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SHW
A member of the Pankl Group

DRIVING RESPONSIBLY INTO THE FUTURE

PUMPS AND INTEGRATED SYSTEM SOLUTIONS

with focus on cooling, lubrication and actuation of the E-Axle and the Battery

COMPOSITE BRAKE DISCS

with focus on weight, performance and design

focus on
solutions for
electric vehicles
(xEVs)



THE COMPANY

SHW is a member of the Pankl Group and a global player specialized in developing and manufacturing single components or complete systems like **lightweight pin discs**, **pumps** as well as **integrated modules** for cooling and lubrication of components in different markets: passenger cars, high performance cars and truck & off-highway.

pankl AG



KEY FIGURES

SALES 2023

532,9

Mio. EUR

1.826

employees

GLOBAL
FOOTPRINT

9

locations

KEY MARKETS

Passenger cars



High performance cars



Commercial vehicles



INNOVATION. SPEED. QUALITY

Inhouse hardware development

SHW offers all kinds of mechanical and electrical oil pumps, oil modules, electrical main water pumps, thermal management modules and battery cooling modules.



Inhouse software development

SHW develops all software and PCBA's inhouse in the R&D centre according to customer and functional safety requirements.



Global production

SHW serves its products globally from the plants in Europe, Northamerica, Southamerica and China.



Inhouse testing and validation

SHW develops, tests and validates its e-pumps and modules completely inhouse.



GLOBAL FOOTPRINT

To offer our customers a local footprint, SHW has nine plants in different regions to supply our products.



Aalen | Bad Schussenried | Neuhausen ob Eck | Tuttingen |
Timisoara | Toronto | Sao Paulo | Kunshan | Haimen

CHALLENGES FOR THE FUTURE POWERTRAIN

Stricter emission fleet targets result in a



change in the automotive sector: increasing share of Hybrid- and Battery Electric Vehicles (BEV).



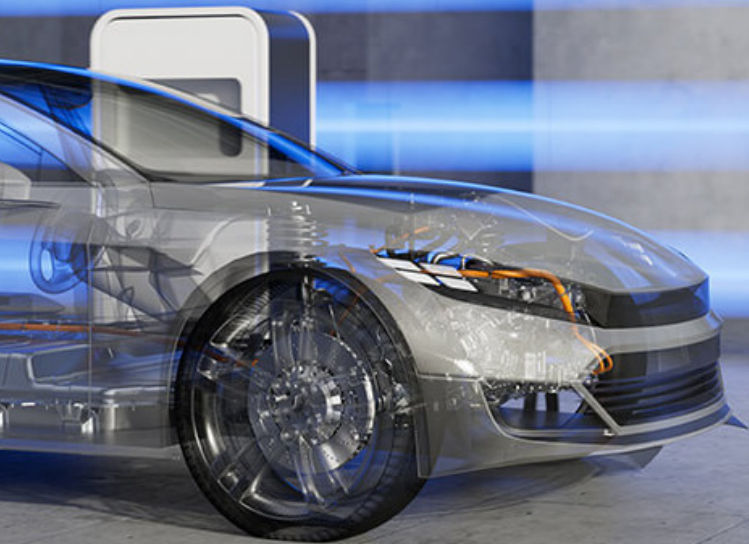
That means new requirements for components in electrified vehicles (especially due to increasing cooling demand).



SHW is developing solutions that are feasible, while being economical and sustainable.







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CUSTOMER REQUIREMENTS

for Hybrid- and Battery Electric Vehicles

WEIGHT

-  lightweight material choice
-  compact design
-  topology optimization
-  multi-functional modules





PERFORMANCE

-  high reliability
-  low NVH-level
-  EMC compliance
-  full functionality over the complete temperature range
-  temperature & media resistance

COOLING

-  efficient on-demand cooling

EFFICIENCY

-  high volumetric efficiency
-  optimized for low friction
-  right-sized system
-  flow optimized design on-demand flow

COSTS

-  design to cost
-  modular design
-  global footprint
-  inhouse production

SUSTAINABILITY

-  sustainable design and production

PRODUCT SOLUTIONS

for cooling, actuation and lubrication of components
in electrified vehicles:

THERMAL MANAGEMENT (WATER-GLYCOL/ DIELECTRIC OIL)

Thermal Management is getting more important for electric vehicles in order to operate them with a high degree of efficiency, extended driving range, long battery lifetime, fast battery loading, high climate comfort and full power performance on demand.



Battery Cooling
Module



Electrical
Coolant Pump



Coolant Manifold



Water-Glycol TMM

COOLING AND LUBRICATION (OIL/ WATER-GLYCOL)

Thermal Oil Management for electric vehicles allows to operate the E-axes with a high degree of efficiency even with high performance requirements.



Oil-Management-Module
(Pump Heat-Exchanger Module)

PRODUCT OVERVIEW

for Hybrid Electric Vehicle-application



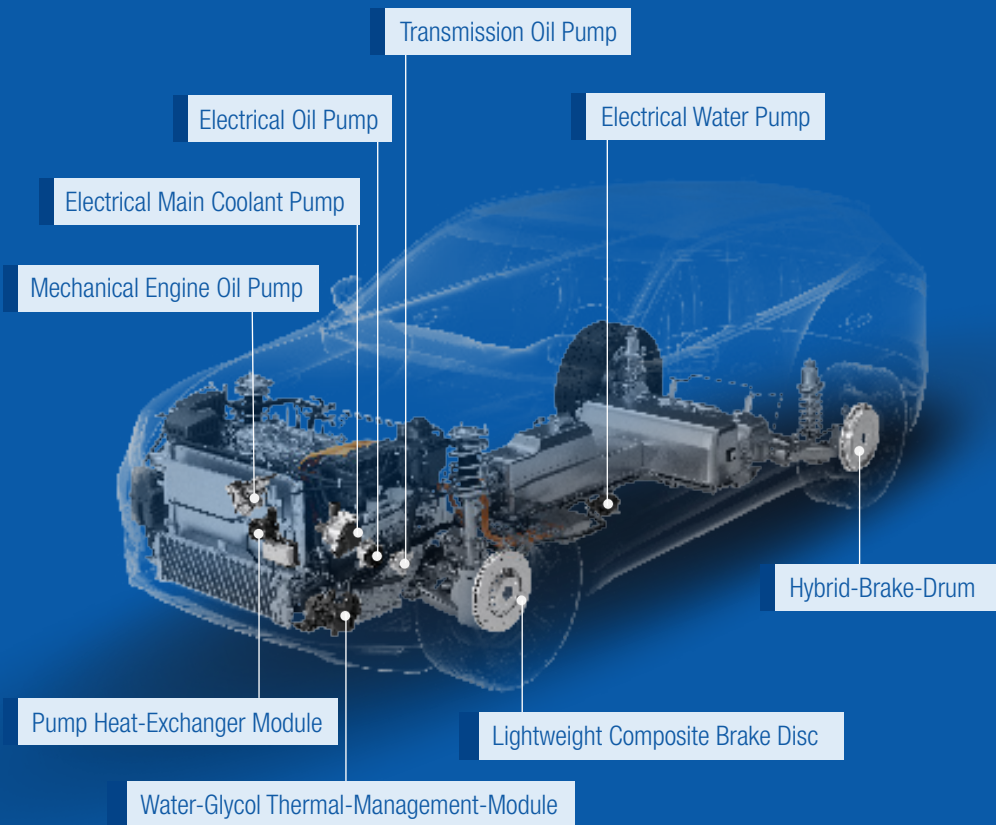
ICE



MHEV



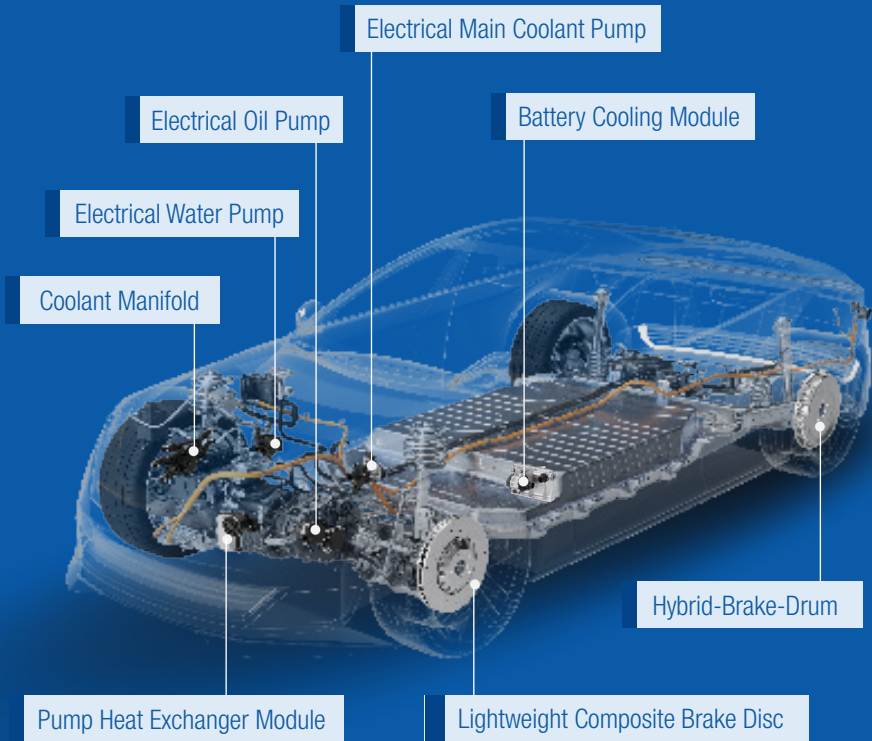
PHEV





BEV

for Battery Electric Vehicle-application



ELECTRICAL OIL PUMPS

SHW developed different modular families of Electrical Pumps, which can be easily adapted to the customer specific requirements.



Electrical voltage: 12V or 24V



PWM, CAN or LIN communication available



Temperature range -40°C to 130°C



Speed sensor optional



Motor power and pump-size easy adaptable due to modular design concept



G-Rotor, External Gear or Binary Vane Pump type
Tandem Pump design possible



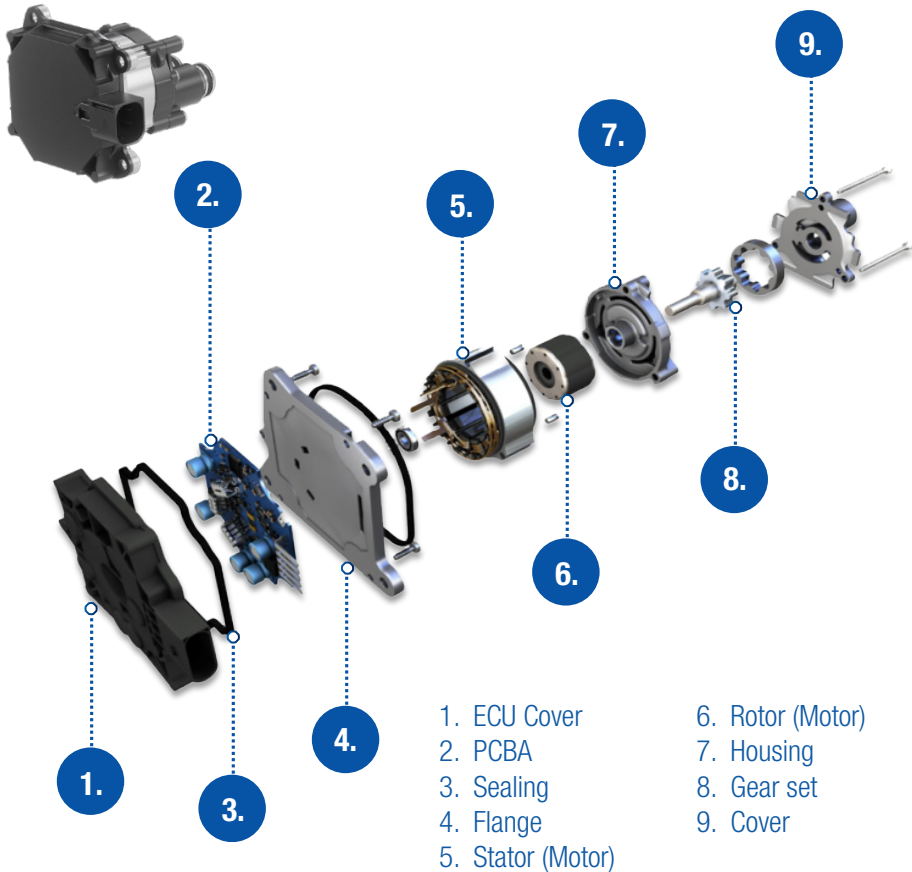
Q: 1 – 10 ccm/rev

Pel: 50 - 500W

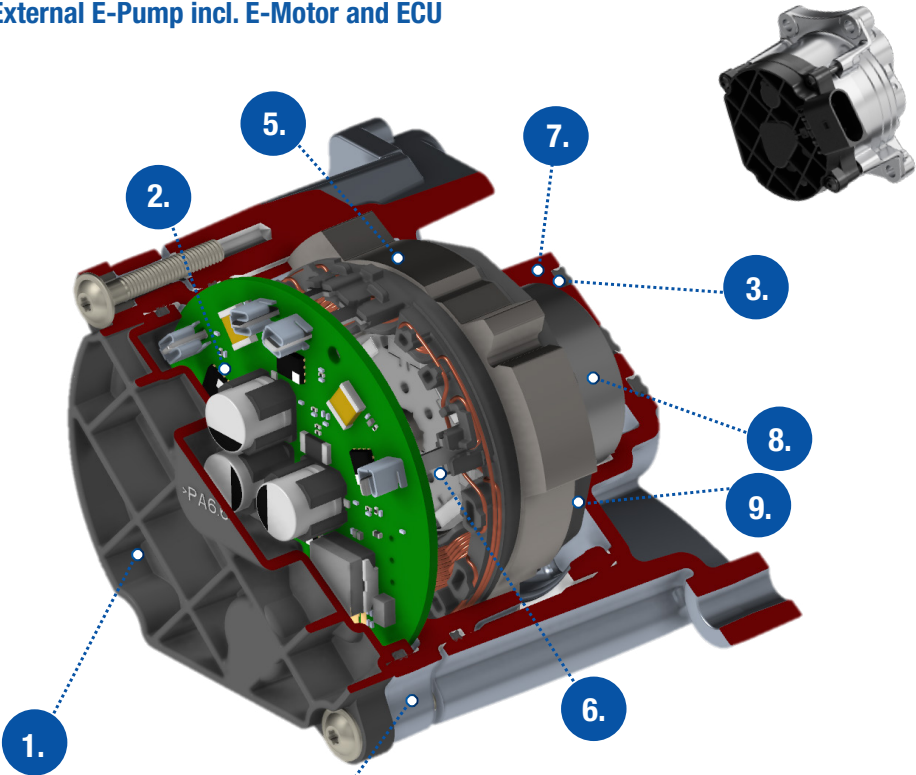
Cooling: i.e. 30 l/min @ 2 bar

Actuation: i.e. 6 l/min @ 20 bar or 3 l/min @ 40 bar

Cartridge E-Pump incl. E-Motor and ECU

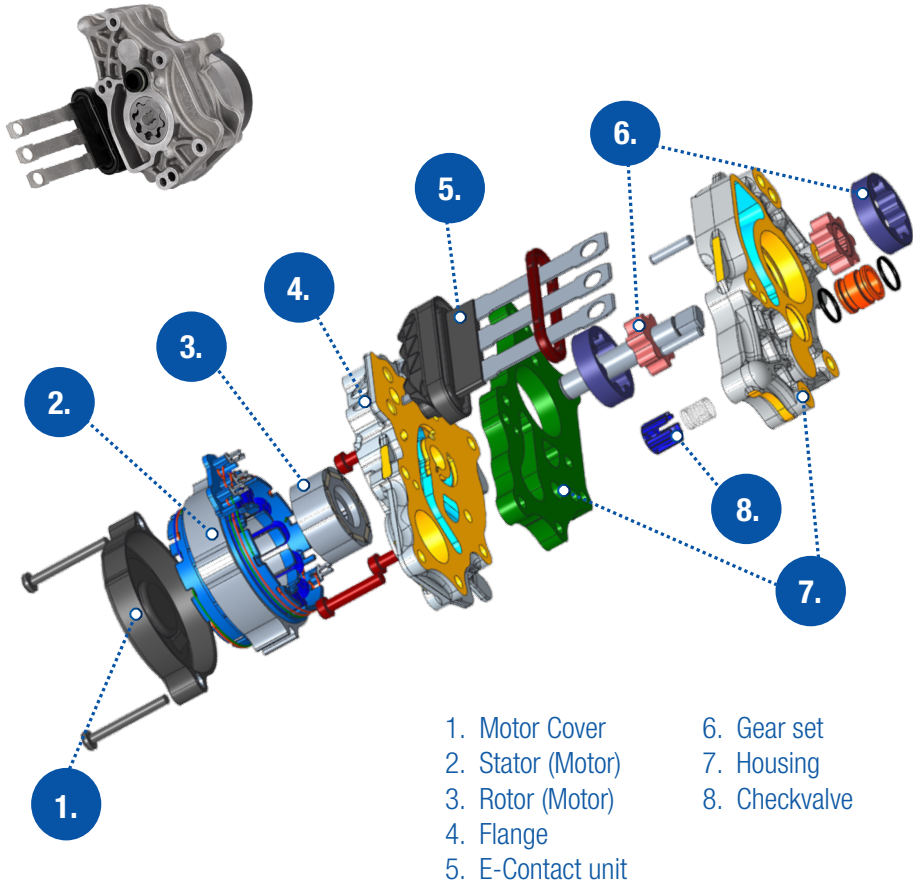


External E-Pump incl. E-Motor and ECU



- 1. ECU Cover
- 2. PCBA
- 3. Sealing
- 4. Flange
- 5. Stator (Motor)
- 6. Rotor (Motor)
- 7. Housing
- 8. Gear set
- 9. Cover

Electrical Motor Oil Pump incl. E-Motor



OIL-MANAGEMENT-MODULE

System overview



high system and function integration level



integrated Electrical Oil Pumps



integrated Heat-Exchanger



integrated Oil Filter



integrated Temperature sensor



PWM, CAN or LIN communication available



Temperature range -40°C to 150°C

Pump Heat Exchanger Module



ELECTRICAL MAIN COOLANT PUMP

System overview



Motor power and pump-size easy adaptable due to modular design concept



EWP Electrical power range: 100W – 350W (12V)
EMWP Electrical power range: 300W – 600W (12V)



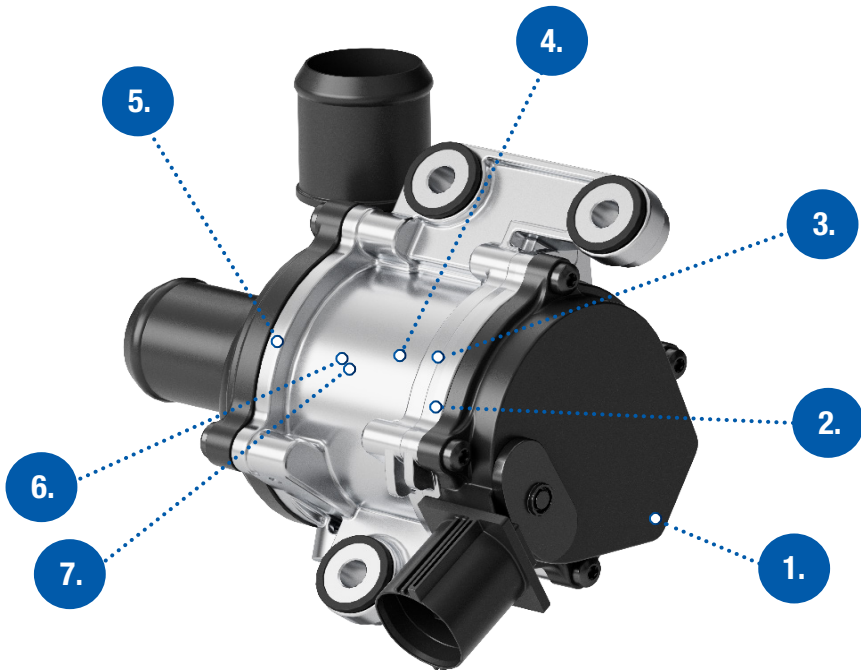
PWM, CAN or LIN communication available



Temperature range -40°C to 135°C



Example flow-rates depending on impeller-design:
i.e. 140 l/min @ 1 bar or 40 l/min @ 3 bar



- 1. ECU Cover
- 2. PCBA + Flange
- 3. Sealing

- 4. Rotor + Stator (Motor)
inkl. Motor-Housing
- 5. Impeller + Housing

- 6. Shaft-Sealing
- 7. WP-Bearing

THERMAL-MANAGEMENT-MODULE

System overview



Easy adaptable due to flexible modular design concept



Electrical Water Pump optional

EWP Electrical power range: 100W – 350W (12V)

EMWP Electrical power range: 300W – 600W (12V)



PWM, CAN or LIN communication available



Friction and lifetime optimized sealing concept



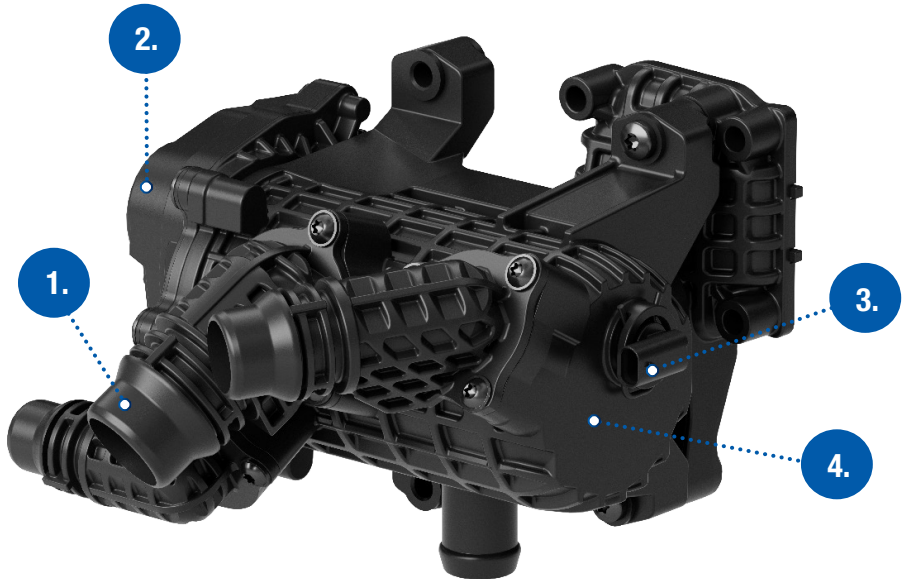
Temperature range -40°C to 135°C

Integrated Temperature Sensor possible



Exact flow regulation via Electrical Actuator

Water-Glycol Thermal-Management-Module



1. Electrical Coolant Pump (optional integrated)
2. Actuator
3. Temperatur sensor
4. Rotary valve

BATTERY COOLING MODULE

Battery modules with immersive battery cell cooling by dielectric oil is more effective cooled compared to indirect cooling with water-glycol coolant. This immersive cooling in combination with battery cooling modules allows to keep the cell temperature under control even when in near future higher voltages and current will be used for fast charging.



Coolant pump with BLDC-Motor with max. 400W (12 V) pump size and type depending on requirements
Integration of pump, heat exchanger, sensors, pipes and connectors

Medium: Water-glycol and dielectric oil



PWM, CAN or LIN communication available

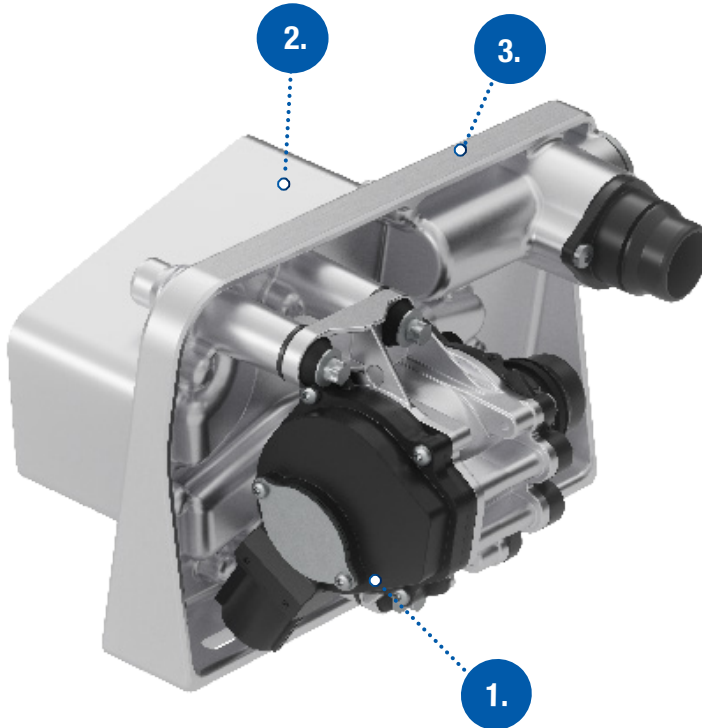


Coolant temperature range -40°C to 65°C
Ambient temperature range -40°C to 85°C



Example flow-rate:
i.e. impeller-pump 80 l/min @ 1,5 bar 50°C
max. operating pressure 4 bar absolute

Battery Cooling Module



1. Electrical Coolant Pump
2. Heat Exchanger
3. Cover

COMPOSITE BRAKE DISC



*EXCELLENT COOLING,
EXTREME DURABILITY AND SAFETY*

*DISTINGUISHED APPEARANCE AND
IMPROVED BRAKE COMFORT*

*SUSTAINABLE
WITH LOWER CO₂-EMISSION*

Answer to customer requirements.



FUNCTION

improvement of resistance to corrosion, brake performance and durability/safety



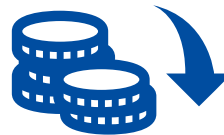
ENVIRONMENT

reduction of brake-induced emissions (brake dust) and wear behavior



WEIGHT

further weight reduction, e.g. due to optimized design with focus on cooling behaviour



ECONOMY

cost efficient design and economic production

LIGHTWEIGHT BRAKE DISCS

As pioneer of the pin disc SHW set the standard in lightweight design as early as 1993 and has continued to improve its product portfolio over the years.

PIN-DISC CONCEPT

The pin disc concept is a two piece fully floating disc brake rotor. The friction ring is connected to the central aluminum rotor bell by means of stainless steel pins which are cast into the assembly during the manufacturing process.

SHW pin discs carries many benefits: low weight, maximum braking performance and excellent brake-comfort.



BEST-IN-CLASS: SHW PIN-DISC

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consisting of stainless steel pins casted in the aluminum bell – grey iron friction ring with radial bearing. Manufactured by inhouse composite-casting.



Up to 2.5 kg mass reduction possible (depending on size)



Reduced thermal strain due to floating friction ring



Excellent cooling



Extreme durability and safety



Improved brake-comfort



Distinguished appearance



Significant CO₂-reduction over lifetime



ADVANCED COMPOSITE BRAKE DISC (ACBD)

consisting of stainless steel pins casted in the aluminum bell – grey iron friction ring with radial bearing. Manufactured by inhouse composite-casting.



Up to 3.5 kg mass reduction possible (depending on size)



Reduced thermal strain due to floating friction ring and more homogenous mass allocation



Highest endurance, durability and safety



Superior cooling



Excellent brake-comfort



Distinguished appearance



Significant CO₂-reduction over lifetime



HYBRID-BRAKE-DRUM

Lightweight Brake-Drum concept, consisting of a grey cast iron friction ring and an aluminum housing. Manufactured by composite-casting.



Tremendous weight save of up to 40% compared to a Grey Iron Brake-Drum



Better resistance to corrosion and reduced brake dust emission compared to disc brake system



Superior reactivity after long periods of disuse (due to regen. braking)



Significant CO₂-reduction over lifetime



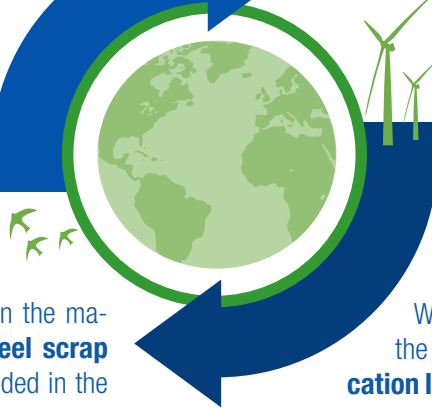
SUSTAINABILITY

@ SHW

SHW contributes to achievement of global **goals** for **sustainable** development.



In 2029, the change to an **electric melting furnace** is scheduled, so that climate-neutral production will be possible before 2030.



At our location in Tuttlingen the materials are melted from **steel scrap** and are therefore not included in the emissions balance.

Furthermore, we **remelt chips** from aluminum and gray cast iron. This results in the **re-recycling of raw materials**.

We are **certified** with the **environmental certification ISO 14001** and **ISO 50001**.

German locations used **100% emission-neutral electricity** for the first time in 2021.

The structure of the **supply chains** follows the principle of being as **regional** as possible.

* Goals for a climate-neutral production

CLIMATE-NEUTRAL PRODUCTION

@ SHW

SHW will make its own production climate-neutral* by 2040. The focus is primarily on reduction measures and the supply of emission-neutral energy sources.



Until **2030** all European locations will be **climate-neutral***.



Until **2040** all locations worldwide will be **climate-neutral***.

* CO₂-neutral in Scope 1 und 2 acc. GHGP-definition



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