SULZER PUMPS Products for the Hydrocarbon Processing Industry

Chinese Delegation from Shengli Oilfield in Berlin Adlershof, 5th Nov 2010

The Heart of Your Process
OHH Design Features
Hydraulics

- Enclosed impellers provided for increased efficiency.
- Over 70 different hydraulics.
- Dynamically balanced impeller.
- Wear rings and balance holes optimized to maximize seal and bearing life.
- Proven Coke Crusher available for coking applications.
OHH Performance
2950 rpm
OHH Performance
1475 rpm

Q [USGPM]

H [m]

Q [m³/h]

n = 1475 rpm
OHHL
Low flow – high head

Latest addition to the OH family:
- continuously rising H-Q curve
- flows from 3 m³/hr to 35 m³/hr
- heads to 300 m at 60 Hz
- over 100 combinations
- direct drive – OHH bearing frame
- VFD compatible for higher head
OHH Design Features
Volute Casing

- Pressure boundary components designed to ASME Section VIII - with 3 mm (1/8") corrosion allowance.

- Self venting, centerline discharge on all but 4 very large sizes.

- Double volutes for larger sizes.

- Confined controlled compression gasket with metal to metal rabbet fit.
Mounting

- Casing mounting feet and baseplate designed to meet ISO 13709 (API 610).

- 2 x API nozzle load option available.

- Non-grouted baseplates available for motor or steam turbine drivers.

- API 610 defined baseplate dimensions are standard. Similar designs and standards are used where larger bases are required to accommodate oversize pumps or drivers.
Flanges

- Back faced ANSI B16.5 300# R.F. flanges with required serrations.
- ISO/DIN flanges available.
- Top Suction available.
OHH Design Features
Seal Chamber

- API 682 2nd edition (ISO 24109) seal chambers and flush piping for improved seal life.

- Single or dual cartridge type mechanical seals available to meet all process requirements.

- API 610 cooling water plans available.
OHH Design Features
Bearing Frame

- 6 sizes of bearing housing cover the entire product line for maximum interchangeability.

- Extra heavy duty, large diameter shaft for low shaft deflection and long life.

- The oil ring is located in a deep groove retainer to assure it does not become displaced and rub interior of bearing housing.
OHH Design Features
Bearings and Lubrication

- Thrust bearings are back to back, heavy duty 40 deg. angular contact with machined brass cages.
- Ball radial bearing has C3 clearance required by API 610.
- Bearing housing oil channel routes lubricant to the rear of each bearing assuring adequate oiling under difficult operating conditions.
- Ports for purge mist, and pure mist lubrication are standard.
- Other lubrication options are available.
OHH Design Features
Cooling and Coupling Guard

- The standard coupling guard meets API 610 and OSHA requirements. Other types of guards are available.

- Bearing housing is finned carbon steel for added heat dissipation and API 610 compliance.

- For high ambient or operating temperatures, a low noise fan is added.

- For extremely high operating temperatures a predefined list of features is available to meet the most difficult conditions.

- For cryogenic or low ambient conditions, an oil sump heater is available.
OHH Design Features
Casing Drain

- Socket welded flanged drains are standard.
- Butt welding is available.
- Gussets or bracing available to suit customer specifications.
- Schedule 160 pipe is standard to first flange per API 610.
- 1" piping available.
Type OHM Pump
API 685 Magdrive End Suction Pump
OHM Design Features
Hydraulics

- Casing, impeller and front wear rings are interchangeable with OHH pump.

- Enclosed impellers provided for increased efficiency.

- Over 40 different hydraulics (limited to 250 kw currently).

- Dynamically balanced impeller.

- Wear rings and balance holes optimized to maximize product lubricated bearing life.
OHM Performance
2950 rpm
OHM Design Features
Inner Shaft & Bearing System

- Inner pump shaft is an extra heavy stiff shaft supported in silicon carbide radial and thrust bearings.

- Shaft is protected by a silicon carbide shaft sleeve.

- Sleeve support design allows for thermal expansion of shaft without cracking.

- Grooved radial and thrust bearings are clamped into easily removable bearing carrier for ease of maintenance.
Sulzer Pumps

OHM Design Features
MAK Magdrive System

- Synchronous drive speeds – same head and flow as the OHH pump.

- Neodenum iron boron or samarium cobalt permanent magnets on inner and outer magnet carrier.

- Hastalloy C containment shell and encapsulated inner magnet carrier for low eddy current losses and corrosion resistance.

- High pressure circulation of fluid thru magnetic filter to cool magdrive and lubricate bearings.

- Nonsparking rub ring on intermediate piece to protect containment shell in case of ball bearing upset.
**OHM Design Features**
**NMB Magdrive System**

- Patented NMB magdrive system is similar to MAK magdrive in function.
- Segmental inner rings of containment shell reduce eddy currents to extremely low levels.
- Allows transmission of much higher torque with lower losses and less heating.
- Most efficient magdrive ever!
OHM Design Features
Secondary Containment

- Intermediate Piece designed for full discharge pressure.
- Includes 12 mm (0.12”) corrosion allowance.
- Optional secondary gas seal is non-contacting until leakage pressure closes seal.
- Liquid presence sensor or pressure sensor can detect leakage.
3 sizes of bearing housing cover the entire product line for maximum interchangeability.

Extra heavy duty, large diameter shaft for smooth running and long life.

The oil ring is located in a deep groove retainer to assure it does not become displaced and rub interior of bearing housing.

Low noise fan, oil ring, and bearing end cover are interchangeable with OHH fan.

Ring Oil, Purge Mist, or Pure Mist lubrication is available.
OHM Design Features
Cooling and Coupling Guard

- The standard coupling guard meets API 610 and OSHA requirements. Other types of guards are available.

- Bearing Housing is finned Carbon Steel for added heat dissipation and API 610 compliance.

- For high ambient or operating temperatures, a low noise fan is added.

- For extremely high operating temperatures a predefined list of features is available to meet the most difficult conditions.

- For cryogenic or low ambient conditions, an oil sump heater is available.
OHC Pump
API 685 Canned Motor, End Suction Pump
OHC Pump
API 685 Canned Motor Pump

The OHC canned motor pumps represent the ultimate in pressure containment with two full pressure boundaries and static sealing.

The OHM magdrive is next in line with primary static containment shell and gas seal secondary.

The OHH conventional API 610 pumps provide security with mechanical sealing technology.

All use hydraulic components of the Sulzer OH family.
OHC Design Features
Axial Thrust Compensator

Thrust compensator is effective over entire operating range

How it works:
- Any increase in suction pressure forces rotor toward motor, closing "variable throttle".
- That builds pressure behind impeller.
- That pressure forces rotor toward suction, which opens "variable throttle".
- Compensator is therefore self-equalizing and virtually unaffected by wear.
OHC Design Features
Bearing System

- Canned motor pumps are inherently axially balanced since both ends of the shaft are normally exposed to suction pressure.

- In the OHC, the hydraulic thrust compensator takes most of the axial thrust load; grooved thrust pads take the remainder.

- The OHC rotor is supported in silicon carbide bearings with Teflon/carbon residual thrust pads.

- Shaft is protected by a tungsten carbide coated stainless steel sleeve at each bearing.
OHC Design Features
Circulation Flow Paths

3 Flow paths cover virtually all applications

- Standard flow is from impeller discharge through the motor and exiting into the impeller eye.

- For fluids near their vapor pressure, an auxiliary impeller is used to boost pressure within the motor cavity. Flow exits radially thru the shaft behind the impeller into a pressurized zone to avoid flashing.

- Depending upon power rating and ATEX temperature class, either ceramic insulation, or aux impeller and heat exchanger are used for high temperatures.
OHC Design Features
Canned Motor Types

- Standard Motor is designed for services up to 100° C (212° F).

- Adding the heat exchanger and auxiliary impeller extends its capability to 427° C (800° F).

- Up to 360° C (680° F), depending upon power rating and ATEX temperature class, ceramic insulation can be used to provide longterm operability without the need for cooling water.

- Motors are certified to the new European Explosion Proof requirements – ATEX.
OHC Design Features
Secondary Containment

- Hastalloy stator liner is welded to SS stator endcovers to form a permanent pressure boundary.

- Armature cover is welded SS or Hastalloy depending upon application.

- Secondary containment is formed by CS motor casing, conduit box, and endcovers.

- If some foreign object causes a stator liner breach, the full pressure secondary containment will contain it.

- Motor frame bolts are not part of primary pressure boundary; they are for rigidity.

- A variety of instrumentation is available for pump protection, rotor position and rotation direction.
OHC Applications

- Aromatics
- Phosgene
- Carbon Dioxide Loading
- Ethane Loading
- LPG transfer or booster
- Dowtherm circulation
- Freon/134A refrigerant transfer
- Cryogenics
- Deethanizer reflux
- Demethanizer reflux
- Amine, Acids, Caustic, Sulphur

The normal ISO canned motor pumps are available for lower pressures. Hermetic also builds canned motor pumps to over 1000 bar (15,000 psi).
OHC Experience

- Hermetic is believed to be the largest industrial canned motor supplier in Europe and has sold over 100,000 canned motor pumps in the past 30 years.

- Virtually all the major chemical and refining companies have installations; many on toxic or critical service.

- The Sulzer OHH hydraulics are a combination of the Sulzer ZE and CAP8 pumps from Europe and America.

- Over 13,000 of those pumps are installed around the world.

- The OHC represents the best in canned motor technology combined with the best in API pump hydraulics.
Type BBT, BBT-D Pumps
ISO 13709 (API 610)

BBT single suction, 2 stages, radially split

BBT-D double suction, 2 stages, radially split
Type BBT & BBT-D Pumps
Hydraulics

- High efficiency impellers

- Individually secured against axial displacement.

- Variety of wear ring materials for clean, corrosive or abrasive applications.

- Over 25 different hydraulics.

- BBT-D double suction first stage impellers reduce NPSHr – ideal for processing unit capacity increases.

- Coke Crusher available for coking applications.
Coke Crushers

The Challenge:

- Some processes produce coke particles or chunks. If those particles are too large, they are trapped between impeller vanes and reduce or stall flow.
- Sulzer’s Coke Crusher is used on the first stage to break up those particles and help maintain pump output.

How it works:

- Flat spot on coke crusher rotor vane impales coke particles that are too large to travel between impeller vanes.
- Rotation carries particle around to next stator lug where the particle is crushed.
- Coke Crushers are designed for each application. They provide a slight flow inducement so that NPSHr is not impaired from that of a normal pump.
BBT Performance
50 Hz

n = 2950 rpm

Q [USGPM]

H [m]

100 200 300 400 500 600

H [ft]

100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500

Q [m³/h]

20 50 100 200 500 1000
BBT-D Performance
50 Hz
Type BBT & BBT-D Pumps
Volute Casing

- Pressure boundary components designed with 3 mm (1/8") corrosion allowance.
- Top suction and discharge nozzles are standard with back spot facing required by API 610.
- ANSI 300# RF or 600# RF flanges provided; DIN flanges available.
- Volutes are opposed on BBT to balance radial loads.
- Double volutes used on larger sizes.
- End covers are confined controlled compression gaskets with metal to metal rabbet fit.
Type BBT & BBT-D Pumps
Mounting & Baseplates

- Casing mounting feet and baseplate designed to meet ISO 13709 (API 610).
- 2 x API 610 nozzle loads available on most sizes.
- Non-grouted baseplates available for motor or steam turbine drivers.
- API 610 defined baseplate dimensions are standard. Similar designs and standards are used where larger bases are required to accommodate larger size pumps or drivers.
Type BBT & BBT-D Pumps
Rotor & Seal Chambers

- Extra heavy stiff shaft rotor system as required by API 610 does not rely on wear rings for rotor stability.

- Sulzer’s year long wear testing study improved wear part materials and reduced galling tendencies.

- ISO 24109 (API 682) seal chambers and flush piping are provided for improved seal life.

- Single or dual cartridge type mechanical seals available to meet process requirements.
Type BBT / BBT-D Pumps

Bearing Systems

- C.S. finned bearing housings readily dissipate heat
- Ring oil lubricated ball bearings are standard on most sizes and speeds
- Radial bearings are ball with C3 clearance. Thrust bearings are 40 degree angular contact with machined bronze cages. Roller bearings used on some sizes.
- Cooling fans, water cooling, oil mist taps and a variety of instrumentation are available.
- Isolators are standard.
- Larger sizes and higher speeds utilize sleeve radial, ball thrust bearings.
- Sleeve radial, pivot shoe thrust bearings and force feed lube systems are available.
Type BBT & BBT-D Pumps
Manufacturing & Testing

- Castings are procured from Sulzer owned or qualified foundries.

- Most BBT / BBT-D components are produced on multi-axis CNC machining centers.

- Quality checks are accomplished with calibrated equipment in accordance with ISO 9001 and other standards.

- A variety of non-destructive examination methods are available to meet customer requirements.

- Performance test data is captured using Sulzer’s CATS data capture software in many manufacturing locations.
Type BBT & BBT-D Pumps
Total Life Cycle Care

- Over 55 Sulzer Pump service centers around the globe provide a variety of pump services:
  - Parts
  - Repairs
  - Hydraulic & Mechanical Upgrades
  - Performance Based Maintenance Agreements
  - For Sulzer and non-Sulzer pumps
GSG Barrel type pump

- The Sulzer type GSG is a horizontal, radially split, multistage diffuser pump with outer barrel casing, designed for heavy duty applications in:
  - Refineries,
  - Petrochemical plants,
  - Gas processing,
  - Coal processing,
  - Offshore installations and Injection

- API 610 9th Edition
  Pump Type BB5
GSG Back-to-Back Design
### Operating data
**GSG - HPI**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Pump sizes</td>
<td>$DN$</td>
<td>40 to 150 mm (1.5&quot; - 6&quot;)</td>
</tr>
<tr>
<td>Capacities</td>
<td>$Q$</td>
<td>up to 800 m³/h (3,500 USgpm)</td>
</tr>
<tr>
<td>Heads</td>
<td>$H$</td>
<td>up to 2450 m (8,000 ft)</td>
</tr>
<tr>
<td>Temperatures</td>
<td>$T$</td>
<td>-60 °C up to +450 °C (-20 °F to 840 °F)</td>
</tr>
<tr>
<td>Pressures</td>
<td>$p_d$</td>
<td>up to 275 bar (4,000 psi)</td>
</tr>
</tbody>
</table>
GSG Barrel type pump

Design features

- Casted barrel for low pressure / forged for high pressure - DIN/ANSI flanges
- Hydraulic set (impeller, diffuser) from
  - MC/MD - range – single stage fixation incl. wear rings
  - double suction 1st stage impeller (option)
- Hydraulic axial thrust compensated by balance piston or back-to-back design
- Stage casings sealed by o-rings < 180° C
- API 682 Seal Chambers with or without cooling jacket
- Materials acc. to API 610 S-6, C-6, A-8, D1, D2
- Mechanical seals according to API 682
GSG Barrel type pump

GSG with roller bearings
HPI application
GSG 80-260 / 5 stg.
GSG twist lock design / high pressure

- Twist lock is an existing Sulzer patent used for high pressure injection pumps
- Successful tests with test rig shows new development
- Cross section of new design

Main advantages:

- Larger casing studs and nuts eliminated including torque procedure
- Barrel casting/forging easier
- Savings in assembly/disassembly time
- Quick cartridge chances
GSG twist lock design / high pressure

Twist lock design
GSG twist lock design / high pressure

Twist lock assembly in steps

Insert

Twist

Lock
Horizontal, Multistage, Axially Split Pump

- Double Volute
- Return Cannel
- Radial Bearing
- Upper Casing Half
- Inner rotor
- Split Center Bushing
- Balance Line
- Axial Thrust Bearing
- Bottom Casing Half
The Sulzer type **TTMC-HPI** is a vertical suspended, double casing multistage diffuser pump, designed for heavy duty applications in refineries, petrochemical plants, gas processing.

- API 610 9th Edition
- Pump Type VS6