

Centrifugal Pump Infographics

Key components	Impeller	Casing	Shaft	Mechanical Seal	Bearings	
Key aspects over entire life cycle of pump	Selection	Design	Manufacturing and testing	Installation and commissioning	Maintenance and overhaul	Operation and control
Advantages over other technology	Simple construction	Highly reliable, Low maintenance	Wide operating range	Smooth / Steady non-pulsating flow	Less space / Smaller footprint	
Disadvantages over other technology	Less efficient	More Expensive	Not suitable for high viscosity	Constant, accurate flow is not possible	Priming is necessary	
Classification based on hydraulics output	Radial flow	Mixed flow	Axial flow	Mechanical Seal	Bearings	
Pump types as per API 610 Classifications	Overhung 6 subtypes	Between bearing 5 Subtypes	Verticle suspended 7 Subtypes	Engineered Pump		
Applicable international standards	API 610 API 685	ISO 2858, 9905, 5199, 9908, 13709, 15783	ASME B73.1, 73.2, 73.3	Various ANSI / HI standard		
Impeller construction types	Closed	Semi-open	Closed	Special-engineered		
Casing design	Volute (Single /Double)	Vortex	Diffuser	Special		
Process end shaft Sealing arrangement	Gland packing	Mechanical Seal	Sealless Pump			
Key formulas to assess performance	Head= $\frac{10.2 \times P}{SG}$	$P_{hyd} = \frac{Flow \times head \times Sg}{367}$	$Rated\ KW = \frac{\sqrt{3} * VI \cos\emptyset}{1000}$			
Important components of NPSH available	Vapor pressure head	Static pressure at suction source	Suction head or lift	Friction head in suction	Velocity Head	
Major operational issues	Low flow instability	High flow instability	Suction starvation and Cavitation	Change in fluid characteristic		
Symptoms indicate pump problem	Performance issue	High vibration	Abnormal sound	Excessive temperature	Leakages	
Major sources of high vibrations	Dynamic unbalance	Mis-alignment	Bent shaft / excessive run out	Flow induced	Bearing fault	
Major sources of abnormal sound	Cavitation	Turbulance and recirculation	Damaged bearings	Coupling		
Bearing types	Rolling element - Radial and Thrust	Hydrodynamic radial and rolling element thrust	Hydrodynamic - Radial and thrust			
Sealing of bearing housing	Lip Seal	Simple labyrinth seal	Bearing isolator	Gas seal (Sealess pump)		
Driver type	Electric motor	Gas Turbine	Steam turbine	Engine		
Power transmission mechanism	Direct drive	Flexible coupling	Rigid coupling	Coupling with Gearbox		
Index to evaluate pump design, performance and reliability	Specific speed	Suction specific speed	Shaft stiffness	Energy density		
Critical start up check points	Suction pressure and temperature	Venting	Healthieness of Seal plan	Strainer cleanliness	Lubrication quality and quantity	
Pump health check-up parameters	Suction pressure and Temp.	DP. across strainer	Discharge pressure	Total flow and input currant	Vibration trends	Lube quality and quantity
Challenging applications	High temperature (water or HC)	Extremmaly High pressure	Slurry or highly viscous fluid	Light hydrocarbon	Cryogenic service	
Important assembly check points	Shaft runout	Seal chamber concentricity and squareness	Wear ring clearances	Impeller back vane / front vane gap	Shaft axial / radial float	
Main components of Life cycle costs	Initial cost	Installation and commissioning cost	Energy and operational cost	Maintenance and repair cost		
Key Global player	Flowserve	Sulzer	KSB	ITT Goulds	Sundyne	Ruhrpumpen
	Grundfos	Wilo	Weir	Ebara	Clydeunion	SPX