MANN+HUMMEL ProVent®

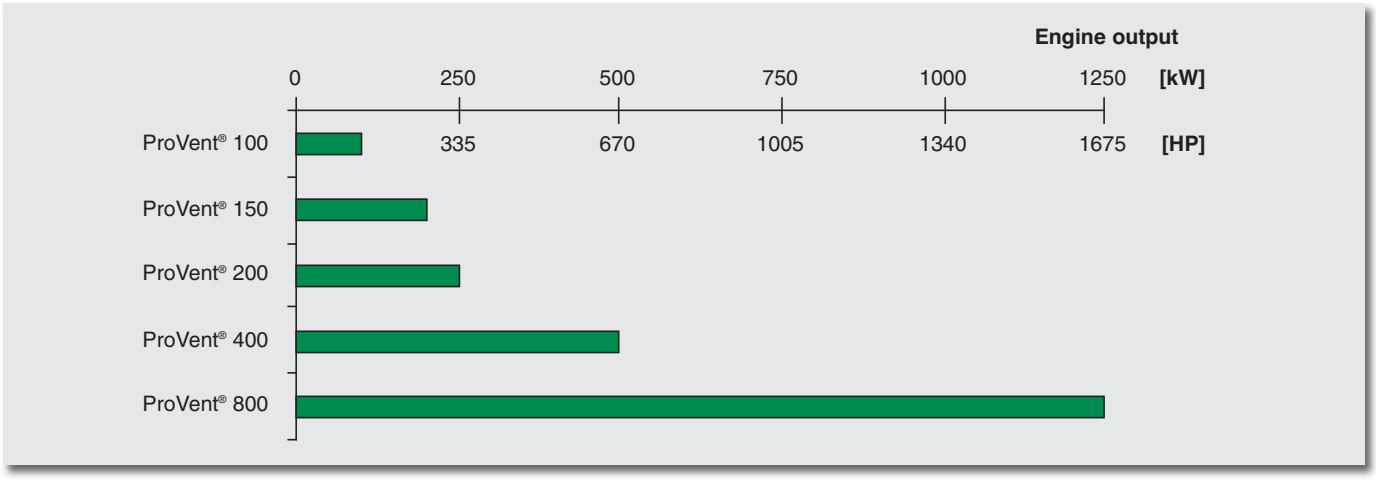
Oil separator for closed and open crankcase ventilation

MANN+HUMMEL

ProVent® – high performance with distinct advantages

The development of the whole MANN+HUMMEL ProVent® product family was directed towards the newest generation of industrial diesel engines. ProVent® sets the standard for crankcase ventilation and offers important advantages:

- Highly efficient oil separation through high performance media
- Excellent protection for the turbocharger and components fitted downstream
- Integrated safety feature against irregularly high crankcase pressure
- Low installation height to oil level possible through low pressure drop
- Lower engine oil consumption in comparison to less efficient separators or to conventional open systems without an oil separator
- Easy to service through quick access and protection against incorrect insertion of replacement element
- Suitable for universal use with different flow rates
- Excellent flexibility for choice of installation position and ports
- Compact and light design, but robust
- No auxiliary power required
- Extremely reliable, also at low temperatures
- Very low running costs
- All ProVent® products are suitable for use with open or closed crankcase ventilation

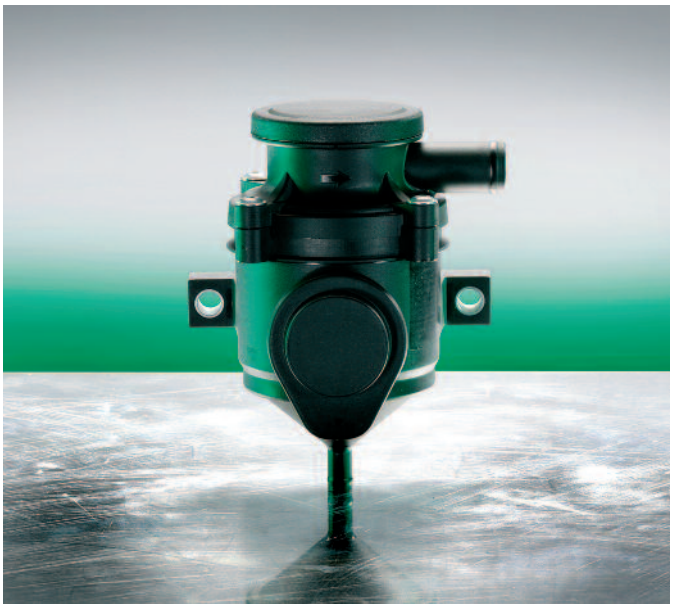


Contents

ProVent® 100

The ProVent® 100 is designed to offer compact crankcase ventilation for engines up to 100 kW and is characterised by the following advantages:

- Up to 100 l/min blow-by gas
- Compact design suitable for fitting in tight installation spaces
- Integrated pressure regulation for crankcase
- High-efficiency medium
- Available with by-pass valve or pressure-relief valve



- Suitable for open or closed CCV
- Use of two ProVent® 100 in parallel possible
- Check valve for oil return available as option (recommended)
- Symmetrical element design protects against incorrect insertion

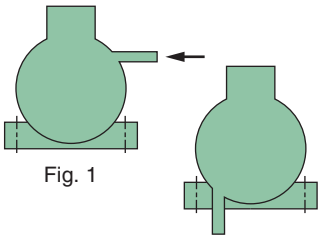


Fig. 1

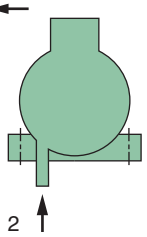
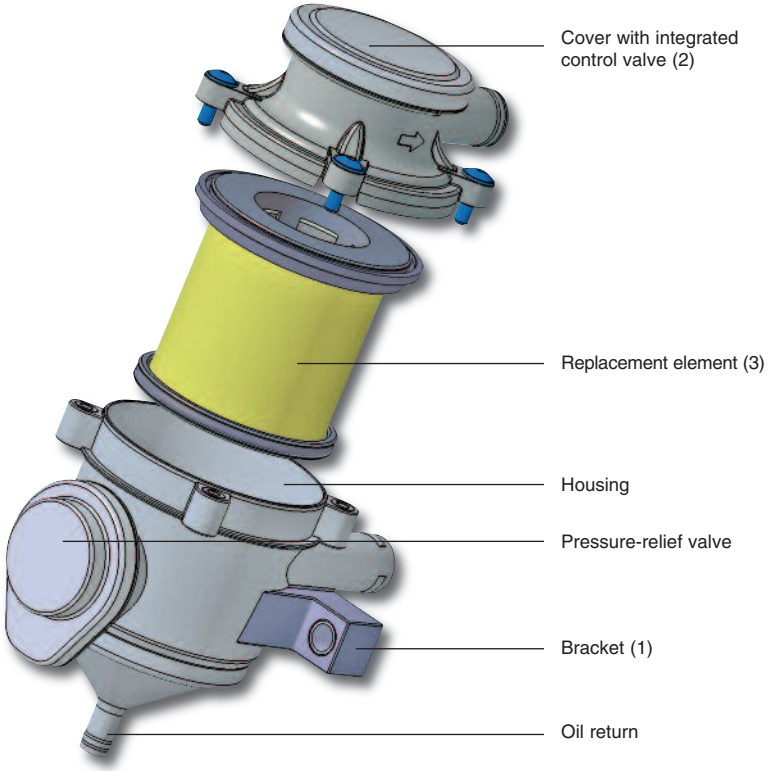


Fig. 2

Part No. ProVent® with pressure-relief valve	Part No. ProVent® with by-pass valve	Fig.	Blow-by inlet to housing	MANN-FILTER replacement element HE*	MANN-FILTER replacement element UE**
39 310 70 792	**39 310 70 793**	1	right	**LC 7001**	on request
39 310 70 790	**39 310 70 791**	2	rear		

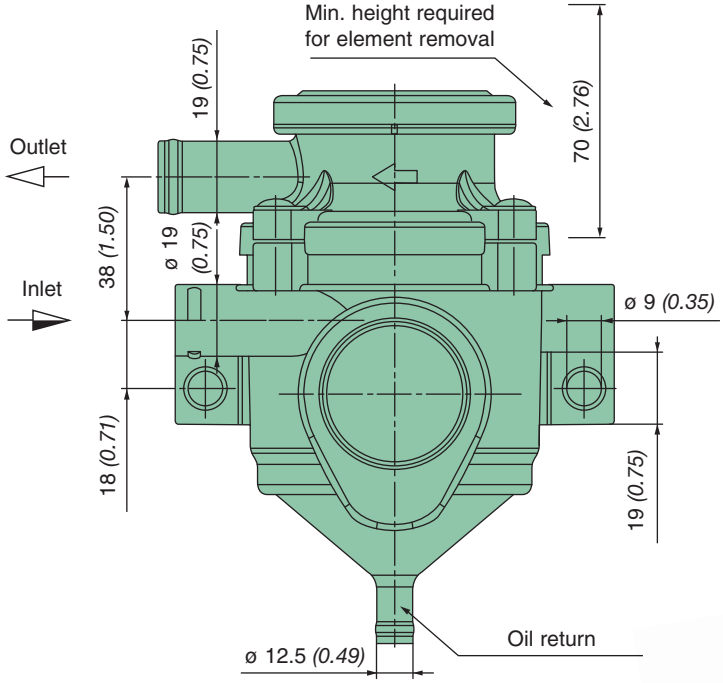
* HE = High-efficiency medium
** UE = Ultra-efficiency medium

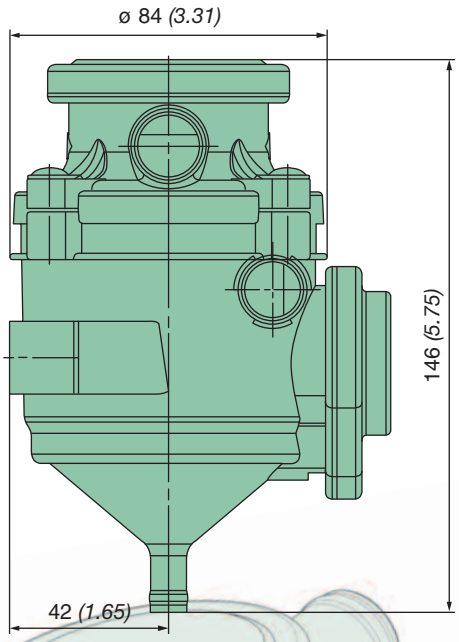


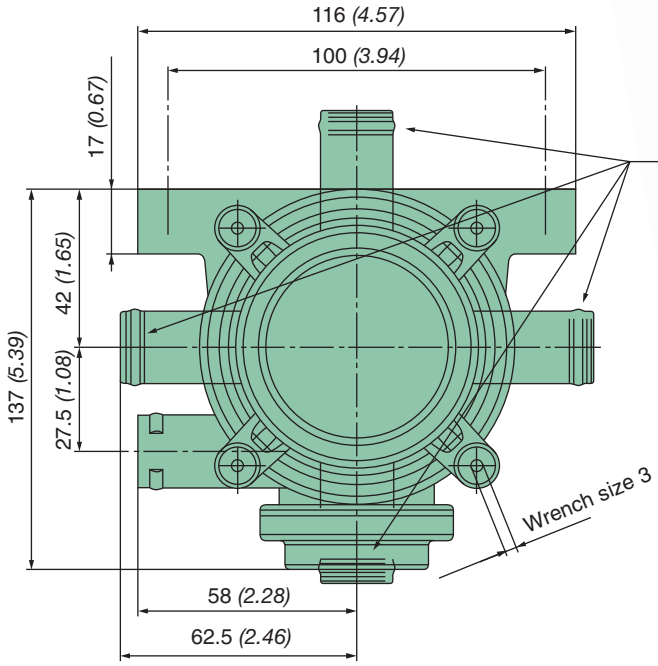
ProVent® 100 spare parts list

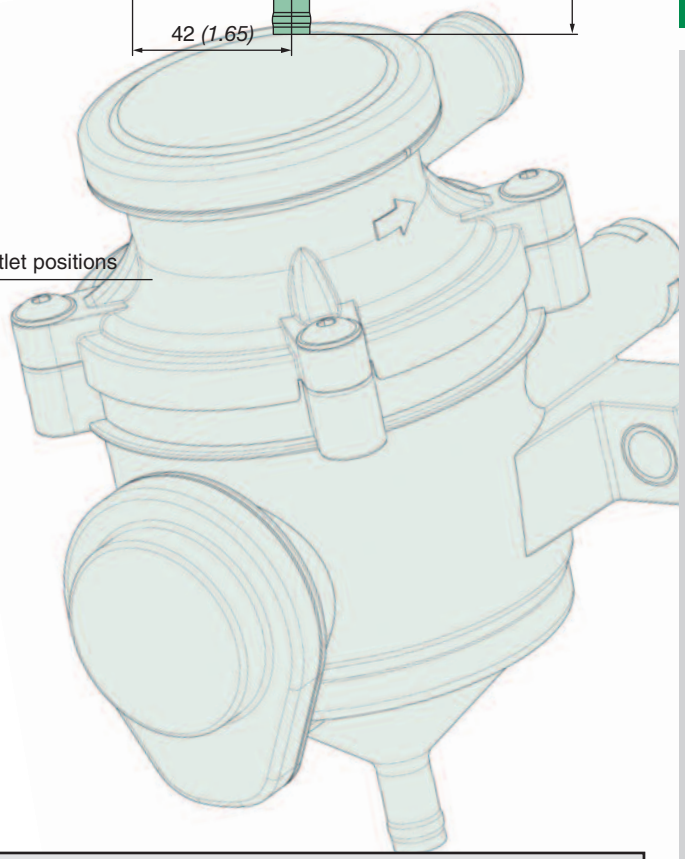
	Part No.	Art.	Quantity
Bracket	integrated	1	1
Cover	**39 310 30 320** (integrated pressure regulation)	2	1
Replacement element HE	**LC 7001**	3	1

ProVent® 100 – Specifications





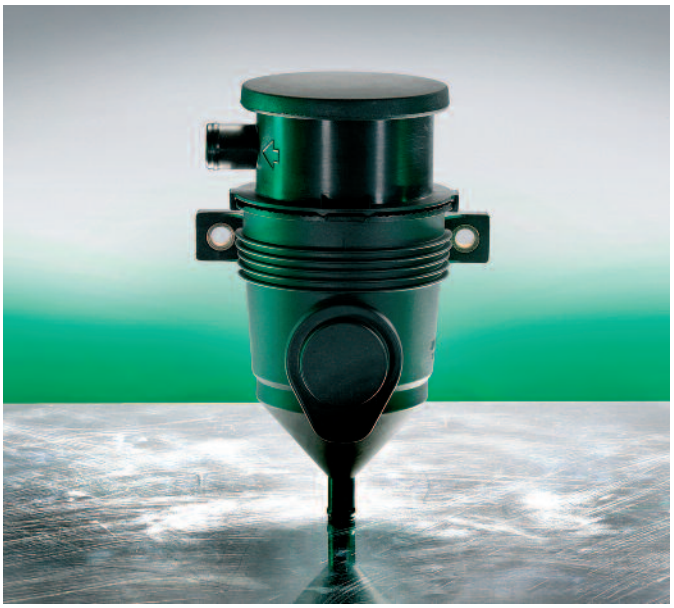




Standard value for use of ProVent®	single unit *	up to 100 kW
Blow-by flow rate		max. 100 l/min
Installation position		vertical
Allowed tilt position of vertical axis		45° in all directions
Positioning	Inlet Outlet	2 positions 4 positions
Ambient temperature		-35 °C to 120 °C, for a short time to 140 °C
Screw mounting to engine block		2 x M8
Material	Housing Cover Bracket	PA GF
Resistant against		diesel fuel, engine oil, lube oil, cleaning agents

* Use of two ProVent® of the same type in parallel possible

ProVent® 150



The ProVent® 150 is a compact crankcase ventilation unit for engines up to 200 kW and is characterised by the following advantages:

- Ultra-compact design
- Up to 150 l/min blow-by gas
- Equipped as standard with high-efficiency medium
- Pressure regulation
- Available with by-pass or pressure-relief valve
- Suitable for use as an open or closed CCV
- Use of two ProVent® 150 in parallel possible
- Protection against incorrect insertion of replacement element through symmetrical design
- Check valve for oil return available as option (recommended)
- Cover position adjustable in steps of 3 degrees

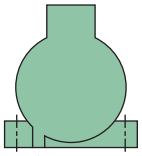
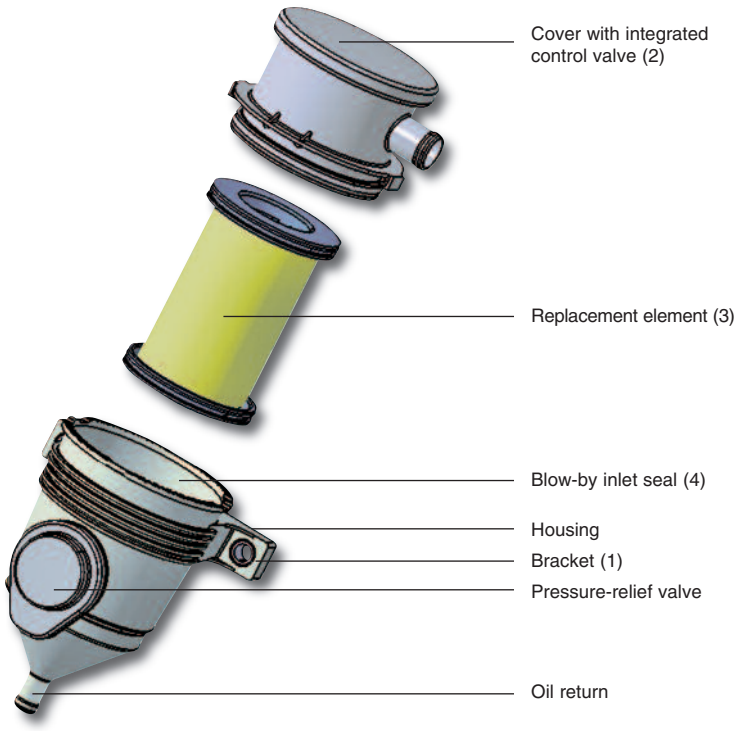


Fig. 1

Part No. ProVent® with pressure-relief valve	Part No. ProVent® with by-pass valve	Fig.	Blow-by inlet housing	MANN-FILTER replacement element HE*	MANN-FILTER replacement element other
39 310 70 870	on request	1	rear (integrated in bracket)	**LC 7201 X**	on request
on request	on request	2	left		
on request	on request	3	right		

* HE = High-efficiency medium



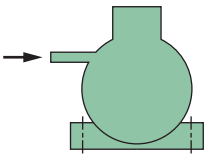


Fig. 2

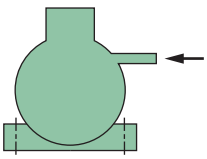


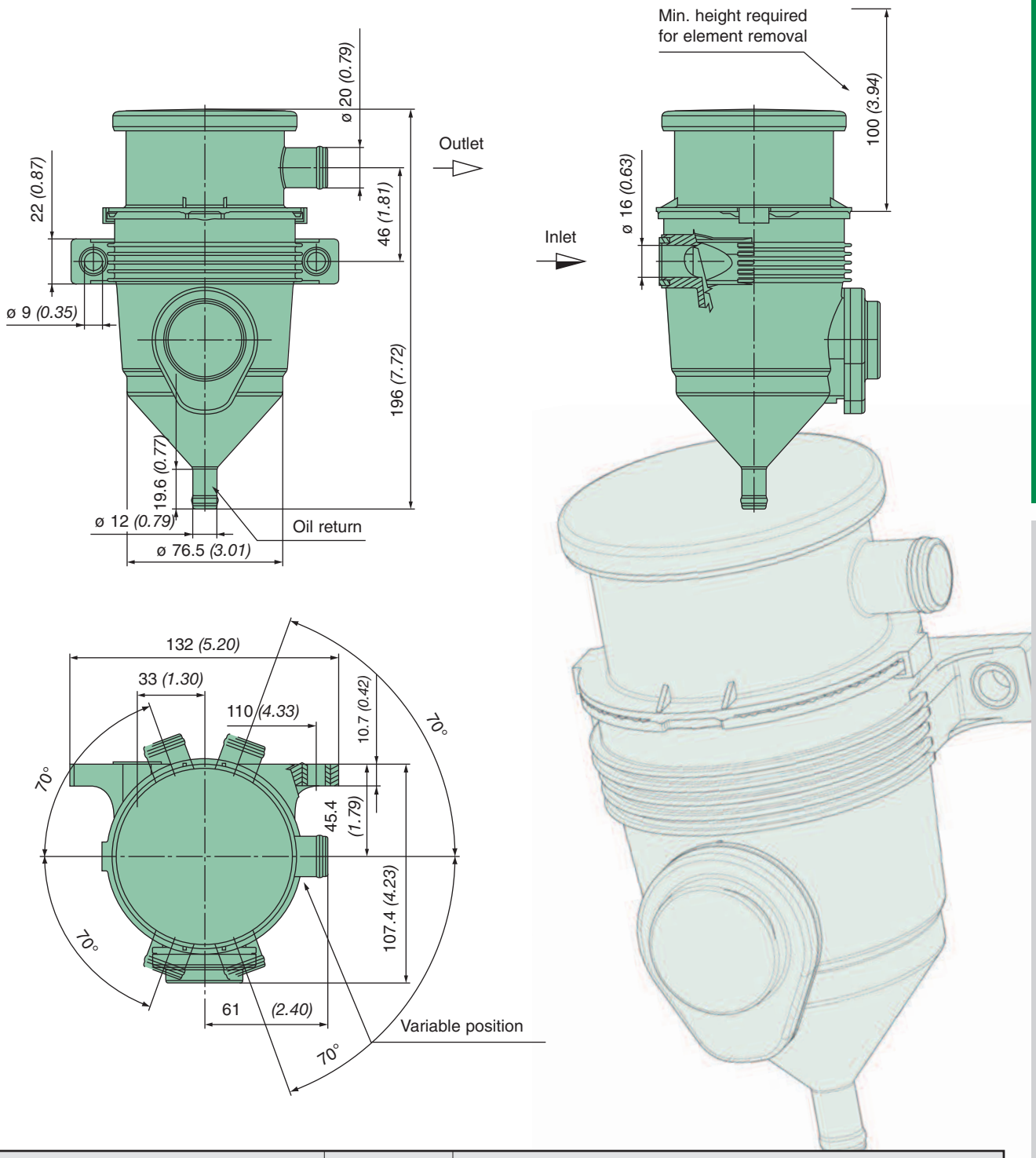
Fig. 3

ProVent® 150 spare parts list

	Part No.	Art.	Quantity
Bracket	integrated	1	1
Cover	**39 310 50 990** (integrated pressure regulation)	2	1
Replacement element HE	**LC 7201 X ****	3	1
Blow-by inlet seal	**23 019 33 171**	4	1

** Sealing element for cover supplied

ProVent® 150 – Specifications



Standard value for use of ProVent®	single unit *	up to 200 kW
Blow-by flow rate		max. 150 l/min
Installation position		vertical
Allowed tilt position of vertical axis		45° in all directions
Positioning	Inlet Outlet	1 position adjustable in steps of 3 degrees!
Ambient temperature		-35 °C to 120 °C, for a short time to 140 °C
Screw mounting to engine block		2 x M8
Material	Housing Cover Bracket	PA GF
Resistant against		diesel fuel, engine oil, lube oil, cleaning agents

* Use of two ProVent® of the same type in parallel possible

ProVent® 200

The ProVent® 200 is a compact crankcase ventilation system for engines up to 250 kW and is characterised by the following advantages:

- Up to 200 l/min blow-by gas
- Very compact design
- Available with high-efficiency or ultra-efficiency medium
- Integrated pressure regulation for crankcase
- Also available with by-pass valve (integrated in separation element)

- Tool-free element replacement with protection against incorrect insertion through turn-lock mechanism and element with integrated handle
- Suitable for use with open or closed CCV system
- Use of two ProVent® 200 in parallel possible
- Check valve for oil return available (recommended)

Part No. ProVent® with pressure-relief valve	Fig.	Blow-by inlet housing	MANN-FILTER replacement element		
			HE*	UE**	HE/UE each with by-pass valve
39 310 70 550	1	Fixed position for inlet and outlet adjustable bracket	**LC 5001 X**	**LC 5002 X**	on request

* HE = High-efficiency medium
** UE = Ultra-efficiency medium

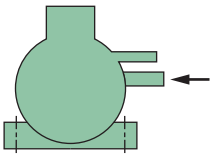
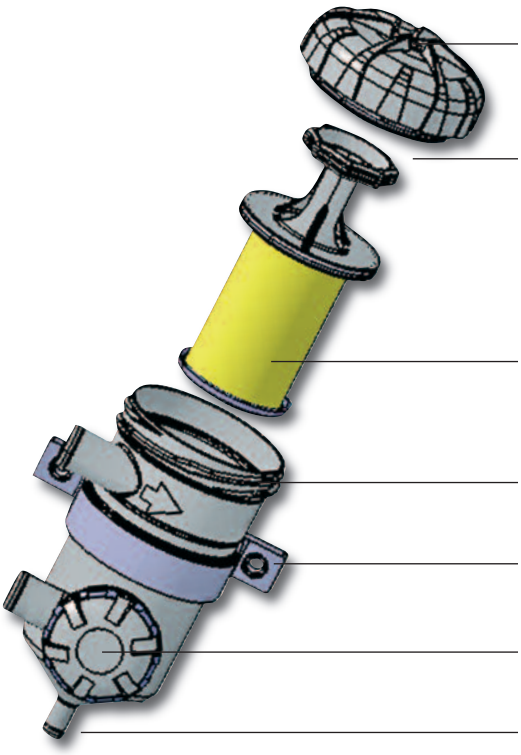


Fig. 1

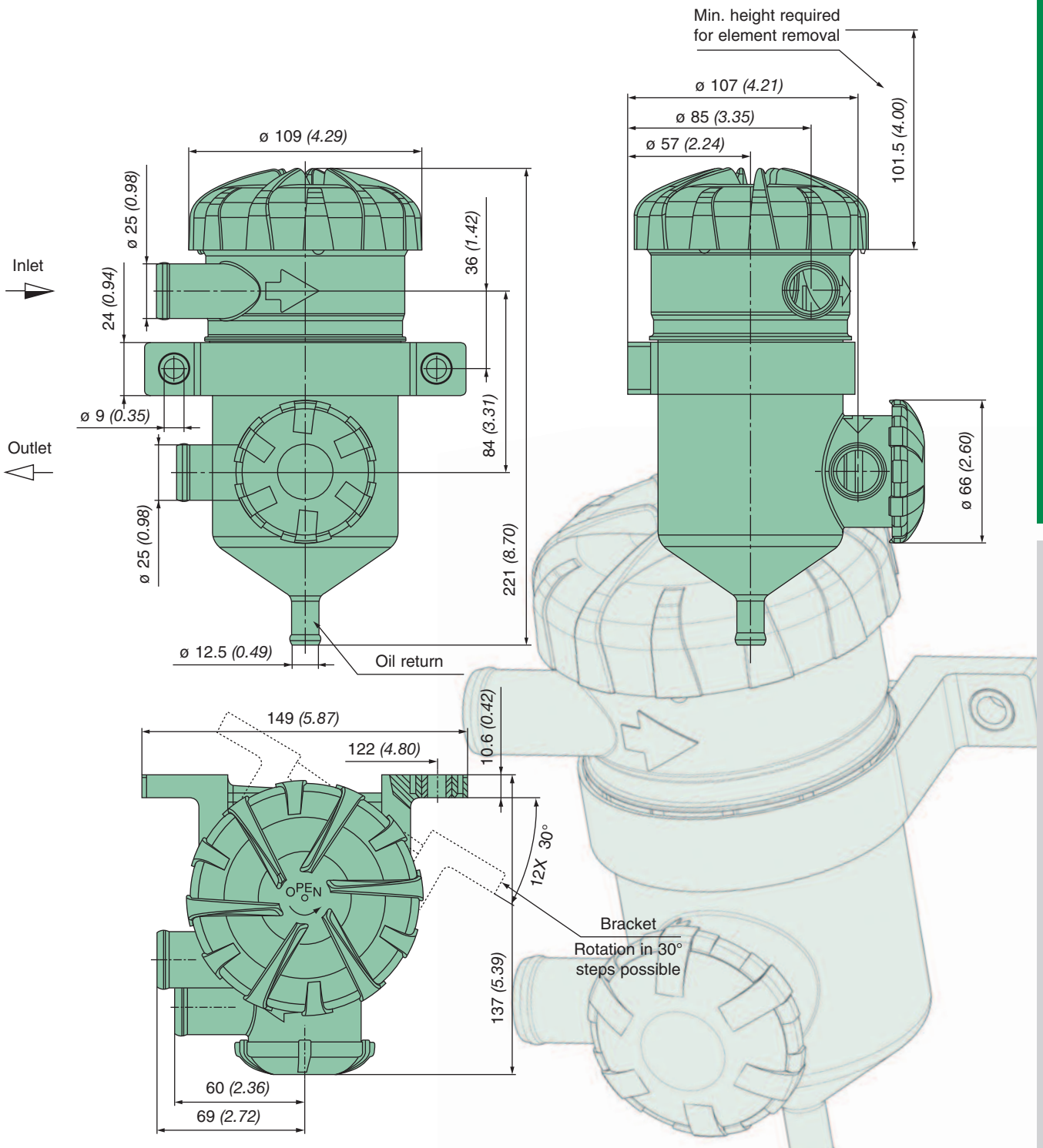


ProVent® 200 spare parts list

	Part No.	Art.	Quantity
Bracket	**39 310 30 955**	1	1
Cover	**39 310 17 950**	2	1
Replacement element HE	**LC 5001 X *****	3	1
Replacement element UE	**LC 5002 X *****	3	1

*** Sealing element for cover supplied

ProVent® 200 – Specifications



Standard value for use of ProVent®	single unit *	up to 250 kW
Blow-by flow rate		max. 200 l/min
Installation position		vertical
Allowed tilt position of vertical axis		45° in all directions
Positioning	Inlet Outlet	12 positions, further positions on request
Ambient temperature		-35 °C to 120 °C, for a short time to 140 °C
Screw mounting to engine block		2 x M8
Material	Housing Cover Bracket	PA GF
Resistant against		diesel fuel, engine oil, lube oil, cleaning agents

* Use of two ProVent® of the same type in parallel possible

ProVent® 400

The ProVent® 400 is a compact crankcase ventilation system for engines up to 500 kW and is characterised by the following advantages:

- Up to 400 l/min blow-by gas
- Very compact design
- High-efficiency medium
- Integrated pressure regulation for crankcase
- Very easy to service with tool-free element replacement and fitting of element and cover in only one position
- Suitable for use with open or closed CCV system
- Use of two ProVent® 400 in parallel possible
- Check valve for oil return available (recommended)

Part No. ProVent®	Fig.	Blow-by inlet housing	MANN-FILTER replacement element		
			HE*	UE**	HE/UE each with by-pass valve
39 310 70 700	1	Fixed position for inlet and outlet adjustable bracket	**LC 10 001 X**	on request	on request

* HE = High-efficiency medium
** UE = Ultra-efficiency medium

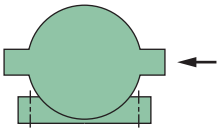
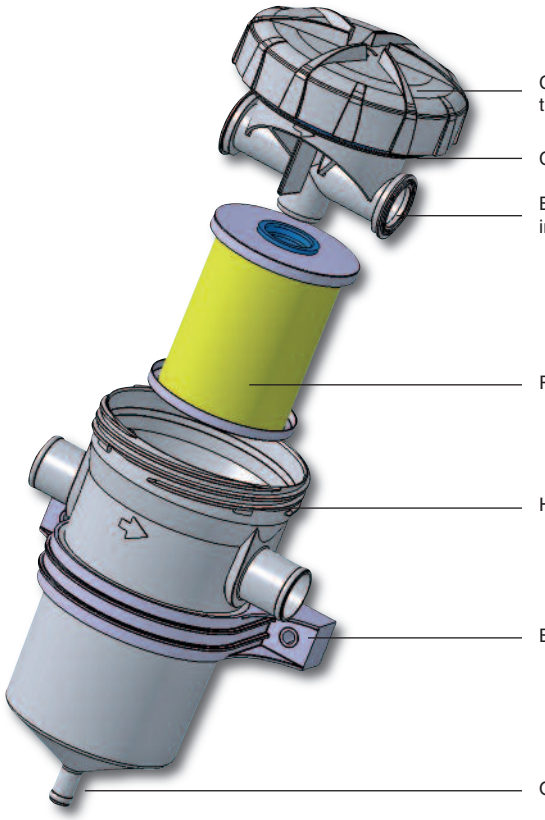


Fig. 1

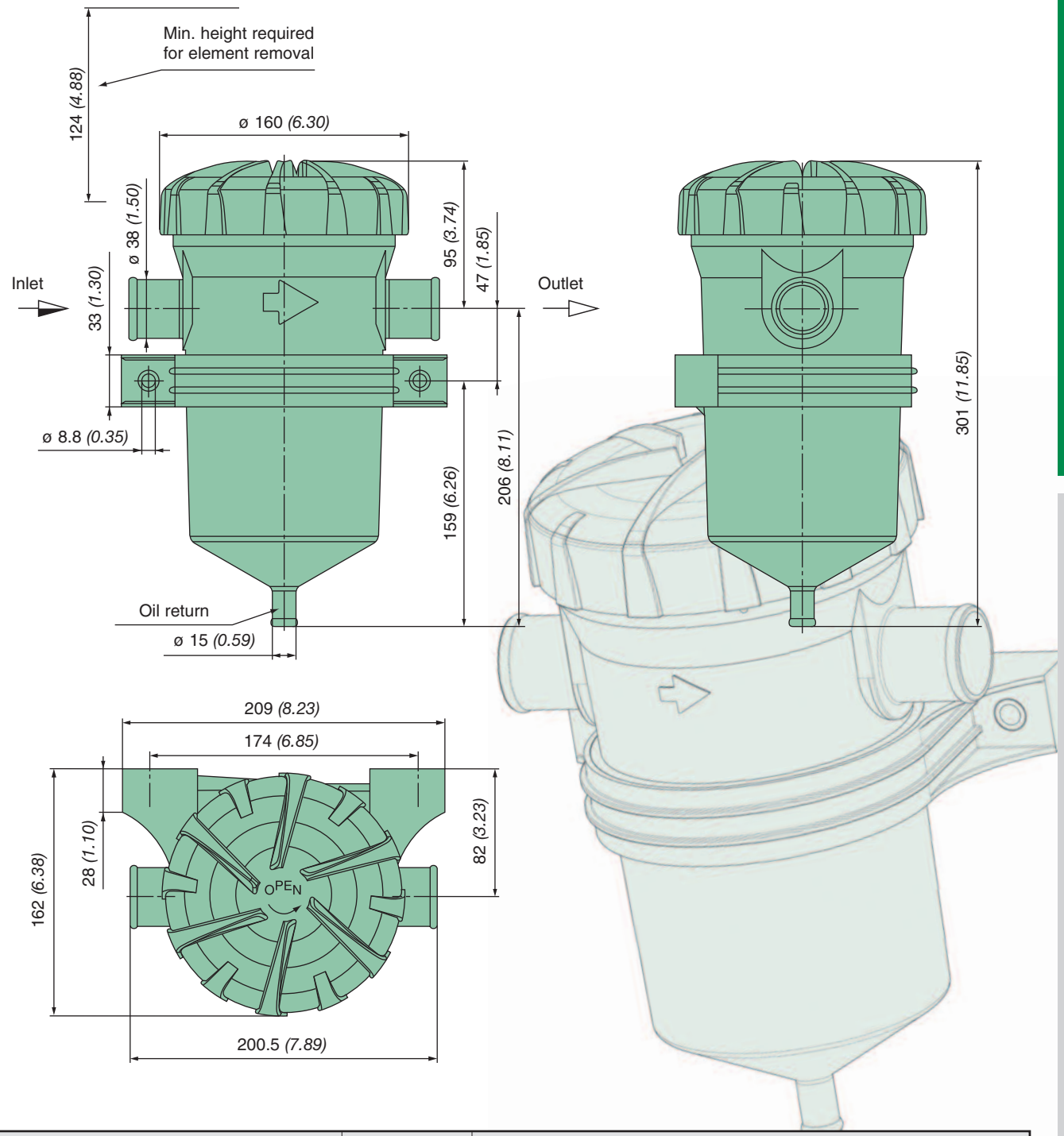


ProVent® 400 spare parts list

	Part No.	Art.	Quantity
Bracket	**39 310 30 956**	1	1
Cover	**39 310 30 970** (integrated pressure regulation)	2	1
Replacement element HE	**LC 10 001 X *****	3	1
Blow-by seal inlet/outlet	**23 033 33 102**	4	2

*** Sealing element for cover supplied

ProVent® 400 – Specifications



Standard value for use of ProVent®	single unit *	up to 500 kW
Blow-by flow rate		max. 400 l/min
Installation position		vertical
Allowed tilt position of vertical axis		45° in all directions
Positioning	Inlet Outlet	12 positions
Ambient temperature		-35 °C to 120 °C, for a short time to 140 °C
Screw mounting to engine block		2 x M8
Material	Housing Cover Bracket	PA GF
Resistant against		diesel fuel, engine oil, lube oil, cleaning agents

* Use of two ProVent® of the same type in parallel possible

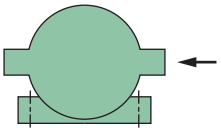
ProVent® 800

The ProVent® 800 is the largest available crankcase ventilation system. It is suitable for engines up to 1250 kW and is characterised by the following advantages:

- Extremely stable design in steel (housing and bracket)
- Up to 1000 l/min blow-by gas
- Equipped as standard with high-efficiency medium
- Pressure regulation
- Suitable for use as open or closed crankcase ventilation system
- Pressure-relief and by-pass valve available on request
- Use of two ProVent® 800 in parallel possible
- Easy to service through tool-free element replacement and fitting of element and cover in only one position
- Check valve for oil return available (recommended)

Part No. ProVent®	Fig.	Blow-by inlet housing	MANN-FILTER replacement element		
			HE*	UE**	HE/UE each with by-pass valve
39 310 70 800	1	Fixed position for inlet and outlet adjustable bracket	**LC 16 001 X**	on request	on request

* HE = High-efficiency medium
** UE = Ultra-efficiency medium



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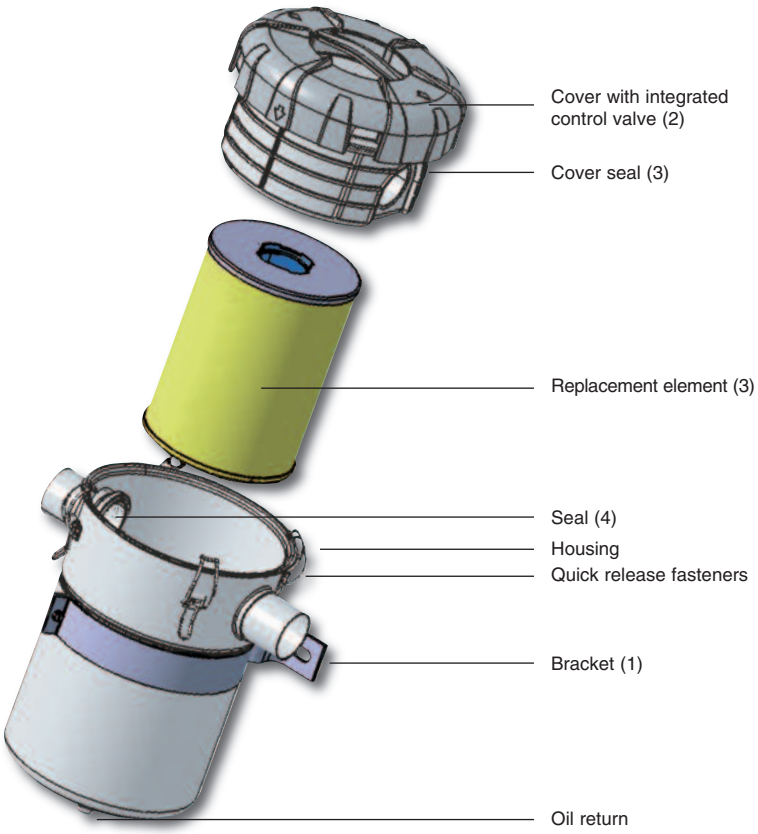
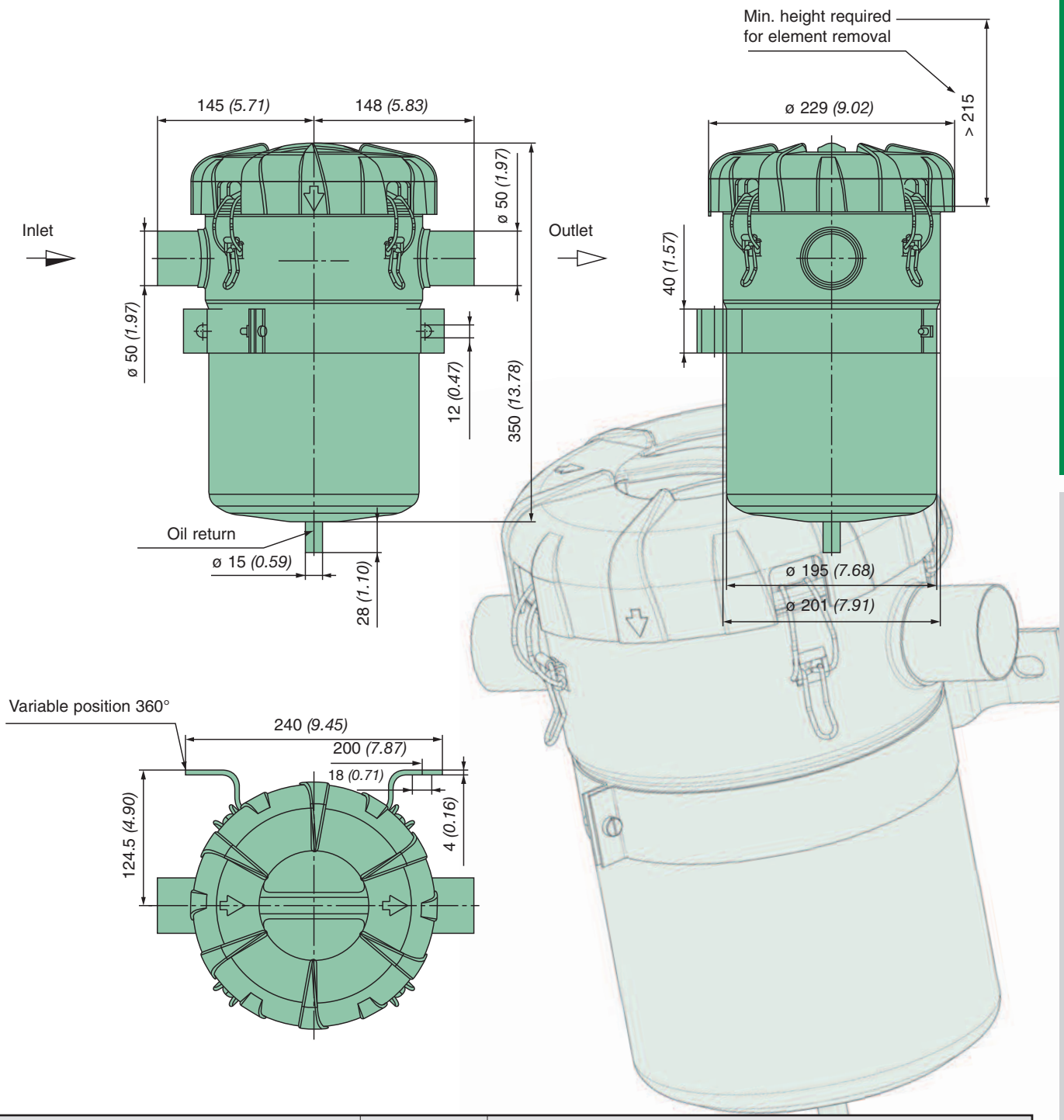


ProVent® 800 spare parts list

	Part No.	Art.	Quantity
Bracket	**39 165 38 970**	1	1
Cover	**39 111 71 948** (integrated pressure regulation)	2	1
Replacement element HE	**LC 16 001 X *****	3	1
Blow-by seal inlet/outlet	**23 051 33 131**	4	2

*** Sealing element for cover supplied

ProVent® 800 – Specifications



Standard value for use of ProVent®	single unit *	up to 1250 kW
Blow-by flow rate		max. 1000 l/min
Installation position		vertical
Allowed tilt position of vertical axis		45° in all directions
Positioning	Inlet Outlet	stepless
Ambient temperature		-35 °C to 120 °C, for a short time to 140 °C
Screw mounting to engine block		2 x M10
Material	Housing Cover Bracket	Steel PA GF Steel
Resistant against		diesel fuel, engine oil, lube oil, cleaning agents

* Use of two ProVent® of the same type in parallel possible

ProVent® – Protects the crankcase and the environment

The service life of diesel engines used in commercial and industrial applications is longer than the service life of diesel engines used in motor cars. Therefore components of diesel engines used in industrial applications are subject to higher requirements with regard to efficiency and lifetime. One of these components is the closed crankcase ventilation system, which is becoming increasingly important.

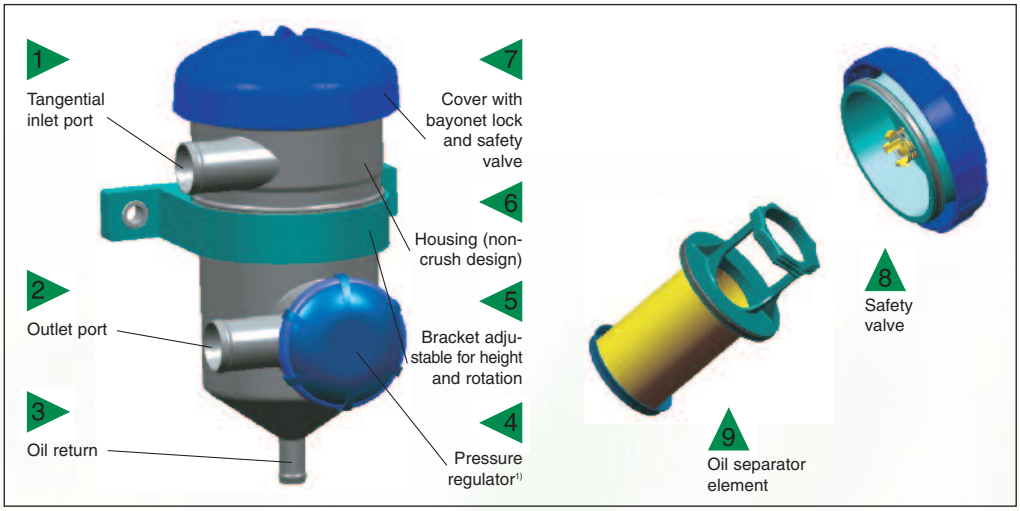


Fig. 1: Components with example of ProVent® 200 ¹⁾ only effective with closed systems

Generation of blow-by gases

For every piston stroke in a combustion engine there are exhaust gases which flow between the piston rings and sleeves. These gases enter the crankcase. In turbocharged engine applications, air can also make its way into the crankcase through the oil return pipe of the turbocharger. These gases are generally called **blow-by gases**. The pressure they generate leads to an unacceptable pressure build-up and crankcase ventilation becomes necessary.

In many countries, regulations governing car emissions stipulate that gases removed from the crankcase during the ventilation process must not enter the atmosphere. That is the reason why blow-by gases from car engines are redirected by so-called closed crankcase ventilation to the intake pipe assembly and burned. Commercial and industrial diesel engines are also subject to international emission regulations which in future can only be met through the application of reliable closed crankcase ventilation systems.

Closed crankcase ventilation

All MANN+HUMMEL crankcase ventilation solutions are suitable for use in closed systems. They therefore offer ideal protection for the crankcase and enable compliance with future environmental regulations. Contaminants can cause damaging, oily deposits in the engine intake, turbocharger and charge cooler. In addition, they compromise engine performance, increase fuel consumption and shorten engine life. To avoid this, an oil separator (9) is used to remove oil from the blow-by gas. The separated engine oil is then returned to the oil sump without loss where it can re-enter the oil circuit. After the blow-by gases are cleaned in the oil separator, they pass the pressure valve (4). This valve regulates the pressure inside the crankcase to within permissible limits.

Open crankcase ventilation

All ProVent® systems can also be used for open crankcase ventilation. In this case the pressure regulator of the ProVent® is not in operation. The outlet port (2) leads to the atmosphere. In this configuration there is a slight excess pressure in the crankcase.

Design and function of ProVent®

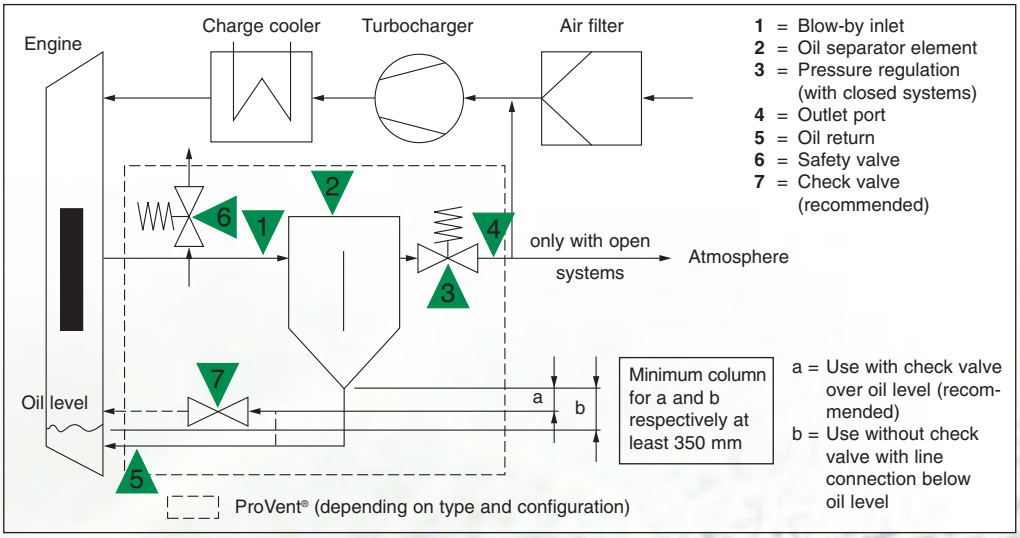


Fig. 2: Diagram of closed and open crankcase ventilation

Design and function of ProVent®

During development of the ProVent®, priority was given to functionality and design. High quality, robust components (see Fig. 2) are representative of the high performance of the whole system.

Oil separator

The filter elements used by MANN+HUMMEL (see item 2 in diagram) are the result of intensive development work and experience. The respective medium is perfectly matched to each ProVent® while satisfying the requirements for quality and economy. The high performance coalescence separators are able to reduce the residual oil content of the blow by gas to an extremely low level. Depending on the particle spectrum of the oil content, the separator uses the most appropriate separation principle. As a result, ProVent® is ideally suitable to comprehensively meet the requirements of the next generation of engines. Servicing of the oil separator is made according to the installation and maintenance instructions under consideration of the specifications of the engine producer.

Pressure regulation

In closed systems the pressure regulator (item 3 in diagram) can be set as required to maintain a constant level independent of the negative pressure of the air intake manifold. The set pressure level simply depends on the quantity of blow-by gases (see Fig. 3).
The crankcase pressure remains within a narrow range even with a variable negative air intake pressure and fluctuating blow-by gas volumes. The pressure regulator does not operate in an open ProVent® system.

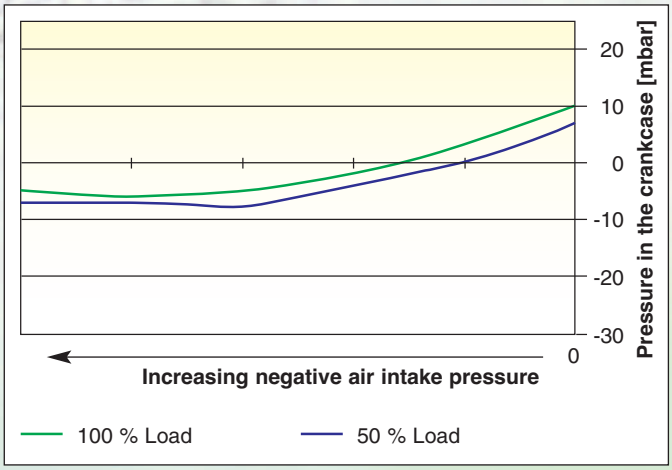


Fig. 3: Pressure adjustment curve (ProVent® 200)

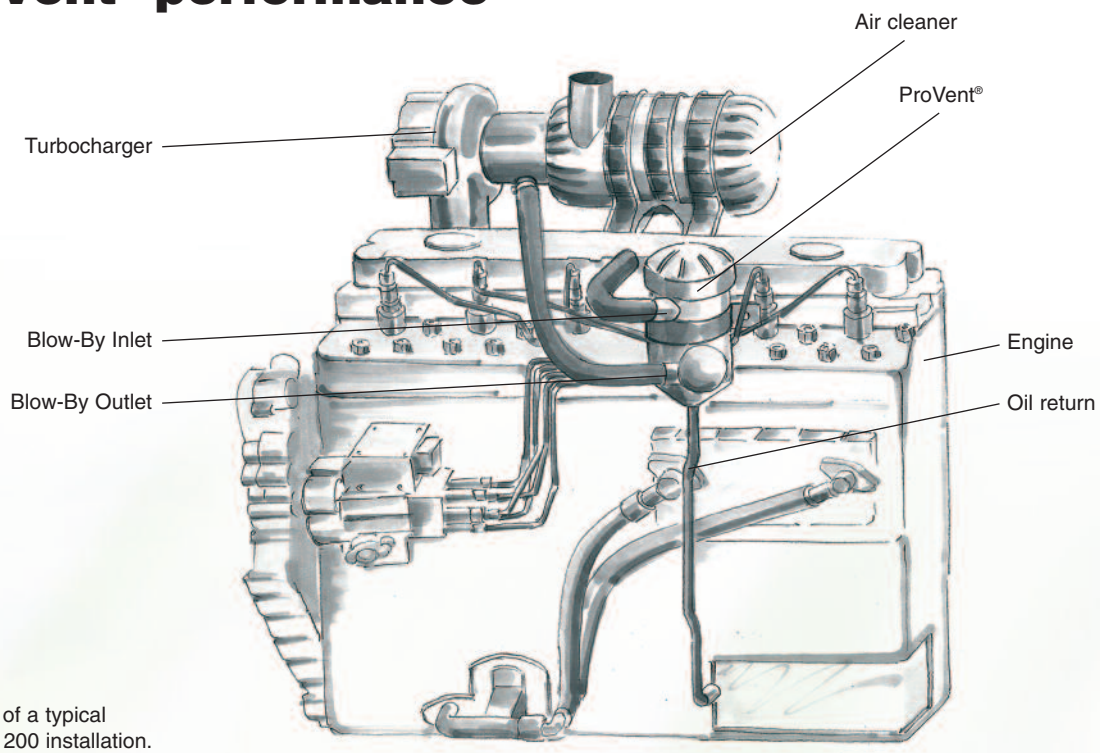
Housing

All ProVent® systems have a low flow resistance in order to protect the engine from excessive crankcase pressure. Generous cross-section connections and other technical details facilitate the flow and ensure that its compact design is not subject to high flow resistance.

Safety valve

A safety valve (item 6 in diagram) is integrated in the housing cover to protect the engine from an impermissible rise in pressure in case other components fail. If the engine is fitted with a crankcase pressure monitoring system, it is possible to configure the bypass valve such that the opening pressure of the safety valve is greater than the pick-up pressure of the monitoring pressure on the engine side.

ProVent® performance



Example of a typical ProVent® 200 installation.

Fractional separation efficiency

As there is no standard governing the determination of separation efficiency, it is not possible to publish standardised values. However, numerous tests have shown that operating conditions such as speed, output, torque and age of the unit are relevant factors with regard to the generation of oil droplets. Thus the size and distribution of the oil droplets partly depend on these factors.

The separation efficiencies listed in the table for MANN+HUMMEL HE and UE media relate to an oil presence of
$\leq$ 1 g/m³ in the blow-by gas with an oil droplet distribution of d_s = 0.8 (Sauter diameter).

In respect of the Δp value, a lower value signifies a greater flexibility with regard to the mounting location. If the Δp is lower, the ProVent® can be fitted closer to the oil level or check valve in the oil return pipe of the engine.

Separation efficiencies of media types		
Medium	**Efficiency**	**Δp**
HE	80 - 85 %	10 - 15 mbar
UE	85 - 90 %	20 - 35 mbar

The exact fractional separation efficiencies, i.e. the separation efficiencies of certain particle size ranges, have to be determined for the respective application in tests.

The non-existence of a standard and numerous operating parameters requiring definition mean that in many cases dimensioning of the filter is necessary.

In this case MANN+HUMMEL offers support and technical assistance.

Instructions regarding the use of ProVent®

Mounting location on the engine

ProVent® systems are designed for OE producers and are also suitable for retrofitting.

Instructions

- ProVent® can be fitted to the engine or application frame.
- Observe the installation and maintenance instructions of the respective ProVent® system.

Connection to the engine

Observe the following when connecting to diesel engines:

- Position the blow-by outlet in an area free of splashing oil (e.g. upper area of the crankcase).
- Observe the mounting and maintenance instructions of the respective ProVent® system.

Connection with a closed system

The respective outlet port is connected to the engine intake. As opposed to conventional systems, the ProVent® installation location is practically independent of the negative air intake pressure on the outlet port. The result is a large degree of flexibility for the fitting position on the engine. The negative air intake pressure present during operation sucks the blow-by gas via ProVent® and returns the cleaned blow-by gas to the engine air intake.

Connection with an open system

The blow-by gas now free of oil is released into the atmosphere.

Oil return

The respective port of the oil return (see diagram on page 15) is connected to the oil sump via a drainage pipe. There are two principal connection possibilities:

1. Below the oil level

The oil return is connected via a drainage pipe below the minimum permissible oil level of the engine oil sump. According to the principle of connected pipes, the same oil level is present in the oil sump and the drainage pipe. This oil receiver acts like a siphon so that when the oil is sucked from the outlet port the blow-by is directed via the oil separator. The negative pressure in the oil return pipe during operation is the same as the negative pressure at the oil separator. As opposed to conventional solutions, this intake negative pressure is reduced due to design considerations so that the height of the oil column in the drainage pipe during operation is accordingly low. As a result the drainage pipe need only take into account a respectively low oil column and this enables numerous installation possibilities.

2. Above the oil level

This connection variation requires fitting of a check valve which is available as an option. The valve is fitted in the drainage pipe as close to the engine as possible. Separated oil collects above the check valve during operation. The check valve is closed during operation by the negative suction pressure present in the housing of the ProVent®. When the weight of the oil column is above the closing pressure of the valve, for example when the engine has been switched off, the separated oil flows back to the oil sump.

Instruction

In all cases observe Fig. 2 on page 15, the general overview, and the respective installation and maintenance instructions.

Notes

Dimensioning the ProVent®

Fax to:

MANN+HUMMEL GMBH
Industrial Filters Business Unit
67346 Speyer, Germany
E-Mail: if.info@mann-hummel.com

copy – fill in – fax
Fax-No. +49 (62 32) 53 – 82 70

Required information: to dimension the ProVent® MANN+HUMMEL needs the following information

- Engine manufacturer: _____
- Engine type: _____
- Effective mean pressure (BMEP): _____
- No. of cylinders: _____
- Engine capacity [l]: _____
- Output [kW]: _____
- Blow-by flow rate [l/min]: _____
- Permissible crankcase pressure min./max. [mbar]: _____
- Available intake negative pressure at the intake port (1) when idling, at 50% load, and with 100% load [mbar]: _____

  _____
- Available installation space: _____
- Optional specifications (if available): _____
- Blow-by oil content before ProVent® [g/h]: _____
- Permissible oil content after ProVent® [g/h]: _____

Company _____
Name _____
Department _____
Street _____
Town/Post code _____
Country _____
Tel. no. _____
Mobile tel. no. _____
Fax _____
Email _____

ProVent® – Overview

			ProVent® 100	ProVent® 150	ProVent® 200	ProVent® 400	ProVent® 800
Specifications	Standard value for use of ProVent®	single * up to [KW]	100	200	250	500	1250
		single * up to [HP]	135	270	340	675	1690
	Blow-by flow rate (single unit)		max. 100 l/min	max. 150 l/min	max. 200 l/min	max. 400 l/min	max. 1000 l/min
	Installation position		vertical				
	Allowed tilt position of vertical axis		45° in all directions				
	Positioning	Inlet	2 positions	1 position further on request	12 positions further positions on request	12 positions	stepless
		Outlet	4 positions	adjustable in steps of 3°			
	Ambient temperature		-35 °C bis 120 °C, kurzzeitig bis 140 °C				
	Screw mounting to engine block		2 x M8				2 x M10
	Material	Housing	PA GF				Bracket
		Cover					PA GF
		Bracket					Bracket
	Resistant against		diesel fuel, engine oil, lube oil, cleaning agents				
	Weight		0.25 kg	0.33 kg	0.39 kg	1.20 kg	5.41 kg

Part Nos.	ProVent® standard version	Complete	39 310 70 792	39 310 70 870	39 310 70 550	39 310 70 700	39 310 70 800
		with element	HE element **				
	Oil separator element	HE **	LC 7001	LC 7201 X	LC 5001 X	LC 10 001 X	LC 16 001 X
		UE **	on request	on request	LC 5002 X	on request	on request
	Check valve for oil return (recommended)		24 008 43 621			24 013 45 992	

Configuration & instructions	Highly efficient oil separation		S	S	S	S	S
	Crankcase pressure regulation		S	S	S	S	S
	Oil return		S	S	S	S	S
	Mounting bracket		S	S	S	S	S
	Pressure-relief valve		S	S	S	O	O
	Check valve for oil return (recommended)		O	O	O	O	O
	By-pass valve		option instead of pressure-relief valve		option	on request	on request
	Used as open CCV system		yes	yes	yes	yes	yes
	Used as closed CCV system		yes	yes	yes	yes	yes
	Service interval		depends on the application				
	Installation height of ProVent® above check valve or oil level	Stationary applica-tions	For continuous operation at the rated load dimensioning is necessary by MANN+HUMMEL.				
		Mobile applica-tions	min. 350 mm with use of the check valve				

O = Option
S = Series/within scope of delivery

* Use of two ProVent® of the same type in parallel possible
** HE = High-efficiency medium UE = Ultra-efficiency medium

Selection from the range of MANN+HUMMEL industrial filters catalogue program

Liquid filters

Spin-on filters
Fuel filters
In-line filters

Catalogue part no.
19 942 10 100 de
19 942 10 101 en
Other languages
available on request.

Air cleaners

Oil-wetted air cleaners
Europiclon®
Vacuum filter

Catalogue part no.
19 941 10 100 de
19 941 10 101 en
Other languages
available on request.

Air/oil separators for compressors and vacuum pumps

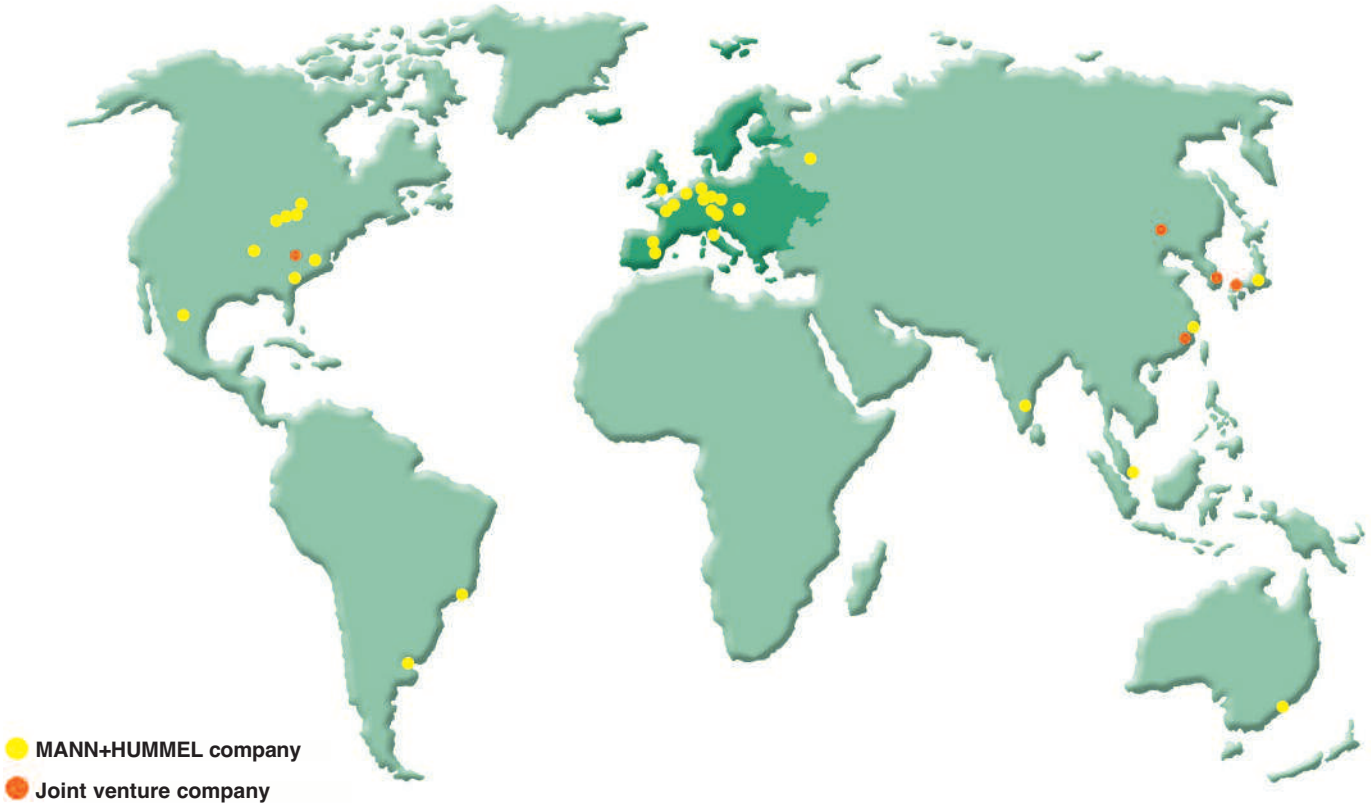
Air/oil separators
Air/oil boxes

Catalogue part no.
19 943 00 100 de
19 943 00 101 en
Other languages
available on request.

MANN-FILTER

Filter elements in OEM matching quality for construction and agricultural machines:
- Air cleaners
- Oil filters
- Fuel filters
- Hydraulics filters
- Cabin filters

Catalogue part no.
19 939 24 600
Available in a number
of languages



MANN+HUMMEL Group

The MANN+HUMMEL Group is an international company with its headquarters in Ludwigsburg, Germany. The group employs approx. 11,500 people worldwide at more than 41 locations.

The company develops, produces and sells technically complex components for the automotive and other industries. A key area is high quality filtration products for vehicles, engines and industrial applications. The OEM business with global market leaders and producers of vehicles, machines and installations defines the quality and performance of the group. Filters for the international aftermarket are sold under numerous international brands as well as under the MANN-FILTER brand.

MANN+HUMMEL Industrial Filters

The Industrial Filters Business Unit with its headquarters in Speyer, Germany is specialised in meeting the requirements of off-highway vehicle and engine applications, compressed air and vacuum technology, mechanical engineering and plant construction. For these and other industrial fields MANN+HUMMEL Industrial Filters offers high performance products for the filtration and separation of air, gases and liquids.

MANN+HUMMEL GMBH, Business Unit Industrial Filters
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E-Mail: if.info@mann-hummel.com, Internet: www.mann-hummel.com

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MANN + HUMMEL
ProVent - Oil Separator for Open and Closed Crankcase Ventilation Systems Models 100, 150, 200, 400, 800

Installation and Maintenance Manual

Model 100

Model 150

Model 200

Model 400

Model 800

Contact information

This installation and maintenance manual is a component part of the scope of delivery. It must be kept in a safe place and remain with the equipment in the event of resale.

We reserve the right to make technical improvements to the products described in this installation and maintenance manual without notification.

This operating and maintenance manual is not subject to an updating service.

Information on the current status is available from

MANN+HUMMEL GMBH

Geschäftsbereich Industriefilter

(Industrial Filters Business Division)

Brunckstr. 15

D - 67346 Speyer

Internet: http://www.mann-hummel.com/

E-mail: if.info@mann-hummel.com

Contents

1 Foreword

This Installation and Maintenance Manual is intended to help become familiar with the oil separators of the ProVent series and their proper use.

The installation and maintenance manual contains important information on operating the components safely, properly and economically. Observation of the manual helps avoid potential risks, reduce repair costs and downtimes as well as improve machine reliability and increase its service life.

The instructions must be made accessible to any person charged with working on the device.

The respective existing national environmental protection regulations (especially on the disposal of removed parts), the general accident prevention regulations and the other generally recognised safety-related and industrial safety and health rules must be complied with.

We reserve the right to make technical changes to the oil separator and/or changes to the content of this installation and maintenance manual.

Information for the operator:

The operator is responsible for the provision of working equipment complying with basic health and safety requirements in accordance with the Ordinance on Industrial Safety and Health. This also includes deploying the work equipment such that it is only used within the scope of its intended use. The operator can define individual maintenance and service plans and intervals in addition to those stipulated in the installation and maintenance manual.

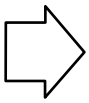
2 Safety

2.1 Warning notes and symbols

This symbol appears in all the sections of the manual in which your safety could be at risk. Failure to observe the information provided could put persons at risk.

!

This symbol appears in all the sections of the manual in which the information provided must be strictly observed to prevent damage to or destruction of system parts.



This symbol appears in all the sections of the manual in which the information provided must be carefully observed to ensure trouble-free, economic operation.

2.2 General information

Read the EU Material Safety Data Sheet on diesel fuel and observe the information contained in it regarding handling diesel fuel.

- Diesel fuel and fuel fumes are damaging to health.
- Do not inhale them, let them get in your eyes or come into direct contact with bare skin.
- Only complete assembly work when the engine has stopped.
- Relieve pressurised lines before starting any work.
- If fuel escapes, a collecting vessel must be placed under the vehicle to prevent environmental pollution.
- Only complete work for which you have been trained and received the necessary instruction.

2.3 Intended use

The various models of the ProVent series are exclusively intended for mechanical oil separation of blow-by-gas or for crankcase ventilation of diesel and gas engines. Any other use above or beyond this is considered unintended use. The manufacturer/supplier is not considered liable for damage resulting from unintended use.

Intended use also includes observing the information in the installation and maintenance manual and meeting all the inspection and maintenance conditions.

The operator is obliged to check the ProVent once a week for externally recognisable damage and defects, and to immediately report any changes which have occurred (including in the operating behaviour), which impair the functional safety.

All labels and identifications on the ProVent must be kept in legible condition.

The crankcase ventilation system may only be serviced by trained and authorized personnel.

All ProVent systems are built according to state-of-the-art technology and the recognised safety-related rules. However, the functional safety of connected equipment can be at risk when:

- A ProVent system is used improperly,
- the operating conditions have changed,
- reconstructions have been made without prior consultation with the manufacturer,
- the necessary maintenance and repair work has been neglected.

Only use models of the ProVent series when in proper technical condition and in accordance with the technical design in a safety and danger-conscious manner while observing the installation and maintenance manual! Investigate faults (or have them investigated) immediately, particularly those which could impair safety!

3 Function Description

ProVent is a system for crankcase ventilation with integrated oil separation and pressure control which reduces the emissions of vehicles and deposits in the intake section to a minimum.

The ProVent series separates the blow-by gases containing oil which result during fuel combustion by means of an oil separating element, therefore reducing the residual oil content of the gas to a minimum level.

The ProVent systems mainly consist of an oil separating element, a pressure control system and, depending on the model, an overpressure or a bypass valve.

The mounting location and the design of the respective components vary depending on the size of the ProVent system.

ProVent oil separators can be used as open or closed systems.

Both with closed and with open systems, separated oil is routed back into the oil sump and is then available for the oil circuit again.

With an open crankcase ventilation system, the pressure control system is not active. After flowing through the oil separator, the blow-by gas is routed via the outlet fitting into the open. In the process, overpressure results in the crankcase during operation.

With a close crankcase ventilation system, the crankcase pressure is regulated by the pressure control system; after flowing through the oil separator, the blow-by gas is routed via the outlet fitting into the intake section of the engine.

Production of blow-by gases

During each working cycle of an engine, combustion gases (so-called blow-by-gases) flow between the piston rings and the cylinder sleeves into the crankcase.

On turbocharged engines, air can also flow into the crankcase via the oil return of the turbocharger.

This would result in an impermissibly high pressure in the crankcase after a short time.

This pressure build-up is prevented by an crankcase opening in a suitable location.

The blow-by gases mixed with oil mist from the crankcase exit from this ventilation hole.

ProVent oil separating systems can be used to prevent the blow-by gases from transporting oil mist out of the crankcase and from polluting the environment with blow-by gases containing oil.

ProVent systems are designed both for use as original equipment and for retrofitting.

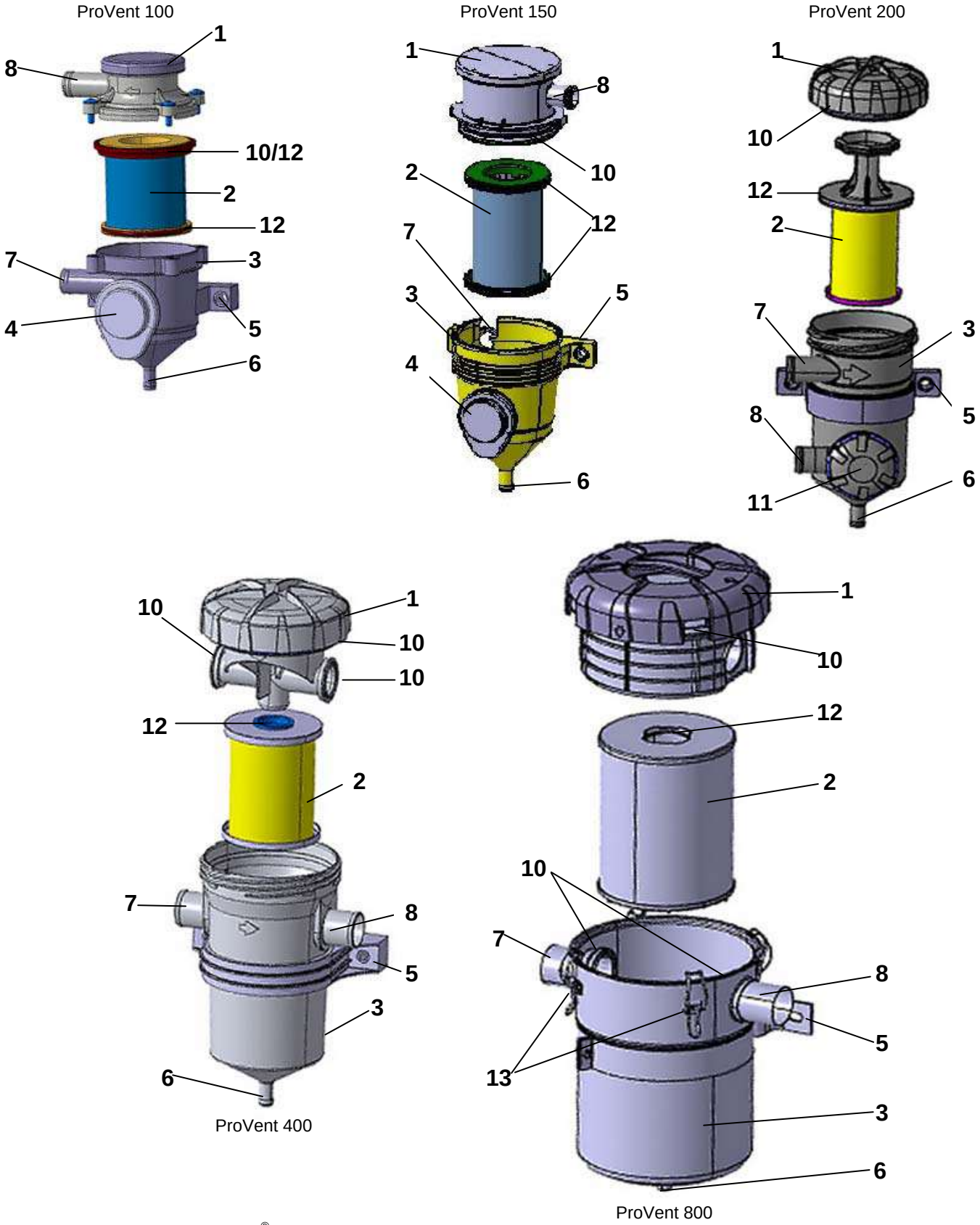


Fig. 1 Overview of ProVent® series

Pos.	Name	Pos.	Name
1	Lid with integrated pressure control valve	8	Outlet
2	Oil separating element	9	Seal of blow-by inlet
3	Housing	10	Seal of lid/housing
4	Pressure relief valve/bypass valve	11	Pressure control valve
5	Holder	12	Seals of element
6	Oil return	13	Quick-connect couplings
7	Inlet	14	Lid with integrated pressure relief valve

4 Assembly

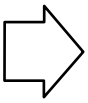
4.1 General information

Check that the scope of delivery is complete and that there are no signs of damage.

If parts delivered are damaged, please inform MANN+HUMMEL immediately.

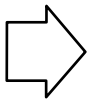
! The assembly of the ProVent and the installation of the lines may only be carried out by qualified persons instructed for this purpose.

! It is essential to observe the information on correct assembly when completing assembly and installation work.



Pay attention to the direction of flow.

Carry out fixations conscientiously.



When working on the fuel supply, always place collecting vessels under the tank or lines to collect any escaping fuel. Dispose of collected fuel or oil in accordance with the respective applicable local waste disposal directives.

Health hazard due to escaping oil!

Wear safety goggles and gloves.

(Also refer to the material safety data sheet for diesel fuel)

4.2 Requirements for installation location

The ProVent system can be mounted on the engine or the frame of the machine/vehicle with the holder (5).

The arrow on the ProVent housing marks the direction of flow of the blow-by gas from the inlet to the outlet.

The highest possible point above the engine oil level (or, if present, above the non-return valve of the oil return line) must be selected as the installation location for the ProVent housing.

Minimum distance from surface of oil (or non-return valve) to oil return (6) of ProVent housing: at least 350 mm.

Connecting inlet fitting

The blow-by gases flow through a (hose) line from the crankcase via the inlet fitting (7) into the ProVent system.

Experience shows that optimum gas removal points from the crankcase are in the areas in which there are no moving parts and little oil spray, e.g. the upper areas of the crankcase or the cylinder-head cover.

This opening on the crankcase must be connected to the inlet fitting (7) of the ProVent system.

Connection of outlet fitting with closed crankcase ventilation system

The outlet fitting (8) is connected to the engine intake section with a (hose) line (after the air filter, but before the turbocharger, if present).

The intake vacuum present when a closed system is operating sucks the blow-by gas via the ProVent system and routes the cleaned blow-by gas back into the engine intake section.

When selecting the point of installation, the type of oil return must be taken into account (see 4.3 ff.)

Connection of outlet fitting with open crankcase ventilation system

The outlet fitting (8) remains open. The cleaned blow-by gas flows out of the outlet fitting (8) into the surrounding area.

Exiting blow-by gas may be hot. It must be ensured that the existing blow-by gases do not endanger persons or objects.

4.3 Connecting oil return fitting

Connecting drain line under engine oil level

The oil return fitting (6) is connected to the engine oil sump with a drain line.

The connection to the engine oil sump is made below the minimum permissible oil level.

For the ProVent system to function properly, the minimum distance of the oil level from the oil return fitting (6) of the ProVent housing must be at least 350 mm (see Fig. 2).

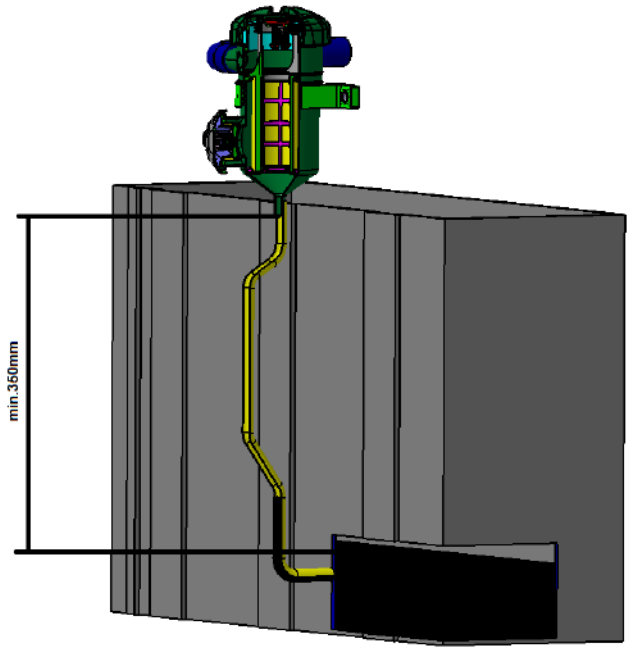


Fig. 2 Minimum distance from oil level to oil return fitting

Connecting above oil level

An optionally available non-return valve is required for this connection version.

The oil return fitting (6) is connected to the non-return valve with a drain line.

The non-return valve is then connected approx. 30 to 50 mm above the maximum oil level of the engine oil sump.

For the ProVent system to function properly, the minimum distance from the non-return valve to the oil return fitting (6) of the ProVent housing must be at least 350 mm (see Fig. 2).

Any angled positions which occur during mobile applications, which lead to a fluctuating oil level, must always be taken into account.

MANN+HUMMEL always recommends the use of a non-return valve for all ProVent installations.

4.4 Installing ProVent

ProVent 100

The holder (1) and the inlet fitting are integrated on the housing and are not adjustable.

The lid with the outlet fitting can be turned in 90° steps (2).

- Loosen the 4 screws (3) (3 mm Allen screw) and turn the lid to the desired position
- Retighten the 4 screws (3).
  Tightening torque: 4 Nm.
- Mount the holder in the vertical position.
  Recommended tightening torque for M8 screws: 10 Nm.
- Ensure sufficient strength of the screw and nut material.
- Connect the hoses to the inlet, outlet and oil return fittings (make sure a sufficient length of hose is pushed on) and secure with hose clamps (see Chap.4.2and 4.3).
- Connect the oil return hose (and non-return valve if necessary) to the oil sump.
- To ensure proper functioning, the ProVent should be protected against dirt (mount splash guards if necessary).

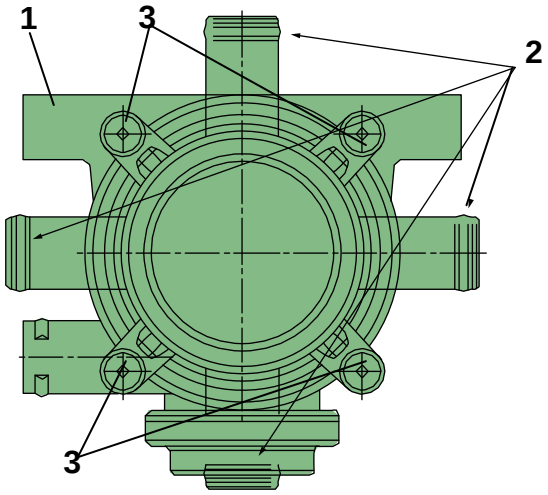


Fig. 3 Positions of outlet for ProVent 100

ProVent 150

The holder (1) and the inlet fitting are integrated on the housing and are not adjustable.

The lid with the outlet fitting can be offset in 3° steps.

ATTENTION:
not in "Service/Open" position

- Turn the lid to the desired position.

Do not turn the outlet to the 90° position (2)

Ensure locking of the retaining groove!

- Mount the holder in the vertical position.
  Recommended tightening torque for M8 screws: 10 Nm.

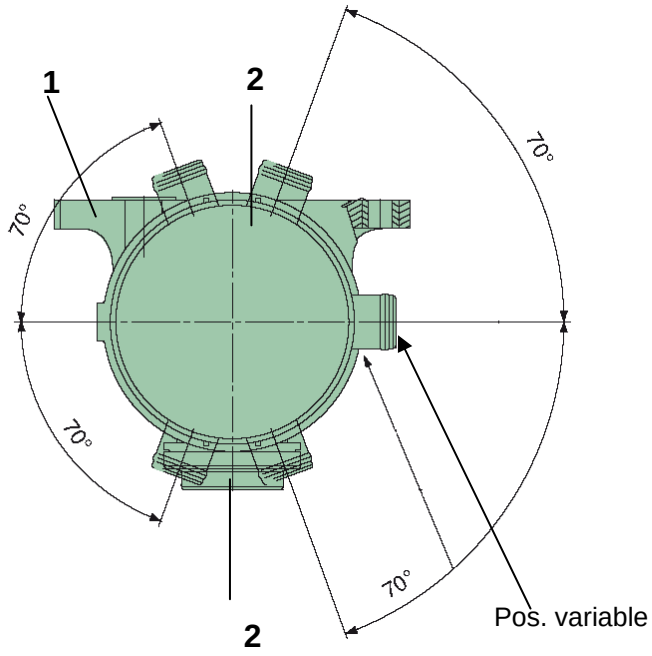


Fig. 4 Positions of outlet for ProVent 150

- Ensure sufficient strength of the screw and nut material.
- Connect the hoses to the inlet, outlet and oil return fittings (make sure a sufficient length of hose is pushed on) and secure with hose clamps (see Chap.4.2 and 4.3).
- Connect the oil return hose (and non-return valve if necessary) to the oil sump.
- To ensure proper functioning, the ProVent should be protected against dirt (mount splash guards if necessary).

ProVent 200

The housing can (prior to installation) be turned in the holder in 30° steps around the longitudinal axis.

This enables the position "Inlet and outlet fitting to flange" to be flexibly adjusted to the installation situation.

- Remove the retaining clip (1) upward from the groove and turn the holder into the desired position.
- Press the holder together somewhat in the desired position and engage the retaining clip in the groove again
- Mount the holder in the vertical position. Recommended tightening torque for M8 screws: 10 Nm.
- Ensure sufficient strength of the screw and nut material.
- Connect the hoses to the inlet, outlet and oil return fittings (make sure a sufficient length of hose is pushed on) and secure with hose clamps (see Chap.4.2 and 4.3).
- Connect the oil return hose (and non-return valve if necessary) to the oil sump.
- To ensure proper functioning, the ProVent should be protected against dirt (mount splash guards if necessary).

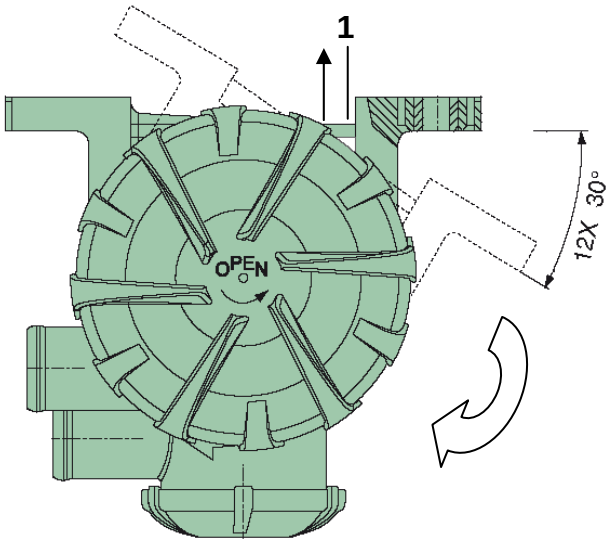


Fig. 5 Positions of outlet for ProVent 200

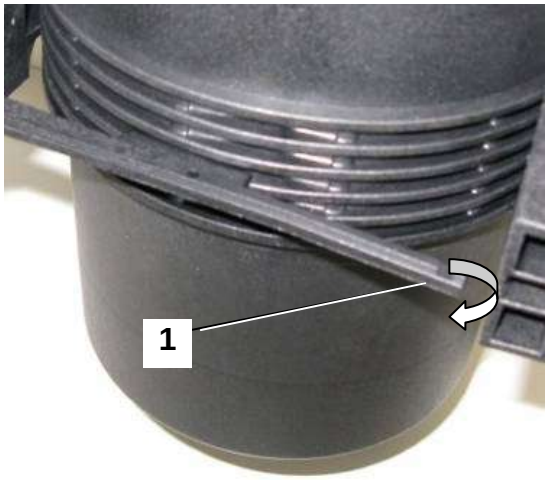


Fig. 6 Holder for ProVent 200

ProVent 400

The housing can (prior to installation) be turned in the holder in 30° steps around the longitudinal axis.

This enables the position "Inlet and outlet fitting to flange" to be flexibly adjusted to the installation situation.

- Remove the retaining clip (1) upward from the groove and turn the holder into the desired position.
- Press the holder together somewhat in the desired position and engage the retaining clip in the groove again
- Mount the holder in the vertical position. Recommended tightening torque for M8 screws: 10 Nm.
- Ensure sufficient strength of the screw and nut material.
- Connect the hoses to the inlet, outlet and oil return fittings (make sure a sufficient length of hose is pushed on) and secure with hose clamps (see Chap.4.2 and 4.3).
- Connect the oil return hose (and non-return valve if necessary) to the oil sump.
- To ensure proper functioning, the ProVent should be protected against dirt (mount splash guards if necessary).

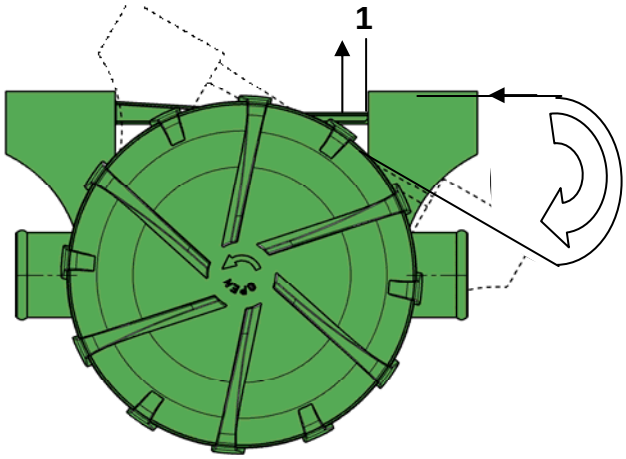


Fig. 7 Positions of outlet for ProVent 400

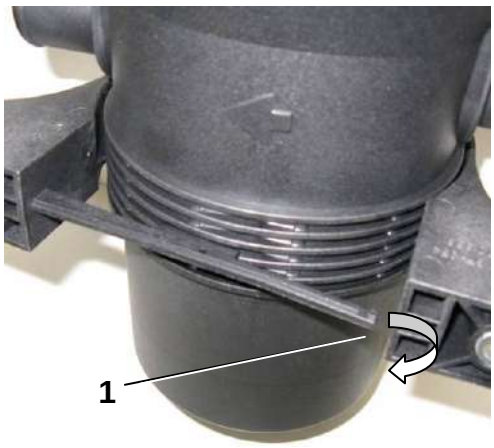


Fig. 8 Holder for ProVent 400

ProVent 800

The housing can be turned around the longitudinal axis before installing it in the holder.

This enables inlet and outlet fittings to be adjusted to the installation situation.

- Loosen the screw (1)
- Turn the holder (2) into the desired position and tighten the screw with the nut. Tightening torque: 9 Nm
- Mount the holder in the vertical position.

- Ensure sufficient strength of the screw and nut material.
- Connect the hoses to the inlet (3), outlet (4) and oil return fittings (5) (make sure a sufficient length of hose is pushed on) and secure with hose clamps.
- Connect the oil return hose (and non-return valve if necessary) to the oil sump.
- To ensure proper functioning, the ProVent should be protected against dirt (mount splash guards if necessary).

Fig. 9 Adjusting holder of ProVent 800

5 Maintenance

Repair of the ProVent system by the driver or the workshop personnel is not possible.

5.1 Maintenance plan

Component	Activity	Comment
Oil separator element	Changing*	after 1,000 operating hours*, however at the latest after 1 year.
Check the ProVent system/non-return valve	(optional) for damage	when performing maintenance

* The maintenance interval can vary greatly depending on the actual oil available and the dirt/soot content in the blow-by gas.

5.2 Changing oil separator element

When working on the ProVent, place a collecting vessel underneath it beforehand and dispose of the collected oil properly

Before removing the old replacement element, unpack the new oil separator and check it for completeness and possible transport damage.

Only install undamaged replacement elements.

ProVent 100

- Detach the hose on the outlet fitting (1) if necessary.
- Loosen the 4 screws (3 mm Allen head) The screws cannot be lost.
- Remove the lid (2).

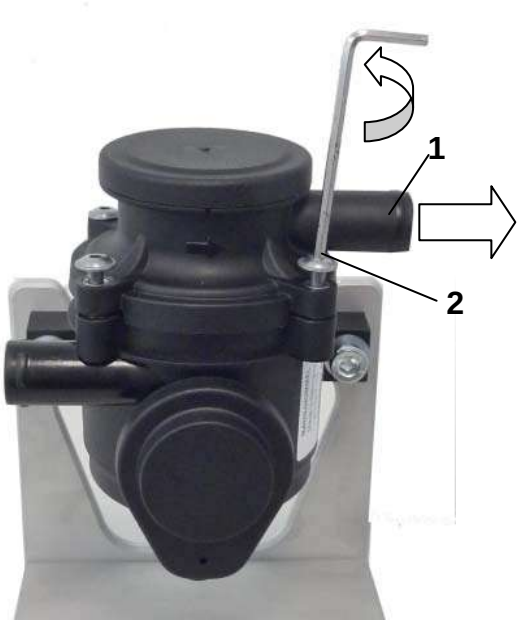


Fig. 10 Detaching lid of ProVent 100

- Manually remove the old oil separator element, if necessary with a suitable aid, and dispose of it properly.
- Mount the new replacement element in the ProVent. Ensure correct seating.
- Screw on the lit in the previous position again. Tightening torque: 4 Nm.
- Reconnect the drain hose if necessary.

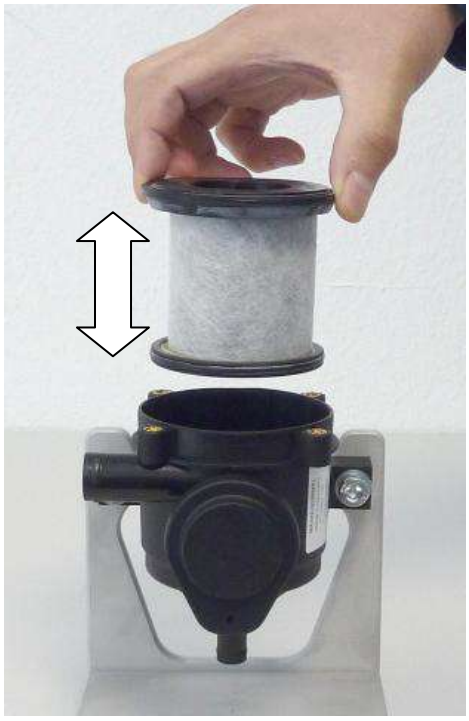


Fig. 11 Changing oil separator of ProVent 100

ProVent 150

- Detach the hose on the outlet fitting (1) if necessary.
- Turn the lid up to the fold recess ("Service" position, Fig. 12) and remove the lid upward with the element (see Fig. 12).

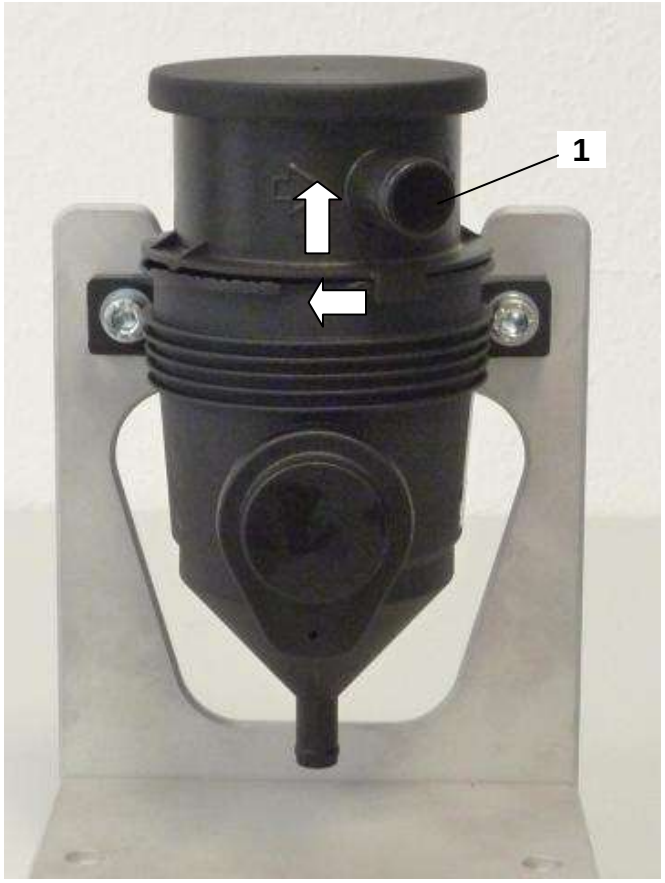


Fig. 12 Detaching lid of ProVent 150

- Pull the old oil separator element off the lid and dispose of properly.
- Mount the new replacement element in the ProVent. Ensure correct seating.
- Lay on the lid and turn it to the desired position.
- Reconnect the drain hose.

Fig. 13 Changing oil separator of ProVent 150

ProVent 200

- Screw off the lid in the direction of the arrow of the lid marking. If the lid is difficult to remove, use a suitable aid (see Fig. 14)

Fig. 14 Detaching lid of ProVent 200

- Remove the old oil separator element and dispose of it properly.
- Mount the new replacement element in the ProVent. Ensure correct seating.
- Lay on the lid and turn it opposite the direction of the arrow on the lid marking until it engages.

Fig. 15 Changing oil separator of ProVent 200

ProVent 400

- Screw off the lid in the direction of the arrow of the lid marking.

Fig. 16 Opening lid of ProVent 400 (1)

- If the lid is difficult to remove, use a suitable aid (see Fig. 17).

Fig. 17 Opening lid of ProVent 400 (2)

- Remove the lid with the oil separator element.

Fig. 18 Removing oil separator of ProVent 400

- Pull the oil separator element off the lid fitting (see Fig. 19)
  Dispose of the old oil separator element properly.
- Mount the new replacement element on the lid fitting (see Fig. 19).

Fig. 19 Changing oil separator of ProVent 400

- Place the lid with the oil separator element on the housing. When doing so, watch the position of the inlet and outlet fitting (arrows on housing and lid (1) face in the same direction, see Fig. 20).
- Press the lid onto the housing and turn it opposite the direction of the arrow on the lid marking until it engages.

Fig. 20 Marking on ProVent 400

ProVent 800

- Open the 4 quick-connect couplings

Attention
Danger of clamping bar pinching and striking fingers.

Fig. 21 Opening quick-connect couplings of ProVent 800

- If necessary, position a suitable aid at the locking points at the edge of the lid and carefully lift the lid. This loosens the lid.

Fig. 22 Removing lid of ProVent 800

- Remove the lid with the oil separator element.

Fig. 23 Removing oil separator of ProVent 800

- Pull the oil separator element off the lid fitting (see Fig. 24)
  Dispose of the old oil separator element properly.
- Mount the new replacement element on the lid fitting.

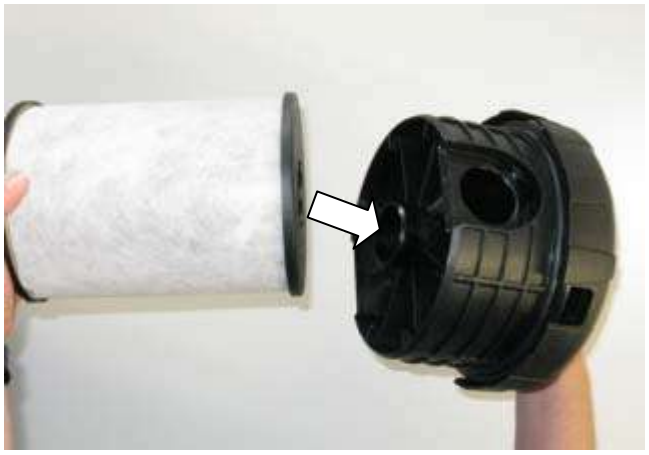


Fig. 24 Fitting oil separator of ProVent 800

- Place the lid with the oil separator on the housing. When doing so, watch the position of the inlet and outlet fitting (marking) (see Fig. 25).
- Close the quick-connect couplings.

Fig. 25 Marking on ProVent 800

5.3 Seal change

When changing the oil separator elements, the seals in the lid and the housing should also be checked for damage and correct seating regularly. Replace the seals if necessary. Seal sets are available as service kits.

- Service Kit for ProVent 100: LC 7001 (HE*)
- Service Kit for ProVent 150: LC 7201 X (HE)
- Service Kit for ProVent 200: LC 5001 X (HE)
  LC 5002 X (UE**)
- Service Kit for ProVent 400: LC 10 001 X (HE)
- Service Kit for ProVent 800: LC 16 001X (HE)

*HE = High-Efficient Medium
**UE = Ultra-High-Efficient Medium

New separator elements are supplied with new seals.

Lightly coat the sealing rings (1) with oil before installation and lay them in the corresponding groove (2).

Fig. 26 Seal for lid of ProVent 150

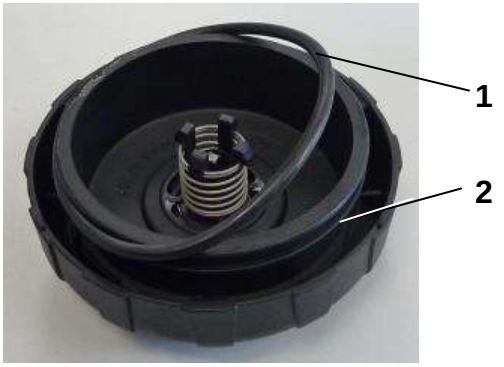


Fig. 27 Seal for lid of ProVent 200

Fig. 28 Seal for lid, inlet and outlet of ProVent 400

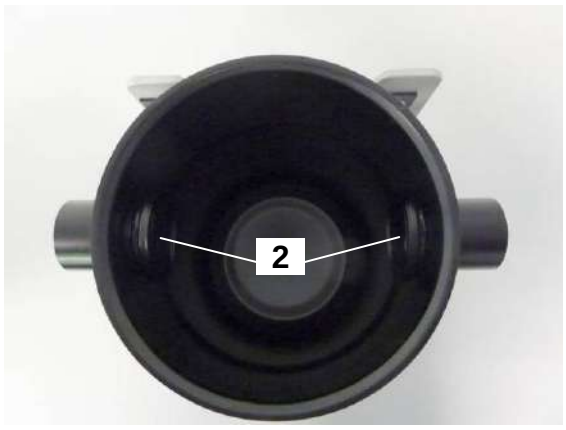


Fig. 29 Seals for inlet and outlet of ProVent 800

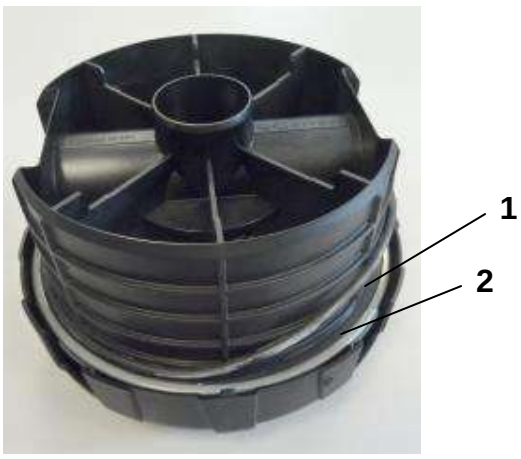


Fig. 30 Seal for lid of ProVent 800

5.4 Troubleshooting

Fault	Possible cause	Solution
Oil is sucked into the intake section	Mounting height too low No non-return valve in oil return line Separator element exhausted	Check mounting height Install non-return valve in oil return Conduct maintenance
Oil is not separated	Separator element is damaged	Conduct maintenance
Oil on outside of ProVent housing	Seal not in seal seat Seal defective Housing defective Hose not properly mounted Overpressure valve open	Check seal, hoses and housing. Correct if necessary Conduct maintenance
Increased crankcase pressure	Separator element exhausted Kinked or clogged hose	Conduct maintenance Check hose and correct if necessary
Oil drain-off not ensured	Oil return hose kinked	Check oil return hose and correct if necessary

5.5 Disposing of parts

Component	Material	Disposal
Oil separator element (contains oil)	PA-GF, elastomer, PU, metal, oil, soot	Dispose of according to local regulations
Oil separator element, free of oil/unused	PA-GF, elastomer, PU, metal	Dispose of according to local regulations
Housing parts, contain oil	PA-GF, metal elastomers, oil, soot	Dispose of according to local regulations
Oil non-return valve, contains oil	Aluminium, PA-GF, oil, soot	Dispose of according to local regulations

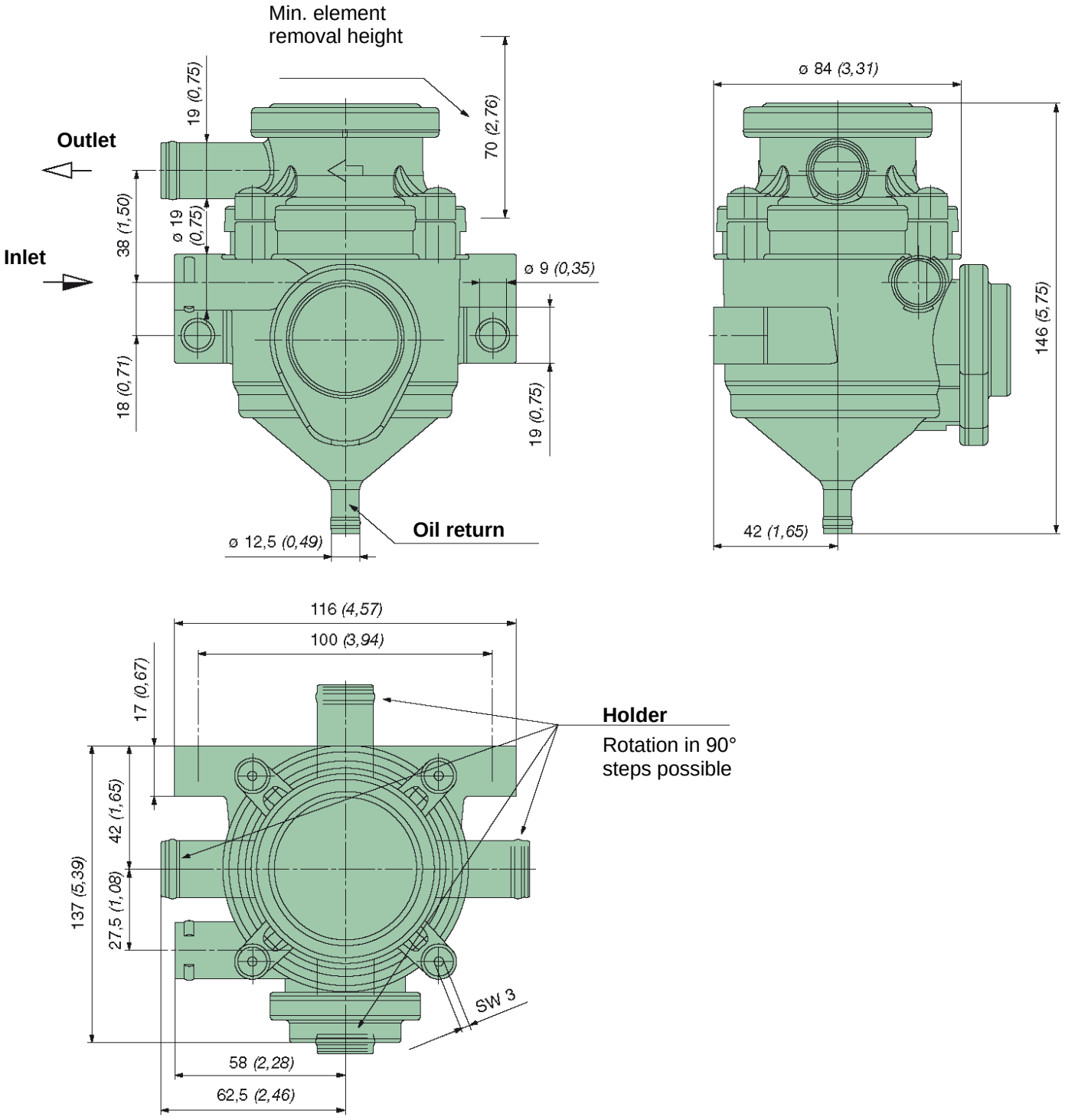
6 Technical Data

Also see the corresponding order drawing (on request).

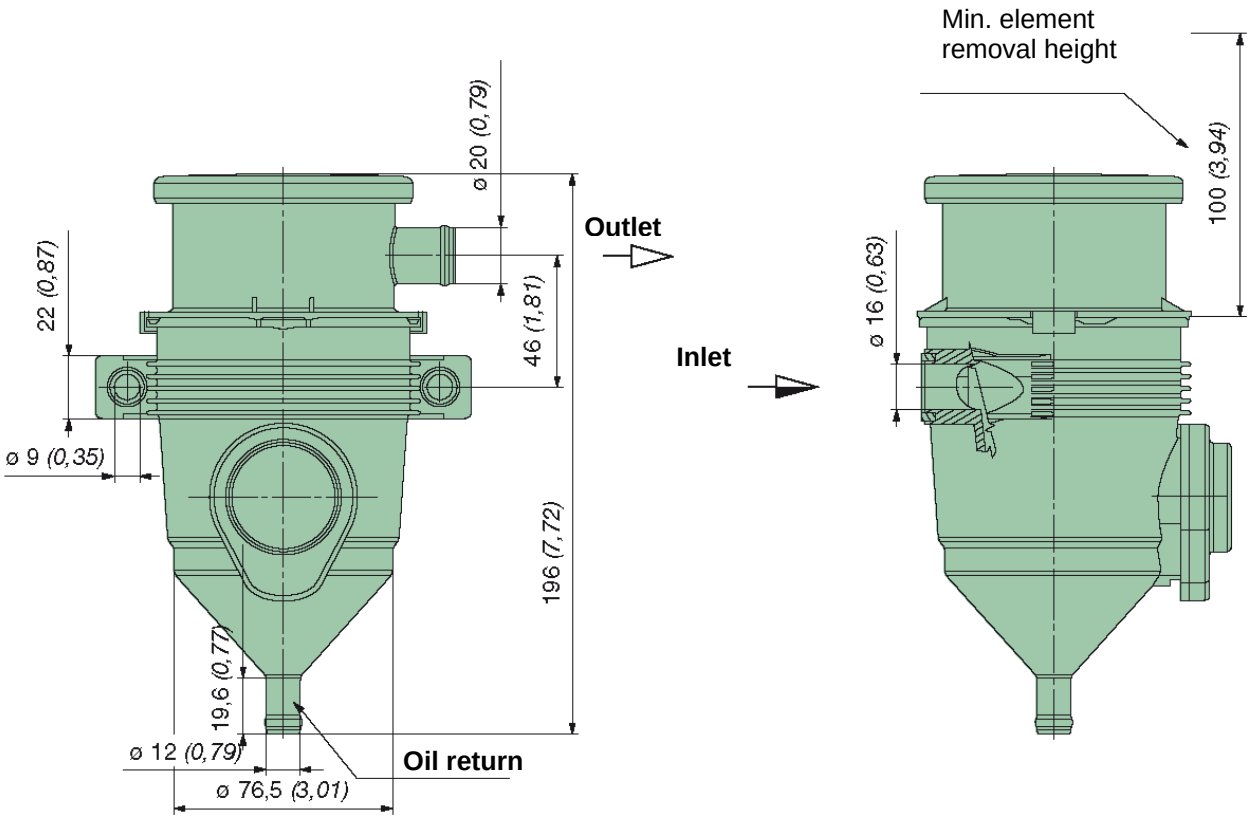
		ProVent 100	ProVent 150	ProVent 200	ProVent 400	ProVent 800
Reference value for the use of ProVent		up to 100 kW	up to 200 kW	up to 250 kW	up to 500 kW	up to 1,250 kW
Blow-by volume flow		max.100 l/min	max.150 l/min	max. 200 l/min	max. 400 l/min	max. 800 l/min
Installation position		vertical				
Permitted angled position of high axis		45° in all directions				
Positioning	Inlet	2 positions	1 position additional on request	12 positions	12 positions	stepless
	Outlet	4 positions	can be rotated in 3° steps			
Ambient temperature		-35°C to 120°C, briefly up to 140°C				
Mounting, screwing connection on engine block		2xM8				2xM10
Material	Housing	PA GF				Steel sheet
	Lid					PA GF
	Holder					Steel sheet
Resistant to		Diesel fuel, engine oil, lubricating oil, cold cleaner				
Weight		0.25 kg	0.33 kg	0.39 kg	1.20 kg	5.41 kg
Possible use of parallel connection of two ProVent of same size		X	X	X	X	X

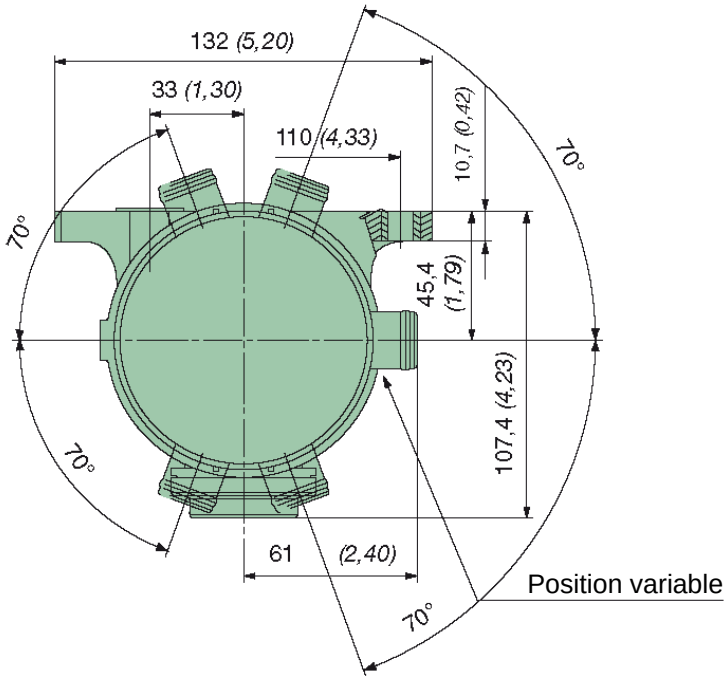
6.1 Dimensions

ProVent 100

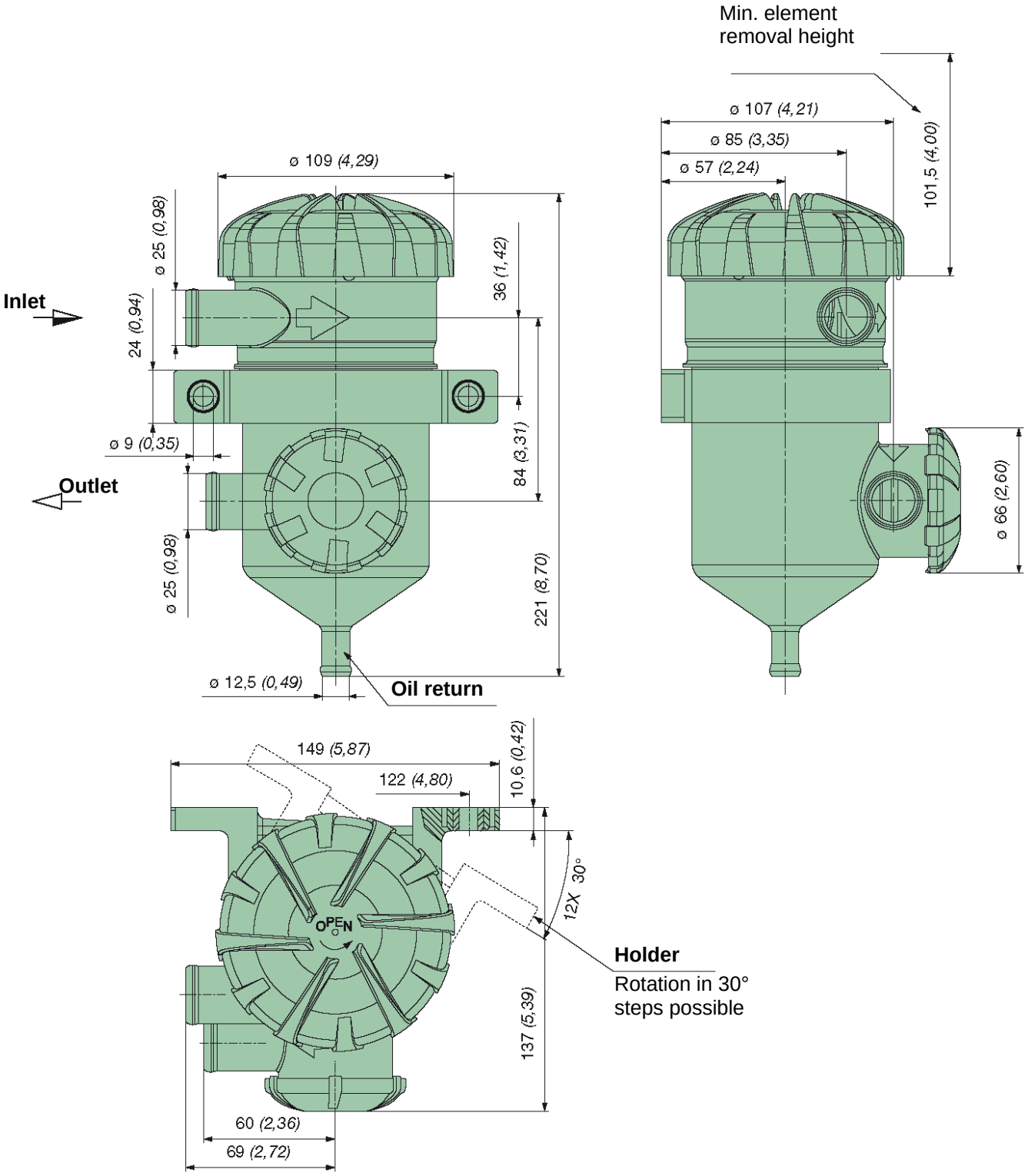


ProVent 150

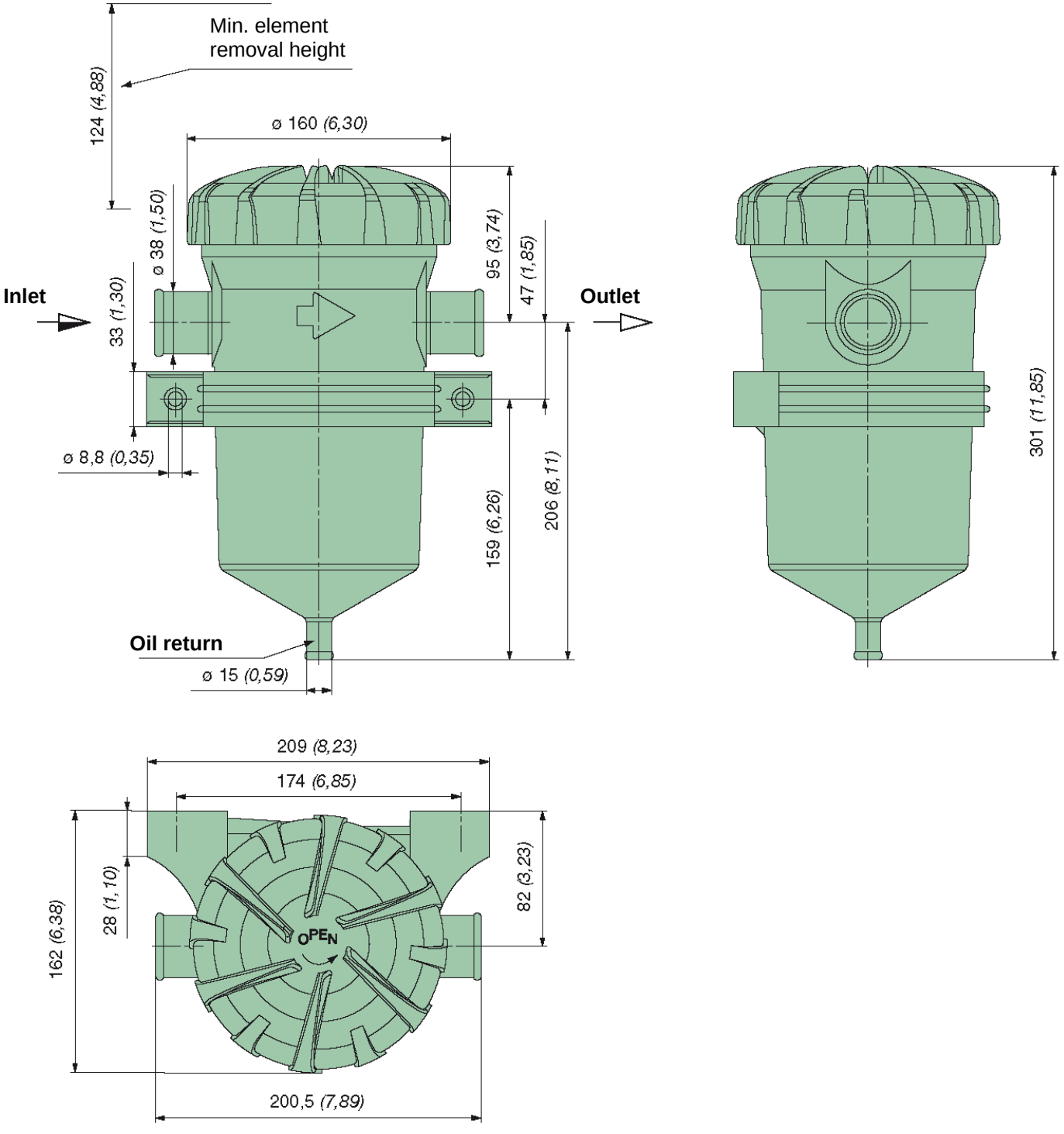

Min. element
removal height
100 (3,94)
ø 20 (0,79)
Outlet
22 (0,87)
46 (1,81)
Inlet
ø 16 (0,63)
ø 9 (0,35)
196 (7,72)
19,6 (0,77)
ø 12 (0,79)
Oil return
ø 76,5 (3,01)


132 (5,20)
33 (1,30)
110 (4,33)
10,7 (0,42)
70°
70°
45,4
(1,79)
107,4 (4,23)
70°
61
(2,40)
70°
Position variable

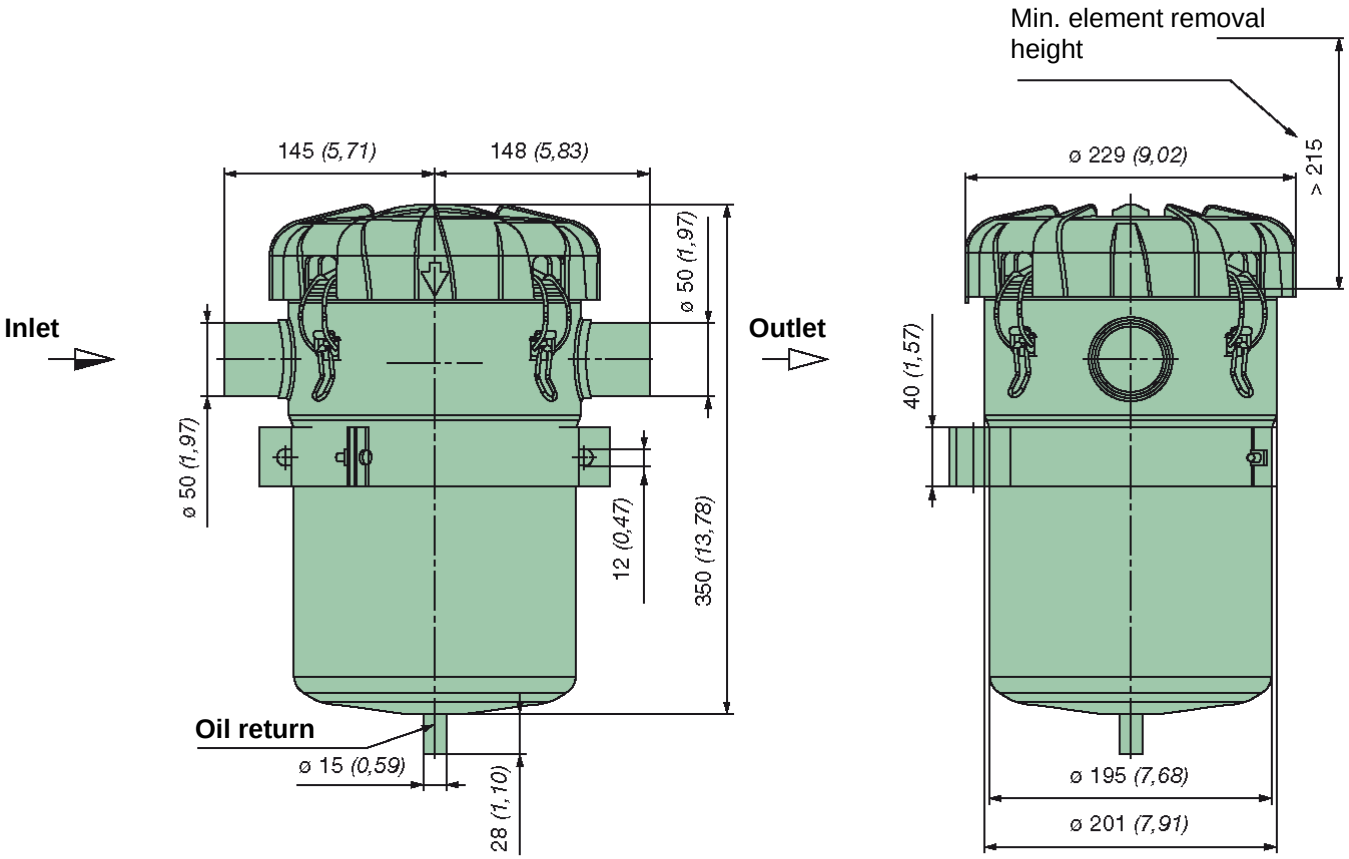
ProVent 200


Min. element
removal height
ø 107 (4,21)
ø 85 (3,35)
ø 57 (2,24)
101,5 (4,00)
ø 109 (4,29)
ø 25 (0,98)
36 (1,42)
Inlet
24 (0,94)
ø 9 (0,35)
84 (3,31)
Outlet
ø 25 (0,98)
221 (8,70)
ø 66 (2,60)
ø 12,5 (0,49)
Oil return
149 (5,87)
122 (4,80)
10,6 (0,42)
12X 30°
OPEN
Holder
Rotation in 30°
steps possible
137 (5,39)
60 (2,36)
69 (2,72)

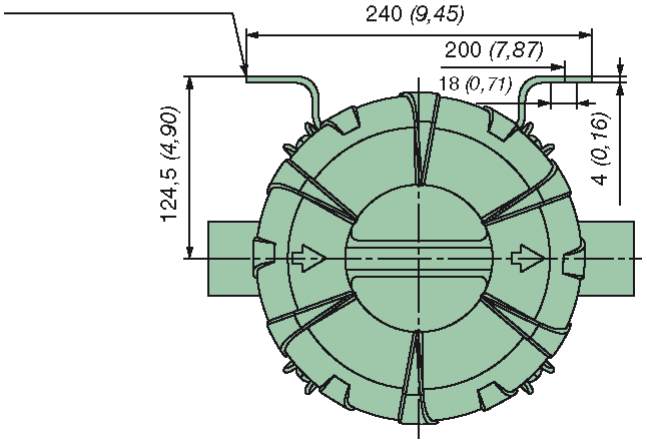
ProVent 400


Min. element
removal height
124 (4,88)
ø 160 (6,30)
ø 38 (1,50)
95 (3,74)
47 (1,85)
Inlet
33 (1,30)
Outlet
ø 8,8 (0,35)
159 (6,26)
206 (8,11)
301 (11,85)
Oil return
ø 15 (0,59)
209 (8,23)
174 (6,85)
28 (1,10)
82 (3,23)
162 (6,38)
OPEN
200,5 (7,89)

ProVent 800



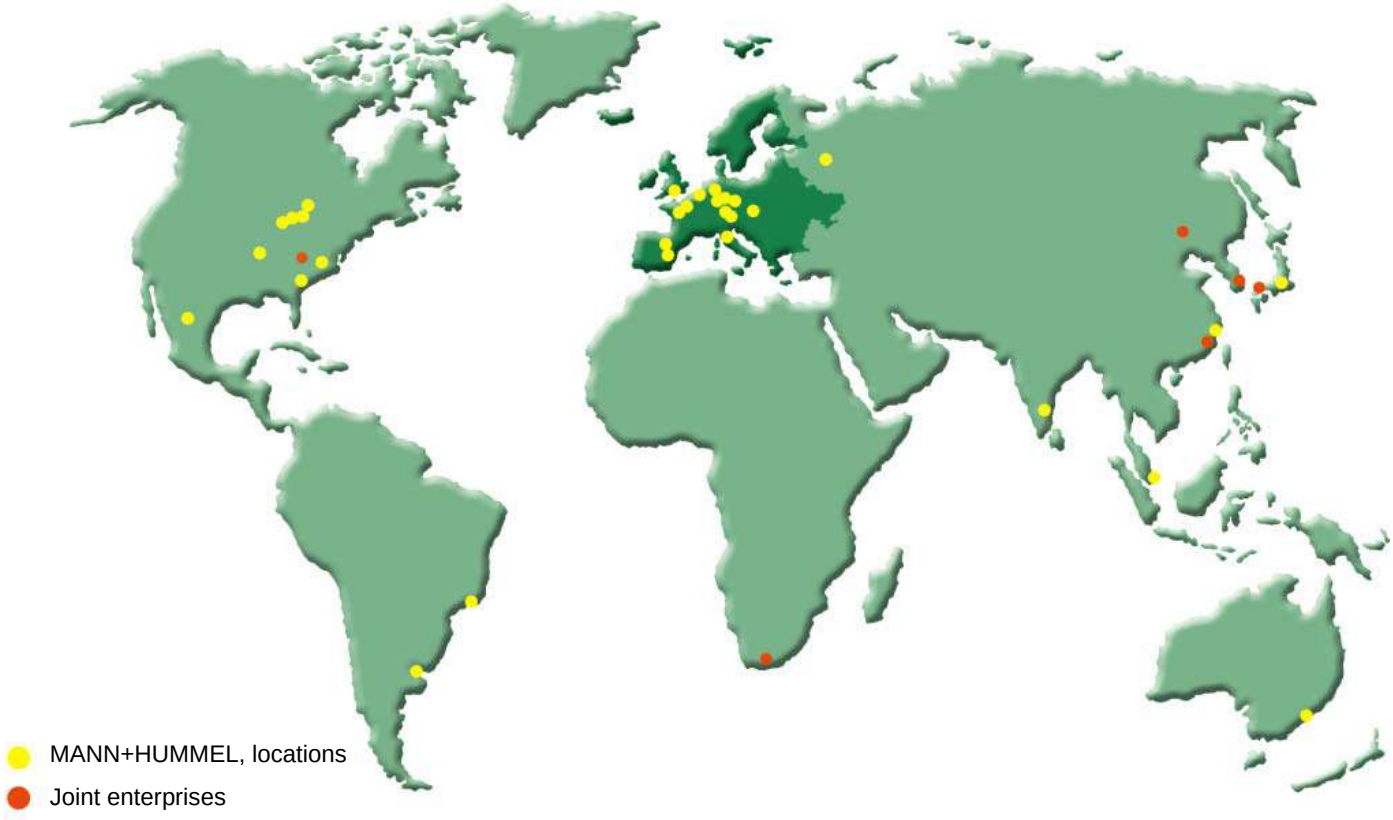
Position variable 360°



7 Related Documents

The following documents must also be observed and applied in addition to this Operating and Maintenance Manual:

- Technical data in accordance with respective order drawing.



MANN + Hummel Industrial Filters

The MANN+HUMMEL Group is an internationally active business with its company headquarters in Ludwigsburg (Germany) and employs a staff of over 9,500 people worldwide in more than 40 locations.

The company develops, produces and sells innovative technical components and systems for the automobile industry and many other market sectors.

High quality filtration products for vehicles (devices), engines and industrial applications play a key role in our business activities. The initial equipment business with the world's leading vehicle, machine and system manufacturers defines the basis for quality and performance capabilities of the products.

Filters for the international spare parts market are sold under the names of internationally renowned customer brand names as well as our own MANN-FILTER brand.

The Industrial Filters Business Division with headquarters in Speyer (Germany) specialises in the special requirements of the customers from the segments off-road vehicles/device and engine technology, compressed-air and vacuum technology, mechanical and systems engineering.

MANN+HUMMEL Industrial Filters provides a wide range of high performance products concerned with filtration and separation of air, gases and liquids for these and other business sectors.

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