Benchmark CO_2 Incubator

OPERATING MANUAL

ST-180



ST-45 PLUS



DOMINIQUE DUTSCHER SAS

Benchmark Scientific

Table of Contents

NO.	CONTENTS	PAGE
1	SAFETY AND GENERAL PRECAUTION	3-4
2	FEATURES AND SPECIFICATIONS	4-5
3	CONTROL PANEL	6
4	INSTALLATION	7
5	CO2 INCUBATOR OPERATION	8-10
6	Humidity Set-up for PLUS Model	11-12
7	Hot Air Decontamination function for PLUS Model	13-14

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1. General Information and Precautions

Safety Symbols:



1.1. Precautions related to the power cable



Always allow at least 3cm between the power cable and the back wall to prevent the back wall from causing pressure on the power cable.



Always use the electrical plug that was supplied with this instrument.



Never touch the power cord with wet hands. (This can result in electric shock.)



Never use a damaged power cord or power outlet.



In the event of smoke or a burning smell, immediately remove the power cord from the outlet.

1.3. Precaution for use



Do not attempt to disassemble this instrument. If service is required, please contact your local representative.



Never operate a flammable spray near this instrument. (This can result in a fire hazard.)



Always use caution when using flammable substances such as benzene, alcohol and LP gas. (Failure to do so can result in a fire hazard.)



Prevent foreign substances from contacting the door seal. (The inflow of outside air can negatively impact the temperature in chamber.)



Permissible ambient temperature range for transport: -10℃ to 60℃.

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ALWAYS ensure that the instrument is connected to an outlet with specifciations that match those of the serial number label.

(Over-voltage or under-voltage can damage the product and result in poor performance.)



When installing the instrument, always allow a distance of at least 30cm from the back wall. Install the unit in the way that the power plug is easily accessible and can be easily pulled in case of danger.



Install the instrument on a flat and stable surface, free from vibration and in a well-ventilated location. (If the surface is not level, it can cause an excessive vibration of the product.)



Excessive CO2 can be harmful when in high concentrations.

Any excess amount of CO2 should be properly ventilated or by connection to a suitable exhaust system.

2. FEATURES AND SPECIFICATIONS:

2.1 Features

1. Excellent temperature uniformity of Temperature and CO_2
2. 6 Side direct heat for temperature uniformity and fast recovery
3. IR CO_2Sensor detects precise density of CO_2
4. Outer heated door prevents condensation on glass viewing door.
5. Microprocessor control for Temperature, CO_2
6. Natural Humidification by water tray

2.2 Additional Features in Plus Model

1. Programmable humidification with internal humidifier
2. Hot air decontamination system with dry heat, 125℃
3. 2 divided inner doors for “ST-45 PLUS”
4. 6 divided inner doors for “ST-180 PLUS”

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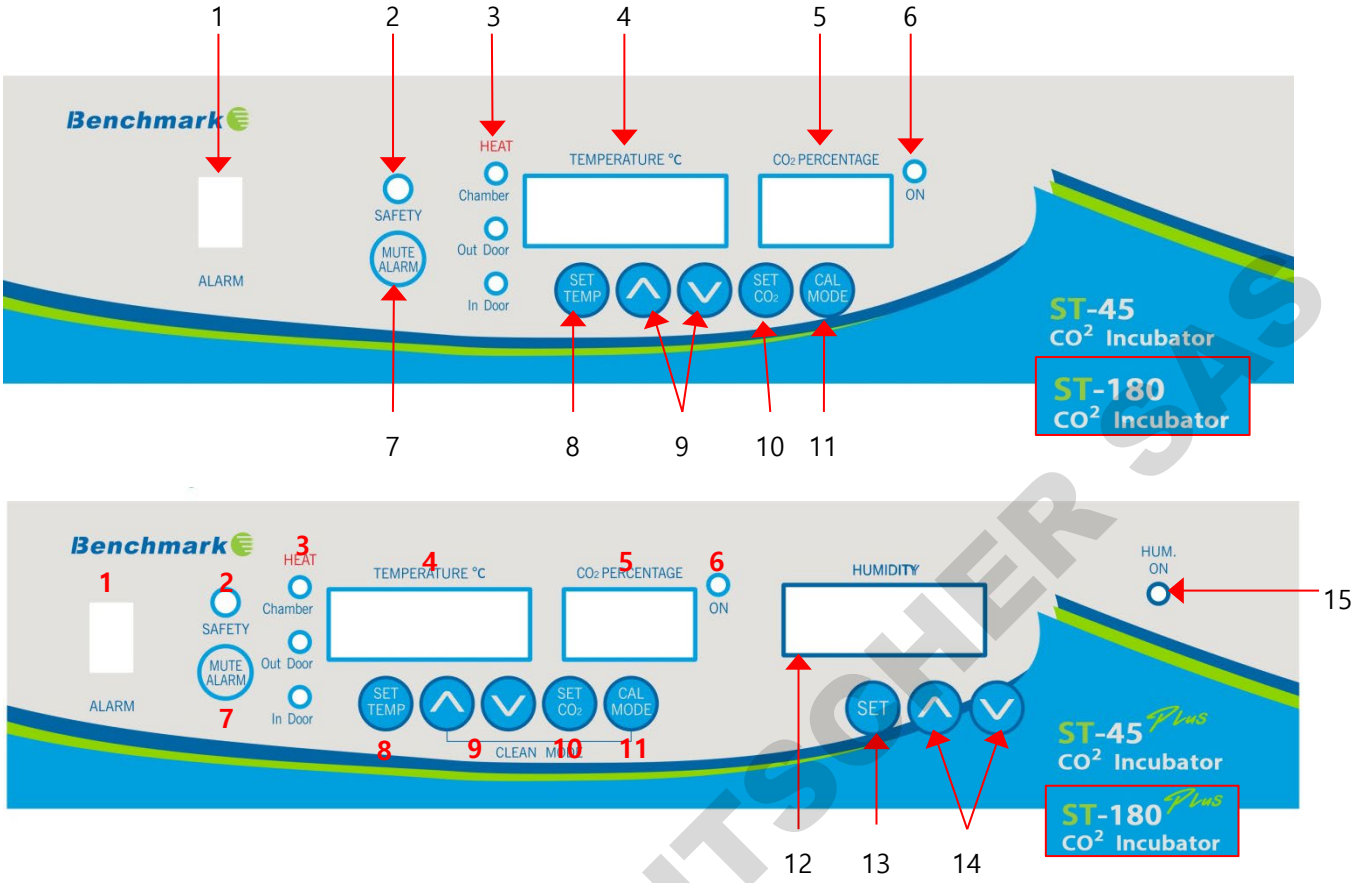
2.3 Specification

Items	ST45 & ST45-PLUS	ST180 & ST180-PLUS
Temperature		
Range	Ambient +5℃ to 60℃ *	
Accuracy	±0.1℃ at 37℃	
Controller	Microprocessor On Off Control	
Humidity	Standard Model - 70% ~ 85% at 37℃ with water tray at the bottom of chamber / PLUS Model – Air Humidity in Chamber +5% to 95% with a humidifier	
CO_2		
Range	0% to 20%	
Accuracy	±0.1% at 5% at 37℃ setting	
CO_2 Increment	0.1%	
CO_2 Sensor	IR CO_2 Sensor	
Outer door	Silicon Magnet Packing Door	
Inner door	Tempered Glass Door 2 Divided Inner Door for ST-45 PLUS / 6 Divided Inner Door for ST-180 PLUS	
Jacket type	Dry wall type (6 sides direct heating type)	
Chamber material	STAINLESS STEEL 304	
Weight	35Kg	78Kg
Capacity / Shelve	45Liter / 2 shelves	180Liter / 3 shelves
Chamber dimension	335(W) x 361(D) x 392(H)mm	473(W) x 528(D) x 710(H)mm
Overall dimension	420(W) x 465(D) x 553(H)mm	560(W) x 665(D) x 945(H)mm
Power	110/220V, 50/60Hz (AC 230V : 350W , AC 115V : 340W)	

*The minimum temperature specification may vary depending on the room temperature.

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3. Control Panel



1. Alarm On/Off Switch
2. SAFETY activation indicator : If the over-temperature safety is activated, this LED will be ON
3. Heating Signal : Shows the status of each heating at the 3 sensor locations.
   (Glass door = heater around glass door.)
4. Temperature display LED window
5. CO_2Gas % display window
6. CO_2 Supply Status Pilot Lamp : Pilot lamp ON means inflow of gas
7. Alarm Mute Button : When pressed, provides 10 minutes audible alarm delay.
8. Temperature Setting Button.
9. Adjustment button
10. CO_2Gas Setting Button
11. Calibration Mode button
12. Humidity display : Current Humidity value display
13. Humidification setting Button
14. Humidity Adjustment Button
15. Humidity Status Pilot Lamp : Pilot lamp ON means inflow of humidity.

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4. Installation

Before beginning the installation, always:

Inspect the packaging for damage. When the instrument is received, please inspect the item carefully to check for any potential transit damage. In the event of damage, always report the damage to the shipping carrier and your local representative immediately.

Included in the package:

1. Stainless Steel Perforated shelf - 2 Pcs in ST45 & ST45-PLUS / 3Pcs in ST180 & ST180-PLUS
2. Power Cord - 1 Pcs
3. Stainless Steel Water Container for humidity - 1Pc(ST45, ST180)
4. Stainless Steel Water Container with a humidifier – 1Pc(Plus models)
4. CO_2 Gas Tubing with in-line CO_2 Gas filter - 1Pc
5. Operating Manual - 1Pcs

Above parts are packed inside incubator. When received, open the door of incubator and remove all parts to check confirm receipt.

Cleaning before use

Before conducting cell culture in this mini incubator, it is recommended to clean entire chamber, shelves and water container by using soft cloth with at least 70% Ethanol mixed with 30% distilled water.

Installation Procedure:

4.1 Place the incubator at the desired location.

Always avoid placing the incubator in:

- An area near equipment generating heat or cold air
- Direct sunlight
- An uneven surface or table.
- A place with heavy vibration
- A place with little air ventilation space behind the incubator.

4.2 Place the shelves and water container as shown in chapter “CONFIGURATION”. If desired, place the stainless-steel water container at bottom of chamber toward the back of incubator (in order to get it to be close to circulation fan). This increases the humidity.

Compliance

Distilled water is recommended in order to avoid contamination and corrosion.
If possible, use warm (~37℃) distilled water for immediate humidification.

4.3. Connect the CO_2 Gas supply

The Gas tubes provided are 6mm (dia) tubes. Insert the edge of the tube to gas inlet port and connect it to a gas regulator which should be installed on the gas cylinder. Or, install to the gas line in your lab.

-Turn on the gas supply with the pressure set to 1 Bar (or 14.5 Psi)

NOTE! : To confirm that there are no leaks in the CO_2 connections, a “bubble check” is recommended. Apply soapy water to each fitting and check if any bubbles are generated. If so, readjust the fitting.

4.4. Connect the power cord.

-Plug the power cord into the power inlet on the back side of the incubator (refer to CONFIGURATION)
-Plug the power plug into an outlet of the appropriate voltage.

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5. CO_2 Incubator Operation

5.1 Power switch

Turn on the power switch. The digital LED will display current temperature and CO_2% in the chamber.

5.2 Setting temperature

a. Press the "SET TEMP" key, then, the LED screen will flash and display current programmed temperature.
b. Set up the desired temperature by pressing UP (▲) or DOWN (▼).
c. Press "SET TEMP" key after adjustment. The “SAVE” message is shown on the display.



Note: Always press the “SET TEMP” key after adjusting to the desired value. Otherwise, the value will not be saved.

5.3 Setting CO_2

a. Press "SET CO_2" key. Then, the LED screen will begin flashing.

b. Input the desired value of CO_2 density by adjusting UP (▲) or DOWN (▼) key

c. Press "SET CO_2" key again after inputting the value. “SAVE” is shown up on LED screen as below.



Note: Always press the “SET CO_2” key after adjusting to the desired value. Otherwise, the value will not be saved.

5.4 Calibration for temperature and CO_2

In the event of a discrepancy, please follow the below procedure for adjusting the calibration.

Caution

Measure CO_2 density and Temperature after incubator is stabilized.
(Allow 2 hours for stabilization after the desired setting has been reached.)
Please note that a very low deviation range such as ±0.1 ~ 0.3% could be difficult to correct precisely by this calibration.

No.	DISPLAY	FUNCTION
1		Chamber Temperature
2		Door Heater Temperature
3		Glass Door Heater Temperature
4		CO_2 Calibration
5		Heating control
6		CO_2 gas control valve control
7		To apply a new value

a. Press and hold “CAL MODE” for 10 seconds. Then, LED will be flickering as below.

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Channel 1 is for adjusting the calibration of the main chamber temperature.

Press UP (▲) by the difference measured from the set value and the value measured by precision thermometer or thermocouple. OR

Press DOWN (▼) by the difference measured from the set value and the value measured by precision thermometer or thermocouple

Ex.) If measured temperature is 38℃ and Display shows 37℃, then press up 1℃.

Note

* Temperature Calibration range is ±5℃

* To proceed to next calibration channel, press "CAL/SET" button. After 5th channel, the LED is back to temperature display.

b. Second Calibration Setting: Outer Door Temperature



Caution

The purpose of this heater is to prevent water condensation from forming on the glass door, caused by a large temperature difference between chamber and outside air. If water is condensing on the front door, we recommend adjusting this channel.

Note: Other than water condensing on the glass door, the calibration of channel 2 and 3 would not be recommended.

c. Third Calibration Setting: Door Frame



Caution

The purpose of this heater is to prevent water condensation from forming on the glass door, caused by a large temperature difference between chamber and outside air. This setting should be adjusted if making a change to setting 2 has not resulted in preventing this condensation.

d. Fourth Calibration Setting: CO_2 density calibration



Channel 4 is for adjusting the CO_2 density.

Press UP (▲) by the difference measured from the set value and the value measured by precision analyzer.

Press DOWN (▼)by the difference measured from the set value and the value measured by precision analyzer.

Ex.) If the measured CO_2 value is 5% and Display shows 4%, then press up to set to 1%.

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e. Fifth Calibration Setting: Heating control



NOTE

Channel 5 is to set heating control point and is designed to prevent a significant temperature overshoot. This mode is preprogrammed in the factory and should NOT be adjusted by the user.

f. Sixth Calibration Setting: CO_2 gas supply control.



NOTE

Channel 6 is to set the values associated with the CO_2 release solenoid. This mode is preprogrammed in the factory and should NOT be adjusted by the user.



5.5 Alarm

Three minutes after the temperature and the CO_2 density have reached the desired setting, all alarm systems are activated. (If the temperature or CO_2 does not reach the set point, the alarm system will not be activated.) If the user would like to disable these alarms, the alarm can be set to the “OFF” position.

Alarm Activation

Temperature： ±1℃ from set point

CO_2 ： ± 1% from set point

Door Open: 1 minute after door opening.

*When pressing the alarm mute button on the control panel will stop the alarm from activating.
If the alarm was stopped by mute button, the alarm will be re-activated after 3 minutes.

5.6 Temperature Thermostat

In the event of a malfunction, this thermostat knob is designed to prevent the heater from overheating.

■Always set the safety knob to a HIGHER value than the set temperature.
■The safety knob has a fairly wide deviation
■The safety knob is designed to prevent the heater from overheating when the temperature control is malfunctioning.



This is the safety device for preventing temperature from rising caused by any circumstances.
Set the temperature at 5℃ higher than operating temperature or desired point.

■ If the “SAFETY” LED on the front panel is illuminated, this switch has been activated and is limiting the temperature.

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6. Humidity Set-up for PLUS Model

6.1 Precaution



* To avoid contamination inside the incubator and water, sterile distilled water must be used.

* Make sure all components for humidification fully dry after cleaning with no water remaining. When incubator is not used, make sure all materials inside chamber are dried. If water is remaining in the incubator while is not used being used but, the door is sealed, there can be condensation which can cause corrosion inside incubator.

* Water should be filled high enough to make sponge stick of humidifier continuously wet for humidification.

* The filter set (sponge and its plastic holder) can be cleaned with ethanol. The humidifier and its parts are not autoclavable. After cleaning, make sure ethanol is fully dried out before use.

* Secure connection of cable to the humidifier so it keeps working when humidification is required.

* When using Hot Air Decontamination, remove the humidifier and its filter parts. Set the humidity at 0% and disconnect the cable of humidifier to get it out of incubator. During the hot air decontamination, humidity display keeps showing the humidity % inside the chamber.

*The water container of the humidifier can be remained in the chamber during hot air decontamination but, it should be fully dried without any water remaining. All parts of humidifier except water container should be removed before running hot air decontamination.

**** Please be aware of condensation which can occur in cases as below.**

- When the door is open, heating and humidification stop and humidity can go down sharply. After the door is closed, both heating and humidification are reactivated automatically. At this time, some condensation can occur on the glass door because steam is generated to the glass door immediately after the door is closed. Once temperature is stabilized, condensation will disappear.

-If opening and closing door is frequent, condensation may occur frequently.

* Please be aware that there should be larger fluctuation in Humidity display when humidity is high.
Ex) When 95% humidity is set, humidity display can be fluctuating in 94~98%.

*If humidification is not necessary, please set humidity value very low like 0% and disconnect the humidifier.

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6.2 Installation

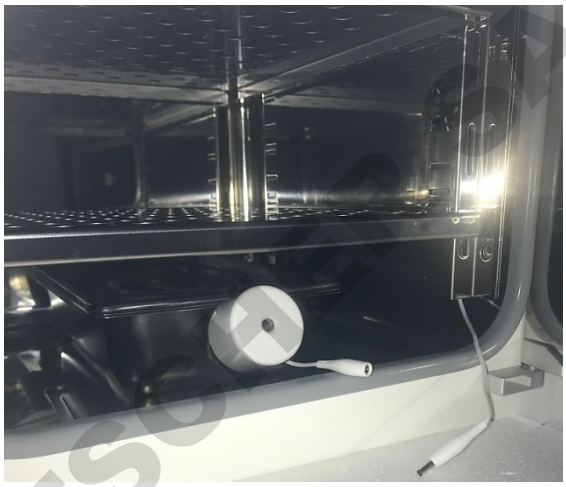
1. Find the water container with humidifier and its cable connection inside incubator like photo #1.
2. Open the cover of container and fill sterile distilled water into the tray as much as sponge stick can soak.
3. Cover and place the tray carefully at the bottom of incubator chamber.
4. And connect the cable and place the tray close to the back of chamber.
5. Close the inner glass door and outer door.

* When humidification is activated, if temperature inside is low, there should be some condensation.
To avoid such condensation, begin humidity setup once temperature is stabilized

6. Set the target value by press set button once and change calibration value press set button twice.



#1. The Tray with Humidifier and Cable



#2. Disconnecting the cable before taking tray out



#3. Open the cover of Tray





#4. Fill sterile distilled water. Carefully put tray back and connect the cable

6.3 Set-up

Setting Up Humidity (RH)

-Press Set button to enter the mode of humidity setting
-Then, display will flicker
-Adjust the RH value with up and down button.
-Press SET button to save the value finally.
※Press the SET button finally to program the value.
※Only Humidification is available. (Ambient +5% to 95%)
※Dehumidification is not available.

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Appendix I (Hot Air Decontamination, Option)

The Benchmark CO2 Incubators (Plus models) feature a decontamination program that heats the chamber to 125°C. The decontamination process (signified by "CLEAn" on the temperature display) takes approximately 8 hours in total (including heating and cool down time). Following the 8 hour cycle, the display returns to the values of the most recent program. At this time, the incubator is now ready for use.

Before operating Hot Air Decontamination, ensure the following:

*** Removal of CO_2 Sensor is not** required as the sensor is out of reach to high heat.
*Remove the cells, cell container and any heat-sensitive material from the chamber before the decontamination.
* Remove the humidifier and filter parts. Water container and its cover can remain in hot chamber but, it should be dried before hot air decontamination.
* Clean the inside of the chamber and make sure the chamber is dried thoroughly.
* Temperature and CO_2 will reset to last setting value automatically after the 8-hour program.
* DO NOT place the cable of humidifier on the bottom of chamber. Put it on the shelve like below.





During and After Hot Air Decontamination, ensure the following:

*** Do not open the door** when temperature display indicates **CLEAN** message like below.



* Always be careful for the injury from hot air.
* Be sure to check the temperature through its display before opening the door.
* Do not turn off the incubator when decontamination is ongoing and the incubator is hot. Someone may open the door without recognition of the hot temperature in the incubator.

Note:
*Humidity display (in PLUS model only) keeps showing the humidity during hot air sterilization. To stop its control, set the humidity at Zero or much lower than present humidity.
*To cancel ongoing hot air decontamination, just turn the main power off then on. But, DO NOT OPEN THE DOOR until low temperature (lower than 50℃) is displayed. Keep incubator on after cancelling the decontamination program so people recognize the temperature inside the chamber.

STERILIZATION CYCLE (Total 8 Hours Program)

Cycle: 3 Hours sterilization and 5 hours for cooling down.

Phase 1: Heat up from 37°C to 125°C (it can take about 2 hour)

Phase 2 : 125℃ Hot Air for about 1 Hour

Phase 3: Cooling down for 5 hours

After above 8 hours decontamination program, both temperature and CO_2 controls will reset to last programmed temperature and CO_2

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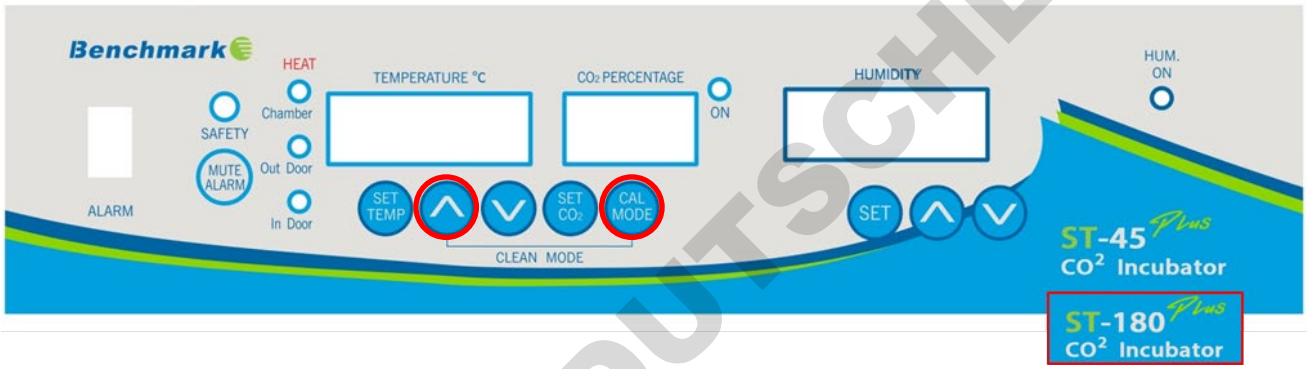
How to start

After conducting prerequisite, take following step.

1. Turning on : In the status of Incubator power off, TURN the main power of incubator ON **while pressing two buttons(∧ & CAL/MODE) directed with CLEAN MODE at same time.**
2. Then, temperature display indicates CLEAn and CO_2 display indicates 480 which means the remaining time of hot air decontamination. See below.



3. Once 8 hours program is over, all displays return to normal and show present CO_2 and Temperature.
4. Then, both CO_2 and temperature reset to last programmed setup and both controls start working to reach temperature and CO_2 to last programmed values.



DO NOT OPEN THE DOOR until appropriate low temperature is confirmed through temperature display and feeling the incubator.

Service and Contact

Service on the instrument should only be performed by qualified service personnel. To request service or technical support, please contact Benchmark Scientific or your local Benchmark Scientific representative.

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