PROPER OPERATION & MAINTENANCE OF MECHANICAL GRAIN DRYER

Biochem Technology Phils. Corporation

OUTLINE

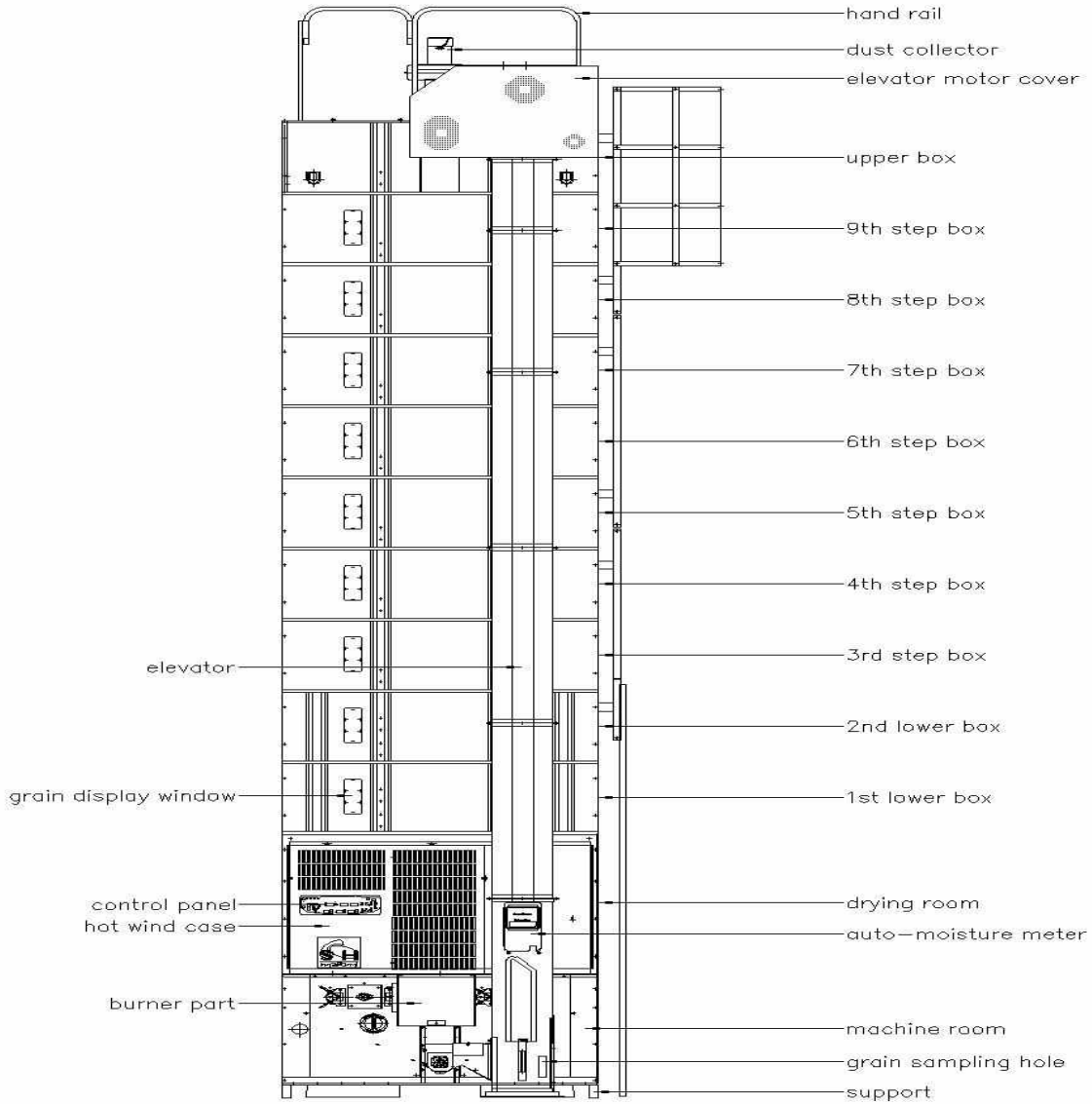
- OBJECTIVES OF THIS TRAINING
- INTERNAL STRUCTURES AND OPERATIONAL PRINCIPLE
- PROPER OPERATION OF DRYER
- ABNORMAL DIAGNOSIS AND COUNTER MEASURES
- MAINTENANCE AND SAFEKEEPING OF DRYER

OBJECTIVES:

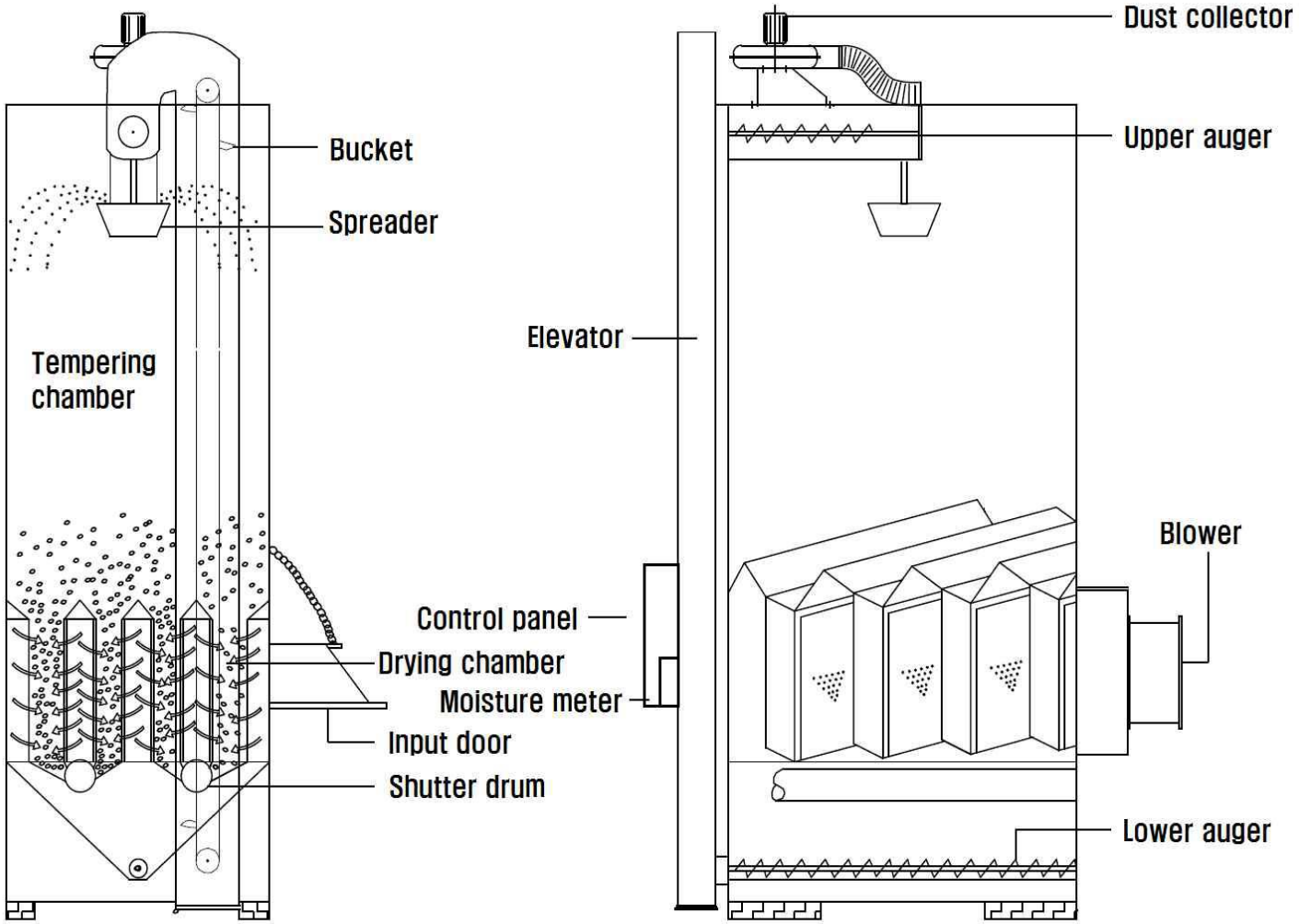
- TO ACQUIRE AN IN-DEPTH KNOWLEDGE ON THE PROPER OPERATION AND MAINTENANCE OF MECHANICAL GRAIN DRYER.
- TO BE ABLE TO APPLY THE KNOWLEDGE ACQUIRED.

Internal Structures and Operational Principle

PARTS OF THE MAIN BODY

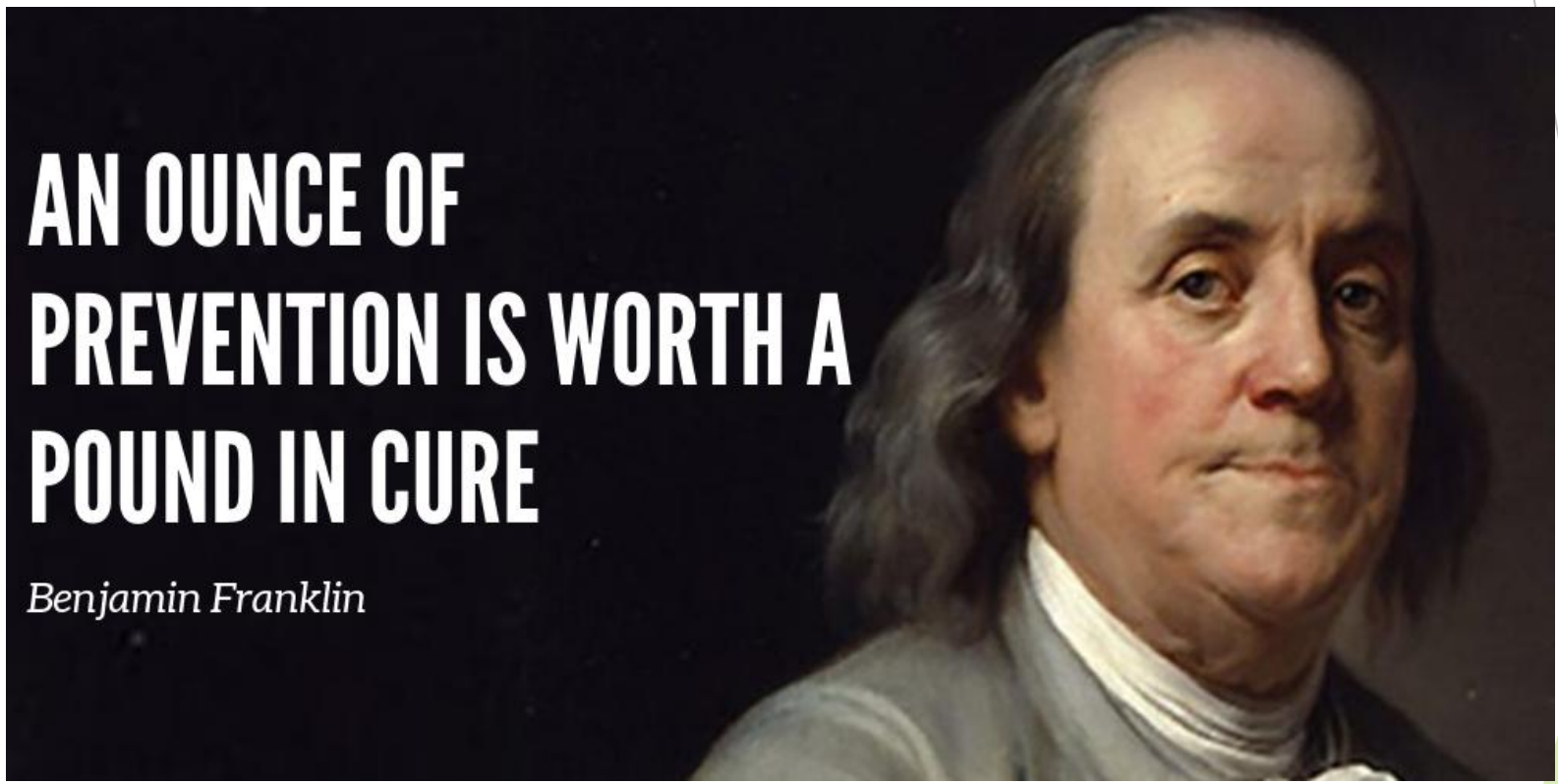


Internal Structures and Operational Principle



1. The grain received through the loading door is delivered to the lower part of the elevator by the lower auger.
2. The grain is delivered to the upper part by bucket elevator and is delivered to the central part of the tempering chamber and then falls to the spreader.
3. The grain spreader makes the grain piled up evenly in the tempering chamber.
4. On dry selection of the control panel, the motors of each driving part are operating and grain drying starts.
5. The dry hot wind generated by a husk furnace or a oil burner is flown into the drying chamber and passes the grain layer dry hot wind through the perforated sheets by the blower takes away moisture from the grain.
6. The dried grain falls to the lower part of dryer through the shutter drum and is delivered lower auger, elevator and upper auger into the drying chamber.

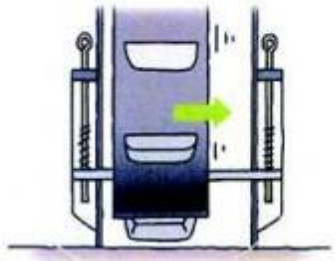
SAFETY FIRST!!!


AN OUNCE OF
PREVENTION IS WORTH A
POUND IN CURE
Benjamin Franklin

Checkpoint before operation

1. Safety
2. Power
3. Cleaning around the Dryer
4. Driving

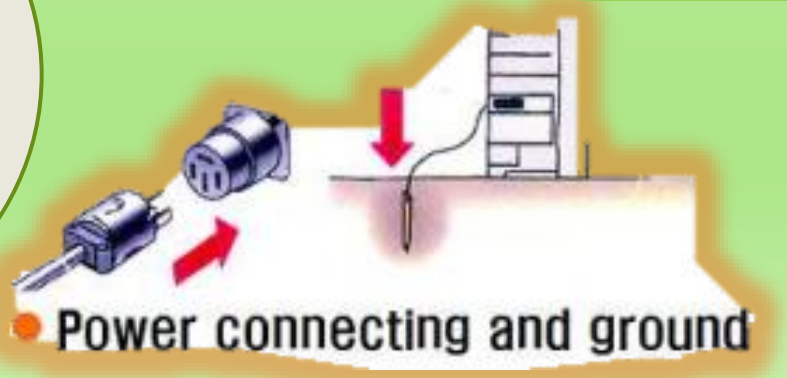
● V belt status & tension



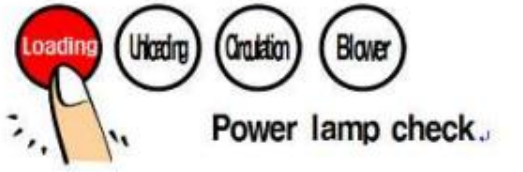
● Elevator bucket belt tension

● Dust outlet & Blower hose check

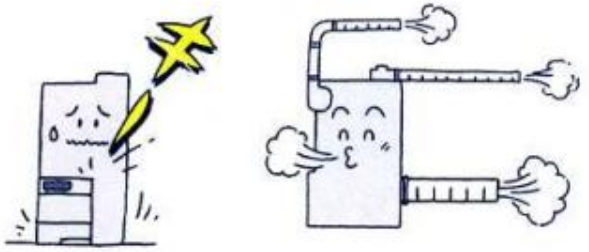
● Electric wire check



● Power connecting and ground



Power lamp check

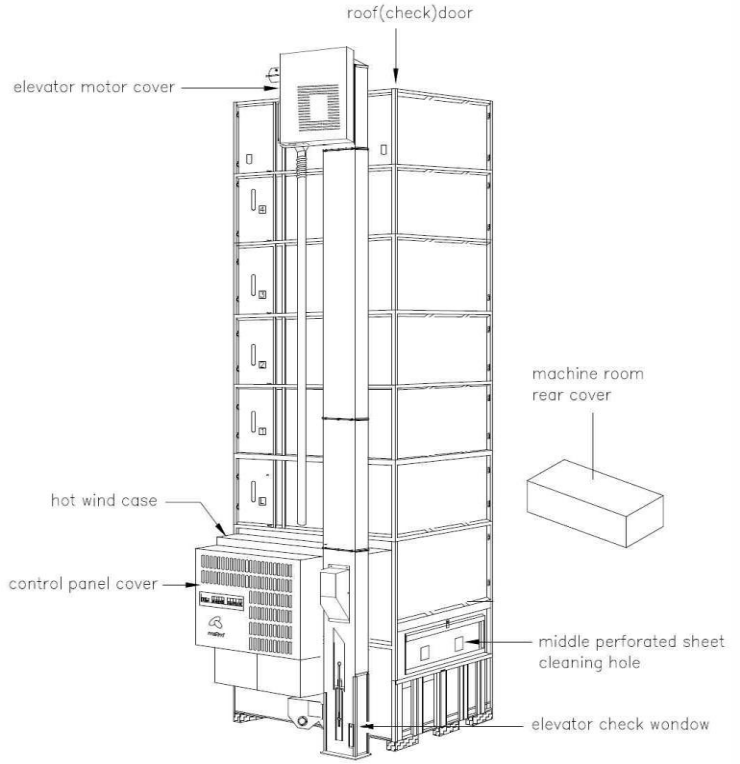


● Abnormal noise check ● Blower & Dust fan check

Checkpoint before operation

1. Safety Check

- ✓ Check surroundings (Sharp things, playing children, etc.)
- ✓ Please install safety covers and check if all the check windows and cleaning holes
- ✓ Check the connecting and accessing status of each connector part of control panel.



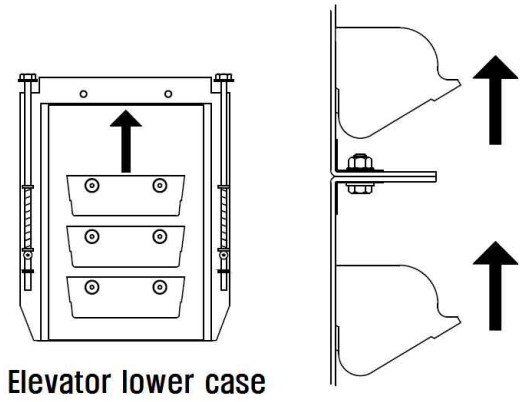
⚠ Attention

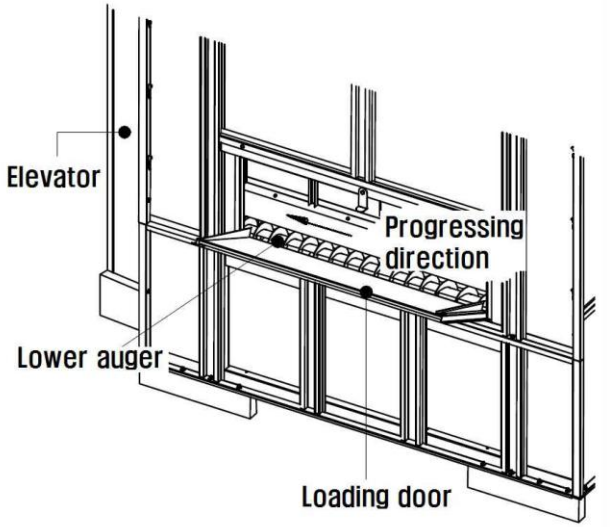
- In any case that the dryer is not in operation, please cutoff the power supplied to the dryer. (Cut off the power by operating the circuit breaker)

Checkpoint before operation

2. Driving Parts

- ✓ Check the connector binding of control panel, motor and other parts.
- ✓ If loading is selected among operation selections, the elevator and lower auger are operated in order. At this moment, the blower is operated upon pressing blow among the operation selections.
- ✓ Check the rotating direction and status of elevator bucket belt through the check window of elevator when the dryer starts operation.
- ✓ Open the loading door and check the progressing direction of lower auger. The progression toward the elevator is the normal rotating direction.
- ✓ Close the loading door and check the rotating direction and air discharge status of the blower.
- ✓ Check the operational status and dust discharging status of the dust collector.





CONTROL PANEL

Name and Function of Control Panel

Heated air temperature indication

- Indicates the hot wind temperature.
- You can select grain temperature and ambient air temperature to check them.
- The indicated items are changed upon pressing display selection button.

Abnormal warning indication

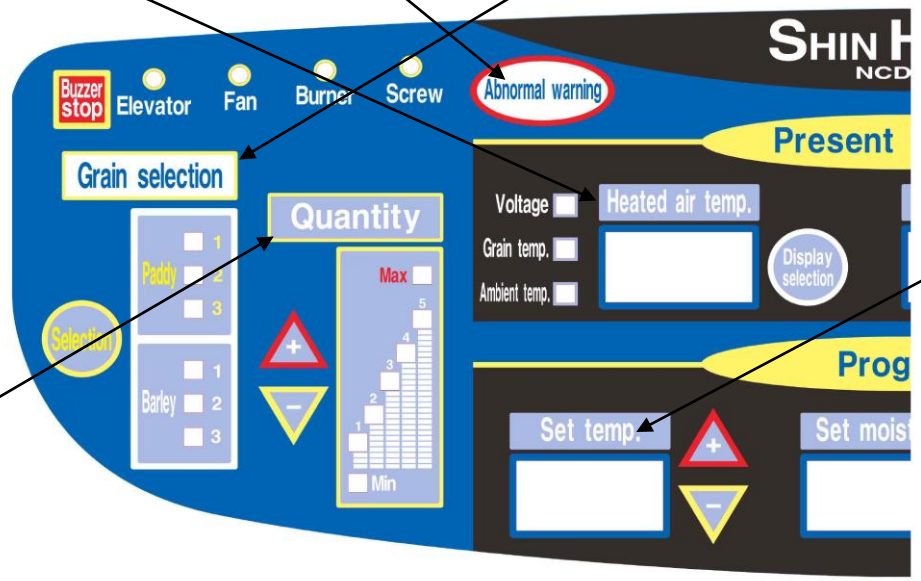
- Indicates major abnormality.
- Buzzer stop button stops the operation of alarm.
- If buzzer stop button is pressed upon burner abnormality, reignition is tried after a short time.

Grain selection

- Selects the grain type.
- Divides the grain type into paddy and barley and they are divided in detail by the moisture correction.
- The selected lamp is lighted when every time pressing the select button.

Grain quantity setting

- Sets up the grain quantity loading into the dryer.
- Set up correctly according to the grain quantity indicating graduation of the dryer.
- It is related to the circulating speed.



Hot wind temperature setting

- Sets up the desired hot wind temperature.
- The hot wind temperature is automatically setup upon selecting drying operation.
- Modify it if necessary.

Name and Function of Control Panel

Grain moisture content indication

- Moisture meter is optional.
- "OFF" is indicated in moisture display, if not using moisture meter.

Drying time indication

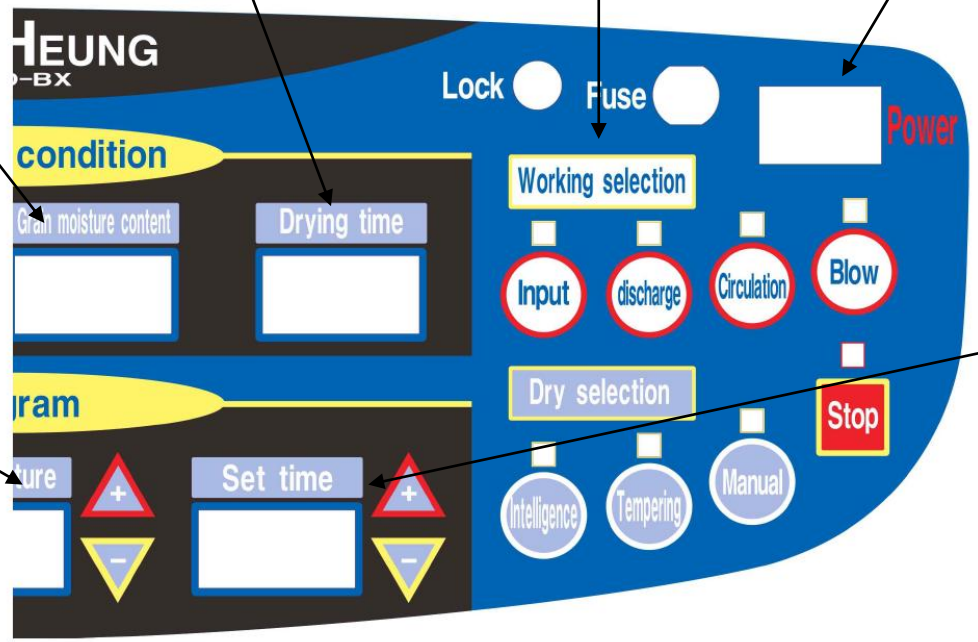
- Indicates the progressed operation time.
- Decimal point means the 10 minutes unit. For example, 12.3 = 12 hours and 30 minutes

Working selection

- Sets up the desired operation.
- Selects loading, unloading, circulation, blow.
- Power switch off for the immediately stop.

Power switch

- Used to turn the power on/off.
- If it is not lighted upon power on, please check the power fuse.



Grain moisture setting

- Sets up the objective moisture.
- Please check after selecting operation and then modify it.
- Error may be generated according to the grain status so use it carefully.

Operation time setting

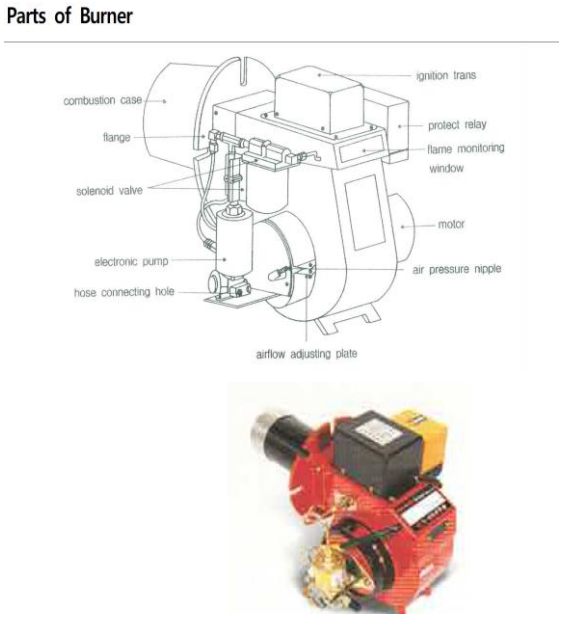
- Sets up the time limit of the operation to be implemented.
- The setup time automatically setup upon selecting operation; however, please adjust it after check.

PROPER OPERATION OF DRYER

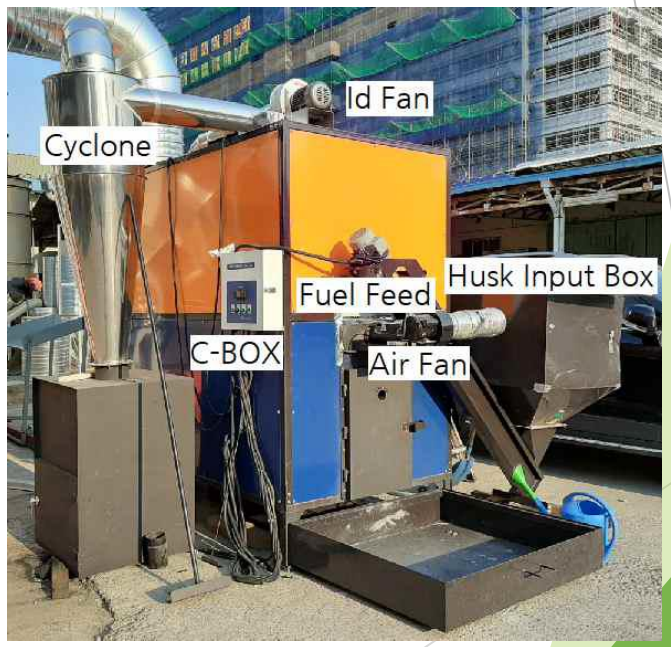
(LOADING, CIRCULATION, DRYING, UNLOADING)

HEATING SYSTEMS

Diesel Burner



Biomass Furnace

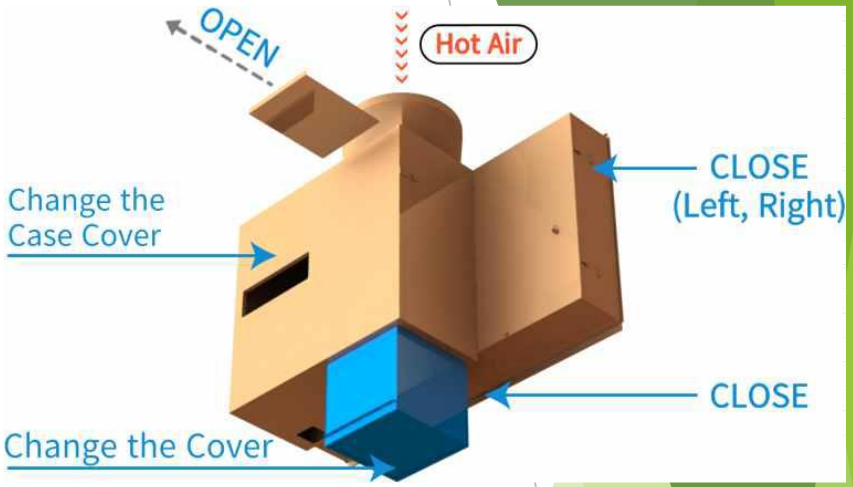


DRYING OPERATION

❑ Switching Burner & Husk Furnace

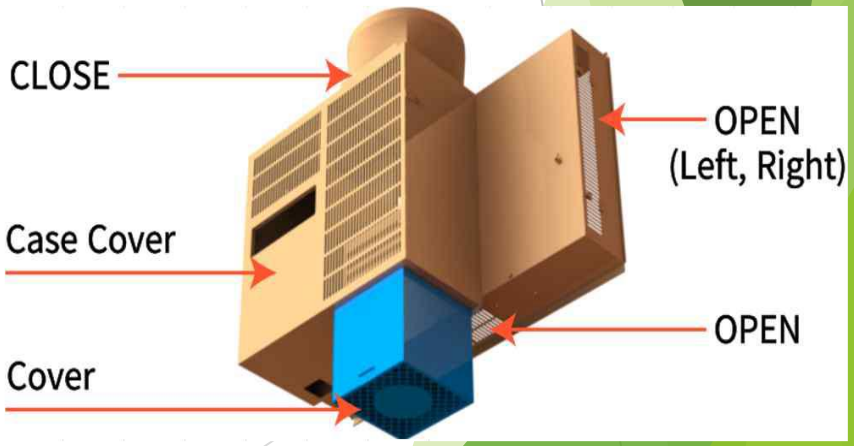
Husk Furnace

- ✓ Close the air inlet cover on the how wind case and bottom of burner.
- ✓ Open the furnace hot air inlet cover.



Burner

- ✓ Open the air inlet cover on the how wind case and bottom of burner.
- ✓ Close the furnace hot air inlet cover.

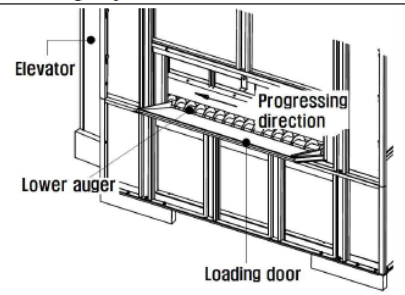


Sort		Setting	Display	Note
Heat Source Choice	Burner			Switch the button on the Control Panel
	Husk			
Moisture Meter	Use			Main PCB SW3.2 UP
	Un-use			Main PCB SW3.2 DOWN

LOADING OPERATION

(DIESEL BURNER)

1. Open loading door and prepare the loading operation.



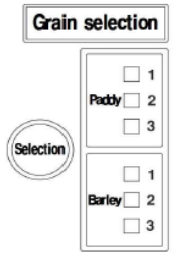
· Convert into the loading status by pulling white string attached to the elevator.

2. Turn the power switch ON.

· Power lamp is lighted and countdown for checking figure-indicating part is progressed.

· Check if the figure indicating part is in normal status.

3. Select desired type of grain to be loading. (Grain selecting part)

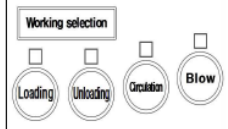


· Select paddy or barley according to the grain type.

· Select sub item according to moisture correction.

· The reference of paddy and barley is each 2nd sub item.

4. Press loading button (Selecting operation)

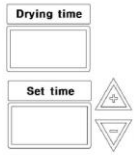


· Loading lamp is lighted and internal alarming sound is generated for 3 seconds.

· Dryer begins to operate.

· Elevator and lower screw are operated in order.

5. Check the time setting and adjust it.



· Upon selecting loading operation, time setting is basically set up for 20 hours.

· Time setting can be changed with + - buttons.

6. Press blow button

· The blower is not operated upon loading.

· Blow function is effective for the loading operation ccompanying lots of dust.

· To stop the blower in action, press blow button once more.

LOADING OPERATION

7. Loading grain

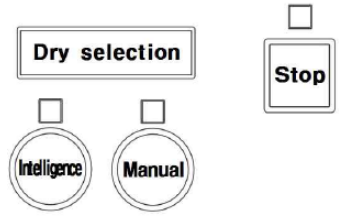
· Remove alien substances such as rice straw, waste and grass as much as possible since they disturb the flow of grain.

· If 002 is indicated on the hot wind temperature indicating part and stops automatically, that means the loading amount is full.

a. Stop loading.

b. Re-operate the dryer and deliver the remained grain left in the lower auger into the dryer.

8. Press stop button for the forcible stop.



· Stop lamp is lighted and the dryer stops.

· When stop the dryer after completing grain loading, press stop button after loading all the remained grain of loading door. (idle for 30 seconds)

9. Close the loading door and clean around the dryer.

· If drying is progressed with the loading door open, the sucking force of the blower is decreased and the combustion status of burner gets bad and the drying is not performed smoothly.

· Please remove flammable grain or sack littered around during the operation.

⚠ Attention

- Before loading, make sure to pull down white string attached to the elevator to make loading state.
- Please remove alien substances (paddy straw, twigs, waste and grass) before loading if possible.
- Turn off the power switch upon emergency


GPS Map Camera
Penaranda, Central Luzon, Philippines
9XFW+7R8, Penaranda, Nueva Ecija, Philippines
Lat 15.374412°
Long 120.997132°
03/07/24 02:21 PM GMT +08:00
Google

CIRCULATION OPERATION

- ✓ After loading operation, check the current moisture reading in the control panel display area.
- ✓ If the display showed 25% above, circulate at least 1-2 hrs depends on the current condition of palay. It can be done by pressing Circulate buttons 1 times, then palay inside will start to circulate via bucket elevator together with the blower.

Present moisture content display area

Circulation buttons

DRYING OPERATION

- ✓ After circulation process, check if the sample palay was initial in a perfect condition for drying (25% MC) before firing to lessen the drying time operation.

Drying Operation(Mode) Selection

1. Manual drying mode

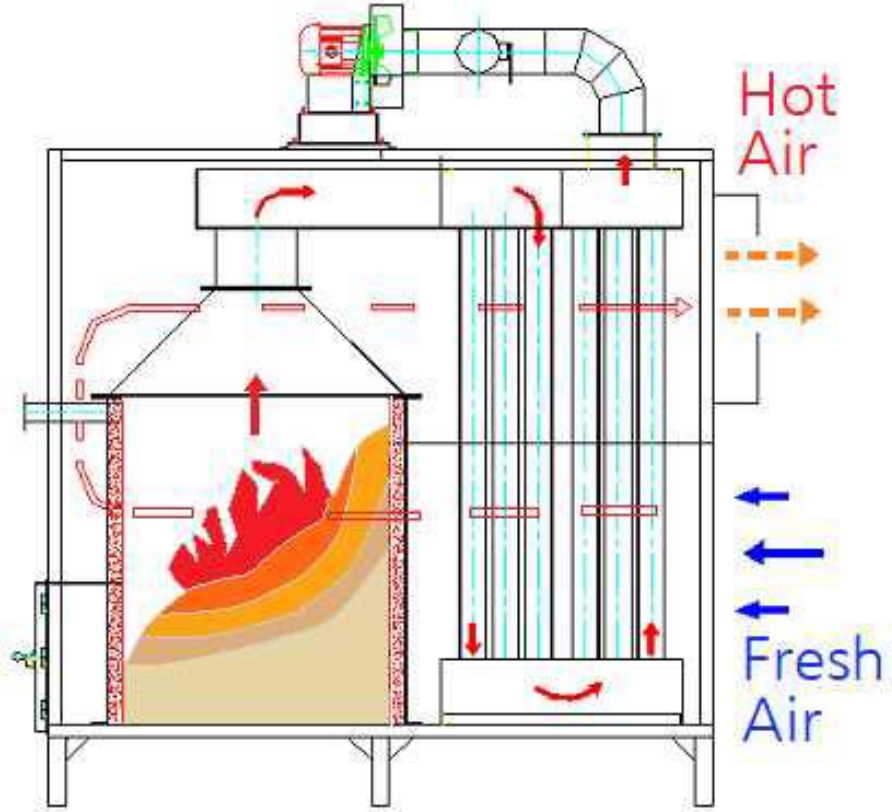
- ✓ This mode is proceeded from beginning to end at user's selected certain conditions.
- ✓ The drying conditions such as setting temperature, moisture and time is manually set as selected.

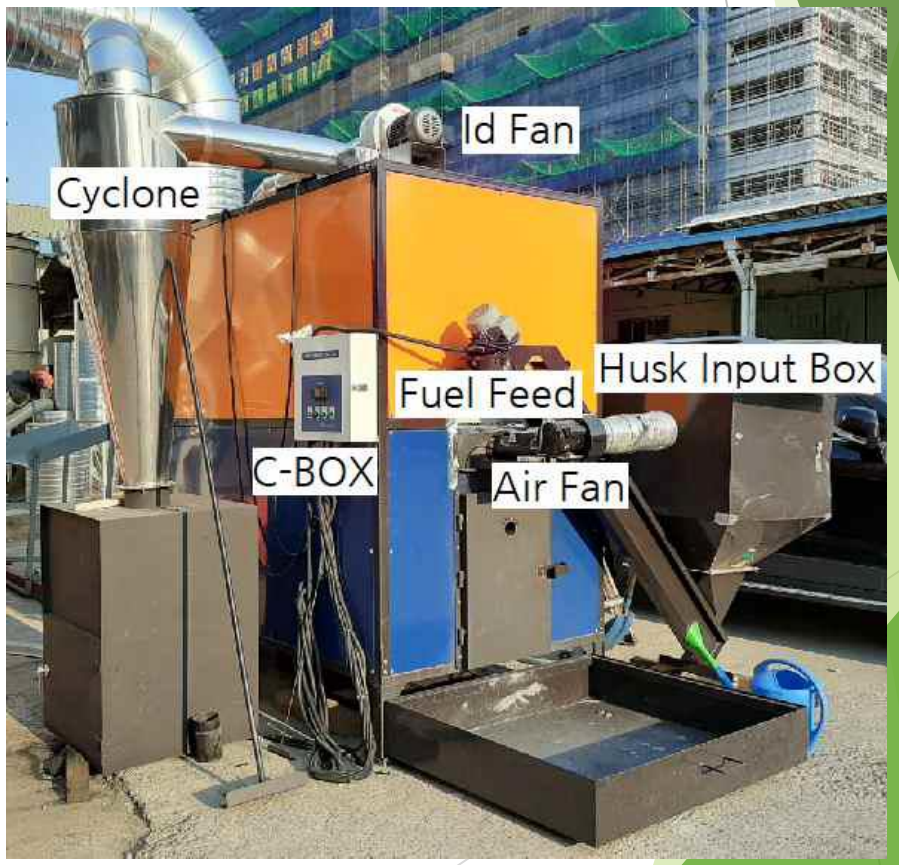
2. Intelligent drying mode

- ✓ This mode dries by applying artificial intelligent control program until user's established target moisture and auto-adjusting properly at changes of ambient conditions.
- ✓ The drying condition such as a setting temperature, moisture and time is automatically set as selected. But be sure to check the drying condition and if necessary, modify the setting values.
- ✓ Calculates and establishes drying conditions such as a setting temperature, moisture, time, etc. But be sure to use this function after checking the drying conditions.

DRYING OPERATION

HUSK FURNACE





HUSK FURNACE

Control Panel	Parts Description
	1. Temperature Controller 2. ID Fan On/Off Switch 3. Fuel Feed Screw On/Off Switch (MN : Manual, On : Auto) 4. Air Fan On/Off Switch 5. Ash Discharge Fan On/Off Switch

HUSK FURNACE OPERATION

- ✓ Before operation, check if the dust discharging area is clean to avoid blocking of some heated air going to the drying chamber.

	• Switch main breaker [On] • Turn on the main breaker, the light is on
	1) Set the Selector switch of ID FAN to [ON] • By doing so, the ID Fan run and turn on the light, • Set the selector switch of ID FAN to [OFF] then stop the ID Fan and turn off the light.
	1) Set the Selector switch of AIR FAN to [ON] • By doing so, the AIR Fan run and turn on the light, • Set the selector switch of AIR FAN to [OFF] then stop the AIR Fan and turn off the light.
	1) Set the Selector switch of FUEL FEED to [ON] • By doing so, the FUEL FEED screw run and turn on the light, • Set the selector switch of FUEL FEED to [OFF] then stop the FUEL FEED screw and turn off the light. • But If the following conditions are satisfied, the screw motor operates. (1) ID FAN [ON] (2) when the current temperature of the temperature controller is lower than the set temperature
	• Setting of desire temperature of temperature controller Please refer on the temperature controller setting manual.
	1) Setting the overload relays • Adjustment dial (Setting Value ID FAN : 4.8A, Fuel Feed : 3.0A) Before adjusting the dial open the protection cover. • Current setting can be done easily by using (+) or (-) driver. • Do not rotate the dial out of the setting range.

CHECKPOINT IN OPERATION

1. Power, Signal, ID Fan etc. connecting	
2. Turn the power switch Dryer "ON" Dryer C-BOX Press button "Auto Dry"	
3. Ignition A. check rice husk inside the combustion chamber B. Ignite rice husk C. It may be dangerous "SAFETY FIRST"	
4. Adjust Air FAN blower and ID FAN blower	
5. Setting of desire temperature HF-170 : Furnace & Dryer temperature	
6. If any abnormality is occurred on the furnace, Please check the motor, screw & c-box items considering safety	
7. Sometimes pull out the ashes with tools	

Checkpoints when Feeding Fuel

		
Beware of clogged rope	Beware of putting alien substance	Do not use wet husk

Checkpoints and Measures in Operation

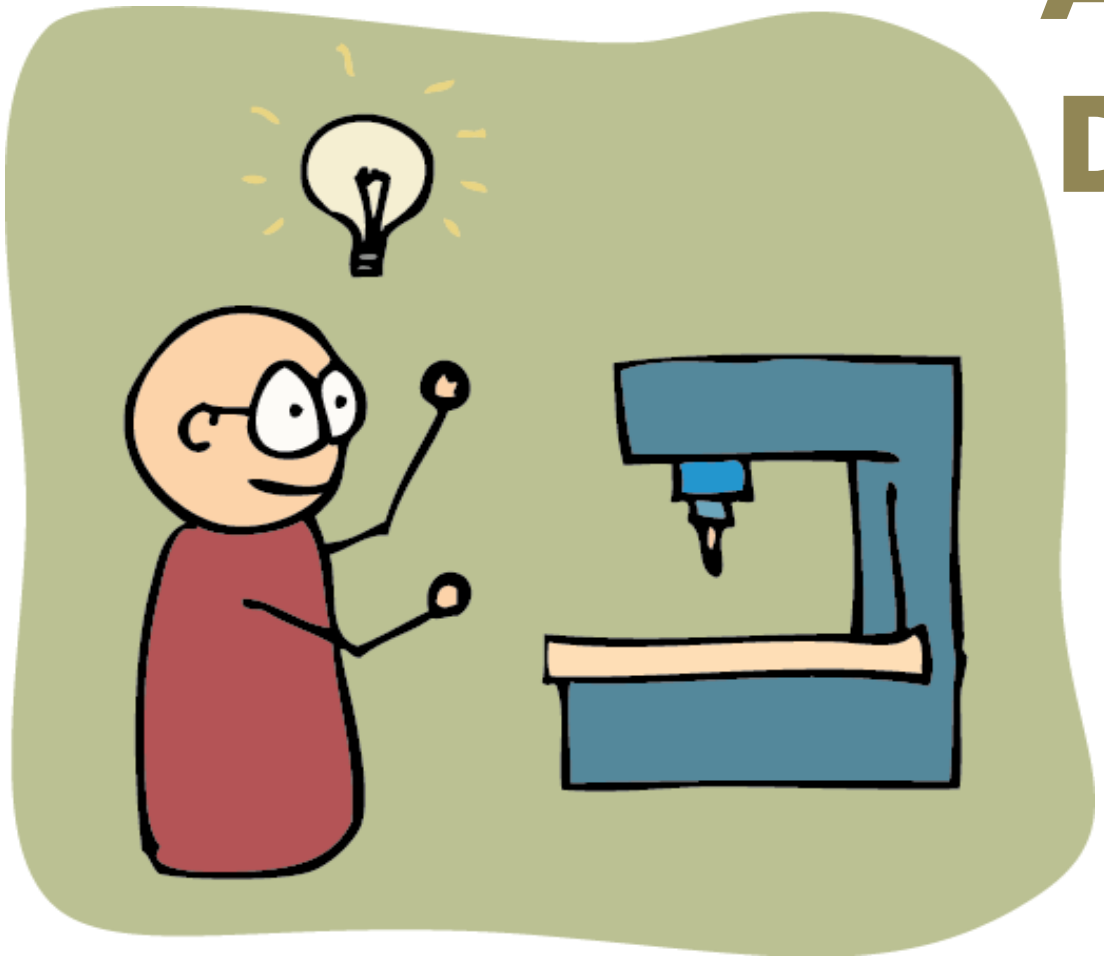
1) Heat temperature falls.

- The husk is not transferred freely. → Remove the bridge in the husk tank
- Drying efficiency is low, heat exchange pipe is blocked with ashes or soot.

  → Clean up the heat exchanger after stop the dry and husk furnace.
- Cyclone is blocked with ashes. → Clean up the cyclone.

UNLOADING OPERATION

- ✓ After met the required or set moisture content of palay based on the purpose of drying palay, the last operation is **UNLOADING**.
- ✓ Press the STOP button on the control panel to stop the firing (For Diesel) or **SWITCH OFF** all the operating parts in furnace control box (For , the Biomass) Then press **BLOW** button to cool down the palay before Unloading.
- ✓ After cooling the palay, press UNLOAD button to unload the palay.
- ✓ Control the Unloading of palay to the bagging bin via Unloading Rope.



ABNORMAL DIAGNOSIS AND COUNTER MEASURES

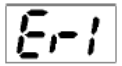
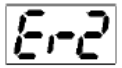
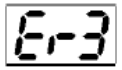
000 Drying Completion	001 Power Abnormal	002 Grain Overloading	003 Burner	004 Elevator Motor Abnormal
005 Lower Screw Motor Abnormal	006 Blower Motor Abnormal	007 Shutter Drum Abnormal	008 Tempering Drying is Running	009 Time Completion
00R Dust Collector Motor Abnormal	FFF Thermal Sensor Abnormal	Er1 Moisture Abnormal (Connection)	Er2 Moisture Abnormal (Grain Sampling)	Er3 Moisture Abnormal (Sensor)

Trouble shooting of Abnormal Phenomenon

Abnormality	Cause	Solution
Power Lamp is not lighted up	Power breaker is shut down.	Turn on the power breaker.
	The fuse of cover knife switch (fuse box) is blown.	Replace the fuse.
	Power plug of the control panel is out of receptacle.	Insert the plug in a receptacle.
No indication is appeared on the control panel even though power lamp is lighted.	The round fuse of control panel is blown.	Turn off the power switch and replace it with spare fuse (250V, 2A)
Figures appear on the control panel, but the dryer is not running upon working selection	The connector between control panel and motor is pulled out.	Insert the connector firmly. Check if the alarm sound is generated upon working selection
003 **Burner** (burner abnormal lamp is on with alarm)	connecting line is plugged out.	Check the connecting line.
	Motor is damaged slightly.	Check the heat level of the motors and contact the Service Center.
004 **Elevator motor** (elevator abnormal lamp is on with alarm)	Elevator connecting line is plugged out.	Check the connecting line.
	Grain is overloaded.	Remove the grain.
	Elevator bucket belt is loosened or inclined	Check and adjust the bucket belt.
	Tension of the elevator motor belt is wrongly adjusted.	Adjust the belt tension.

Abnormality	Cause	Solution
005 **Lower screw motor** (lower screw abnormal lamp is on with alarm)	Lower screw motor connecting line is plugged out	Check the connecting line.
	Too much grain over lower screw due to overload from loading door.	Remove the grain
	Tension of the lower screw motor belt is wrongly adjusted.	Adjust the belt tension.
	Trouble in lower screw motor.	Contact the Service Center.
	Grain overload due to the elevator trouble.	Check the elevator and remove the grain.
Grain is coming out of dust collector	Airflow dust collector of is too strong.	Open tairflow adjusting plate a little bit.
Dust collection is not sufficient	Airflow dust collector of is too weak	Close airflow adjusting plate a little bit.
006 **Blower motor** (blower abnormal lamp is on with alarm)	Blower connecting line is plugged out.	Check the connecting line.
	Alien substance is stained on the wing of blower.	Check the rotating status of blower and remove the alien substance.
	Blower motor is damaged slightly.	Check the motor heat level and contact the Service Center.
007 **Shutter drum motor** (alarm only with no abnormal lamp)	Shutter drum connecting line is plugged out.	Check the connecting line.
	Too much grain in the lower screw hopper up to shutter drum.	Check the elevator and lower screw status and remove the grain.
	Shutter drum limit switch connecting line is plugged out.	Check the connecting line.
	Shutter drum coupling is come out of the place.	Check the coupling.
	Shutter drum motor is slightly damaged or motor condenser is out of order.	Check the motor heat level and connecting status of condenser.

Trouble shooting of Abnormal Pheomenon

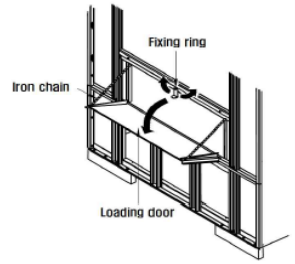
Abnormality	Cause	Solution
 **Dust collector motor** (alarm only with no abnormal lamp)	Dust collector connecting line is plugged out.	Check the connecting line.
	Motor is damaged slightly.	Check the heat level of the motors and contact the Service Center.
 **Moisture meter connection**	Main PCB and moisture meter PCB problems.	Check the Communication IC main PCB and moisture meter PCB replace Communication IC Check the PCB and replace PCBs.
	Connecting cable cutoff between main PCB and moisture meter PCB	Check the connecting cable.
 **Moisture meter sampling**	In sufficient grain is collected by moisture meter	Check the grain collector on the elevator and clean.
 **Moisture meter roller**	Roller in moisture meter are stained or choked	Clean the rollers in moisture meter

MAINTENANCE and SAFEKEEPING METHOD

5. Maintenance and Safekeeping Method

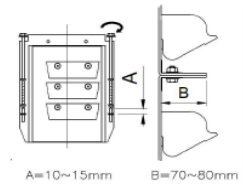
5.1 Inspection and Adjustment on Each Part

1. Opening / Closing and Adjustment of Loading Door



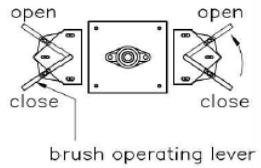
1) Release the fixing screw at the both ends of loading door and pull the fixing ring following the arrow direction and then open the door.
2) Upon adjusting loading door, remove the iron chain from fixing peg and hang on again after adjusting it.
3) Be sure to close the loading door after loading.
4) Do not stand on the loading door. It is very dangerous.

2. Adjusting Tension of Elevator Belt



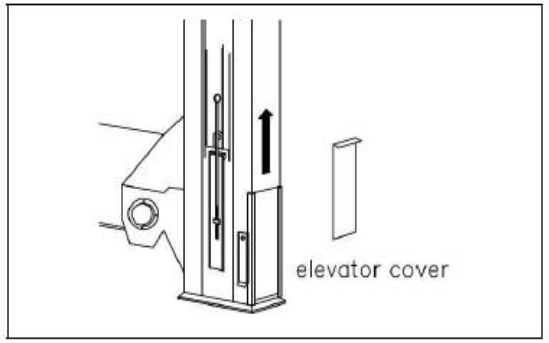
1) Check the elevator belt after removing automatic moisture meter.
2) If elevator belt is loosened or leaned toward a direction, adjust it with belt tension with adjusting bolt.

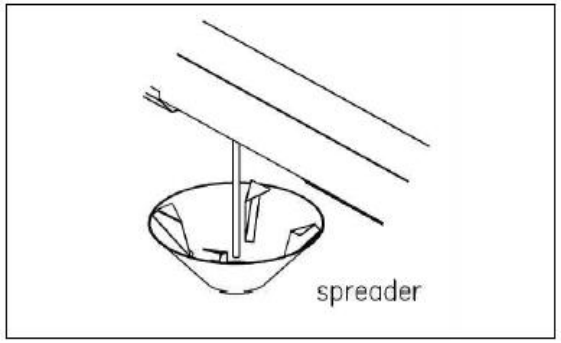
3. Cleaning Grain Residual



1) Run the machine as unloading operation till all the grain get out of the dryer and then stop the machine.
2) Fix the brush operating lever at the rear of the machine room at open and fix the screw.
3) Open the grain drain cover of the impeller case and remove the grain residual completely.

4) Open the side and the lower cover of the elevator and remove the grain residual.
5) Open the cover fixing ring under the equal distributor case and perform cleaning.
6) Clean the drying room inside.
7) Check each part after cleaning and fix the operation lever at "close" and then close the cover of each part.





⚠ Attention

- Attach all the cover to the original place after inspection, adjustment and maintenance of this dryer. If not, it may cause injury.

4. Cleaning automatic moisture

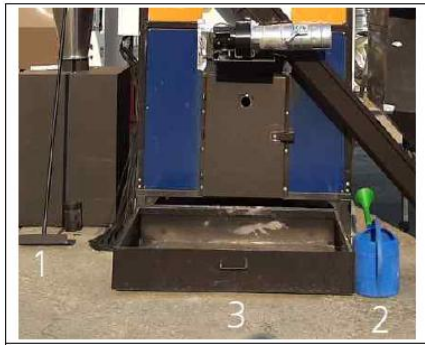
1) Place a power switch to OFF position.
2) Remove, if possible, other substances such as rice straw, twig, waste, weed etc., from an input entry that cause a problem in circulating of grain.

▣ Important

- Error of moisture value may be caused in case that grain is not supplied enough into auto-moisture meter and grain is mixed with other substances such as paddy straws, weed and dust, etc.

CLEANING MANUAL

1) Ash Discharge ①

		
Prepare Water and Tools	Fuel Feeding off	Check the Inside of Furnace
		
Discharge the ash	Put out Embers	Clean the ash

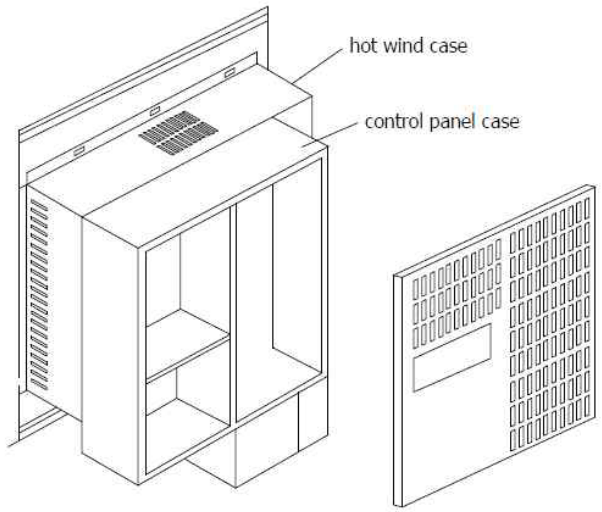
2) Cleaning Period

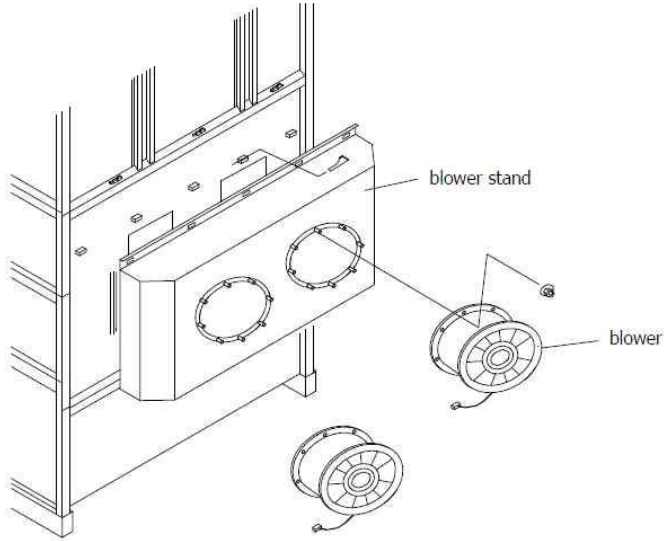
		
Upper Heat Exchange ④ **(2 times/Year)**	Lower Heat Exchange ③ **(1 time/Week)**	Dust Box of Cyclone ② **(Each Time of Finishing drying)**

☞ **Please use the furnace in clean condition. The more you clean, the more you can use.**

DRYER SAFEKEEPING METHOD

1) Detach the inhalation hole cover and check inside the hot wind room. If dust or soot is piled up, remove them.
2) Detach the circulation hole cover on the blower at the rear side of the dryer and check inside the supplementary hot wind room and clean the piled up dust with rod.





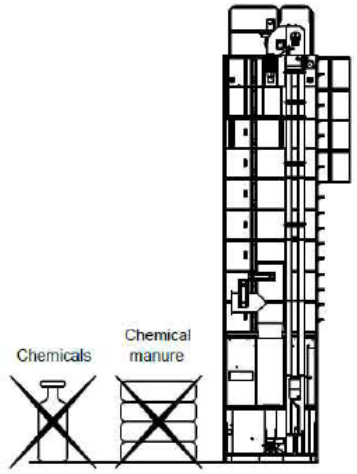
DRYER SAFEKEEPING METHOD

2. Cleaning Blower

- Detach the air discharge duct and clean the dust inside blower and then block the outlet of blower to prevent rats or birds from entering.

3. Safekeeping Electric Parts

1) Moisture or rain soaked into the control panel, burner and automatic moisture measurer may cause a trouble, so store them in the dry warehouse separate from the dryer while not in use after the drying period if possible. Take care of wire not to be damaged by rat.
2) If separate safekeeping is impossible, wrap them to prevent from moisture soaking or rain and please disconnect the power cable.



3) Since the electronic parts cause chemical reaction near the chemicals and it causes trouble, so do not place ammonia, chlorine, acid, chemical manure or disinfectant near the electronic parts.
4) Safekeeping the driving motors of each part by wrapping not to be wet, and adjust the tension pulley of various driving belts loosened upon storing.

DRYER SAFEKEEPING METHOD

4. Safekeeping Main Body

1) Remove dirt such as dust piled up during drying from each part of the dryer, and make the parts waterproof not to be soaked by moisture or rain from outside upon storing.
2) The external parts of the dryer are painted to proof them from rust, however, take measure for the part on which the paint has been removed while using to proof them from rust upon storing.
3) Please remove the remained grain inside the main body after drying. If not, rat and other animals may enter inside the dryer and cause trouble.
4) Clean bearing, chain and fueling part of each driving part and fuel them upon storing.

⚠ Attention

- Upon using ladder, please make sure to hang the end of ladder on the ladder peg.
- If it is felt down during the use, severe injury may be occurred.


THANK
YOU