



## 承认书

# APPROVAL SHEET

版本号: A0

客户信息	客户 Customer	
	客户代码 Customer code	
	项目名称 Project	
	料号 Part No.	
	客户承认签章 Customer's Approval & Signatures	

宝龙公司	产品名称 Product Name	圆柱振动电机 Cylindrical vibration motor				
	产品型号 Product Model	BL4I2G6-PF6				
	设计 Design	马续强 Ma Xuqiang	审核 Checked	徐建辉 Xu Jianhui	批准 Approved	兰德福 Lan Defu

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ROHS/HF

产品规格书/Specifications	日期/Date :2018-04-18	
振动电机/Vibration motor:BL4I2G6-PF6	页码/Page:2 / 15	版本/Version:A0

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**更改记录/Change the record**

版本 version	编制 originator	批准 approval	更改详情 Detail spec changes	日期 Date
A0	马续强	兰德福	初始规格/Preliminary spec	2018-04-18

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### 1. 结构形式/Construction Form

本规格书适用于宝龙电子集团有限公司制造的应用于移动电话的振动电机。  
This specification sheet is stipulated for vibration motor, which is manufactured by baolong electron co., Ltd. for mobile phone.

NO.	项目/Item	规格/Specifications
1-1	电机结构 Motor construction	Φ4 圆柱形无铁芯直流电机 Φ4 cylindrical DC coreless motor
1-2	换向片数 Number of phases	3 组换向片 3-phases
1-3	磁极数 Number of magnet poles	两极 (内置磁极型式) 2-poles (Inner magnet type)
1-4	线圈 Coil construction	空心杯式线圈 Columnar coil
1-5	整流技术 Rectifying method	采用高精度电刷和换向器 Precious brush and commutator

### 2. 使用条件/Standard operating condition

NO.	项目/Item	规格/Specifications
2-1	额定电压 Rated voltage	DC3.0V
2-2	使用电压范围 Operating voltage range	DC 2.5~3.6V
2-3	旋转方向 Rotating direction	CW / CCW
2-4	使用温度范围 Operating temperature range	-30℃~+70℃

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### 3. 测试条件/Testing condition

NO.	项目/Item	规格/Specifications
3-1	温度 Temperature	20°C ±3
3-2	湿度 Humidity	45% ~85%RH
3-3	电源电压 Power supply, voltage source	直流电源或电池 3.0V DC power supply or battery 3.0V
3-4	电机安放状态 Posture of motor	水平/竖直 Horizontal / vertical

### 4. 贮存环境/Storage environment

NO.	项目/Item	规格/Specifications
4-1	贮存温度 Storage temp	20°C ±3
4-2	相对湿度 relative humidity	65 ±5% RH

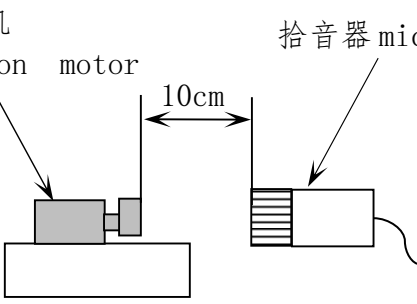
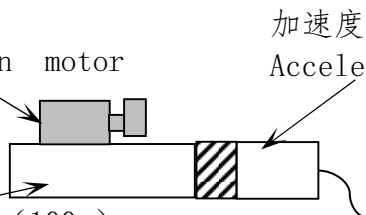
### 5. 电气特性/Electrical characteristic

NO.	项目/Item	单位 /Unit	规格/Spec	条件/Condition
5-1	额定转速 Rated speed	rpm	14000 ±2500	额定电压/Rated voltage: DC 3.0V
5-2	额定电流 Rated current	mA	85Max	额定电压/Rated voltage: DC 3.0V
5-3	启动电流 Starting current	mA	100Max	在额定电压下锁定振动轮, 测 电机电流/Measure current at locked counterweight in rated voltage
5-4	启动电压 Starting voltage	V	2.3Max	在额定负荷下电机的任一位置 都能转动/The motor can be rotated at any position under rated load

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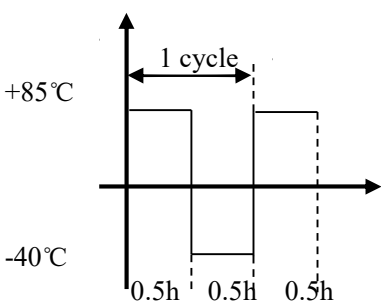
5-5	端子阻抗 Terminal resistance	Ω	37 (1±20%) Ω	正极和负极之间/ Between positive and negative
5-6	绝缘电阻 Insulation resistance	MΩ	10Min	测量机壳和引线之间,测试电 压直流100V。/ Measuring between case and lead wire.Test voltage DC 100V .
5-7	耐电压 Dielectric voltage	mA	1Max	在电机的机壳和引线间施加交 流电 110V, 历时 1 分钟。 /Supply with AC 110V between a lead wire and motor case during 1 minute.

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6. 机械特性/Mechanical characteristics				
NO	项目/Item	单位/Unit	规格/Spec	条件/Condition
6-1	外观 Appearance	/	无划痕、 锈蚀、污 迹等不良现象 /No scar, rust, stain and dent	目测/Visual
6-2	尺寸 size	mm	详见外形图 /See outline drawing	使用游标卡尺和千分尺测量/ Use vernier caliper and micrometer to measure
6-3	电机重量 Motor Weight	g	0.8±10%	用天平测量/Use scale
6-4	机械噪音 Mechanical Noise	dB	50 Max	振动电机 Vibration motor  拾音器 microphone 10cm 额定电压/Rated voltage : DC 3.0V 背景噪音/Back ground noise: 30dB Max. 拾音器沿轴向正对电机平面/Microphone faces the plane of motor along the shaft
6-5	振动量 Vibration Strength	Gms	0.8 Min	振动电机 Vibration motor  加速度传感器 Accelerometer 测试夹具 (100g) Test Fixture 额定电压/Rated voltage : DC 3.0V
		Gp	1.1 Min	

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## 7. 环境试验/Environmental test

NO	项目/Item	条件/Condition
7-1	高温贮存试验 High temperature Storage test	在+80℃的环境下放置96小时, 然后在常温常湿下恢复2小时后测试。/Exposed at +80℃ for 96hours, then return to normal temperature and humidity for 2 hours before test.
7-2	低温贮存试验 Low temperature Storage test	在-30℃的环境下放置96小时, 然后在常温常湿下恢复2小时后测试。/Exposed at -30℃ for 96hours, then return to normal temperature and humidity for 2 hours before test.
7-3	湿热试验 Humidity test	将电机置于50℃、95%R. H. 的环境下96 小时, 然后在室温下放置2 小时, 进行恢复, 而后进行测试。/Expose to 50℃, 95%R. H. for 96 hours and then return to normal temperature and humidity for 2hours before test.
7-4	高低温试验 Heat cycle test	<p>确保电机在下图所示的条件下放置12个周期, 在室温下恢复2 小时后, 进行测试。/Confirmed to operating of motor during 12 cycles as following test condition and then return to normal temperature and humidity for 2 hours before test.</p> 
7-5	振动试验 Vibration test	<p>将电机固定在100g的塑料夹具上, 按以下要求进行试验/The motor that is attached to a 100g jig (plastic housing) and test according following condition:</p> <ol style="list-style-type: none"> <li>1) 振频范围/Vibration frequency range:10-55Hz</li> <li>2) 全振幅/Total amplitude:1.5mm</li> <li>3) 振频变化/Sweep ratio:10~55~10Hz 约2分钟/approximate 2 min</li> <li>4) 振动方向/Direction of vibration:三个垂直方向/Three perpendicular directions</li> <li>5) 持续时间/Duration:每个方向10分钟 (共30分钟) / 10 minutes in each direction (30 minutes each)</li> </ol>



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7-6	跌落试验 Drop test	电机放在大约100g（包括电机）重的物体上自由落体到水泥地板上。/Set the motor on the heavy block about 100g weight (include the motor) and drop the motor on the concrete floor. 高度/Height: 1.5m 方向/Direction: ±X, ±Y, ±Z 次数/Times: 每一平面下落2次, 共计12次。/Two drops per plane for a total of 12 drops.
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▶ 判定标准/Judgment standard

试验后, 测试数据必须符合以下规格:

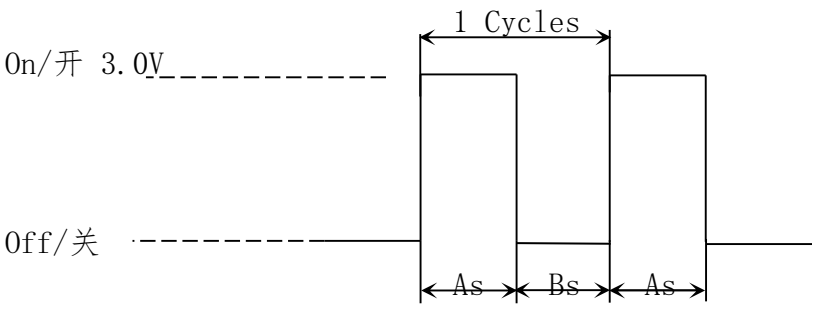
After test, measured data must be satisfied as following specifications;

- 启动电压/Starting voltage: DC 2.0V Max.
- 额定转速/Rated speed: 变化率在初始值的+50%~-30%以内/ changing rate must be within +50%~-30% of initial value.
- 额定电流/Rated current: 变化率在初始值的+50%~-30%以内。/changing rate must be within +50%~-30% of initial value.
- 端子阻抗/Terminal resistance: 变化率在初始值的±15%以内。/changing rate must be within ±15% of initial value.

外形结构无异常。/There should be no abnormalities in appearance and structure.

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### 8. 寿命试验/Life test

NO	项目/Item	条件/Condition
8-1	寿命试验	<p>在常温、常湿下，将 DC 3.0V 不断地施加在电机的正负极上，按 A 秒开、B 秒关为一个周期，运行 S 个周期（如下图所示）。 /At room temperature, often wet, the DC 3.0V will continue to be applied to the positive and negative electrode, according to A seconds, B seconds off for a cycle, run S cycle (as shown below).</p> <p>模式/mode A=1, B=1, S=200,000</p> 

#### ▶ 判定标准/Judgment standard

① 试验后，测试数据必须符合以下规格：

After test, measured data must be satisfied as following specifications;

- 额定转速/Rated speed: 变化率在初始值的+50%~-30%以内/ changing rate must be within +50%~-30% of initial value.
- 额定电流/Rated current: 变化率在初始值的+50%~-30%以内。/changing rate must be within +50%~-30% of initial value.
- 噪音/noise: 电机应能正常启动，无异常机械噪音。/Should not fail in starting, Should not be unusual mechanical noise.

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### 9. 环保要求/Environment Protections

本产品所有零部件符合欧盟RoHS2.0/无卤/REACH指令要求，具体环境有害物质管控限制如下/This product conforms to the EU ROHS2.0, halogen-free and REACH certification, Specific content as follows:

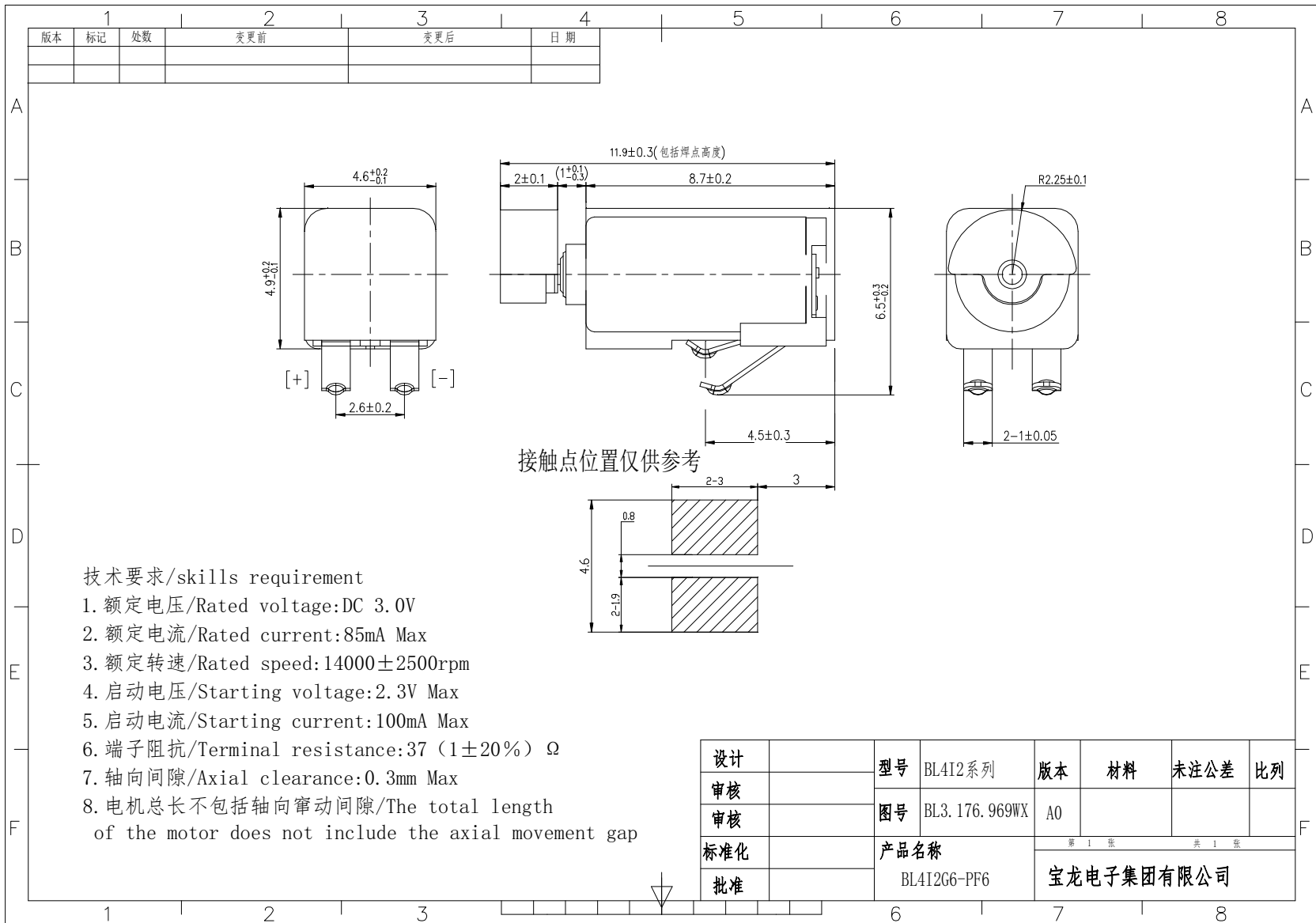
- 铅及其化合物最大允许含量为1000ppm/Lead and Lead compounds $\leq$ 1000ppm
  - 镉及其化合物最大允许含量为1000ppm/Cadmium and cadmium compounds $\leq$ 1000ppm
  - 汞及其化合物最大允许含量为1000ppm/Mercury and Mercury compounds $\leq$ 1000ppm
  - 六价铬化物最大允许含量为1000ppm/Hexavalent chromium compounds $\leq$ 1000ppm
  - 多溴联苯 (PBB) 最大允许含量为1000ppm/Polybrominated biphenylethers $\leq$ 1000ppm
  - 多溴联苯醚 (PBDE) 最大允许含量为1000ppm/Polybrominated diphenylethers $\leq$ 1000ppm
  - 邻苯二甲酸二正丁酯 (DBP) 最大允许含量为1000ppm /DBP $\leq$ 1000ppm
  - 邻苯二甲酸正丁基苄酯 (BBP) 最大允许含量为1000ppm/BBP $\leq$ 1000ppm
  - 邻苯二甲酸 (2-己基) 己酯 (DEHP) 最大允许含量为1000ppm/DEHP $\leq$ 1000ppm
  - 六溴环十二烷 (HBCDD) 最大允许含量为1000ppm/HBCDD $\leq$ 1000ppm
  - 溴Br最大允许含量为900ppm/Br $\leq$ 900ppm
  - 氯Cl最大允许含量为900ppm/Cl $\leq$ 900ppm
  - 溴加氯之和最大允许含量为1500ppm/Br+Cl $\leq$ 1500ppm
- REACH指令按最新法规内容管控执行  
 包装材料环保管控要求：Pb, Cd, Hg, Cr+6 : 4种物质总和 $<$  100ppm (其中, Cd $<$ 50ppm)

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## 10. 注意事项/CAUTION FOR USE

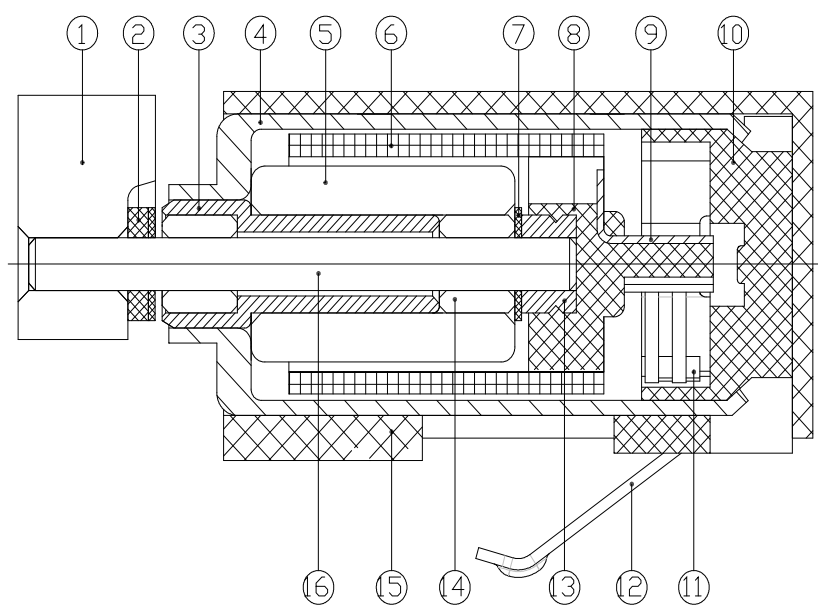
- (1) 该马达是微型精密产品，在运输过程中不要承受超过0.5 kgf的力，否则会引起外形或性能的变化。/As this motor is small and precise, do not press it over 0.5kgf force or while transportation, it can cause the transformation of performance or external appearance.
- (2) 请注意马达不要接触到液体性物质（比如：水，酒精等）。/Please be careful, not to be contacted fluid substances(such as: water, alcohol etc.)
- (3) 不要在高温下长时间放置，否则有可能导致电机的性能下降。/Do not expose the motor to high temperature for a long periods of time,it may cause a decline in performance.
- (4) 马达不要在以下环境中使用。/Avoid using the motor in the following environment:
  - 高温和高湿的场所/High temperature and high humidity area.
  - 腐蚀性气体如H<sub>2</sub>S、SO<sub>2</sub>、NO<sub>2</sub>等/Corrosive gas such as H<sub>2</sub>S、SO<sub>2</sub>、NO<sub>2</sub> etc.
- (5) 请不要在靠近磁铁或带有磁场的仪器旁边使用或存放马达。/Please do not operate or store the motor adjacent to magnet or apparatus That has a magnetic field.
- (6) 请注意底盖的表面存在漏磁通量。/Please be careful that there exists a leaking magnetic flux on the surface of bracket.
- (7) 电刷和换向器的相互作用，有可能产生轻微的电噪音。/Due to interaction between brush and commutator, there is a possibility to occur electrical noise slightly.
- (8) 如有任何问题，宝龙和客户双方应共同努力解决。/If any problems occur, both the user and baolong electron shall try to solve the problem.
- (9) 因测试设备有误差，允许有±5%偏差。/ Because there is error of the measurement equipment ,permit the standard of the rotational frequency to ±5%.
- (10) 马达通过ROHS认证。/This motor pass the system of ROHS certification.

11. 外形图/Outside view



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12. 结构图及物料清单/Structure drawing & BOM



NO.	部件名称/Part name	材料名称/Material name
1	振动轮/weight	钨合金/Tungsten alloy
2	定位片/Lock washer	聚酯薄膜/Polyester film
3	套管/Housing	易切钢/Steel alloy
4	机壳/Case	冷轧钢板/Steel board
5	磁钢/Magnet	钕铁硼/Nd-iron-boron
6	线圈/Coil	铜/Copper
7	垫片/washer	聚酯薄膜/Polyester film
8	塑料/Plastic	PBT
9	换向片/Commutator slice	CDF-2
10	端盖/Top Cover	PBT
11	电刷/Brush	AgPd50/MX215
12	接触片/Contact small plate	铍青铜/Beryllium bronze
13	轴套/Bushing ring	铍青铜/Beryllium bronze
14	含油轴承/Bearing	铜粉/Copper powder
15	胶套/Build in sheath	硅橡胶/Silica gel
16	钢轴/Shaft	SUS420J2

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### 13. 包装要求/Packaging require

- (1) 每个吸塑盒里放50个电机。/50 vibrators in each plastic capsule.
- (2) 每25个吸塑盒上盖一个吸塑盒盖，用胶带捆成一捆。/Every 25 capsules as a group put a plastic cover on the group and wrap it in tape.
- (3) 每4捆按图中的叠放方式放入一个外包箱（315×315×185）。/Every 4 bundle are put into an outer case with a size of (315×315×185) by the ways stipulated as the drawing.
- (4) 数量、生产批号均写在外包装箱上。/Quantity and batch number are written on the surface of the outer case.

