



SRM



SRM
OPCON Group

WATER LUBRICATED Air-Ends WL

Water Lubricated Compressor Market

Oil free air market:

- **Few suppliers / High entry barriers**
- **High margin applications**
- **Competition with dry screws/hook/claw/piston compressors.**
(Better efficiency, lower air-end cost and noise/vibrations, no gear box oil mist)
- **Atlas, IHI, Kobe, Hitachi, Mitsui-Seiki, Gardner Denver, SRM Oil injected air market**
- **High competition / Low entry barriers**
- **Increasing cost for separation/filtration of oil carry-over**
- **Increasing cost for condensate removal**
(Similar high volume cost, similar efficiency, "old vs new")
- **Low cost suppliers on "their way"**

Development history of SRM Water-Lubricated-Air-ends

- **First products developed 1965 (Synchronized)**
- **Several new concepts built and tested 1970-1992**
- **Development cost 25-35 MSEK**

- **Modern development started 1992 (~20MSEK)**
- **7 proven modern design generations**
- **>200 modern air ends produced**
- **>10.000 hours long-term tests**
- **2 sizes in current production**

- **Composite Rotor manufacturing development (15 MSEK)**
- **14 generations >1000 rotor pairs (Thermosetting)**
- **X generations >2000 rotorpairs (Thermoplastic)**

Composite Rotor Manufacturing

Applications:

- Water lubricated
- Oil lubricated compressors
- Dry compressors

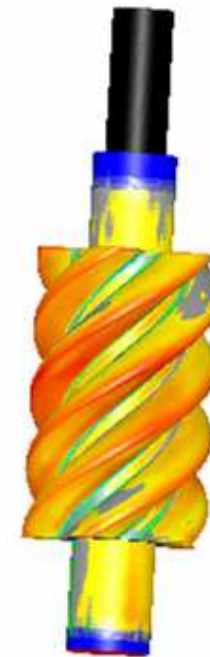
Drivers:

- Tribology
- Cost



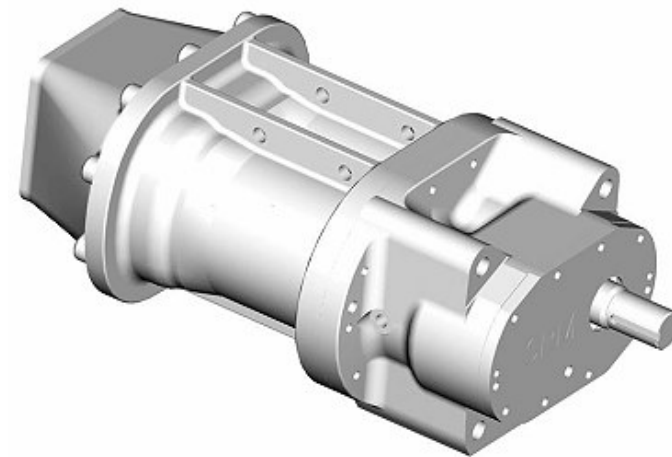
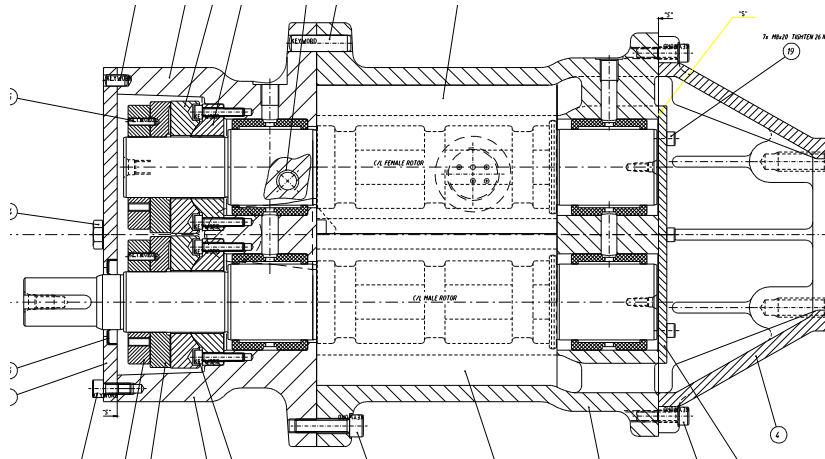
Rotor molding process

- **Mold and shaft preparation**
- **Filling**
- **Curing**
- **Ejection**
- **Post-curing**
- **Quality control**



1999: Water lubricated Air-end WL 37

- Polymer rotors
- Water lubricated bearings
- Shaft seal has no pressure difference



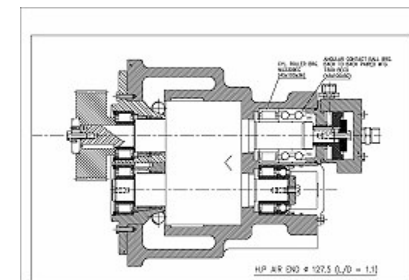
SRM profiles

Manufacturing



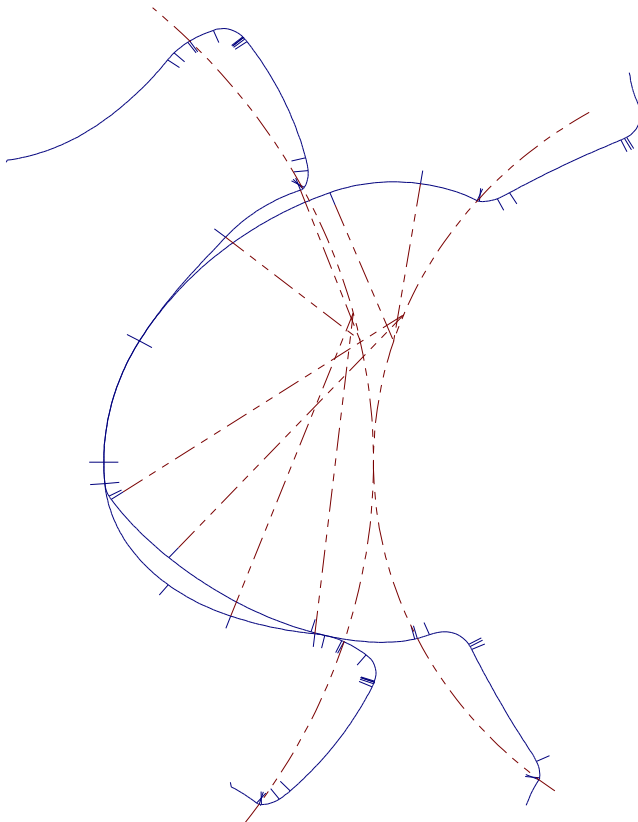
- Tool wear
- Release
- Lobe deformation
- Tolerances
- Measurability

Application



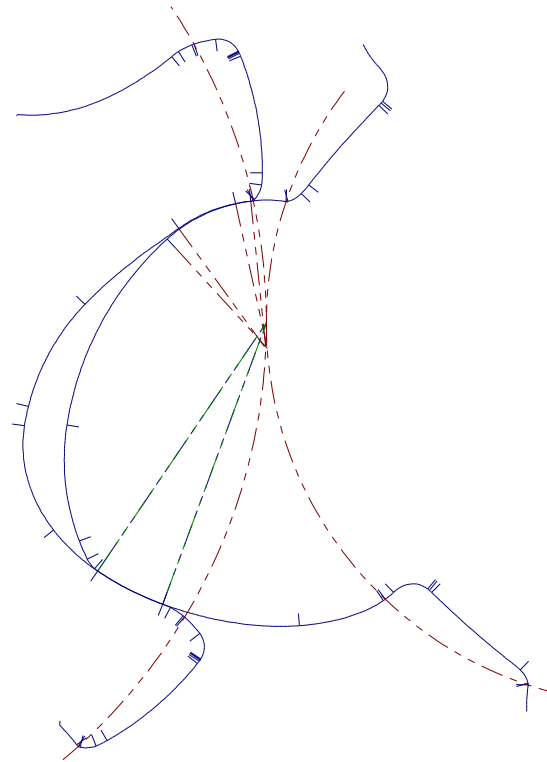
- Lubrication
- Clearances
- Dynamics
- Flow
- Material

G-profile

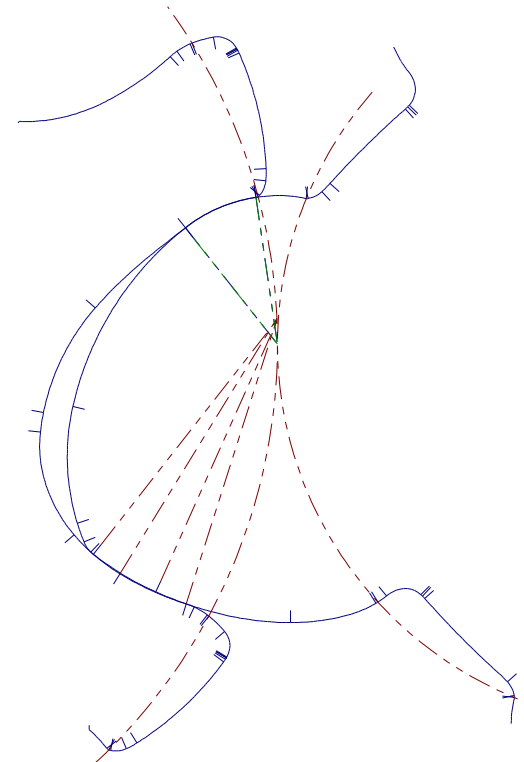


- **Self limiting wear-in effect compensates for manufacturing errors**
- **Low contact stress**
- **Shorter sealing line**
- **Larger theoretical discharge port**

The G-radius

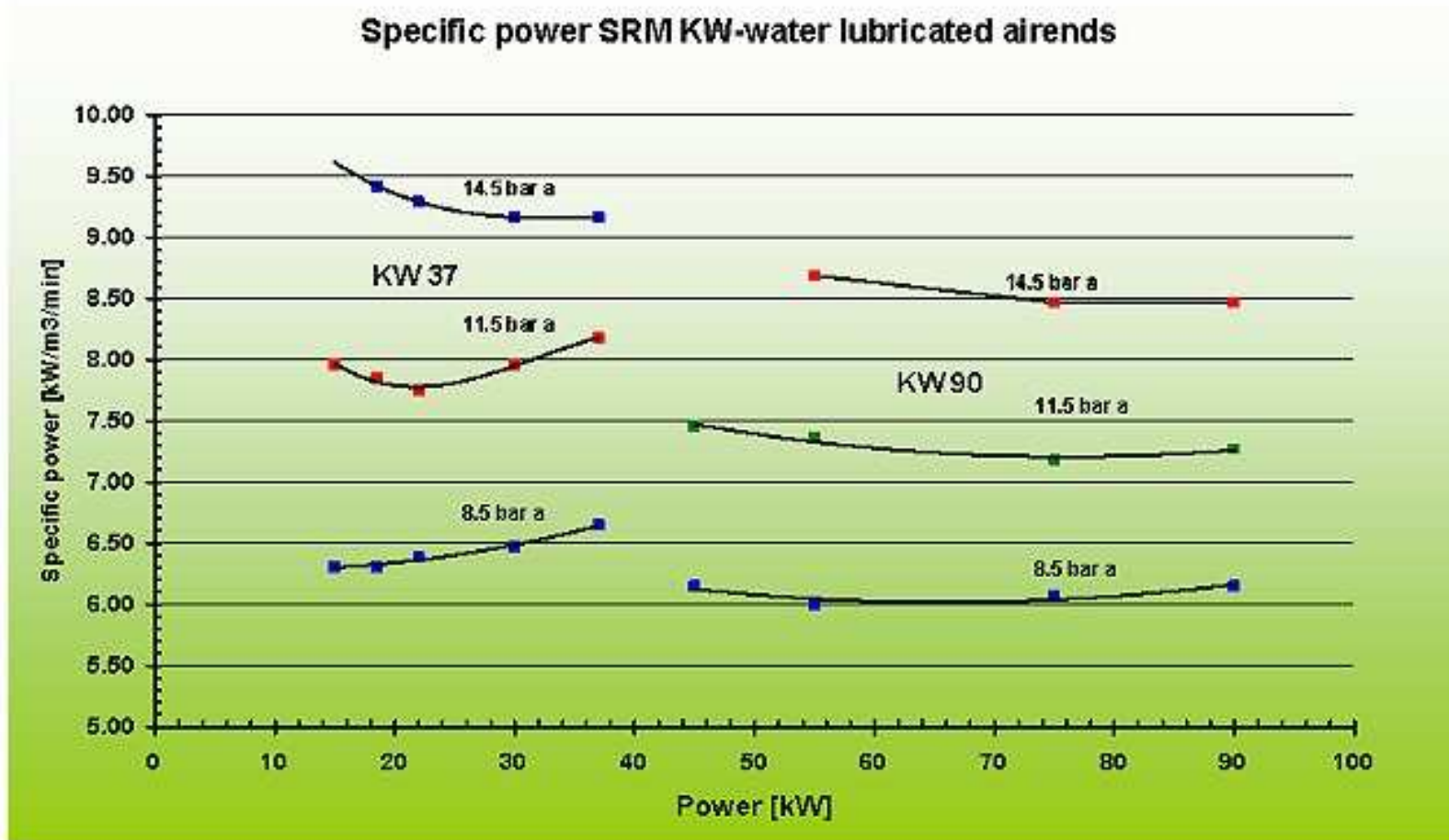


female drive side



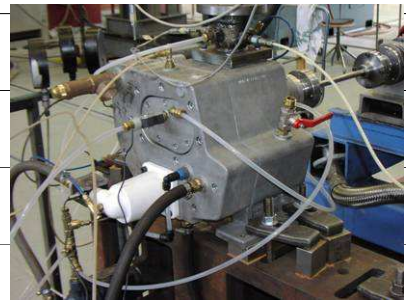
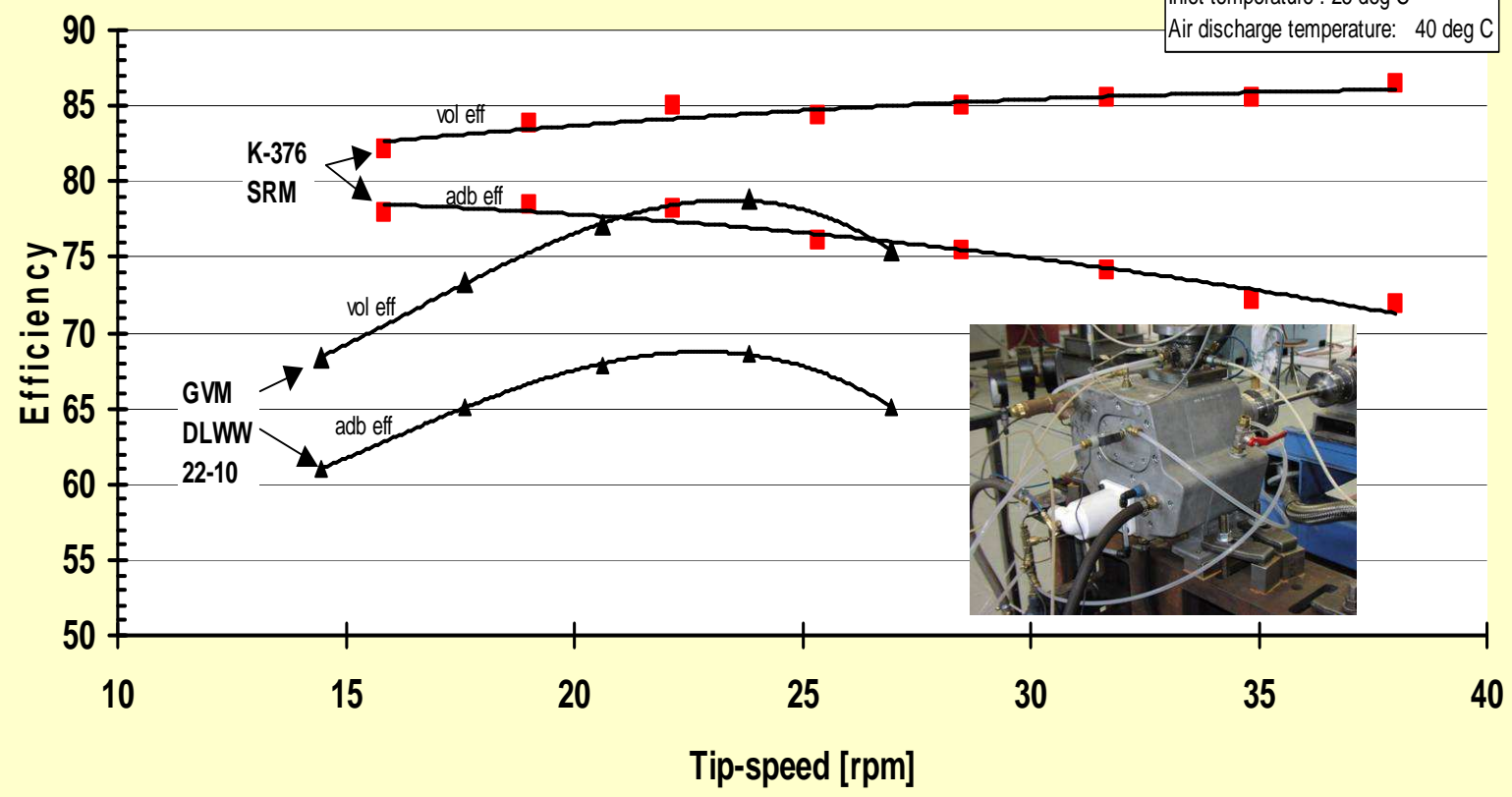
male drive side

Efficiency



Efficiency comparison between GVM and SRM water lubricated airends

Pressure ratio : 8.0
 Inlet pressure : 1 bar
 Inlet temperature : 25 deg C
 Air discharge temperature: 40 deg C

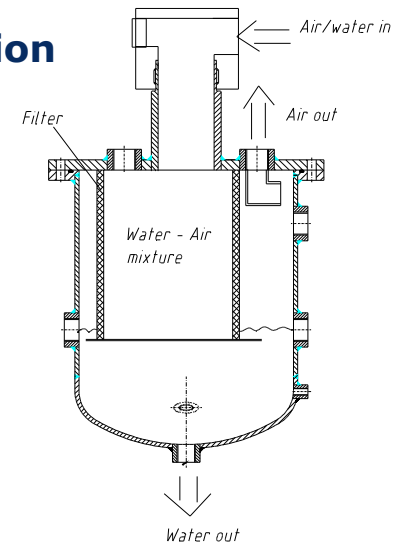


2001: Prototype water lubricated Screw- Package



Endurance testing

Water separation



Water treatment

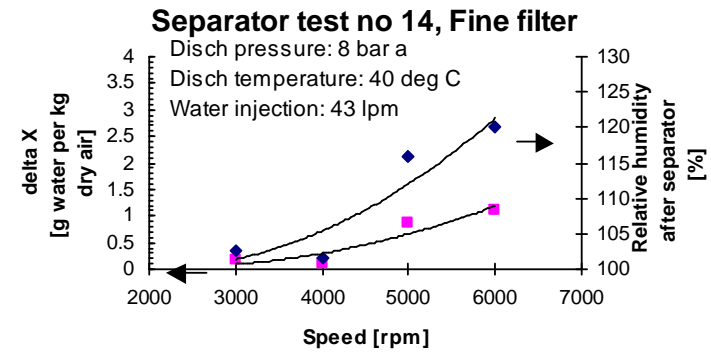


Reliability Issues

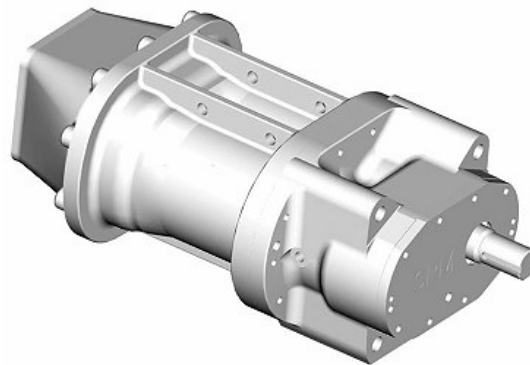
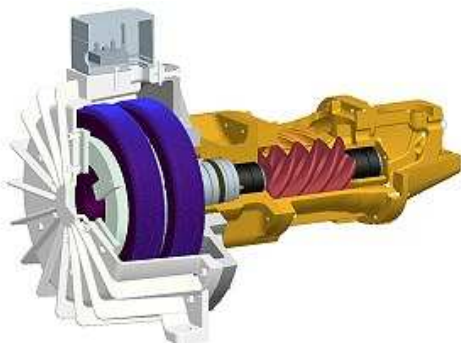
Corrosion/wear



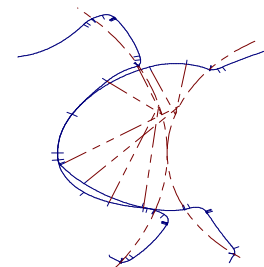
Water Circulation System



Product designs



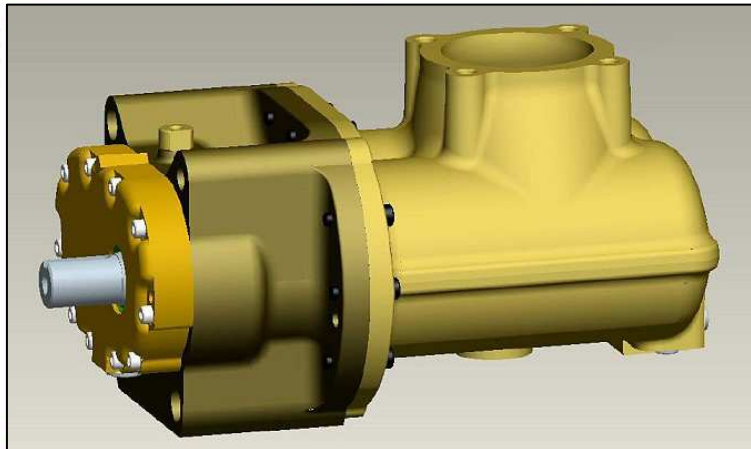
Lubrication



2004: New Generation WL, direct- and belt drive

WL 37 (axial air-intake) WL 38 (radial air-intake)

WL38



WL37



K413



Development history of Package Design from 1996 to the finished product 2006

1996: SRM first Prototype for testing



2001: SRM Prototype for endurance test



2006: First Water Lubricated Screw Compressor WLC 38 by GCI Consulting GmbH, Germany



The SRM logo is displayed in white text on a dark blue rectangular background. The letters 'S', 'R', and 'M' are bold and sans-serif. To the right of the letters is a white circular arrow icon pointing clockwise.

Marketing of SRM WL Air-ends to OEM Customers

July 2004:

Exclusive Sales Agreement of SRM WL Air-ends between SRM and GCI Consulting:

GCI distributes WL Air-ends and support OEM Customers re Water Screw Packaging due to GCI expertise in order to build their own Water Lubricated Compressor Range fast and with low cost.

April 2005, Hannover Fair :

SRM presented their Market-Ready oil-less WL 37/38 Air-ends and GCI their Package-Design know how



SRM

GCI-Package Design

*From the idea...
...to the finished product!*



- "Bacteria-free" world class oil-less water lubricated screw compressors and/or
- Package-Support

Exclusive sales and service of:



SRM
Oil-less water lubricated airends



CORAC

High speed turbo compressors,
CS-Fusion compressors

- Dipl.-Ing. Gerd Cromm
Director Industrial Air

Area of operation:

- Exclusive sales and service of oil-less water lubricated airends.
- Consultancy to companies concerning products, marketing and sale.
- Research, development and package design concepts of oil- and water lubricated screw- and turbo compressors.
- Value engineering and cost efficiency valuation of existing products/product ranges.
- Supporting customers regarding mergers and acquisitions, company integration, joint ventures etc.

Get in contact:

GCI Consulting GmbH
Untermarktstr. 63
D-44267 Dortmund
Germany

Fon: +49 (0) 231-49 40 230
Fax: +49 (0) 231-49 40 231
Mobile: +49 (0) 160-94 72 58 46
Email: info@gci-consulting.de
Web: www.gci-consulting.de

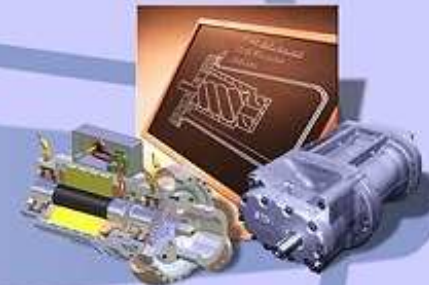
All technical Data are subject to change without notice.



GCI Consulting GmbH

Gerd Cromm International Consulting GmbH

*All about industrial air...
...alles rund um die Druckluft!*



**Sales
Service
Consultancy
Package design
Value engineering**

SRM

SRM Water Lubricated Airednd Design

Oil-Less WL Range

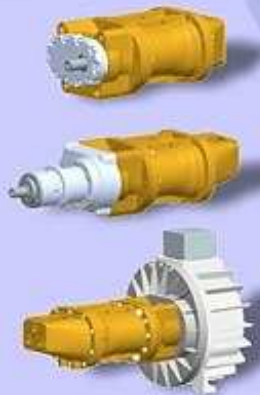
- **High reliability, high quality**
 - over 10.000 h field tested
 - SRM patented rotor moulding process: repeatable performance
- **Low cost of ownership:**
 - SRM-G-Profile: increased efficiency
 - Axial air intake: high volumetric efficiency
- **Absolute no oil (oil-less)**
 - Water lubricated bearings
- **No corrosion**
 - Marine bronze housing
 - Polymer rotors, stainless steel shaft
- **No leakage, barrier seal**
 - Shaft seal pressure balanced during operation

WL Range

Direct drive design
WL 37 D
WL 90 D

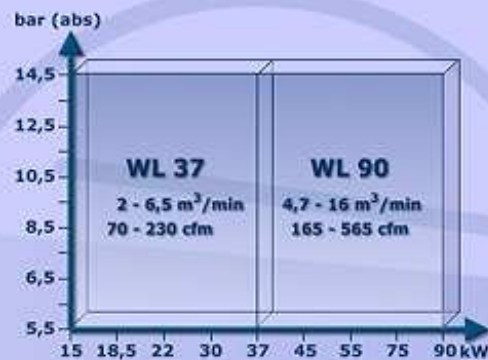
Belt drive design
WL 37 B
WL 90 B

VSD design
WL 37 VSD
WL 90 VSD



WL Power Range

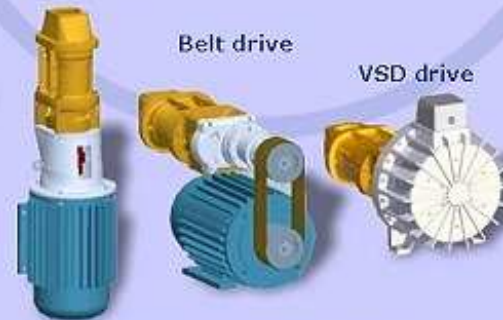
15 - 90 kW	20 - 125 HP
2,0 - 16 m ³ /min	70 - 565 cfm
5,5 - 14,5 bar a	80 - 225 psi a



Drive Concepts

(Possible arrangements)

Direct drive



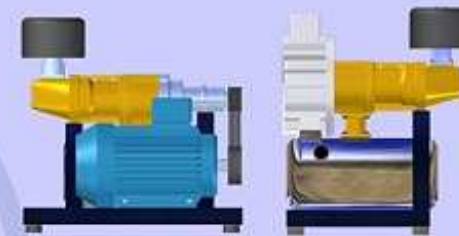
© Copyright GCI Consulting GmbH

Design Concepts:

GCI Compressor modules:

Belt drive version

VSD version



R & D, Design and Manufacturing
Over 30 years professional experience

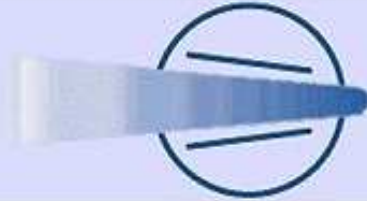
Packaging Concepts: (Sample)



2006: GCI supplied several oil-less WLC 38-Packages to OEM-Manufacturers in Europe, Asia and USA.



SRM



GCI Consulting GmbH

Gerd Cromm International Consulting GmbH

GCI presenting: WLC38 Range

15 - 55 kW, 5 - 13 bar, 30 - 45 kW VSD

WLC38 are oil-less, water-lubricated and water injected single-stage screw compressors

