

# Drive & Control profile

## Fast Cycle Times on Appliance Press Line with Rexroth Hydraulics



The 630 ton Laple press with Rexroth hydraulics.

Bosch Rexroth provided the hydraulic system on a new press line for Miele, a manufacturer of automatic washers and dryers, helping them integrate an existing press with five new presses to improve their manufacturing process for coated appliance panels.

When the Miele & Cie. KG appliance company expanded its offering of automatic washers and dryers, they decided to build a new hydraulic press line to make

the rear metal panels. The press line needed hydraulic control capable of producing extremely fast press strokes to handle the transfer of each metal sheet to the

### Challenge

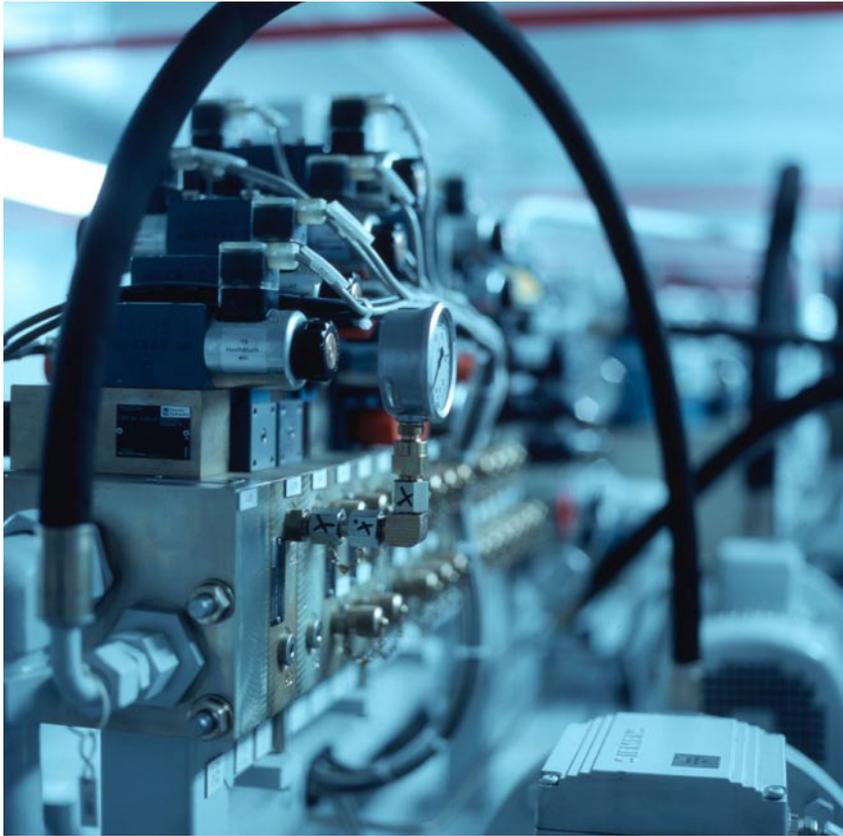
Provide hydraulics system for five new sheet metal presses, integrating with existing sixth press to handle a 10-second cycle time when forming appliance panels.

### Solution

- A4VSO pump for pressure up to 3770 psi
- LR2NT hydraulic controller
- A10VSO operating up to 1160 psi
- GF2-011 pump up to 2900 psi
- PVV4-1X/082 vane pump
- 4WRZE proportional valve
- 4WRTE 25 E350P high-response directional valve
- IH20 control block
- EcoDrive electric drives/motors

### Benefits

- Pump flow can be regulated for exceptional energy savings
- Compact construction
- Reduced amount of piping and no outlet rail on power unit
- Quick start up and commissioning
- Accomplished entire press stroke within five seconds, with five seconds for transfer



View of the IH20 control for the press auxiliary movements.

next stage of the press. With help from the Bosch Rexroth industrial hydraulics Press Application Center, the new press line was successfully commissioned, running at 10-second cycle times.

The process begins with zinc-plated, steel sheet metal pieces, which serve as the starting material for producing the rear panels of the appliances. Previously, the pieces were formed and then coated. Since it is more advantageous to coat the panels first before forming, Miele planned to cut, then coat, and finally form the panels. To avoid damaging the coated metal during forming, the process requires high precision from both the tooling and the machine.

### **Impressive Hydraulic Press Line**

Miele partnered with Läßle, a machine builder for the sheet metal processing industry, to produce five new hydraulic presses through which the plates travel step-by-step in the forming press. A special challenge was integrating a sixth existing press into the line. It has a press force of 630 tons and is used in the system as the head press. Typically the head press does the most forming, with the presses further down the line operating with less tonnage. The five new hydraulic Läßle presses downstream have a force of 280 tons each, which is produced by a 14-inch diameter hydraulic cylinder.

Located just before the head press is a fully automatic plate loader which places the previously coated plates in the press tool area. A suction transfer transports the plates to the downstream presses by removing the formed workpiece after each press stroke and moving it to the next press. The workpiece is held in place by pneumatic suction forming a vacuum. After the final processing station, the finished workpiece is placed on a conveyor belt and brought to the pickup area. The forward and backward movement of the transfer is accomplished via electric drive.

The cycle time of the system is designed to perform at a speed of 10 seconds, in which the entire press stroke including the transfer of the processed sheet from one station to the next takes place. Miele required the system to produce 6,200 parts per day in three shifts.

### **Hydraulic Control from Rexroth**

Läßle engineers partnered with the Bosch Rexroth industrial hydraulics Press Application Center, which specializes in designing hydraulic press drives and hydraulic protection equipment for mechanical presses.

Bosch Rexroth was given a stringent and thorough outline, detailing the requirements for the hydraulic control. For example, the entire press stroke had to be accomplished within five seconds, since the transfer of the processed sheet requires an additional five seconds. During the design phase, the individual hydraulic

components from Bosch Rexroth were combined in a complete drive system, including the power unit. It is equipped with one main pump and three auxiliary pumps, a main control block, as well as a control block for the auxiliary movements of the individual presses. Accessories such as level and temperature switches are also used, as well as a butterfly valve for the press cylinder fill valve.

The main pump is a Rexroth A4VSO 355 LR2NT variable displacement axial piston pump with mechanical power control for implementing the required cylinder speeds of up to 1.8 ft/sec and pressures up to 3770 psi. The LR2NT hydraulic control enables the flow of the pump to be regulated optimally depending on the requirement of the machine, thus providing exceptional energy

savings. The drive capacity of the main pump is 120 hp. Serving as auxiliary pumps are a Rexroth pressure-controlled A10VSO 18 DR axial piston pump operating at up to 1160 psi, and a GF2-011 internal gear pump operating at up to 2900 psi. They operate 12 hydraulic auxiliary axes in each of the five presses. For example, half of them are used for the automatic tool changing. The third pump is a Rexroth PVV4-1X/082 vane pump used in the filter-cooler circuit of the power unit.

The main control block controls the up-and-down movement of the ram. It is designed for maximum flow rate up to 140 gal/min. A Rexroth 4WRZE 32 E520 proportional valve is used to control the fast advance of the ram under gravity until the actual press stroke is reached. The ram is

decelerated to pressing speed and the part is pressed until the lower dead point and required pressing pressure is reached. Nitrogen gas springs are also used in the tools for optimizing the forming process. These place special demands on the hydraulic control because if the press cylinder were simply unloaded after pressing, these springs would allow it to jump back up and possibly damage the workpiece, tool or even the machine. As a result, an additional valve is needed in the hydraulic control. Based on the force of the springs, which diminishes with increasing up-stroke, the valve provides controlled pressure release on the piston side of the press cylinder. The springs force it upward displacing a volume of 145 gal/min. Installed on the control block for this venting is a Rexroth 4WRTE 25 E350P high-response directional valve with an inflected characteristic curve and dual flow.

The ring chamber of the hydraulic cylinder is filled with oil, along with increasing stroke through the main directional valve. Once the venting cycle is completed, the press cylinder is retracted again to the upper dead point through the main directional valve at rapid traverse speed of 1.8 ft/sec.

The auxiliary axes are controlled by a separate Rexroth IH20 control block, which consists of 17 individual segments joined to each other via tie rods. Each segment controls an axis. The IH20 kit system enables very compact construction, with the ability to



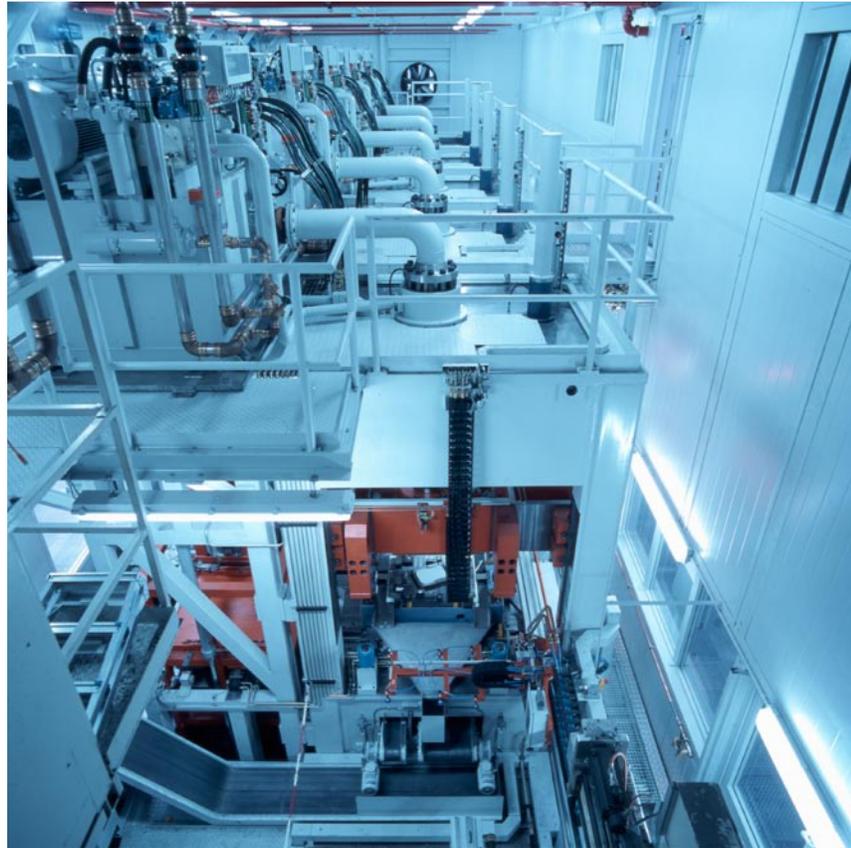
The hydraulic power unit installed in a press sound encapsulator.

install valves of various nominal sizes. A significant advantage to the system is the reduced amount of piping, whereby the outlets of the individual segments are all in one level with measurement connections. This means no outlet rail is required on the power unit. The unique feature of the IH20 systems installed in the power units is a separation in the common pressure channel. The axial piston pump acts on the one side of the system at up to 1160 psi, with the internal gear pump acting on the other side at up to 2900 psi.

Components from the Bosch Rexroth Electric Drives and Controls group were also installed in the new press line, with the company's EcoDrive drives and motors controlling the plate loader and suction transfer.

**Easy Startup**

The hydraulic power units were first delivered to Laple for initial testing, where the system ran flawlessly. The presses and associated transfer equipment and motion controls were then erected



View from above of the Laple presses. The hydraulic power units are installed above the tool magazines.

at the Miele facility in only four months, with testing and startup occurring shortly afterward thanks to the help and timely assistance of Bosch Rexroth.

