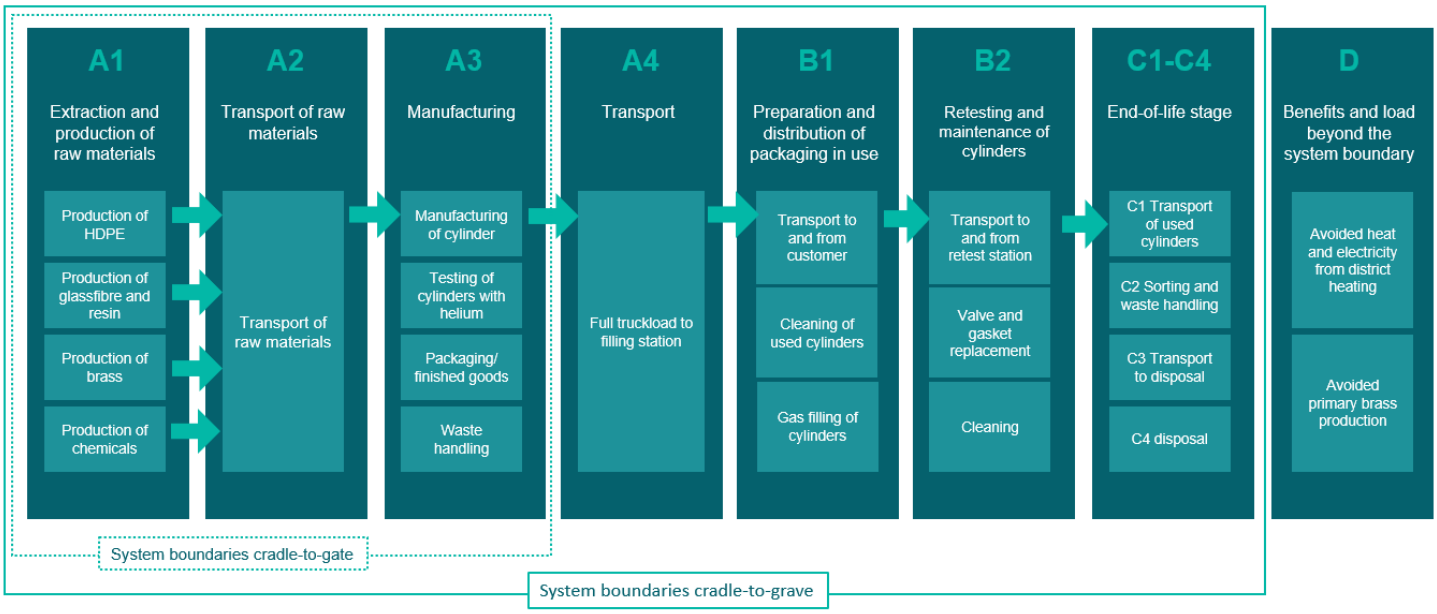
Market:
Cradle-to-gate is valid for the global market. Transport, use and end-of-life scenarios are valid for the Norwegian market.

Reference service life:
30 years.

Declared unit:
1 Composite LPG cylinder with a capacity of 24,5 L

Functional unit:
One delivery of 10 kg of propane gas with a Hexagon Ragasco composite LPG cylinder, 24,5L with an expected lifetime of 60 deliveries over 30 years, cradle-to-grave.

Figure 1: System boundary



Data Quality:
Data for production and transport is site specific for Raufoss and based on specific data for the year 2019. Generic data is mainly from ecoinvent v3.7, with some processes based on ecoinvent v3.6. All generic data is <10 years old. Characterization factors are according to EN 15804:2012+A2 2019.

Allocation:
The allocation is made in accordance with the provisions of ISO 14025. Incoming energy and waste production in-house is allocated equally among all products through mass allocation. Transportation of the material is allocated to this analysis.

System boundary:
A1-A3, A4, B1, B2, C1-C4, D

Cut-off criteria:
All major raw materials and all the essential energy is included. The production process for raw materials and energy flows that are included with very small amounts (<1%) are not included. This cut-off rule does not apply for hazardous materials and substances.

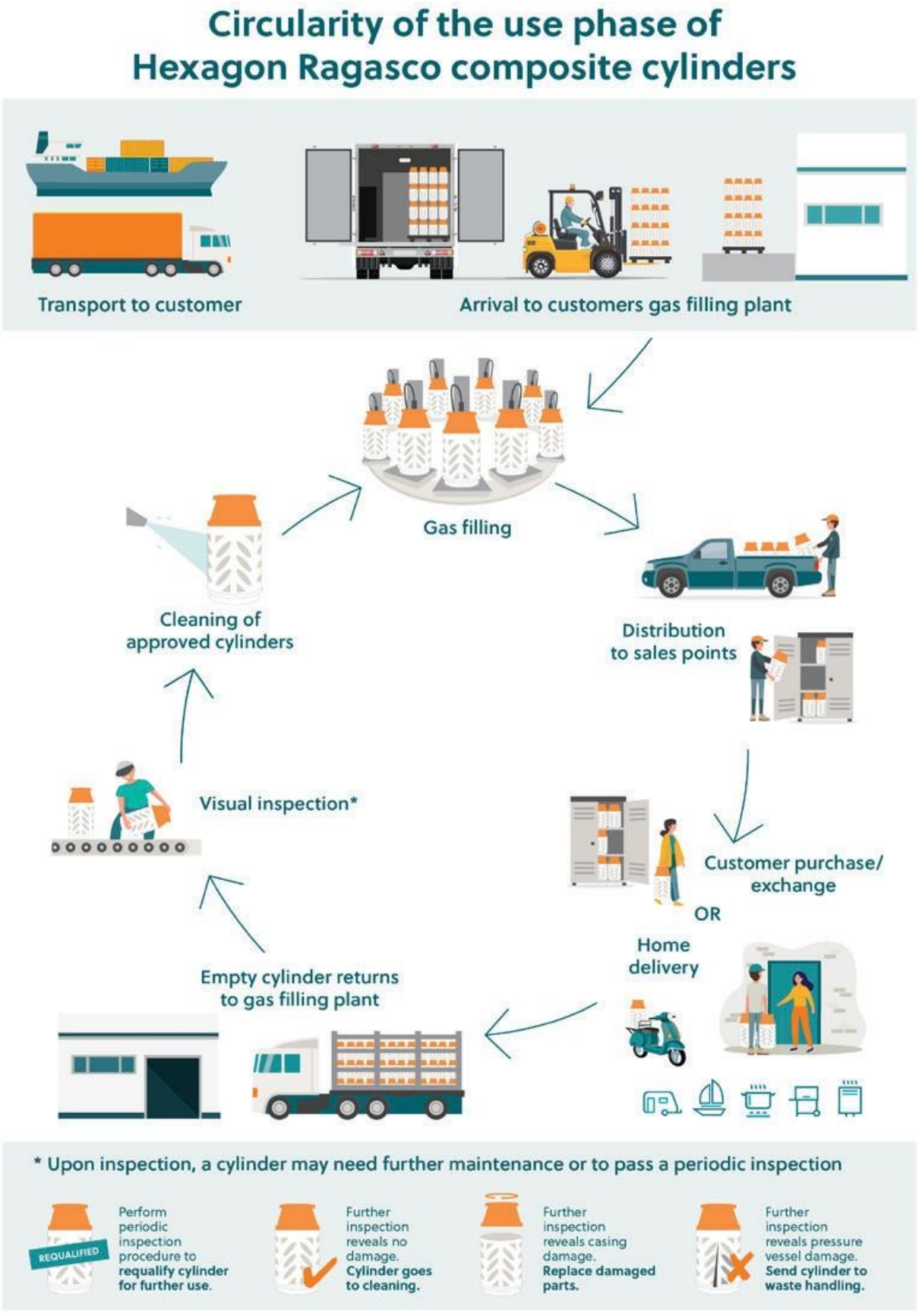
The functional unit for the packaging product is, according to PCR 023, related to one delivery of gas with a 24,5 liters composite cylinder. Based on use data from Norwegian gas cylinders, the cylinder is assumed to be filled (B1) two times a year with an expected lifetime of 30 years, resulting in 60 fillings during the cylinder's lifetime. Maintenance (B2) is assumed to be performed 2 times during the cylinder's lifetime. Please note that the production of the transported gas is not included in the scope of the EPD.

Transport from production place to assembly/user (A4)
The transportation distance represents transport of the cylinder to filling station in Oslo, which is the most likely scenario for the Norwegian market. The amount of cylinders in one truck is limited by volume, and therefore the capacity utilization by mass is relatively low. The volume capacity utilization factor is 100 %.

The results are sensitive for changes to the number of fillings (60 fillings), and total transport distance for each use. To get results for cradle-to-gate (A1-A3, A4) and end-of-life (C1-C4, D) for one 24,5 l cylinder, the LCA results can be multiplied by 60.
The following information describe the scenarios in the different modules of the EPD.

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance KM	Fuel/Energy consumption	Value (l/t)
Truck	17 %	32 t Euro 6	120	0,062	l/tkm

Use (B1)
Between each use cylinders are sent to filling station for inspection, washing and filling. Additional packaging and labelling for retail sale is applied. The cylinders are then distributed to central retail sales point by train, and further by truck. The use phase does not include customer purchase/exchange and home delivery, as this is not a part of the system boundaries.



	Unit	Value
Transport to and from filling station, 24 t Euro 6 truck	km (one way)	100
Transport to and from filling station, train	km (one way)	450
Water	liter	0,2
Soap	liter	0,013
Degrease	liter	0,0005
Shrink plastic	kg	0,0015
Glossy carton	kg	0,002
O-ring	kg	0,002
Electricity	kWh	0,24
Permeation of propane gas during use	g/year	14,46

Maintenance (B2)
Cylinders are periodically sent to retesting in Denmark. It is assumed that the cylinders are retested twice before being discarded after 30 years.

Resource use per one maintenance cycle	Unit	Value
Maintenance cycle (number of cycles)		2
Transport to and from maintenance center, 32 t Euro 6 truck	km (one way)	560
Valve replacement (30% replacement)	kg	0,156
O-ring	kg	0,002
Water consumption	liter	0,2
Electricity consumption	kWh	0,173
Natural gas	kWh	0,102

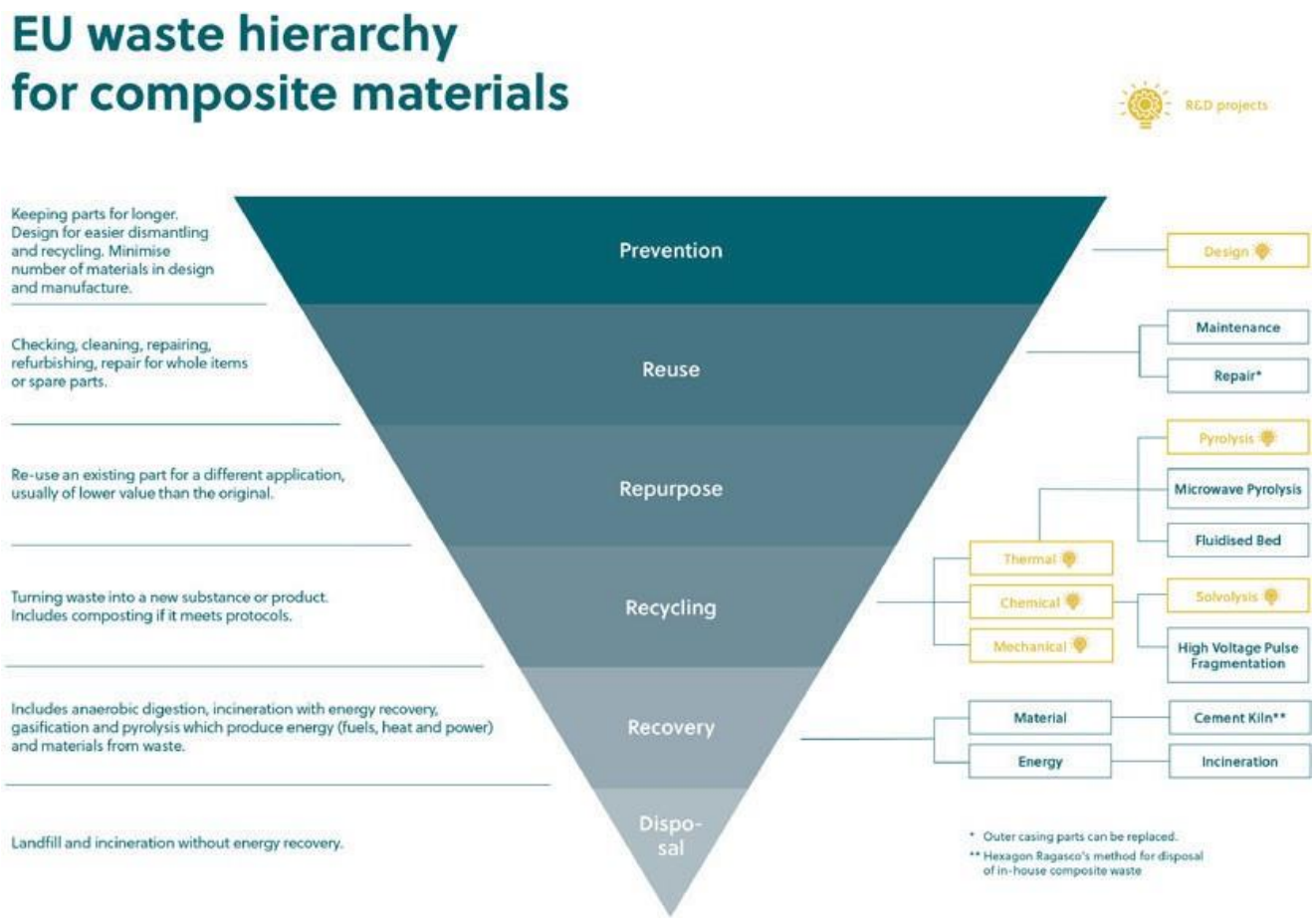
[1] Propane has a GWP value of 3,3 kg CO2 eq. (IPCC 2021)

Cylinders used for mobile home application distributed by Hexagon Ragasco’s customer Linde Gas AS

Cylinder used in barbecue application

Connection for cylinders distributed by Hexagon Ragasco’s customer Linde Gas AS

End of Life (C2, C3, C4)
Waste processing of cylinders are sent to incineration, while the brass valve and insert are recycled. Disposal of ashes is assumed to happen at the same location as the incineration facility.



Unit		Value
Recycling	kg	0,766
Energy recovery	kg	5,25
To landfill	kg	0,00

Transport to waste processing (C1)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance KM	Fuel/ Energy consumption	value (l/t)
Truck, incineration	17%	24 t Euro 6	30	0,062	l/tkm
Truck, recycling	17%	24 t Euro 6	130	0,062	l/tkm

Transportation of cylinders to a nearby incineration facility. Brass valves are sent to recycling.

Benefits and loads beyond the system boundaries (D)

	Unit	Value
Substitution of heat	MJ	13,56
Substitution of electricity	MJ	0,136
Substitution of primary brass production	kg	0,156

The benefits and load beyond the system boundary are calculated from net flows sent to incineration and recycling. The substitution of heat and electricity is based on the danish district heating mix of 2020. Only primary brass is used for calculating substitution of brass. Since the valve contains 60 % recycled content and a recycling rate of 99 % is assumed, the net scrap brass is 39 %.

LCA: Results

LCA results are related to the functional unit of one delivery of 24,5 l of gas with a composite cylinder. To get the total impact of the entire lifetime of the cylinders the impacts for each module can be multiplied by 60. Using the declared unit is however not recommended as it does not take into account the benefit of reusing the gas cylinders. Environmental impact of the transported gas is not included in the scope of the EPD.

SYSTEM BOUNDARIES (X=included, MND=module not declared, MNR=module not relevant)

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Waste Transport	Waste processing	Transport to disposal	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	MNR	X	X	MNR	MNR	MNR	MNR	MNR	X	X	X	X	X

CORE ENVIRONMENTAL IMPACT INDICATORS

Indicator	Unit	A1	A2	A3	A1-A3	A4	B1	B2
GWP-total	kg CO2 eq.	2,55E-01	1,86E-02	1,60E-02	2,90E-01	6,36E-03	4,66E-01	7,11E-02
GWP-fossil	kg CO2 eq.	2,64E-01	1,86E-02	1,64E-02	2,99E-01	6,36E-03	4,63E-01	7,05E-02
GWP-biogenic	kg CO2 eq.	-8,83E-03	3,39E-06	-4,86E-04	-9,31E-03	2,74E-06	1,75E-03	5,35E-04
GWP-LULUC	kg CO2 eq.	1,31E-04	9,24E-06	2,14E-05	1,62E-04	9,44E-07	1,08E-03	3,38E-05
ODP	kg CFC11 eq.	1,39E-08	4,03E-09	1,16E-09	1,91E-08	1,54E-09	6,94E-08	1,46E-08
AP	mol H^+ eq.	1,70E-03	3,66E-04	9,48E-05	2,16E-03	1,60E-05	2,09E-03	3,27E-04
EP-freshwater	kg P eq.	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EP-marine	kg N eq.	3,13E-04	9,26E-05	1,84E-05	4,24E-04	2,94E-06	5,42E-04	5,37E-05
EP-terrestrial	mol N eq.	3,41E-03	1,03E-03	2,12E-04	4,65E-03	3,26E-05	5,76E-03	6,33E-04
POCP	kg NMVOC eq.	1,25E-03	2,73E-04	7,15E-05	1,60E-03	1,21E-05	1,86E-03	1,89E-04
ADP-M&M	kg Sb eq.	2,69E-05	2,18E-07	6,52E-07	2,78E-05	2,28E-08	4,56E-06	8,90E-06
ADP-fossil	MJ	5,40E+00	2,62E-01	3,79E-01	6,04E+00	9,83E-02	6,52E+00	1,05E+00
WDP	m^3	1,10E-01	9,28E-04	1,79E-01	2,90E-01	6,29E-04	1,97E+00	1,38E-02

Parameter	Unit	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	1,06E-03	1,71E-01	0,00E+00	5,64E-04	-5,31E-02
GWP-fossil	kg CO2 eq.	1,06E-03	1,70E-01	0,00E+00	5,59E-04	-4,30E-02
GWP-biogenic	kg CO2 eq.	4,86E-07	1,03E-04	0,00E+00	4,90E-06	-1,01E-02
GWP-LULUC	kg CO2 eq.	1,68E-07	2,63E-07	0,00E+00	1,36E-07	-9,42E-05
ODP	kg CFC11 eq.	2,73E-10	1,52E-10	0,00E+00	1,52E-10	-2,94E-09
AP	mol H^+ eq.	2,81E-06	2,20E-05	0,00E+00	3,57E-06	-2,03E-03
EP-freshwater	kg P eq.	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EP-marine	kg N eq.	5,10E-07	1,00E-05	0,00E+00	1,44E-06	-1,53E-04
EP-terrestrial	mol N eq.	5,65E-06	1,11E-04	0,00E+00	1,37E-05	-1,81E-03
POCP	kg NMVOC eq.	2,10E-06	2,69E-05	0,00E+00	3,95E-06	-4,82E-04
ADP-M&M	kg Sb eq.	4,04E-09	4,13E-09	0,00E+00	6,07E-09	-4,82E-05
ADP-fossil	MJ	1,75E-02	1,31E-02	0,00E+00	1,15E-02	-5,54E-01
WDP	m^3	1,12E-04	2,09E-03	0,00E+00	-2,46E-05	-5,42E-02

GWP-total: *Global Warming Potential;* ***GWP-fossil:*** *Global Warming Potential fossil fuels;* ***GWP-biogenic:*** *Global Warming Potential biogenic;* ***GWP-LULUC:*** *Global Warming Potential land use and land use change;* ***ODP:*** *Depletion potential of the stratospheric ozone layer;* ***AP:*** *Acidification potential, Accumulated Exceedance;* ***EP-freshwater:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment; See "additional Norwegian requirements" for indicator given as PO4 eq.* ***EP-marine:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment;* ***EP-terrestrial:*** *Eutrophication potential, Accumulated Exceedance;* ***POCP:*** *Formation potential of tropospheric ozone;* ***ADP-M&M:*** *Abiotic depletion potential for non-fossil resources (minerals and metals);* ***ADP-fossil:*** *Abiotic depletion potential for fossil resources;* ***WDP:*** *Water deprivation potential, deprivation weighted water consumption*

Indicator	Unit	A1	A2	A3	A1-A3	A4	B1	B2
PM	Disease incidence	1,45E-08	1,08E-09	7,70E-10	1,64E-08	2,32E-10	3,30E-08	3,06E-09
IRP	kBq U235 eq.	1,40E-02	1,26E-03	2,74E-03	1,80E-02	4,80E-04	5,85E-02	5,85E-03
ETP-fw	CTUe	1,03E+01	1,88E-01	3,76E-01	1,09E+01	5,50E-02	7,64E+00	3,34E+00
HTP-c	CTUh	3,44E-10	8,19E-12	1,94E-11	3,71E-10	1,00E-12	5,57E-10	4,81E-11
HTP-nc	CTUh	1,29E-08	1,85E-10	4,67E-10	1,36E-08	4,39E-11	7,44E-09	3,63E-09
SQP	Dimensionless	1,41E+00	1,69E-01	2,79E-01	1,86E+00	4,75E-02	8,27E+00	5,39E-01

Indicator	Unit	C1	C2	C3	C4	D
PM	Disease incidence	4,10E-11	1,55E-10	0,00E+00	6,33E-11	-1,30E-08
IRP	kBq U235 eq.	8,52E-05	4,50E-05	0,00E+00	5,92E-05	-4,65E-03
ETP-fw	CTUe	9,77E-03	2,34E-02	0,00E+00	3,55E-02	-1,56E+01
HTP-c	CTUh	1,75E-13	2,07E-12	0,00E+00	2,75E-12	-3,68E-10
HTP-nc	CTUh	7,68E-12	4,85E-11	0,00E+00	1,15E-10	-2,65E-08
SQP	Dimensionless	8,43E-03	2,73E-03	0,00E+00	1,86E-02	-3,96E+00

PM: *Particulate matter emissions; IRP: Ionising radiation, human health;* ***ETP-fw:*** *Ecotoxicity (freshwater);* ***ETP-c:*** *Human toxicity, cancer effects;* ***HTP-nc:*** *Human toxicity, non-cancer effects;* ***SQP:*** *Land use related impacts / soil quality*

CLASSIFICATION OF DISCLAIMERS TO THE DECLARATION OF CORE AND ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

ILCD classification	Indicator	Disclaymer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
	Acidification potential, Accumulated Exceedance (AP)	None
ILCD type / level 2	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	Abiotic depletion potential for non-fossil resources (ADP-minerals & metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in under-ground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.
Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator

RESOURCE USE

Parameter	Unit	A1	A2	A3	A1-A3	A4	B1	B2
RPEE	MJ	2,96E-01	2,52E-03	5,76E-01	8,75E-01	7,61E-04	6,24E+00	4,73E-02
RPEM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TPE	MJ	2,96E-01	2,52E-03	5,76E-01	8,75E-01	7,61E-04	6,24E+00	4,73E-02
NRPE	MJ	3,48E+00	2,62E-01	2,40E-01	3,98E+00	9,83E-02	6,52E+00	1,05E+00
NRPM	MJ	1,92E+00	0,00E+00	1,38E-01	2,06E+00	0,00E+00	0,00E+00	0,00E+00
TRPE	MJ	5,40E+00	2,62E-01	3,79E-01	6,04E+00	9,83E-02	6,52E+00	1,05E+00
SM	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
W	m3	2,57E-03	2,16E-05	4,16E-03	6,76E-03	1,46E-05	4,58E-02	3,21E-04

Parameter	Unit	C1	C2	C3	C4	D
RPEE	MJ	1,35E-04	4,18E-04	0,00E+00	2,18E-04	-8,13E-01
RPEM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TPE	MJ	1,35E-04	4,18E-04	0,00E+00	2,18E-04	-8,13E-01
NRPE	MJ	1,75E-02	1,31E-02	0,00E+00	1,15E-02	-5,54E-01
NRPM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TRPE	MJ	1,75E-02	1,31E-02	0,00E+00	1,15E-02	-5,54E-01
SM	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
W	m3	2,60E-06	4,88E-05	0,00E+00	-5,73E-07	-1,26E-03

RPEE: *Renewable primary energy resources used as energy carrier;* ***RPEM:*** *Renewable primary energy resources used as raw materials;* ***TPE:*** *Total use of renewable primary energy resources;* ***NRPE:*** *Non-renewable primary energy resources used as energy carrier;* ***NRPM****: Non-renewable primary energy resources used as materials;* ***TRPE:*** *Total use of non-renewable primary energy resources;* ***SM:*** *Use of secondary materials;* ***RSF:*** *Use of renewable secondary fuels;* ***NRSF:*** *Use of non-renewable secondary fuels;* ***W:*** *Use of net fresh water*

END OF LIFE - WASTE

Parameter	Unit	A1	A2	A3	A1-A3	A4	B1	B2
HW	kg	4,78E-04	1,26E-05	1,69E-03	2,19E-03	1,52E-06	8,84E-04	9,23E-05
NHW	kg	2,55E-02	1,18E-02	5,39E-03	4,27E-02	3,01E-03	3,88E-01	2,95E-02
NHW	kg	5,40E-06	1,80E-06	8,57E-07	8,06E-06	6,92E-07	3,79E-05	6,74E-06

Parameter	Unit	C1	C2	C3	C4	D
HW	kg	2,70E-07	8,32E-05	0,00E+00	4,20E-02	-3,32E-04
NHW	kg	5,34E-04	3,24E-04	0,00E+00	1,23E-03	-1,28E-02
NHW	kg	1,23E-07	3,06E-08	0,00E+00	7,05E-08	-1,72E-06

HW *Hazardous waste disposed;* ***NHW*** *Non-hazardous waste disposed;* ***RW*** *Radioactive waste disposed*

END OF LIFE - OUTPUT FLOW

Parameter	Unit	A1	A2	A3	A1-A3	A4	B1	B2
CR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ETE	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Parameter	Unit	C1	C2	C3	C4	D
CR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MR	kg	0,00E+00	1,27E-02	0,00E+00	0,00E+00	0,00E+00
MER	kg	0,00E+00	8,95E-02	0,00E+00	0,00E+00	0,00E+00
EEE	kg	0,00E+00	1,35E-01	0,00E+00	0,00E+00	0,00E+00
ETE	kg	0,00E+00	1,10E+00	0,00E+00	0,00E+00	0,00E+00

HW CR *Components for reuse;* ***MR*** *Materials for recycling;* ***MER*** *Materials for energy recovery;* ***EEE*** *Exported electric energy;* ***ETE*** *Exported thermal energy*

Reading example: 9,0 E-03 = 9,0*10-3 = 0,009

Biogenic carbon content	Unit	Value
Biogenic carbon content in product	kg C	0,00E+00
Biogenic carbon content in the accompanying packaging	kg C	4,45E-0,1

Greenhouse gas emission from the use of electricity in the manufacturing phase
National production mix from import, low voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing process (A3).

National electricity grid	Unit	Value
Norwegian grid mix, Ecoinvent v3.7	kg CO2 -eq/kWh	0,0203

Hazardous substances
The declaration is based upon reference to threshold values and/or test results and/or material safety data sheets provided to EPD verifiers. Some products used in the manufacturing may contain substances on the REACH candidate list, but during the curing process these materials change properties and are no longer considered harmful substances. This is confirmed by the material supplier and documentation is available upon request.

☒ The product contains no substances given by the REACH Candidate list or the Norwegian priority list.
☐ The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.
☐ The product contains dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.
☐ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

Indoor environment
No tests have been carried out on the product concerning indoor climate.

Additional information – GWP-total for different cylinder sizes
The “GWP, total” value for different cylinder sizes has been calculated and is presented in the table below.

Cylinder size	Unit	A1	A2	A3	A1-A3	A4	B1	B2
12,5l	kg CO2 eq.	1,79E-01	1,10E-02	1,14E-02	1,91E-01	4,55E-03	2,99E-01	5,51E-02
18,2l	kg CO2 eq.	2,11E-01	1,36E-02	1,33E-02	2,27E-01	5,33E-03	3,77E-01	6,20E-02
20,6l	kg CO2 eq.	2,30E-01	1,42E-02	1,55E-02	2,46E-01	5,91E-03	4,13E-01	6,74E-02
26,2l	kg CO2 eq.	2,63E-01	1,77E-02	1,62E-02	2,82E-01	6,40E-03	4,86E-01	7,13E-02
33,5l	kg CO2 eq.	3,21E-01	2,24E-02	2,01E-02	3,45E-01	8,03E-03	6,10E-01	8,57E-02

Parameter	Unit	C1	C2	C3	C4	D
18,2l	kg CO2 eq.	9,45E-04	1,43E-01	4,60E-04	-4,96E-02	9,45E-04
20,6l	kg CO2 eq.	1,01E-03	1,67E-01	4,86E-04	-5,44E-02	1,01E-03
26,2l	kg CO2 eq.	1,03E-03	1,38E-01	5,94E-04	-5,35E-02	1,03E-03
33,5l	kg CO2 eq.	1,24E-03	2,10E-01	7,36E-04	-5,92E-02	1,24E-03

ISO 14025:2010	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14044:2006	Environmental management - Life cycle assessment - Requirements and guidelines
EN 15804:2012+A2:2019	Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products
ISO 21930:2007	Sustainability in building construction - Environmental declaration of building products
LCI Report	Life Cycle Assessment report of Composite LPG cylinders, 2022, Alexander Borg
NPCR 023:2021	Packaging products and services v 1.1., Norwegian EPD foundation
ISO 9001:2015	Quality management systems – Requirements
ISO 14001:2015	Environmental management systems – Requirements with guidance for use
ISO 50001:2018	Energy management systems – Requirements with guidance for use
ISO 11119-3:2020	Gas cylinders- Design, construction and testing of refillable composite gas cylinders and tubes
CEN – EN 12245:2009	Transportable gas cylinders – Fully wrapped composite cylinders
DIN – EN 14427:2014	LPG equipment and accessories – Transportable refillable fully wrapped composite cylinders for LPG – Design and construction

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