**Short-Set Lineshaft (VIT) Specification**

PART 1- GENERAL

* 1. SCOPE
1. Pumps that are supplied under this specification shall be vertical turbine open or enclosed lineshaft design with lubrication method, including a bowl assembly, column assembly, discharge head and driver. The discharge head shall be designed to carry the entire weight of the bowl and column assembly along with the specified driver without excessive vibration or noise. All of the supplied equipment shall conform to this specification.
2. The required units shall be Bell & Gossett’s Model Choose a model with number of stages, or an approved equal.
	1. QUALITY ASSURANCES
3. Warranty

 The manufacturer shall warrant their pumps to be free of defects for a period of one year after the product is put into operation or eighteen months from the shipment date, whichever occurs first.

1. Certifications
2. The pump manufacturer shall be certified to the ISO 9001 standard for design and manufacture of vertical turbine pumps.
3. The manufacturer shall be capable of producing vertical turbine pumps certified to NSF/ANSI 61 & 372.
4. Pressure containing fabrications shall be welded only by those whom are qualified on ASME code section IX. Welder certification shall be provided with the submittal package.
5. Foundry

 The manufacturer shall own and operate its own U.S. based foundry producing vertical turbine components.

1. Testing Standards

 All vertical turbine pumps shall conform to ANSI/AWWA E101-88 and to the most current edition of Hydraulic Institute Standards.

* 1. SUBMITTALS
1. With the proposal, the contractor shall submit complete fabrication and assembly drawings together with detailed specifications covering materials, parts, devices, and accessories. The data and specifications for each pumping unit shall include, but not be limited to the following:

Name of Manufacturer

Type and Model

Design Rotational Speed

Number of Stages

Type of Bowl Bearings

Type of line shaft bearings

Size of Shafting

Size of Pump Column

Size of Discharge Outlet

OD of Pump Bowls

Weight

Type of Finish

Total Weight

Total Pump Length

Complete performance curves showing capacity versus head, NPSH required, efficiency, and BHP plotted scales consistent with performance requirements

PART 2 – PRODUCT SELECTION

* 1. MANUFACTURER
1. Bell & Gossett, A Xylem Brand
2. The equipment covered by this specification shall be standard products as manufactured by Bell & Gossett or an equivalent having a minimum of 20 years’ experience in the production of such equipment. All pumps and pump components specified in this specification shall be supplied by a single pump manufacturer. The pump manufacturer shall be required to supply the pumps and drivers, and shall be responsible for their compatibility only.
3. A factory authorized service facility shall have trained service technicians and be able to show evidence of parts inventory for routine maintenance items such as bearings, gaskets, shafts, and sleeves.
	1. OPERATION SELECTION
4. Stated total dynamic head (TDH) includes lift and all system pressure. Pump manufacturer shall include pump’s internal loses.
5. Pump item number:
6. Number of required units:
7. Condition “A” (Design Point),

Capacity, GPM:

TDH, head in feet:

1. Condition “B” (On the Curve and Left of Design Point),

Capacity, GPM:

TDH, head in feet:

1. Condition “C” (On the Curve and Right of Design Point),

Capacity, GPM:

TDH, head in feet:

1. Condition “D” (Shutoff),

Capacity, GPM:

TDH, head in feet:

1. Condition “E” (Runout),

Capacity, GPM:

TDH, head in feet:

1. Driver horsepower:
2. Minimum bowl efficiency,

Percent (design point):

1. Maximum pump operating speed:
2. Minimum column and discharge diameter, inches:
3. NPSHR not to exceed:
4. Condition “A” as listed above is the design point and will be used for any performance evaluation in accordance with the set tolerance grade standards of the Hydraulic Institute.
5. The pump horsepower requirements for any point on the curve shall not utilize the service factor nor exceed the motor nameplate horsepower rating.
	1. SERVICE CONDITIONS

 Liquid to be pumped:

 Pumping temperature (PT)

 Specific gravity at PT:

 Viscosity at PT:

 Vapor pressure at PT/max temp:

 Pumping Liquid pH:

 Suction pressure:

 Available liquid level from sump floor:

 Site elevation:

 Distance from bottom of Choose an item to the bottom of sump:

* 1. MATERIALS AND CONSTRUCTION
1. The vertical turbine lineshaft Choose an item pump shall conform to the materials of construction for select one design. (Insert table from Xylem Online pump configuration, or review and edit applicable table below)

Sectional Type “VIT-FFFM”

LINESHAFT, W/L, ‘F’ FABRICATED HEAD, FLANGED COLUMN PACKING

|  **DISCHARGE HEAD ASSEMBLY** |
| --- |
| **Description** | **MC** | **Material Description** | **ASTM** |
| Headshaft | 2227 | SST 416 | A582 S41600 |
| Adjusting Nut | 2242 | Steel 1018 | A108 G10180 |
| Gib Key | 2242 | Steel 1018 | A108 G10180 |
| Slinger | 5121 | Rubber | 3CA715A25 B14 |
| Discharge Head | 9645 | Steel | A120 GRB |
| Stuffing Box Bearing | 1109 | Bronze | B584 C90300 |
| Stuffing Box | 1003 | Cast Iron | A48 CL30 |
| Stuffing Box Gasket | 5136 | Acrylic Gasket | Garlock Blue Guard |
| Split Gland | 1205 | SST 304 | A744 S30400 |
| Gland Adjusting Screw | 2229 | SST 316 | A276 S31600 |
| Packing | 5026 | Acrylic Yarn | Packmaster 2 |
| **COLUMN AND LINESHAFT ASSEMBLY** |
| Column Pipe (FLG) | 6501 | Black Pipe | A53 |
| Column Bolting | 2298 | Grade 8 | SAE J429 GR8 |
| Lineshaft | 2227 | SST 416 | A582 S41600 |
| Bearing Retainer | 1003 | Cast Iron | A48 CL30 |
| Lineshaft Bearing | 1109 | Bronze | B584 C90300 |
| Lineshaft Coupling | 2265 | SST 416 | A582 S41600 |
| **BOWL ASSEMBLY** |
| Bowl Shaft | 2227 | SST 416 | A582 S41600 |
| Intermediate Bowl | 6911 | Coated Cast Iron | A48 CL30 |
| Inter Bowl Bearing | 1109 | Bronze | B584 C90300 |
| Impeller | 1398 | Bronze | B584 C87600 |
| Impeller Taper Lock | 2242 | Steel 1018 | A108 G10180 |
| Wear Rings (optional) | 1128 | Bronze | B148 C95200 |
| Hex Bolt | 2298 | Grade 8 | SAE J429 GR8 |
| Sand Collar | 1205 | SST 304 | A744 S30400 |
| Suction Bowl / Bell | 1003 | Cast Iron | A48 CL30 |
| Suction Bearing | 1109 | Bronze | B584 C90300 |
| Suction Strainer | 6952 | Galvanized Steel | A108 G10180 |
| Plug | 1046 | Mal Iron | A197 |

Sectional Type “VIT-FFFM”

LINESHAFT, W/L, ‘F’ FABRICATED HEAD, FLANGED COLUMN, SEAL, VSS, AS COUPLING

| **DISCHARGE HEAD ASSEMBLY** |
| --- |
| **Description** | **MC** | **Material Description** | **ASTM** |
| Discharge Head | 9645 | Steel | A53 |
| Coupling Assembly | 5932 | Brass  | B16 C3600 |
| Seal Housing | 1003 | Cast Iron | A48 CL30 |
| Seal Housing Bearing | 1109 | Bronze | B584 C90300 |
| Mechanical Seal |  | Vendor Standard |  |
| Seal Housing Gasket | 5136 | Acrylic Gasket | Garlock Blue Guard |
| **COLUMN AND LINESHAFT ASSEMBLY** |
| Column Pipe (FLG) | 9645 | Steel | A53 |
| Column Bolting | 2298 | Grade 8 | SAE J429 GR8 |
| Lineshaft | 2227 | SST 416 | A582 S41600 |
| Lineshaft Coupling | 2265 | SST 416 | A582 S41600 |
| Bearing Retainer | 1003 | Cast Iron | A48 CL30 |
| Lineshaft Bearing | 1109 | Bronze | B584 C90300 |
| **BOWL ASSEMBLY** |
| Bowl Shaft | 2227 | SST 416 | A582 S41600 |
| Intermediate Bowl | 6911 | Coated Cast Iron | A48 CL30 |
| Inter Bowl Bearing | 1109 | Bronze | B584 C90300 |
| Impeller | 1398 | Bronze | B584 C87600 |
| Impeller Taper Lock | 2242 | Steel 1018 | A108 G10180 |
| Wear Rings (optional) | 1128 | Bronze | B148 C95200 |
| Suction Bowl / Bell | 1003 | Cast Iron | A48 CL30 |
| Suction Bearing | 1109 | Bronze | B584 C90300 |
| Sand Collar | 1205 | SST304 | A744 S30400 |
| Plug | 1046 | Mal Iron | A197 |
| Hex Bolt | 2298 | Grade 8 | SAE J429 GR8 |

Sectional Type “VIT-CATM”

LINESHAFT, W/L, ‘A’ CAST HEAD, THREADED COLUMN PACKING

| **DISCHARGE HEAD ASSEMBLY** |
| --- |
| **Description** | **MC** | **Material Description** | **ASTM** |
| Headshaft | 2227 | SST 416 | A582 S41600 |
| Adjusting Nut | 2242 | Steel 1018 | A108 G10180 |
| Gib Key | 2242 | Steel 1018 | A108 G10180 |
| Slinger | 5121 | Rubber | 3CA715A25 B14 |
| Discharge Head | 1003 | Cast Iron | A48 CL30 |
| Stuffing Box Bearing | 1109 | Bronze | B584 C90300 |
| Stuffing Box | 1003 | Cast Iron | A48 CL30 |
| Stuffing Box Gasket | 5136 | Acrylic Gasket | Garlock Blue Guard |
| Split Gland | 1205 | SST 304 | A744 S30400 |
| Gland Adjusting Screw | 2229 | SST 316 | A276 S31600 |
| Packing | 5026 | Acrylic Yarn | Packmaster 2 |
| Column Flange | 1003 | Cast Iron | A48 CL30 |
| **COLUMN AND LINESHAFT ASSEMBLY** |
| Column Coupling | 6501 | Black Pipe | A53 |
| Column Pipe | 6501 | Black Pipe | A53 |
| Lineshaft | 2227 | SST 416 | A582 S41600 |
| Bearing Retainer | 2321 | SST 304 | A320 |
| Lineshaft Bearing | 5121 | Rubber | 3CA715A25 B14 |
| Lineshaft Coupling | 2265 | SST 416 | A582 S41600 |
| **BOWL ASSEMBLY** |
| Bowl Shaft | 2227 | SST 416 | A582 S41600 |
| Discharge Bowl | 1003 | Cast Iron | A48 CL30 |
| Discharge Bearing | 1109 | Bronze | B584 C90300 |
| Intermediate Bowl | 6911 | Coated Cast Iron | A48 CL30 |
| Inter Bowl Bearing | 1109 | Bronze | B584 C90300 |
| Impeller | 1398 | Bronze | B584 C87600 |
| Impeller Taper Lock | 2242 | Steel 1018 | A108 G10180 |
| Wear Rings (optional) | 1128 | Bronze | B148 C95200 |
| Hex Bolt | 2298 | Grade 8 | SAE J429 GR8 |
| Sand Collar | 1205 | SST 304 | A744 S30400 |
| Suction Bowl / Bell | 1003 | Cast Iron | A48 CL30 |
| Suction Bearing | 1109 | Bronze | B584 C90300 |
| Suction Strainer | 6952 | Galvanized Steel | A108 G10180 |
| Plug | 1046 | Mal Iron | A197 |

Sectional Type “VIT-CFFM”

LINESHAFT, W/L, ‘F’ CAST HEAD, FLANGED COLUMN PACKING

|  **DISCHARGE HEAD ASSEMBLY** |
| --- |
| **Description** | **MC** | **Material Description** | **ASTM** |
| Headshaft | 2227 | SST 416 | A582 S41600 |
| Adjusting Nut | 2242 | Steel 1018 | A108 G10180 |
| Gib Key | 2242 | Steel 1018 | A108 G10180 |
| Slinger | 5121 | Rubber | 3CA715A25 B14 |
| Discharge Head | 9645 | Steel | A120 GRB |
| Stuffing Box Bearing | 1109 | Bronze | B584 C90300 |
| Stuffing Box | 1003 | Cast Iron | A48 CL30 |
| Stuffing Box Gasket | 5136 | Acrylic Gasket | Garlock Blue Guard |
| Split Gland | 1205 | SST 304 | A744 S30400 |
| Gland Adjusting Screw | 2229 | SST 316 | A276 S31600 |
| Packing | 5026 | Acrylic Yarn | Packmaster 2 |
| **COLUMN AND LINESHAFT ASSEMBLY** |
| Column Pipe (FLG) | 6501 | Black Pipe | A53 |
| Column Bolting | 2298 | Grade 8 | SAE J429 GR8 |
| Lineshaft | 2227 | SST 416 | A582 S41600 |
| Bearing Retainer | 1003 | Cast Iron | A48 CL30 |
| Lineshaft Bearing | 1109 | Bronze | B584 C90300 |
| Lineshaft Coupling | 2265 | SST 416 | A582 S41600 |
| **BOWL ASSEMBLY** |
| Bowl Shaft | 2227 | SST 416 | A582 S41600 |
| Intermediate Bowl | 6911 | Coated Cast Iron | A48 CL30 |
| Inter Bowl Bearing | 1109 | Bronze | B584 C90300 |
| Impeller | 1398 | Bronze | B584 C87600 |
| Impeller Taper Lock | 2242 | Steel 1018 | A108 G10180 |
| Wear Rings (optional) | 1128 | Bronze | B148 C95200 |
| Hex Bolt | 2298 | Grade 8 | SAE J429 GR8 |
| Sand Collar | 1205 | SST 304 | A744 S30400 |
| Suction Bowl / Bell | 1003 | Cast Iron | A48 CL30 |
| Suction Bearing | 1109 | Bronze | B584 C90300 |
| Suction Strainer | 6952 | Galvanized Steel | A108 G10180 |
| Plug | 1046 | Mal Iron | A197 |

Sectional Type “VIT-FUFM”

LINESHAFT, W/L, ‘U’ FABRICATED HEAD, FLANGED COLUMN, PACKING, VSS – TYPE A

|  **DISCHARGE HEAD ASSEMBLY** |
| --- |
| **Description** | **MC** | **Material Description** | **ASTM** |
| Motor Coupling Assembly | 5933 | Carbon Steel | A108 G10180 |
| Slinger | 5121 | Rubber | 3CA715A25 B14 |
| Discharge Head | 9645 | Steel | A120 GRB |
| Stuffing Box Bearing | 1109 | Bronze | B584 C90300 |
| Stuffing Box | 1003 | Cast Iron | A48 CL30 |
| Stuffing Box Gasket | 5136 | Acrylic Gasket | Garlock Blue Guard |
| Split Gland | 1205 | SST 304 | A744 S30400 |
| Gland Adjusting Screw | 2229 | SST 316 | A276 S31600 |
| Packing | 5026 | Acrylic Yarn | Packmaster 2 |
| **COLUMN AND LINESHAFT ASSEMBLY** |
| Column Pipe (FLG) | 6501 | Black Pipe | A53 |
| Column Bolting | 2298 | Grade 8 | SAE J429 GR8 |
| Lineshaft | 2227 | SST 416 | A582 S41600 |
| Bearing Retainer | 1003 | Cast Iron | A48 CL30 |
| Lineshaft Bearing | 1109 | Bronze | B584 C90300 |
| Lineshaft Coupling | 2265 | SST 416 | A582 S41600 |
| **BOWL ASSEMBLY** |
| Bowl Shaft | 2227 | SST 416 | A582 S41600 |
| Intermediate Bowl | 6911 | Coated Cast Iron | A48 CL30 |
| Inter Bowl Bearing | 1109 | Bronze | B584 C90300 |
| Impeller | 1398 | Bronze | B584 C87600 |
| Impeller Taper Lock | 2242 | Steel 1018 | A108 G10180 |
| Wear Rings (optional) | 1128 | Bronze | B148 C95200 |
| Hex Bolt | 2298 | Grade 8 | SAE J429 GR8 |
| Sand Collar | 1205 | SST 304 | A744 S30400 |
| Suction Bowl / Bell | 1003 | Cast Iron | A48 CL30 |
| Suction Bearing | 1109 | Bronze | B584 C90300 |
| Suction Strainer | 6952 | Galvanized Steel | A108 G10180 |
| Plug | 1046 | Mal Iron | A197 |

1. Bowl Assembly
	1. The suction bell/bowl shall be designed to provide conservative entrance velocities and direct the flow to the first stage impeller. The inner surface of the suction bell shall be smooth and free of sharp projections which could cause turbulence or cavitation. The suction casing shall be designed to house the suction bell bearing by means of four vanes.
	2. The bowls shall be smooth and free of sharp projections and shall have register fits for alignment and be connected by flanged and bolted construction. Bowl sizes 6" to 15" shall be porcelain enameled on the bowl interior. Bowl sizes 16" and larger shall be epoxy-lined.
	3. The impellers shall be machined and finished smooth to insure proper performance. They are to be balanced prior to assembly. The impellers shall be connected to the bowl shaft by means of Choose an item.
	4. The suction strainer shall be a select one design and have a free inlet area of at least 3-4 times the impeller eye area. The suction strainer shall be connected to the bowl assembly suction casing.
2. Column Assembly
	1. The column shall include column type connections and shall be of open/enclosed design with lubrication method.
	2. The bearing spacing shall be selected to insure operation at a minimum of 25% above or below the first critical speed. Bearing spacing shall not exceed size.

* 1. Select one. The interior of the column shall be free of offsets, burrs, discontinuities and irregularities.
	2. The lineshaft shall be of adequate size to transmit the full power of the pump without slip, excessive vibration or elongation, and shall have threaded/keyed joints. Lineshaft lengths shall not exceed 10 feet. The lineshaft shall have left hand threads that tighten during pump operation.
1. Discharge Head Assembly

Select one. The flange shall be a select one. The discharge head shall be designed to carry the entire weight of the complete pump and driver without distortion when spanning an opening of sufficient size to permit removal of the complete pump assembly. The discharge head shall be provided with a coupling guard. Lifting lugs shall be provided as standard.

 Select one: Stuffing Box, Seal Housing, Tube Tension Assembly

1. The stuffing box shall be designed for 6 rings of packing and lantern ring. An extra-long bearing shall be located below the packing in the stuffing box. Packing lubrication leakage through the stuffing box shall be drained back to the sump. The packing gland shall be of a two piece design.
2. The seal housing shall be designed to accept a type mechanical seal.
3. The oil tube tension assembly shall be designed and installed on the discharge head to allow proper tension to be placed on the shaft enclosing tube. An extra-long bearing shall be installed in the assembly to allow for position alignment and support for the shaft. A one gallon oil reservoir shall be provided for lubrication of the enclosed lineshaft. choose an item shall be included.
4. A tube tension assembly shall be provided for units that will be enclosed lineshaft fresh water flush. A connection on the packing nut will be provided for the injection of the flush water. A packing gland will be installed with non-corrosive studs and nuts to compress upper packing.
5. Driver

 The driver will be Choose an item. The driver and any related equipment will ship unmounted from the pump to ship.

* 1. COATING
1. The bowl assembly exterior shall be coated with select coating.
2. The column assembly choose an item shall be coated with select coating.
3. The head assembly choose an item shall be coated with select coating.
4. For *lubrication method* configuration, tube assembly exterior shall be coated with select coating.
	1. TESTING
5. All factory testing shall conform to the most current edition of the Hydraulic Institute Standards. All pump performance testing shall be performed at the manufacturer’s facility. (Specify if there are any additional standards)
6. Performance testing shall be witnessed/non-witnessed and performed on the Choose an item. The test shall cover seven points including the design point (HI 14.6). The design point shall be used for any performance evaluation.
7. Hydrostatic testing shall be witnessed/non-witnessed in compliance with HI14.6. Hydro testing is to be performed on the pressure containing components. select one
8. A standard 10 business days’ notice shall be given to the engineer before starting any witness testing. The manufacturer shall not be responsible for expenses including, but not limited to travel, food, and lodging to observe all witness testing.
9. A written approval for all witness testing is required prior to release for shipment. All non-witness testing shall require written approval/no written approval prior to release for shipment.
10. Field/functional testing will be performed by the contractor to insure proper mechanical operation at the jobsite. All testing data to be used for evaluation shall be performed at the pump manufacturer's facility.
11. Motor tests and test reports shall be provided as required in accordance with the motor specification.

PART 3 - EXECUTION

3.01 SHIPPING

 Pumps that are less than 30 feet in length shall be shipped fully assembled with the driver and shaft seal unmounted. The discharge flange shall be protected with a wooden flange cover.

3.02 STORAGE, HANDLING, AND INSTALLATION

The skidded pump and related equipment shall be unloaded, stored, and installed in agreement with the Manufacturer’s operation and installation manuals. If storage is planned to be longer than six months or in harsh environment, long term storage practices should be followed per the Manufacturer’s operation and installation manuals.

3.03 START-UP FIELD SERVICES

 The pump manufacturer shall include two days of start-up field services with the proposal for the purpose of supervising the start-up and instructions of proper maintenance and operations.

 Service Provided By Factory Representative Time on Site

 Inspect and Approve Installation ½ Day

 Supervise Initial Adjustment ½ Day

 Supervise Field Run Test ½ Day

 Instruct Owner in Proper Start-Up and O&M ½ Day

 Additional time on site shall be billed at the rate deemed by the manufacturer.

**Guide Specification Future Revisions**

If you would like to be informed of future revisions to this specification, please fill-out the below information and return this form to your local Bell & Gossett salesman. The B&G salesman will file your request with Xylem’s Vertical Turbine Product Management team, and updates will be sent to you automatically via the contact information you provide.

|  |  |
| --- | --- |
| Name:Date:Company Name:Company Address:Phone Number:E-mail address: |  |
|  |  |

We are using this Guide Specification to specify: [type of market or application]

Additional Comments/Feedback: