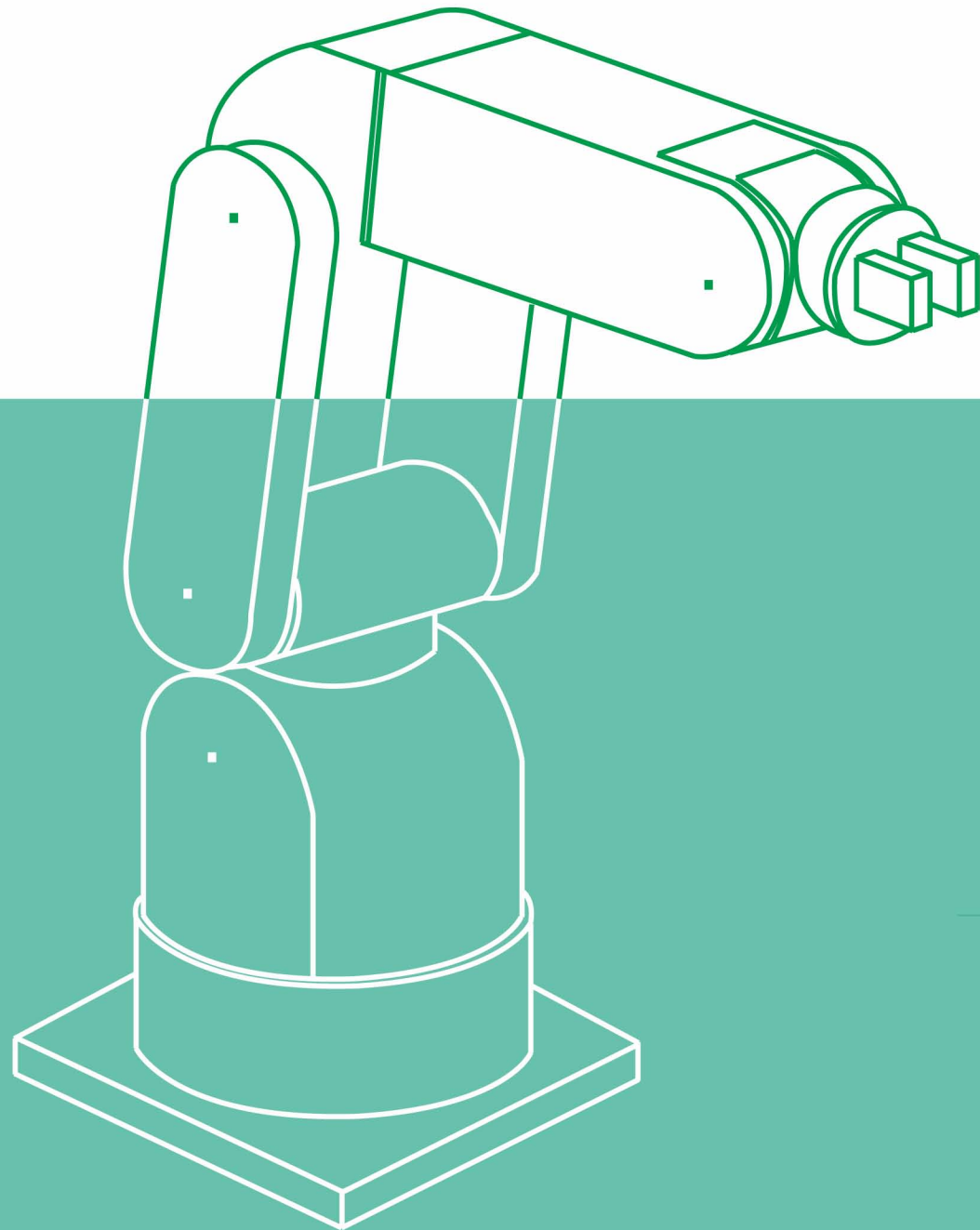


BEGEMA ROBOTS

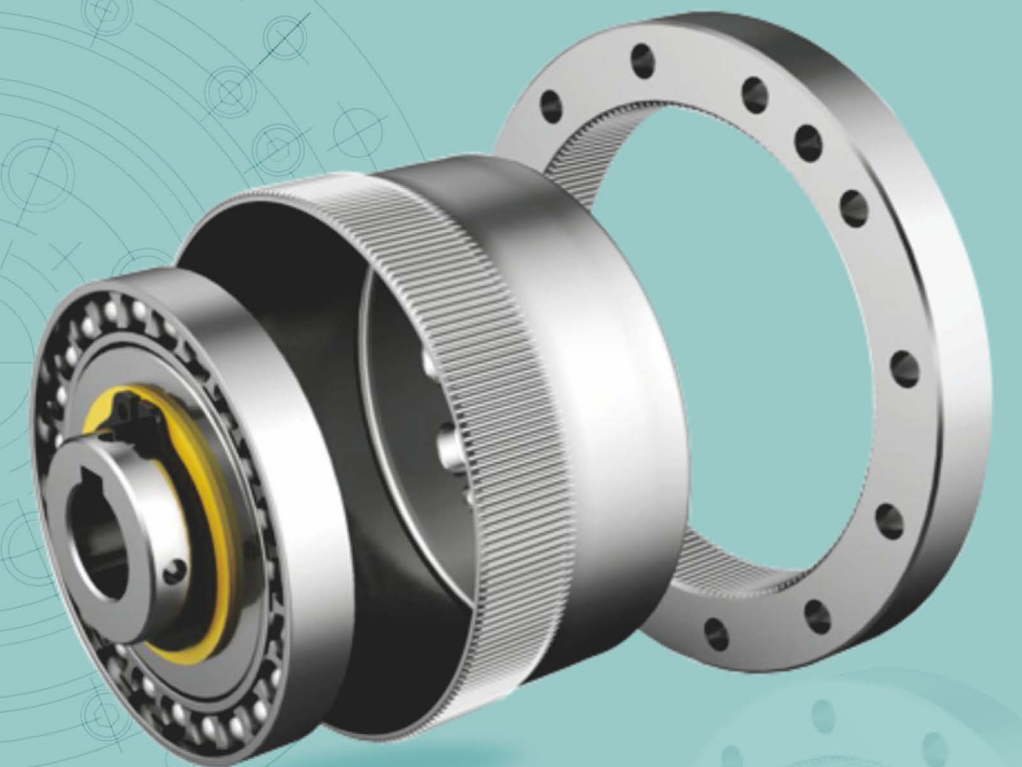


**BEGEMA 宝戈玛®**

— 国际知名的动力传动设备专业供应商

## 精密谐波减速器选型简本

HARMONIC REDUCER PRODUCT CATALOGUE



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Tel: (86)-769-21681362 Fax: (86)-769-21681363

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本刊如有勘误,敬请谅解,内容涉及参数若有变动恕不另行通知。

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2017版

**BEGEMA**  
INDUSTRIAL EQUIPMENT

# Company 公司简介 Introduction

BEGEMA宝戈玛工业是一家集科研、生产、销售于一体的动力传动装置专业制造商。公司总部位于意大利博洛尼亚市，并在中国苏州、东莞设有大型生产基地和营销中心。公司拥有专业的研发团队、顶尖的加工生产线和严格的质量控制体系，经过不断开拓和发展，宝戈玛逐步成为动力传动和自动化控制领域中的知名品牌。

公司产品主要包括BHS系列谐波减速器、BCS系列谐波减速器、精密行星减速器等精密传动元件，具有可靠性高、扭矩大、寿命长、体积小等特点，广泛应用于机器人、半导体制造设备、数控机床、医疗设施、精密机械自动化控制等领域，尤其在工业机器人机械臂行业，宝戈玛产品超高的精度和结构优点得到广大客户的一致好评与信赖。

征程万里鹏程举，敢立潮头唱大风。紧紧围绕“用户至上”的服务理念和“创新提效”的发展思路，公司产品质量和 service 赢得大批用户支持。在未来的进取之路上，我们将永葆诚信、专业、高效、安全的企业精神，继续为广大客户提供整套动力传动系统解决方案，确保宝戈玛在国内外市场中的领先地位！



# Harmonic Drive

## 产品简介

谐波驱动是美国发明家C.Walt Musser马瑟基于崭新的构思和独树一帜的理论发明创造的。马瑟是一位天才发明家，他跨越了所学的机械工程领域，在物理、化学、生物等广泛领域，获得了1500多项专利。

迄今为止，传达动力的齿轮装置，为了达到“高速度、高精密”这一至上目标，使齿轮的刚度不断得到提高。

对此，马瑟的谐波驱动理论即应用金属的挠性和弹性力学，推翻了传统常识的动力传达方式跃然赢得举世瞩目。

谐波减速器具有无与伦比的传动优势：

速比大：单级同轴可获得1/30 ~ 1/320的高减速比。

齿隙小：谐波驱动的齿隙极小，该特长对于控制器领域而言是不可缺少的要素。

精度高：多齿同时啮合，并且有两个180度对称的齿轮啮合，因此齿轮齿距误差和累积齿距误差对旋转精度的影响较为平均，使位置旋转精度达到极高水准。

容量高：柔轮材料使用疲劳强度大的特殊钢，同时啮合的齿数占总齿数约30%，而且是面接触，使得每个齿轮所承受的压力变小，可获得很高的转矩容量。

效率高：轮齿啮合部位滑动甚小，减少了摩擦产生的动力损失，得以维持高效率。

噪音小：轮齿啮合周速低，传递运动力量平衡，因此运转安静，且振动极小。

零部件少，安装简便，体积小、重量轻。

Harmonic reducer has unparalleled transmission advantages:

High speed ratio: single stage can obtain 1/30 to 1/320 high reduction ratio.

Small backlash: the backlash of the harmonic reducer is minimum, the expertise in the field of controller is an indispensable element.

High precision: multi teeth simultaneous meshing, and there are two 180° symmetrical gear meshing, so the gear pitch error and cumulative error on the rotation accuracy is relatively average, so that the accuracy of rotation to a very high standard.

High capacity: the flexible wheel material adopts special steel with high fatigue strength, and the number of meshing teeth is 30% of the total number of teeth, it is surface contact, so that each gear pressure decreases, can obtain very high torque capacity.

High efficiency: the sliding of the meshing part of the gear tooth is very small, so that the power loss caused by friction is reduced and the efficiency is maintained.

Small noise: the gear meshing speed is slow and the movement is stable, and therefore quiet operation, and minimal vibration.

Less parts, easy installation, small size, light weight.



BEGEMA宝戈玛谐波减速器系列产品经过长达十数年攻关研发和性能测试，在传动精度、使用寿命、扭转强度及运行噪音等方面取得了突破性的进展，现已全面推广应用于各行业、领域，是工业机械手、印刷、电子、医疗、光学、通讯等精密传动设备的绝佳选择。

目前，我司主要提供BHS、BCS两大系列的数十种规格类型的高精密谐波减速器，此外，公司还运用积累的伺服控制技术与精密测量设备，推动可高精度定位的电机与减速器一体化的产品开发，未来，宝戈玛谐波驱动产品会更丰富，品质更优越！

After more than ten years of research and development of performance, BEGEMA harmonic reducer achieved a breakthrough in the transmission precision, service life, torsional strength and operation noise and so on, now it is widely applied in various industries and fields.

At present, our company mainly provides BHS, BCS two series reducer, the company also uses accumulated servo control technology and precision measurement equipment to promote the motor and reducer integrated product development. BEGEMA harmonic drive products will be more abundant and superior quality in the years ahead!

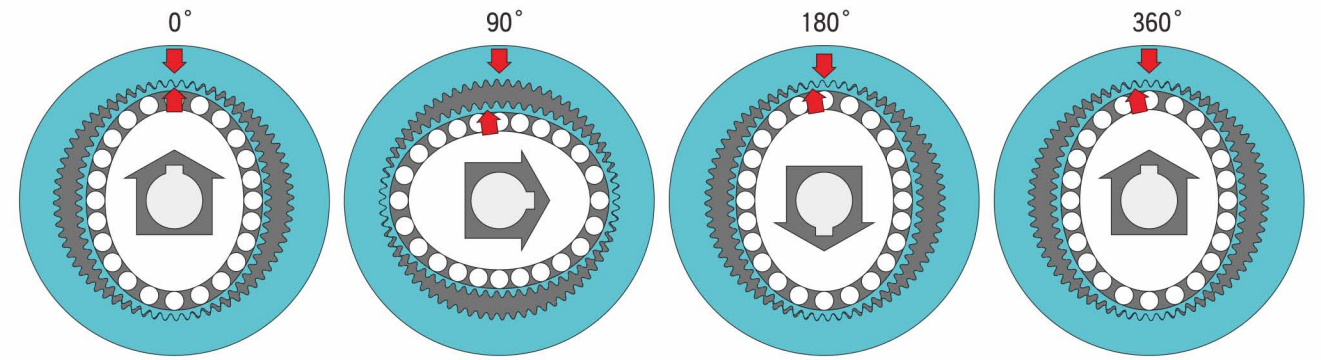




# Constructional Detail

结构组成与运行原理 The structure and motion principle of harmonic reducer

## 运行原理



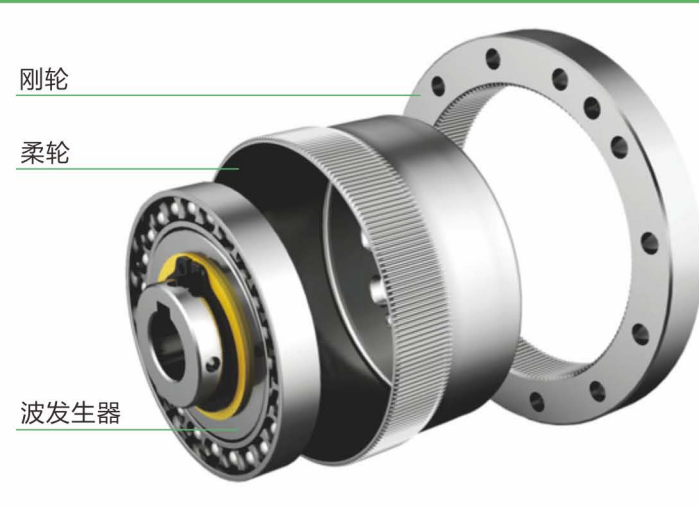
柔轮被波发生器弯曲成椭圆状，因此，在长轴部分刚轮与齿轮啮合，在短轴部分则完全与齿轮呈脱离状态。固定刚轮，使波发生器按照顺时针方向旋转后，柔轮发生弹性形变，与刚轮啮合的齿轮位置顺次移动。波发生器向顺时针方向旋转180度之后，柔轮仅向逆时针方向移动一齿，波发生器旋转一周(360度)后，由于刚轮齿数比柔轮增加2齿，因此柔轮向逆时针方向移动2齿。波发生器周而复始的运行，从而实现柔轮相对刚轮向波发生器反方向的缓慢旋转。

The Flexspline is forced into an elliptical shape by the Wave Generator causing the Flexspline teeth to engage with the tooth profile of the Circular Spline along the major axis of the Wave Generator ellipse, with the teeth completely disengaged across the minor axis of the ellipse.

As the Wave Generator rotates clockwise with the Circular Spline fixed, the Flexspline is subjected to elastic deformation and its tooth engagement position moves turning relative to the Circular Spline.

As the wave generator rotates 180 degrees clockwise, the Flexspline moves counterclockwise by one tooth relative to the Circular Spline.

For every one full rotation clockwise (360°) of the Wave Generator, the Flexspline moves counterclockwise by two teeth relative to the Circular Spline because the Flexspline has two fewer teeth than there are on the Circular spline. In general, this movement is treated as output power.



## 结构组成

应用金属弹性力学的谐波驱动仅由三个基本零部件（波发生器、柔轮和刚轮）构成（因形状不同，有的是由四种基本元件构成，但传动原理不变）。

波发生器：椭圆形凸轮，外周嵌有薄壁滚珠轴承。轴承内轮固定在凸轮上，外轮通过滚珠实现弹性变形，通常安装在输入轴上。

柔轮：薄壁型的金属弹性体部件，开口部外周刻有齿轮，通常安装在输出轴上。

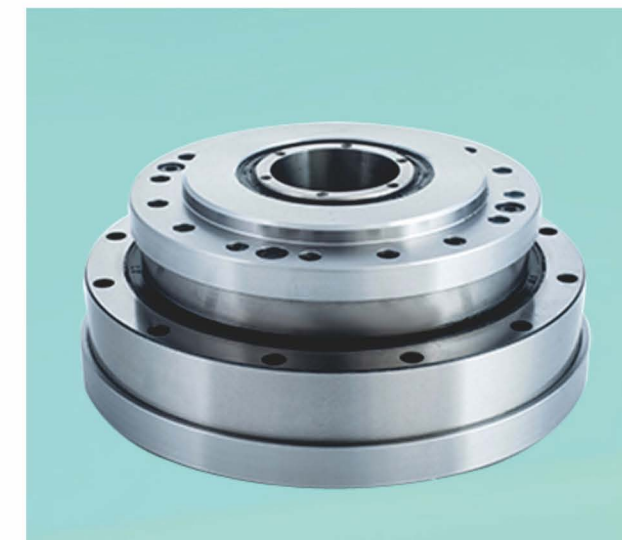
刚轮：刚体环状部件，内周刻有齿轮，比柔轮多两个轮齿，通常固定在外壳上。

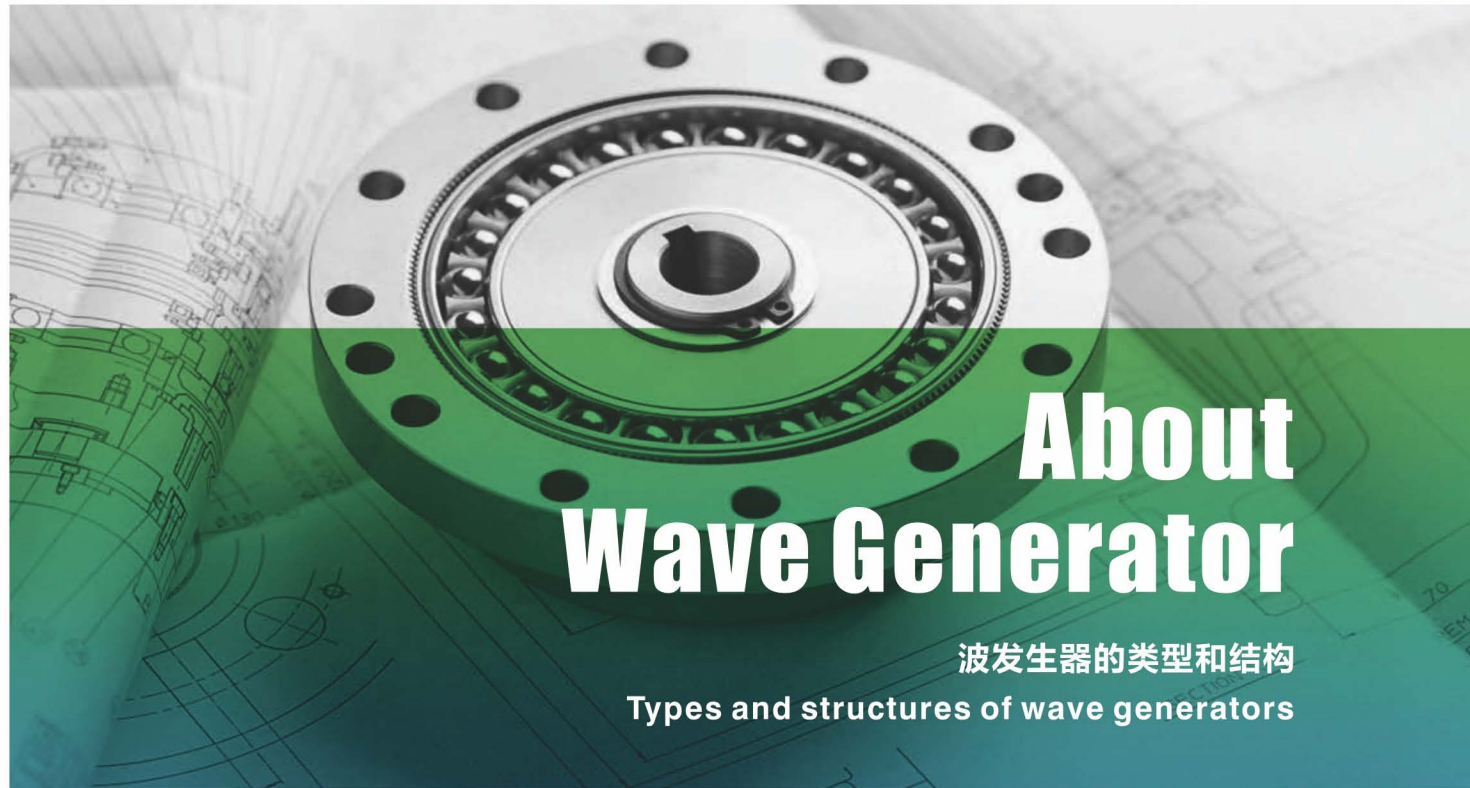
The harmonic drive based on metal elasticity consists of only three basic components (wave generator, flexible wheel and rigid wheel). (because of the different shapes, some of them are composed of four basic components, but the driving principle remains unchanged).

Wave generator: elliptical cam with a thin ball bearing embedded in the periphery. The inner wheel of the bearing is fixed on the cam, and the outer ship realizes the elastic deformation through the ball. Usually mounted on the input shaft.

Flexible wheel: thin-walled metal elastomer parts. The outer part of the opening is provided with a gear and is usually mounted on the output shaft.

Rigid wheel: rigid annular parts, The inside is engraved with gears, the number of gears is two more than flexible wheel's, usually fixed on the shell.





# About Wave Generator

波发生器的类型和结构  
Types and structures of wave generators

## 结构特点

相对于一体式的波发生器，十字滑块联轴节是由两个在端面上开有凹槽的半联轴器和一个两面带有凸牙的中间盘组成，因凸牙可在槽中滑动，故可补偿安装及运转时两轴间的相对位移。

The cross slider coupling consists of two half couplings with one groove at the end face and one intermediate disk with convex teeth on both sides. Because the convex teeth can slide in the groove, the relative displacement between the two shafts during installation and operation can be compensated.

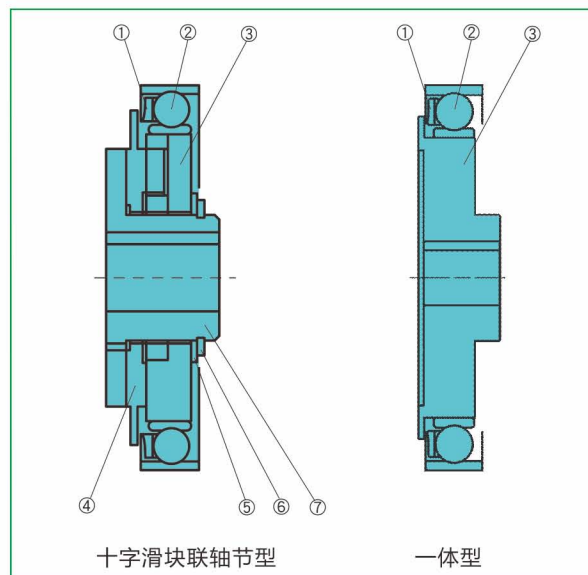


## 波发生器的类型

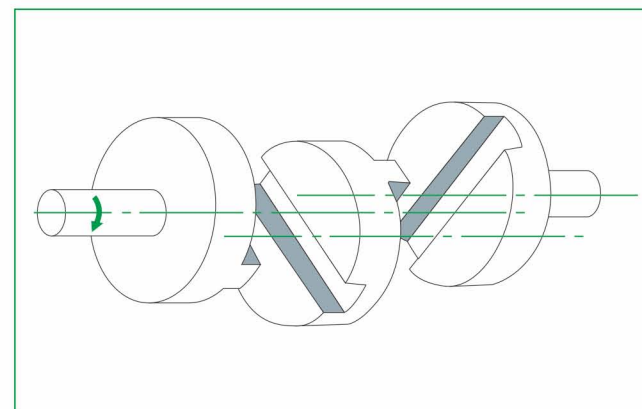
波发生器包括带自调心结构的十字滑块联轴节型和不带自调心结构的一体型两种类型，根据各系列的不同也有所差异。详细尺寸见本手册。

There are two types of wave generators, one is the cross slider coupling type with automatic correcting structure, and the other is a body shape without correcting structure. The sizes of the different series wave generators are also different, See the manual for details.

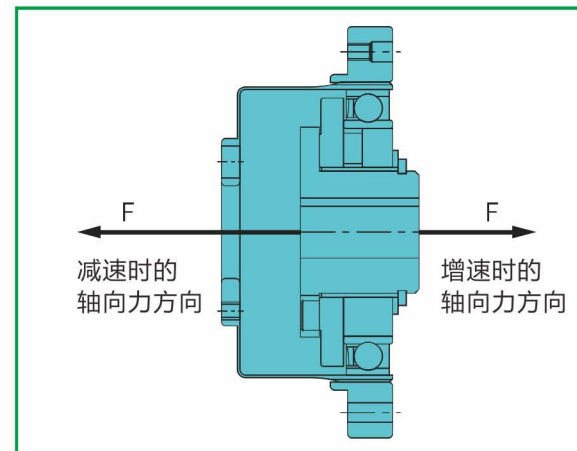
波发生器的基本结构及外形  
Structure and shape of wave generator



十字滑块联轴节的结构  
Structure of cross slide coupling



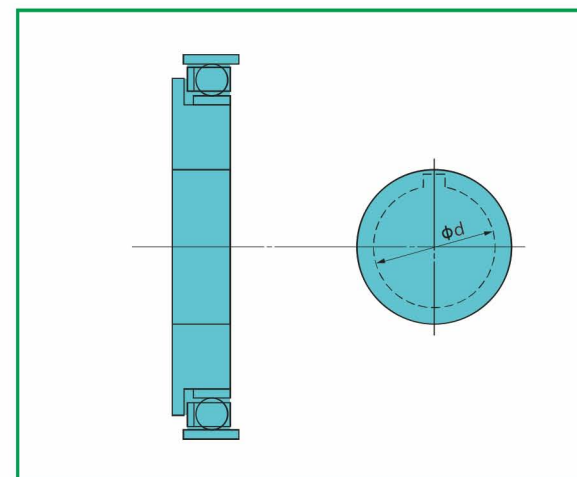
- ①轴承保持架 ②波发生器轴承 ③波发生器凸轮 ④镶块
- ⑤摩擦垫圈 ⑥C型卡环 ⑦波发生器轮毂
- ①Bearing cage ②Wave generator bearing
- ③Wave generator cam ④Insert block ⑤Friction washer
- ⑥C-type snap ring ⑦Wave generator hub



### 波发生器的轴向力与轴的固定

由于柔轮的弹性形变，运转中波发生器上的轴向力发生运动。作为减速器使用时，轴向力向柔轮内部方向运动作为增速器时，轴向力则相反。无论在何种使用条件下，都需要采用阻止波发生器轴向力的设计。

Because of the elastic deformation of the flexible wheel, the axial force on the medium wave generator moves. As the reducer is used, the axial force moves to the inner direction of the flexible wheel. As the speeder, the axial force is opposite. No matter what kind of conditions are used, the design of preventing the axial force of the wave generator is needed.



### 一体型波发生器的最大孔径尺寸

波发生器的标准孔径可见本手册尺寸图，但其尺寸也可在下表所示最大尺寸范围内进行变更，以方便与电机的连接配合。此时的键槽尺寸推荐使用GB规格，键的有效长度，请设计成可以完全承受传达扭矩的值。

The inner hole of the wave generator can be customized to different sizes, shown in the following table.

| 型号 Type     | 14 | 17 | 20 | 25 | 32 | 40 |
|-------------|----|----|----|----|----|----|
| 标准孔径(H7) mm | 6  | 8  | 8  | 14 | 14 | 14 |
| 最小尺寸(H7) mm | 3  | 4  | 5  | 6  | 6  | 10 |
| 最大尺寸(H7) mm | 17 | 20 | 23 | 28 | 36 | 42 |

# HarmonicDrive

## 工业机器人核心部件——精密谐波减速器

BEGEMA宝戈玛谐波减速器目前以BCS、BHS两大系列为主，具有体积小、精度高、

运行平稳等特点，最大限度体现了谐波传动的结构优势。

输入端与波发生器凸轮连接方式：I-IV

规格类型：14-32

速比选择：30-160



[www.begemachina.com](http://www.begemachina.com)

# Directory 产品目录

谐波减速器的命名规则

Harmonic Drive modle symbol

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谐波减速器的安装方式

Harmonic drive reducer mount method

P3

谐波减速机的规格参数

Harmonic reducer specification parameter

P9

谐波减速器的外形及安装尺寸

Installation dimension of harmonic reducer

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其他注意事项及说明

Other considerations and instructions

P41

## 谐波减速器的命名规则

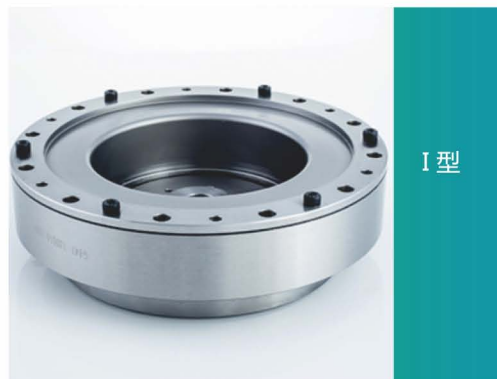
谐波减速器按照柔轮的形状可以分为杯型和中空礼帽型两大类，每类根据柔轮的长度又分为标准和短筒两种类型。同一种机型包括若干减速比。

谐波减速器产品的命名由我司英文首字母、产品形式代号、规格代号、减速比、结构代号及输入端与波发生器凸轮连接形式六部分组成。

型号示例：

$$\frac{\text{B-CSG-17-80-U-II}}{\text{① ② ③ ④ ⑤ ⑥}}$$

- ①：我司英文首字母“B”
- ②：产品形式代号由柔轮的形状、柔轮的长度及是否为高扭矩机型三部分组成  
柔轮的形状分为杯型（Cup）和中空礼帽型（Hollow）两类，杯型柔轮用字母“C”表示，中空礼帽型柔轮用字母“H”表示。  
柔轮的长度分为标准（Standard）、短筒（Dwarf）两类，标准长度的柔轮用字母“S”表示，短筒长度的柔轮用字母“D”表示。  
形式代号第三位有字母“G”，表示该机型为高扭矩型，否则，为普通机型。
- ③：规格代号对应谐波齿轮的节圆直径，目前我司可提供14、17、20、25、32、40六种规格。
- ④：谐波齿轮减速器的减速比目前主要有30、50、80、100、120、160六种可选。
- ⑤：谐波减速器的结构分为整机型“U”、部件型“P”两类。
- ⑥：输入端与波发生器凸轮连接形式可分为四类  
I型：标准型，输入轴与凸轮内孔配合，通过平键连接。  
II型：十字滑块联轴节型，输入轴与凸轮采用十字滑块联轴节连接。  
III型：筒形中空型，输入端部件与中空凸轮通过螺钉连接。  
IV型：实轴输入型，减速器高速端自带输入轴。



I 型



II 型



III 型



IV 型

## Harmonic Drive modle symbol

Harmonic gear reducer with flexible wheel shape can be divided into cup shaped and hollow shaped hat two categories, each category according to the length of flexspline is divided into standard and short barrel two types. The same type includes several transmission ratios.

The product number is composed of brand initials, the type code, the specification code, the reduction ratio, the structure code and the connection mode.

Model example

$$\frac{\text{B-CSG-17-80-U-II}}{\text{① ② ③ ④ ⑤ ⑥}}$$

- ①：the brand initials.
- ②：the product form code consists of 3 parts:the shape of the flexible wheel and the length of the flexible wheel and the torque.  
The flexible wheel shape is divided into cup type (Cup) and hollow hat shaped (Hollow) two categories. The cup-shaped flexible wheel with a capital letter C and the hollow hat shape in capital letter H. Flexible wheel length is divided into standard and short cylinder. The standard flexible wheel with a capital letter S, the short cylinder with D.  
Torque is divided standard and high torque two types, the high torque with G, or the standard type.
- ③：the specification coder represents pitch circle diameter of harmonic gear.
- ④：six kinds reduction ratio of harmonic reducer is provided with 30、50、80、100、120、160.
- ⑤：Harmonic drive reducer structure code is divided into the unit and part two categories.  
The unit is indicated in capital letter U, the part is indicated in capital letter P.
- ⑥：There are four types of connection between the input and the wave generator cam.  
I type: standard type, the input shaft is matched with the inner hole of the cam, through the flat key connection.  
II type: the cross slider coupling type, the input shaft and the cam shaft is connected with the cross slider.  
III type: hollow type, the input shaft is connected with the hollow cam through screws.  
IV type: input shaft mode.

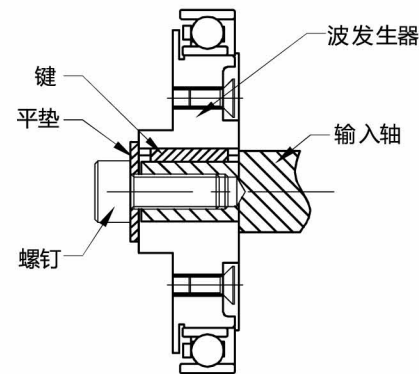
| 形式代号<br>type code | 规格代号<br>spec code | 减速比<br>ratio |    |    |     |     |     | 结构代号<br>structure code                   | 连接方式<br>connection mode   |
|-------------------|-------------------|--------------|----|----|-----|-----|-----|--|---|
| BHS               | 14                | 30           | 50 | 80 | 100 |     |     | U：表示整机<br>U：unit<br><br>P：表示部件<br>P：part | I：标准型<br>I：standard type<br>II：十字滑块联轴节型<br>II：the cross slider coupling type<br>III：中空型<br>III：hollow type<br>IV：实轴输入型<br>IV：input shaft mode |
|                   | 17                | 30           | 50 | 80 | 100 | 120 |     |  |   |
|                   | 20                | 30           | 50 | 80 | 100 | 120 | 160 |  |   |
|                   | 25                | 30           | 50 | 80 | 100 | 120 | 160 |  |   |
|                   | 32                | 30           | 50 | 80 | 100 | 120 | 160 |  |   |
|                   | 40                |              | 50 | 80 | 100 | 120 | 160 |  |   |

| 形式代号<br>type code | 规格代号<br>spec code | 减速比<br>ratio |    |    |     |     |     | 结构代号<br>structure code                   | 连接方式<br>connection mode  |
|-------------------|-------------------|--------------|----|----|-----|-----|-----|--|--|
| BCS               | 14                | 30           | 50 | 80 | 100 |     |     | U：表示整机<br>U：unit<br><br>P：表示部件<br>P：part | I：标准型<br>I：standard type<br><br>II：十字滑块联轴节型<br>II：the cross slider coupling type |
|                   | 17                | 30           | 50 | 80 | 100 | 120 |     |  |  |
|                   | 20                | 30           | 50 | 80 | 100 | 120 | 160 |  |  |
|                   | 25                | 30           | 50 | 80 | 100 | 120 | 160 |  |  |
|                   | 32                | 30           | 50 | 80 | 100 | 120 | 160 |  |  |
|                   | 40                |              | 50 | 80 | 100 | 120 | 160 |  |  |

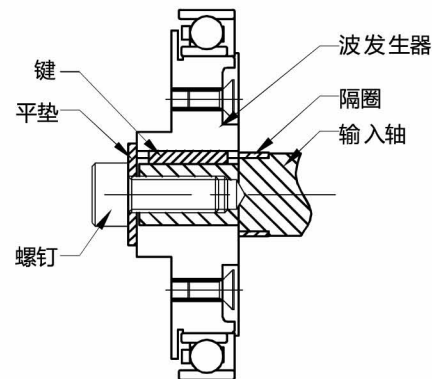
谐波减速器的安装方式 Harmonic drive reducer mount method

波发生器常用连接固定方式 Motor and wave generator direct connection mode

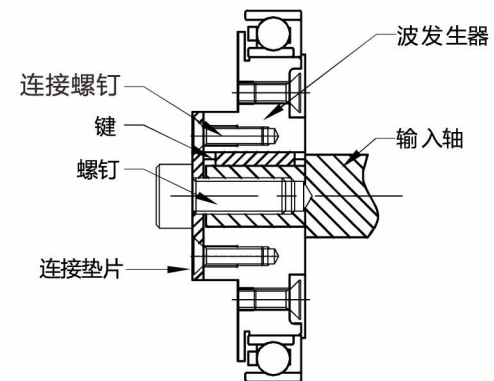
1. 输入轴与波发生器直接连接  
输入轴有轴肩，可以与波发生器直接连接固定。



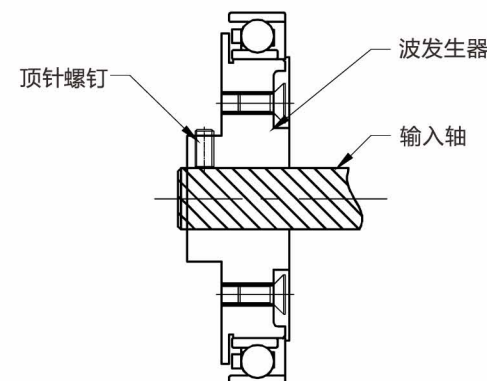
2. 输入轴加隔圈后与波发生器连接  
输入轴有轴肩，但长度过长，可在轴上加一个隔圈（该隔圈平面平行度需在0.01mm以内），后再与波发生器连接固定。



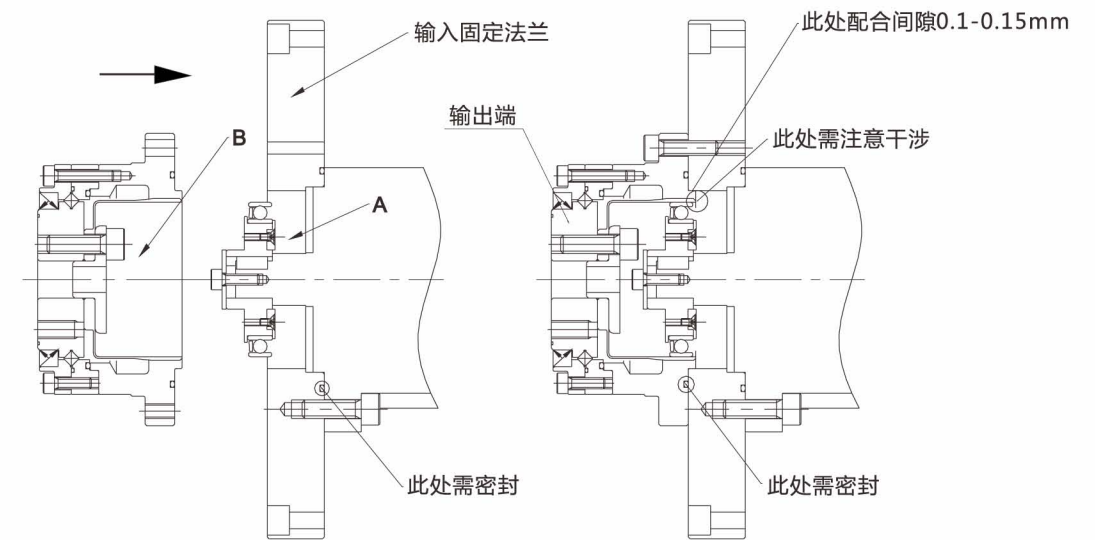
3. 用连接垫片固定在波发生器上后与输入轴连接  
输入轴有轴肩，需用一个连接垫片先固定在波发生器上后再与输入轴连接固定。



4. 此固定方式适用于小型光轴输入，输入轴插入波发生器后，通过波发生器上的顶针螺钉将输入轴连接固定。



BCS系列安装方式 BCS series harmonic drive reducer mount method



\*钢轮固定，柔轮输出，减速比为标示减速比

The rigid wheel fixed, the flexible wheel serves as the output, the reduction ratio is the indicated reduction ratio

1. 在柔轮轴承上均匀涂抹上润滑脂，A处腔体内注80%润滑脂，将波发生器装在输入端电机轴或连接轴上用螺钉加平垫连接固定。
2. 先在柔轮内壁上均匀涂抹一层润滑脂，后柔轮空间B处注入润滑脂，注入量大约为柔轮腔体的80%，将减速器按图示方向装入，装入时波发生器长轴对准减速器柔轮的长轴方向，到位后用对应的螺钉将减速器固定，螺钉稍微带紧。
3. 将电机转速设定在100转/分左右，启动电机，螺钉以十字交叉的方式锁紧，以四至五次均等递增至螺钉对应的锁紧力（对应锁紧力见P8附表）。
4. 与减速器连接固定的安装平面加工要求：平面度0.01mm，与轴线垂直度0.01mm，螺纹孔或通孔与轴线同心度0.1mm。

**注意：**减速器使用时如输出端始终水平朝下的情况下（不建议这样使用），柔轮内壁空间注入的润滑脂需超过啮合齿面（即A和B空间须注满油脂）或与我司联系。请使用指定的润滑脂，勿随意更换以避免造成减速器的损坏。

减速器钢轮与输入端安装平面之间需采用静态密封，以保证减速器使用过程中油脂不会泄露。

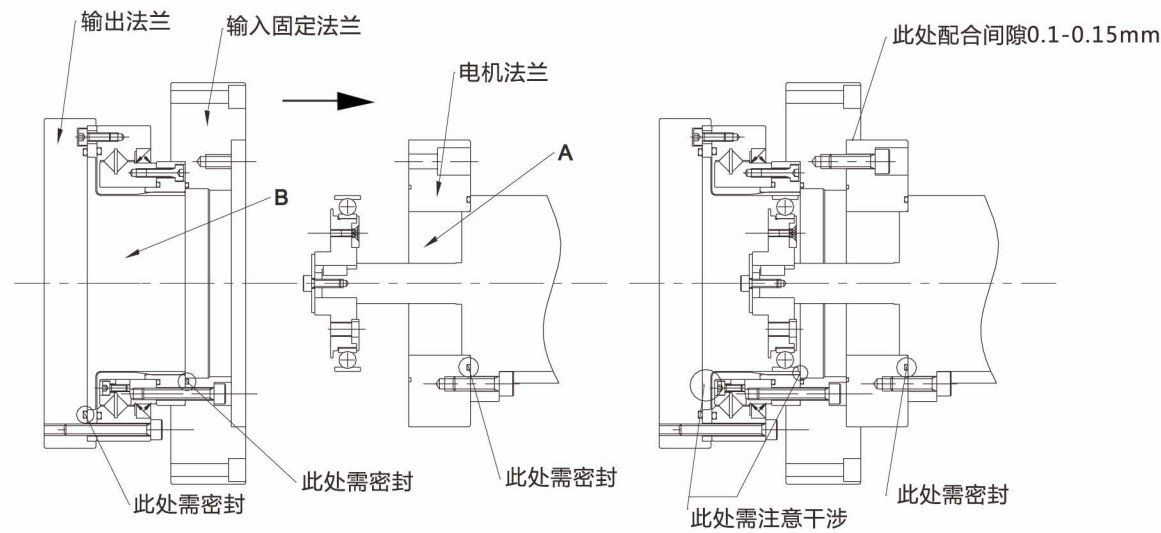
1. Apply grease evenly on the flexible wheel bearings, 80% grease is injected into the A cavity, the wave generator is mounted on the motor shaft and fixed with screws.
2. Apply grease evenly on the inside of the flexible wheel, 80% grease is injected into the B cavity, fit the reducer in the direction shown above to make sure that the long axis of the wave generator is aligned with the direction of the long axis of the flexible wheel of the reducer.
3. Set the motor speed at 100 rpm and start, tighten the screws in a criss cross manner, increasing the locking force to the screw by four to five equal passes.
4. Requirements for installation of flat surfaces fixed with reducer: flatness 0.01mm, and axis verticality 0.01mm, thread hole or through hole and axis concentricity 0.1mm.

**ATTENTION:** If the output of the reducer is always level down (not recommended), the grease injected into the inner space of the flexible wheel needs to be more than the meshing tooth surface (A、B spaces should be filled with grease) or contact with us.

Please use the specified grease, do not change at random to avoid damage to the gear reducer. It needs to use the static seal between the reducer rigid wheel and the input installation plane, in order to guarantee that the grease will not leak.



◆ BHS系列安装方式一 BHS series harmonic drive reducer mount method one



\*钢轮固定，柔轮输出，减速比为标示减速比

The rigid wheel fixed, the flexible wheel serves as the output, the reduction ratio is the indicated reduction ratio

1. 将减速器固定在输出法兰上，然后将输入固定法兰与钢轮固定连接。
2. 在柔轮轴承上均匀涂抹上润滑脂，A处腔体内注80%润滑脂，将波发生器装在输入端电机轴或连接轴上用螺钉加平垫连接固定。
3. 将减速器按图示方向装入，装入时波发生器长轴对准减速器柔轮的长轴方向，到位后用对应的螺钉将减速器固定，螺钉稍微带紧。
4. 将电机转速设定在100转/分左右，启动电机，螺钉以十字交叉的方式锁紧，以四至五次均等递增至螺钉对应的锁紧力（对应锁紧力见P8附表）。
5. 先在柔轮内壁上均匀涂抹一层润滑脂，后柔轮空间B处注入润滑脂，注入量大约为柔轮腔体的80%。
6. 与减速器连接固定的安装平面加工要求：平面度0.01mm，与轴线垂直度0.01mm，螺纹孔或通孔与轴线同心度0.1mm。

**注意：**减速器使用时如输出端始终水平朝下的情况下（不建议这样使用），柔轮内壁空间注入的润滑脂需超过啮合齿面（即A和B空间须注满油脂）或与我司联系。请使用指定的润滑脂，勿随意更换以避免造成减速器的损坏。

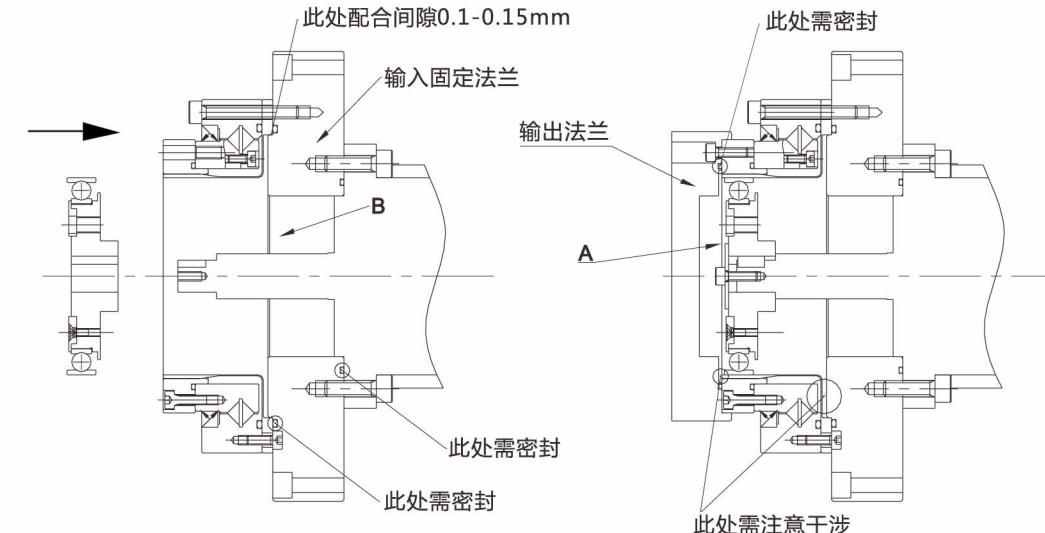
减速器钢轮与输入端安装平面以及柔轮与输出端安装平面之间需采用静态密封，以保证减速器使用过程中油脂不会泄露。

1. Fix the reducer on the output flange, and then fix the input connecting flange to the steel wheel.
2. Apply grease evenly on the flexible wheel bearings, 80% grease is injected into the A cavity, the wave generator is mounted on the motor shaft and fixed with screws.
3. Fix the reducer in the direction shown above to make sure that the long axis of the wave generator is aligned with the direction of the long axis of the flexible wheel of the reducer.
4. Set the motor speed at 100 rpm and start, tighten the screws in a criss cross manner, increasing the locking force to the screw by four to five equal passes.
5. Apply grease evenly on the inside of the flexible wheel, 80% grease is injected into the B cavity.
6. Requirements for installation of flat surfaces fixed with reducer: flatness 0.01mm, and axis verticality 0.01mm, thread hole or through hole and axis concentricity 0.1mm.

**ATTENTION:** If the output of the reducer is always level down (not recommended), the grease injected into the inner space of the flexible wheel needs to be more than the meshing tooth surface (A、B spaces should be filled with grease) or contact with us.

Please use the specified grease, do not change at random to avoid damage to the gear reducer. It needs to use the static seal between the reducer rigid wheel and the input end installation plane, also between the reducer flexible wheel and output mounting plane, in order to guarantee that the grease will not leak.

◆ BHS系列安装方式二 BHS series harmonic drive reducer mount method two



\*柔轮固定，刚轮输出，减速比为标示减速比+1

The flexible wheel fixed, the rigid wheel serves as the output, the reduction ratio is the indicated reduction ratio + 1

1. 将减速器装在输入端，用对应的螺钉将减速器连接固定，螺钉稍微带紧。
2. 先在柔轮内壁上均匀涂抹一层润滑脂，后柔轮空间B处注入润滑脂，注入量大约为柔轮腔体的80%。
3. 将波发生器按图示方向装入，装入时波发生器长轴对准减速器柔轮的长轴方向，到位后转动波发生器使凸轮上的键槽与输入轴上的键槽对齐，装入键，用螺钉加上大垫片将波发生器固定在轴上。
4. 在柔轮轴承上均匀涂抹上润滑脂，A处腔体内注80%润滑脂。
5. 将电机转速设定在100转/分左右，启动电机，螺钉以十字交叉的方式锁紧，以四至五次均等递增至螺钉对应的锁紧力（对应锁紧力见P8附表）。
6. 输出端同样参照步骤5固定。
7. 与减速器连接固定的安装平面加工要求：平面度0.01mm，与轴线垂直度0.01mm，螺纹孔或通孔与轴线同心度0.1mm。

**注意：**减速器使用时如输出端始终水平朝上的情况下（不建议这样使用），柔轮内壁空间注入的润滑脂需超过啮合齿面（即A和B空间须注满油脂）或与我司联系。请使用指定的润滑脂，勿随意更换以避免造成减速器的损坏。

减速器钢轮与输出端安装平面以及柔轮与输入端安装平面之间需采用静态密封，以保证减速器使用过程中油脂不会泄露。

1. The reducer is installed at the input end, and connected and fixed by the corresponding screw.
2. Apply grease evenly on the inside of the flexible wheel, 80% grease is injected into the B cavity.
3. Fix the reducer in the direction shown above to make sure that the long axis of the wave generator is aligned with the direction of the long axis of the flexible wheel of the reducer. Rotating wave generator to align the keyway of the cam with the keyway of the motor shaft, load key, fix with screws and gaskets.
4. Apply grease evenly on the flexible wheel bearings, 80% grease is injected into the A cavity.
5. Set the motor speed at 100 rpm and start, tighten the screws in a criss cross manner, increasing the locking force to the screw by four to five equal passes.
6. The output is fixed with reference to step 5.
7. Requirements for installation of flat surfaces fixed with reducer: flatness 0.01mm, and axis verticality 0.01mm, thread hole or through hole and axis concentricity 0.1mm.

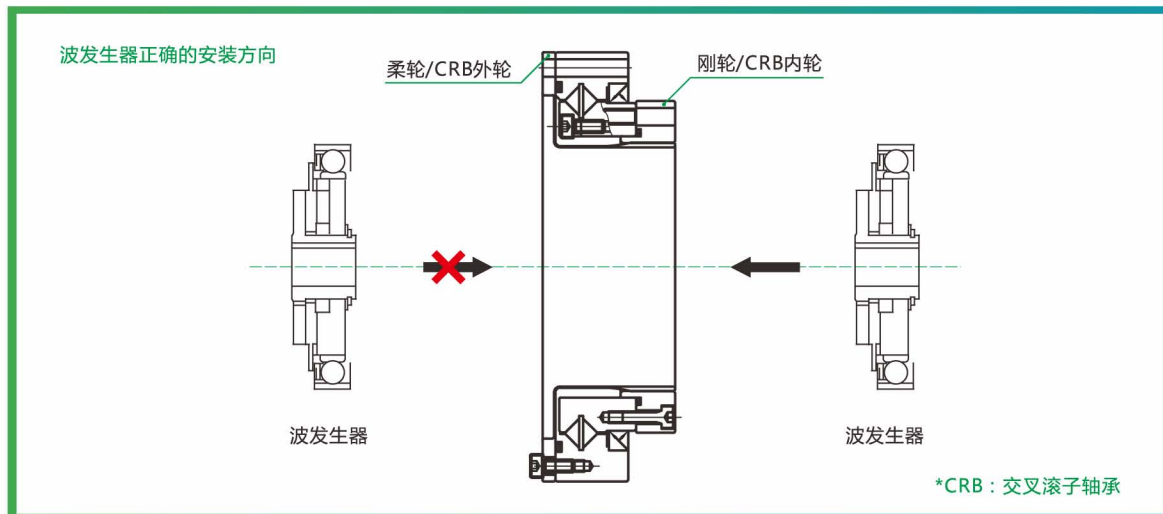
**ATTENTION:** If the output of the reducer is always level up (not recommended), the grease injected into the inner space of the flexible wheel needs to be more than the meshing tooth surface (A、B spaces should be filled with grease) or contact with us.

Please use the specified grease, do not change at random to avoid damage to the gear reducer. It needs to use the static seal between the reducer rigid wheel and output mounting plane, in order to guarantee that the grease will not leak.

谐波减速器的安装注意事项 Harmonic drive reducer installation notes

- 1.谐波减速器必须在**足够清洁**的环境中安装，安装过程中不能有任何异物进入减速器内部，以免造成减速器的损坏。
  - 2.请确认减速器齿面及柔轮轴承部分始终保持充分润滑，**不建议齿面始终朝上使用**，会影响润滑效果。
  - 3.安装凸轮后，请确认柔轮与钢轮啮合是180°对称的，如偏向一边，会引起震动并使柔轮很快损坏。
  - 4.安装完成后**请先低速运行**（电机转速设定在100转/分左右），如有异常震动或异常响声，请立即停止并联系我司，避免因安装不正确造成减速器的损坏。
  - 5.谐波减速器的输入、输出端必须**设计严格的密封机构**，动密封部位建议采用骨架式油封进行密封，静密封部位建议采用O型圈或密封胶进行密封，且必须保证密封面不得歪斜或存在伤痕。
1. Harmonic reducer installation environment should be clean enough to avoid foreign matter into the reducer.
  2. Make sure the gear teeth and flexible wheel bearings are fully lubricated and do not recommend that gears face up all the time.
  3. Make sure the engagement of the soft and rigid wheels is symmetrical at 180 degrees.
  4. After the reducer is installed, it should be operated at low speed to check whether it is abnormal or not.
  5. The input and output of the reducer must be designed with strict sealing mechanism.

波发生器安装方向 Wave generator installation direction



- 1.请在组装时避免向波发生器轴承部位施加过度的力，可通过使波发生器旋转顺畅地实施插入。
  - 2.使用不带十字滑块联轴节的波发生器时，请特别注意把中心偏移、歪斜的影响控制在推荐值内。
1. Avoid applying excessive force to the bearing part of the wave generator, which can be smoothly inserted by making the wave generator rotate smoothly.
  2. When using a wave generator without a cross slider coupling, please pay special attention to the deviation of the center offset and the deviation in the recommended value.

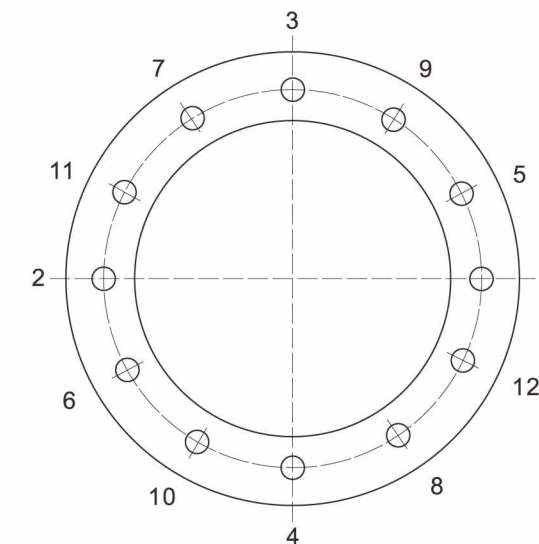
谐波减速器的润滑要求 Lubrication requirements

| 型号 Type   | 加油量 ml | 型号 Type   | 加油量 ml |
|-----------|--------|-----------|--------|
| BCS(G)-14 | 10     | BHS(G)-14 | 13.5   |
| BCS(G)-17 | 16     | BHS(G)-17 | 22.5   |
| BCS(G)-20 | 24     | BHS(G)-20 | 32     |
| BCS(G)-25 | 45.5   | BHS(G)-25 | 60     |
| BCS(G)-32 | 100    | BHS(G)-32 | 125    |
| BCS(G)-40 | 180    | BHS(G)-40 | 225    |

谐波减速器的润滑要求 Lubrication requirements

- 1.中空轴型（III）和实轴型（IV）出厂前已封入润滑脂，组装时无需另行加注。其余机型的内部隐藏部分已封入润滑脂，但组装波发生器时需注入、涂抹润滑脂。
  - 2.请避免与其他种类的润滑脂混用。
  - 3.通过以下途径可提升润滑寿命：①在运转初期向各接触部位涂抹润滑脂；②彻底清除各接触密封阶段产生的初期磨损粉尘；③为各接触补充涂抹润滑脂。
1. III type and IV type reducer has been enclosed in grease before delivery, no grease is required for assembly. The rest type reducer's hidden parts have been injected with grease, when assembled, the wave generator needs to be painted and injected with grease.
  2. Avoid mixing with other types of grease.
  3. Please carry out the following operations to increase lubricant life span: ① Apply grease on contacting parts during initial running stage; ② Remove the initial abrasion powder from contacting parts during sealing stage; ③ Reapply grease on contacting parts.

螺钉锁紧方式与推荐螺钉紧固力矩 Screw tightening torque



请按照图示的方式交叉依次锁紧螺丝，以四至五次均等递增至螺钉对应的锁紧力。  
Please cross the locking screws in the way shown above, increasing the locking force to the screw by four to five equal passes.

| 螺钉性能等级 screw grade | 12.9 |     |    |      |    |     |
|--------------------|------|-----|----|------|----|-----|
| 螺丝规格 screw spec    | M3   | M4  | M5 | M6   | M8 | M10 |
| 推荐紧固力矩 torque N.m  | 2    | 4.5 | 9  | 15.3 | 37 | 74  |

■ 常规型谐波减速器的规格参数 specification parameter of conventional type

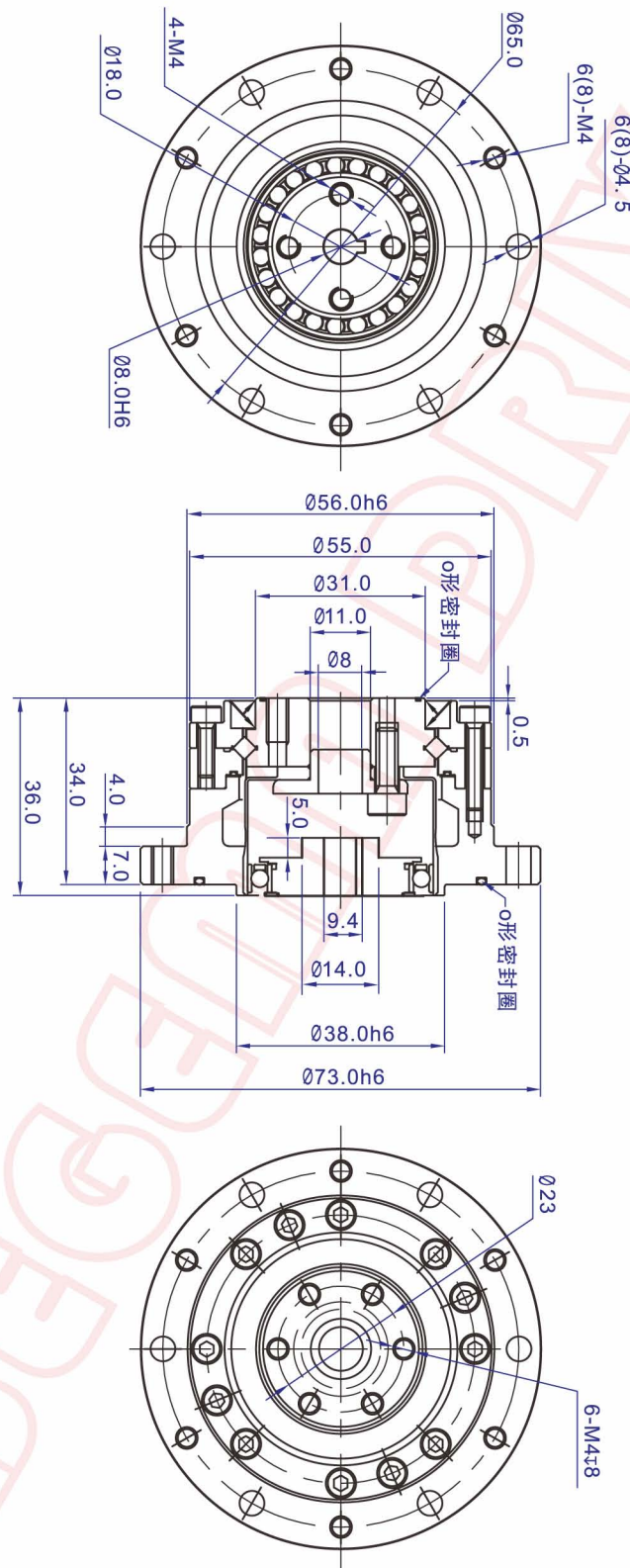
| 型号<br>Type | 减速比<br>Ratio | 额定转矩<br>2000rpm | 启动停止时<br>允许<br>最大转矩                              | 平均负载<br>转矩的<br>容许最大值                            | 瞬时允许<br>最大转矩                    | 容许最高<br>输入转速                            | 容许平均<br>输入转速                     | 背隙<br>Back<br>clearance |
|------------|--------------|-----------------|--|---|---------------------------------|---|----------------------------------|-------------------------|
|            |              | Rated torque    | Maximum torque<br>allowed at<br>startup and stop | Average load<br>torque maximum<br>allowed value | Instantaneous<br>maximum torque | Instantaneous<br>maximum<br>input speed | Allowable average<br>input speed |                         |
|            |              | N.m             | N.m  | N.m   | N.m                             | r/min                                   | r/min                            |                         |
| 14         | 30           | 3.8             | 7.8  | 5.8   | 16                              | 8000                                    | 3500                             | ≤20                     |
|            | 50           | 5.1             | 16   | 6.6   | 33                              |   |                                  | ≤20                     |
|            | 80           | 7.4             | 20   | 10.5  | 45                              |   |                                  | ≤10                     |
|            | 100          | 7.4             | 26   | 10.5  | 51                              |   |                                  | ≤10                     |
| 17         | 30           | 8.4             | 15.2   | 11.5  | 29                              | 7000                                    | 3500                             | ≤20                     |
|            | 50           | 15.2            | 32   | 25  | 66                              |   |                                  | ≤20                     |
|            | 80           | 21              | 40   | 26  | 83                              |   |                                  | ≤10                     |
|            | 100          | 23              | 50   | 37  | 104                             |   |                                  | ≤10                     |
|            | 120          | 23              | 50   | 37  | 104                             |   |                                  | ≤10                     |
| 20         | 30           | 14              | 26   | 19  | 48                              | 6000                                    | 3500                             | ≤20                     |
|            | 50           | 24              | 52   | 32  | 93                              |   |                                  | ≤20                     |
|            | 80           | 32              | 71   | 45  | 121                             |   |                                  | ≤10                     |
|            | 100          | 38              | 77   | 47  | 140                             |   |                                  | ≤10                     |
|            | 120          | 38              | 82   | 47  | 140                             |   |                                  | ≤10                     |
|            | 160          | 38              | 86   | 47  | 140                             |   |                                  | ≤10                     |
| 25         | 30           | 26              | 47   | 36  | 90                              | 5500                                    | 3500                             | ≤20                     |
|            | 50           | 37              | 92   | 52  | 177                             |   |                                  | ≤20                     |
|            | 80           | 60              | 130  | 83  | 242                             |   |                                  | ≤10                     |
|            | 100          | 64              | 148  | 103   | 270                             |   |                                  | ≤10                     |
|            | 120          | 64              | 158  | 103   | 289                             |   |                                  | ≤10                     |
|            | 160          | 64              | 166  | 103   | 289                             |   |                                  | ≤10                     |
| 32         | 30           | 51              | 94   | 71  | 190                             | 4500                                    | 3500                             | ≤20                     |
|            | 50           | 72              | 206  | 103   | 363                             |   |                                  | ≤20                     |
|            | 80           | 112             | 290  | 159   | 540                             |   |                                  | ≤10                     |
|            | 100          | 130             | 325  | 205   | 615                             |   |                                  | ≤10                     |
|            | 120          | 130             | 338  | 205   | 652                             |   |                                  | ≤10                     |
|            | 160          | 130             | 352  | 205   | 652                             |   |                                  | ≤10                     |
| 40         | 50           | 130             | 382  | 186   | 652                             | 4000                                    | 3000                             | ≤20                     |
|            | 80           | 196             | 493  | 270   | 931                             |   |                                  | ≤10                     |
|            | 100          | 252             | 540  | 353   | 1026                            |   |                                  | ≤10                     |
|            | 120          | 279             | 586  | 428   | 1121                            |   |                                  | ≤10                     |
|            | 160          | 279             | 615  | 428   | 1121                            |   |                                  | ≤10                     |

■ 高扭矩型谐波减速器的规格参数 specification parameter of torque reinforced type

| 型号<br>Type | 减速比<br>Ratio | 额定转矩<br>2000rpm | 启动停止时<br>允许<br>最大转矩                              | 平均负载<br>转矩的<br>容许最大值                            | 瞬时允许<br>最大转矩                    | 容许最高<br>输入转速                            | 容许平均<br>输入转速                     | 背隙<br>Back<br>clearance |
|------------|--------------|-----------------|--|---|---------------------------------|---|----------------------------------|-------------------------|
|            |              | Rated torque    | Maximum torque<br>allowed at<br>startup and stop | Average load<br>torque maximum<br>allowed value | Instantaneous<br>maximum torque | Instantaneous<br>maximum<br>input speed | Allowable average<br>input speed |                         |
|            |              | N.m             | N.m  | N.m   | N.m                             | r/min                                   | r/min                            |                         |
| 14         | 50           | 6.6             | 23   | 8.6   | 43                              | 8000                                    | 3500                             | ≤10                     |
|            | 80           | 9.6             | 29   | 13.5  | 57                              |   |                                  | ≤10                     |
|            | 100          | 9.6             | 34   | 13.5  | 66                              |   |                                  | ≤10                     |
| 17         | 50           | 19.8            | 42   | 32.5  | 86                              | 7000                                    | 3500                             | ≤10                     |
|            | 80           | 27.5            | 53   | 33.5  | 108                             |   |                                  | ≤10                     |
|            | 100          | 30              | 66   | 48.5  | 134                             |   |                                  | ≤10                     |
|            | 120          | 30              | 66   | 48.5  | 107                             |   |                                  | ≤10                     |
| 20         | 50           | 32              | 69   | 42  | 121                             | 6000                                    | 3500                             | ≤10                     |
|            | 80           | 42              | 91   | 58  | 158                             |   |                                  | ≤10                     |
|            | 100          | 50              | 102  | 61  | 182                             |   |                                  | ≤10                     |
|            | 120          | 50              | 108  | 61  | 182                             |   |                                  | ≤10                     |
| 25         | 50           | 48              | 121  | 68.5  | 230                             | 5500                                    | 3500                             | ≤10                     |
|            | 80           | 78              | 169  | 107.5   | 315                             |   |                                  | ≤10                     |
|            | 100          | 84              | 194  | 133   | 351                             |   |                                  | ≤10                     |
|            | 120          | 84              | 207  | 133   | 376                             |   |                                  | ≤10                     |
| 32         | 50           | 94              | 267  | 133   | 472                             | 4500                                    | 3500                             | ≤10                     |
|            | 80           | 146             | 376  | 206   | 702                             |   |                                  | ≤10                     |
|            | 100          | 169             | 411  | 267   | 800                             |   |                                  | ≤10                     |
|            | 120          | 169             | 436  | 267   | 848                             |   |                                  | ≤10                     |
|            | 160          | 169             | 459  | 267   | 848                             |   |                                  | ≤10                     |
| 40         | 50           | 169             | 497  | 242   | 847                             | 4000                                    | 3000                             | ≤10                     |
|            | 80           | 255             | 641  | 351   | 1210                            |   |                                  | ≤10                     |
|            | 100          | 328             | 702  | 460   | 1334                            |   |                                  | ≤10                     |
|            | 120          | 363             | 762  | 557   | 1458                            |   |                                  | ≤10                     |
|            | 160          | 363             | 800  | 557   | 1458                            |   |                                  | ≤10                     |

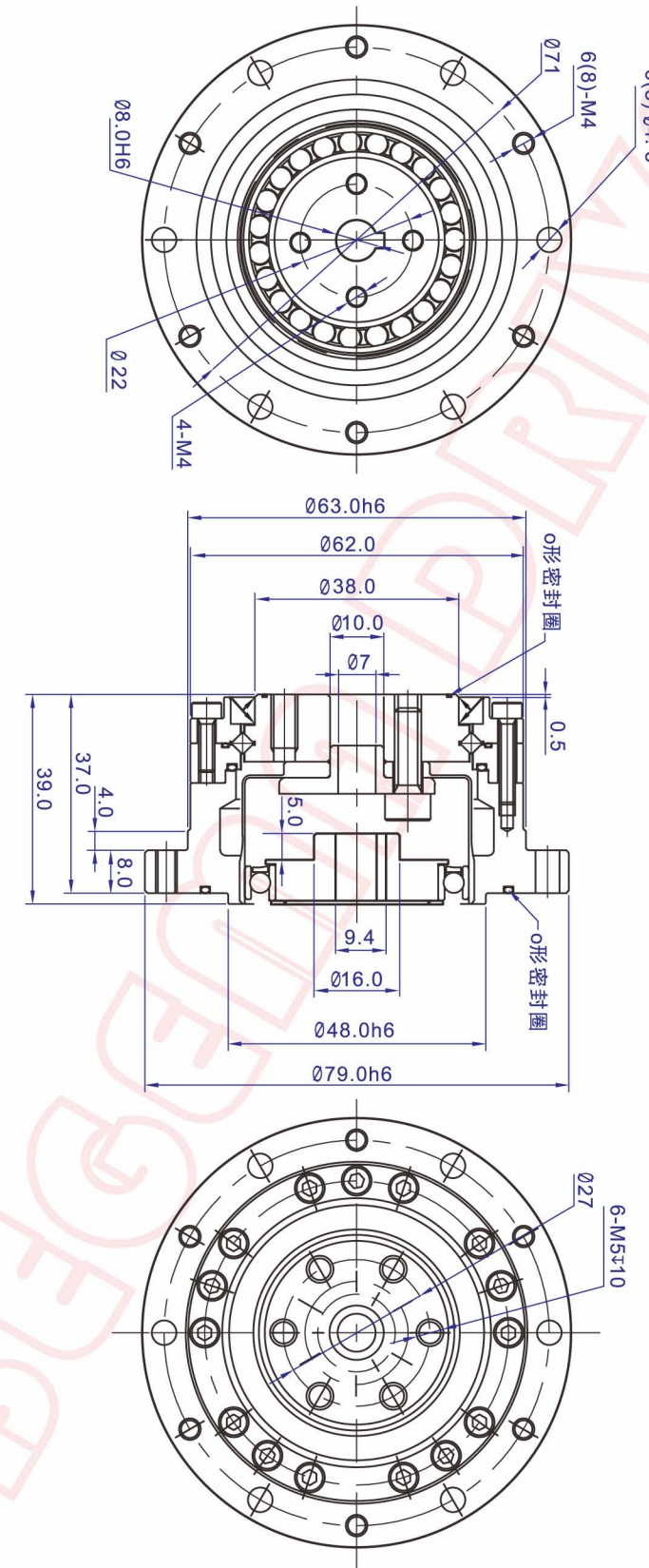
■ BCS(G)系列 I 型谐波减速器尺寸图 BCS(G)-I series reducer installation dimensions

◆ BCS(G)-14-XXX-U-I



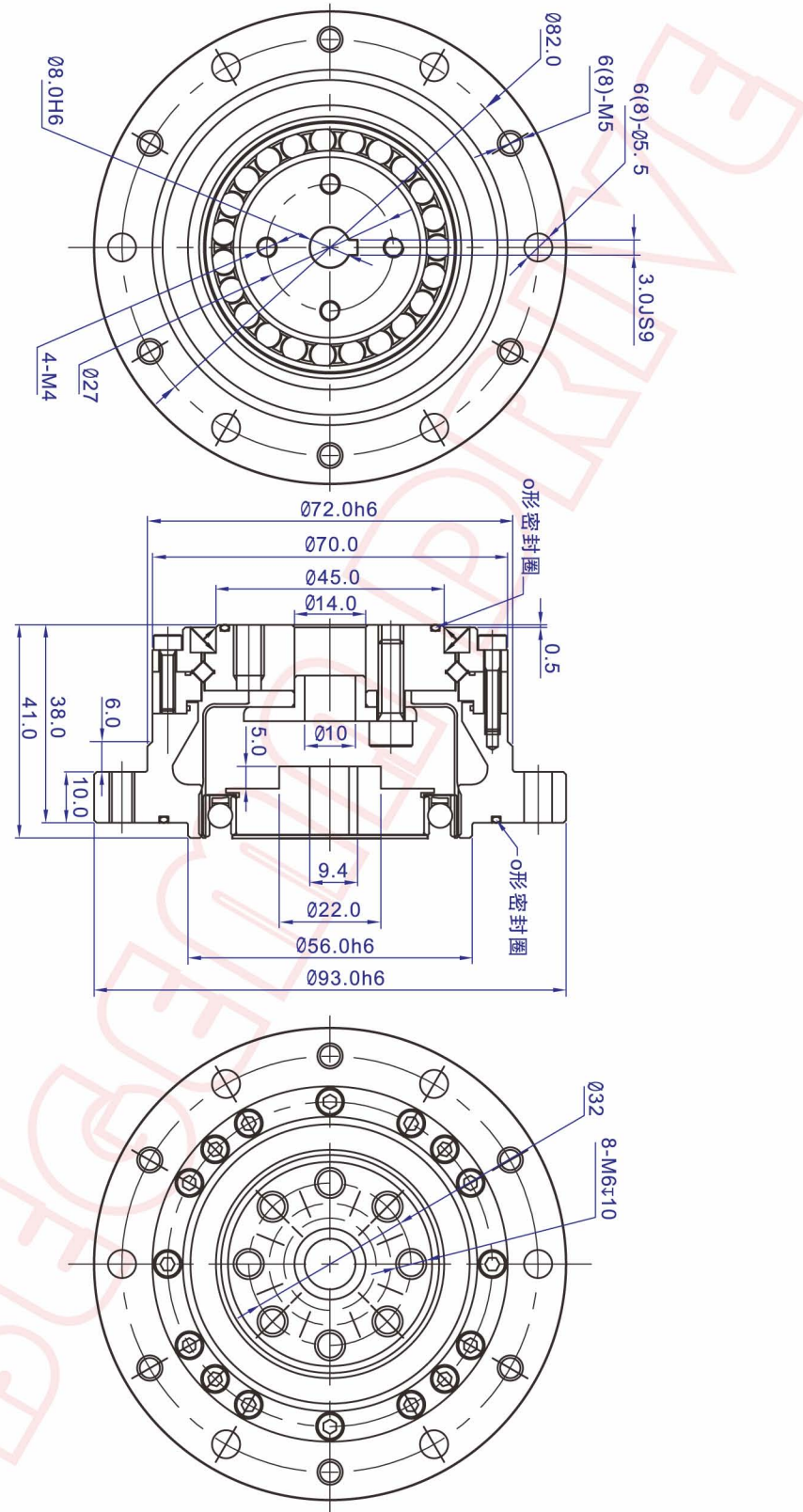
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◆ BCS(G)-17-XXX-U-I



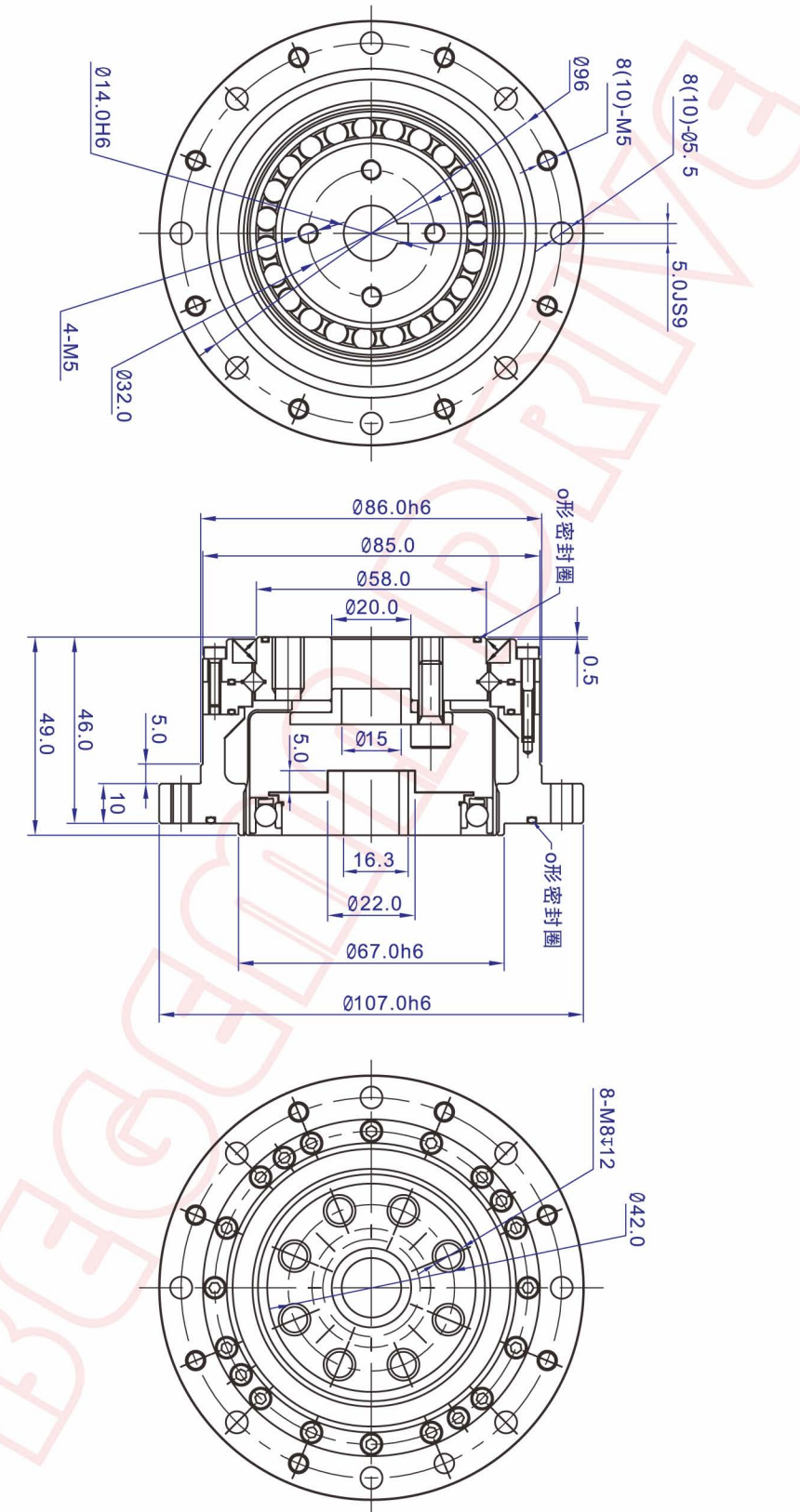
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◆ BCS(G)-20-XXX-U-I



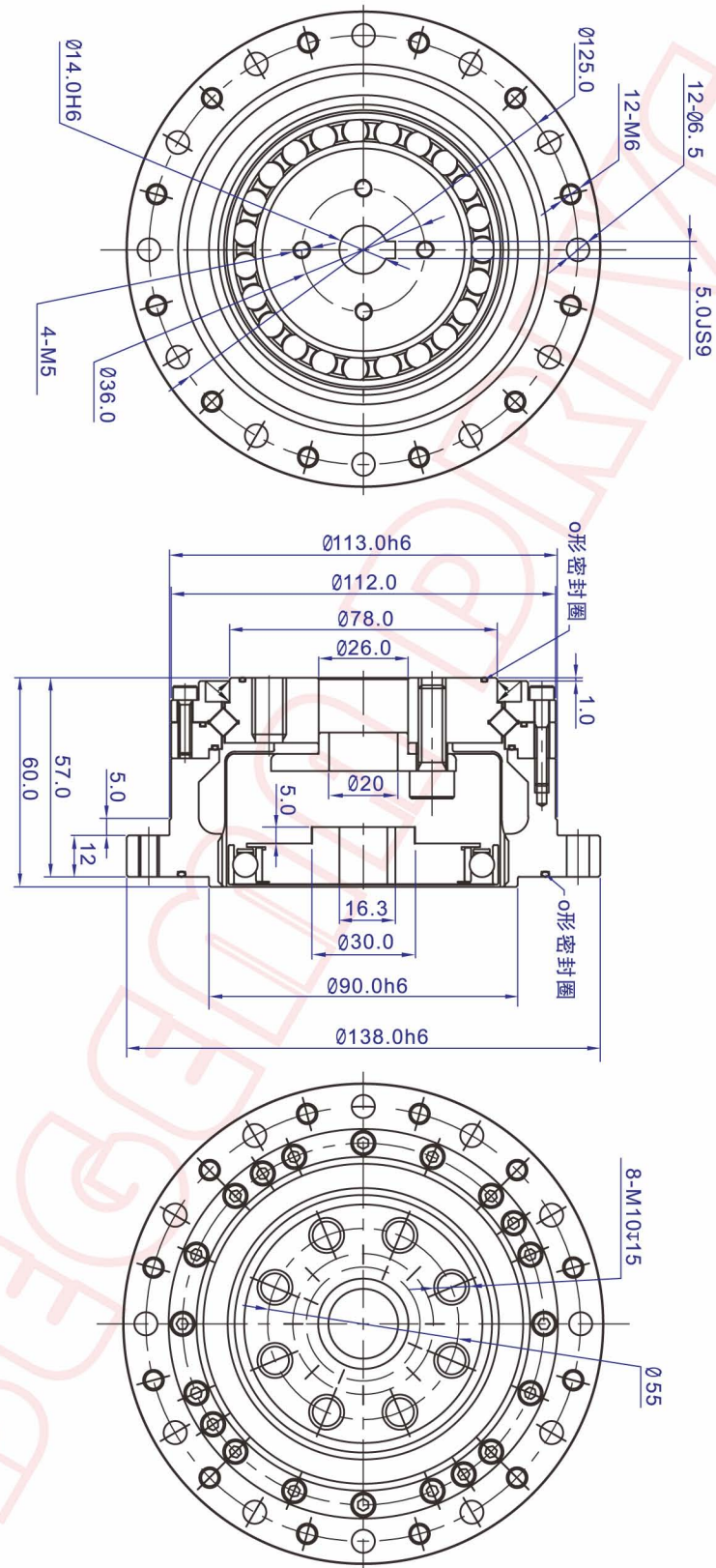
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◆ BCS(G)-25-XXX-U-I



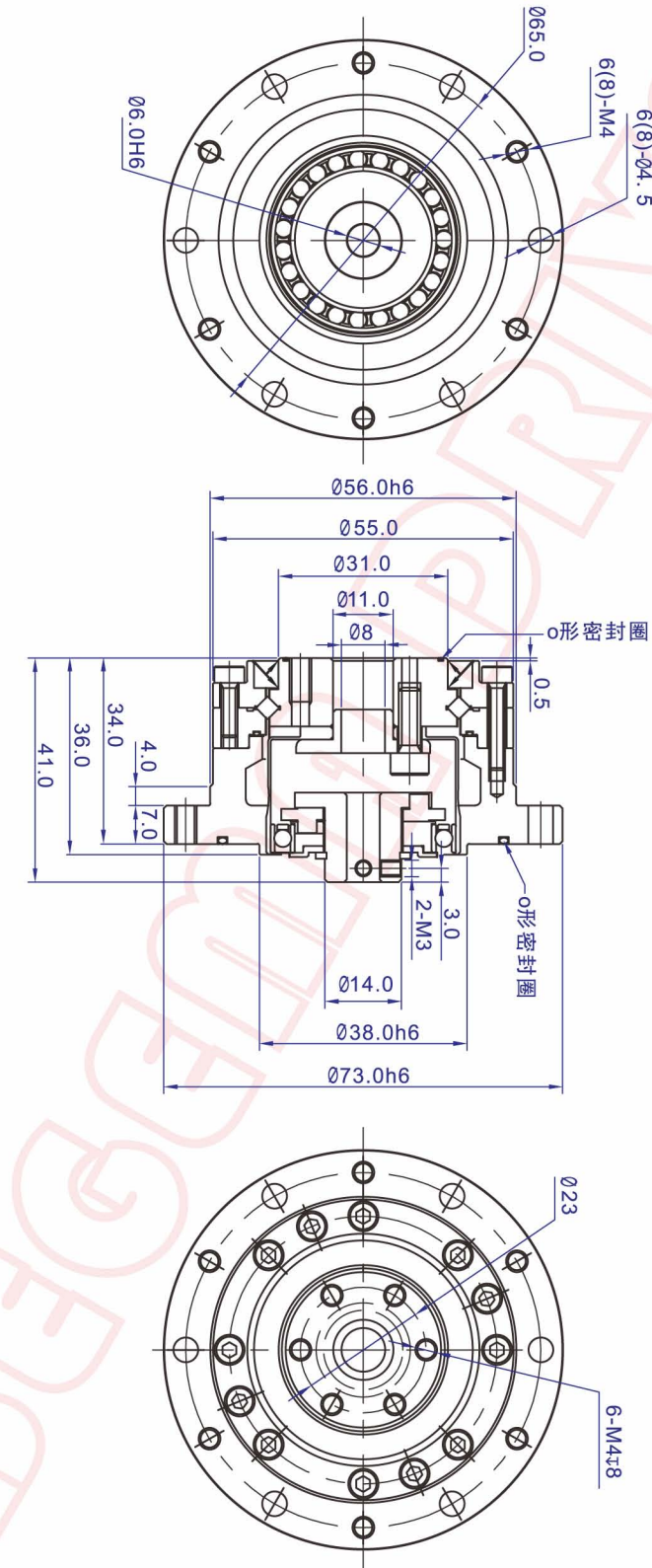
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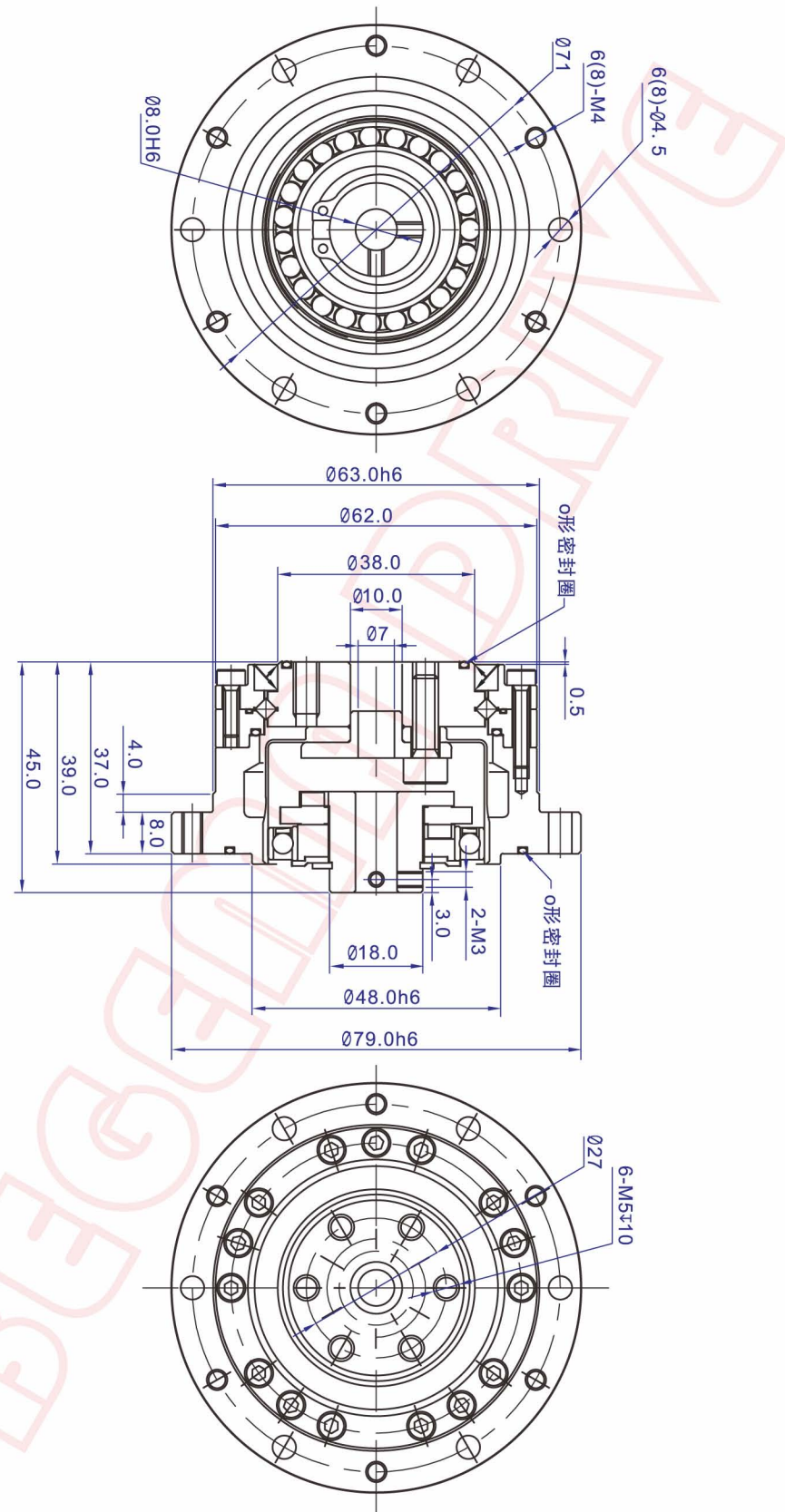
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◆ BCS(G)-14-XXX-U-II



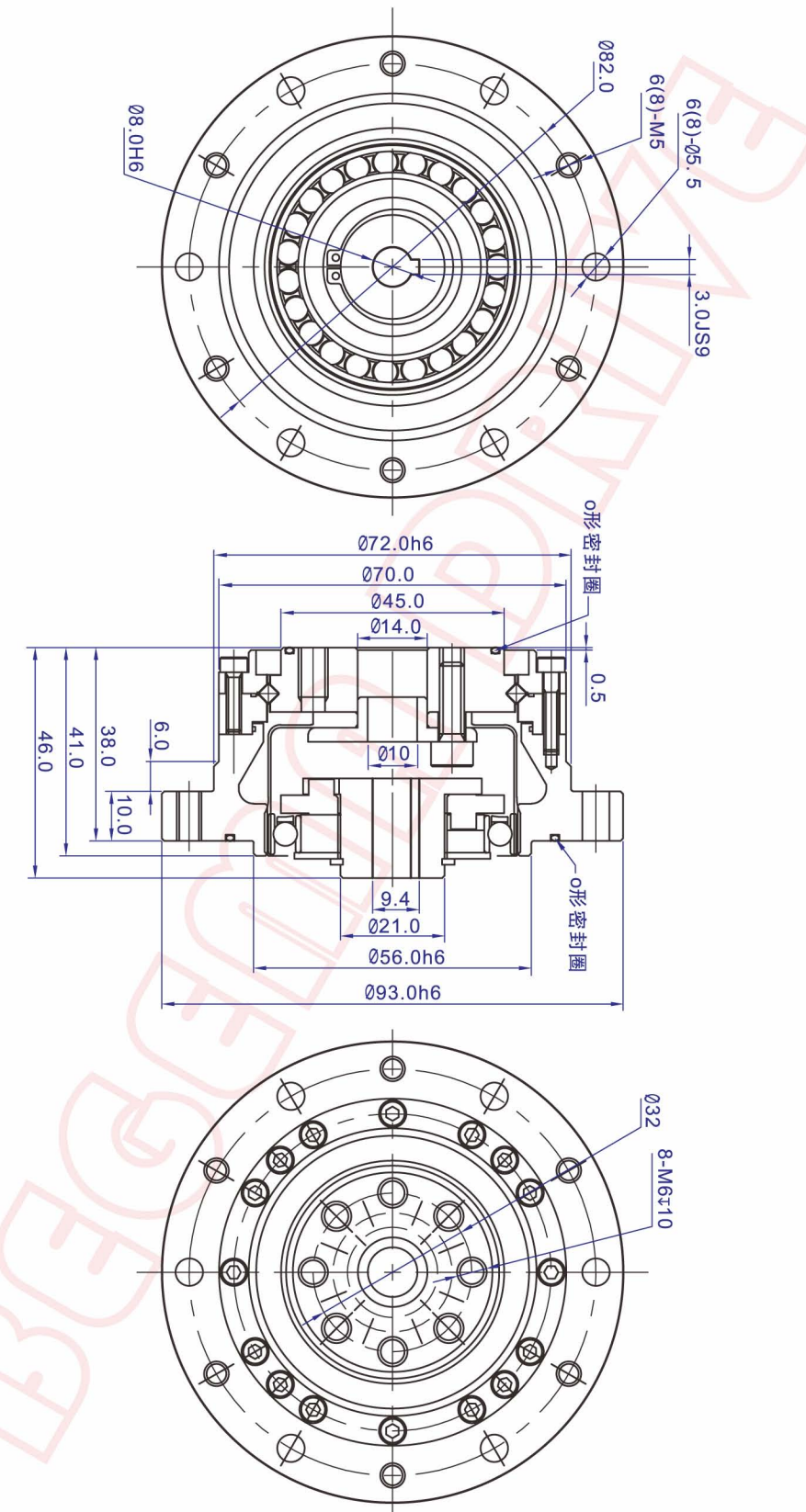
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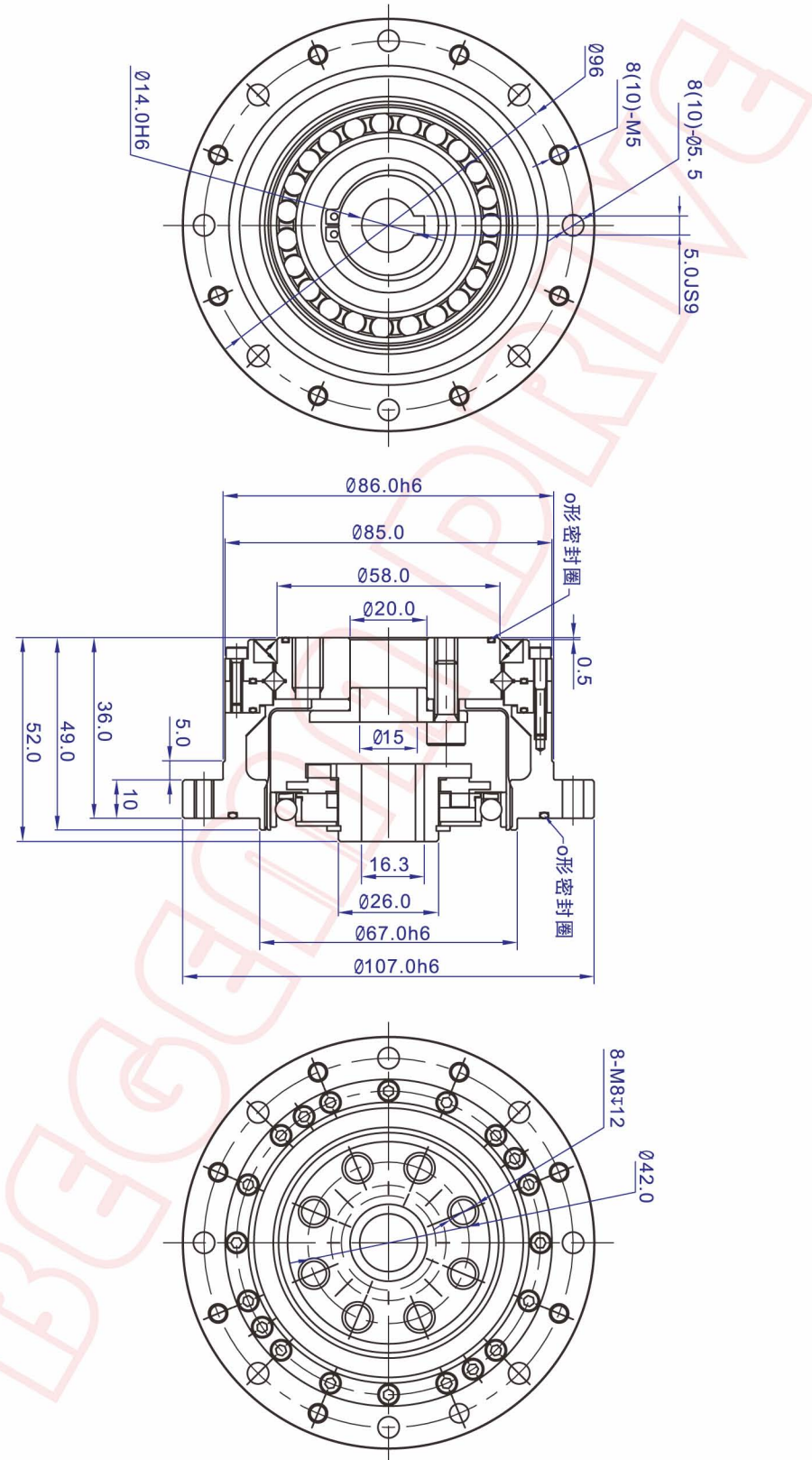
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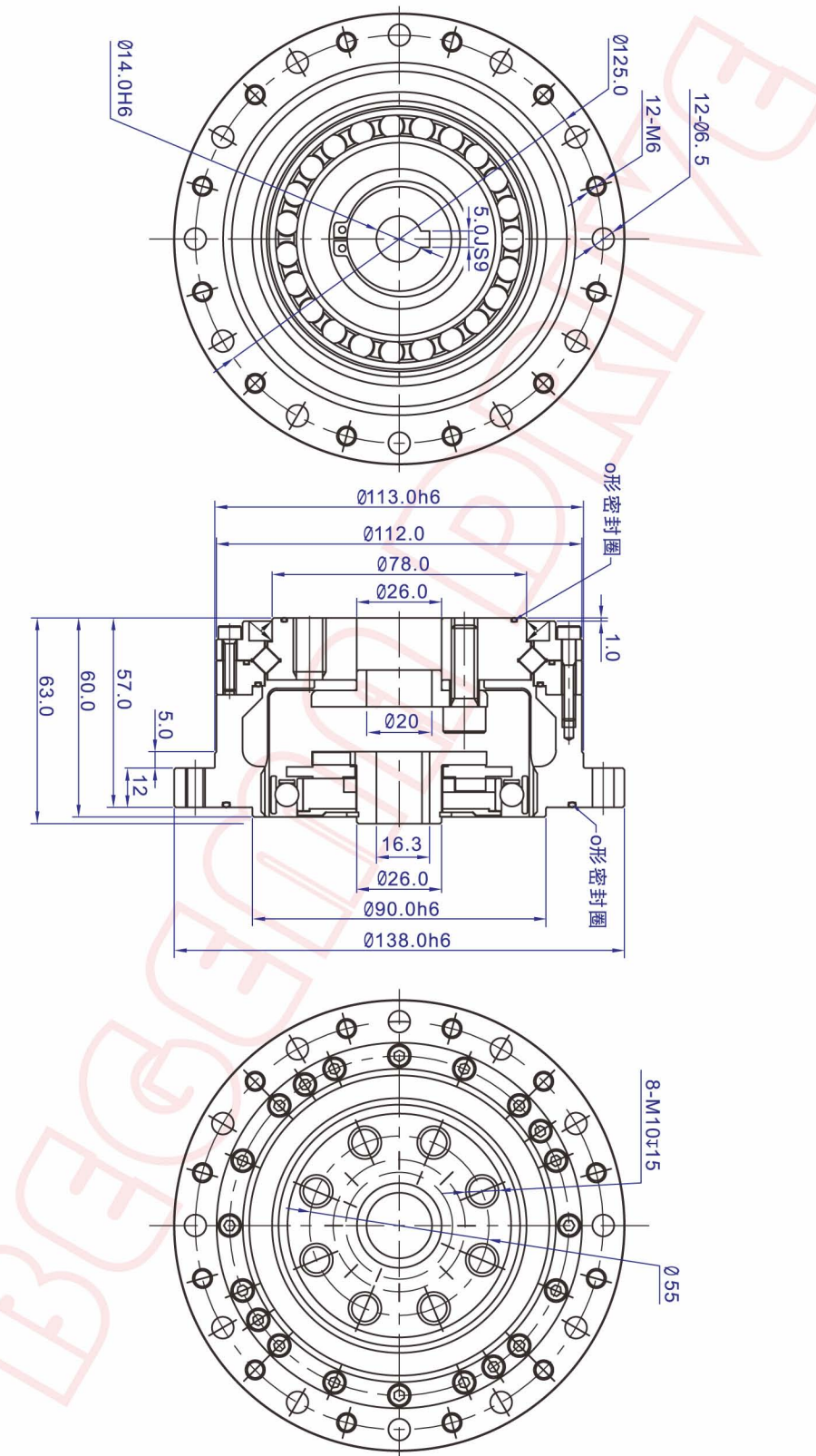
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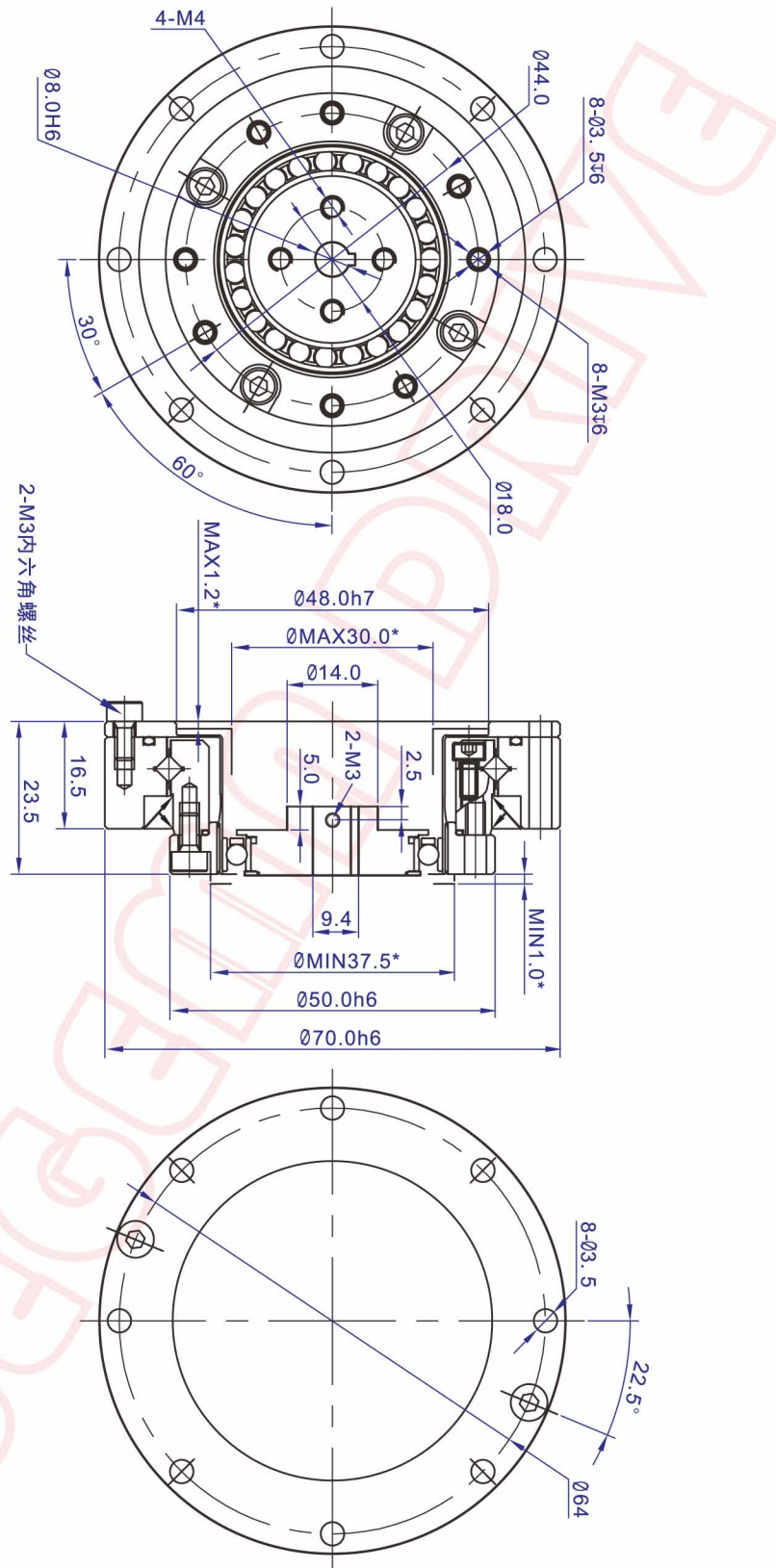
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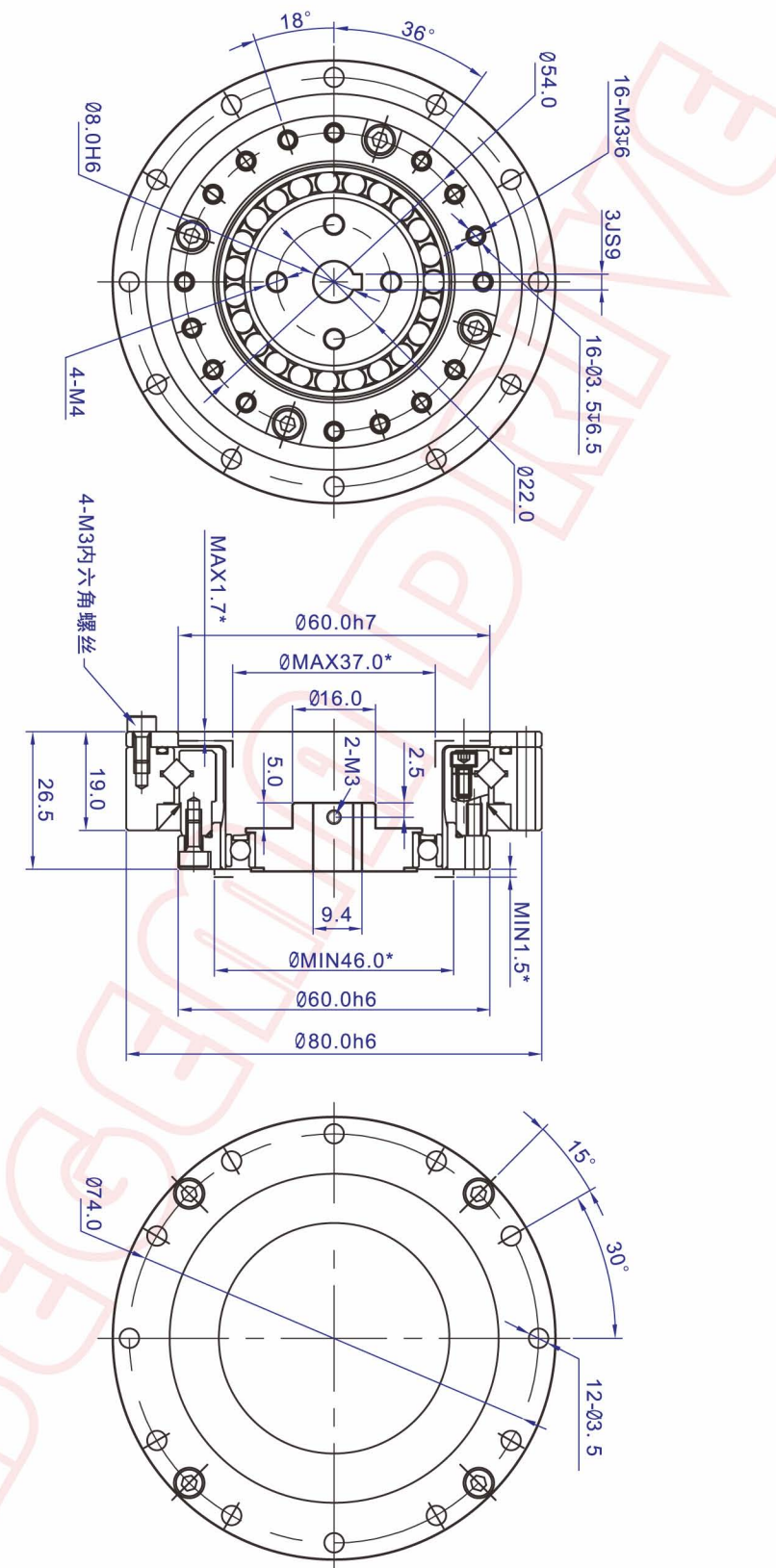
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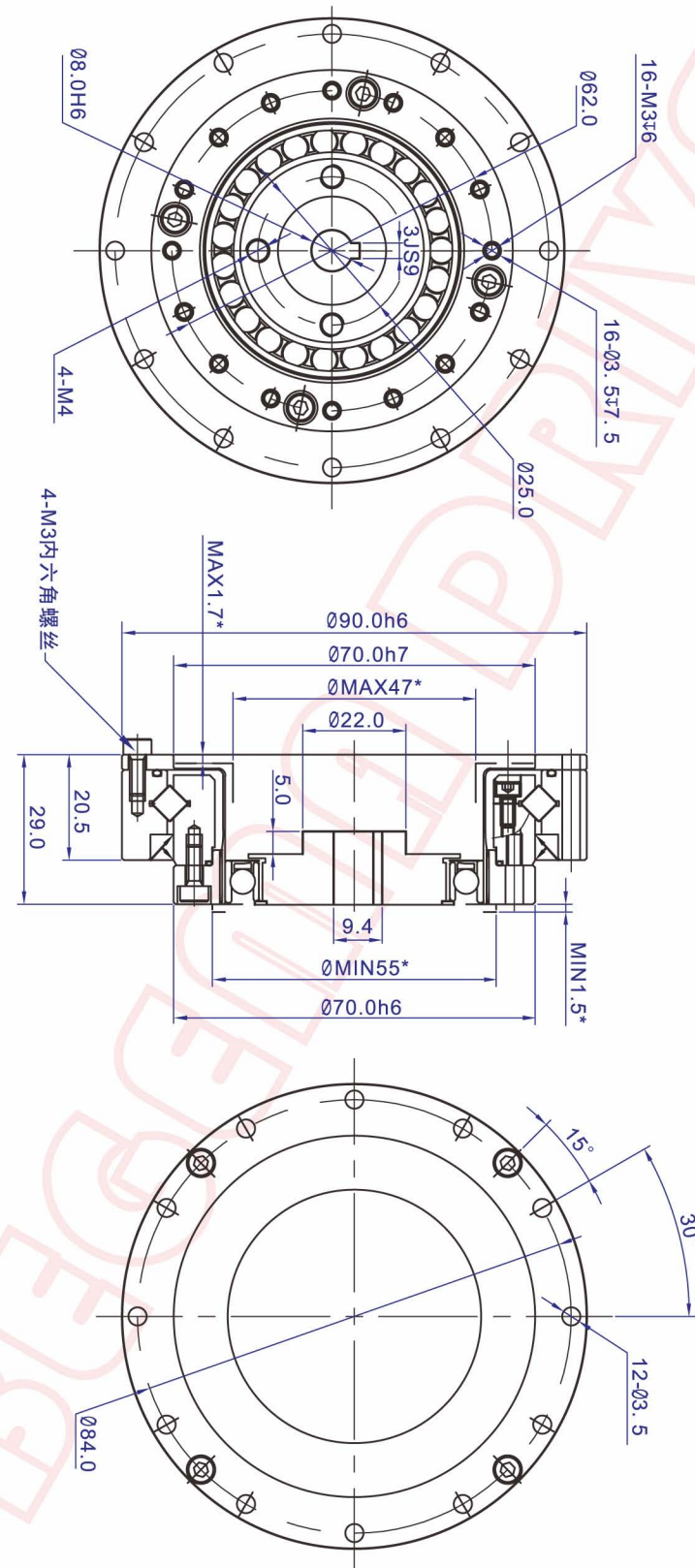
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◆ BHS(G)-17-XXX-U-I



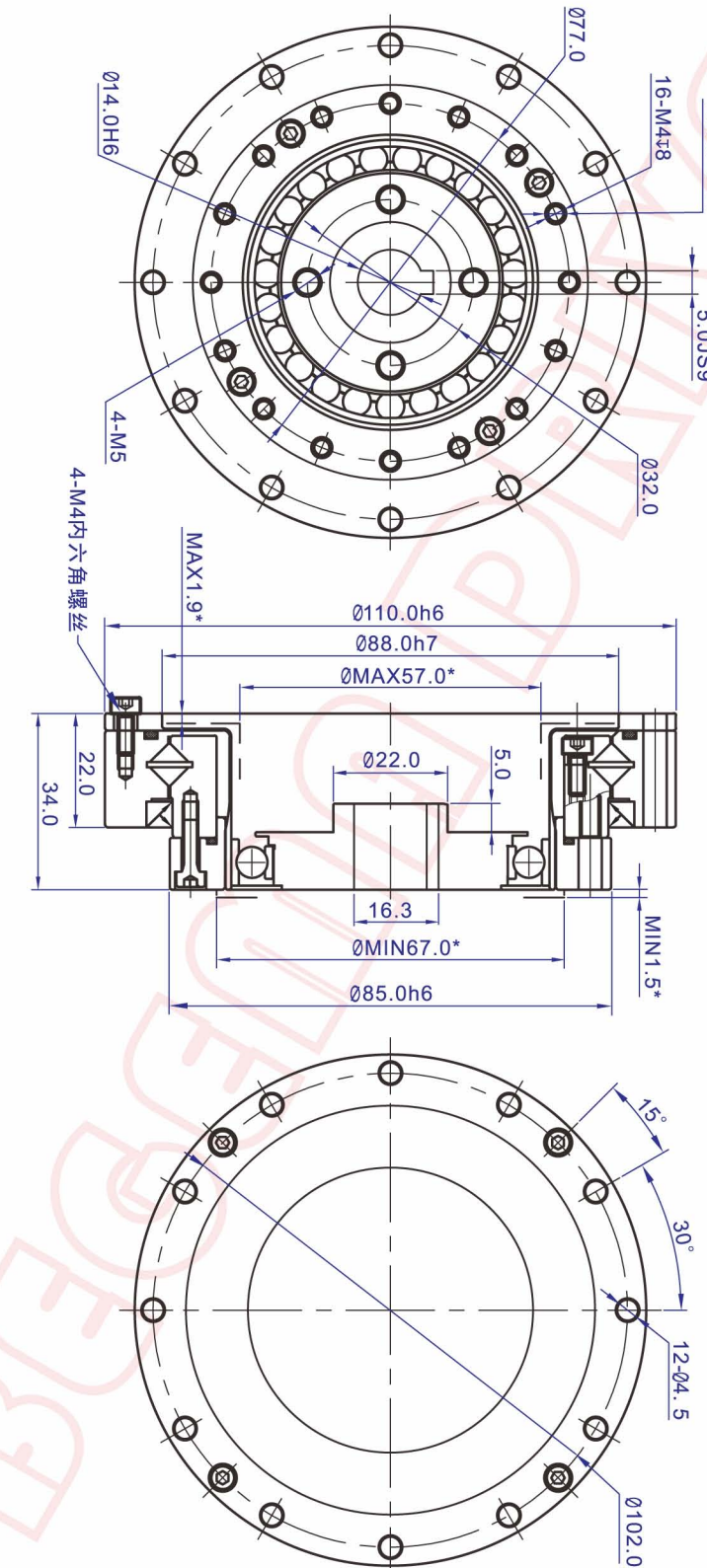
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◆ BHS(G)-20-XXX-U-I



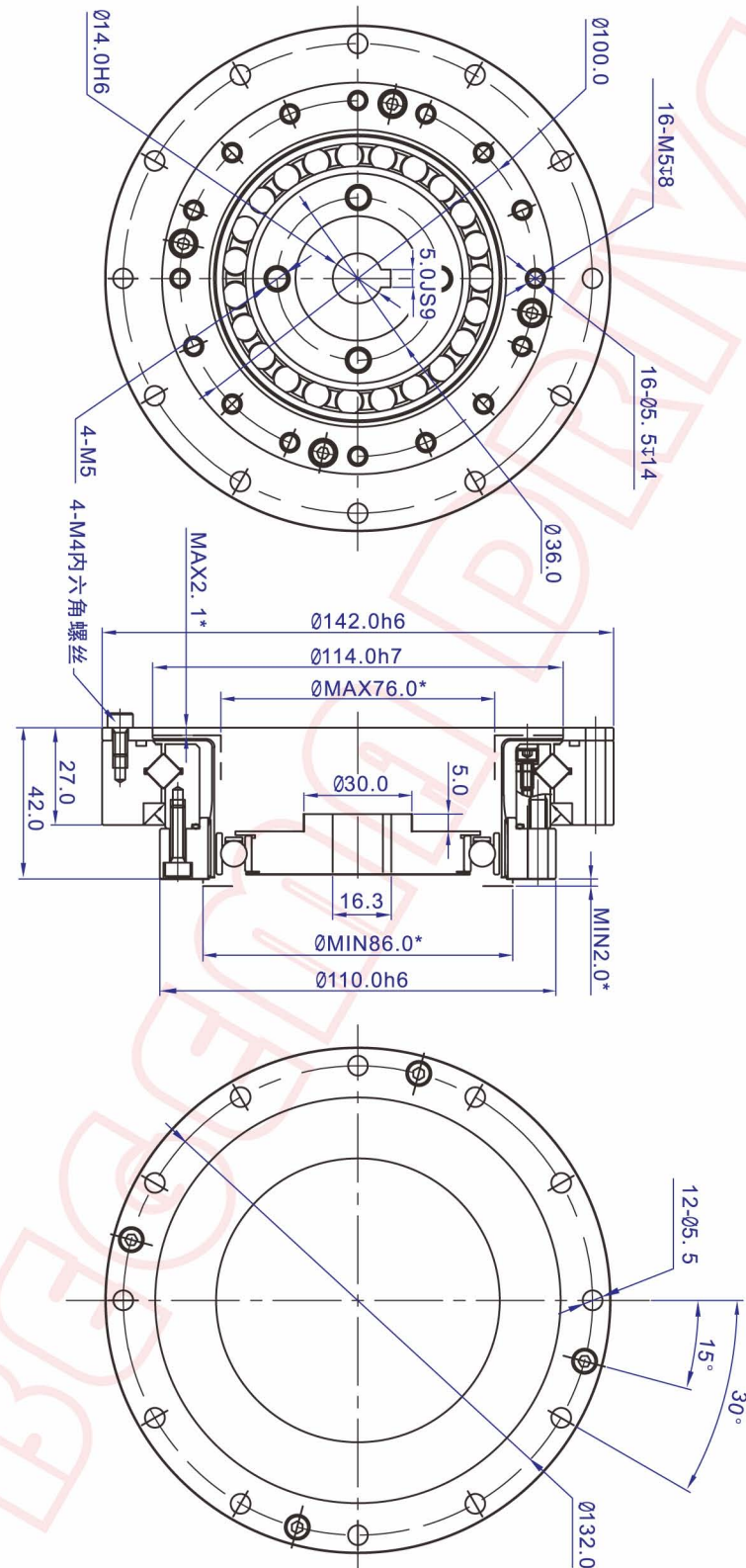
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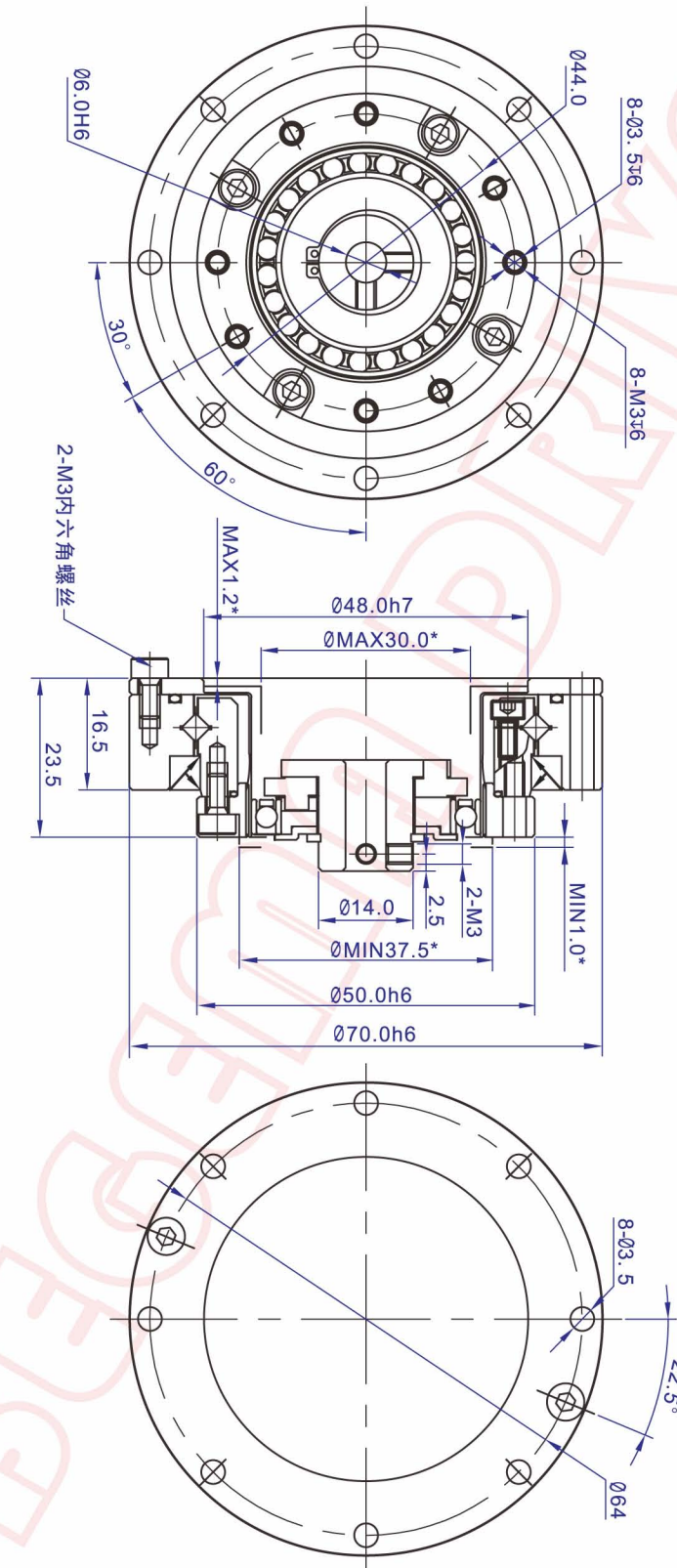
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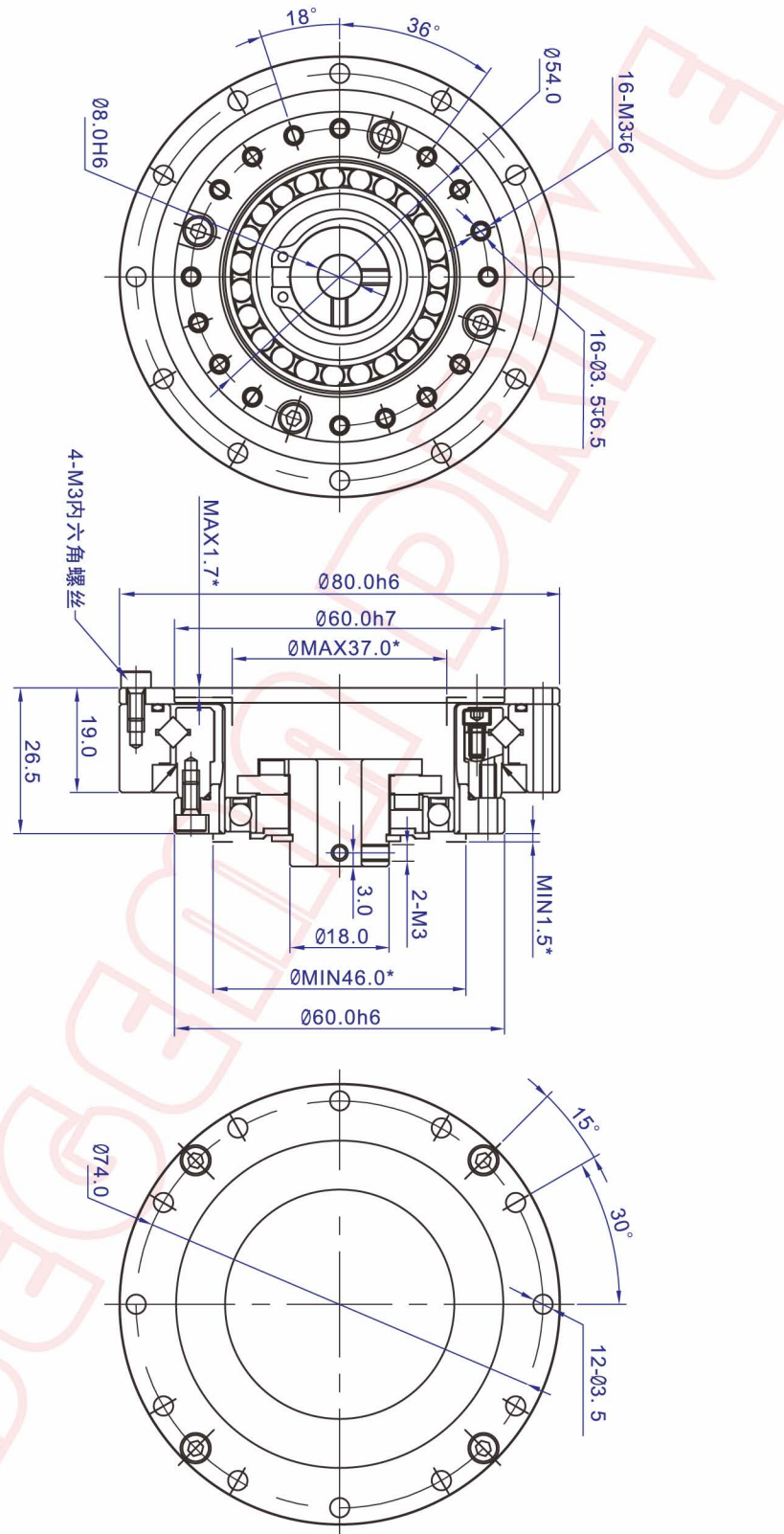
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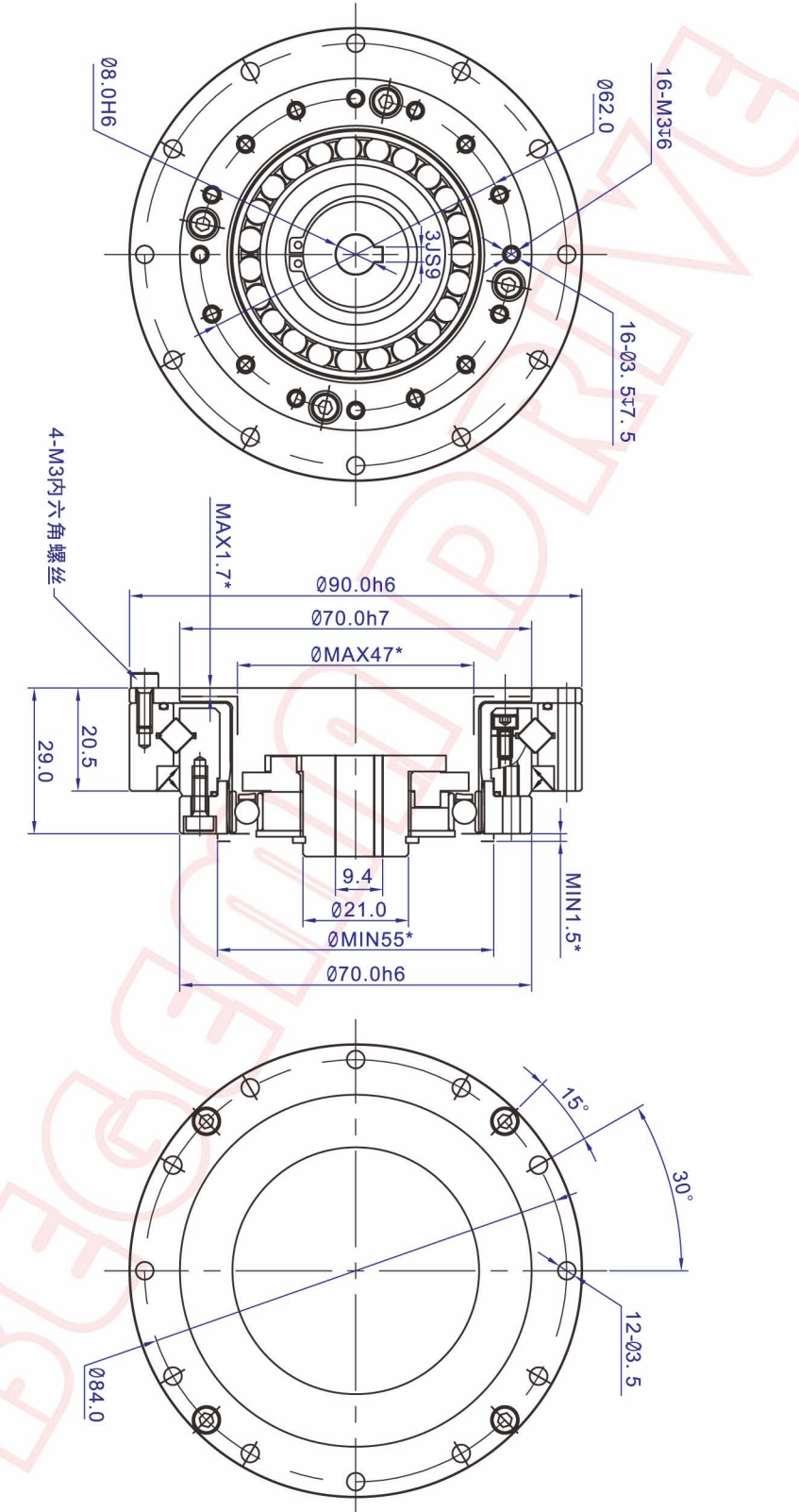
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◆ BHS(G)-17-XXX-U-II



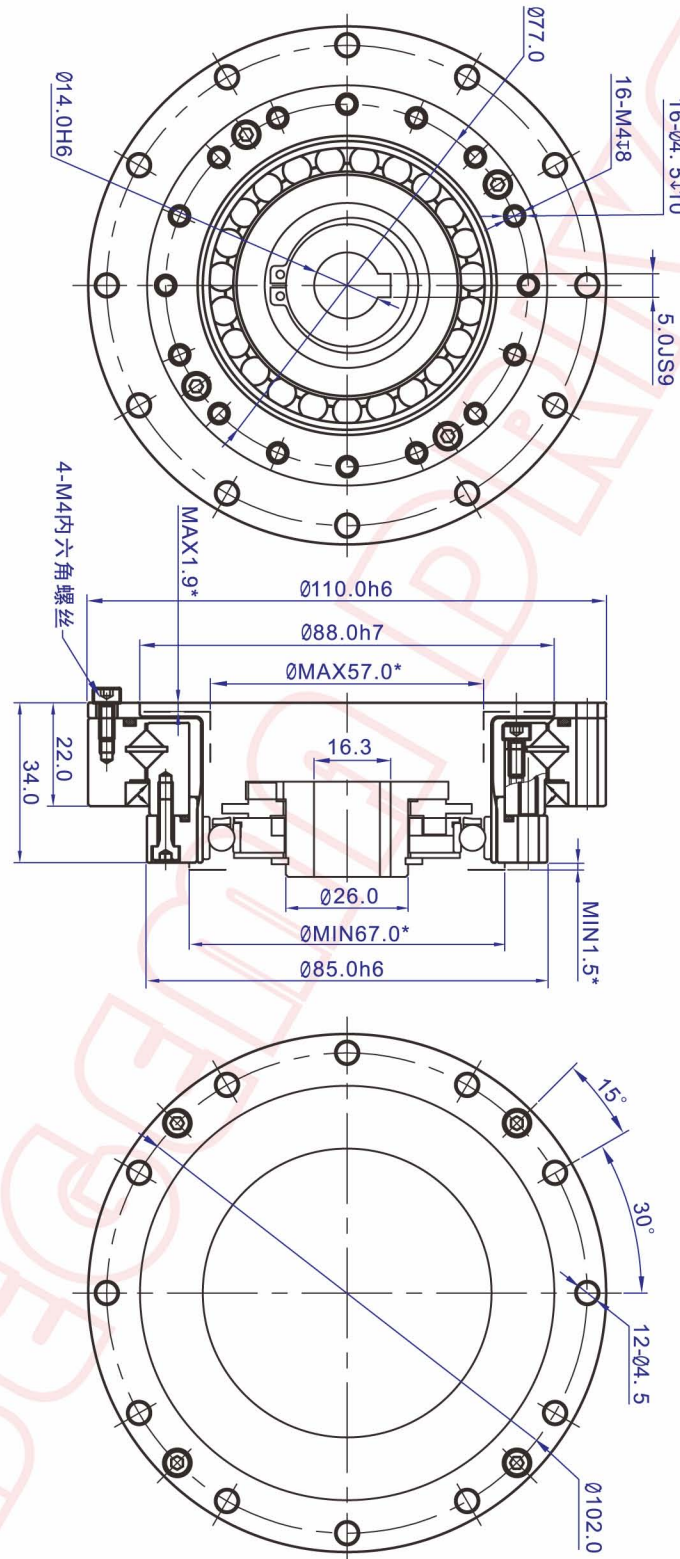
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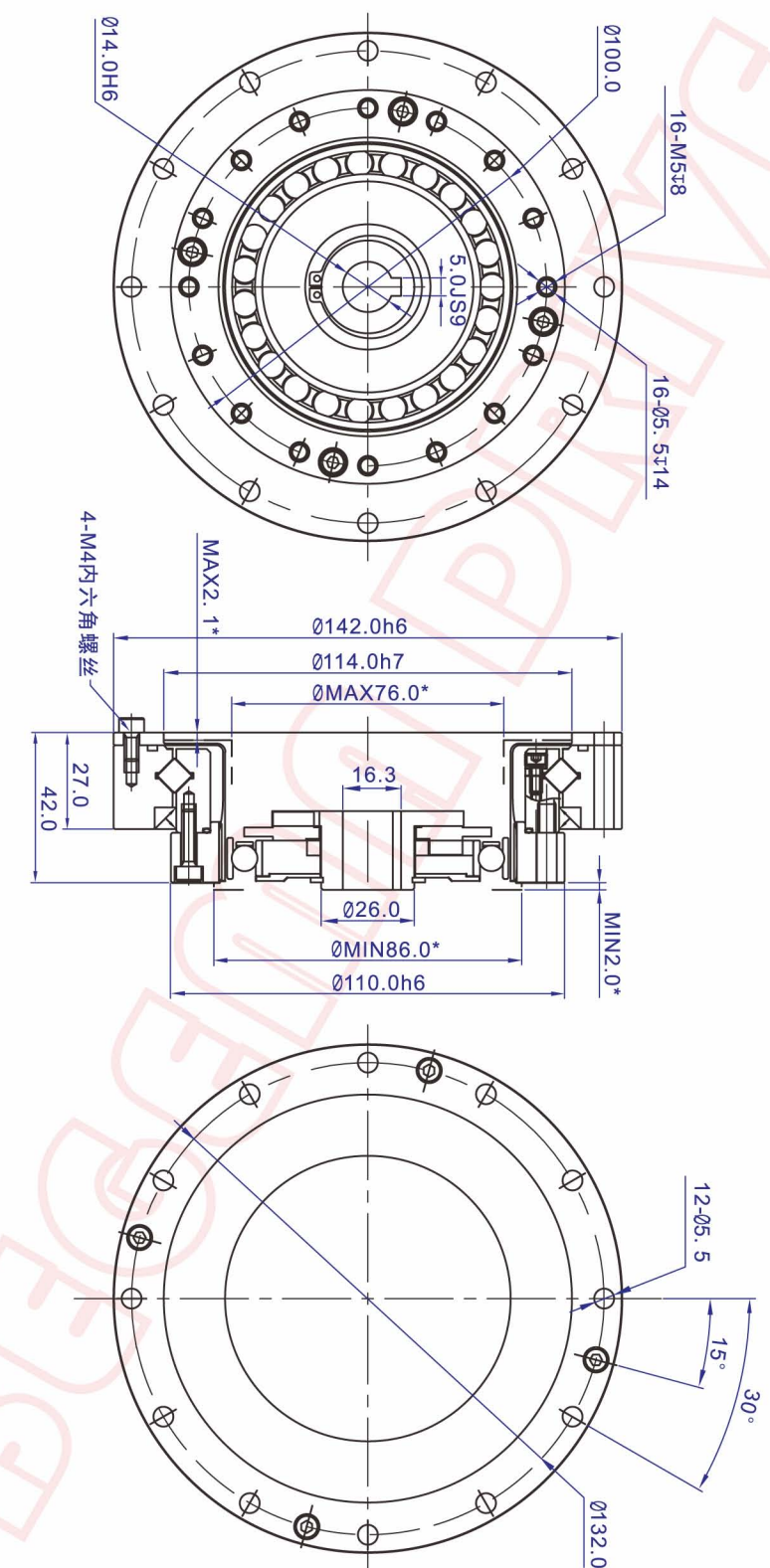
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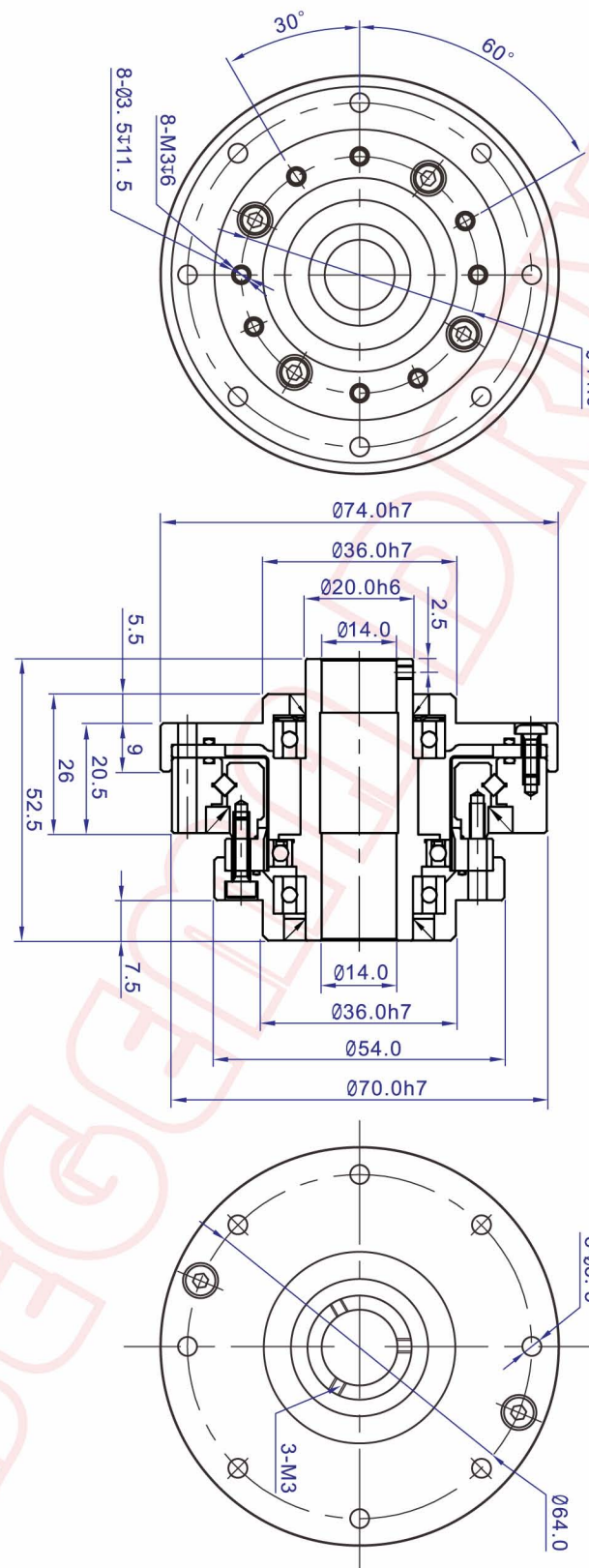
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◆ BHS(G)-32-XXX-U-II



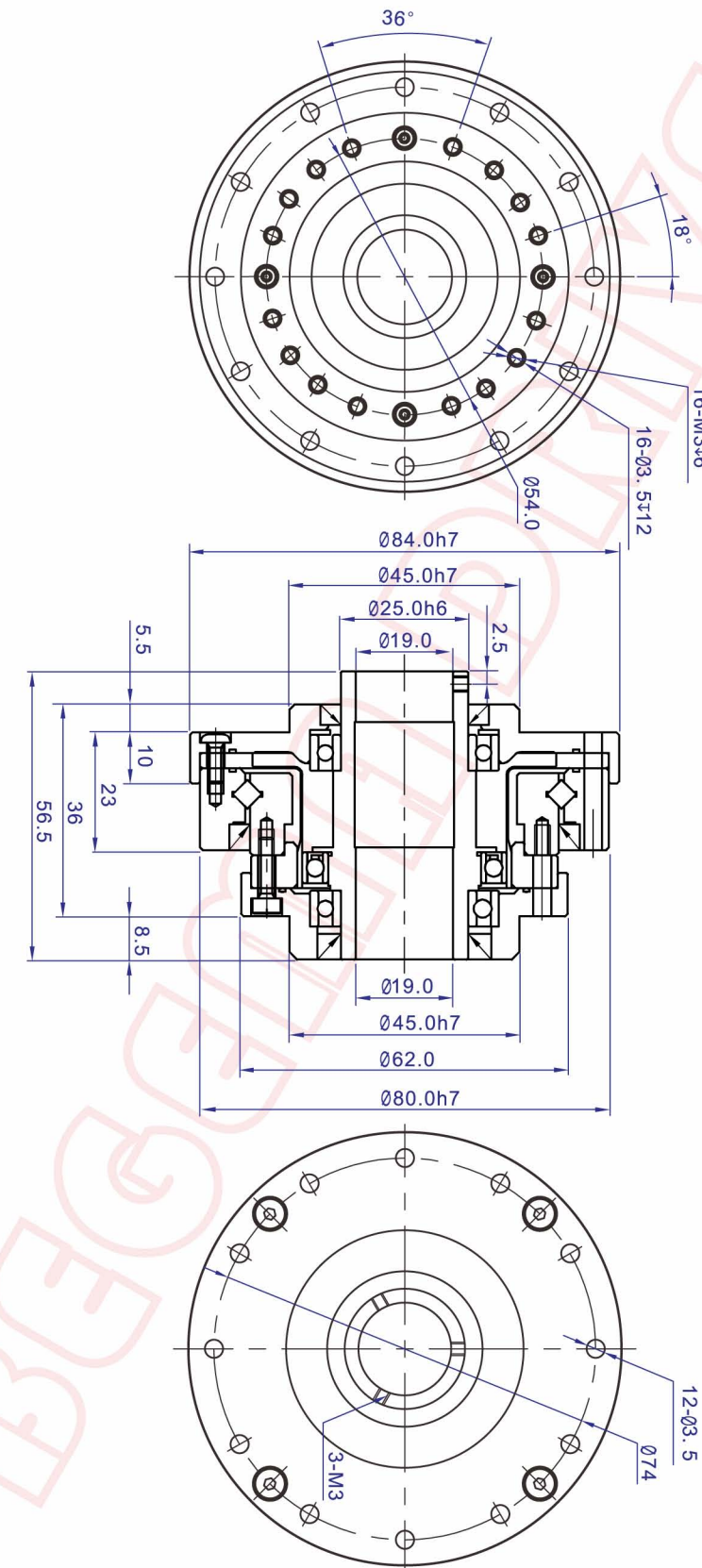
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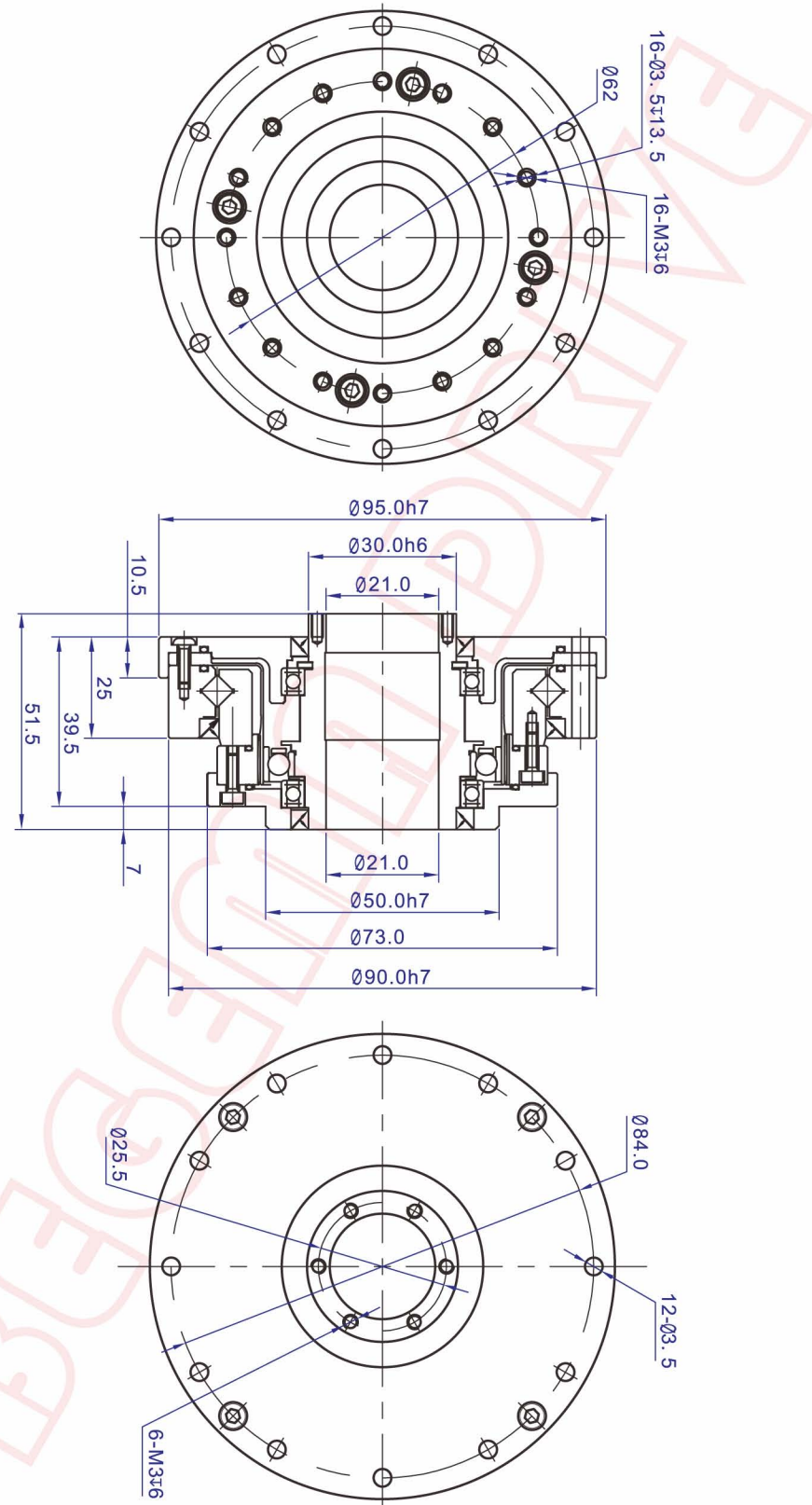
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◆ BHS(G)-17-XXX-U-III



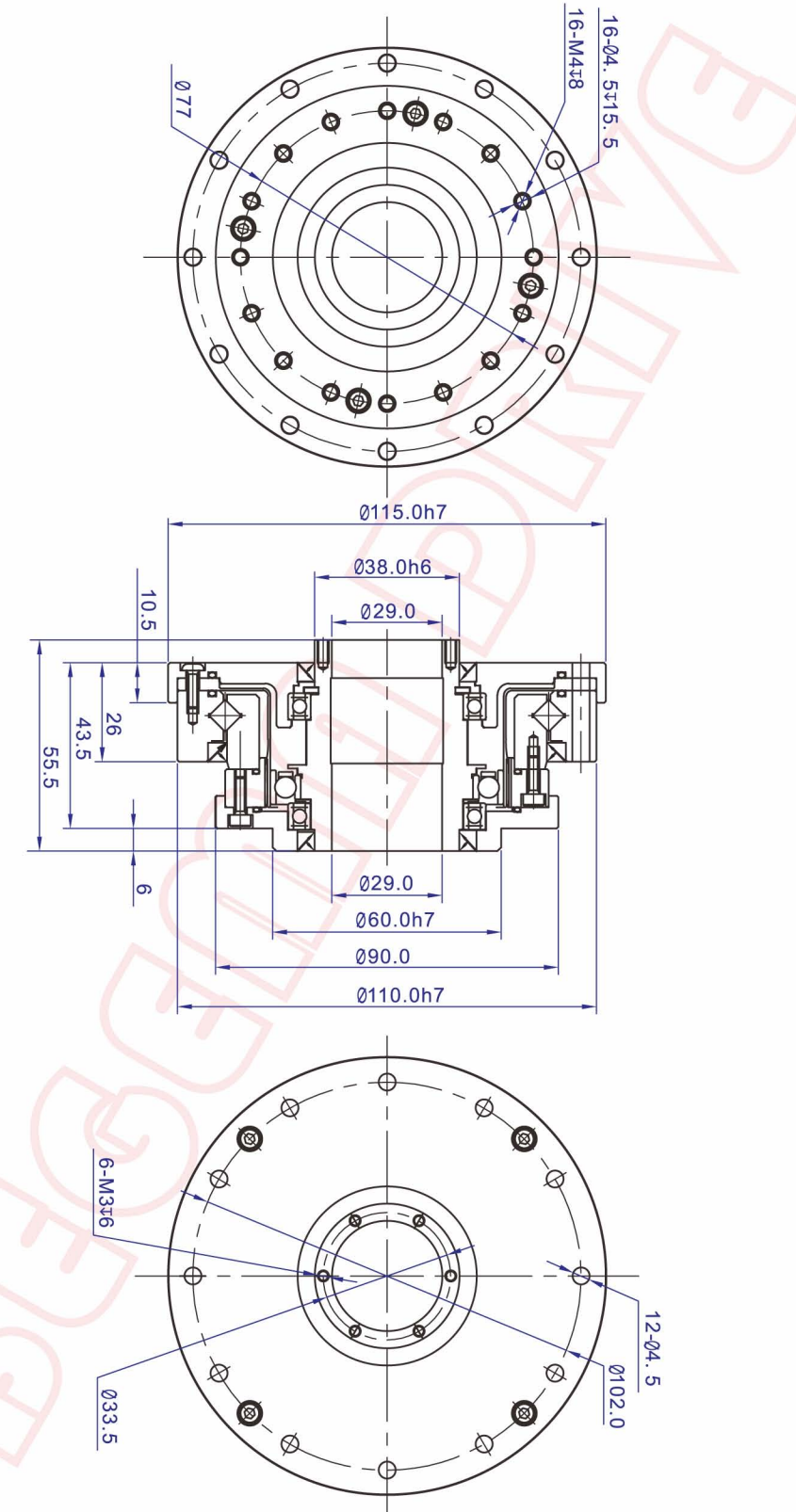
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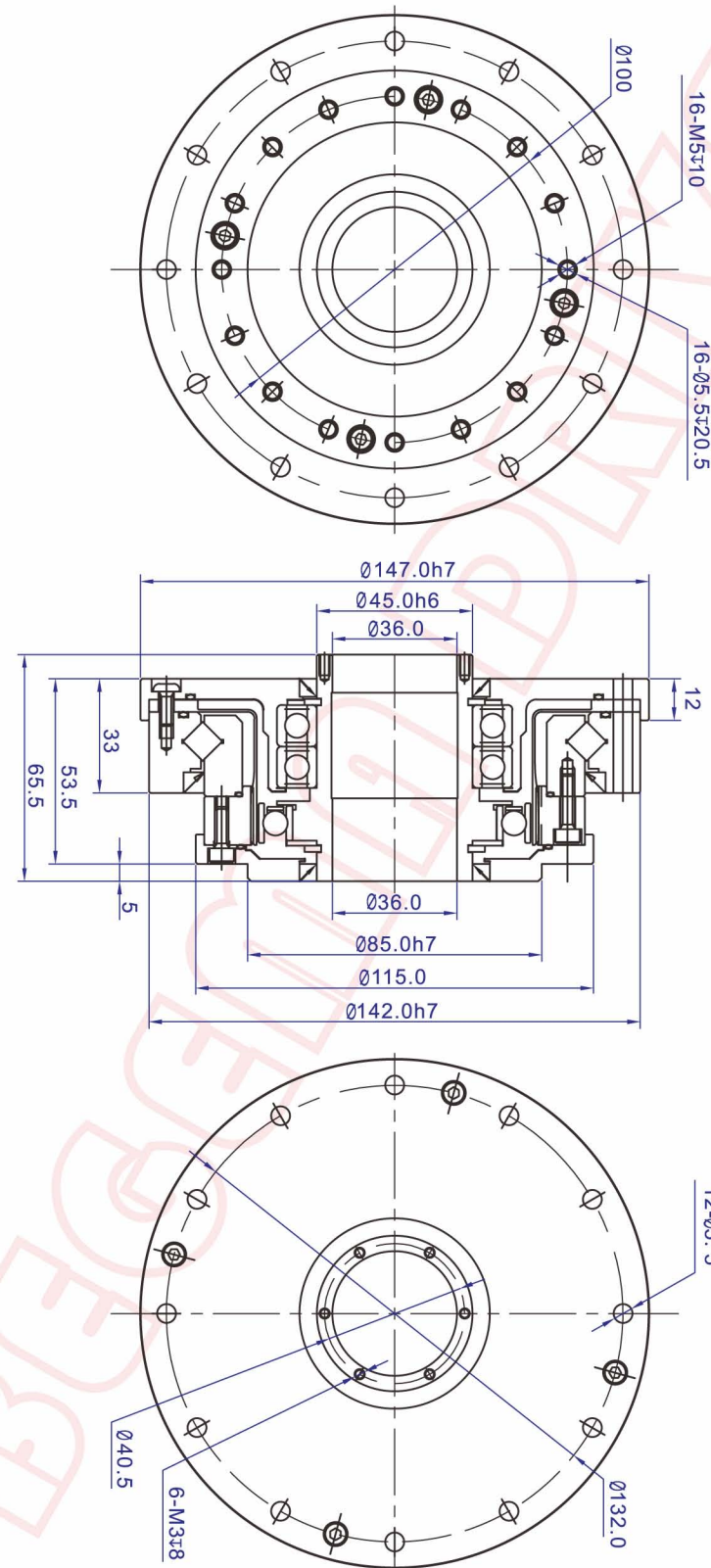
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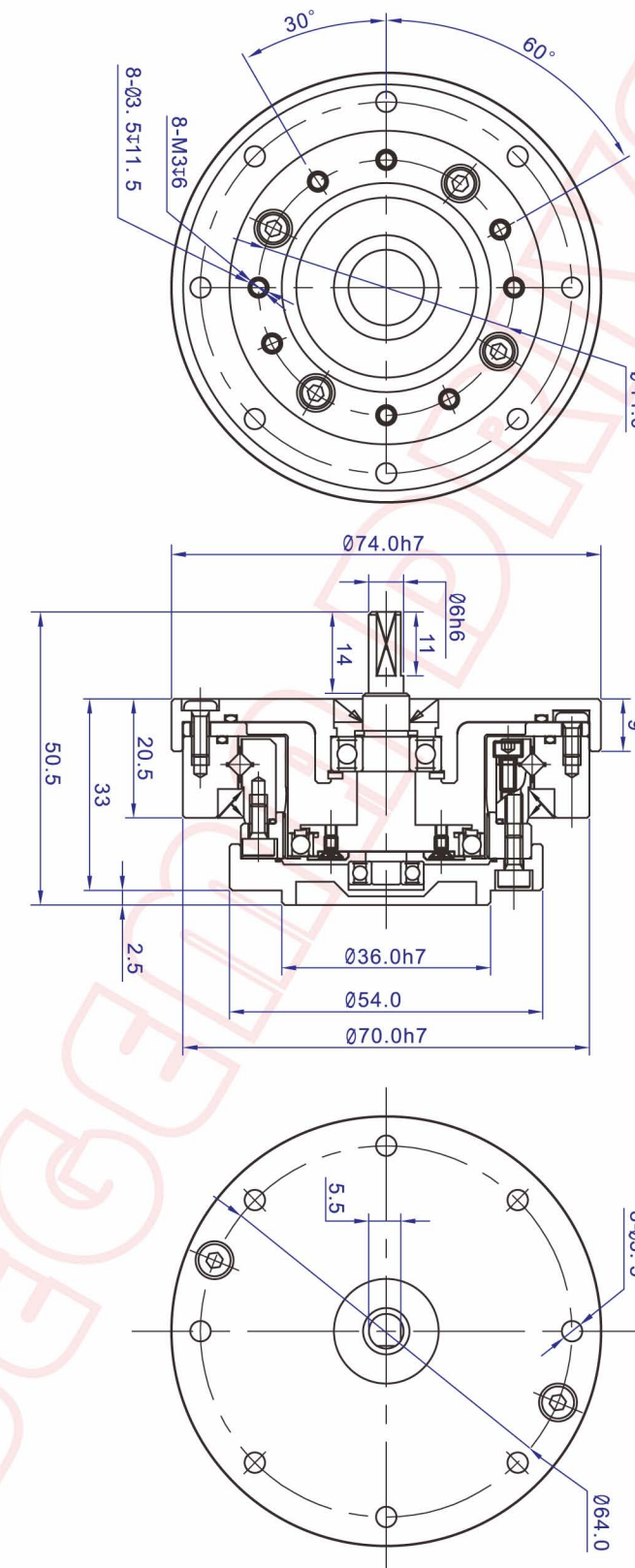
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■ BHS(G)系列 IV 型谐波减速器尺寸图 BHS(G)-IV series reducer installation dimensions

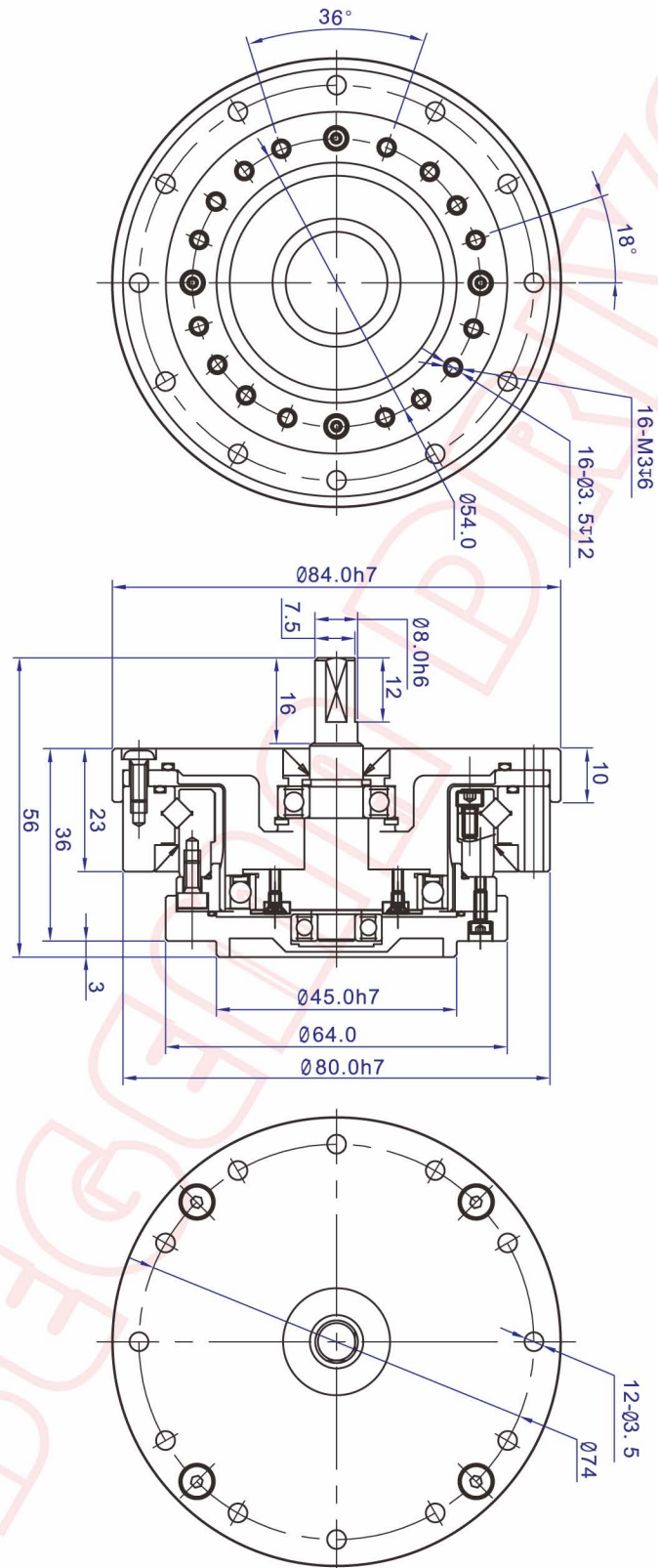
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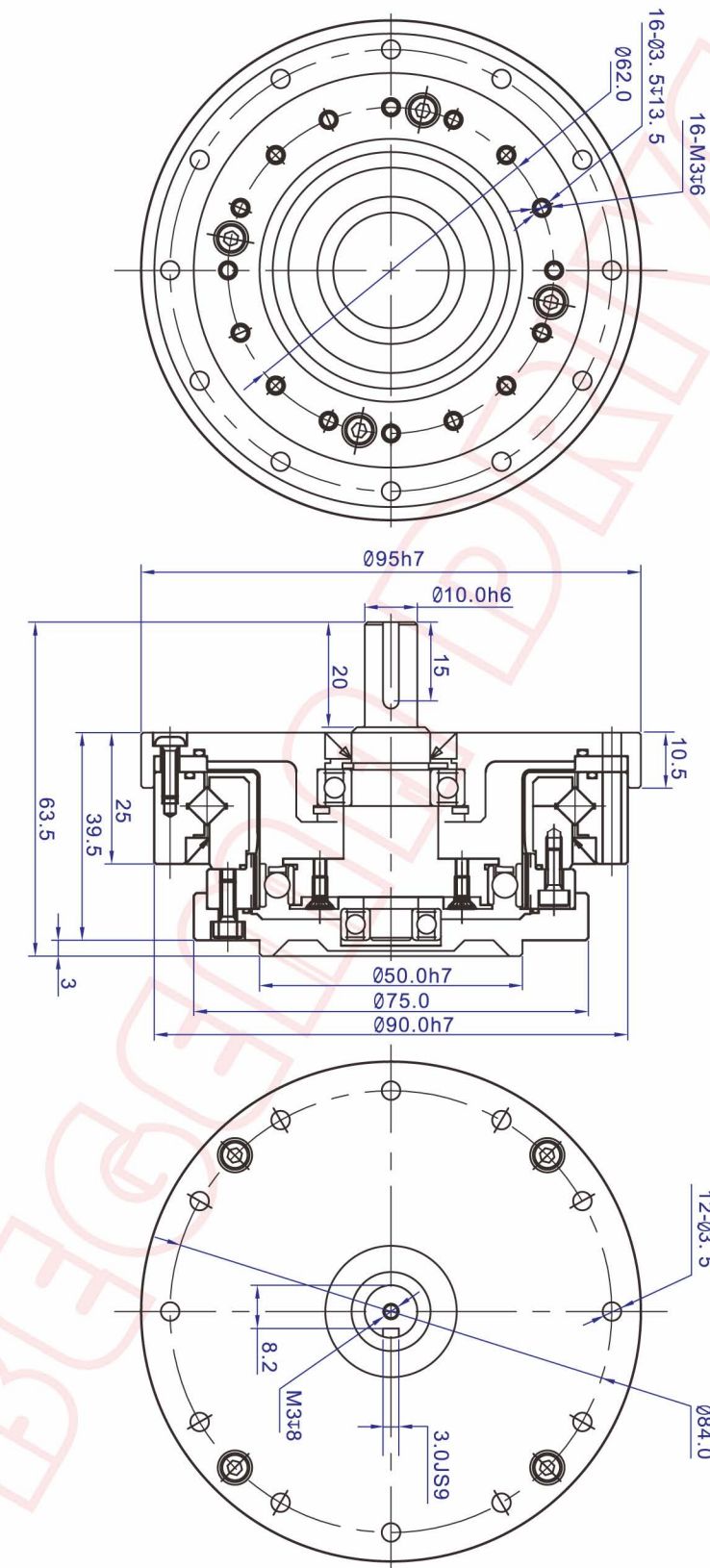
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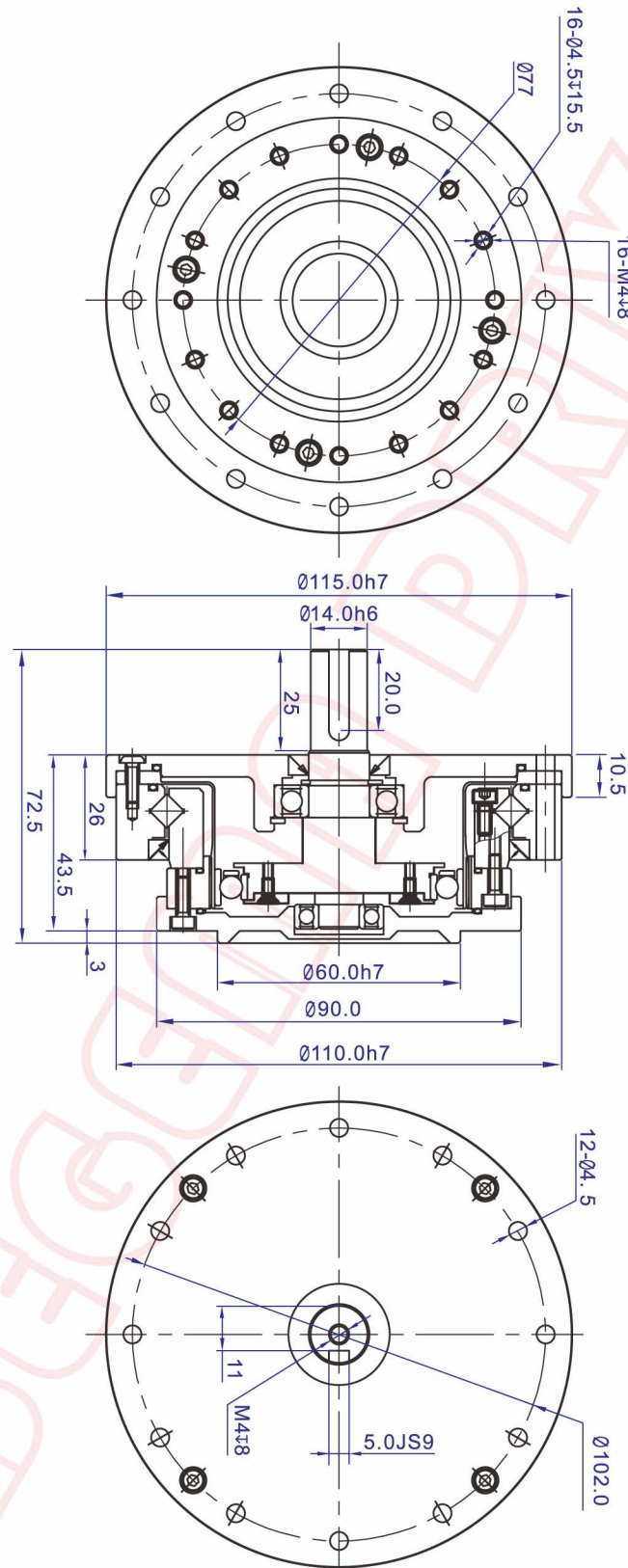
◆ BHS(G)-20-XXX-U-IV



BHS(G) 系列外形尺寸

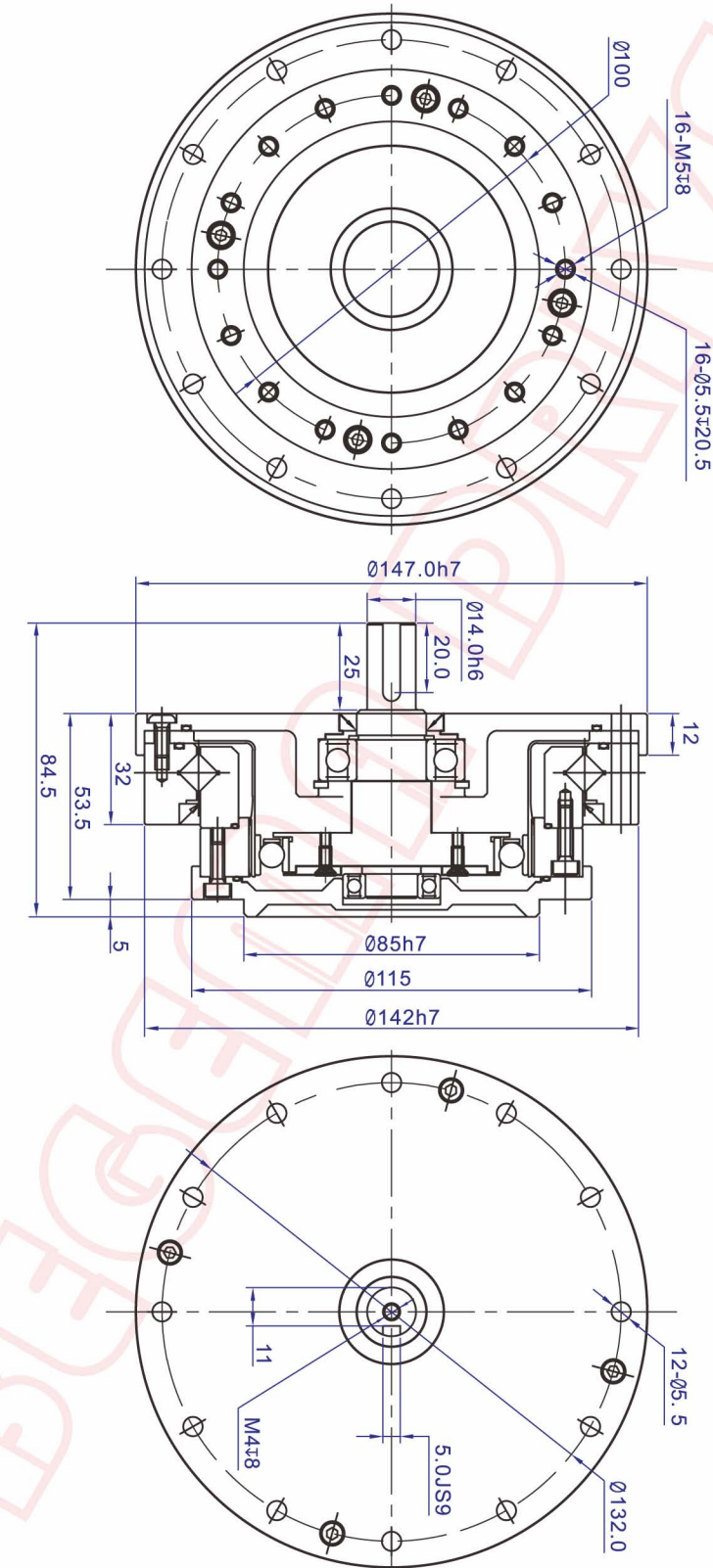
■ BHS(G)系列 IV 型谐波减速器尺寸图 BHS(G)-IV series reducer installation dimensions

◆ BHS(G)-25-XXX-U-IV



■ BHS(G)系列 IV 型谐波减速器尺寸图 BHS(G)-IV series reducer installation dimensions

◆ BHS(G)-32-XXX-U-IV



使用安全注意事项 Safety instructions

- 1.使用时请勿超出允许转矩；
- 2.请在如下环境中使用：环境温度0-40°C，无腐蚀性、爆炸性气体，无金属粉尘，不溅水、油等；
- 3.请正确设计、组装各种部件，确保其能够达到产品目录中的推荐安装精度；
- 4.严禁对组合型产品实施拆解、重新组装，否则，将无法恢复产品原有性能；
- 5.请勿用工具大力敲击产品各部件，请确保安装及使用过程中产品不会因坠落等原因导致裂纹、瘪痕等；
- 6.安装调试过程中注意避免润滑剂溅入眼睛或接触皮肤，请佩戴防护眼罩及手套；
- 7.使用前后将产品密封，防止灰尘、水分等进入，请在阴凉处保存，防止日光直射，如长期库存，请确保做好防锈工作；
- 8.报废时，请按工业废弃物进行处理。

1. Do not exceed allowable torque when using;
2. Please use in the following circumstances: the ambient temperature of 0-40°C, non corrosive, explosive gas, metal dust, no water, oil etc.;
3. Correctly design and assemble components to ensure that the recommended installation accuracy is achieved in the catalogue;
4. It is strictly prohibited to disassemble and reassemble the assembled products, otherwise, the original performance of the products will not be restored;
5. Do not use tools to knock on all parts of the product, please ensure that the products will not lead to flat marks or cracks due to falling during the process of installation and use;
6. During the installation and debugging, be careful to avoid lubricant splash into the eye or touch the skin. Please wear protective goggles and gloves;
7. Before and after use, please seal the product to prevent dust, moisture and other access, please keep in the shade, to prevent direct sunlight, if long-term inventory, please ensure that the rust prevention work;
8. When discarding, please deal with industrial waste.

产品保障服务 Product support services

- 1.正常组装、额定负载运转及润滑充分状态下，质保期为自交期之日起12个月或2000H，以先达到的时间为准；
- 2.因以下情况导致的故障不在保修范围内：

- ①长时间暴露于空气中，因灰尘、潮湿、水浸等因素造成的产品失效；
- ②非本公司实施的改装或拆解而导致的产品损坏；
- ③因违反产品使用规范而导致的故障；
- ④非本产品本身品质因素导致的故障；
- ⑤不可抗力力的自然外力因素导致的故障。

1. Under the condotion of normal assembly, rated load, operation and lubrication in full state, the warranty period is 12 months or 2000H from the date of inbreeding, whichever is the first time of arrival;
2. The failure due to the following conditions is not covered by the warranty:
  - ① Exposure to air for a long time, product failure due to dust, moisture, flooding and other factors;
  - ② Product damage caused by modification or disassembly except for our company;
  - ③ Failure caused by violation of product specifications;
  - ④ The failure caused by the factor except for the quality of the product itself;
  - ⑤ Failure caused by natural external forces of force majeure.

产品用途限制 Limited applications

本产品不能用于以下用途：

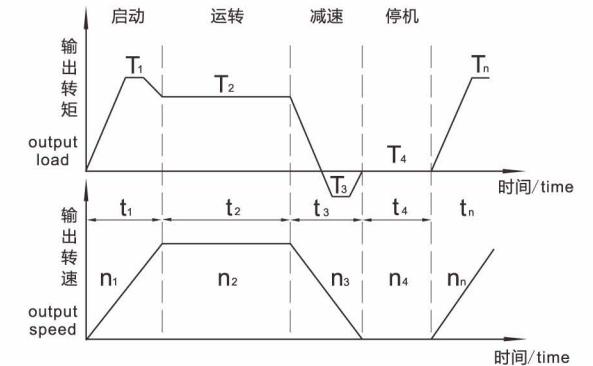
- |             |       |          |             |
|-------------|-------|----------|-------------|
| *航天设施       | *航空设施 | *原子能设施   | *家用电器、设备    |
| *真空设备       | *汽车设备 | *游戏设备    | *直接作用于人体的设备 |
| *以运送人为目的的设备 |       | *特殊环境用设备 |             |

This product cannot be used for the following purposes:  
 Space facilities/Aviation facilities/Atomic energy facility/Household electric appliances  
 Vacuum equipment/Automotive equipment/Sporting facilities/Device used directly in human body  
 Equipment for transport of humans/Equipment for use in special environment

谐波减速机选型流程 Harmonic reducer type selection process

1.输出端平均负载转矩确认 The output average load calculation

$$T_{av} = \sqrt[3]{\frac{n_1 \cdot t_1 \cdot T_1^3 + n_2 \cdot t_2 \cdot T_2^3 + \dots + n_n \cdot t_n \cdot T_n^3}{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}} \leq T_{avmax}$$



$n_n$ : 输出转速/output speed (rpm)

$t_n$ : 时间/time (sec)

$T_n$ : 负载转矩/torque (N. M)

$T_{avmax}$ : 平均负载转矩允许最大值/average load torque maximum allowable value (N. M)

根据上述公式计算出平均负载转矩，再参照各系列谐波减速器的额定参数初步选定型号。  
 According to the above formula to calculate the average load torque and then select the product model by reference to the parameters.

2.计算平均输出转速 Calculate the average output speed

$$n_{oav} = \frac{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}{t_1 + t_2 + \dots + t_n}$$

3.确定减速比 Determine deceleration ratio

$$i = \frac{n_{imax}}{n_{omax}}$$

$n_{imax}$ : 最大输入转速/maximum input speed  
 $n_{omax}$ : 最大输出转速/maximum output speed

4.计算平均输入转速 Calculate average input speed

$$n_{iav} = n_{oav} \cdot i$$

5.计算最高输入转速 Calculate maximum input speed

$$n_{imax} = n_{omax} \cdot i$$

6.确认选定型号是否满足以下条件 Selected models need to meet the following conditions

$$n_{iav} \leq n_{iav \text{ allow}} \quad n_{iav \text{ allow}}: \text{允许平均输入转速/allowable average input speed}$$

$$n_{imax} \leq n_{imax \text{ allow}} \quad n_{imax \text{ allow}}: \text{允许最高输入转速/allowable maximum input speed}$$

7.确认启动和停止时的最大转矩是否在允许的最大值内

Verify that the maximum torque at start and stop is within the allowable maximum

8.确认施加的冲击转矩是否在允许的最大值内

Confirm whether the impact torque is within the allowable maximum value



注意  
事项

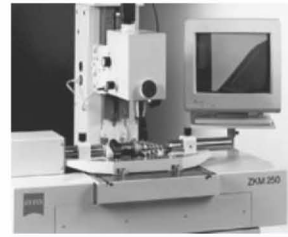
## 主要采用市场



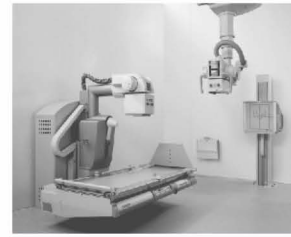
金属机床  
Metal Working Machine



金属加工机械  
Processing Machines



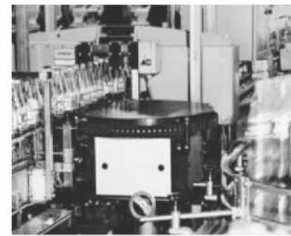
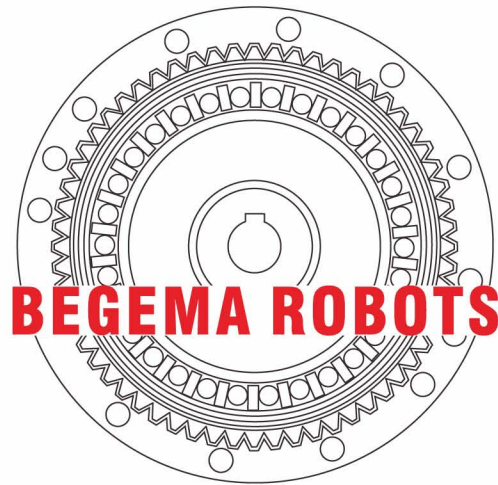
测定·分析·试验设备  
Measurement, Analytical and Test Systems



医疗机械  
Medical Equipment



望远镜  
Telescopes



包装·装箱设备  
Crating and Packaging Machines



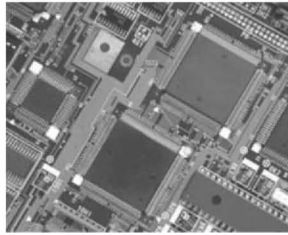
机器人  
Robots



人型机器人  
Humanoid Robots



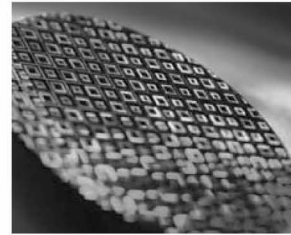
印刷·装订·纸品加工机械  
Printing, Bookbinding and Paper



印刷电路制造装置  
Printed Circuit Board Manufacturing Machines



通信设备  
Communication Equipment



半导体制造装置  
Semiconductor Manufacturing Systems



FPD 制造装置  
Flat Panel Display Manufacturing Systems



木材·轻金属·塑料加工机床  
Wood, Light Metal and Plastic Machine Tools



制造机械  
Paper-making Machines



光学相关机械  
Optical Machines