

The FRCSW Autoclave System

The FRCSW Autoclave System is comprised of three autoclaves (12 ft., 7 ft. AND 3 ft.), a control room, and supporting utilities such as vacuum pumps, cooling water supply system and a nitrogen pressure supply system. The autoclave system was built in 1983 by Thermal Equipment Corporation of Torrance California and was designed to support the Navy's move into the repair of composite aircraft structures. In addition each autoclave has connectivity for vacuum bagging and individual heating blankets.

The 12 foot and 7 foot autoclave are similar in construction and operation. Both have a natural gas furnace in the rear of the vessel that supplies 6 million and 3 million BTU/hour respectively. The soak (dwell time) heat supply 500,000 and 250,000 BTU/hour respectively. The 3 foot autoclave heating is provided by a 60 kilowatt electric heater occupying the door. Full power and soak operation for the 3 foot autoclave is 45 and 25 kilowatts respectively. Hot and cooling air, in all autoclaves, is circulated by a centrifugal fan located in the back of each vessel. Pressurization is supplied from a liquid nitrogen to gas converter located outside the autoclave area. Venting of pressure is to the roof via piping. The cooling system for all three autoclaves is closed looped supplied from a reservoir located outside the autoclave area. Two vacuum pumps provide 0 to 30 inches of vacuum to all three systems. Electrical power for the common facility functions, control room power, cooling, pressure and vacuum supply, is provided from the 7 foot autoclave motor control center.

The control room houses the electrical and mechanical controls, wiring, instruments and computers used to gather data and control the autoclaves and facilities. There is one Dell computer for each autoclave to gather data and control the cure cycles. The computers use Microsoft XP to run Taricco Corporation's TCS™ Thermal Control System which is a powerful application program designed for part-manufacturing heating systems. The program offers precision and flexibility in the design, implementation, monitoring and recording of an entire curing process. The program is very user friendly. The facility and autoclave interface is through a Programmable Logic Controller, (PLC). The TCS™ program is capable of running the autoclave and as many as 28 heater blanket cures through the PLC.

The autoclave specifications and equipment are as follows:

Temperature

- a) Design maximum working temperature: 500° F
- b) Design normal operating temperature: 400° F
- c) Heating control accuracy: 200° F - 500° F ± 10° F
- d) Heating rate: 100° F to 400° F at 10° F/minute, 400° F to 500° F at 12° F/minute
- e) Cooling rate: 400° F to 200° F at -10° F/minute, 500° F to 400° F at -12° F/minute
- f) Temperature uniformity throughout the work space at a steady rate ± 5° F
- g) Heating medium: Natural gas
- h) Maximum clear working space (Excluding door cavity)
 - i) 12'-0" diameter by 44'-0", 4976 cubic feet
 - ii) 7'-0" diameter by 32'-0", 1232 cubic feet

- iii) 3'-0" diameter by 4'-0", 28 cubic feet
- i) Design Load: aluminum, steel or composite parts
 - i) 12'-0" diameter – 20,000 pounds
 - ii) 7'-0" diameter – 10,000 pounds
 - iii) 3'-0" diameter – 500 pounds

Pressure

- a) Design maximum working pressure: 200 psig
- b) Design normal operating pressure: 100 psig
- c) Pressure control accuracy: 0-200 psig \pm 2 psig
- d) Pressurizing rate:
 - 0 to 85 psig in 20 minutes or less
 - 85 to 100 psig in 5 minutes or less
 - 100 to 200 psig in 30 minutes or less
- e) Vent rate: 200 to 0 psig in 20 minutes or less
- f) Pressure medium: Liquid nitrogen converted to gas by steam heating

Equipment:

12 Foot Autoclave:

- Vacuum Ports-28
- Vacuum Sensors-28
- Heater Blankets-28
- Heater Blanket Thermocouples -28
- Part Thermocouples-112

7 Foot Autoclave:

- Vacuum Ports-10
- Vacuum Sensors-10
- Heater Blankets-10
- Heater Blanket Thermocouples -10
- Part Thermocouples-40

3 Foot Autoclave:

- Vacuum Ports-4
- Vacuum Sensors-4
- Heater Blankets-2
- Heater Blanket Thermocouples -2
- Part Thermocouples-8