VERISTEEL PRODUCTION LINE DETAILS

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INTRODUCTION

The Veristeel panel production line was designed to produce two types of composite structural panels. The panels are 4 inches thick, 48 inches wide and 6 to 26 feet in length. Each panel is composed of light gauge galvanized steel skins, a light gauge galvanized steel perimeter frame, and a structural core typically made of foam. The skins are laminated to the top and bottom of the core material with a structural grade adhesive and the steel frame surrounds the edges of the panels.

The first type of panel has flat skins for both the top and bottom surfaces of the panel (Figure 1). The flat skin panel is typically used as a structural flooring system to replace standard joist-insulation-deck construction. When installed the flat skin panels perform as a structural floor but includes moisture protection, insulation, and structure in a single product.

The second type of panel is produced with a top skin that is formed into standing seam profiles and a flat skin for the bottom surface (Figure 2). The standing seam top skin allows multiple panels to be joined together with a single-lock standing seam joint at the edge of each panel. When installed the panels perform as a typical standing seem roof system but also provide structural support and insulation.

Both types of panels utilize a tongue and groove (T&G) edge system that assist with panel alignment during installation and provides vertical support at panel joints. The T&G edge system is roll formed from light gauge steel and is assembled into a frame by connecting two roll formed edges with metal end caps at the 48" ends of the panels. The metal frame of T&G edges and end caps encapsulate the foam core and is used to lock the top and bottom skins in place until the laminating adhesive cures between the core and the skins.

The production equipment used to produce both panels includes three PLC controlled roll forming lines, a panel assembly line, two hydraulic pump units, and a compressed air supply system. The following sections will provide details on the components of each equipment group and the parts that they produce.

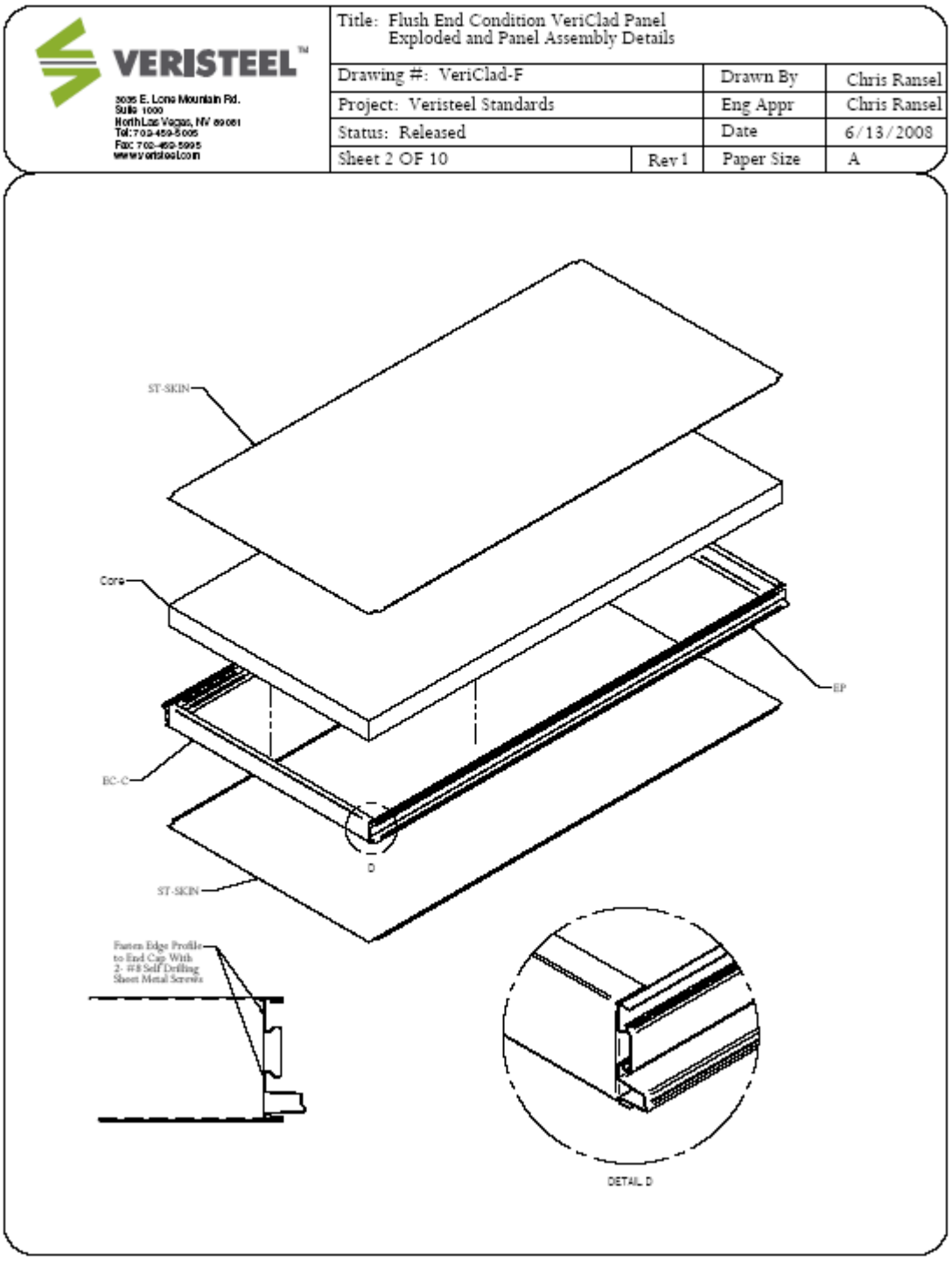

Figure 1: Construction of Flat Skin Panel

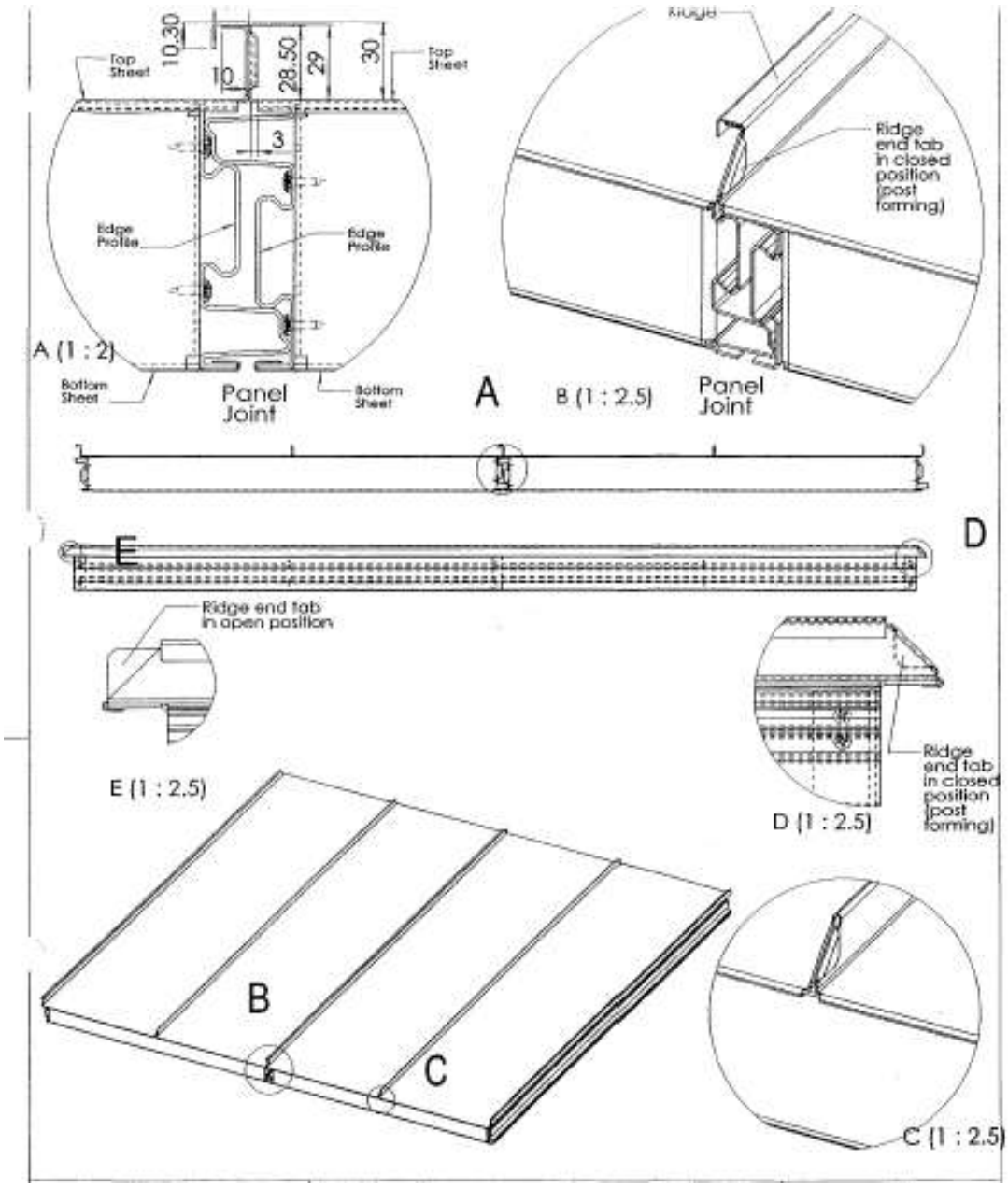

Figure 2: Construction of Standing Seam Roof Panel

ROLL FORMING LINES

There are three roll forming lines that produce three different sheet metal parts for the production of the two composite panel types. The lines are named for their respective parts; Edge Line, Floor Line, and Roof Line.

Edge Line

The edge line consists of an 11 ton capacity decoiler, 11 ton coil lifter, 18 pass roll former, hydraulic shear, and material stacking table (see Figure 3 and Figure 4).

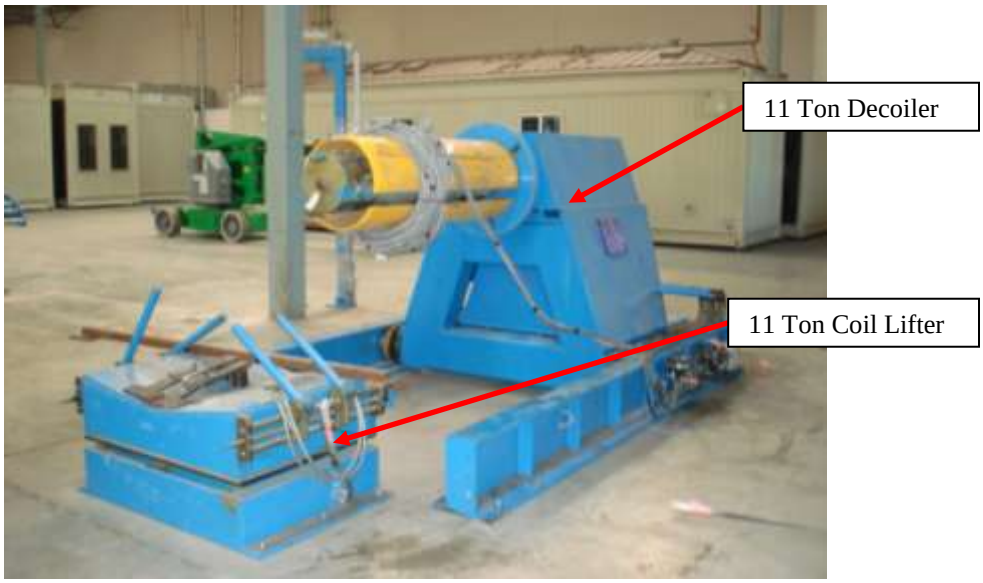

Figure 3: Edge Line 11 Ton Decoiler and 11 Ton Coil Lifter

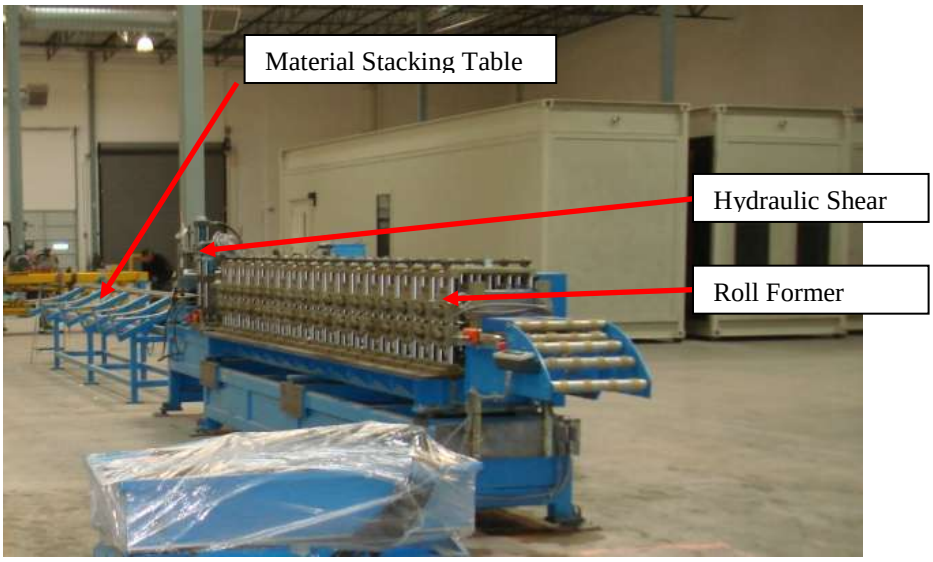

Figure 4: Edge Line Roll Former and Material Stacking Table

The Edge Line Roll Former forms a part that makes up the long edges of the composite panels. The part is called the "edge profile" and it forms a tongue and groove system between adjoining finished panels when installed by the end user. The edge profile is used in the production of both the flat skin and the standing seam panel. The shape of the edge profile is detailed in Figure 5. Material requirements, production details, and equipment data for the Edge Line are summarized in the following tables.

Table 1: Edge Line Material Data

Profile Description	Rolling Passes	Coil Width (in)	Material Thickness (in)	Material Yield Strength (psi)	Coating
Edge Profile	18	Max. 11.75	0.0394-0.0591	52,000	G60-G90

Table 2: Edge Line Roll Forming Equipment Data

Electrical Connection	Hydraulic Pressure (psi)	Pneumatics	Max Line Speed (ft/min)
480 V/60 Hz	Max. 2500	Min. 70/Max. 110	100

Table 3: Edge Line Decoiler Data

Electrical Connection	Hydraulic Pressure (psi)	Coil Width (in.)	Coil Weight (lbf)
480 V/60 Hz	Max. 2500	Max. 11	22,000

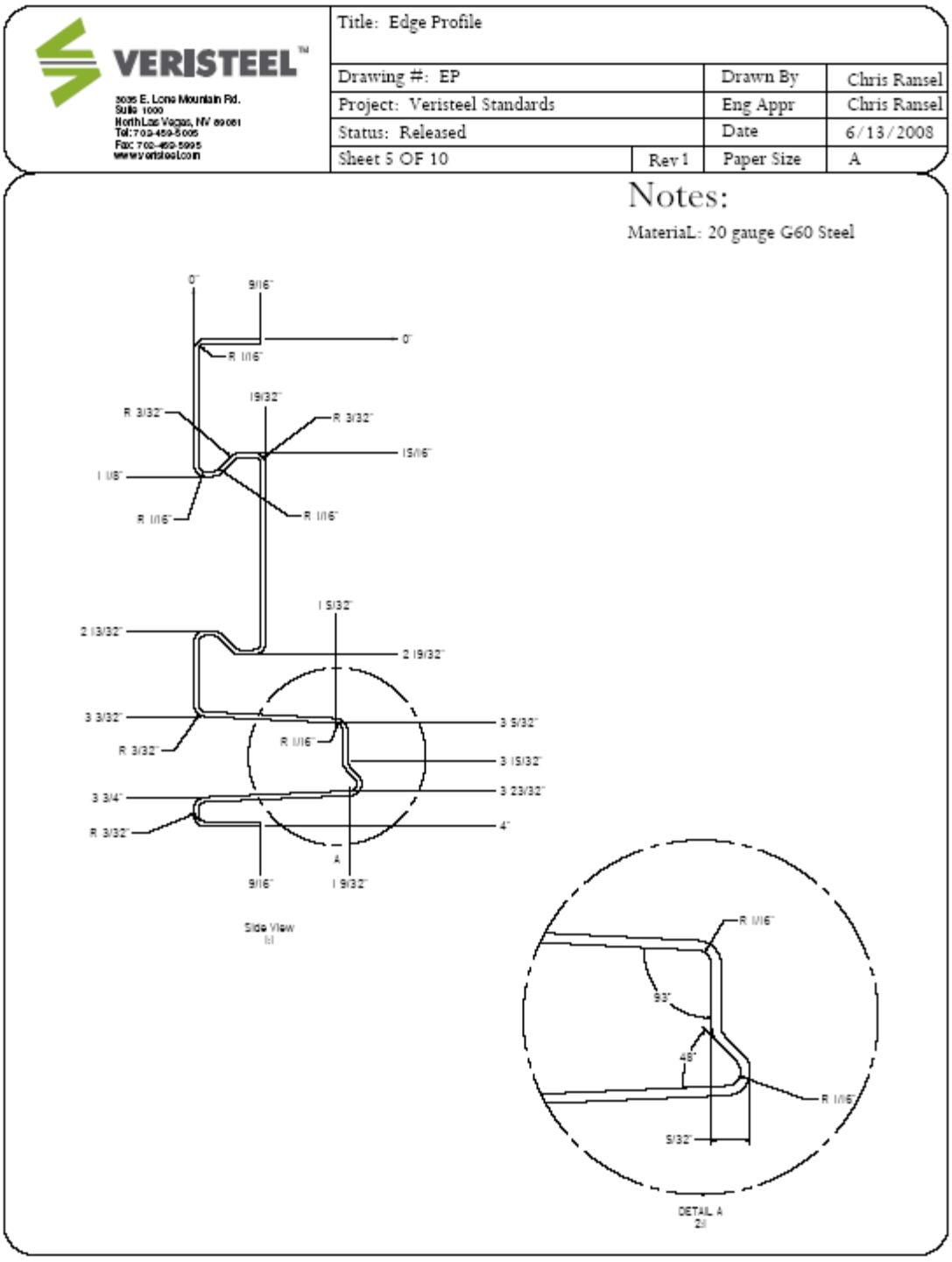

Figure 5: Edge Profile detail drawing

Floor Line

The Floor Line consists of a 20 ton decoiler, 20 ton coil car, 10 pass roll former and hydraulic shear (see Figure 6 and Figure 7).

Figure 6: Floor Line Decoiler and Coil Car

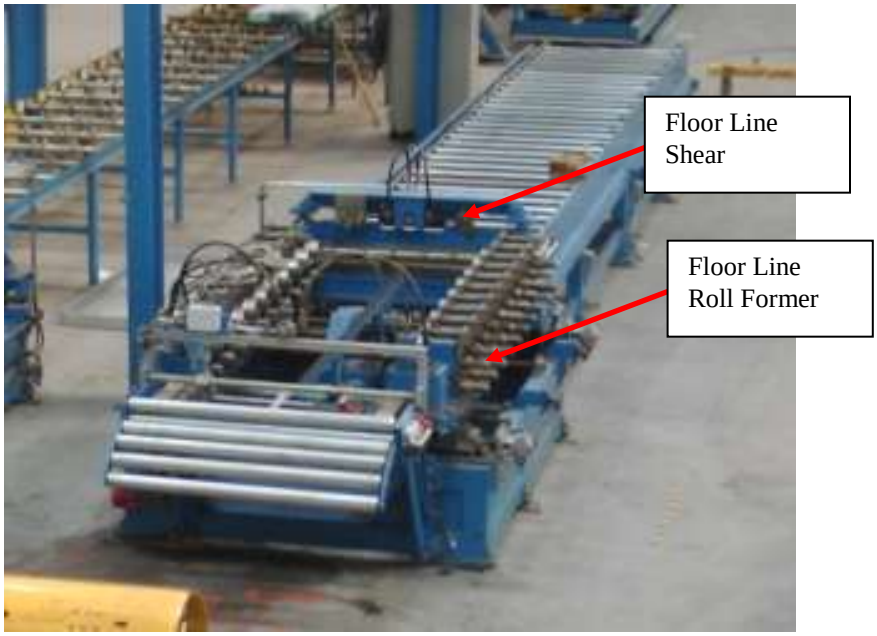

Figure 7: Floor Line Roll Former and Shear

The Floor Line Roll Former forms the part that makes up the top and bottom skins of the flat skin composite panel and the bottom skin only on the standing seam composite panel. The skin is formed with a 90^o bend along one side and a 180^o bend along the other (see Figure 8). The 90 and 180 bends capture legs on the edge profiles that are assembled into a frame from two edge profiles and two end caps (Figure 1). The skins are secured to the edge profile frames by forming the 90^o bend into a 180^o bend. End caps are assembled off line with manually operated bending and shearing equipment. Material requirements, production details, and equipment data for the Floor Line are summarized in the following tables.

Table 4: Floor Line Material Data

Profile Description	Rolling Passes	Coil Width (in)	Material Thickness (in)	Material Yield Strength (psi)	Coating
Floor panel skin	10	Max. 53	0.0276-0.0394	52,000	G60-G90

Table 5: Floor Line Roll Forming Equipment Data

Electrical Connection	Hydraulic Pressure (psi)	Pneumatic Pressure (psi)	Max Line Speed (ft/min)
480 V/60 Hz	Max. 2500	Min. 70/Max. 110	100

Table 6: Floor Line Decoiler Data

Electrical Connection	Hydraulic Pressure (psi)	Coil Width (in.)	Coil Weight (lbf)
480 V/60 Hz	Max. 2500	Max. 53	44,000

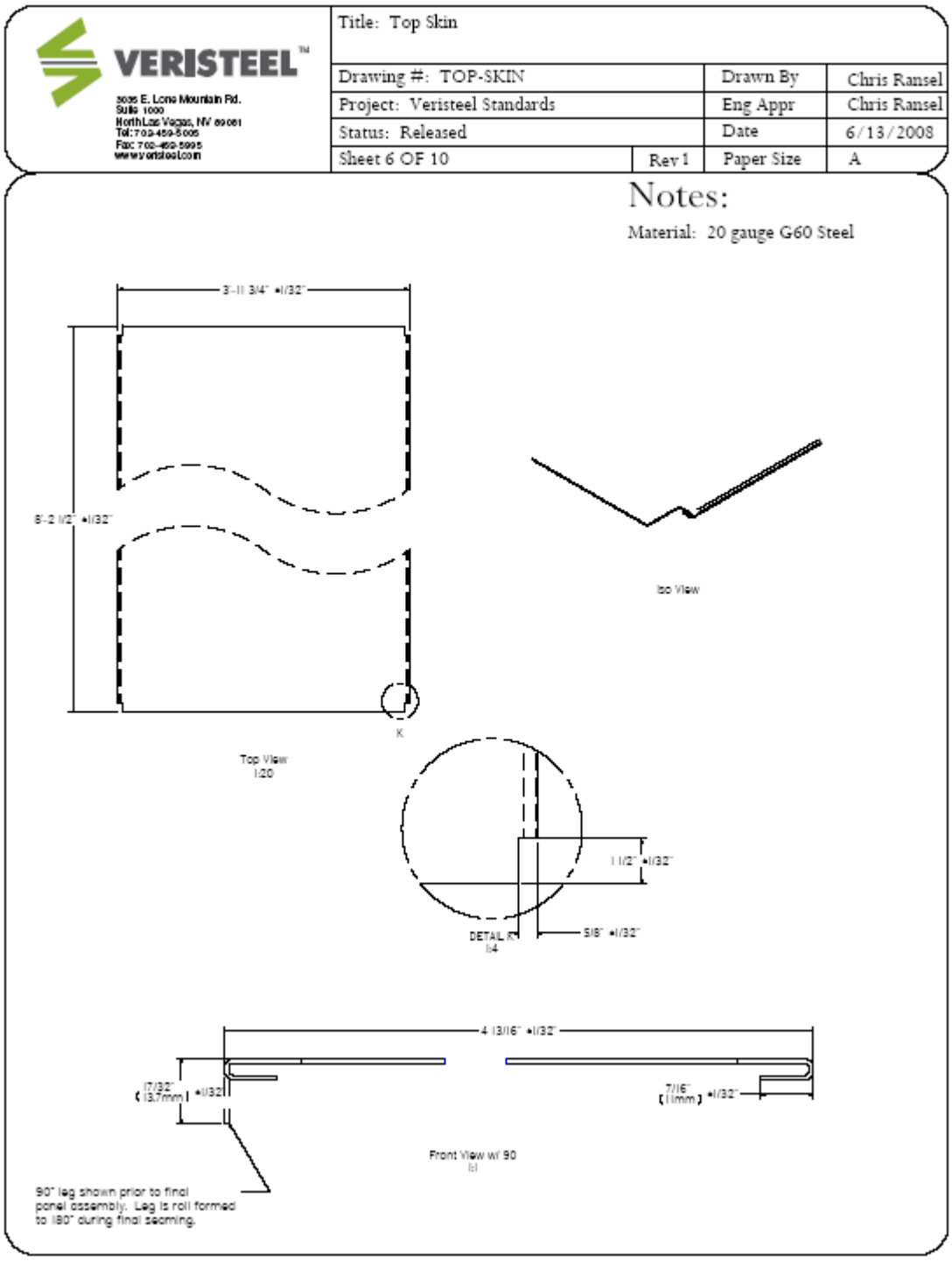

Figure 8: Floor Line skin detail drawing

Roof Line

The Roof Line consists of a 20 ton decoiler, 20 ton coil car, 14 pass roll former, 6 pass roll former and hydraulic shear (see Figure 9 and Figure 10).

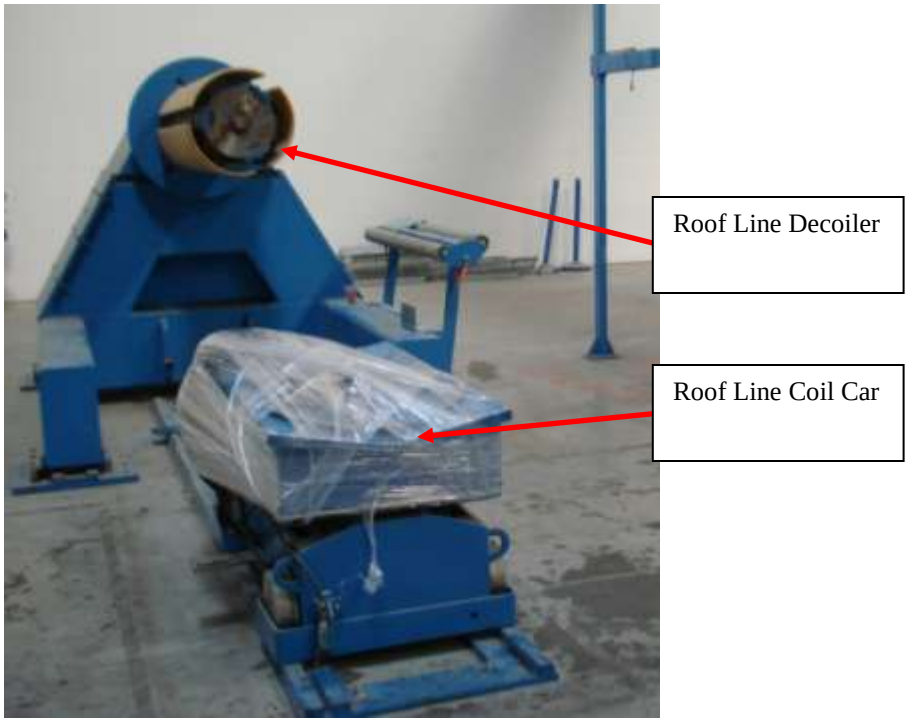

Figure 9: Roof Line Decoiler and Coil Car

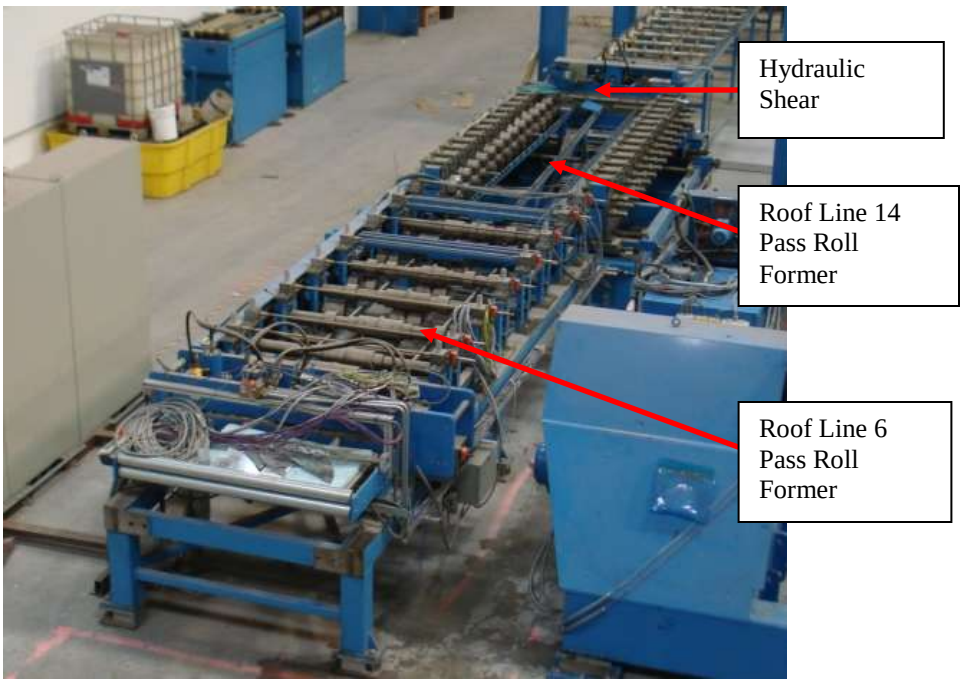

Figure 10: Roof Line Roll Formers and Shear

The Roof Line Roll Formers form only the top skin for composite panels that are produced as standing seam roof panels (Figure 2). The bottom skin of these panels is formed by the Floor Line Roll Former. The standing seam skin is formed with the male portion of the standing seam along one edge and the female along the other. The skin also has a simulated seam formed at the center of the panel to create the look of a seam every 24 inches. Material requirements, production details, and equipment data for the Floor Line are summarized in the following tables.

Table 7: Roof Line Material Data

Profile Description	Rolling Passes	Coil Width (in)	Material Thickness (in)	Material Yield Strength (psi)	Coating
Standing seam panel skin	20	Max. 60	0.0276-0.0394	52,000	G60-G90

Table 8: Roof Line Roll Forming Equipment Data

Electrical Connection	Hydraulic Pressure (psi)	Pneumatic Pressure (psi)	Max Line Speed (ft/min)
480 V/60 Hz	Max. 2500	Min. 70/Max. 110	100

Table 9: Roof Line Decoiler Data

Electrical Connection	Hydraulic Pressure (psi)	Coil Width (in.)	Coil Weight (lbf)
480 V/60 Hz	Max. 2500	Max. 60	44,000

PANEL ASSEMBLY LINE

The panel assembly line consists of several pieces of equipment that perform operations such as moving panels down the line, applying adhesive, curing and pressing panels, and removing panels from the line for packaging and shipping. The main pieces of equipment are the Assembly Table, Transfer Gantry, Roller Tables, Adhesive Application System, Cross Transfer/Flipping Table, Scissor Lift/Core Assembly Table, Heated Press, and Offload Scissor Lift. The function of each piece of equipment will be described in the following sections.

Assembly Table

The Assembly table is located at the outlet of the Floor Line Roll Former (Figure 11 and Figure 12). It supports the floor skins as they exit the roll former and provides a work surface for production staff to assemble and secure the edge profile frame to the bottom skin of each panel. The edge profile frame is secured to the bottom skin with a moveable seaming head that traverses on a guide along the back side of the table. The table is equipped with a pneumatic ram system that is used to secure the panel skin and frame in place during the seaming operation. Motor driven steel rollers allow manual and automatic positioning of the skins on the table.

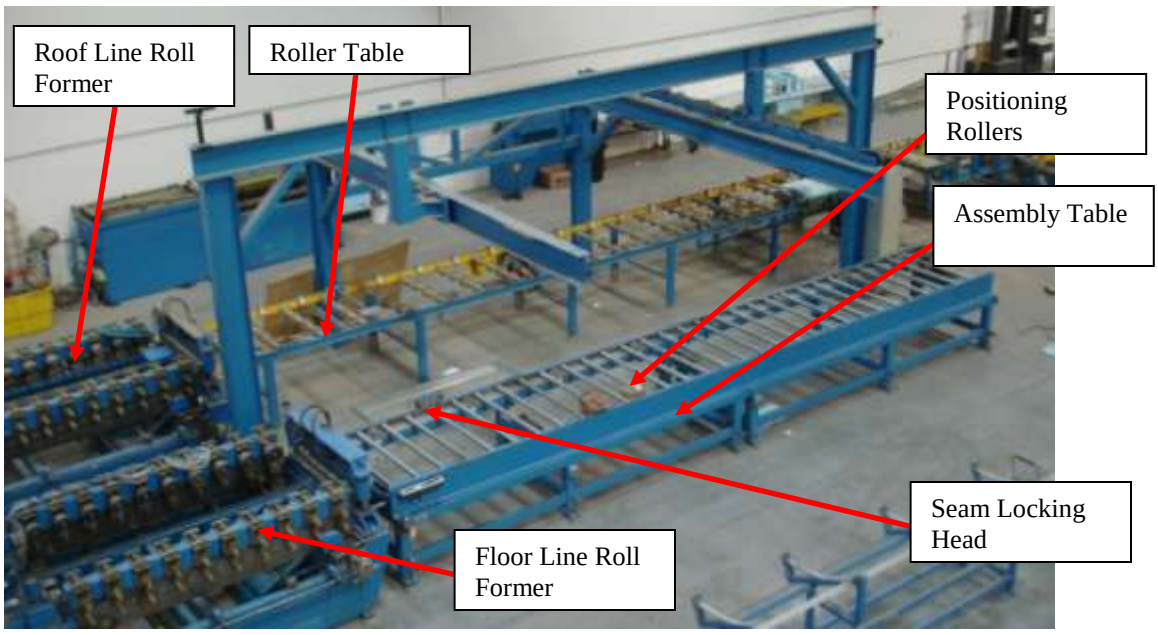

Figure 11: Assembly Table

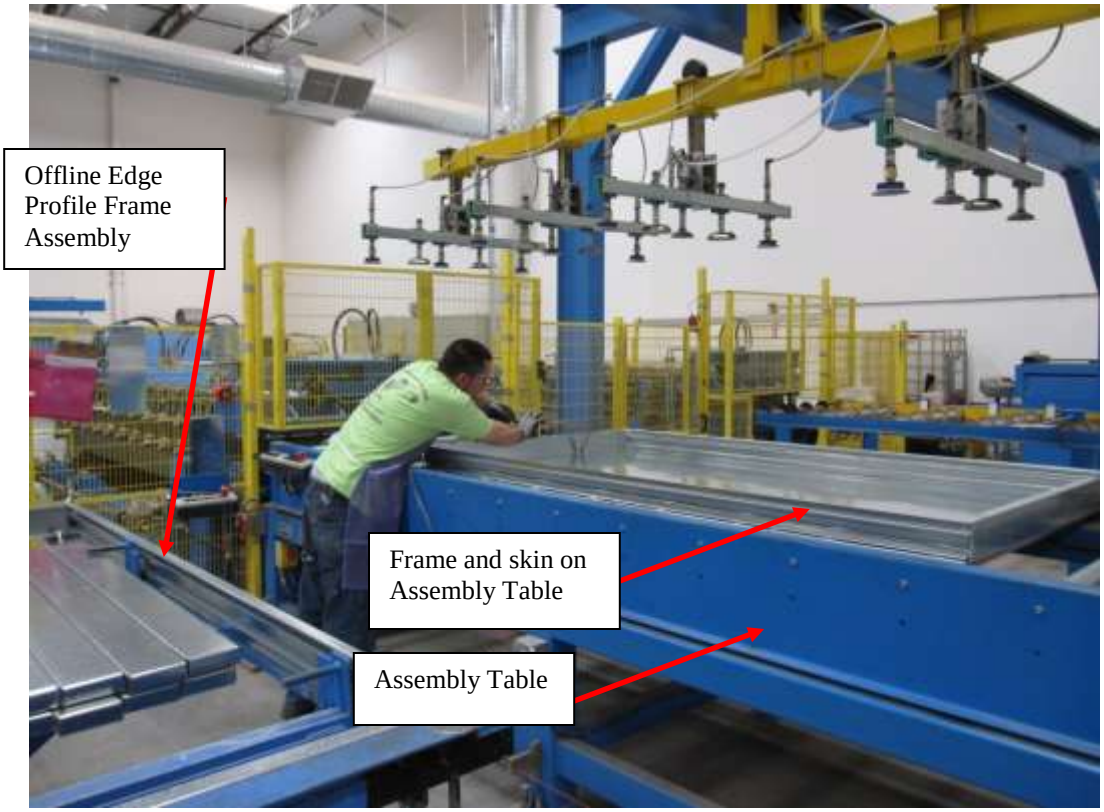

Figure 12: Panel being assembled on Assembly Table

Transfer Gantry

The Transfer Gantry consists of a structural frame that supports a moveable trolley and pickup assembly (Figure 13). The gantry is located above the assembly table and its function is to transfer panels from the Assembly Table to the Roller Table at the back of the production line. The transfer takes place when the pickup assembly is automatically lowered onto a panel that is waiting on the Assembly Table. Suction cups on the pickup assembly adhere to the skin of the panel and allow the pickup assembly to lift the panel to transfer height. Once the pick assembly is at transfer height the trolley travels along the structural frame to the roller table. Once over the roller table the trolley stops, lowers the pickup arm, then releases the vacuum to place the panel onto the roller table rollers.

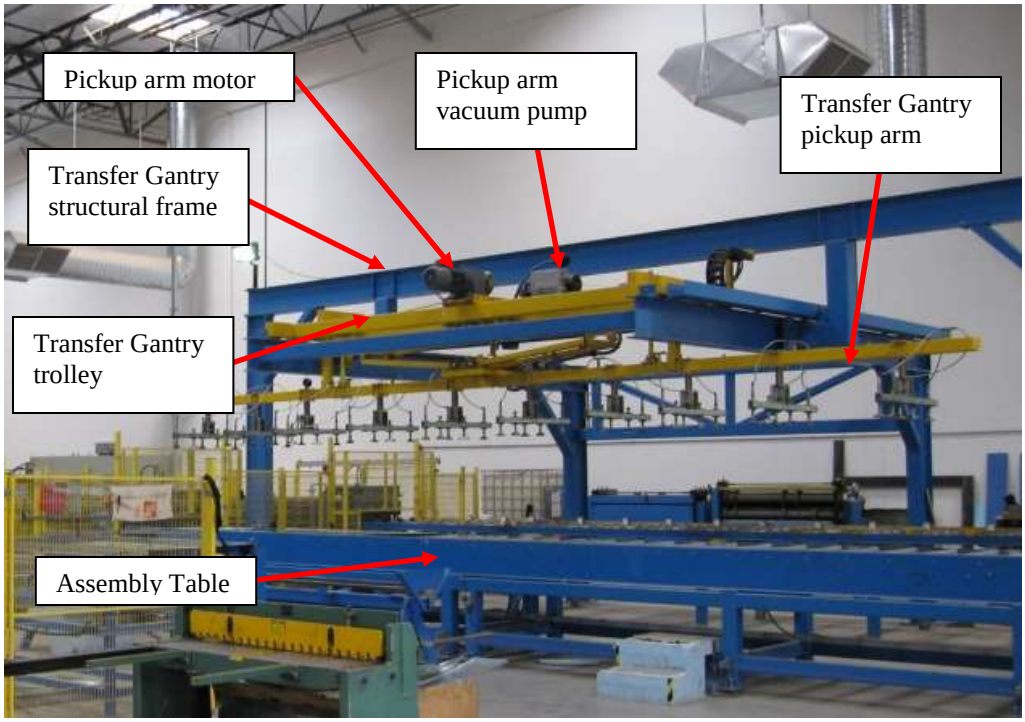

Figure 13: Transfer Gantry

Roller Tables

The Roller Tables are located behind the Assembly Table at the rear of the production line (Figure 11). The function of the Roller Tables are to carry the panels through the Adhesive Application System and then to the Cross Transfer/Flipping Table. The Roller Tables consist of a steel frame that supports rows of rubber coated wheels mounted to shafts. The shafts are driven by a motor through a chain and sprocket drive system.

Adhesive Application System

The Adhesive Application System bridges over the Roller Tables (Figure 14). The system is designed to apply a consistent layer of adhesive (spread rate) on sheet steel as it passes underneath on a roll conveyor. The system utilizes spatter technology developed by Adhesive Systems Technology (AST) to apply a one-part moisture cured urethane adhesive to galvanized sheet steel. The complete system is composed of several AST spatter gun assemblies, a Dopag hydraulically driven reciprocating metering pump, a heated material reservoir, a pneumatically driven adhesive re-supply piston pump, and a rotary motion system developed by Veristeel (Figure 14 and Figure 15).

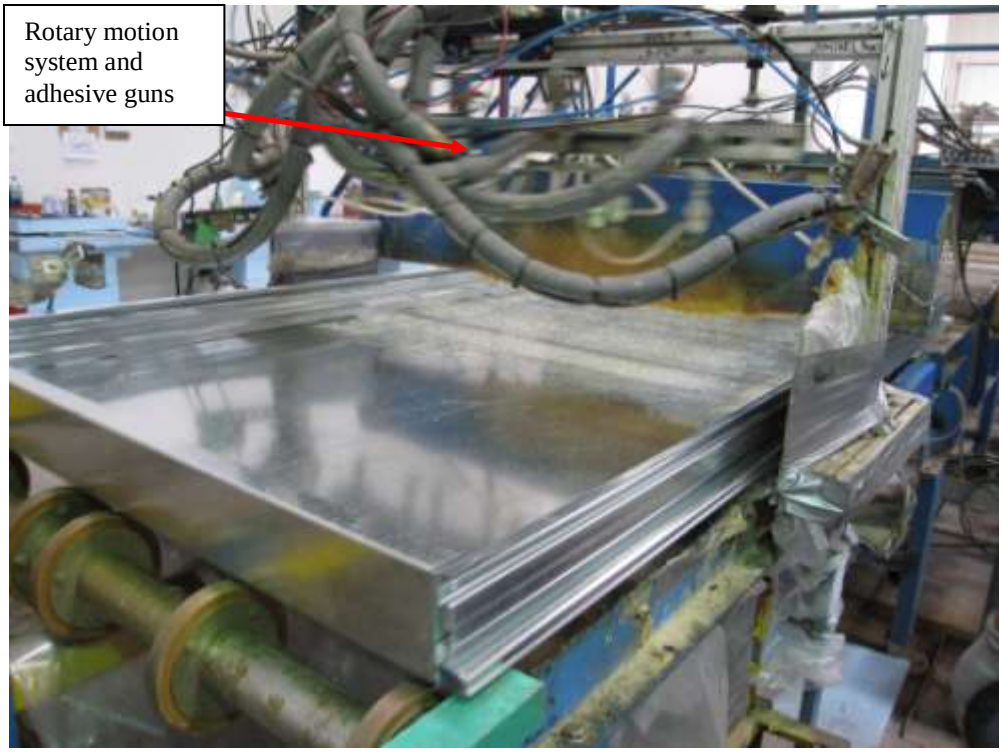

Figure 14: Adhesive Application System

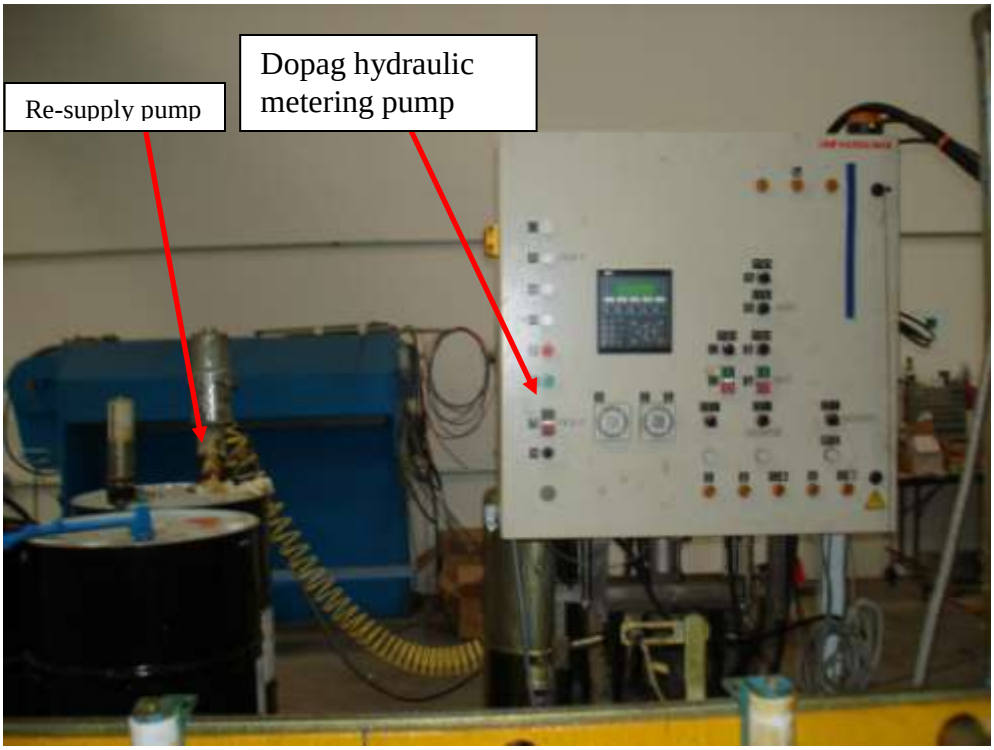

Figure 15: Adhesive pumping system

Cross Transfer/Flipping Table

The Cross Transfer/Flipping Table is located at the end of the Roller Tables. It serves two functions during the production of composite panels. First it transfers framed panels across to the Scissor Lift/Core Assembly Table where the foam core is loaded into the panel (Figure 16). Second it flips top skins over onto the frame assembly for final assembly (Figure 17).

The cross transfer system consists of motor driven belts that rise up to transfer the framed panel across to the Core Assembly Table (Figure 16). The flipping mechanism consists of a long square tube that is mounted to a geared motor at the center of the long axis of the tube. Attached to the tube are arms with suction cups which capture the top skin as the flipping mechanism rotates (Figure 17). When the flipping arm rotates 180^{o} the suction cups are released and the top skin is placed in the proper orientation onto the top surface of the waiting frame and foam core.

Figure 16: Cross Transfer Table

Figure 17: Flipping Table

Scissor Lift/Core Assembly Table

The Scissor Lift/Core Assembly Table is located in front of the Heated Press (Figure 18 and Figure 19). It is a hydraulically driven scissor lift that automatically lifts and lowers to the correct bay of the Heated Press to load panels into the press to cure. The location of the lift is controlled by a PLC which takes inputs from a string pot and adjusts a proportional hydraulic valve to raise and lower the lift. The lift also serves as an assembly table where the core material is loaded into frames that have been through the Adhesive Application System (Figure 18).

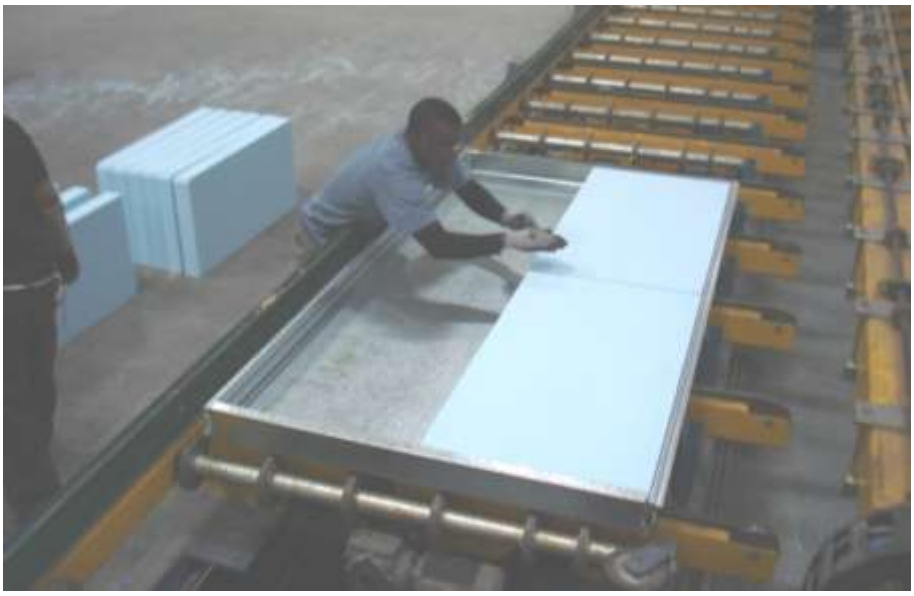

Figure 18: Scissor Lift and Core Assembly Table

Figure 19: Scissor Lift loading assembled panel into press

Heated Press

The Heated Press is located in line with and directly after the Scissor Lift/Assembly Table. The press has two bays that are opened and closed with hydraulic rams. Panels are loaded into the press bays by a motor driven belt that is activated by proximity sensors at the entry of the press. The press has electrically heated platens that are capable of maintaining a temperature of 150^{o}F to heat both top and bottom surfaces of each panel. The gap between platens is set by mechanical stops that are located along the length of both bays. The press can hold panels up to 26 feet in length and can press up to 4 panels at a time depending on panel length.

Figure 20: Heated Press

Offload Scissor Lift

The Offload Scissor Lift is located on the exit end of the Heated Press (Figure 21). It is a hydraulically driven scissor lift that automatically lifts and lowers to the correct bay of the Heated Press to unload finished panels. The location of the lift is controlled by the main PLC which takes inputs from a string pot and adjusts a proportional hydraulic valve to raise and lower the lift. The scissor lift moves finished panel to the offload end with plastic coated wheels that are mounted to motor driven shafts. The wheels are activated and deactivated with proximity sensors at each end of the scissor lift.

Figure 21: Offload Scissor Lift

HYDRAULIC PUMP UNITS

The production line has two separate hydraulic pumping systems. One supplies hydraulic pressure to all of the shears, notchers, punches, and decoilers on the three roll forming lines (Figure 22). The other system provides hydraulic pressure to the Scissor Lift/Core Assembly Table, Heated Press, and Offload Scissor Lift (Figure 23).

Figure 22: Hydraulic pump for roll formers

Figure 23: Press and Scissor Lift Hydraulic Pump System

COMPRESSED AIR SUPPLY SYSTEM

The Compressed Air Supply System supplies moisture free air to all of the pneumatic components on the production line. The system consists of a Gardner Denver rotary screw compressor, Zeks air dryer, and compressed air reservoir.

Figure 24: Air Compressor

Figure 25: Air Dryer and Reservoir