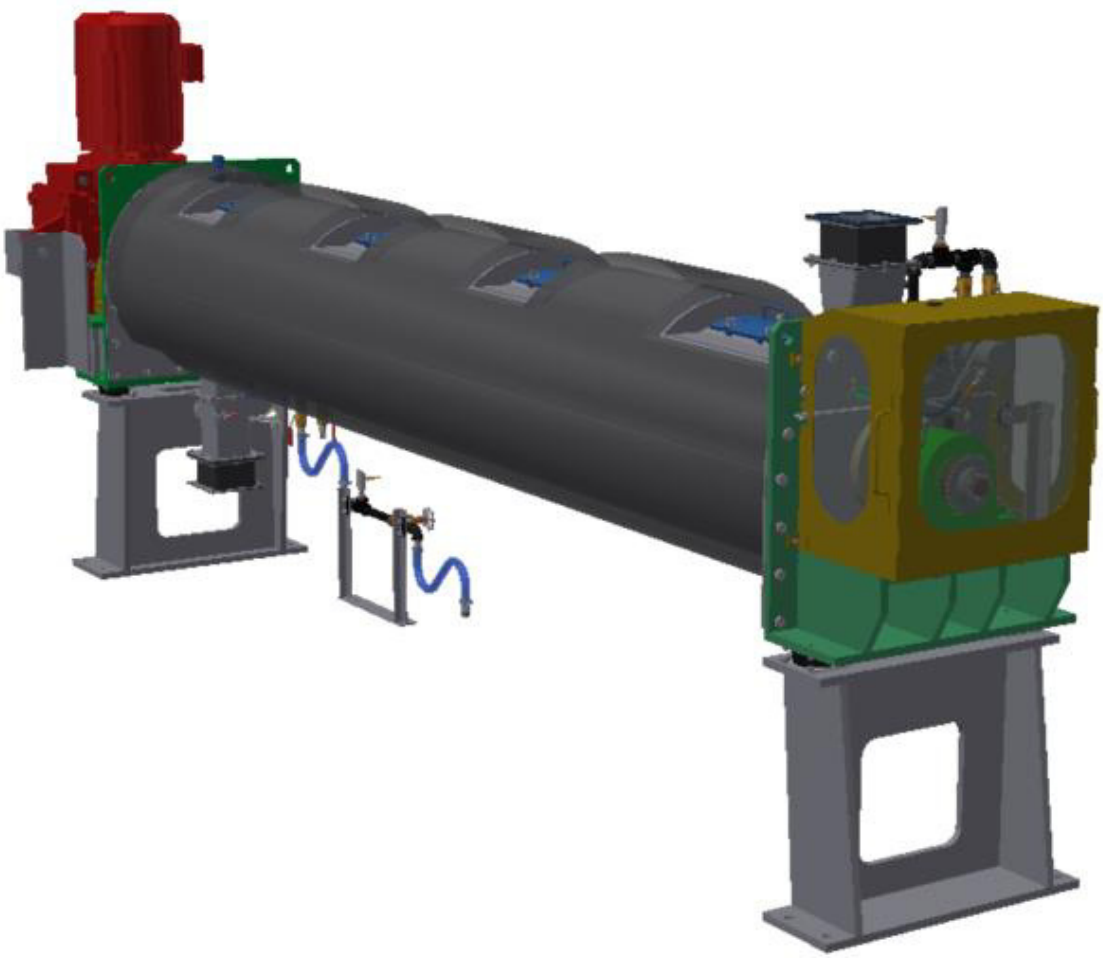
24″ Ball Mill

Operation & Maintenance Manual



Introduction

This manual contains **Original Instructions** written to assist in the maintenance of the Ball Mill equipment. For information regarding normal operation please refer to the Area Operator's Manual. Maintenance should only be performed by qualified, trained personnel.

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1 Safety

1.1 General Safety Precautions for Machine Operations and Maintenance

All safety requirements listed below are those generally applicable to this equipment but are not intended to be all-inclusive. They are intended for qualified, experienced personnel who can understand the maintenance and hazards of machinery operation. Types of components may require other precautions as determined by the customer's own safety policies. These precautions should be included in the comprehensive safety program for the installation.

These general safety precautions apply to all electrically or mechanically powered equipment and should be observed, as appropriate.

This equipment has been constructed using the highest standards of workmanship with industry accepted state-of-the-art techniques, components, and designs. It has been inspected and tested as thoroughly as possible prior to shipment for proper operation and defects in workmanship. However, this equipment, like any other, may develop problems due to normal wear, abuse, or unforeseeable circumstances. The equipment therefore requires proper operation and maintenance. While performing these functions, personnel will be required to work on or near the equipment. The following precautions are given to avoid injury to these personnel.

Warning:

As with many types of equipment, parts of this machine may start moving as soon as the pneumatic circuits are pressurized or electrical connections are energized, which may result in injury to personnel or damage to the machine.

1.2 Ball Mill Safety Guidelines

Warning:

Never insert any foreign objects into the operating equipment openings.

DO NOT open the inspection hatches while the equipment is in operation. Lockout all sources of energy before opening the hatches.

DO NOT put any part of your body or any foreign objects in the inlet of the Ball Mill; it has a Lump Breaker which may result in injury to personnel or damage to the machine.

DO NOT put your hands or arms into the inspection door of the Ball Mill Product Outlet. It is for taking samples only.

DO NOT try to clear any jams or plugs while the equipment is in operation.

The Ball Mill contains grinding media (steel balls) which generate a fair amount of noise and precautions around this safety situation must be taken. Gyptech recommends that the Ball Mill systems be installed in isolation rooms near the additive delivery system. Appropriate hearing protection must be worn when in close proximity to the Ball Mill.

1.3 Set-Up Safety

Avoid locating equipment in environments for which it was not designed (wet, extreme temperatures) or environments which may create a dangerous operating condition such as an explosive atmosphere (gas, dust).

Avoid the use of unauthorized or substitute parts and materials in servicing the equipment. Substitute parts or materials could produce a hazardous operating condition.

Use only materials of adequate size and strength to suit the flows and pressures which will be present in the operating system. Use safety factors in selecting materials for strength to allow for shock and over-pressure conditions should they occur.

1.4 Start-Up Safety

Ensure all pneumatic and electrical connections which may have been removed, replaced, or disconnected during an equipment shutdown have been reconnected securely before starting any equipment.

Return all valves (manual and control system operated) and movable machine members which may have been changed from their normal start-up condition during shutdown back to their normal start-up condition before starting any equipment.

Ensure that all personnel, product, etc., are clear of machinery prior to starting any equipment.

1.5 During Operation

All guards need to be secured in position when the Ball Mill is in use. Maintain and keep in place all equipment guards. Do not wear loose clothing or jewelry which could get caught in moving parts.

1.6 Shutdown Safety

Prior to any work being done on the Ball Mills, LOCK OUT ALL SOURCES OF POWER!

1.7 General Safety

Refer to the Safety Overview manual.

2 Overview

The function of the Ball Mill is to produce Ball Mill Accelerator (BMA). BMA is a very fine ground material produced by feeding small amounts of landplaster into the Ball Mill. Usually, a stabilizing aid such as sugar, dextrose, starch, or powdered dispersant is used to protect the landplaster from calcining during the milling operation and stabilize the BMA for prolonged storage purposes. The product produced from the Ball Mill is used to accelerate the set of gypsum wallboard as it is conveyed down the board line. It is usually added to the Stucco just before the Mixer.

A Ball Mill is used to grind landplaster into extremely fine powder. The Ball Mill is 60 cm in diameter and is cooled by water in a cooling jacket which envelopes the Mill.

2.1 Part Identification

The Ball Mill contains 1¼" (32 mm) diameter grinding media (steel balls), 200 lbs (91 kg) of balls in each of the 12 rotor sections with total of 2400 lbs (1091 kg) of balls in twelve pockets. The maximum output rate is 10.8 lb/min (4.9 kg/min).

The Ball Mill has a Lump Breaker at the landplaster feed point to ensure a steady flow into the Mill and break any lumps that may be present in the feed.

Ball Mill is fully insulated. It includes trouble free access doors to allow easy grinding media inspection. It is also equipped with a sampling door which is built into the Ball Mill Product Outlet.

The Ball Mill mounting arrangement incorporates vibration isolation to isolate surrounding equipment from the Ball Mill vibration and allow Ball Mill removal for repair and maintenance.

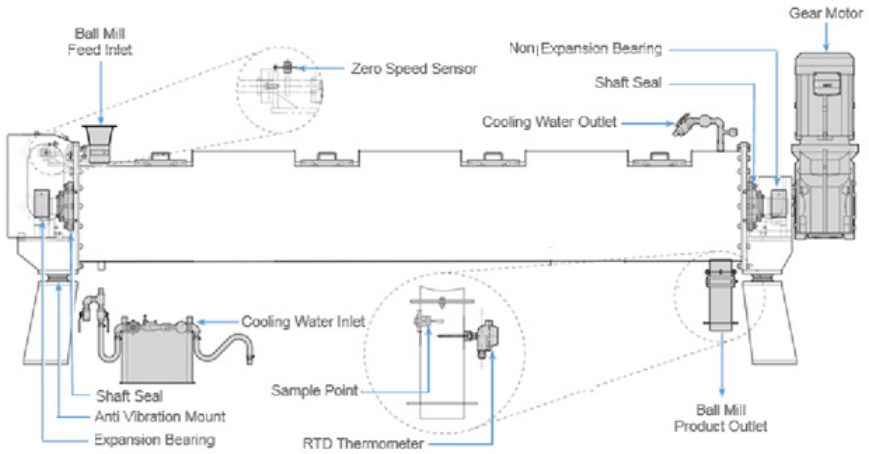


Figure 1: Part Identification - Side View

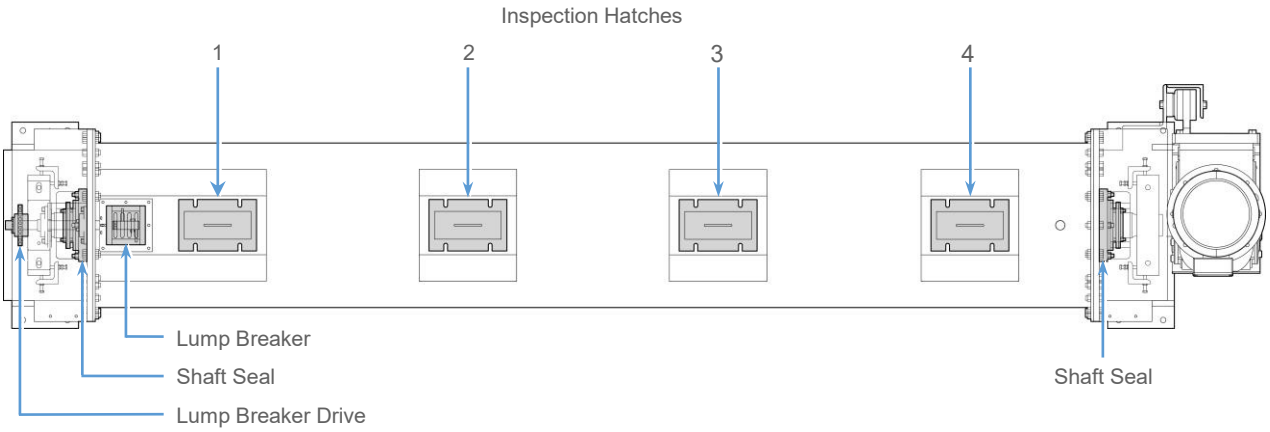


Figure 2: Part Identification - Top View

2.2 Cooling Water Inlet Line

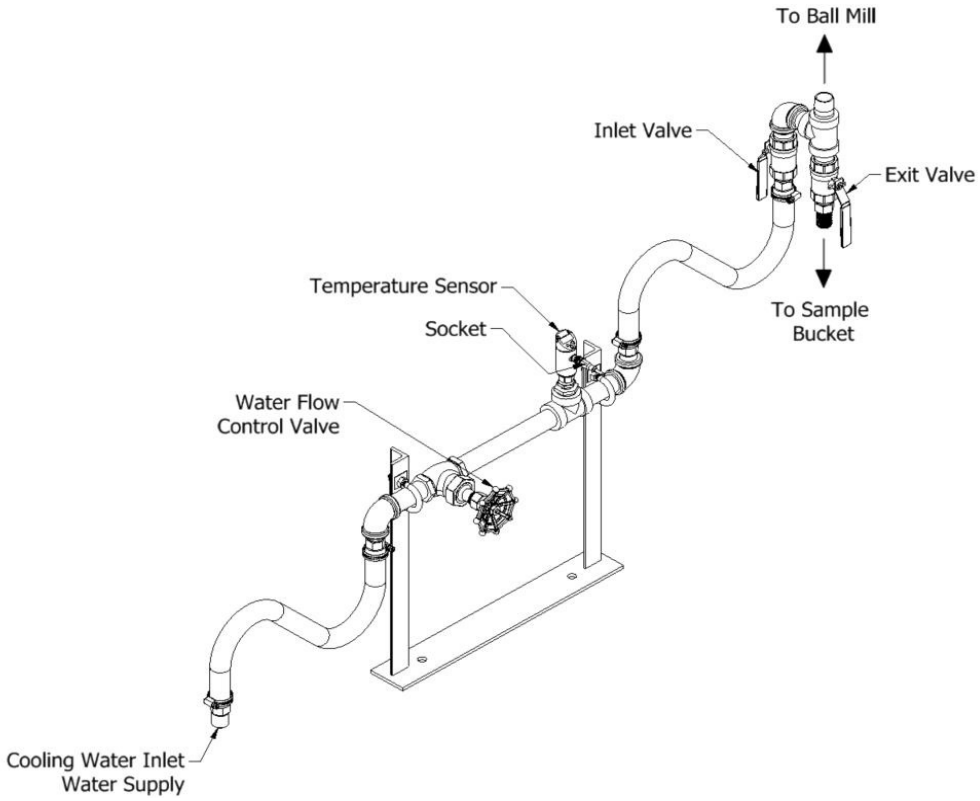


Figure 3: Part Identification – Cooling Water Inlet Line

2.2.1 Cooling Water Inlet Valve

The Inlet Valve is used to start and stop the Cooling Water flow into the Ball Mill cooling jacket.

2.2.2 Cooling Water Exit Valve

The Cooling Water Exit Valve is used to stop the Cooling Water flow into the cooling jacket.

2.2.3 Cooling Water Inlet Temperature Sensor

The Temperature Sensor is used to measure the temperature of the water at the cooling water inlet.

2.2.4 Water Flow Control Valve

The Water Flow Control Valve manually regulates the water flow.

2.3 Cooling Water Jacket

The Cooling Water Jacket envelopes the Ball Mill and is used to cool down the Ball Mill and the product inside it.

2.4 Cooling Water Outlet Line

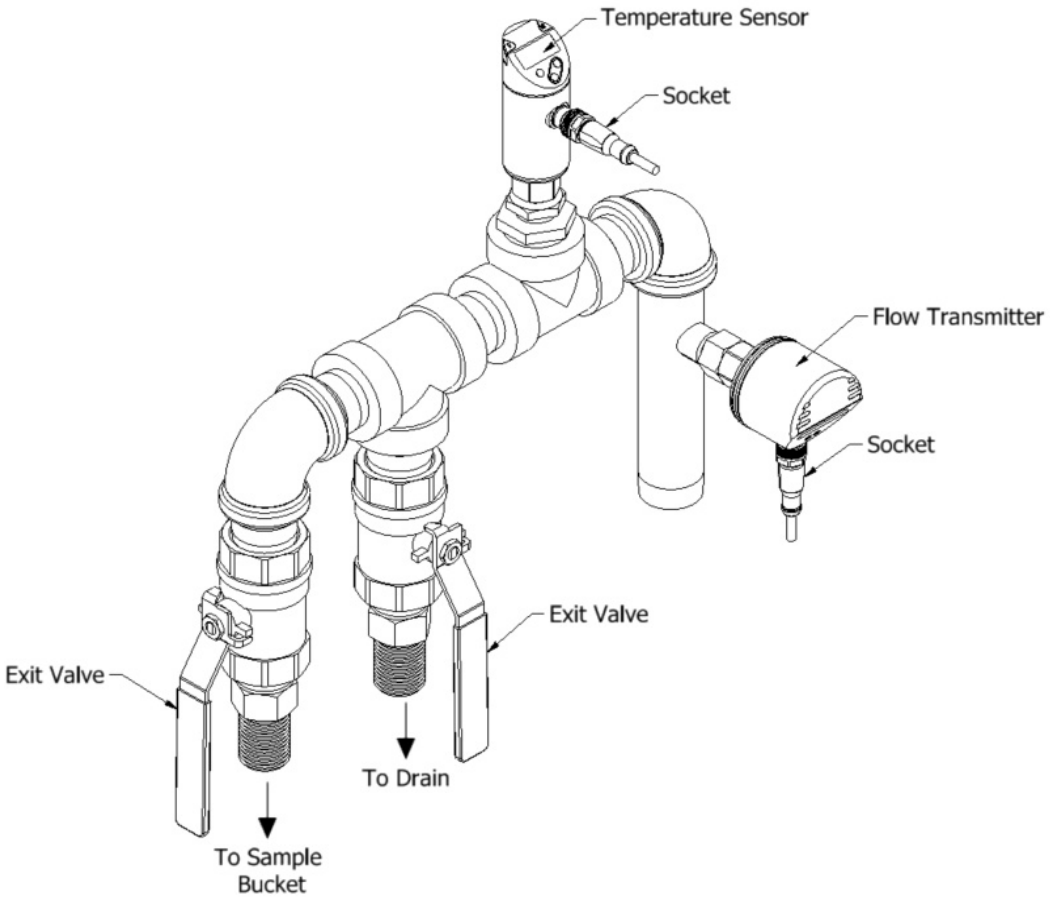


Figure 4: Part Identification – Cooling Water Outlet Line

2.4.1 Flow Transmitter

The Flow Transmitter is used to indicate the cooling water flow rate.

2.4.2 Outlet Valves

There are two exit valves at the Cooling Water Outlet:

- Drain Valve: water goes to the drain through this valve. Should be always open.
- Sample valve: used only when taking samples of the Cooling Water as it exits the mill.

Warning:

Never close the two Cooling Water Exit Valves (Drain & Sample Valves) at the same time, if the Cooling Water Inlet valve is opened.

2.4.3 Temperature Sensor

The Temperature Sensor is used to measure the temperature of the water at the cooling water outlet.

2.5 Inspection Hatches

There are four Inspection Hatches for Maintenance purposes only. They are used to inspect the condition of the balls and the rotor. Don't open these Hatches while the equipment is in operation.

2.6 Ball Mill Feed Inlet

The Feed Inlet is the inlet for landplaster into the Ball Mill. Stabilizing aid is added to this point as well.

2.7 Lump Breaker

The Lump Breaker is located at the Ball Mill feed inlet. It breaks any lumps that maybe present in the feed and ensures a steady feed to the mill.

2.8 Lump Breaker Drive

The Lump Breaker Drive drives the Lump Breaker Assembly. It has a sprocket, chain drive, and tensioner. It is driven off the main drive shaft.

2.9 Zero Speed Sensor

The Zero Speed Sensor senses the rotation of the Ball Mill. Once the Ball Mill starts to rotate, the zero speed sensor will turn ON.

2.10 Ball Mill Product outlet

The Product Outlet is the outlet of the Ball Mill Product. It has an inspection door for product sampling.

Warning:

Never put any body part into the inspection door. Only use a specialized tool for product sampling.

2.11 Drive End & Tail End Shaft Seals

The Drive End and the Tail End Shaft Seals are packing glands containing a rope packing. They are adjustable to prevent the leakage of the material out of the ends of the Ball Mill.

2.12 Anti-Vibration Mount

The Anti Vibration Mounts isolate the Ball Mill to prevent the transmission of vibrations from the Ball Mill to the surrounding equipment.

2.13 RTD Thermometer

The RTD Thermometer is used to indicate the product temperature at the Ball Mill discharge.

2.14 Bearings

- The Drive End bearings are Non-Expansion bearings. They are Pillow Block bearings and are attached to the Ball Mill Rotor Shaft.
- The Tail End Bearings are Expansion Bearings. They are Pillow Block bearings and are attached to the Ball Mill Rotor Shaft. During operation the Ball Mill heats up the Rotor Shaft causing it to expand. The thermal expansion is allowed for at the Tail End with proper set-up of the expansion bearing.

3 Installation

3.1 Receiving Your Equipment

As soon as the equipment is received, it should be carefully inspected to make certain the unit is in good condition and all items listed on the packing list are received. Even though the equipment is packaged at our plant, it is possible for it to be damaged in shipment. All damages or shortages should be noted on the Bill of Lading. Purchaser should take immediate steps to file reports and damage claims with the carrier. All damages incurred to the units in transit are the responsibility of the common carrier since it is the manufacturer's policy to make shipment F.O.B. its factory: i.e., Ownership passes to the purchaser when the unit is loaded and accepted by the carrier. Any claims for in-transit damage or shortage must be brought against the carrier by the Purchaser.

3.2 Pre-Installation

1. If there is any cleaning/power washing or painting to be done, it should be done before installation. To ensure accurate alignment and squaring, clean any surfaces of existing equipment that mates with the new equipment.

2. Prepare the Ball Mill for installation by removing any shipping bolts/blocks, straps, plastic and clean off any rust protective coatings.

3. Ensure the shipping wedges between the plates of the vibrating isolation pads are removed and the Isolation pads can move freely.

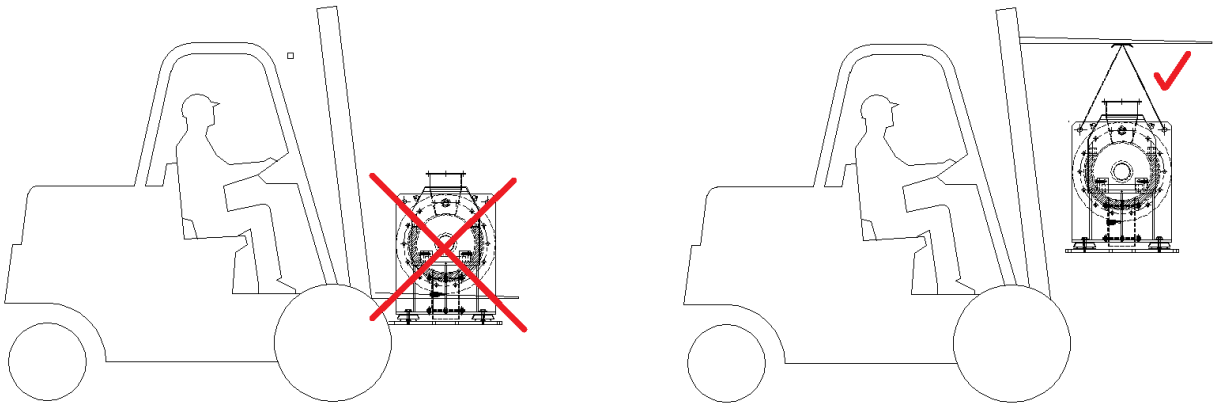
4. Install any air, electrical and water services prior to the final equipment placement. Coil wrap hoses to ensure there are no pinch points on the hoses. Mark all wiring, conduits and pneumatic lines before installation. Mark all electrical drawings as per any field additions or changes, etc.

5. Review and train production personnel on the operation of the Ball Mill.

6. Gyptech highly recommends using a variable frequency drive (VFD) on this motor.

Warning:

Never lift the Ball Mill from below. Attach the slings using the 4 designed lifting holes in the end plates. Extra care should be taken to avoid any components that protrude below the frame. Unit should be supported off the ground if the components protrude from below.



3.3 Installing

At a minimum, installation requires the expertise of a millwright with alignment credentials and an electrician.

3.3.1 Installation of the Equipment and Leveling

1. Move the Ball Mill into place. Adjust to the proper elevation.
2. The Ball Mill must be level both ways.
3. Ball Mill should be securely mounted through the eight mounting holes provided on the base plates.
4. The inlet and outlet chutes should have flexible connections to isolate them from the Ball Mill.
5. Inspect all bearings, chain drives and lump breaker for proper mechanical installation. Ensure all fasteners are tight (check set screws on bearings, etc).
6. Ensure drive is securely tight to the shaft.
7. Clearly, document, note, or mark the direction of rotation of the mill where it can be quickly and easily referenced during operation or troubleshooting.
8. Refer to Install drawings as needed
9. Cooling Water Supply System:
    - It has a 1” cooling water supply inlet.

- Cooling water should be standard clean fresh water.
- Water pressure should not exceed 60 PSI (4 Bars).
- Inlet water temperature should not exceed 20ºC.
- Minimum available water flow should be 8 gallons/min (30 liters/min).
- The 1” barbed hose fitting at the cooling water outlet needs to be connected to a drain.
- The sample valve at the cooling water outlet is used to take samples. It is used to check the water flow, the flow meter operation and the RTD temperature probe accuracy.

3.3.2 Electrical Installation

1. Connect the cooling water flow transmitter, the RTD temperature probe and the zero speed switch to the control system.

2. Connect the gearmotor to the VFD or starter system. A VFD is strongly recommended.

3. Upon completion of electrical connections all covers should be kept closed and secure at all times. Disconnect power before opening areas where electrical terminations exist.

4. Connect any electrical, water and pneumatic lines to existing equipment that were disconnected for the Ball Mill installation.

5. Reinstall any guards and covers that have been removed during installation.

3.3.3 Ventilation Requirements

Venting is required. Ensure that there is enough air flow to have air movement through the mill but not enough to pick up the “fines”. The main purpose of the venting is to move the air that has become moist due to the grinding action in the Mill (typical is about 24-30 CFM (40-50 m3/h). Additionally, the mill should be run for a short period of 20-30 minutes with no feed before it shuts down. This will help reduce the possibility of trapping moisture in the Mill when it is idle and reduces internal scale buildup.

4 Operation

Operation is based on the Ball Mill discharging into a screw conveyor and being fed by a variable speed feeder (volumetric or gravimetric). For optimal mill operation, it is recommended that 15%-20% more product than required is produced. Overproduction greater than 20% is not recommended as reactivity will drop during storage.

It is recommended that the optimal amount of BMA held in storage be determined through testing (ideally less than two days) – benefits of low storage include longer mill operation periods which will result in more consistent performance, temperatures, and particle size.

The Ball Mill should be continuously fed during operation to avoid any lapses in the discharge and maintain the product consistency. Optimally, the feed material (Land Plaster) specifications should fall between 2000-3000 Blaine and contain less than 0.2% moisture. Product particle size is dependent on throughput, inlet particle size, and rotation velocity of the mill (RPM). Ensure that the coating material is only fed when land plaster is being fed – do not attempt to feed sugar or starch alone.

The Cooling Water should always be flowing during operation to avoiding overheating and calcining during the milling process. Ensure all hand valves and cooling water solenoid are open during operation. The Cooling Water flow should be adjusted with the hand valve to keep product discharge temperature as close to 38ºC (100°F) as possible. Product temperatures above 65ºC (150°F) should be avoided.

Cooling Water temperature and Cooling Water flow must be monitored and should initiate an alarm, and a system shutdown if flow values vary outside of the normal operating range. Overcooling may cause condensation to build up in the mill – this can be avoided by monitoring and maintaining water temperature and flow rate.

The feed rate of the Ball Mill should be regulated to ensure that BMA potency and usage are appropriate for correct setting action on the board line. To optimize BMA potency, ensure that coating materials are being used (Sugar, starch powder soaps, or powder dispersants), storage time is minimized after grinding (introduce as close to the mixer as possible and try to use the product right away), and that Ball Mill temperatures are within the specified range during operation.

4.1 Cooling Water System

Warning:

Never run the Ball Mill without Cooling Water.

The purpose of the Cooling Water System is to maintain the BMA product temperature below the calcination temperature. The product temperature should not exceed 65 °C. The ball mill is supplied with a water chiller to create a closed loop cooling circuit for the equipment.

Before starting the Ball Mill, Ensure that:

- All the water lines and valves are piped and valve opened.
- The Cooling Water Inlet is connected to the water chiller supply line.
- The drain/return line is connected and piped to the chiller.

- The chiller and ball mill are filled with manufacturers recommended water/glycol mix based on the environmental conditions at the plant. Refer to the Water Chiller manufacturer manual for further details.
- The sample valve is closed.
- Readings have been confirmed for correct operation of the cooling water inlet temperature sensor and water flow transmitter.

During operation set the water flow control valve to achieve the desired product exit temperature and prevent the BMA from calcining during the milling process.

A water jacket pressure test may be performed for maintenance and troubleshooting purposes consisting of the following steps:

1. Fill water jacket with clean, fresh water.
2. Hold pressure at 60 PSI (410 kPa) between 1 and 2 hours,
3. If a reduction in pressure is found, inspect the jacket for leaks. Repeat the pressure test following maintenance to ensure optimal water jacket performance.

5 Troubleshooting

Troubleshooting Ball Mill Problems	
BMA effectiveness is decreasing.	Check initial grind, moisture, and discharge temperature.
Ball Mill grinding media is dirty. Material is building up on the balls.	Clean Ball Mill by running sand through it. Care should be taken when adding the sand. Do not overload the Ball Mill with too much sand. Sand should be added slowly. Ensure that the Mill is not too hot and a suitable stabilizing aid is being used.
Ball Mill Rotor seized.	-Check landplaster feed rate. If there is insufficient amount of landplaster is fed into the Ball Mill, the stabilizing aid can melt inside the equipment and get the rotor seized. The Ball Mill end plate will need to be removed, in order to access and remove the rotor for cleaning. -Check for broken or split grinding media. Broken balls can get wedged between the rotor and the inner wall of the Ball Mill, and get the rotor stuck.
Too much material is being fed into the Mill.	Slow down feed rate.
Ball Mill is running rough / jumpy.	Plugging due to high content of moisture supply.
Grinding media is worn down.	Change out grinding media.
Grinding media is split.	Find and remove any split balls.
Ball Mill is running hot.	Check coating material supply rate. (dexterous) Check water supply.
Cooling water system needs adjustment.	Ensure water is flowing. Increase water flow to decrease Ball Mill temperature.
Ball Mill is seized or jammed.	Reverse mill rotation to attempt to dislodge media. If successful, do not immediately return to production; using LOTO procedures, perform an inspection and remove broken media. Ensure root cause of jam is removed, and the mill can rotate freely prior to returning to production. Do not strike rotor vanes with tools as this can result in damage to the rotor. Repetitive start attempts with a jammed mill may result in shaft and keyway damage

6 Maintenance

The following refers specifically to the basic Gypsum Technologies Ball Mill. The instructions below may not encompass any customization or optional components on your machine.

In order to prevent premature failure of the equipment, the following preventative maintenance procedures are recommended. It is recommended that maintenance work be done by qualified trained millwrights only. The following procedures are not intended to be in-depth technical procedures but a simple step-by-step guide for skilled maintenance personnel.

Ball Mill must have regular, personal inspections. This general observation is for detecting any extreme vibration that could be taking place due to foreign objects in the Ball Mill grinding chambers (i.e. a split ball inside the rotating Mill).

Warning:

When performing any maintenance work always lockout all sources of energy (electrical, pneumatic, mechanical, electromagnetic, chemical, thermal, hydraulic, etc.).

6.1 Preventive Maintenance Schedule

Monthly

Unit	What should be done
Gearmotor mount	Check for proper fit & ensure no excessive looseness.
Safety Guards	Check their condition.
Machine	Clean-up around the machine and remove build-up.

3-4 Months

Unit	What should be done
Grinding media (steel balls)	• Check their condition. • Ensure all broken fragments and under sized balls to be discarded, also balls less than 1” (25 mm) should be replaced. Replenish as required.
Lump breaker fingers	• Check their condition. • Build up or replace as necessary.

6 Months

Unit	What should be done
Grinding media (steel balls)	• Record diameters from a sample of balls in each pocket– a change of media or blending in of new media are recommended after an average diameter loss of 6% or more.

6.2 Maintenance Procedures

6.2.1 Replacement of End Seal Packing

At both ends of the Ball Mill there is a packing gland assembly. There are three pieces of Teflon-impregnated rope packing that will require periodic replacement. The replacement procedure is as follows:

1. Loosen packing gland bolts to allow removal of packing.
2. Remove packing with a packing removal tool.
3. Replace packing as illustrated below.
4. Tighten packing until snug while equipment is down.
5. After equipment is restarted tighten packing just tight enough to ensure no product leakage out the ends of the mill.

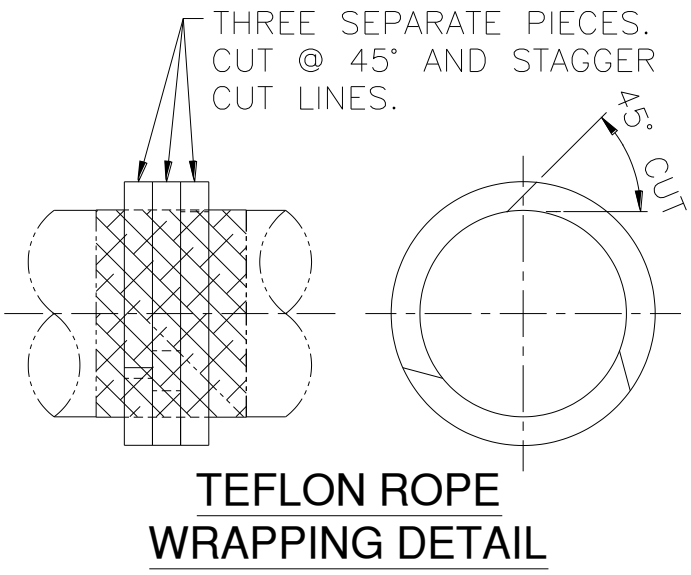


Figure 5: Teflon Rope Wrapping Detail

6.2.2 Repair and Replacement of Lump Breaker Fingers

Inspect fingers on Lump Breaker for wear.

If fingers are worn, build up fingers with weld or replace them to ensure that product inlet is being cleaned by fingers.

6.2.3 Replacement and Setup of Drive End (Fixed) & Tail End (Floating) Bearings

Please complete the following steps to install QM Blue Brute EC Series bearings.

1. Ensure the shaft is within recommended diameter tolerance shown below in Figure 7, Table 1, and that it is straight, clean and free of any burrs or debris.
2. If using an open-end cover, slide open-end cover/seal combination into position on shaft.
3. Apply a thin oil film to shaft and bearing bore.
4. Slide bearing into position on shaft.
5. Tighten housing mounting bolts.
6. Slide eccentric locking collar along shaft and onto the extended portion of the bearing's inner ring.
7. Rotate the eccentric locking collar until it is hand tight (the direction of rotation does not matter when using QM Blue Brute EC Series bearings).
8. Lock the eccentric locking collar firmly in place using a spanner wrench or hammer and drift.

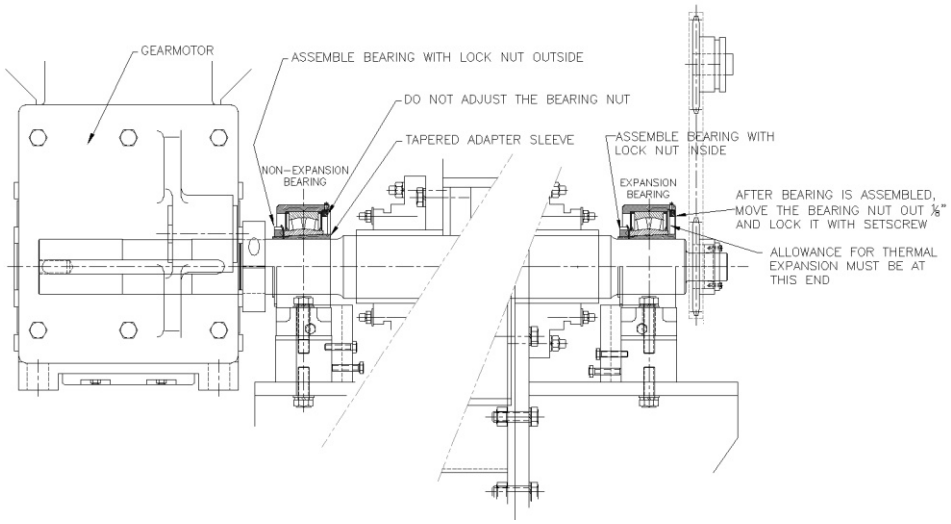


Figure 6: Bearings

Please note: When using a hammer and drift, one or two good blows will be sufficient due to the shallow eccentric ramp on QM Blue Brute EC Series bearings. Be sure to drive the collar in the same direction in which you hand tightened it so as to turn it to a tighter position on the bearing's inner ring.

9. Tighten the eccentric locking collar set screws (x2) to the torque values shown below in Figure 7, Table 2.

10. If using covers:

    a. Make sure mating surface of cover is clean and dry.

    b. Using sandpaper, slightly roughen the mating surface of the cover.

    c. Place a 1/8" - 1/4" bead of polyurethane adhesive sealant on mating surface of the cover.

    d. Start two tabs of the cover into the cover slots on bearing making sure that the grease fitting on the cover is accessible.

    e. Using a dead blow hammer, drive the remaining tabs into place to lock the cover onto the bearing.

TABLE 1. Recommended shaft tolerances.

Shaft Size		Bearing Number	Tolerance (in)
1-7/16" 1-1/2"	-	22208	+0.000 / -0.001
1-11/16" 1-3/4"	40mm 45mm	22209	+0.000 / -0.0015
1-15/16" 2"	50mm	22210	+0.000 / -0.0015
2-3/16" 2-1/4"	55mm	22211	+0.000 / -0.0015
2-7/16" 2-1/2"	60mm 65mm	22213	+0.000 / -0.0015
2-11/16" 2-3/4" 2-15/16" 3"	70mm 75mm	22215	+0.000 / -0.002
3-3/16" 3-1/4" 3-7/16" 3-1/2"	80mm 85mm 90mm	22218	+0.000 / -0.003
3-11/16" 3-15/16" 4"	100mm	22220	+0.000 / -0.003
4-7/16" 4-1/2"	110mm 115mm	22222	+0.000 / -0.005
4-15/16" 5"	125mm 130mm	22226	+0.000 / -0.005
5-7/16" 5-1/2" 5-15/16" 6"	140mm 150mm	23230	+0.000 / -0.005
6-7/16" 6-1/2" 6-15/16" 7"	170mm 180mm	23234	+0.000 / -0.005

TABLE 2. Set screw torque values.

Shaft Size		Bearing Number	Set Screw Size	Torque (in-lbs)
1-7/16" 1-1/2"	-	22208	3/8"-24TPI	290
1-11/16" 1-3/4"	40mm 45mm	22209	3/8"-24TPI	290
1-15/16" 2"	50mm	22210	3/8"-24TPI	290
2-3/16" 2-1/4"	55mm	22211	3/8"-24TPI	290
2-7/16" 2-1/2"	60mm 65mm	22213	7/16"-20TPI	430
2-11/16" 2-3/4" 2-15/16" 3"	70mm 75mm	22215	7/16"-20TPI	430
3-3/16" 3-1/4" 3-7/16" 3-1/2"	80mm 85mm 90mm	22218	7/16"-20TPI	430
3-11/16" 3-15/16" 4"	100mm	22220	9/16"-18TPI	620
4-7/16" 4-1/2"	110mm 115mm	22222	5/8"-18TPI	1325
4-15/16" 5"	125mm 130mm	22226	5/8"-18TPI	1325
5-7/16" 5-1/2" 5-15/16" 6"	140mm 150mm	23230	5/8"-18TPI	1325
6-7/16" 6-1/2" 6-15/16" 7"	170mm 180mm	23234	5/8"-18TPI	1325

Figure 7: Shaft and Collar Set Screw Details

6.2.4 Convert a Blue Brute Bearing from Fixed to Expansion (floating) Pillow Block

1. Make a reference mark on the housing and retaining nut.
2. Loosen the Teflon tipped set screw that locks the retaining nut in place.
3. Loosen retaining nut by tapping with a hammer and punch, rotating retaining nut counter clockwise one complete revolution.
4. Tighten the Teflon tipped set screw.

Please note: When converting a Blue Brute bearing from fixed to expansion, it is imperative that the unit to be converted to expansion is oriented correctly. Since the insert in a Blue Brute pillow block is held against either a shoulder or snap ring opposite the housing retaining nut, a pillow block that has been converted to expansion can only float in the direction of the retaining nut. Based on this the retaining nut must be on the side of the housing opposite the fixed bearing.

6.2.5 Convert a Blue Brute Bearing from Expansion (floating) to Fixed Pillow Block

1. Loosen the Teflon tipped set screw that locks the retaining nut in place.
2. Tighten retaining nut by tapping with a hammer and punch, rotating retaining nut clockwise until tight. It is not possible to over-tighten the retaining nut.
3. Tighten the Teflon tipped set screw.

Please note: When converting a Blue Brute from expansion to fixed on a bearing that is mounted, the locking collar set screws must be released to allow the insert to move both in the housing and on the shaft.

6.2.6 Maintenance of Grinding Media (Steel Balls)

The balls will wear down because of the constant grinding action and they should be inspected every 3-4 months of continual usage. Broken fragments and under-sized balls are to be discarded. Balls less than 1" (25mm) diameter should be replaced. Replenish as required.

Some balls are softer than others (despite the annealing process) and they will wear faster and can cause jams between the rotor and stator. Some balls will break in half.

The clearance between the rotor and stator is 1/8" to 3/16" (3.2mm – 4.8mm). This varies because the stator is a pipe and the tolerances on standard pipe have some variations.

6.2.7 Cleaning of Media using Coarse Sand

It is recommended that the end user set up minimum and maximum size or wear specifications for the media (balls) based on their physical size as well as the Blaine / reactivity of the accelerator. When these specifications are marginal or out of spec, it is recommended that a cleaning be performed using 'Coarse Brick Mortar' sand:

1. Run mill empty (no feed) for thirty (30) minutes, ensuring temperatures do not exceed 45°C (113°F).
2. Add 100 grams (1/4 lbs.) of coarse brick sand or coarse glass beads slowly (a cup at a time, fed slowly) until approximately 2500 grams (5-7 lbs.) have been added. Run the mill for three (3) minutes.
3. Repeat Step 2 two more times.
4. Run the mill empty for 15 minutes to clean most of the residual buildup on the media.

If this cleaning has not been performed for an excessively long period of time, there will likely be a residual build up on the inner wall of the mill. Cleaning this built-up material requires total disassembly and overhaul of the mill.

6.2.8 Inspection and Maintenance of the Gear Motor

SEW Gearmotors – See section 6, *Inspection and Maintenance,* of the SEW Eurodrive Operating Instructions Manual.

SIEMENS gearmotors - See section 8, *Service and Maintenance,* of the SIEMENS operating Instruction Manual.

6.3 Lubrication

6.3.1 Chain Lubrication

Your Gyptech equipment has been engineered and designed to provide you with a long equipment life. Bearings, bushings, and equipment subjected to wear have been designed to resist wear with minimal servicing time.

6.3.2 Suggested Lubrication for Bearings

QM Bearings recommends using Dow Corning Molykote® G4700 grease. It is a lithium complex extreme pressure synthetic grease that combines the benefits of wide operating temperatures and broad compatibility with varied materials. This grease offers excellent thermal stability through temperatures ranging from -40°C to 177°C (-40°F - 350°F). QM Blue Brute bearings are factory lubricated and are ready for use without additional lubrication. Re-lubrication intervals noted below in Table 3 depending on the type of application, speed, operating temperature, and other environmental conditions. Knowledge of your particular application will determine the best re-lubrication interval but use the intervals shown below for general purposes.

TABLE 3. Re-Lubrication Intervals
(Please note: The average manual grease gun will produce approximately 1 ounce of grease per 33 strokes. Please check with the manufacturer of your grease delivery system for specific information.)

Shaft Size		Bearing Number	Initial Weight (oz)	Relubrication Weight (oz)	Relubrication Interval (Hours of Service Based On RPM and Temperature)											
					100 RPM		250 RPM		500 RPM		1000 RPM		2000 RPM		3000 RPM	
					<160°	>160°	<160°	>160°	<160°	>160°	<160°	>160°	<160°	>160°	<160°	>160°
1-7/16" 1-1/2"	-	22208	0.5	0.1	2200	1000	1400	700	1000	500	240	120	120	60	40	20
1-11/16" 1-3/4"	40mm 45mm	22209	0.7	0.2	2000	1000	1200	600	800	400	320	160	160	80	80	40
1-15/16" 2"	50mm	22210	0.8	0.2	1600	800	1000	500	640	320	240	120	120	60	60	30
2-3/16" 2-1/4"	55mm	22211	1.0	0.3	1200	600	800	400	440	220	160	80	100	50	60	30
2-7/16" 2-1/2"	60mm 65mm	22213	1.4	0.4	1120	560	720	360	360	180	120	60	80	40	40	20
2-11/16" 2-3/4" 2-15/16" 3"	70mm 75mm	22215	2.7	0.7	1040	520	680	340	340	170	100	50	60	30		
3-3/16" 3-1/4" 3-7/16" 3-1/2"	80mm 85mm 90mm	22218	3.7	0.9	960	480	600	300	300	150	80	40	40	20		
3-11/16" 3-15/16" 4"	100mm	22220	6.5	1.6	840	420	520	260	240	120	60	30	20	16		
4-7/16" 4-1/2"	110mm 115mm	22222	7.4	1.9	680	340	440	220	200	100	60	30	20	16		
4-15/16" 5"	125mm 130mm	22226	10.6	2.7	560	280	360	180	160	80						
5-7/16" 5-1/2" 5-15/16" 6"	140mm 150mm	23230	20.8	5.2	480	240	320	160	120	68						
6-7/16" 6-1/2" 6-15/16" 7"	170mm 180mm	23234	30.0	8.5	400	160	240	160	110	60						

Figure 8: Bearing Lubrication Intervals

6.3.3 Gear Motor Lubricant Change Intervals

SEW Gearmotors – See section 6.2, *Lubricant change intervals,* of the SEW Eurodrive Operating Instructions Manual.

SIEMENS gearmotors - See section 8.2.10, *Service Life of the Lubricants,* of the SIEMENS operating Instruction Manual.

6.3.4 Chain Lubrication

Periodic lubrication of the lump breaker drive chain is required. A periodic inspection will determine the frequency, and it depends on the operating environment.

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