Chapter C

MODERNIZING OLDER EXTRUSION PLANTS

There are many extrusion presses in service around the world today that are 40 to 50 years old (and a few even older) that are still in good condition and making good production. However, because of their design they are not as efficient or reliable as newer presses. What options are available for modernizing older presses, and what upgrade steps should be done first?

In this chapter we try to answer these questions to help the press owner decide which changes are most profitable. Then we will review some of the considerations for specifying and purchasing a new extrusion press. We will also review possible changes to press feed lines (billet heaters and log shears) and extrusion handling equipment after the press.

Planning for Modernizing the Older Press

Before beginning the modernization project, ask these questions:

- **What is the structural condition of the main press components, and what is their remaining life?** (see **Chapter 4 – Inspecting and Repairing Major Components**). The plan should Include the cost of replacing any failing components in the project cost estimate.
- **What is the estimated total cost of all modernization projects and repair/replacement of the major press components?** Even is all items in the plan will not be done immediately, consider the total plan for the long term.
- **What would be the cost for a new press of comparable capacity?** Consider the total cost including installation, less the resale value of the old press.
- **Which is the better investment over many years -- replacement or modernization?** Consider the improved performance, lower maintenance, and improved life of the new press.

The 40% Rule: Proceed with caution if the cost of repair and modernization will exceed 40% of the cost of new equipment. Based on the author's past experience, if costs exceed 40% of new cost, it is probably better to purchase new, if possible. The risk of hidden wear and failing components, the additional time and work required on your part, and the probability of lower performance from the modified machine compared to new equipment --- together will offset any savings!

- **Are the press feed line and after-press handling systems capable of handling any increase in press capacity that may result from press improvement projects?** Otherwise, the cost of eliminating these bottlenecks must be included in the total project cost.

After answering these questions, if the decision is made to modernize the press, next make a list of possible upgrade options. For convenience, following is a checklist of possible upgrade projects, listed generally in the order of priority (your priorities may vary). Also see the **Inquiry for Press Line Modernization** form on Pages C-34 & of this chapter.

Figure C-1: Upgraded hydraulic system, on floor at rear of press.

Figure C-2: Unistation Die Changer

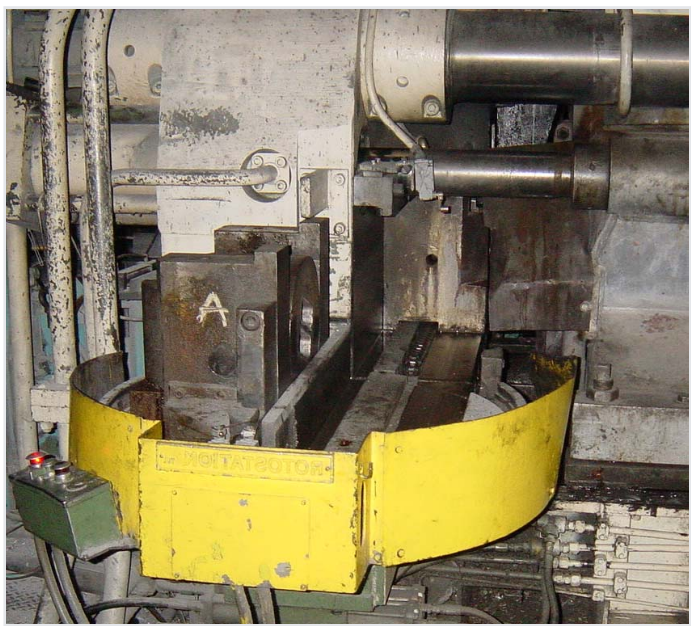


Figure C-3: Rotostation Die Changer

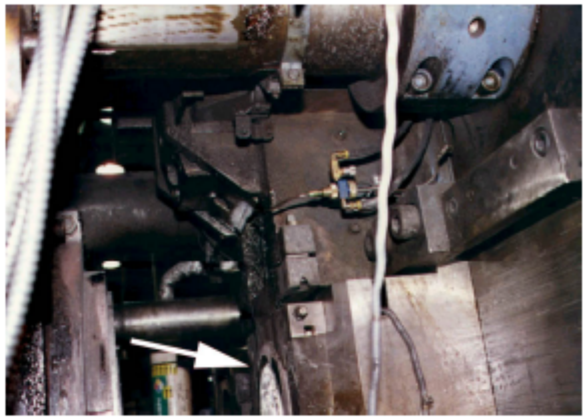


Figure C-4: Lubricant sprayer on butt shear assures a clean butt separation and freedom from build-up on die. (Photo courtesy of Amcol)

- **Replace any failing or weak components.** Perform the component tests recommended in **Chapter 4 – Inspecting and Repairing Major Components**, and replace any cracked or failing components according to the recommendations from the inspections.
- **Convert the press from relay control to full PLC (Programmable Logic Control).** "Full" PLC control includes features other than just relay replacement; for example, ram position measurement by transducer, fault diagnosis, and communication with a host computer for data functions. Considering the low cost, high reliability, and performance capabilities of modern PLC controls, it is inconceivable in the 21st Century to operate an extrusion press without full PLC controls.
- **Modernize the hydraulic system.** The exact list of changes will depend on the state of the old system; a study of your system by a qualified hydraulic system engineer is recommended when planning the project. Some possibilities include:
- **Replace pneumatic servo controls** with modern electronic servos.
- **Improve filtration** to increase component life and reduce downtime.
- **Modernize pumps** with newer models, for improved performance and better availability of parts and service support.
- **Increase pumping capacity** in order to decrease the press dead cycle.
- **Install manifolds and re-pipe** the press, to reduce leaks and improve performance.
- **Improve oil-cooling** capacity.
- **Consider converting to variable-frequency motors,** with either fixed-volume or variable volume pumps.[1][2] Others suppliers are proposing gear pumps instead of piston-type[3].

1. Rutkowski, Richard, "Upgrading Extrusion Presses with Variable Frequency Drives," Proceedings of 8th International Aluminum Extrusion Technology Seminar, (2004).

- **Install a fixed dummy block** in place of loose dummy blocks. Modern presses require this modification to improve reliability and reduce operator involvement in the press cycle. See also **Chapter 3 – Tooling** for additional information.
- **Install a unistation or rotostation die changer** to reduce operator labor and to speed up the die change process **(Figures C-2** and **C-3)**. Most presses with single or double die slides require 3 to 5 minutes to change dies, which can be reduced to less than 30 seconds with the new system. Payback for this investment is very quick. In addition, unistation or rotostation changers give a more precise, consistent die alignment, which is critical to production tolerances on some profile shapes.
- **Improve butt shear performance** with a better design of the shear and blade, a butt knocker, and/or automatic blade lubrication. On some presses the butts do not always fall clear from the press, so the press operators must control the press manually, to be sure that the butt is sheared properly and falls away. Press time is lost when operating the press in manual mode to check or remove a butt, or to manually spray a release lubricant to the blade. There are now several equipment options which can free the operator for other tasks, save press time, and still protect against equipment damage. (See also **Chapter 3 – Tooling**.) First are high-tech lubricants which may be automatically sprayed on the shear blade to improve butt separation **(Figure C-4)**. Second, butt knockers are available, usually installed together with an improved-design butt shear **(Figures C-5, C-6, and C-7)**. Finally, photocells and light curtains may be strategically located to stop the press unless it is confirmed that the butt has been safely discarded.

Figure C-6: Butt shearing

2. Schreiber, Marco; Sacristani, Giovanni; Guilotta, Giorgio; and Fraternale, Paolo; "Energy Saving in Extrusion Presses – Latest Developments," Proceedings of 11th International Aluminum Extrusion Technology Seminar, (2016), p.471-487.
3. Turla, Davide, and Guerrini, Alessandro, "Eco+Logic 2.0 – Saving Energy at the Extrusion Press," Proceedings of 11th International Aluminum Extrusion Technology Seminar, (2016), p.489-498.

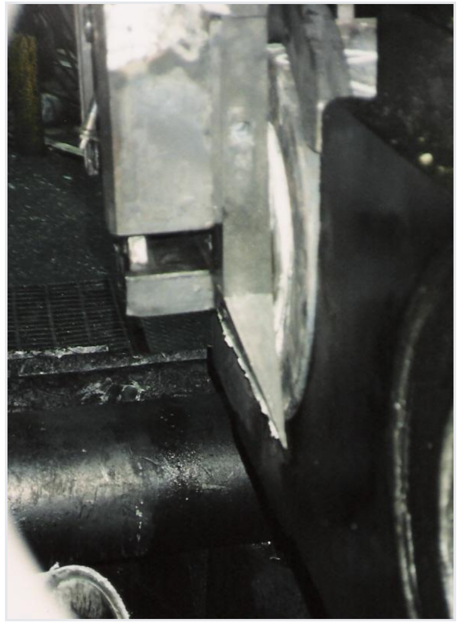


Figure C-7: Butt knocker extended to remove butt

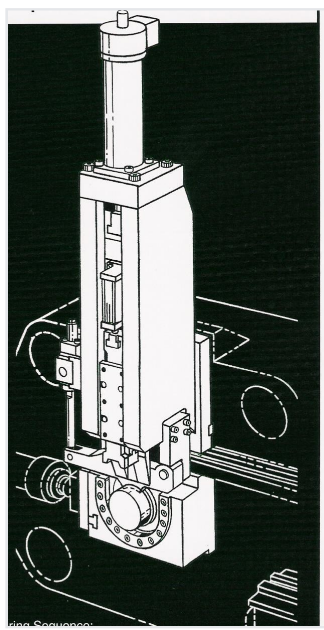


Figure C-5: Drawing of improved butt shear (Illustration courtesy of Lake Park Tool)

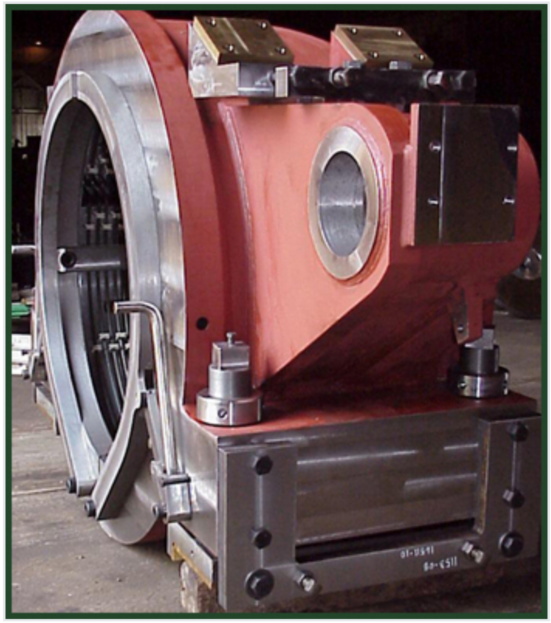


Figure C-8: Container Housing and flat guide system. (Photo courtesy of Lake Park Tool)

Figure C-9: Container housing with V-guide system. (Photo courtesy of OMAV)

Figure C-10: Moveable stem conversion, showing horizontally-moving stem, billet pusher, and robot loader.Photo courtesy of OMAV

- **Improve the container housing and container alignment:** replace a 2-piece or cast container housing with a well-designed 1-piece housing and simplified container alignment system. Many older presses (and even some new ones) are fitted with "X" guiding systems, which have angled guide ways and can only be aligned by trial-and-error techniques. Ask the mechanic who must work with this type of guides and he will confirm: when you make an adjustment in one direction it causes an unintended movement in another direction. With X-guides, adjustment involves a series of approximations, usually until he becomes frustrated and stops even though correct alignment has not been made. There are also designs that use top or bottom center guides, which require that someone climb into the hot press to make adjustments; that is a dangerous and impractical job if the container is at operating temperature, and if done cold the heat expansion must be "guess-timated." More often than not, center guides are left unadjusted. The result is poor alignment, which affects dimensional tolerances of the profiles.
- A better solution is to use "V" guides or flat ways **(Figures C-8 and C-9)**. With these systems, all adjustments are completely logical -- simple vertical and horizontal adjustments -- and will be as accurate as you wish to make them. All changes are made from outside the press frame and may be made with the container at full operating temperature. This system has been in operation for more than 25 years on numerous presses and has been completely trouble free.
- An improved guiding system is usually installed together with a new one-piece container housing, which also improves alignment accuracy and makes it easier to use fixed dummy blocks.
- **Install an improved billet loader.** Improved designs are discussed in **Chapter 7 – Billet and Log Feed Systems**. Designs such as the overhead and robot loaders, or the single arm with telescoping support, represent the state-of-the-art for loader design. They increase reliability and simplify maintenance.

- **Convert the press to a short-stroke or moveable-stem design.** Most conventional presses can be converted to short-stroke, reducing dead cycle by about 4 seconds and increasing billet length by about 25%. The result is an increase in output per press cycle and therefore reduced scrap percentage. Dead-cycle time is also significantly reduced as a percentage of total extrusion cycle time. This conversion is well proven from a practical standpoint – alignment accuracy and reliability are equal to a conventional press. Payback time is usually less than 6 months. **(Figure C-10)**
- **Install automatic lubrication for the fixed dummy block.** The time spent to manually stop the press and spray lubricant on the fixed dummy block may be saved by installing an automatic system to spray the block during the dead cycle, for example after every 5 or 10 billets. (See **Chapter 3 – Tooling**.)
- **Improve container heating (or cooling).** Modern container rature control is much improved, including new types of container heaters, better controllers, and equally important, cooling for the container[4,5,6,7]. Recent developments have confirmed the importance of consistent ratures throughout the extrusion process, and new designs permit a much better control of the container temperature. See **Chapter 3 – Tooling**, pages 3-20 to 3-24. Container life can also be significantly improved.

Specifying and Purchasing a New Press

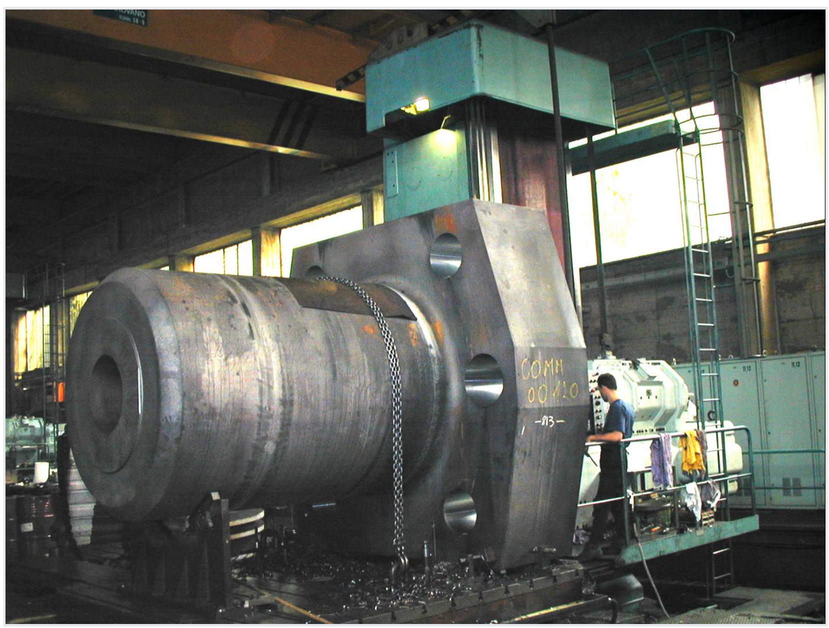


Figure C-11: Machining a main cylinder for a new press. Photo courtesy of Presezzi Extrusion.

4. Hahnel, Werner, and Herder, Manfred, "Tool Steel and Design of Modern Containers for Extrusion of Light Metal," Proceedings of 8th International Aluminum Extrusion Technology Seminar, (2004).
5. Wieser, Volker; Sommitsch, Christof; Haberfellner, Kurt; and Lehofer, Paul;" New Developments in the Design and Production of Container Assemblies, " Proceedings of 8th International Aluminum Extrusion Technology Seminar, (2004).
6. Van Dine, Dennis, "Thermal Control of the Extrusion Press Container," Proceedings of 8th International Aluminum Extrusion Technology Seminar, (2004).
7. Chien, Ken; Dixon, Bill; Robbins, Paul; and Jowett, Chris; "The Design and Benefits of a Thermally Stable Container," Proceedings of 11th International Aluminum Extrusion Technology Seminar, (2016), p.427-450.

Specifying and purchasing a new extrusion press is a major responsibility --- after all, the press you install will likely be in service for 50 years or more. Therefore it is critical to insure that the press you specify will perform efficiently and reliably, with minimum maintenance and operating cost, throughout its life span.

When proposals from various press suppliers are evaluated, it is necessary to compare construction details and features point-by-point for each press. Where differences are identified, the press suppliers should be asked to explain and justify their particular specification. Then your own engineering evaluation may be made of the different explanations.

Following is a general guide to the main points to consider when specifying a new press and evaluating proposals.

Press size. The most basic decision – press size – is also the most subjective. What is the target market, not only today, but over the life of the press? What is the target circle size and weight-per-length range of the products? Past order history is only a guide to the past, not necessarily to future needs. In the end, press size is eventually a subjective, intuitive decision.

When considering press size, it is recommended to select a specific pressure within the target range of 60 to 80 kg/mm2 or 85,000 to 115,000 lb/in2. Specific pressure is calculated by dividing the press tonnage by the area of the container opening (usually based on billet diameter plus 3%). Reference charts are available at **Pages xvi and xvii of the Useful Tables**. Many presses are operated outside the range of recommended specific pressure, for example for very simple shapes; and your own experience may give you confidence to select a press outside of the recommended range. However, in general you may be risking some loss of productivity due to slower upset and breakthrough.

Billet length. Typical billet lengths have increased greatly in the past 25 years or so, resulting in greater production flexibility and productivity. Some typical maximum billet lengths for common press sizes:

Billet Dia. in / mm	Press Tons	Press M Tons	Billet Length mm	Billet Length in
6″ – 152mm	1350 – 1800	1200 – 1600	750 – 850mm	30″ – 34″
7″ – 178mm	1800 – 2200	1600 – 2000	850 – 1000mm	34″ – 40″
8″ – 203mm	2400 – 2750	2200 – 2500	850 – 1250mm	34″ – 50″
9″ – 229mm	2750 – 3100	2500 – 2800	1000 – 1350mm	40″ – 53″
10″ – 254 mm	3000 – 3600	2800 – 3100	1250 – 1400mm	50″ – 55″
12″ – 305mm	4200 – 5000	3850 – 4600	1350 – 1400mm	53″ – 55″
14″ – 356mm	5200 +	4700 +	1500 mm +	60″ +

Some important recent studies have shed new light on the choices of billet length and diameter: there may be productivity advantages in choosing larger billet diameter and shorter billet length. For more information see the following references[8,9].

Conventional vs. short-stroke or compact-type press. Today's market has moved overwhelmingly toward short-stroke (moveable stem) and compact presses, especially in . These three press types are illustrated in **Chapter 1 – Routine Maintenance**.

The short-stroke press reduces ram travel by moving the stem sideways (or downwards) immediately after it exits the container. With the compact press, the container moves back over the stem, and then both travel back to make room for loading the billet; the billet is loaded in front of the container, and the container "swallows" the billet as it closes against the die.

Both the short-stroke and compact types reduce dead cycle by reducing, in a logical manner, the distance which the main ram must travel in relation to maximum billet length. Since this travel is slow and occurs in both directions, the savings in dead-cycle time are significant, usually about 4 seconds compared to a conventional press with comparable hydraulic system. These press types are also much more rigid in structure, with shorter tie-rods and less overall deflection of the platen.

Component construction -- cast or forged. In the early days of aluminum extrusion, many of the main press components (platens, main cylinders, container housings) were supplied in cast iron or cast steel. In recent years, most of these components have been built of forged steel instead, for reasons well explained by Mr. J.O. Nøkleby of Det Norsk Veritas in **Chapter 4 – Inspecting & Repairing Major Components**.

Platen thickness. The press front platen should be as thick as possible within practical limits. Rigidity of the platen for die support increases geometrically with the thickness. Platen deflection should be less than 0.010 to 0.015 inches (0.254 to 0.381 mm) under full load in order to minimize die deflection.

Pre-stressed tie rods. Fatigue failure of tie rods, common in earlier press designs, may be virtually eliminated by installing sleeves over the tie rods and pre-stressing them over their whole length. Details of the sleeve design and pre-stress procedures are critical to the application.

Press dead cycle. Capacity lost to dead-cycle time is a major factor in press performance. Fortunately, dead-cycle times have fallen dramatically in recent years, thanks to PLC controls, improved hydraulic systems, conversion to short-stroke and compact press designs, and other innovations. While very short dead-cycle times may be quoted by press suppliers, it is extremely important to **always use the same definition of dead cycle** when making comparisons of different presses. Items which may or may not be included in a supplier's calculation include decompression, billet upset, and burp cycle. Be sure that all suppliers are referring to the same definition of dead-cycle. The best way to get correct information is to require a **cycle bar chart** with all component movements diagrammed on a time scale.

8. Chien, Ken; Robbins, Paul; and Jowett, Chris; "Extrusion Productivity, Part I – Billet Geometry," Light Metal Age Magazine, April, 2018.
9. Chien, Ken; Robbins, Paul; and Jowett, Chris; "Extrusion Productivity, Part I – Predicting Ram Speed," Light Metal Age Magazine, February, 2019.

Hydraulic system. This area of the specification involves many issues:

- **Supplier** – hydraulic components should be supplied by your preferred vendor, based on your past experience and maintenance program. Spare parts in common with your existing presses should be one issue to consider. Second, consider the responsiveness of different vendors when on-site service and training are required. The press supplier should be willing to use components supplied by the vendor you prefer. Your preferred hydraulic vendor may also be helpful in specifying the system details for the new press.
- **Type of Pumping System.** Choose between variable-volume and variable speed pumps, or a combination, and between piston and gear pumps. See references on page C-2 of this chapter.
- **Number of main pumps.** Consider increasing the number of main hydraulic pumps in order to improve performance and reduce dead-cycle time.
- **Location of pumps.** The pumps may be located on the tank over the press, on the floor behind the press, or even in a pit or separate room. Location affects noise level, maintenance access, and system performance.
- **Oil filters and cooling.** Proper filtration is critical to component life and performance (see **Chapter 5 – Hydraulic Equipment**). Be sure that the design of filters, heat exchangers, and temperature control takes into account the actual conditions and climate of your plant.
- **Manifolding, piping, and miscellaneous components.** Specify the use of manifolds to reduce oil leaks. Careful selection and placement of valves and other components can reduce system shock and oil leaks, and permit reduced dead-cycle time.

PLC controls. All modern presses are controlled by PLC controls, but it is still important to define which features will be included in the control scheme of your new press. Some issues include:

- **Supplier.** Whether Allen-Bradley, Siemens, Modicon, or other --- specify the brand of PLC that you prefer, based on performance, technical support, and familiarity of your maintenance technicians.
- **Features and integration.** Today's PLC's may be integrated with company-wide computer systems to offer capture and recall of data and on-line order entry. Touch-screen displays inform the operator of data trends as well as the past history of each die. The range of options is great and still growing- make sure your new press takes advantage of the potential.
- **Diagnostics**. Fault displays can notify you of potential breakdowns before they occur. For example, some new presses allow continuous measurement of container alignment. Networking allows remote display of press condition and faults at a screen in the maintenance shop, or even on the maintenance person's home computer (through cable or dial-up networking). The press or software supplier may diagnose and resolve problems from anywhere in the world via the internet.

Container guiding. Most modern presses use container guiding systems which may be adjusted from outside the press frame --- no center guides. Guide surfaces should be in the horizontal and vertical planes --- no "X" guiding. See the illustrations above.

Container heating/cooling. Newer presses, especially larger sizes, offer multi-zone heating control and multiple points for measurement of container temperature. It is preferred to separate the container into upper and lower zones, as the top tends to get hotter than the bottom. Some suppliers also offer container cooling in order to be able to reduce the temperature when it exceeds a pre-set limit (usually in the center or rear of the billet). **See Chapter 3 – Tooling, pages 3-20 to 3-24.**

Die stack dimensions. The depth of the tooling stack determines the deflection of the die under load: deflection is reduced by the third power of the stack depth. On the other hand, a larger tool stack will increase costs. Be sure to carefully select the optimum die stack dimensions.

Die changer type. Layout considerations are key to this choice. The rotostation changer extends farther away from the press but is more compact in the direction along the press axis. The unistation or shuttle-type is longer along the press axis but does not stick out as far. The unistation may have a slight advantage in accessibility for ease of maintenance.

Billet loader type. For swing-arm type loaders, the two-piece loader has generally been dropped in favor of a one-piece with a telescoping support. Compact and short-stroke presses typically use an overhead or robot-type loader to transport the billet from the shear to the press centerline.

Butt Shear. Design should include a butt-knocker. Some suppliers offer proprietary designs, which may improve blade contact with the shearing surface.

Quick-change container and stem. Where more than one billet size is to be used, it is recommended to specify a quick-change design for the container and stem. Various designs are available to permit change-over in the minimum possible time.

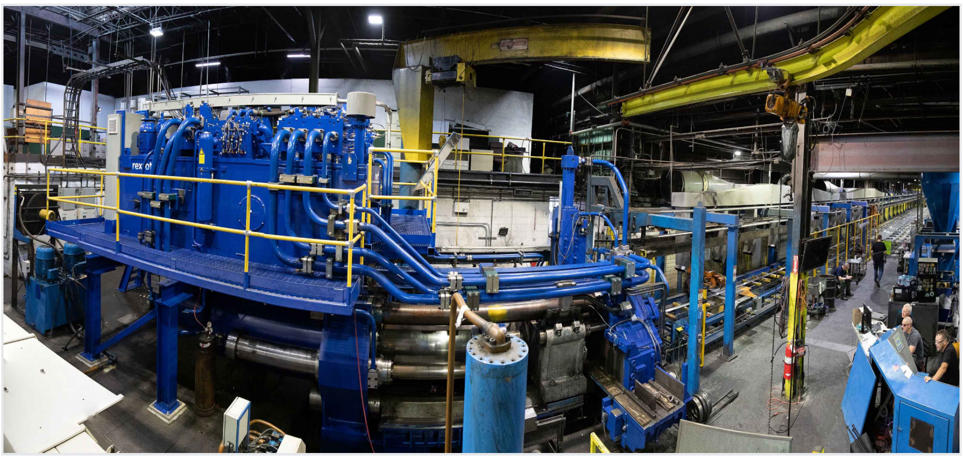
Other specialty features. Proprietary press features offered by various press suppliers include:

- **No-burp extrusion**, where the container is held open during billet upset in order to eliminate or minimize the "burp" cycle.
- **Die locking**, to hold the die face fixed in both the horizontal and vertical directions while the butt is sheared, in order to insure a uniform, smooth sheared surface.
- **Profile shearing between the die and backer**, to reduce the quantity of aluminum wasted at each die change.

Spare parts. The initial project appropriation should include about 5% for purchase of spare parts. Spare parts should be negotiated as part of the press purchase, including the make and model of purchased components, to insure local availability as well as matching existing parts inventory.Following are selected images and recommendations from a presentation by **Michael Kramer of Bosch Rexroth** about upgrades to extrusion press hydraulic systems, from the AEC Press Maintenance Workshop, Atlanta, 2023.

UPGRADING THE PRESS HYDRAULIC SYSTEM

Press Upgrades - Components or Complete Systems

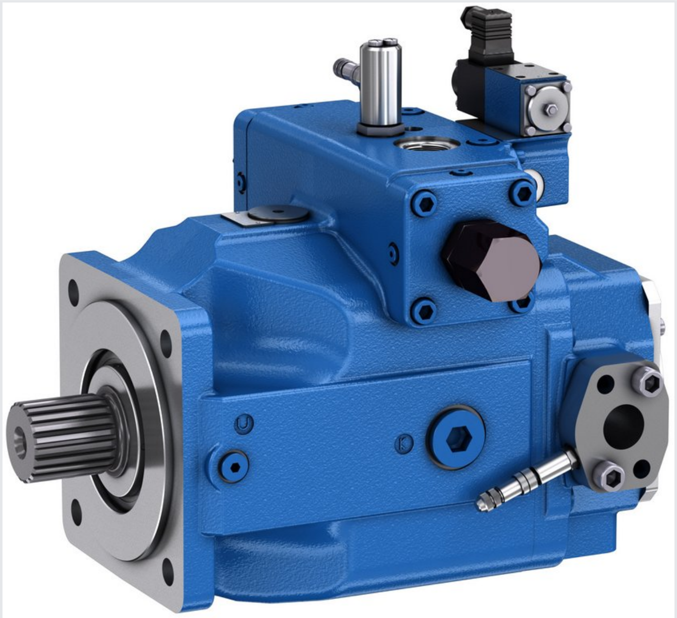


Benefits of Press Upgrades

- Increased productivity
- Longer operational life of major components
- Implementation of modern safety features
- Elimination of obsolete components
- Minimal lost production time
- Energy savings
- Improved troubleshooting
- Reduced scrap rates
- i4.0 Functionality

Start With a Plan

- Evaluate current condition of system
- Determine goals and their priorities
- Consult with experts to develop a plan
- Implement the plan, in phases or as a single project



A Full Range of Upgrade Options

Press Mechanical Upgrades:

- Stem shifting
- Billet loaders
- High performance containers
- Short stroke / front loading conversions
- Fire resistant fluid system for hot end of press

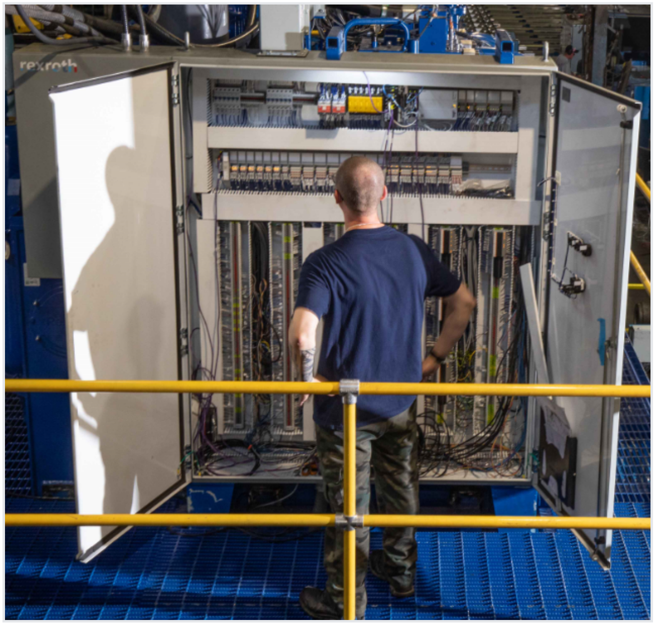
Press Hydraulic Upgrades:

- Pump control valves
- Pumps
- Manifolds or manifold systems
- Prefill valves
- Piping systems
- Complete power unit

Press Controls Upgrades:

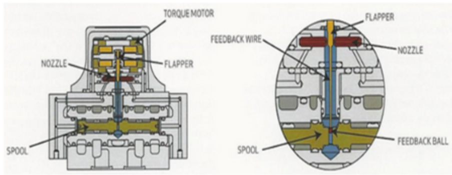
- Pump feedbacks and controls
- Closed-loop extrusion controls

- Safety PLC systems
- Complete control systems
- Advanced Diagnostics systems



Hydraulic Upgrades- Pump Control

Servo vs Proportional Valves

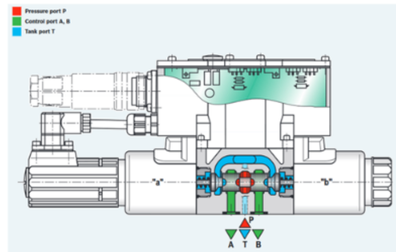


Servo Valves

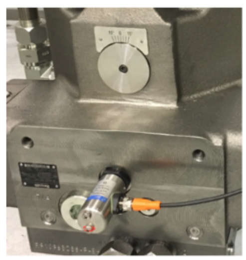
- Highly dynamic
- Delicate internal parts
- Susceptible to damage and clogging
- Expensive to repair or replace

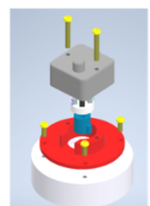
Proportional Valves

- Equal or better dynamics
- Few moving parts
- Rugged & tolerant of contamination
- Less expensive to repair or replace



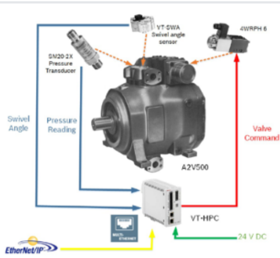
Pump Feedbacks



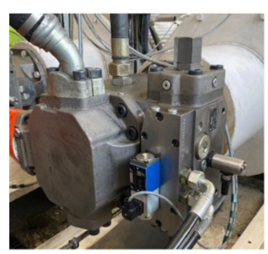


- Older feedbacks are usually contact-style potentiometers subject to wear, or amplified-style requiring additional electronic signal conditioning devices
- Modern feedbacks are self-contained, requiring only 24V input and providing a voltage or current output directly to the control system
- Kits are available for direct replacement of older equipment

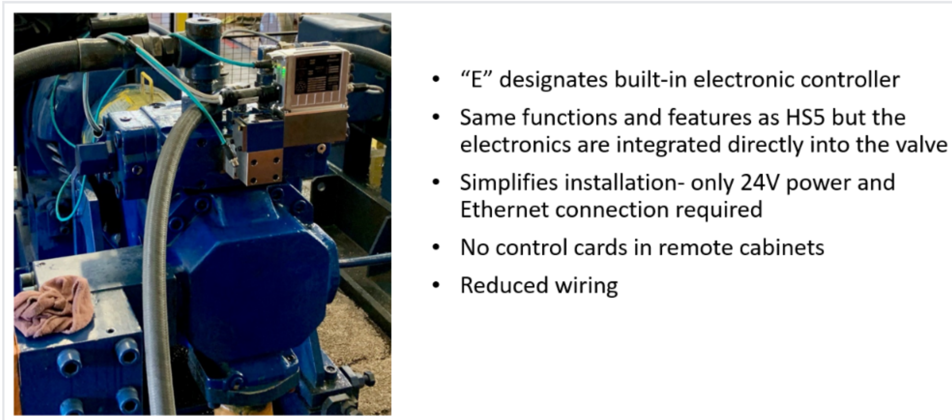
HS5 Upgrade



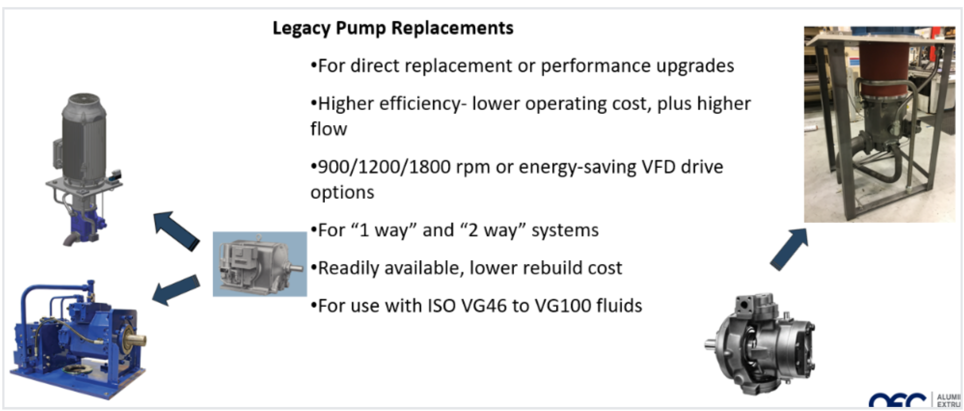
- Kit includes:
  - New proportional valve
  - VT-HPC controller
  - New swash angle & pressure transducers
- Functions:
  - Closed-loop swashplate control
  - Pressure control
  - Power control
- Features:
  - Ethernet connectivity
  - Built-in diagnostics
  - Easy "wizard" style configuration with free software
  - Optional "n" feature for variable-speed motor control



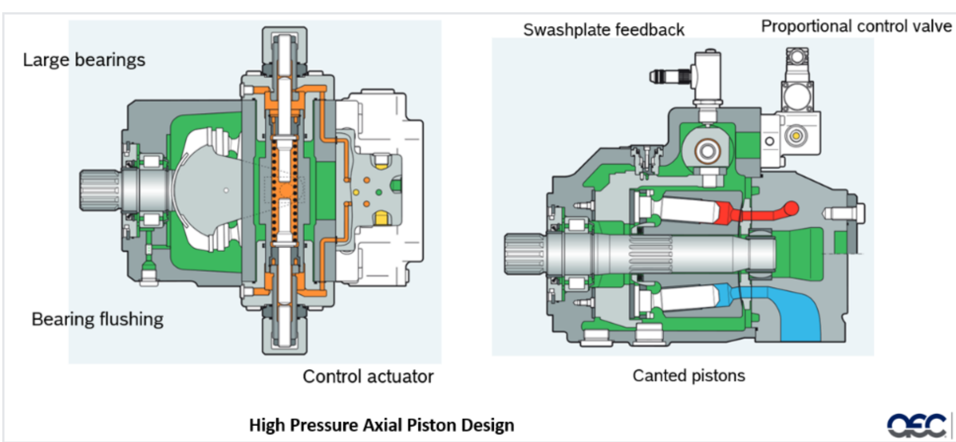
HS5E Upgrade



Hydraulic Upgrades- Pumps

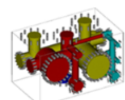


Hydraulic Upgrades- Pumps



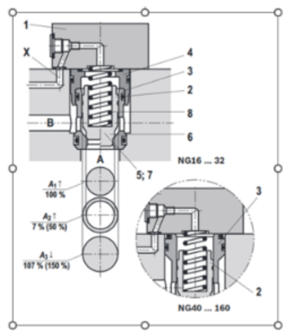
Hydraulic Upgrades- Manifolds

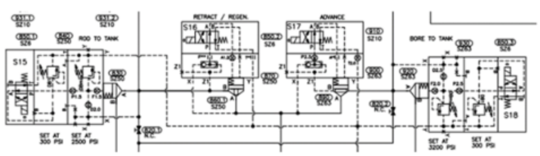
- Simplified piping layout improves maintainability
- Reduction of leak points
- Performance increases
- Modern, available valves



DIN "logic" cartridges

- Many function options
- Leak free for improved pressurization rates
- Readily available replacement parts
- Allows tuning to reduce shock
- Improved maintainability





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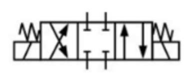
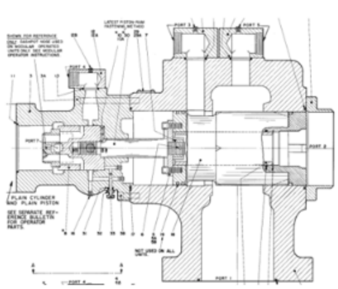
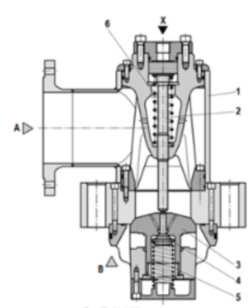


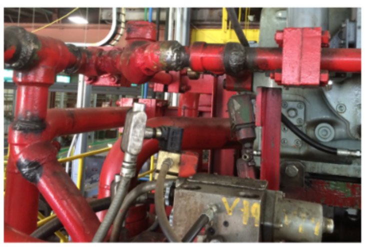
Hydraulic Upgrades- Prefill Valves

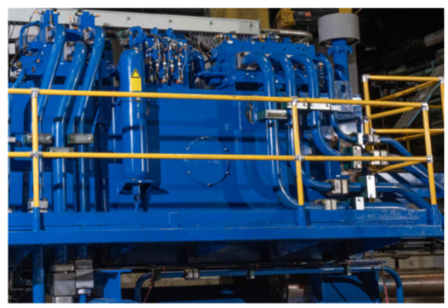
- Legacy prefill valves may be difficult to find parts for & expensive to repair
- Older valves leak through sleeve contact, wasting energy and slowing pressurization
- Modern prefill valves are dynamic, providing a reduction in DCT & pressurization rate





Hydraulic Upgrades- Piping





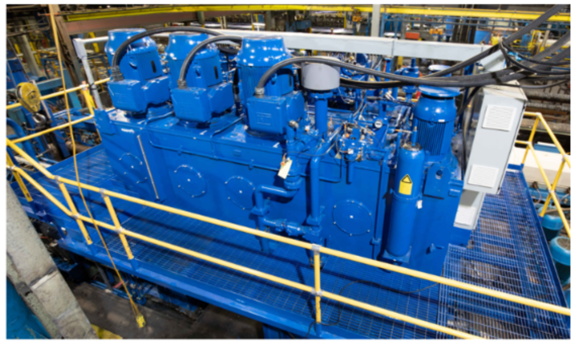
Hydraulic Upgrades- Piping

Non-welded piping systems are the new standard:

- Cracked piping is often a significant cause of press downtime due to leak repairs
- Non-welded piping systems offer quick and clean installation
- Proven over 45 years of use worldwide
- Press can be laser-scanned and piping pre-fabricated for minimum downtime
- Installed costs typically 30-40% less than welded piping

Hydraulic Upgrades- Complete Power Unit

- Complete new system including reservoir, motor pump groups, manifolds, piping, controls
- Turnkey installation and commissioning
- Minimizes installation downtime
- Can make a structurally-sound press “New” at lower cost



Controls Upgrades- Pump Control

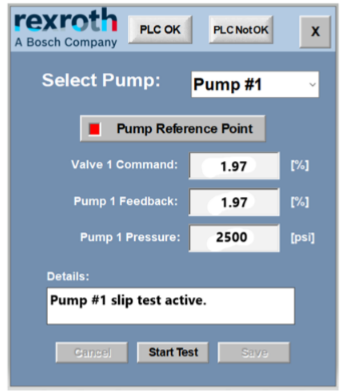
- Systems for individual or multiple pumps
- Closed-loop digital displacement control is extremely accurate and repeatable
- Built-in setup wizards and diagnostics

Controls Upgrades- Extrusion Control

- Precision closed-loop control of extrusion speed and breakthrough force, plus power limiting
- Extends life of hydraulic equipment through reduced pressure spikes and included pump safety routines
- Includes built-in pump slip testing

Controls Upgrades- Automatic Slip Testing

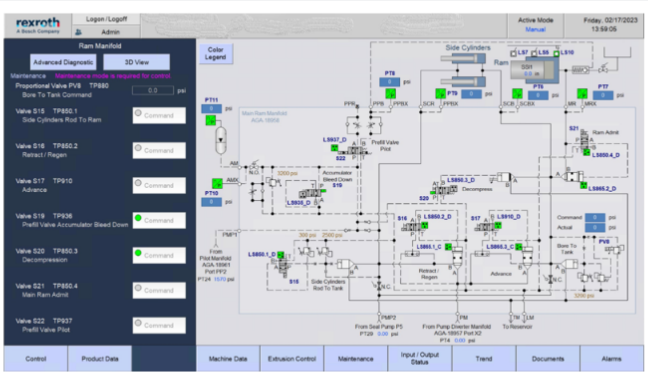
- System automatically performs slip testing at the “press of a button”
- Commands pump to pre-set pressure and records swashplate angle
- Stores data from previous tests and compares to new pump reference
- Provides an indication of pump wear over time
- Maintenance personnel can schedule pump rebuilds prior to catastrophic failure



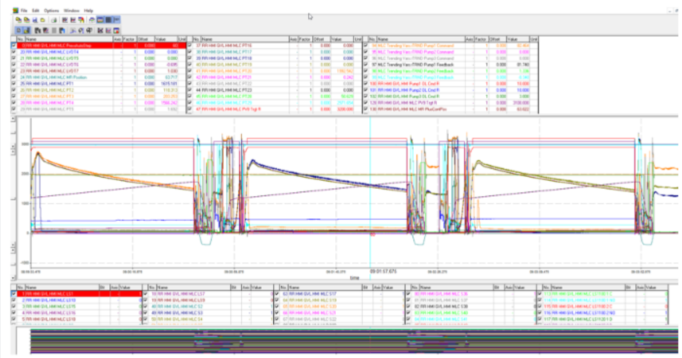
Controls Upgrades- Complete System

- Eliminate obsolete components that could cause extended downtime
- Precision closed-loop control of extrusion speed and breakthrough force, plus power limiting
- Extends life of hydraulic equipment through reduced pressure spikes and included pump safety routines
- Ethernet communications and remote I/O simplifies integration with other systems

Controls Upgrades- Complete System



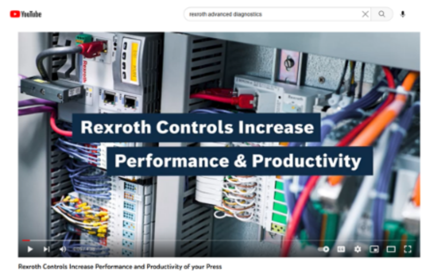
- Accurate circuit diagrams
- Active symbols
- Real time data
- Intuitive navigation



- Capable of trending hundreds of inputs
- Great tool for troubleshooting and performance optimization

Controls Upgrades- Advanced Diagnostics

- Hydraulics or controls expertise not required to diagnose an issue
- Complete system diagnostic tests completed in minutes
- Location of failed components & repair instructions displayed on the HMI screen
- Drawings, gauges or diagnostic tools not required



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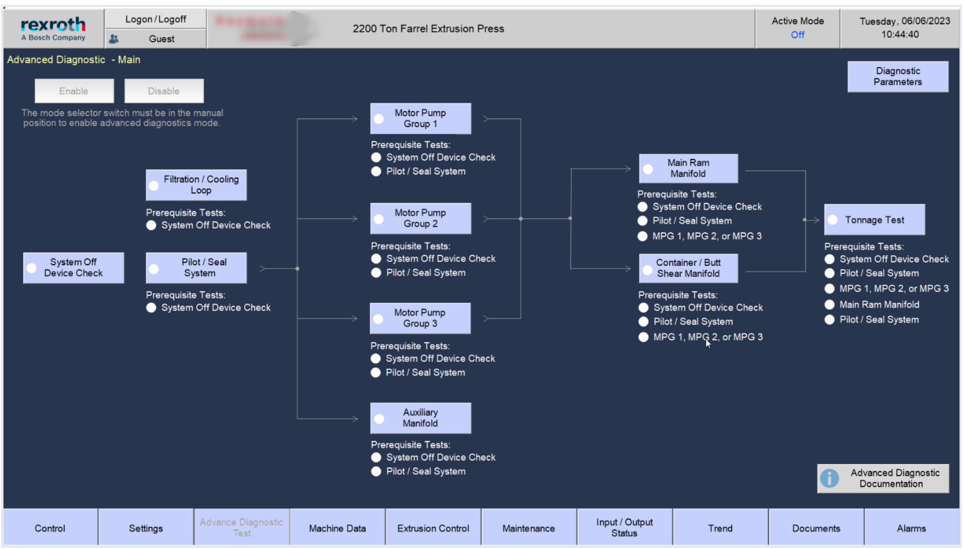
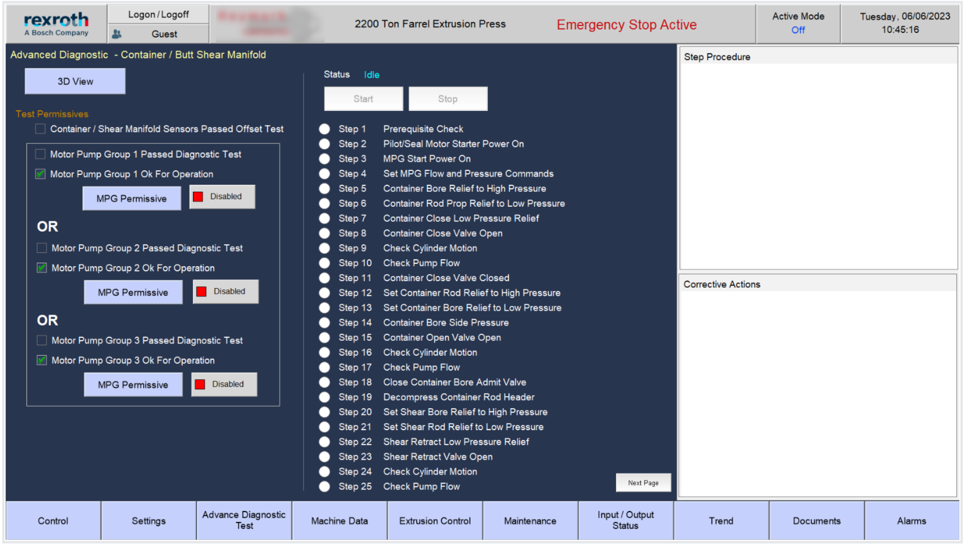
Advanced Diagnostics- Main Screen



Advanced Diagnostics- Manifold Test



Advanced Diagnostics- 3D View

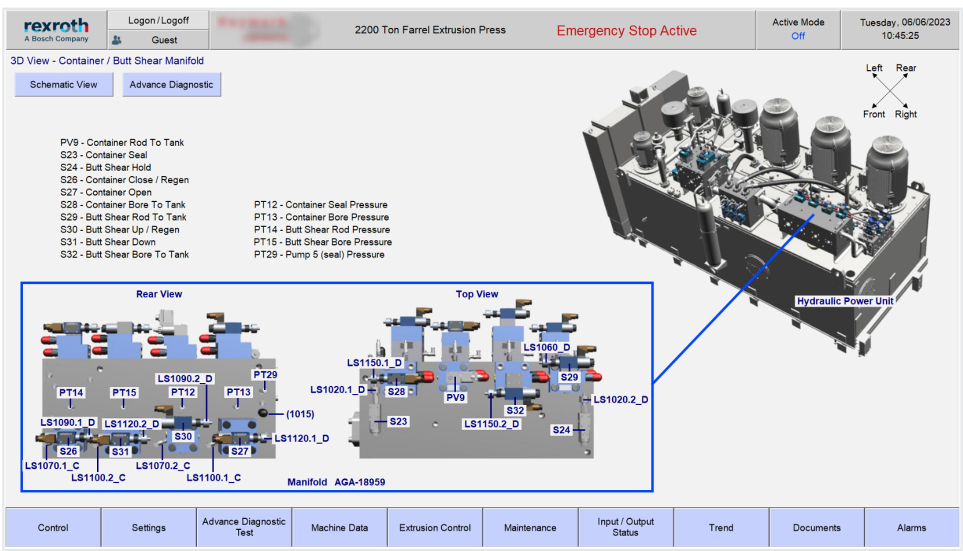


Figure C-12: Log furnace with waste heat recuperator (Photo courtesy of OMAV)

Modernizing the Press Feed Line

Figure C-12: Log furnace with waste heat recuperator (Photo courtesy of OMAV)

Energy-efficient Billet Heater. Many older billet heaters were built when energy efficiency was not important due to low fuel cost. For example, chain-bottom furnaces have an open bottom so that cold air may keep the chain cool and improve chain life; these furnaces are typically only 18 to 20% efficient. Later designs used a closed bottom with support rollers and a pusher device to push the billets through; these improved efficiency to 25% or so. More recent designs improve efficiency by recirculating hot exhaust gas over the incoming billets or logs. The latest improvements include:

- Hot jets to increase convection heat transfer
- Preheating combustion air with waste heat
- Improved sealing of exit door and thermocouple ports
- Improved insulation

The latest billet heaters improve fuel efficiency to the range of 50 to 60% or more. Electrical power consumption should be included when evaluating total energy efficiency of various billet heaters, and the desired efficiency should be guaranteed at normal operating conditions.

Figure C-13: Log furnace with hot gas recirculation (Photo courtesy of Granco Clark)

There have also been significant improvements in refractory design, and in the billet support rollers.

Another important consideration when purchasing a new billet furnace is the ability to accurately control billet temperature within a narrow range, in order to maximize the extrusion speed of the press.

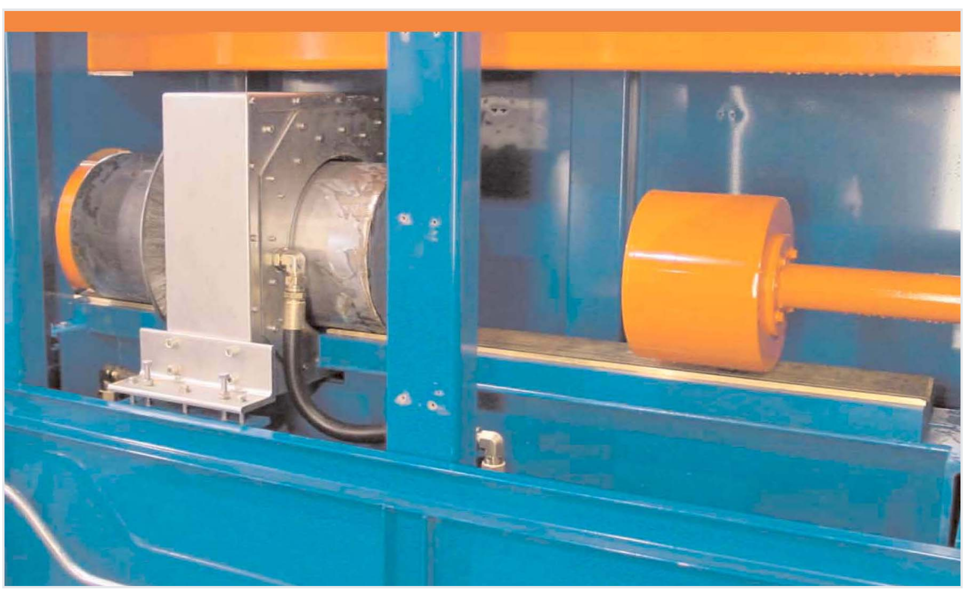


Figure C-14: Billet taper quench system (Photo courtesy of Granco Clark)

- **Taper Heating or Taper Quenching of Billets.** Because each billet gains heat at the back end during extrusion, the ideal situation is to use a billet that is hotter at the front end; in theory this allows extrusion at a constant, maximum speed. There are several schemes for supplying "taper-heated" billets to the press:

- Use electric induction heating, in which case it is relatively easy to taper heat. (However, both the equipment investment and operating cost are quite high.)
- Use gas preheat with only the taper applied by induction (see illustration at **Chapter 7, Figure 7-4**).
- Use gas heat with a gas burner at the end to apply a taper heat to the end. (The temperature profile is not as precisely controlled, but the operating cost and investment are significantly lower.)
- Pass the heated billet through a water quench unit in order to cool one end.

At this time, taper heating and quenching are relatively a new technologies, and reports of the success and benefits vary from complete success to negligible change. It is not yet possible to absolutely confirm or deny the benefits claimed by the various suppliers and users.

- **Log Shear or Saw.** For most new soft-alloy extrusion lines, the press feed includes a hot shear or saw for cutting hot logs to the correct billet length. This option allows quick changes of billet length to match the requirement, for example when the die is changed. The optimum billet length may be instantly calculated (and re-calculated if necessary) based on data from the press and puller PLC's.

Figure C-15: Hot log saw (Photo courtesy of Belco)

The hot log shear or saw cuts the log after the heater and therefore can respond immediately to changing process demands. However, if a saw is used before the heater, any decision to change length must be anticipated well in advance of the need. For this reason most new plants choose a hot shear or saw between the heater and the press. Typical hot shears are illustrated in **Chapter 7 – Billet & Log Feed Systems**, **Figures 7-16, -17, and -18**. A hot log saw is shown in **Figure C-15** (at right).

When is it justified to convert an existing plant from pre-cut billets to a log furnace and hot shear or saw? There is no general answer to this question --- it depends on the specific economics of each plant. While most new presses today are equipped with log shears or saws, the situation is different for a retrofit. There are several factors to be considered in the economic evaluation:

- The inventory of logs will be much less compared to the pre-cut billets which must be maintained if there is no shear or saw. The working capital saved will largely offset the investment in equipment.
- The quantity of butt scrap and also handling system scrap will be reduced, typically by more than 5 percent. One extruder found that with pre-cut billets, incorrect lengths were being used more than half of the time, due either to insufficient inventory, or to having the wrong billets in the billet furnace for the die being run.
- Newer log furnaces may exceed 60% fuel efficiency, compared to 18% for old chain-bottom furnaces. These savings can be substantial.

Added together these savings usually justify a retrofit, unless major building modifications are necessary to provide space for the system. Of course the hot shear or saw system must be reliable and efficient, or the savings may not be realized.

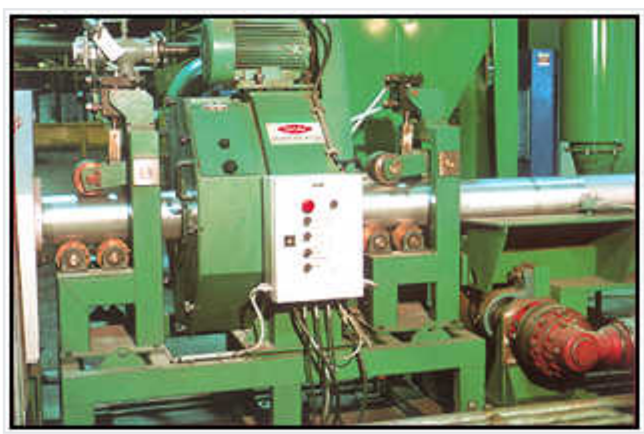


Figure C-16: Brushing machine for cleaning logs (Photo courtesy of OMAV)

- **Log brush.** Logs on their way to the log furnace pass through spinning wire brushes, which remove oxides and other contamination from the logs' exterior. In most cases a large amount of dirt, oxide, and other contamination is removed from the surface, and it is clear that these materials can only damage the quality of the extrusions if not removed.
- **Billet Transfer Conveyor and Loader.** The conveyors which transport hot billets from the billet heater or log shear to the press are critical to press performance, because they often cause excessive downtime and require constant operator attention. Many of the older systems still in use are difficult to maintain because the components are inaccessible. Billets don't stay aligned, so the operator must watch each billet, ready to grab a pry bar and help the billet into position; this keeps the operator tied to the press and prevents truly automatic operation of the press. For these reasons, billet conveyors offer one of the

best ways to improve press maintenance. Described below are some of the more common billet conveyor designs, listed in order from best to worst (also illustrated in **Chapter 7 – Billet & Log Feed Systems**, **Figures 7-20, -21, and -22**).

- **Robot loader:** Today many new presses are equipped with robot-type billet loaders, designed to accommodate moveable-stem systems. Robot loaders offer precise positioning and easy access for maintenance. A telescoping device supports the billet, yet permits the robot to withdraw quickly so as not to adversely affect the dead-cycle.
- **Overhead billet conveyor:** This type picks up the billet in a clamp and transfers it over the press tie rods, lowering it onto a billet support during the press dead cycle. It offers the advantage of gentler billet handling (important for 2-piece billets), plus free access to the floor area between the press and log shear or billet furnace.
- **Transveyor:** This device consists of a billet holder "tray" which travels on a fixed track from the billet furnace or log shear to the press loader, where the tray is mechanically tipped over to dump the billet into the loader. The transveyor is simple, elegant, reliable, accessible for maintenance, and easily adapted to most presses. ("Dumping" a 2-piece billet is not preferred, but reliability is still good.) By using an encoder and PLC control, the tray may be paused in intermediate positions for billet lubrication. It is available from most equipment suppliers.
- **Pivot arms:** Often used with one of the other type devices below; a pivoting arm, or a series of arms, actuated by air cylinders, cradles the billet loosely within a "cage" while moving it horizontally and down to the next device. Pivot arms are rugged and reliable and easy to design and build. Because the billet rotates, pivot arms are not very reliable for handling 2-piece billets. **2-piece loaders** using pivot arms have been retro-fitted on some presses in order to reduce dead-cycle time. However, the general experience has been that the extra maintenance downtime caused by increased mechanical complexity more than offsets any benefits in reduced dead-cycle. A 1-piece loader with telescoping tray seems to be a better solution.
- **Elevator (cylinder or chain):** Common on older presses, a carrier is actuated by chain/sprocket or air cylinder, to lower the billet from the heater to a lateral conveyor. These devices are simple, crude, and fairly reliable.
- **Gravity (rolling) tables:** Often used together with elevators or pivots to replace parallel chains (below); however, hot billets tend not to roll in a predictable manner. Two-piece billets can't be handled. With no moving parts, the only maintenance needed is occasional cleaning.
- **Parallel chains (with lugs):** Always found with a set of pry bars used by the operators to straighten cocked billets. It is almost impossible to keep the different chains synchronized. Access for maintenance of chains, sprockets, and drives is extremely difficult.

Modernizing the Handling System

Figure C-17: Air cooling duct located over run-out (Photo courtesy of Granco Clark)

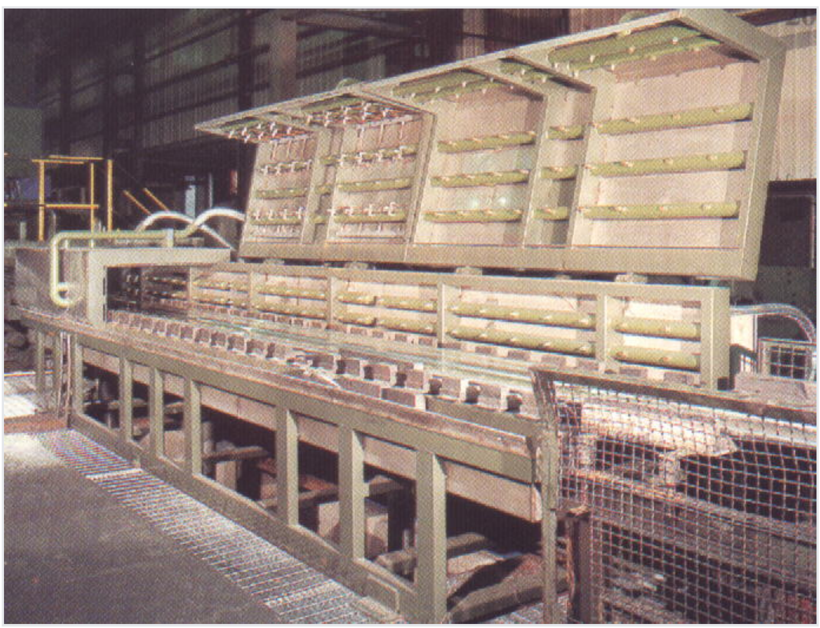


Figure C-18: Water quench for profiles (Photo courtesy of OMAV)

While extrusion presses usually have a working life of 40 to 50 years or more, handling systems after the press tend to wear out or become obsolete every 10 to 15 years. The most common problem occurs when press output increases due to new technology, but the handling system is unable to keep up with the increased production. Therefore, the first step in modernizing the handling system is to determine the real capacity of the press as well as the forecast capacity for the future. The modernization projects should be designed to eliminate any bottlenecks within the handling system. One goal is to insure that worker fatigue does not limit the output of the press; this is accomplished with automation that allows the press system to operate without routine operator intervention.

The other goals of modernizing the handling system are to improve product quality, reduce scrap, and improve manpower efficiency.

Suggested projects follow, listed in the order of material flow through the plant:

- **Air quench systems.** Air quench systems may be upgraded by adding individual fans above and below the lead-out, run-out, and cooling tables. A better solution may be to install plenum ducts, either above or underneath the tables, and feed them by remote blowers; in this case control of the air volume is simpler and the air may be better directed onto the profiles. Another recent design achieves high-intensity cooling with air nozzles arrayed around the profiles, supplying high-velocity air from remote blowers. High-intensity cooling may increase profile surface quality and improve tensile properties.
- **Water quench systems.** For alloys that require rapid cooling with water, wave-type quenches are often replaced with high-intensity water sprays. The sprays should be designed to disrupt the barrier layer of steam on the profile surface; the steam may actually decrease the cooling rate. Some sophisticated quench units allow selective activation of sprays at various points around the profiles being cooled.
- **Puller/hot saw.** Modern production efficiency requires continuous extrusion, in which pocket or feeder dies produce continuous strands welded together; a hot saw or shear cuts the long strands on the lead-out or run-out table. With a modern puller/hot saw system, it is no longer necessary for the press operator to manually guide or cut off the profiles every billet.

Most presses now require double pullers, because it is impractical to return a single puller within today's dead cycles, which are commonly less than 20 seconds. Double pullers may be either hand-off or parallel types.

Double pullers with flying-cut saws - hand-off type: these have the saw on board one of the pullers and cut on the weld mark during the extrusion cycle to save scrap. To avoid marring the profile surface during the hand-off it is critical that the speeds of the two pullers be precisely synchronized and that they be accurately aligned.

Figure C-19: Hand-off type flying cut double pullers (Photo courtesy of Granco Clark)

Figure C-20: Non-hand-off type flying cut double pullers (Photo courtesy of OMAV)

Figure C-21: Roller-type run-out table with cooling air ducts beneath (Photo courtesy of OMAV)

Double pullers with flying-cut saws – non-hand-off type: with these the saw is separate from the pullers (a "third machine"). They also cut on the weld mark during the extrusion cycle to reduce scrap. Synchronization of speeds is still important but this type is not as likely to cause marking.

Parallel double pullers work on alternating extrusion cycles and do not hand-off the profiles; they may be used with a positionable saw, with a single (separate) flying-cut saw, or with a flying-cut saw on each puller.

For the lowest possible scrap rate, the profile must be cut directly on the weld mark. This may be accomplished with a flying-cut saw, or a positionable saw combined with a "double-length" lead-out table[10]. When a positionable saw is used with shorter lead-outs, the weld must later be sawed out and discarded, resulting in about 2% additional scrap.

Flying-cut saws require a longer lead-out in order to be able to accommodate higher extrusion speeds. The time required for essential actions such as acceleration, clamping, sawing, saw retraction, etc., require a finite time cycle. As extrusion speeds increase, the distance required for these actions to take place also increases, usually a minimum of 50 feet (16 meters) lead-out length, and often much more. As this distance increases, the "Double Length" line becomes attractive because flying cut is no longer necessary. See pages **C-36 and -37**.

Figure C-22: Belt-type cooling table with saw feed conveyor (Photo courtesy of Belco)

10. See Double-Length Run-out Systems at the end of this chapter, page C-30 and -31.

Figure C-23: Belt-type cooling table with saw feed conveyor (Photo courtesy of Granco Clark)

Figure C-24: Belt-type cooling table with saw feed conveyor (Photo courtesy of OMAV)

Profile shears are occasionally used on small profiles but often cause problems on hollows or larger shapes. The trend is toward hot saws, quipped with saw blade lubricants and chip collectors[11].

- **Lead-out and Run-out tables.** These tables now use rollers instead of moving slats to support and convey the profiles. Kevlar-covered rollers in various designs reduce damage to the profile surface and

11. Chip collectors are not suitable for flying-cut hot saws.

resist the heat very well (a good cooling system is critical). Hardened steel rollers may be used with bars and very heavy profiles. Rollers may be idle or powered. The run-out table should drop down at the end of each cycle to allow transfer of the profiles by transfer belts. Cooling air ducts are usually integrated within the framework with air distribution nozzles near the top of the rollers.**Lift-overs.** With modern systems the run-out table drops down to place the profiles on transfer belts, which move the profiles to the cooling table. For very heavy profiles, lift-over arms may still be used; these should be designed for minimum tilt angle, to prevent the profiles from rolling or sliding off during the transfer.

- **Cooling Tables.** Belt-type cooling tables are the standard for all but the heaviest profiles. Kevlar belts give excellent service life in a well-designed system: profiles must be well cooled before contacting the belts. Mechanical design is also important: belt alignment and change-out should be simple as possible.

For bars and heavy profiles, tables may use walking beams with Kevlar felt covers, or Kevlar belts with tooth-type positive drive pulleys.

Figure C-25: 500 ton stretcher with de-twist (Photo courtesy of OMAV)

Figure C-26: Saw and length gauge-table with manual off-load belts (Photo courtesy of Belco)

Figure C-27: Automatic profile stacker (Photo courtesy of Granco Clark)

- **Stretcher.** some extruders must decline some business because their stretchers are too small. The stretcher should be sized for the yield strength of the heaviest profile, plus 20%. **One-man** and **no-man** stretchers are very common; they save manpower and also damage caused by manually sliding the profiles into the jaws. Newer stretcher jaws clamp vertically and limit the degree of crushing, to reduce scrap. Stretching may be controlled by displacement, by force, or by percentage of total length (profile length must be measured).
- **Batching Table.** The table after the stretcher is used to automatically accumulate profiles into the correct batch width for sawing, using reversible belts and photocells. It is desirable to store two or more batches if possible, to avoid loss of time.
- **Saw Feed Conveyor.** This conveyor usually consists of idle rollers plus several driving belts, or else power-driven rollers. The conveyor drive is 2-speed, slowing down just before the profiles contact the gauge stop. The table usually drops down to receive the profiles from the batching belts.
- **Saw.** Today's finish saws have the blade and drive located under the table, with clamps above the table to clamp down on the profiles. The blade rises up for the cutting cycle, then drops below the table for return. This design is able to significantly reduce the noise from profile sawing.
- **Length Gauge.** Profile length gauges are set-up automatically to the correct length, which is continually confirmed to the PLC controls via encoder. Accuracy of cut is improved by slowing the conveyor just before the profiles reach the gauge stop.
- **Manual Off-loading and Stacking of Profiles.** Lateral belt conveyors transfer the profiles over to the basket or cart for manual stacking; they reduce the risk of back injuries or other ergonomic problems.

- **Automatic Profile Stacker.** Manpower is reduced and a potential bottleneck to the press eliminated when profiles are automatically stacked. Batching belts are used to create a batch of the same width as the basket. Certain types of stackers also permit automatic de-stacking in other areas of the plant.

Downstream Material Handling

Figure C-28: Floor-mounted conveyor rollers for baskets

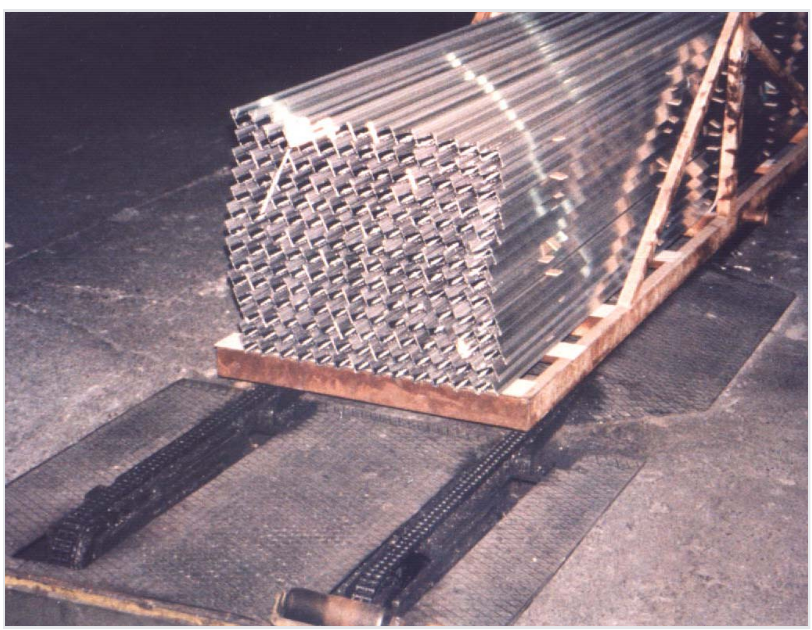


Figure C-29: Chain conveyors for baskets

Handling containers of profiles. There are several commonly used systems to handle the baskets or buggies of profiles after leaving the press, including floor-mounted wheels **(Figure C-28)**, and floor-mounted chain conveyors **(Figure C-29)**. Both of these are simple, low cost, low tech, and easy to maintain and operate.

Packaging finished profiles. Some plants spend almost as much for packaging profiles as for extruding them. In several different automatic wrapping systems are used, for example:

- spiral wrapping, with clear plastic or crepe paper (note: this is quite different from the stretch wrapping offered by some US packaging companies; stretch wraps may bend the profiles)
- auto feeders for interleaving paper
- auto carton makers
- auto strapping of bundles

Various options are offered, with different degrees of automation.

Auxiliary Equipment

- **Die Ovens.** There are important developments in die heaters, as described in **Chapter 10 – Die Ovens**. The objectives are to improve accuracy of die temperature control; to minimize oxidation of the die (especially the bearings); to avoid over-heating or heating for too long; and to conserve energy. In the standard oven is the drawer type, which provides for more orderly management of dies within the oven; and also to prevent the thermal shock when a lid is raised, exposing an oven full of dies to the cold air. Beyond this standard, many extruders are changing to ovens with inert gas atmospheres, to eliminate bearing oxidation, and also to reach temperature faster and more uniformly. Another new heater technology uses induction current to heat dies within 20 minutes, according to the manufacturer's claims.
- **Age Ovens.** There are several alternative age oven designs to be considered:
- **Direct Fired vs. Indirect.** Age ovens are most commonly direct fired; that is, the products of combustion are mixed with the circulated hot air. In applications where metallurgical or finishing requirements prohibit contact between the profiles and combustion products (principally water), the burner(s) fire through a radiant tube and then exhaust to the outside; circulating air passes over the outside of the tube and is heated by radiation and convection. Unless properly designed, indirect firing may result in higher temperature exhaust and lower energy efficiency; and greater firing capacity may be required for the oven.
- **End-Flow vs. Cross Flow.** The majority of age ovens are end flow, with the circulating hot air passing lengthwise over the profiles. In theory, cross-flow ovens offer improved temperature uniformity but slightly lower energy efficiency. However, uniformity may be better or worse with cross flow, depending on the nature of the load and how it is stacked in the oven. Heat transfer predominately occurs by means of convection, so an important objective is to have maximum contact between the profile

surface and the circulated air. If profiles are stacked so that cross flow of air through the load is effectively blocked, or so that only the edges of the profiles are touched by the air stream, heat transfer will be poor for all but the first profile in each row. With end flow ovens, profiles must also be stacked to permit good air flow through the load.

- **Oven Length: Efficiency vs. Uniformity.** In theory, thermal efficiency increases with greater length of the load along the path of air flow. Unfortunately, temperature uniformity also decreases with load length. Therefore, each oven design is something of a trade-off of these factors. Because of the layout of most extrusion plants, age ovens are commonly built to hold 1 or 2 containers of profiles end-to-end. Where space and capacity requirements dictate a longer oven, multi-zone construction is preferred (see below). Otherwise, regular temperature surveys are even more important.
- **Multi-zone vs. Single Zone.** To improve temperature uniformity, longer ovens may be built with two or more zones of circulation and control. Older single zone ovens may also be converted. Each control zone will have its own systems for combustion, air circulation, and temperature control. Modern end-flow ovens should have one control zone for every length of profiles placed end-to-end.
- **Combustion Systems.** Among the various types of industrial heating equipment, age ovens are a relatively low-temperature application and so may be heated with various types of combustion systems. One common type is the **package** or **integral burner** system, which incorporates the burner, air blower, air control damper, air filter, pilot, spark igniter, flame rod, and other features in a single unit. The package unit may be flange-mounted directly into the hot air recirculation chamber or plenum. The burner may be either **nozzle mix** or **premix**.

See also **Chapter 9 – Age Ovens**.

Complete Extrusion Press Rebuilds[12]

From a presentation by Butech-Bliss engineer Ben Demar at the AEC Press Maintenmance Workshop, Atlanta, April 2018.

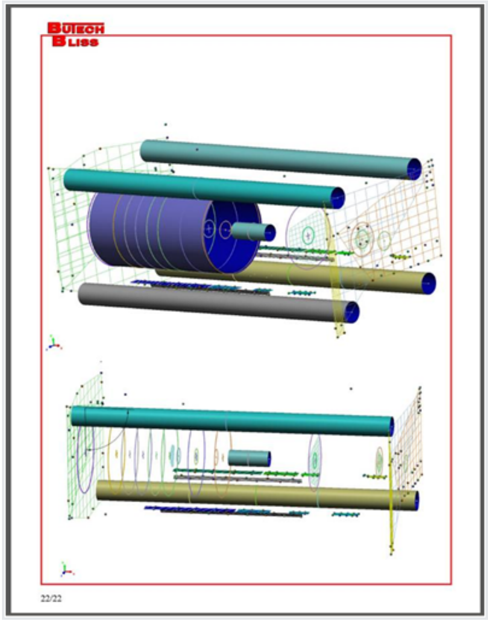
There are several reasons for considering major rebuilds to extrusion presses:

12. Demar, B., Basic Mechanical Aspects of an Extrusion Press Rebuild, presentation at AEC Press Maintenance Workshop, Atlanta, April 17, 2018.

- Worn out or failing components
- Decrease dead cycle time or otherwise improve efficiency
- Increase pressure and tonnage
- Better control, repeatability & accuracy

Worn out or failing components may be due to:

- Fatigue
- Casting issues
- Stress risers
- Improper loading, for example:
- Past tonnage upgrades made without engineering evaluation
- "Crashes"
- Operation with misalignment

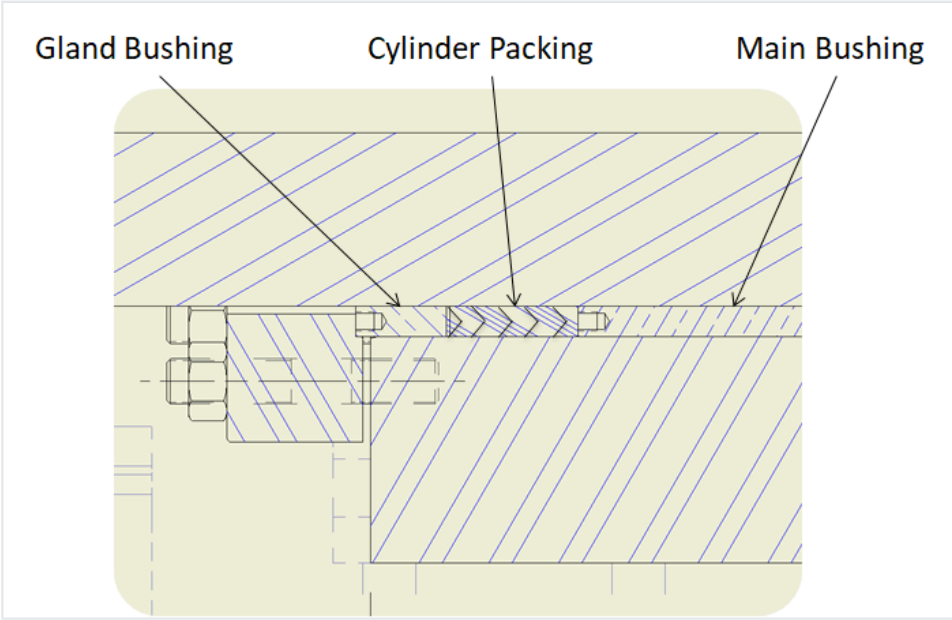


The first step prior to a major rebuild is an engineering evaluation, consisting of a visual inspection, review of the process requirements, a stress analysis and fatigue analysis of the press. Next step is a physical inspection or survey, using both conventional tools and laser trackers, to assess component:

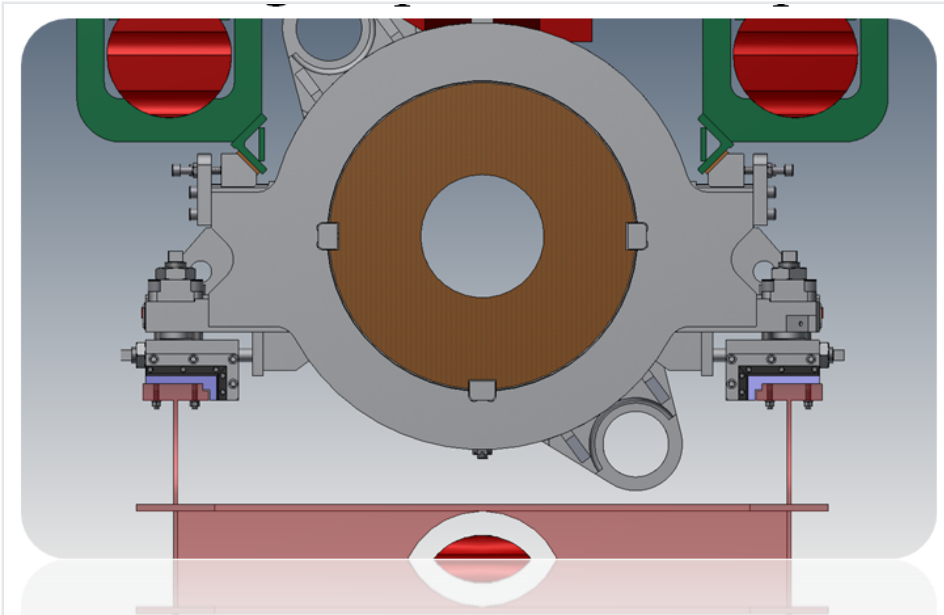
- Position
- Shape
- Alignment – to gravity and to other components
- Trueness

Component condition may be examined with non-destructive testing (NDT)

- Ultrasonic Test (UT)
- Magnetic Particle Test (MT)
- Die Penetrant Test (DP)



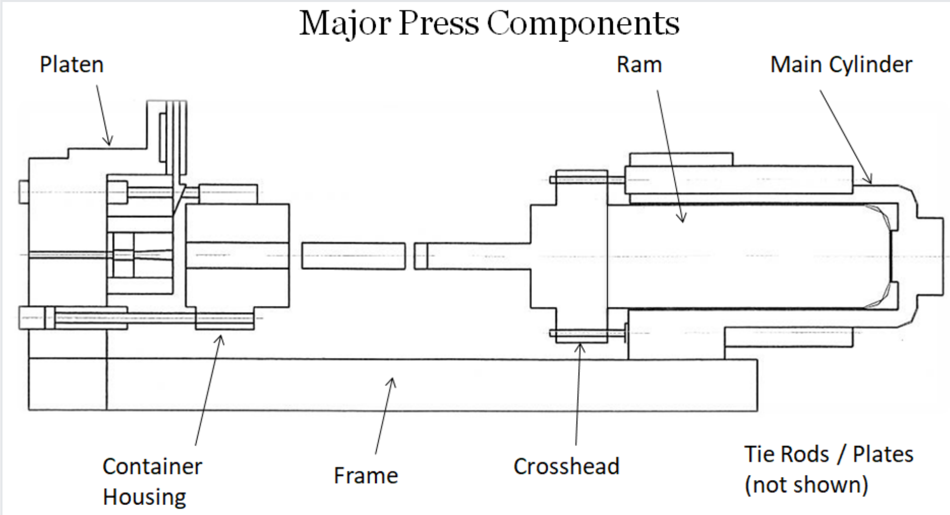
Specific component examinations are as follows:

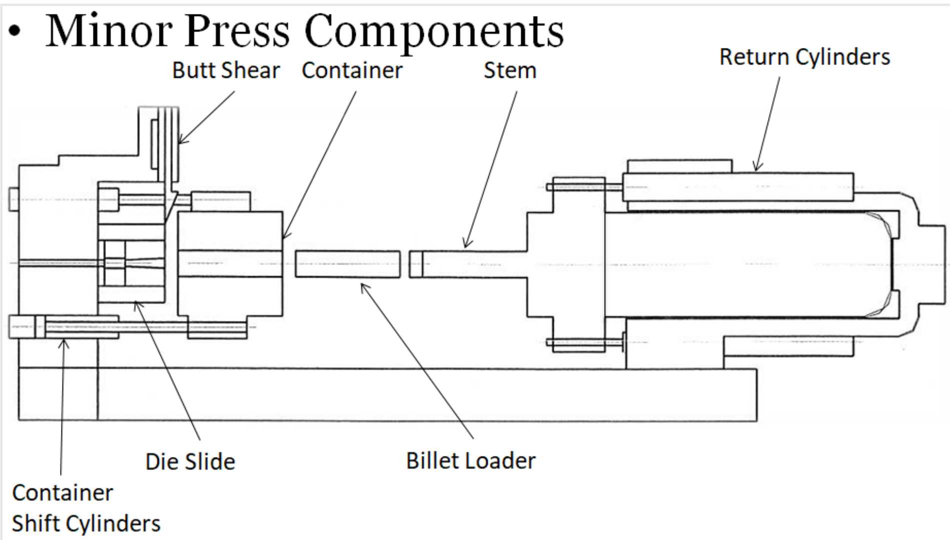


- Main Cylinder Structural Components
- Visual = Leaks / Defects & Weld repairs
- Physical = Parallelism / Perpendicularity
- NDT = UT / MT / DP
- Main Cylinder Replaceable Components
- Main Bushing
- Gland Bushing
- Packing
- Ram
- Visual = Leaks, Scoring
- Physical = Diameter, Trueness
- NDT = Case specific
- Ram Replaceable Components
- Cylinder wear components
- Crosshead wear component
- Crosshead
- Visual = Loose / Jump
- Physical = Trueness
- NDT = UT / MT / DP

- Crosshead Replaceable Components
- Vertical Guide Wear Plates
- Horizontal Guide Wear Plates
- Mandrel Crosshead Wear Plates
- Mandrel Bushing
- Container Housing
- Visual = Loose / Jump
- Physical = Trueness
- NDT = UT / MT / DP
- Container Housing Replaceable Components
- Vertical Guide Wear Plates
- Horizontal Guide Wear Plates
- Container Liner
- Platen
- Visual = Defects / Weld Repairs
- Physical = Parallelism
- NDT = UT / MT / DP
- Platen Wear Surfaces
- Frame interface
- Pressure plate counter bore
- Frame
- Visual = misalignment, fdtn. issues
- Physical = Flatness / Parallelism
- NDT = Case specific
- Frame Replaceable Components
- Crosshead ways
- Container housing ways
- Tie Rods
- Visual = Loose nuts, crash effects
- Physical = Loaded vs. Unloaded (amount of stretch)

- NDT = UT+





Summary

- Rebuilds are an excellent way to make your press like new or to give it an upgrade
- Many tools exist today for both inspection and engineering evaluation, such as Laser Trackers and Finite Element Analysis
- Don't just replace your worn out or failing components with in-kind replacements – take the opportunity to upgrade them with superior materials and FEA-aided design.

Vendor Request form for Possible Press Upgrades

(Indicate interest with and fill in details)

Date

Client Name

Address

City-State-Postal Code

Country

Telephone ___________________________________Fax

E-mail

Information about the Existing Press:

Press manufacturer and year?

Press tons (Metric or US Tons?)

Number of columns (tie rods)?

Conventional or short stroke?

Billet diameter(s)?

Maximum billet length?

Maximum profile weight (per foot or meter)?

Approximate dead cycle?

Fixed dummy block?

Are any major components cracked or failing?

Die changer: single, double, or other?

Container holder: 1-piece or 2-piece?

Relay or PLC control? If PLC, what type?

Hydraulic system manufacturer?

Main hydraulic pumps – number and type?

Billet heater: gas or induction?

Billet heater manufacturer and year installed?

Log shear installed? Supplier and year installed?

Lead-out table length?

Profile cooling: water, air, or both?

Puller installed? If so, supplier? Single or double?

Hot profile saw or shear installed? If so, is it fixed or moveable?

Run-out table length and width?

Is space available for extending the handling system?

Run-out table type (fixed, moveable slats, or rollers)?

Lift-over type (belts or lift arms)?

Cooling table type (walking beams, belts, or other)?

Stretcher feed type (manual or powered belts)?

Stretcher capacity (Metric or US tons)?

Stretcher type – 2-man, 1-man, no man)?

Batching table type – beams or belts?

Batching table width?

Transfer to saw table – belts, walking beams, manual?

Saw table width?

Saw table type – powered rollers or drive belts?

Saw type, manufacturer, and year?

Length gauge – automatic or manual positioning?

Maximum finished profile length?

Off-load and stacking – are transfer belts or stacker installed?

Die heaters – number, type, and manufacturer(s)

Press:

- Replace major parts (columns, main cylinder, platen, etc.)
- Convert from relay control to PLC
- Modernize hydraulic system/reduce dead cycle
- Install fixed dummy block
- Install unistation die changer (shuttle type)

- Replace or improve butt shear
- Improved container holder and alignment
- Improved billet loader

Press Feed Line:

- Energy-efficient gas billet heater
- Induction or hybrid (gas + induction) billet heater
- Taper heating or cooling of billets
- Log shear (or saw)
- Log cleaning brush
- Improved billet transfer and loader

Handling System:

- Improve air quench system
- Improve or add water quench system
- Add/replace puller system
- Add/replace profile saw or shear
- Convert run-out to rollers
- Convert profile transfer to belts
- Convert cooling bed to belts
- Replace stretcher: Capacity? ______________________ 1-man or no man?
- Convert batching table (after stretcher) to belts
- Replace saw feed conveyor table
- Replace cold saw
- Replace profile length gauge
- Add manual off-loading belts for profiles
- Add automatic profile stacker
- Convert to double length

Die Heaters:

- New die heater(s)

Other:

- New age oven(s)
- Upgrade age oven(s)
- Profile conveying system

"Double-Length" Run-Out Systems

The ideal layout for an extrusion press handling system --- when space allows --- is the so-called "Double Length" system. Sometimes circumstances prohibit using this design (for example when retrofitting handling equipment into a limited space in an old plant); but wherever possible it offers the most efficient possible extrusion operation.

The "Double Length" run-out system was developed in order to provide a practical means of sawing hot profiles on the weld point during the press dead cycle. The system offers other benefits as well, for example: cooling takes place while the profiles are under tension from the puller so that they remain straighter. Profiles are also much cooler before they contact the cooling belts, which increases belt life.

Positionable hot saw (or hot shear) systems cut the profiles at a distance of one finished length from the die, but the weld points are then left to be removed at the cold saw. The result is extra scrap (about 3 feet per strand), and extra operator attention may be required. The 3 feet of scrap represents 2% for a 150 foot strand, for example.

Flying-cut systems can saw on the weld mark but pose other design and maintenance problems. Hand-off type double pullers often mark the profiles at the die when handing off, which is unacceptable to many extruders due to quality problems. Long lead-outs are needed to allow time for the flying-cut operation without reducing extrusion speed; for higher extrusion speeds, the required lead-out distance approaches double length and still requires the expense and complexity of flying-cut e.

The "Double Length" system has one complete extrusion strand on the run-out system at all times, and the saw is automatically positioned to cut on the weld mark during the press dead cycle. Cooling is substantially improved, since the profiles are exposed to cooling air for two complete cycles before being released from the puller and transferred to the cooling table. Profiles are not subjected to the extreme twisting forces required to bring them into alignment on a short table. Overall, a 2% to 3% net reduction in press scrap can be expected.

At first glance the "Double Length" system appears to require twice as much floor space as a conventional system. However, referring to the diagrams makes it clear that the total increase is much smaller --- considering that in any case the minimum distance from press to cooling table must be equal to the longest finished profile produced. In terms of the overall plant area, the increase is even less, about 30 to 40%.

And, the extra space is not wasted, since it allows adequate room for die ovens, tooling storage, scrap removal, etc. There is space for an effective water quench and air fans as well. The press operator's area is no longer congested, and there is good access for maintenance.

Wherever it is possible to install the "Double length" system, any increase in building cost will be offset by the 2-3% reduction in press scrap over the entire life of the press. Add in the improved cooling and longer belt life, and it becomes clear that the "Double Length" system is the ideal plant layout.

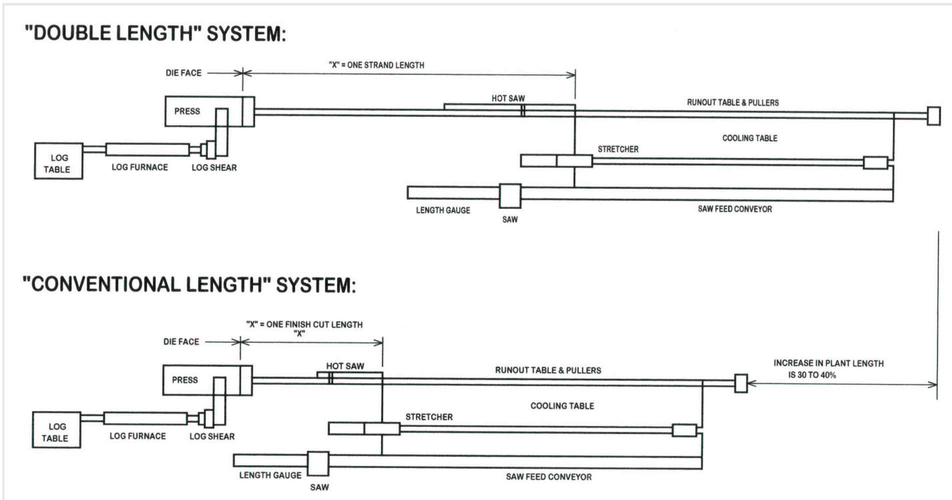


Figure C-30: Comparison of "Conventional" and "Double Length" Handling Systems