# A new triaxial apparatus for testing soil water retention curves of unsaturated soils under different temperatures



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## 1. Objective

To design a new triaxial apparatus for testing soil water retention curves (SWRCs) under different temperatures

## 2. Methodology

- 2.1 Experimental Setup
- 2.2 Calibration
- 2.3 Test material and procedure

## 3. Conclusion

## 2.1 Experimental Setup

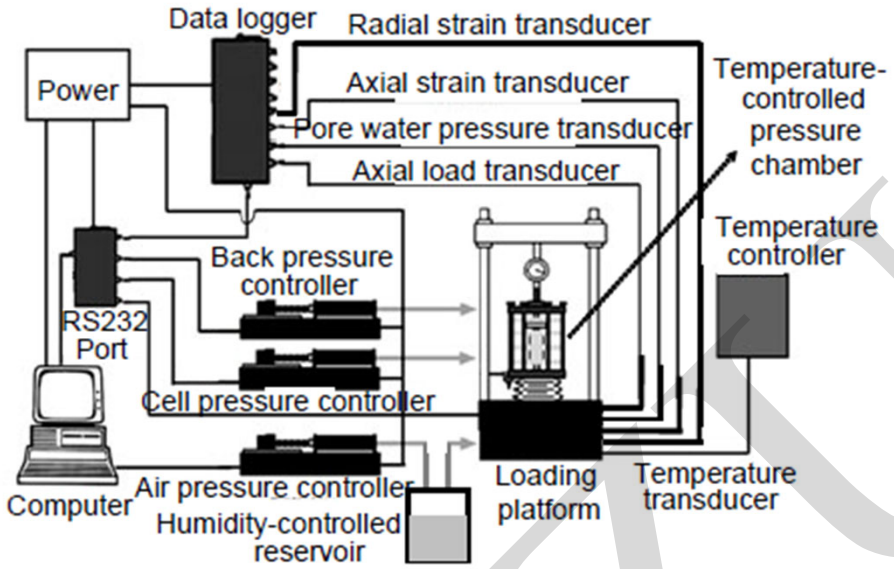



**Fig. 1 Schematic diagram of temperature-controlled triaxial test system**

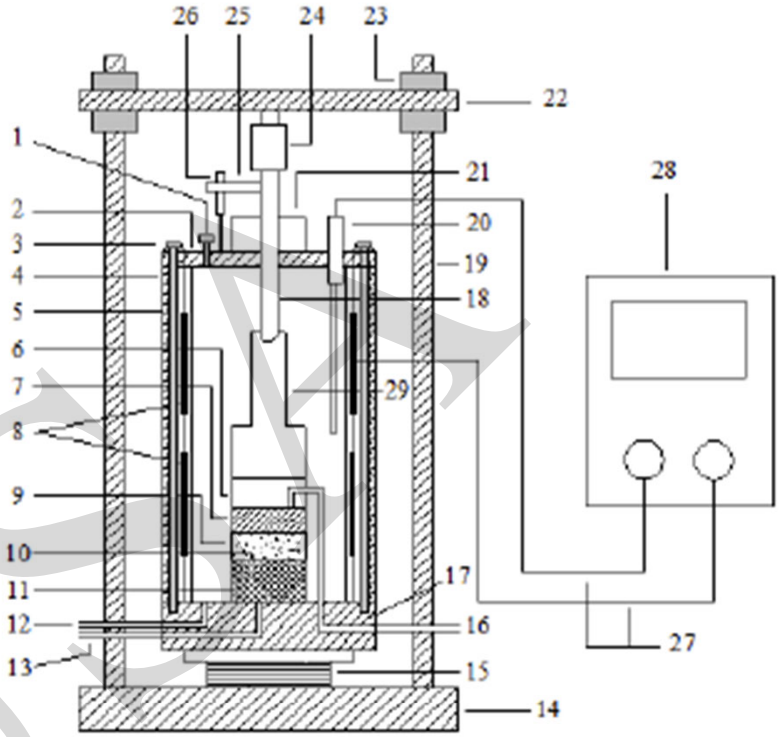



**Fig. 2 Schematic diagram of the pressure chamber in the temperature-controlled triaxial test system for unsaturated soils**

1: vent valve; 2: head cover of the pressure chamber; 3: fixed screw rod of pressure chamber; 4: stainless steel cylinder; 5: insulating asbestos; 6: sample cover made of organic glass; 7: porous stone; 8: heater; 9: rubber membrane; 10: soil sample; 11: ceramic plate with high air-entry value; 12: confining pressure imposing and testing tube; 13: counter pressure imposing and testing tube; 14: loading frame bearing platform; 15: lifting platform; 16: air pressure imposing and testing tube; 17: base of pressure chamber; 18: axial piston rod; 19: support bar of loading frame; 20: temperature sensor; 21: piston cover; 22: beam; 23: fixing bolt of loading frame; 24: axial load sensor; 25: bracket; 26: axial displacement sensor; 27: wire; 28: temperature controller; 29: elevated cushion block

## 2.2 Calibration

### Calibration of measurement devices

1. Axial load and displacement transducer

2. Pressure Transducers

3. Thermocouple

### Calibration of the time for thermal equilibrium

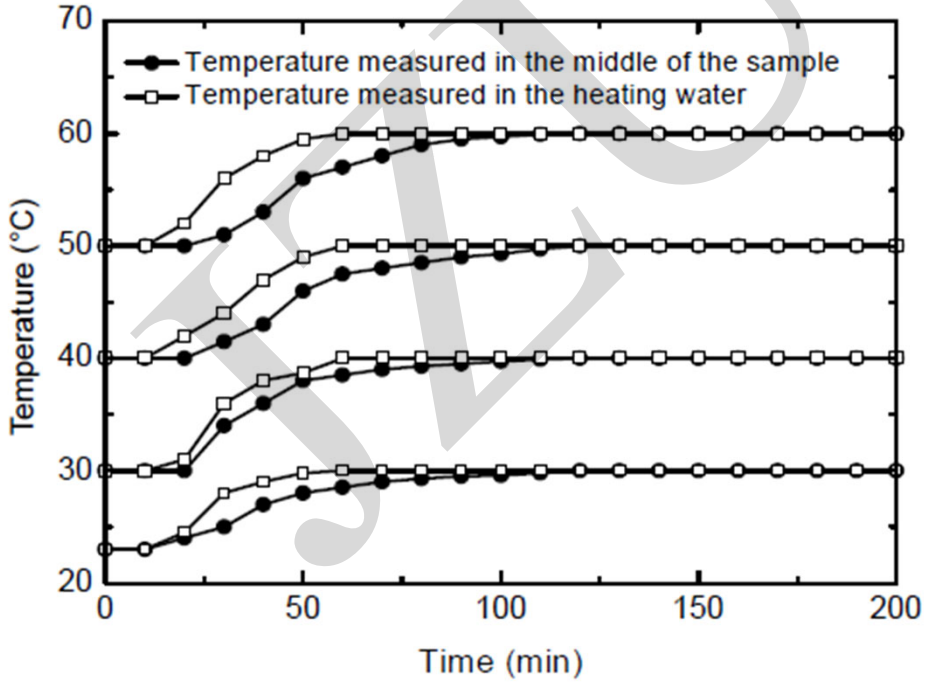



**Fig. 3 Temperature changes in the middle of the sample and the heating water versus time during heating (isotropic stress is 500 kPa)**

## 2.3 Test material and procedure

**Silty clay, particle specific density 2.73.**
**liquid limit $w_L$=33.4%, plastic limit of $w_P$=20.1%,**

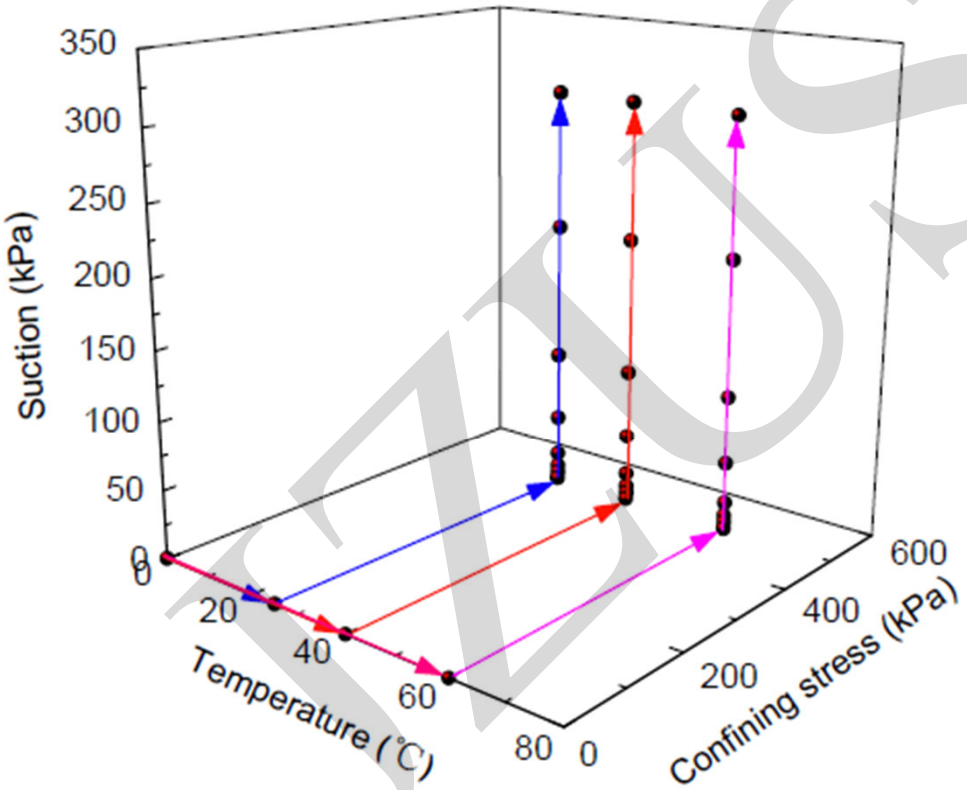
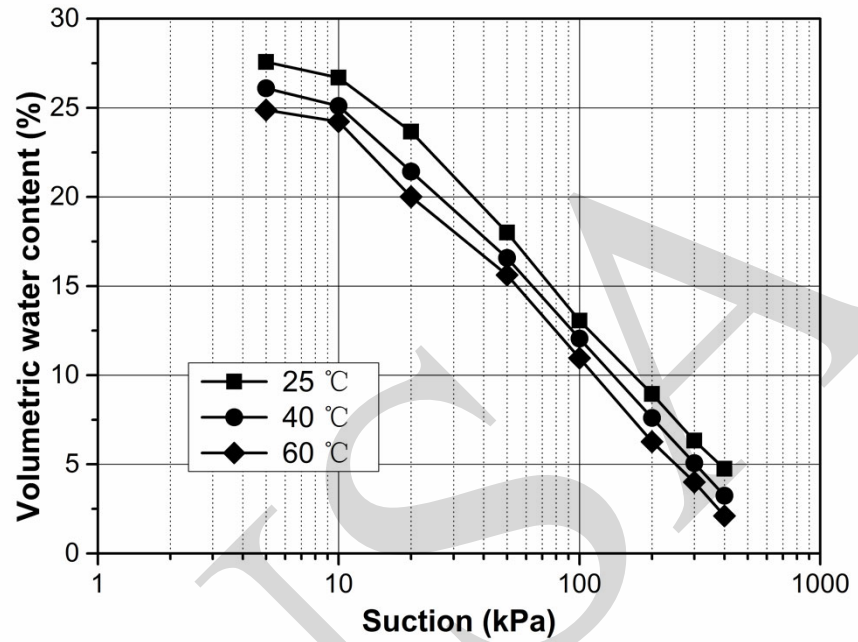


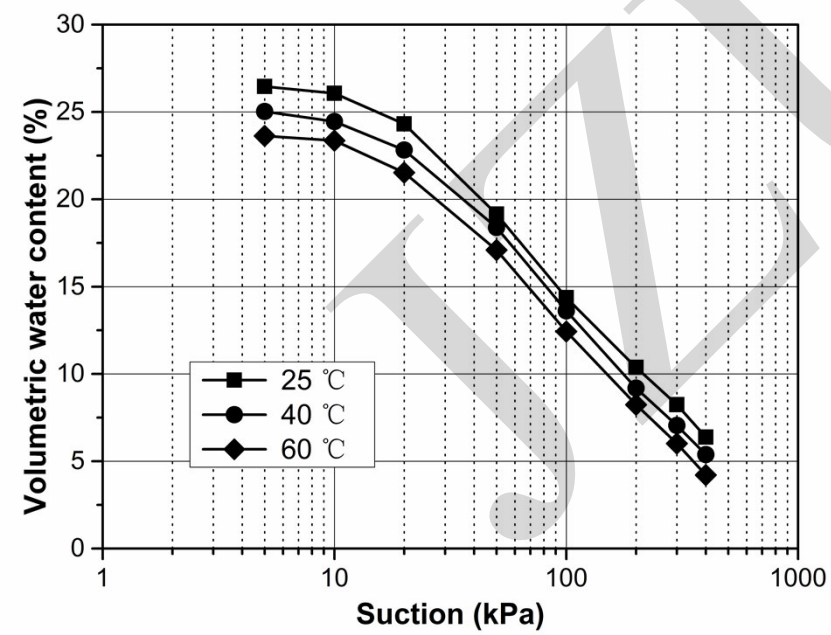

**Fig. 4 Stress paths during the test**

# 3. Conclusion-1

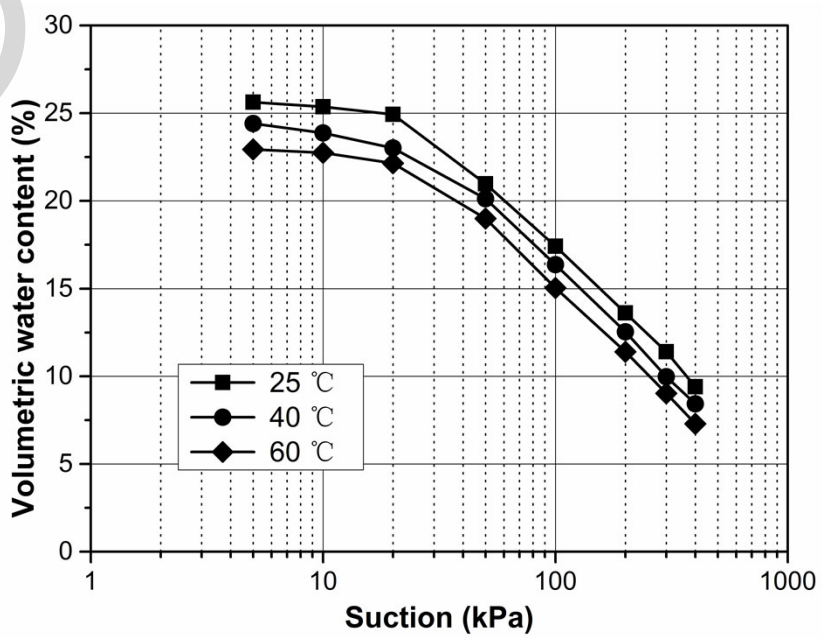
**Net mean stress:40kPa**




**Net mean stress:100kPa**

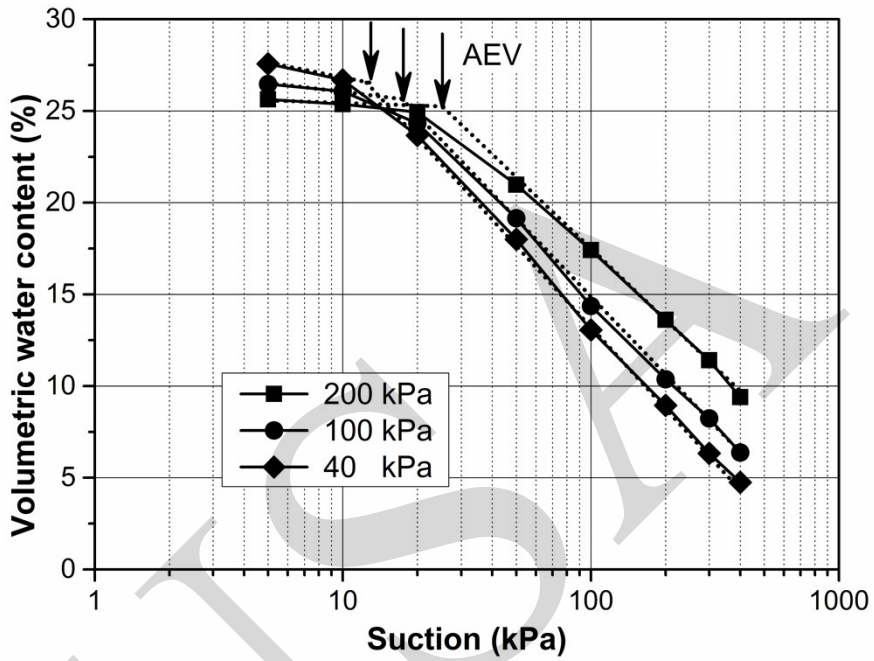



**Net mean stress:200kPa**

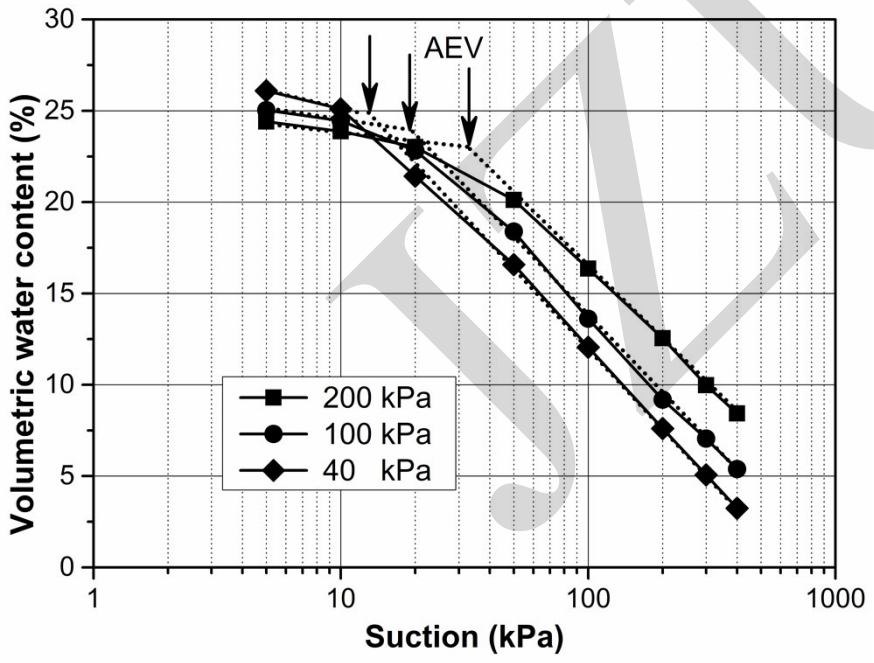


# 3. Conclusion-2

**Temperature: 25℃**




**Temperature: 40℃**




**Temperature: 60℃**