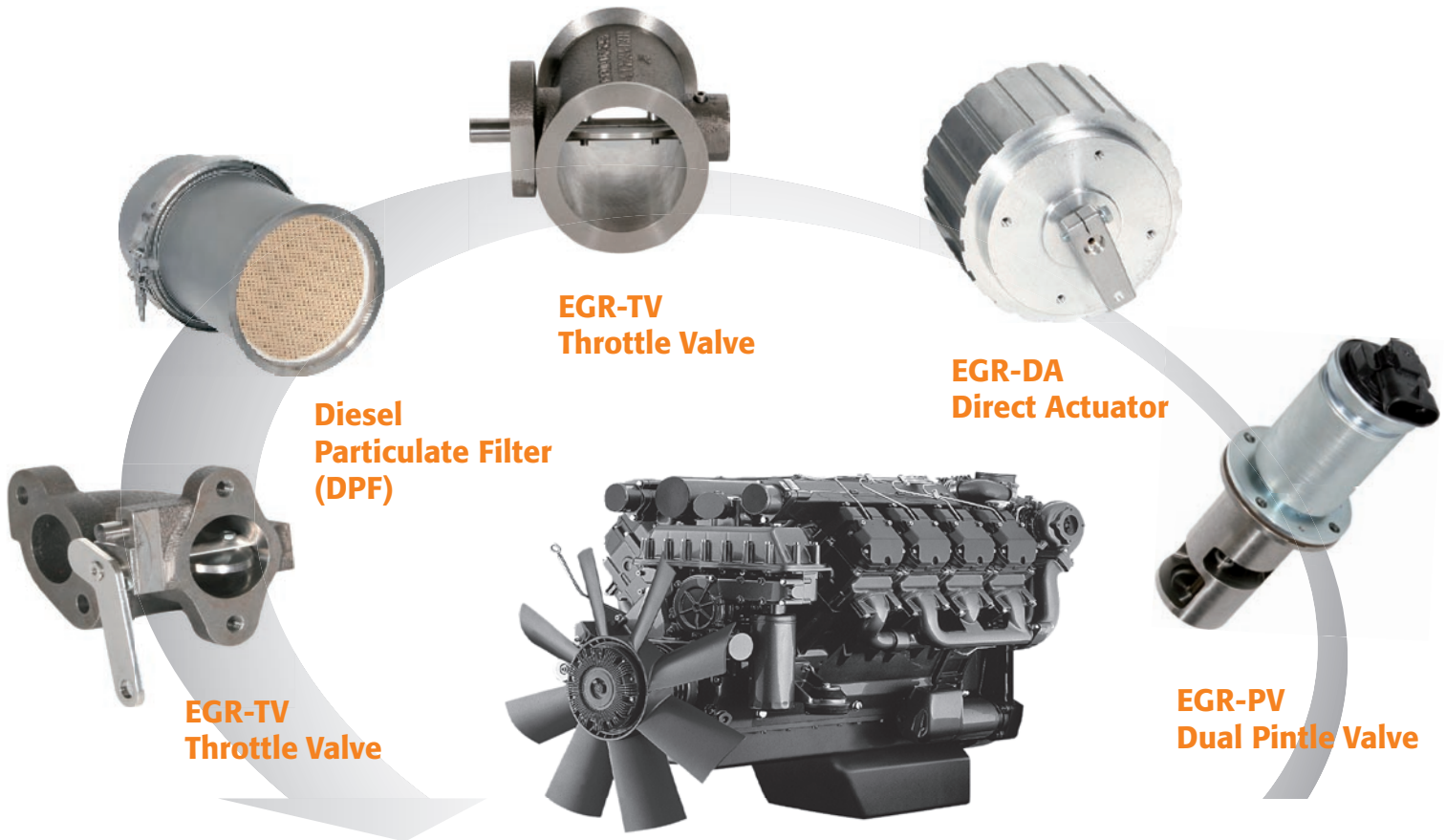


# APOLLON

## Exhaust Gas Recirculation (EGR)



- ✓ Reduction of NOx emissions
- ✓ For engines from 50 kW to 1500 kW
- ✓ System integration includes valve, actuator and control system
- ✓ Open loop or closed loop

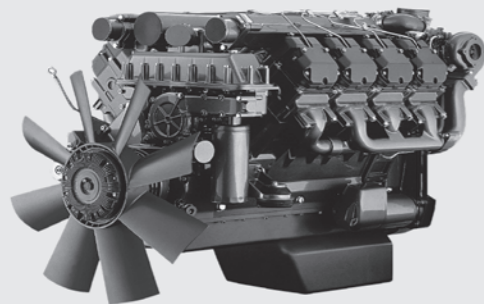


## APOLLON

### The benefits of exhaust gas recirculation

Exhaust gas recirculation (EGR) minimises the formation of oxides of nitrogen (NOx) when fuel is burned in internal combustion engines and gas turbines.

In engines with EGR, exhaust gas is fed back to the combustion chamber, serving the dual purpose of providing an inert gas that slows combustion and also reducing the amount of oxygen in the combustion chamber – both mechanisms that contribute directly to the reduction of oxides of nitrogen. Due to the reduction in the pressure gradient at the start of the combustion process, EGR also has the effect of decreasing the harsh combustion noise typical of diesel engines.



### APOLLON features

- ✓ **High exhaust gas recirculation rates**
- ✓ **Short opening and closing times**
- ✓ **Precise metering**
- ✓ **Steady-state and dynamic control modes**
- ✓ **Low leakage**
- ✓ **Mapped control for optimal EGR rate**
- ✓ **Diagnostic capabilities**
- ✓ **Robust and durable**
- ✓ **Simple system integration**

### APOLLON applications

- **Commercial road vehicles**
- **Off-Road**
  - **Construction vehicles**
  - **Agricultural vehicles and machinery**
- **Industrial applications**
- **Stationary engines**
- **Locomotive engines**
- **Marine applications**
- **Generators**

### Requirements for EGR systems

In order to comply with future emission restrictions, EGR valves and EGR systems will have to meet considerably more demanding requirements.

The most important criteria are factors such as control accuracy, dynamic behaviour, rapid closing times to avoid soot in the exhaust, and positional feedback with diagnostic capabilities.

The APOLLON range of EGR valves already meets all of these requirements today.

### The APOLLON modular range

The APOLLON EGR range uses a modular design and is therefore very flexible. This means that the actuators can be combined with different valves for system optimisation to meet individual customer requirements. It is also possible to integrate the control and driver unit at the valve.

APOLLON EGR valves are available in several configurations, from individual components to complete EGR systems with regulators and control software. The system can be connected via a CAN bus interface, providing communication directly with the engine management system.

### APOLLON EGR-T

#### (Throttle valve with direct actuator)

The throttle valve controlled EGR-T valves in the APOLLON range are operated by high-performance actuators. The control electronics allow the size of the opening to be calculated precisely without the need for a position sensor.

The throttle valve demonstrates excellent control dynamics. In the low range it benefits from the high resolution of the flow rate and the metering accuracy. The high holding force provided by

the actuator means the valve is not sensitive to pulsations in the exhaust.

The EGR-TV valve has high dynamic response. Due to its fast opening, the maximum exhaust gas recirculation rate is available very quickly. Conversely, rapid closing of the valve prevents unwanted soot blow-off during transitions to low load on the engine.

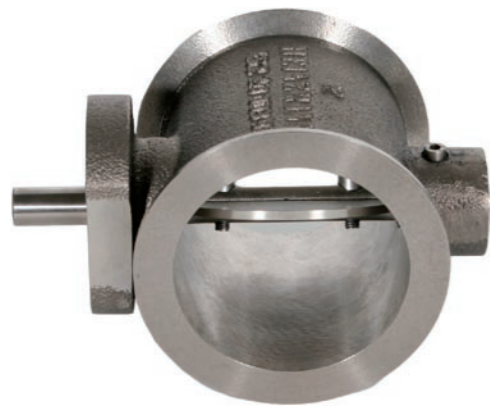
The functional unit formed by the throttle valve and the stepper motor can be customised according to the intended application. The two components can be mounted separately or as a combined unit. The deflection of the throttle valve is achieved using a linkage, which means that a high resolution can be achieved for the exhaust rate in the low flow range. Further advantages are high metering accuracy and high opening forces when the valve is closed.

The EGR-TV valve has a robust design that is not sensitive to contaminants, making it ideal for deployment in the harsh environment of a diesel engine exhaust system.

The compact design and flexible installation options mean the valve can be used universally in the most varied of engine applications.



Throttle Valve EGR-TV 35



Throttle Valve EGR-TV 50

The electronic control system is based on a programmable PID controller, which ensures the system can be optimised for the widest variety of applications.

The dual-seat valve is compensated with respect to pulsations and exhaust pressure. This provides conceptual advantages such as lower force requirements for positioning the valve, reduced valve bounce and low tendency to flutter. Again, this ensures high metering accuracy in the low range.

The EGR-PV valve demonstrates a high dynamic response in the low range, and has short opening and closing times.

High opening forces mean that the unit is largely insensitive to contaminants.

The compact design and flexibility in the choice of the mounting angle provide extensive flexibility in the design of the mounting spot of the engine.

### APOLLON EGR-P (Dual pintle valve)

The APOLLON range of EGR-PV valves provides exhaust gas metering using pressure-compensated dual-seat valves controlled by high-performance, compact actuators.

The required valve deflection is achieved using a PWM current. Positional feedback is provided by a position sensor, which can also be used for diagnostic purposes.



Direct Actuator EGR-DA 35

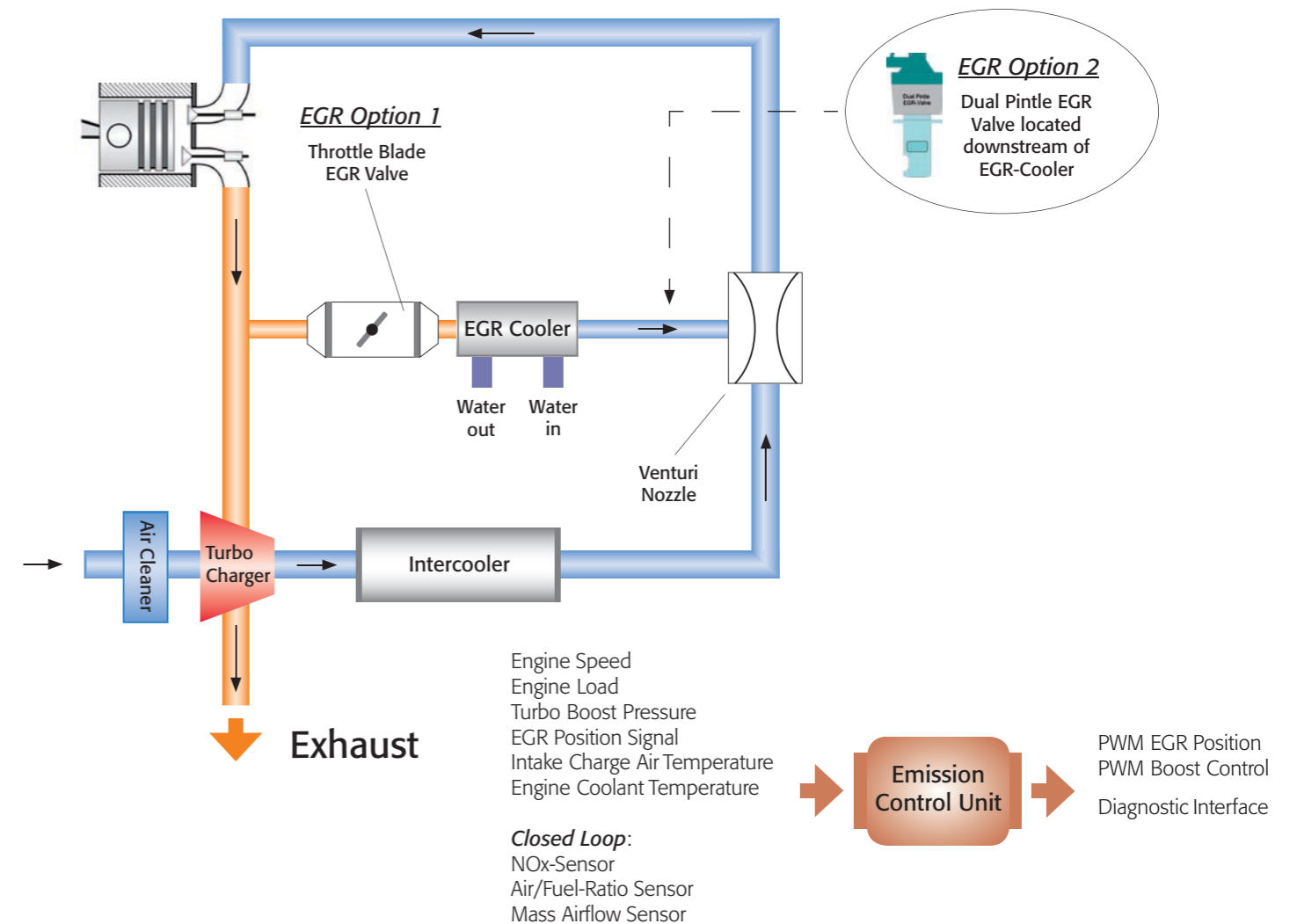


Dual Pintle Valves EGR-PV 35/45

## APOLLON system overview – integrated emissions management

In order to comply with ever increasing emissions limits, the interactions within the whole engine management system must be taken into account. HEINZMANN has risen to this challenge and offers customer-specific emission management systems

that comprise the complete common rail high-pressure injection system, wastegate control, EGR control, exhaust treatment, sensors, and control and development tools.



## APOLLON - EGR-T SYSTEMS: THROTTLE VALVES AND ACTUATORS

The EGR-T range of EGR systems uses EGR-DA actuators with direct drive to control the deflection of EGR-TV throttle valves. The actuators and

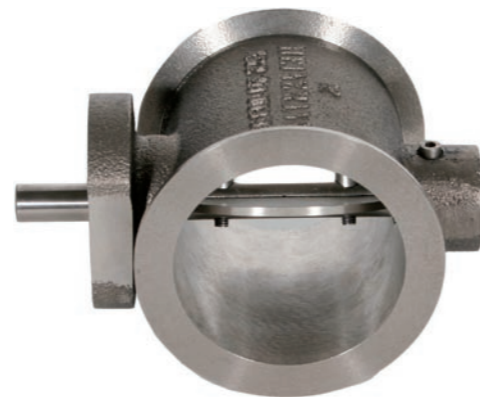
throttle valves are matched to each other, and can also be used in different pairings according to the particular application.

### Technical data EGR-T systems

APOLLON EGR-T systems	EGR-T 35	EGR-T 50	EGR-T 70
<b>APOLLON Throttle Valves</b>	<b>EGR-TV 35</b>	<b>EGR-TV 50</b>	<b>EGR-TV 70</b>
Flow rate at 100 mbar	200 kg/h	470 kg/h	980 kg/h
Rotation angle	68°	68°	68°
Throttle valve diameter	35 mm	50 mm	70 mm
Operation temperature	-40°C to +720°C	-40°C to +720°C	-40°C to +720°C
Weight	0.9 kg	1.1 kg	1.8 kg
<b>APOLLON Actuators</b>	<b>EGR-DA 18</b>	<b>EGR-DA 35</b>	<b>EGR-DA 45</b>
Operating voltage	9 - 30 V	9 - 30 V	9 - 30 V
Peak torque	1.8 Nm	3.5 Nm	4.5 Nm
Continuous holding torque	1.2 Nm	2.0 Nm	3.0 Nm
Rotation angle	90°	90°	90°
Opening/closing response	200 ms	250 ms	300 ms
Protection class	IP6K9K	IP6K9K	IP6K9K
Operating temperature			
➔ Actuator, external ECU	-40 °C to +150 °C	-40 °C to +150 °C	-40 °C to +150 °C
➔ Actuator with integrated ECU	-40 °C to +80 °C	-40 °C to +80 °C	-40 °C to +80 °C
Weight	1.6 kg	3.6 kg	5.0 kg



Actuator EGR-DA 45



Throttle Valve EGR-TV 70

## APOLLON - EGR-P SYSTEMS

The EGR-P range of EGR systems uses proportional solenoids to control deflection of dual-seat valves. The design of the valves

provides force compensation, making them largely insensitive to pulsations in the exhaust flow.

### Technical data EGR-P systems

APOLLON EGR-P systems	EGR-P 35	EGR-P 45	EGR-P 55
Flow rate at 100 mbar	145 kg/h	315 kg/h	(Currently under development)
Minimum flow area	430 mm <sup>2</sup>	970 mm <sup>2</sup>	
Maximum stroke	6.5 mm	6.5 mm	
Maximum opening force	30 N	40 N	
Valve diameter	35 mm	45 mm	
Operating temperature	-40°C to +150°C	-40°C to +150°C	
Maximum current draw	2.5 A	3.5 A	
Opening/closing response	50 ms	80 ms	
Protection class	IP6K9K	IP6K9K	
Weight	1.2 kg	1.3 kg	



EGR Valve EGR-PV 45    EGR Valve EGR-PV 35



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## **Selection of HEINZMANN products**

### **Wide range of digital and analogue control units**



### **Different sizes of electrical actuators for 1 Nm up to 500 Nm**



### **Electronic fuel control system (EFI) - control units from 4 cyl. up to 20 cyl. engines**



### **Range of analogue and digital generator management units**



### **Gas engine management**



### **Common rail systems**



### **Sensors & solenoids**



### **Digital control systems for gas turbines**



### **Hydraulic governors & actuators**



### **Electric components of hybrid drive systems**



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