

# Computerized Balloon Forming Machine

Model 2210H

- Computer Interface and Data Communication
- 9" Color LCD Touch Screen Display with Tilt Adjustment
- Centralized Display of Parameters
- Multiple Temperature & Pressure Settings Per Cycle
- Electronic Output and Real Time Graphical Viewing of Forming Parameters in Lab-view or Excel
- Mold Zone Heating for Difficult to Form Balloons
- Fast Mold Changes
- Precision Ball Screw Stretch Slides
- Pressure Profile Control During Forming Process
- Closed Loop Control of all Balloon Forming Parameters



## GENERAL INFORMATION

Interface Associates **Balloon Forming Machine** (figure 1) is a bench-top system designed to produce a variety of high strength polymer balloons using a stretch, blow molding process. These balloons are almost exclusively used in medical procedures; such as angioplasty, stent delivery and many other dilation and occlusion applications.

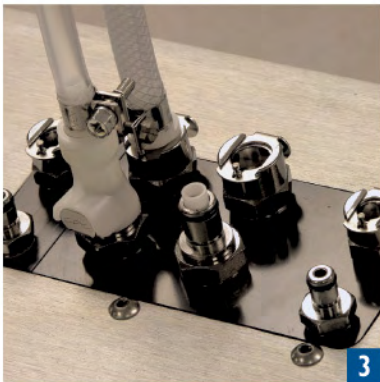
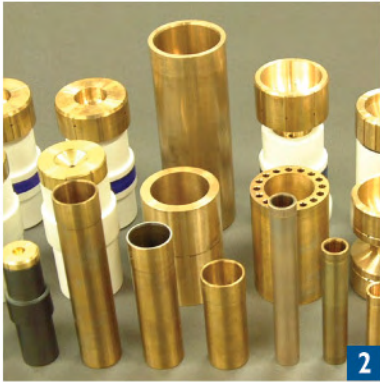
The balloons are formed from precision extruded polymer tubing inside a metal mold. The forming process requires careful synchronization of heating, axial stretching and internal pressurization of the tubing. Interface Associates' machines provide very accurate and repeatable control needed to produce high quality balloons, with tight tolerances. Since the forming process is different for each balloon size and material, the machine operator must have at his disposal sufficient means to quickly set the individual parameters and arrange them in a specific sequence or program. This program is then automatically executed by the machine during balloon production.

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## Computerized Balloon Forming Machine



### DESCRIPTION

The 2210 Series Computerized Balloon Forming Machine from Interface Associates is the most sophisticated system on the market today. It offers unparalleled programming flexibility and hardware versatility, as well as process control accuracy. This sound bench-top system is designed for continuous production and can withstand vigorous 24 hour shifts, as well as, serving as a valuable research and development tool. The machine housing is built from a sturdy anodized aluminum plate and mounted on an angled top panel where the displays and controls are easily accessed by the operator. The top panel of the enclosure is hinged and can be tilted up for easy access to all internal components. This feature is appreciated namely during machine set-up or re-configuration, routine servicing and calibration. Only the highest quality industrial process control devices and motion control components are used in the machine construction. The key components or modules of the machine are described in greater detail below.

### MOLDS - figure 2

The machine uses electrically heated, water cooled molds. The molds are machined from a special heat treated alloy that provides excellent thermal conductivity and guarantees uniform and fast heating. The material is strong and hard, ensuring durability. The 3-piece mold consists of a mold center and a pair of end plugs that define the balloon cones. The mold opens axially for finished balloon removal. The molds can be quickly changed to a different size in a matter of minutes. Center split molds are also available for shorter lengths or spherical balloons. See separate Specification Sheet for additional details about our balloon molds.

### MOLD COOLING - figure 3 (Manifold detail - Cooling water connection)

A stand alone, compact water recirculation tank and an electric chiller are used with the system. They can be conveniently located under the bench and can be easily moved with the machine. This simplifies the machine set-up since no custom plumbing and permanent connections are required for chilled water hook-up. Chilled cooling water is delivered to the mold on demand by a high pressure electric pump.

### WATER JACKETS - figure 4

The module that facilitates mold heating and cooling is called a "water jacket". In order to handle a wide range of balloon sizes efficiently, a total of thirty-three standard interchangeable water jackets are available.

The design of the water jacket features:

- a) sealed channel around the mold for circulation of chilled water during mold cooling
- b) beryllium copper heater sleeve for mounting of multiple electric cartridge heaters
- c) mechanism for fast mold changes

All water jackets are equipped with quick-connect heater cables and cooling water hoses in order to make the installation fast and simple. The water jacket is allowed to slide on a ball bearing guide rail in the center of the machine. Two pairs of air cylinders mounted parallel to the rail provide mold opening and closing force.

## AXIAL STRETCH MECHANISM

On each side of the center guide rail, aligned with the balloon mold centerline, are precision ball screw slides that carry the left and right tubing clamps. The left and right ball screw slides are driven independently by powerful servomotors equipped with position feedback transducers. As the balloon tubing is axially stretched, the system has accurate information about the position and the speed of stretch. Furthermore, each stretch slide has a built-in force transducer that monitors the axial force exerted on the tubing. With such extensive information about the tubing status, the operator can perform axial stretch in multiple steps at incremental distances, varying speeds and forces, thus allowing him to achieve a thinner wall thickness in the cone and neck area of the balloon.

## TUBING CHUCKS AND CLAMPS - figure 5 and 6

These devices are used to firmly grip a section of the tubing during the stretch portion of the cycle. Additionally, they must seal one end of the tube section and supply high pressure gas into it on the opposite end. The tubing chuck (figure 5) and clamp (figure 6) are installed on top of stretch slides described in the previous paragraph. Since the machine must handle a wide range of balloon sizes, Interface Associates offers a large selection of air activated chucks and clamps with interchangeable collets.

## PRESSURE CONTROL

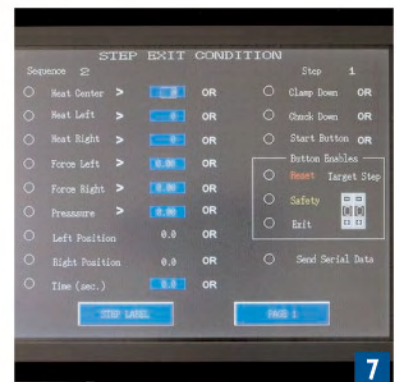
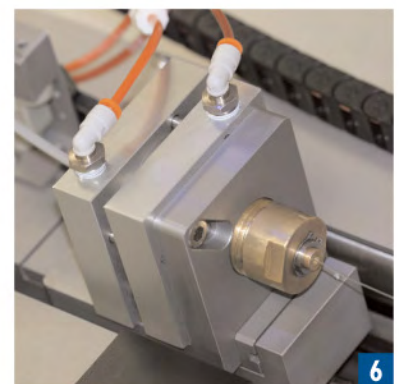
The formation of the balloon inside the metal mold is driven by high pressure gas (typically dry pure nitrogen) that is introduced inside the stretched and heated section of the balloon tubing. The timing of tubing stretch and pressure introduction must be carefully synchronized to optimize the balloon forming process. The 2210 Series machine use a high speed, high pressure digital module that accurately controls the magnitude of gas pressure and gas flow into the balloon. This approach also allows for multiple pressure levels used during different parts of the balloon forming cycle.

## USER INTERFACE - figure 7 and 8

The 2210 Series Computerized Balloon Forming Machine utilizes an industrial grade computer to control all of its functions. It provides closed loop control of temperature, axial stretch distance and speed, stretch force and gas pressure and flow. Real time data output of all process parameters is available on a RS-232 data port.

Operator inputs are through a touch-screen display panel (figure 7). The touch-screen integrates input, control and display of all machine parameters in one location. The tilt angle of the panel can be adjusted for optimum viewing clarity (figure 8).

The operator can enter new parameters, manually activate individual machine functions during testing or trial runs, perform machine calibration, set limits, configure new balloon forming sequence, recall complete programs from machines internal memory, and up-load or down-load programs to or from an external PC computer. Multiple programs (up to 18) can be stored in the internal memory.



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### DATA OUTPUT

The machine real time data output can be connected to a PC via an RS-232 cable. The individual parameters of the balloon forming process can be then viewed graphically using a program such as Visual Basics. Using empirically established criteria for the shape of the curve, the operator is then able to determine if any process adjustments are required. A complete set of balloon forming parameters for each balloon production order can be stored in an electronic format in an external data base for future recall.

### CAPABILITIES

The machine can form balloons in shapes that are generally suitable for the stretch blow molding process in sizes from  $\varnothing 1.0$  to  $\varnothing 50$ mm in diameter and 1.0 to 250mm in length. Materials such as PE, PVC, polyurethanes, polyamides (Nylon, Pebax) and PET can be processed. Due to its nearly unlimited programming capabilities, multiple temperature and pressure levels can be used within one balloon forming cycle as well as incremental axial tubing stretch at varying speeds. These features are especially important when processing difficult-to-form balloons (large body diameter, small neck diameter, long balloon length) that require, e.g., a secondary neck and cone thinning step at reduced pressure, balloon heat-setting at elevated temperature and pressure, etc.

Based on the expected range of balloon sizes, the machine is typically configured with desirable options at the time of order. Additional modules can be added as the need for the new balloon sizes arise.

### SPECIFICATIONS

Power Requirements:	110 VAC, 60 hz • 220 VAC, 60 hz • 220 VAC, 50 hz *
Size:	54" L x 21" W x 20" H
Weight:	120 lbs. • 21 Kg
Finished Balloon Sizes:	.5 to 50mm by 1 to 250mm long
Heating Power:	Up to 3,000 Watts
Forming Pressure:	Up to 1,000 PSI (up to 6.89 MPa) Dry Nitrogen
Compressed Air:	80 - 120 PSI (.55 MPa - .83 MPa)

### ADDITIONAL MODELS AND CUSTOMIZED VERSIONS AVAILABLE \*\*

Model 9608H	Large, Hot Mold Balloon Forming Machine
Model 9506H	Small, Hot Mold Balloon Forming Machine

\* Due to many different machine configurations, wattage requirements vary

\*\* Consult manufacturer for details.