
1.0 – VTM-3000-WB

Item 1.0 VERTIMILL® Grinding Mill

General Design, Mill Inspection and Quality Assurance

The VERTIMILL® Grinding Mill and ancillary equipment as specified here in is described and quoted per Metso's standard, heavy duty design with a proven record of reliability. The equipment is designed for 24 hours per day, 365 days per year operations. The equipment offered will be fabricated, painted, tested, protected from the elements, and shipped all in accordance with the general standards for this class of equipment.

The equipment manufactured by Metso is subject to a system of controls which will assure the quality of the products. This system is defined in Metso Quality Assurance Manual form E-0002. All welding shall be in accordance with the latest edition of AWS D1.1. Magnetic particle examination will be used for spot checking welds or where Metso deems appropriate. Further information regarding manufacturing of Vertimill components and inspections can be found in below references Quality and Inspection Specifications.

Mill structural design loading is based on a total charge volume of 100 percent including a ball charge of 100 percent of total mill grinding volume. The Vertimill seismic design criteria utilizes horizontal coefficient of 0.41 which satisfies UBC zone 4 and Chilean Zone 3.

All exposed metal surfaces shall be prepared, primed and finish painted according Metso Painting Specification T-101 or the sub-suppliers standard paint specification. Prior to painting, all loose mill scale, rust, etc., will be cleaned from those surfaces to be painted. Equipment to be painted with manufacturer's Standard Paint Coating. Machined surfaces will be coated with a rust-preventative compound.

Please refer to Forms T-124 for Metso Shipping Standards for Imported Items.

Additional Specifications

In addition to this specification, the equipment will be provided in accordance with the following Metso specifications and data sheets:

E-0002	Quality Assurance Manual
A06-001064 R4	Welding, Fabrication, & Inspection Requirements for Vertimill Bodies
A06-000869 R4	Welding, Fabrication, & Inspection Requirements for General Equipment
A06-000553 R1	MT & UT Inspection of Vertimill Screw Shafts
A06-000506 R4	Storage procedure
A06-001049 R2	Specification for Rubber Lining
T-101	Surface Preparation and Painting Specification
T-124	Export Shipping Standards
T-125	Domestic and Containerized Shipping Standards

1.1 - Engineering Description / General Components

One (1) VTM-3000-WB Metso Minerals VERTIMILL® Grinding Mill, arranged for wet grinding, complete with the following:

Model Number	VTM-3000-WB	
Mill Weight	754,050 lbs.	(342,750 kg)
Recommended Grinding Media Charge Weight	610,720 lbs.	(277,600 kg)



Figure 1: VTM-3000-WB typical Configuration

Mill Lower Body: The lower body is a fabricated A-36 steel cylindrical construction consisting of four (4) Lower Body segments, with the dimensions as noted above, to minimize shipping window. The segments have machined flanges for bolting together in the field (figure 2).

Assembled, the Lower Body includes two flanged connections near the bottom of the mill for recycle return, mill drainage, mill flushing, or bottom feeding. Four (4) inlet ports are located near the top of the mill for feed, ball loading, and/or water addition. The lower body also includes an integral baffle plate to control material flow and an enclosed overflow launder for connection to separating tank. The mill lower body is prepped and painted in accordance with Metso Specification T-101.

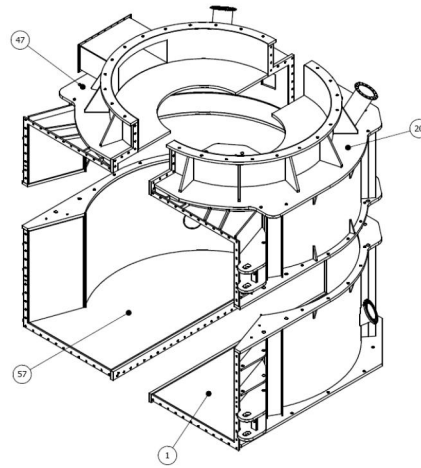


Figure 2: Lower Body Segmentation

Screw Access Door: One (1) hinged access door for maintenance and screw removal. Access door ships in two segments machined flanges for bolting together in the field. The door includes two (2) molasses gate discharge ports for emptying the mill for maintenance. While typically discharged from the front, as an option, one of the discharge ports can be located on the mill lower body if discharging will be done from the sides or back of the mill.

Mill Upper Body and Drive Pedestal: The fabricated A-36 steel upper body and drive pedestal assembly houses the mill bearings and drive shaft and supports the motor and reducer. It can be rotated at 15 degree intervals about the center line of body for easy integration with plant piping and access to platforms.

Access Door Jack System: The access door jack system is designed to aid in opening the access door by powering it straight out for the first 7 inches, to clear the door jamb. This system consists of four 5 Ton capacity jacks mounted on the access door jamb. Plumbing is provided to power all four jacks with one 10,000 PSI capacity manual hand pump. Also included are manual jacks at the door hinges, to keep the door straight during opening and closing. After the door is jacked straight out, the force required to open the door is minimal so it can be opened by several men or using existing mobile equipment.

Screw Grinding Media Agitator and Liners: Fabricated steel, double helical screw with solid steel shaft is suspended in the mill body and attached to the upper drive shaft by a heavy duty keyed and bolted flange, is designed to last the life of the mill. Agitator shaft and flights are covered with abrasion resistant material for corrosion resistance and to improve the mating surface fit up from the permanent screw and the cast flight liner.

Screw liners are bolt on replaceable castings designed to give maximum life. (Bolt on liners are shipped separate for field installation by others.) Liner material is a proprietary high chrome-molybdenum white iron alloy, heat treated for high hardness (>650 HBN) and providing excellent abrasion resistance and maximum wear life. One set of VTM-3000-WB screw liners includes two (2) end liners and four (4) wear liners.

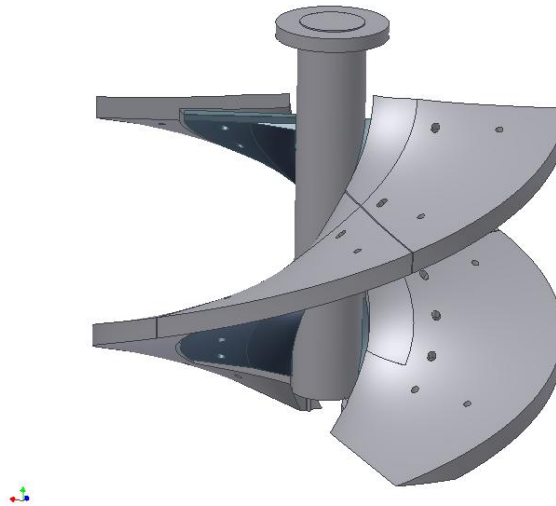


Figure 3 – VTM-3000-WB Screw with Liners

Mill Body Lining: The lower 3050 mm of the body, is the primary action zone of the mill and is lined with Orebed[®] magnetic liners which consist of 160 mm x 254 mm tiles of magnets embedded in rubber. These tiles ship loose and are magnetically mounted in the field (by others) directly to the shell of the mill without hardware. Small balls and other magnetic material attach themselves to the liners and form an autogenous wear surface. This bed is continually replaced from the charge such that the Orebed[®] liners should last the life of the mill. The Mill body under the tiles is painted for corrosion resistance. The mill body interior above the Orebed[®] lining and the overflow launder are covered with abrasion resistant material.

Bearings and Drive Shaft: The Vertimill has Three (3) bearings main shaft bearings: one (1) radial bearing with replaceable split sleeve bronze bushing, one(1) spherical radial roller bearing, and one(1) spherical thrust roller bearing, all with double lip seals and designed for grease lubrication. The bearings are located above the mill body (and above the operating pulp level) and are supported the upper body steel fabrication. The solid steel drive shaft connects the low speed reducer shaft to the grinding media agitator. Calculated L10 bearing exceeds 100,000 hours. The main shaft bearings and driven LS coupling half are preassembled to the drive shaft and mounting plates for ease of installation.

Automatic Grease Assembly: A pneumatically driven grease pump system that delivers the required amount of lubricating grease in set intervals to the Vertimill bearings. The automatic grease assembly includes:

- One (1) pneumatic grease pump
- One (1) air control panel
- One (1) manifold assembly
 - One (1) cycle switch assembly
 - One (1) set of hose assemblies

System for use with a customer supplied 35 pound grease bucket. Logic provided for controlling system by Plant DCS.

High Speed Coupling: SteelFlex type high speed flexible coupling with factory mounted halves for coupling the motor output shaft to the reducer input shaft.

Section 4.0 - Scope of Supply

Low Speed Coupling: One (1) Elastomeric low speed coupling with b-loc mechanical locking device. The flexible coupling is capable of transmitting high torque while providing resilience and damping of shock loads and vibrations, and accommodating shaft misalignment. The coupling is a low maintenance coupling never requiring lubrication and helping extend the life of the gearbox. The coupling halves are factory mounted to the reducer output shaft and drive shaft

Mill Drive Reducer: Three (3) stage Vertical speed reducer is designed considering high requirements for continuous smooth running and the ability to handle high starting loads (260% Torque). Reducer complete with anti-friction bearings, temperature RTD PT100, immersion oil heaters with thermostat control. The reducer acts as oil reservoir, so no external reservoir required.

Select Technical Data

Bearing Lifetime	L10 >50,000 hours
Static load safety factor	> 3.0
SF according to DIN /ISO	> 2.25
SF according to AGMA	> 2.00
Maximum Noise	85 dBA

Reducer Lubrication Unit: Standard external, skid mounted oil circulating system for conditioning reducer oil complete with:

- Oil Pump with TEFC NEMA motors
- Duplex oil filters with differential pressure switches
- thermostat controlled fan motor on the oil to air heat exchanger
- Pressure gauge
- Temperature gauge
- Two (2) universal flow indicators with micro switches
- Oil sample valve on instruments panel
- Valve for filling and draining the gear unit oil sump through lube unit
- NEMA 4x (IP65) protection class Electrical wiring and connection box
- 5 m long, self adjusting, heated pressure and suction hoses between gear unit and lube unit with connection flanges
- 440-480 V/60 Hz
- 1000 m / 3300 ft max. altitude

Mill Drive Motor: One (1) 3000 HP (2237 kW) Wound Rotor Induction Motor, 4160 V / 3 ph / 60, vertical flange mounted, shaft down, TEFC, premium efficiency, Class F insulation with Class B temperature rise, designed for 260% starting torque, 1.15 service factor and for use up to 1000 m.a.s.l. Motor complete with:

- grease lubricated anti-friction bearings, Bearing L10 life >40,000 hours
- one (1) PT 100 RTD per bearing
- two (2) PT 100 stator RTDs per phase
- Space heaters
- Free standing self supported main terminal box with
 - surge arrestor
 - surge capacitor
 - 3 window type CT's

Includes vendor standard routine test procedure and compliant with and all applicable with IEC standard testing.

Section 4.0 - Scope of Supply

Liquid Resistance Starter: The starter is designed to provide the optimum starting torque characteristics for the Vertimill, resulting in smooth progressive acceleration to full load speed and fixed speed operation. The variation in the resistance is achieved by displacement of the electrodes in the electrolyte. The starting current is reduced to a minimum during the starting period and is generally limited to a maximum of 250% Full Load Current by increasing the rotor resistance by connection to the WRIM brushes. Starter complete with: IP54 304 Stainless steel electrolyte tank, three fixed and three moving electrodes, operated by a VVVF drive. A SST Contactor Enclosure and a SST Control Panel are also provided. Heating elements and heat exchanger as required. Cooling water by others. Cabling by others.

Separating Tank: The separating tank is designed to control the split of the mill overflow into a product and recycle stream. The Vertimill overflow enters the tank tangentially, producing a vortex. Part of the slurry exits the stand pipe as product and part of the slurry is diverted by the dart valve into the bottom half of the tank. The slurry motion creates a slight hydrodynamic classifying affect whereby the fine material preferentially goes down the stand pipe as product, while the coarse material preferentially goes to the perimeter an through the dart valve to be recycled back into the bottom of the mill.

The operator controls the recycle rate via the pump speed to optimize the process performance. The separating tank is also fitted with an ultrasonic level control sensor in the lower chamber that will send a signal to an electrically operated dart valve that will control the split of slurry between recycle and product discharge. Instrumentation provided to control the dart valve consists of an electric actuator with positioner and transducer for a 4 to 20mA control input.

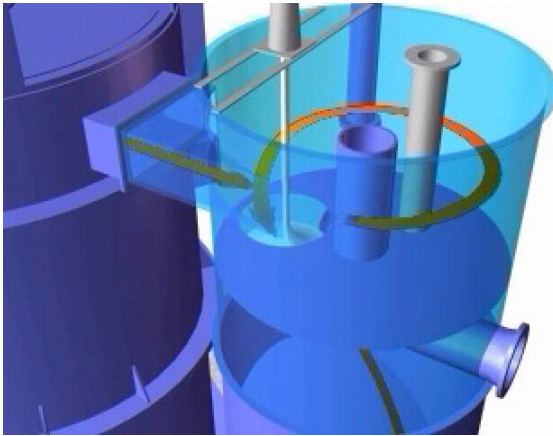


Figure 4

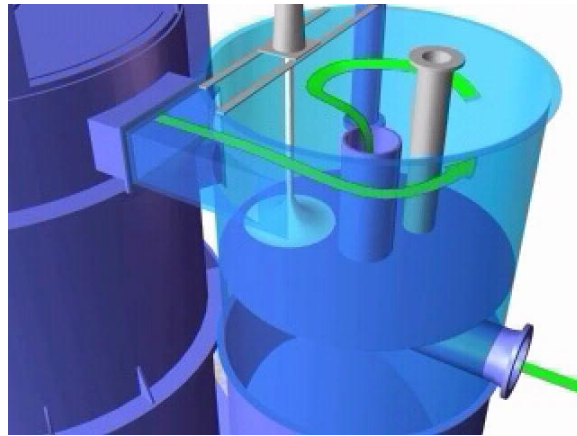


Figure 5

The separating tank is welded A-36 steel two-compartment, sloped bottom tank. The bottom half of the tank can be rotated bolt by bolt to provide optimum arrangement for maintenance. The interior is lined with abrasion resistant material and the exterior is paint per Metso's standards. The separating tank is the same height as the mill body and is mounted on the same foundation level. The Tank includes:

- Launder inlet
- Product stand pipe
- Vent Pipe
- Clean out
- Recycle Outlet
- Two (2) Dart Valve with Beck electric actuator
- Level Sensor

Recycle Pump: Recycle pump shall deliver the recycle volume to the bottom of the mill through the Lower Body recycle inlet. The recycle system has many operational and process advantages including:

- Reduced screw wear
- Reduced starting torque (Easier start up after emergency shutdown)
- In coarse applications, sharper product particle size distribution

The Orion Series metal pump will incorporate a Hi-Chrome casing, closed impeller, and back liner. Pump is equipped with a Metso mechanical slurry seal (double) shaft seal. The bearing assembly includes a high strength alloy steel shaft, grease lubricated taper roller bearings, and a cast iron bearing housing. The assembly is mounted into a pump frame that facilitates single impeller axial adjustment. Pump assembly includes the following items:

- V-belt Drive
- Overhead Mounted Motor Base and Guard
- Metso Double Slurry Mechanical Seal
- TEFC, premium efficiency motor, VFD duty. (VFD by others)

Also included is 10 m of Trellex hose for connecting the pump to the mill recycle inlet, which is cut to fit in the field.

1.2- One (1) Screw Transporter

Screw transport assembly is designed to aid in the installation and removal of the Screw. One screw transporter can be shared between Vertimills of the same size. The structural steel wide flange I-beams are supported by attachment to the door jamb flange and are secured in beam pockets in the rear of the Mill body. The screw transport assembly is balanced by a counterweight for ease of installation in the Vertimill grinding body.

The screw transport cart is a steel fabrication and is supported by heavy duty V-grooved wheels with tapered roller bearings, which ride on a solid steel half round rail that is welded to the top of the structural steel I-beam.

A hydraulic jacks are included to lift the screw from the cart into place on the upper drive shaft or to lower the screw onto the cart. The pump supplied with the Access Door jacking system is utilized by the jacks provided with the screw transporter.