VHIT

VHIT

# VHIT- Mechatronics & Beyond

**We are a long-standing Italian company with a broad international outlook:**
**we have always been active in production for the Automotive sector**
**and today we are looking with interest at foreign markets**
**and the developments in the electrification of mobility.**

# VHIT

## Mechatronics & Beyond

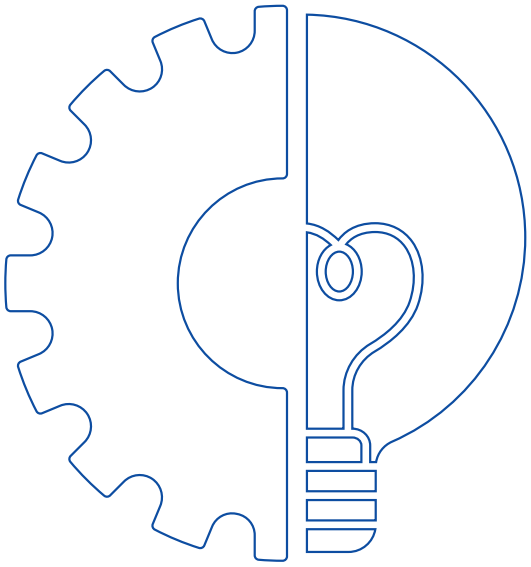
VHIT specialises in the research, development, production and marketing of mechatronic products for the Automotive industry. Our expertise covers the vacuum, engine lubrication and cooling areas, for both power trains with internal combustion engines and electric motors, as well as in the field of hydraulic applications for commercial vehicles.

VHIT was founded in the late 1950s, and throughout its history, spanning more than sixty years, the company has pioneered major developments, eventually becoming part of the Weifu High-Technology Group Co., Ltd. in 2022.

Today, VHIT employs more than 600 employees, who all play an active part in the company's success and growth. Alongside the importance of product quality, we also see sustainability as a key value. On a collective level, we adopt the principles of green economy and waste reduction, while at the same time striving to create a stimulating working environment where all our employees can realise their full potential.

## Our Vision

**We create new technologies bringing value for our customers, benefit for people and the environment**



## Our Mission

**We enhance our know-how by letting ideas flow all over the world, giving young talent and experts space to grow and make their marks**

# A BENCHMARK
## in the Automotive market

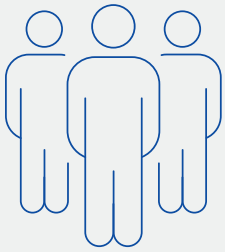
Recent developments in the Automotive market have contributed to the growth of our expertise, prompting us to expand our portfolio of offerings and forge innovative partnerships. We have successfully approached the mechatronics sector and have been able to take advantage of the ongoing digital transformation by integrating artificial intelligence (AI) and the Industry 4.0 model into our production systems. The development and spread of the electrification of mobility has led us to adapt our offer, enabling us to find new, highly efficient solutions for our customers. Over the past decade, we have gone from being a company focused exclusively on mechanical products to one with a strong focus on electrified products for hybrid and electric vehicles. We have thus become a benchmark in the Automotive market for the development and design of hardware and software systems for mobility.

# OUR TARGET MARKET
## is global

We primarily target European customers, but we also export our products further afield, especially to Central and South America, as well as to the Asian continent. With the company's recent entry into the Weifu High-Technology Group Co., Ltd., we aim to further strengthen our position in the Eastern market. At the end of 2021 we thus also established a subsidiary based in China, in Wuxi: VHIT Automotive Systems.

**since 1958**

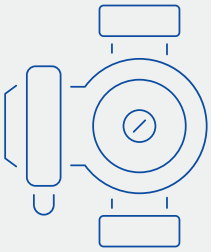
**experience in the Automotive sector**



**more than**

**600**

**employees**



**more than**

**8 million**

**pumps produced on average per year**

# WEIFU

## Worldwide Business Footprint

Founded in 1958, Weifu Group is a prestige domestic automotive component manufacturer and one of Top 50 China Auto Parts Industry Companies. After more than 60 years of steady development, Weifu Group now has 22 wholly/majority-owned subsidiaries and 10 joint-investment companies with over 7400 employees around the globe. The Group is a well profitable listed company with “Su Weifu” A and B shares, and for the leading position in the industry, Weifu was awarded as one of Top 100 Valuable Public Companies in China Mainboard Stock Market.

Weifu keeps technical innovation and product structure upgrading. We have extended our product portfolio from fuel injection field to energy saving & emission reduction, green hydrogen energy, intelligence & electrification as well as industrial & others, forming a competitive industrial chain of automotive products.

As certified the National High-Tech Enterprise, Weifu group has various scientific research platforms, i.e. ‘National Enterprise Technical Center’ and other 3 provincial engineering & technological research centers as well as 1 provincial engineering lab. With the innovative and down-to-earth spirit, Weifu is devoted to the technology innovation and R&D capability enhancement.

For the future, Weifu will still keep focusing on core auto parts business and implement ‘Duel Engines’ strategy under ‘Internationalization, Self-dependency, Multi-dimension’ strategic principal, and develop new business starting with new energy power and intelligent connected vehicle products. Weifu Group will continuously satisfy our customers with high quality products and services while contributing long-term stable development to the employees and society.

# FUEL CELL CORE COMPONENTS

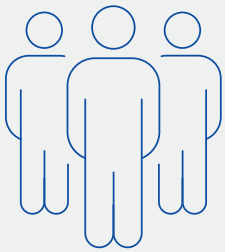
Through long term cooperation with international partners and institutions, Weifu focuses on:

- Accumulating and deepening understanding of customer system requirements
- Specializing in FC core component technology, mass production, and quality assurance
- Expanding business globally

Weifu supports customers' FC system solutions to achieve more efficient, reliable and cost-effective products.

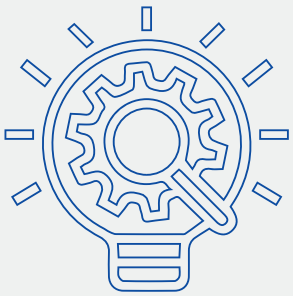
**¥11+ bln**

**Turnover**



**7400+**

**Global Employees**



**6**

**R&D Center (National & Provincial)**

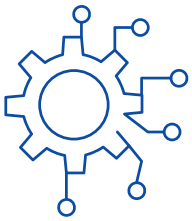
VHIT

## Smart

We innovate
processes and products
with the most advanced
technologies.

## Global

Our products
are distributed globally
and used by the major
car manufacturers
to build their vehicles.



## Mechatronics

Our skills in mechanics
and electronics enable
us to develop complex
mechatronic products
and systems.

## Beyond

We always have
an eye on the future.
Our portfolio includes
smart and sustainable
products supported
by innovative services.

# INTERNAL COMBUSTION ENGINE

# COMBINED VACUUM AND ENGINE OIL PUMPS

VHIT combined vacuum and engine oil pumps for passenger cars and light commercial vehicles incorporate braking and lubrication functions in one product.

- Incorporating an oil pump and a vacuum pump in one unit, the combined vacuum and engine oil pumps allow the integration of a high-pressure fuel pump as well
- Compact design to meet even the most complex installation requirements
- High performance and $CO_2$ efficiency due to modular design
- Optional measures in case of high cold-start requirements

### Vacuum and oil pump combined

With a compact design and option to integrate high-pressure fuel pump

### 50% $CO_2$ reduction

Compared to average market vacuum pumps and fixed-displacement oil pumps (NEDC)

### One solution, many application

Able to fulfill several functions and complex installation space requirements

## MAIN TECHNICAL CHARACTERISTICS

| | |
|---|---|
| **Individual components** | Vacuum pumps, oil pumps (standard or variable), low-pressure fuel pumps, high-pressure gasoline and diesel pumps |
| **External drive** | Directly by crankshaft or by gear, chain or pulley |
| **Internal drive** | Coupling or through shaft |
| **Installation position** | In the oil pan, as part of the engine cover or as an engine component |

# VARIABLE OIL PUMP

## for gasoline and diesel engines

VHIT variable oil pumps can be used in cars and commercial vehicles for engine lubrication and cooling. The many variants meet the most diverse requirements.

- CO2 emissions reduced by up to 50% due to proportional valve technology (compared to a fix displacement oil pump)
- Choice of constant and variable delivery pressure over the entire temperature range
- Combinable with vacuum pumps and water pumps
- Wide range of displacements and speeds
- Optional safety valve in case of high cold-start requirements

### $CO_2$ reduction up to -50%

Due to the variable oil pump with proportional valve compared to a fix displacement oil pump

### 3-stages optimization

Variable oil pump, oil circuit and specific driving cycle

### One solution for hardware, software and calibration

Allowing to achieve particularly efficient oil circuits and to reduce $CO_2$ emissions to a fix displacement oil pump

## MAIN TECHNICAL CHARACTERISTICS

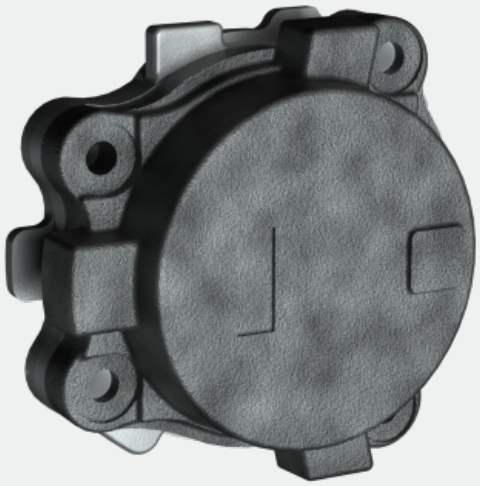
| | |
|---|---|
| **Regulation** | Displacement adjustment through eccentric stator |
| **Control strategy** | Self-regulation, two-pressure level, full-map control |
| **Regulation** | Fully variable from 1 to 5 bar |
| **Control strategy** | Directly by crankshaft or via pulley, gears or chain |

# LOW PRESSURE DIESEL PUMP

## Injection system

The most reliable solution.

- Possibility to integrate many functions in a single product
- Compact and reliable design



### Low pressure diesel pump for injection system

With a compact design and option to integrate pressure regulating, priming and limiting valves

### Optimized application

Improved design to minimize internal flow losses and power consumption

### Scalable solution

Modular design able to fulfill  performance according to customer requirements

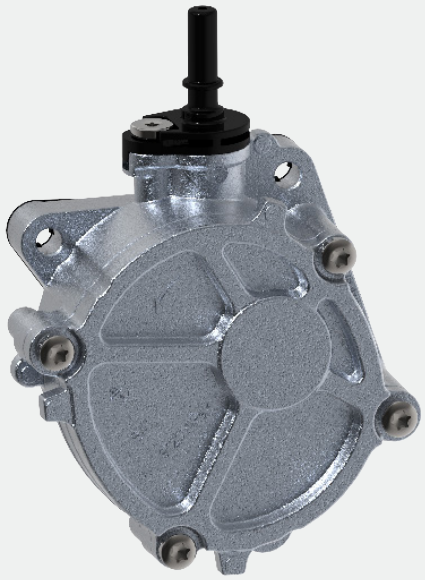
## MAIN TECHNICAL CHARACTERISTICS

| | |
|---|---|
| **Individual components** | Pump, regulating valve (optional), limiting valve (optional) , priming valve (optional) |
| **External drive** | Directly by high-pressure pump shaft (Oldham joint) |
| **Internal drive** | Coupling or through shaft |
| **Installation position** | On high pressure diesel pump |

# MECHANICAL VACUUM PUMPS

Mechanical vacuum pumps for cars and light commercial vehicles have always been the core business of VHIT. Always abreast of market developments, our range has never stopped evolving and our level of expertise in this sector is remarkably high.

- Thermoplastic rotor for lighter weight
- Excellent evacuation performance
- Noise-reducing design
- Low $CO_2$ emissions resulting from reduced friction loss
- Optimised, modular design
- Safety options for optimised cold starts and to prevent counter-rotation



### Emission reduction

-0.6 g $CO_2$/km thanks to optimized torque absorption (compared to the average market level of new applications)

### Weight reduction

-200 g per pump, thanks to the use of thermoplastic rotor, resulting in more dynamic driving behavior and lower $CO_2$ emissions

### Optimized design

Modular design, engineered to guarantee a noise reduction

## MAIN TECHNICAL CHARACTERISTICS

| | |
|---|---|
| **Direction of rotation** | Clockwise/counterclockwise |
| **Lubrication** | Engine oil |
| **Drive** | Driven directly by engine camshaft or crankshaft via pulley, gear or chain |

# ELECTRIC AND $H_2$ APPLICATIONS

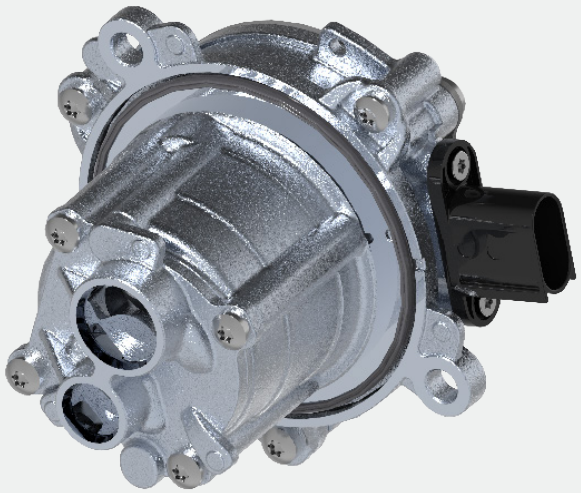
# ELECTRIC OIL PUMP

## for cars and LCV*

Various models of VHIT electric oil pumps are made to suit cars or light commercial vehicles best. They can be used for cooling or lubrication functions according to the application.

- Integrated design with pumping elements, electric motor and ECU (motor control unit) for good energy savings and installation in small spaces
- Modular power classes and dedicated hydraulic components make it meet an array of different market requirements
- IoT offers PD and PM functions, including the option to replace physical sensors with virtual ones
- Electric oil pumps are a smart solution for cooling, lubrication and driving in electric cars and transmissions

*Light commercial vehicles



### eAxle electric machine cooling

High power density enabler
and high continuous power enabler

### Gearbox efficiency

By cooling, lubrication and actuation

### Energy optimization

On demand thermal management

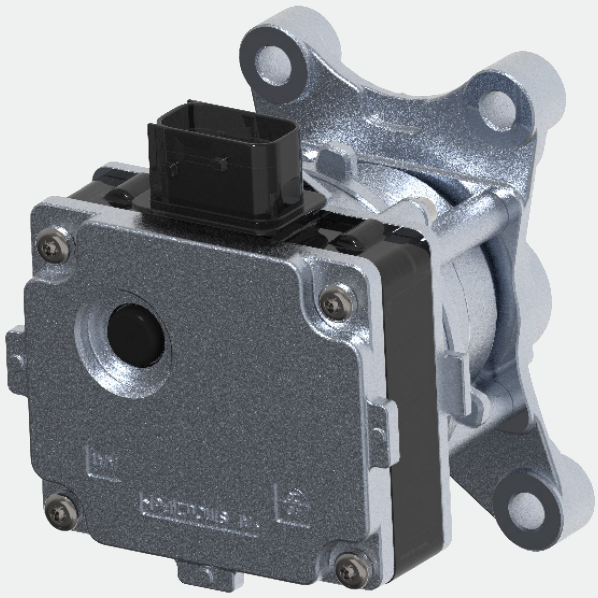
## MAIN TECHNICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| **Power class** | 80 W | 150-300 W | Up to 500 W |
| **Typical oil flow & pressure** | 10 l/min at 0.5 bar<br>7 l/min at 0.9 bar | 22 l/min at 2 bar<br>2.6 l/min at 30 bar | 24 l/min at 2.4 bar<br>4.6 l/min at 30 bar |
| **Motor** | 12V BLDC | 12V BLDC | 12V BLDC |
| **Control strategy** | LIN | CAN/LIN | CAN (LIN) |

# ELECTRIC OIL PUMPS

## for medium and heavy-duty applications

- Cooling of e-Axle and e-Machine for high power density, even under continuous operation
- Gearbox efficiency by cooling, lubricating and driving
- Tested for long service life, proven even in heavy use



### eAxle electric machine cooling

High power density enabler

and high continuous power enabler

### Gearbox efficiency

By cooling, lubrication and actuation

### Tested for long durability

Heavy-duty proof

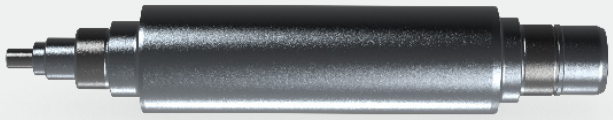
## MAIN TECHNICAL CHARACTERISTICS

| | |
|---|---|
| **Power class** | 150-500 W |
| **Typical oil flow & pressure** | 30 l/min at 2 bar<br>4 l/min at 30 bar |
| **Motor** | 12-24 V |
| **Control strategy** | CAN |

# SHAFT

The shaft is the core part of the motor rotor, and the assembled parts include: transfer molded rotor core, balance disc, spring, bearing, rotary rotor and seal.

- The highest operating speed is 16000rpm and the overspeed is 21000rpm
- It can withstand the working torque of 310Nm for a long time and 530Nm for a short time
- In electric mode, the motor transmits torque to the reducer through splines on the shaft. In power generation mode, the reducer is transmitted to the motor through splines on the shaft
- High speed direct drive input shaft
- Spline torque transmission, full-tooth torque transmission, floating self-centering
- Local high-frequency heat treatment, higher wear resistance, lower cost
- Some products are hollowed out, and their free mode frequency, torsional strength, and torsional fatigue life do not weaken when the quality is reduced by 25%
- New energy electric passenger vehicle



## MAIN TECHNICAL CHARACTERISTICS

| PRODUCT SERIES | DUAL FUEL INJECTOR |
|---|---|
| Motor speed | Max 21000rpm |
| Torque | 310~530Nm |
| Motor type | Permanent magnet synchronous motor/Induction motor |

# FC HYDROGEN SUBSYSTEM

## Anode Isolation Valve

Cut off and isolate high-pressure hydrogen in the event of a fuel cell system failure.

- Lower Pressure Drop
- Quick Response
- Automotive Grade Hydrogen-Related Valves
- Customized Flow Rate

## MAIN TECHNICAL CHARACTERISTICS

| PARAMETER | TARGET |
|---|---|
| Inlet Pressure Range | 12~ 15bar.g |
| Maximal Allowable Working Pressure | 18bar.g |
| Working Flow Rate | 3.25g/s@85°C&14bar.g |
| Working Temperature | -40~85°C |
| Pressure Drop | <0.5bar@max. flow |
| Leakage | ⩽10Ncc/h |
| Operation Voltage | 24 (18~32) VDC |
| Normai Operation Current | ⩽1A |
| Normai Position | Closed |
| Response Time | ⩽60ms |

# FC HYDROGEN SUBSYSTEM

## Low Pressure Relief valve

Prevent hydrogen overpressure, Ensure the safety of the FC stack and the whole system.

- Good Repeatability
- High Durability
- Customized Pressure and Flow Rate

## MAIN TECHNICAL CHARACTERISTICS

| PARAMETER | TARGET |
|---|---|
| Relief Pressure | 2.15bar.g |
| Nominal Flow Rate | 0.9 g/s @2.5bar.g&H2 &25°C |
| Working Temperature | -40~85°C |
| Leakage | ⩽10Ncc/h |
| Normal Position | Closed |
| Control Method | 1-5s Mechanical spring,<br>Switching time1-5s |

# FC HYDROGEN SUBSYSTEM

## Anode Purge/Drain Valve

Remove fuel celi impurities (nitrogen) and moisture.

- Automotive Grade Hydrogen-Related Valves
- Customized Flow Rate

## MAIN TECHNICAL CHARACTERISTICS

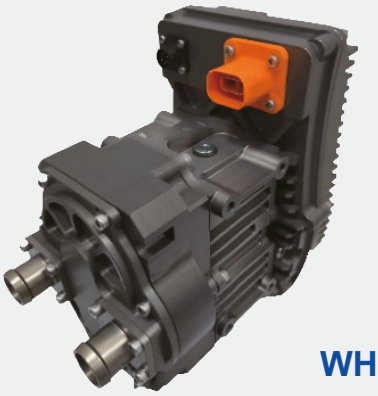
| PARAMETER | TARGET |
|---|---|
| Working Medium | A mixture of H2, N2 and Deionized Water |
| Response Time | ⩽30ms |
| Operation Voltage | 24VDC |
| Working Temperature | -40~100°C |
| Working Pressure | ⩽2bar.g |
| Flow Rate | 55±5.5PLM@Pin=2bar.a&Air |
| Leakage | ⩽10Ncc/h |

# FC HYDROGEN SUBSYSTEM

## Hydrogen Circulation Pump

HCP pumps unreacted humidified hydrogen back to inlet of stack to increase the utilization rate of hydrogen and avoid water flooding on the anode side.

- Natural cooling, High cleanliness, Fast dynamic response, Flow and pressure rise are controllable
- Hydrogen compression chamber without oil, Strong pressure boosting ability, Strong ice-breaking ability



WHP122

WHP111

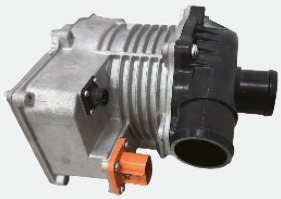
## MAIN TECHNICAL CHARACTERISTICS

| PRODUCT SERIES | WHP122 | WHP111 |
|---|---|---|
| Operating voltage (high voltage) | 560(400~750)V | 24(18~32)V |
| Operating voltage (low voltage) | 24(18~32)V | 24(18~32)V |
| Rated speed | 5000rpm | 5000 |
| Rated power | 500W | 300W |
| @1bar, Air Input Pressure rise | 0.2bar,0.4max | 0.2bar,0.3max |
| @1.5bar, Air input; 0.2bar Pressure Rise Air outlet Flow | ⩾ 600NLPM | ⩾ 400NLPM |

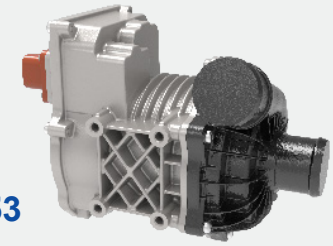
# HV COOLANT PUMP

The function of the pump is to overcome the flow resistance of the system cooling path and provide the coolant with a certain flow and pressure to ensure the normal operation of the reactor.

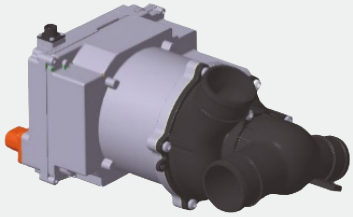
- Large flow, High head, High mechanical efficiency, Low conductivity
- The working medium is insulated from the outer surface, Long-life



WCP31



WCP53



WCP74

## MAIN TECHNICAL CHARACTERISTICS

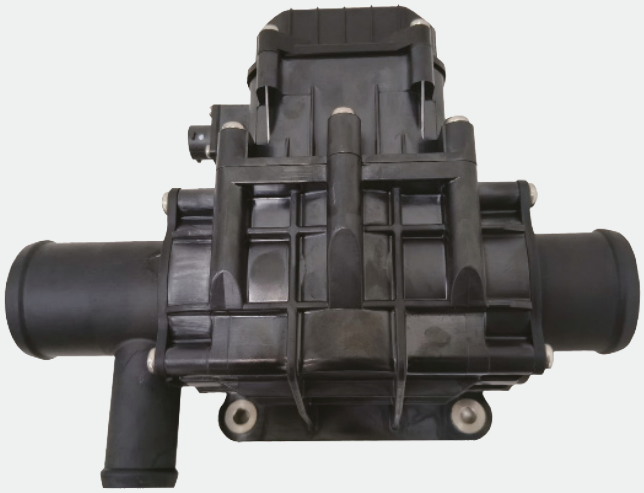
| PRODUCT MODEL | WCP31 | WCP53 | WCP74 |
|---|---|---|---|
| Operating temperature range | -40~90°C | -40~90°C | -40~90°C |
| Operating voltage | 400~750V | 400~750V | 400~850V |
| Control voltage | 18~32V | 18~32V | 18~32V |
| Rated head@flow | ⩾15m@ 260L/min | ⩾20m@ 360L/min | ⩾24m@ 600L/min |
| Rated power | ⩽1.5kW | ⩽2.5kW | ⩽4.5kW |
| IP Grade | IP67 | IP67 | IP67 |
| Lifetime | 30000h | 30000h | 30000h |

# PROPORTIONAL CONTROL VALVE

The Proportional Control valve is a Fuel Cell Thermal Control Valve (FC TCV), which is used for distributing the flow of coolant circuit.

- Real-time control of coolant flow direction and flow size.
  The material meets the low conductivity requirements of fuel cells Direct motor spindle drive, simple and reliable

- High control accuracy and fast response time, Simple and compact structure, easy to assemble, Mature and reliable control strategy



## MAIN TECHNICAL CHARACTERISTICS

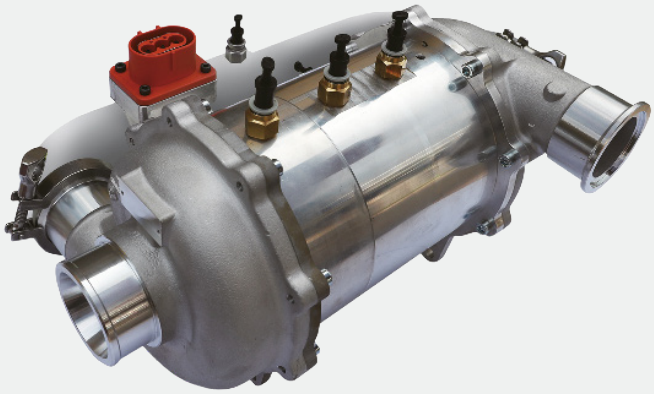
| PRODUCT SERIES | TARGET |
|---|---|
| Operating voltage | 18~32V |
| Pressure drop | ⩽0.25bar@360L/min |
| Noise | <60dB@1m |
| Insulation level | ⩾20MΩ@500VDC |
| Anti electric strength | ⩽10mA@500VAC |
| Response time | ⩽2s |
| Control Precision | 1% |
| IP Grade | IP67 |

# FC AIR SUBSYSTEM

## Air Compressor Key Components

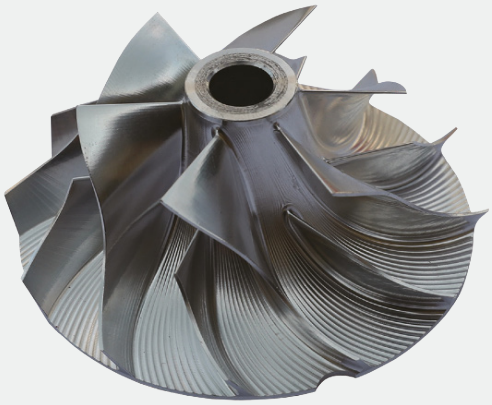
Improve the performance of air compressor and realize the following characteristics.

- Oilless
- Low Cost
- Low Noise
- Large Flow Range
- High Efficiency
- Rapid Dynamic Response
- Miniaturization



# IMPELLER

- Independent Design and Manufacture Capacity of Compressor and Expander
- Parameterization Design, DOE Calculation, Multi-Objective Optimization
- The Annual Capacity of Compressor & Expander is 1.2 million



# AIR BEARING

Radial Bearing

Thrust Bearing

## MAIN TECHNICAL CHARACTERISTICS

| PARAMETER | RADIAL BEARING | | THRUST BEARING |
|---|---|---|---|
| Specification | Diameter: 31.8mm | Diameter: 30mm | Inner diameter: 35mm<br>External diameter: 70mm |
| Maximum operating speed | 100000rpm | 120000rpm | 120000rpm |
| Maximum bearing capacity | 250N | 200N | 200N |
| Start-stop life | 25W | 25W | 25W |

# INTELLIGENT SENSE CORE MODULE

# CABIN RADAR

- **Product Introduction**
  Heart rate monitoring; breath detection; Intrusion detection; Child presence detection;Partition for vital signs.

- **Advantages**
  Low power consumption and Small in size; Easy to arrange in the vehicles; Localization design and Privacy protection

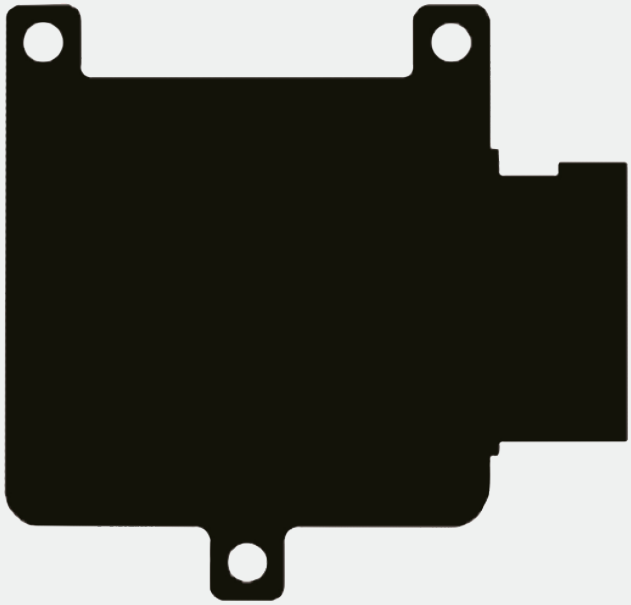
- **Application**
  ADAS including ACC, AEB, FCW, SLAM and Free Space Intelligent transportation

## PRODUCT PARAMETERS

| PRODUCT | CABIN RADAR |
|---|---|
| Frequency | 79GHz/60GHz |
| Distance Range | 2m |
| Band | 76-80GHz/60-64GHz |
| FOV | ⩽130°x130° |
| Power Dissipation | <2W |
| Interface | CAN |
| Number of Channels | 4T4R |
| Protection Grade | IP66 |

# CORNER RADAR

- **Product Introduction**
  High-precision angle measurement, Multi-target processing capability, Strong anti-interference ability-
- **Advantages**
  Low cost; High detection sensitivity; Strong adaptability; Altitude measurement capability
- **Application**
  In the field of intelligent driving, there are terms like BSD/LCA, RCTA/B, DOW, RCW, and FCTA/B



## PRODUCT PARAMETERS

| PRODUCT SERIES | TARGET |
|---|---|
| Frequency | 79-81GHz |
| Distance Range | 0.2-150m |
| Horizontal FOV | ±75° |
| Vertical FOV | ±15° |
| Velocity Measurement | ±80m/s |
| Horizontal Separability | 3° |
| Distance Separability | 0.6m |
| Velocity Separability | 0.3m/s |

# 4D Imaging Radar

- **Product Introduction**
  Enable real-time, high-resolution imaging; Point cloud of 4D: distance, velocity, azimuth, elevation; Process long range detection and objects tracking

- **Advantages**
  Ultra high resolution; High performance perception; Dedicated computing platform; Deep data fusion

- **Application**
  ADAS, including ACC, AEB, FCW, SLAM and Free Space Intelligent transportation

## PRODUCT PARAMETERS

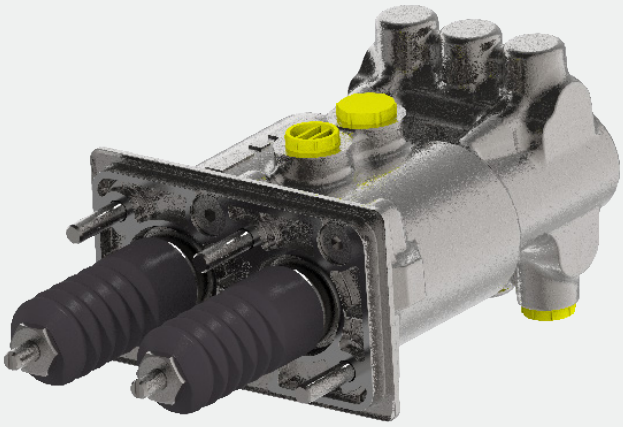
| PRODUCT | 4D IMAGING RADAR |
|---|---|
| Frequency | 79-81GHz |
| Distance Range | 0.8-350m |
| Horizontal FOV | ±60° |
| Vertical FOV | ±15° |
| Velocity Measurement | -70-35m/s |
| Horizontal Separability | 1.2° |
| Vertical Separability | 1.6° |
| Distance Separability | 0.1m |
| Velocity Separability | 0.1m/s |
| Update Rate | 20Hz |
| Power Dissipation | 23W |

# SOLUTIONS FOR OFF ROAD VEHICLES

# HYDRO BOOSTERS

Hydro boosters are suitable for medium-to-high-power Off Road vehicles with dual-circuit brake systems.

- Suitable for medium-to-high-power vehicles. A numerical simulation is required to identify the appropriate solution in terms of MC diameter and pre-fill pressure
- Enhanced double master cylinder designed to meet the requirements of dual-circuit braking systems
- Advanced technology during development enables an additional function to be introduced to the standard product
- Integrated compensation valve
- Integrated overpressure protection valve



## MAIN TECHNICAL CHARACTERISTICS

| DIAMETER | DISPLACEMENT | MEDIUM |
|---|---|---|
| Ø31 mm | 36.5 $cm^3$ (each side) | Mineral oil |
| Ø33.34 mm | 43 $cm^3$ (each side) | Mineral oil |
| Ø34.92 mm | 46 $cm^3$ (each side) | Mineral oil |

# SINGLE-ACTING MASTER CYLINDERS

Single-acting master cylinders are an excellent solution for low-to-medium-power Off Road vehicles with dual-circuit braking systems.

- Basic product suitable for medium-to-low-power vehicles
- Single-acting master cylinders are designed to meet the requirements of dual-circuit braking systems
- Integrated equalizing valve
- Technology used in development saves space in the engine compartment
- Standard flange and connection ports allow easy installation and replacement of one product type with another

## MAIN TECHNICAL CHARACTERISTICS

| DIAMETER | DISPLACEMENT | MEDIUM |
|---|---|---|
| Ø22.2 mm | 12.4 $cm^3$ | Mineral oil |
| Ø23.81 mm | 14.2 $cm^3$ | Mineral oil |
| Ø25.4 mm | 16.2 $cm^3$ | Mineral oil |

# DUAL-ACTING MASTER CYLINDERS

The dual-acting master cylinders, suitable for medium-power Off Road vehicles, are specially designed for dual-circuit braking systems.

- Suitable for medium-power vehicles, the dual-acting master cylinders require a final cut-out pressure tuning to balance the first- and second-stage effects
- Designed to meet the requirements of dual-circuit braking systems
- Integrated equalizing valve

## MAIN TECHNICAL CHARACTERISTICS

| DIAMETER | DISPLACEMENT | MEDIUM |
|---|---|---|
| Ø25.4/15.2 mm | 0.51/0.18 $cm^3$/mm | Mineral oil |
| Ø31.75/21.6 mm | 0.79/0.37 $cm^3$/mm | Mineral oil |
| Ø33.34/23 mm | 0.87/0.41 $cm^3$/mm | Mineral oil |

# BRAKE SERVO CYLINDERS

VHIT brake servo cylinders are a basic yet essential products for Off Road vehicles implementing a non-Axle-integrated slave cylinder.

- Basic products for vehicles using a non-Axle-integrated secondary cylinder for brake actuation

## MAIN TECHNICAL CHARACTERISTICS

| DIAMETER | DISPLACEMENT | MEDIUM |
|---|---|---|
| Ø22.2 mm | 8.9 $cm^3$ | Mineral oil |
| Ø25.4 mm | 11.6 $cm^3$ | Mineral oil, DOT fluid |

# MASTER CYLINDERS

Master cylinders are basic yet essential components for Off Road vehicles equipped with mixed hydropneumatic braking systems.

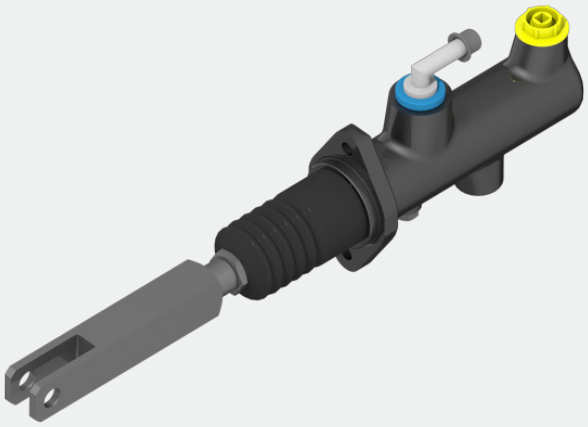
- Basic products for vehicles using a mixed hydropneumatic braking system
- Master cylinders are normally coupled to an enhanced engine to amplify the force

## MAIN TECHNICAL CHARACTERISTICS

| DIAMETER | DISPLACEMENT | MEDIUM |
|---|---|---|
| Ø28.57 mm | 29.7 $cm^3$ | DOT fluid |
| Ø31.75 mm | 38.2 $cm^3$ | DOT fluid |
| Ø33.34 mm | 40.5 $cm^3$ | DOT fluid |
| Ø34.94 mm | 46.2 $cm^3$ | Mineral oil |

# MASTER CYLINDERS CLUTCH

Master cylinders clutch are fundamental elements of hydraulic clutches in Off Road vehicles.



## MAIN TECHNICAL CHARACTERISTICS

| DIAMETER | DISPLACEMENT | MEDIUM |
|---|---|---|
| Ø19 mm | 8.2 $cm^3$ | Mineral oil |
| Ø19 mm | 9.2 $cm^3$ | Mineral oil |
| Ø22.2 mm | 11.2 $cm^3$ | Mineral oil |
| Ø25.4 mm | 15.45 $cm^3$ | Mineral oil |

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