



ProVent® – MANN+HUMMEL Oil Separator for Closed and Open Crankcase Ventilation



ProVent® – high performance with distinct advantages

ProVent® is MANN+HUMMEL's newest innovation for crankcase ventilation. It is specifically designed to accommodate the latest generation of turbo-charged engines and has the following advantages over existing solutions:

- Highly efficient oil separation as a closed as well as an open system providing ideal protection for the turbocharger and other components installed downstream
- Low pressure loss
- Less motor oil consumption in comparison to less efficient separators or conventional open systems
- Maintenance friendly: fittings are not removed during element maintenance
- Universal usage: exceptional for variable flow rates
- Flexible installation locations on the engine or in the engine compartment
- Compact design
- Light and robust design
- Integrated safety feature against irregularly high crankcase pressure
- No electrical energy required
- Low running costs

ProVent® an innovation for combustion engines

The creation of blow-by gases

Commercial and Industrial diesel engines have a longer operational life than passenger car engines. Consequently, engine components need to be respectively more robust. One of these components, the closed crankcase ventilation system, is steadily growing in importance.

For every piston stroke in a combustion engine, there are exhaust gases, which flow between the piston rings and sleeves. These gases enter into the crankcase. In turbo-charged 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 create lead to an unaccepta-

ble pressure build-up and crankcase ventilation becomes necessary. In many countries, regulations governing car emissions stipulate that the crankcase ventilation 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. However up until now, there

are no standard international regulations for commercial or industrial diesel engines. Both closed and open crankcase ventilation systems are available. The open systems (without a cleaning process) direct the oily blow-by gases through a pipe into the atmosphere exposing the environment to all the undesirable gases and their detrimental environmental effects.

Closed crankcase ventilation

In view of existing and pending regulations, the pollution aspect and environmental protection, it is clear that allowing these blow-by gases into the environment is unacceptable. The closed crankcase ventilation system solves this problem (see Fig. 1). These pollutants can cause damaging, oily depo-

sits that form on the intake pipe assembly components (turbocharger, charge cooler, etc.). This damage can negatively influence the engine performance, fuel consumption and the life of the engine. To avoid this, an oil separator (9) is used to remove the oil from the blow-by gases.

Without loss, the engine oil taken out is then returned to the oil sump where it can re-enter the engine 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.

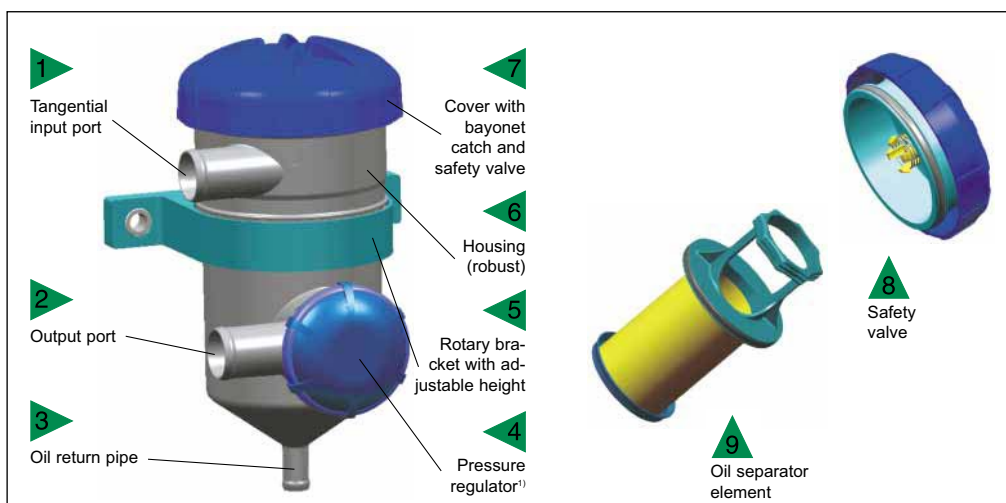


Figure 1: ProVent® components

¹⁾ only closed systems

Open crankcase ventilation

In this case the pressure regulator of ProVent® is not in operation. The output port is conducted in the atmosphere. In this configuration there is a slight excess pressure in the crankcase.

ProVent® design and function

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While developing the ProVent®, function and design were of the highest priority. The superior quality and robust components ensure high performance in a compact design (see Fig. 2).

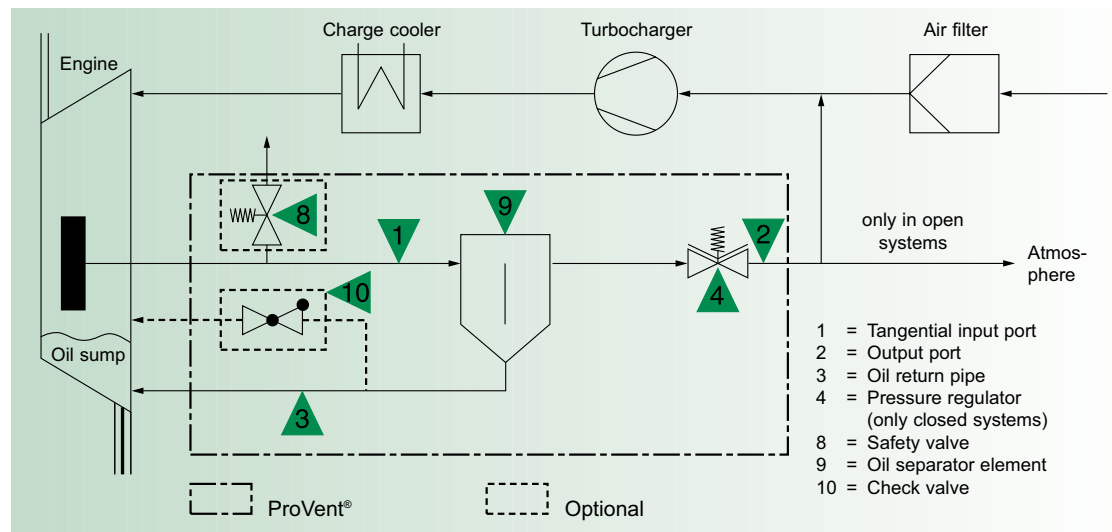


Figure 2: Closed and open crankcase ventilation

Oil separator (9)

MANN+HUMMEL has carried out extensive tests on a wide range of media. The medium used in filter element (9) is cost-effective and fulfils the highest quality requirements. The new type of coalescence separator is able to reduce the residual oil content of 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.

To service the separator, please consult the operating and service instructions or the engine producer.

Pressure Regulator (4)

In closed systems the pressure regulator can be set as required while keeping the crankcase pressure independent from the negative pressure of the air intake manifold. Setting the pressure level simply depends on the quantity of blow-by gases (see Fig. 3).

The crankcase pressure remains within the acceptable range even with variable air flow rate, negative pressure and varying blow-by gas volumes. The pressure regulator does not exist in an open ProVent® system.

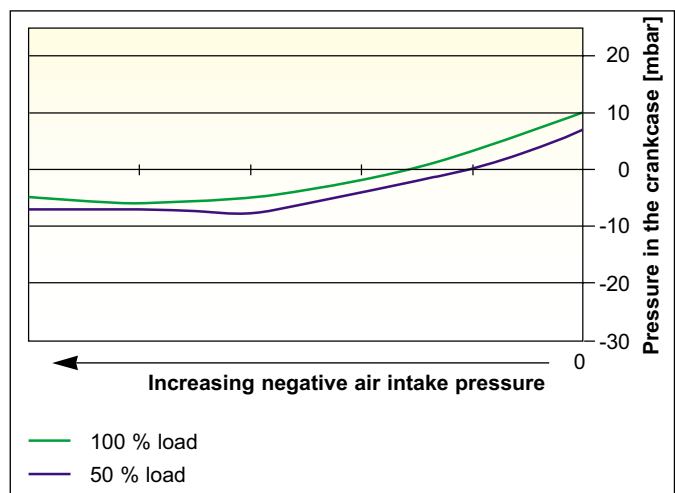


Figure 3: Pressure adjustment curve

ProVent® design and function

Housing (6):

The ProVent® does not have a high flow resistance and as a result protects the engine from excessive crankcase pressure. Generous cross-section connections and other technical details that facilitate the flow, ensure that its compact design will not be subject to high flow resistance.

Safety valve (8)

A bypass valve is integrated in the housing cover, which protects the engine from an impermissible rise in pressure in case other components fail. When the OEM (original engine manufacturer) fits the engine with a crankcase pressure monitoring system the bypass valve is designed,

in cooperation with MANN+HUMMEL, so that the opening pressure is greater than the pick-up pressure of the monitoring pressure on the engine side. The bypass valve is pre-set to an opening pressure of 50 mbar.

ProVent® installation and fitting

Port connection to the engine

Inlet port (1)

The gases enter ProVent® through the inlet port. The outlet port that removes the blow-by gases should be positioned in an area where there is proportionally less oil, no moving parts and no oil spray present such as the upper region of the crank-

case or the cylinder head cover. The tangential ingestion leads to an excellent pre-separation of the oil vapour in the blow-by gases. The gases flow through the oil separator (9) located in the housing. The separated oil is directed through the oil return pipe (3) back to the engine oil sump. The cleaned blow-by gases flow through the pressure regulator (4) and exit ProVent®

through the outlet port (2).

Outlet port in a closed system (2)

Outlet port (2) is connected to the engine inlet manifold. Compared to conventional systems, the ProVent® installation location is almost independent from the negative inlet pressure on the outlet port (2) resulting in mounting position flexibility on the

engine. The operational negative intake pressure sucks the blow-by gases through the ProVent® and takes the cleaned blow-by gases back into the engine inlet manifold.

Outlet port in an open system (2)

The oil-free Blow-by is conducted to the atmosphere.

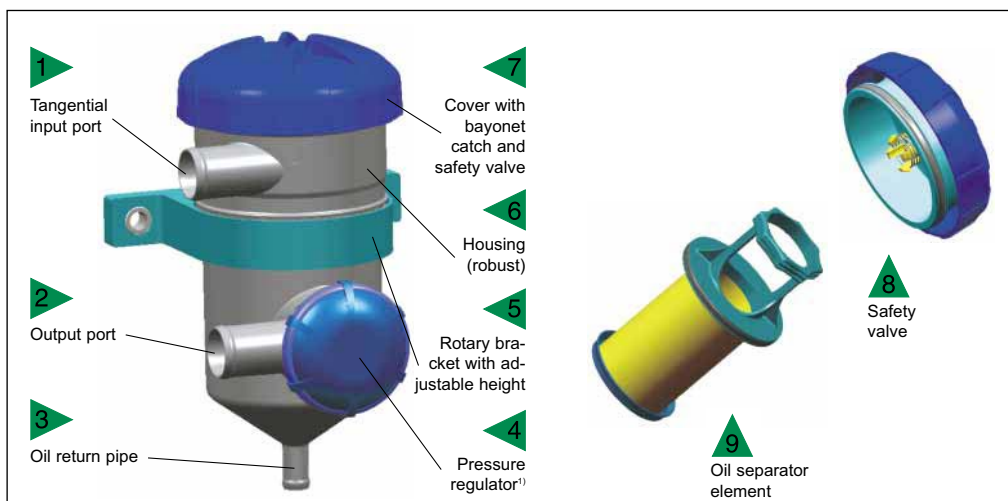


Figure 4: ProVent® components

1) only closed systems

ProVent® installation and fitting

Oil return pipe (3)

The port (3) is connected to the sump through a drainage pipe. In principle, there are two types of connection:

Below the oil liquid level:

The oil return pipe (3) is connected below the minimum allowed oil level of the sump using a drainage pipe. According to the interconnected pipes principle, the oil level in the oil sump and the drainage pipe will be the same. This oil receiver acts like a siphon so that as there

is suction at the outlet port (2) the blow-by gases are directed to the oil separator (9). During operation there is the same negative pressure at the oil receiver as at the oil separator. The design of the ProVent® allows this negative suction pressure to be adjusted to a lower level than in comparable solutions so that the oil column height in the drainage pipe is relatively low during operation. Accordingly, the drainage pipe is designed to only handle the

correspondingly low height of the oil column, which considerably increases the installation options on the engine.

Above the oil level:

This connection variation requires a check valve, which is supplied as an extra option. The valve is fitted in the drainage pipe where the connection is made to the engine. During operation the separated oil collects above the check valve (10), while

at the same time the valve is closed by the negative suction pressure present in the ProVent® housing. When the weight of the oil column is above the closing pressure of the valve or after the engine has been switched off, the separated engine oil flows back into the oil sump.

Bracket (5)

The housing can be fitted in the bracket (5) in one of 12 positions (see Fig. 1) and can be rotated around its longitudinal axis so that the inlet (1) and outlet (2) can be properly positioned. This excellent flexibility makes ProVent® easily adaptable for any existing engine state.



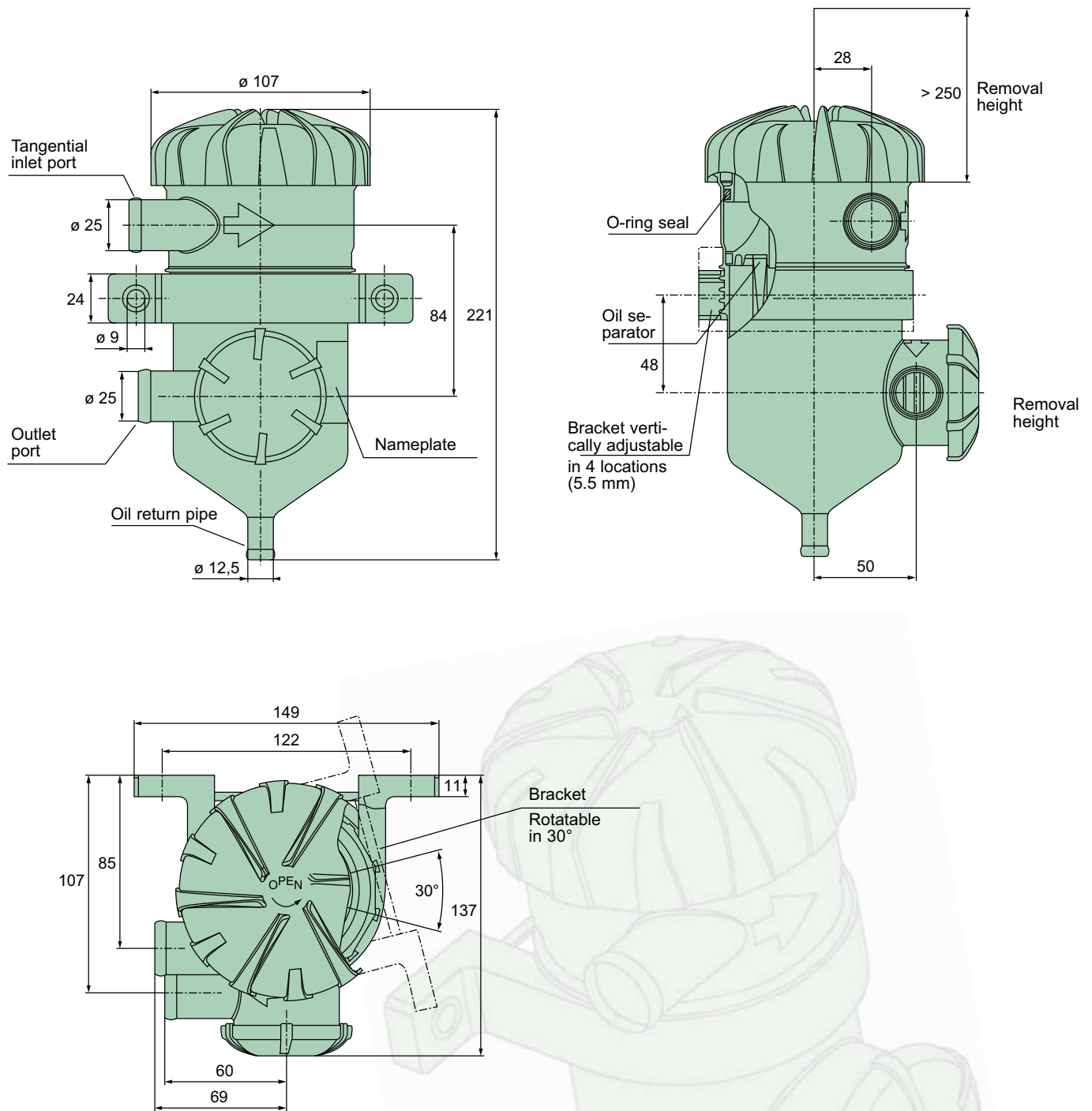
Figure 5: Top view of housing with various port positions

Please consult MANN+HUMMEL when you are planning to install your ProVent® and we will help you with any clarification.



Figure 6: Check valve

Specifications



ProVent® 200 specification

Approximate guide line for the use of ProVent® ¹⁾	up to 350 kW: 1 unit; up to 700 kW: 2 units
Blow-by gas flow rate:	Max. 52.8 g/min (200 l/min)
Installation position:	Vertical
Allowed tilt position:	45° in all directions
Allowed ambient temperature:	-31° to 248 °F (-35 °C to 120 °C), for short periods to 284°F (140 °C)
Screw fitted to the engine block:	2 x M8
Housing material, screwed cover and bracket:	Nylon
Resistant to:	Fuels, engine oil, cold cleaning agents
Standard version (complete)	Order No. 39 310 70 550
Oil separator element	Order No. 39 310 50 950
Check valve	Order No. 24 008 43 621
O-seal	Order No. 23 079 32 101

¹⁾ if other parameters for the configuration are unknown

Operating Instructions

Series 39 310 70 550

1. Preface

We reserve the right to make technical modifications to the ProVent® and/or modify the content of these operating instructions.

These operating instructions should make it easier for personnel to familiarize themselves with the ProVent® and to use it in the various application areas for which it was designed.

The operating instructions contain important information on operating the components

safely, correctly and economically. Observing these instructions helps to eliminate danger, reduce repair costs and downtimes and increase the reliability and service life of the MANN products.

The instructions must be made accessible to all personnel working with the ProVent®.

Instructions based on existing national regulations for accident prevention and environmental protection

should be added to these operating instructions, if necessary (especially instructions on the disposal of removed parts).

In addition to the operating instructions and binding regulations for accident prevention applicable in the country and location of application, approved technical regulations for performing work safely and professionally must also be observed.

2. Safety

2.1 Warning instructions and symbols

All instructions in the operating manual that affect safety are marked with this symbol. Ignoring the symbol may endanger personnel.



All instructions marked with this symbol must be observed closely in order to avoid damage to or the destruction of unit components.



This symbol indicates that special attention must be paid to these instructions in order to ensure trouble-free, economical operation.



Operating Instructions

Series 39 310 70 550

2.2 Intended use

The ProVent® was constructed using state-of-the-art technology in accordance with recognised safety specifications. However, the functional safety of downstream assemblies may be affected if:

- the ProVent® is used incorrectly or for a purpose for which it was not intended,
- the operating conditions change,

- conversions are carried out without consultation with the manufacturer,
- necessary maintenance and repair work is not performed.

Use the ProVent® only if in perfect condition and in accordance with the respective technical specifications, observing correct procedures regarding safety and danger, and in compliance with the operating instructions.

Rectify immediately (or have rectified) all faults, especially if they affect safety.

Intended use also includes observing operating instructions and complying with inspection and maintenance requirements.

The filter manufacturer is **not** liable for dangers caused by the product being filtered. This applies in particular for the processing of hazardous

materials. The operator of the ProVent® is responsible for providing the necessary, specified safety equipment.

2.3 Operational safety

All modes of operation that may affect operational safety of the ProVent® must be avoided.

Independent conversions or modifications to the ProVent® are not permitted under any circumstances. **Furthermore, the manufacturer's warranty would immediately become invalid.**

All labelling and identification marks on the ProVent® must be legible at all times.

3. Description

The ProVent® is a closed crankcase ventilation system and essentially consists of a housing with an integral pressure control valve, a cover with a bypass valve, an oil separator and a support.



4. Installation

The ProVent® can be positioned in the support at twelve increments of 30° and at four height settings.

- Open fixing.
- Move ProVent® to required position.
- Close fixing.
- Mount bracket fitted to the ProVent® vertically. Tightening torque: 9 ± 2 Nm.
- Attach hose lines at inlet, outlet and oil return connectors and secure using hose clamps.

Operating Instructions

Series 39 310 70 550

5. Maintenance

Only carry out maintenance work when the motor is switched off. Never start without an oil separator and/or cover.



Danger of burns from hot air that may escape. Housing, cover and hoses can become very hot.



The maintenance of the ProVent® essentially involves replacing the oil separator. To guarantee safe operation, the ProVent® should be protected from dirt (by fitting splash guards).

Check the ProVent® regularly for damage and external soiling.

High-pressure cleaners may not be used, as the valves may be damaged and water may enter the oil circuit.



5.1. Maintenance intervals

The oil separator must be replaced in accordance with specifications from the device manufacturer or after 1000 operating hours at the latest.

Maintenance intervals may need to be shortened depending on the operating conditions. In normal mode, if the O-ring is intact and oil leaks through the by-pass valve (item 2, project drawing), this indicates that the oil separator is worn and must be replaced immediately.



5.2. Removing the oil separator

- Rotate the cover approx. half a turn anticlockwise and remove. Should the cover be difficult to move, a tool (e.g. screwdriver) can be used to help turn the cover (see project drawing).
- Pull the oil separator upwards to remove and dispose of as per local waste regulations.

5.3. Assembly

- Clean housing, cover, O-ring (item 2, project drawing) and sealing surfaces.
- Check O-ring for damage and rub in a small amount of engine oil. Replace damaged or permanently deformed O-rings.
- Slide the new oil separator into the housing with a new, slightly oiled O-ring.
- Put on the cover and turn clockwise until it latches into place.



6. Technical data/Spare parts list

see page 7