Settima Pumps for Wind Turbine

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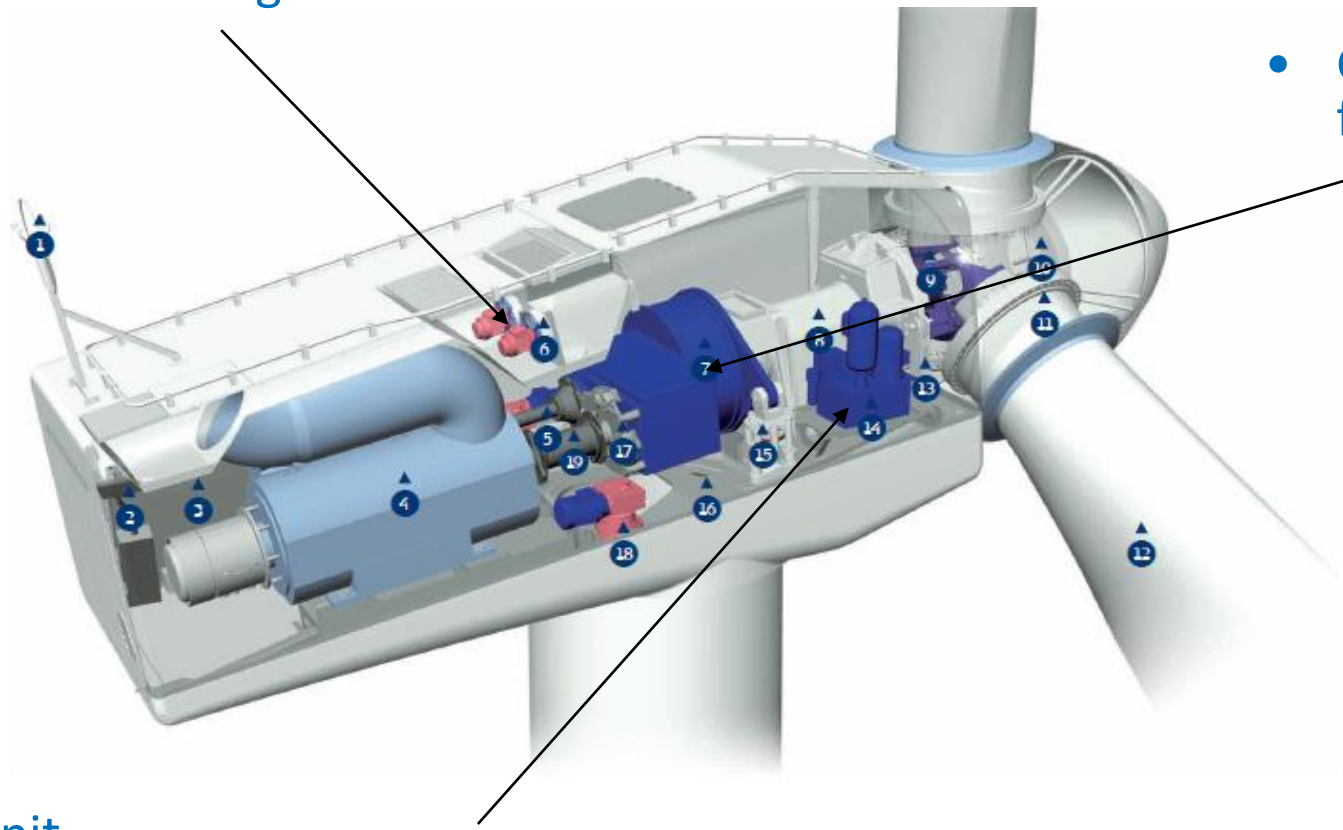
QUALITY SYSTEM CERTIFICATION ISO 9001 DNV

Where pumps are used

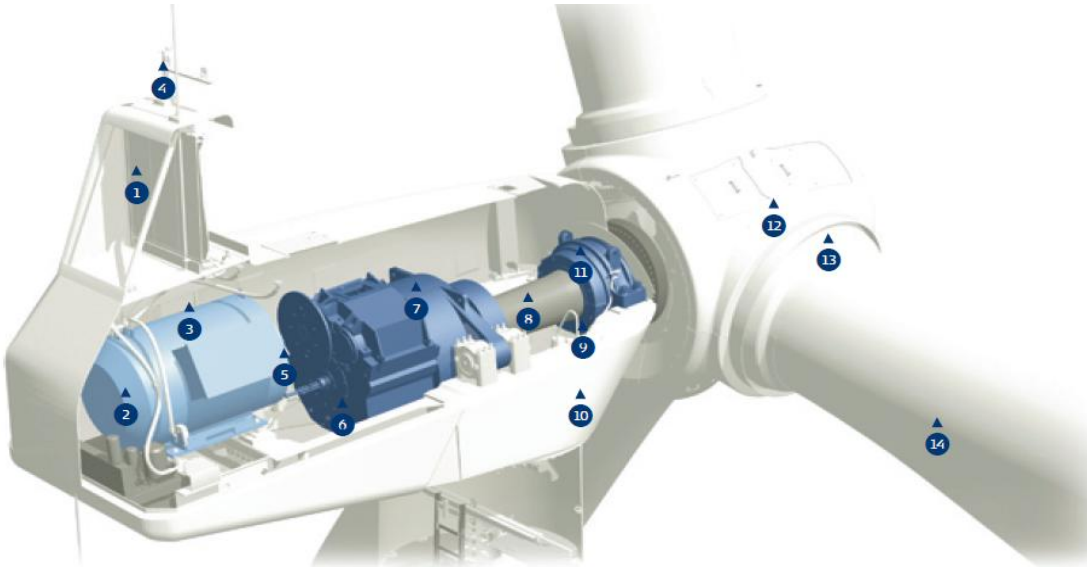
- Oil and water cooling unit



- Gear box lube and filtration system

- Hydraulic unit
  - Nearly half of the utility grade wind turbines currently in service depend on hydraulic pitch and yaw controls. Many of the others use electric pitch and yaw controls but may incorporate the use of hydraulics for braking or utilize a forced lubrication system.

Where Technology Matters



- Quality
  - weight, weight and weight !
  - compactness
  - Low noise operation
  - Low pulsation operation

- Reliability
  - Turbine must run unattended for more than 5 years of continuous operations thus all parts must run w/o maintenance in all season with MTBF > 100.000 hrs
    - Inside the turbine the temperature range can be -40°C +40°C
    - High gear temperature can causes power losses: the oil must be controlled within 5°C by efficient cooling unit
    - Strong vibration generated by the wind speed can degrades fitting and sealing
    - Salt water corrosion in off-shore installation degrades parts and and eventually can results in component failure

SETTIMA solutions for wind mill

SMT SN Series

2VHL Continuum® Series

SETTIMA SMT SN SERIES

3 Screw technology

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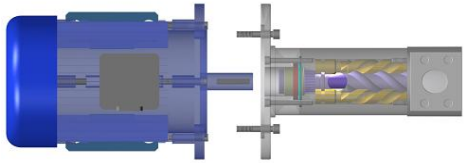
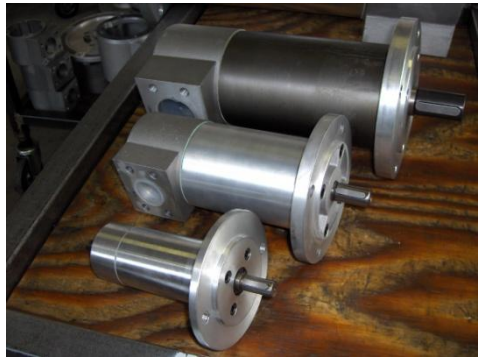
Pump technology SMT SN series

- Screw set:
  - Standard material (steel for main shaft & cast iron for idler pump)
  - Special profile type SMT SN, for high viscosity and for **oil + air foam (up to 70%)**
    - To enable good suction capability + smooth and low noise operations
- Body, flange, suction port:
  - Aluminium
  - Hard anodic oxidation (according to military rules and UNI 7796) to avoid corrosion (you can install offshore)
- Sealing:
  - Standard lip sealing (FKM standard, other material available)
  - Mechanical sealing (Silicon / Tungsten carbide high performance heavy duty)
  - **Magnetic driven coupling (no rotary seals, no leakage for many years)**
- Fixing screws
  - Inox or nichel steel, to avoid corrosions (you can install offshore)

Layout technology

- AC pump
  - Compact
  - Seal:
    - Lip seal
    - No seal if installed vertically under the oil level
- Male shaft pump
  - Less compact
  - All seal type are allowed:
    - No seal if under the oil level
    - Lip seal
    - Mechanical seal
- Magnetic Driven
  - No moving seal for no leakage





Screw profile technology

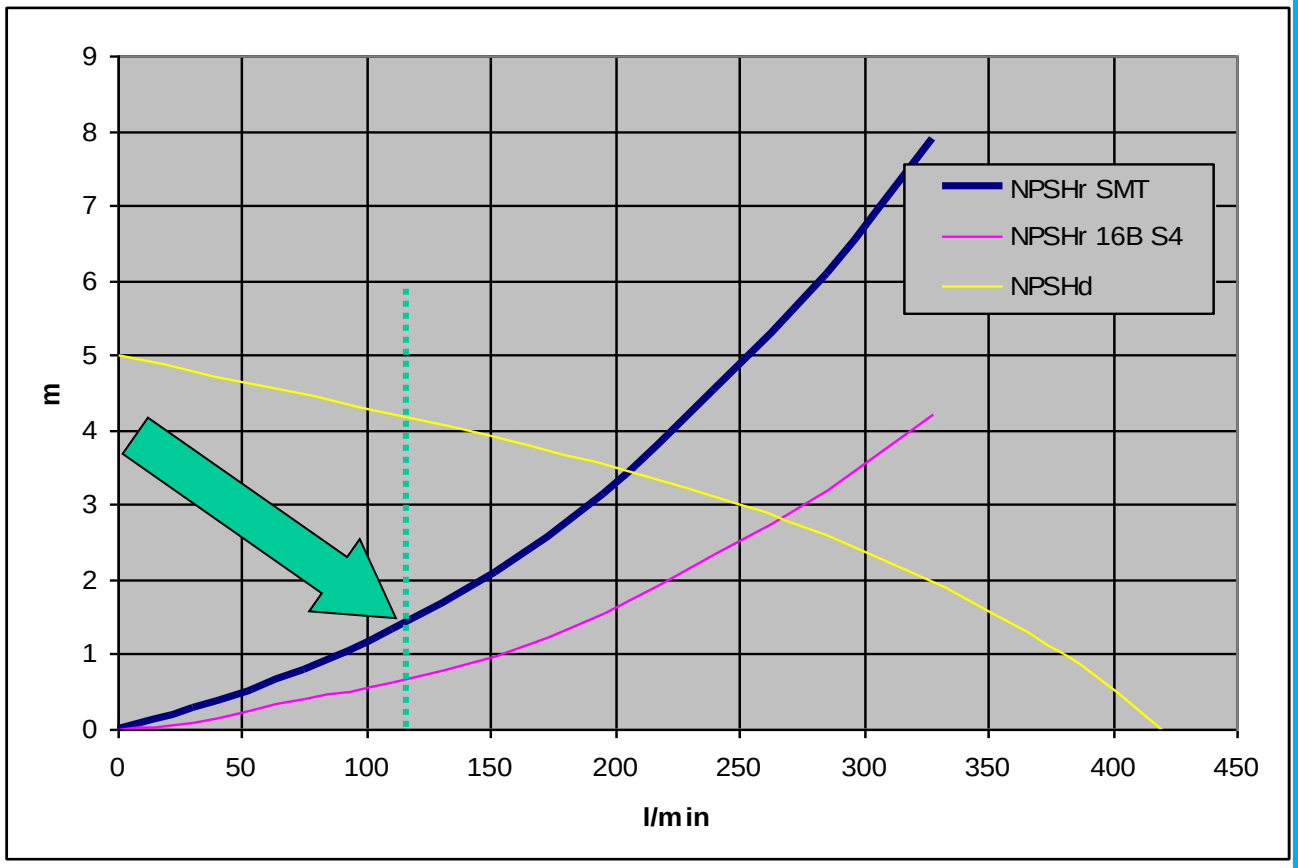
- SMT16B (AC or male shaft)
  - Installation: below oil level
  - Suction capability: medium
  - Pressure: up to 40 bar
  - Pressure pulsation: deltaP < 3%

- SMT SN (AC or male shaft)
  - Installation: above or below oil level
  - Suction capability: high
  - Pressure: up to 80 bar
  - Pressure pulsation: deltaP < 1%

- green: SN screw profile
  - The oil bubbles in air foam are smoothly transported such that the new profile enables no noise, very low pulsation and high internal lubrication also in presence of air emulsion
- red: non-SN screw profile

SMT SN characteristics

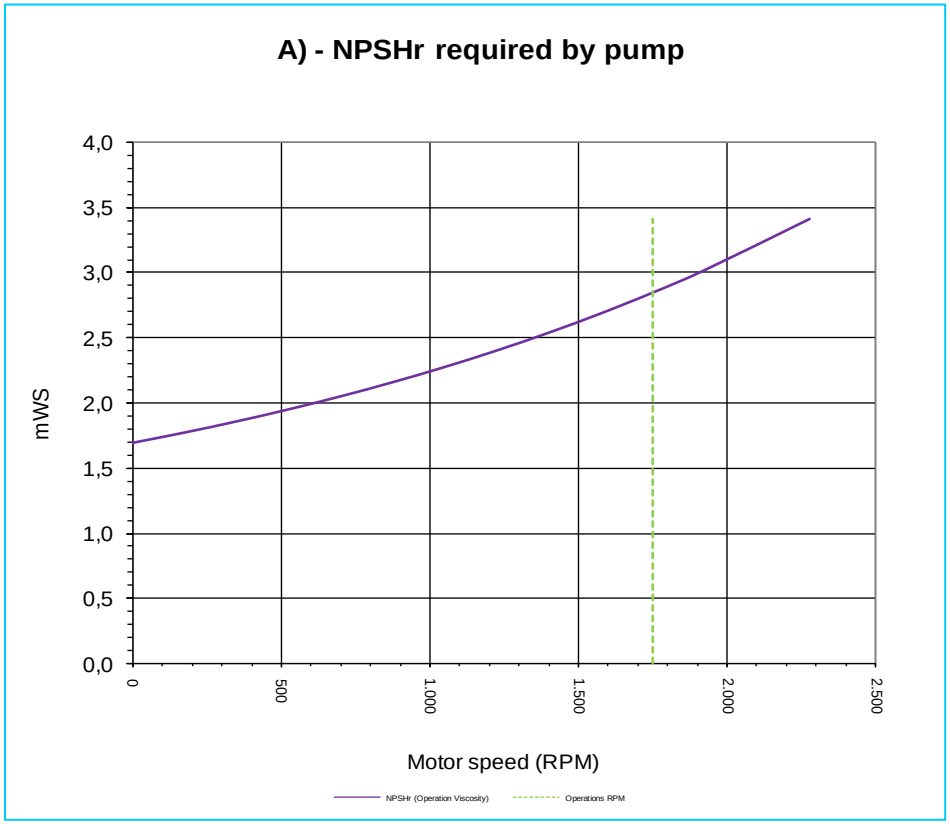
- Body up to 80 bar
- High suction capabilities
  - The diagram below show generic calculations for ISO VG320 cSt oil
  - Blu line: NPSH requested by SMT SN
  - Yellow line: simulation of a NPSH available from oil line
  - **You can install ABOVE OIL LEVEL, making free the design decision** (our competitor manufacturing gear pump cannot do that)
- Lower point of cavitation start-up
- **Low noise** and high performance with **air into the oil**



Product documentation

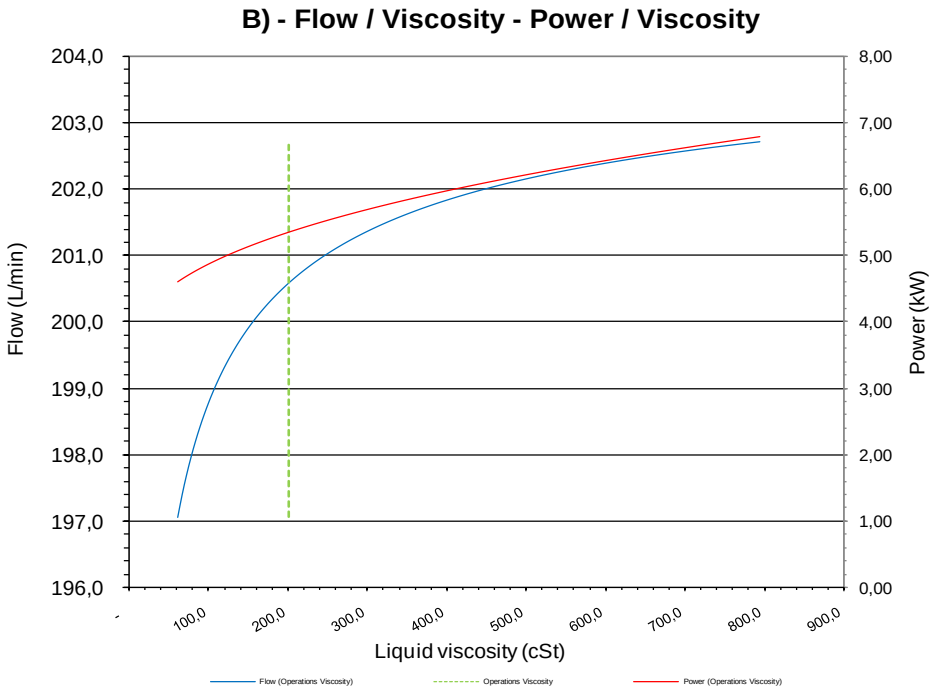
- We provide datasheet with full testing results
- i.e. pump type **GR55 SMT 300L SN TM OX**

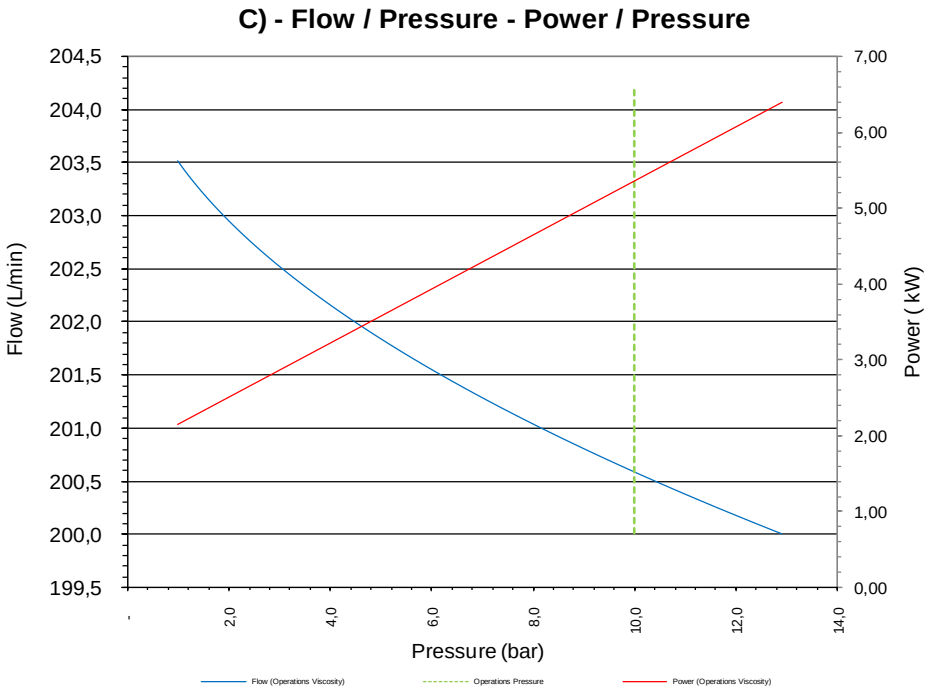
Pump: GR55 SMT16B / SMT 300L						
Pump data						
Screw size	55	mm				
Screw step	86	mm				
Motor speed	**1.750**	RPM				
Application data						
Pressure	**10**	bar	**145**	PSI	**1,0**	Mpa
	Minimum (A)		**Operations**		Maximum (B)	
Viscosity	60	mm^2/s	**200**	mm^2/s	800	mm^2/s
	278	SSU	927	SSU	3.708	SSU
Performances						
Flow	197,1	L/min	**200,6**	L/min	202,7	L/min
	52,1	GPM	53,0	GPM	53,6	GPM
	11,8	m^3/h	12,0	m^3/h	12,2	m^3/h
Power	4,6	KW	**5,4**	KW	6,8	KW
	6,3	HP	7,3	HP	9,2	HP
Oil speed	*2,5*	*m/sec*	*2,5*	*m/sec*	*2,5*	*m/sec*
NPSH	2,4	mWS	**2,8**	mWS	4,0	mWS



Product documentation

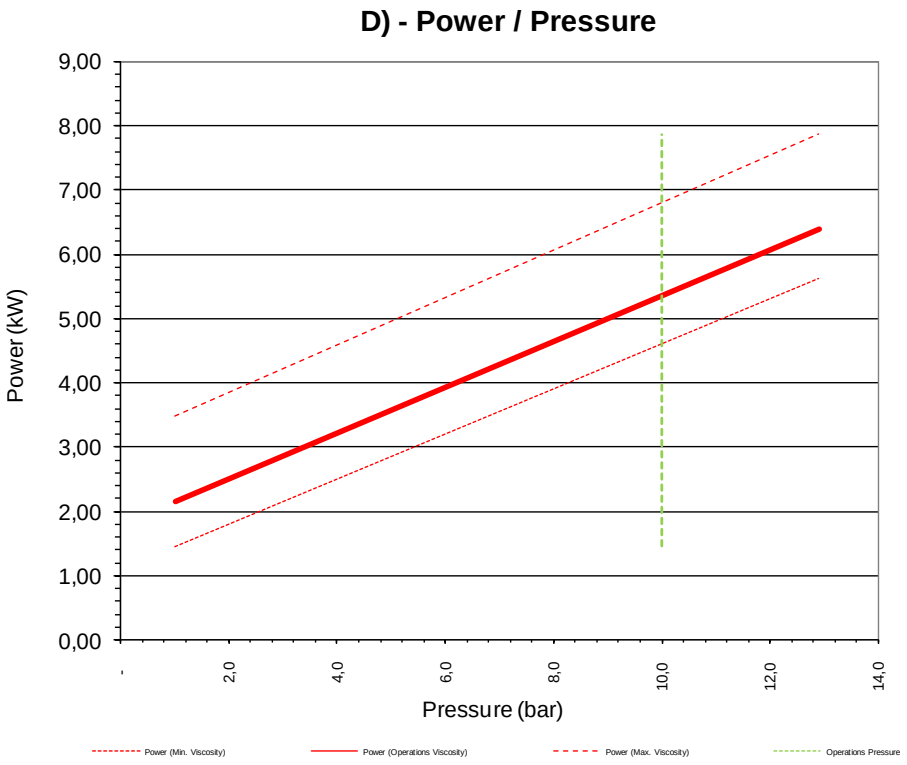
- Power and flow - 1:

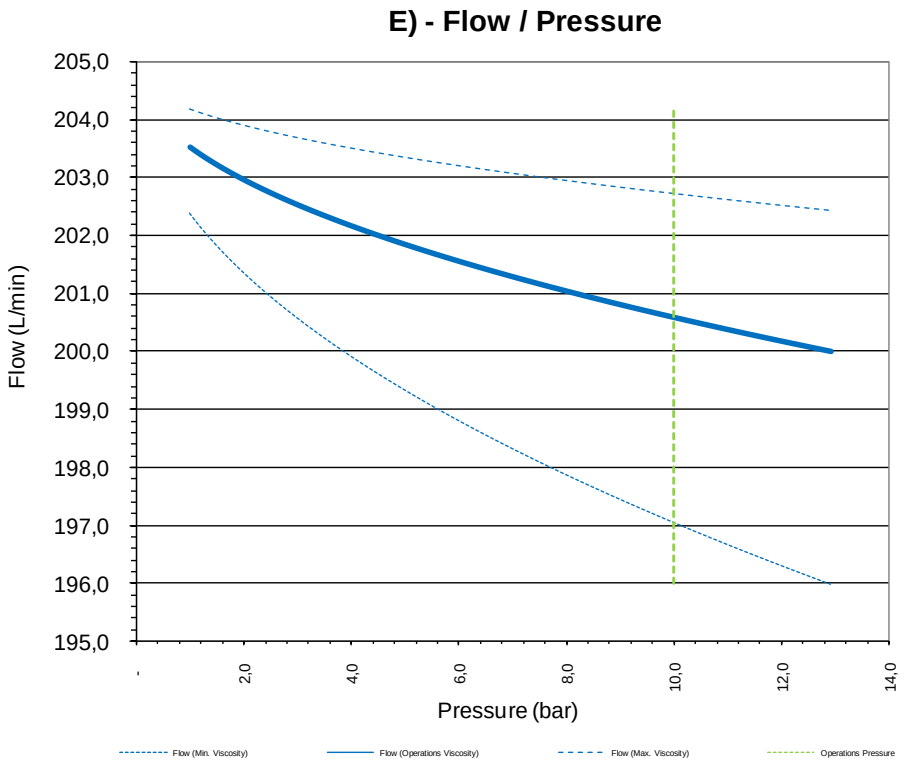




Product documentation

- Power and flow - 2:





SETTIMA 2VHL CONTINUUM®SERIES

Helical rotors technology

Pump technology 2VHL Continuum® series

- Screw set: Helical rotors
  - Standard material: high strength hardened steel
  - Special profile of rotors to eliminate acoustic emissions, pulsation and vibration, suitable for very high viscosity (up to 100.000 cSt*)
- Body, flange:
  - GJL 250 cast iron with lamellar graphite
  - GJL 250 cast iron with lamellar graphite
- Sealing:
  - Standard: NBR
  - With high temperature and particular fluids: FKM
- Fixing screws
  - Inox or nichel steel, to avoid corrosions (you can install offshore)

*Please contact Settima for viscosity level over 15.000cSt.

Pump technology 2VHL Continuum® series

Settima has long experience on wind and similar applications:

More than 14.000 pumps for high viscosity installed per year

- **Pump reliability:**
  - GJL 250 → casing and flanges
  - Phosphating treatment according to C4H
  - 18NiCrM05 (65HRC hardened steel)
  - Bronze bushings
- **Lip seal:**
  - Lifetime depending on operation condition (2/4 years approx.)
    - Standard construction shape: BABSL (SIMRIT brand)
    - Standard material: NBR
- **Potential for leakage:**
  - Lip seal ensures no leakaging
- **Possible requirements**
  - Arrangement with two lips seal
  - Optional material: lip seal with different material (FKM, PTFE) in function of fluid handled

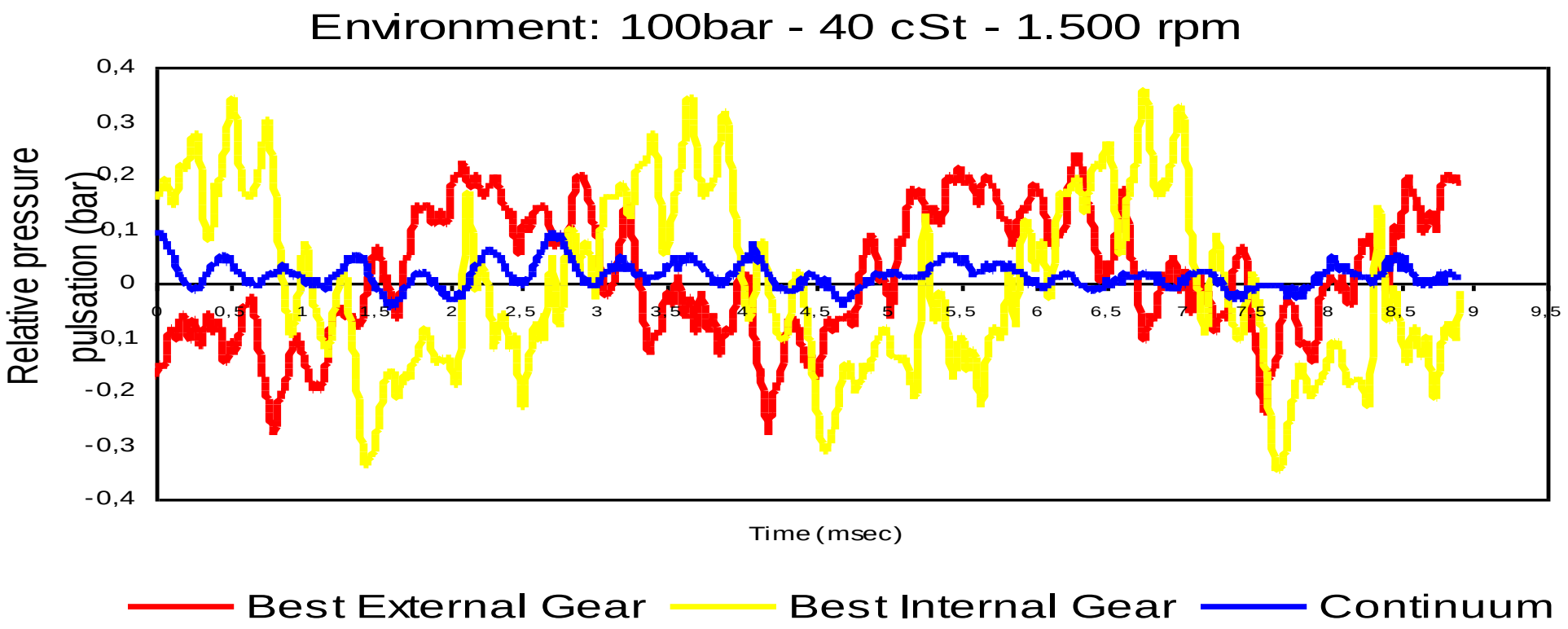
Pump technology 2VHL Continuum® series

The properties of the different elastomers used are in function of the working conditions and fluid handled, to ensure always perfect performances.

	NBR	FKM	PTFE
Abrasion resistance	good	very good	moderate
High temperature resistance	moderate max. +100°C	very good max. +200°C max. +150°C continuous temperature	max. +200°C max. +150°C continuous temperature
Low temperature resistance	down to -40°C	down to -25°C	down to -80°C
Oil resistance	good	very good	very good

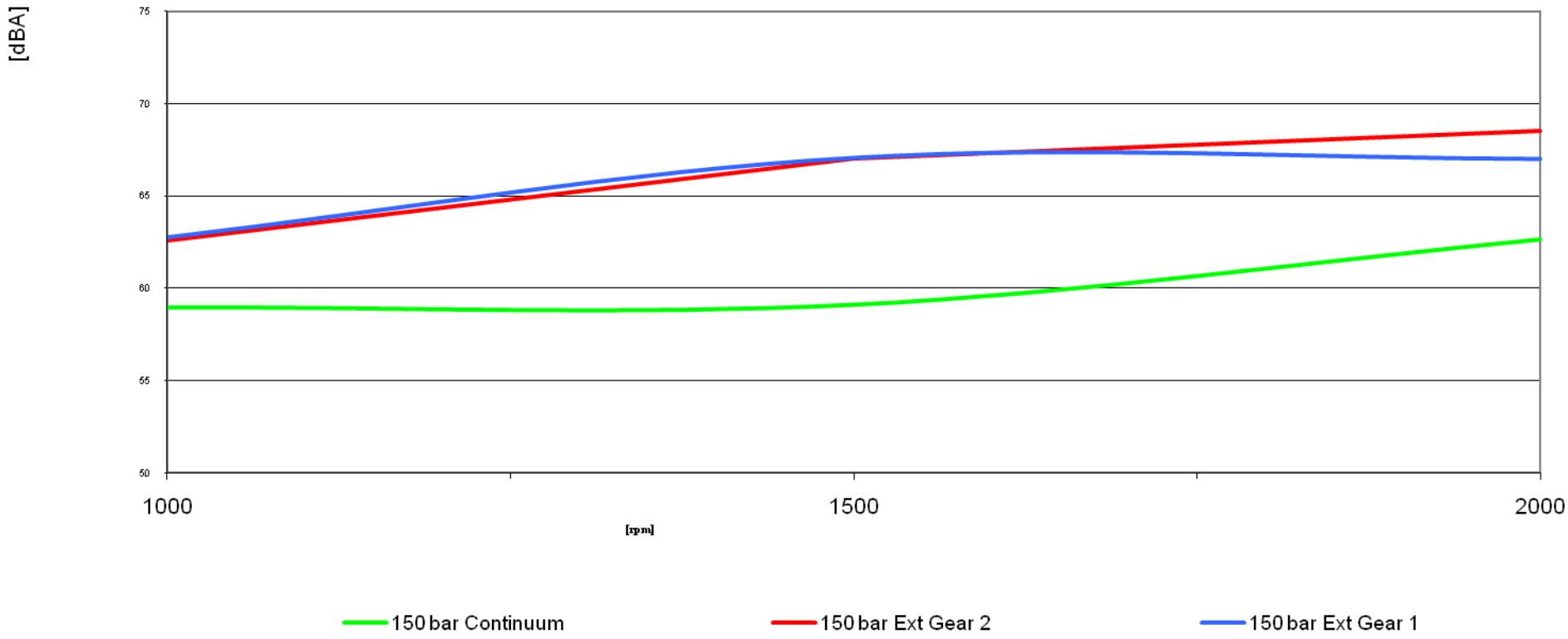
Pump technology 2VHL Continuum® series

Pulsation level: +0,1 to -0,05 bar fluctuation, as per below comparison curve:



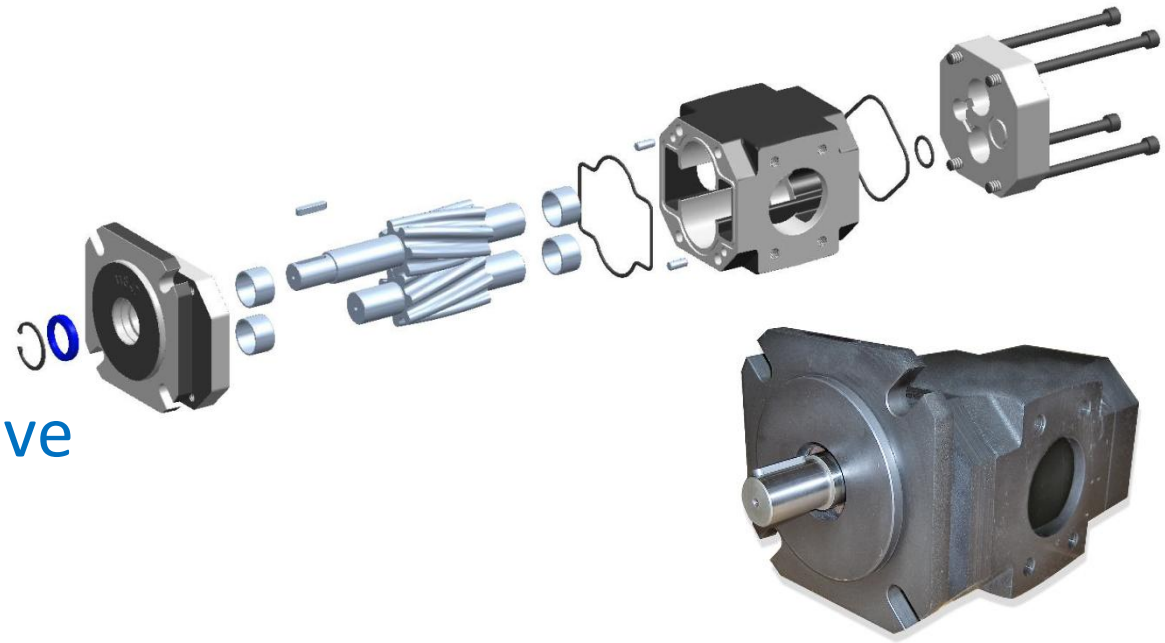
Pump technology 2VHL Continuum® series

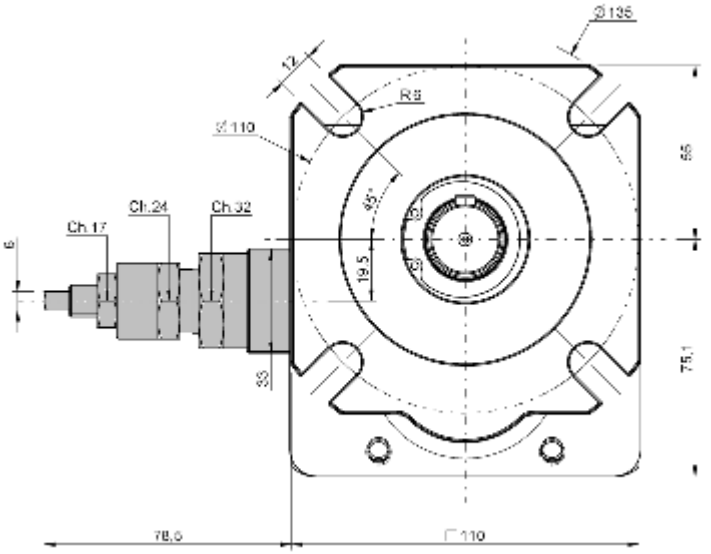
Noise level: ALWAYS below 60db up to 4 poles 60Hz motor speed:



Layout technology

- Male shaft pump
  - Compact
  - Seal:
    - Lip seal
- Ext. Adjustable safety valve
  - Option
- Rotation
  - Clockwise
  - Counter clockwise (option)
- Corrosion & preservation
  - Phosphating
  - Varnishing (option)





Screw profile technology

- 2VHL Continuum®
  - Special Helical rotors eliminate pulsation ensuring a continuous flow of the fluid.
    - This ensure a longer life time to the system filter.
    - No pulsation equal to no vibration to give longer life time to the complete system.
  - Possibility to handle fluid with very high viscosity
  - Pressure: up to 25 bar (peak 40 bar)
  - High volumetric efficiency
  - High efficiency also at very low revolution
  - Same external dimensions as the most used pump systems
  - Better price than the direct competitors.

In the **2VHL Continuum pump** the transport flow is perpendicular to the axes like in the classic gear pumps, but the especially studied profile does not trap any volume while the profiles have a helical course. In the Continuum rotors there is just a single point of contact between the profiles. There is so no encapsulated volume between the profiles and this completely eliminates the need for pockets on the axial thrust washer and any noise linked to that problem. The helical course makes a gentle transmission of movemenet and minimization of the pulsation possible. This lead to eliminate any vibration with no dispersion of energy.

Product documentation

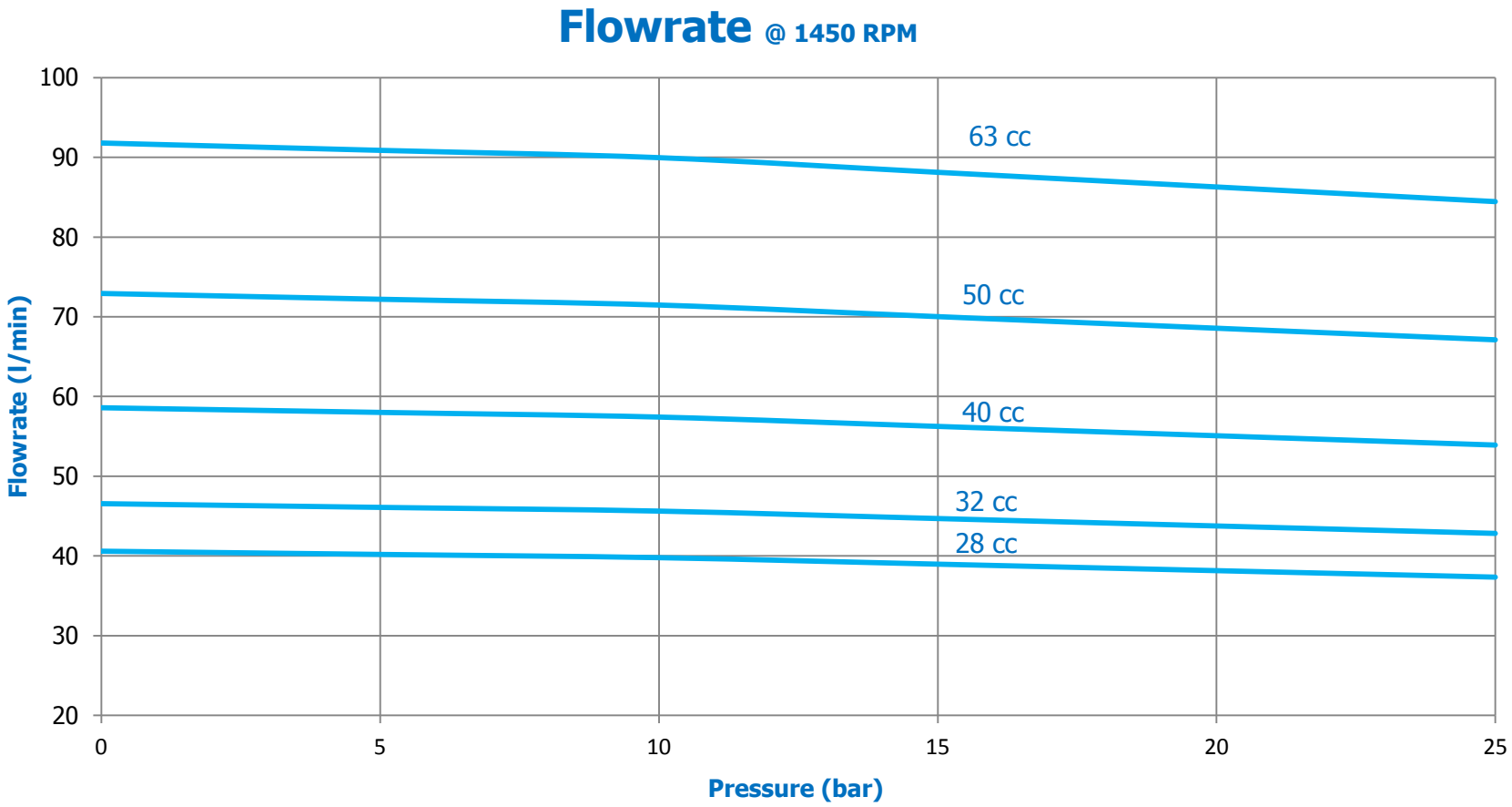
TYPE	Class	cc	Flange & shaft	Ports
GR47	2VHL	28	F80IAC	M
		32		
		40		
		50		
		63		
TYPE	**Class**	**cc**	**Flange & shaft**	**Ports**
GR55	2VHL	75	F110EAC	M
		91		
		101		
		125		
		160		

CHARACTERISTICS	UNIT	MINIMUM	MAXIMUM
Gas content (undissolved)	Vol. %	–	10
Level of contamination	ISO4406	–	21/19/17
Kinematic viscosity	mm^2/s	7	100.000*
Temperature (NBR seals)	°C	-25	80
Temperature (FPM seals)	°C	-25	150
Acoustic emissions	db(A)	52 @ 1.500 rpm	63 @2.950 rpm

For viscosity level over 15.000 cSt, please contact Settima

Product documentation

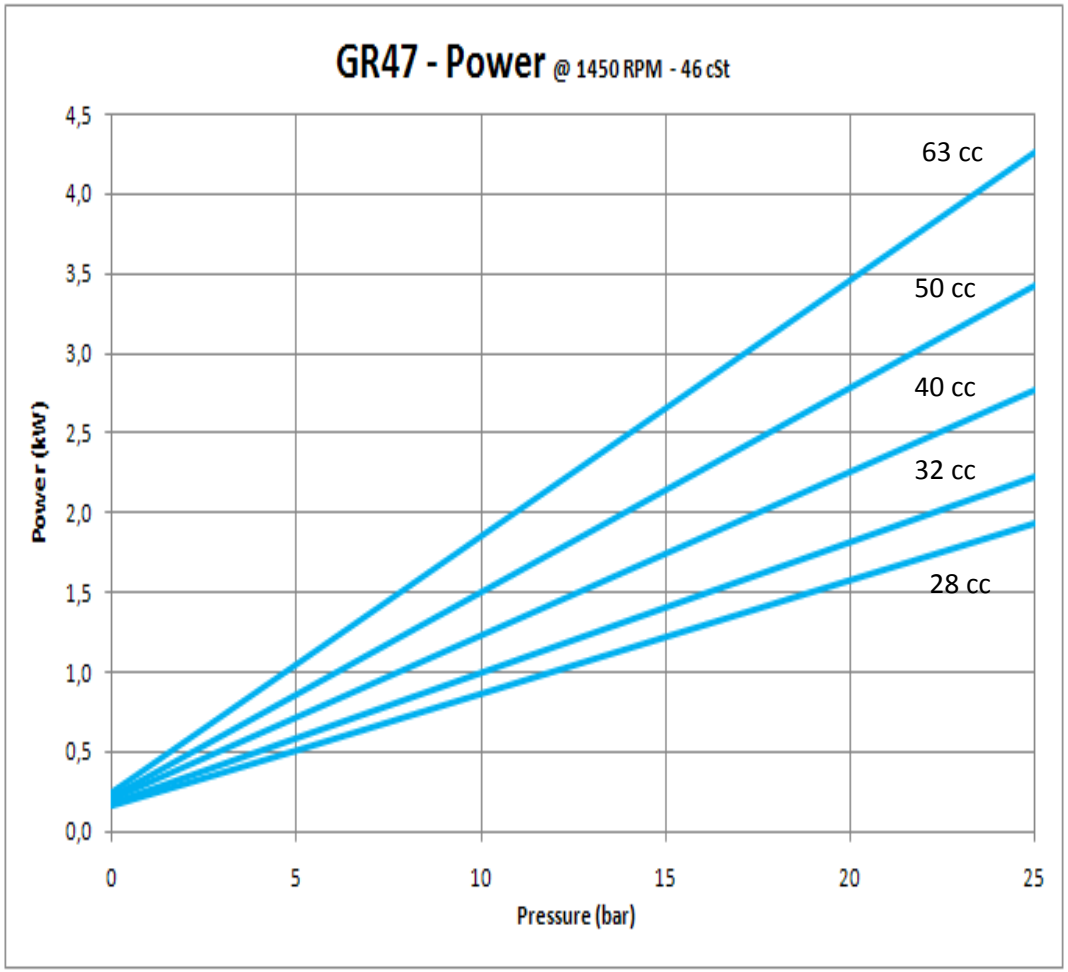
Flow rate GR47 2VHL Continuum®

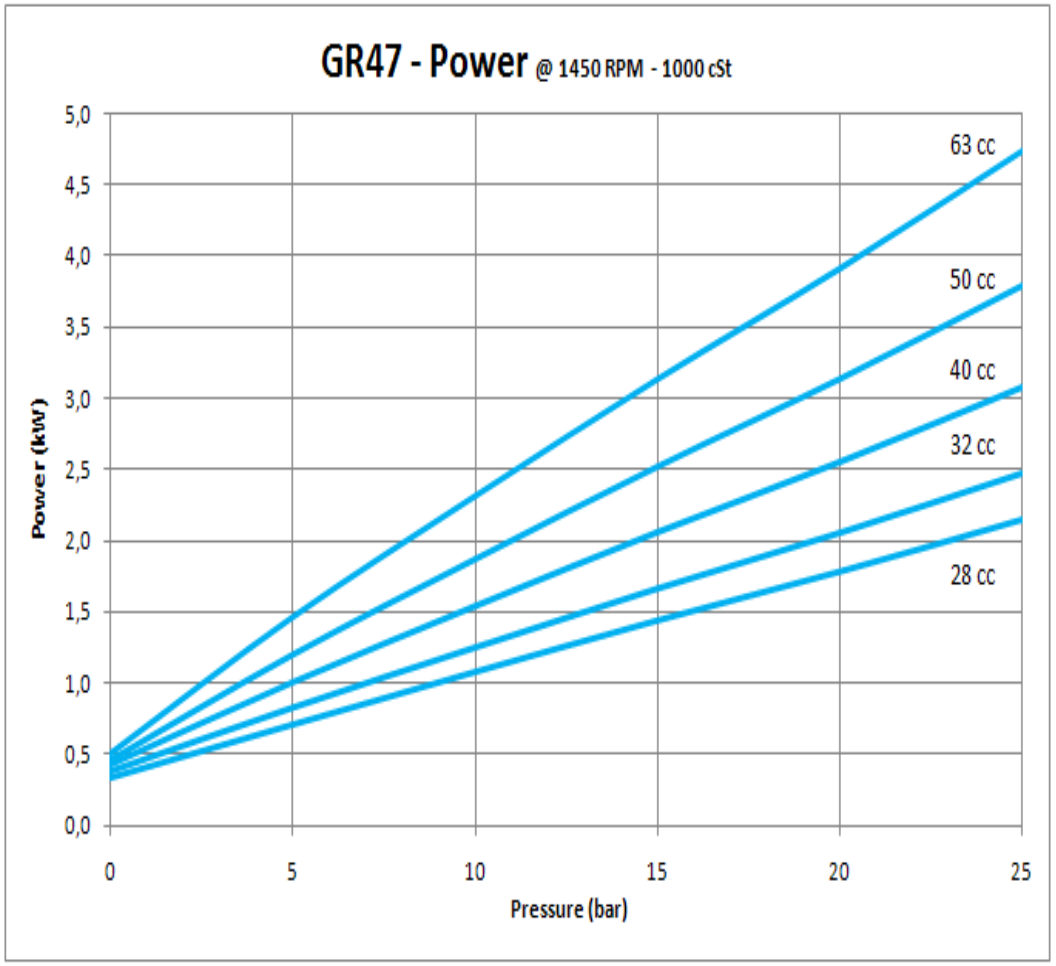


We provide datasheet with full testing results

Product documentation

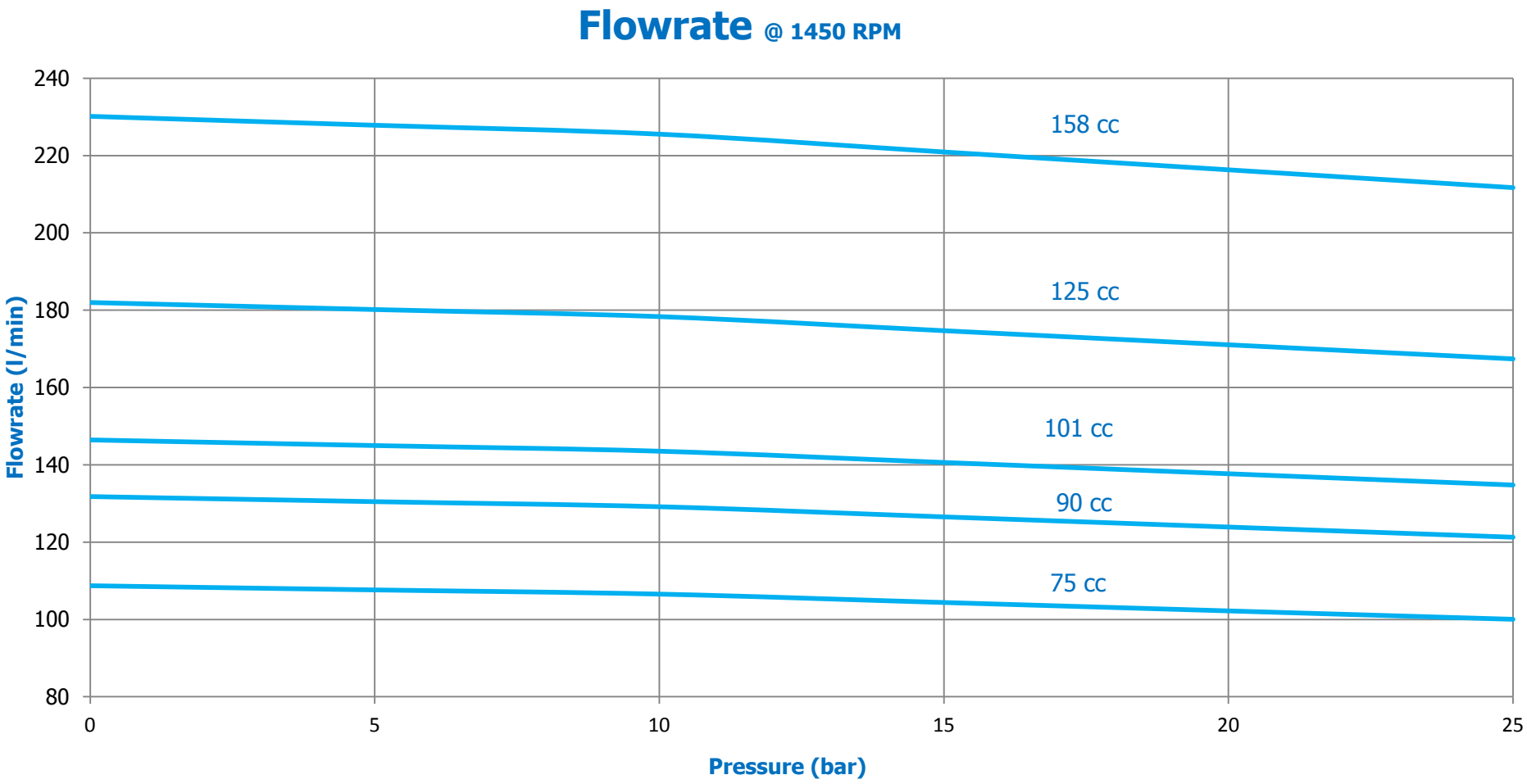
Power GR47 2VHL Continuum®





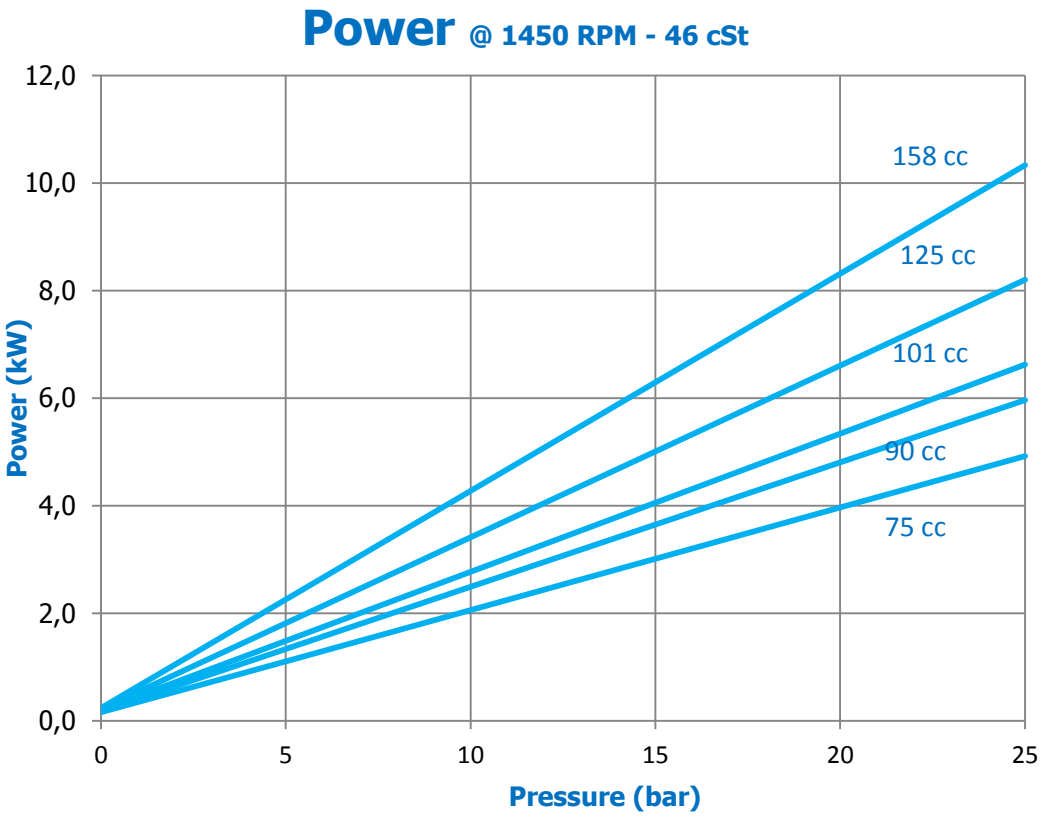
Product documentation

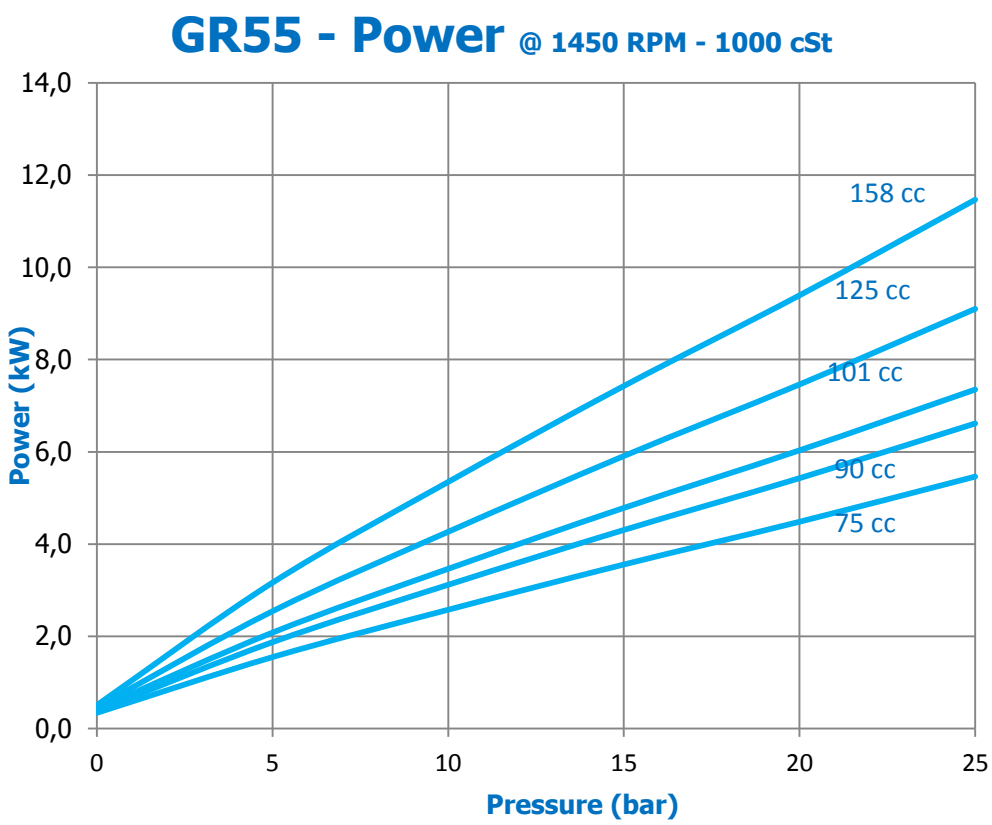
Flow rate GR55 2VHL Continuum®



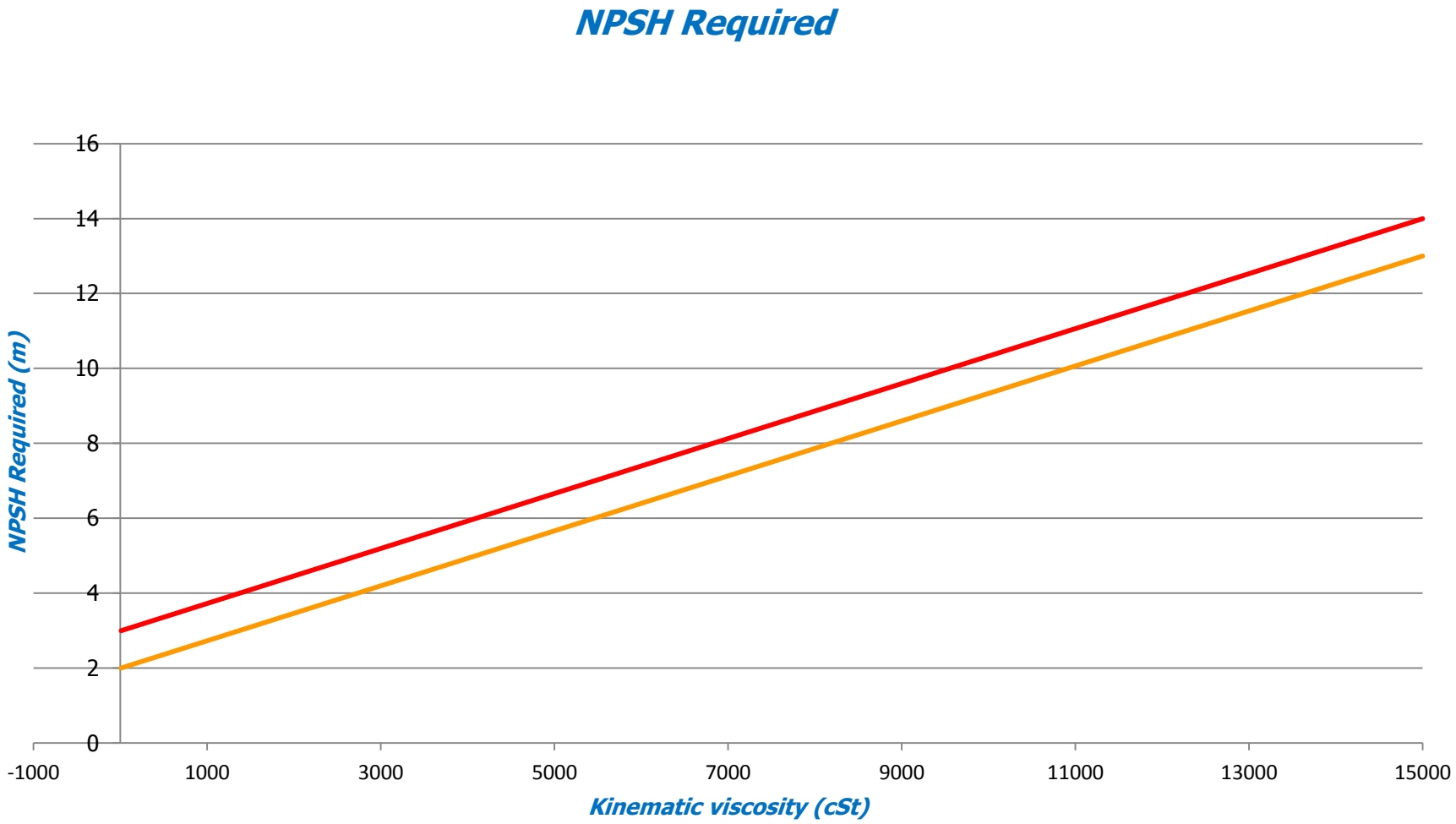
Product documentation

Flow rate GR55 2VHL Continuum®





Product documentation



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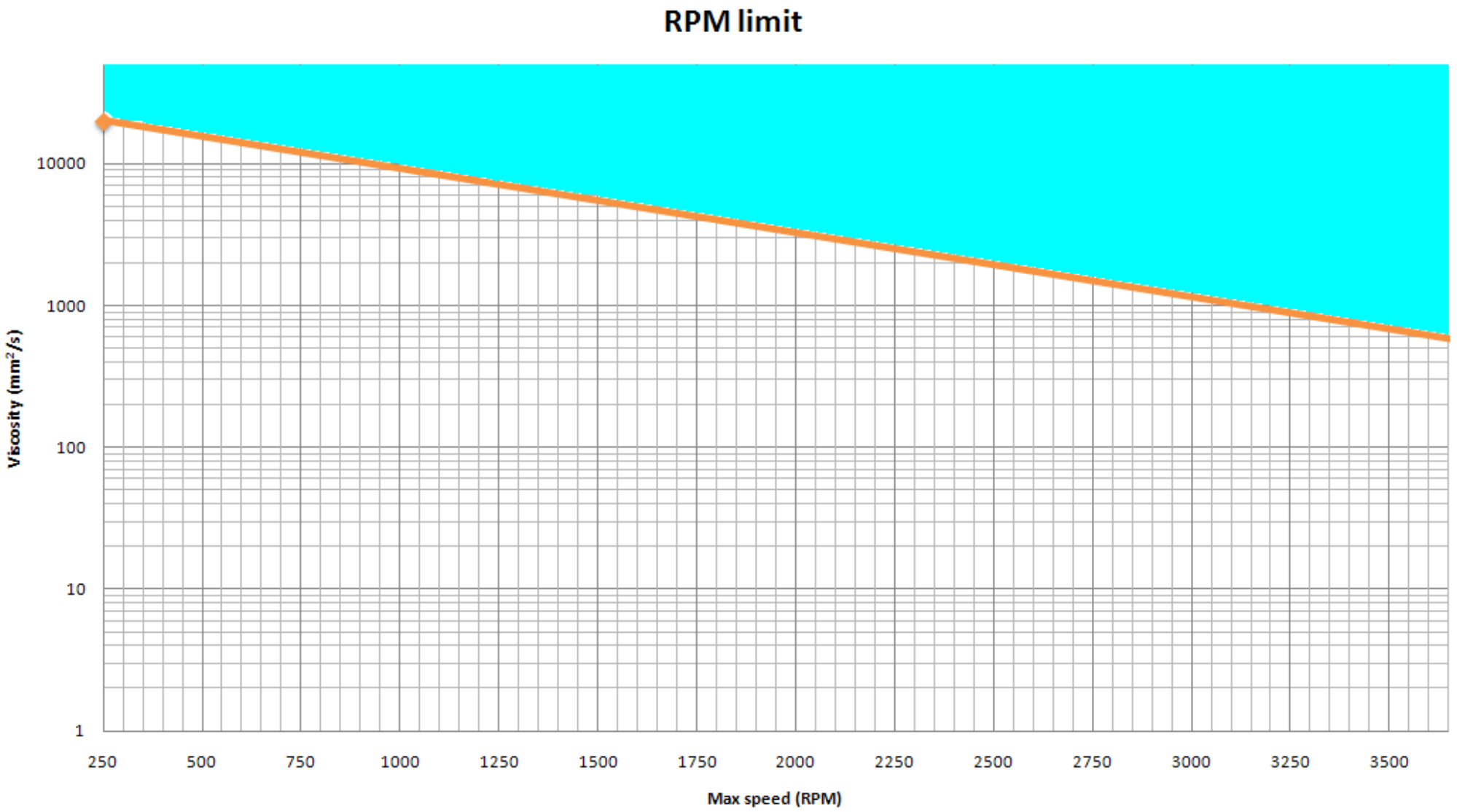
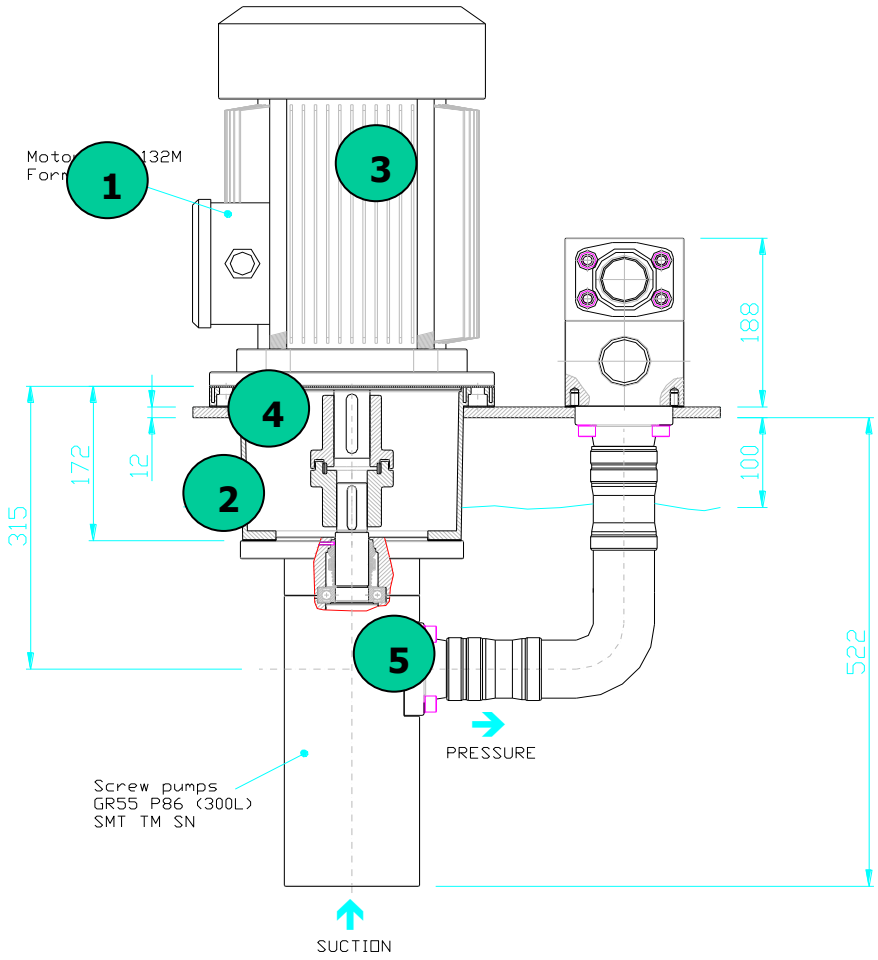


We support your integration needs

- Custom design and integration with other components is available as per customer request
- Best fit and integration friendly system

Example with SMT SN pump:

- Sub-system supply:
  1. Motor pump unit already assembled
  2. Bell-housings and couplings
  3. Valve block
  4. Fixing plate according to customer requirements
  5. Hoses and flanges



The competition

	Settima SMT16B AC	Settima SMT SN AC	Settima 2VHL Continuum®	Gear pump (Kracht, Richmeir, etc…)
Lightness	+	=	=	=
Pressure range	=	+	=	=
Customization flexibility	+	+	+	-
Low noise / Low pulsation operations	=	+	+	-
Compactness	+	=	=	=
Cost efficency (components & installation)	+	=	+	-
Pump efficency	-	+	+	-
Installation above oil level (flexible positioning)	-	+	+	-

Reference list

- Up & running
  - **Vestas**: 2Mw, cooling
  - **Made**: 1.5Mw, cooling / lube
  - **Vernier**: 1.5Mw, cooling
  - **Gamesa**: 2Mw, cooling
  - **Yu-sung**: N/A, cooling / lube / filtration
  - **Hansen Transmission**: lube / filtration
  - **Mitsubishi**: pitch control cooling system
  - **Acciona**: lube / filtration
  - **Gamesa**: 4.5Mw, cooling / lube / filtration
  - **Siemens**: 2.3Mw, cooling / lube / filtration
  - **Vestas**: 3Mw, cooling / lube / filtration

Product certification

- **ISO 9001 – DNV**
  - All the products of Settima are manufactured according to this standard
- Additional certification (free of charge under request)
  - **ATEX**: area CE eX II 2 GD ck T3
  - Material certification: **EN10204 3.1b**
- Some of the possible certifications
  - **ABS, BV, DNV, LLOYD, RINA**

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