青岛创梦仪器有限公司
Qingdao Chuangmeng Instrument Co., Ltd.

固相含量测定仪

Oil and Water Retort

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.

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Ⅰ.概述 Summary

固相含量测定仪是用来分离和测定钻井液样品中水、油和固相体积的仪器。是了解固相浓度和组成钻井液粘度、滤失控制的基础。其特点为结构简单，操作方便，是实验室和现场理想适用的专用仪器。

Oil and Water Retort is used to separate and determine the volume of water, oil and solid phase in the well drilling fluid sample, which is the foundation to know the solid phase concentration and the viscosity and filtration control of water base drilling fluid. It is characterized by simple structure and easy operation, which is an ideal and special instrument in the laboratory and field.

Ⅱ.型号及规格 Model and specification

型号 Model	名称 Name
1402	固相含量测定仪 Oil and Water Retort

Ⅲ.仪器的主要技术参数 Main technical parameters of the instrument

名称 Name	技术参数 Technical parameter
电源 Power Supply	220V 50/60Hz
功率 Power	100W
蒸馏器容量 Capacity of distiller	20±1%ml 10±1%ml

Ⅳ.仪器的结构及工作原理 Structure and working principle

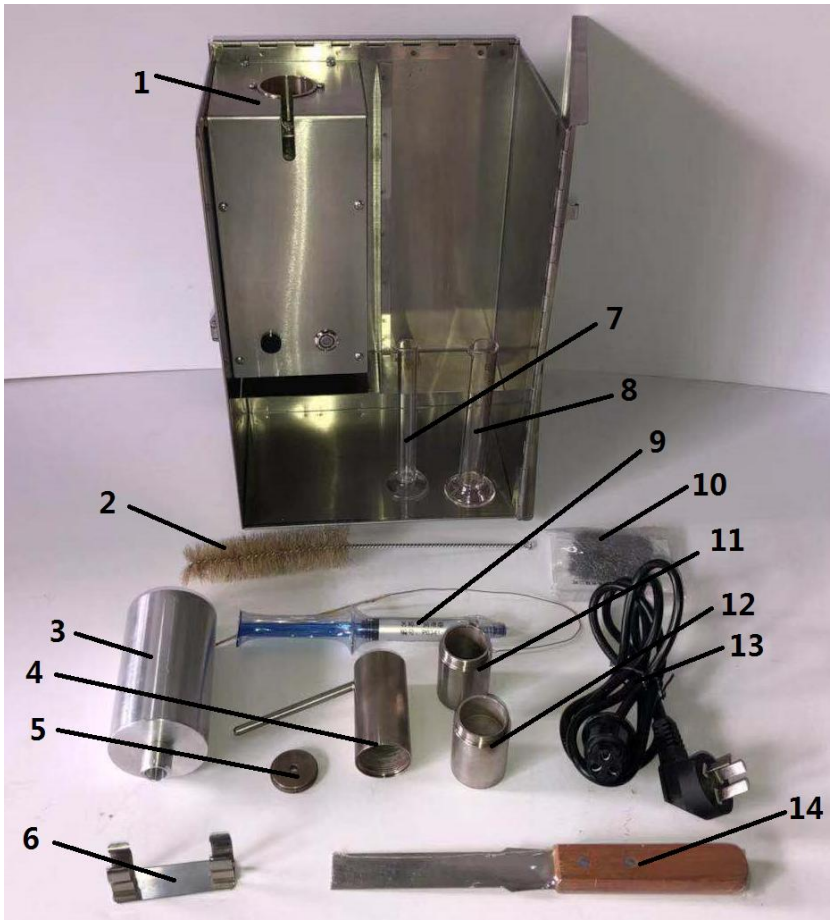
A.组成部分 Constituent parts

1.蒸馏器：不锈钢材料精制而成。
2.液体冷凝器：具有足够的容量以便油和水的蒸汽在离开冷凝器之前冷却至蒸发温度以下。
3.加热棒组件：具有足够的功率以便在 15 分钟之内将样品温度升至液相蒸发温度以上，而不致使固相沸腾出来。
4.量筒：容量 20ml%、10ml%、精度±0.2ml。

5.试管刷：清洗量筒用的毛刷。
6.刮刀：用来刮取蒸馏器内剩余的固相成分。
7.杯架：当蒸馏器被加热用其拿取蒸馏器。
8.箱体：采用全不锈钢材料制成，固定盛装其他部件用的容器。

1. Distiller: made from stainless steel materials.
2. Liquid condenser: it has enough capacity so as to facilitate the vapor of water and oil to cool down below the evaporating temperature before leaving the condenser.
3. Heating rod component: it has enough power to raise the sample temperature above the evaporating temperature of the liquid phase in 15min without causing the solid phase to boil out.
4. Measuring cylinder: capacity: 20ml%, accuracy: ±0.2ml.
5. Test-tube brush: the brush for cleaning the measuring cylinder.
6. Scraper: it is used to scrape the remaining solid components in the distiller.
7. Cup holder: it is used to take the distiller when the distiller is heated.
8. Box: the container made from all stainless steel material, and fixedly hold other parts.

B．固相含量测定仪结构图 Structure chart



序号 No	编号	名称 Name	序号 No	编号	名称 Name
1	14021	箱体组件 Box assembly	8	G0100	量筒 20ml% Measuring cylinder 20ml%
2	G0311	毛刷	9	G0427	高温润滑脂
3	14025	冷凝体组件 Condensate assembly	10	P0322	钢丝绒
4	14022404	蒸馏套 Distiller	11	14022401	蒸馏杯 20ml
5	14022403	计量盖 Metering lid	12	14022402	蒸馏杯 10ml
6	1402107	量筒支架	13	P0191	电源线
7	G0109	量筒 10ml% Measuring cylinder 10ml%	14	P0344	刮刀 Scraper

C.工作原理 Working principal

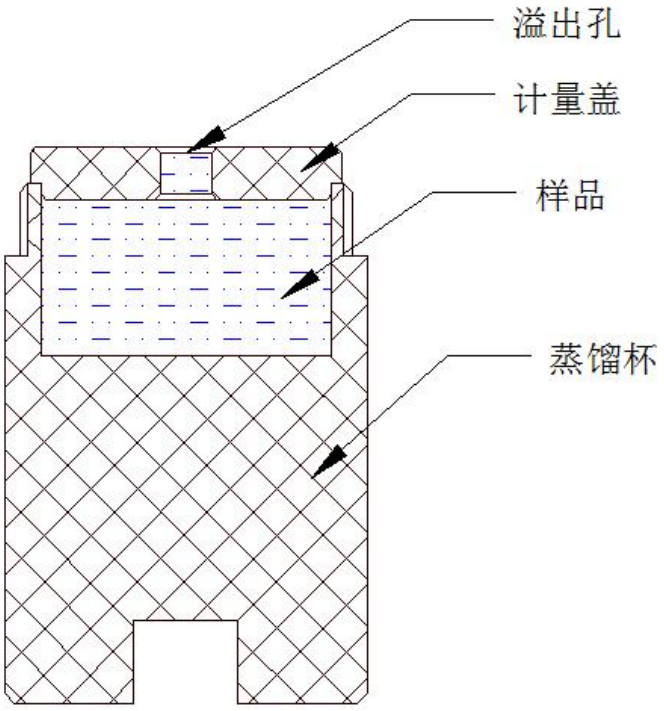
在蒸馏器内加热已知体积的钻井液样品,使其液相成分通过蒸馏方法收集在量筒内,液体体积直接从量筒中油相和水相的读值确定。总的固相体积（悬浮的和溶解的）从差值（样品总体积减去液相体积）得到。由于任何溶解的固体将留在蒸馏器内。所以必须经过计算才能确定悬浮固相体积。也能通过计算得到低比重固相和加重材料的相对体积。

First, heat a given volume of water-based drilling fluid sample in the distiller to evaporate the liquid composition of the sample; second, condense the vapor and collect it in the measuring cylinder, the liquid volume can be directly known from the measuring cylinder through its oil and water phases reading. The total solid volume (suspended and dissolved) is obtained from the difference (the total volume of the sample-the liquid phase volume). As any dissolved solid will remain in the distiller, the volume of suspended solid must be done to determine through calculation. The relative volume of the low gravity solid materials and the weighting material can also be calculated.

Ⅴ.仪器的操作

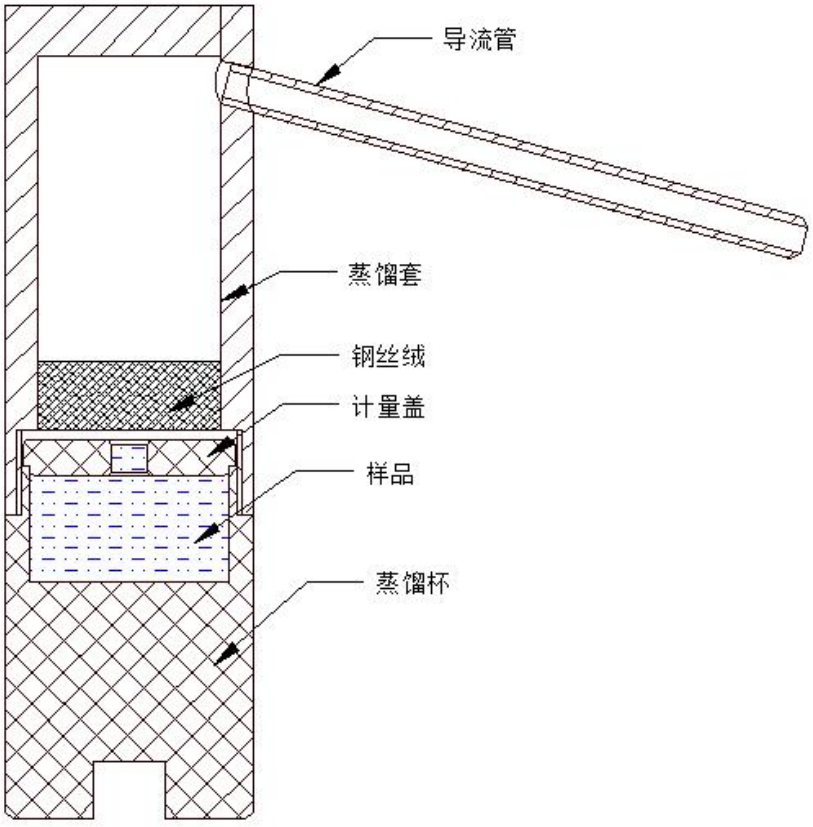
1.检查仪器各部件是否清洁干燥，否则应重新清洗并干燥。
2.取有代表性的样品，通过 12 目筛网倒入容器中。充分搅拌样品，排出空气，使样品混合均匀。
注：样品不可以是含油量过高的泥浆。
3.将样品倒入蒸馏杯中，放上计量盖，样品从计量盖上端小孔溢出，擦净多余的样品。（如图

二）



（图二）蒸馏杯

4.将钢丝绒放入蒸馏套，再装上蒸馏杯。（如图三）



（图三）蒸馏器组件

注：为保证密封，丝扣上需抹一些高温润滑脂或密封脂。

5.将蒸馏器放入加热套内，把冷凝器装在蒸馏器的出液管上，用量筒支架将量筒与冷凝器的

排液管口连接。

6 打开开关，开始实验（一般为 15～25min，取决于样品中油的含量和室温）。

7.实验结束，关闭开关，等蒸出的液相冷却至室温，读取总液相 VL、油和水的体积百分数 VO 和 VW（如油水界面不清晰，可滴入 1～2 滴破乳剂）。

8.拆卸，清洗各部件以备下一次使用。

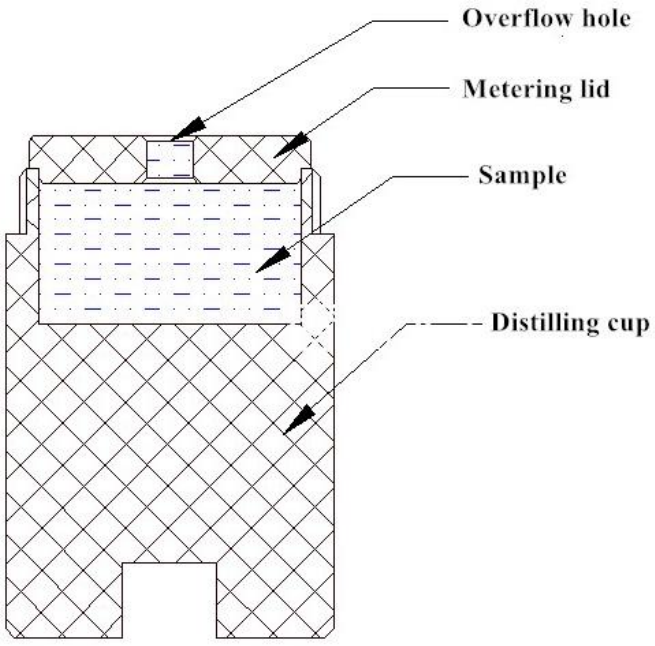
9.对于两种常用的水基钻井液——淡水钻井液和盐水钻井液，计算的方法不同。

1. Check whether all parts of the instrument are clean and dry or not, or the instrument should be cleaned and dried again.

2.Select a typical sample and pour it into the container through a 12-mesh sieve of a marsh funnel viscometer. Stir the sample thoroughly, discharge the air and mix the sample well.

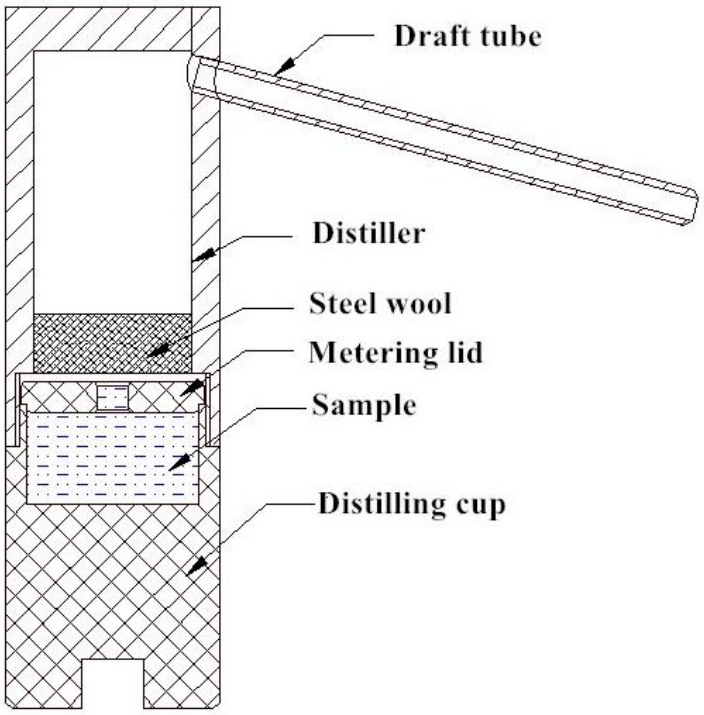
Note: slurry containing excessive oil content can not be taken as sample.

3.Inject the sample into the distiller cup directly or by a clean inspection syringe, and the sample should be injected slowly to avoid mixing with air. Use a levelling ruler to scrap and smooth the liquid level and the upper end of the distiller cup, taking 20ml liquid sample. Then pour 5~10 ml "steel wool liquid" onto the sample surface. (Fig. 2)



(Figure 2)　Distillation cup

4.Wipe the screw thread of the distiller cup with a damp cloth, screw down the evaporating tube with screw thread onto the distiller cup. Next, firmly hold together the evaporating tube and the distiller cup vertically, then put the heating rod into the evaporating tube and screw it on the tube. (Fig. 3)



(Figure 3) Distiller assembly

Note: to ensure the sealing, the screw thread needs to be applied with some lubricating oil or sealing grease.

5.Tightly insert the exhaust nozzle of the evaporating tube into the small hole of the condenser. The measuring cylinder with volume centigrade scale should be connected to the liquid discharge pipe of the condenser.

6.Energize the heating rod and heat it until the condenser has no liquid discharge (usually 15 to 25min, depending on the amount of oil in the sample and room temperature). Then unplug the heating rod.

7.Cool down the evaporated liquid to room temperature and read the total liquid VL, volume percentage of oil and water VO and VW (if the oil-water interface is not clear, add 1～2 drops of Demulsifier).

8.Disassemble all parts of the solid content distiller, then clean and dry these parts for next time use. Clean and small tubes can be used to clean and poke through the distiller tube and gas vents and drain holes of the condenser for removing the grease.

9.With the direct readings of measured data, the solid content of drilling fluid can be calculated. For two common-used water-based drilling fluids: fresh water drilling fluid and brine drilling fluid, the calculation ways are different.

淡水钻井液固相含量计算

Calculation of solid phase content in fresh water drilling fluid

1）总固相含量 VS：

Total solid phase content VS:

$$VS = 100 - (VW+VO)，\%$$

式中 VS——淡水钻井液中总固相体积含量（包括粘土地、钻屑等低密度固相和多数情况下为重晶石的加重材料等高密度固相），%；

VO——由固相含量测定仪测得的钻井液中油的体积含量，%；

VW——由固相含量测定仪测得的钻井液中水的体积含量，%。

VS——total solid phase volume content in fresh water drilling fluid (including low-density solid phase such as clay soil, drilling cuttings and high-density solid phase such as the weighting materials that are barite in most cases), %；

VO——the oil volume content in drilling fluid measured by solid content determinator, %；

VW——the water volume content in drilling fluid measured by solid content determinator, %；

2）钻井液中固相的平均密度 ρ S：

Solid phase average density in drilling fluid ρS：

$$\rho S = \frac{100 \cdot \rho m - (VW \cdot \rho w + VO \cdot \rho O)}{VS}, g/cm^3$$

式中 ρ S——钻井液中固相的平均密度，g/cm³ ；

ρ m——钻井液密度，g/cm³ ；

ρ w——水的密度，通常取得 1.0 g/cm³ ；

ρ O——油的密谋，通常取暖.48 g/cm³ 。

ρ S——solid phase average density in drilling fluid, g/cm³；

ρ m——density of drilling fluid, g/cm³；

ρ w——density of water, normal value: 1.0 g/cm³；

ρ O——density of oil, normal value: 48 g/cm³。

3）钻井液中低密度固体（包括粘土和钻屑）的体积含量 VLG：

Volume content of low-density solids (including clay soil and drilling cuttings) in drilling fluid VLG：

$$VLG = \frac{VS \quad \rho WM - \rho s}{\rho WM - \rho LG}, \%$$

式中 VLG——钻井液中低密度固体（包括粘土和钻屑）的体含量，%；

ρ WM——加重材料的密度，g/cm³

ρ s——钻井液中固相的平均密度，g/cm³

ρ LG——低密度固体的密度（可实测求得或设 ρ LG=2.60 g/cm³ ），g/cm³ .

VLG——volume content of low-density solids (including clay soil and drilling cuttings) in drilling fluid, %

ρ s——average solid density in drilling fluid, g/cm³

ρ WM——desity of weighting material, g/cm³

ρ LG——desity of low-density solid (obtaining the measured data or supposing ρLG=2.60

g/cm³) , g/cm³。

4）钻井液中加重材料的体积含量 VWM：

Volume content of weighting material in drilling fluid VWM：

VWM=VS-VLG，%

$$VWM=\frac{VS\ \rho s-\rho LG}{\rho WM-P lg}$$ ，%

5）钻井液中低密度固体的重量含量 WLG：

Weight content of low-density solid in drilling fluid WLG：

WLG=10（VLG× ρ LG），kg/m³

WLG=3.5（VLG× ρ LG）,1b/bbl

6)钻井液中加重材料的重量含量 WWM:

Weight content of weighting material in drilling fluid WWM:

WWM=10(VWM× ρ WM) ， kg/m³

WWM=3.5(VWM× ρ WM) ， 1b/bbl

盐水钻井液的固相和液相含量的计算

Calculation of solid and liquid phase content in brine drilling fluid

1）盐水钻井液滤液的密度 ρ WC：

Density of brine drilling filtrate ρWC

ρ WC=1+0.00000109・CCl

式中 ρ WC——盐水钻井液滤液的密度，g/cm³

CCl——钻井液滤液分析得出的钻井液中 CL^- 的浓度，mg/L

ρ WC——density of brine drilling filtrate, g/cm³

CCl——density of CL^- in drilling fluid through an analysis of drilling filtrate, mg/L

2)盐水钻井液中修正了的总固相体积含量 VSC：

Total solid phase volume content in brine drilling fluid revised VSC：

$$VSC=VS-VW\frac{(\quad CCl\quad)}{1680000-1.21\cdot CCl}$$

式中 VSC——含盐钻井液中修正了的总固相体积含量（减去了盐的体积），%

VS——固相含量测定仪测出的总固相体积含量，%

VW——固相含量测定仪测出的水的体积含量，%

VSC ——total solid phase volume content in brine drilling fluid revised (subtructing it from the volume of salt) , %

VS——total solid phase volume content measured by solid content determinator, %

VW——water volume content measured by solid content determinator, %

3)盐水钻井液中低密度固体体积含量 VLG：

Volume content of low-density solid in brine drilling fluid VLG：

$$VLG=\frac{1}{(\rho WM-\rho LG)}[100\cdot \rho WC+VSC(\rho WM-\rho WC)-100\cdot \rho m-VO(\rho WC-\rho O)],\%$$

式中 VLG——盐水钻井液中低密度固体体积含量，%

ρ WM——加重材料密度，g/cm³；

ρ LG——低密度固体密度，g/cm³；

ρ WC——盐水钻井液滤液的密度，g/cm³；

VSC——盐水钻井液中修正了的总固相体积含量，%；

ρ m——盐水钻井液的密度，g/cm³；

VO——固相含量测定仪测出的油的体积含量，%；

ρ O——油的密度，g/cm³。

VLG——volume content of low-density solid in brine drilling fluid, %

ρWM——desity of weighting material, g/cm³;

ρLG——desity of low-density solid, g/cm³;

ρWC——density of brine drilling filtrate, g/cm³;

VSC——total solid phase volume content in brine drilling fluid revised, %;

ρm——desity of brine drilling fluid, g/cm³;

VO——oil volume content measured by solid content determinator, %;

ρO——desity of oil, g/cm³.

4)盐水钻井液中加重材料的体积含量 VWM：

Volume content of weighting material in brine drilling fluid VWM

VWM= VSC- VLG，%

式中 VWM——盐水钻井液中加重材料的体积含量，%

VWM in the formula——volume content of weighting material in brine drilling fluid, %

5)盐水钻井液中低密度固体重量含量 WLG：

Weight content of low-density solid in brine drilling fluid WLG：

WLG=10（VLG× ρ LG），kg/m³

WLG=3.5（VLG× ρ LG），1b/bbl

6)盐水钻井液中加重材料的重量含量 WWM：

Weight content of weighting material in brine drilling fluid WWM：

WWM=10（VWM× ρ WM），kg/m³

WWM=3.5（VWM× ρ WM），1b/bbl

Ⅵ.仪器的维护与保养 Maintenance of the instrument

1.清洗各部件并干燥待用，仪器置于干燥环境中。

2.移动、维修或保养仪器时。要轻拿、轻放，以免造成部件变形影响精度和使用。

3. 实验结束后，及时关闭加热。

4. 蒸馏杯和套筒之间的密封面不要损伤以免影响密封。

1. Clean and dry all parts. The instrument is stored in a dry place

2. When moving, repairing or maintaining the instrument, the instrument must be handled with care to avoid any deformation of the parts and components affecting the accuracy and use.

3. Heating rod should be gently handled, free from any damage to the rod.

4. Heating time should not be too long, the distillation generally lasts for about 40 minutes.

5. The sealing surface between the distilling cup and the sleeve shall not be damaged so as not to affect the sealing.

Ⅶ.故障的判定与排除 Troubleshooting procedures

故障 Fault	原因 Reasons	维修方法 Maintenance methods
蒸馏器组件通电不加热 Distiller assemble at power-up state doesn't heat	加热圈坏 Heating ring breakdown	用万用表Ω档测量加热棒两端有无阻值，若无阻值加热圈线烧断，更换加热圈. Use the multimeter to measure the resistance at the two ends of the heating ring. Replace the heating ring if there is no resistance for the burn-out of the heating wire.
	电线插头接触不好. Bad connections at plugs of electric wire.	检查电线接头组件各插头是否牢固插牢. Check whether all wire connections are securely fixed.

注意：

连续加热时间不能超过 1 小时。

Continuous heating time shall not exceed 1 hour.

青岛创梦仪器有限公司 装箱单

Qingdao Chuangmeng Instrument Co., Ltd. Packing list

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	数量 Qty	备注 Remarks
1		箱体 Box body	1	
2		蒸馏套 Distiller	1	
3		蒸馏杯 10ml Distilling cup 10ml	1	
4		蒸馏杯 20ml Distilling cup 20ml	1	
5		计量盖 Metering lid	1	
6		刮刀 Scraper	1	
7		量筒支架 Measuring cylinder bracket	1	
8		量筒 10ml Measuring cylinder 10ml	1	
9		量筒 20ml Measuring cylinder 20ml	1	
10		电源线 Power cord	1	
11		钢丝绒 Steel wool		
12		高温润滑脂 High temperature grease	1	非常规配件 Unconventional
13		毛刷（大） Brush	1	
14		毛刷（小） Brush	1	
15		使用手册 Operation manual	1	