Electro-Hydraulic Pumps (EHP) for Mobile Applications
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Electro-Hydraulic Pumps - EHP

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Parker Hannifin
The global leader in motion and control technologies

A world class player on a local stage

Global Product Design
Parker Hannifin has more than 40 years experience in the design and manufacturing of drives, controls, motors and mechanical products. With dedicated global product development teams, Parker draws on industry-leading technological leadership and experience from engineering teams in Europe, North America and Asia.

Local Application Expertise
Parker has local engineering resources committed to adapting and applying our current products and technologies to best fit our customers’ needs.

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Parker is committed to meeting the increasing service demands that our customers require to succeed in the global industrial market. Parker’s manufacturing teams seek continuous improvement through the implementation of lean manufacturing methods throughout the process. We measure ourselves on meeting our customers’ expectations of quality and delivery, not just our own. In order to meet these expectations, Parker operates and continues to invest in our manufacturing facilities in Europe, North America and Asia.

Electromechanical Worldwide Manufacturing Locations

Europe
Littlehampton, United Kingdom
Dijon, France
Offenburg, Germany
Filderstadt, Germany
Milan, Italy

Asia
Wuxi, China
Jangan, Korea
Chennai, India

North America
Rohnert Park, California
Irwin, Pennsylvania
Charlotte, North Carolina
New Ulm, Minnesota

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Electro-Hydraulic Pumps - EHP

Overview

Description
The Electro-Hydraulic Pump (EHP) kits are designed for hybrid electric and all electric mobile applications. EHP systems consist of an electric motor directly coupled to a hydraulic pump controlled by a high performance mobile hardened drive. Parker’s global expertise in hydraulic, electric motor, and drive technologies is brought together in the EHP to create a system that has been optimally adapted to the customer requirements.

Selecting the required EHP could not be simpler. In fact, just three parameters are required to select the right EHP specification for the application.

These are:
- Battery Voltage
- Flow
- Pressure

They are part of the order code (page 21)

The standard system consist of a: Low voltage drive (MC) or High voltage drive (MD) + Synchronous motor (GVM) or Low voltage induction motor + Hydraulic pump. The EHP range benefits from high level of expertise in all of the different technologies.

Features
- Complete Electro-Hydraulic Pump solutions
- Pre engineered system with fully validated pressure, flow and voltage characteristics
- Wide range of motor/pump combinations with large voltage ranges to adapt to every battery pack
- Drives, Motors and Pumps perfectly mechanically matched (no need for extra adaptors)
- High efficiency and low inertia PMAC motors

Applications
- Electric power steering
  - Buses and Coaches
  - Vocational vehicles
- Electro-Hydraulic systems and circuits
  - Street sweepers
  - Construction
  - Material handling
  - Refuse trucks
  - Agricultural equipments

Technical Characteristics

<table>
<thead>
<tr>
<th>Model</th>
<th>EHP</th>
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<tbody>
<tr>
<td>Motor type</td>
<td>GVM Permanent Magnet AC synchronous motor (PMAC) or low voltage induction motors</td>
</tr>
<tr>
<td>Pump type</td>
<td>Parker Hydraulic Vane pumps (axial piston, bent axis, gear pumps on request) or Helical Gear pumps</td>
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<tr>
<td>Rated voltage</td>
<td>24 to 800 VDC</td>
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<td>Hydraulic power</td>
<td>2 kW to 145 kW</td>
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<tr>
<td>Flow range</td>
<td>up to 300 l/min</td>
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<td>Pressure range</td>
<td>up to 310 bar</td>
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<td>Protection (motor + pump)</td>
<td>IP6K9K as standard with GVM servomotors Up to IP65 with induction motors</td>
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<tr>
<td>Marking</td>
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EHP a New Concept

System Example in a Reach Stacker Application

This illustration shows a typical EHP system that is used to power hydraulic implements. In this case, the electronics are not used for the main traction drive, but to facilitate energy savings in the elevation and extension lift and lower cycle. Using two variable speed PMAC servo motors coupled to fixed displacement hydraulic pumps, the system controls the elevation and extension movements of the arm under load. The ICE is producing electric power through a generator to charge the battery. When the battery is charged (ensured by the Battery Management System), moving the container becomes independent from the ICE.

When lowering, the EHP converts the energy, storing it in the battery, where it will be used to assist the next lift operation without ICE intervention. The EHP systems manage the regeneration and charging functions. The net result is a very efficient vehicle that recovers considerable energy amount that would previously have been dissipated as heat.

The maximum power level required on the ICE side is lower as part of it is averaged (no more peak power to manage the hydraulics as the battery provide power as well) and because of regenerative mode, so that it allows the ICE size to be reduced, the fuel consumption and the emission level too.

By decoupling mechanical and hydraulic power through EHP concept it is possible to comply with the ever more stringent emission and noise level directives.

When comparing the fixed displacement pump technology with variable speed electric motors, to the usual load sensing (LS) variable displacement pump technology fitted on the ICE, there is significant saving of 20 to 30 bars during movements and stand-by, and no more hydraulic lines.

Benefits:

- Quick and easy product selection (complete system fully determined through pressure, flow and voltage values)
- Highly reliable components giving peace of mind (drives, motors and pumps perfectly matched, no need for extra adaptors)
- Single supplier making sourcing simple (EHP kit is a multi-technology Parker solution)
- High Flexibility (wide range of motor/pump combinations adapted to every battery pack)
- High reliability (specific performing area determined through drive configuration)
- Reduced fuel consumption and emissions
- Dynamic performance delivers instantly available hydraulic power (low inertia PMAC motors and vane pumps)
- Quiet operation
- Downsizing of the power system (ICE)
- Higher global efficiency (regenerative system)
**EHP - PMAC motors**

**Technical Characteristics**

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Cooling: IEC34-6 Maximum temperature: 65 °C Maximum pressure: 5 bars
Not all listed here, other combinations on request

**Calculation of the RMS Pressure**

Select the correct EHP as follows:
- Identify the EHP which meets PEAK demand
- Ensure that the RMS pressure is lower than the continuous rating

Confirm the suitability of the selected EHP by calculating the required RMS pressure which the system will attain during the chosen cycle (see example aside).

\[
P_{\text{RMS}} = \sqrt{\frac{1}{100} \left( P_1^2 T_1 + P_2^2 T_2 + P_3^2 T_3 + P_4^2 T_4 \right)}
\]

For thermal reasons (motor overheating), the RMS pressure value must be lower than the given EHP continuous value, even if the maximum instantaneous value can reach the maximum pressure value.

In any case, the max pressure value possibly provided by the EHP must not be maintained for more than 10 seconds to avoid overheating.
Pressure/Flow Curves for Low Voltage EHP

Data obtained with a pump internal leakage value calculated with 10 cSt (1 St = 1 cm²/s) oil viscosity (most severe operating conditions)
Data obtained with a pump internal leakage value calculated with 10 cSt (1 St = 1 cm²/s) oil viscosity (most severe operating conditions).
Pressure/Flow Curves for Low Voltage EHP

Data obtained with a pump internal leakage value calculated with 10 cSt (1 St = 1 cm²/s) oil viscosity (most severe operating conditions)
Electro-Hydraulic Pumps - EHP
Pressure/Flow Curves for High Voltage EHP

Pressure/Flow Curves for High Voltage EHP

Max. pressure value (intermittent duty)
Continuous pressure value or max. rms pressure value

Data obtained with a pump internal leakage value calculated with 10 cSt (1 St = 1 cm²/s) oil viscosity (most severe operating conditions)
Electro-Hydraulic Pumps - EHP
Pressure/Flow Curves for High Voltage EHP

Data obtained with a pump internal leakage value calculated with 10 cSt (1 St = 1 cm²/s) oil viscosity (most severe operating conditions)
Dimensions

GVM142

Figure 1: GVM142_WC_T7AS
Electro-Hydraulic Pumps - EHP

Dimensions

GVM210

Figure 2: GVM210_WC_T7AS

Figure 3: GVM210_WC_T7BS
Figure 4: GVM210_WC_T7DS
EHP - Induction Motors

Technical Characteristics

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This EHP feature an IP65 induction motor.
Other combinations on request.

Pressure/Flow Curves

Data obtained with a pump internal leakage value calculated with 10 cSt (1 St = 1 cm²/s) oil viscosity (most severe operating conditions)

Dimensions
EHP - Helical Gear Pump

Technical Characteristics

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This EHP feature a helical gear pump and a PMAC motor. Other combinations on request.

Pressure/Flow Curves

Data obtained with a pump internal leakage value calculated with 10 cSt (1 St = 1 cm²/s) oil viscosity (most severe operating conditions)

Dimensions
EHP Component Descriptions

Low Voltage Drives - MC Drives

Description
Providing a motor control solution for battery systems between 24 and 96 VDC, the MC motor controllers provide OEMs with a superb combination of power, performance and functionality. The compact dimensions and high efficiency of this controller make integration into very tight spaces a reality without sacrificing output performance. It’s design has been optimized to produce the lowest possible installed cost, whilst still maintaining superior reliability even in the most demanding applications.

Product Features
- IP65 protection class
- Motor temperature sensor input
- Configurable CAN communication
- Parker IQAN compatible
- 5 configurable coil drive outputs
- 2 configurable digital outputs
- 2 Analogue inputs / 6 Digital inputs

For more information see catalogue 192-300107

High Voltage Drives - MD Drives

Description
With a compact, rugged and cost effective design these reliable controllers are intended to meet the high performance requirements of on-road and off-road electric vehicles (EV) and Hybrid Electric Vehicles (HEV). Its high voltage range, up to 800VDC, is well matched to the needs of the automotive and commercial transport markets. The same hardware platform handles both AC Induction and Permanent Magnet AC motor technologies.

Product Features
- Up to 800 VDC peak supply voltage
- Advanced flux vector control
- Integrated logic circuit
- Includes an additional dedicated safety supervisory processor
- Safety interlock pulsed enable signal
- Autocheck system diagnostic
- Hardware & software failsafe watchdog operation

For more information see catalogue 192-300107
Global Vehicle Motor - GVM Series

Description
PMAC servomotors offer the best solution to meet the requirements of vehicle duty performance. The torque density and speed capabilities of Parker Permanent Magnet AC motors (PMAC) combined with a voltage matched drive provide the speed and torque required to achieve breakthrough performance in a variety of vehicle platforms.

The adapted nominal voltage range 24 - 800 VDC depending on the drive. IP6K9K protection when assembled with a pump.

Product Features
- High efficiency (PMAC servomotor)
- Compact (High power density)
- Can be used either as motor or generator

<table>
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<th>GVM</th>
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<tr>
<td>Magnet materials</td>
<td>Rare earth magnets</td>
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| Ambient temperature* | liquid cooled: -40…+120 °C  
natural convection: -40…+65 °C |
| Random Vibration | 0.1 g²/Hz in frequency range 5…2000 Hz (12 g rms – 3 x 8h) |
| Operational Shock | 25 g, 11 ms, 3 x 6 (with 2 directions per axis) |
| Thermal protection | 1 PTC probes and 1 KTY84-130 sensor |

For more information see catalogue 192-300108

* with resolver as feedback

Low Voltage Induction Motor - CFR Series

Description
Available for 24 VDC to 96 VDC drive operation voltage, Parker’s ruggedised induction motors can be supplied as part of a complete mobile system with a preconfigured and tested mobile drive.

Typically adapted for Electro-Hydraulic-Pump, they are commonly used in steering applications.

Product Features
- Low voltage induction motor
- Speed up to 3500 min⁻¹
- Torque up to 150 Nm

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<th>Model</th>
<th>CFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Induction motor</td>
</tr>
<tr>
<td>Voltage</td>
<td>24 VDC to 96 VDC (MC drive)</td>
</tr>
<tr>
<td>Power</td>
<td>Up to 40 kW</td>
</tr>
<tr>
<td>Protection</td>
<td>IP20 to IP65</td>
</tr>
</tbody>
</table>
Vane Pump - T7 Exx Series

Description
Parker vane pumps are especially suited to variable speed applications. They enable very quick changes in pressure at a very high flow rate reproducibility and at a low noise level. It is particularly modification and service friendly. The wide range of designs (displacement, connections, etc.) offers the best preconditions for individual solutions tailored to a customer’s requirements.

Product Features
- High efficiency (can even be used at low speeds)
- High pressure capabilities up to 300 bar, in a small size envelope, reducing installation costs and delivering an extended service life
- Wide speed range (up to 3000 min⁻¹)
- Specially designed to be quiet in operation reducing overall noise levels from the vehicle
- Very long service life with constant performances
- Very low inertia (dynamic response to fit the application demand)

For more information see catalogue HY29-0110

Model | T7
---|---
**Pump type** | Vane pumps
**Displacement range** | Size A: 5.8...24.9 ml/rev
| Size B: 5.8...50.0 ml/rev
| Size D: 44.0...137.5 ml/rev
**Pressure range** | Size A: up to 300 bar max
| Size B: up to 320 bar max
| Size D: up to 300 bar max

An oil filtering system has to be placed on the pump outlet. No filter or strainer is allowed at the inlet side.

Helical Gear Pump - HGP Series

Description
New gear pump generation capable to reduce as much as possible the acoustic emissions and the consequent vibration level.

Product Features
- Low noise
- High volumetrical efficiency
- Wide speed range (up to 3000 min⁻¹)
- Intermittent operation at high pressure and low speed
- SAEA mounting interface

Model | GR
---|---
**Pump type** | Helical gear pumps
**Displacement range** | HGP-GR33: 10...18 ml/rev
| HGP-GR38: 16...28 ml/rev
**Max continuous operating pressure** | 275 bar

An oil filtering system has to be placed on the pump outlet. No filter or strainer is allowed at the inlet side.
## Order Code

<table>
<thead>
<tr>
<th>1</th>
<th>Series name</th>
<th>EHP Electro Hydraulic Pump</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Hydraulic power (max. power in kW)</td>
<td>010 10 kW (as an example)</td>
</tr>
<tr>
<td>3</td>
<td>Pump type (fixed displacement only)</td>
<td>V Vane (standard), A Axial piston (on request), H Helical gear pump (esteering), B Bent axis (on request), G Gear (on request)</td>
</tr>
<tr>
<td>4</td>
<td>Hydraulic pressure (max. pressure in bar)</td>
<td>270 270 bar (as an example)</td>
</tr>
<tr>
<td>5</td>
<td>Hydraulic flow (max. flow in l/min)</td>
<td>030 30 l/min (as an example)</td>
</tr>
<tr>
<td>6</td>
<td>Motor type</td>
<td>IM Induction Motor, PM Permanent magnet Motor (standard)</td>
</tr>
<tr>
<td>7</td>
<td>Battery Voltage (nominal voltage in VDC)</td>
<td>048 48 VDC (as an example)</td>
</tr>
<tr>
<td>8</td>
<td>Unique Designation</td>
<td>( \text{angular position of the input hole} = B ) (please see drawing - vane pump side)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>xx1</th>
<th>xx2</th>
<th>xx3</th>
<th>xx4</th>
</tr>
</thead>
<tbody>
<tr>
<td>GVM142</td>
<td>GVM210</td>
<td>SAE A</td>
<td>SAE A/B</td>
</tr>
<tr>
<td>xx1</td>
<td>xx2</td>
<td>xx3</td>
<td>xx4</td>
</tr>
<tr>
<td>0° trigo</td>
<td>45° trigo</td>
<td>0° trigo</td>
<td></td>
</tr>
<tr>
<td>90° trigo</td>
<td>135° trigo</td>
<td>90° trigo</td>
<td></td>
</tr>
<tr>
<td>180° trigo</td>
<td>225° trigo</td>
<td>180° trigo</td>
<td></td>
</tr>
<tr>
<td>270° trigo</td>
<td>315° trigo</td>
<td>270° trigo</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
The three needed parameters determining the EHP characteristics are appearing in the product code:
Pressure (4) Flow (5) Voltage (7)
Motor Pumps - MP

On request Parker is able to provide an Electro Hydraulic Pump without the drive according to the following part number. Final performances as output pressure/flow will be under the customer’s responsibility.

Order Code

<table>
<thead>
<tr>
<th>Order example</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP</td>
<td>MP</td>
<td>142</td>
<td>100</td>
<td>ZQ</td>
<td>W</td>
<td>A</td>
<td>-</td>
<td>T7ASE11</td>
</tr>
</tbody>
</table>

1 **Series**
   MP Motor Pump

2 **Frame**
   142 Outer diameter of GVM motor in millimeter

3 **Stack**
   100 Number of magnetic segments in millimeter.
   See configurable for frame-specific lengths

4 **Winding**
   ZQ Winding

5 **Cooling**
   W Water cooling tubes populated
   N Natural convection

6 **Feedback**
   A Resolver for HV drives
   L Sin/Cos for LV drives

7 **Pump type**
   T7ASE11 Based on type and displacement

8 **Options**
   001 Cf EHP
Parker’s Motion & Control Technologies

At Parker, we’re guided by a relentless drive to help our customers become more productive and achieve higher levels of profitability by engineering the best systems for their requirements. It means looking at customer applications from many angles to find new ways to create value. Whatever the motion and control technology need, Parker has the experience, breadth of product and global reach to consistently deliver. No company knows more about motion and control technology than Parker. For further information, please call 00800 27 27 5374

Aerospace

Key Markets:
- Aftermarket services
- Commercial transports
- Engines
- General & business aviation
- Helicopters
- Launch vehicles
- Military aircraft
- Missiles
- Power generation
- Regional transports
- Unmanned aerial vehicles

Key Products:
- Control systems & actuators
- Engine systems & components
- Fuel conveyance systems & components
- Fluid metering, delivery & abrasion devices
- Fuel systems & components
- Fuel tank lining systems
- Hydraulic systems & components
- Thermal management
- Wheels & brakes

Climate Control

Key Markets:
- Agriculture
- Air conditioning
- Construction/Machinery
- Food & beverage
- Industrial machinery
- Life sciences
- Oil & gas
- Precision cooling
- Process
- Refrigeration
- Transportation

Key Products:
- Accumulators
- Advanced actuators
- CO2 controls
- Electronic controllers
- Filter devices
- Hand holding valves
- Heat exchangers
- Hose & fittings
- Pressure regulating valves
- Refrigerant distributors
- Safety relief valves
- Solar pumps
- Soil test devices
- Thermostatic expansion valves

Electromechanical

Key Markets:
- Aerospace
- Factory automation
- Life science & medical
- Machine tools
- Packaging machinery
- Paper machinery
- Plastic machinery & converting
- Primary metals
- Semiconductor & electronics
- Textile
- Wire & cable

Key Products:
- AC/DC drives & systems
- Electric actuators, gantry robots & robots
- Electrohydraulic actuation systems
- Electromechanical actuation systems
- Human machine interface
- Linear motors
- Step motors, servo motors, drives & controls
- Structural extrusions

Filtration

Key Markets:
- Aerospace
- Food & beverage
- Industrial plant & equipment
- Life sciences
- Marine
- Oil & gas
- Power generation & renewable energy
- Process
- Transportation
- Water Purification

Key Products:
- Analytical gas generators
- Compressed air filters & dryers
- Engine oil, coolant, fuel & air filtration systems
- Fluid condition monitoring systems
- Hydraulic & lubrication filters
- Hydrogen, nitrogen & zero air generators
- Instrumentation filters
- Membrane & filter systems
- Microfiltration
- Stellite air filtration
- Water desalination & purification filters & systems

Fluid & Gas Handling

Key Markets:
- Aerial lift
- Agriculture
- Bulk chemical handling
- Construction machinery
- Food & beverage
- Fuel & gas delivery
- Industrial machinery
- Life sciences
- Marine
- Mining
- Mobile
- Oil & gas
- Renewable energy
- Transportation

Key Products:
- Check valves
- Connectors for low pressure fluid conveyance
- Deep-sea umbilicals
- Diagnostic equipment
- Hose couplings
- Industrial hose
- Misting systems & power cables
- PTFE hose & tubing
- Quick couplings
- Rubber & thermoplastic hose
- Tube fittings & adapters
- Tubing & plastic fittings

Hydraulics

Key Markets:
- Aerial lift
- Agriculture
- Alternative energy
- Construction machinery
- Factory automation
- Industrial machinery
- Machine tools
- Marine
- Material handling
- Mining
- Oil & gas
- Power generation
- Refuse vehicles
- Renewable energy
- Trucks & hydraulics
- Turf equipment

Key Products:
- Accumulators
- Cartridge valves
- Electrohydraulic actuators
- Human machine interfaces
- Housed devices
- Hydraulic cylinders
- Hydraulic motors & pumps
- Hydraulic systems
- Hydraulic valves & controls
- Hydrostatic steering
- Integrated hydraulic circuits
- Power take-offs
- Power units
- Pneumatic actuators
- Sensors

Pneumatics

Key Markets:
- Aerospace
- Conveyor & material handling
- Factory automation
- Life science & medical machine tools
- Packaging machinery
- Transportation & automotive

Key Products:
- Air preparation
- Brass fittings & valves
- Manifolds
- Pneumatic accessories
- Pneumatic actuators & grinders
- Pneumatic valves & controls
- Quick disconnects
- Rotary actuators
- Rubber & thermoplastic hose & couplings
- Structural extrusions
- Thermoplastic tubing & fittings
- Vacuum generation, cups & sensors

Process Control

Key Markets:
- Alternative fuels
- Bioprocessing/foods
- Chemical & refining
- Food & beverage
- Marine & shipbuilding
- Medical & dental
- Microelectronics
- Nuclear Power
- Offshore oil exploration
- Oil & gas
- Pharmaceuticals
- Power generation
- pulp & paper
- Steel
- Water/steam/water

Key Products:
- Analytical Instruments
- Analytical sample conditioning products & systems
- Chemical injection fittings & valves
- Fluoropolymer chemical delivery fittings, valves & pumps
- High purity gas delivery fittings, valves, regulators & digital flow controllers
- Industrial mass flow meters/ controllers
- Permanent no-weld tube fittings
- Precision industrial regulators & flow controllers
- Process control double block & bleed
- Process control fittings, valves, regulators & manifolds

Sealing & Shielding

Key Markets:
- Aerospace
- Chemical processing/energy
- Consumer
- Fluid power
- General industrial
- Information technology
- Life sciences
- Microelectronics
- Military
- Oil & gas
- Power generation
- Renewable energy
- Telecommunications
- Transportation

Key Products:
- Dynamic seals
- Elasticomeric o-rings
- Electric medical instrument design & assembly
- EMI shielding
- Extracted & precision cut, fabricated elastomeric seals
- High temperature metal seals
- Honegrooves & inserted elastomeric shapes
- Medical device fabrication & assembly
- Metal & plastic retained composite seals
- Shieldeed optical windows
- Silicon tube fittings & extrusions
- Thermal management
- Vibration dampening

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