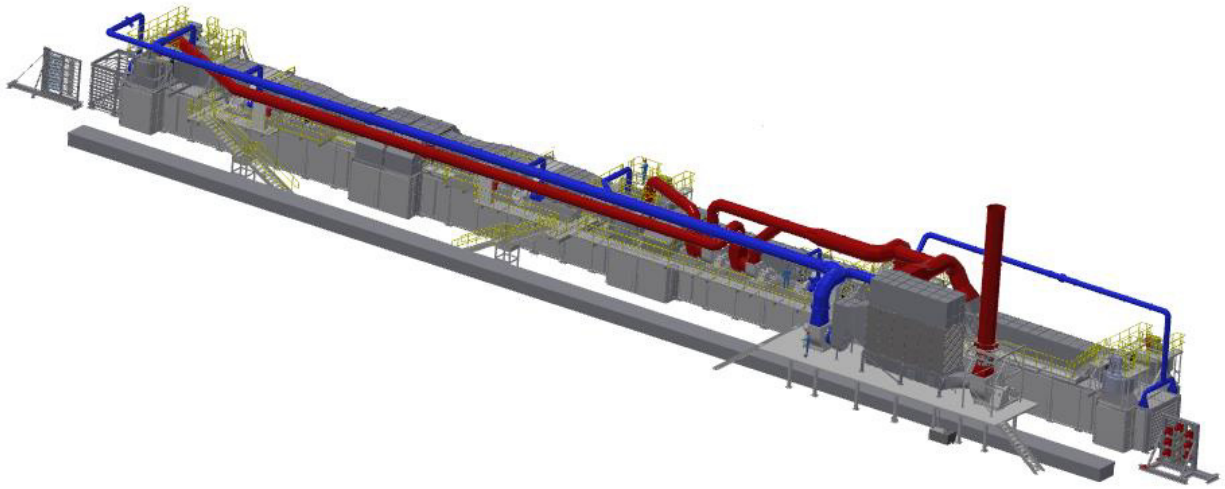
Gyptech

Proven Technology Worldwide

Dryer

Area Operator´s Manual

Carmit Mister Fix Israel



Customer: Carmit Mr Fix
Location: Caesarea, Israel
Project: CAIS 130200
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Introduction

This manual is written to provide information to assist in the normal operation of the Dryer 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 DRYER AREA OVERVIEW

The Gyptech dryer area equipment consists of a 3-zone Dryer. This section will explain the various components in the dryer. This description is intended for personnel engaged in the operation and maintenance of the plant.

The dryer has two main functions; to evaporate excess water added to the gypsum at the mixer and to allow the starch to gelatinize creating a proper bond to the gypsum core. Wet gypsum board enters the dryer in a continuous stream on multiple decks and depending on designed capacity, up to three boards wide. The boards enter and thereafter pass through 3 consecutive drying zones. Each drying zone contains a burner to heat the drying air and fans to circulate this hot air to dry the boards. It is important that all boards are dried evenly to achieve consistent quality. If boards are overheated this could result in calcination of the core leading to brittle board. If the boards aren't heated enough; the paper will not bond to the core.

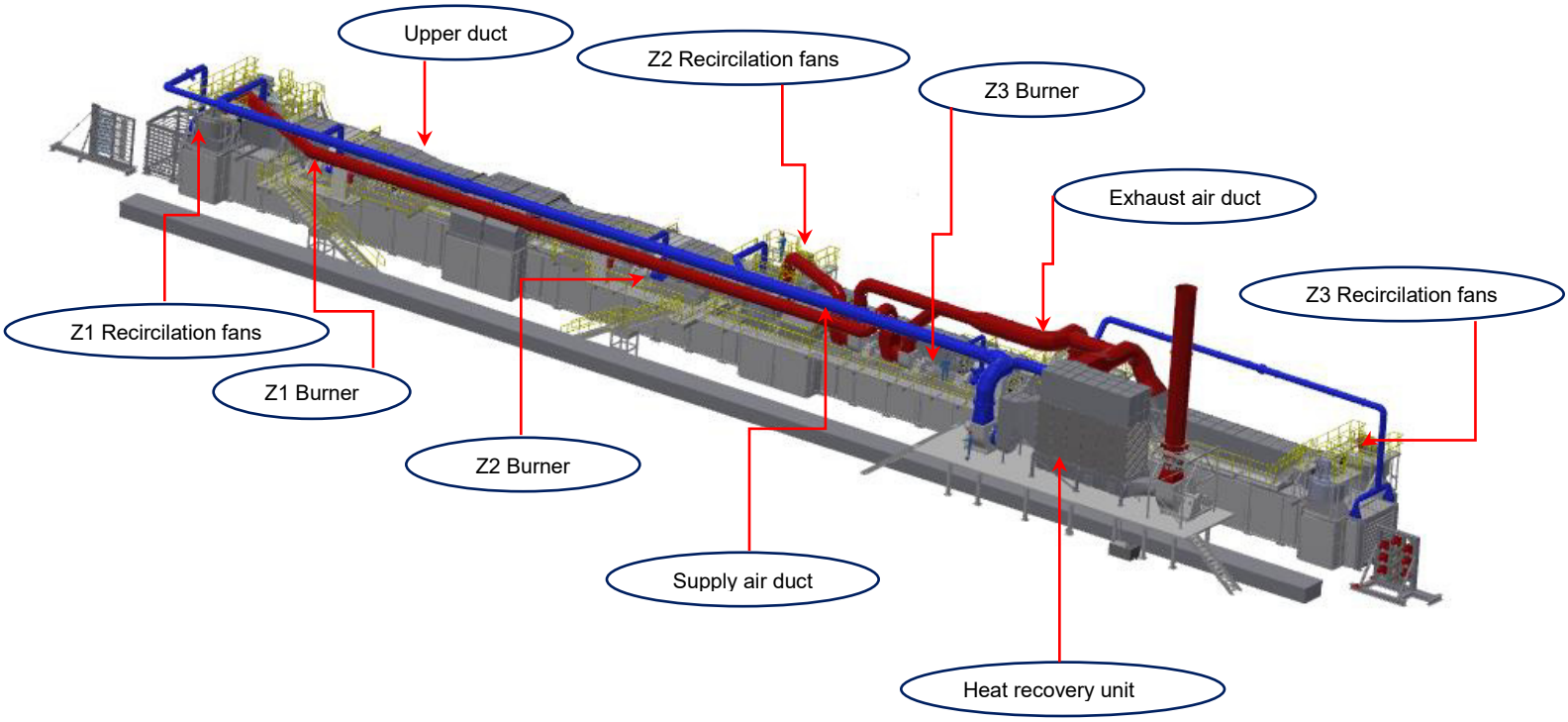

Image 1: 3D model of the dryer

1.1 Board Conveying System

Boards are carried through the dryer on a series of rollers. The rollers of each deck are chain driven by drives located at the outlet end of the dryer. At the opposite end there are pneumatic chain tensioning devices to accommodate natural lengthening of the chain as well as thermal expansion. Take-up can be adjusted by changing the pressure to the cylinders on the chain tensioner. Limit switches on the chain tensioning device indicates if a problem with the drive system arises. A pressure switch assures that pneumatic air is available. An automatic lubrication unit located at the outlet end provides oil for the chain at given intervals. Speed sensors at the inlet end of the dryer provide feedback to the chain drives.

1.2 Air Handling System

The dryer air handling system consists of:

- Three longitudinal drying zones; each with two recirculation fans, one exhaust fan, one air heater with a combustion fan.
- One supply air fan for zones 1-3, that feeds the entire dryer with fresh make-up air.
- One Heat Recovery units for zone 1-3, to extract energy from the dryer exhaust air.
- Wet and dry end seals fed with pre-heated air from the heat recovery to block out cold ambient air.
- Air pressure transmitters.
- Air temperature transmitters.

Fans and burners for board drying are located on top of the dryer top panels. The fans and burners are fixed to the top of the dryer whilst the interconnecting ductwork is allowed to move independently from the dryer framework. Air is circulated by two recirculation fans and heated by a gas fired air heater. The heater is integrated in the ductwork to give an even temperature distribution.

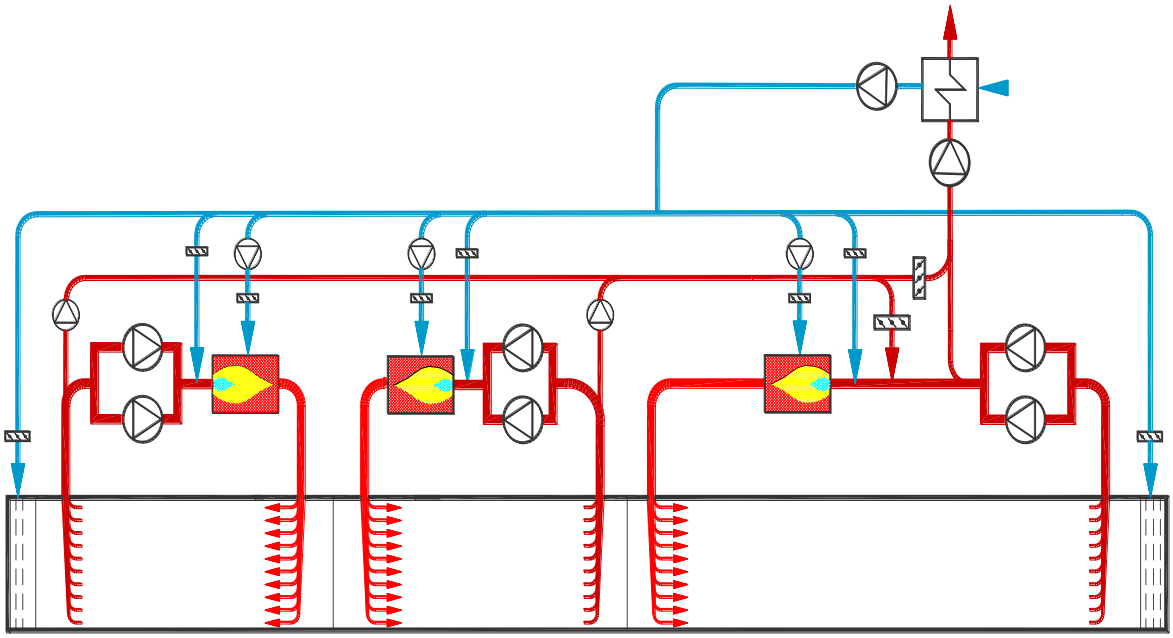

Image 2: Dryer flow sheet

The hot air is then distributed to the boards through plenums and blow boxes. The blow boxes are designed to give an even air distribution across the dryer.

Exhaust air from zones 1 and 2 is utilized in an EOS (Energy Optimizing System) to heat up zone 3. This allows for the exhausted energy from the hot drying zones to be used in zone 3.

All exhaust air is passed through the heat exchangers and are used to heat up the supply air. The pre-heated supply air is used for make-up air as well as combustion air to all burners. The air flows are shown in Image 2.

1.2.1 Fans

Each of the three main drying zones has two recirculation fans, one exhaust fan and one combustion air fan. All of these fans are mounted on top of the dryer.

All fans are intended to operate with a variable frequency drive.

During cold starts, the density of the air might cause the fans to run at less than their specified speed set point. Current limited operation is required to allow the purging process of the dryer to be performed without overloading the fan motors. When the burners have started, the air temperature increases, reducing the air density and the fan speeds increase automatically until the specified speed set point has been reached. Every fan motor in the dryer should have a minimum operating speed of lowest 20 Hz to protect the fan motor from overheating.

1.2.1.1 Supply Air Fan

One main supply air fan provides all necessary fresh air to the dryer. The supply air system feeds the dryer with make-up air to replace the extracted exhaust air and also provides the fresh air that will be delivered to the air heaters as combustion air.

1.2.1.2 Combustion Fans

The combustion fans draw fresh air from the supply air flow and deliver it directly to the air heaters.

1.2.1.3 Recirculation Fans

Each zone contains two recirculation fans, which deliver the heated air from the burners and ducts into the kiln to dry the board.

1.2.1.4 Exhaust Fans

The exhaust air fans draw humid air out of each zone and remove it from the drying process to keep the air humidity in the dryer zones at a proper level.

1.2.2 Air Heaters

The air heaters supply the thermal energy necessary for board drying. These heaters use natural gas for fuel. Each drying zone contains an air heater located in the upper ducts. Each air heater will have an independent fuel train and a line style burner that distributes heat within the duct. Figure 3 below shows an Air Heater unit.

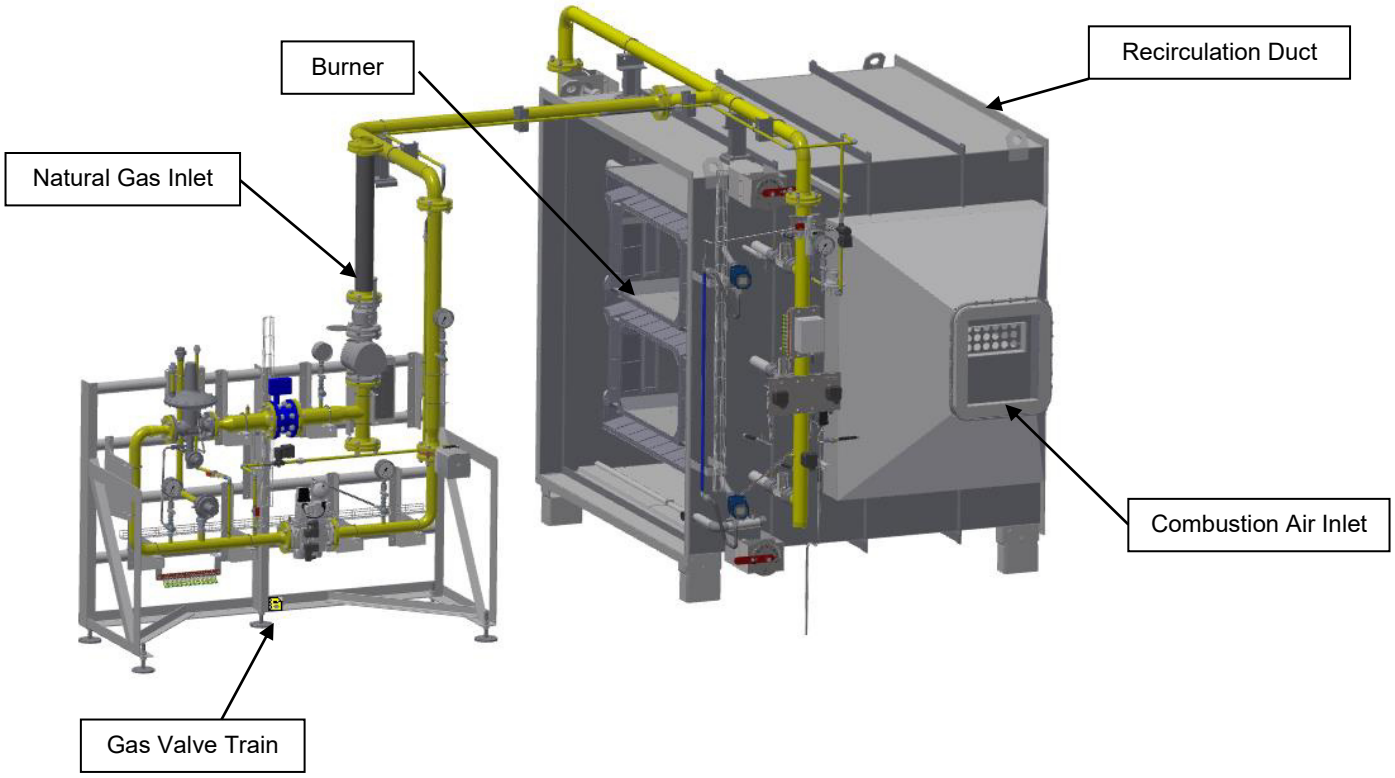

Image 3: Air heater

1.2.3 Air Dampers

Each zone has one supply air damper. The purpose of these dampers is to control the flow of make-up air to the drying process. However, most fresh air is supplied as combustion air directly to the burner.

In zone 1 and 2 exhaust air is controlled by the EOS and EOS-bypass dampers. These dampers allow for exhaust air from zones 1 and 2 to be diverted to either zone 3 or to the heat recovery unit.

1.2.4 Heat Recovery Unit

The heat recovery units consists of a 3-passage tubular heat exchanger as illustrated in Image 4. The heat recovery unit is constructed of tube coils (see picture below). The exhaust air passes inside the tubes while supply air is forced around the outside of the tubes allowing for an efficient heat transfer.

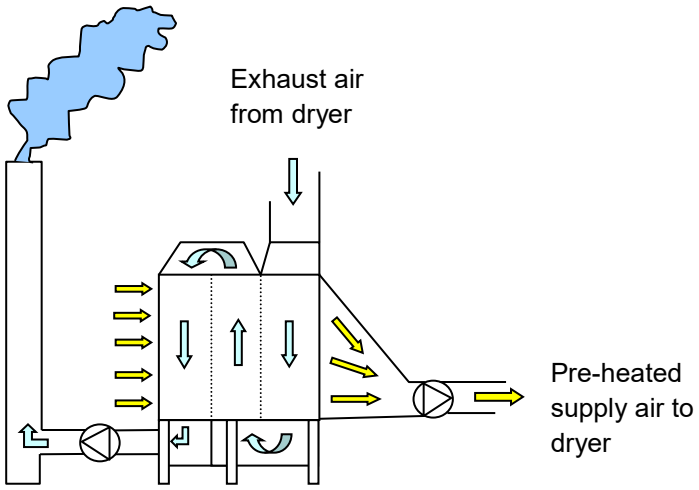

Image 4: 3-pass heat recovery unit

The heat recovery unit is constructed of tube coils with 2” tubes (see Image).

Image 5: Heat recovery unit tube coils

A differential pressure transmitter is installed to give a pressure drop reading across the heat exchanger. A high pressure drop means that the coils need cleaning.

The dryer is equipped with one heat recovery units, for zone 1-3.

1.2.5 Nozzle Boxes and Plenums

The drying air enters the dryer kiln through nozzle boxes that are located at the dryer plenums. The plenums connect the recirculation ducts (or upper duct) with the kiln. The longitudinal nozzle boxes blow air between the

dryer decks. In the drying zones air is let in through blow boxes forcing the air longitudinally in the dryer. Adjustable dampers for each blow box can redirect the air into different segments of the dryer.

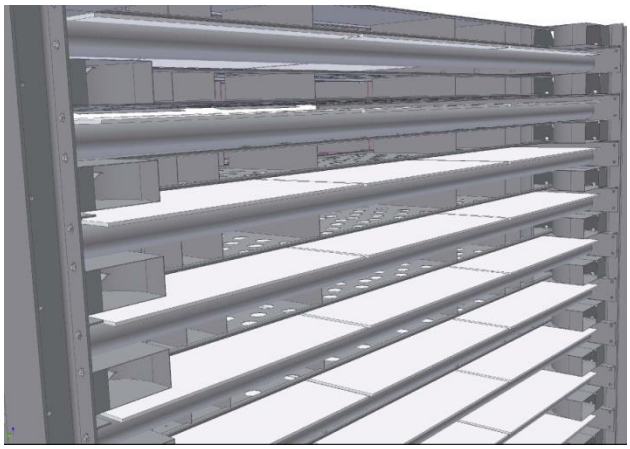

Image 6: longitudinally directional blow boxes

1.3 Dryer Frame

The dryer's main body construction consists of a steel frame covered with doors along both sides and insulated top and bottom panels. These panels are insulated to avoid heat loss.

The entire dryer is standing on support rolls on rails. The rails are run the entire length of the dryer – this allows for thermal expansion of the dryer framework.

1.4 Instrumentation

All zones have instruments for process control.

- Temperature transmitters at zone inlets and outlets to control drying force.
- Pressure transmitters at zone inlets and outlets to control exhaust and supply air.

1.5 Drying Theory

1.5.1 Drying Conditions inside the Dryer

The board is dried by hot air circulated around the boards. The drying conditions are affected by three main factors:

- Burner output – affects the drying temperature. The temperature difference between the board and the drying air affects the heat transfer rate and thus the drying rate. Changing the burner output is the normal way for the operator to affect the drying rate.

- Speed of recirculation fans – sets the air velocity inside the kiln which affects the heat transfer. The recirculation fans are configured to give as high air flow as possible without causing operational problems (like board jams) or unnecessarily wasting electrical power.

- Air Humidity – controlled by exhausts and supply fan speeds. The drying rate is less affected by air humidity than recirculation speed and temperature, but humidity is crucial for energy consumption – the more humid the air the lower the energy consumption. However, from an operational point of view, the

humidity shouldn't be too high; very high humidity can make it harder to operate the dryer and cause condensation issues for board quality.

1.5.2 Different Board Types and Mixer Settings

Drying takes place on the surface of the board. This means that the water in the center of the board must travel out to the surface before it can be evaporated. When boards first enter the dryer, the surface is wet and moisture is more easily removed, but the longer the board has been in the dryer, the harder it is to get the remaining water out. As a consequence, thin boards are normally very easy to dry; the distance from the board core to the board surface is short. Oppositely - thick boards are harder to dry because a substantial part of the water that must be evaporated is at the center of the core and has a long way out to the board surface.

1.5.3 Reducing Energy Consumption

As the amount of mixer water increases, so does the amount of water that needs to be dried off. It is often easier to form board at the mixer by increasing the amount of water added, but one should keep in mind that the workload on the dryer increases relative to the amount of mixer water; and the energy costs will go up. Other main factors affecting Energy Consumption include:

1. Energy Optimizing System (EOS). The EOS system brings a controlled amount of exhaust gases from zones 1 and 2 into zone 3. Because the temperatures are higher in zone 1 and 2 the exhaust gases can be reused in zone 3 before they are let out through the exhaust stack. This can help reduce the energy required to heat zone 3.
2. Heat Recovery Unit. The exhaust from all zones will go to a heat recovery unit. The residual heat in the exhaust is used to warm the incoming supply air decreasing the energy needed to heat the supply air to the correct temperature for drying.
3. Tightness of dryer and ducts. If there are air leaks into or out from the dryer will energy be lost either because energy is lost when hot air leave the dryer or because cold air that leak in needs to be warmed up by the dryer burner, Especially the condition of the dryer outlet seals are crucial but also the condition of door gaskets and inlet seals are important.
4. Insulation of dryer and ductwork. The dryer and the ductwork are insulated in order to keep the heat inside the dryer. The better the insulation is the lower will the energy losses be.

1.6 Basic Technical Data

1.6.1 Zone lengths

Inlet Seal Section	1000 mm
Zone 1	20 500 mm
Zone 2	20 500 mm
Zone 3	38 700 mm
End seal section	1000 mm
Total dryer length	81 700mm

1.6.2 Electrical Power and Burners

El. power	Hz (cps)	60
Motor voltage supply	V, 3-phase	440
Signals	VDC	24
Installed burner cap., zone 1	MW	4,7
Installed burner cap., zone 2	MW	4,7
Installed burner cap., zone 3	MW	2,1

1.6.3 Board Production capacity and performance base

Forming speed	m/min	40
Board thickness	mm	12,5
Board width	mm	1200,0
Max. Total water evaporation	kg H_2O/m^2	4,5

2 SAFETY OVERVIEW

2.1 General Regulations

All personnel working with the equipment shall be advised and instructed regarding the safety regulations below. This is the responsibility of the appropriate works manager/foreman. Over and above the general and locally applicable safety regulations the following also apply:

- Over and above the general and locally applicable regulations the following safety regulations also apply.
- Check that fully working and up-to-date safety equipment is available. All personnel working on the plant shall be advised and instructed regarding the safety regulations below. This is the responsibility of the works manager/foreman on duty.
- Only fully trained personnel and authorized operators shall work with the equipment.
- Immediately report any faults that could lead to the risk of personnel injury to the nearest person in responsibility.
- During maintenance or repair work on motors, fans, transport (conveyors) and other motor driven equipment, the safety switch to the respective motors must be locked in OFF-position. A sign saying “WORK IN PROGRESS” should also be displayed on the control panel.
- The power supply to the equipment should be shut off and locked at the main control switch as well as at the local safety switch.
- Never make a by-pass connection of the safety switch – not even if it’s faulty – replace instead.
- The locking keys to relay cabinets etc., shall be kept in a safe place so that they are not accessible to unauthorized personnel.
- When work is being carried out on shut-down equipment, the relevant safety switch shall always be locked in OFF-position. A sign saying “WORK IN PROGRESS” is visibly displayed.
- Before maintenance or repair work is started check that the relevant control switch is in OFF-position and that the sign saying “WORK IN PROGRESS” is visibly displayed.
- A specific safety regulation for components delivered by third party also applies (see appendixes).

Never put yourself at risk.

Many pieces of equipment have the potential to cause serious injury or even death. Be sure to understand the safety concerns related to a piece of equipment before undertaking or performing any maintenance or clean out procedure. Work with your supervisors to address any safety concerns prior to undertaking work.

2.2 Regulations Relating Specific to Dryer

2.2.1 Dryer

All personnel working with the dryer, even on temporary basis, shall be advised of the safety regulations below; this is the responsibility of the appropriate works manager/foreman.

It shall always be kept in mind that:

- The dryer is a kiln and contain hot air and hot vapour. Any leaks, damaged insulation etc. may create hot surfaces and everyone shall be aware of the potential risk for hot surfaces and similar.

- The dryer has built in, gas fired, burners. Mechanical damages on the system can lead to leaks which are (can cause) a risk for explosion.

- The dryer is pressurized. If the dryer is damaged or if inspection doors are opened during operation hot air, humid air as well as particles and dust can exit the dryer. This can lead to injury or equipment failure.

- Some parts of the dryer are under negative pressure. If the dryer is started with open doors or doors or hatches are opened during operation they can close by vacuum and lock in or squeeze persons close to the opened door.

- The dryer contains moving parts, for instance chain driven conveyors, fans and actuated air dampers. When the dryer is in operation no moving parts are accessible. If doors and hatches are opened during operation the dryer is not safe, therefore no doors or hatches shall be opened during operation and all parts of the dryer cover must be in place before start of the dryer.

Warning!

Do not open the doors or inspection doors before the dryer is ventilated.

1 Before the dryer doors are opened the following measures must be taken:
   a) Turn off the burners.
   b) Make sure that the exhaust dampers are fully opened (100 %).
   c) Leave the exhaust air fans running until temperature is below 140° F and thereafter turn them off and lock them out.
2 When closing the dryer doors it is essential that the locking mechanism is grabbing the locking plate arms.
3 Before any dryer doors or inspection doors are closed it must be ensured that no-one is inside the dryer.

2.2.2 Resetting Burner Faults

Some burner safety devices must be reset locally at the equipment. For instance, the pressure switches for high and low gas pressure, high and low combustion air pressure and the differential pressure switch that proves flow in the upper duct must be reset locally. This is due to safety concerns; these switches have tripped out due to a reason that might be serious; for instance, a gas leak or a failed fan. By approaching the reset the operator has an opportunity to smell for gas leaks, check that fans etc. are running properly and see that everything looks normal before resetting the switch.

2.3 Lockout Procedures

As equipment may start automatically, always lock out any source of motive power (electric, hydraulic, steam, compressed air, etc.) before performing maintenance or cleaning functions. Note that potential energy may also be stored in some equipment such as those held in a raised position by hydraulic or air pressure and that such equipment may move or fall suddenly if pressure is removed.

Depending on the equipment layout, electrical locked out may be performed at the electrical panel or locally with a safety switch or disconnect. Air pressure is removed at locked out at the manual air disconnect switch. As a further safeguard, you must confirm that any equipment in the system being worked on is not operational after being locked out. Test for this by using the normal means of starting, i.e. the operator controls on the HMI station or the manual HOA switch.

The above procedure is a general recommendation. Operating and maintenance staff must follow lockout procedures and operate in compliance with their company policy and local regulations.

2.4 Electrical Disconnect Switches

Electrical disconnects are a means of physically isolating an area. Each drive panel is equipped with a lockable panel mounted disconnect switch, which isolates all drives in that panel. Some areas may also have a field mounted disconnect, which removes power to a motor or series of motors. When performing equipment maintenance or cleaning, the HOA switch must be moved to the OFF position before the disconnect switch is opened. After the disconnect switch has been opened, a lock should be placed on the switch to prevent the system from being re-energized. For safety reasons, the equipment or motor should be put into manual mode for a few

seconds after the disconnect switch is opened, to ensure that the motor will not start, and then returned to OFF. There is an indicator on the HMI to show that this procedure has been correctly followed.

2.5 Electrical Safety Switches

Each section is also divided in sub-sections or “Zones”. The Zone system is used to manage starting/stopping of a group of equipment and for lockout purposes. There is at least one electrical safety switch for each Zone. Each Zone also has one manual and one electric safety dump valve for pneumatic powers.

Safety switches are a means of electrically isolating a zone. To do so the HOA switch must be moved to the OFF position before the safety switch is opened. After the safety switch has been opened, a lock should be placed on the switch to prevent the system from being re-energized. For safety reasons, the equipment or motor should be put into manual mode for a few seconds after the safety switch is opened, to ensure that the motor will not start, and then returned to OFF.

2.6 Air Disconnect

Equipment requiring compressed air will have an electronically controlled air dump solenoid coupled with a manual valve for lockout procedures. Under some circumstances air pressure is dumped from a piece of equipment automatically; however it may be necessary to manually dump air pressure by locating the manual air disconnects. In either case, once air is dumped ensure that air pressure has been isolated and locked out before servicing any piece of equipment.

2.7 Emergency Stop Pushbuttons

There are a series of emergency stop buttons throughout the area. Pressing any emergency stop, will shut down the entire area immediately or in the safest manner possible and then power will be removed from the drives. To re-energize equipment the E-stop must be depressed, and the safety system reset from the HMI. The equipment will re-energize after a delay of about 30 sec. This delay is necessary to allow the variable frequency drives to properly discharge before power is restored to them.

In an emergency do not hesitate to use an Emergency Stop Button, however E-stops are not to be used as a normal means of shutting down equipment or as a lockout mechanism. See operational procedures for stopping the area for further details on normal shutdown procedures.

2.8 Gate Switches and Controlled Access

A physical barrier such as a safety fence often surrounds potentially hazardous areas that generally don’t require access during normal operation. These areas are accessible only through designated safety gates. To open the gate the operator must request access and wait until the area has been safely shutdown and isolated before the gate will open. Once the operator has exited the area and closed the gate the system can be reset, and normal operation can be restored. No personnel should ever try to override this gate system or enter the gated area while equipment is operational.

2.9 HMI Safety Overview Screen

The status of the safety system and all safety devices can be viewed on the HMI by referring to the Area Safety Overview screen. While the HMI system provides an added level of safety and valuable information and diagnostic tools, it is none of its functions are to be considered a replacement for physically isolating equipment and being alert and aware of potentially hazardous situations.

3 OPERATION PROCEDURES

3.1 Preparing for start

- Check that there is no extraneous matter on the equipment in the plant.
- Check that no emergency-stop buttons have been activated.
- Check that no alarm has been activated.
- Check that all doors and inspection doors are closed.
- Make sure that the compressed air and gas supplies are operational.
- Check that all AUTO-MAN switches on the control panels are in the AUTO position.

3.2 Operational check

- Check that the distance between boards is normal and that the boards lie correctly on the different pieces of equipment in the plant.
- Check that no alarm has been activated.
- Check for leaks. If it is drying air leaking out it will be visible as wet pools or steam coming out.
- Check for abnormal sounds, for instance; hard grinding sounds may indicate bearing problems on fans, rattling noises may indicate that metal is in contact with rotating parts.
- Check for overheated motors; if the motor cover is too hot to touch for more than a few seconds, contact maintenance to measure the motor temperature.
- Check for abnormal vibrations; contact maintenance if the vibrations that are transferred to surrounding platforms etc. seem larger than normal or if it feels unpleasant to stand next to the fan. If this is the case there could be a problem with the balancing or bearing of the fan.

3.3 Shut-down

- Make sure the dryer is empty before shut-down.
- Stop all equipment from the control view in the HMI.
- To exhaust all humidity from the dryer, the fans must be in operation for at least 10 min after the burners have been switched off.

3.4 In the event of a fault/alarm

When a fault that causes an alarm to be activated occurs in the plant, the following should happen:

- The alarm warning lamps on the relevant main control panels light up.

The following measures must be taken:

- Immediately check what has occurred in the plant. If possible, stop a particular section or reject the boards in order to avoid further consequences of the fault spreading.
- Clear the relevant equipment as necessary.
- If possible, take the necessary measures to correct the fault or call in the responsible repair personnel or electrician. Report the fault.
- When the fault has been rectified, reset the alarm on the relevant panel.
- In case of an emergency stop, if a quick restart of the dryer is not possible and there are boards in the dryer, run the dryer drive motors until the boards are out from the dryer.

3.5 Burner Operation

The burners are supervised by a dedicated burner safety PLC. As soon as the purging sequence is complete, the burners can be started by the main PLC. If a burner is locked out due to failure in any of the safety functions, the burner will stop and there will be an alarm.

Some burner safety devices must be reset locally at the equipment. By approaching the reset the operator has an opportunity to smell for gas leaks, check that fans etc. are running properly and see that everything looks normal before resetting the switch.

The duty of each burner is then controlled by the software controller. The burner output is normally controlled by different dryer temperature sensors.

Before the heater burner can be started, the zone must be purged of any residual combustible gases and must be expelled to the atmosphere. Purging will begin automatically if the following pre-ignition conditions are met:

- The supply air fans are running at purge speed
- The recirculation and combustion fans are running at purge speed
- The exhaust and supply air dampers are open
- The zone high temperature limit is off
- The burner permissive conditions for air pressure and oil pressures are met

WARNING! For a cold start, the temperature should be steadily ramped up over a time period of 30 minutes in order to spare the dryer from excessive stress when the metal the dryer is made of expands from the heat.

DANGER! Never make ad hoc alteration to the flame safety system in the burner management system. This will put personnel and equipment in severe danger.

3.6 Blow box dampers

NOTE! CONTACT PRODUCTION MANAGEMENT BEFORE CHANGING DAMPER SETTINGS

Board quality is constantly monitored. Maintaining proper heat distribution in the various sections of the dryer is essential to achieving consistent quality. To adjust the temperature profile inside the dryer the position of the blow box dampers may be modified. In each zone, there are three dampers on each side of the dryer and on each deck as shown in figure 10. When the dampers are closed in a section of the dryer, hot air flow is reduced to this section.

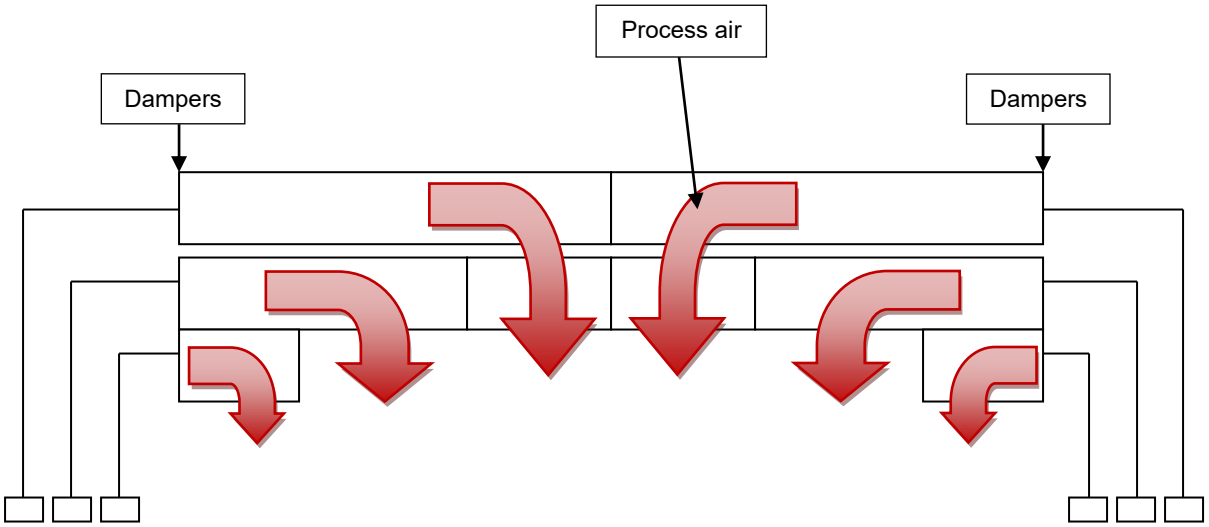

Figure 7: Schematic image of dryer blow box dampers.

3.7 Controls Layout and Strategy

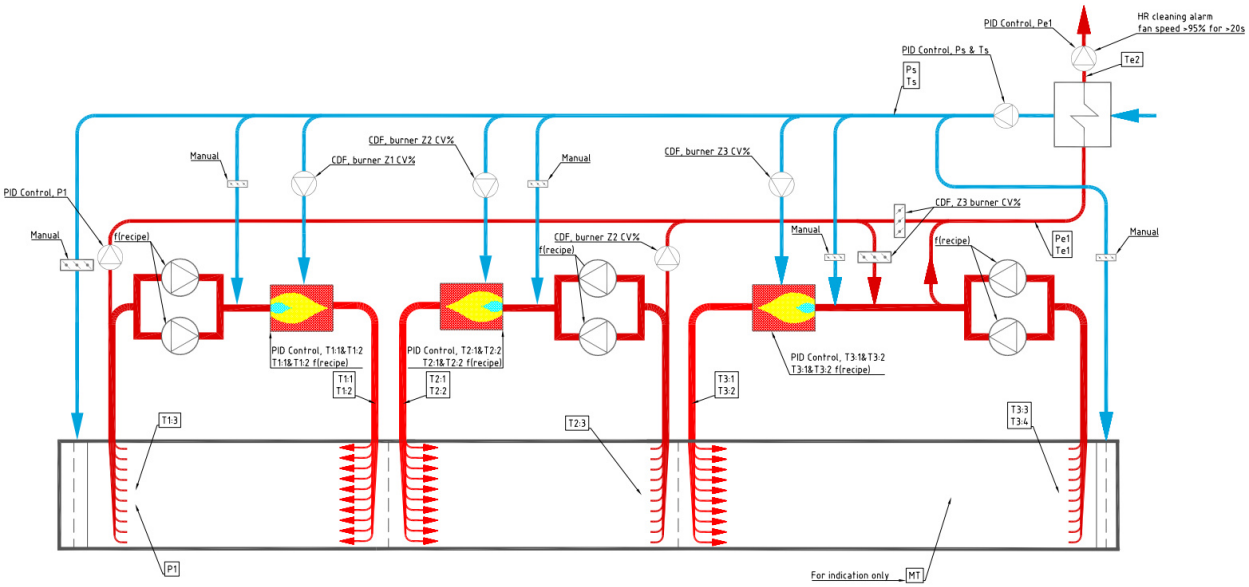

Image 5: Process flow diagram with control descriptions

Table 1: Control loops, CDF's and manual values in running operation.

Control output	Control input	Control type
Zone 1 burner CV%	Zone 1 delivery temperature [T1:1 & T1:2]	PID
Zone 1 exhaust fan speed	Zone 1 inlet pressure [P1]	PID
Zone 1 combustion fan speed	Zone 1 burner CV%	CDF
Zone 1 recirculation fans speed	Recipe set point	Manual
Tag read by HMI	Zone 1 delivery temperature [T1:1 & T1:2]	Indication only
Tag read by HMI	Zone 1 return temperature [T1:3]	Indication only
Tag read by HMI	Zone 1 inlet pressure [P1]	Indication only
Zone 2 burner CV%	Zone 2 delivery temperature [T2:1 & T2:2]	PID
Zone 2 exhaust fan speed	Zone 2 burner CV%	CDF
Zone 2 combustion fan speed	Zone 2 burner CV%	CDF
Zone 2 recirculation fans speed	Recipe set point	Manual
Tag read by HMI	Zone 2 delivery temperature [T2:1 & T2:2]	Indication only
Tag read by HMI	Zone 2 return temperature [T2:3]	Indication only
Zone 3 burner CV%	Zone 3 delivery temperature [T3:1 & T3:2] **OR** zone 3 return temperature [T3:3 & T3:4]	PID
Zone 3 combustion fan speed	Zone 3 burner CV%	CDF
Zone 3 recirculation fans speed	Recipe set point	Manual
Tag read by HMI	Zone 3 delivery temperature [T3:1 & T3:2]	Indication only
Tag read by HMI	Zone 3 return temperature [T3:3 & T3:4]	Indication only
Tag read by HMI	In-kiln board moisture [MT]	Indication only
EOS damper	Zone 3 burner CV%	CDF
EOS bypass damper	Zone 3 burner CV%	CDF
Main exhaust fan speed	Heat recovery exhaust air inlet pressure [Pe1]	PID
Main supply fan speed	Heat recovery supply outlet pressure & temperature [Ps & Ts]	PID
Tag read by HMI	Heat recovery supply air outlet pressure [Ps]	Indication only
Tag read by HMI	Heat recovery supply air outlet temperature [Ts]	Indication only
Tag read by HMI	Heat recovery exhaust air inlet pressure [Pe1]	Indication only
Tag read by HMI	Heat recovery exhaust air inlet temperature [Te1]	Indication only
Tag read by HMI	Heat recovery exhaust air outlet pressure [Te2]	Indication only

4 TROUBLESHOOTING

4.1 General – Dryer Operation

Problem	Possible Cause(s)	Possible Solutions
Burnt board edges *(Short side)*	Poor board butting: there are gaps between the boards inside the dryer Boards are generally very dry. When the boards average moisture is very low; the edges are at high risk for getting burnt	Fine tune the board butting. Increase the overall board moisture level slightly by decreasing the drying, i.e. decrease temperature.
Burnt board edges *(Long side)*	Boards are being over dried; the sides of the boards are thinner and will therefore get burnt more easily. Wrong formulation or wrong slurry distribution from mixer	Increase the overall board moisture level slightly by decreasing the drying, i.e. decrease temperature. Contact foreman. Check that slurry distribution is functioning, and formulation is set up correctly at mixer.
Uneven drying of the boards *(All boards or unrelated to position within dryer)*	Consistent wet streaks on every board – usually caused at the forming station. Wet or dry streaks that occur regardless of which position the board had in the dryer are normally caused at the forming station.	Contact foreman. Make adjustments at the forming station.
Uneven drying of the boards *(Consistently from one deck or from one side of the dryer).*	Wet or dry streaks in consecutive boards that have had the same position in the dryer (boards on one side of the dryer, boards from a certain deck etc.) could be caused by the dryer, for instance: Dryer plenum damper linkages have been damaged or wrongly mounted after maintenance work in plenums Damaged burner rails causing a temperature distortion Air flow restrictions in ductwork, plenums or nozzle boxes causing disturbed airflows.	Inspect plenum dampers and damper linkages (at production stop) Inspect burners when running; look at the flame and make sure that the flame looks normal and has an even flame distribution. Inspect for extraneous materials in the dryer at next production stop.
Buildup of paper and dirt on dryer roller at zone 1 entrance and pre-dryer	Starch is migrating to the paper surface of the boards because the drying air is too humid.	Air should travel on deck level from pre-dryer into zone 1. This is achieved by increasing the supply air to the pre-dryer and/or increasing the exhaust air flow out from zone 1.
Boards exits the dryer with damages on leading	Mechanical obstacles inside or outside the dryer	Check inside the dryer and at infeed and outfeed at a production stop; make sure there are no mechanical obstacles in the board travel path.

corners	Board tracking has changed; all dryer rollers can be adjusted in vertical and horizontal position.	Check board tracking; at the production stop make sure the boards on all decks exit the dryer in the center. If required, check board tracking when the dryer is not running. Caution! All safety regulations must be followed when doing this!

4.2 Board Conveying

Problem	Possible Cause(s)	Possible Solutions
Alarm from the chain tensioning switches	The switch will send an alarm when the chain tensioning cylinder/cylinders are either stretched out too long or are retracted too much	If the chain has tangled up and doesn't move; open the doors on the chain side and find the place where the chain is stuck. Remove possible obstacles and/or repair broken parts.
	If the tensioning cylinder is stretched out it is either caused by a chain hang up or that the compressed air pressure has dropped	If the chain is too long due to wear: shorten the chain by removing chain links. If it is broken, repair it.
	If the cylinder has retracted too long, it is probably caused by chain brake or that the chain has grown longer due to wear.	If the chain is worn several problems could arise. If so, a chain replacement should be considered.
A jerky chain and board travel through the dryer and "folded chain links"	The dryer starts from cold conditions; the chain travel might get smoother when the dryer has reached working temperature.	Check lubrication unit and oil distributors at dryer drive tower; see that the oil droplets are applied on the chain links when the lubrication cycle is running. The chain lubricator wheel could be plugged.
	Chain lubrication is not working properly	
	Chain tension is not correct	Check chain tension tower: see that air pressure is normal, and cylinders looks normal
	Worn out drive and/or tensioning sprockets	Check status of drive and tension sprockets

4.3 Dryer Fans

Problem	Possible Cause(s)	Possible Solutions
Noise from fan bearings (hard, grinding sound)	Bad bearing	Contact the maintenance department for bearing status check. Replace if necessary.

Noise from fan, rattling	Guard is deformed and is touching motor coupling, cooling disc or fan impeller Cooling disk is loose	Adjust the guard (requires production stop). Fasten cooling disk during maintenance stop.
High vibrations at fans (either the fan itself or the surrounding platforms).	Unbalanced fan, could be caused by: Dirt build-ups on fan wheel Balancing weights on fan wheel have fallen off Bad fan bearing Mechanical damages on fan	Inspect fan; check bearings at operation, inspect fan wheel at production stop. Repair if required. Re-balance fan if needed.

4.4 Dryer Burners

Problem	Possible Cause(s)	Possible Solutions
Burners don’t start when they should	All starting criteria are not met such as: • Purging sequence not done • Equipment is locked out, fans, manual gas valves etc. • E-stop active Tripped out or faulty component in burner safety system	Go through dryer system on HMI, check that everything is ready for start or running Check for alarms; take required actions to reset the alarms. Check manual gas valves on gas trains Check on the controls screens if a specific component causes an alarm. Try to reset, if it fails contact maintenance.

Burner flameout during operation	Burner is stopped by interlock or commando from control system Burner gas filter is plugged (especially when the dryer is new, due to dirt in gas pipes from installation) Air pressure switch has tripped. • Plugged impulse pipes from switch to measuring point • Changed fan speeds has affected air pressure • Too tightly set trip limits Other failed component in burner valve train	Check through HMI screens; look for indications of equipment that is not ready for start (like fans put in manual mode) or giving alarms. Reset alarms and make equipment ready for auto start. Should show up as an alarm for low gas pressure. If reset of the low gas pressure switch fails, contact maintenance to clean the gas filter. Identify which switch is from the HMI screens; try to reset it. When doing the reset – look for things that are not normal like smell of gas or fans that are not running. If the reset doesn't solve the problem: Check impulse pipes, connections to the switch. Investigating if any fan settings have been changed? For instance, at production of light weight boards like ¼" thick boards can the recirculation fan speed have been adjusted down so much that an air pressure switch trips out. Contact foreman. The failed component should have been causing an alarm. Identify it from the HMI, try to reset alarm. If it fails, contact maintenance.
Burner alarms can't be reset from HMI	Some burner components such as pressure switch for high and low gas and combustion air pressures must be reset locally due to safety.	Go to the burner. Look out for gas leaks (gas smell), fans that are not running etc. If everything looks normal, reset the switch. In case problems are observed at the burner, contact maintenance and/or foreman.

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