

Hayward Tyler's High Pressure Reactor Recycle Pumps for Butanediol (BDO) Production

Chemical and Polymer Facility Relies on Hayward Tyler's BDO Solution

The compound butanediol 1,4 (BDO) is a versatile intermediate used in the chemical industry. Its largest derivative product is tetrahydrofuran (THF), which is used to make spandex fibers, resins, solvents and printing inks. The second largest product is polybutylene terephthalate (PBT), which is used to make high-performance materials, electronics and automotive equipment.

Production of BDO occurs in a reactor where high-pressure hydrogen is injected into a feedstock chemical stream to produce BDO. Within the reactor system, a set of high-pressure process pumps continuously recycle the BDO reactor fluid. With large quantities of gas being injected and consumed in the reactor process, the BDO recycle pumps face challenging conditions. Gas can become entrained and loss of liquid in the pump end becomes a primary concern. Rapid pressure spikes up to 6,000 psi can occur in the process. Continuous operation of the BDO production is of significant importance. Unplanned downtime of the production plant can cost the operators as much as \$500,000 per day in lost revenue.

Following a string of bearing failures every six months within the existing oil-filled, canned motor pumps at a BDO production plant in LaPorte, Texas, Hayward Tyler, Inc. (HTI) successfully replaced the existing pumps with its own sealless, vertical, canned motor pump (dry stator) package. HTI's design and application team worked directly with site engineers to understand the problem and design a reliable solution that met their requirements. These pumps have been operated reliably since 1997.

BASIC DESIGN DETAILS

- Rated Flow: 850 gpm
- Design Pressure: 6,000 psi
- Design Temp: 300 °F
- Rated Power: 75 hp
- Power Supply: 460 V / 60 Hz / 3 ph
- Designed in accordance with ASME B & PV VIII DIV 1
- Designed and manufactured in Colchester, VT, USA

Project Summary

SITE / LOCATION:

LaPorte, Texas, USA
Intermediates/BDO Production Facility

SOLUTION AND FEATURES:

- Sealless, Vertical, Single Stage Centrifugal Pump with Dry Stator Unit
- Encapsulated stator for increased strength and heat transfer
- Complete thrust disc assembly to take thrust in both directions and reliably handle significant transient conditions
- VFD duty design for full speed control during start-up and operation



Butanediol reactor recycle pumps installed in LaPorte, TX since 1997

Project Data Sheet

Name	LaPorte, Texas Intermediates Manufacturing Facility		
Product	Butanediol (BDO) / Reactor Recycle Process Pumps		
Quantity	Three (3)		
Codes and Standards			
Design	ASME B & PV VIII DIV 1		
Pump Test Standard	Hydraulic Institute Standards		
Flange Standard	ANSI B16.5		
Materials Standard	ASME / ASTM		
Welding Standard	ASME P & PV IX		
Electrical Standard	IEEE 252 / NEMA MG1		
Pump Details			
Pump Type	Centrifugal, Single Suction, Single Discharge		
Pump Size	5 x 5 x 9 (8.75" Rated Impeller)		
Fluid Pumped	Butanediol (BDO)		
	Minimum	Maximum	Normal
Operating Temperature (°F)	185	284	212
Start-up Temperature (°F)	77	248	104
Operating Flow (gpm)	450	850	750
Specific Gravity	0.098	0.095	0.0978
Viscosity (cP)	1.5	0.8	1.0
Specific Heat (BTU lb-°F)	0.86 @ 176 °F		
Rated Head (FT)	Primary: 250' @ 3627 rpm, 62 Hz, 114.5 amps		
	Secondary: 235' @ 3510 rpm, 60 Hz, 108 amps		
Rated Flow (gpm)	850		
Design Pressure	6000 psi		
Design Temperature	300 °F		
Hydrostatic Test Pressure	9000 psi		
Motor Details			
Motor Rating	75 HP		
Service Factor	1.00		
RPM	3503		
Power Supply	460 V / 3 ph / 60 Hz		
Motor Full Load Current	122 Amps		
Heat Exchanger Details			
Design Code	ASME VIII, Division 1, TEMA C		
Cooling Water Flow	15 gpm		
Cooling Water Temperature	100 °F (maximum)		
Weights (Approximate wet)			
Motor and Rotating Assembly	4000 lbs.		
Pump Casing	1750 lbs.		
Heat Exchanger	200 lbs.		
Total	5950 lbs.		



BDO reactor recycle pump with ATEX instrumentation package



200 HP, 5,800 psi designed BDO reactor recycle pump installations in China



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