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HARVEST INSTALLATIONS

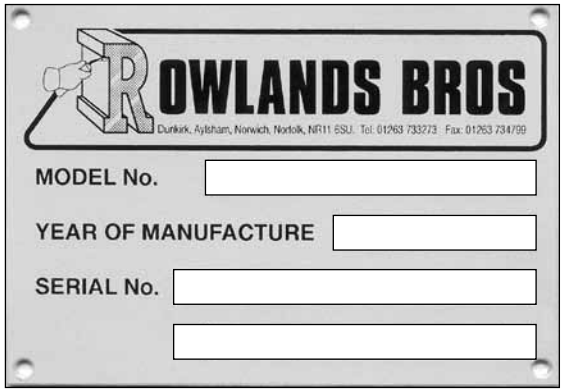
Maxi-Stirrer™ systems

for floor stores & silos - Operating & Maintenance Manual

E.C. DECLARATION OF CONFORMITY

We hereby declare that the following machinery complies with the essential Health and Safety requirements of the Supply of Machinery (Safety) Regulations 1992 No, 3073.

Machine Description:- **Maxi Stirrer**



Manufactured by:
Rowlands Bros., Dunkirk, Aylsham, Norwich, Norfolk.
for Harvest Installations, Unit E, North Yard, The Brents, Faversham, Kent ME13 7DZ.

The machine has been designed and manufactured in accordance with the following transposed harmonised European standards:-

EN 292 Parts 1&2 1991 Safety of Machinery Basic concepts general principles for design.
EB 294 1992 Safety of Machinery safety distances to prevent danger zones being reached by the upper-limbs. (Fan guarding).
EN 349

Technical construction file for this machine can be made available for inspection by the enforcement authorities at the manufacturers address.

Signed: _____ Name: _____ Date: _____

Being the "Responsible Person" appointed by the manufacturing company.

HARVEST INSTALLATIONS LTD
MAXI-STIRRER SYSTEMS
INSTALLATION AND HANDOVER FORM

The Harvest Installations Maxi-Stirrer System,

MODEL NO. _____ **SERIAL NO.** _____

has been installed and commissioned for,

_____

_____

_____

_____

_____

_____

_____

ON: _____ **BY:** _____

_____

has received proper instruction on the safe operation, setting and controls of this Harvest Installations Maxi-Stirrer System.

Signed: _____

AGRICULTURAL HARVEST STORE INSTALLATIONS LTD.
REG. NO. 1439743

Health & Safety at work 1974

Under section 6 of the above act, it is the duty of the manufacturer and suppliers of products for use at work to ensure, so far as is reasonably practicable, that such products are safe and without risk to health when properly used and to make available to users of such products adequate information about their safe and proper operation.

Our units should only be used in the manner and purpose for which they were intended, and in accordance with the recommendations detailed in this Manual. Our units have been designed, produced and inspected with safety in mind, but there are certain basic precautions which should be taken by the user and in particular, attention is drawn to the safety precautions in this manual and in the Operating Instructions.

It is imperative, therefore that all persons who make use of our units, have all the information and instruction they require to ensure that they are fully aware of any hazards and they know both the purpose and the correct manner of use of our units.

Preface

All personnel must have read and understood the Operations Manual before any kind of operation takes place.

All protection guards must be in position before starting.

All electrical connections must be carried out by experienced installers.

HARVEST INSTALLATIONS GUARANTEE

All components which become faulty by reason of defective materials or negligent workmanship are covered for a period of 1 year from the date of commissioning, the guarantee covers parts and labour.

The guarantee is subject to:

(1) New equipment only.
(2) Use under normal conditions ie. Protected from water and direct rain entering wiring and electronics
(3) Correct adjustments of bolts and drive chains.
(4) Electricity supply as per instructions.
(5) Installation by approved engineers.
(6) No exterior physical damage to components ie. Leads, wires, caused by rats, mice etc.
(7) No contamination of sensors.
(8) Not over filling store to impede travel of stirrer.

Exclusions to guarantee:

(1) Any damage or malfunction being caused directly of indirectly by non-standard electricity supply characteristics.
(2) Any damage to units caused by foreign objects within the crop.

INTRODUCTION

The Harvest Maxi Stirrer has been designed to operate in round silos and on floor drying systems, for the drying of all combinable crops. The system uses the control of relative humidity, or temperature, of air through fans into bulk/batch drying systems.

The system allows drying to take place 24 hours per day under all weather conditions.

The Harvest Maxi Stirrer has been independently assessed using both drying procedures. The full report is available on request.

Suggested drying methods are describes in this booklet. Should you require further information or advice on drying, please contact Harvest Installations.

HAZARD RISKS

HAZARD	MECHANISM	INJURY	RISK	SAFEGUARD
Entanglement	Belt pulley	Various	High	Steel mesh guard
Entanglement	Chain drive	Various	High	Steel mesh guard
Electrocution	Motor	Death	High	Insulation
Electrocution	Control panel	Death	High	Insulation and switching
Entanglement	Auger flights	Various	High	Switched safety cable
Entanglement	Friction drive	Various	High	Steel mesh guard

THE HARVEST MAXI-STIRRER SYSTEM FOR ON FLOOR STORES

OPERATION AND MAINTENANCE

DANGER: Always isolate electrical supply to stirrer before carrying out any service work.

AFTER FIRST 6 HOURS OF OPERATION

Check main auger drive belts for tension. Inspection hatch in underside of guard.
Check main adjustment of drive chains.
Check auger coupling bolts are tight.

AFTER 48 HOURS OF OPERATION

Check drive belts and all chain drives, and adjust if required.
Check top of beam and carriage travel is free and clear from debris. Clean as required.
Check and clean all electrical motor cooling fans and guards.

GENERAL

Ensure all safety signs and guards are fitted and in good order.
Check all electrical cables and connection are in good order.
Check drive wheels for wear and free float along shaft. Keep free with water repellent grease or spray.

INSTALLATION CHECKS BEFORE STARTING

- Check that the track has been installed at the correct centres for your machine. Check for adequate clearance from the track to any fixed point such as posts, handrails and brackets. Allow for the end float of the stirrer when checking clearances.
- Check auger length to floor. Shorten if required to 75mm (3") above floor level.
- Check installation and mounting of catenary cable. Check that cable does not create an obstruction on the walkway or to the stirrer travel.
- Position catenary pick-up arm on stirrer to suit store layout.
- Ensure all electrical installations are carried out by a qualified electrical engineer.
- Check motor rotations. Augers operate clockwise when viewed from above.
- Check stirrer wheel seating on track and that stirrer is square to track.
- Install end stops and adjustable stops. Ensure correct positioning to prevent damage at the end of travel.
- Remove lifting beam and eye-bolts from Stirrer. Keep safe for later use.
  DO NOT RUN AUGER FLIGHT OUT OF THE CROP.

POWER SUPPLY

3 PHASE SUPPLY

These units will require a switch, fused, 3phase isolator and 4 pin socket and plug.
Socket to be installed at walkway lever at one end of main air duct. This is preferable at the end furthest from the normal park position of the stirrer.
Further advise on request.
Isolator for single carriage, 2 auger machine. 3.5kW
Isolator for double carriage, 4 auger machine. 4.69kW
Isolator for largest triple carriage, 6 auger machine. 6.94kW

1 PHASE MODEL

Please contact Harvest Installations for site specific advice.

PRE-HARVEST MAINTENANCE CHECKS

- Ensure complete machine is thoroughly cleaned and is free of dust and debris.
- Examine stirrer track for signs of excessive wear or damage.
- Check drive wheels for damage or wear and free float along shaft. Keep free with water repellent grease or spray. Note there are four drive wheels on floor stirrers.
- Check main auger drive belts for tension. Inspection hatch in underside of guard. Replace worn or damaged belts. Belt tension is adjusted by moving the main drive motor. Ensure that even adjustments on all four bolts in maintained.
- Check auger drive shafts for wear and check drive pulleys are aligned.
- Check gear motor drive units and drive chains. Adjust on four motor mounting bolts.
- Check top of beam and carriage travel is free and clear from debris. Clean as required.
- Ensure all safety signs and guards are fitted and in good order.
- Examine switched safety cable and operation.
- Check all end travel stops are in good order and the operation of the reversing switch.
- Check all electrical cables and connection are in good order. Check catenary cable for cracking and snagging damage.
- Check all augers for signs of wear and that they run straight and true. Bent or damaged flight should be replaced.
- If stirrer has been moved, remove lifting beam and eye-bolts from beam.

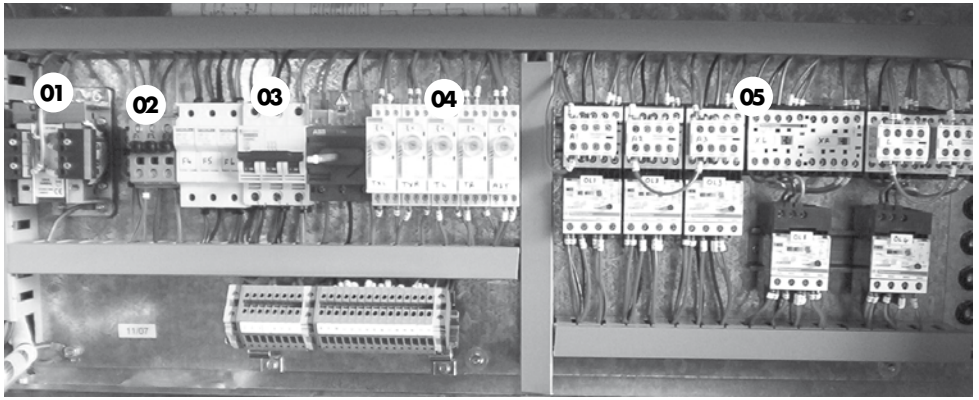
OPERATING INSTRUCTIONS

- Stirrer should be parked at rear of store before filling commences. Isolate electrical supply and remove augers before driving stirrer to back of store. Refit augers.
- Tip first loads at base of augers to a depth of 600mm (2'). Start all augers. Fill store normally ensuring augers are running at all times. Do not switch to travel until one complete bay is full and adjustable stops are in place.
- Care should be taken when using pushers or front end loaders in store. The auger flights are exposed during initial loading and are easily damaged.
- Care is needed not to overfill the store beyond designed limits. The top of the auger flight should always be visible above finish loaded height. During operation the auger will lift grain 400mm (16"). Grain should not be seen any higher than the auger flange at any time during operation.

01: 2 position switch. Start/Travel **02:** 3 position switch. Left park - Auto - Right park
03: Mains isolator switch **04:** Auger 1 (number of lights depend on number of carriages)
05: Auger 2 **06:** Auger 3 **07:** Overload **08:** Power

- With power connected and mains isolator on, turn on the panel isolator switch. Place switch (1) in start position and start auger 1, auger 2 and auger 3 (if fitted). Place switch (2) in Auto. Turn switch (1) to travel. The stirrer will now travel along the store, with the carriage(s) moving across the store, until it is parked or stopped.

- Whilst in the Auto position, the stirrer will continue up and down the store, reversing at each end stop.
- To stop the stirrer at either end stop, use the Park Left/Park Right switch. Left and right are set whilst standing facing the panel. Park left will stop the stirrer travel at the end stop to your left. Park right, at the end stop to your right. Note: if you select Park Left whilst the stirrer is travelling right, it will continue right until it hits the end stop then travel left and park at the left stop. The stirrer will not immediately travel left if Park Left is selected.
- A timer in the control panel will keep the augers and cross travel operating once the stirrer reaches its park position. Once the timer counts down (normally 9 minutes) the complete stirrer will turn off.
- With its positive four wheel drive system, the Harvest Maxi Stirrer should run true on its tracks. However, other factors can affect the running of the stirrer. If the stirrer runs out of true it will require re-aligning with the track. Lift and pack the panel end of the stirrer clear of the track. Start the augers and select travel on switch (1). Watch for the start of the travel and its direction on the tail end of the stirrer. If required, push the reversing bars to change direction. Watch for the stirrer end to drive into the correct position so the stirrer is once more square to the track. Remove the packers from the panel end and check travel.
- Sequence Starting. Switch (1) must be in Start position before initial starting of stirrer. Start augers 1, 2 and 3, where fitted, in sequence. Travel switch can be turned once all augers are running. Sequence starting prevents volt drop through the electrical system and allows each pair of augers full power for starting.
- The green run light will illuminate during all normal stirrer running. If any of the motors on the stirrer assembly fails to start or locks out, the red overload light will show. Turn off panel isolator, turn off and disconnect mains supply to panel before opening panel to investigate. MCB and overloads will take a couple of moments to cool down and then should reset. If items continue to trip out, an underline problem exists and should be investigated further.
- If no overload light shows and motors fail to start, check the safety cable switch and reset if required.



01: Transformer **02:** Fuses **03:** M.C.B **04:** Timers **05:** Contactors for all motors

TIMER SETTING

A delay timer is tripped whenever the stirrer changes direction, at the end of cross travel or at the front and back of the store. The delay on the cross travel allows for stirring along the tunnel or outside wall. This prevents damp areas developing and reduced wall condensation by aiding air flow. Both delays also help ensure a random stir pattern and reduce tracking of the stirrer. Timers can be changed if required to aid in ensuring 100% coverage of the store or to help in difficult areas.

01: Set units of time **02:** Dial select 1 to 10 **03:** Cross travel left **04:** Cross travel right
05: Travel Left **06:** Travel right **07:** Auto-Shut-Down (must have longest delay of all timers)
08: Indicator light green (lit when relevent motor is running)
09: Indicator light amber (flashes when timer is operating)

The AST timer is the final shut down timer and MUST always be set higher than any of the other timers. Failure to do so will prevent the stirrer from running.
Ensure timer is set to correct units, dial (1). Turn timer, dial (2), to desired delay time.
TXL and TXL are cross travel timers and are set at commission to 5 minutes.
TL and TR are long travel timers and are set at commission to 7 minutes.
AST timer set to 9 minutes.

CROP DEPTH RELEVANT TO MOISTURE CONTENT

It is important never to overfill a store. During normal operation grain should never reach above the level of the auger fixing flange and should never be allowed to get into the auger drive guard. This can lead to severe damage to the auger drive and flights.

Average moisture content of 30% to 35%. (Emergency conditions)
Under extreme conditions it is vital not to overload the stirrer, and to allow for fast drying to safe limits. A maximum storage depth of 2.5m (8') should be used in these circumstances.

Average moisture content of 25% to 30%.
Load the store to a maximum depth of 3.6m (12'). Stir and ventilate immediately to reduce moisture to safe levels.

Average moisture content below 25%.
Normal loading to full depth possible. Maximum 4.2m (14').

LINSEED
Maximum loading depth for linseed is 3.0m (10'). Depth should be reduced if very wet along the lines detailed above for grain. Due to the nature of linseed, structural limitations may be in place for the store. Abide by these at all times. NEVER attempt to stand or walk on linseed as there is a certain risk of drowning in the crop!

RAPESEED
Modern stirrer stores allow rapeseed to be stored and dried at full depth. However, very wet crops should be dried at a lower level in accordance with the advice above.

SAFETY GRAB CABLE

The grab cable is fitted around the perimeter of the stirrer and allows the stirrer to be stopped from any point along the machine.

Once activated, the stirrer can only be started once the safety switch mounted on the side of the control panel is reset.

If the stirrer fails to start at any time during normal operation, check the cable switch is in the run position.

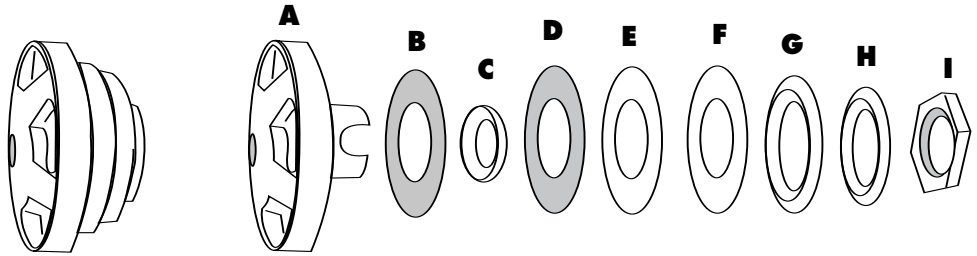
The cable tension, and therefore the sensitivity of the switch can be adjusted by the eye bolt on the side of the machine.

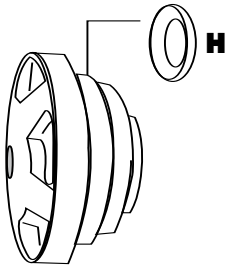
TORQUE LIMITER (SLIP CLUTCH)

All parts of the clutch should be free from oil, grease dirt or rust. Assemble onto the hub as shown in the diagram. Ensure that all parts are aligned and centred correctly before final tightening of the retaining nut.

Periodically inspect and clean all parts of the clutch. The friction plates and bush are wearing parts and may require replacement if they appear damaged or highly polished.

Take care when reassembling the clutch parts. It is very easy to break a new clutch plate if it is misaligned during assembly.





(A) HUB

(B) BUSHING

(C) CENTRE MEMBER

(D) SECOND FRICTION FACING
(ENSURE IT LOCATES ON BUSHING)

(E) PRESSURE PLATE

(F) SPRING

(G) PILOT PLATE

(H) LOCK WASHER

(I) ADJUSTING NUT

LIFT DEVICE OPERATION

The on floor stirrer system can be used on each side of a main air duct, or even in different stores. For this reason, each stirrer comes with a spreader beam and eye bolt fittings preinstalled on factory fitted lifting points on the main beam.

To change stirrer sides, the building will be fitted with a transfer beam and hoist system. Drive the stirrer to a point under this transfer beam using the adjustable stops and park switch.

At this point the auger flights will be disconnected and will need to be unscrewed from the crop. However if the store is loaded at the front down to angle of repose, this job is far easier from a proprietary man cage fitted to a front end loader.

Once in position under the transfer beam and without the augers fitted, turn off and disconnect the power supply to the stirrer. Release the tension on the catenary cable and lower it below the track level. On some stores, it will be required to move the catenary cable to its new fixings on the other side of the tunnel.

Release the clutch on the cross travel drive. This will allow the carriages to be pushed into place at the balance point marked on the first carriage and beam. Remember to tighten the clutch to prevent the carriages moving during the lift.

Move the hoist and spreader beam over the stirrer and fit the two eye bolts into the fixing point on the main beam. Shackle the spreader beam to the eye bolts and start to lift. This operation is easier with two people.

Lift the stirrer so it clears the tunnel sides and track. Push the stirrer across the tunnel at the same time turning through 180 degrees. Locate the drive wheels on the track and gently lower the stirrer into place. Make a final check for wheel alignment and that the stirrer is square to the track before lowering into place.

Remove the spreader beam and eye bolts. Lift the hoist clear.

Re-fit catenary cable if required and winch catenary cable into place. Install into cable guide on stirrer and connect mains power.

If the store is loaded to angle of repose, drive the stirrer to the front of the store and refit augers, ensuring that at least 600mm (2') is covered at the bottom of the flight. If the store is fully loaded with door barriers, the augers will require winding into the crop by hand at the shallowest part. Once in place, release the slip clutch and locate the carriage over the auger and reconnect.

Once all augers are fitted, the stirrer is ready to run between the stops as previously.

STIRRER MONITORING

Down time of any intensive on farm system is always stressful, and no more so than in the middle of harvest and drying season. This is why Harvest Installations have developed two new stirrer monitoring safeguards.

Contactless rotation sensors placed on the auger shaft look for the slippage and/or breakage of drive belts. Detecting this event early prevents considerable damage to flights, bearings and drive train. The system is built around a series of magnetic sensors which stop the stirrer if any rotation speed falls below set limits. This can be further linked to a dedicated system for text alert the client of any faults. Factory fitted, or fitted to existing units it gives peace of mind and long term savings.

This factory fitted unit uses two sensors to monitor the main beam rotation. Extreme conditions of exceptionally wet or compacted areas of crop, can create flight drag and in severe cases, breakage. Monitoring the beam position within the driving, and driven end frames, means that travel can be suspended to allow the auger flights to overcome the problem area. Delayed travel with consistent stirring means no break in drying capacity or alarm and reset delays. The system self-starts and continues to monitor beam rotation throughout the drying process.

Fitting, service and adjustment of the above monitoring system should only be carried out by a Harvest Installations nominated service engineer. Disabling or removal of fitted systems may cause severe damage to the stirrer.

FAULT FINDING

STIRRER OFF TRACK
Long travel drive wheel seized on shaft. Lift carriage clear and free wheel on shaft to ensure smooth movement. Realign stirrer.
Store overfilled. Consult Harvest Installations.

TRAVEL DRIVE MOTORS RUNNING BUT NO TRAVEL ON STIRRER
Inspect and adjust slip clutch.

TRAMLINING
Eye bolts left in beam. Remove bolts and inspect and adjust slip clutch.
Cross travel switch faulty. Consult Harvest Installation for replacement.

STIRRER VIBRATION
Auger drive system out of line or bent. Inspect flight, drive shaft, pulley and bearings for wear or damage. Replace as required.

AUGER MOTORS WILL NOT OPERATE
Check power to panel.
Check for emergency stop not reset.
Fuse F1, F2 or F3 blown.
Overloads OL1 or OL2 tripped.
Wiring damage.

NEITHER TRAVEL MOTORS RUNNING
All augers not running.
Switch not in travel position.
Overloads.
Wiring damage.

CROSS TRAVEL - NO LEFT TRAVEL
XL Timer no green light. Direction switch not working.
XL Timer green light, no amber light. Timer operating but not timed out. Faulty timer.

CROSS TRAVEL – NO RIGHT TRAVEL
XR Timer no green light. Direction switch not working.
XR Timer green light, no amber light. Timer operating but not timed out. Faulty timer.

LONG TRAVEL – NO LEFT TRAVEL
TL Timer no green light. Direction switch not working.
TL Timer green light, no amber light. Timer operating but not timed out. Faulty timer.

CROSS TRAVEL – NO RIGHT TRAVEL
TR Timer no green light. Direction switch not working.
TR Timer green light, no amber light. Timer operating but not timed out. Faulty timer.

ROUND SILO STIRRER
INSTALLATION CHECKS BEFORE STARTING

(1) Check above track for sufficient clearance around silo.

(2) Check auger length to silo floor (to finish 50mm (2") above floor highest point).

(3) Electrical installation must have been carried out by a qualified experienced electrician to include isolator inside silo as following instruction pages.

(4) Check auger flight rotation is clockwise from top.

(5) Check clearance inside silo, eg internal ladders, unloading augers, etc.

(6) DO NOT RUN AUGERS OUT OF CROP

PRE-HARVEST MAINTENANCE CHECKS

(1) Check the silo track is undamaged and all the bolts and nuts are tight, repair if damaged.

(2) Check the main drive wheels for broken teeth or damage. If not in good condition replace.

(3) Check the vee belt pulleys for wear or damage. Adjust the belts evenly. If worn or damaged replace before use. Check pulley alignment with straight edge.

(4) Check adjust and lubricate if required the two small drive chains at the drive end of the unit.

(4a) Adjust and check the main carriage movement chain and the top pull link.

(5) Check that guide arm is free and the safety tilt switch operates. Adjust with 1mm gap when operating.

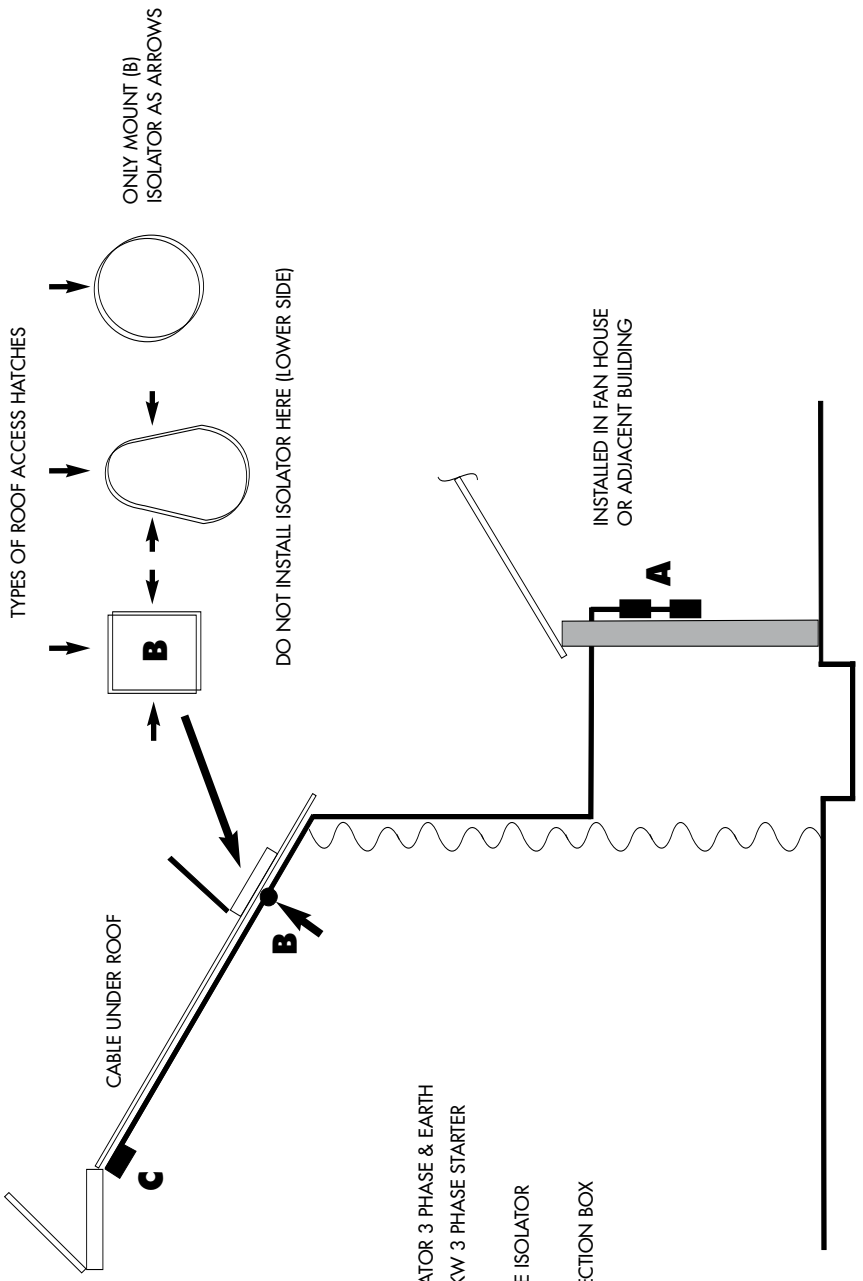
(6) Check all the electrical feed cables are securely fixed to the frame. Check for worn or broken cable outer covering.

(7) Make sure that the safety switch by the silo access hatch operates.

(8) Examine the vertical auger for wear. If they are worn or broken replace before use.

(9) Check the gear box oil filler level plug. If low top up using EP90 gear oil.

HARVEST MAXI STIRRER ROUND SILO TYPE ELECTRICAL INSTALLATIONS (BY OTHERS)



IF IN ANY DOUBT ABOUT THESE INSTRUCTIONS CONTACT HARVEST INSTALLATIONS ON 01795 533903

POWER SUPPLY FOR THE HARVEST MAXI-STIRRER ROUND SILO MODEL

1 ELECTRICAL DETAILS 3 PHASE

The Harvest Maxi-Stirrer round silo model requires to be installed using the following information.

To supply and install a 3phase isolator and direct on line (DOL) type starter unit, rated at up to 4.5kw, into the fan house or adjacent building (A).

2 ELECTRICAL DETAILS 1 PHASE

The single phase unit will require the same layout as the 3phase unit eg isolator and DOL starter, 1 phase neutral and earth (Please check power supply and loadings with your local electricity company and your installing electrician)

3 The power supply from the above starter up to the Maxi-Stirrer as follows, from the above position up the outside of the silo wall to the eaves, then under the roof to the roof access hatch by the vertical access ladder (B). Here a rotary type isolator to be installed just under the roof hatch frame to the top of RH and LH side, (not at the bottom or on the inside eaves of silo) see arrows (B).

4 The power supply cable is then installed up the under side of the silo roof to the top access hatch (C) where a junction box is installed. The Stirrer supply cable will be connected and tested by an approved installer.

5 If the silo is an open topped silo inside a building, it will be fitted with a horizontal float beam,with vertical support frame, one each end, then the rotating isolator (B) will have to be installed by the vertical access ladder at the top, then the power supply run around the outside of the silo rim to the float beam frame, where the junction box is to be installed (C).

If there are any further details required about this information please contact Harvest Installations Tel: 01795 533903 Or Fax 01795 538524

GENERAL GUIDE TO SILO AND FLOOR DRYING

EQUIPMENT REQUIRED

Casella airflow meter. Temperature / moisture spear. Moisture meter. Manometer.

HUMIDITY DRYING

Airflow

Calculated at between 50 and 60cf/m per tonne of crop, it is important to keep good airflow through the stack at all times. This allows the air to collect its maximum capacity of moisture from around the crop whilst maintaining continuous ventilation and preventing stale areas of air developing.

Duct pressures are a good way to gauge fan performance and readings on a water pressure gauge (Manometer) should typically be between 2.5 and 3.5 inches.

Opening, to reduce tunnel pressure, or closing, to increase tunnel pressure, is an ideal way to alter pressure readings and ensures maximum tonnage dried for any given fan performance.

Humidity Settings

Crop moisture content and air Relative Humidity values are directly related. A relative humidity value of 65% equates to a grain moisture content of 14.5%. It is virtually impossible to over-dry grain crop using the correct settings and an accurate humidity controller.

A full table of values is shown in the manual and on each CHC machine.

In order to dry efficiently, it is important not to try and dry down to final target values too quickly. A programme of staged removal of 2% moisture should be used. ie. 19% to 17% to 15% to finished dry stored crop. Regular readings should be made to ensure even drying and so changes to settings can be made at the optimum time to save on fan run time and gas usage.

Note: Relative Humidity Equilibrium charts are given for an ambient temperature of 15°C. Settings need to be altered if the ambient temperature falls much below this figure, as can happen overnight. For every 1°C drop in temperature, a corresponding 1% drop in target RH is required. However, during normal running and temperature fluctuations it is not necessary to make regular changes. Only reduce target RH if the temperature drops, or is likely to drop, more than 5°C overnight.

Dry Early

Generally speaking, post-harvest weather lends itself to making the best use of free drying and low gas bills when extra heat is required to maintain incoming Relative Humidity values. If the drying is left until later into the autumn when ambient temperatures are generally lower and Humidity higher, changes are required to CHC settings to maintain correct airflow into the store. This results in higher gas usage and longer drying times.

Stirring

Always stir the complete store before starting any drying. Start the stirrer once the store is part filled, and move the end stops to cover the days harvest. This practise shortens the period before drying can begin.

Making a single pass of the stirrer up and down the store every 24 hours is sufficient to maintain free flowing material and aids good airflow through the crop. If the store is loaded to a natural angle of repose at the front of the store, do not stir past the top of the slope.

Air Extraction and Condensation

It is vital during drying to maintain the correct airflows over the top of the crop and exhaust to the outside. The air flow from the top of a stack can be close to 95% RH so condensation can be an issue if good extraction is not maintained. If the drying season is being extended into the latter part of the year when cold nights are a possibility, the store should be closely monitored to prevent condensation delaying the drying process.

Forced air extraction is now the norm for new grain stores and for most conversions. This is a vital part of the efficient working of the system. As such it should never be overlooked during normal running of the store.

Final Drying

Removing the last 0.5% of moisture from the crop takes the longest time. Be patient. It may help to set incoming air 1 or 2% below the values shown on the equilibrium chart. This will help with final finishing of the drying. As always, maintain a good system of sampling and testing to ensure no over-drying takes place.

Time Scale

No heat should be applied to the stack until initial stirring of the crop is complete. If the store is to be loaded in batches, each batch requires initial stirring before its drying starts.

Once stirring is complete, turn on ventilation fans and CHC. Fans and burners should be run 24Hrs a day to ensure efficient drying takes place. It is a false economy to turn fans and burners off overnight to save power and gas. Up to 4 or 5 hours of drying can be required to get the stack back to where it was before making any new progress drying.

Keep it turned on.

Drying performance varies depending on ambient conditions, store design, store age and condition, and of course crop condition. However as a general rule, it is expected that between 0.3 and 0.5% moisture extraction should be possible from the stack in a 24Hr period.

TEMPERATURE DRYING

Airflow

Calculated at a maximum of 50cf/m per tonne of crop, it is important to keep airspeed through the stack to a minimum. This allows the heated air to transfer as much of its heat as possible into the stack. Typical air speeds measured at the top of the stack are 5 to 6f/m. Duct pressures are a good way to gauge fan performance and readings on a water pressure gauge (Manometer) should typically be between 1.5 and 2 inches.

Opening, to reduce tunnel pressure, or closing, to increase tunnel pressure, is an ideal way to alter pressure readings and ensures maximum tonnage dried for any given fan performance.

Air Temperature

Target tunnel temperature of 45 to 50°C should be a starting point for temperature drying. Once the stack temperature (See below) has reached its peak, or target level, it may be possible to reduce tunnel temperature to maintain the stack temperature.

It is becoming more common to insulate the inside of steel tunnels. This has been proved to increase the efficiency of heat transfer from air to crop, thus saving on time and gas.

Grain Temperature

A target stack temperature of 28°C is considered sufficient for high moisture extraction rates to be achieved. A maximum stack temperature of 30°C should not be exceeded.

Maintaining stack temperature throughout the drying phase is important, and reading should be taken regularly to ensure heat settings are sufficient to raise incoming ambient air to the required level. This is especially true if extending the drying time into the autumn months when colder, wetter ambient condition are the norm.

Stirring

Always stir the complete store before starting temperature drying. Start the stirrer once the store is part filled, and move the end stops to cover the days harvest. This practise shortens the period before drying can begin.

Do not stir during initial heating of the stack. Once the stack reaches target temperature commence stirring programme, either continuous or daily.

Making a single pass of the stirrer up and down the store every 24 hours is sufficient to maintain free flowing material and avoid over drying of the bottom layer. If the store is loaded to a natural angle of repose at the front of the store, do not stir past the top of the slope.

Air Extraction and Condensation

It is vital during temperature drying to maintain the correct airflows over the top of the crop and exhaust to the outside. The air flow from the top of a stack can be at 95% RH so condensation can be an issue if good ventilation is not maintained. If the drying season is being extended into the latter part of the year when cold nights are a possibility, the store should be closely monitored to prevent condensation delaying the drying process.
Forced air extraction is now the norm for new grain stores and for most conversions. This is a vital part of the efficient working of the system. As such it should never be overlooked during normal running of the store.

Final Cooling

The final part of the drying process takes part during the cooling stage. Once the sampled crop is between 1 and 1.5% above the target moisture level required, cooling should start. Cooler dry nights in late summer normally allow sufficient cooling to get grain temperatures down to safe levels. It is good practise to increase airflows as far as the store design allows during this stage to completely expel the warm damp air from the stack. This may mean blowing smaller sections of crop on increased airflows and tunnel pressures, but the effort of changing floor sections and taking regular readings of crop conditions at this stage makes for a better and more cost effective final product.

Time Scale

No heat should be applied to the stack until initial stirring of the crop is complete. If the store is to be loaded in batches, each batch requires initial stirring before its drying starts. Under normal harvest time conditions, heating of the stack to the target 28°C should take between 8 and 12 hours. Keeping airflows low as described above will make maximum use of the heat energy in the air stream.

Drying performance varies depending on ambient conditions, store design, store age and condition, and of course crop condition. However as a general rule, it is expected that between 1.5 and 2% moisture extraction should be possible from the stack in a 24Hr period. Careful and regular readings should be taken and monitored during this period. And remember that an extra 1% reduction can easily be achieved during cooling.

QUESTIONS & ANSWERS

Q. How long does it take for the stack to reach target temperature of 28 to 30°C.
A. Depending on harvest conditions it general takes between 8 and 12 hours.

Q. I cannot get the stack temperature up to 28°C?
A. Ensure that the correct airflow is being used. Slowing the airflow down will give the heated air longer to transfer its energy to the crop.
Ensure all forced exhaust ventilation is operating correctly.
Check temperature setting on CHC unit and that tunnel temperature is being held.
If all the above is correct. Run the stirrer for one complete pass up and down the store.

Q. Should I operate the stirrer continuously during temperature drying?
A. It is not necessary to operate the stirrer continuously to maintain airflow.
However, stirring can affect stack temperature. Not stirring will generally help increase stack temperature. Stir to lower stack temperature.
The store should still generally be stirred once every 24 hours.

Q. What is the difference in cost of temperature and humidity drying?
A. Temperature drying costs are generally 15% to 20% lower than humidity drying.
Temperature drying consumes large volumes of gas for a short period.
Humidity drying will consume far lower volumes of gas but for a much extended period.

Q. Should I operate the stirrer continuously during humidity drying?
A. No. Operating the stirrer once every 24 hours is sufficient to maintain good airflow and even out moisture gradients in the crop.

Q. When using humidity drying, should I use the same CHC setting as on a conventional static store?
A. Generally, yes. The CHC unit works most efficiently when drying 2% - 3% at any one time.

Q. Will I re-wet the crop during cooling?
A. Cool nights after harvest give the best cooling time but can lead to higher humidity than is desirable. Only when stack temperature is very close to ambient temperature is it possible, but unlikely, to wet the crop. To safeguard night time cooling, set the CHC unit to RH with a target setting of 70%. This will allow cooler air to be used whilst guarding against blowing saturated air.

Q. How many passes are required to totally stir the crop?
A. Nominally 6 complete passes up and down the store would be sufficient to cover the total store area. The stirrer track should be checked to ensure no tracking has occurred and sections of the store missed.