Pumpspeak 101

Vertical Lineshaft Turbine Pump Jargon
**Purpose**: To improve understanding of VLT pump construction, components involved, and communication among those working with pumps of this design type.
“Vertical lineshaft turbine pumps are centrifugal pumps specially designed to pump water from an underground well, reservoir, or sump. Also known as deep well turbine pumps or vertical lineshaft turbine pumps. The driver (typically a vertical shaft electric motor or a right-angle gear drive) is located above ground and connected to the bowl assembly at the bottom end of the pump by lineshafting. Despite the name, these pump types are diffuser pumps, and have nothing to do with turbines, as defined by Webster.

The bowl may be single or multi-stage as conditions require, and after the water exits the bowl it passes through a vertical column pipe towards the surface. The spinning shaft inside this column is supported at regular intervals to prevent deflection. The pumped fluid then reaches the discharge head where it changes direction and connects to the system’s discharge piping.”
Short coupled VLT pump

Major Components

Motor/ Driver

Discharge Head

Column/ Innercolumn

Bowl Assembly
Why and where are VLT pumps specified?
(Compared to suction lift pumps)

➢ **Advantages:**
  - Submerged impeller(s) eliminate need for priming
  - Huge variety of designs and sizes
  - Multi-stage capable
  - Uses less floor space
  - Can be modified for changes in system hydraulics
  - Drivers not affected by conditions in well or sump, or limited by casing size.
    Relative ease of rebuilding motor by local repair shops, increased tolerance of electrical supply issues, serviceable without pulling entire pump

➢ **Disadvantages:**
  - Specialized hoisting and handling equipment required for disassembly, inspection, and repair
  - Disassembly for inspection and repair more difficult
  - More bearings exposed to the fluid, which is a problem with abrasive or corrosive water being pumped. Enclosed lineshaft design can be of help in abrasive fluids
Why would our company want to be involved with these products?

- Customer base *typically* stable and financially sound, understands and appreciates the costs of working on larger equipment
- Construction easily understood by those with average mechanical aptitude
- Gross margins per job typically higher than water systems work
- Qualified contractors fewer in number, less competition than water systems/ small pump installation and repair
- It’s a pump, what could be more interesting?
How are VLT pumps classified?

- **Pump lubrication types**
  - Product (pumped fluid) lube/ open-lineshaft (OLS)/ water-lube
  - Oil lube/ enclosed lineshaft (ELS)

- **Inch reference of bowl assemblies**: traditionally designated by the *minimum possible* casing diameter in which the bowl will fit, which is not necessarily the *preferred minimum* casing size, followed by manufacturer’s model designation which may reference relative capacity, followed by number of stages. Most model designation systems are unique to a particular brand.
  - Example #1: **Goulds 12CLC-6**: 12-inch minimum casing fit; C-series (arbitrarily assigned by manufacturer, maybe head engineer on design team was “Charlie”); L would be a Low-capacity impeller offering for this series pump; C in this instance would reference Closed impeller design; -6 would indicate 6-stages
  - Example #2: **Flowserve 10EMM-4**: 10” minimum casing fit; enclosed impeller; medium capacity series; medium capacity impeller; 4-stage assembly

- **Outercolumn** is the term used to call out the “drop” pipe in a VLT pump assembly
  - Threaded and coupled style: Nominal diameter; nominal standard length; thread type
  - Flanged column connection: Nominal diameter; nominal standard length; typically manufacturer specific
Innercolumn is the term used for the lineshaft/driveline assembly, which consists of the lineshaft and related parts that support, align, and protect the lineshaft.

- Water lube/ OLS innercolumn consists of:
  - Lineshaft
  - Lineshaft coupling
  - Lineshaft sleeve (if carbon steel shafting used for the lineshaft)
  - Bearing retainer with insert bearing (usually Buna rubber)

- Oil lube/ ELS innercolumn consists of:
  - Lineshaft
  - Lineshaft coupling
  - Threaded lineshaft bearings
  - Enclosing tubes
  - Rubber centering spiders
Discharge Heads

Common dimensional abbreviations and their importance

- “BD” = Base Dimension or driver fit.
- Centerline of pump to discharge flange (no common abbreviation)
- Centerline of discharge flange to base (no common abbreviation)
Motors

Vertical Hollow Shaft (VHS) motor jargon to know:

- “BD”………. Base Diameter (10-12”/ 16 ½”; 20”; 24”...)
- “CD”………. Coupling Distance (Base of motor to where headnut contacts drive coupling)
- “BX”... Drive Coupling “Box”
  - Example: 1 ½” x 3/8”... this is the bore of the drive coupling for the headshaft and the keyway size
- “AG”………. Overall height of the motor w/ canopy

These are the most critical dimensions to know when replacing or purchasing a motor for your project. Motor dimensions have changed and varied over the years, and just because you’re replacing an older 75 HP 1800-rpm driver with a new unit, the replacement may not fit unless you account for these important dimensions. Many older motors differ in particular to the “CD” dimension. Some very old VHS motors did not even conform to NEMA (National Electric Manufacturer’s Association) base mounts and were brand-only specific.
### Bill of Materials/ B.O.M.

(Original Build Configuration)

#### Job Single-Level BOM Report

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Parts on the Bill of Materials

Enclosing Tube, std. 2” x 28”

Lineshaft 1.25” x 60”, 12TPI LH

Enclosing Tube, 2” x 5 ft.

Bearing, threaded reducer, 2 ½” x 2” x 1 ¼”

Bearing Threaded lineshaft LH, 1.25” x 2”

Coupling, lineshaft 1.25” LH
Other Common Parts

- Headnut/Top Adjusting Nut
- Gib Drive Key
- Lineshaft Coupling and Headshaft
- Water Lube Lineshaft with SS Sleeve
- OLS Bearing Retainer w/ Insert Bearing
- Bowl Shaft Sleeve Bearings
- Impeller and Taper Collet
- Bowl Shafts
Common Part Identification and Callouts/ Jargon

- **Enclosing Tubes**: Diameter; length; manufacturer; and thread (right-hand/ left-hand)
  - 2” x 30” (special length) Worthington left-hand
  - 2 ½” x 5 ft. (longest standard length) Western Land Roller Right-Hand

- **Lineshaft Bearings (regular)**: Manufacturer; shaft diameter; tube diameter; left or right hand thread
  - Byron-Jackson 1 3/16” x 2” left-hand
  - Johnston 1 ¼” x 2” left hand

- **Lineshaft Couplings**: Manufacturer*; shaft diameter; thread pitch; material
  - Flowserve 1 ¼”-12 TPI #316 Stainless Steel

- **Intermediate Lineshafts**: Manufacturer*; shaft diameter; length; thread pitch; material
  - Peerless 1 ½” x 5 ft.; 10 TPI; C1045 Carbon Steel

- **Bowl Shafts**: Manufacturer*; nominal diameter; turndown diameter (if needed) and length; thread pitch (Almost always #416 material in our industry)
  - Goulds 1 11/16” x 66”; turndown to 1 3/16” x 14” on top w/ 10 TPI

- **Water Lube Lineshafts**: Manufacturer*; shaft diameter and length; shaft sleeve diameter and length; sleeve position on shaft

*Manufacturer not necessarily required, but may aid in part identification
Common Parts Identification/ continued

- **Water Lube Retainers**: Manufacturer*; Column diameter; OD Ring Width*; Bore Diameter and Length; Material
  
  * Measure actual length of outercolumn. Outercolumn length plus retainer width will usually equal an even inch of foot measurement.

- **Water Lube Insert Bearings**: Manufacturer*; Shaft or Shaft Sleeve Diameter; Retainer Hub Bore and Bore Length

- **Bowl Sleeve Bearings**: Manufacturer*; Shaft Size; Outside Diameter; Length

- **Bowl Sleeve Bearings w/ OD Turndown**: Manufacturer; Model; and Dimensions Required
  
  *Manufacturer often helpful, but not absolutely required
Other Documentation

Pumping Equipment Removal Report

Date: __________________ Shop Workorder #: __________________
Customer: __________________ Location: __________________
UTM COORDINATES: __________________ Static Water Level: __________________
Well Depth: __________________ Casing Type and size: __________________ Reline: YES NO
Pump setting (number and lengths of columns): __________________
Column / inner-column type or brand: __________________
Column Size: __________________ Enclosing Tube size: __________________ Lineshaft size: __________________
Discharge head type/size/description: __________________
Discharge piping: __________________
Headshaft diameter: __________________ Length: __________________ Gudgeon: __________________ Keyway size: __________________
Top enclosing tube diameter: __________________ Length: __________________
Bowl type/size/description: __________________
Bowl shaft projection: __________________ Enclosing tube projection: __________________
Bowl discharge: __________________ Bowl suction: __________________
Intake screen/strainer description: __________________
Motor Data/Brand: __________________ Horsepower: __________________ RPM: __________________
Serial #: __________________ Motor Notes: __________________
Control Panel Voltage: __________________ Electric Meter #: __________________
Labor / Hours: __________________ Crew: __________________ Unit #: __________________

NOTES: __________________

Rebowl Information

Required

Customer / Job Name: __________________

Column Connection Information

Line Shaft Size - D: __________________ & TPI: __________________
Bearing Size - E: __________________ & TPI: __________________

TPI = Number of Threads Per Inch

Wood Lined Tube: [ ] Yes [ ] No

Column Size: __________________

Measurements of Stick-ups Must be made with shaft down

Record the following Information

Shaft Stick-up - A: __________________
Tube Stick-up - B: __________________
Bearing Stick-up - C: __________________
Brand of Old Pump: __________________
If the pump is relatively new, a serial number and Bill of Materials *may* be helpful in pump identification and ordering of parts. If the pump is more than 15-years old, experience has taught that the probability of the pump being original is low, and the service man must have knowledge of the vocabulary, jargon, and descriptions used with VLT pumps. Understand and know that the distributor and factory employees in today’s workforce will be lacking in experience, application, and interest in your project. You will quickly realize if your contact is knowledgeable and able to assist in communicating on the level required to identify and supply the correct parts and components for your project.
“Proper installation will contribute to maximum efficiency and long trouble-free life.”