GVM310 Global Vehicle Motor

Permanent Magnet (PMAC) Motor for Mobile Systems

Parker

ENGINEERING YOUR SUCCESS.

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WARNING

This product can expose you to chemicals including nickel and nickel compounds, which are known to the State of California to cause cancer. For more information go to www.p65warnings.ca.gov

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GVM310

General Description:

High power Permanent Magnet AC motors (PMAC) offer the best solution to meet the requirements of vehicle duty performance. With a ten year legacy and thousands of units sold in the GVM series, the high power density and speed capabilities of Parker GVM motors combined with a voltage matched inverter provide the speed and torque required to achieve breakthrough performance in a variety of vehicle platforms.

The GVM310 is the latest extension to the series, and is a powerful choice for both on and off-road vehicles, engineered for traction and electro-hydraulic pumps (EHP) up to 409 kW peak power. The GVM310 provides very high efficiency, up to 2% higher versus comparable PMAC designs, enabling energy savings of up to 30% compared to induction technologies.

In addition to operating as a high-power motor, the GVM310 is a very high efficiency generator. A variety of available magnetic options allow for a wide range of voltage, speed, and torque requirements. The GVM family achieves high power density thanks to a patented liquid cooling system, which also results in a cleaner, less complex, oil-free design.

The GVM310 is an example of how Parker is providing the building blocks for vehicle electrification, developing turnkey technologies that cut time to market while reducing supply chain complexity.

Applications:

- **Traction**
- **Generators**
- **Electro-hydraulic pumps**

Markets:

- **Construction**
- **Mining**
- **Material Handling**
- **Trucks**
- **Bus**
- **Agriculture**
- **Military**

And other off-highway vehicle, autonomous vehicle, and E-Mobility markets

Overview:

- Rated power up to 228 kW (continuous)
- High power density
- Peak torque up to 1430 Nm
- Rotational speed up to 8000 rpm[1]
- Low inertia / high dynamic
- Low and high voltage options 350 VDC to 650 VDC
- Scalable torque with multiple magnetic lengths
- Multiple shaft options available

[1] For higher speeds, please review your application with our applications team.

GVM310

RELIABILITY & DURABILITY

To ensure reliability and long life under tough conditions, the GVM motors have been put through a battery of validation tests. These tests, designed to simulate the worst conditions a vehicle would be subjected to, cover mechanical, environmental, and electrical categories. The lists below include highlights of the testing. Please contact Parker regarding specific or custom validation standards.

- **Long lifetime**
- **Reduced downtime**
- **Less maintenance**
- **Subjected to rigorous environmental testing**
- **High ingress protection level available**
- **Ceramic bearings**

"[We've] tested a lot of motors in the GVM class and the Parker GVM was clearly the best of the lot"
Engineer, scientific research facility

Testing and Validation Details:

Mechanical
- Random and swept sine vibration testing to simulate worst case fatigue exposure to SAE J1455
- Shock and vibration levels exceeding SAE J1455 for unsprung mass applications.

Environmental
- Dust and sand, and gravel bombardment to SAE J1455
- Salt Spray - Fog and Immersion to SAE J1455

Electrical
- HiPot insulation test to IEC 34-1 at 2xVRMS + 1000VRMS
- Insulation resistance to ISO 6469-3
- EMC emission and immunity to IEC 34-1 (motor only)

DURABILITY/RELIABILITY

are characteristics of the GVM that make it suitable for rough environments.

QUICK FACT:
Over 135 million road miles have been logged by Parker GVM motors since 2012.

Test standards meet **SAE J1455** for Dust, Sand,Gravel Bombardment, Humidity, Salt Spray and Immersion, Operating Temps from -40° to 120°C, Crash Shock, and Vibration

EFFICIENCY

Lowering energy consumption, making the most of a battery charge, and reducing the amount of waste heat produced are design goals of any electric or hybrid vehicle project. The high efficiency of the GVM series make it a stand-out in the field of mobile duty motors.

- **Lower energy consumption for compliance with emerging energy legislations and green initiatives**
- **Up to 2% more efficient than comparable PMAC designs**
- **Operates efficiently as motor or generator for maximum energy recovery during braking and deceleration**
- **Reduced vehicle emissions for smaller CO_2 footprint**
- **Reduced battery size**
- **Extended vehicle range**
- **Lower cost of ownership over life of vehicle**
- **Reduced thermal losses allow for smaller, less expensive vehicle cooling system**
- **On electro-hydraulic systems, efficiency gains are made by allowing the use of a constant displacement pump versus variable, increasing pump efficiency**

The battery is one of the most expensive and largest components in a vehicle system, and a high efficiency motor can help optimize both battery lifetime and time between charges. This translates to more time in service and more revenue for the fleet owner.

"We've tested four different competitive products and the Parker GVM is the most efficient, and we are recommending this motor ..."

Design engineer, OEM truck manufacturer

"The GVM technology provides more value than the competition. This includes better continuous torques without oil cooling and improved efficiency at peak power."

Engineering manager, OEM bus company

EFFICIENCY

is the motor's capability to produce useful mechanical power efficiently. A more efficient motor reduces the cost to operate, runs cooler, and is better for the environment.

UP TO **2%** **MORE EFFICIENT** THAN COMPETITIVE MOTORS

GVM applications have reduced emissions by over 20,000 tons of CO_2

Parker's higher efficiency GVM means a **cost reduction of the vehicle battery** or **longer range** between charges.

POWER DENSITY

Limited mounting space and the need to pack a lot of power into close quarters requires a motor design with high power density, which is defined by the amount of power (time rate of energy transfer) per unit volume. The GVM is designed to meet these criteria, providing value to the vehicle manufacturer.

- **Reduced space claim**
- **Less weight for better performance**
- **Lighter motor can provide larger payload capacity**
- **Helps vehicle designers meet packaging and performance goals**
- **Patented cooling helps achieve vehicle performance objectives**
- **Enhanced productivity in the form of higher vehicle capacity**

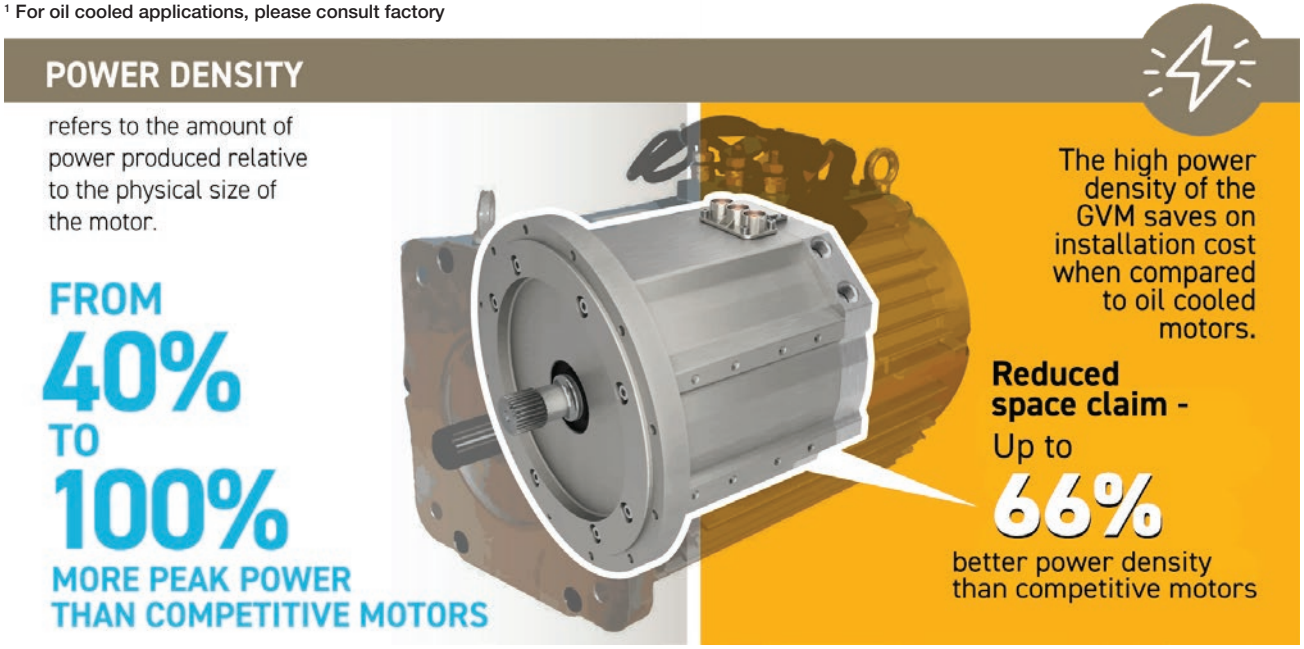
"The GVM space claim and power density allowed Parker to win the business and allow our customers to realize fuel savings. These motors have proven to be very reliable for nearly 100 million cumulative miles driven"

Hybrid vehicle system company co-founder

Cooling System

- Enables high power density
- Cooling liquid: Water/Glycol 50%[1]
- Circular stator comprising the cooling system can be inserted as a kit in any circular housing (Parker or customer)
- Eliminates the cooling jacket required in other motor technologies, saving weight and space
- Low pressure drop reduces power required to circulate coolant

[1] For oil cooled applications, please consult factory



GVM310

Performance

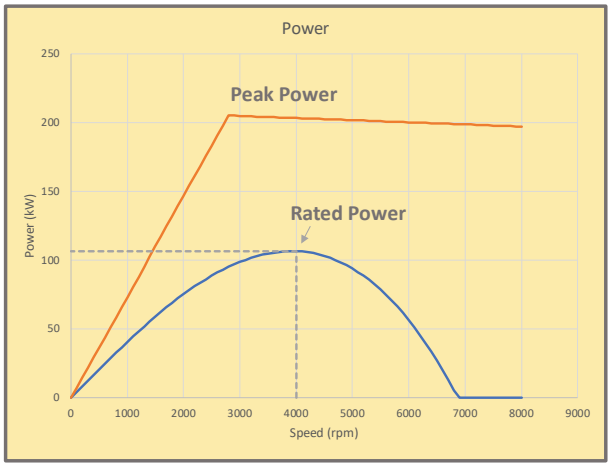
GVM310 Summarized Performance Data

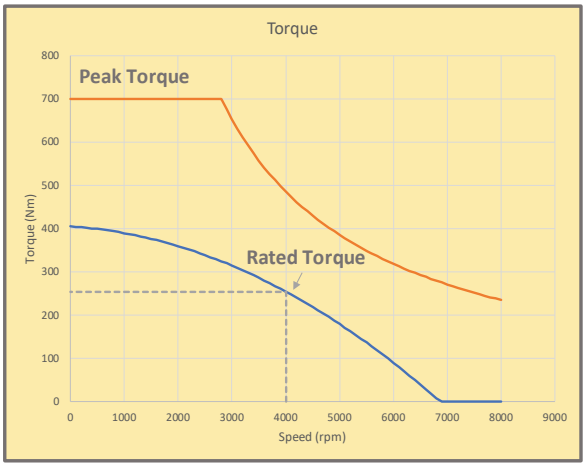
GVM Series motors are designed to meet the power requirements in a wide variety of vehicle applications. The GVM has the ability to operate at different battery voltages without loss of power.

- Up to 800 VDC
- Numerous rotor lengths
- Multiple winding configurations per length

By selecting the appropriate voltage, rotor length and winding variation, the following parameters can refined to match the vehicle's specific performance requirements:

- Peak torque
- Peak power
- Rated torque
- Rated speed
- Rated power
- Maximum speed





Motor Model Number	Battery Voltage [VDC]	Rated Torque Mn [Nm]	Rated Power Pn [kW]	Rated Current In [Arms]	Rated Speed Nn [rpm]	Peak Torque Mp [Nm]	Peak Power Pp [kW]	Peak Current Ip [Arms]	Max Speed Nmax [rpm]	Max Mechanical Speed Nmax* [rpm]	Ke [Vrms/ Krpm]
GVM310-125-BG2-W	350	302	92	241	2910	700	147	685	8000	8000	96
GVM310-125-BA1-W		222	100	266	4280	610	165	902	8000		64
GVM310-125-MW1-W		198	114	300	5500	610	185	1015	8000		58
GVM310-125-CE2-W	650	292	104	145	3390	700	170	424	5500	8000	154
GVM310-125-BT2-W		256	108	151	4040	700	205	514	6600		128
GVM310-125-NP1-W		204	117	166	5500	610	192	559	8000		106
GVM310-200-MP1-W	350	315	165	437	5010	990	241	1323	8000	8000	73
GVM310-200-MW2-W		442	124	325	2670	1140	216	984	8000		105
GVM310-200-MP2-W		419	145	378	3310	1140	281	1287	8000		81
GVM310-200-BG2-W	650	463	161	225	3310	1140	280	694	5500	8000	153
GVM310-200-NH1-W		308	159	225	4930	990	229	678	6300		134
GVM310-200-NC1-W		334	178	253	5090	990	283	828	7300		116
GVM310-250-BA1-W	350	542	138	370	2420	1240	166	906	6400	8000	132
GVM310-250-MW1-W		404	147	390	3480	1240	185	987	7100		119
GVM310-250-MP1-W		432	179	475	3960	1240	241	1320	8000		90
GVM310-250MW1-W	650	434	228	323	5010	1240	350	1022	7100	8000	119
GVM310-250NC2-W		537	177	246	3150	1430	331	814	5200		162
GVM310-250MW2-W		479	199	278	3960	1430	409	1001	6400		132

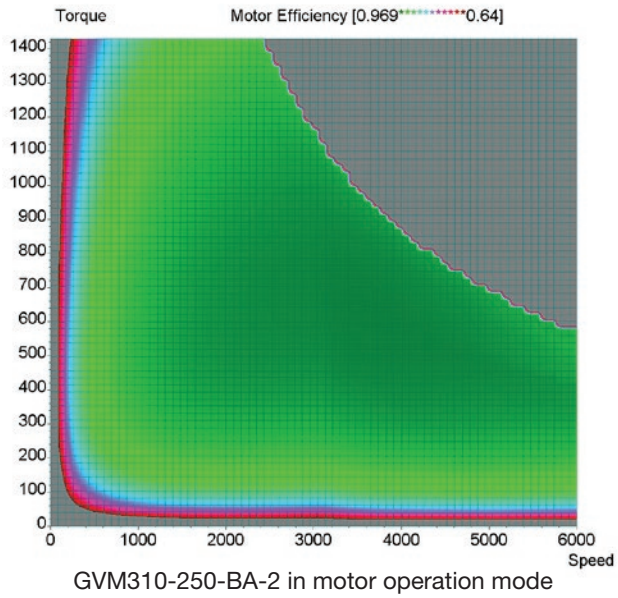
*The maximum operating speed depends on maximum BEMF accepted by the drive
Values in table represent GVM310 ratings with input cooling liquid at **65°C** (Characteristics are given for an optimal drive/motor association without any limitation coming from the drive). For alternative cooling temperatures please contact us.

Efficiency

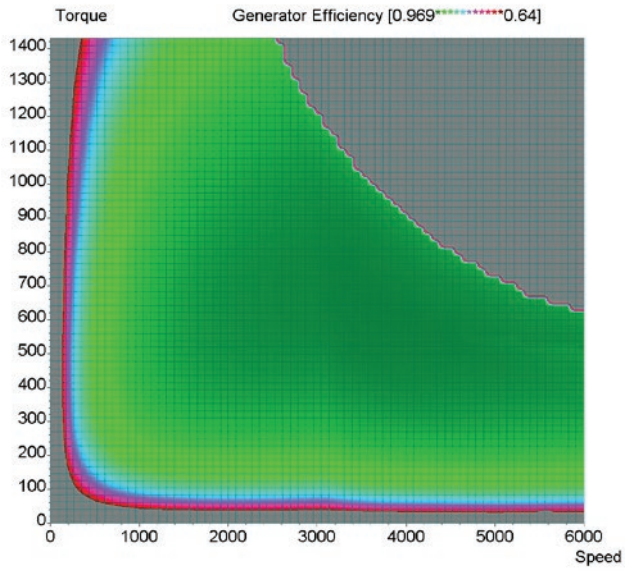
GVM Motors: An Efficient Range

Only when using the best component technology and optimal design characteristics do traction motors/ generators and controllers minimize losses both during motoring and power generation (four quadrant mode) increasing vehicle range. Variable speed system allows higher efficiency even at low speed.

Typical Efficiency Maps - Battery Voltage 650 VDC



GVM310-250-BA-2 in motor operation mode



GVM310-250-BA-2 in generator operation mode

GVK Kit Motor

Frameless kit motors can be the ideal solution for high volume machine designs that require high performance in small spaces. **Lightweighting** is an important design concept used by automotive engineers that is especially important to employ in heavy on-highway and off-highway hybrid and electric vehicle to increase range, performance, productivity and reliability. For high volume OEM applications “kit” or frameless motor can be the ideal solution to meet these lightweighting objectives. By integrating Parkers active magnetics, and patented cooling into your mechanics you can eliminate mechanical, electrical, and cooling interfaces that reduce space claim, reduce parts, and failure modes. Kit motors also allow for direct integration with a mechanical transmission device, eliminating parts that add size and complexity. Direct drive motion construction gives equipment designers the advantages of lower costs, increased reliability and improved performance. If you have an application in mind, our engineering team will be happy to discuss the particulars of a frameless design option.

- Flexibility of design by using a kit version to integrate the motor into a global system
- Available as a potted circular stator including the cooling system
- Provides a customized and integrated mechanical design
- GVK range has the same electrical characteristics as GVM range
- Easier to maintain
- Parker is able to offer support in the integration of GVM kits, please contact us

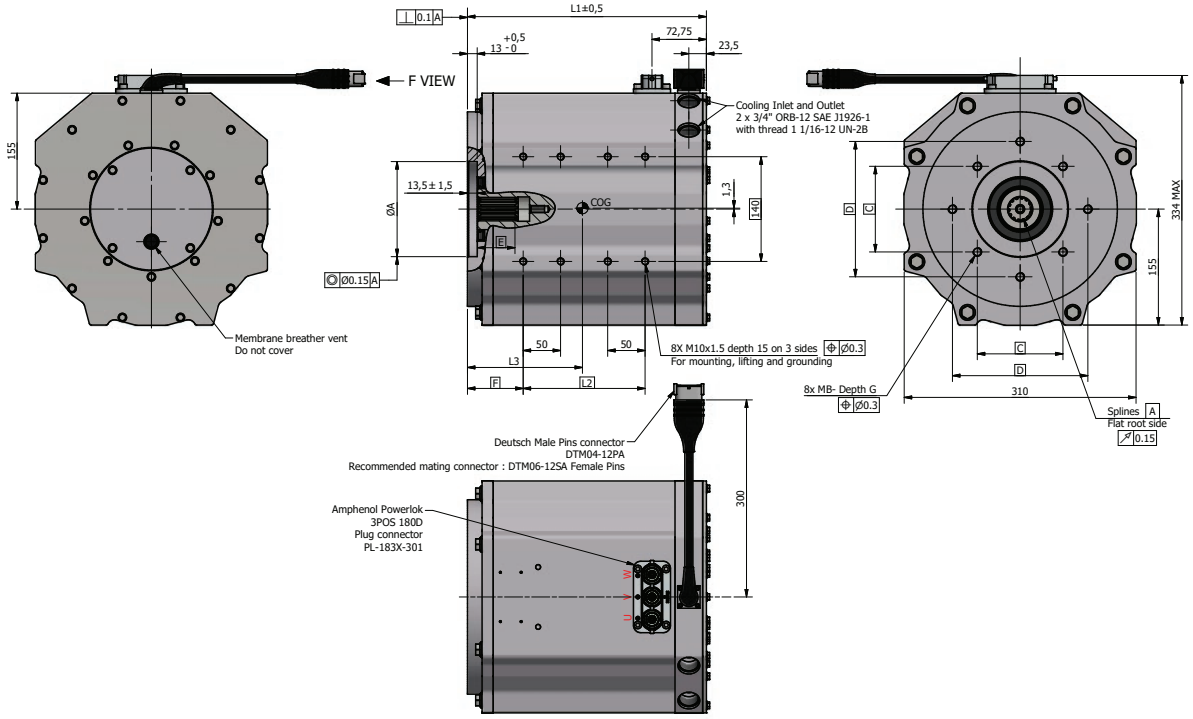
Consider a kit motor for:

- Integration into axles
- Integration into transmission
- Truck
- Bus
- Construction
- Mining

Dimensions

GVM310 / SAE Pump Mount Style

Power connector option 3 - HV 1 PowerLok™ 300A



Motor Data

Motor size	GVM310-125 (SAE C)	GVM310-200 (SAE C)	GVM310-200 (SAE D)
L1 [mm]	320	395	402
L2 [mm]	163	238	238
Weight [kg]	97	132	132

SAE Interface Data

SAE Type	A	B	C	D	E	F	S
SAE C	Ø127.15 G7	12	114.5	181	50	74.5	SAE C 14T 12/24 DP
SAE D	Ø152.55 G7	16	161.6	228.6	65	81.5	SAE D 13T 8/16 DP

Spline Interface Data

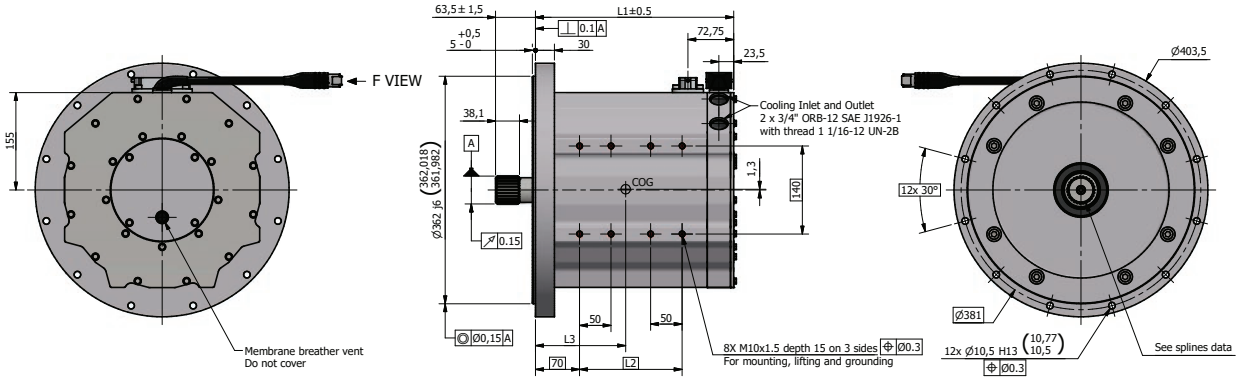
Consult factory for wet spline option

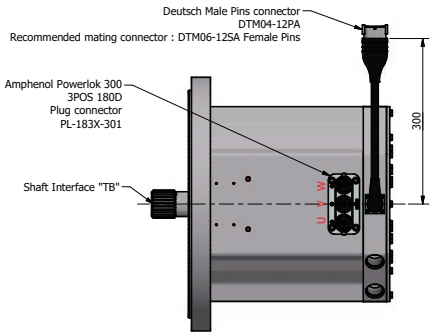
ANSI B92.1	SAE C	SAE D
Flat root side fit	Class 5	Class 6
Number of teeth	14	13
Spline Pitch	12/24	8/16
Pressure angle	30°	30°
Base diameter (Ref)	Ø25.663	Ø35.745
Pitch diameter (Ref)	Ø29.63	Ø41.275
Major diameter (Max)	Ø32.588	Ø45.669
Form diameter (Max)	Ø31.852	Ø44.452
Minor diameter (Min)	Ø27.610	Ø38.252
Circular space width (Max actual)	3.426	5.095
Circular space width (Min effective)	3.325	4.986

Dimensions

GVM310 / Traction Mount (SAE 4)

Power connector option 3 - HV 1 PowerLok™ 300A





Motor Data

Motor size	GVM310-125	GVM310-200
L1 [mm]	315	390
L2 [mm]	163	238
Weight [kg]	100	134

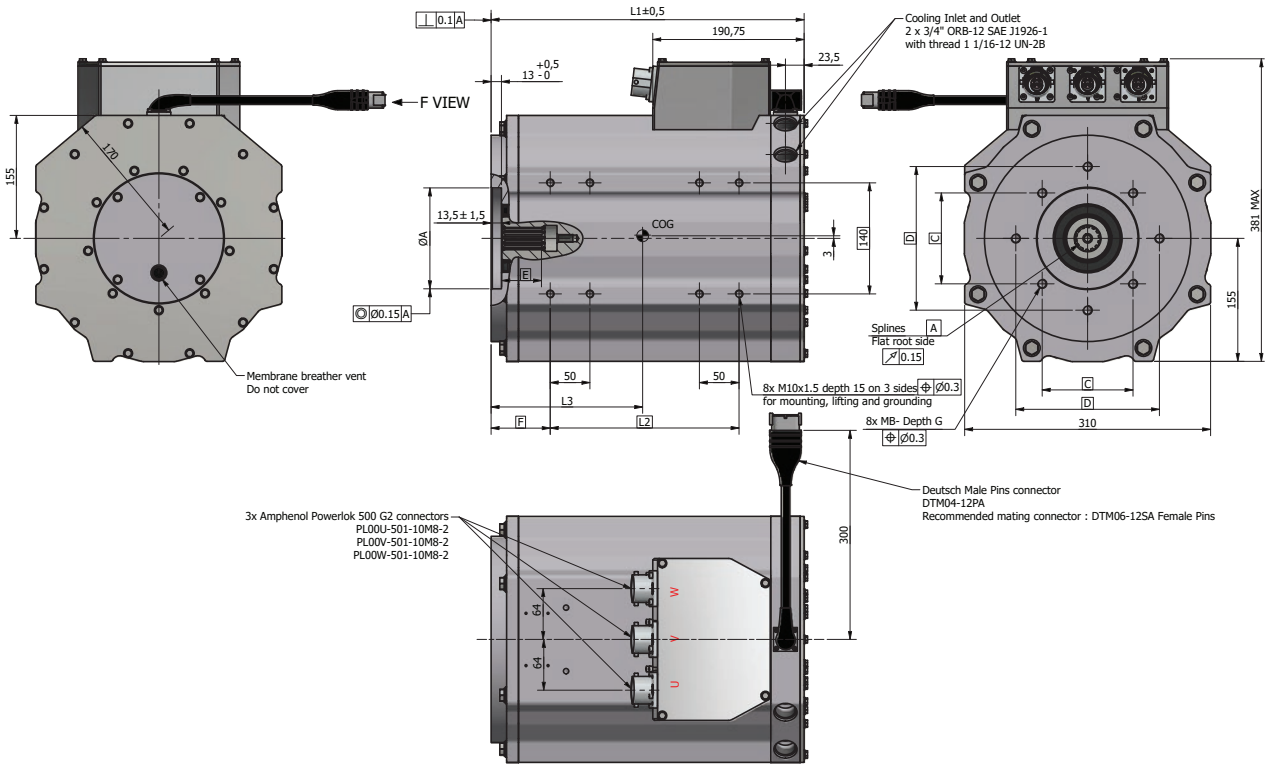
Spline Interface Data

ANSI B92.1	Involute
Flat root side fit	Class 5
Number of teeth	27
Spline Pitch	16/32
Pressure angle	30°
Base diameter (Ref)	Ø37.12
Pitch diameter (Ref)	Ø42.863
Major diameter	Ø44.45/Ø44.32
Form diameter (Max)	Ø41.17
Minor diameter	Ø40.36
Circular tooth thickness (Max effective)	2.456
Circular tooth thickness (Min actual)	2.421
Pin diameter	3.048
Measurement over pins (Ref)	Ø47.460/Ø47.407

GVM310

GVM310 / SAE Pump Mount Style

Power connector option 4 - HV 3 PowerLok™ 500A



Motor Data

Motor size	GVM310-200 (SAE C)	GVM310-200 (SAE D)	GVM310-250 (SAE D)
L1 [mm]	395	402	452
L2 [mm]	238	238	288
Weight [kg]	132	132	157

SAE Interface Data

SAE Type	A	B	C	D	E	F	S
SAE C	Ø127.15 G7	12	114.5	181	50	74.5	SAE C 14T 12/24 DP
SAE D	Ø152.55 G7	16	161.6	228.6	65	81.5	SAE D 13T 8/16 DP

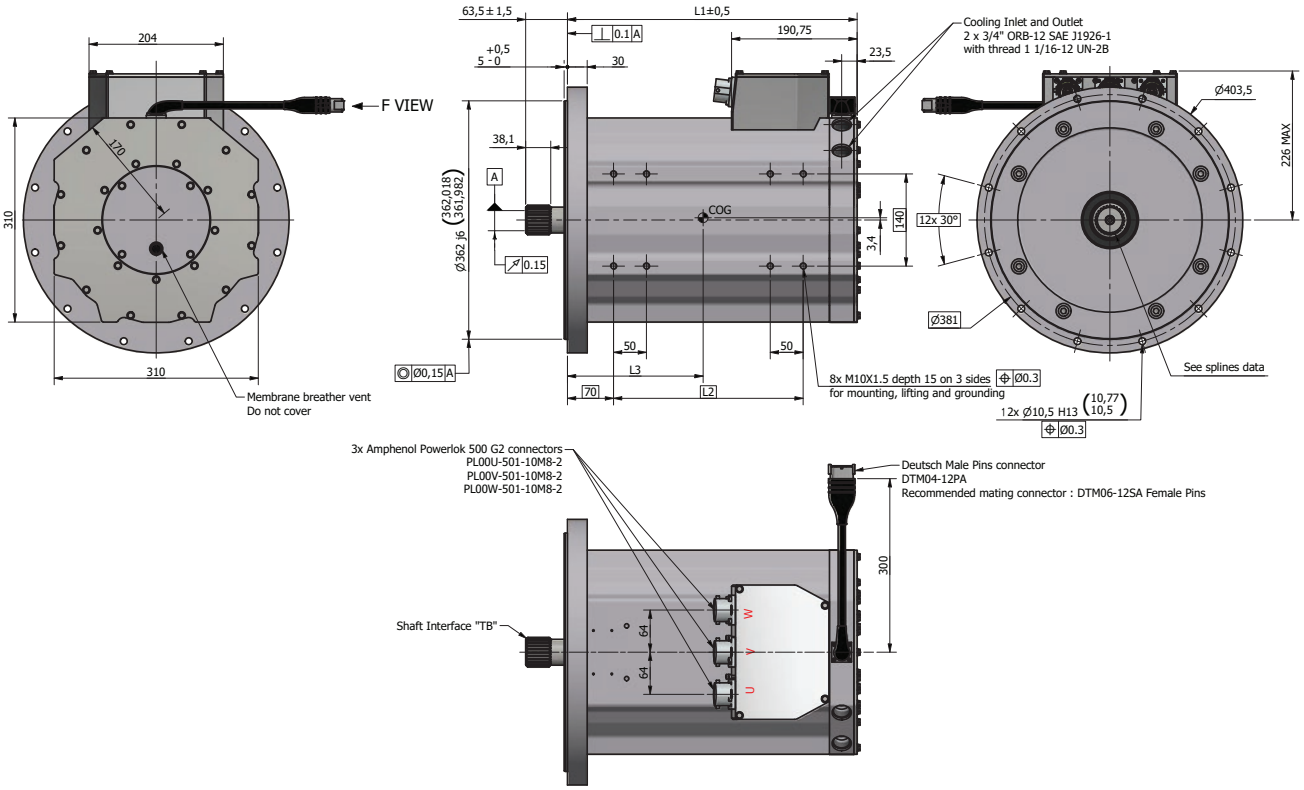
Consult factory for wet spline option

Spline Interface Data

ANSI B92.1	SAE C	SAE D
Flat root side fit	Class 5	Class 6
Number of teeth	14	13
Spline Pitch	12/24	8/16
Pressure angle	30°	30°
Base diameter (Ref)	Ø25.663	Ø35.745
Pitch diameter (Ref)	Ø29.63	Ø41.275
Major diameter (Max)	Ø32.588	Ø45.669
Form diameter (Max)	Ø31.852	Ø44.452
Minor diameter (Min)	Ø27.610	Ø38.252
Circular space width (Max actual)	3.426	5.095
Circular space width (Min effective)	3.325	4.986

GVM310 / Traction Mount (SAE 4)

Power connector option 4 - HV 3 PowerLok™ 500A



Motor Data

Motor size	GVM310-200	GVM310-250
L1 [mm]	390	440
L2 [mm]	238	288
Weight [kg]	135	158

Spline Interface Data

ANSI B92.1	Involute
Flat root side fit	Class 5
Number of teeth	27
Spline Pitch	16/32
Pressure angle	30°
Base diameter (Ref)	Ø37.12
Pitch diameter (Ref)	Ø42.863
Major diameter	Ø44.45/Ø44.32
Form diameter (Max)	Ø41.17
Minor diameter	Ø40.36
Circular tooth thickness (Max effective)	2.456
Circular tooth thickness (Min actual)	2.421
Pin diameter	3.048
Measurement over pins (Ref)	Ø47.460/Ø47.407

GVM Cable Accessories

Please consult factory for power and feedback cable options compatible with the GVI inverter.

GVM Fittings

To complete your installation some additional components like hose fittings, connectors, and hoses may be required. While we do not provide these items, your local Parker hose distributor can assist. Find one on www.parker.com or call (800) C-Parker.

Order Code

	1	2	3	4	5	6	7	8	9	10
Order example	**GVM**	**310**	**200**	**BA1**	**W**	**R**	**A**	**3**	**1**	**PD**

1	**Motor series**	
	GVM	Global Vehicle Motor
	GVK[1]	Global Vehicle Kit Motor
2	**Frame size (outer width)**	
	310	310 mm
3	**Stack length**	
	125	See chapter "Technical Characteristics"
	200	
	250	
4	**Magnetics option**	
	....	See motor tables
5	**Cooling system**	
	W	Liquid cooling (please contact us for flow & cooling temperature data)
6	**Feedback**	
	R	Brushless Resolver
7	**Thermal switch**	
	A	PT1000 and PTC

8	**Power Termination**	
	3	HV 1 PowerLok™ 300A PL083X-301
	4	HV 3 PowerLok™ 500A PL00X-500
	5[1]	HV 2 PowerLok™ 300A PL083X-301
9	**Feedback Termination**	
	1	12 male pin pigtail Deutsch DTM04-12PA
10	**Output Shaft**	
	PC	SAE C
	PD	SAE D
	TB	Traction
	WC[1]	Wet Spline SAE C
	WD[1]	Wet Spline SAE D

[1] Available on request. Please consult factory for details.

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