Standard Manual Operation Process

Operation Regulation for VTO-669 Oil Quenching Vacuum Furnace

Before opening furnace, check if water, power and air work well. Power on equipment and there is no fault alarming. Only after this, equipment can be operated.

In the case of non - use, the cold room and hot room is kept in a vacuum condition. It is often used to pay attention to the cleaning of the heat room (Clean the quenching oil residue in the heat room) and the timely replacement of the slide valve pump / rotary pump oil.

When the gate valve is switched, the pressure difference between the two rooms should not be higher than 100 Pa.

Bell rings after completion of heating. Bell on interface can be released to confirm completion of heating. If equipment fails, red light for alarming is illuminated, and prompting sound. Alerts will be shown in ALARM PAGE, and the users shall confirm fault and clear it, then press ALARM CLEAR to clear it.

The red light in the operation interface indicates that it has output at the corresponding location. The button displays in bright font, indicates that the device is in action.

The inlet temperature of the equipment should be controlled at 15 to 30 degrees. When the temperature is below 4 degrees in Winter, the cooling water in the furnace should be emptied to prevent the equipment from freezing.

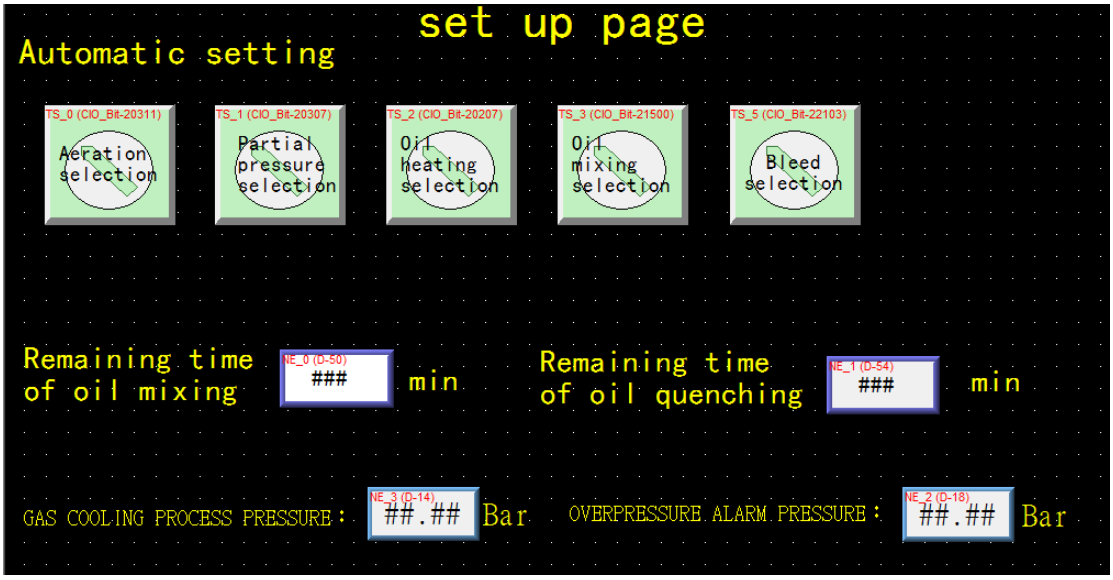
When the transmission system fails, and the temperature of the heat room is

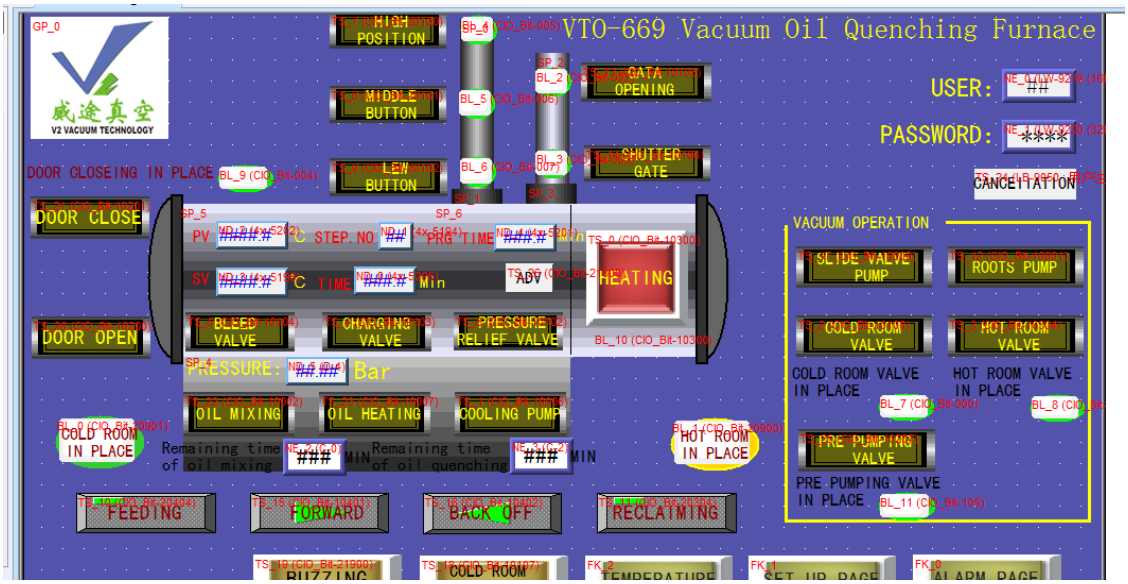
below 100 degrees, close vacuum pump unit and the corresponding valve, so as to release air in body of furnace. Open furnace door for maintenance, and the safety pin of the gate valve must be inserted.

When lift mechanism of car faults, it is treated in the same as that of reclaiming.

If the test needs to run semi automatically, it is necessary to observe the running condition of the transmission between feeding and reclaiming. Choose the function in the automatic selection window. If there is a problem that needs to stop the operation of the equipment, the semi-automatic will be terminated according to the "EMERGENCY STOP" button.

The specific operation process is as follows:





i. After power on, open 

. After reaching high position, press 

, press 

. Press door button to desired position

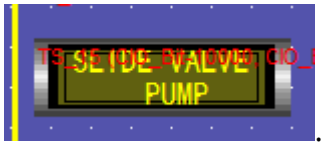
(travelling indicator is on), open 

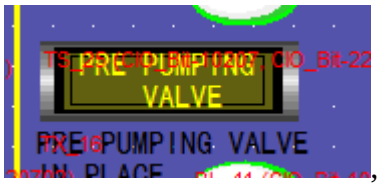
. Close bleed valve, open manually furnace door to automatic locking position. Push material car to feed material and arrange material cars symmetrically to prevent the middle door from being crashed. Complete material feeding, close door and press DOOR CLOSE.

ii. Semi-automatic production test, Select required function on automatic selection window. Open AUTOMATIC RUN button after completion of setting time, pressure and temperature. The precondition for automatic running is that vacuum in hot room is lower than 600. The following is of manual operation process. For automatic operation, refer to manual operation.

iii. Vacuuming Process

The cold room and the hot room are both in atmospheric conditions.(In the case, hot room shall be vacuumed)

1. Open slide pump or rotary pump by pressing 

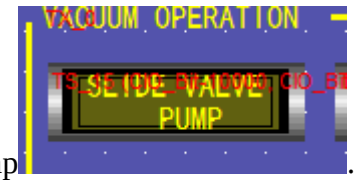
. After the pump is operated stable, press 

, →
2. Press button and open hot room 

,→
3. Wait vacuum in hot room is below 600PA(Vacuum meter J1 shows green), close hot room valve.→
4. Press button and open cold room 

, Wait vacuum in cold room is below 600PA(Vacuum meter J3 shows green), open hot room valve. Conduct pumping in both cold & hot rooms at the same time.

The cold room is in atmospheric condition. Vacuum in hot room is below 600PA.

1. Press button to open slide valve pump or rotary pump 

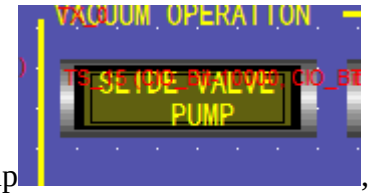
. After the pump runs stable, open button to open pre-pumping valve 

.→
2. Press button to open cold room valve.→
3. Wait vacuum in cold room is below 600PA, press button to open roots pump 

. →
4. Wait vacuum in cold room is near to that in hot room， press button to open hot room valve 

. Pump cold room and hot room at the same time.

Cold room is at atmospheric pressure, and vacuum in hot room is over 600PA.

1. press button to open slide valve pump or rotary pump 

, press button to open pre-pumping valve 

. →
2. press button to open hot room valve 

, Wait vacuum in hot room is below 600PA, close hot room valve, press button to open cold room

valve 

. →

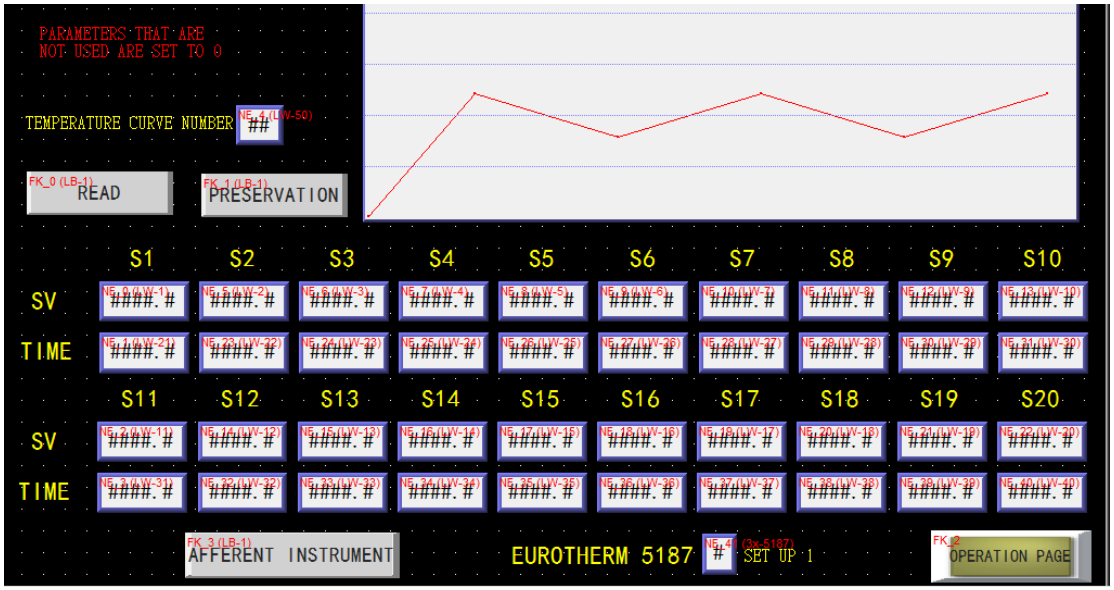
3. When vacuum in two rooms are below 600PA，press button to open roots pump 

iv. Feeding Process (no other operation during feeding)

Press feed button when vacuum for both rooms are below 10PA(J4 shows green), press 

，to start automatic feeding process. Operator should observe the running state of the car in the furnace, prevent car from slipping. Feeding lamp is out indicating the end of the feed. Only after this, proceed to successive step(If emergency occurs, press alarm to stop feeding action or press directly emergency stop button to stop remaining action).

v. Heating and Precautions



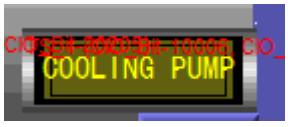
Edit heating process curve in TEMPERATURE CONTROL WINDOW on touch

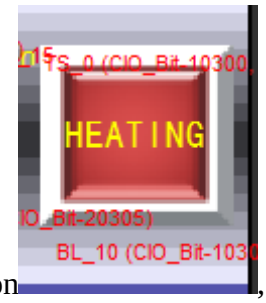
screen, check curve number to be edited 

, store it after editing 

to find it quickly for next time. Use it directly for same process 

. Then press Write IN INSTRUMENT button, wait font in green, indicating the process is input into temperature controller. Thus the currently input process will be executed after heating starts. During heating, heating voltage and heating current is required to observe to understand heating process and judge heating system failure.

1. On the 3504 meter, select process parameters. →
2. Confirm that process parameters are used.→
3. Wait vacuum meter J4 light for hot room shows green, press button 

to open cooling pump of sluice gate, Press button 

, open power of heating system (If vacuum heating is required, wait vacuum meter J5 indicates green, open it and heat)→
4. During heating and cooling, ensure all circulation water are normal. Press RUN on 3504 for 3 seconds to stop heating. RUN indicator turns off indicating equipment is in standby state.

vi. Reclaiming and Precautions (no other operation during reclaiming)

1.Heating completion bell indicates automatic closing of cold room valve. 

, →

2. Press button 

, to start automatic reclaiming process. →

3. Maintain pressure automatically during reclaiming, operator is required to observe running state of car inside furnace during reclaiming, to prevent car from slipping. Reclaiming light off indicates completion of reclaiming(If emergency occurs, press alarm to stop feeding action or press directly emergency stop button to stop remaining action).

vii. Oil quenching should be charged according to the needs of the process

1. If no charging is required, then:

①Press low position button 

, car will enter directly oil tank for quenching→

②Press button 

, to start oil mixing motor. →

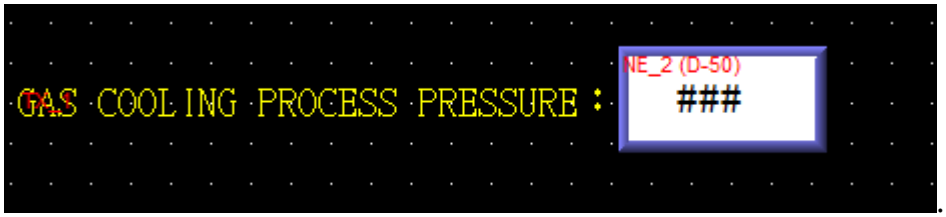
③Keep mixing until closing oil is mixed automatically or mix closing oil in advance, press high position button of cylinder 

, car will be lifted to reclaiming position.

2. If recharging is required, then:

① Open button 

, start charging valve for charging. Close it when required charging pressure reaches (0.5BAR-0.75BAR)



. →

②press button 

, car will enter directly to oil tank for quenching, Press button 

, start oil mixing motor→

③ Close oil mixing automatically when oil mixing time reaches, or close is in advance, press button 

, car will be lifted to reclaiming position.

viii. Work Piece Drawing

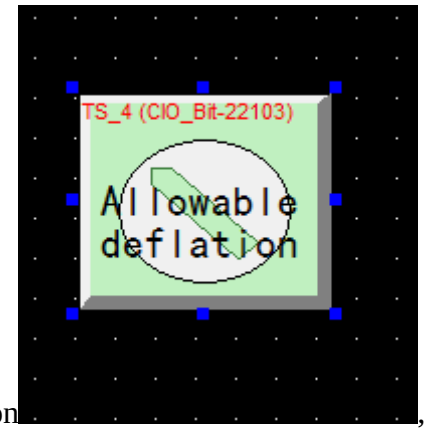
1. Oil quenching without charging

① Press button 

to open door. When door reaches its position,→

② Press button 

to open bleed valve→③ End bleeding（to atmospheric pressure）, press off bleeding valve（If bleeding valve fails to open, press

button 

, then open bleeding valve again）

2.Oil quenching with charging

Press button 

， bleed air directly if door reaches the position. If failing to do so, wait hot room is cooled below 600℃, press button 

to close hot room valve, press button 

to close roots pump. 2 minutes after, press button 

to open cold room valve. Keep DOOR OPEN button in open position, wait door reaches the position, close cold room valve. One minute after, open hot room valve to re-vacuum hot room, then open roots pump to increase vacuum of hot room. Press button 

to open bleed valve of cold room.

Close it when bleeding ends, pull door for reclaiming.

ix. whether continuous work is required according to the needs

Discontinuous work: after reclaiming, close door of the furnace, light the DOOR CLOSE button, wait for the hot room temperature to 400 degrees, close the hot room valve, turn off the roots pump for two minutes, open the cold room valve and open the hot room valve in the 3 and hot room below 600 PA, close the cold room valve hot room valve within 300 degrees, close the roots pump and after one minute, close the slide valve pump and close the power supply. Hold water in the furnace and door, and close the intake pump power for ten minutes.(If high vacuum is selected, close diffusion pump after heating ends. Close main pumping valve, front stage valve and roots pump when hot room is cooled to 400 degree. After cold room is pumped, close all valves and pump units)

Continuous work: after reloading following reclaiming, turn off the furnace door and light the DOOR CLOSE button, wait for the heat room temperature cooling to 600 degrees, close the heat room valve, turn off the roots pump for two minutes, open the cold room valve. Pump it and keep vacuum is same to that of hot room (both in 3) open the hot room valve, the process repeats the above iii to viii.

x. Charging
(If charging is used, oil shall be degassed before oil quenching).

xi. Work Piece Drawing

① In case that pressure in furnace is over 1 bar, press BLEED VALVE to open bleed valve, close it when bleeding ends, open furnace door. If failing to do so, must pump out vacuum in cold room to open it. Stop pumping when door can be opened.

② In case that pressure in furnace is below 1bar, press DOOR OPEN to open door. Bleed and open door directly if door locking ring is opened. Otherwise, pumping cold room is still required to open door.

③ The whole cooling process of the heat room must be pumped, only to below 400 degrees, the vacuum degree below 3PA , hot room valve, roots pump can be closed. Two minutes after the slide valve pump is closed, but the air quenching work piece is urgently required to reclaim, while door can’t be open. Hot room temperature is less than 500 degrees below 2PA ,the hot room valve and roots pump can be shut down for two minutes. The cold room valve is opened, the cold room valve opens, the hot room valve opens, the roots pump is opened to the heat room until the air is met and the air can be stopped.

xii. Continuous discontinuous work is the same as oil quenching.

If semi-automation is selected, require to select on setting up window on touch screen. Set correspondingly according to process requirement as shown in the following figure.

If automatic partial pressure is selected, require to operate manually the whole process. Automatic partial pressure means partial pressure valve opens when partial pressure starts and vacuum opens, and vacuum closes when partial pressure ends, so as to ensure vacuum in hot room is kept within a certain range. The process detail include: heat hot room after it is pumped to high vacuum and feed, and cold room is kept in vacuum state. After reaching 900 degree, close roots valve, open hot room valve, open partial pressure valve and automatic partial pressure starts. After heating ends, close cold room valve and partial pressure valve, open roots pump to pump hot room. Then reclaiming and cooling process follows.

Hot room cleaning

When the two rooms are both in vacuum conditions, the difference is not more than two hundred PA(if the difference is too much time to meet the requirements of the pump, turn off the corresponding pump valve), light the CYLINDER HIGH position, light the sluice gate opening, after the opening to the position, press DOOR VALVE. Press BLEED VALVE after door locking ring reaches position. Close bleed valve after bleeding ends. Then open door of hot room to clean oil, lock door after oil cleaning ends. Preserve vacuum in both rooms or start to work.

Alarm Fault

Equipment alarms, such as valve failure, check whether valve is good or bad, and signal switch (Travelling switch , magnetic switch) is good or bad.

Check whether the transmission fault is stuck. It is necessary to check the insulation of the heating room regularly.