Mixing / Forming

Area Operations Guide Prepared for:

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כרמית מקבוצת אינרום תעשיות בע"מ

Israel

Gyptech

Proven Technology Worldwide

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Introduction

This manual contains **Original Instructions** written to assist in the normal operation of the mixing / forming area. This provides an overview only. For more detailed information regarding maintenance, please refer to the maintenance manual specific to the equipment being maintained. Personnel should undergo proper training before attempting to operate any piece of equipment.

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1 Safety Overview

This **Area Operations Guide** provides an overview only. For general safety information, read the **Gypsum Technologies Safety Overview** manual. For the safe operation and maintenance of specific equipment, read the **Gypsum Technologies Operation & Maintenance Manuals**.

All personnel must follow **Lockout** procedures (see Section: Lockout Procedures).

CAUTION: This section is NOT a complete safety procedure for performing maintenance or cleaning functions.

Important: Incorporate this information into your plant specific Lockout/Tagout procedure.

All personnel must operate in compliance with both company policies and local regulations.

CAUTION: Equipment has the potential to cause severe injury or even death.

Important: Before undertaking or performing any maintenance or clean out procedure, be sure to understand the safety concerns related to a piece of equipment. NEVER put yourself at risk.

Note: For any safety concerns, speak with your management prior to undertaking any work.

1.1 HMI Display

The **Human-Machine Interface (HMI)** provides valuable information and diagnostic tools, adding a level of safety. View status of all area safety devices on the **Safety Overview** screen.

Prior to working on any equipment, always confirm that system equipment is NOT operational by using the normal means of starting it (Operator Control Station or manual **Start**/**Test** button).

CAUTION: The HMI functions are NOT a replacement for physically isolating equipment.

Important: To avoid potentially hazardous situations, ALWAYS be alert and aware of your surroundings.

The **HMI** controls for each **Motor Drive** can be put into **Forward**, **Reverse**, **Off**, or **Auto**. Equipment runs continuously when a Drive is manually put in Forward or Reverse.

Note: For motors with a field-mounted **HOA** selector switch, the **HMI** controls are only for display.

1.2 PLC Controls

Safety relays and all safety devices are monitored by the **Programmable Logic Controller (PLC)**. When a problem occurs, the **HMI** identifies which hard-wired device has been activated, and then displays status to aid in rapid troubleshooting.

1.3 Shutdown Guidelines

General Safety Guidelines to follow during **Shutdown**, and before any maintenance or repair work is started on motor-driven equipment:

- Confirm that the relevant control switch is in **OFF** position, and remains in the **OFF** position.
- Confirm that power supply to equipment is shut off and Locked at:
  - The main control switch
  - The local safety switch to the respective motors
- Display a "**WORK IN PROGRESS**" sign on the equipment.
- NEVER make a by-pass connection of a **Safety** switch (not even if it's faulty) – Replace it!
- For any fault that could lead to personal injury, report this to the nearest person in responsibility.
- Keep locking keys to relay cabinets, etc. in a safe place accessible only to authorized personnel.

1.4 Lockout Procedures

It is your organization's responsibility to develop, implement, and enforce an energy control program in compliance with the **Occupational Safety & Health Service (OSH)** standard for **Lockout/Tagout (LOTO)**.

Equipment can store potential energy which can cause equipment to move or suddenly fall if pressure is removed. Examples are those held in a raised position by hydraulic or air pressure. Be aware that hazards can arise from equipment or material movement upstream or downstream of the machine that is Locked out.

CAUTION: Equipment may move or suddenly fall.

Important: Before performing equipment maintenance or cleaning functions, ALWAYS lock out motive power sources (electrical, hydraulic, compressed air, pneumatic, etc.).

Prior to performing any equipment maintenance or cleaning, this **LOTO** procedure must be followed:

1. Identify the equipment that needs to be locked out
2. Shutdown equipment
3. Confirm **Area/Zone** is turned **OFF**
4. Open the **Disconnect** switch
5. Place a personal **Lock** on the switch to prevent system from being re-energized
6. Confirm that no personnel are in the **Area/Zone**

7. Test the **Lockout** by putting equipment or motor into **Manual** mode for a few seconds to confirm that it will not start, then back to the **OFF** position

To continue operation after **LOTO**, remove **Lock** from the switch, then turn switch back to the **ON** position.

1.5 Electrical Disconnect

Electrical Disconnect switches are used to physically isolate Drives and remove power to a motor or series of motors. Electrical equipment can be disconnected at the **Electrical Panel** with a lockable switch that isolates all Drives in the corresponding Panel.

CAUTION: Equipment may automatically start.

Important: To prevent equipment from being re-energized after an Electrical Disconnect Switch has been opened, ALWAYS place a lock on the switch.

1.6 Air Disconnect

Equipment requiring compressed air will have an electronically controlled air dump solenoid (if supplied) coupled with a manual valve for lockout procedures. Under some circumstances air pressure is automatically dumped from a piece of equipment, and in others it may be necessary to manually dump air pressure by locating the manual Air Disconnect.

CAUTION: Equipment automatically dumps air pressure under some circumstances.

Important: Once air is dumped, ALWAYS ensure that air pressure has been isolated and locked out before servicing any piece of equipment.

1.7 Emergency Stop

A series of **Emergency Stop (E-Stop) Push Buttons (PBs)** located throughout the plant are for use in an emergency. To immediately stop equipment or an entire zone/area and remove power to **Drives**, press an E-Stop PB.

CAUTION: Use E-Stops only in an EMERGENCY Only – NOT for normal shutdown.

Important: Using E-Stop Push Buttons for normal shutdown can cause equipment damage.

To reset an **E-Stop**:

1. Pull the **E-Stop** PB back out.
2. Press the **E-Stop Reset** button and wait approximately 30 seconds for equipment to re-energize.
3. Restart the system from the **Operator Console.**

1.8 Pull Cords

Emergency Stop **Pull Cords** are switches that can be pulled during hazardous situations to immediately Stop equipment and remove power to **Drives**.

CAUTION: Use Pull Cords ONLY in an EMERGENCY.

Important: Using Pull Cords for normal Shutdown can cause equipment damage.

To reset a **Pull Cord**:

1. Push the **Reset** button on the Pull Cord
2. Wait approximately 30 seconds for equipment to re-energize
3. Restart system from the **Operator Console**

1.9 Safe Torque Off

Safe Torque Off (STO) is an integrated safety function of the **Variable Frequency Drive (VFD)** which ensures that no torque generating energy can be applied to a Motor, and prevents unintentional starting of the motor.

CAUTION: The STO function does NOT electrically disconnect VFDs.

Important: The STO only halts torque in the motor – power is usually still connected to the VFD.

2 Area Overview

The mixing / forming area is the center of the board formation process. It is where all the raw materials come together to form a continuous stream of gypsum board product.

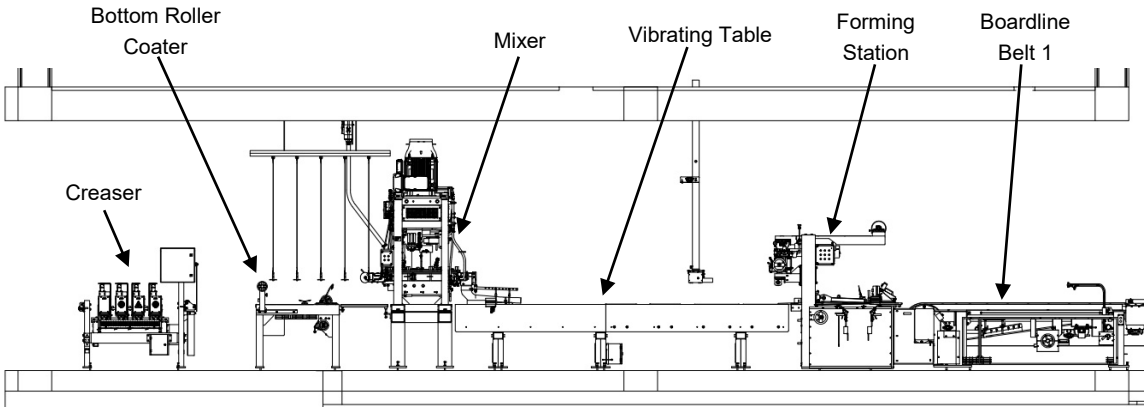

Figure 1: Mixing / Forming Area Overview

The major equipment in this area includes:

- Creaser
- Bottom Roller Coater
- Mixer
- Emergency Water System
- Vibrating Table
- Forming Station
- Boardline Belts

There are two papers used to form the board. The face paper (bottom paper) travels on the lower part of the process, the back paper (top paper) travels on the upper level of the process. The face paper travels from the creaser, where it is mechanically creased to allow the board to form to the proper final dimensions.

A controlled flow of stucco, water and dry additives are continuously fed to the mixer, which is designed to rapidly and efficiently mix the materials into homogenous slurry. This slurry is used to create the main core of the board. The roller coater distributes higher density slurry across the paper prior to reaching the mixer.

As the paper and slurry moves toward the forming table, vibrators help evenly spread the slurry across the width of the board. A thin bead of glue is applied to the back paper edges as it enters the forming table to allow it to adhere to the folded edge of the face paper as shown below. At the forming table, paper and slurry come together where they are mechanically folded into the properly dimensioned board envelope. The forming plate functions like an extruder where the top plate is raised to a precise height to control the thickness profile of the board as it moves through the two plates onto the forming belts of the board line.

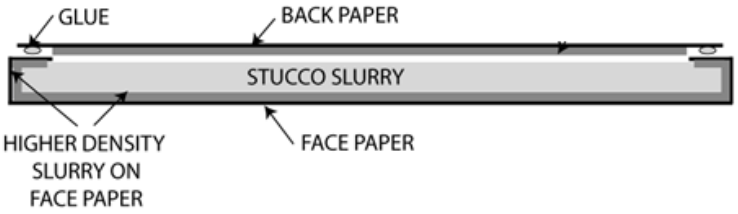

Figure 2: Cross Section of the Board Envelope

2.1 Creaser

The creaser uses a blade and anvil mechanism to crease the bottom web to allow the board to form to the correct final dimensions. Each individual head assembly includes a creaser wheel and anvil which creates one crease line per side. Depending on the number of crease lines required per product, multiple board thicknesses can be pre-set, allowing for fast changeovers 'on the fly'. In total there are eight creasing heads, with four on the left and four on the right. The heads can all be independently controlled and set to any desired position via stepper motors which give a theoretical accuracy of 0.001 inches. Creaser heads not in use are disengaged from creasing the paper based on the recipes entered in the HMI. There are two identical HMI Screens (one on each side of the creaser) which are used to control the cylinders on the creaser.

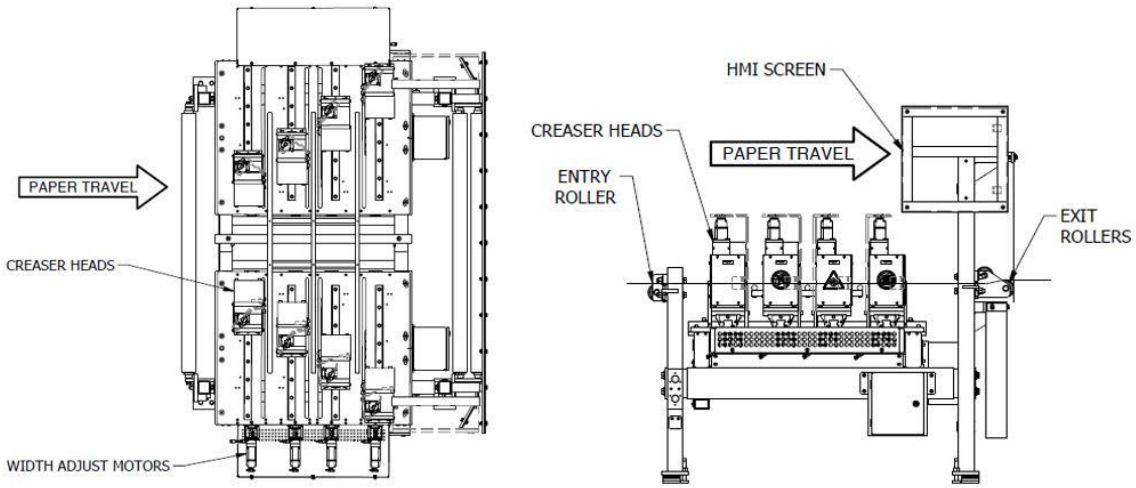

Figure 3: Creaser

2.2 Roller Coater

The function of the roller coater is to skim-coat the surface of the paper with the densified layer of slurry. This significantly improves the humidified bond between paper and core. The thickness of the skim coat is approximately 1/16” or 1.6mm, but can vary depending on requirements.

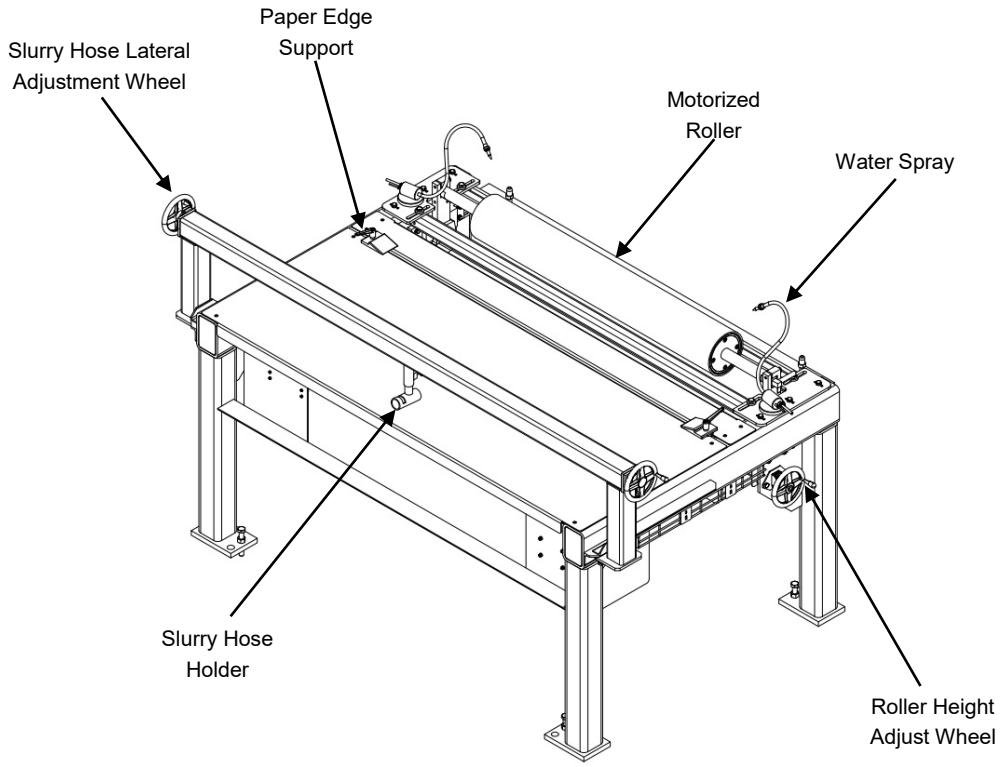

Figure 4: Bottom Roller Coater

The roller forces the paper down between two anvils and creates a cleaning section at the bottom of the roller. The height of the roller is controlled using a hand wheel. The roller is internally motorized, and the rotation of the roller must be reversed to the paper travel direction. This creates a buildup of slurry at the intake side, which the roller picks up and wipes off onto the paper at the exit side. Any slurry that isn’t deposited on the paper spills over onto the crease lines and helps to harden the edges. It is important that the densified slurry cover both crease lines, on each side, to achieve adequate edge hardness of the finished board. Adjustable edge supports are provided to aid in this.

Slurry is extracted from the mixer and supplied to the roller coater through a hose. The hose holder can be moved laterally with the hand wheels to adjust the slurry supply location. Water sprays are supplied on the sides of the roller.

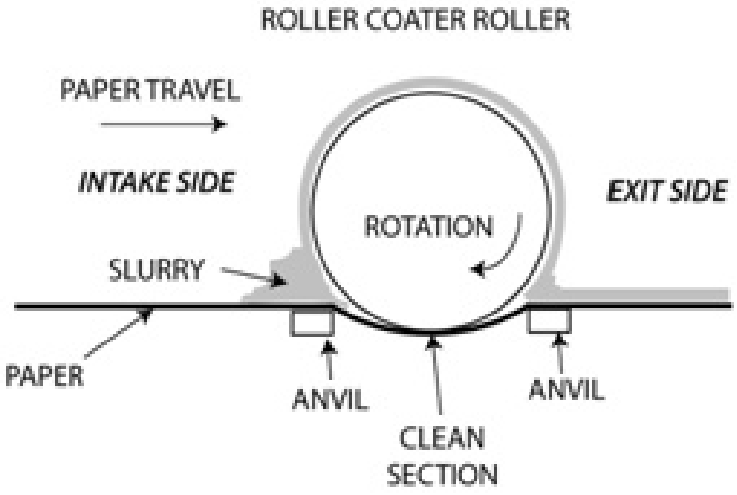

Figure 5: Roller Coater Roller Action

2.3 Mixer

The function of the mixer is to mix stucco, dry additives, water and other wet additives to form a homogenous slurry, which is then discharged on a moving paper stream.

2.3.1 Mixer Operations

The mixer should not be shut down until it has been adequately flushed with water. During normal operations, liquids are introduced to the mixer slightly before dry materials, and dry materials are shut down momentarily before wet materials to ensure that the mixer is kept clean. Mixer cleanliness is important for ensuring proper operation.

The mixer can be broken down into four (4) quadrants. Typically wet additives are added at strategic locations in quadrants 1, 3 and 4, and venting occurs in quadrant 2.

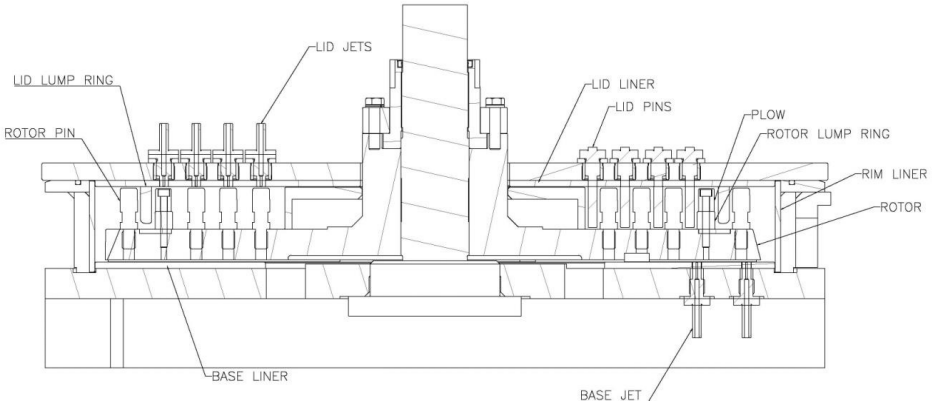

Figure 6: Mixer Cross-section

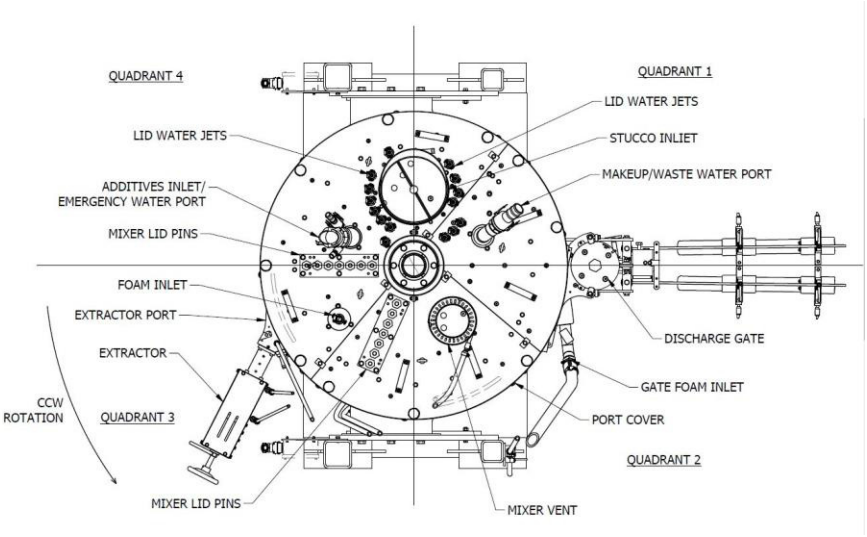

Figure 7: Mixer Top View

2.3.2 Mixer Vent

The function of the mixer vent is to remove air from the mixer body. As air is released the vent will also release a certain amount of stucco dust and water droplets. A flexible suction hose is situated to the side of the vent and should be used to remove the dust and droplets. If over time the hose builds up with set gypsum the operator can remove the hose temporarily for cleaning.

The vent is continuously flushed with water from the manifold to limit buildup inside of the vent.

2.3.3 Water Flow to the Mixer

Water enters the mixer through either the mixer manifold or through a direct additives connection. Water entering through the manifold is routed through various jets in the mixer's lid and base, and water added through additives connections are routed through various inlet trees on the mixer's lid.

There are several water jets located strategically on the lid of the mixer. These both add water to the mixing process and help keep the inside of the mixer clean. There are also 2 water jets in the base of the mixer. One is positioned to clean the root of the rotor teeth and the other to lay down a small film of water under the rotor, to keep it clean.

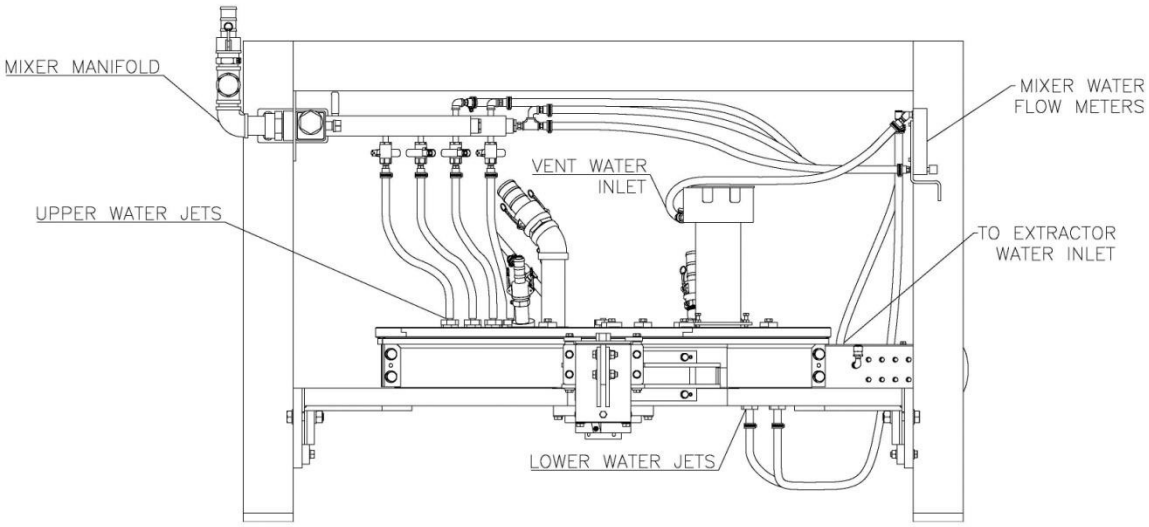

Figure 8: Water Flow to the Mixer

2.3.4 Mixer Emergency Water

Each mixer has an emergency water (E-water) inlet in which water is added to flush out the mixer in an upset condition. The water flow is controlled by a solenoid valve. During operation, the solenoid valve is normally shut. The E-water prevents the mixer from seizing if an upset condition occurs (process water flow loss, stucco surge, power loss). During normal operation, the E-water valve is automatically opened when a) the load on the mixer motor exceeds a pre-set value b) the solenoid stops receiving a signal or air pressure loss or c) there is a power failure. In the case of a high load condition the E-water valve opens until the load returns to normal. In the case of power loss or system fault the E-Water remains on until the manual valve is closed. The manual valve is provided with a proximity switch to prove the valve is open before starting up production. The E-Water can be manually turned on to flush the mixer after cleaning, maintenance or during upset conditions.

The purpose of this water is to prevent the mixer from seizing in the event that a problem occurs with normal process water flow or with an unexpected surge of stucco or dry additives. The emergency water can be activated in automatic or manual mode.

When the solenoid valve opens during an upset condition, the operator must shut off the emergency water by closing the manual valve to avoid excessive flooding. The manual valve should also be closed during any mixer shutdown where the mixer is not continually supervised to prevent flooding in the event of a power failure.

In automatic mode, the emergency water valve is automatically activated when the power load on the mixer motor exceeds a preset value. The emergency water valve opens, and the mixer emergency water button illuminates until the load returns to normal. An alarm is triggered on the HMI so that operators are aware of the problem.

In manual mode, the emergency water valve is activated by pressing the mixer emergency water illuminated button on the control panel for each mixer. When the button is pressed the valve opens, water flows into the mixer, and the button illuminates.

2.3.5 Extractor

The function of the extractor is to control the volume of slurry moving from the main mixer to the bottom roller coater. A controlled amount of water is added to the slurry though the manifold. Too much water should be avoided as this prevents the board edges from drying properly in the dryer.

The extractor cycles from a fully closed to an operator adjustable open position using a threaded rod and handle located at the back of the extractor; the more open the plunger, the more slurry passes through.

The extractor is set to cycle between the fully closed and operator set open position regularly to dislodge any build-up inside the extractor.

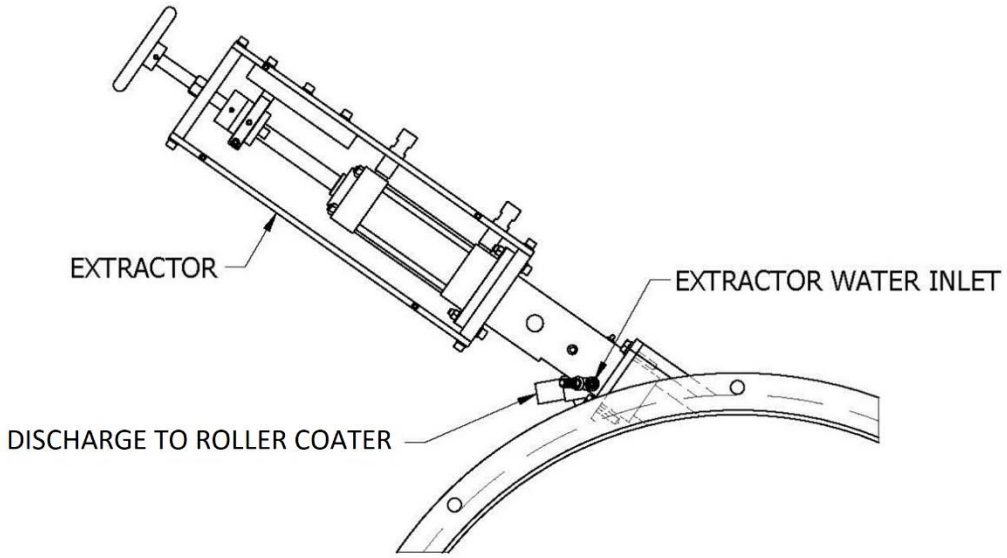

Figure 9: Extractor Components

2.3.6 Stucco Inlet

Stucco is added to the mixer through a chute that is attached to a conveying screw. The stucco inlet is equipped with a scraper which prevents it from blinding over from build up. The Stucco Chute Scraper should be rotating counter clockwise when looked on from top down.

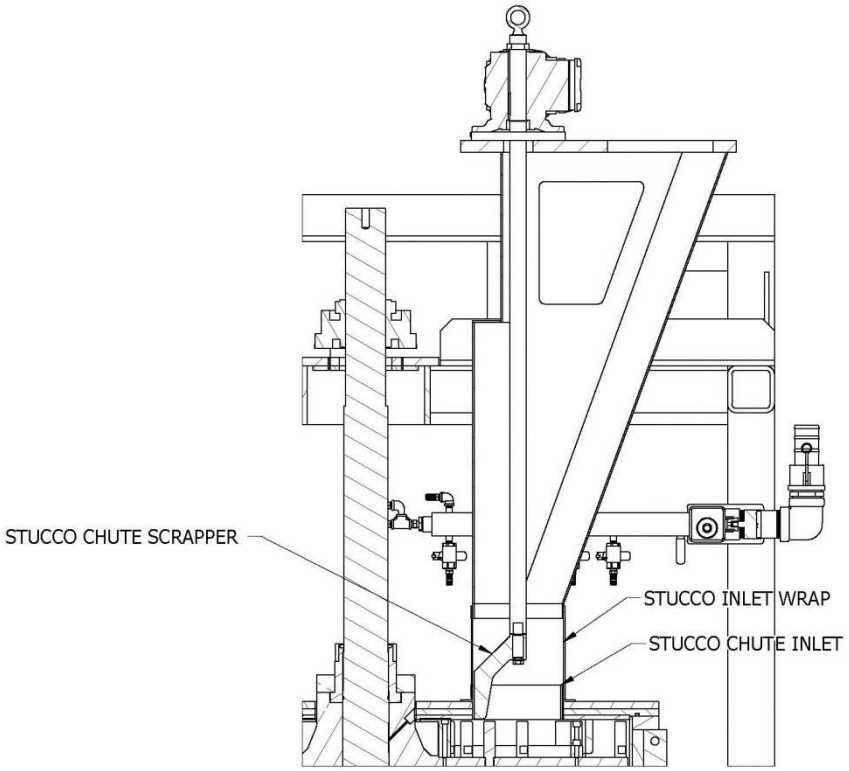

Figure 10: Stucco Chute Components

2.4 Vibrating Table

As the slurry leaves the mixer and is deposited onto the back of the face paper, it is carried over the vibrating table towards the forming table by the movement of the paper. The function of the plate vibrators is to ensure that the slurry is evenly spread and distributed across the field of the board and to breakdown over-sized air bubbles in the slurry by the time it reaches the forming plate.

The control of the speed for each vibrating pad is adjusted via the HMI. The key to effective use of the vibrating table is controlling the speed of each pair of vibrating pads. If they run too fast for the nature and volume of slurry then excessive splattering and de-aeration will occur. If they run too slow for the current product conditions then the slurry may not be distributed evenly across the field of the board.

The forward vibrating pads are mounted on air bags. The pressure in these bags can be adjusted via a regulator to further adjust the pad's vibration.

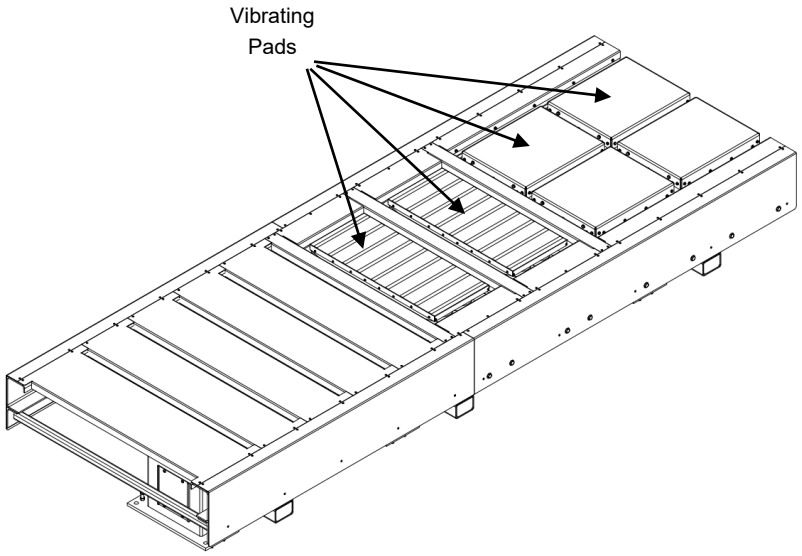

Figure 11: Vibrating Table

2.5 Forming Table

The main functions of the forming table are glue application, initial edge formation and board thickness (caliper) control. Glue and folder guide adjustments are completed manually using hand wheels, while board thickness is automated.

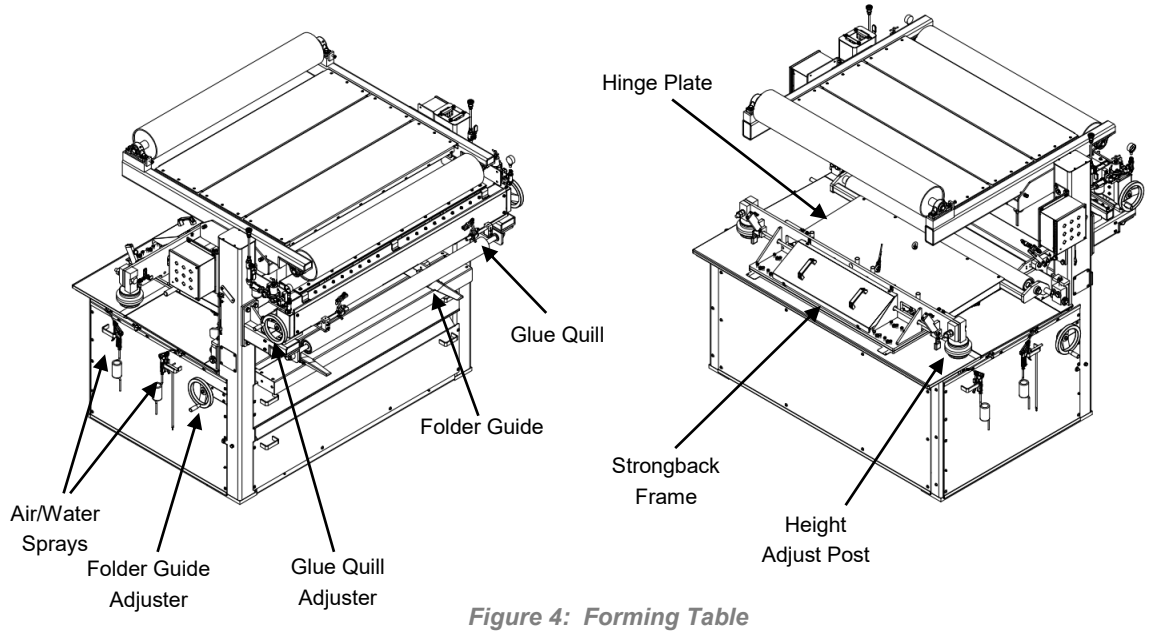

Figure 4: Forming Table

2.5.1 Forming Plate Thickness Caliper

The most critical components on the forming station are the top and bottom forming plates. Care should be taken to ensure the surface of the plates are not damaged. The bottom plate is rigidly fixed to the equipment frame while the top plate is mounted to a 'strong back' frame. The strong back frame is connected to two lifting shafts which in turn are coupled to a lifting beam. The geometry of the four items allows for height adjustments on either side of the plate without affecting the other side. Board thickness is set by raising/lowering screw jacks located under the lifting beam. To ensure accuracy on the plate gap, the lifting beam is also pulled down tight against the jacks via the air cylinder that also raises the plate for cleaning, etc. The plate gap is measured on either side by monitoring the lifting shafts via linear encoders.

2.5.2 Safety Bars

The safety bars are located on the downstream side of the top forming plate. They are designed to prevent the top forming plate and strong back frame from suddenly dropping while work is being done beneath it. Safety bars can be locked in the down position. Safety bar shapes may look different.

Before doing any work underneath the top forming plate or strong back frame, ensure that the safety bars are in the down position to prevent the top forming plate or the strong back frame from lowering suddenly.

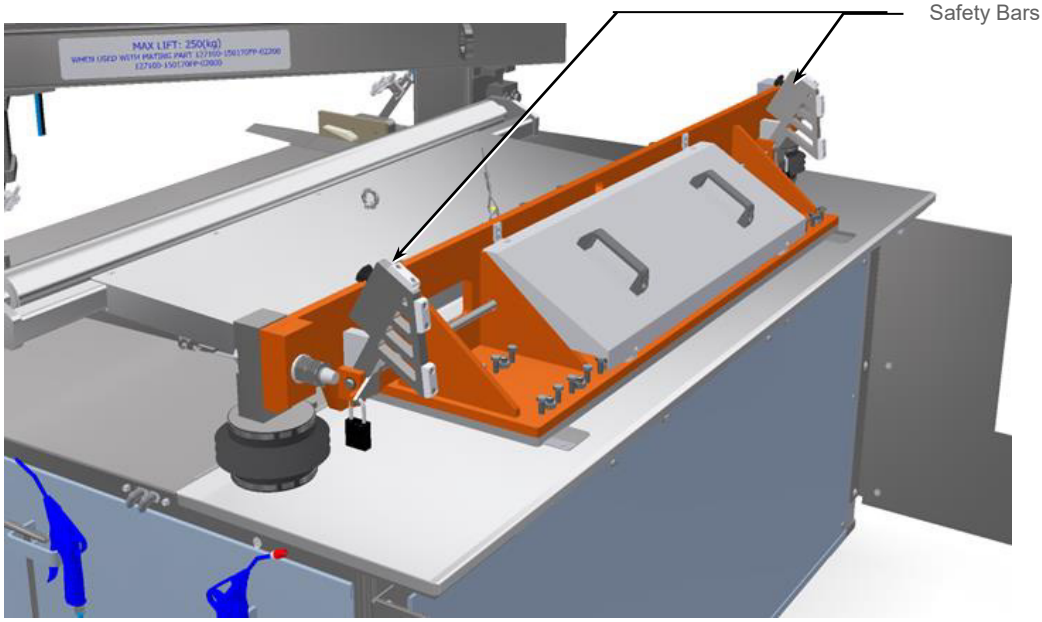

Figure 13: Forming Plate Safety Bars

2.5.3 Glue Application

Glue is applied on the front face of the forming station. A thin bead of glue is applied to the back paper as it enters the forming station to allow it to adhere to the folded edge of the face paper.

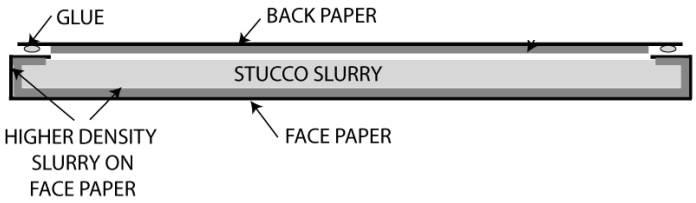

Figure 14: Glue Application on the Board Envelope

The glue system on the forming table includes an inline filter, pressure regulator, pressure gauge, applicator valve and nozzle. Glue volume flow is controlled partially by the glue pump skid and then finally regulated using the pressure regulators mounted on the forming table. It is important to routinely clean out the filters mounted on the forming table. Immediately after board production is complete, the nozzles should be soaked in cups of water in-place or removed, cleaned and re-installed to remove leftover paste downstream of the applicator valve.

The amount of glue applied and the tack time of the glue are important quality variables.

- Too much glue will cause a mess down the boardline and it will also result in “glue rings” forming on the equipment in the wet transfer area.
- Too little glue can result in unsealed edges.

2.5.4 Edge Formation Components

The initial edges on the board are created using the folder guides located on either side of the paper stream. Folder guides consist of lead-ins, the main folder guide, paper folder, edge fingers and plate shims. The folder guides are manually adjusted for board width via the hand wheels on either side of the machine. The edge fingers can be angled in or out by adjusting the second fastener holding them to the folder guides. Due to the continuous rubbing of the paper, all components should be routinely inspected for wear and replaced as required to ensure proper edge formation. It is also important to keep the components clean and remove any material buildup throughout the duration of running.

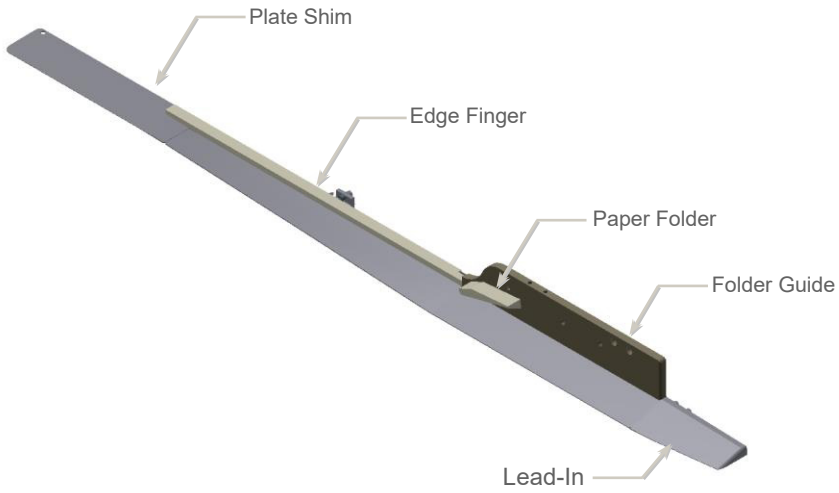

Figure 5: Edge Formation Components

The edge fingers on the forming table are used to guide the folded edge as it enters the space between the top and bottom forming plates. As the paper enters the folders, the heel of the folders should be slightly wider than the finished board width, and the tips of the edge fingers "toe in" slightly at the forming plate.

2.6 Boardline

The boardline consists of a series of belt conveyors to carry the continuously formed board from the mixer area to the wet transfer area. The first boardline belt conveyor will generally consist of edge bars, edge sprays and back sprays to aid in the control of the board forming process. Other typical components include walker wheels, belt washers, and taper belt guides.

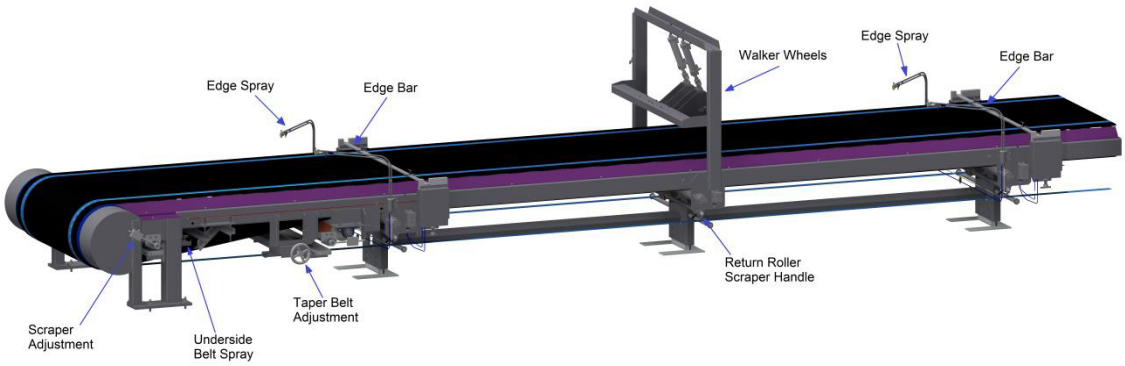

Figure 6: Boardline Typical Components

2.6.1 Edge Bars

Several sets of edge bars are located along the length of the first board line conveyor to help maintain the desired edge profile during the initial stage of board formation. Pneumatic cylinders are equipped to raise and lower the edge bars.

2.6.2 Edge Sprays

Several sets of edge sprays are located along the length of the board line conveyor and are used to wet the edges of the board where the face paper meets the back paper. A manual valve at each air atomizing spray nozzle will allow the operator to set the desired level of misting spray. Solenoid valves are equipped to control the on/off operation of the edge sprays. The edge sprays are shorter in length than the back sprays and are located upstream of the edge bars.

2.6.3 Back Sprays

Back sprays are positioned to wet the back of the board to relax the back paper and allow it to expand. The back sprays are longer than the edge sprays and are located farther down the boardline.

2.6.4 Walker Wheel

Walker wheels are positioned along the length of the boardline conveyor to aid in the start-up procedure. The wheels are lowered to apply adequate friction and traction between the paper and the belt to pull the paper through the mixing area during start-up. A pressure regulator can be used to adjust the amount of pressure applied by the walking wheel to the paper.

2.6.5 Belt Washers

Where equipped, a belt washer is located at the head end of the conveyor and is designed to clean slurry from the surface of the belt after process upset conditions. This may be used during start-up or normal shut-down to maintain belt cleanliness. The belt washer consists of a powered rotary brush, water spray and squeegee system that is automatically raised against the belt during a cleaning cycle.

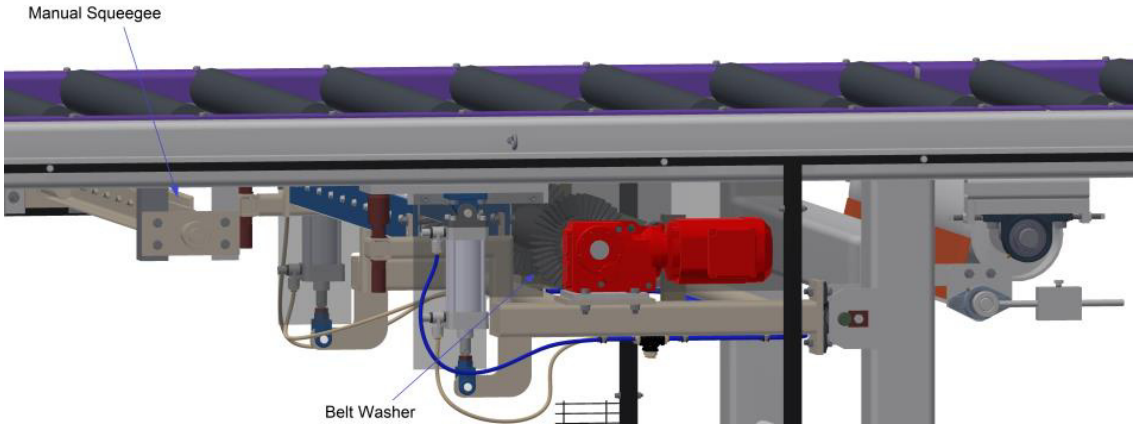

Figure 7: Boardline Belt Washer

2.6.6 Underside Belt Spray

An underside belt spray is located downstream of the tail pulley of the first board line conveyor and is used to aid in cleaning the belt. The operation of the underside spray is generally used outside of normal production and is turned on/off using a manual valve.

2.6.7 Taper Belts

The taper belts run down each side of the boardline and are used to shape the edges of the board until it hardens enough to maintain the tapered edge. The taper belt guides are used to set the position of the taper belt for the desired board width when required and is adjusted manually with hand wheels located on each side of the equipment.

3 Operator Procedures

3.1 Starting and Stopping the Mixing Forming Area

Starting and stopping the mixing forming area is done on the operator control panel. The HMI indicates conditions not met prior to starting the area. Before the area can be started, these conditions must be met:

- All disconnects in the zone must be closed
- No emergency stop conditions can exist
- No external critical zone process faults can exist
- Area safety contactors need to be energized
- The area relay needs to be energized
- Air pressure needs to be operational

Activation of any of the emergency stop buttons or pull cords will shut down the entire area. Emergency stop conditions include activation of any emergency stop button.

Before attempting to start the mixing forming equipment:

1. Ensure that the head control laser located before the forming plate is clean and properly adjusted.
2. Confirm that all air valves are open.
3. Confirm that the paper has been properly threaded through the equipment.
4. Confirm that the emergency water manual valve is open.
5. Confirm that all motors & valves are ready. The HMI will show the system to be 'ready'.

If any of the above conditions are not met prior to starting the line, it will be so indicated on the HMI. If any of the above conditions fail during operation, the affected motor is automatically shut down, and the reason for the shutdown is displayed on the HMI. If an additive is not selected in the current formulation, the status indicators will be 'grayed' out and ignored as far as the master start is concerned.

3.1.1 Master Start Sequence

Once the plant is ready to make board, the master start sequence is initiated.

During a start sequence, various master start timers / linear board travel variables are used to delay when equipment will automatically turn on or off.

3.1.2 Fatal Shutdown Faults

While the board line is running, the PLC program monitors for fault conditions that would mandate a mixer shutdown. These fatal faults are called first outs.

From the first out setup screen these faults can be configured.

- Enable / disable alarm
- Fault is critical or non-critical which will adjust the magnitude of the mixer flushing which occurs during the shutdown sequence.

- Delay buffer which configures how long the alarm condition will be allowed to occur before actually shutting down.

3.2 General Operations

3.2.1 Threading of Paper

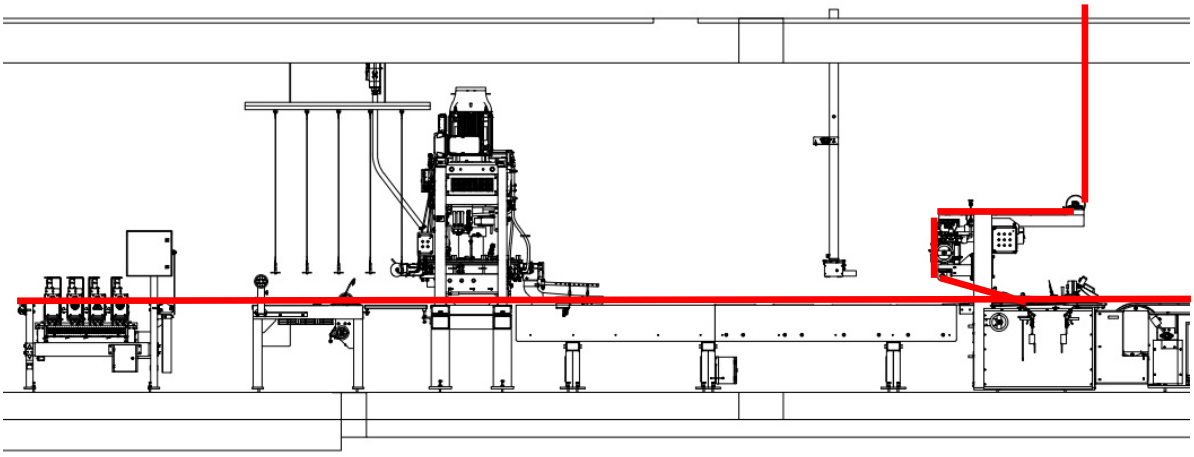

Figure 18: Paper Path

1. Ensure that all equipment is completely stopped.
2. Raise all heads on the creaser assembly. Lift the forming plate and flip the safety bars down.
3. Ensure that the paper has been threaded through all paper handling equipment.
4. Thread the bottom paper through the creaser.
5. Thread the paper between the bottom roller coater and the table, then underneath the mixer and over the vibrating table towards the forming table.
6. Thread the top paper down from the upper level, under the downstream roller on the top of the forming plate, over the upstream roller on top of the forming plate, and down towards the hinge plate.
7. Pass both the top and bottom paper underneath the hinge plate and the top forming plate, and out towards the boardline.
8. Pass the paper under the walking wheel and lower the walking wheel to hold the paper in place.

Note: See the **Paper Handling Area Operations Guide** for paper handling paper threading instructions, and an overview of how the threading assist function works.

3.2.2 General Area Start-Up

1. Ensure that all machine-specific start-up tasks have been completed.
2. Ensure that all personnel are clear of the equipment. Raise and hold the safety bars from the forming plate.
3. Signal the mixing forming area is ready to begin production.

4. Initiate the master start sequence.
5. As production begins, hold the leading edge of the paper in place folding it over the leading edge of the slurry. Once the slurry meets the folded part of the paper release it.
6. Lower the forming plate once consistent output from the mixer is observed.
7. Adjust the folder guides and fingers at the forming plate to form an appropriate edge.
8. Lower the edge bars and adjust their position to form and hold an appropriate edge.
9. Adjust edge and back sprays accordingly.

3.3 Creaser

3.3.1 Threading Paper

Prior to re-threading paper following a paper break etc., the crease blades should be disengaged in order to provide easier access and paper threading.

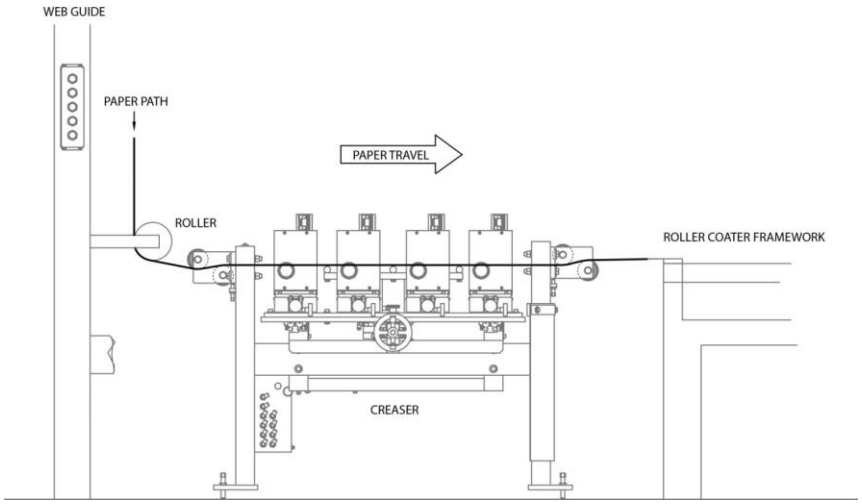

Figure 19: Paper Path through the Creaser and Bottom Roller Coater

1. Pass the paper under the first roller in the entry rollers and over the second roller.
2. In order to thread paper disengage the top heads by pressing the corresponding creaser head pushbutton(s) on the remote push button controls.
3. The paper should then be routed between the top and bottom head guards (and consequently the heads themselves) on all head assemblies.
4. Ensure that the paper is lying flat on top of the paper support bar.
5. The paper should continue under the first roller and over the last roller of the exit paper guide.
6. The paper can now be passed under the mixer, along the forming table as per normal procedure.

3.3.2 Width Adjustment

All horizontal adjustments are done with inputs into the local HMI. The width of the board is determined by the two inner creases. It is suggested the entry set of creaser head assemblies (marked Head 1) be used for the inside crease and Heads 2, 3 and 4 should be used for the outer crease lines.

Note that the actual distance between the creases will be slightly less than the width of the desired board. Expansion of the board must be considered. Exact settings must be based off of samples taken at the wet transfer and/or takeoff area.

3.3.3 Thickness Adjustment

The thickness of the board is determined by the second crease. The distance between the first crease (Head 1) and the second crease (Head 2, 3 or 4) is the thickness. Head 2, 3 and 4 should be set to correspond to different board thicknesses and/or positions of tapers

3.3.4 Crease Depth Adjustment

Adjust desired depth of crease using the HMI screens located on the machine. The adjusting screw is powered by a stepper which determines the elevation of the upper rotating element. The lower rotating element is fixed in place.

The depth of the crease cannot be set by measuring as with the board width. It is set by operator feel and experience. Depth varies between paper weights and can even vary between different lots of the same paper.

A test crease will determine whether a crease depth needs to be increased or decreased. See section on “Trouble-Shooting” below for characteristics of different crease depths to help set the proper depth. One complete revolution of the motor raises or lowers the element approximately 0.20” (5mm).

3.4 Mixer

3.4.1 Ready Mixer for Start-Up after a Shutdown

After any shutdown, planned or unplanned, ensure that the following steps are completed before the mixer is restarted:

1. Flush the mixer with water to remove any excess slurry or stucco powder from the mixer.
2. Clear the area around the mixer, vibrating table and forming table.

3.5 Forming Table

3.5.1 Shutdown Procedures

1. Allow the boardline to come to a complete stop.
2. Remove any paper past the roller coater from the table and dispose of it.
3. Use hoses and squeegees to clean the forming plate and vibrating table of any remaining slurry.
4. Soak each glue application nozzle in cups of water in place. During longer shutdowns, remove and clean these nozzles.
5. Re-thread the paper.

3.5.2 Lifting the Forming Plate

1. Ensure that the boardline is completely stopped.
2. Ensure that the forming plate is clear of all personnel and debris.
3. Use the manual controls to raise the forming plate.

4. Rotate the safety bars so that they are completely in the down position.

3.5.3 Lowering the Forming Plate

1. Hold the safety bars in the upward position. A sensor will detect this and prevent the plate from lowering if the bars are not raised.
2. Ensure that the forming plate is clear of all personnel and debris.
3. Use the manual controls to lower the forming plate.

3.5.4 Calibration of Forming Plate

The forming plate requires periodic calibration to ensure that the target board thickness is consistently met. **Do not perform any task requiring you to move under the top forming plate without first engaging the safety bars.** To calibrate the forming plate:

1. Ensure that the board line is completely stopped and locked out.
2. Start with the forming plate below the thinnest keystock being used for calibration
3. Raise the forming plate and ensure that the safety bars are engaged.
4. Place precision machined keystock of known dimensions along the far edges of the forming plate then raise the safety bars.
5. Slowly lower the top plate onto the keystock. Record the position in the HMI.
6. Repeat steps 1-4 for a second size of machined keystock.
7. Use the HMI to calibrate the board thickness function.

3.6 Board Line

3.6.1 Start/Stop

The equipment on the board line is normally started and stopped by a single button on the mixer operator panel. Before attempting to start the board line ensure that the following activities have been completed:

1. Ensure that all photo-eye are clean and properly adjusted.
2. Confirm that no emergency stop (e-stop) buttons have been activated (including pull-cords).
3. All disconnects on the line must be closed.
4. Confirm that all air valves are opened.
5. Confirm that all HMI and selector switches are in the ‘AUTO’ position.
6. Confirm that all circuit breakers are closed.
7. Confirm that no faults exist on the line.

If any of the above conditions are not met prior to starting the line, they will be indicated on the HMI. If any of the above conditions fail during the operation, the board line will automatically shut down, and the reason for the shutdown will be displayed on the HMI.

Once the above conditions have been met:

8. Start the area with the associated pushbutton on the operator panels. The pushbutton illuminates in a different manner depending on the condition of the area:
    a. Light off: The area is off

b. Light flashing on-off: The area is starting or is on, but one or more fault conditions are present.
c. Light on: The area is on and no fault conditions are present.

9. Pushing the area start pushbutton once will initiate the “Area Start Sequence” where a start delay timer is enabled and a horn is sounded to warn personnel that the area is starting. Any person sees anything that would indicate that it is not currently safe to start up the board line, such as individuals on top of or inside the board line, or any material or equipment that would disrupt the board line’s normal function, should immediately push an Emergency Stop button or pull the pull-cord to prevent the line from starting up.
10. Once the alarm has finished sounding, the equipment will start accelerating until it reaches the set point.

In the event of an emergency or a dangerous situation, individuals should not hesitate to press an e-stop button or pull a pull-cord. However, these features should not be used to shut down the board line during normal operation.

4 Troubleshooting

Due to the intricate nature of the equipment, this section will outline only basic mechanical approaches to problem solving. Should the maintenance steps outlined below fail to fix the issues, we recommend contacting a Gyptech representative.

4.1 Creaser

4.1.1 Crease Lines

Problem	Possible Cause(s)	Possible Solutions
No crease	- Creaser head not engaged - Creaser head not contacting paper - Creaser head not in correct position	- Engaging creaser head - Increasing overall depth - Check creaser head positions
Crease lines too shallow	-Creaser head not engaged -Creaser head not contacting paper	- Increase overall depth - Disengage creaser head and clean underneath
Creasers are cutting paper	-Creaser depth too deep	-Reduce overall depth
Crease lines too deep	-Creaser depth too deep	-Reduce overall depth
Crease lines becoming rounder and shallower	-Creaser blade dulling	-Replace creaser blade
Inconsistent crease depth (pulsing)	-Creaser blade has worn unevenly across the creasing edge	-Replace creaser blade

4.1.2 Product Quality – Creaser Related

Problem	Possible Cause(s)	Possible Solutions
Distance between crease lines not appropriate for product	-Distance between opposing heads incorrect	-Adjust width
Scuffing or tearing of paper	-Excessive paper tension -Creaser elements not turning on paper	-Check tension of paper and adjust -Try rotating element by hand, bearings may need replacing
Buckling or tearing of paper	-Creaser heads need toe-in or toe-out	-Pivot slide bases accordingly
Creases off center from paper	-Paper not tracking dead center on board line	-Make off-center adjustment to creaser assembly or adjust paper web guide.

4.1.3 Edge Formation – Creaser Related

Problem	Possible Cause(s)	Possible Solutions
Very round edges on formed board	-Creaser depth too shallow	-Increase overall depth

4.2 Mixer

4.2.1 Mixer – General Troubleshooting

Problem	Possible Cause(s)	Possible Solutions
Leaks – Where Mixer Lid meets the Rim	-O-Ring is excessively compressed, preventing proper sealing -The O-Ring is damaged -The Lid Liner is worn down near the rim liner	- Ensure mixer lid T-Bolts are tightened according to Gyptech Recommendation - Inspect O-Ring for damage. Replace if necessary - Replace worn liners
Leaks – Mixer Lid around Mixer Drive Shaft	-Mixer vent is blocked, increasing internal pressure -Flow is restricted at mixer discharge --Mixer is over-full	- Ensure mixer vent is running clean. If dirty, see "Material is Building Up in Mixer Lid" -Inspect Boot/Discharge Gate for blockages -Increase Boot and/or gate donut ID
Leaks – Mixer at Extractors	-Extractor – Mixer connection not properly sealed	- Add silicone sealant around extractor connection. Keep in mind silicone will only work properly if it is dry, dirt free, and has had enough time to cure
Leaks – Extractor Vent Holes	-Extractor plunger is worn	-Replace Extractor Plunger
Leaks – Tangential Discharge Gate	- Fit of gate to mixer distorted -Improper sealant used	-Add silicone sealant around gate connection. Keep in mind silicone will only work properly if it is dry, dirt free, and has had enough time to cure
Lumps in Mixer Discharge	- Lumps forming in mixer Boot - Lumps are forming inside mixing chamber (behind rotor teeth, pins, etc) - Lumps forming in vent	-Periodically squeeze mixer boot to clear out any lumps forming in boot -Check to see if mixer is running dirty. Look for buildup, particularly outside of the lump rings. See 'Troubleshooting a mixer that is running dirty' -Ensure vent is level. Ensure that there is enough water flowing to vent that water spills uniformly over 360 degrees into the vent
Extractor Slurry is not dense enough	- Impeller in hard edge mixer may be worn - Flow through the extractor may be inadequate	- Check extractor and connections to hard edge mixer for any lumps/ blockages that are restricting flow - Request that maintenance inspects/replaces the impeller in the hard edge mixer

Mixer is Spitting at the Vent	- The mixer is having trouble discharging slurry	-Open the lid and check that no lumps or obstructions are in the lump ring area. Clean if necessary -Change the spiral type / adjust how open the spiral is. Impacts the downward force on the slurry
There is excessive buildup in the stucco inlet	- Water is splashing up the stucco inlet - Water vapor is being drawn up the stucco inlet by the dust collection system	- Reduce the water pressure in the manifold. -Reduce the flow through the lid jets upstream of the stucco inlet. - Adjust the makeup/fibre water inlet to aim farther away from the stucco inlet. - Reduce amount of dust collection in the stucco inlet chute. -Inspect the upstream dry additives system for moisture/clumping
Material is building up in the Mixer Vent	-Water is not evenly cascading around the inner edge of the mixer vent. -There is excessive suction on the mixer vent	-Ensure that mixer vent is sitting level on the mixer lid. -Ensure that the correct amount of water is running to the vent. Too little water will prevent it from cascading over the entire diameter of the vent. Too much water will create turbulent 'dry spots' around the ID of the vent. -Ensure that there is no material in the outer chamber of the vent which could disrupt the flow of water. -Adjust the suction valve to reduce the air pressure at the vent.

4.2.2 Mixer – Troubleshooting a Dirty Mixer

Problem	Possible Cause(s)	Possible Solutions
Mixer is running Dirty	-Pins are worn and not adequately scrapping buildup -Too little retarder in the formulation -Water jets are blocked and not properly cleaning mixer -Make-up/Fibre water entry port improperly positioned -Water delivery not properly fine-tuned -Inside diameter of the donut section of the mixer discharge unit not properly fine-tuned -Water is splashing up the stucco chute inlet -Stucco Quality may not be uniform	-Inspect inside of mixer for damaged/worn components near buildup locations. Replace as needed. See Gyptech Mixer manual for more details. -Adjust formula to increase the amount of retarder used -Temporarily increasing the flow to a water jet may clear any blockage. If it does not clear the blockage, return the flow to the jet to normal and clean jet after shutdown. -Make-Up/Fibre water should be aimed to fall between the stucco inlet and the rotor. -Adjust amount of water entering mixer at certain locations -Change donut used in mixer discharge unit. A smaller donut ID can improve the mixing of the slurry, while restricting the flow out of the mixer.

		- Direct the make-up/fibre water port away from the stucco inlet. Reduce the amount of water flowing to the mixer jets around the

4.3 Forming Station

4.3.1 Forming Station – General

Problem	Possible Cause(s)	Possible Solutions
Too little or no edge glue	-Running low on supply -Edge glue skid system error -Filter plugged -Regulator set too low -Applicator nozzle clogged	-Check edge glue supply/skid system. -Clean out filter and applicator nozzle. -Check pressure setting on regulator.
Too much glue	-Regulator set too high	-Adjust pressure setting on regulator.
Folder guide cannot be adjusted in/out	-Physical obstruction -Adjustment screw binding	-Check for physical obstructions and clean area. -Inspect condition of adjustment screw, adjustment nut and associated bearings.
Initial board edge formation incorrect	-Improper creasing -Folder guide setup incorrect	-Corrective action should be taken by trained personnel only. Several adjustments can be made to the folder guides including position, angle…
Top plate does not raise	-Top plate requires homing -Physical binding	-Calibrate the top plate to ensure the position set point is properly configured. Inspect bolted connections, linear rails and bearings on top plate lifting system for binding.
Top plate does not fully return to down position	-Top plate requires homing -Physical binding	Calibrate the top plate to ensure the position set point is properly configured. Most likely, the possible cause is related to physical binding.
Unable to make board thickness change to one or both sides	-Motors not running -Screw jack failure -Physical binding	-Verify motors run when requested and are not faulted. Inspect system for possible binding.
Board thickness profile incorrect	-Top plate not set correctly -Slurry head profile changed -Slurry consistency changed	-Corrective action should be taken by trained personnel only to adjust top plate. Note that both slurry head profile and slurry consistency (mix ratios, foam structure, stucco quality) can affect board thickness profile.
Paper break remains active (if applicable)	-Water or slurry still present -Surface of paper is wet	-Sensor should dry out as paper continues to slide over surface. -Ensure no additional water or slurry is contacting paper upstream of forming plate.

4.4 Board Line

Problem	Possible Cause(s)	Possible Solutions
Belt Tracking	-Return roller misalignment -Interference from belt washer (only when belt washer is in operation)	-Check all return roller positions and fasteners for tightness -Adjust the hard stops on both sides of the belt washer so that it makes even contact across the width of the belt -Check for even water spray across the width which may cause slippage on one side of the pulleys -Have maintenance refer to the belt tracking section of the belt-maintenance manual
Belt bowed along the length of travel	-Top conveying rollers misaligned -Uneven belt stretch or swelling across the width of the belt -Poor belt splice	-Check top rollers are square and parallel. A Gyptech laser alignment tool is available to verify. Adjust top roller sections or individual rollers -For cotton fiber reinforced belts with sealed edges: check belt washer or other sprayers for uneven water distribution. Not common for synthetic or polyester fiber belts. Replace belt if necessary -Contact belt-splicer and re-splice if necessary
Belt slippage	-Belt Tensions too loose -Belt too wet	-Have maintenance refer to belt tensioning section of the equipment maintenance manual -Check belt washer operation and water shut-off solenoid -Apply manual squeegee to wipe off excess water from the underside of the board belt
Paper cockles	-Poor belt tracking -Belt misalignment from one belt section to another -Poor paper expansion -Belt speed difference from one belt section to another	-Refer to belt tracking -Check head and tail pulley alignment for parallel and tighten all jack bolts -Check back spray operation and clean as necessary -See HMI Operations Manual

END OF DOCUMENT

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