



**Thermal Equipment Corporation
Autoclave Quotation Request**

Please complete and fax to:
**Thermal Equipment Corporation
Attn: Customer Service
2030 East University Drive
Rancho Dominguez, CA 90220 USA
Phone: 310-328-6600 Fax: 310-603-9625**

Use this form to specify the autoclave you want TEC to Quote. The form provides many of the options which affect price and performance.

Note: The information below is designed to narrow your request to provide the exact autoclave for you application. Because each option may dramatically change the autoclave price, we suggest that you think through your choices carefully.

Contact Information

Name	_____
Title	_____
Company	_____
Address	_____
City	_____
State	_____
Zip Code	_____
Country	_____
E-Mail	_____
Telephone	_____
Fax	_____

What type of quotation are you interested in? (select one)

Budgetary +/- 5%
 Firm Fixed Price

When do you need the quotation?

Due Date _____

What "Internal Working Diameter" is required?

_____ **Feet**
_____ **Meters**

What "Internal Working Length" is required?

_____ **Feet**
_____ **Meters**

What is the "Maximum Pressure Capability" of the autoclave?

_____ Psig
_____ Bar

What is the "Maximum Temperature Capability" of the autoclave?

_____ Deg. F
_____ Deg. C

Pressure System Selection

Pressurization Gas

Most autoclaves use either gaseous Nitrogen (GN₂) or compressed air for a pressurization media. Though the use of compressed air is generally less expensive than Nitrogen, it also promotes combustion and can support an internal fire in the autoclave, especially when operating at higher temperatures and/or with solvent-based materials.

What pressurization source gas will your autoclave use? (select one) _____ GN2 - Nitrogen
_____ Compressed Air
_____ Mix of GN2 and Air

Maximum Pressurization Capability

Pressurization rates are dependent on autoclave inlet valve size, gas supply pressure, gas supply flow, and up-stream line size. Pressurization rates are normally defined as the average maximum rate from atmospheric pressure to normal autoclave working pressure.

Please be aware that higher pressurization requirements can increase the cost of the autoclave and support equipment.

What average maximum rate is required for pressurization?
(Typical value: 10 Psig/min.)
_____ Psig/Min
_____ Bar/Min

What average rate is required for depressurization?
(Typical value: 10 Psig/min.)
_____ Psig/Min
_____ Bar/Min

Pressure Control

Please select from the following valve options:

_____ Proportional operating valves	Select this option if your application requires minimum control accuracy at +/- 1 Psig. (suggested)
_____ On/Off operating valves	Select this option if you want to reduce cost and if your process can operate with a pressure control accuracy of +/- 2 Psig.

Fan Circulation System

Proper circulation in an autoclave is important to guaranteeing good temperature uniformity as well as improved part heat transfer.

The recommended minimum air-speed is 250 – 300 ft/min, which will provide +/- 5 Deg. F temperature uniformity throughout the autoclave working area.

Please enter the required temperature uniformity (after autoclave temperature reaches steady-state conditions): (+/- 5 Deg. F – suggested)

+/- _____ _____ Deg. F
 _____ _____ Deg. C

Fan Motor Operation

The fan motor can be operated in one of three ways.

TEC will select the most cost effective unit that meets your processing requirements.

Direct “across the line” starter (single speed)	This is the least expensive option, but is not recommended for motors larger than 1—HP due to the high in-rush current associated with starting motors of this size.
Solid-state “soft starter (single speed)	This provides smooth ramp starting of the motor. Recommended for motors over 100 HP.
Variable-speed drive (Inverter)	This provides infinite control of air speed and mass-flow, and allows a smaller motor to be utilized in high-flow and high-pressure applications. Recommended for large autoclaves (i.e. > 10ft diameter) and high-pressure autoclaves (> 250 Psig).

Thermocouple Selection

To monitor the temperature of parts in the autoclave, the autoclave must have part thermocouple capacity. For composite parts, it is a general recommendation that 2 thermocouples be placed on each part.

How many part temperature thermocouples: _____

Select thermocouple type

_____ J
_____ K

Part and Tool Load Selection

In order to properly size the heater and cooling system for the autoclave, we must know what your typical load would be. This load will then be used for calculations of heating and cooling rates.

What is the part and tool load that should be used for heating and cooling calculations?

_____ Lbs.
_____ KG of Steel

_____ Lbs.
_____ KG of Aluminum

_____ Lbs.
_____ KG of Composites

_____ Lbs.
_____ KG of Glass

_____ Lbs.
_____ KG of Concrete

_____ Lbs.
_____ KG of Rubber

Is an internal autoclave cart required? _____ No
_____ Yes

Is a floor transfer cart required? _____ No
_____ Yes

Heating System Selection

Maximum Heating Rate

Heating rate is sized based on the average air temperature rate from ambient to maximum temperature, when the autoclave is loaded and at maximum working pressure.

What maximum heating rate is required? (Typical = 10 Deg. F/min)
_____ Deg. F
_____ Deg. C

Heating Methods

Please select from the following heating methods.

- | | | |
|-------|---------------------|---|
| _____ | Electric | Least Expensive and best control accuracy. Recommended for most applications. |
| _____ | Gas-Fired | Most expensive, but will save operating costs in the future in areas with high electricity costs. Recommended only for larger autoclaves (10 ft diameter and greater). Can add \$100,000+ to a large autoclave price. |
| _____ | Steam via Exchanger | This method uses customer supplied steam into an internal autoclave heat exchanger. This method is cost effective and efficient, but is limited to temperatures based on available steam pressure. |

Cooling System Selection

Maximum Cooling Rate

Cooling rate is sized based on the average air temperature rate from maximum temperature to 60 Deg. F above ambient (i.e. 130 Deg. F), when the autoclave is loaded and at maximum working pressure.

What maximum cooling rate is required? (Typical 10 Deg. F/Min)
_____ Deg. F/Min
_____ Deg. C/Min

Please provide your local wet bulb temperature, if known. (Typical 72 Deg. F)
_____ Deg. F
_____ Deg. C

The autoclave can include a closed-loop cooling water supply system or it can utilize your plant's existing water system.

Please select from the following options:

- | | | |
|-------|---|---|
| _____ | Use customer supplied cooling water from plant source | TEC will provide reservoir tank, pumps and heat exchanger. |
| _____ | TEC to provide closed-loop cooling system. | Reservoir tank, water circulation pump, tower circulation pump, evaporative cooling tower and level controls. |

Vacuum System Selection

Vacuum system options are utilized on autoclaves that process bagged parts.

The autoclave can be supplied with a vacuum pump(s), or it can be connected to your existing plant vacuum source.

Please indicate below if you want TEC to quote a vacuum pump(s) for this autoclave.

No The autoclave will use customer's plant vacuum source.

Yes The autoclave should be equipped with Oil-Seal Vacuum pump(s)
 Water-Seal

Other information: _____

The autoclave can have the ability to control vacuum levels. This is a capability that is recommended and often required for composite processing autoclaves.

Do you need vacuum level control?

No The autoclave will provide full vacuum only – no control will be provided.

Yes The autoclave will be able to control vacuum level between 1-29" Hg. (101-0kPa) (suggested)

Vacuum source lines are required for individual connections to internally bagged parts.

How many vacuum source lines are required? _____

Vacuum source lines can be manually or automatically controlled to switch from OFF to VAC to VENT. Automatic control provides a number of capabilities, including automatic leak test and automatic isolation on bag failure. Automatic control is more expensive than a manual system, but is strongly recommended for composite autoclaves.

Do you want automatic vacuum line control?

No Autoclave source lines will include manual ball valves for connection to VAC, OFF, or VENT

Yes Autoclave source lines will include automated valves for PC control of VAC, OFF or VENT. (suggested)

TEC can supply individual Resin Traps for either option above.

Please indicate if Resin Traps are desired. Yes (suggested)
 No

Vacuum probe lines are used to monitor the vacuum level in bagged parts. Each probe line includes a transducer which can be connected to the PC control system.

How many vacuum probe lines are required? _____

Control System Selection

TEC has standardized on its ACCS Control System for all new autoclaves. This PC-based system is easy to use, and provides all the capabilities needed for composites, glass, and bonding applications.

Please select from the following control system options:

- | | | |
|--------------------------|------------------------------|---|
| <input type="checkbox"/> | ACCS Option 1
(suggested) | This is the most common solution for autoclave control. It includes a Pentium PC, 17" monitor, color report printer, I/O hardware, enclosure, and a Nema-12 PC station. Full recipe-based part control, part reporting, and data-acquisition is provided. |
| <input type="checkbox"/> | ACCS Option 2 | This dual-PC control system provides complete redundant control via a second "backup" PC system. The dual-PC system is recommended for larger autoclaves. This backup capability provides automatic backup of process, including data collection, part entries, and other capabilities. |
| <input type="checkbox"/> | ACCS Option 3 | This dual-PC control system includes a 3 rd level of backup – manual set-point controllers. TEC seldom recommends this option, primarily due to the high initial cost, and increase in system complexity. |

Oxygen Monitoring and Purge Systems

It is recommended that larger autoclaves (greater than 10 feet long) include oxygen monitoring equipment to measure and alarm if the autoclave is not safe to enter. A purge system may also be included to purge the autoclave with fresh-air prior to opening door.

- | | | |
|--------------------------|---|---|
| <input type="checkbox"/> | None | Autoclave is small and/or not required. |
| <input type="checkbox"/> | Oxygen monitor and indicator | TEC will provide an oxygen sensor connected to the control system for alarm functions. |
| <input type="checkbox"/> | Oxygen monitor and fresh-air purge system | At the end of a run, an autoclave can be purged with fresh air by opening the door with the circulation fan still running. This purge method is used by many companies; many others require that the autoclave be purged <u>prior to</u> opening the door. In this case, a purge system must be installed. The TEC fresh-air purge system will include a purge valve, purge blower, exhaust valve, and electrical interlocks. |

Installation, Startup and Training Options

TEC can provide a turnkey autoclave, including installation, startup and training.

Please select from the following options:

_____ Autoclave Only Customer will provide rigging and transportation from TEC to site. Customer will install autoclave per TEC installation drawings.

_____ Turnkey TEC to provide a complete turnkey autoclave, including installation, startup, checkout, and training. This option does not include civil work, (i.e. foundation, building walls, etc...). This option assumes free-and-clear access at site and utilities within 30 feet.

Please provide installation information below, if different than contact information. (i.e. site location, city, state, building #, floor, etc...)

_____ Installation Supervision Only This option provides a TEC field supervisor to instruct customer on installation, startup, and checkout of the autoclave. Training is also included in this option.

Anticipated Equipment On-Line?
Date

Additional Information
