青岛创梦仪器有限公司

Qingdao Chuangmeng Instrument Co., Ltd.

便携式稠化仪

Bench-Top Pressurized Consistometer

Model:2011

使用手册

Instruction Manual

版本.1.0
Ver. 1.0

请你仔细阅读《使用手册》，正确掌握本产品的安装和使用方法。阅读后请将本《使用手册》妥善保管，以备今后进行检修和维护时使用。

Please read the Instruction Manual carefully, for correctly grasping the installation and using method of this product. Please keep properly this Instruction Manual after reading, for the usage during troubleshooting and maintenance in the future.

Внимательно, пожалуйста, прочитайте “руководство по эксплуатации”, чтобы правильно понять, как установить и использовать этот продукт.После того, как прочитали это руководство по эксплуатации, пожалуйста, храните его для дальнейшего использования при ремонте и обслуживании.

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一、概述

青岛创梦仪器有限公司生产的2011型便携式增压稠化仪是严格按照美国石油学会（API）规范10的要求制造，是专用于测量水泥浆稠化时间的仪器。

水泥浆稠化时间是进行一次或二次固井前必须测量的一项重要指标，相应的技术要求和操作程序在美国（API）规范10推荐测试方法RP-10B中有详细说明。

2011型便携式增压稠化仪具有较宽的压力和温度范围。该仪器结构紧凑，体积较小，可放置在一般实验室的工作台上；釜体采用高强度合金材料制作；其主要控制及执行单元采用进口部件（德、日、美等国），能够完成绝大多数美国石油协会所要求的高温高压实验方案。

2011型便携式增压稠化仪操作非常简便，所有控制阀门和开关均布置在前面板上，压力可由前面的压力表指示。.温度控制器自动地控制水泥浆的升温速率（即升温梯度），当温度达到所需值时，温控器自动的保持恒定的目标温度。压力控制通过释压阀和泵开关控制液力泵的输入气压来完成，用户也可选购我厂生产的4000计算机数据采集系统与控制系统，将测试结构送入计算机（PC），实现试验数据的实时采集、储存及打印。

水泥浆的稠度是经电位器标准弹簧上的受力得出。当浆杯按规定转速转动时，浆杯内的浆叶受水泥浆作用，施力给桨叶连接的标准弹簧，当达到所需稠度时，仪器将自动断开加热器，关闭驱动电机电源，同时自动打开冷却水并终止计时器计时，仪器给出音响报警，提示操作人员试验结束。

二、技术参数

温度控制：内接2500W加热器及内热电偶，控制器控制其升温和恒温过程。（详见温度控制器使用指南）
压力控制：采用空气驱动增压泵，空气驱动开关及释压阀控制。
最高工作温度：≤204℃
最高工作压力：≤137Mpa
稠度范围：0～100BC
压力介质：矿物油
浆杯转速：150r/min
加热器功率：3000W
电源要求：输入电压：VAC220±10% 50HZ
输入功率： >3KVA
环境温度要求：0～40℃
环境湿度要求：0～95%
高度：560mm
宽度：370mm
长度：710mm
重量：116Kg
气源：600～1000kpa
冷却水：200～600kpa

三、特点：

- 完全符合美国石油协会规范 10 的要求；
- 制造企业通过 ISO9001 质量认证；
- 数字式智能温度控制器及数字温度显示；
- 釜体采用特殊合金制造；
- 压力最大可达 137Mpa；
- 温度最大可达 204℃；
- 采用大功率加热器；
- 坚固耐用使用方便；
- 主要控制和执行单元全部采用进口零部件；
- 采用磁力驱动装置，维修方便；
- 釜体可得到快速冷却；
- 釜体的密封采用高温“〇”型圈及特制金属圈，确保密封；
- 可在上位机显示压力曲线
- 可选配基于计算机的 4000 数据采集与控制系统，通过通讯 1 端口进行试验数据的实时采集、储存及打印。

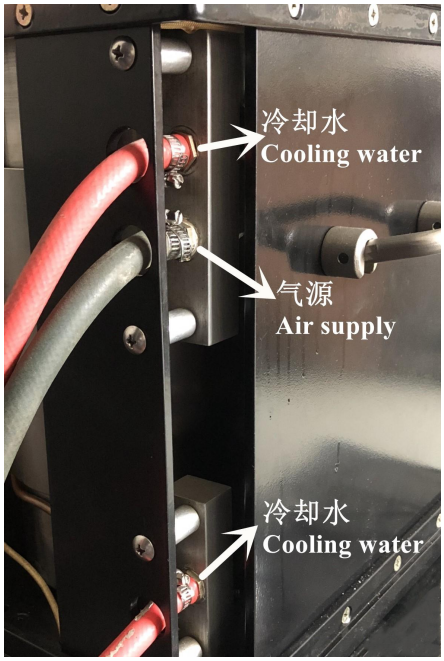
四、安装

1、拆箱

拆箱后，根据装箱单检查仪器和备件，确保所有配件已收到，且没有损坏，如有意外情况，请与本公司联系。

2、安装仪器

A. 连接气源和水（如图 1 所示）



（图 1）侧向图

- 气源：600～1000kpa
- 冷却水：200～600kpa
- 连接【Φ10】胶管到仪器背面进气口并缩紧；
- 连接【Φ10】胶管到仪器背面进水口并缩紧；
- 连接【Φ10】胶管到仪器背面底部排水口并缩紧；

B. 连接电源

注意：仪器的输入电源为 AC220V±10%，必须有可靠的接地，在打开侧盖
将连接电源线一端至仪器后面的插座上，另一端连接到合适的额定电源插座上。

●将热电偶插头插入热电偶插槽中（见图 2）；

（图 2）电器盒后视图

五、仪器的操作

A.准备工作：

1. 仔细检查安装各部件是否到位；全部电器开关及空气至釜阀、气源开关、手动释压阀都必须在关闭状态（见图 3）。

2. 将油倒入釜体，给釜体内加上压力，将油压回到油箱，具体步骤如下：（见图 6）

1) 在釜体内倒入约 2000ml 稠化仪专用油；

注意：油箱内的油不允许太满，要求在油标中能看到液位，如加油太多可打开油箱下面的球阀排出。

2) 将釜盖旋入釜体中，用手轻轻旋入即可，不要太紧；

3) 利用热电偶上的紧固螺钉密封釜盖，即：将热电偶插入釜体内旋紧即可；

注意：热电偶上端有一左旋小套管，旋紧前小套管应在螺纹上端。

4) 逆时针方向旋转，打开空气至釜阀（此时压缩空气进入釜体）；

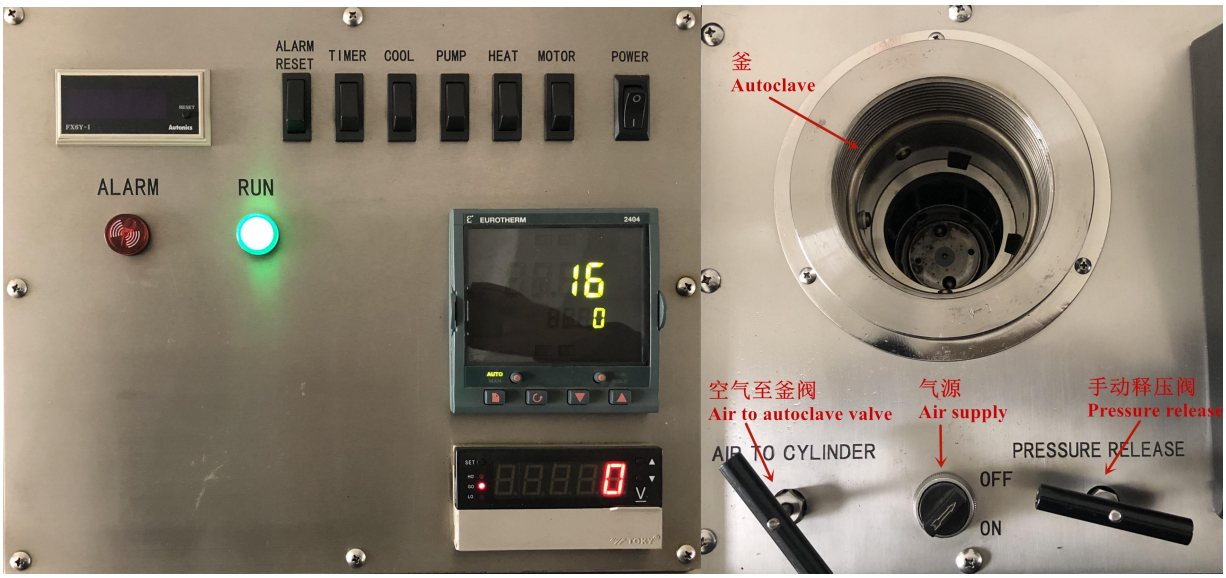
5) 逆时针方向旋转打开手动释压阀，（此时压力油慢慢流进油箱）；

6) 关闭空气至釜阀；

7) 打开热电偶上的紧固螺钉，将釜体内余气排除；

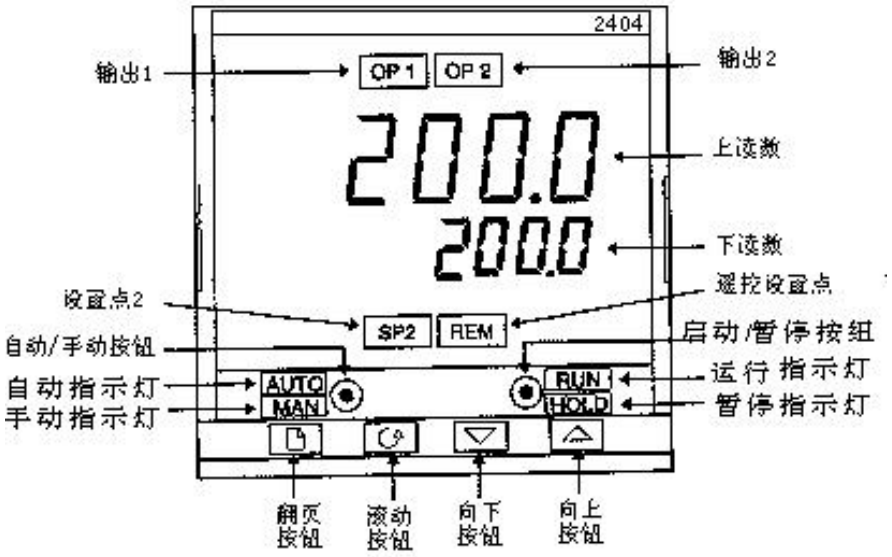
8) 关闭手动释压阀；

9) 取下热电偶，取下釜盖，加油完毕。



（图 3）操作面板

- 按试验样品要求的升温速率设定温度控制器；
- 设定方法如下：



温度控制器面板

输出 1 或 2：连接到输出 1 或 2 的继电器接通时，灯亮。

UPPERREADOUT-上读数：显示当前温度值。

LOWERREADOUT 下方读数：如果控制器正在执行一个程序，在此显示目标温度。显示值随控制器所在的模式而变化。

SP1/2-设置点 1 或 2：指示控制器所用的设置点。多数情况下，控制器都用设置点 1。

REM-远程传输：如果控制器备了这个选项，指示远程传输状态。

AUTO/MAN-自动/手动按钮：在自动和手动之间改变控制器的模式。如果控制器不用时，应把控制器设置为手动模式并核实输出功率调到0.0%。

RUN/HOLD-启动/暂停按钮：用来启动，暂停或终止温控程序。按第一次为启动，再按一次为暂停，按住三秒以上为终止。

PAGE-翻页按钮：用于翻阅控制器的不同菜单。

SCROLL-滚动菜单按纽：在某个菜单内翻阅控制参数。

UP/DOWN 上/下按钮：用来改变参数值。按住此按钮可快速改变参数值。

B.操作

在温控器上设置一个控温方案，需要用户输入两个基本参数：升温时间（即由当前温度升至最终保持温度的时间），及最终目标温度。通常分别称为“升温时间”和“保持温度”。升温时间以分钟为单位。

控温方案由用户输入到控制器中。温控程序输入到温控器中后，按“启动/暂停”键即开始执行控制程序。如须暂停正在执行的温控程序，在运行状态下按一次“启动/暂停”(此时控制器面板上 RUN-运行指示灯闪亮)，再按一次即恢复执行该程序。如须终止控制程序，按住“启动/`暂停”键直到面板上的“RUN”运行指使灯熄灭。

注意：做为良好使用习惯，每次终止控温程序后，按下“自动/手动”按钮把温控器调到手动状态，用上/下按钮将控制器输出调到 0.0%。这样可防止无意中误操作加热器。

C.输入温控程序步骤：

1、打开控制器的开关。
2、按下翻页按钮，直到出现“Prog”
3、按下滚动按钮，直到出现“Segn”
4、输入数值 1；即定义程序升温段
5、按下滚动按钮。
6、输入段的类型 Type；用上/下按钮选择升温时间 rmP.t 方式。
7、按下滚动按钮。
8、输入目标温度 tGt；即此段的目标温度。
9、按滚动按钮。
10、输入升温时间(分钟)；
11、按滚动按钮。
12、输入数字值 2；即定义程序保温段。
13、按滚动按钮。
14、选择段的类型(Type)为 End；用“上/下”按钮选择保温方式(dwEll)
15、按滚动按钮。
16、连续按翻页按钮，直到看到面板上方显示当前温度。
17、按“自动/手动”按钮，把控制器设置为自动模式。
18、按下启动/暂停按钮开始运行温控程序。输出 1/2 指示灯闪亮表示有控制输出。

注意：别忘记把仪器面板上的加热器开关放到“开”的位置。温控程序输入到控制器中后，可重复使用。只需按启动/暂停按钮即重新运行该程序。

D.终止控制程序步骤

1. 按住启动/暂停按钮，直到 RUN 运行指示灯熄灭。
2. 按下自动/手动按钮，把控制器设置为手动模式。
3. 用上/下键将输出功率百分比为调到 0.0%。
4. 关闭仪器前面板上加热器开关。

E.硬件

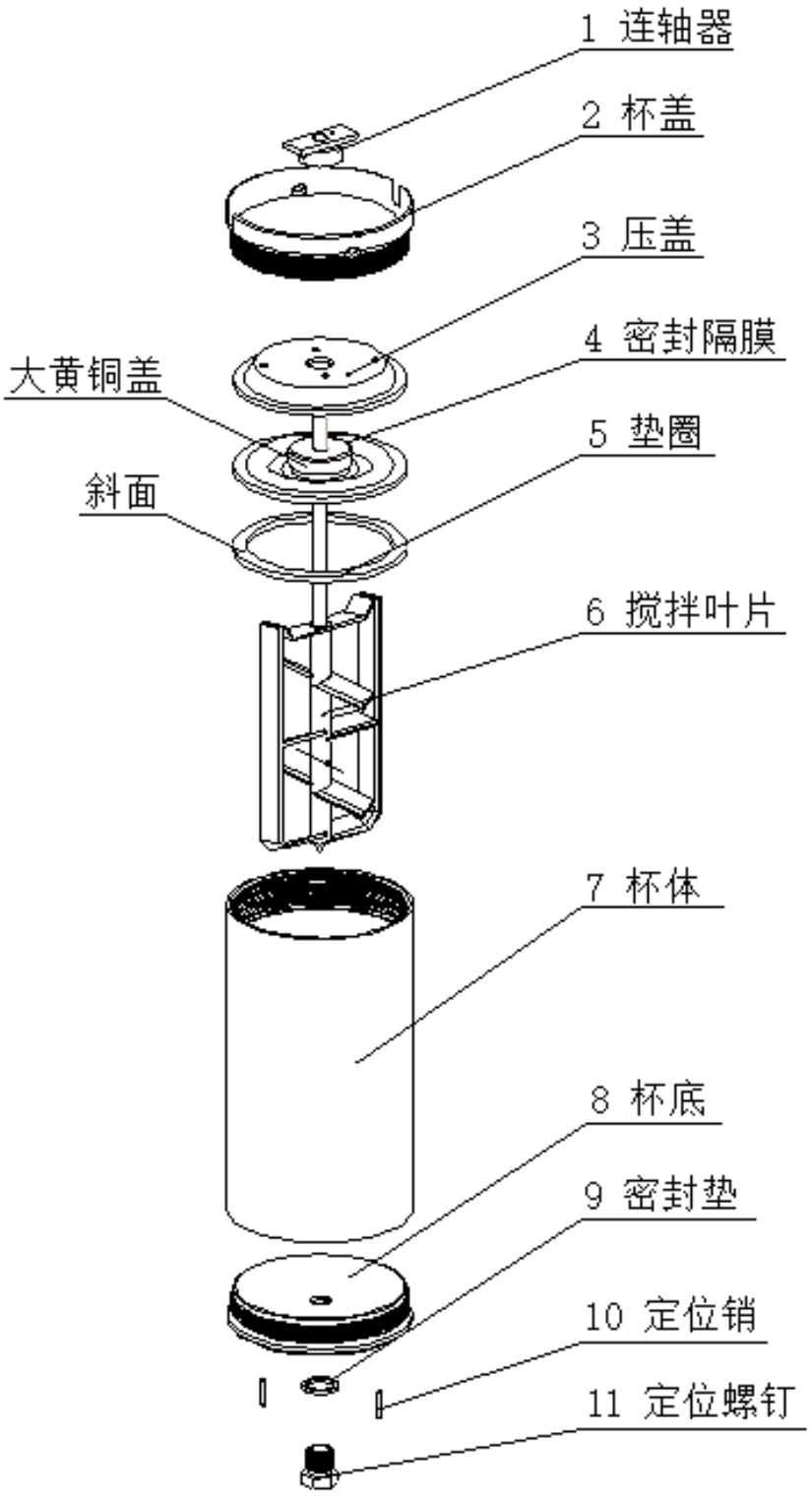
松开控制器前面板上的左、右卡子，将控制器底盘从后壳中抽出。控制器由两个在面板后面定位的塑料卡子卡仪器面板上。可用一个小改刀挑开卡子，控制器和后机身即可从面板上抽出。

F.按要求的稠度需对稠度表进行设定，设定方法如下：

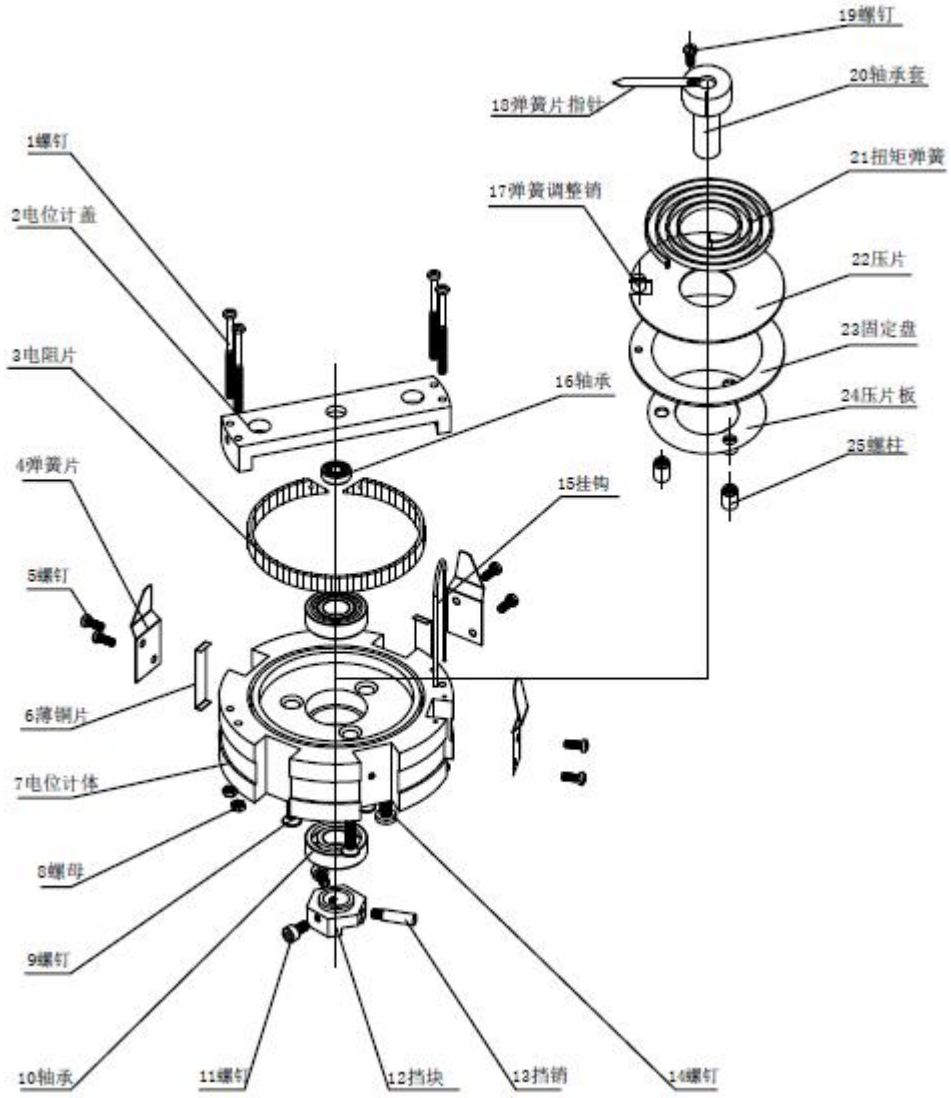
打开稠度表上的面板门，左边黑色拨码为上限报警设定，右边白色拨码为下限报警设定。

注意：下限报警在出厂之前已经设定好，无需再次设定，数值为（-19999）。上限报警在出厂后可根据需要设定，例：设定报警值为70，把上限报警的“第十位数”用上下键调至“7”，把“个位数”调至“0”， “百位”以上应在出厂前已设定为“0”，因此无需设定。

六、API浆杯的准备（见图4）；



（图 4）浆杯分解图



（图5）电位计分解图

浆杯的准备须按以下步骤:

1、彻底清洁所有部件并检查其状况良好；

2、用高温润滑脂涂在浆杯所有内表面，螺纹部位应涂厚一些；

3、参照图四的排列顺序，依次将垫圈【5】，密封隔膜组件【4】，压盖【3】，将杯盖【2】装入杯体【7】中，并用专用扳手轻轻拧紧；

注意：密封隔膜组件【4】大的黄铜盖向上，垫圈【5】的斜面向上。

4、倒转杯体，将其置于“Π”形架上，座落在“Π”形架上的两个销子上；

5、将搅拌叶片【6】从密封隔膜【4】中穿入；

6、依次将杯底【8】，垫片【9】，定位螺钉【11】旋入，用手拧紧；

注意：叶片一端的锥度应座落在定位螺钉的中心，使其活动自如。

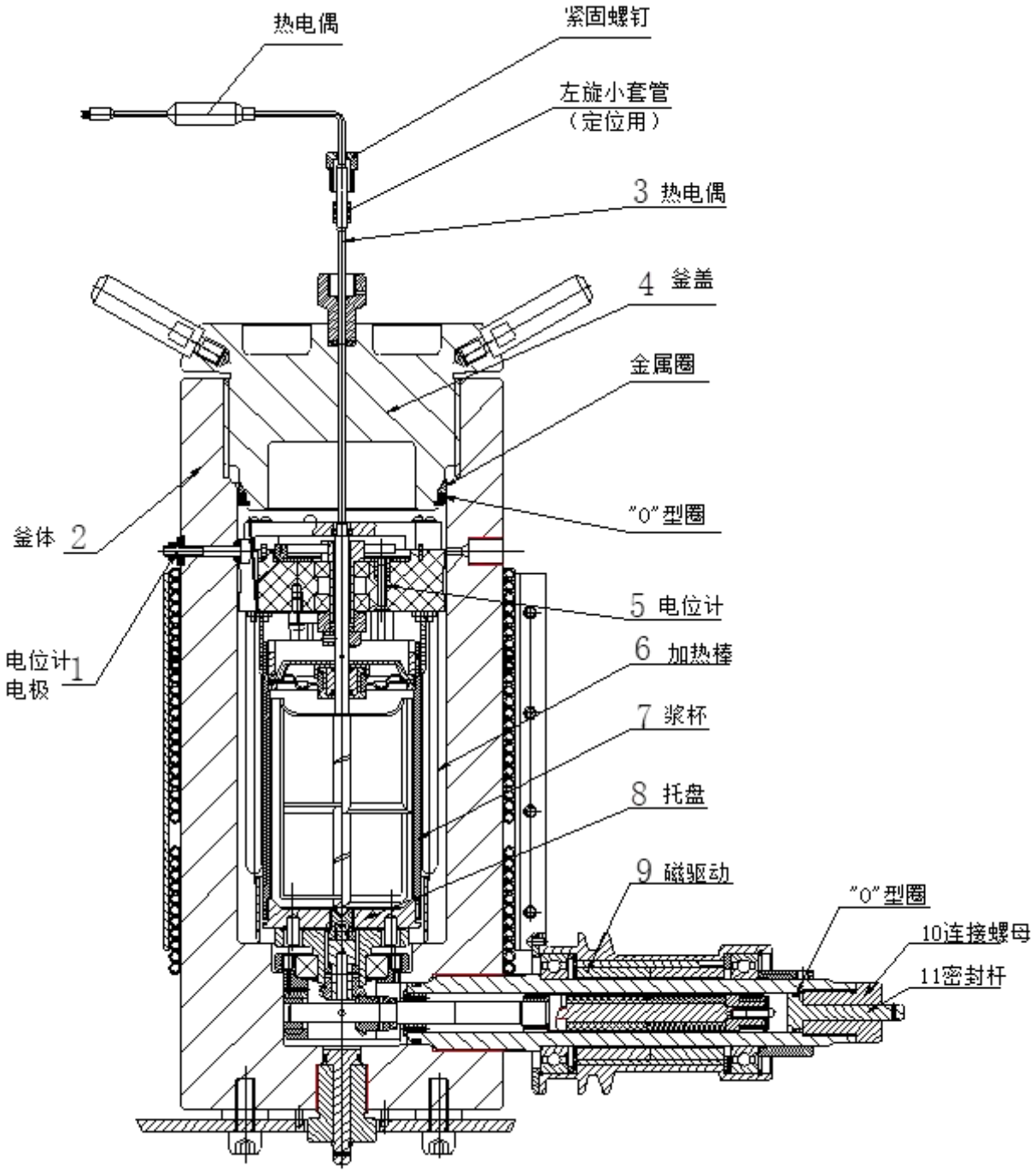
7、连轴器组件【1】装入伸出的叶片轴上；

8、取出电位计（见图5），将电位计装入叶片轴上，调整联轴器组件【1】，使其与档块【12】配合，最后用内六角扳手拧紧定位螺钉；

9、调整完毕后，将电位计组件从叶片轴上取下；

10、将定位螺钉【11】，杯底【8】取下，此时，浆杯的准备工作结束，等待下步实验；

七、开始实验（参见图 3、图 6）所示



（图 6）釜体装配图

1、打开总电源开关；

2、将搅拌好的水泥浆，边搅拌边倒入浆杯中，至浆杯螺纹部位，向下推桨叶扩展浆杯隔膜，排除气体，继续倒入水泥浆；

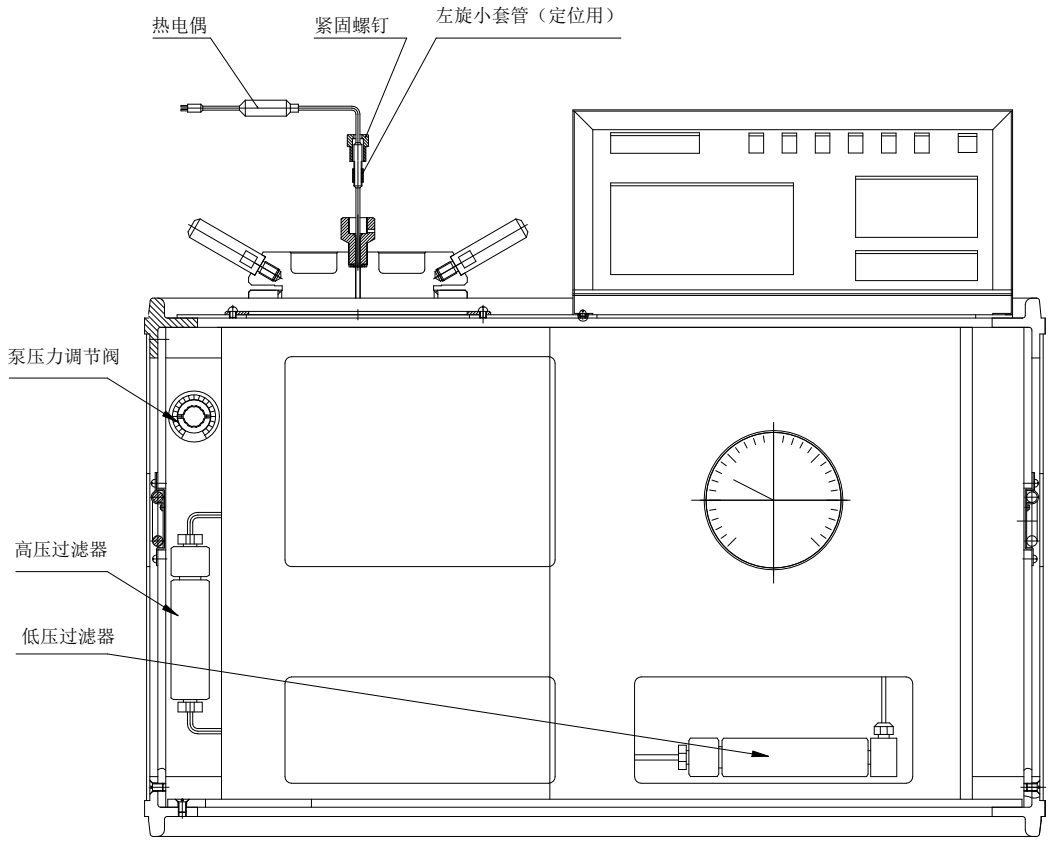
注意：浆杯中不允许有残留空气，否则影响测试，如果水泥浆倒满，拧紧底盖，少量水泥浆将从底盖上流出，相反可以从中间孔中添加水泥浆，从孔中溢出为准，表明浆杯内无气体。

3、正向放置浆杯，用专用提手将浆杯放入釜体底部，转动浆杯直至浆杯底部销子插入旋转杯上的两孔中，取走提手；

4、用专用提手勾住电位计放入釜体内，转动电位计直到电位计槽对齐釜体接触电极，浆杯轴穿

过电位计后面轴承，并转动自由，也可以打开马达开关转动浆杯来实现确认到位，关闭马达；
5、将釜盖顺时针方向旋入釜体中，釜盖中的“0”型圈接触釜体密封部位时，会有一个反作用力，继续旋转釜盖使釜盖中的金属密封圈与釜体接触；**注意：**千万不能突然加力拧紧，用手轻轻旋到位即可（否则试验结束后很难取下釜盖）；
6、将热电偶的插头插入仪器后面的“热电偶”插槽中，并将热电偶通过釜盖插到底（如图6中所示）。热电偶连接处有一左旋小套管，是定位密封用，小套管应在螺纹的上端，如在下端将无法实现密封，因此，必须逆时针方向旋转小套管，使其回到上端，（该项工作每次做实验都必须要做）；然后再将紧固螺钉旋入釜盖中，不能旋到底，保留一圈以上间隙；
7、打开气源开关至ON，（此时压缩空气进入油箱，釜体内开始进油）；
8、当釜体内油满时，多余的油则从上部小孔中溢出，此时迅速将紧固螺钉旋紧；
9、打开马达开关，打开加热器开关，打开计时器开关，立即按动温度控制器上的按钮到 “自动”，实验开始；
10、设定的稠度一到，警报器响，此时加热器电源自动切断，马达停止转动，冷却水自动打开，冷却釜体，实验结束；

A.压力部分的操作与控制：（见图7）



（图7）压力操作控制图

仪器前左边有一泵压力调节阀（出厂时已经调整好，一般情况下不允许再调整，如果特殊情况下，需快速加压，可以调整，即：将前端盖轴向拔出，顺时针方向旋转，观察压力表，其压力最大不得超过0.6MPa），压力是通过手动来实现的，如果在加压过程中，不要求压力，那么随温度的升高压力会自然增大，需要通过手动释压来控制，反之，只要打开泵开关【7】，立即增压。

注意：当最高工作温度设定204℃时，最高工作压力设定上限为100Mpa。

B. 拆卸

1、关闭马达MOTOR；关闭加热器HEAT；关闭计时器TIME；停止温控器的运行，保留冷却开关COOL继续冷却釜体；
2、关闭气源开关至OFF位置，（此时进气源被切断，油箱内低压空气被排出）
3、逆时针方向慢慢地打开手动释压阀，压力表回零；
4、逆时针方向打开空气至釜阀，（此时压缩空气进入釜体，使油流回油箱）当听到排气声后，回油结束；
5、关闭空气至釜阀；
6、逆时针方向，旋出紧固螺钉，将釜体内余气放出，取出热电偶；
7、关闭手动释压阀；
8、逆时针方向取下釜盖；
9、取出电位计，放入带油的容器中；
10、取出浆杯并立即放入水中冷却，去除泥浆，清洗干净并涂上耐高温油脂，备下次使用。

八、仪器维护

每次试验结束

A. 压力釜

●检查并清除釜体内的污物；

●检查釜盖上的“〇”型圈及金属圈，清除擦净（包括螺纹），在螺纹部位涂一层润滑.

B. 浆杯

- 每次实验结束，所有浆杯部件必须彻底清洁和检查；
- 检查浆杯底塞，任何磨损比如内锥度座凹陷或者磨圆了，内锥度座磨损超出磨损范围后，将造成桨叶轴偏心导致桨叶摩擦浆杯内壁或者转动不灵活；
- 检查浆杯轴尖是否磨损，确保轴转动垂直，浆杯轴尖磨损后或者轴弯曲将妨碍轴对准浆杯底塞中心，并导致桨叶摩擦浆杯内壁或者转动不灵活；
- 如果桨叶损坏（偏向、叶片有裂口）更换桨叶，在第一次使用前记录桨叶重量，做20次实验以后记录重量，如果重量少于20%，更换桨叶；
- 用二硫化钼油脂润滑所有部件。

C.热电偶

检查热电偶确保垂直，检查螺纹接头密封位置并清洁干净，接头任何部件疲劳受损都是一个安全隐患，如果螺纹损坏，热电偶可能在高压下弹出，仔细检查热电偶接头内部密封是否变薄或者有缺口，如有缺陷应立即更换，以保证操作者的安全。

D.电位计

每次实验结束，电位计必须清洁干净，用毛刷沾少量洗涤剂轻轻刷掉水泥颗粒、弹簧、电阻片等外表面的水泥沉淀物，要清洗干净，将整个电位计在水中漂洗干净，然后放在盛有油的容器中。

E.电位计总成 （见图5）

电位计必须彻底拆散并清洗干净，如果下面任何部件存在明显磨损，则必须按下面步骤更换.

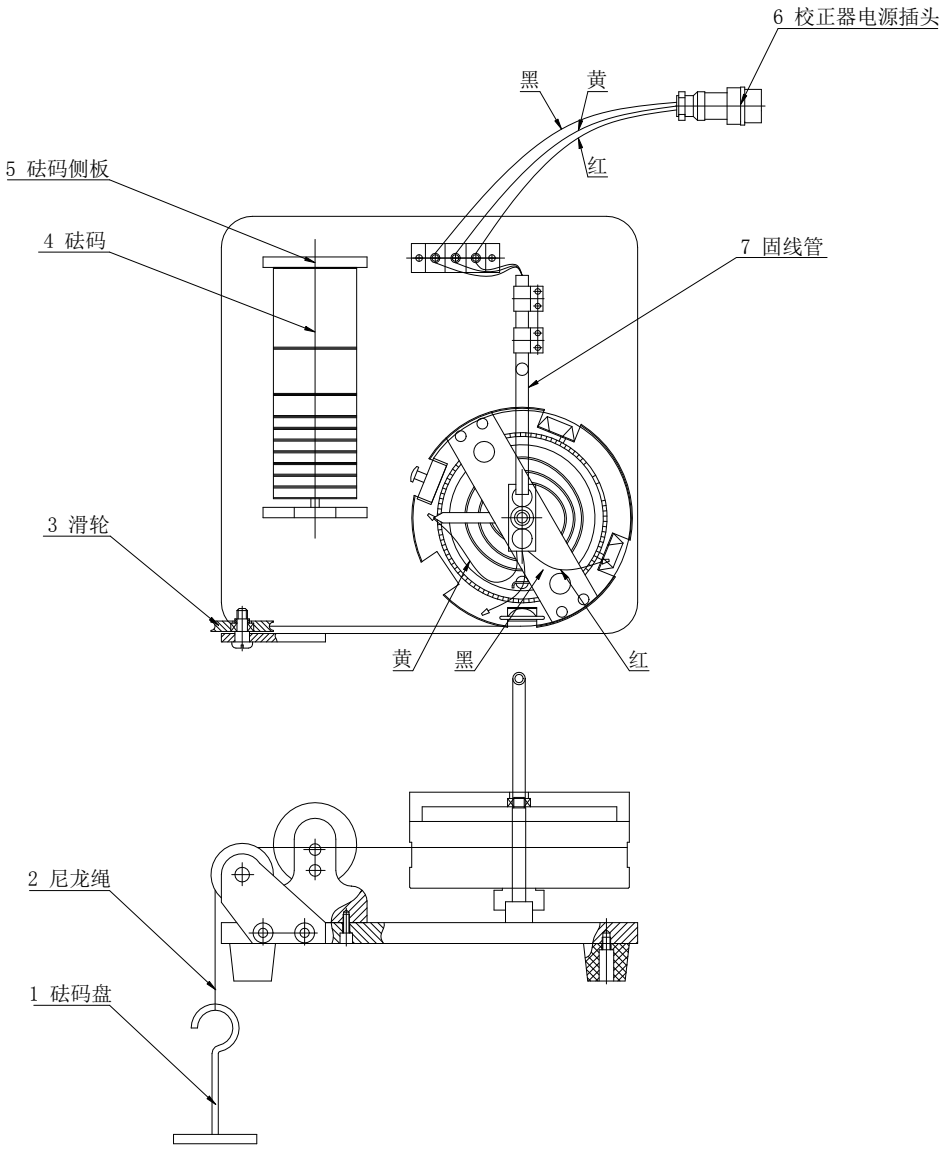
F.电阻片更换

1、拆掉中心万向轴承固定块和指针；
2、拆掉电阻片，小心不要损坏电阻片槽子；
3、垂直放入一个新电阻片，电阻片两端与接触片重叠部分之外长度应该留相同；
4、将电阻片牢牢卡入槽子，电阻片上表面必须水平。
5、用一个硬木轻轻磨光电阻片绕线上表面，这样可确保指针滑动光滑。
6、用手转动指针，确保指针转动光滑，接触良好，并且指针在接触片与接触片之间滑动无发涩感觉，如果需要，上下弯曲调整指针接触；
7、调整中心轴上的指针停止臂位置，确保指针在接触片与接触片之间滑动，所有螺钉必须拧紧；
8、安装轴承固定块；
9、标定电位计。

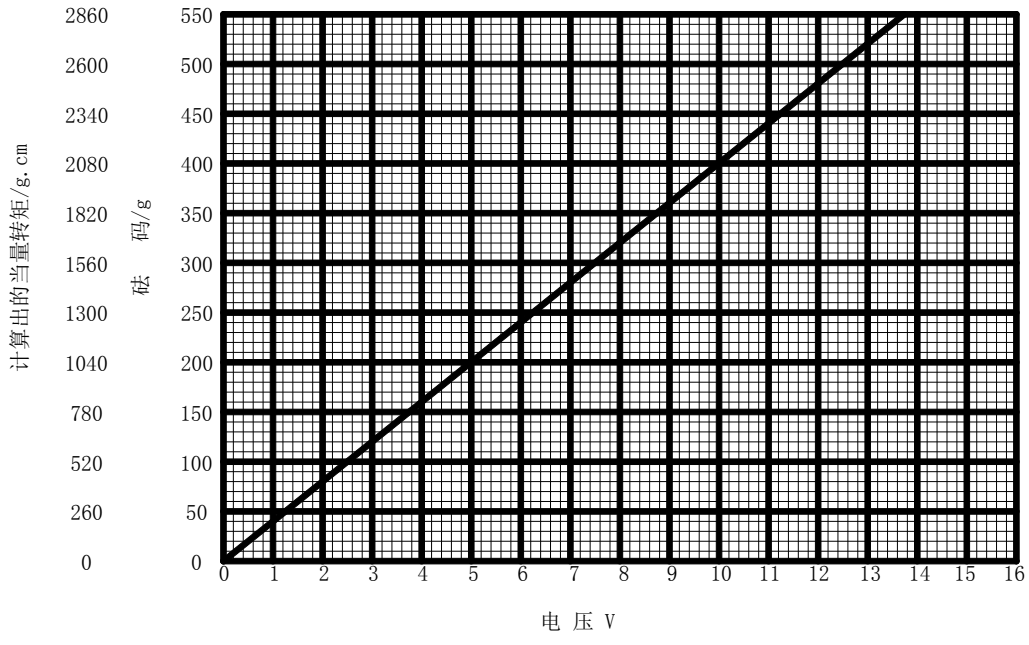
G.更换标定弹簧

1、 拆掉中心万向轴承固定块和指针；
2、 拆掉标定弹簧；
3、 安装一个新弹簧，（电位计轴逆时针转，弹簧拉紧）；
4、 安装指针；
5、 松开但不要拆掉电位计3个内六角螺钉；
6、 转动弹簧调节器，直到弹簧开始拉紧，并且指针与接触片对齐,拧紧螺钉；
7、 安装轴承固定块；
8、标定电位计。

H.标定电位计（见图8、图9）



(图8)电位计校准



（图9）电位计标定

1.安装电位计标定装置，并连接好；
2.连接好导线，插头插入仪器标定插孔。
3.打开仪器电源，挂400Kg砝码；
4.稠度显示应该为100BC，可轻轻震动，并在弹簧上抹稠化油，如果仍然不是100BC，可能需要调节弹簧位置或者电阻片，如果与100BC接近，手动调节面板上标定旋钮达到100BC。

水泥浆稠度与当量转矩的关系		
计算出的当量转矩/g．cm	砝码/g	计算出的水泥浆稠度/BC
260	50±0.1	9
520	100±0.1	22
780	150±0.1	35
1040	200±0.1	48
1300	250±0.1	61
1560	300±0.1	74
1820	350±0.1	87
2080	400±0.1	100

I.磁力驱动

该装置属组合元件，一般情况不易损坏，如出现问题需组件更换，通常由于维护保养的需要，将连接螺母【10】打开，取出密封杆【11】或更换“〇”型圈。（见图6）

J.高压过滤器

只需将上下两个螺母打开即可清洗，其缩紧的结构与热电偶的密封是相同的，注意小套管的位置，必须在螺纹的上端。（见图7）

K.低压过滤器

与高压过滤器相同（见图7）。

九、常见故障排除指南

故障	原因	解决方法
设备不供电	1.保险丝烧断。 2.主开关故障。	
不稳定/错误的温度输出	1.热电偶缺陷。 2.接线端断开。	1.检查所有热电偶线路和组件。 2.更换热电偶。 3.修复线路。
不能增压或不能增至较高压力	1.空气至釜阀打开或泄漏。 2.高压释放阀打开或泄漏。 3.供油量不足。 4.高压管道泄漏。 5.釜盖密封不严（泄漏）。 6.调压器失灵。 7.泵进气压力太低。	1.检查油箱中存油量（如油标中没有指示，应加油） 2.检查所有管道及阀门。 3.更换“0”型密封圈或金属密封圈。 4.检查气源是否畅通，调压器有无压力输出。 5.检查电磁阀是否正常，否则更换电磁阀。 6.泵进气量决定增压的高低，如果气源压力过低也不能产生高压，应检查空压机输出压力，一般情况下应>7kgf/cm^2
压力无法释放	水泥或其它杂质进入“高压释入”阀。	拆下并清洁阀，重新安装。
泵工作不稳定	1.在泵的活塞腔空气阻塞。 2.在泵的阀体内有污物。	1.逐渐增加空气驱动压力，放慢泵工作循环。 2.泵必须有技术售后部维修。

Ⅰ. Summary

Qingdao Chuangmeng Instrument Co., Ltd. produces the Model 2011 Bench-Top Pressurized Consistometer, which is manufactured in strict accordance with API Spec 10. It is an instrument specially used to measure the thickening time of cement slurry.

Cement thickening time is an important index that must be measured before cementing once or twice. The corresponding technical requirements and operating procedures are described in detail in the test method RP-10B recommended by API Spec 10.

The Chuangmeng Model 2011 Bench-Top Pressurized Consistometer has a wide range of pressure and temperature. The instrument has compact structure, small volume and can be placed on the workbench of general laboratory; the autoclave is made of high strength alloy material; its main control and execution unit is imported components (Germany, Japan, the United States and other countries), which can complete the high temperature and high pressure experimental scheme required by most American Petroleum Association.

All control valves and switches are on the front panel. Pressure can be indicated by the pressure gauge in front of it Temperature controller automatically controls the temperature rising rate (i.e. temperature gradient) of cement slurry. When the temperature reaches the required value, the thermostat automatically maintains a constant target temperature. Pressure control is accomplished by pressure relief valves and the input pressure of hydraulic pumps. The Model 2011 Bench-Top Pressurized Consistometer is very easy to operate. Users can also choose the 4000 computer data acquisition and control system produced by the company, and send the test structure to the computer (PC) to realize the real-time acquisition, storage and printing of test data.

The consistency of cement slurry is obtained by the force exerted on the standard spring of potentiometer. When the slurry cup rotates at the prescribed speed, the slurry blades in the slurry cup are acted by the cement slurry, and the force is applied to the standard spring connecting the blades. When the required consistency is reached, the instrument will automatically disconnect the heater, turn off the power supply of the driving motor, and automatically turn on the cooling water and stop the timer. The instrument gives an audio alarm to remind the operator that the test is over.

Ⅱ. Technical parameter

Temperature control: Inside 2500W heater and thermocouple, the controller controls its heating and constant temperature process. (See the Guide for the Use of Temperature Controllers for details)
Pressure control: using air-driven booster pump, air-driven switch and pressure relief valve control.
Maximum Operating Temperature: ≤204℃
Maximum Operating Pressure: ≤137Mpa
Consistency range: 0～100BC
Pressure medium: Mineral oil
Slurry cup speed:150rpm
Heater power: 3000W
Power Requirements:(Input Voltage) VAC220±10% 50HZ
Input power: >3KVA
Operating ambient temperature: 0～40℃
Ambient humidity requirements: 0～95%
Dimensions of Basic Unit: 370mm(wide) x 560mm(height) x 710mm(length)
Total weight: 116Kg
Air Supply: 600～1000kpa
Cooling Water: 200～600kpa

Ⅲ. Characteristic：

●Compliance with API Spec 10.
●Manufacturing enterprises have passed the ISO 9001 quality certification.
●Digital intelligent temperature controller and digital temperature display.
●The autoclave body is made of special alloy.
●The maximum pressure is 137 Mpa.
●The maximum temperature can reach 204 ℃.
●High-power heater is used.
●Strong, durable and easy to use.
●The main control and execution units are all imported components.
●The magnetic drive device is used for easy maintenance.
●The autoclave can be cooled rapidly.
●The autoclave is sealed with high temperature "0" -ring and special metal ring to ensure the sealing.
●Pressure curve can be displayed on PC.
●Computer-based 4000 data acquisition and control system can be selected to collect, store and print test data in real time through communication port 1.

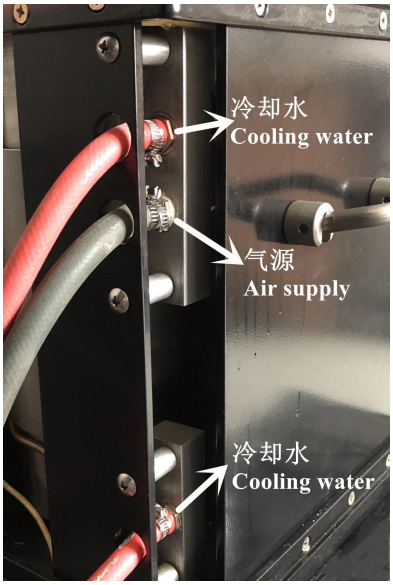
Ⅳ. Installation instructions

1.Open package

After opening the package, check the instruments and spare parts according to the packing list to ensure that all the parts have been received without damage. If there is any accident, please contact our company.

2.Install instruments

A. Connect air supply and cooling water (as shown in Figure 1)



（Figure 1）

●Air Supply: 600～1000kpa

●Cooling Water: 200～600kpa

●Connect 【Φ10】hose to the air inlet on the back of the instrument and tighten it.

●Connect 【Φ10】 hose to the water inlet on the back of the instrument and tighten it.

●Connect 【Φ10】 hose to bottom drain on back of instrument and tighten it.

B.Connecting power supply

Note: The input power supply of the instrument is AC220V +10%. It must be grounded. Then open the side cover to connect one end of the power cord to the socket behind the instrument and the other end to the appropriate rated power socket.

●Insert the thermocouple plug into **THERMOCOUPLE** (see Figure 2);

Figure 2

V. Operation of Instruments

A. Dead work:

1.Carefully check whether the installation parts are in place. All electrical switches and the air to autoclave valves, air supply switches and pressure release valves must be closed (see Figure 3).

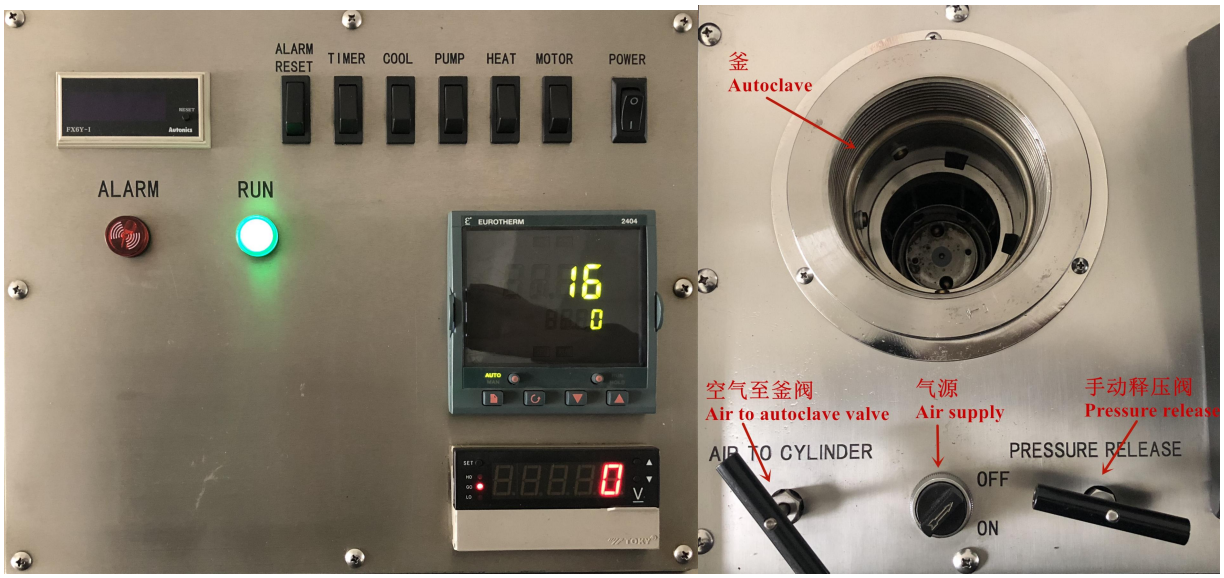


Figure 3

2. Pour the oil into the autoclave, add pressure to the autoclave, and return the oil pressure to the tank. The specific steps are as follows: (see Figure 6)

1) The autoclave is poured into the special oil for the Consistometer of about 2000 ml;

Note: Fuel in the tank is not allowed to be too full. It is required to see the level in the oil mark. If there is too much fuel, the ball valve under the tank can be opened to discharge.

2) Turn the autoclave cap into the autoclave and gently turn it in with your hands, not too tight;

3) Seal the autoclave head with the fastening screw on the thermocouple, that is, insert the thermocouple into the autoclave and tighten it;

Note: There is a small left-handed sleeve at the top of the thermocouple. The small sleeve before tightening should be at the top of the thread.

4) Rotate counterclockwise and open the air to autoclave valves (when compressed air enters the autoclave);

5) Turn the pressure release valve counter-clockwise (when the pressure oil slowly flows into the tank);

6) Close the air to autoclave valves;

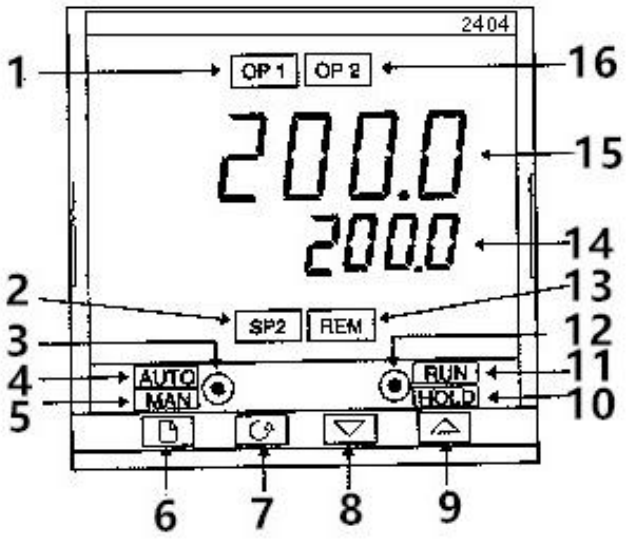
7) Open the fastening screw on the thermocouple and remove the residual air from the autoclave.

8) Close the pressure release valves;

9) Remove the thermocouple, remove the autoclave head, and finish filling.

●The temperature controller is set according to the heating rate required by the test sample.

●The setting method is as follows:



[1/16] Export 1/2-When the relay connected to Export 1 or 2 is switched on, the light turns on.

[15] UPPERREADOUT- Upper Reading: Displays the current temperature value.

[14] LOWERREADOUT- Lower readings: If the controller is executing a program, the target temperature is displayed here. The display value varies with the mode of the controller.

[2] SP1/2- Setting point 1 or 2: Indicates the setting point used by the controller. In most cases, the controller uses set point 1.

[13] REM- Remote transmission: If the controller has this option, it indicates the remote transmission status.

[4] AUTO/MAN- Auto/Manual Button: Change the mode of the controller between auto and manual. If the controller is not in use, the controller should be set to manual mode and the output power should be adjusted to 0.0%.

[11] RUN/HOLD- Used to start, pause or terminate the temperature control program. Press the first time to start, press again to pause and hold for more than three seconds to terminate.

[6] PAGE- Page turning button: Used to flip through different menus of the controller.

[7] SCROLL- Scroll menu button: flip through control parameters in a menu.

[8][9] UP/DOWN- Up/Down Button: Used to change parameter values. Press this button to quickly change the parameter value.

B. Operation

To set up a temperature control scheme on the thermostat, users need to input two basic parameters: the heating time (that is, the time from the current temperature to the final holding temperature), and the final target temperature. Usually referred to as "heating up time" and "holding temperature" respectively. The heating time is in minutes.

The temperature control scheme is input to the controller by the user. When the temperature control program is input into the thermostat, press the "Start/Stop" button to start executing the control program. If it is necessary to suspend the temperature control program being executed, press " **RUN/HOLD** " once in the running state (when "RUN" indicator on the controller panel is flashing), and then press once again to resume execution of the program. To terminate the control program, hold the " **RUN/HOLD** " button until the "**RUN**" indicator on the panel indicates that the light is off.

Note: As a good use habit, after each termination of the temperature control program, press the

"automatic/manual" button to adjust the temperature controller to manual state, and use the up/down button to adjust the output of the controller to 0.0%. This prevents accidental misoperation of the heater.

C. Input temperature control procedure steps:

1. Open the switch of the controller.
2. Press the page-turning button until **"Prog"** appears.
3. Press the scroll button until **"Segn"** appears.
4. Input value 1; Define program heating section
5. Press the **SCROLL** button.
6. Type of input segment; Use the up/down button to select the heating time **"rmP. t "** mode.
7. Press the **SCROLL** button.
8. Input target temperature "**tGt** "; that is, target temperature in this section.
9. Press the **SCROLL** button.
10. Input heating time (minutes);
11. Press the **SCROLL** button.
12. Input digital value 2; Define program insulation section.
13. Press the **SCROLL** button.
14. The type of the selected segment is End; the "up/down" button is used to select **"dwEll ".**
15. Press the **SCROLL** button.
16. Press **Page** button continuously until you see the current temperature above the panel.
17. Press the **AUTO/MAN** button to set the controller to automatic mode.
18. Press the **RUN/HOLD** button to start running the temperature control program. Output 1/2 indicator flash.

Note: Don't forget to put the heater switch on the instrument panel in the "on" position. After the temperature control program is input into the controller, it can be reused. Simply press the* RUN/HOLD *button to rerun the program.

D. Termination of Control Procedure Steps

1. Hold down the **RUN/HOLD** button until the RUN runs out.
2. Press the **AUTO/MAN** button and set the controller to manual mode.
3. Use the **up/down** button to adjust the output power percentage to 0.0%.
4. Close the heater switch on the front panel of the instrument.

E. Installation:

The controller includes many unrealistic menus that can't be seen in normal use. During normal use, the controller is used in normal mode. In this mode, only the menu required for operation is displayed.

The working modes of the controller are as follows:

●Complete - Enter the parameter menu. First-level password is required.

●Edit - Defines which menus and parameters to hide.

●Configuration - Access to all configuration menus of the controller requires a second-level password.

●Operations - Normal use, unnecessary parameter menu hidden.

F. Hardware:

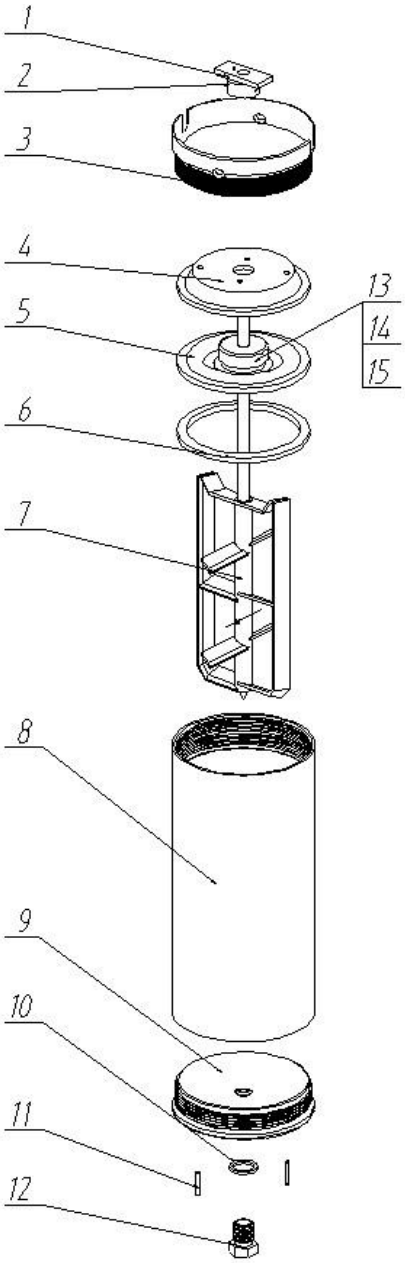
Release the left and right clips on the front panel of the controller and pull the chassis out of the rear housing. The controller consists of two plastic clips positioned behind the panel on the instrument panel. The clip can be opened with a small adjusting knife, and the controller and the rear fuselage can be pulled out from the panel.

G. The consistency meter should be set according to the required consistency.The setting method is as follows:

Open the panel door on the consistency meter, set the upper limit alarm by black dialing on the left and the lower limit alarm by white dialing on the right.

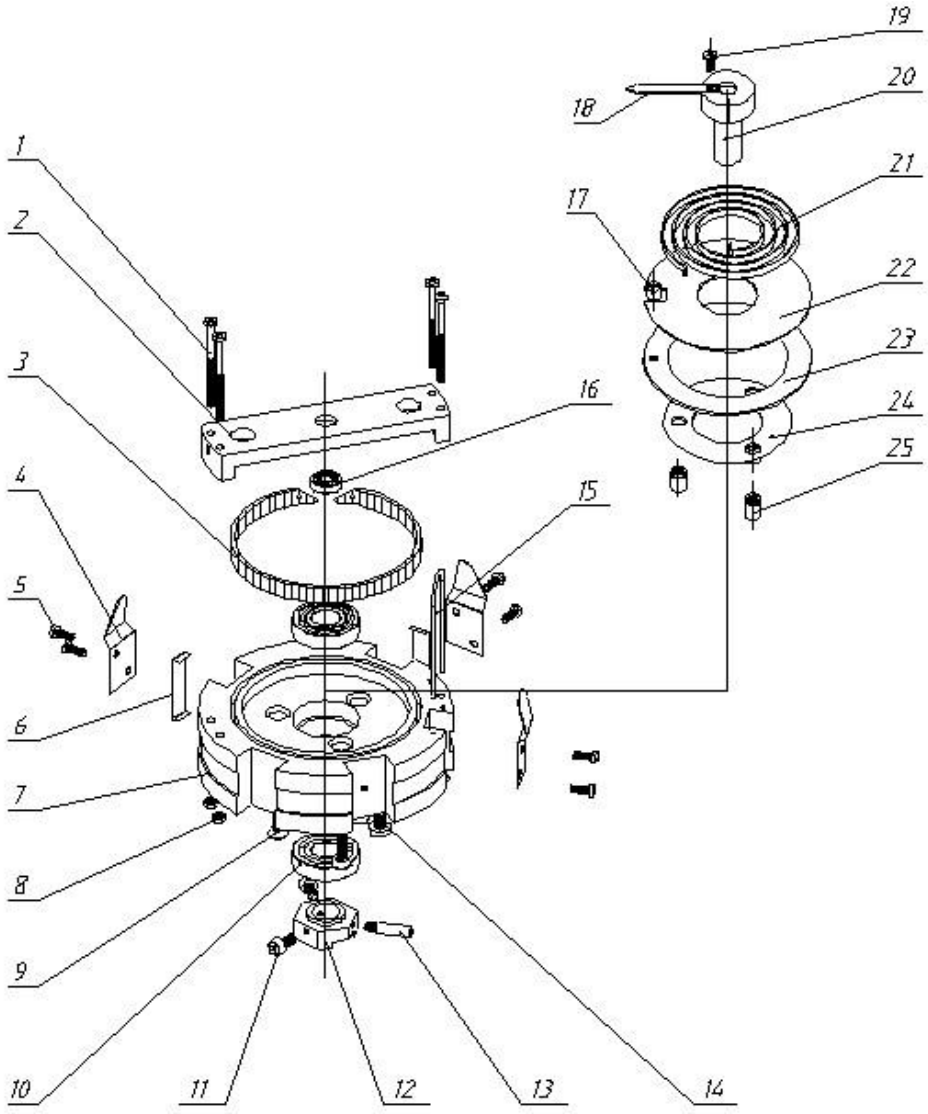
Note: The lower limit alarm has been set before leaving the factory. There is no need to set it again. The value is (-19999). The upper limit alarm can be set as needed after leaving the factory. For example, setting the alarm value to 70, setting the "tenth digit" of the upper limit alarm to "7" with the upper and lower keys, setting the "single digit" to "0" and setting the "hundred digits" above "0" before leaving the factory, so there is no need to set it.

Ⅵ. API slurry cup preparation (see Figure 4);



No.	Part No.	Name
1	P2410	Drive bar
2	P2411	Drive disc
3	P2301	Ring,cup lock
4	P2408	Diaphram support
5	P2406	Diaphragm
6	P2407	Collar, diaphram
7	P232	Paddle
8	P2405	Sleeve
9	P2404	Cup base
10	P2402	Gasket
11	P2403	Roll pin
12	P2401	Plug
13	P2414	Shaft sleeve
14	P2415	Inner sleeve
15	P2415	Middle sleeve

(Fig. 4) Potentiometer decomposition diagram



(Fig. 5) Potentiometer decomposition diagram

NO.	Part No.	Description& specification	NO.	Part No.	Description& specification
1	S01A3	*Crossed round head screw M3X45, lock washer ∅3*	14	S01A24	Inner hexagon screw
2	P2502	*Retainer, bearing, shaft*	15	P2507	Stop, mounting frame
3	P2504	*Resistor*	16	S0428	Bearing
4	P2506	Springs, contact	17	P25141	Spring adjustment pin
5	S0104	Crossed discal screw	18	P2505	Arm, contact
6		Strips, connecting	19	S0104	Crossed discal screw
7	P2509	Frame, Mounting	20	P2511	Bearing bush
8	S0200	Nut	21	P2503	Spring
9	S0117	crossed discal screw	22	P2510	Insulator
10	S0429	Bearing, frame	23	P25142	Adjuster, spring
11	S01A41	Hexagon screws	24	P25122	Clamp, spring adjuster
12	P2513	Check block	25	P25121	Stud
13	P2501	Arm, stop			

The preparation of slurry cups should follow the following steps:

1. Clean all parts thoroughly and check them in good condition.

2. Apply high-temperature grease to all inner surfaces of the slurry cup, and the threads should be thicker.

3. Referring to the arrangement order of Fig. 4, the gasket [5], the sealing diaphragm assembly [4], the pressure cover [3], the cup cover [2] is loaded into the cup body [7], and tightened gently with a special wrench.

Note: The large brass cover of the sealing diaphragm assembly [4] is upward and the gasket [5] is obliquely upward.

4. Turn the cup body upside down and place it on the "∏"-shaped rack and two pins on the "∏"-shaped rack.

5. Put the agitator sheet [6] through the sealing diaphragm [4].

6. Turn the bottom of the cup [8], the gasket [9], the positioning screw [11], and tighten it by hand.

Note: The taper of one end of the blade should be located in the center of the positioning screw to make it move freely.

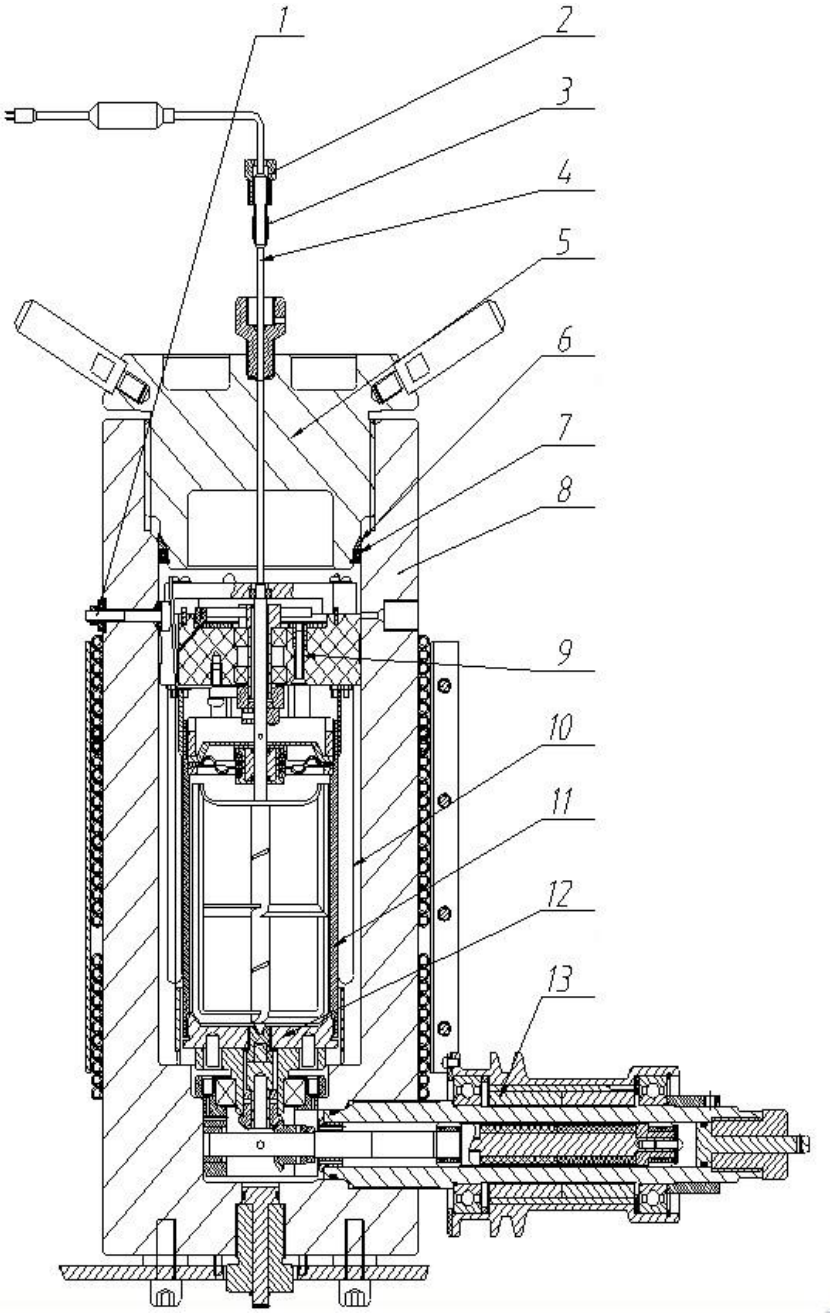
7. The coupling assembly [1] is mounted on the extended blade shaft;

8. Remove the potentiometer (see Fig. 5). Install the potentiometer on the blade shaft, adjust the coupling assembly [1] to match the gear block [12], and tighten the positioning screw with the inner hexagonal wrench.

9. After adjustment, the potentiometer assembly is removed from the blade axis.

10. Remove the positioning screw [11] and the bottom of the cup [8]. At this time, the preparation of the slurry cup is finished and the next experiment is awaited.

Ⅶ. Start the experiment (see Figures 3 and 6)

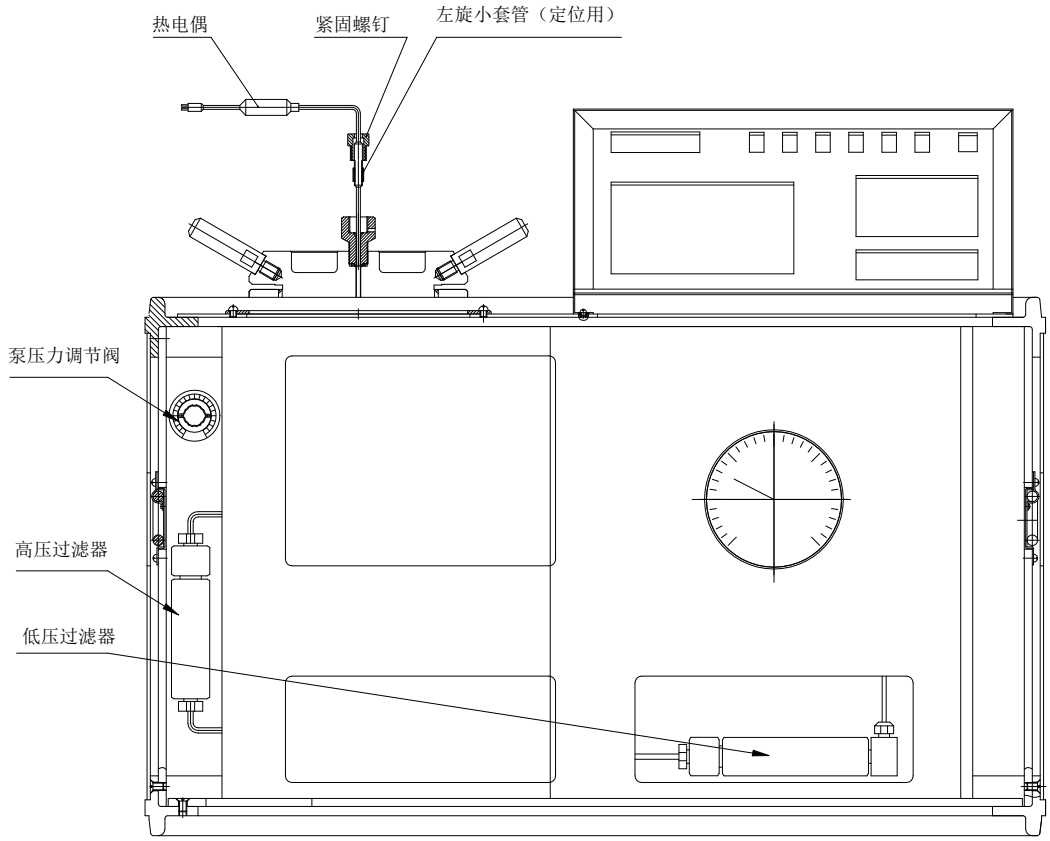


(Fig. 6) Assembly drawings of autoclave

No.	Part No.	Name
1	201115	Electrolyte assembly
2	20111401	Thermocouple assembly
3	20111302	Plug, cylinder
4	20111301	Seal ring, plug
5	S0574	O-ring
6	20111201	Cylinder, pressure
7	P25	Potentiometer mechanism
8	20111604	Heater assembly
9	P2405	Slurry cup assembly
10	2011402	Slurry cup fixed seat assembly
11	201111	Magnetic drive assembly

1. Turn on the main power switch.
2. Put the stirred cement slurry into the slurry cup while stirring. Push the cement slurry to the threaded part of the slurry cup and push down the blade to expand the slurry cup diaphragm. Remove gas and continue pouring cement slurry.
Note: Residual air is not allowed in the slurry cup. Otherwise, the test will be affected. If the slurry is filled and the bottom cover is tightened, a small amount of slurry will flow out of the bottom cover. On the contrary, the slurry can be added into the middle hole, and the overflow from the hole is the criterion, indicating that there is no gas in the slurry cup.
3. Place the slurry cup forward and put the slurry cup into the bottom of the autoclave with a special handle. Turn the cup until the pin at the bottom of the cup is inserted into the two holes in the cup and remove the handle.
4. Put the potentiometer in the autoclave with a special handle. Rotate the potentiometer until the potentiometer slot aligns the autoclave body and contacts the electrodes. The slurry cup shaft passes through the back bearing of the potentiometer and rotates freely. It can also open the **motor** switch and rotate the slurry cup to confirm that the slurry cup is in place and close the **motor**.
5. Rotate the cover clockwise into the autoclave body. When the "O"-ring in the autoclave cap contacts the sealing part of the autoclave body, there will be a reaction force. Continue to rotate the autoclave cap so that the metal sealing ring in the autoclave cap contacts the autoclave body.
Note: Do not suddenly tighten, gently rotate with your hand in place (otherwise it will be difficult to remove the autoclave cap after the end of the test);
6. Insert the plug of the thermocouple into the "**Thermocouple**" slot behind the instrument, and insert the thermocouple through the autoclave cover to the end (as shown in Figure 6). There is a small left-handed sleeve at the thermocouple connection, which is used for positioning and sealing. The small sleeve should be at the top of the thread, if it can not be sealed at the bottom, so the small sleeve must be rotated counter-clockwise to return to the top (***this work must be done every time***); and then the fastening screw should be screwed into the cover of the kettle, which can not be placed at the bottom, leaving more than one circle of clearance.
7. Turn on the **Air supply** switch to **ON** (at this time compressed air enters the tank and oil enters the autoclave body);
8. When the kettle body is full of oil, the excess oil spills over from the upper orifice, and the fastening screw is quickly tightened at this time.
9. Turn on the **motor** switch, the **heat** switch, the **timer** switch, and press the button on the temperature controller to "automatic" immediately. The experiment begins.

A. Operation and control of pressure part: (see Figure 7)



(Fig. 7) Pressure Operation Control Chart

There is a pump pressure regulating valve on the left side of the front of the instrument (it has been adjusted when it leaves the factory, and it is not allowed to readjust in general. If it needs rapid pressure under special circumstances, it can be adjusted, that is, pull out the front cover axially, rotate clockwise, observe the pressure gauge, and its maximum pressure must not exceed 0.6MPa). The pressure is realized manually. If it is not required in the process of pressurization. Pressure will naturally increase with the increase of temperature, which needs to be controlled by manual pressure relief. On the contrary, as long as the pump switch is turned on, the pressure will be increased immediately.

Note: When the maximum working temperature is set to 204℃, the maximum working pressure is set to 100 Mpa.

B. Disassemble

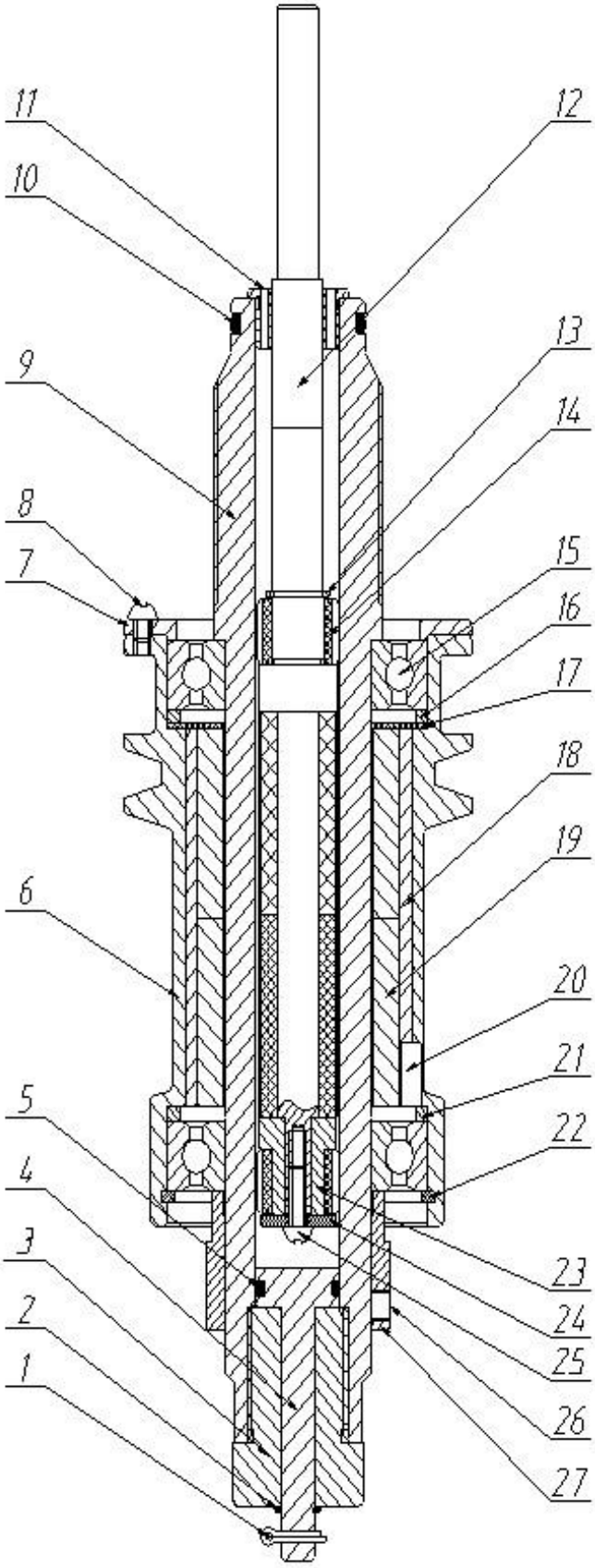
1. Turn off the **MOTOR** switch; Turn off the **HEAT** switch; Turn off the **TIMER**; Stop the operation of the thermostat, keep the **COOL** switch to continue cooling the autoclave body;
2. Turn off the Air supply switch to the **OFF** position. (At this time, the intake is cut off and the low-pressure air in the tank is discharged.)
3. Slowly open the **Pressure release** valve counterclockwise and return the pressure gauge to zero.
4. Open the air to autoclave valve counter-clockwise. (At this time, compressed air enters the autoclave body and makes the oil flow back to the tank). When the exhaust sound is heard, the oil return ends.
5. Close the air to autoclave valve.
6. Remove the fastening screw counterclockwise, release the residual gas from the autoclave and take out the thermocouple.

7. Close the **Pressure release** valve.

8. Remove the autoclave cap counterclockwise.

9. Remove the potentiometer and put it in the oil container.

10. Take out the pulp cup and put it into water to cool immediately. Remove the mud, clean it and coat it with heat-resistant grease for next use.



No.	Part No.	Name
1	S0311	Split pin
2	S0244	Washer on shaft
3	20111101	Pipe plug
4	20111102	Seal plug
5	S0555	O-ring
6	20111103	Magnetic drive coat
7	20111104	Magnetic cover
8	S0111	Crossed discal screw
9	20111105	Magnetic drive body
10	S0520	O-ring
11	20111106	Magnetic drive bearing
12	2011117	Magnetic drive shaft components
13	S0243	Washer on shaft
14	20121112	Inner graphite bearing
15	S0418	Bearing
16	20111108	Bearing gasket
17	20111109	Upper gasket
18	20121117	Outer magnetic steel sleeve
19	20121118	Outer magnetic steel
20	20121119	pin
21	20121120	Bearing gasket
22	S0246	Washer on shaft
23	20121121	Bearing sleeve
24	20121122	Block pieces
25	S0114	Crossed discal screw
26	20111110	Magnetic drive retainer ring
27	S0148	Socket hexagon screw

Ⅷ. Instrument maintenance

End of each test

A. Autoclave

1.Inspection and removal of dirt from the autoclave；

2.Check the "0"-rings and metal rings on the autoclave cap, remove and erase (including threads) and apply a layer of lubrication on the threaded parts.

B． Slurry cup

1.At the end of each experiment, all slurry cup parts must be thoroughly cleaned and inspected.

2.Check the bottom plug of the slurry cup. Any wear, such as hollowing or rounding of the inner taper seat, will cause eccentricity of the blade shaft when the wear of the inner taper seat exceeds the wear range, resulting in the friction of the blade cup inner wall or inflexible rotation.

3.Check whether the axle tip of the slurry cup is worn to ensure that the axle rotates vertically. The

wear of the axle tip of the slurry cup or the bending of the axle will hinder the alignment of the axle to the center of the bottom plug of the slurry cup, and cause the blade to rub against the inner wall of the slurry cup or to rotate inflexibly.

4.If the blade is damaged (deflection, blade cracks) and replaced, the blade weight should be recorded before the first use, after 20 experiments, and if the weight is less than 20%, the blade should be replaced.

5.Lubricate all parts with molybdenum disulfide grease.

C. Thermocouple

Check the thermocouple to make sure it is vertical. Check the sealing position of threaded joints and clean them. Fatigue damage of any part of the joint is a potential safety hazard. If the thread is damaged, the thermocouple may pop up under high pressure. Carefully check whether the internal seal of thermocouple joint is thinner or has a gap. If there is a defect, it should be replaced immediately to ensure the safety of the operator.

D. Potentiometer

At the end of each experiment, the potentiometer must be clean and clean. Use a brush with a small amount of detergent to gently brush off cement particles, springs, resistors and other external surface sediments. To clean up, rinse the potentiometer in water and place it in a container containing oil.

E. Potentiometer assembly (see Fig. 5)

The potentiometer must be completely disassembled and cleaned. If any of the following parts are obviously worn out, the potentiometer must be replaced in the following steps.

F. Replacement of Resistors

1. Remove the fixed block and pointer of the central universal bearing;
2. Remove the resistor and do not damage the groove of the resistor.
3. Insert a new resistor vertically. The length of the two ends of the resistor should be the same as that of the overlapping part of the contact piece.
4. Firmly clamp the resistor into the slot, and the upper surface of the resistor must be level.
5. Use a hardwood to gently grind the surface of the photoresistors around the wire, so as to ensure that the pointer slides smoothly.
6. Rotate the pointer by hand to ensure that the pointer rotates smoothly and contacts well. The pointer slides between the contact sheet and the contact sheet without astringency. If necessary, bend up and down to adjust the pointer contact.
7. Adjust the stop arm position of the pointer on the central axis to ensure that the pointer slides between the contact sheet and the contact sheet. All screws must be tightened.
8. Install bearing fixing block;
9. Calibration of potentiometers.

G. Replacement of calibration spring

1. Remove the fixing block and pointer of the central universal bearing;
2. Remove the calibration spring.
3. Install a new spring (counter-clockwise rotation of potentiometer axis, tension of spring);

4. Install pointer;

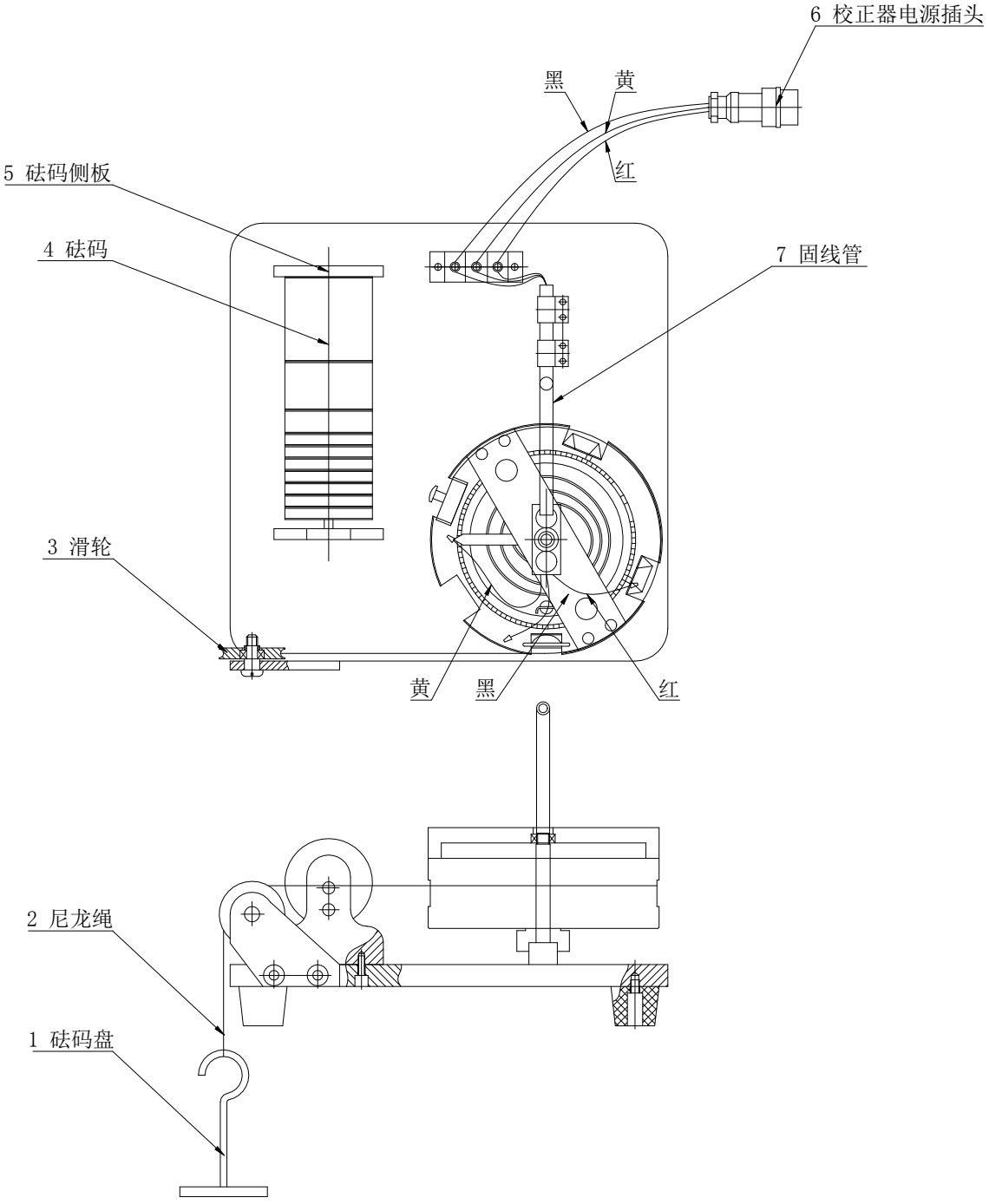
5. Loosen but do not remove the three inner hexagonal bolts of potentiometer.

6. Turn the spring regulator until the spring begins to tighten, and the pointer is aligned with the contact plate, tightening the screw;

7. Install bearing fixing block;

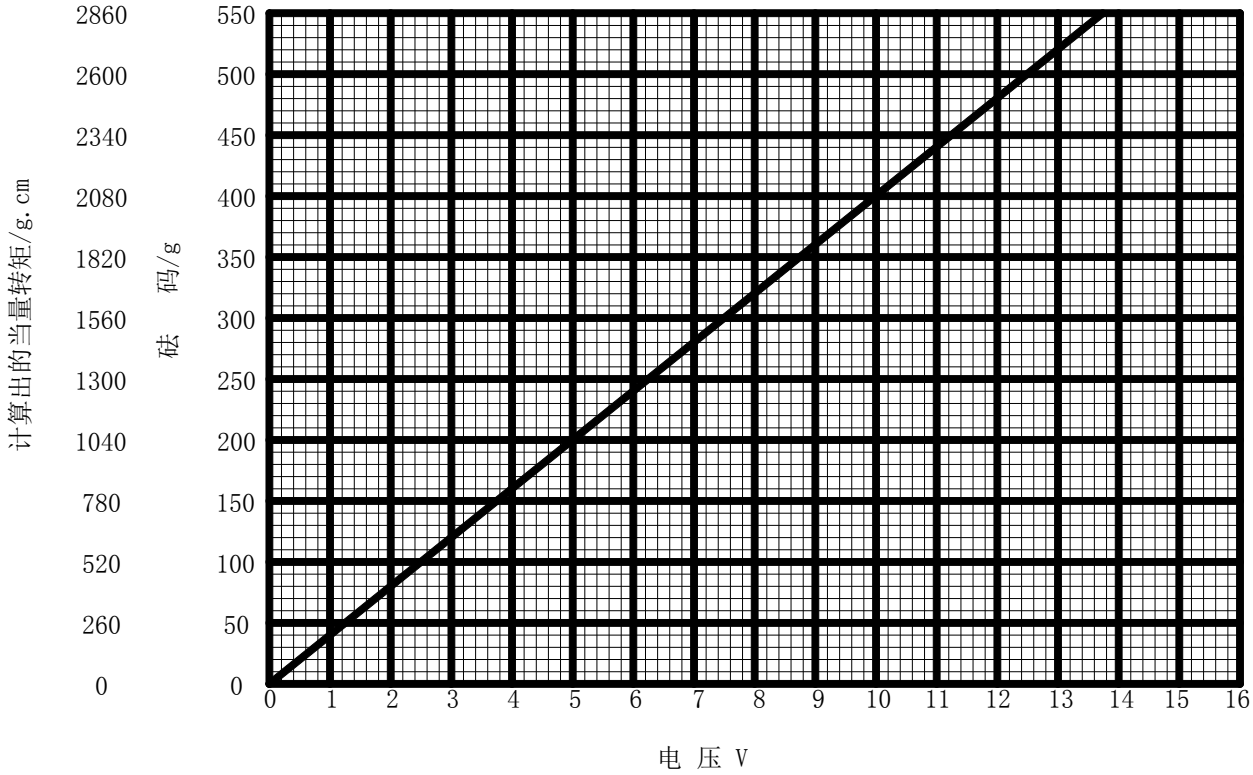
8. Calibration of potentiometers.

H. Calibrated potentiometer (see figs.8and 9)



(Figure 8) Calibration of potentiometer

1. Code disk	5. Weight side plate
2. Nylon rope	6. Corrector power plug
3. Pulley	7. Fixed line pipe
4. Weight	



(Figure 9) Calibration of potentiometer

1. Install potentiometer calibration device and connect it well.
2. Connect the wire and insert the plug into the calibration jack of the instrument.
3. Turn on the power supply of the instrument and hang 400 kg weight.
4. The consistency display should be 100BC. It can shake slightly and apply thickening oil on the spring. If it is still not 100BC, it may be necessary to adjust the position of the spring or the resistor. If it is close to 100BC, the calibration knob on the manual adjustment panel will reach 100BC.

Relation between Cement Slurry Consistency and Equivalent Torque		
Calculated Equivalent Torque /g. cm	Weight /g	Calculated consistency of cement slurry /BC
260	50±0.1	9
520	100±0.1	22
780	150±0.1	35
1040	200±0.1	48
1300	250±0.1	61
1560	300±0.1	74
1820	350±0.1	87
2080	400±0.1	100

I. Magnetic drive

The device belongs to a combined component, which is not easy to be damaged in general. If there is a problem, it needs to be replaced. Usually, due to the need of maintenance, the connecting nut [10] is opened, and the sealing rod [11] is taken out or the "0"-ring is replaced. (See Figure 6)

J. High Pressure Filter

Just open the upper and lower nuts and clean them. The tightening structure is the same as that of the thermocouple. Pay attention to the position of the small sleeve. It must be at the top of the thread. (see figure 7)

K. Low Pressure Filter

Same as high pressure filter (see figure 7).

Ⅸ. Common troubleshooting methods

Fault	Reason	Resolvent
No power supply for equipment	1. The fuse burned out. 2. Main switch failure.	
Instability/Error Temperature Output	1. The thermocouple is broken. 2. The terminal is disconnected.	1. Check all thermocouple circuits and components. 2. Replace the thermocouple. 3. Repair lines.
Not able to pressurize or increase to a higher pressure.	1. Air to autoclave valve open or leak. 2. High pressure relief valve open or leak.. 3. Insufficient oil supply. 4. Leakage of high pressure pipeline. 5. The autoclave cap is not tightly sealed (leaking). 6. Voltage regulator failure. 7. Pump intake pressure is too low.	1. Check the amount of oil stored in the tank (if there is no indication in the oil mark, oil should be added) 2. Check all pipes and valves. 3. Replace "O"-ring or metal sealing ring. 4. Check whether the air source is unblocked and whether the regulator has pressure output. 5. Check whether the solenoid valve is normal or not, otherwise replace the solenoid valve. 6. Pump intake determines the level of boosting. If the pressure of air source is too low to produce high pressure, the output pressure of air compressor should be checked. In general, it should be>7kgf/cm^2
Pressure cannot be released	Cement or other impurities enter the "high pressure release" valve.	Remove and clean the valve and reinstall it.
Pump instability	1. Air blockage in the piston chamber of the pump. 2. There is dirt in the valve body of the pump.	1. Increase the air driving pressure gradually and slow down the pump working cycle. 2. Pumps must be technically repaired after sales.

青岛创梦仪器有限公司 装箱单

Qingdao Chuangmeng Instrument Co., Ltd. Packing list

Циндао Чуанмэн Инструмент Co. , Лтд. Упаковочный Лист

生产企业：青岛创梦仪器有限公司

Manufacturing enterprise: Qingdao Chuangmeng Instrument Co.,Ltd.

生产地址：青岛市城阳区流亭街道兴海路 3 号

Production address: No. 3 Xinghai Road, Liuting Street, Chengyang District, Qingdao

主机型号:

Model of the main motor:

出厂编号：

Manufacturing No:

序号 No.	编号	名称及规格 Name and specification Название и стандарт	数量 Quantity Количество	备注 Remarks Примечание
1		主机 Main engine	1	
2		泥浆杯备用叶片 Mud cup spare blade	5	
3		备用叶片轴 Spare blade shaft	5	
4		叶片轴销 Blade shaft pin	20	
5		备用成型隔膜 Spare moulded diaphragm	20	
6		备用电位计电阻器 Standby potentiometer resistor	10	
7		电位计备用弹簧	3	

		Potentiometer Standby Spring		
8		电位计备用轴承 Potentiometer spare bearing	2	
9		备用电位计接触臂 Potentiometer contact arms	10	
10		导热油 Mineral oil for consistometer	4L	
11		釜盖密封圈 Sealing ring for cell cover	10	橡胶 103.16×5.33 Rubber 103.16×5.33
12		釜盖金属密封圈 The retaining ring for cell cover	1	
13		釜盖挡圈 Cover ring	1	
14		热电偶 Thermocouple	1	
15		保险丝 6×30 Fuse 6×30	10	30A 陶瓷 30A Ceramics
16		保险丝 5×20 Fuse 5×20	10	6.3A 陶瓷 6.3A Ceramics
17		杯底螺丝 Bottom screw	10	
18		联轴器 Coupling	2	
19		联轴器销	1	

		Coupling pin		
20		浆杯 Slurry cup	2	
21		电位计 Potentiometer	2	
22		电位计电阻器接触片 Contact plate of resistor for potentiometer	1	
23		磁驱动石墨轴承 Magnetic Driven Graphite Bearing	4	
24		磁驱动齿轮 Magnetic drive gear	4	
25		磁驱动密封圈 Magnetic Driven Seal Ring	4	橡胶 32×3.1 Rubber 32×3.1
26		磁驱动密封圈 Magnetic Driven Seal Ring	4	橡胶 20×2.4 Rubber 20×2.4
27		传动皮带 Driving belt	2	
28		浆杯拧紧板手 Slurry cup tightener	1	
29		浆杯、电位计取出器 Slurry cup and potentiometer remover	1	
30		200mm 活扳手 Diagonal wrench	1	
31		3mm 内六角扳手	1	

		Inner hexagon spanner		
32		浆杯座 Slurry holder	1	
33		主机电源线 Power cord	1	
34		胶管 Rubber hose	1	10m
35		橡胶锤 Rubber hammer	1	
36		10mm 管夹 Pipe clamp	6	
37		高压过滤芯 High Pressure filter element	4	
38		低压过滤芯 Low Pressure filter element	4	
39		使用手册 Instruction Manual	1	
40		合格证 Certificate	1	