



## Steam Chest



# A.T. Ferrell

Manufacturers of Ferrell-Ross Mills

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(800) 248-8318



Customer:  
Serial No.:

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## WARRANTY

### The A. T. Ferrell Company, Inc. Manufacturer's Warranty for the following product lines:

#### FERRELL-ROSS

Roller Mills, Flaking Mills, Cereal Mills, Industrial Mills, Flake and Pellet Coolers, Crumblers, Grain Cleaners, Steam Chests, Roll Feeders, Vibratory Feeders and Conveyers, Loss in Weight Feeders, Mixers and Blenders.

(“FERRELL-ROSS” IS A REGISTERED TRADEMARK OF THE A. T. FERRELL COMPANY, INC.)

The A. T. Ferrell Company, Inc. warrants each new product of its manufacture when purchased from an authorized representative for a period of one year from the date of shipment. This warranty shall apply to all parts and workmanship (except products or components not manufactured by The A. T. Ferrell Company, Inc.), which shall appear to A. T. Ferrell Company to have been defective in manufacture. The A. T. Ferrell Company's sole and entire obligation under such warranty shall be satisfied by shipment to the Purchaser-User, without charge, (except for transportation costs, which shall be paid by the Purchaser-User) of the part or parts returned for inspection and parts intended to replace those acknowledged by The A. T. Ferrell Company, Inc. to be defective.

This warranty shall not apply and shall be void under the following conditions:

1. If the product is transported from original installation site.
2. If any part of the product has been altered, modified, or changed, except at The A. T. Ferrell Company, Inc. factory or is authorized in by The A. T. Ferrell Company, Inc. in writing.
3. If attachments or devices unsuitable to the product have been used on or in conjunction with the product.
4. If the product has not been installed, used, operated, handled, or serviced in accordance with the appropriate instruction manual.

The A. T. Ferrell Company, Inc. reserves the right to make changes in design or improvements in its products without obligation whatsoever to prior Purchaser-User of such products.

The A. T. Ferrell Company, Inc. will pass on to a Purchaser-User only such warranty as it shall receive on products or components not of its manufactured from the manufacturer or supplier thereof.

We will not be liable for any consequential damages, loss or expenses arising in connection with the use or inability to use the product for any purpose whatever. Our maximum liability shall not in any case exceed the cost of replacing defective parts if returned to us within one year from date of shipment. No salesman, manufacturer's representative or other person may make or has the authority to make any guarantees or warranties expressed or implied on behalf of A. T. Ferrell Company, Inc. which are inconsistent with these terms and conditions or any catalogue or other publication of A. T. Ferrell Company, Inc.

Claims for warranty should be directed to our sales department, 1440 South Adams Street, Bluffton, IN 46714 U.S.A. or phone (260) 824-3400. The machine serial number and description of the type of failure is required to file a claim.

Contact our sales department before returning warranty items for a RMO (Returned Material Order) which must accompany all returned items. All returned items are to be shipped freight pre-paid and credit will be issued after inspection and acknowledgement of warranty defect. A. T. Ferrell Company, Inc. will pass on to the purchaser/user only such warranty as it shall receive on products or components not of its manufacture from the manufacturer or supplier thereof.

## **FORWARD**

Many years of experience and engineering background have gone into the design of your Steam Chest. Each FERRELL-ROSS is a precision built machine, constructed from durable materials to close tolerance specifications.

We prepared this booklet for our Steam Chest to help you install, operate and maintain your unit to the highest standard and to obtain the greatest efficiency.

Every unit is thoroughly tested and inspected at the factory before shipment. However, it will be necessary to make minor adjustments to your flaking system after it has been installed to get the performance you desire.

If a commercial carrier shipped your machine, ensure that you check all parts carefully to see if there is any damage in the shipping. If damage is found, make a notation of such and make certain that your local agent makes a similar note on your freight bill, before you accept shipment. This is necessary to support your claim.

Do not hesitate to accept damaged equipment after the agent has made the notation on the freight bill. You will be reimbursed when you present your claim.

We assume no responsibility for loss or damages after the equipment leaves our dock, but we will gladly render our services to assist you in adjusting your claim.

Determine the parts you require, submit an order to us and we will prepare an invoice. Upon receiving our invoice you will be in a position to file a claim against the shipping company.

There are drawings and parts lists in the back of this booklet to assist you in ordering spare parts. When you order spare parts specify the cooler serial number, size, part number, description and quantity to assure prompt and correct replacements.

### **A.T. Ferrell Co., Inc.**

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# BE A SAFE OPERATOR

## AVOID ACCIDENTS



This safety alert symbol identifies important safety messages in this manual. When you see this symbol, be alert to the possibility of personal injury and carefully read the message that follows. Regardless, of the care used in the design and construction of any type of equipment, there are many conditions that cannot be completely safeguarded against without interfering with reasonable accessibility and efficient machine operation. A careful operator is the best insurance against an accident.



Carefully read and understand the operator's manual before operating the machine. Do not attempt to install, connect power to, operate or service machine without proper instruction and until you have been thoroughly trained in its use by your employer.



Keep children, visitors and all untrained personnel away from machine while in operation.



Caution – High Pressure Steam, Severe Burns from High Temperature may result.



**Danger** – Do not attempt to work on, clean or service this equipment or open or remove any protective cover, guard, or grate until power has been turned off and mechanically locked out and the machine has come to a complete stop.



**Danger** – Keep hands, feet and clothing clear from rotating belts, pulleys, rolls and gears when machine is operating. Failure to do so will cause severe injury or death.



**Danger** – Never operate machine without protective covers, guards, or grates properly installed.



**Do not** obscure or remove safety decals from the equipment. Replacement decals are available from the manufacturer.



This equipment was manufactured in compliance with existing OSHA regulations. It is the responsibility of the owner/user to maintain OSHA compliance when operating the equipment.

**Replace all guards and shields after servicing and before starting up the machine.**



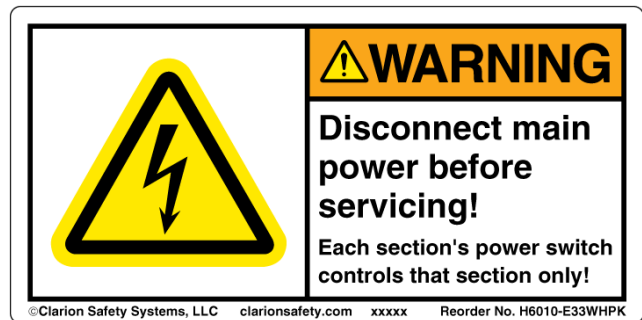
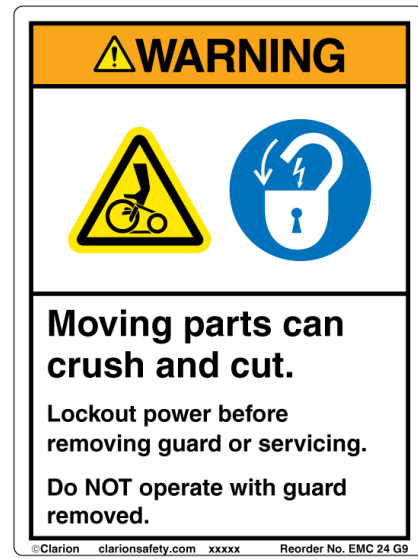
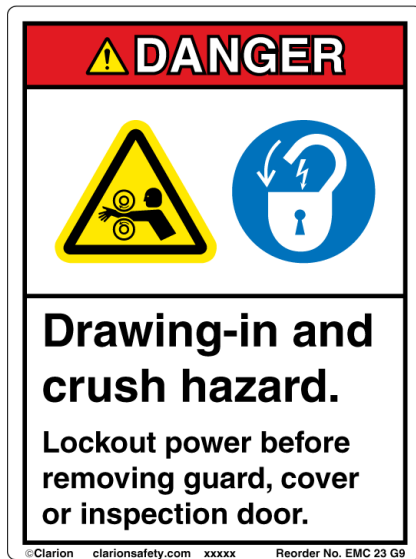
**Do not** clean, lubricate or adjust equipment while it is in operation.



After servicing, make sure all tools, parts and service equipment are removed from the machine.

**Do not** start the machine until you are sure that everyone is clear.

# TYPICAL SAFETY DECALS



# **GENERAL STEAM CHEST FEATURES**

Ferrell-Ross Steam Chests provide the proper retention time required to produce high quality flakes. Built to match your specific capacity needs, each Ferrell-Ross Steam Chest is constructed from 10 gauge 304 stainless steel for maximum longevity. Precisely placed steam injection rings improve steam efficiency and steep cone transitions allow the high moisture material to flow evenly. Ferrell-Ross Steam Chests are available in 38", 48", 66", and 84" diameters.

## Standard Features:

- 10 Gauge T304 Stainless Steel Cylindrical Body
- 10 Gauge T304 Stainless Steel Round to Rectangular Transition
- Stainless Steel Internal Steam Diffusion Injectors and Supports
- Mild Steel Manifold with Easy-Reach Controls
- Mild Steel External Pipe and Fittings
- One T304 Stainless Steel Inspection Door
- Sight Glass in Transition Section with Stainless Steel Bezel
- One Thermometer or TC Temperature Probe Below Each Steam Ring
- One Grain Inlet and One Steam Vent
- ¼-Turn Ball Valves with Stainless Steel Balls and Teflon Seats
- (4) Supports Welded to top of Steam Chest
- (4) Level Adjusting Bolts

## Options:

- Left Hand or Right Hand External Piping
- Stainless Steel External Piping
- RTD Temperature Probes
- Level Indicators
- Extra Access Doors
- Extra Sight Glass
- External Insulation Package

# STEAM CHEST INSTALLATION RECOMENDATIONS

1. All valves used in the installation should be industrial steam type valves capable of withstanding steam supply pressures and conforming to local codes.
2. Horizontal steam lines should be mounted at a slight angle or slant to allow condensation to flow back toward the steam chest and waway from the boiler. This method will help prevent any “hammering” from the condensation contact with the boiler.
3. All pipes and fittings should be well insulated to prevent loss of heat and contact with hot pipes.
4. It is recommended that you use a small exhaust fan (1/4 to ½ hp) at the top of the steam chest to discharge excess steam to the outside.

**Note: Be sure the exhaust pipe condensate does not flow back to the steam chest and mill.**

5. Excess steam should be exhausted from the interior area of the flaking mill to prevent “roll wash” or wear spots on the rolls, and also prevent premature rusting in the interior of the flaker. If you are using an airlift system to handle the material from the flaker, it is not necessary to add any additional exhaust. If you are using a standard screw or drag conveyor at the discharge, we recommend that you exhaust the excess steam at the pin feeders vent section of the mill. We recommend the Ferrell-Ross steam vent plenum which was specifically designed to fit the vent on our pin feeder’s vent opening and transitions to a 12 inch (305mm) vent riser. The exhaust system is necessary to keep condensation from forming on the inside of the feeder and spilling onto the rolls. In addition to protecting you milling equipment, the exhaust system will assist in preventing damaged caused by the moisture condensation on the interior of the plants electrical components and other equipment. The exhaust system can be a separate wall fan or incorporated with other moving systems within the plant.
6. The piping connecting the steam chest to the boiler is field installed and customer supplied. A water separator and main valve should be installed as close to the steam manifold as possible. A steam trap should be connected to the drain at the bottom of the water separator. Water coming out of the steam trap can be drained outside or returned to the boiler. A means should be provided so the main steam line can be drained before opening the valve to the steamer.
7. The recommended piping sizes and locations for connection are shown on the Ferrell-Ross installation drawings for the steam chest.



## **GENERAL INFORMATION**

1. Checking on vertical standpipes as well as strainer elements should be removed periodically for cleaning. Open the globe valve on the steam trap every 20 hours of operation to clean out the trap.
2. Higher moisture increases capacity and produces a tougher flake up to a point, providing the moisture is internal and not just surface moisture. If additional moisture is required in the grain, reduce the steam working pressure of the boiler to 50-60 PSI. If less moisture is desired, raise the steam working pressure to 125 PSI. It may also be necessary to install an additional water trap in the steam supply line.
3. Meal or exceptionally chaffy grain may clog the steam chest and flaking mill. Make sure you clean the grain as much as possible to prevent the foreign material from causing bridging inside the steam chest. This material also tends to soak up moisture first, reducing moisture from entering the grain.

The discharge on the Ferrell Ross Steam Chest is flanged to mate to the inlet of the Ferrell Ross Mill, if the steamer is used with other equipment it may be necessary to make a transition to adapt these pieces of equipment. This transition may be necessary in order to remove the roll covers on other mills in order to service the rolls

## **Steam Flaking General Information**

1. Steam flaking is the process of making grain into a better food source for animals.
  - a. Speeds digestibility
  - b. Increases the energy value of grain
  - c. Increases food efficiency
  - d. Kills fungus spores and weed seed in grain
2. Heat and moisture causes the starch cells in grain to gelatinize and absorb moisture
3. Flaking ruptures the cells releasing nutrients

## **Factors Affecting Steam Flaking**

1. Flake Thickness
2. Temperature of Grain
3. Moisture of Grain
4. Retention Time
5. Grain quality and cleanliness

## **Factors Preventing Material from Pulling Through Rolls**

1. Over Feeding
2. Moisture Too High
3. Worn Corrugations

### **Example of When a Soak Bin Would Be Used**

- Corn arrives at 10 – 11% moisture
- You are targeting 20% flake moisture
- A steamer for 45 – 60 minutes will add approximately 4 – 6% moisture
- The additional 4 – 5% moisture will need to come from a soak bin

### **Your Readings After 30 Minutes Continuous Run**

- Temperature at Ring 1: \_\_\_\_\_ Ring 2: \_\_\_\_\_ Ring 3: \_\_\_\_\_ Ring 4: \_\_\_\_\_
- Moisture of product before steam chest: \_\_\_\_\_
- Moisture of flaked product out of mill: \_\_\_\_\_
- Moisture of flaked product after cooler (if present): \_\_\_\_\_
- Moisture of flaked product after dryer (if present): \_\_\_\_\_

# **FLAKING OPERATION**

GRAIN FLOW (RETENTION TIME) THROUGH THE STEAM CHEST IS ALWAYS REGULATED WITH THE MILLS FEEDER, NEVER USE SLIDE GATES AS THEY WILL BRIDGE MATERIALS AND CAUSE POSSIBLE DAMAGE TO THE STEAM CHEST OR A COMPLETE STOPPAGE INSIDE THE CHEST. THE OPERATOR MUST BALANCE THE CAPACITY OF THE STEAMING OPERATION WITH THE CAPACITY OF THE MILL AND THE DESIRED FLAKE.

1. Start the boiler or steam generator using the manufactures instructions and recommendation.
2. Drain water out of the steam lines.
3. Blow out steam lines in steam chest by closing the steam lines to the lower section and open the line to the top section and then repeat the same with the other sections.
4. Close the Feed Gate on the mill or the slide gate at the bottom of the steamer if one is used.
5. Begin filling the steam chest with grain.
6. Set the air regulator of the hydraulic pump to 800 – 1200 psi.
7. Check that roll scrapers are just touching (making light contact) with the rolls even from side to side. Bounce the scrapers against the rolls and tighten the nut to accomplish this. Please note that the scrapers will wear quickly at first and require additional adjustment.
8. When the boiler is up to full pressure, open the main gate valve all the way. Do not regulate the steam flow into the steamer through the main valve or “wire draw” will necessitate early replacement of the valve. Steam flow into various levels of the steamer must be regulated with the small valves on the vertical line to the various steam chest sections.
9. Open each sections steam valve all the way. Total cook time is approximately 45 – 60 minutes.

NOTE: The desired steam flaking moisture in corn as an example is 18% - 22%, at 190 deg. to 210 deg. F. (88 deg. to 100 deg. C)

NOTE: WHILE THE STEAM CHEST IS COMING UP TO TEMPERATURE IT IS A GOOD TIME TO CHECK YOUR MILL FOR PROPER OPERATION (mill motor should be stopped). CHECK FOR GREASE IN BEARINGS, BELT TENSION, AND ADJUSTMENTS. WHEN THIS IS COMPLETE, START THE MILL WITH THE ROLLS OPEN AND NO PRODUCT GOING INTO THE MILL. DO NOT CLOSE THE ROLLS AT THIS TIME.

10. Current models of Ferrell-Ross Feed Flaking mills are equipped with our roll pre-heat system. The roll preheat system should be started after the mill has been checked for proper operation. To start the roll preheat clear the rolls, start the mill motor(s), and slowly open the roll preheat steam valve or valves to the desired setting. The roll preheat cycle should be complete in approximately 15 minutes. Close the preheat steam valve(s) several minutes before introducing product to the rolls.
11. When the temperature gauge displays a reading of 210-215 degrees at the top of the steam chest, close the lower steam valve to approximately  $\frac{1}{4}$  open and close the next section valves partially to avoid overcooking. Overcooking of grain will cause bridging of material in the steam chest which can prevent free flow of product into the feeder. If allowed to cool this product will set up inside of the chest and will require to be removed manually.
12. After lower sections have reached a temperature of 210-215 degrees steam should begin to exit the feeder. This means the process is nearly ready to begin. NOTE: It is understood that the first portion of material exiting the steamer will be under cooked because of the lack of retention time. But, by starting with the top valves and working your way down to the bottom valve you will prevent premature blow by in the feeder and give the initial steamer load the greatest amount of cook time for start-up.
13. Open the feed gate on the mill.
14. Adjust the feeder motor on the mill with the inverter (VFD) to obtain the desired rate of feed to the roller mill. WARNING: do not stop the feeder or close the feed gate for any extended period of time or you will bridge or block the steamer.
15. Checking the product for flake uniformity will indicate the general condition of the feeder and roll settings to begin with and you should wait until the completely cooked grain reaches the mill before making any determination of flake quality.

# **BOILER CAPACITY/STEAM INFORMATION**

The general rule in sizing the boiler is to figure 10 to 12 boiler H.P. per ton of corn, milo, barley, or wheat to be flaked per hour.

The boiler should be rated at 125 P.S.I. (8.78 kg/sq cm) with an operating pressure of 70 P.S.I. to 95 P.S.I. (5.39 kg/sq cm to 6.68 kg/sq cm)

The steamed grain as it is fed to the flaking mill should be approximately

Temperature	190 to 210 Degrees F. (88 to 99 degrees C)
Moisture	18 to 22 % (Most run at 22%)

Effects of using higher or lower Steam P.S.I. / Temperature/moisture

Higher boiler pressure will give higher temperatures.

Lower boiler pressure will give lower temperatures.

Higher moisture increases capacity and produces a tougher flake, up to a point, providing the moisture is internal and not surface moisture. Surface moisture will reduce the ability of the rolls to pull the grain through the rolls, and in turn a much reduced capacity.

Lower moisture in the grain being fed to the flaking mill will result in a thicker flake, and usually a flake that will break in transit.

## **Boiler & Steam Flaking Hints**

### **Boiler Horsepower:**

1 – Boiler H. P. = 34.5 Lbs. of Water converted to steam per Hour

1 - Boiler H. P. = 45 Cu. Ft Natural Gas Consumed per Hour

1 – Boiler H. P. = 33,475 B. T. U. Hour

1 – Boiler H. P. = Requires 4 Gallon of Water per Hour  
Ideal water hardness for best boiler  
Operation is 3 – 4 grains.

Low Pressure Boiler -----15 P. S. I. or less Pressure

High Pressure Boiler ----- Over 15 P. S. I.

### **High Moisture steam is caused by:**

- 1 – Water level in boiler too high.
- 2 – Too much additive or improper water treatment of boiler.
- 3 – Boiler overloaded or being worked to hard
- 4 – Dirty boiler – follow mfg. recommendation for cleaning.
- 5 – Steam travels long distance through uninsulated pipe.
- 6 – No water separator or steam traps in line.
- 7 – Increased steam pressure does not mean less moisture in steam, but it does give higher temperatures.

Boiler Pressure <u>PSI</u>	Temperature <u>Degrees F</u>	Boiler Pressure <u>kg/sq cm</u>	Temperature <u>Degrees C</u>
15	213	1.055	100
100	338	7.03	170
125	353	8.78	178
150	366	10.545	186
200	388	14.06	198

These figures are general rule of thumb and may vary with atmospheric or temperature changes.

### **Boiler Capacity information:**

The general rule in sizing the boiler is to figure 12 to 15 boiler H. P. per ton of corn, milo, barley, or wheat to be flaked per hour. (Fig. 10 to 12 H. P. for oats)

### **Proper Steam:**

The boiler should be 125 P. S. I. with an operating pressure of 70 to 95 pounds.

The gain as it is fed to the flaking mill should be:

Temperature	190 to 210 Degrees F.
Moisture	18 to 22% (most run at 22%)

### **Effects of using higher or lower Steam P. S. I. / Temperature / Moisture:**

Higher boiler pressure will give higher temperatures and lower boiler pressures will give lower temperatures.

Higher moisture increases capacity and produces a tougher flake, up to a point, providing the moisture is internal and not surface moisture. Surface moisture will reduce the ability of the rolls to pull the grain through the rolls, and in turn a much reduced capacity.

Lower moisture in the grain being fed to the flaking mill will result in thicker flake and usually a flake that will break in transit.

# **MAINTENANCE**

Little maintenance is required by the steam chest other than regular cleaning of the chest and inspection of steam piping and joints. Any bridging of material inside the chest must be removed in order for proper flow and cooking of product.

Please refer to the boiler manufacturers documentation for any additional items they may specify for the steam chest, piping and valves.