FLOWSERVE

Lawrence Pumps® VPL1700
Multistage Vertical Toxic Liquid Pump

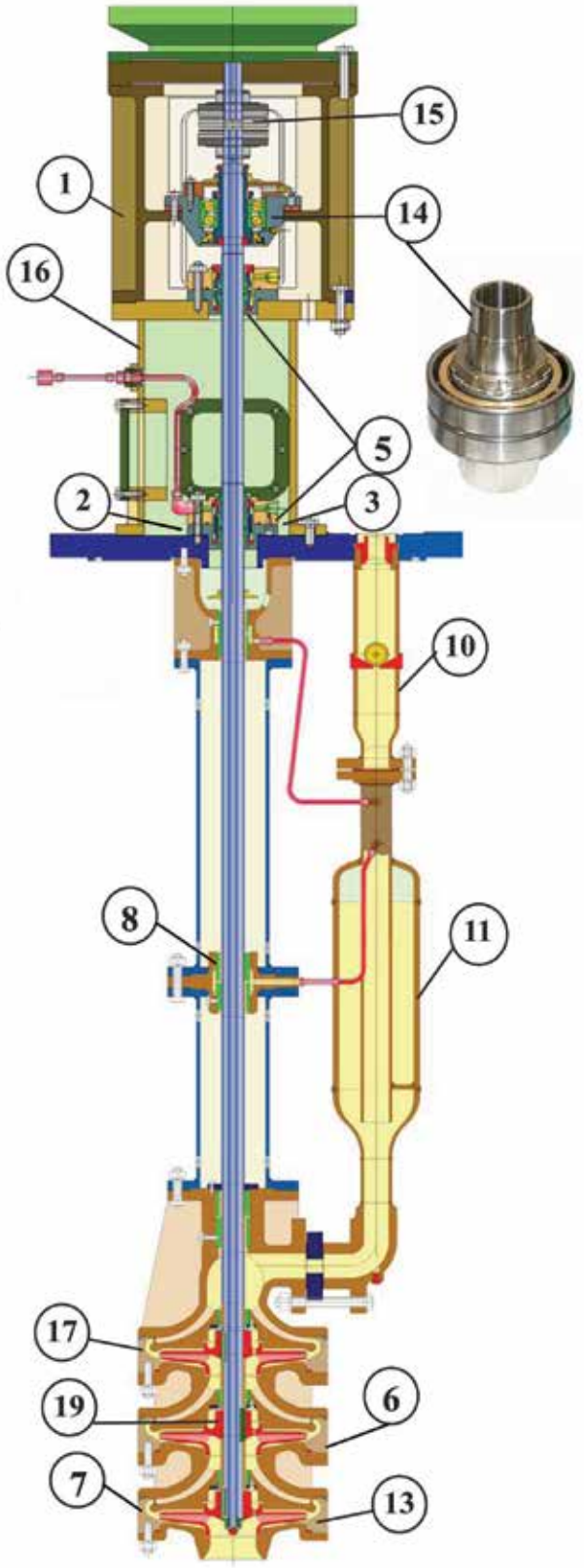
Mechanical and Hydraulic Upgrades

Experience In Motion

VPL1700 Mechanical and Hydraulic Upgrades

With safety and reliability being of equal importance in the handling of toxic liquids, Flowserve offers upgrades that increase environmental and personnel safety during the production and distribution of toxic liquefied gases.

High-performance, cost-effective upgrades are available for Lawrence Pumps' complete line of VPL1700 vertical, top tank entry, bottom suction pumps used for handling chlorine, anhydrous hydrogen cyanide, phosgene, bromine, sulfur trioxide and other lethal liquids. These upgrades increase operating reliability, reduce maintenance costs, and improve safety and performance.



Shaft and Sealing System Upgrades

1. **Vibration Monitoring** — transducers and proximity probes sense any changes in the mechanical operation.
2. **Temperature Monitoring** — thermocouples or RTD's for the lower seal chamber or packing box send a signal notifying the operator of an excessive temperature in this area.
3. **Adjustable Gland Mechanism** — permits remote packing adjustment external to the process environment.
4. **Emergency Seal** — located below the lower sealing element, isolating the storage vessel from the atmosphere should a packing or mechanical seal failure occur.
5. **Gas Mechanical Seals** — to replace packing or older seals for energy savings, lowest level of buffer gas consumption and fewer emissions. The seals employ state of the art, non-contacting seal face geometry, for a new level of sealing reliability over a wide range of operating pressures. Gas mechanical seals provide the lowest fugitive emissions without complex piping, instrumentation or regulation.

Material and Arrangement Upgrades

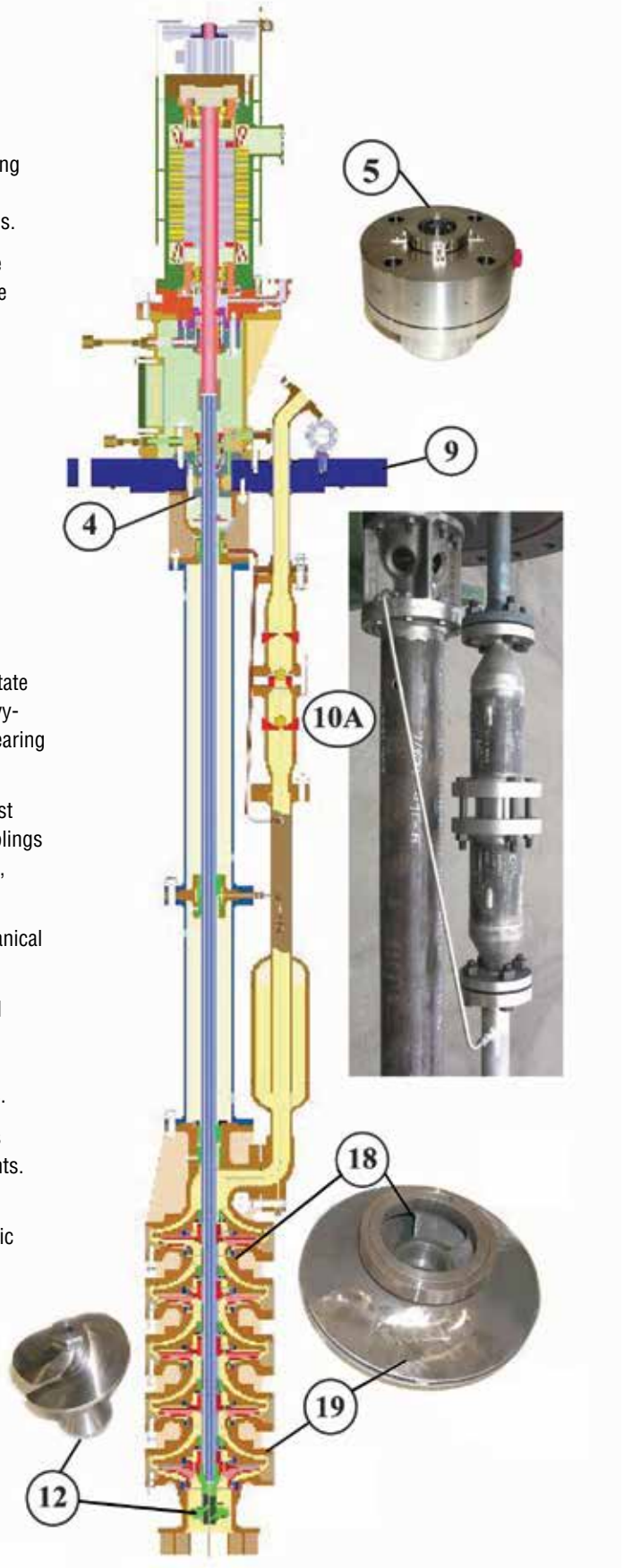
6. **Overall Pump Length Changes and Additional Stages** — for increased head output to accommodate system changes and/or for alternate tank use.
7. **High Alloy Wet Ends** — for corrosion and/or erosion prevention, low temperature and resistance to sparking.
8. **Ceramic/Intermetallic Wear Components** — for applications requiring high heat dissipation or wear resistance due to lack of lubrication or solids being present.
9. **ASME Code Stamped Mounting Plate** — available for pressure and toxic services.

Hydraulic Upgrades

10. **Excess Flow Check Valve** — stops the flow of toxic fluids should a line rupture occur outside the tank. A double-acting check valve is shown as item 10A. Check valves are also sold separately for systems handling dangerous toxic fluids.
11. **Surge Chamber** — absorbs the high-pressure shock wave (water-hammer) that occurs with the sudden closure of the check valve or system control valves.
12. **Inducer** — reduces the pump's required submergence (NPSHA) by 35% to 50%, thus minimizing tank inventory levels.
13. **Higher Flow and Head Wet Ends** — that fit through the same tank nozzle are available for capacities of up to 136 m^3/h (600 gpm) and heads up to 274 m (900 ft) on chlorine, 427 m (1400 ft) on water. New hydraulics can be developed to meet special operating conditions.

Reliability and Maintenance Upgrades

14. **Cartridge Thrust Bearing** — mounted on a sleeve to facilitate removal of seals and thrust bearings during rebuilds. Heavy-duty, anti-friction bearings operating in a well-protected bearing housing, providing an L10 life in excess of 25 000 hours.
15. **Dry Disc Spacer Coupling** — goes with the cartridge thrust bearing to facilitate bearing and seal removal. Spacer couplings are maintenance free, have low axial and bending stiffness, reducing the load on the pump and motor bearings.
16. **Compact Style Bearing Frame** — for use with new mechanical gas seals.
17. **Diffuser Style Casings** — balance the radial thrust around the circumference of the impeller. The radial load carried by the sleeve bearings is minimized. Confined, controlled compression gasketing for more positive sealing of stages.
18. **Wear Rings** — replaceable casing and impeller wear rings optimize efficiency and extend the life of critical components.
19. **Enclosed Impellers** — with sealing rings, allow variations in impeller clearances without affecting the overall hydraulic performance. Optional non-metallic and ceramic coated alloys are available for wear surfaces.



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