



## Rubber & Plastics Industry

### Application Pack

# Delta Twin-Cylinder Rubber Hot Press Solution

IABG Global Solution Center

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# Twin-Cylinder Rubber Hot Press Solution

## Introduction

Shoes are one of the most representative civilized products of human development. Different shoes are available for houses, workplaces, sports, and banquets. Take sports shoes for example, each one consists of 4 parts, which are from the top to the bottom, upper, quarter, insole, and outsole. **The Twin-Cylinder Rubber Hot Press** is dedicated to the production of outsoles. It heats and presses the rubber into outsoles. During this process, the 3 most important conditions are heating temperature, heating time, and pressure. It can derive the best mold opening time point for an optimized elasticity and abrasion resistance based on the vulcanization curve of each material, thus producing the common sports soles in daily life.



Single-color outsole



Double-color outsole



## Application

After hot pressed, the material is made into single-color or multi-color outsoles. Based on the different designs of shoe manufacturers, the semi-finished outsoles are stitched up or stuck together with the fabric or leather to produce shoes that can be often seen on the market.



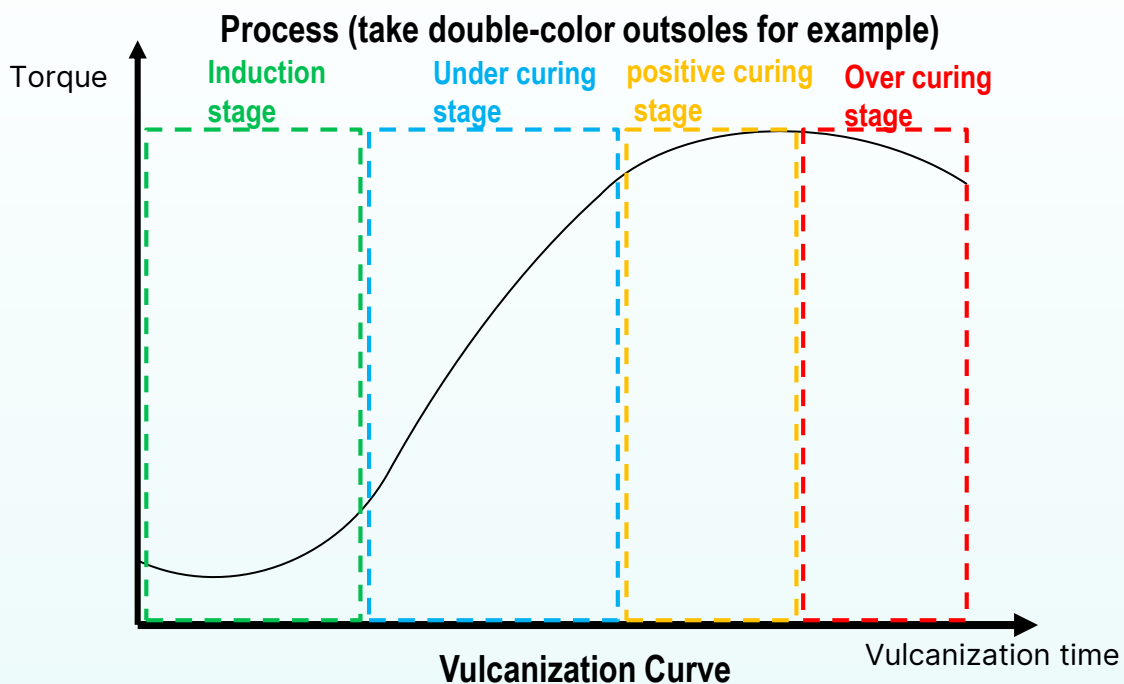
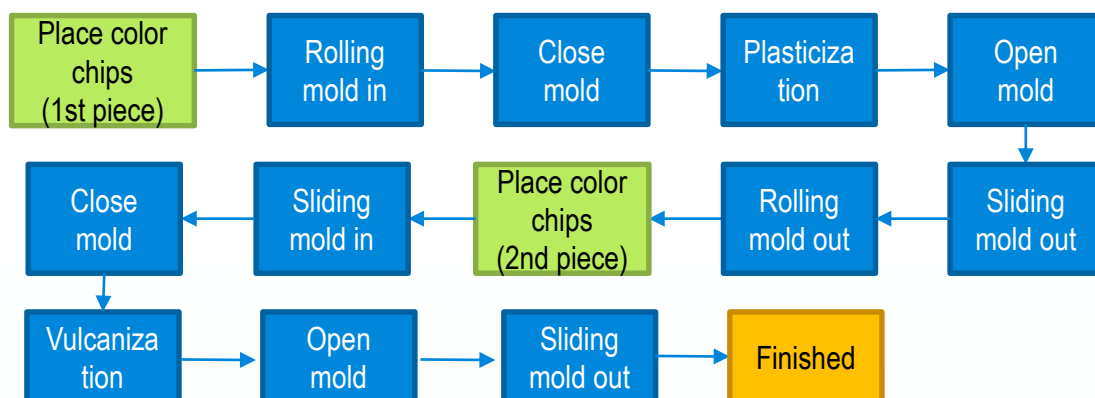
Sports shoes



Leather shoes

## Process

1. Preparation: Before processing the outsoles, the rubber materials are mixed up by composition and color at a certain ratio, then mixed up with the raw materials with the rolling press.
2. Cutting/pressing: Cut or press the mixed materials into blocks with a similar area with outsoles, which are also called color chips.
3. Putting in/closing mold: Put the color chips into the mold. Whether additional materials are needed depends on the outsole thickness. Close mold and enter the hot press.
4. Plasticization: Right at the beginning of heating, the rubber undergoes a bridging process between molecules to form the network polymer structure. This process is called Induction Stage, also known as Plasticization. Therefore, the plasticizing time is critical to the process. A long plasticizing time makes it hard to combine different materials. To produce double-color or multi-color outsoles, different rubbers must be mixed up during plasticization.
5. Vulcanization: After plasticization, the rubber is basically set and cannot be changed in appearance and size. Then it applies a fixed temperature while maintaining the pressure until the rubber reaches the optimum curing stage so that to produce outsoles with high strength, toughness, and abrasion resistance.
6. Opening mold/taking out: Demold and take out the soles, remove the overflow rubber, trim the edge, and finally the process is completed.



## Solution Architecture

### Info



Delta HMI

Modbus

### Control

Delta Temperature Controller



x32



Delta PLC

CANopen



Delta Remote I/O Modules

### Device

I/O



Delta Hybrid Electric Servo System

x2



Delta Synchronous Motor

x8



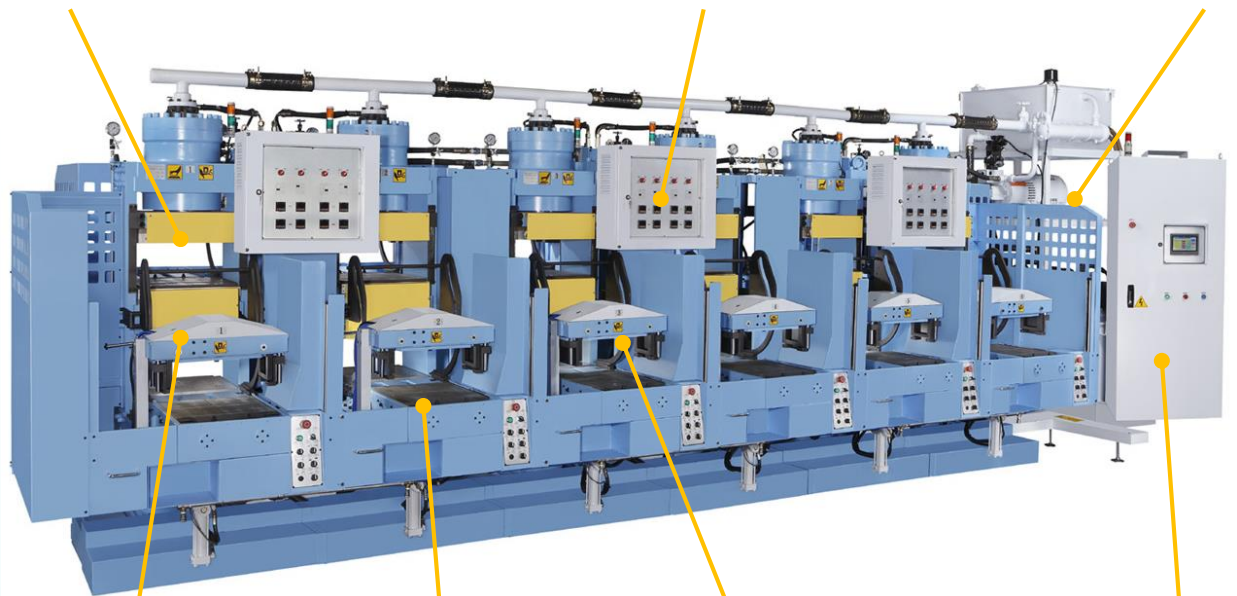
Delta Safety Light Curtain

x8

Mold opening and closing

Temperature control system

Oil-way system



Mold opening and closing

Mold area

Mold lifting unit

Electrical cabinet



## Customer Pain Points



**Station expansion/reduction** requires a rapid and flexible mapping of device stations and I/O points



**A large number of temperature control points** are required to detect the current mold temperature



Limited execution sequence plan of the overall equipment **due to the vulcanization curve and oil hydraulic system**



**Excessive execution sequences**, requiring the corresponding number of PLC timers to support programming

## Features

### • Increase or Decrease I/Os Flexibly

With the outsole hot press, it takes about 2 to 3 minutes to complete the process. The number of devices can be increased to improve the utilization rate. A standard production line usually has 2 to 8 stations. Delta PLC allows flexible allocation of stations according to customers' manpower, and the number of I/Os can be increased or decreased according to the project requirements.

### • Centralized Temperature Management with Temperature Controller

With the multi-channel temperature controller, the temperature control and operating interface of the entire production line are integrated into an HMI project, with 30 to 60+ temperature control points clear at a glance. Delta PLC offers function blocks for temperature control, significantly reducing programs, offering easier maintenance and faster communication, and allowing adjustment.

### • Process Sequence Control with PLC

The vulcanization time is critical for the production process. Diverse and durable soles can be produced only by following the vulcanization curve of materials. The hot press oil hydraulic system is used for a long enough press time. Considering the hardware cost, usually can increase the number of stations to improve the utilization rate. A well-organized time allocation is required. Delta AS300 Series PLC enables high-speed calculation and processing (up to 25ns) and real-time multitasking, to ensure accurate process sequence.

### • Integrated Control Architecture with PLC and C Language

Delta compact modular mid-range PLC AS300 Series enable mixed use of PLC ladder diagram and C language applets for efficient and easy compilation of the program architecture. At the same time, Delta also developed a timer function block with C language for the hot press application, which runs concurrently with the PLC functions, greatly reducing programs and mitigating the load of the PLC CPU.

## Advantages



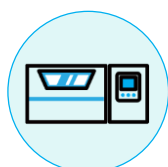
### Function Blocks Dedicated to Outsole Hot Press Application

Object-oriented development allows function call and program maintenance, eliminating the risk of human errors caused by numerous and similar programming architectures at the modification stage. It also saves engineers repetitive operations, saves time, and increases per capita output.



### High Compatibility for Easy Integration of Peripheral Devices

The multi-station and continuous process integrates multiple electronic control products and open communication architecture, and establishes an electronic control master for all modules in each station of the product line. Delta hot press uses RS-485 interface and Modbus protocol to connect the peripheral devices. In addition, it also uses Ethernet for data transmission. Its high compatibility can meet different industrial communication requirements.



### Flexible Number of Hot Press Stations

The hot press allows increasing or decreasing the number of stations according to the end users' manpower, and allocating the production line's utilization during the vulcanization process. 2 to 8 stations can be set according to customers' requirements. The number of hot presses can be adjusted quickly with the built-in shielding function of the PLC.

## Solution Resource

### Delta Twin-Cylinder Rubber Hot Press Solution includes:



Promotion file: Twin-Cylinder Rubber Hot Press Solution

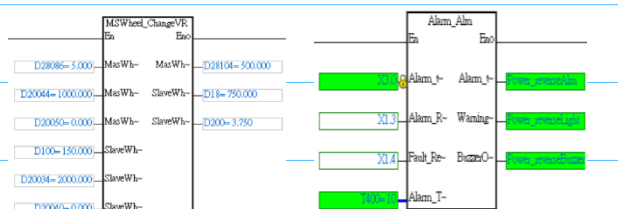


Project file: Twin-Cylinder Rubber Hot Press Solution  
(Device list, wiring diagram, IO table, parameter definition, FB description)

Program

Complete program: PLC AS300

Function block: Timer, Temperature



Request for resource:  
Solution Contact

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