



Preventative Maintenance For Feed Processing Facilities and Equipment

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The goal of on-farm feed manufacturing is to produce feed that meets the intended specifications, both in nutritional composition and desired medication level, and is free of contaminants. The production of quality feed will enhance animal performance and improve the profitability of the livestock enterprise.

A set of guidelines for processing feed, referred to as Good

Manufacturing Practices (GMPs), are designed to prevent feed contamination and provide reasonable assurance that the feed is manufactured accurately. These guidelines serve as Food and Drug Administration (FDA) regulations. Everyone involved in producing medicated or nonmedicated feed, whether at a commercial off-farm plant or at an on-farm mill or grinder/mixer, must comply with the GMPs.

The objective of this bulletin is to provide the on-farm feed processor or nonregistered commercial mill operator with useful information pertaining to the maintenance of facilities and equipment. Correct application of these technologies will improve feed quality and operation efficiency, reduce the likelihood of feed contamination, and help ensure safe meat, milk, and eggs destined for human consumption.

Buildings and Grounds

Buildings and grounds must be constructed and maintained to prevent the contamination of feed by rodents, insects, birds, nonfeed additives (chemicals, lubricants, dangerous foreign material such as glass), and moisture.

The Code of Federal Regulations (CFR's Title 21 Part 225.120) states that "buildings used for production of medicated feed shall provide adequate space for equipment, processing, and orderly receipt and storage of medicated feed. Areas shall include access for routine maintenance and cleaning of equipment.

Buildings and grounds shall be constructed and maintained in a manner to minimize vermin and pest infestation."

Grain bins, hatches, lids, augers, and terrain around the bin should all prevent moisture from entering the grain and feed components. Feed ingredients must be protected from excess moisture to avoid contamination by mold that can possibly produce harmful toxins and reduce palatability.

Rodents, birds, and insects can potentially spread disease through feces, urine, and body parts such as feathers or hair. They can cause grain to become sample grade or another type of grade reduction, and they can consume significant amounts of feed ingredients. Roofs, walls, doors, and floors of feed manufacturing and storage facilities should be designed and maintained to prevent entry of these pests.

For further information pertaining to the design of bulk and bagged storage facilities for feed and feed ingredients, refer to Kansas State University Extension Bulletins MF-2039 and MF-2040.

Equipment

Feed processing equipment must be designed, maintained, and operated in such a manner to ensure accuracy in ingredient proportioning and adequate processing. The CFRs (Part 225.130) for feed manufacturing equipment state, "equipment shall be capable of producing medicated feed of intended potency and purity and shall be maintained in a reasonably clean and orderly manner. Scales and liquid metering devices shall be accurate and of suitable size, design, construction, precision, and accuracy for their intended purposes. All equipment shall be designed, constructed, installed, and maintained so as to facilitate inspection and use of clean-out procedure(s)."

Preventive Maintenance

A plan to regularly check (or service) equipment and make necessary repairs on a scheduled basis will more than pay for itself when compared to having to do the same work in a crisis or hurried situation. As a general rule, for every dollar spent on preventive maintenance, you will save at least five dollars in subsequent expenses.

Maintenance is defined as the proper planning and action to minimize and avoid breakdowns and lost time. If an incident does occur, maintenance is a prepared and organized plan to return operations to normal in as short a time as possible.

Maintenance can be divided into four different types.

Routine maintenance consists of servicing equipment on a scheduled basis. This may consist of activities such as lubrication of bearings, replacing hammermill screens, turning or replacing hammers, checking drive V-belts, and checking oil levels in gear boxes.

Emergency maintenance entails reacting to unscheduled breakdowns. This maintenance must be done immediately and supersedes all other types.

Call-in maintenance usually involves an emergency situation where the people required are not at hand and must be summoned from somewhere else, such as a millwright service or contractor.

Preventive maintenance consists of scheduled inspections and making adjustments and repairs to equipment to make sure it is in proper working order. This includes the replacement (based on observed conditions or known useful life spans) of worn parts prior to failure.

The first step in developing a maintenance program entails collecting good information and organizing it in a useful form. The charts in the back of this bulletin will assist the preparation of an individualized program. This information may be gathered under the following headings:

1. Equipment identification
2. Equipment information
3. Equipment maintenance requirements
4. Parts inventory
5. Maintenance records

Equipment Identification

At some point, every piece of equipment in the feed mill will need maintenance of some type. In order to track the frequency of maintenance needed and its type and cost, each piece of equipment must be identified in some manner. Each piece of equipment should have its own identification number. An

easy way to accomplish this is to draw a flow of the entire feed milling process showing each piece of equipment along with its identification number (Figure 1). It also may be desirable, in larger plants, to not only identify the equipment by number, but also by system, cost center, or physical location. An example would be A-RE-1 which says receiving conveyor #1 is located in building or area A.

Once the decision has been made on how to assign identification numbers to the equipment, it is necessary to prepare a master list of the equipment showing each identification number and the piece of equipment it identifies (See Chart 1).

Equipment Information

Having an equipment identification system is useless unless it is used as the key to getting and keeping information about each machine. This is most easily done by filling out an information sheet on each piece of equipment. A sample information sheet is shown in Chart 2. The information may be gathered from operating manuals, purchase records, visual inspection, supplier information, or other sources. The information should include not only key part data and sizes, but also a supplier code to show where parts may be found. This code could indicate a supplier's name, address, and phone number; or if the part is in plant inventory the code may just say "inv." A type of supplier master list could be used as shown in Chart 3. Separate supplier code pages should be used for each letter of the alphabet.

Equipment Maintenance Requirements

Each manufacturer can supply recommended routine maintenance procedures and schedules for the equipment they supply. This information may be found in installation and operating manuals, catalogs, or by direct contact with the supplier. Lubrication frequencies depend on operating conditions and time intervals. The equipment supplier, or your lubricant supplier, can suggest proper scheduling intervals and amounts to be used. Regular equipment checking and maintenance also will help to identify proper preventative maintenance scheduling and types. Emergency maintenance situations, especially as a history is developed for a machine, will determine routine and preventive maintenance scheduling. A suggested maintenance schedule form is shown in Chart 4. Maintenance procedures, except for emergency maintenance, should be tied to a calendar to ensure that required maintenance occurs as scheduled. See Chart 5 for a sample maintenance calendar.

Parts Inventory

It would be wonderful if every time an emergency maintenance situation occurred, the necessary parts were on hand and available. Unfortunately, no company can afford the cash outlay it would require for the parts. A sensible approach to the parts inventory situation is to classify parts into three categories.

- Critical hard-to-get parts,
- Parts readily available from a supplier,
- Parts that allow sufficient time for securing.

Parts that are crucial or hard to get should be kept on hand or where they can be immediately obtained. Noncritical parts may be ordered from suppliers as needed.

On the Equipment Information sheets you may want to include a required availability code by each part or piece of equipment. A suggested coding might be:

- I** = On hand (plant inventory),
- S** = On hand at supplier, and
- O** = must be ordered.

The parts needed in plant inventory will be determined by how often they are needed. Routine, preventive, and emergency maintenance records will help identify availability requirements for parts.

Maintenance Records

As maintenance work is performed, a separate record of what was done, parts required, labor required, special equipment required, and other cost items should be kept. A total cost for each maintenance operation should be figured and shown on the record form. This information will soon establish the maintenance cost for each machine. It will indicate potential and continuing trouble spots. It will tell how often preventive maintenance should be scheduled and what should be done to avoid emergency maintenance situations. It helps in making decisions about repairing or replacing equipment or even eliminating an operation or process. A simple maintenance record form is shown in Chart 6.

Figure 1. Feed mill flow diagram

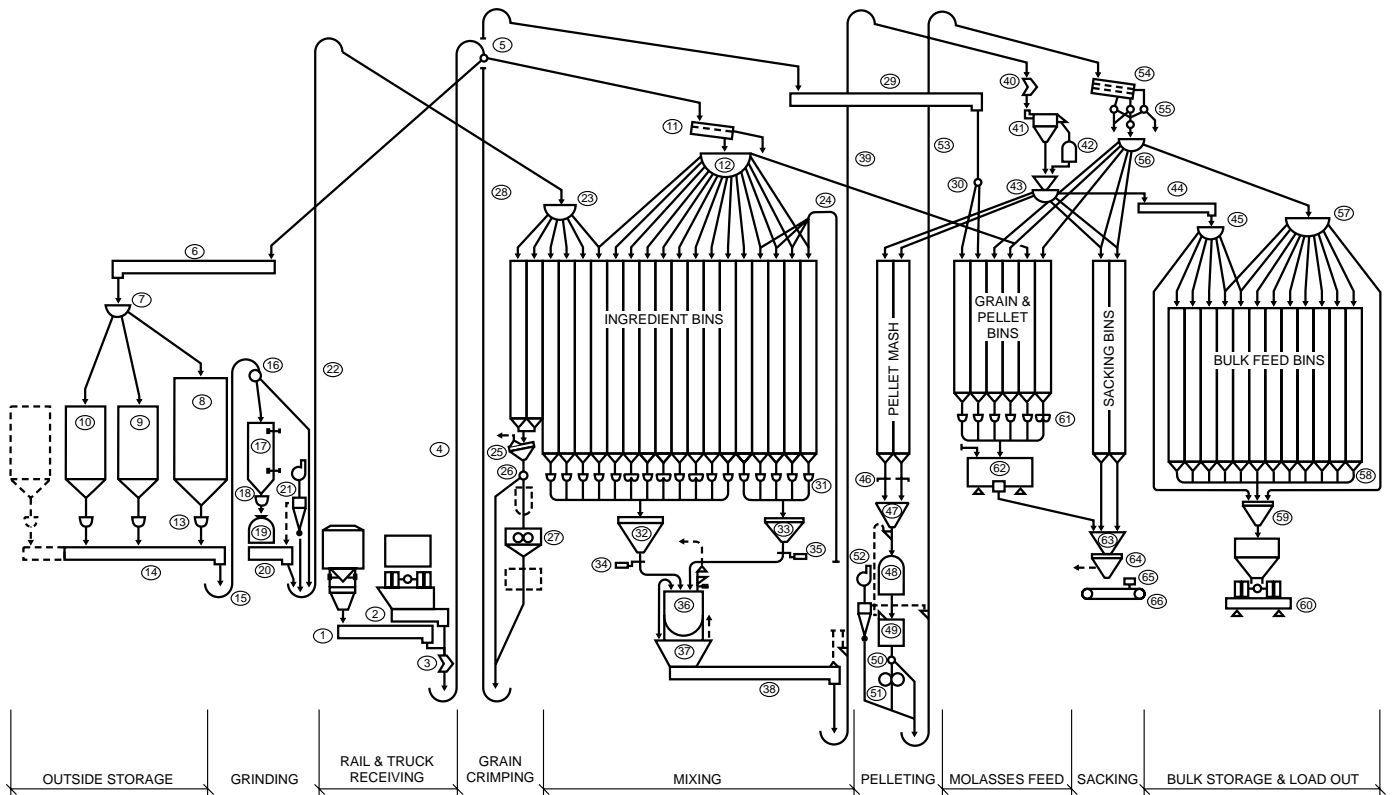


Chart 1 EQUIPMENT LIST

I.D. # Description	I.D. # Description
1. Rail Receiving Conveyor	25. Grain Screener (with Aspiration)
2. Truck Receiving Conveyor	26. Two-Way Valve
3. Magnet	27. Grain Crimper
4. Receiving Elevator	28. Crimped Grain Elevator
5. Two-Way Valve	29. Transfer Conveyor
6. Transfer Conveyor	30. Two-Way Valve
7. Turnhead Distributor	31. Ingredient Bin Screw Feeders
8. Corn Storage Bin	32. Main Ingredient Scale
9. Milo Storage Bin	33. Mineral Ingredient Scale
10. Alfalfa Storage Bin	34. Scale Air Gate
11. Receiving Scalper	35. Scale Air Gate
12. Receiving Distributor	36. Batch Mixer
13. Storage Bin Feeders	37. Surge Bin
14. Grain Transfer Conveyor	38. Surge Conveyor
15. Grain Transfer Elevator	39. Mixing Elevator
16. Two-Way Valve	40. Magnet
17. Surge Bin and Level Control	41. Mash Cleaner
18. Hammermill Feeder	42. Overs Regrinder
19. Hammermill	43. Mash Distributor
20. Hammermill Discharge Conveyor	44. Mash Transfer Conveyor
21. Hammermill Air System	45. Mash Distributor
22. Grinding Elevator	46. Slide Gates
23. Grinding Distributor	47. Surge
24. Pneumatic Receiving Pipes	48. Pellet M

Chart 2 EQUIPMENT INFORMATION

Equipment ID# <u>4</u>	Description <u>Receiving</u>
Date Installed <u>6/85</u>	Installer <u>Goodwell Construction</u>
Motors (Supplier Code <u>A-1</u>)	Frame _____
Brand <u>Bagdor</u>	Serial _____
HP <u>15</u>	Shaft _____
RPM <u>1800</u>	Sleeve _____
Volts <u>230/460</u>	Design _____
Amps _____	Code _____
Input RPM <u>—</u>	Tongue _____
Output RPM <u>—</u>	Misc. _____
Bearings (Fan) <u>—</u>	Input Shaft _____
Gearbox (Supplier Code <u>P-5</u>)	Input Sheave _____
Brand <u>Dodge</u>	Output Shaft _____
Model <u>TXT 525</u>	Misc. _____
Serial _____	Leg Belt _____
Ratio <u>25:1</u>	Leg Cups _____
V-Belts <u>5V630</u>	Augers _____
Chain <u>—</u>	Bearings (Supplier Code _____)
Couplings <u>—</u>	Leg (top) _____ (bottom) _____
Misc. _____	Auger (tail shaft) _____ (hangers) _____
Driven Equipment (Supplier Code _____)	Shafts _____
Driven Shaft _____	Shafts _____
Driven Sheave Sprocket _____	Misc. Bearings _____
Jackshaft Input Shaft _____	Misc. Bearings _____
Input Sheave, Sprocket _____	Misc. Bearings _____
Output Shaft _____	Misc. Bearings _____
Output Sheave, Sprocket _____	Cups/Paddles (Supplier Code _____)
Final Shaft _____	Brand _____
Final Sheave, Sprocket _____	Style _____
Belt/Chain (Supplier Code _____)	Size _____
Brand _____	Spacing _____
Type _____	Bolts _____
Width _____	Punching _____
Ply/Size _____	Quantity _____
Length _____	
Splice _____	
Fastener _____	
Other Information	Supplier Code
_____ (_____)	_____ (_____)
_____ (_____)	_____ (_____)
_____ (_____)	_____ (_____)
_____ (_____)	_____ (_____)

Chart 3 SUPPLIER LIST

A

Code A-1 Code _____
 Name: Acme Electric Co. Name: _____
 Address: 201 S. Green Address: _____
Jones, Kan. 66000 _____

 Day Phone: 913-555-0000 Day Phone: _____
 FAX: 913-555-0900 FAX: _____
 Other Phone: 913-666-5678 Other Phone: _____
 Contact: Bill Smith Contact: _____

Code A-2 Code _____
 Name: Adams Supply Name: _____
 Address: 1613 Highway 1 Address: _____
Southtown, Kan. 60006 _____

 Day Phone: 316-444-5555 Day Phone: _____
 FAX: 316-444-1000 FAX: _____
 Other Phone: 316-321-9876 Other Phone: _____
 Contact: John Adams Contact: _____

Code _____ Code _____
 Name: _____ Name: _____
 Address: _____ Address: _____

 Day Phone: _____ Day Phone: _____
 FAX: _____ FAX: _____
 Other Phone: _____ Other Phone: _____
 Contact: _____ Contact: _____

Chart 4 MAINTENANCE SCHEDULE

Equipment ID: 4 Description: Receiving Elevator

	Daily	Weekly	Monthly	6 Months	12 Months
1. Check Grease Bearings					
2. Check Gearbox Oil			X		
3. Change Gearbox Oil					X
4. Grease Motor Bearings				X	
5. Check V-Belts		X			
6. Oil Chains					
7. Check Leg Belt		X			
8. Check Leg Cups			X		
9. Check Roto Guard/Oil/Belt					
10. Check Head Pulley					X
11. Check Grad Chain Paddles					
12. Check Hanger Bearings					
13. Check Air Filter					
14. Blow Off Condensate					
15. Check Crankcase Oil					
16. Change Crankcase Oil					
17. Check Hydraulic Oil/Leaks					
18. Additional Maintenance					

Chart 1

EQUIPMENT LIST

I.D. #	Description
1.	_____
2.	_____
3.	_____
4.	_____
5.	_____
6.	_____
7.	_____
8.	_____
9.	_____
10.	_____
11.	_____
12.	_____
13.	_____
14.	_____
15.	_____
16.	_____
17.	_____
18.	_____
19.	_____
20.	_____
21.	_____
22.	_____
23.	_____
24.	_____

I.D. #	Description
25.	_____
26.	_____
27.	_____
28.	_____
29.	_____
30.	_____
31.	_____
32.	_____
33.	_____
34.	_____
35.	_____
36.	_____
37.	_____
38.	_____
39.	_____
40.	_____
41.	_____
42.	_____
43.	_____
44.	_____
45.	_____
46.	_____
47.	_____
48.	_____

Chart 2

EQUIPMENT INFORMATION

Equipment ID# _____

Date Installed _____

Motors (Supplier Code _____)

Brand _____

HP _____

RPM _____

Volts _____

Amps _____

Input RPM _____

Output RPM _____

Bearings (Fan) _____

Gearbox (Supplier Code _____)

Brand _____

Model _____

Serial _____

Ratio _____

V-Belts _____

Chain _____

Couplings _____

Misc. _____

Driven Equipment (Supplier Code _____)

Driven Shaft _____

Driven Sheave Sprocket _____

Jackshaft Input Shaft _____

Input Sheave, Sprocket _____

Output Shaft _____

Output Sheave, Sprocket _____

Final Shaft _____

Final Sheave, Sprocket _____

Belt/Chain (Supplier Code _____)

Brand _____

Type _____

Width _____

Ply/Size _____

Length _____

Splice _____

Fastener _____

Description _____

Installer _____

Frame _____

Serial _____

Shaft _____

Sleeve _____

Design _____

Code _____

Tongue _____

Misc. _____

Input Shaft _____

Input Sheave _____

Output Shaft _____

Misc. _____

Leg Belt _____

Leg Cups _____

Augers _____

Bearings (Supplier Code _____)

Leg (top) _____ (bottom) _____

Auger (tail shaft) _____ (hangers) _____

Shafts _____

Shafts _____

Misc. Bearings _____

Misc. Bearings _____

Misc. Bearings _____

Misc. Bearings _____

Cups/Paddles (Supplier Code _____)

Brand _____

Style _____

Size _____

Spacing _____

Bolts _____

Punching _____

Quantity _____

Other Information**Supplier Code**

_____ (_____)

_____ (_____)

_____ (_____)

_____ (_____)

Chart 3

SUPPLIER LIST

A

Code _____

Name: _____

Address: _____

Day Phone: _____

FAX: _____

Other Phone: _____

Contact: _____

Code _____

Name: _____

Address: _____

Day Phone: _____

FAX: _____

Other Phone: _____

Contact: _____

Code _____

Name: _____

Address: _____

Day Phone: _____

FAX: _____

Other Phone: _____

Contact: _____

Code _____

Name: _____

Address: _____

Day Phone: _____

FAX: _____

Other Phone: _____

Contact: _____

Code _____

Name: _____

Address: _____

Day Phone: _____

FAX: _____

Other Phone: _____

Contact: _____

Code _____

Name: _____

Address: _____

Day Phone: _____

FAX: _____

Other Phone: _____

Contact: _____

Chart 4

MAINTENANCE SCHEDULE

Equipment ID: _____

Description: _____

	Daily	Weekly	Monthly	6 Months	12 Months
1. Check Grease Bearings					
2. Check Gearbox Oil					
3. Change Gearbox Oil					
4. Grease Motor Bearings					
5. Check V-Belts					
6. Oil Chains					
7. Check Leg Belt					
8. Check Leg Cups					
9. Check Roto Guard/Oil/Belt					
10. Check Head Pulley					
11. Check Grad Chain Paddles					
12. Check Hanger Bearings					
13. Check Air Filter					
14. Blow Off Condensate					
15. Check Crankcase Oil					
16. Change Crankcase Oil					
17. Check Hydraulic Oil/Leaks					
18. Additional Maintenance					

Chart 5**MAINTENANCE CALENDAR**

Month:

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

