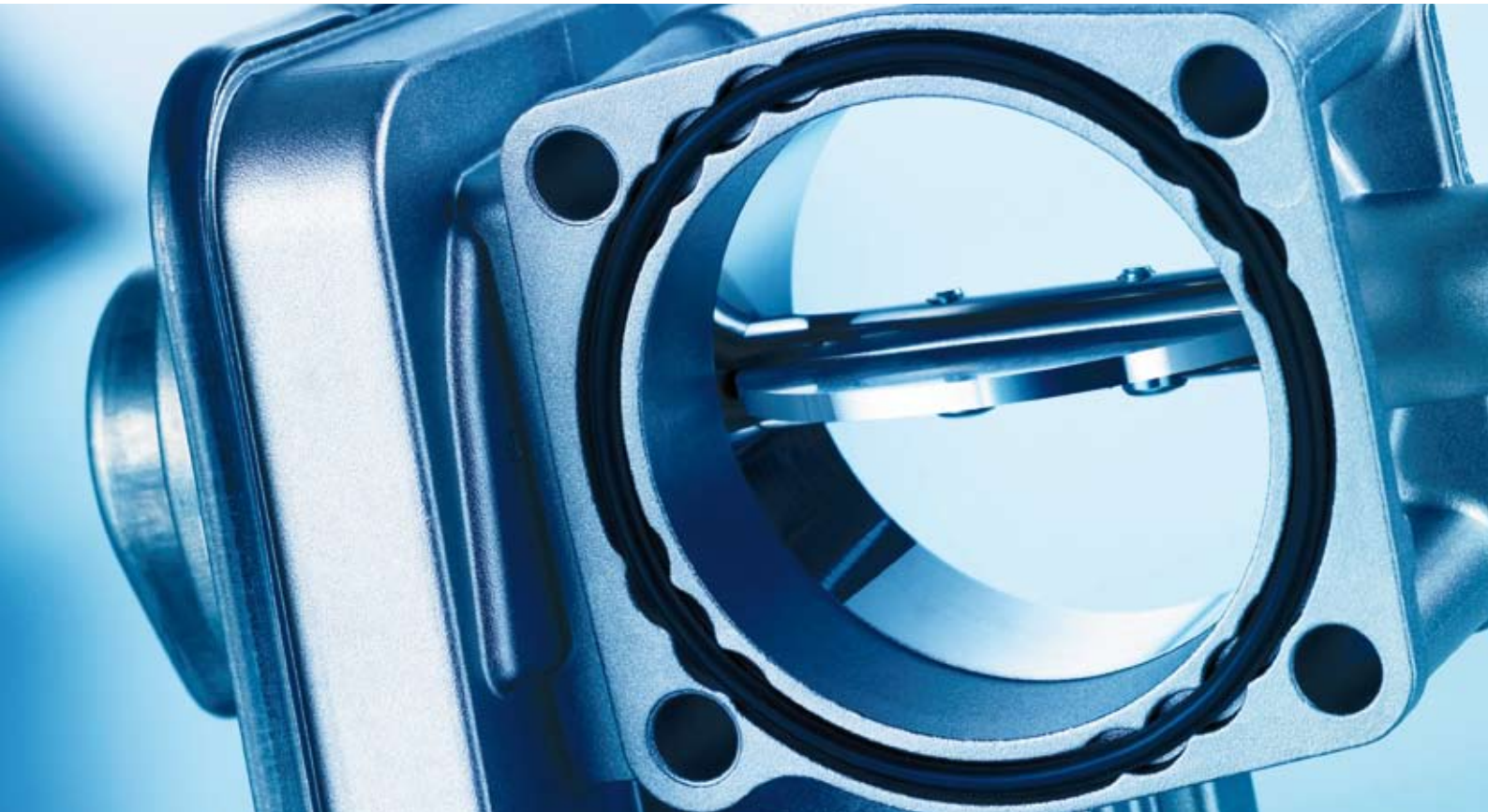


KOLBENSCHMIDT PIERBURG GROUP



**DC MOTOR DRIVEN THROTTLE BODIES
AND CONTROL VALVES –**
Flexible Air Management

DC motor driven throttle bodies and control valves

The Pierburg modular ETC system is a consistent extension of the Pierburg air management design philosophy. The principles we have used for more than 30 million production throttle bodies are also utilized in state-of-the-art DC motor driven throttles for a wide variety of applications. Pierburg throttle bodies cover all automotive applications when effective air flow control for both gasoline and diesel engines is needed. The modular design allows a cost efficient utilisation of multiple use components. At the same time the modular ETC system stands out with extraordinary flexibility allowing its use for any kind of engine, vehicle and control unit.

Gasoline engines

Load control of gasoline engines both presently and in the near future means throttling the intake air. A throttle body is one of those components that translates the driver's demands as well as numerous other functions into specific reactions of gasoline engines. Driveability, idle speed control, comfort functions, cruise control, as well as safety functions like antiskid control depend on a highly refined technology and the manufacturing quality of the throttle body. Even new load control concepts for gasoline engines, such as direct injection and variable valve control, require a throttle body either for λ -control or to control any recirculated gas. Pierburg provides individual concepts constituting the best solution for future applications with regard to both function and price.





Fig. 1: ETC-Di



Fig. 2: ETC-E designs

Diesel engines

A diesel engine has no need for throttle control! True – but only as long as there was no need to exploit the potentials for less fuel consumption and low emissions by high exhaust gas recirculation rates and/or particle filters. These days, however, high exhaust gas recirculation rates are needed for advanced diesel engines.

The pressure difference between exhaust and intake is no longer sufficient for mixing an appropriate exhaust gas quantity to the intake air. For that reason, advanced control valves are used to precisely increase and control the exhaust gas recirculation rate.

Control valves also serve to regenerate diesel particle filters and reduce engine cut-off vibrations.

ETC-E, the E-gas throttle body

The ETC-E combines all options for air flow control of advanced gasoline engines. In addition to translating the driver's demands into throttle positioning and idle speed control of the engine. Comfort functions like cruise control or safety functions such as antiskid control are ensured by an ETC-E. At the same time ETC-E provides a wide range of options to reduce emissions and fuel consumption of gasoline engines.

Essential design criteria for the ETC-E component are fast response, high positioning torque and extraordinary reliability. ETC-E has been designed to be extremely robust in every detail. This is evident, for example, by the effective protection of the sensitive components by a metal housing or the redundant return system of the angle sensor for the throttle position.

ETC-E is made in a large variety i.e. specific housings and progression options for throttle plate diameters from less than 40 mm up to 90 mm. In spite of this flexibility ETC-E is manufactured with a large number of common components. The idea of maximum commonality is important for small annual production quantities that can be combined with large production quantities of other versions thanks to this specific concept.

ETC-Di, electric control valve for current and future advanced diesel engines

Future engines will need improved exhaust gas recirculation precision. Keeping this in mind Pierburg has developed a DC motor driven control valve with integrated position control for diesel engines.

The distinguishing characteristic of this component is the high precision positioning of the throttle plate independent of external position control. The desired angle is achieved by the integrated electronics and the drive. The desired position is relayed as PWM signal by the engine controller. Module-integrated electronic positioning control converts this signal into the correct angle. An angle sensor provides internal feedback of the actual position.

It only takes three connections to activate an ETC-Di (U_{bat} , earth, PWM signal). Faulty operating conditions of the ETC-Di can be fed back to the motor controller by shorting to earth of the control signal line or a separate diagnosis interface (4th pin).

The electronic unit of the control valve is equipped with a processor and offers extended diagnosis options via high-

capacity data memories. This allows highly flexible, tailored adjustment of the interface parameters. In addition, a serial interface is available for communication with BUS systems. To achieve greater adjusting precision, self-calibration of the component can be provided if necessary. Comprehensive on-board diagnosis (OBD) logs enable customer-specific evaluation of system disturbances.

As on the ETC-E a proven drive with DC motor and dual stage train gear is used. The resulting high torque ensures full function throughout its service life despite of recirculating gases and other contaminants, which increase friction.

The ETC-Di is easy to adopt to various applications. It allows designs for different diameters and packaging requirements.

Design features

The right choice of components for every function is reflected in the quality of the overall system. All Pierburg throttle bodies and control valves are the result of fine tuned manufacturing processes delivering the utmost reliability on each individual part.

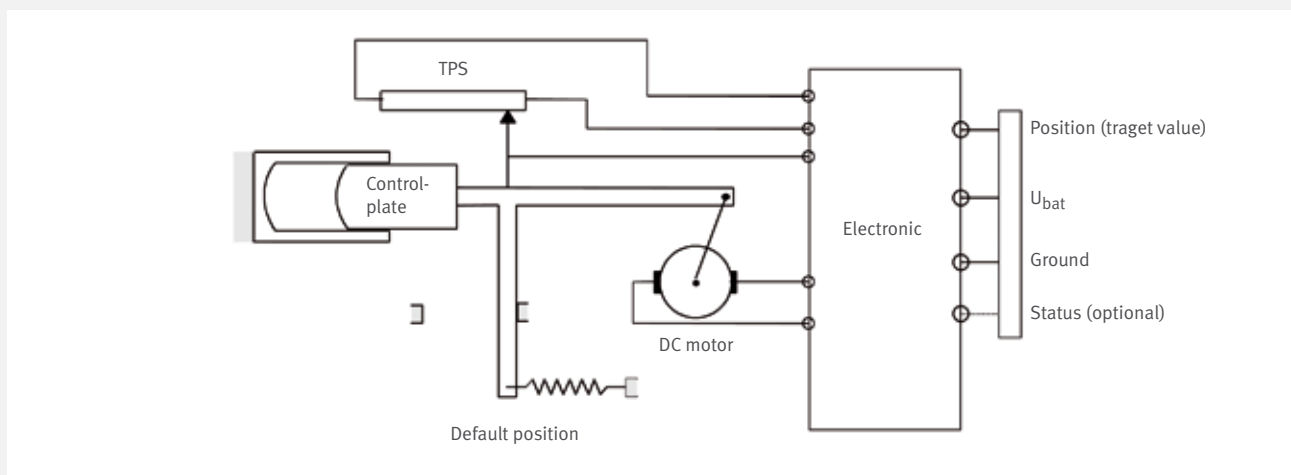


Fig. 3: Scheme for ETC-Di



Fig. 4: ETC-Di



Fig. 5: ETC-Di



Fig. 6: NT ETC

Housings

Aluminum or hybrids – wherever tight tolerances and minimum air flow are essentially, aluminum is the ideal housing material because of its low weight, manufacturing precision, temperature resistance and excellent corrosion resistance. Engineering plastics are used providing they are able to meet the tolerances specified.

Electric drive

A DC motor and a dual stage gear train has proven ideal, offering the perfect combination of torque and positioning speed needed for throttle control. It is remarkable for its outstanding robustness, durability, and competitive production cost. This is the basic principle used on all Pierburg throttle bodies, perfectly tuned to specific applications. During the last 15 years Pierburg has gathered quite a bit of expertise in developing and manufacturing their own DC motors tailored to match all requirements of today's internal combustion engines.

Position feedback

Position feedback is an integral function of every throttle control system. It serves to determine the throttle plate position precisely and is by such inevitable to control air flow. Although potentiometers still provide satisfactory resolution and a high degree of functional reliability at a moderate price, non contact sensors are used increasingly in mass production.

Performance

The present NT family of throttle bodies reflects the never ending efforts of our design engineers to optimize these products. Price, weight (only 700 g for 68 mm diameter) and positioning time have all been reduced by 20 percent.

Philosophy

Pierburg's various companies put their expertise in the engineering and manufacturing of these different components – their mechanics and the electric drives – into one overall system. This is the only way to achieve functional integrity and cost efficient design.

Pierburg GmbH · Alfred-Pierburg-Straße 1 · 41460 Neuss · GERMANY
Fon +49 2131 520-1 · Fax +49 2131 520-645 · www.kspg.com