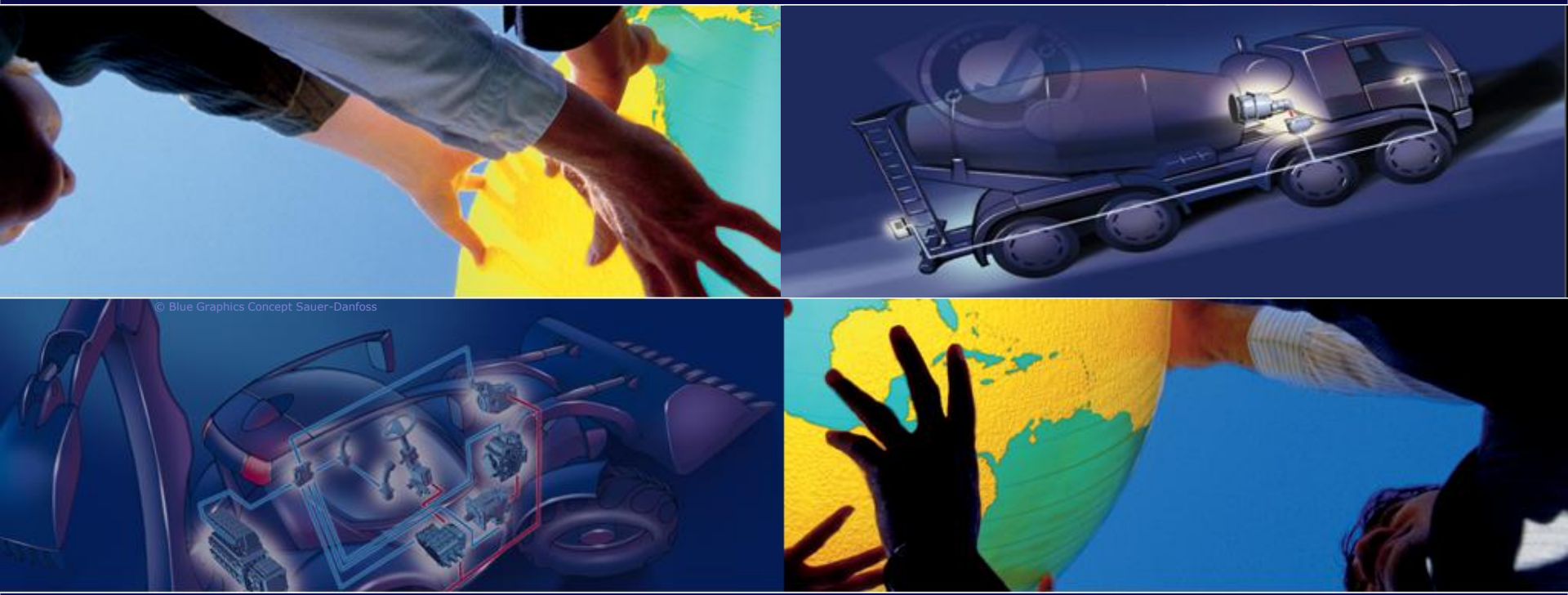
VMP Orbital Motors



September 2012

SAUER DANFOSS

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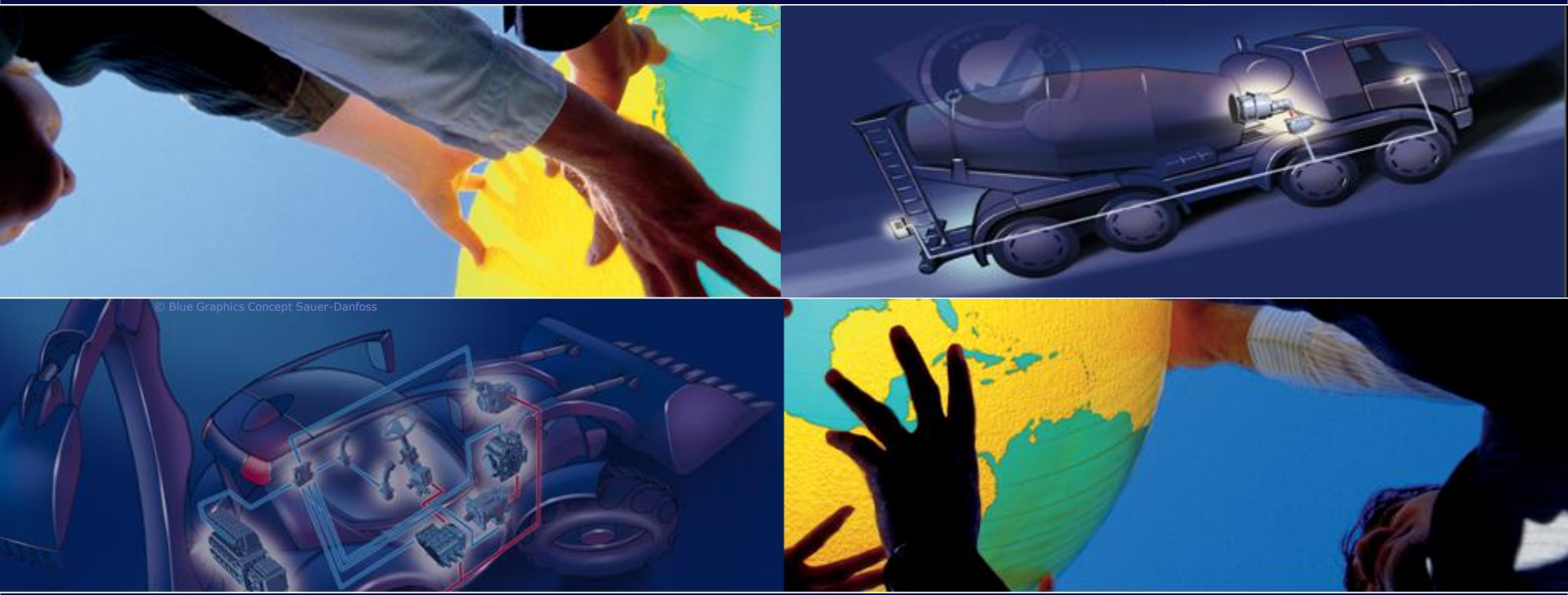
- Introduction
- Market Trends
- Product
- Unique Product Features and Benefits
- Summary

VMP Orbital Motors



Introduction, Market Trends

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Orbital motor market trends

- Competition on small motors is intensifying with more players in the market
- Foreign and Chinese manufacturers are popping up in the market with price competitive products
- Performance and Quality level of orbital motors in the market are very different among the various suppliers
- Customers need to carefully select the right product for each specific application in order to balance cost and performance.
- Compromising on quality is not an option!

Introduction

By launching the VMP, Sauer-Danfoss is introducing the first Orbital Motor of a new Series, in order to meet the demands for motors that have the right duty cycle and efficiency capabilities for a given function.

Sauer-Danfoss now has 3 Orbital Motor Series:

- T-Series: The Highest Torque
- O-Series: The Flexible Choice
- V-Series: The Core Solution

NEW VMP MOTOR

See more information about the series on the next slides.

VMP Orbital Motors

T-Series – The Highest Torque

- Leading performance with a long lifetime makes light work of the heaviest duties.
- Offering pressure capability up to 350 bar (5076 psi) and high starting torque, the T-Series is the energy-efficient choice for the toughest working environments.

Typical applications	***Products***
	

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VMP Orbital Motors

O-Series – The Flexible Choice

- The O-Series is flexible beyond comparison.
- Delivering premium power across the board, these motors cover small to large, medium to heavy-duty needs with pressure capability up to 275 bar (3990 psi).
- Robust, reliable and designed to fulfill the latest emissions standards.

Typical applications

Products

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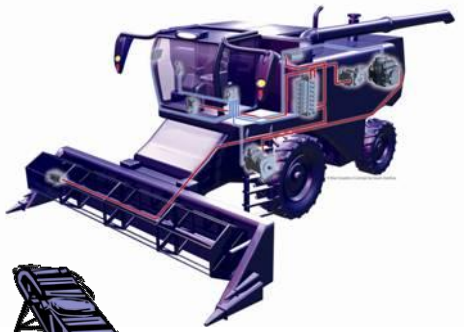
VMP Orbital Motors

V-Series – The Core Solution

- The V-Series is your quality benchmark in the medium duty market.
- Based on proven technology, these reliable motors will reduce your overall system costs while adding value to your machine.
- Perfect for many tasks.

Typical applications



Products

VMP and more coming….

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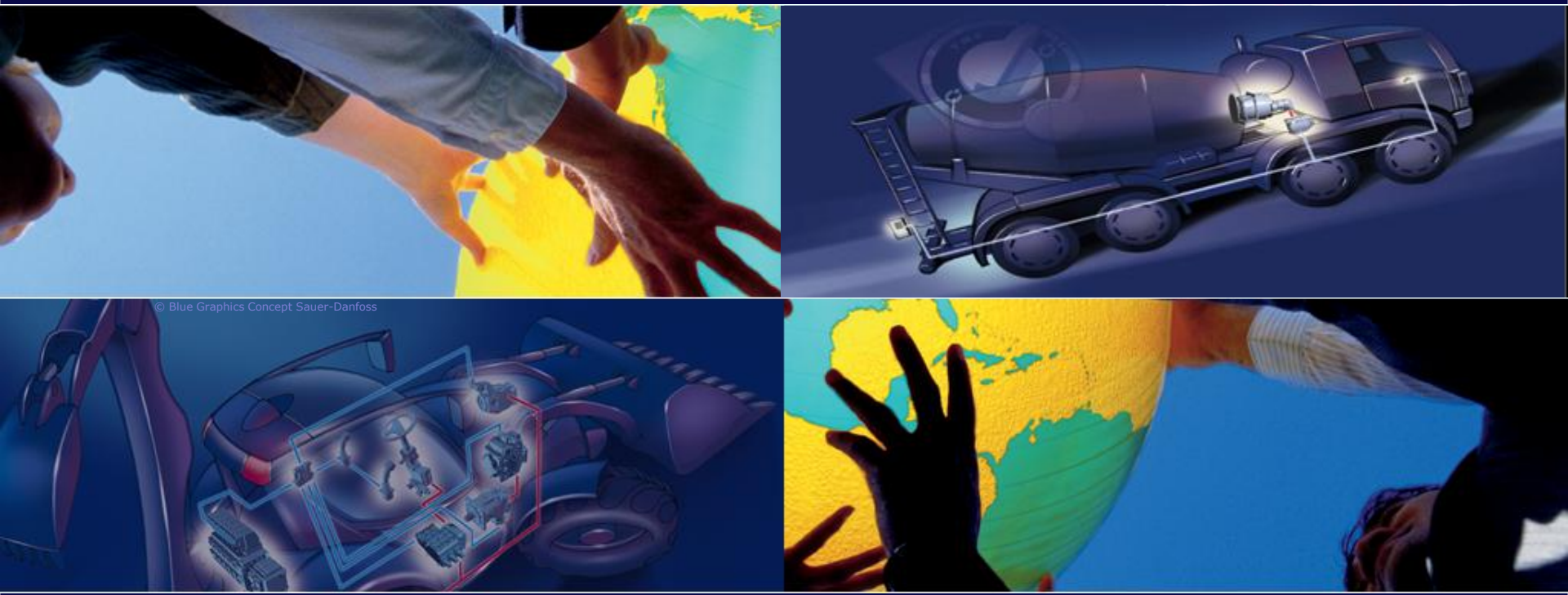
VMP Orbital Motors



Product Information, Features & Benefits

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VMP Orbital Motors

Product Information

- Designed in Denmark
- Assembled at Sauer-Danfoss Plant in Shanghai

Displacement range:	50 to 315 cc
Max intermit pressure:	140 bar 2030 psi
Max intermit inlet pressure:	160 bar 2320 psi
Max intermit flow:	75 l/min 37 gal/min
Bearing capacity:	>4600 N >1034 lbf.

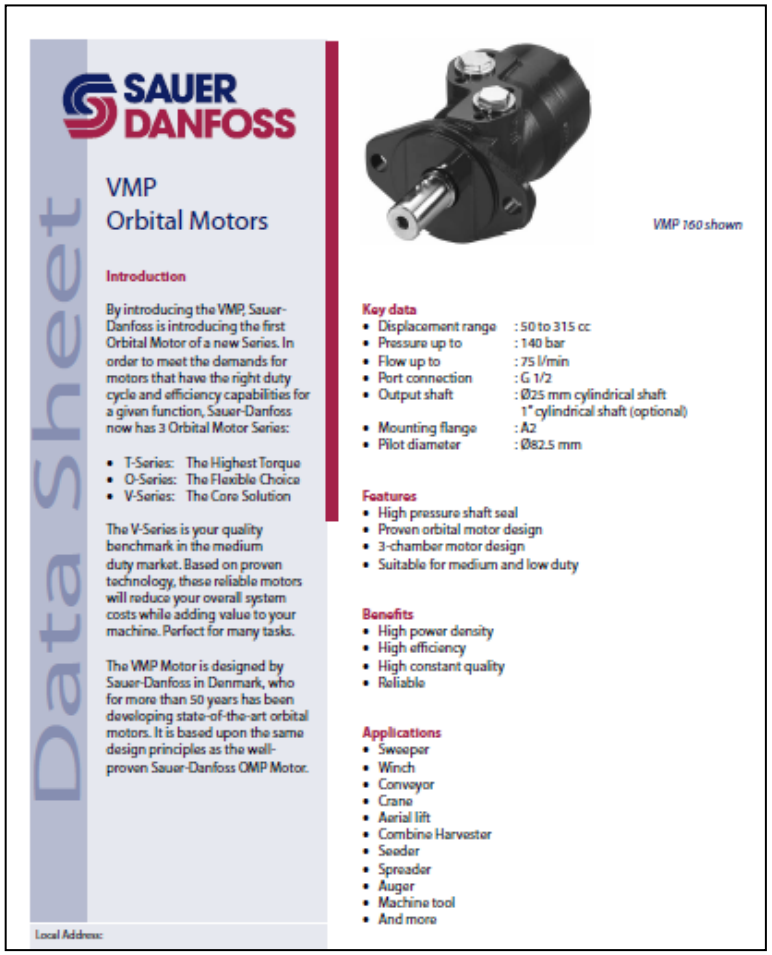
VMP Orbital Motors

Product Information

Please see the technical data in the enclosed data sheet.

Datasheet English

Datasheet Chinese



Data Sheet

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VMP
Orbital Motors

Introduction

By introducing the VMP, Sauer-Danfoss is introducing the first Orbital Motor of a new Series. In order to meet the demands for motors that have the right duty cycle and efficiency capabilities for a given function, Sauer-Danfoss now has 3 Orbital Motor Series:

- T-Series: The Highest Torque
- O-Series: The Flexible Choice
- V-Series: The Core Solution

The V-Series is your quality benchmark in the medium duty market. Based on proven technology, these reliable motors will reduce your overall system costs while adding value to your machine. Perfect for many tasks.

The VMP Motor is designed by Sauer-Danfoss in Denmark, who for more than 50 years has been developing state-of-the-art orbital motors. It is based upon the same design principles as the well-proven Sauer-Danfoss OMP Motor.

Local Address:

VMP 160 shown

Key data

- Displacement range : 50 to 315 cc
- Pressure up to : 140 bar
- Flow up to : 75 l/min
- Port connection : G 1/2
- Output shaft : Ø25 mm cylindrical shaft
  1" cylindrical shaft (optional)
- Mounting flange : A2
- Pilot diameter : Ø82.5 mm

Features

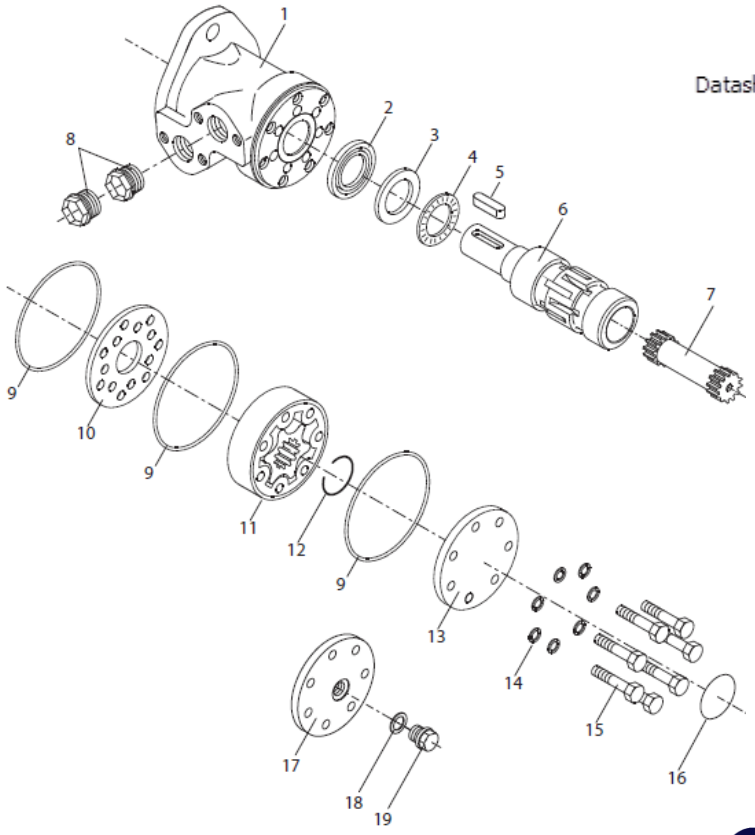
- High pressure shaft seal
- Proven orbital motor design
- 3-chamber motor design
- Suitable for medium and low duty

Benefits

- High power density
- High efficiency
- High constant quality
- Reliable

Applications

- Sweeper
- Winch
- Conveyor
- Crane
- Aerial lift
- Combine Harvester
- Seeder
- Spreader
- Auger
- Machine tool
- And more



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VMP Orbital Motors

Selected small motors

Sweeper motor

Winch motor

Propel motor

Price

Performance/ Features

VMP

Medium Performance
Medium int. Δp: 140 bar
2030 psi
Med. efficiency
Med. durability
Med. radial load

Standard options

High pressure shaft seal

High consistent Quality target <500 ppm

Consistent delivery

OMP

High Performance
High int. Δp: 175 bar
2540 psi
High efficiency
High durability
High radial load

Special features (Wheel, Corrosion protection..)

High pressure shaft seal

High consistent Quality target <500 ppm

Consistent delivery

OMR

High Performance
High int. Δp: 200 bar
2900 psi
High efficiency
High durability
High radial load

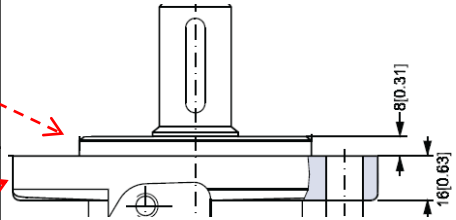
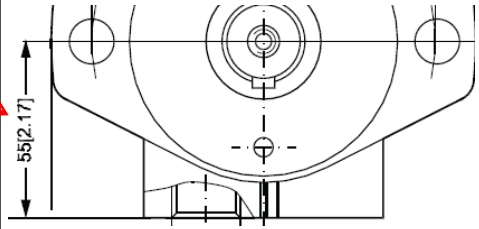
Special features (Wheel, corrosion protection, brakes…)

High pressure shaft seal

High consistent Quality target <500 ppm

Consistent delivery

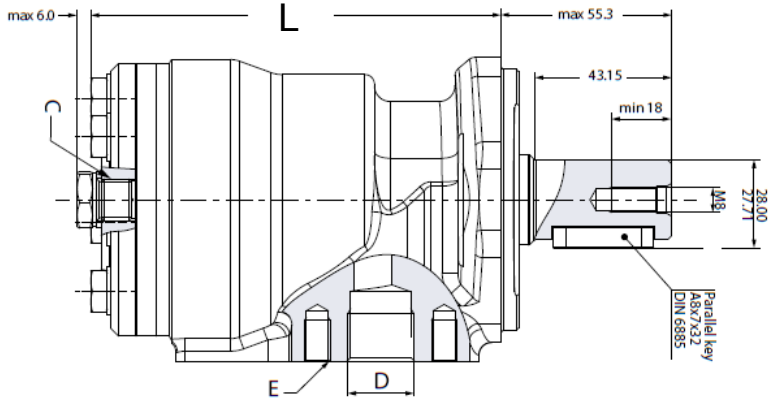
VMP vs. OMP – Dimension

Changed	Drawing / description	VMP	OMP
Design			
Pilot flange height		5.5 mm (0.22 inch) (SAE standard demand < 6,4 mm / ¼ inch)	European 8 mm (0.31 inch) American 2.8 mm (1.10 inch)
Mounting flange thickness		12 mm (0.47 inch)	European 16 mm (0.63 inch) American 22 mm (0.87 inch)
Port flange height		51 mm (2.01 inch)	55 mm (2.17 inch)

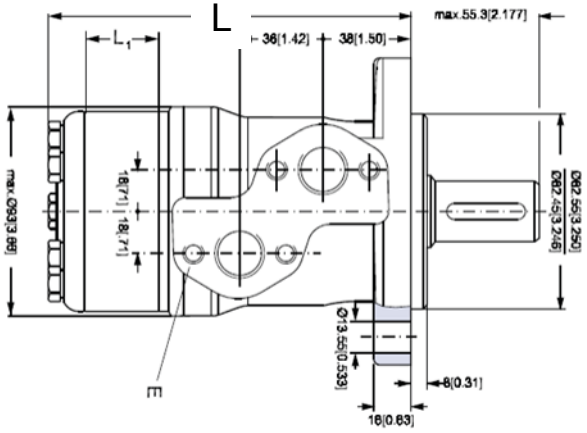
VMP Orbital Motors

VMP vs. OMP – Dimension

VMP



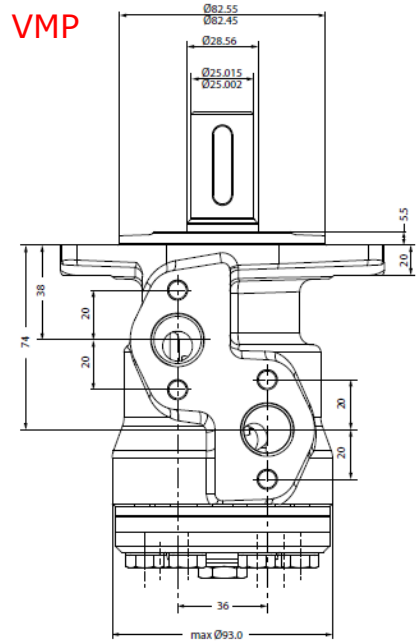
OMP



Displacement cc/rev	Max. L (mm)	
	VMP	OMP
50	132.0	132.0
80	136.0	136.0
100	138.5	138.5
125	142.0	142.0
160	146.5	146.5
200	151.5	151.5
250	158.0	158.0
315	166.5	166.5

VMP vs. OMP – Comparison

VMP



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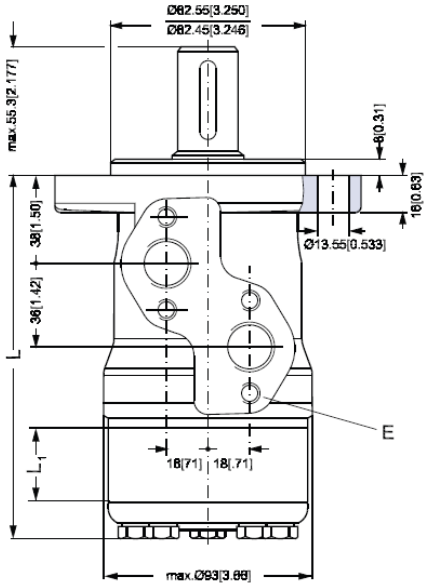
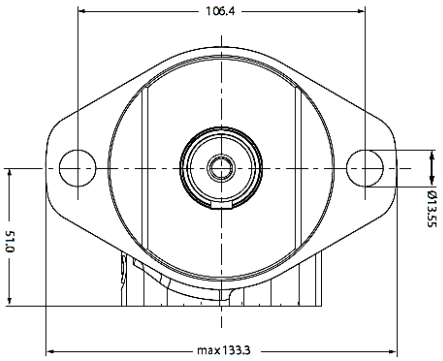
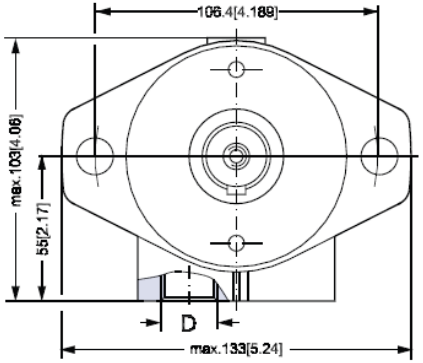






The VMP Motor

- Is designed conservatively like OMP
- has the same length as OMP
- weight is app 700 gram (1.54 lb) lighter than a corresponding OMP

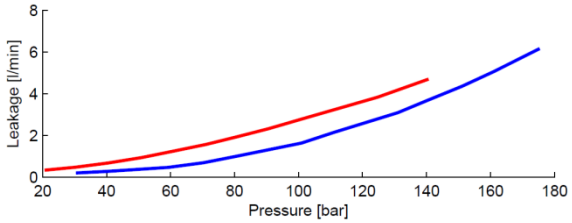
VMP vs. OMP – Pressure & Flow Ratings

Displacement (cm^3)			50	80	100	125	160	200	250	315
Pressure Drop (Bar)	Cont.	VMP	125				120	115	105	95
		OMP	140							120
	Int.	VMP	140				130			
		OMP	175							160
Flow (l/min)	Cont.	VMP	60							
		OMP	60							
	Int.	VMP	75							
		OMP	75							

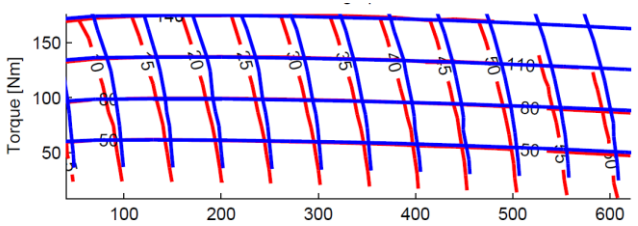
VMP vs. OMP - Efficiency

The below curves compare the VMP medium efficiency motor with the OMP high efficiency motor.

VMP has a slightly higher Internal Leakage



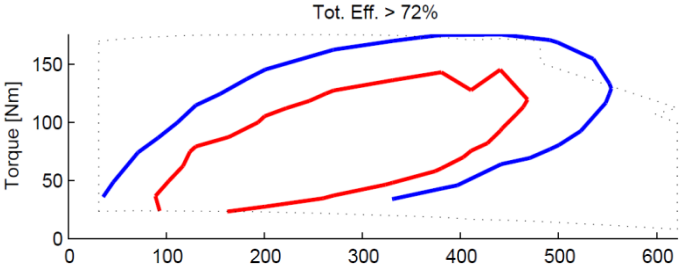
The higher VMP internal leakage result in a lower speed at a given oil flow, especially at higher pressure



The VMP provides the same total efficiency as OMP in the area:

Speed: 100 - 450 rpm

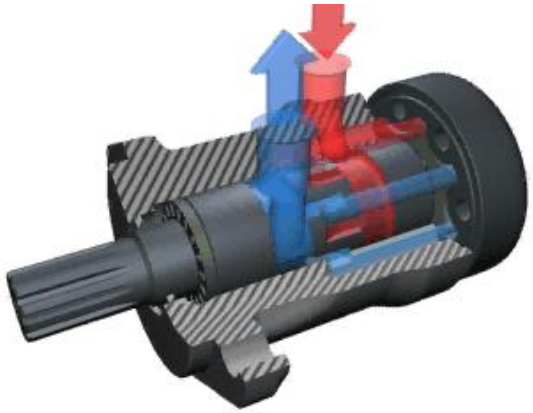
Torque: 25 - 140 Nm (18,43 – 103,26 lbf ft)



Product Information

The VMP motor is based upon the same design principles as the well-proven Sauer-Danfoss OMP motor. It means:

- Based on 50 years experience and know how, Sauer-Danfoss BA Motor has designed this optimized motor.
- The proven 3-chamber spool valve motor principle gives you:
  - Same performance clockwise and counter-clockwise
  - Can use a drain line if necessary
  - Few parts => lower weight than 2-chamber motor

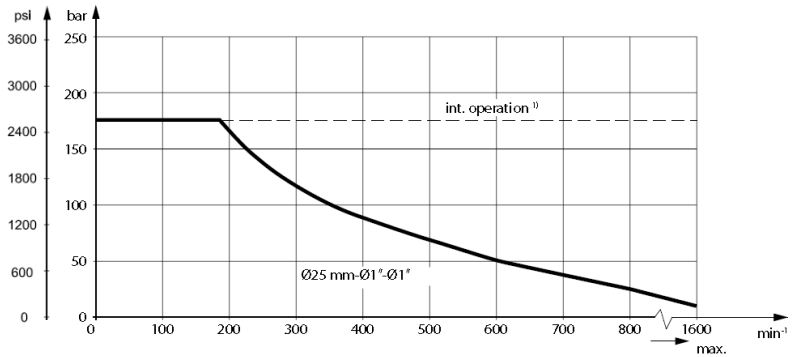


Chambers	2 Chamber motor	3 Chamber motor
Chamber 1	A port	A port
Chamber 2	B port and shaft seal	B port
Chamber 3		Shaft seal

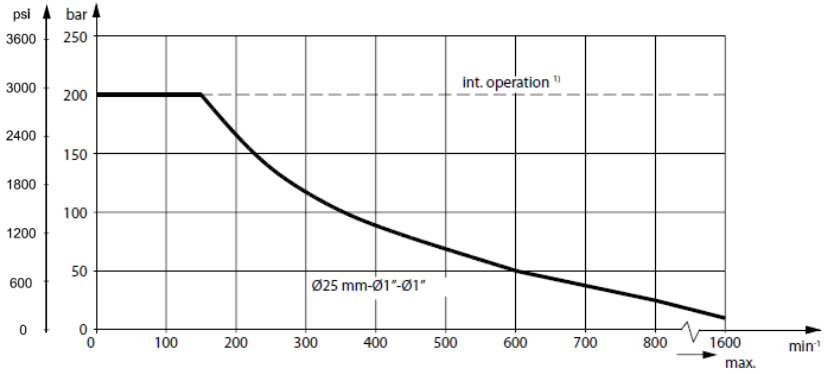
VMP vs. OMP – Permissible Shaft Seal Pressure

As standard, VMP and OMP are both mounted with High Pressure Shaft Seal

VMP – with new shaft seal



OMP

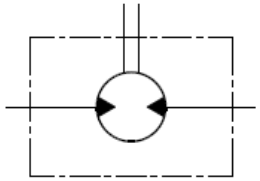


When to select with or without drain connection

Motor without drain line connection

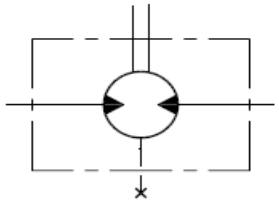
The shaft seal pressure equals the average of input pressure and return pressure.

$$P_{seal} = \frac{P_{in} + P_{return}}{2}$$



Motor with drain line connection

The shaft seal pressure equals the pressure in the drain line.



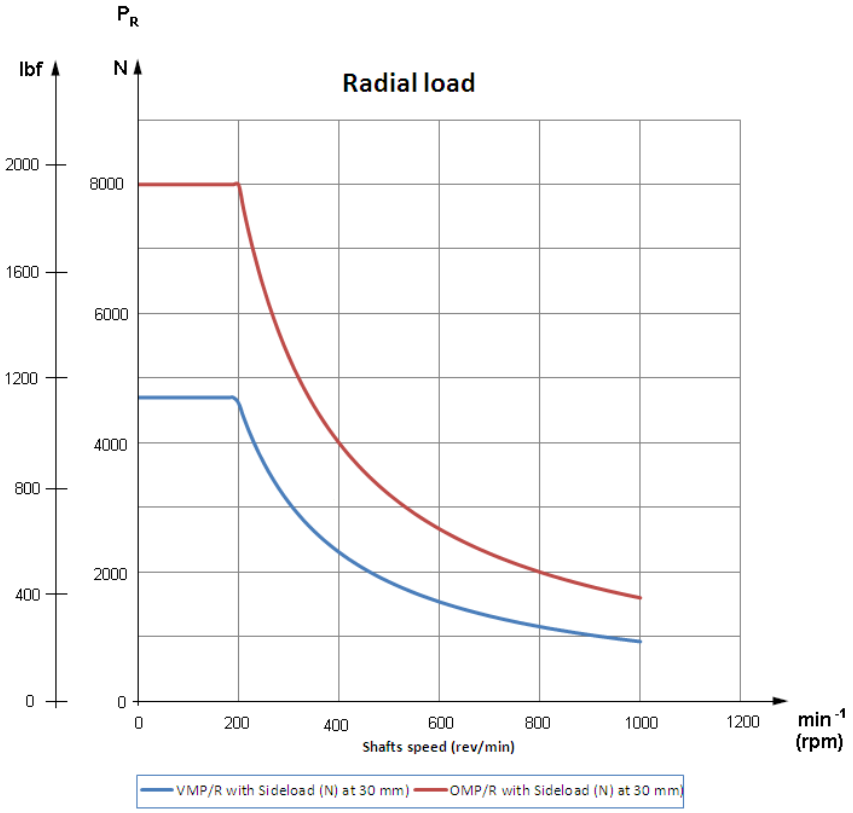
VMP vs. OMP - Permissible Shaft Load

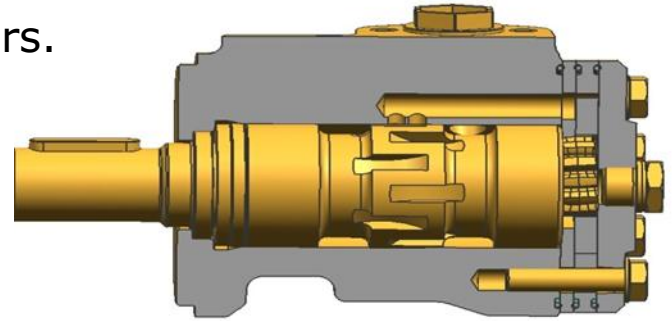
Below is a comparison between the OMP medium and the VMP high permissible radial load.

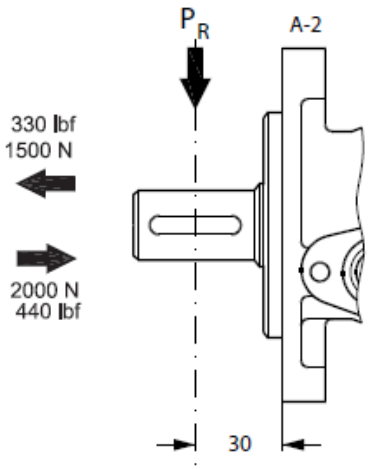
The permissible axial load is the same for both motors.

OMP

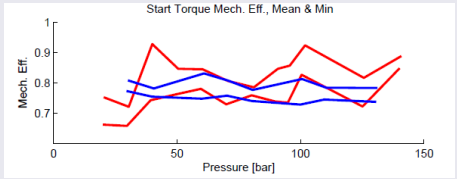
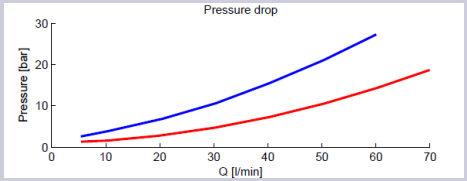
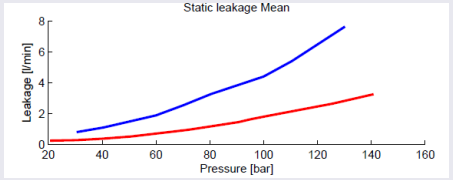
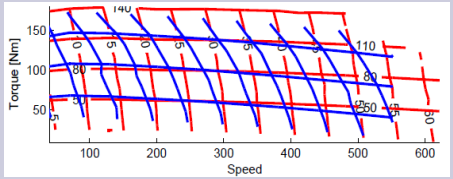
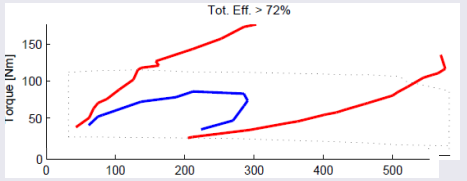
VMP







VMP vs. China Motor Manufacture A

VMP has a higher starting torque than competitor A	
VMP has a lower pressure drop in the motor than competitor A	
VMP has a lower leakage in the motor than competitor A	
The VMP lower leakage and pressure drop mean a higher speed at a given oil flow and a higher torque at a given pressure drop	
The VMP covers a higher functional area with a given efficiency.	

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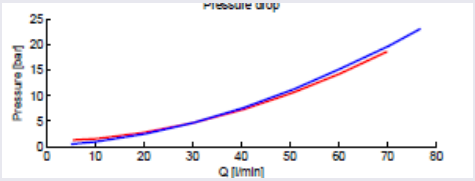
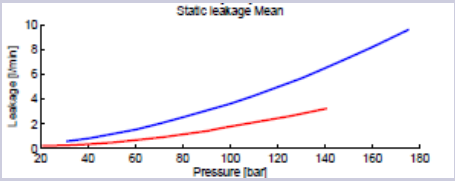
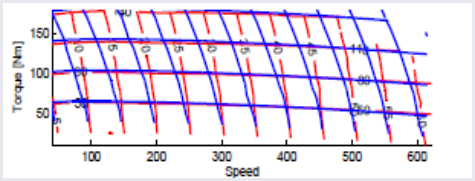
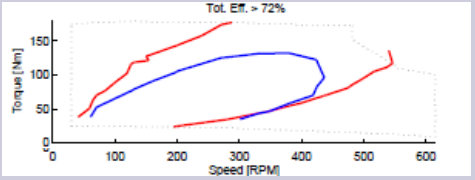
VMP vs. China Motor Manufacture B

VMP has the same pressure drop in the motor than competitor B	
VMP has a lower leakage in the motor than competitor B	
The VMP lower leakage means a higher speed at a given oil flow.	
The VMP covers a higher functional area with a given efficiency.	

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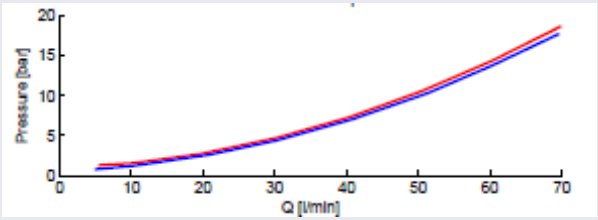
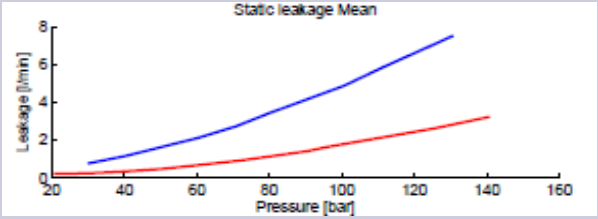
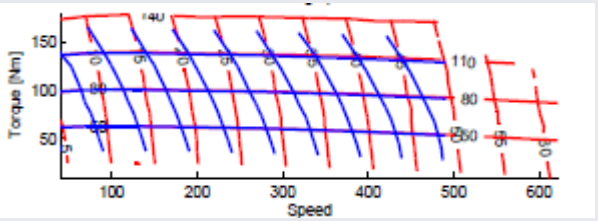
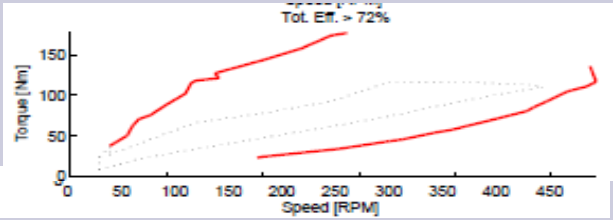
VMP Orbital Motors

VMP vs. China Motor Manufacture C

VMP has the same pressure drop in the motor than competitor C	
VMP has a lower leakage in the motor than competitor C	
The VMP lower leakage means a higher speed at a given oil flow.	
The VMP covers a higher functional area with a given efficiency.	

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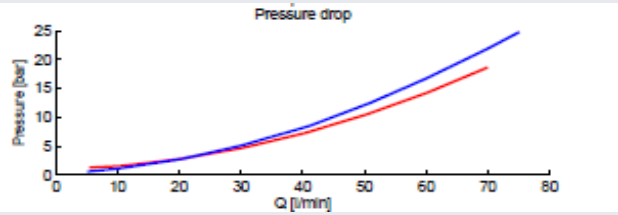
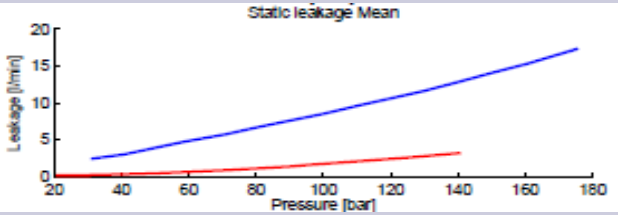
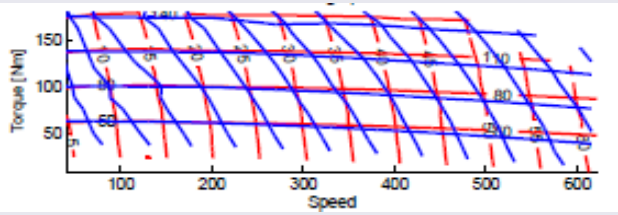
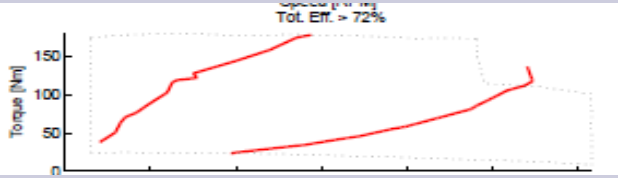
VMP Orbital Motors

VMP vs. China Motor Manufacture D

VMP has a lower pressure drop in the motor than competitor D	
VMP has a lower leakage in the motor than competitor D	
The VMP lower leakage and pressure drop mean a higher speed at a given oil flow and a higher torque at a given pressure drop	
The VMP covers a higher functional area with a given efficiency.	

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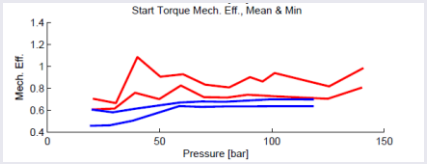
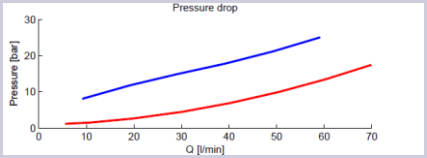
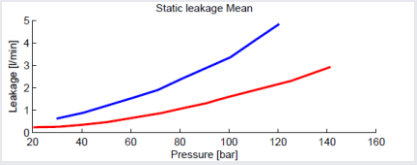
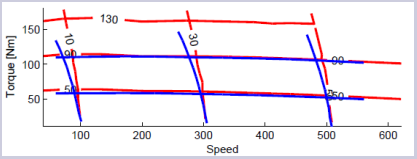
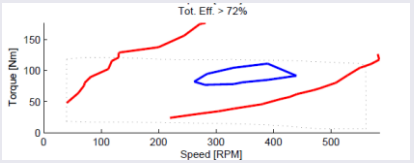
VMP 100cc vs. American brand motor 100cc

VMP has a higher starting torque efficiency than competitor	
VMP has a lower pressure drop in the motor than competitor	
VMP has a lower internal leakage in the motor than competitor	
The VMP lower internal leakage and pressure drop mean a higher speed at a given oil flow and a higher torque at a given pressure drop	
The VMP covers a higher functional area with a given efficiency.	

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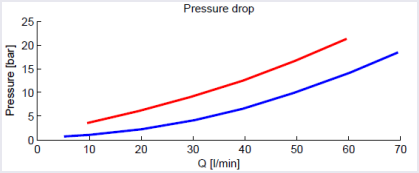
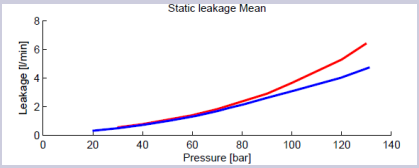
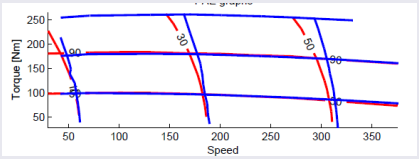
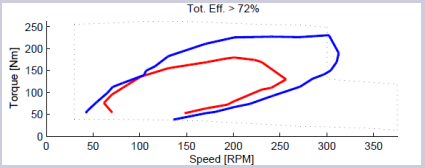
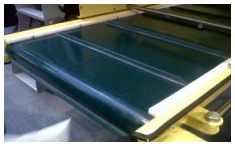
VMP 160 vs. American brand China motor 160cc

VMP has a lower pressure drop in the motor than competitor	
VMP has a lower internal leakage in the motor than competitor	
The VMP lower internal leakage and pressure drop mean a higher speed at a given oil flow and a higher torque at a given pressure drop	
The VMP covers a higher functional area with a given efficiency.	

VMP Orbital Motors

Application example

Agriculture		Description
Combine Harvester		Reel, fan
Seeder		Blower
Baler		Conveyor, wrapper
Spreader		Pump drive
Conveyor		Conveyor

VMP Orbital Motors

Application example

Material Handling		Description
Sweeper		Rotating the brush
Salt spreader		Conveying and spreading salt
Winch		Winch drive
Conveyor		Conveyor drive
Crane, Aerial lift		Slewing function
Industrial		Carriage adjustment function

VMP Orbital Motors

Features and Benefits

Features	Benefits
Three zone design is a proven design for SD	• Years of experience in design, design consistency. • Drain connection possible and available if needed.
Medium motor performance	• Right product for specific applications. • Optimized system cost.
Better life time compared to Chinese manufacturers: longer consistent efficiency over time	• Improves the operating quality of the machine. • Longer operation time.

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VMP Orbital Motors

Features and Benefits

Features	Benefits
Quality (Same O-/T-Series PPM rate)	• 100% end of line test. • Same quality level as O- and T-series.
Light motor, lower weight	• Important for attachments on certain machines like sweepers.
Consistent and reliable technical data	• Trustworthy, performs as expected. • Can use it to the limit, it will endure.

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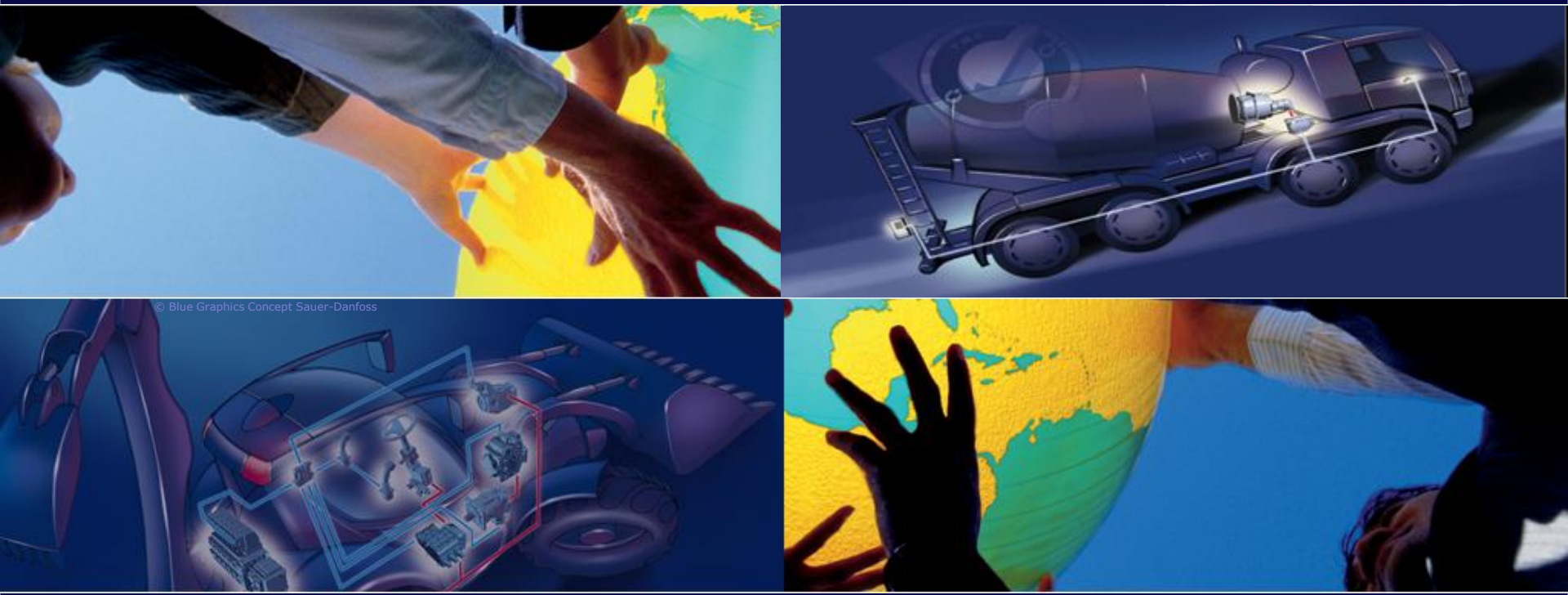
Features and Benefits

Features	Benefits
High pressure shaft seal	• Very often you can avoid to connect the drain line to tank. • Save money in system cost and installation costs.
Same continuous flow as an OMP	• Same speed range as the OMP. • High productivity of the machine.
Brand recognition and reputation	• Get the SD name plate on the motor, best in class. • End-user pull, OEM quality machine feeling and signal.

VMP Orbital Motors



Summary

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Summary

- Processes and quality
  - Same Quality as OMP motors
- Fast delivery, soon local manufacturing
  - Up to 5 weeks lead time in the launch phase, targeting 3 weeks local lead time
- System supplier
  - VMP can be part of a complete system provided by Sauer-Danfoss
- Global supplier
  - Sauer-Danfoss has the capability to provide a global support through a global sales and service organization
- HPS (high pressure shaft seal)
  - No need of drain line in most of the applications