

# Maintenance Schedules

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The Scheduled Maintenance tasks recommended throughout this manual are summarized in the tables in this chapter.

Please remember that all of the tasks and frequencies are general recommendations, which will not suit every plant. Actual schedules for each plant should be adjusted, taking into account other factors such as:

- plant maintenance history
- equipment design and options installed
- equipment manufacturers' recommendations
- age and condition of the equipment
- relative cost and urgency of downtime for the plant

For this reason we have supplied copies of the tables in spreadsheet format on computer CD, so that the tables may be edited to suit each particular plant.

The tables are printed here and saved on the CD with the tasks sorted in two different ways:

- Grouped by "**skills**," or similar types of work, such as Hydraulic, Electrical, and Combustion. While few extruders actually have such specialized maintenance staff, it seems helpful to group similar tasks together in these tables. This master file is saved as MasterPM.\* on the CD.
- Grouped by **frequency** (daily, weekly, monthly, etc.) In fact, PM checks are usually cumulative, i.e. the monthly checks would also include all of the daily and weekly items as well. For this reason the **yearly** schedule incorporates all items and is treated here as the master list.

In the spreadsheet format, each task is coded in the far left column according to skill and frequency, to allow easy sorting into groups by using the Sort function of the spreadsheet program. Of course the user may easily change the sort codes or add others for customizing the tables.

The spreadsheets of scheduled maintenance have been formatted as \*.XLS files for Microsoft® Excel and are included on the CD version (also included with the book version of this manual). Copy it to your hard disk, and make a back-up before it becomes lost or misplaced! To request a copy of these files, send an e-mail to: [alkennedy@usa.net](mailto:alkennedy@usa.net).

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- Pressure Plates



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## When to Perform Extrusion Plant Maintenance

### Preventive, Predictive, or Reactive Maintenance?

Waiting until after a failure has occurred is called **Reactive Maintenance**. Others call this “breakdown maintenance.” Whatever name is used, it is almost always a bad policy to wait for breakdown to take action, for several reasons:

- Unplanned downtime is likely
- Overtime for maintenance workers may be required
- Production workers may have to stand idle during emergency repairs
- Because the work is unplanned, necessary skills and materials may not be on hand
- The damage may be worse than if the problem had been repaired earlier

One alternative is **Preventive Maintenance**, which for our purposes will be defined as *interval-based maintenance*, or maintenance which is scheduled at some fixed interval of time, or perhaps according to some other unit interval such as hours, miles or pounds. For some items, such as oil changes or timing belt replacement on an automobile, interval-based or preventive maintenance is appropriate. However, for many other items wear is not so predictable based on interval alone, so we must consider other factors when deciding to perform maintenance.

**Predictive Maintenance** is defined as *condition-based* and so involves some type of regular inspection or measurement to determine when replacement or maintenance should be performed. Classic examples of predictive maintenance include replacing automobile tires based on tread wear, or monitoring cracks in extrusion press tie-rods to determine when replacement is necessary.

In the 1<sup>st</sup> edition of the Extrusion Press Maintenance Manual we used the term **Preventive Maintenance** to describe the tables of maintenance schedules; but according to the definitions above, most of the schedule items involve checks and so are actually predictive in nature. Perhaps the correct name should be **Proactive Maintenance**, meaning that action is taken before problems occur.

It is useful to look at the patterns of probability of equipment failure during the life of a component<sup>1</sup>. The pattern in **Figure A-1** describes the classical “wear out” view of plant equipment. The theory is that the interval “x” can be determined from equipment records and used to take preventive action just before failure occurs. This relationship between age and failure tends to be true in certain cases, mainly where product comes in contact with a component, such as containers, dies, and graphite or Kevlar materials on cooling tables. Fatigue of major press components is also age-related.

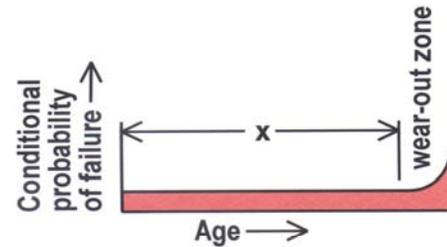


Figure A-1: The traditional “wear out” view of plant equipment.

However, there are other well-defined patterns of equipment failure probability, as shown in **Figure A-2**. Which of these patterns apply to which extrusion plant components? If you plan to overhaul a component on an interval basis, “just in case” it may be needed, you will need to know which of these patterns applies to that component.

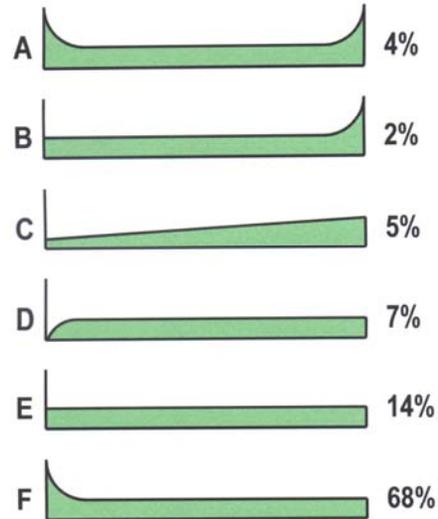


Figure A-2: Six well-defined patterns of equipment failure probability.

As it turns out, it can be very hard to predict which pattern applies. For example, studies on civil aircraft showed the following distribution of failure patterns:

A	4%
B	2%
C	5%
D	7%
E	14%
F	68%

While extrusion presses are quite different from aircraft, we can still see from this example that the connection between reliability and operating age is not always easy to predict. And unless there is a clear connection between age and failure, equipment overhauls at fixed interval may not increase reliability. “Overhauls are extraordinarily invasive undertakings that massively upset stable systems<sup>2</sup>.” In other words, if it isn’t broken, it may be better to check it than to overhaul it.

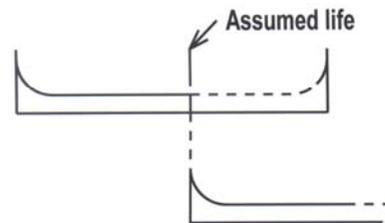


Figure A-3: Overhauling an item “just in case” it might fail after some point creates the possibility that the overhaul itself will cause the item to fail.

Pattern A in **Figure A-2** is often called the “bathtub” because of the upward curves at each end. This is the classic pattern usually predicted for electronic components – high losses during “burn-in,” followed by good reliability until the end. Considering this example, note in **Figure A-3** what happens when such a component is replaced early, “just in case” – the probability of failure is actually increased due to the so-called “infant mortality” of this type of component. Thus we see just one of the possible risks to keep in mind when following interval-based maintenance.

With these limitations in mind, note that most of the Scheduled Maintenance items in the **Maintenance Schedules** actually consist of inspections or checks, and so are condition-based. These

<sup>1</sup> Moubray, John, Aladon Ltd., “Redefining Maintenance”, *Maintenance Technology*, March 1996.

<sup>2</sup> Ibid.

are based on the idea that we will be able to detect when failure has just begun to occur, but before it is too late. This concept is shown in **Figure A-4**.

The time interval between P, when the failure can first be detected, and F, when complete failure occurs, (**Figure A-5**) is quite important, as it determines the frequency of inspections. To illustrate, consider the inspection interval as shown in **Figure A-6**. It becomes clear that almost one complete inspection interval can pass after the problem shows up before it is actually found. Therefore, the ideal inspection interval is somewhere between  $\frac{1}{2}$  and 1 times the P-F interval.

While these concepts help us understand about inspection and maintenance intervals, in practical terms we never have enough information to make informed decisions. We don't know the probability-of-failure pattern, and we don't know the P-F intervals. Therefore we must rely on our past experience and the recommendations of others.

The tables in the **Maintenance Schedules** have been compiled from many sources: prior versions of the manual, vendor's recommendations, and advice from many experienced people. These serve as an excellent starting point or reference for you to construct your own maintenance schedules. The tables are available on diskette to allow for easy revision to suit your own applications.

The other essential tool for a Proactive Maintenance program is the best possible record of repair histories for each equipment component. With Personal Computer-based record systems, it is now very easy to set up and maintain complete histories, which can then be used to identify recurring repairs and to establish the desired frequency for inspection and/or replacement. Records on a PC may be set up using spreadsheet or database software, or a Computerized Maintenance Management System (CMMS), which will be discussed later.

A good program of Proactive Maintenance includes regular, scheduled inspections, lubrication, diagnostic tests, and the occasional strategic replacement of wearing parts before they fail. Each scheduled "PM" shutdown will usually include some repairs which have been identified during daily or weekly inspections.

In any extrusion plant, it is vital to have a plan for managing the problems of fatigue failure of major extrusion press components. High-cycle fatigue is an important strategic business concern in every extrusion plant. Without a plan, a major component failure is sure to occur – it is not a matter of "if" but "when." Therefore, every extrusion firm's top management must be concerned with this issue and must insure that a suitable program is in place, to insure against unplanned expenses and major breakdowns. Various firms can offer assistance in setting up and following such a program; one example is Det Norsk Veritas, whose excellent paper on the subject is included in **Chapter 4** of this *Manual*.

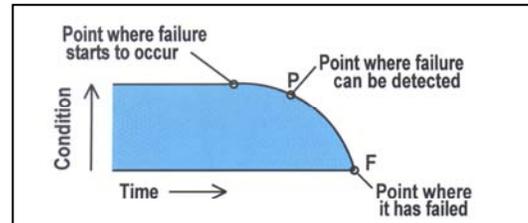


Figure A-4: The P-F curve shows how a failure starts and deteriorates to the point where it can be detected.

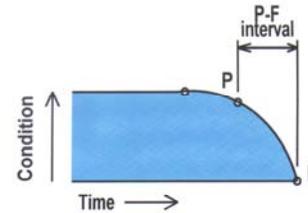


Figure A-5: The P-F interval is the amount of time between the potential failure point and the functional failure point.

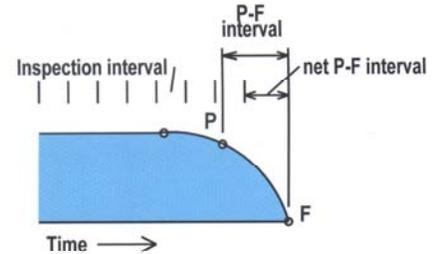


Figure A-6: The net P-F interval is the P-F interval less one inspection interval.

## Extrusion Press Master Maintenance Schedule

Press No. \_\_\_\_\_

Date \_\_\_\_\_

Item	Look For:	Notes	Daily	Weekly	Monthly	Quarterly	6 Mo.	Annually
<b>EXTRUSION PRESS -- MECHANICAL</b>								
Guide ways	Brass pick-up	May indicate partial contact						
Guide ways	Nicks or other damage to surfaces							
Guide way wipers	Failure to wipe guide way clean							
Cylinders (main ram, crosshead, container)	Increase in amount of oil on main ram or cylinder rod	May indicate damage to packing. Also check bushings.						
Cylinders (main ram, crosshead, container)	Oil leaks at cylinder connections							
Cylinders (main ram, crosshead, container)	Nicks or other damage to rods or main cylinder	Damage to packing will result						
Cylinders (crosshead, container)	Excess heat	May indicate oil by-passing piston						
Tie rod nuts	Space between nuts and platen	May indicate loss of pre-stress						
Tie rod nuts	Match marks indicating nut has rotated							
Container cylinders	Oil by-passing piston head	Hold container against die stack at full pressure and check for temperature rise						
Main ram, crosshead and container cylinders	Nicks or other damage to rods or main cylinder	Remove nicks with polishing stone						
Cylinder packing	Embedded particles	Replace packing if scoring recurs						
Billet loader	Loose bolts							
Billet loader	Looseness in bushings or pivot pins							
Butt shear	Blade tight in mounting							
Butt shear	Nicks or other damage to blade							
Die hold-down clamp	Tightness -- properly holds die stack	Die stack should not move during shear cycle						
Clean-up press and related equipment	Metallic chips or dirt on guide ways, cylinder rods, or main ram							
Guide ways	Remove shoes and check fully	Replace or re-machine as needed						
Check and tighten all bolts and other mechanical connections	Bolts or cylinder mountings which may have worked loose; check cylinder bolts under load, re-tighten and check that cylinders are level							
Die changer pockets or carriers	Wear or damage, including keyways							
Tie rod nuts	Space between inside nuts and platen with press under load	May indicate loss of pre-stress						
Tie rod nuts	Space between outside nuts and platen with press relaxed	May need to tram press and restress tie rods						
Tie rod nuts	Match marks indicating nut has rotated							
Guide ways	Remove shoes and check fully	Replace or re-machine as needed						
Guide ways	Check for wear or scoring of guide ways	Use stone or file as needed						
Die changer slide ways (gibs)	Adjustment for wear as needed							
Butt shear	Adjust or replace worn bushings as needed							
Main ram, crosshead and container cylinders	Check clearances of packing and bushings (also when replacing packings)							
Tie rods	Ultrasonic testing for cracks	More frequent follow-up if a flaw is detected						

## Extrusion Press Master Maintenance Schedule

Press No. \_\_\_\_\_

Date \_\_\_\_\_

Item	Look For:	Notes	Daily	Weekly	Monthly	Quarterly	6 Mo.	Annually
<b>EXTRUSION PRESS -- PRESS ALIGNMENT</b>								
Billet loader	Billet centered with container							
Butt shear	Clearance between shear blade and die stack							
Stem and container	Stem level with main ram							
Stem and container	Stem aligned with container							
Billet loader	Aligned with container							
Butt shear	Clearance between blade and tool stack (hot)							
Main ram	Check level in 3 positions	Variation indicates wearing of crosshead shoes; re-adjust						
Press base	Check level -- both ways							
Press frame	Check that tie rods are level, in both directions, both top and bottom rods							
Container and die stack	Check alignment of container to die stack							
Container and die stack	Adjust center guide (if fitted) for excessive clearance							
Die slide	Check die slide stops for centering with platen pressure ring							
Tie rods	Tram press --- measure length between platen & main cylinder flange faces to check parallel	Maximum variation 0.010 inches						
<b>EXTRUSION PRESS -- LUBRICATION</b>								
Fill all oil reservoirs and remove water								
Grease all required locations								
<b>EXTRUSION PRESS -- TOOLING</b>								
Container	Good sealing surface: no nicks or build-up							
Container liner	Not "bellied" (no increase in diameter at center)							
Stem	Straightness, stress cracking							
Dummy block	Wear (dimensional check)							
Dummy block	Aluminum build-up on block							
Dummy block	Nicks, stress fractures							
Stem pressure plate	Coining or dishing	Use straightedge and feeler gauge						
Platen pressure ring	Coining or dishing	Use straightedge and feeler gauge						
Container	Movement between container and holder	Tighten retainer or cap is possible. Repair and remachine if cracked or distorted.						

## Extrusion Press Master Maintenance Schedule

Press No. \_\_\_\_\_

Date \_\_\_\_\_

Item	Look For:	Notes	Daily	Weekly	Monthly	Quarterly	6 Mo.	Annually
<b>EXTRUSION PRESS -- HYDRAULIC</b>								
Oil level	Visual, with main ram in same position each time oil level is checked	Level varies considerably according to the position of the main ram.						
Oil condition	Air bubbles or foam	Aeration of oil may cause cavitation						
Oil color	Darkening (from heat) or clouding (from water)							
Oil temperature	Change in operating temperature; normal maximum 140 F (60 C)	May indicate internal by-passing in system or problems with cooling equipment						
Oil leaks	Visual inspection or pressure test.	Repair as required. Oil leaks may cause loss of pressure, air in system, excessive heat, dirty equipment, safety hazards						
Erratic operation	Movements that are unusual: jerky, chattering, erratic, etc.	May indicate impending part failure						
Oil filters	Filter indicator or pressure gauge	Change cartridge if indicated						
Pumps	Vibration	May indicate impending pump failure						
Control tubing	Excess heat	May indicate system oil in pilot system						
Piping clamps and supports	Loose or broken supports	May result in pipe failures						
Relief valves	Excess heat (in relief line)	May indicate abnormal opening of relief						
Pressures throughout system	Change from normal pressures	May indicate impending component failure						
Heat exchanger	Leaks, scale, or corrosion	Repair or clean. May cause oil contamination, excessive heat, or loss of oil or water.						
Temperature control	Temperature at which water valve opens	Check if opening and closing at proper temperature						
Flexible hoses	Physically inspect for damage or deterioration, replace as required	Avoid downtime, loss of fluid, safety hazard.						
Clean-up of equipment	Wash down, remove rags, etc.	Avoid dirt entering system, makes it easier to spot leaks, eliminates fire and safety hazards						
Air breathers	Remove, clean, re-oil, and re-install	Avoid dirt in system, pump cavitation.						
Hydraulic pipe, tubing, and connections	Tighten all bolts, connections, and pipe supports; replace bad fittings or O-rings	Avoid downtime, loss of fluid, safety hazard.						
Tank magnets	Clean off any foreign material	Avoid oil contamination						
Hydraulic valves	Oil leaks, broken solenoid covers or wires	Tighten bolts and pipe connections						
Oil sample for analysis	Contamination, oil breakdown, loss of properties	Send sample to oil supplier						
Relief valve settings, timer settings, etc.	Incorrect settings --- check with pressure gauges and stop watch; readjust as required	Avoid erratic operation of equipment						





**Extrusion Press  
Master Maintenance Schedule**

Press No. \_\_\_\_\_

Date \_\_\_\_\_

Item	Look For:	Notes	Daily	Weekly	Monthly	Quarterly	6 Mo.	Annually
<b>PRESS FEED LINE -- MECHANICAL</b>								
Check log shear operation.	Correct sequence of function, smoothness, alignment of log travel.		■	■	■	■	■	■
Check that all guards and safety devices are in place and operating properly.			■	■	■	■	■	■
Check log shear cutting tools.	Clearance and metal build-up.		■	■	■	■	■	■
Check guides or tracks of chains or carriages and clean any debris.	Dirt, debris, foreign matter.			■	■	■	■	■
Billet/log feed guides and rollers.	Bent or damaged guides; debris or foreign matter; billet hang-up or metal build-up.	Replace rollers and/or bushings as needed (3 to 12 months life).		■	■	■	■	■
Check operation and sealing of oven doors, lift cylinders, clamps.	Poor closing, air leaks.			■	■	■	■	■
Check air seal around log at oven entry.	Poor seal, air leaks.			■	■	■	■	■
Check, adjust clearance of log shear cutting tools.	*Frequency of adjustment and tolerances may vary according to manufacturer's recommendations			■	■	■	■	■
Check air cylinder packing or seals.	Air leaks.				■	■	■	■
Check chains (conveyor and/or drive) and sprockets, shafts, bearings, and couplings.	Wear, alignment, chain tension, loose keyways or setscrews.				■	■	■	■
Billet/log support rollers.	Bent, broken, or worn rollers.				■	■	■	■
Check billet oven burner tiles	Proper sealing between tiles and burners, burners inserted correct distance into tiles, cracked or broken tiles.				■	■	■	■
Check hot air circulation blower, shaft seals, and drive belts.	Belts properly tensioned, aligned, not worn. Housing clean; no cracked blades, no rubbing or dragging of wheel in housing.	See section on belt tensioning, page 8-20.			■	■	■	■
Check log shear cylinder speeds.	Speed controls not set properly.				■	■	■	■
Check refractory crown blocks.	Broken, cracked, deteriorated refractory.	Caulk with refractory fiber.				■	■	■
Clean log shear cutting tools in caustic soda.	According to manufacturer's recommendations						■	■
Tighten all foundation, mounting, and attachment bolts.	Loose bolts, broken grout.							■
Inspect circulation blower fan wheel.	Wear or corrosion, build-up.							■
Tighten bolts and setscrews on combustion and air circulation blowers.	Loose bolts, keyways, setscrews.							■
Clean around log/billet transport rollers.	Open oven and clean thoroughly any dirt or debris around rollers.							■
Check log shear wear surfaces and guide ways.	Excessive wear.							■

## Extrusion Press Master Maintenance Schedule

Press No. \_\_\_\_\_

Date \_\_\_\_\_

Item	Look For:	Notes	Daily	Weekly	Monthly	Quarterly	6 Mo.	Annually
<b>PRESS FEED LINE -- LUBRICATION</b>								
Check compressed air filter-regulator-lubricator units.	Clean filters, add oil, check pressure.							
Grease all grease nipples.	*Daily on log shear, unless instructed otherwise by manufacturer.							
Fill chain oilers.								
Bearings of hot air circulation blower.		Use correct high-temperature grease.						
Grease all billet conveyor bearings.		Use high-temperature grease.						
Check oil level in gearboxes.								
Change oil in gearboxes.								
<b>PRESS FEED LINE -- HYDRAULIC</b>								
Check hydraulic system(s) fluid level.	Low fluid level.							
Check hydraulic system(s).	Leaks, high temperature, filter by-passing.							
Check hydraulic cylinders' packing and seals.	Fluid leaks.							
Oil sample for analysis	Contamination, oil breakdown, loss of properties	Send sample to oil supplier						
Disassemble log shear cylinders and replace seals and packing.*	*Recommended by some log shear manufacturers.							
<b>PRESS FEED LINE -- ELECTRICAL</b>								
Check all limit or proximity switches and photocells.	Proper functioning; loose switch arms, loose wires. Clean photocells.							
Check purge cycle timers.	Correct settings, proper functioning.							
Check temperature controllers and/or recorders.	Reliability, calibration.							
(Elect. Induction Heater) Check, clean, and lubricate tap switches.	Check terminal connections for tightness, check contacts for oxidation.	See page 7-20						
(Elect. induction heater) Change coil.	*Frequency of change depends on plant history.							

**Extrusion Press  
Master Maintenance Schedule**

Press No. \_\_\_\_\_

Date \_\_\_\_\_

Item	Look For:	Notes	Daily	Weekly	Monthly	Quarterly	6 Mo.	Annually
<b>HANDLING SYSTEM -- MECHANICAL</b>								
Check graphite (or Kevlar) bars and surfaces on lead-out, run-out, and cooling tables.	Broken graphite, excessive wear, sharp projections which may damage the profiles.		•	•	•	•	•	•
Check slat conveyor.	Broken or loose slats, smooth operation, stopping in correct position.		•	•	•	•	•	•
Check all safety guards.	In place and working correctly.		•	•	•	•	•	•
Check rollers and covers on run-out.	Damaged or grooved rollers, rollers not turning; drives working properly.		•	•	•	•	•	•
Check run-out table lift mechanism.	Correct functioning.		•	•	•	•	•	•
Check blade of hot saw or shear.	Sharpness (quality of cut), metal build-up on blade.		•	•	•	•	•	•
Check positioning and actuation of hot saw or shear.	Proper functioning.		•	•	•	•	•	•
Check lubricant applicators.	Fluid level, proper operation.		•	•	•	•	•	•
Observe puller operation.	Smooth, level operation; no impact; correct stopping position, pick-up and release; correct speed and tension.		•	•	•	•	•	•
Observe motion of lift-overs, belts, walking beams.	Smooth operation, no jerking, profiles handled smoothly and together.		•	•	•	•	•	•
Check transfer and cooling table belts.	Damaged or burned surfaces, ragged edges, poor alignment, bad splices.		•	•	•	•	•	•
Observe stretcher operation.	Smooth operation (stretching, movement, and locking).		•	•	•	•	•	•
Observe saw feed conveyor.	Profiles loaded and conveyed smoothly; raise/lower functions smoothly.		•	•	•	•	•	•
Check sharpness of finish saw blade.	Quality of cut, metal build-up on blade.		•	•	•	•	•	•
Check finish saw clamps.	Good clamping, noise control; embedded saw chips.		•	•	•	•	•	•
Check accuracy of finished cut length.	Measure several profiles in batch.	Re-check each time a new blade is installed.	•	•	•	•	•	•
Observe operation of auto profile stacker.	Correct, smooth operation and placement of spacers.		•	•	•	•	•	•
Check water supply pump and piping to water quench.	Water leaks, proper volume and pressure.				•	•	•	•
Check drive chains and sprockets, adjust as needed.	Alignment, correct tension, wear.				•	•	•	•
Check slat conveyor chains and sprockets.	Tension, alignment, wear of chain and sprockets; adjust take-up as needed.				•	•	•	•
Check brake(s) on run-out, puller.	Proper functioning; check and replace friction surfaces as needed.				•	•	•	•
Clean saw chips and other debris from around hot saw and finish saw.					•	•	•	•
Change/clean saw chip collector bags.					•	•	•	•
Check puller drive cable or chain and adjust or replace if needed.	Correct tension and alignment; wear or work hardening.	Replace cables every 6 months.			•	•	•	•

**Extrusion Press  
Master Maintenance Schedule**

Press No. \_\_\_\_\_

Date \_\_\_\_\_

Item	Look For:	Notes	Daily	Weekly	Monthly	Quarterly	6 Mo.	Annually
<b>HANDLING SYSTEM -- MECHANICAL (Continued)</b>								
Check pulleys or sprockets for puller drive cable or chain.	Wear, alignment.				■	■	■	■
Inspect puller support wheels and bearings.	Wear and roundness; free rotation.				■	■	■	■
Inspect puller guide and support rails.	Wear, damage; alignment and straightness.				■	■	■	■
Inspect puller jaws and fingers.	Wear, breakage, metal build-up.				■	■	■	■
Inspect puller shock absorbers.	Condition and functioning.				■	■	■	■
Check drive shafts, eccentrics, couplings, and bearings.	Wear, alignment, loose couplings or setscrews.				■	■	■	■
Inspect stretcher jaws.	Wear or damage.				■	■	■	■
Check and clean stretcher drive wheels and contact surface.	Wheel surface worn smooth, bad bearings, wheels not round.				■	■	■	■
Check stretcher locking mechanism.	Proper operation and locking; signs of overstress or deformation.				■	■	■	■
Check saw feed conveyor drive belt sections; check rollers, roller covers, and roller drive chains.	Damaged belts, correct tracking; damaged roller covers; worn drive chains, incorrect chain tension.				■	■	■	■
Check alignment of finish saw with back stop or guide fence.	Squareness of cut -- compare length of inside and outside profiles.				■	■	■	■
Check saw gauge table for levelness with the saw and feed conveyor.					■	■	■	■
Inspect the automatic stacker's bearings, sprockets, chains, guide rods, rack and pinion, etc.	Wear, alignment; dirt or debris.				■	■	■	■
Check water spray quench spray nozzles.	Full spray pattern; plugging or mineral build-up.					■	■	■
Check actuator cylinder for water spray quench cover.	Air leaks, packing and seals.					■	■	■
Inspect air quench fans and blowers.	Vibration, blade damage or build-up on blades.							■
Check condition of drive couplings.	Condition and alignment.							■
Tighten all foundation, mounting, and attachment bolts.	Loose bolts, broken grout.							■
Check level and alignment of run-out, puller track, lift-overs, walking beams, stretcher base, and saw feed conveyor.	Adjust as needed to maintain units level and straight.	Use piano wire.						■
Check condition and alignment of saw arbors.								■
Check grouting of stretcher frame.	Broken or loose grout or bolts.							■





**Extrusion Press  
Master Maintenance Schedule**

Press No. \_\_\_\_\_

Date \_\_\_\_\_

Item	Look For:	Notes	Daily	Weekly	Monthly	Quarterly	6 Mo.	Annually
<b>AGE OVEN -- COMBUSTION</b>								
Check pilot flames and flame detectors (UV or flame rods)	Pilots operating correctly; flame detectors are clean and working properly.							
Clean/replace intake air filter of combustion blower.								
Remove and clean pilot air strainers								
Perform leak test of safety shut-off and vent valves.	Leakage past safety shut-off when it is closed, or vent valve stuck open.							
Check linkages on air damper motor.	Loose or incorrectly adjusted linkage.							
Remove and clean spark plugs.	Buildup, correct gap. Replace as needed.							
Check burner tile(s) and nozzles.	Cracked or broken tiles, dirty nozzles.							
Check adjustment of exhaust damper.	Excessive air leakage into or out of oven.	Test with smoke or tissue paper. Air leakage is very costly!						
Remove and clean metering rods from atmospheric regulator (premix systems only).								
Clean the inside body of ratio or atmospheric regulator(s)								
Clean and inspect combustion blower impeller and housing.	Cracked or missing blades, signs of rubbing.							
<b>AGE OVEN -- MECHANICAL</b>								
Clean the guiding tracks for load carts.								
Check hot air circulation blower and drive belts.	Belts properly tensioned, aligned, not worn. Housing clean; no cracked blades, no rubbing or dragging of wheel in housing.	See section on belt tensioning, page 8-20						
Check door seals.	Wear or incorrect fit (air leakage in or out).							
Check door hoist(s), cables.	Doors hang evenly, seal properly, open smoothly.							
Check roller or caster-type conveyors.	Alignment, wear, breakage.							
Check load cars or carts.	Alignment, wear, condition of wheels, smoothness of operation.							
Inspect air circulation blower fan wheel.	Wear or corrosion, build-up.							
Tighten fan bolts and setscrews.								
Check door hoist gearbox, motor, brake.	Correct operation, condition of gears and brake surfaces.							
Check all bolts and anchors.	Looseness -- tighten as needed.							
Check oven floor.								
Check oven shell for hot spots.	Hot spots, cracking, settled insulation.	May be checked with infrared detector.						





**Extrusion Press  
Maintenance Schedules**

Press No. \_\_\_\_\_

Date \_\_\_\_\_

	Item	Look For:	Notes
<b>D A I L Y</b>	<b>EXTRUSION PRESS -- MECHANICAL</b>		
	Guide ways	Brass pick-up	May indicate partial contact
	Guide ways	Nicks or other damage to surfaces	
	Guide way wipers	Failure to wipe guide way clean	
	Cylinders (main ram, crosshead, container)	Increase in amount of oil on main ram or cylinder rod	May indicate damage to packing. Also check bushings.
	Cylinders (main ram, crosshead, container)	Oil leaks at cylinder connections	
	Cylinders (main ram, crosshead, container)	Nicks or other damage to rods or main cylinder	Damage to packing will result
	Cylinders (crosshead, container)	Excess heat	May indicate oil by-passing piston
	Tie rod nuts	Space between nuts and platen	May indicate loss of pre-stress
	Tie rod nuts	Match marks indicating nut has rotated	
	<b>EXTRUSION PRESS -- LUBRICATION</b>		
	Fill all oil reservoirs and remove water		
	Grease all required locations		
	<b>EXTRUSION PRESS -- HYDRAULIC</b>		
	Oil level	Visual, with main ram in same position each time oil level is checked	Level varies considerably according to the position of the main ram.
	Oil condition	Air bubbles or foam	Aeration of oil may cause cavitation
	Oil color	Darkening (from heat) or clouding (from water)	
	Oil temperature	Change in operating temperature; normal maximum 140 F (60 C)	May indicate internal by-passing in system or problems with cooling equipment
	Oil leaks	Visual inspection or pressure test.	Repair as required. Oil leaks may cause loss of pressure, air in system, excessive heat, dirty equipment, safety hazards
	Erratic operation	Movements that are unusual: jerky, chattering, erratic, etc.	May indicate impending part failure
	Oil filters	Filter indicator or pressure gauge	Change cartridge if indicated
	Pumps	Vibration	May indicate impending pump failure
	Control tubing	Excess heat	May indicate system oil in pilot system
	Piping clamps and supports	Loose or broken supports	May result in pipe failures
	Relief valves	Excess heat (in relief line)	May indicate abnormal opening of relief
Pressures throughout system	Change from normal pressures	May indicate impending component failure	
<b>EXTRUSION PRESS -- ELECTRICAL</b>			
Limit switches	Loose switch mounting		
Limit switches	Switches not tripping properly		
Electrical connections	Conduit damaged or broken		
<b>PRESS FEED LINE -- COMBUSTION</b>			
Check temperature probes, clean tips, check connections.	Correct functioning. Rod tips not sharp. loose connections.		
Check pilot flames and flame detectors (UV or flame rods).	Pilots operating correctly; flame detectors are clean and working properly.		





**Extrusion Press  
Maintenance Schedules**

Press No. \_\_\_\_\_

Date \_\_\_\_\_

	Item	Look For:	Notes
<b>W E E K L Y</b>	<b>EXTRUSION PRESS -- MECHANICAL</b>		
	Container cylinders	Oil by-passing piston head	Hold container against die stack at full pressure and check for temperature rise
	Main ram, crosshead and container cylinders	Nicks or other damage to rods or main cylinder	Remove nicks with polishing stone
	Cylinder packing	Embedded particles	Replace packing if scoring recurs
	Billet loader	Loose bolts	
	Billet loader	Looseness in bushings or pivot pins	
	Butt shear	Blade tight in mounting	
	Butt shear	Nicks or other damage to blade	
	Die hold-down clamp	Tightness -- properly holds die stack	Die stack should not move during shear cycle
	<b>EXTRUSION PRESS -- TOOLING</b>		
	Container	Good sealing surface: no nicks or build-up	
	Container liner	Not "bellied" (no increase in diameter at center)	
	Stem	Straightness, stress cracking	
	Dummy block	Wear (dimensional check)	
	Dummy block	Aluminum build-up on block	
	Dummy block	Nicks, stress fractures	
	<b>PRESS FEED LINE -- COMBUSTION</b>		
	Check cooling air to thermocouple probes.	Adequate flow and cooling.	
	Check flame-type billet lubricator, clean igniter and nozzle.	Correct operation, safe, reliable ignition.	
	<b>PRESS FEED LINE -- MECHANICAL</b>		
	Check guides or tracks of chains or carriages and clean any debris.	Dirt, debris, foreign matter.	
	Billet/log feed guides and rollers.	Bent or damaged guides; debris or foreign matter; billet hang-up or metal build-up.	Replace rollers and/or bushings as needed (3 to 12 months life).
	Check operation and sealing of oven doors, lift cylinders, clamps.	Poor closing, air leaks.	
	Check air seal around log at oven entry.	Poor seal, air leaks.	
	Check, adjust clearance of log shear cutting tools.	*Frequency of adjustment and tolerances may vary according to manufacturer's recommendations	
	<b>PRESS FEED LINE -- LUBRICATION</b>		
	Check compressed air filter-regulator-lubricator units.	Clean filters, add oil, check pressure.	
	Grease all grease nipples.	*Daily on log shear, unless instructed otherwise by manufacturer.	
	Fill chain oilers.		
	Bearings of hot air circulation blower.		Use correct high-temperature grease.
	Grease all billet conveyor bearings.		Use high-temperature grease.
	<b>PRESS FEED LINE -- HYDRAULIC</b>		
	Check hydraulic system(s).	Leaks, high temperature, filter by-passing.	
<b>PRESS FEED LINE -- ELECTRICAL</b>			
Check all limit or proximity switches and photocells.	Proper functioning; loose switch arms, loose wires. Clean photocells.		

**Extrusion Press  
Maintenance Schedules**

Press No. \_\_\_\_\_

Date \_\_\_\_\_

	Item	Look For:	Notes
W E E K L Y	<b>HANDLING SYSTEM -- LUBRICATION</b>		
	Fill chain lubricator system on run-out table.		
	Lubricate all grease fittings.		
	Check compressed air filter-regulator-lubricator units.	Clean filters, add oil, check pressure.	
	<b>HANDLING SYSTEM -- ELECTRICAL</b>		
	Check all limit or proximity switches and photocells.	Proper functioning; loose switch arms, loose wires. Clean photocells.	

**Extrusion Press  
Maintenance Schedules**

Press No. \_\_\_\_\_

Date \_\_\_\_\_

	Item	Look For:	Notes
<b>M O N T H L Y</b>	<b>EXTRUSION PRESS -- MECHANICAL</b>		
	Clean-up press and related equipment	Metallic chips or dirt on guide ways, cylinder rods, or main ram	
	Guide ways	Remove shoes and check fully	Replace or re-machine as needed
	Check and tighten all bolts and other mechanical connections	Bolts or cylinder mountings which may have worked loose; check cylinder bolts under load, re-tighten and check that cylinders are level	
	Die changer pockets or carriers	Wear or damage, including keyways	
	Tie rod nuts	Space between inside nuts and platen with press under load	May indicate loss of pre-stress
	Tie rod nuts	Space between outside nuts and platen with press relaxed	May need to tram press and restress tie rods
	Tie rod nuts	Match marks indicating nut has rotated	
	<b>EXTRUSION PRESS -- PRESS ALIGNMENT</b>		
	Main ram	Check level in 3 positions	Variation indicates wearing of crosshead shoes; re-adjust
	<b>EXTRUSION PRESS -- HYDRAULIC</b>		
	Clean-up of equipment	Wash down, remove rags, etc.	Avoid dirt entering system, makes it easier to spot leaks, eliminates fire and safety hazards
	Air breathers	Remove, clean, re-oil, and re-install	Avoid dirt in system, pump cavitation.
	Hydraulic pipe, tubing, and connections	Tighten all bolts, connections, and pipe supports; replace bad fittings or O-rings	Avoid downtime, loss of fluid, safety hazard.
	Tank magnets	Clean off any foreign material	Avoid oil contamination
	Hydraulic valves	Oil leaks, broken solenoid covers or wires	Tighten bolts and pipe connections
	<b>EXTRUSION PRESS -- ELECTRICAL</b>		
	Container heating elements	Check connections for tightness	
	Container heating elements	Corrosion of elements	
	Solenoid valves and relays	Overheating or chatter	
	Solenoid valves and relays	Tighten covers and terminal connections	
	<b>PRESS FEED LINE -- COMBUSTION</b>		
	Clean/replace intake air filter of combustion blower.		
	Remove and clean pilot air strainers		
	Perform leak test of safety shut-off and vent valves.	Leakage past safety shut-off when it is closed, or vent valve stuck open.	
	Check linkages on air damper motor.	Loose or incorrectly adjusted linkage.	
	Remove and clean spark plugs.	Buildup, correct gap. Replace as needed.	
	Check burner tile(s) and nozzles.	Cracked or broken tiles, dirty nozzles.	
Check adjustment of air exhaust and/or recirculation damper.	Excessive air leakage into or out of oven. Control linkage loose.	Test with smoke or tissue paper. Air leakage is very costly!	
<b>PRESS FEED LINE -- MECHANICAL</b>			
Check air cylinder packing or seals.	Air leaks.		
Check chains (conveyor and/or drive) and sprockets, shafts, bearings, and couplings.	Wear, alignment, chain tension, loose keyways or setscrews.		
Billet/log support rollers.	Bent, broken, or worn rollers.		
Check billet oven burner tiles	Proper sealing between tiles and burners, burners inserted correct distance into tiles, cracked or broken tiles.		
Check hot air circulation blower, shaft seals, and drive belts.	Belts properly tensioned, aligned, not worn. Housing clean; no cracked blades, no rubbing or dragging of wheel in housing.	See section on belt tensioning, page 8-20	
Check log shear cylinder speeds.	Speed controls not set properly.		

**Extrusion Press  
Maintenance Schedules**

Press No. \_\_\_\_\_

Date \_\_\_\_\_

	Item	Look For:	Notes
<b>M O N T H L Y</b>	<b>PRESS FEED LINE -- LUBRICATION</b> Check oil level in gearboxes.		
	<b>PRESS FEED LINE -- HYDRAULIC</b> Check hydraulic cylinders' packing and seals.	Fluid leaks.	
	<b>PRESS FEED LINE -- ELECTRICAL</b> Check purge cycle timers. Check temperature controllers and/or recorders.	Correct settings, proper functioning. Reliability, calibration.	
	(Elect. Induction Heater) Check, clean, and lubricate tap switches.	Check terminal connections for tightness, check contacts for oxidation.	See page 7-20
	(Elect. induction heater) Change coil.	*Frequency of change depends on plant history.	
	<b>HANDLING SYSTEM -- MECHANICAL</b> Check water supply pump and piping to water quench.	Water leaks, proper volume and pressure.	
	Check drive chains and sprockets, adjust as needed.	Alignment, correct tension, wear.	
	Check slat conveyor chains and sprockets.	Tension, alignment, wear of chain and sprockets; adjust take-up as needed.	
	Check brake(s) on run-out, puller.	Proper functioning; check and replace friction surfaces as needed.	
	Clean saw chips and other debris from around hot saw and finish saw.		
	Change/clean saw chip collector bags.		
	Check puller drive cable or chain and adjust or replace if needed.	Correct tension and alignment; wear or work hardening.	Replace cables every 6 months.
	Check pulleys or sprockets for puller drive cable or chain.	Wear, alignment.	
	Inspect puller support wheels and bearings.	Wear and roundness; free rotation.	
	Inspect puller guide and support rails.	Wear, damage; alignment and straightness.	
	Inspect puller jaws and fingers.	Wear, breakage, metal build-up.	
	Inspect puller shock absorbers.	Condition and functioning.	
	Check drive shafts, eccentrics, couplings, and bearings.	Wear, alignment, loose couplings or setscrews.	
	Inspect stretcher jaws.	Wear or damage.	
	Check and clean stretcher drive wheels and contact surface.	Wheel surface worn smooth, bad bearings, wheels not round.	
	Check stretcher locking mechanism.	Proper operation and locking; signs of overstress or deformation.	
	Check saw feed conveyor drive belt sections; check rollers, roller covers, and roller drive chains.	Damaged belts, correct tracking; damaged roller covers; worn drive chains, incorrect chain tension.	
	Check alignment of finish saw with back stop or guide fence.	Squareness of cut -- compare length of inside and outside profiles.	
	Check saw gauge table for levelness with the saw and feed conveyor.		
	Inspect the automatic stacker's bearings, sprockets, chains, guide rods, rack and pinion, etc.	Wear, alignment; dirt or debris.	
	<b>HANDLING SYSTEM -- LUBRICATION</b> Lubricate bearings of supply pump to water quench.		
	Lubricate bearings of air quench fans.		
	Check oil level in gearboxes.		
<b>HANDLING SYSTEM -- HYDRAULIC</b> Hydraulic systems on run-out, cooling table, stretcher, etc.	Filters, level, temperatures.		









**Extrusion Press  
Maintenance Schedules**

Press No. \_\_\_\_\_

Date \_\_\_\_\_

	Item	Look For:	Notes
<b>Y E A R L Y</b>	<b>EXTRUSION PRESS -- MECHANICAL</b>		
	Tie rods	Ultrasonic testing for cracks	More frequent follow-up if a flaw is detected
	<b>EXTRUSION PRESS -- PRESS ALIGNMENT</b>		
	Tie rods	Tram press -- measure length between platen & main cylinder flange faces to check parallel	Maximum variation 0.010 inches
	<b>EXTRUSION PRESS -- HYDRAULIC</b>		
	Pump/motor couplings	Check coupling alignment	Avoid excessive pump and motor wear
	Pump/motor	Tighten mounting bolts	Avoid misalignment, excessive wear, noise
	<b>EXTRUSION PRESS -- ELECTRICAL</b>		
	Motors	Clean and lubricate	
	Motors	Check windings with megohmmeter	
	<b>PRESS FEED LINE -- COMBUSTION</b>		
	Remove and clean metering rods from atmospheric regulator (premix systems only).		
	Clean the inside body of ratio or atmospheric regulator(s)		
	Clean and inspect combustion blower impeller and housing.	Cracked or missing blades, signs of rubbing.	
	<b>PRESS FEED LINE -- MECHANICAL</b>		
	Tighten all foundation, mounting, and attachment bolts.	Loose bolts, broken grout.	
	Inspect circulation blower fan wheel.	Wear or corrosion, build-up.	
	Tighten bolts and setscrews on combustion and air circulation blowers.	Loose bolts, keyways, setscrews.	
	Clean around log/billet transport rollers.	Open oven and clean thoroughly any dirt or debris around rollers.	
	Check log shear wear surfaces and guide ways.	Excessive wear.	
	<b>PRESS FEED LINE -- HYDRAULIC</b>		
	Disassemble log shear cylinders and replace seals and packing.*	*Recommended by some log shear manufacturers.	
	<b>HANDLING SYSTEM -- MECHANICAL</b>		
	Inspect air quench fans and blowers.	Vibration, blade damage or build-up on blades.	
	Check condition of drive couplings.	Condition and alignment.	
	Tighten all foundation, mounting, and attachment bolts.	Loose bolts, broken grout.	
	Check level and alignment of run-out, puller track, lift-overs, walking beams, stretcher base, and saw feed conveyor.	Adjust as needed to maintain units level and straight.	Use piano wire.
	Check condition and alignment of saw arbors.		
Check grouting of stretcher frame.	Broken or loose grout or bolts.		
<b>HANDLING SYSTEM -- LUBRICATION</b>			
Lubricate drive couplings.			
<b>HANDLING SYSTEM -- ELECTRICAL</b>			
Check variable-speed or variable-volume controllers for quench air.	Correct functioning.		
Check, clean, and lubricate all motors; check and record amps and check motor with megohmmeter.	Dirty or oily windings, clogged vent openings.		

