环动科技 更精准

更可靠 更安静

值得信赖的机器人减速机供应商

TRUSTED SUPPLIER OF ROBOT REDUCER

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2023年版

FMOTION® 环动科技 Fine Motion Technology

高精密关节减速机

High Precision Robot Reducer

- 国家工信部首批智能制造专项成果
- 国家高技术研究发展计划(863) 项目成果
- 获优秀工业新产品一等奖

浙江环动机器人关节科技有限公司

ZHEJIANG FINE-MOTION ROBOT JOINT TECHNOLOGY CO., LTD

企业简介

ENTERPRISE PROFILE

浙江环动机器人关节科技有限公司（以下简称：环动科技）于2020年由控股股东浙江双环传动机械股份有限公司（以下简称：双环传动）注资成立，专门从事机器人关节高精密减速机、高精密液压零部件的研制及产业化，齿轮及其传动系统设计制造、测试分析和故障诊断、强度寿命等领域研究及提供技术服务。

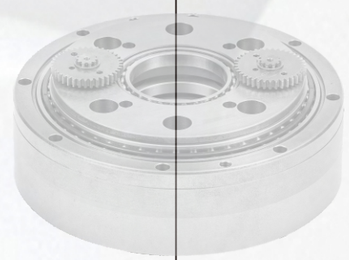
作为新兴技术驱动型企业及新的国家高新技术企业，已有10余年在精密传动领域精耕细作所积累的经验，环动科技致力于攻克我国在精密传动领域的“卡脖子”核心技术，打破技术垄断，加速国产替代。

自成立以来，环动科技将人才队伍的建设作为发展之基。目前拥有员工200余人，其中博士及博士后4人，中高级职称15余人，本科及研究生学位以上30余人。

环动科技拥有两万平米的机器人精密减速机恒温加工车间，数条专业化高精度智能制造产线和装配线，高精密加工及高精度检测设备达 60 余台，拥有专业的材料性能分析、热处理实验、强度寿命实验室，以及功能完善的机器人精密减速机整机综合性能和寿命实验室。

环动科技前身双环传动研究院作为母公司双环传动承担国家“863计划”项目、“工业机器人RV减速器研制和应用示范”项目和国家工信部智能制造专项“工业机器人高精度减速机智能制造建设项目”等多项项目的实施主体，自主研发了型谱齐全的40余种型号的高精密减速机，各项性能指标均达到国际先进水平，与国内外多家知名机器人厂商建立了良好的长期战略合作关系。

环动科技围绕精密减速器设计、制造、装配、检测等关键环节：申报专利50余项，发表多篇论文，参与制定国家标准4项，制定企业标准20余项。为我国工业机器人高精密减速器国产替代、加速国产机器人国产市场占有率的提升，进而为提升我国智能制造装备水平做出贡献。我们将一直致力于为全球高精密传动领域提供卓越的产品，以小博大，以精创优。



企业理念

ENTERPRISE CONCEPT

【企业愿景】让传动更精准、更可靠、更安静

【企业使命】为客户创造价值 为员工创造机会 为股东创造收益 为社会创造效益

【核心价值观】做最值得信赖的机器人减速机供应商

【企业精神】双环品质，环动传承 好一点，好很多

【经营理念】以质量求生存，以管理求效益，以创新求发展

【技术理念】致力于攻克我国在精密传动领域的“卡脖子”核心技术，打破技术垄断，加速国产替代

【服务理念】用心 专业 敏捷 高效

【管理理念】讲方法，求实效，重人本，促创新

【营销理念】技术嵌入式营销

【质量理念】一丝不苟，精益求精

【安全理念】居安思危，常备不懈，全员参与，齐抓共管

【成本理念】强意识，重行动，提效率，促改善

【学习理念】勤思善问，求实纳新，干中成长

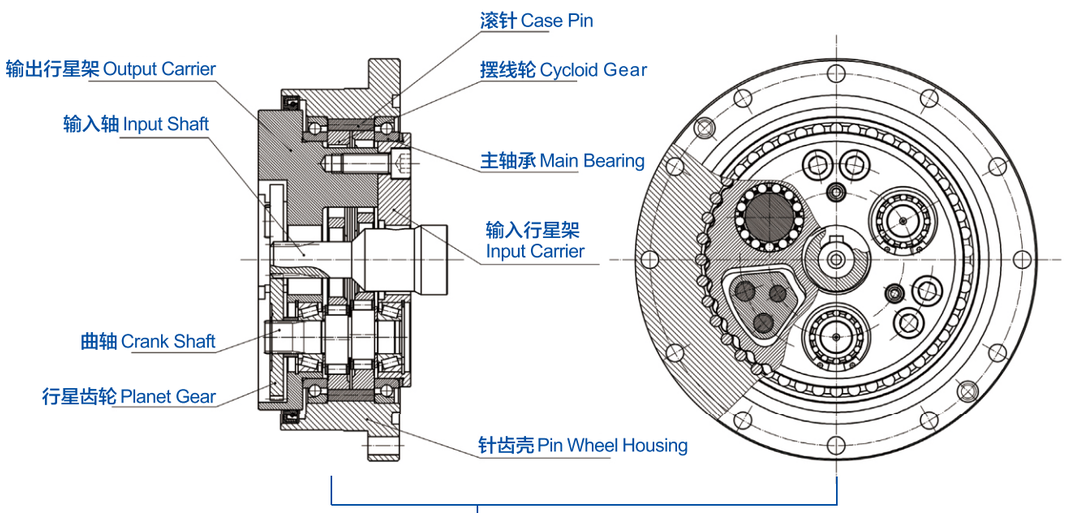
【人才理念】以人为本 以德为先 技术为根 创新为魂

【企业作风】尽心，尽力，尽职，尽责

【企业口号】环动科技，一如既往，精准可靠

SHPR-E

Operating Principle
工作原理

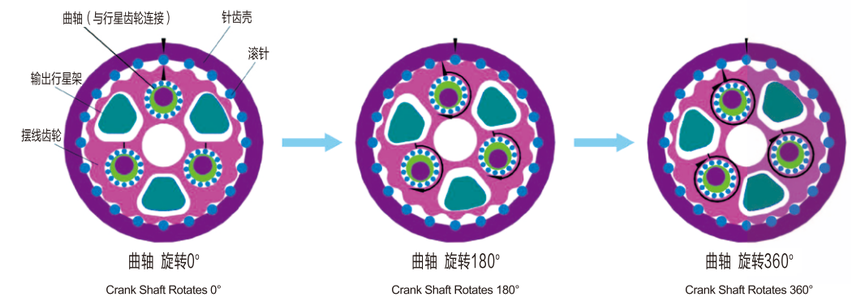


■ SHPR-E 减速机构造图 | SHPR-E Reducer Structure Diagram

SHPR-E 减速机是由一个行星齿轮减速机的一级和一个摆线针轮减速机的后级组成的二级减速机。第一级减速经输入轴的旋转由输入轴上的齿轮传递到行星齿轮，按齿数比进行减速；行星齿轮与曲轴相连接，第二级减速经曲轴的旋转带动摆线轮做偏心运动，曲轴旋转 1 周，摆线轮将沿与曲轴运动相反方向转动 1 个齿。

SHPR-E is a two-stage gear reducer which consists of the 1st stage of planetary gear reducer and the 2nd stage of cycloidal pin-wheel reducer. The first speed reduction is achieved by the meshing between the input shaft gear and the planetary gear based on the gear reduction ratio. The planet gear is connected to the crank shaft, and the rotation of crank shaft causes the eccentric rotation of the cycloid disc. This achieves the second speed reduction and thus if the crank shaft rotates 360°, the cycloid disc will rotate one tooth in the opposite direction.

▼ E 系列工作原理图　E Series Working Principle Diagram



输入轴转动时速比：

$$R=1+\frac{Z2}{Z1}\cdot Z3$$

- R：速比值
- Z1: 输入轴齿数
- Z2: 行星齿轮齿数
- Z3: 滚针数

Speed Ratio When Input Shaft Rotation:

$$R=1+\frac{Z2}{Z1}\cdot Z3$$

- R：Speed ratio value
- Z1: Input Shaft Teeth
- Z2: Planet Gear Teeth
- Z3:Case Pin Number

Model Designations
型号表示

■ 订购、咨询时，请按下述型号标记进行指示。
When ordering, consulting, please follow the model markup instructions below.

SHPR	20	E	141

减速机类型
Reducer Type

机座号（参考额定值表）
Stand NO. (Reference Rated Data)

机型（E：主轴内置）
Model (E: Spindle Build-in)

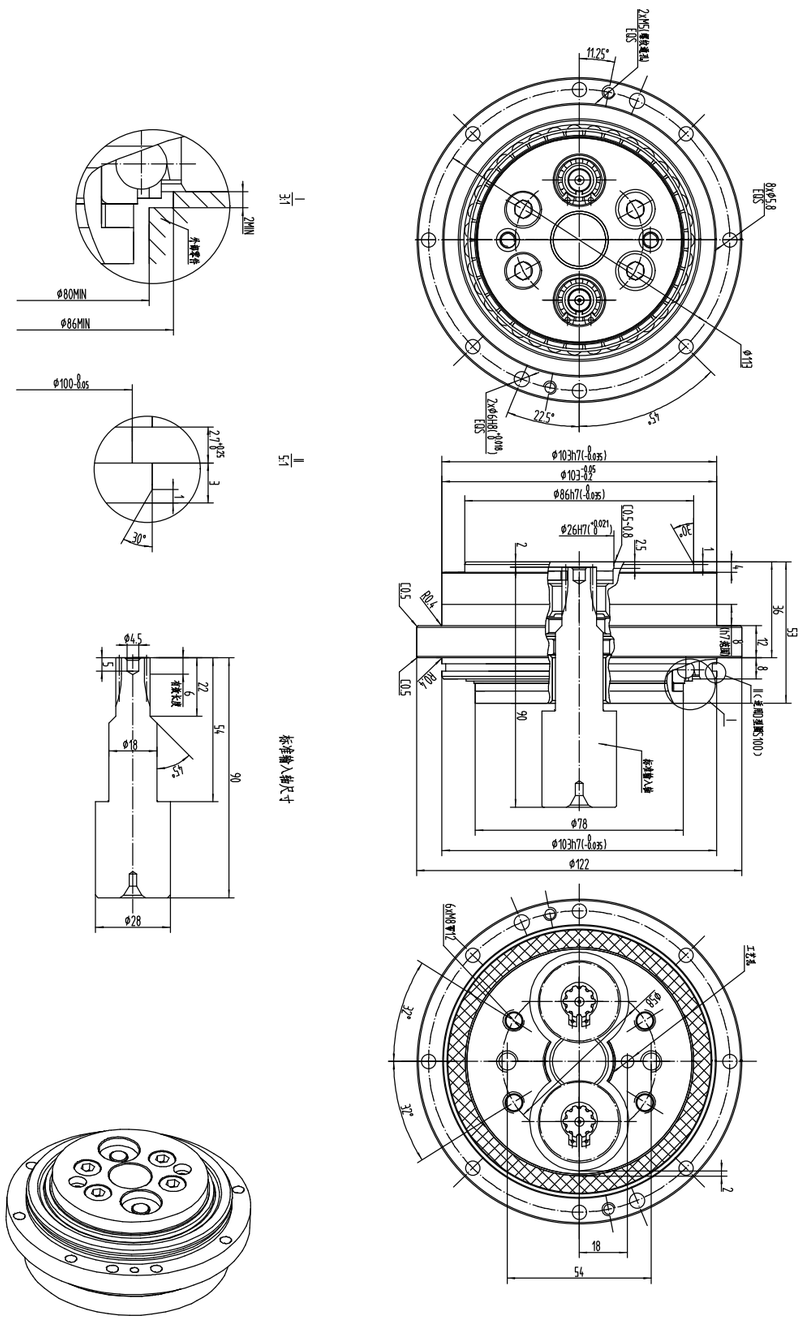
速比值（减速比 =1/R，参考额定值表）
Speed Ratio (Reduction Ratio = 1/R , Reference Rated Data)

SHPR-E | Rated Data 额定值表

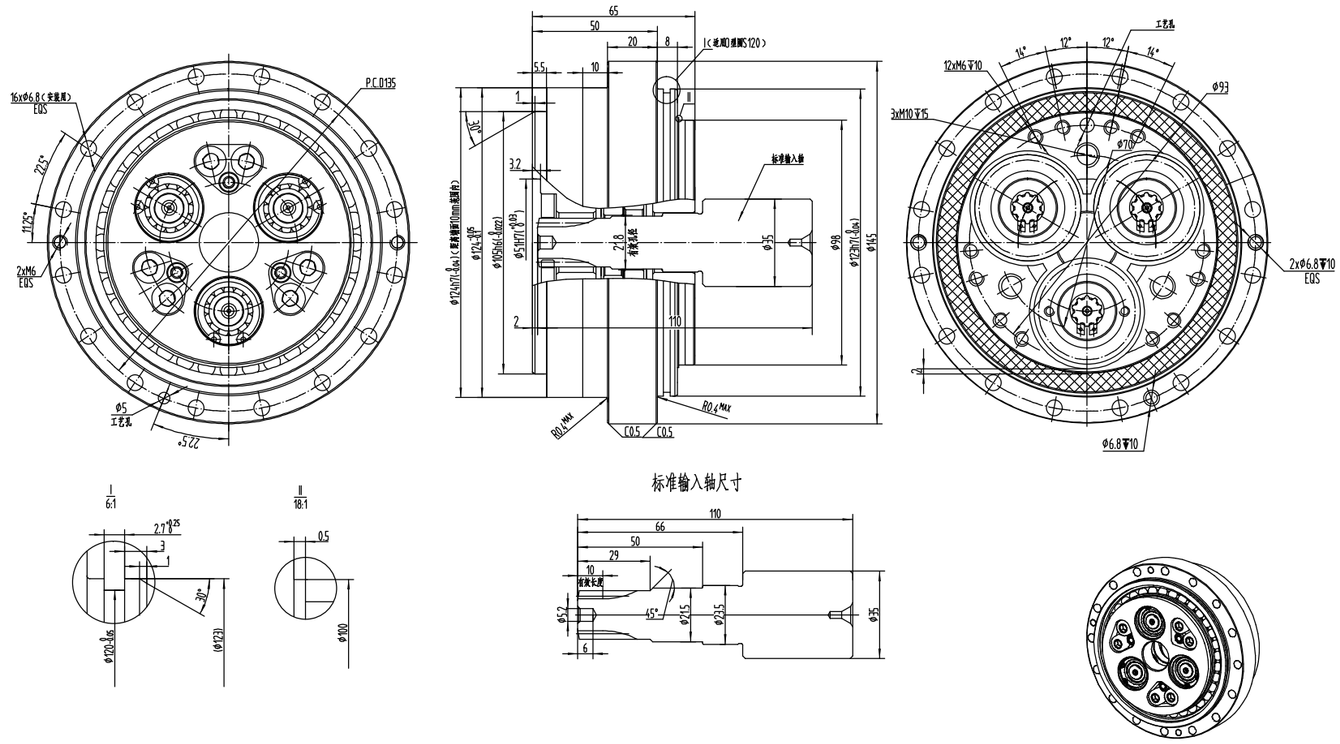
输出转速Output Speed (r/min)			5		10		15		20		20	25		30		40		50		60	
型号 Model	减速比 Ratio 轴旋转 Shaft Rotation	减速比 Ratio 外壳旋转 Shell Rotation	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)		输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)
SHPR-6E	ASK		101	0.07	81	0.11	72	0.15	66		0.19	62	0.22	58	0.25	54	0.3	50	0.35	47	0.4
SHPR-20E	57	56	231	0.16	188	0.26	167	0.35	153		0.43	143	0.5	135	0.57	124	0.70	115	0.81	110	0.92
	81	80																			
	105	104																			
	121	120																			
	141	140																			
	161	160																			
SHPR-35E	ASK		329	0.23	265	0.37	238	0.5	218		0.61	203	0.71	192	0.8	176	0.98	163	1.14	150	1.26
SHPR-40E	57	56	572	0.40	465	0.65	412	0.86	377		1.05	353	1.23	334	1.40	307	1.71	287	2.00	271	2.27
	81	80																			
	105	104																			
	121	120																			
	153	152																			
SHPR-65E	ASK		745	0.52	607	0.85	538	1.13	492		1.37	460	1.61	435	1.82	400	2.23	373	2.6	352	2.95
SHPR-80E	57	56	1088	0.76	885	1.24	784	1.64	719		2.01	672	2.35	637	2.67	584	3.26	546	3.81	517	4.33
	81	80																			
	101	100																			
	121	120																			
	153	152																			
SHPR-110E	81	80	1499	1.05	1215	1.70	1078	2.26	990		2.76	925	3.23	875	3.67	804	4.49	—	—	—	—
	111	110																			
	161	160																			
	175.28	174.28																			
SHPR-160E	81	80	2176	1.52	1774	2.48	1568	3.28	1441		4.02	1343	4.69	1274	5.34	—	—	—	—	—	—
	101	100																			
	129	128																			
	145	144																			
	171	170																			
SHPR-320E	81	80	4361	3.04	3538	4.94	3136	6.57	2881		8.05	2695	9.41	2548	10.7	—	—	—	—	—	—
	101	100																			
	118.5	117.5																			
	129	128																			
	141	140																			
	171	170																			
	185	184																			
SHPR-320E3	201	200	4361	3.04	3538	4.94	3136	6.57	2881		8.05	2695	9.41	—	—	—	—	—	—	—	—
	219.46	218.46																			
SHPR-450E	81	80	6135	4.28	4978	6.95	4410	9.24	4047		11.3	3783	13.2	—	—	—	—	—	—	—	—
	101	100																			
	118.5	117.5																			
	129	128																			
	154.8	153.8																			
	171	170																			
	192.4	191.4																			

型号 Model	启动停止容许转矩 Allowable Acceleration/Deceleration Torque (Nm)	瞬时最大容许转矩 Momentary Max Allowable Torque (Nm)	容许力矩 Allowable Moment (Nm)	瞬时最大容许力矩 Momentary Max Allowable Moment (Nm)	倾覆刚度 Capsized Stiffness (Nm/arc. min)	扭转刚度 Reverse Stiffness (Nm/arc. min)	空程回差 Max. Blacklash (arc.min)	允许轴向负载 Allowable Axial Load(N)	重量 Weight (kg)
SHPR-6E	117	294	196	392	117	20	1'	1470	2.5
SHPR-20E	412	833	882	1764	372	49	1'	3920	4.7
SHPR-35E	595	1190	1103	2206	372	73	1'	4312	4.6
SHPR-40E	1029	2058	1666	3332	931	108	1'	5196	9.3
SHPR-65E	1345	2690	1916	3832	931	162	1'	5250	9.5
SHPR-80E	1960	3920	2156	4312	1176	196	1'	7950	13.1
SHPR-110E	2695	5390	2940	5880	1470	294	1'	10890	17.4
SHPR-160E	3920	7840	3920	7840	2940	392	1'	15000	26.4
SHPR-320E	7840	15680	7056	14112	4900	980	1'	19800	44.3
SHPR-320E3	7840	15680	7840	15680	4950	1078	1'	21070	45.5
SHPR-450E	11025	22050	8820	17640	7448	1176	1'	24700	66.4

SHPR-6E 输出轴螺栓紧固型外形尺寸图 Dimension



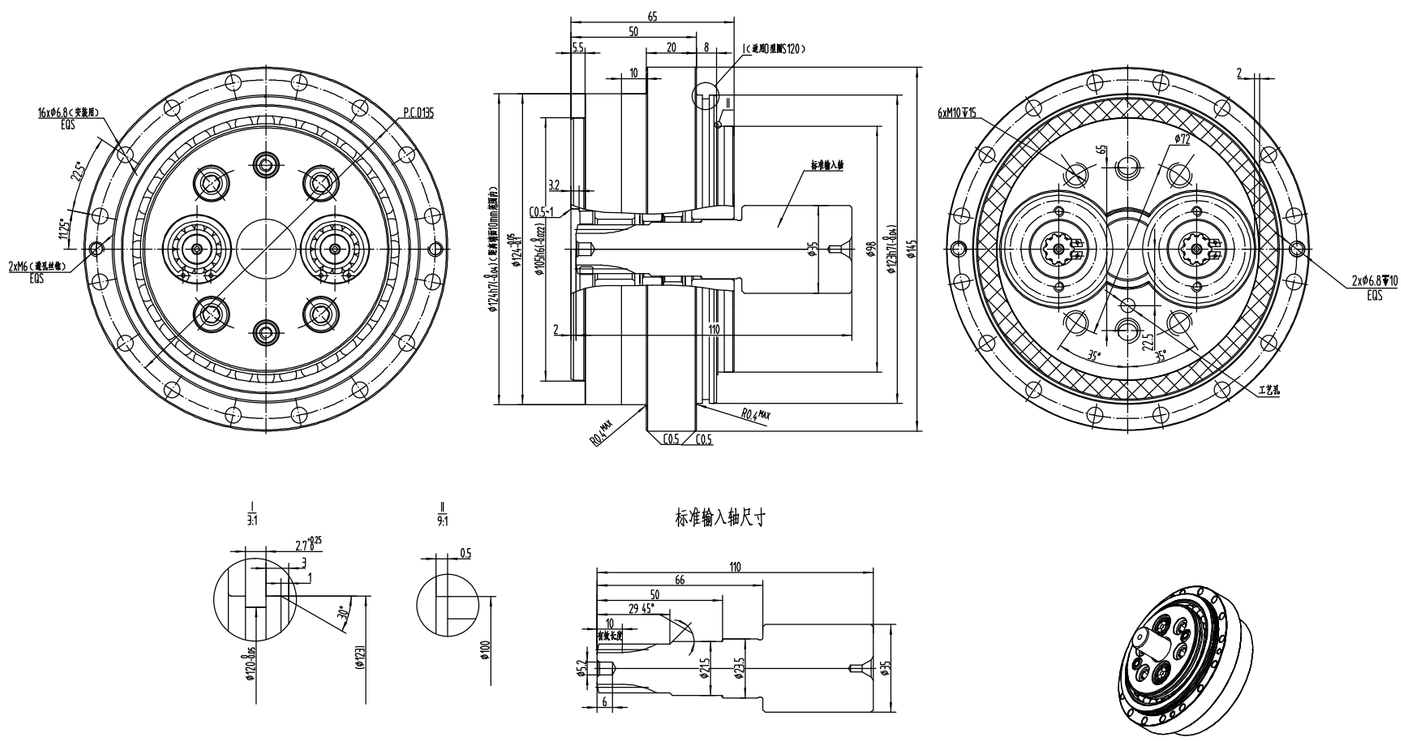
SHPR-35E 输出轴螺栓紧固型外形尺寸图 Dimension



注).可根据厂家具体使用要求定制不同减速比的输入轴和行星齿轮。

Different input shafts and planet gears can be customized according to the using requirements.

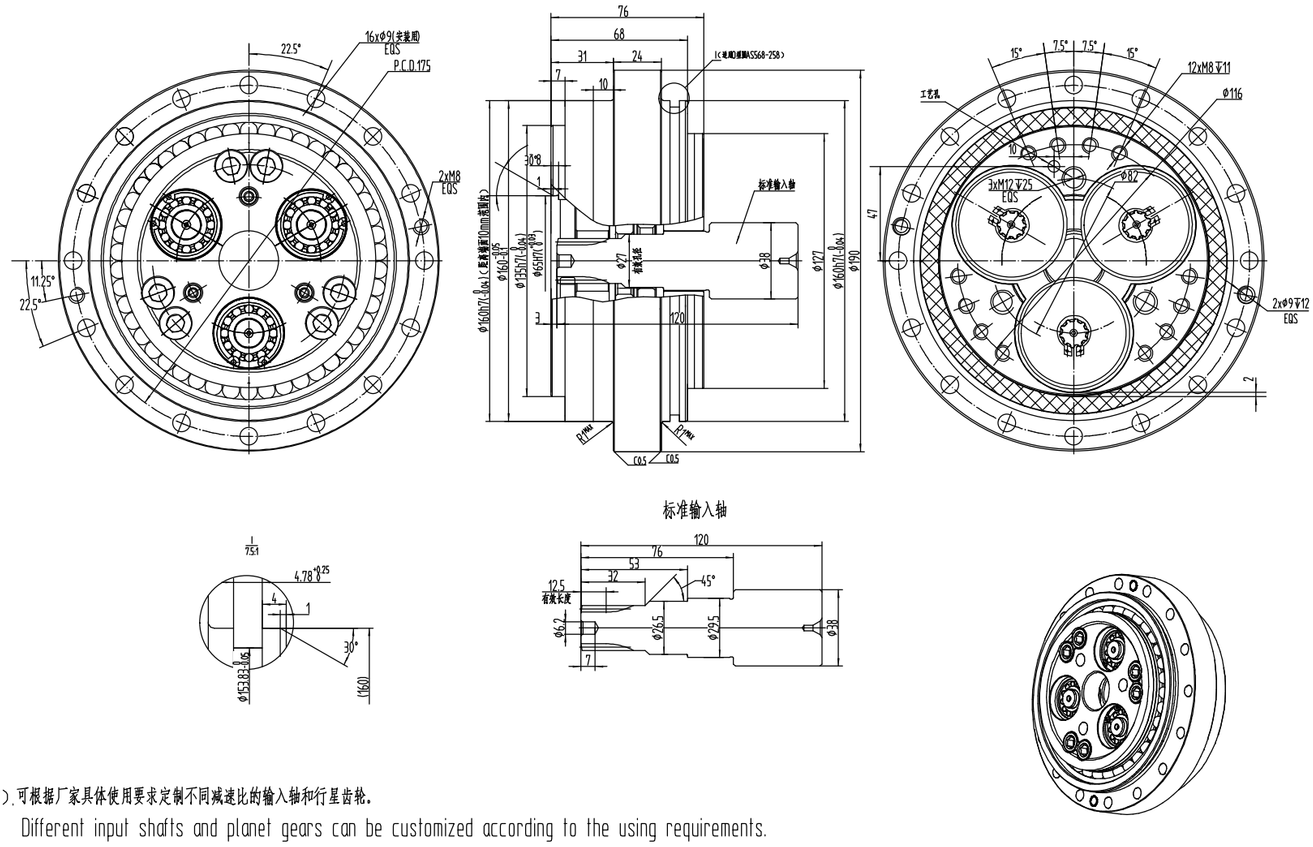
SHPR-20E 输出轴螺栓紧固型外形尺寸图 Dimension



注).可根据厂家具体使用要求定制不同减速比的输入轴和行星齿轮。

Different input shafts and planet gears can be customized according to the using requirements.

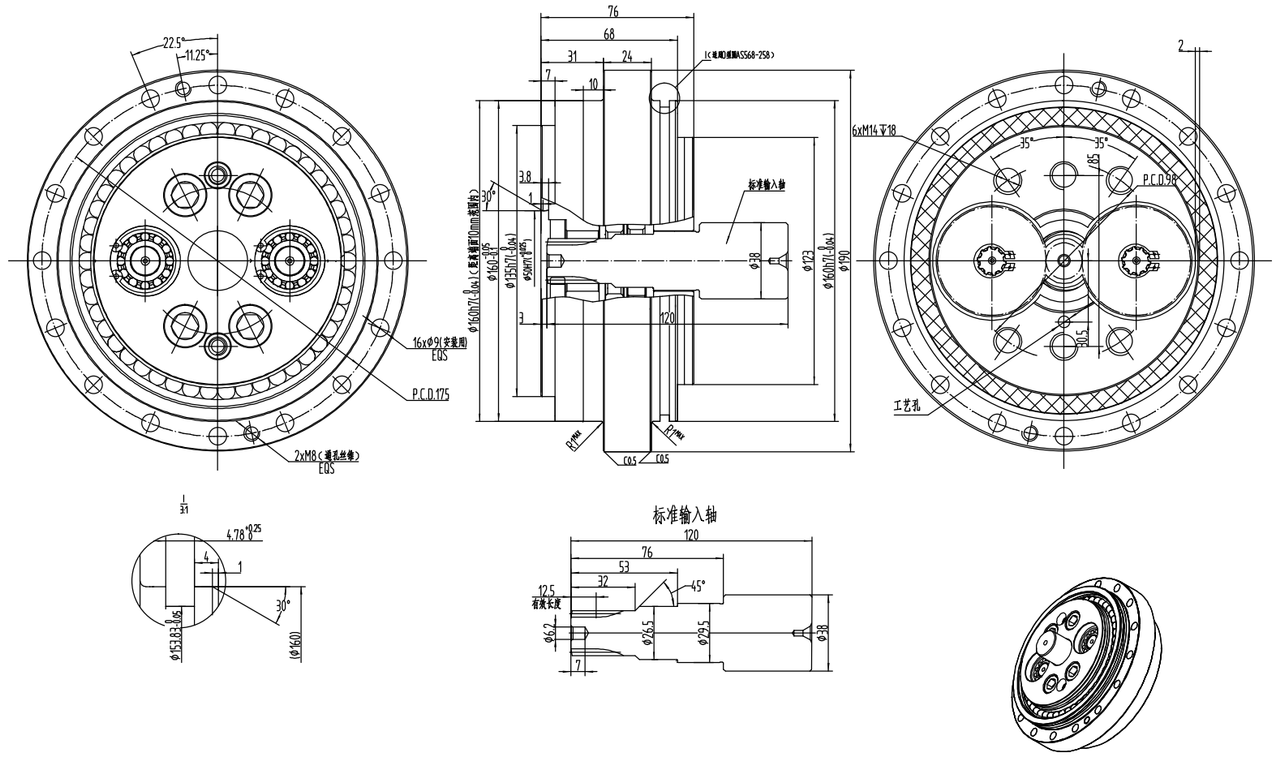
SHPR-65E 输出轴螺栓紧固型外形尺寸图 Dimension



注).可根据厂家具体使用要求定制不同减速比的输入轴和行星齿轮。

Different input shafts and planet gears can be customized according to the using requirements.

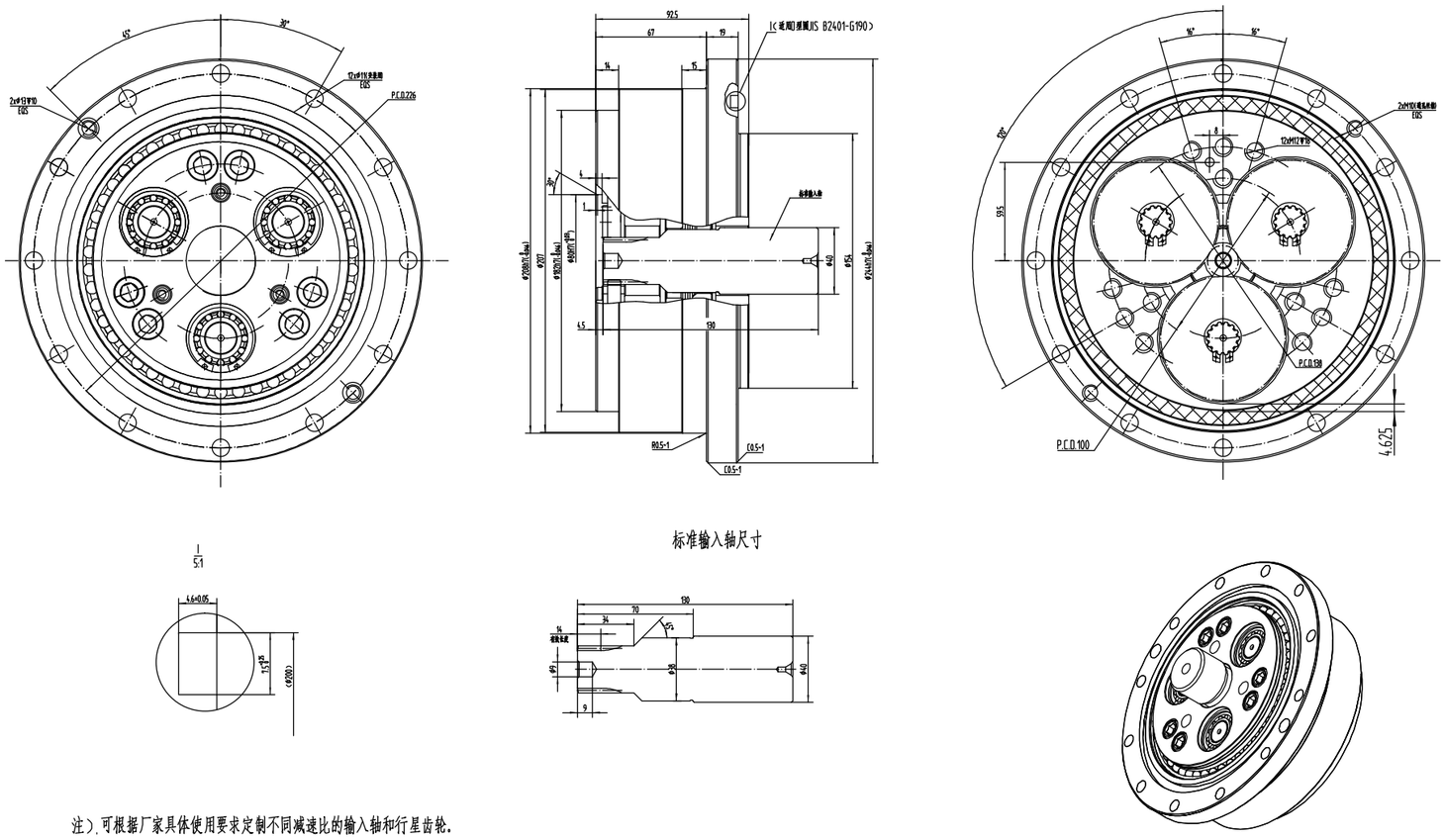
SHPR-40E 输出轴螺栓紧固型外形尺寸图 Dimension



注).可根据厂家具体使用要求定制不同减速比的输入轴和行星齿轮。

Different input shafts and planet gears can be customized according to the using requirements.

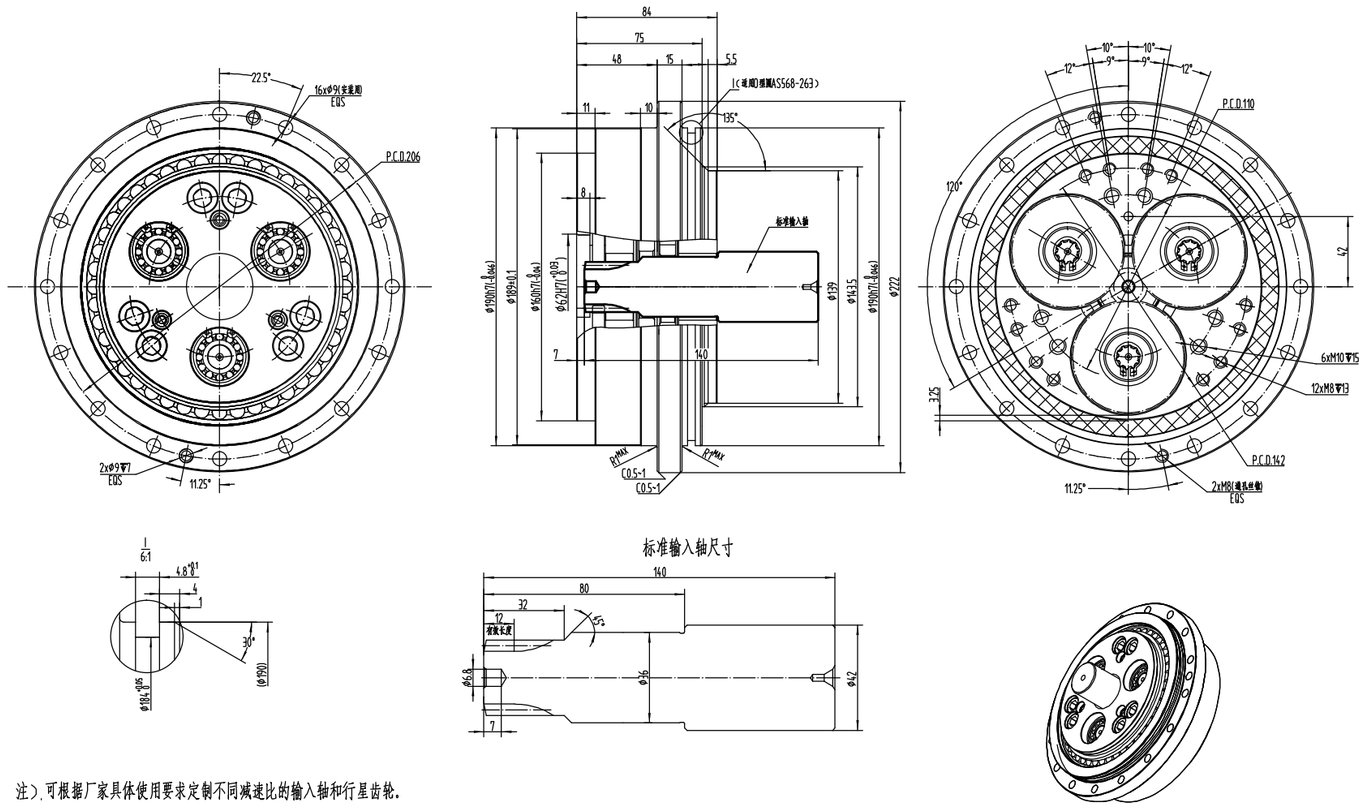
SHPR-110E 输出轴螺栓紧固型外形尺寸图 Dimension



注).可根据厂家具体使用要求定制不同减速比的输入轴和行星齿轮。

Different input shafts and planet gears can be customized according to the using requirements.

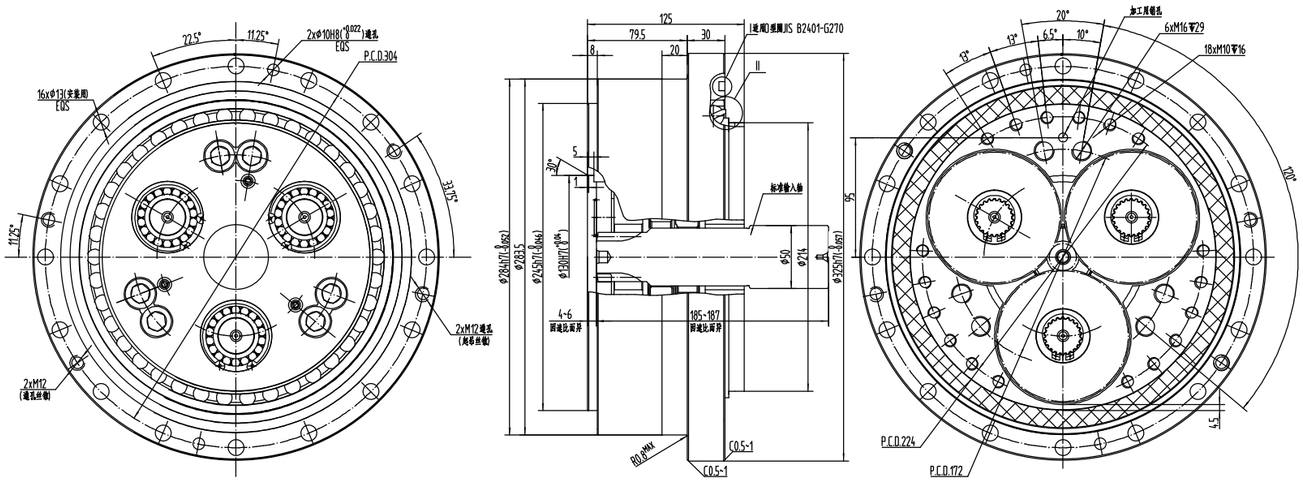
SHPR-80E 输出轴螺栓紧固型外形尺寸图 Dimension

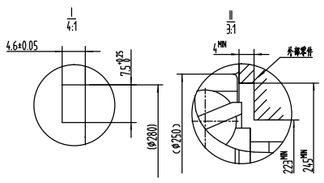


注).可根据厂家具体使用要求定制不同减速比的输入轴和行星齿轮。

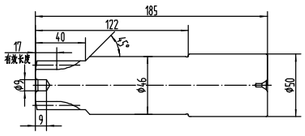
Different input shafts and planet gears can be customized according to the using requirements.

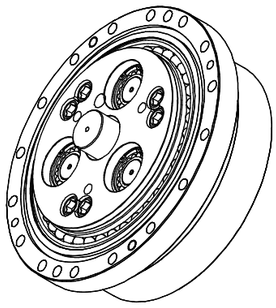
SHPR-320E 输出轴螺栓紧固型外形尺寸图 Dimension





标准输入轴尺寸(不同速比的轴尺寸有差异，需询问确认)

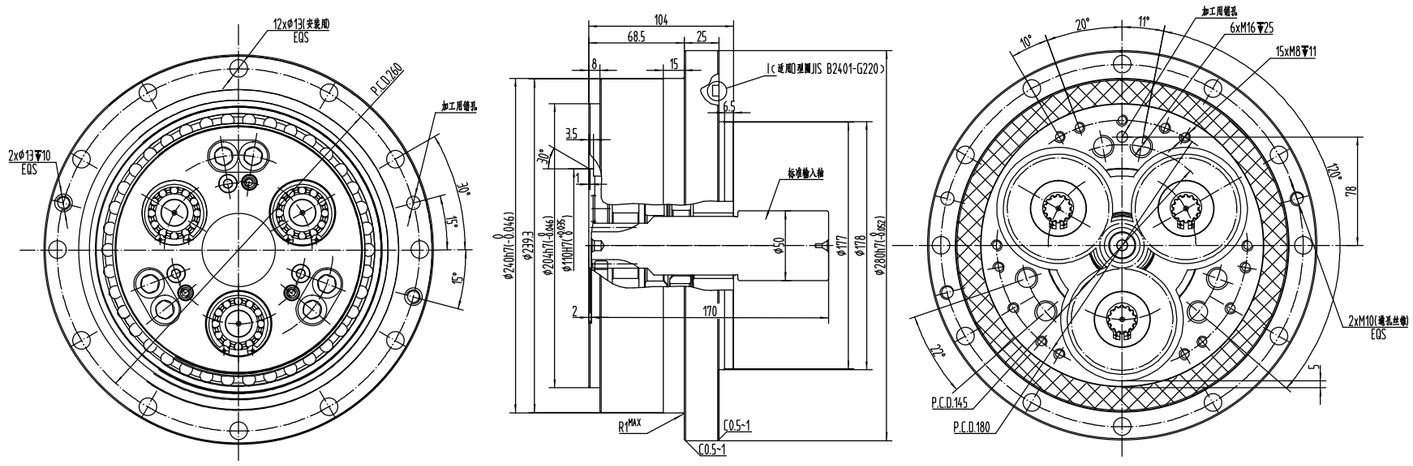


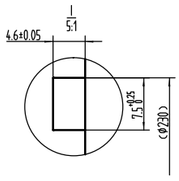


注)、可根据厂家具体使用要求定制不同减速比的输入轴和行星齿轮。

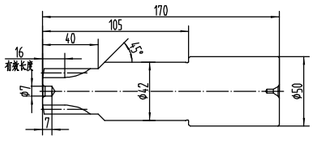
Different input shafts and planet gears can be customized according to the using requirements.

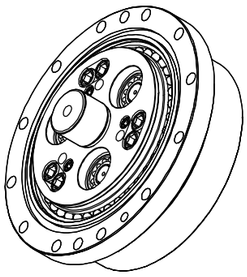
SHPR-160E 输出轴螺栓紧固型外形尺寸图 Dimension





标准输入轴尺寸

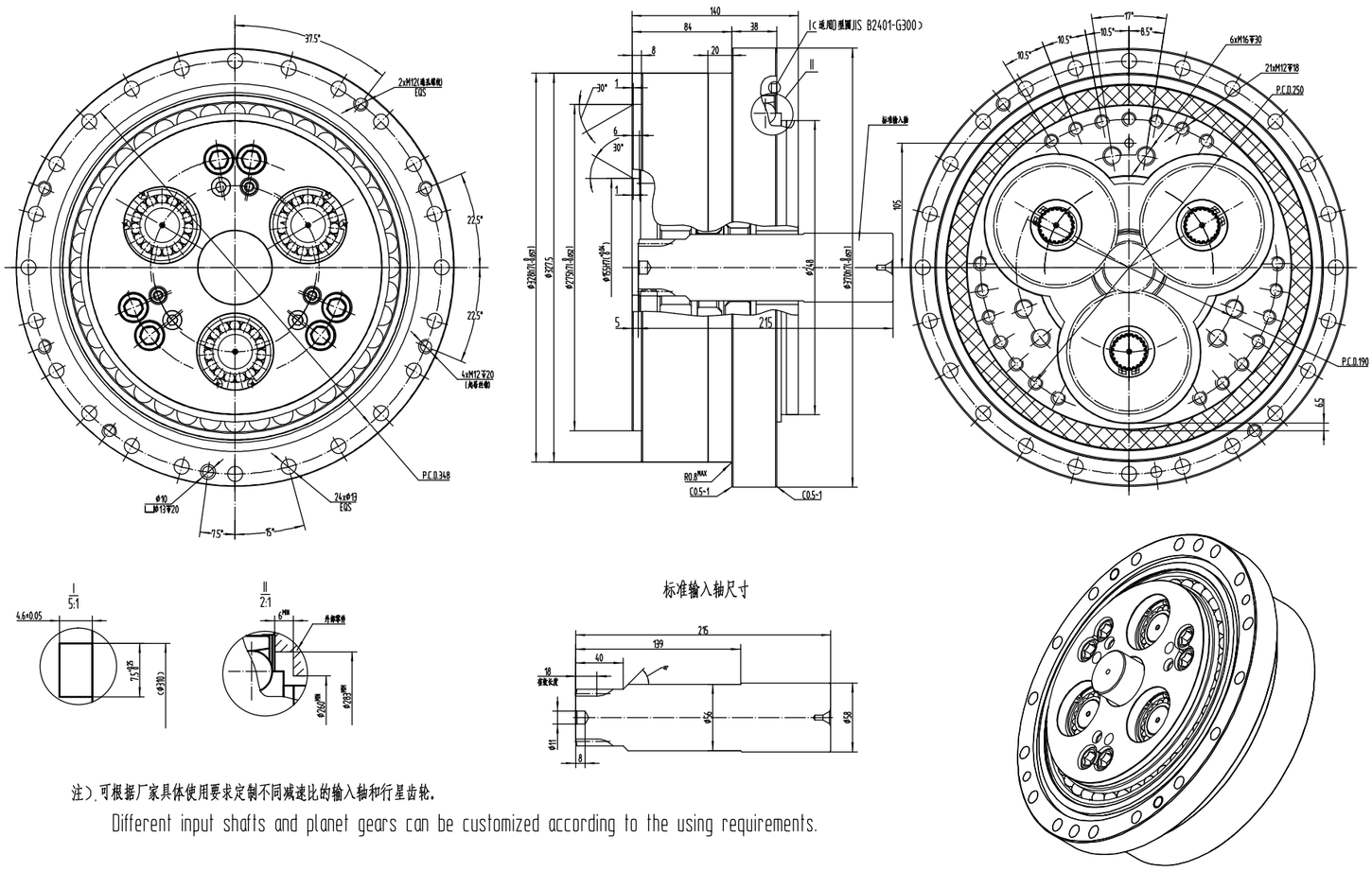




注)、可根据厂家具体使用要求定制不同减速比的输入轴和行星齿轮。

Different input shafts and planet gears can be customized according to the using requirements.

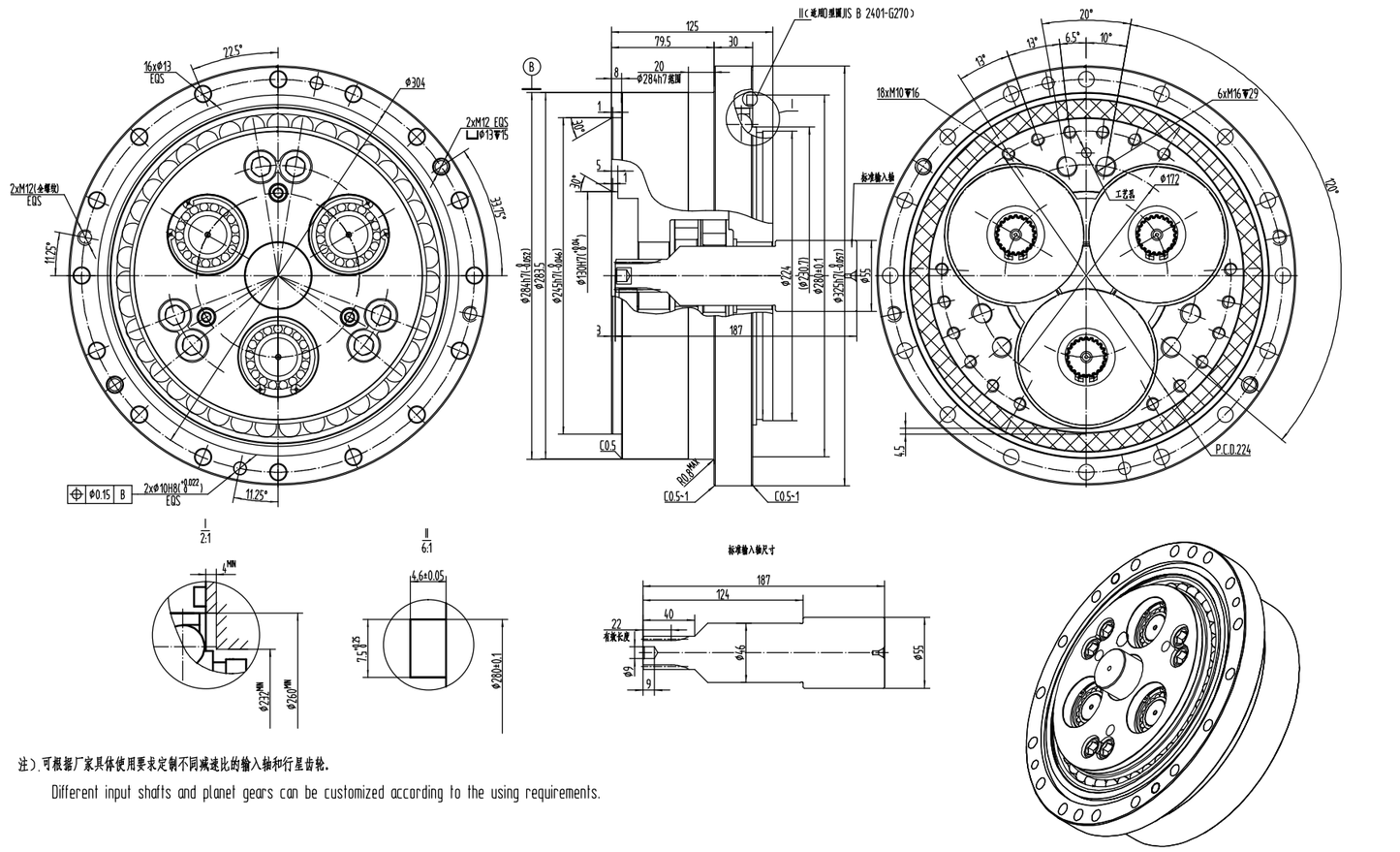
SHPR-450E 输出轴螺栓紧固型外形尺寸图 Dimension



注）.可根据厂家具体使用要求定制不同减速比的输入轴和行星齿轮.

Different input shafts and planet gears can be customized according to the using requirements.

SHPR-320E3 输出轴螺栓紧固型外形尺寸图 Dimension

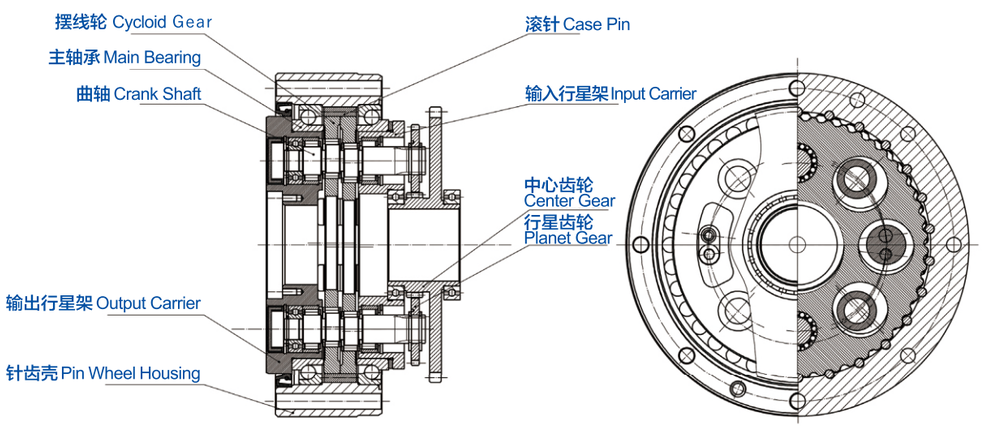


注）.可根据厂家具体使用要求定制不同减速比的输入轴和行星齿轮.

Different input shafts and planet gears can be customized according to the using requirements.

SHPR-C

Operating Principle
工作原理

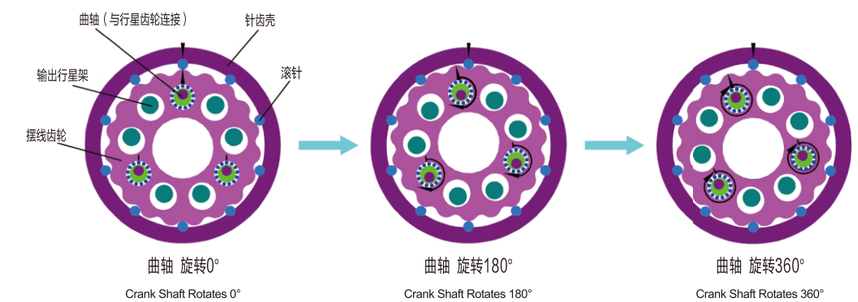


SHPR-C 减速机构造图 | SHPR-C Reducer Structure Diagram

SHPR-C 减速机是由一个行星齿轮减速机的一级和一个摆线针轮减速机的后级组成的二级减速机。第一级减速经中心齿轮的旋转由中心齿轮上的小齿轮传递到行星齿轮，按齿数比进行减速；行星齿轮与曲轴相连接，第二级减速经曲轴的旋转带动摆线轮做偏心运动，曲轴旋转 1 周，摆线轮将沿与曲轴运动相反方向转动 1 个齿。

SHPR-C is a two-stage gear reducer which consists of the 1st stage of planetary gear reducer and the 2nd stage of cycloidal pin-wheel reducer. The first speed reduction is achieved by the meshing between the big gear of center gear and the planetary gear based on the gear reduction ratio. The planet gear is connected to the crank shaft, and the rotation of crank shaft causes the eccentric rotation of the cycloid disc. This achieves the second speed reduction and thus if the crank shaft rotates 360°, the cycloid disc will rotate one tooth in the opposite direction.

▼ C 系列工作原理图　C Series Working Principle Diagram



中心齿轮转动时速比：

$$R=1+\frac{Z2}{Z1}\cdot Z3$$

- R：速比值
- Z1: 中心齿轮小齿轮齿数
- Z2: 行星齿轮齿数
- Z3: 滚针数

Speed Ratio When Center Gear Rotation:

$$R=1+\frac{Z2}{Z1}\cdot Z3$$

- R：Speed ratio value
- Z1: Small Gear Teeth of Center Gear
- Z2: Planet Gear Teeth
- Z3:Case Pin Number

Model Designations
型号表示

订购、咨询时，请按下述型号标记进行指示。
When ordering, consulting, please follow the model markup instructions below.

SHPR	10	C

减速机类型
Reducer Type

机座号（参考额定值表）
Stand NO. (Reference Rated Data)

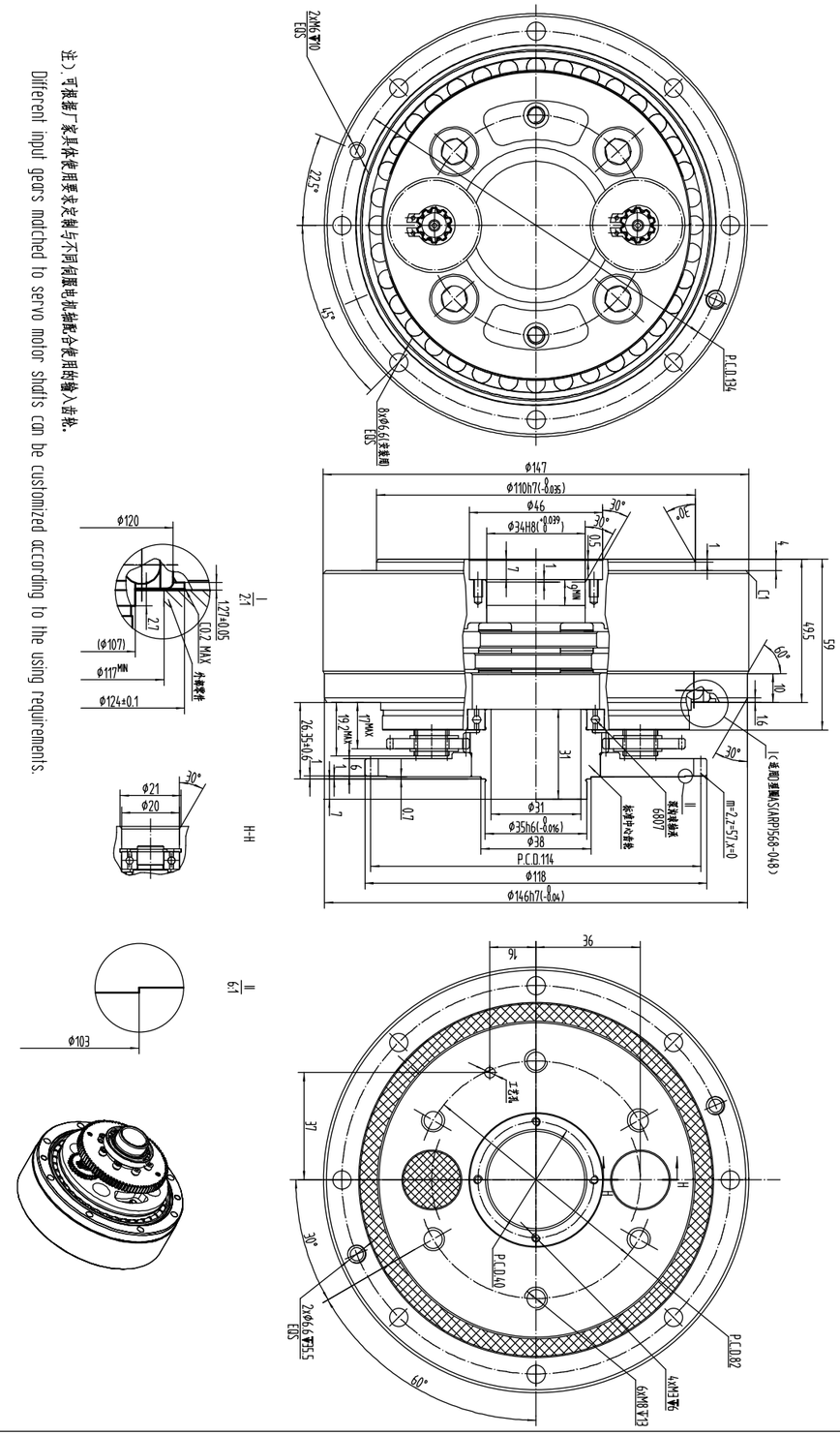
机型（ C：中空型 ）
Model （C: Hollow)

SHPR-C | Rated Data 额定值表

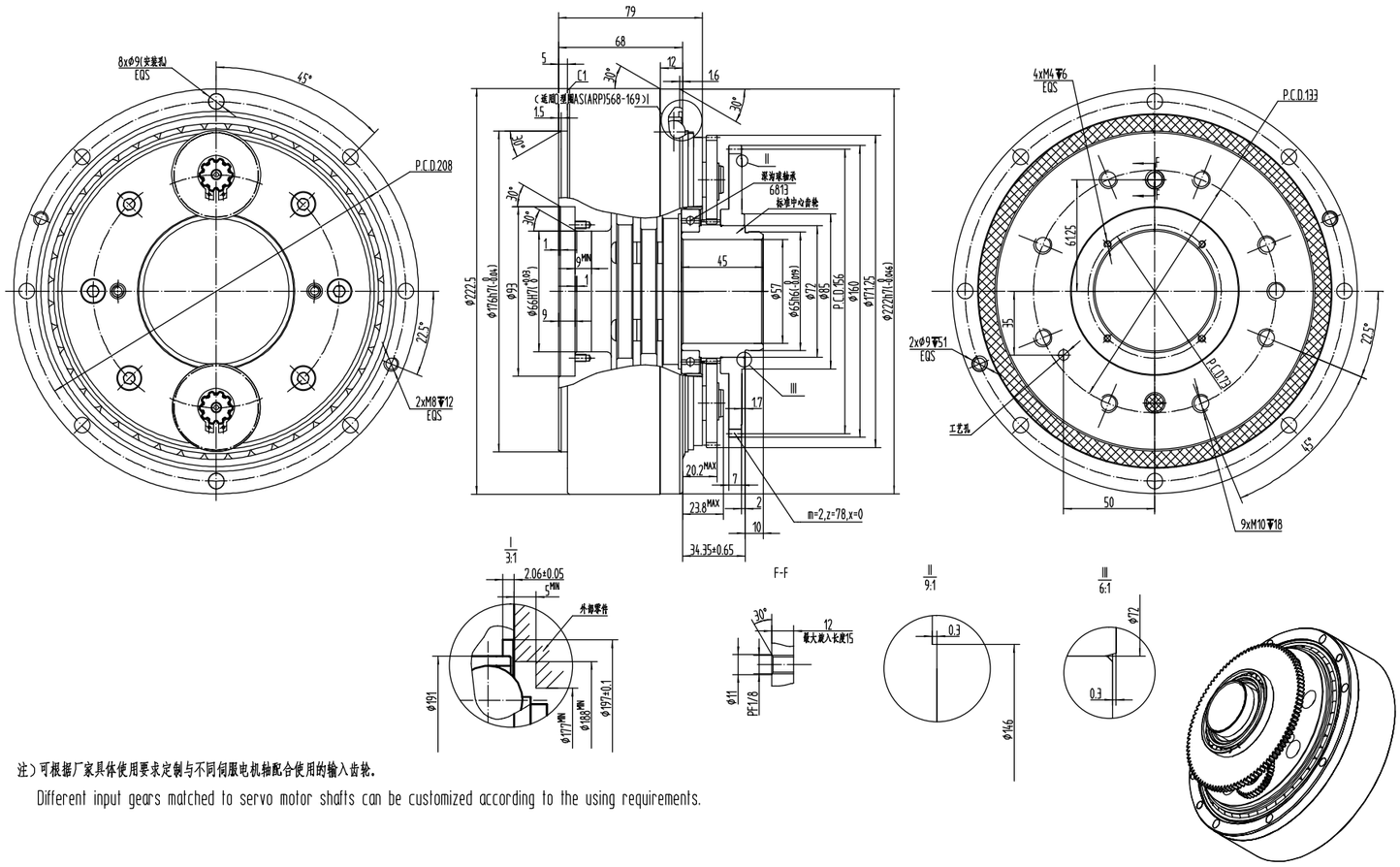
输出转速Output Speed (r/min)			5		10		15		20		20	25		30		40		50		60	
型号 Model	减速比 Ratio																				
	电机在外壳侧 Motor In Shell	电机在轴侧 Motor In Shaft	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)		输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)	输出转矩 Output Torque (Nm)	输入功率 Input Power (kW)
SHPR-10C	27	26	136	0.09	111	0.16	98	0.21	90		0.25	84	0.29	80	0.34	73	0.41	68	0.47	65	0.54
SHPR-27C	36.57	35.57	368	0.26	299	0.42	265	0.55	243		0.68	227	0.79	215	0.90	197	1.10	184	1.29	174	1.46
SHPR-50C	32.54	31.54	681	0.48	554	0.77	490	1.03	450		1.26	420	1.47	398	1.67	366	2.04	341	2.38	——	——
SHPR-100C	36.75	35.75	1362	0.95	1017	1.55	980	2.05	899		2.51	841	2.94	796	3.33	730	4.08	——	——	——	——
SHPR-120C	36.75	35.75	1422	0.992	1308	1.825	1176	2.46	1085		3.03	907	3.16	823	3.45	765	4.27	——	——	——	——
SHPR-200C	34.86	33.86	2724	1.9	2215	3.09	1961	4.11	1803		5.04	1686	5.88	1597	6.69	——	——	——	——	——	——
SHPR-260CA	ASK		3543	2.47	2875	4.01	2548	5.34	2341		6.54	——	——	——	——	——	——	——	——	——	——
SHPR-320CA	ASK		4361	3.04	3538	4.94	3136	6.57	2881		8.05	2690	9.41	——	——	——	——	——	——	——	——
SHPR-320C	35.61	34.61	4361	3.04	3538	4.94	3136	6.57	2881		8.05	2690	9.41	——	——	——	——	——	——	——	——
SHPR-500C	37.34	36.34	6811	4.75	5537	7.73	4900	10.26	4498		12.56	——	——	——	——	——	——	——	——	——	——

型号 Model	启动停止容许转矩 Allowable Acceleration/Deceleration Torque (Nm)	瞬时最大容许转矩 Momentary Max Allowable Torque (Nm)	容许力矩 Allowable Moment (Nm)	瞬时最大容许力矩 Momentary Max Allowable Moment (Nm)	倾覆刚度 Capsized Stiffness (Nm/arc.min)	扭转刚度 Reverse Stiffness (Nm/arc.min)	空程回差 Max. Blacklash (arc.min)	允许轴向负载 Allowable Axial Load(N)	重量 Weight (kg)
SHPR-10C	245	490	686	1372	421	47	1'	5890	4.6
SHPR-27C	662	1323	980	1960	1068	147	1'	8840	8.5
SHPR-50C	1225	2450	1764	3528	1960	255	1'	11750	14.6
SHPR-100C	2450	4900	2450	4900	2813	510	1'	13760	19.5
SHPR-120C	2940	5880	3920	7840	2813	588	1'	15600	20.4
SHPR-200C	4900	9800	8820	17640	9800	980	1'	19700	55.6
SHPR-260CA	6370	12740	12740	25480	8320	1540	1'	24500	68.6
SHPR-320CA	7840	15680	20580	39200	12740	1960	1'	29600	92.1
SHPR-320C	7840	15680	20580	39200	12740	1960	1'	29600	79.5
SHPR-500C	12000	24000	34000	78400	24100	3400	1'	39200	154

SHPR-10C-A-B 输出轴轴栓紧固型外形尺寸图 Dimension



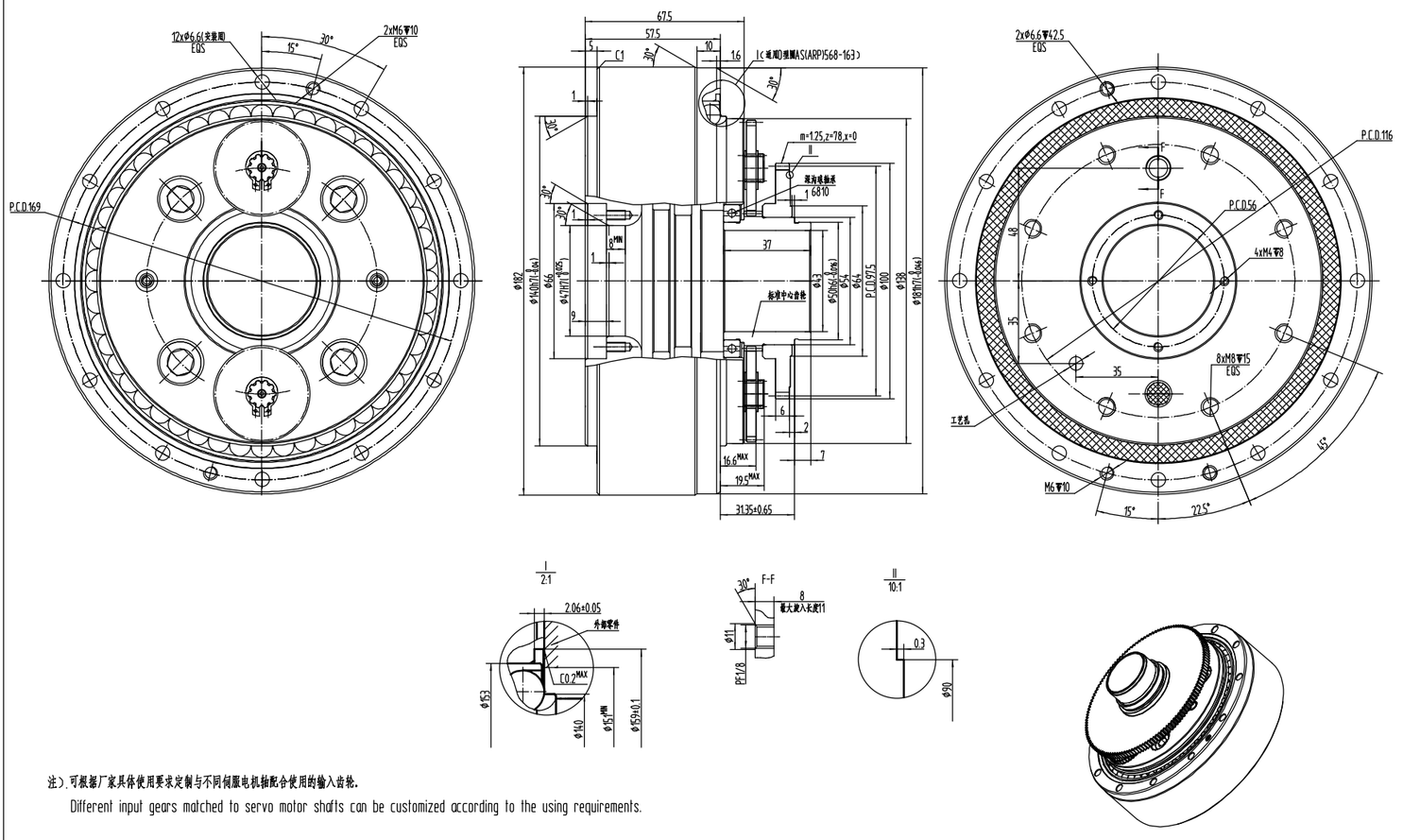
SHPR-50C-A-B 输出轴螺栓紧固型外形尺寸图 Dimension



注）可根据厂家具体使用要求定制与不同伺服电机轴配合使用的输入齿轮。

Different input gears matched to servo motor shafts can be customized according to the using requirements.

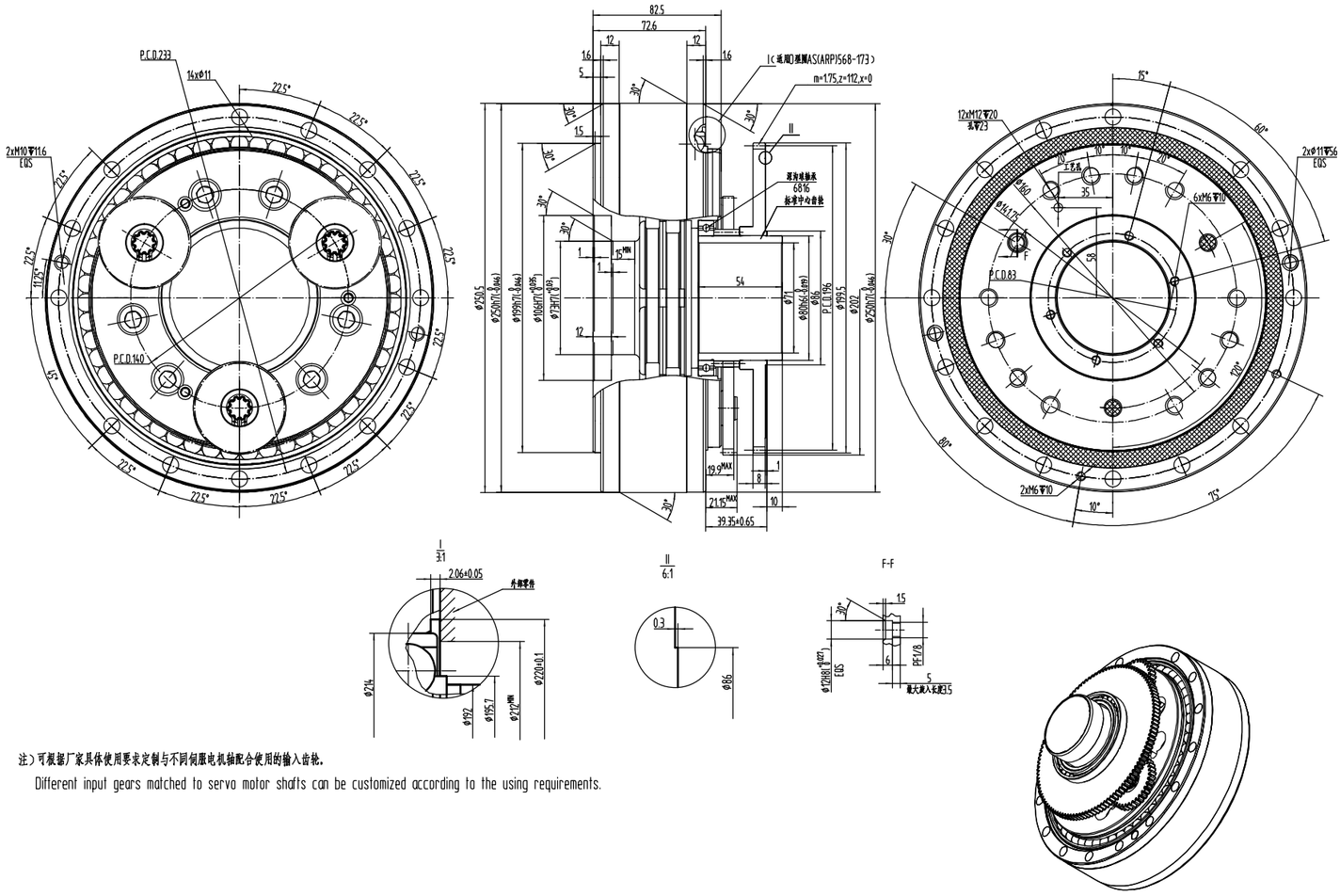
SHPR-27C-A-B 输出轴螺栓紧固型外形尺寸图 Dimension



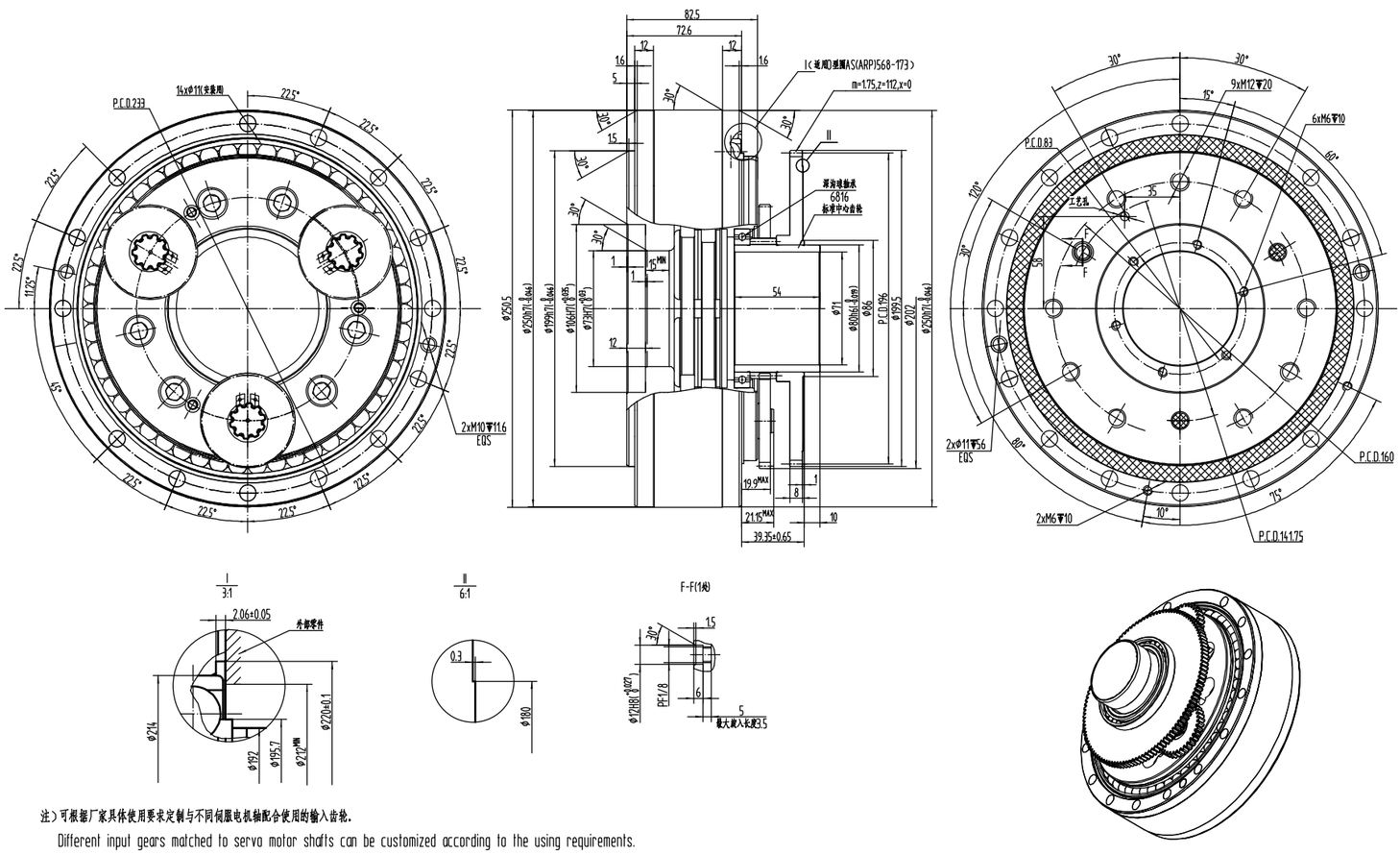
注）可根据厂家具体使用要求定制与不同伺服电机轴配合使用的输入齿轮。

Different input gears matched to servo motor shafts can be customized according to the using requirements.

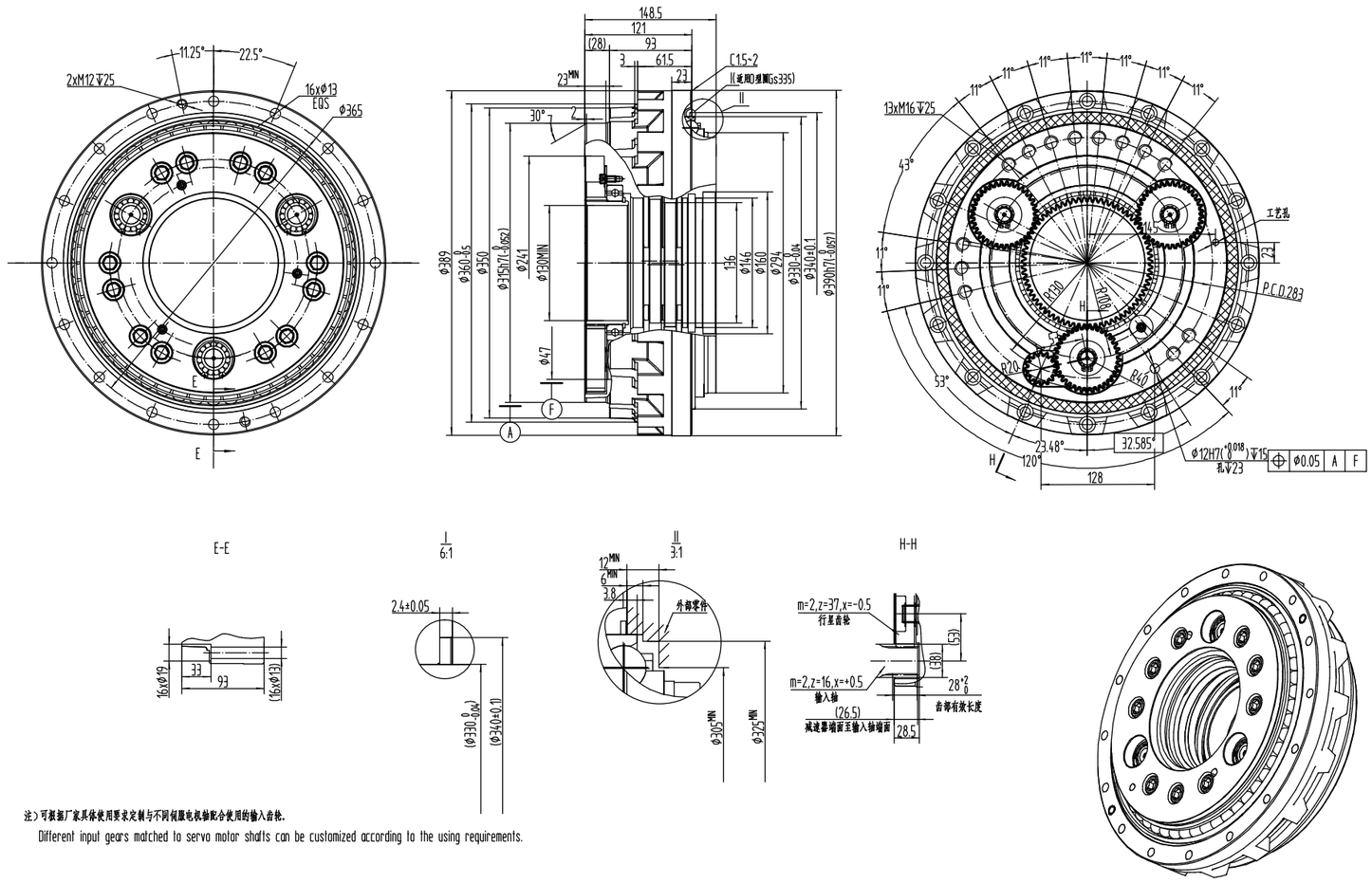
SHPR-120C-A-B 输出轴螺栓紧固型外形尺寸图 Dimension



SHPR-100C-A-B 输出轴螺栓紧固型外形尺寸图 Dimension



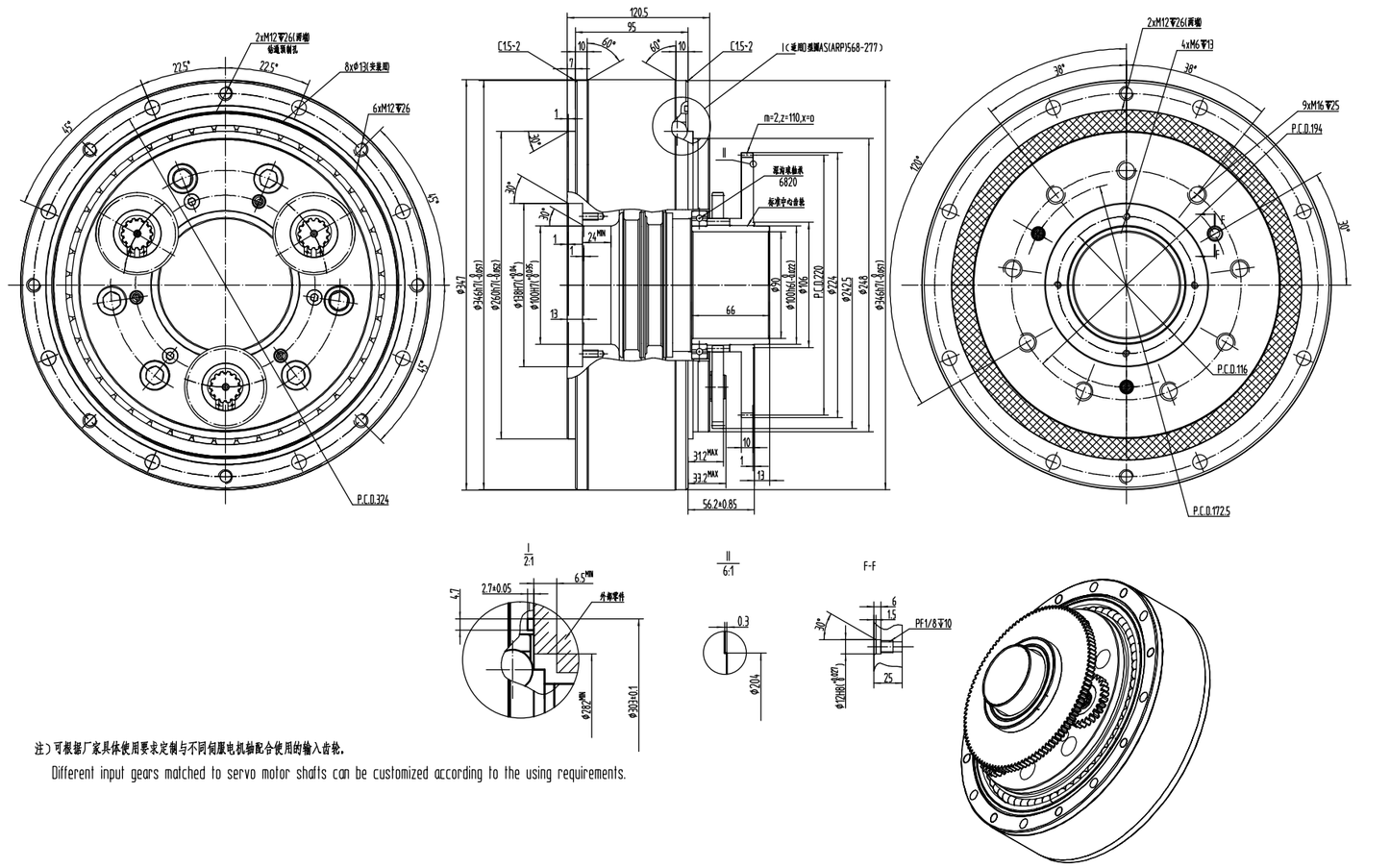
SHPR-260CA 输出轴螺栓紧固型外形尺寸图 Dimension



注）可根据厂家具体使用要求定制与不同伺服电机轴配合使用的输入齿轮。

Different input gears matched to servo motor shafts can be customized according to the using requirements.

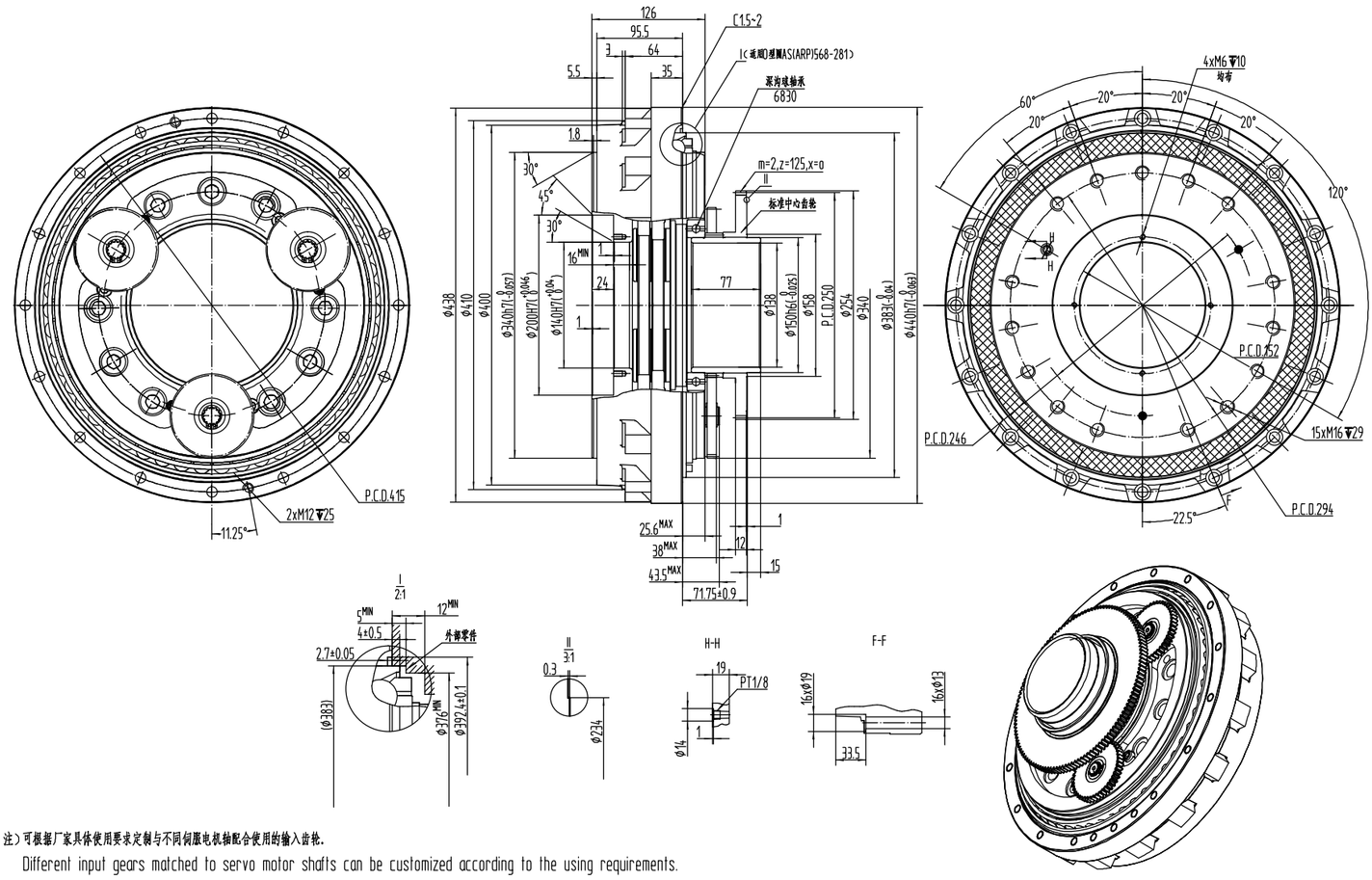
SHPR-200C-A-B 输出轴螺栓紧固型外形尺寸图 Dimension



注）可根据厂家具体使用要求定制与不同伺服电机轴配合使用的输入齿轮。

Different input gears matched to servo motor shafts can be customized according to the using requirements.

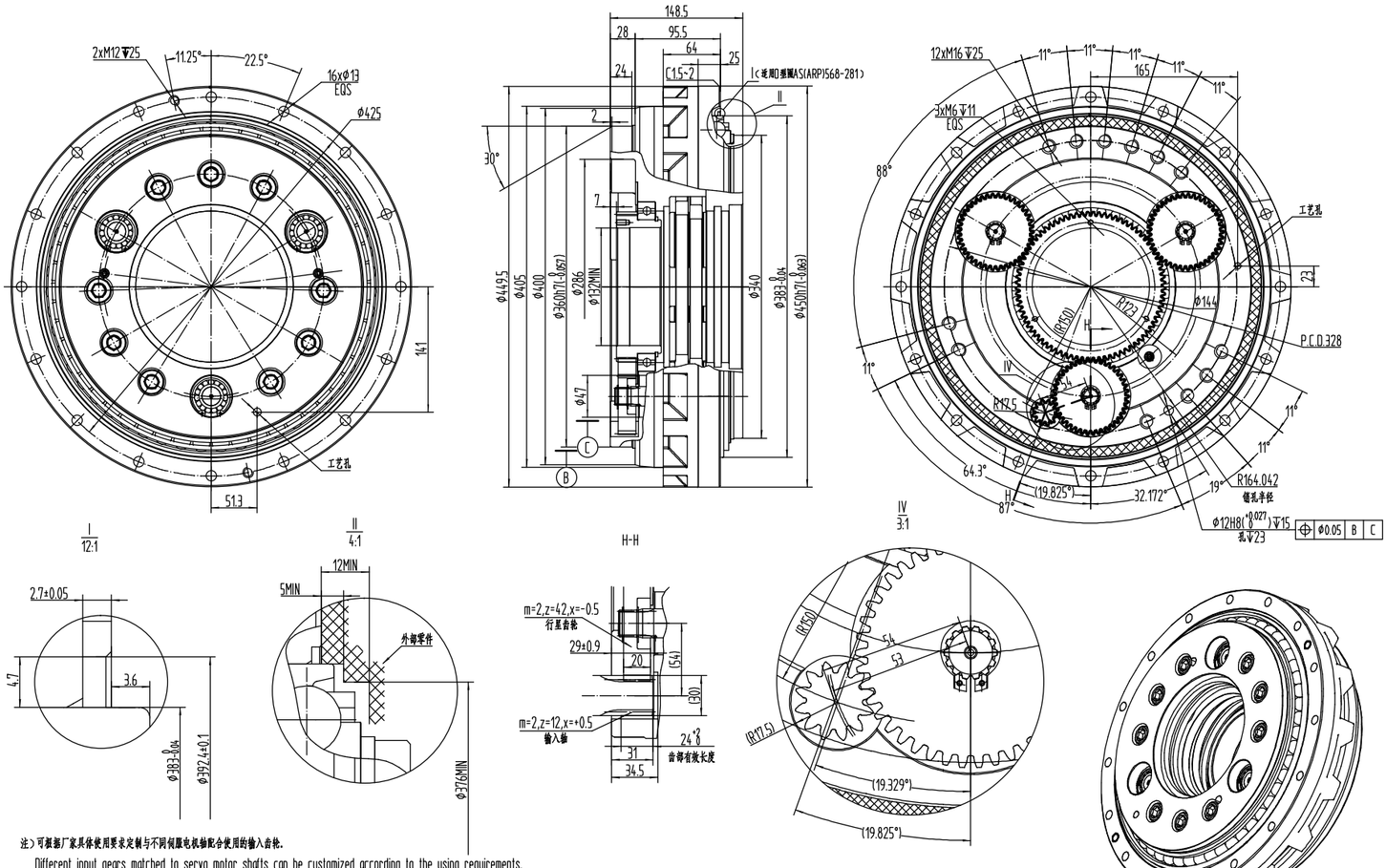
SHPR-320C-A-B 输出轴螺栓紧固型外形尺寸图 Dimension



注）可根据厂家具体使用要求定制与不同伺服电机轴配合使用的输入齿轮.

Different input gears matched to servo motor shafts can be customized according to the using requirements.

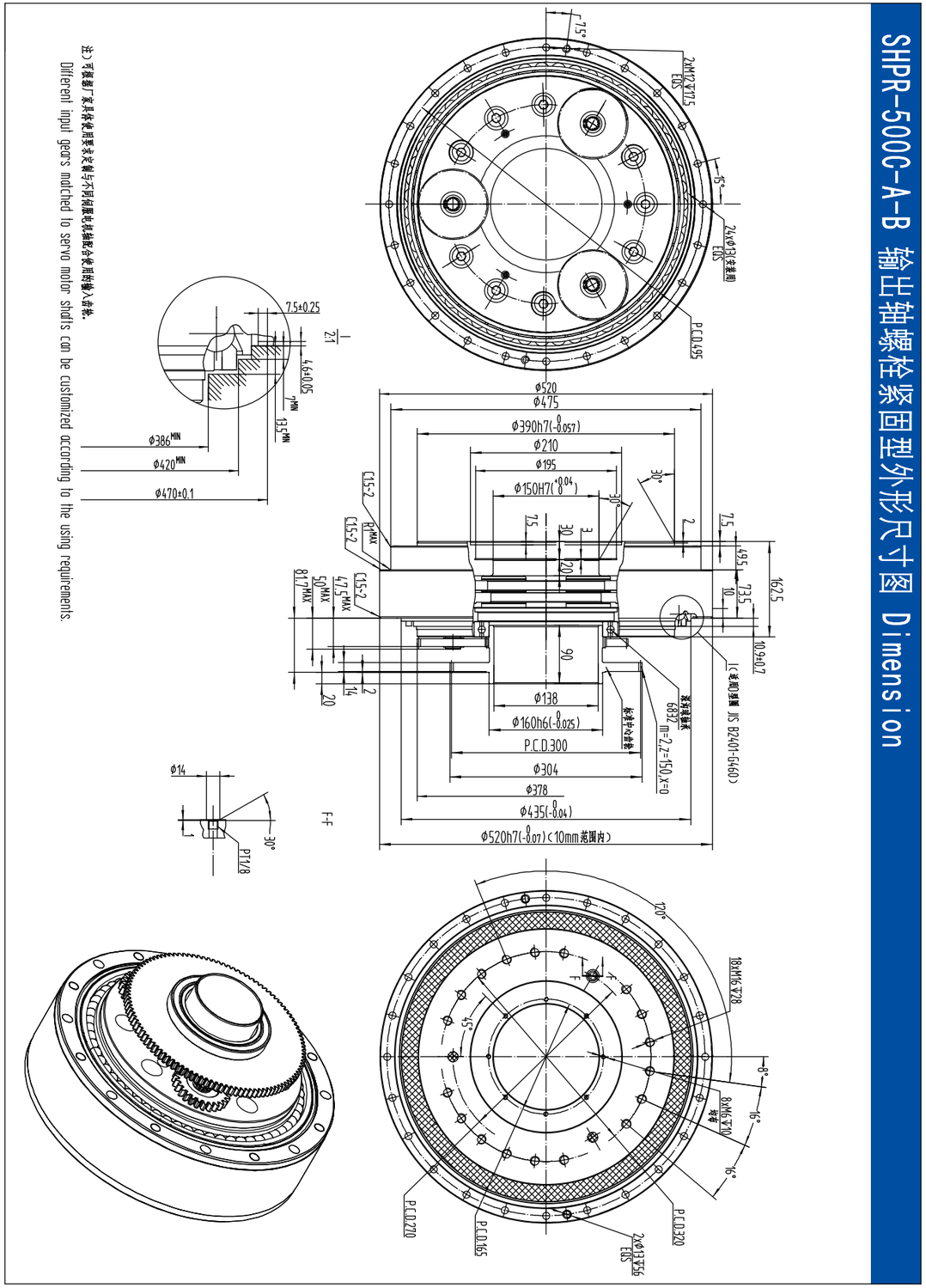
SHPR-320CA 输出轴螺栓紧固型外形尺寸图 Dimension



注）可根据厂家具体使用要求定制与不同伺服电机轴配合使用的输入齿轮.

Different input gears matched to servo motor shafts can be customized according to the using requirements.

SHPR-500C-A-B 输出法兰螺栓紧固里外形尺寸图 Dimension

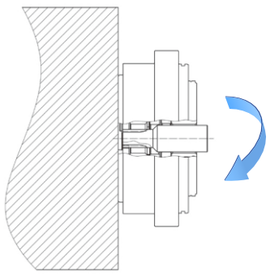


Performance characteristics
性能参数

转矩 Torque

启动停止容许转矩：减速机在启动和停止时，由于载荷的惯性转矩作用，会施加一个大于额定数值的负载转矩，称为最大工作转矩。通常，最大工作转矩约为额定转矩的 250%。

Allowable Acceleration / Deceleration Torque: When the reducer at the start and stop, due to the effect of inertia torque, it will exert a greater than the rated load torque, the torque called the Max. working torque. The Max. working torque is the 2.5 times of the rated torque.

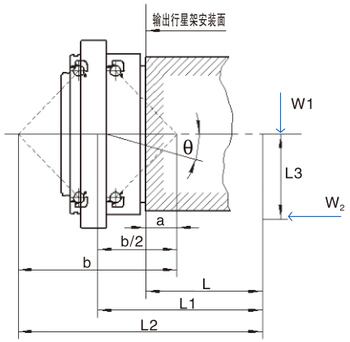


瞬时最大容许转矩：由于紧急停止或者外部载荷的冲击，减速机会承受比额定转矩更大的转矩，称为最大冲击转矩。最大冲击转矩约为额定转矩的 500%。在使用时，最大冲击转矩不能超过规定值，并且不能超过限制次数。SHPR-E 和 SHPR-C 系列减速机的冲击允许次数可以按照下面公式计算。

Momentary Max Allowable Torque: Because of an emergency stop or the impact of the external load, the reducer will exert a greater than the rated load torque.,the torque called the Max. impact torque. The Max. impact torque is the 5 times of the rated torque, and it can't beyond the limited cycle. The number of allowable operation cycles of SHPR reducer can be calculated as follows:

$$C_{em} = \frac{775 \times \left(\frac{5 \times T_0}{T_{em}}\right)^{\frac{10}{3}}}{Z_4 \times \frac{N_{em}}{60} \times t_{em}}$$

Z_4：滚针数the number of case pins
C_{em}：允许作用次数the number of allowable operation cycles
T_0：额定转矩rated torque(Nm)
T_{em}：急停转矩emergency torque(Nm)
N_{em}：急停转速Scram speed (rpm)
t_{em}：急停时间emergency time(sec.)



力矩 Moment

容许力矩：指减速机在日常运转时发生的负载力矩（启动、停止时的力矩等）的允许值。请在最大工作力矩线图范围内使用。

Allowable Moment: The load torque value in daily operation of reducer. Please use it in the max. working moment.

$M_c \leq$ 容许力矩
$M_c = \{W_1 L_2 + W_2 L_3 (L_2 > b)\}/1000$
$L_2 = L + b - a$

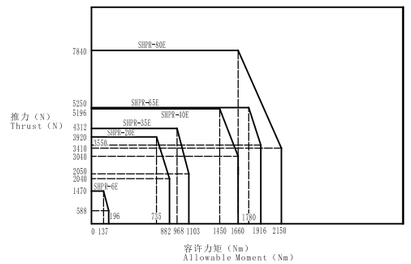
M_c ：负载力矩（Nm）
W_1、W_2：负荷（N）
L_2、L_3：到负荷作用点的距离（mm）
L ：输出轴安装面到载荷点的距离（mm）

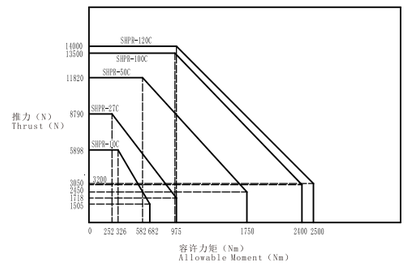
型号	容许力矩 Nm	容许推力 N
SHPR-6E	196	1470
SHPR-20E	882	3960
SHPR-35E	1103	4312
SHPR-40E	1666	5180
SHPR-65E	1916	5250
SHPR-80E	2156	7950
SHPR-110E	2940	10890
SHPR-160E	3920	15000
SHPR-320E	7056	19800
SHPR-320E3	7840	21070
SHPR-450E	8820	24700

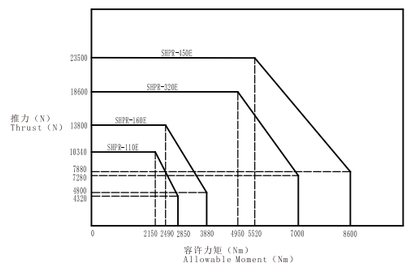
型号	容许力矩 Nm	容许推力 N
SHPR-10C	686	5890
SHPR-27C	980	8840
SHPR-50C	1764	11750
SHPR-100C	2450	13760
SHPR-120C	3920	15600
SHPR-200C	8820	19700
SHPR-260CA	12740	24500
SHPR-320CA	20580	29600
SHPR-320C	20580	29600
SHPR-500C	34000	39200

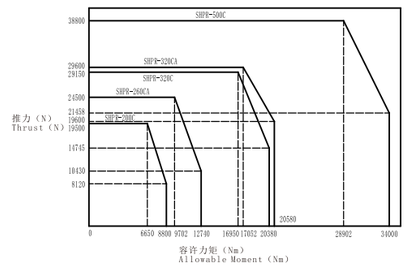
瞬时最大容许力矩：指遭受外部冲击或紧急停止时，减速机所能承受的最大力矩。注意，应尽量避免冲击力矩，否则减速机的性能会下降。瞬时最大容许力矩为容许力矩的200%

Momentary Max Allowable Moment: A large torque and moment due to emergency stop or external impact may be applied to the reduction gear. To be avoided the impact moment, or the performance of reducer will decline. The momentary max allowable moment is the 2 times of the allowable momet.







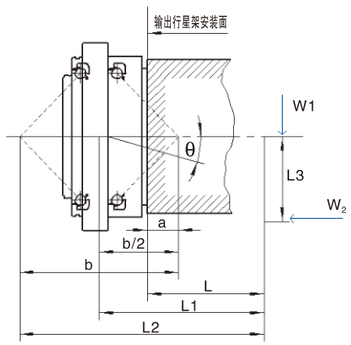


倾覆刚性 Bending rigidity

当减速机受到外部负荷并产生负载力矩时，输出行星架与负载力矩成正比倾斜。倾覆刚性表示的是主轴承的刚性，用倾斜单位角度（1arc.min.）所需的负载力矩值表示。

When an external load is applied to the output shaft, its deflection angle is proportional to the external moment. The Bending rigidity is the capacity of main bearing, and it is expressed as an external moment value, which is required to deflect the output shaft 1arc.min.

$$\theta = \frac{W_1L_1 + W_2L_3}{M_t \times 10^3}$$

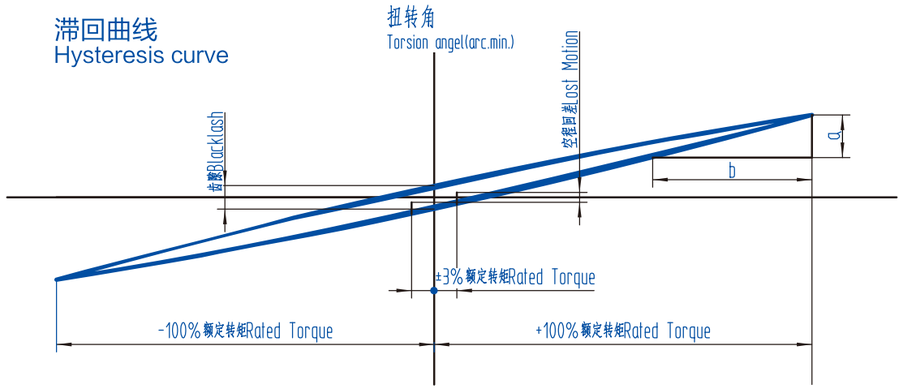


θ：输出行星架的倾斜角度（arc.min.）deflected angle of output shaft(arc.min.)
M_t：倾覆刚性（Nm/arc.min.）Bending rigidity (Nm/arc.min.)
W_1、W_2：负荷（N）weight(N)
L_1、L_3：到负荷作用点的距离（mm）arm length(mm)
L_1:$L+\frac{b}{2}-a$
L：输出行星架安装面到负荷点的距离（mm）the distance between the output shaft mounting surface and the loading point(mm)

型号	倾覆刚性 Nm.arc.min.	尺寸（mm）	
		a	b
SHPR-6E	117	17.6	91.6
SHPR-20E	372	20.1	113.3
SHPR-35E	383	22.8	117.6
SHPR-40E	931	29.6	143.7
SHPR-65E	946	30.8	146.2
SHPR-80E	1176	33.4	166.0
SHPR-110E	1470	32.2	176.6
SHPR-160E	2940	47.8	210.9
SHPR-320E	4900	56.4	251.4
SHPR-320E3	4950	69.0	292.7
SHPR-450E	7448	69.0	292.7

型号	倾覆刚性 Nm.arc.min.	尺寸（mm）	
		a	b
SHPR-10C	421	28.0	119.2
SHPR-27C	1068	38.2	150.3
SHPR-50C	1960	50.4	187.1
SHPR-100C	2813	58.7	207.6
SHPR-120C	2813	58.7	209.8
SHPR-200C	9800	76.0	280.4
SHPR-260CA	8320	71.5	319.3
SHPR-320CA	12740	114.5	360.5
SHPR-320C	12740	114.5	360.5
SHPR-500C	24100	125.0	413.4

扭转刚性（扭转刚度、空程回差）与齿隙
Torsional rigidity(torsional rigidity and lost motion) and backlash



输入轴固定，然后向输出行星架施加转矩，则会产生于转矩响应的扭曲，得到的转矩与扭转角的关系线图叫做滞回曲线。从该曲线获取的扭转刚度、空程回差表示减速机的扭转刚性。

When a torque is applied to the output shaft while the input shaft is fixed, torsion is generated according to the torque value and a hysteresis curve is obtained. The Torsional rigidity of the reduction gear is expressed by the torsional rigidity and the lost motion in this curve.

扭转刚度= $\frac{b}{a}$

Torsional rigidity= $\frac{b}{a}$

空程回差：±3%额定转矩处的滞回曲线宽度中间的扭转角。

Lost motion: The torsional angle at the mid point of the hysteresis curve width at ±3% of rated torque .

齿隙：滞回曲线上，转矩“零”处的扭转角。

Backlash: The torsion angles when the torque indicated by the hysteresis curve is zero.

精度 Angular transmission accuracy

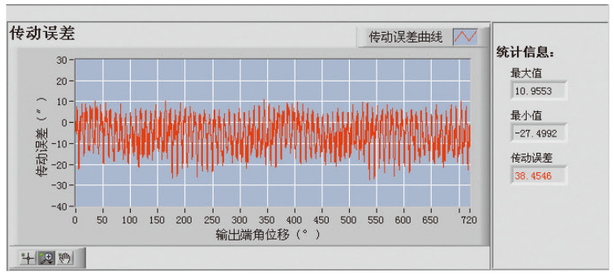
也叫角度传递误差（θ_{er}），指在任意输入旋转角度（θ_{in}）时，减速机理论输出旋转角度与实际输出旋转角度（θ_{out}）之间的差。

Angular transmission accuracy refers to a difference between the theoretical output revolution angle and the actual revolution angle（θ_{er}）when any revolution angle（θ_{in}）is the input, and is expressed as an angular transmission error（θ_{out}）.

$$\theta_{er} = \frac{\theta_{in}}{R} - \theta_{out}$$ （R: 减速比）（R=reduction ratio）

实测示例（SHPR-80E-153）如下图所示The measured example is shown below.

减速机精度测试程序



效率 Efficiency

所有 SHPR 系列减速机在额定状态下，效率＞ 80%

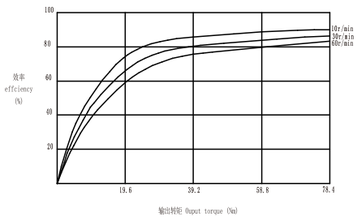
On the rated condition, the efficiency of any reducer is more than 80% .

测试条件：Test conditions

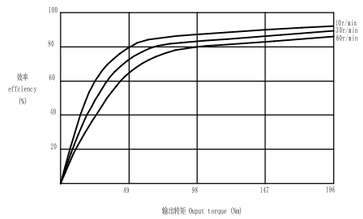
1.外壳温度30℃
Case temperature: 30℃
2.装配精度 建议精度
Assembly accuracy: recommended accuracy
3.润滑 油脂
(MolyWhiteRE00)
Lubricant: grease (Molywhite RE00)
4.C 系列不包括中心齿轮的损耗
Loss at C series' center gear is not included

SHPR-E 效率曲线

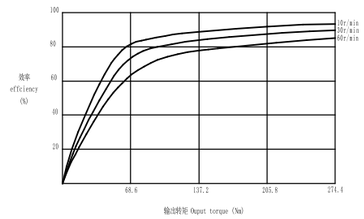
SHPR-6E效率曲线
Efficiency Curve



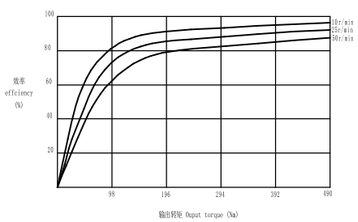
SHPR-20E效率曲线
Efficiency Curve



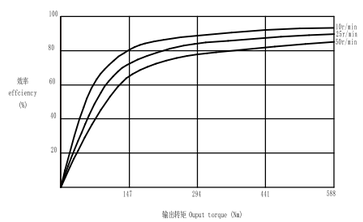
SHPR-35E效率曲线
Efficiency Curve



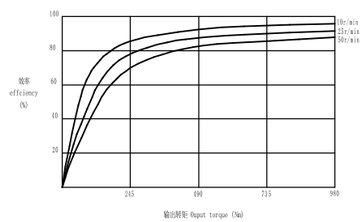
SHPR-10E效率曲线
Efficiency Curve



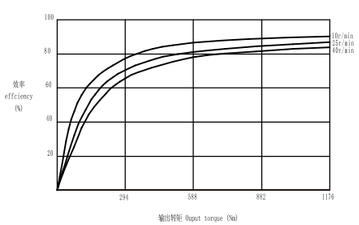
SHPR-65E效率曲线
Efficiency Curve



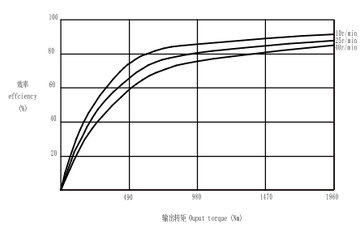
SHPR-80E效率曲线
Efficiency Curve



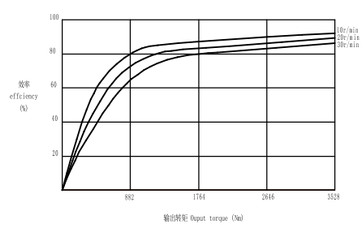
SHPR-110E效率曲线
Efficiency Curve



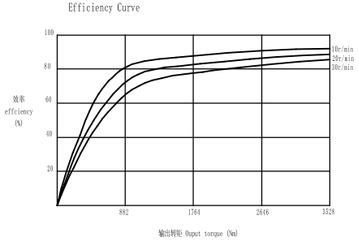
SHPR-160E效率曲线
Efficiency Curve



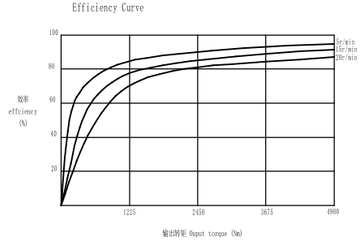
SHPR-320E效率曲线
Efficiency Curve



SHPR-320E3效率曲线
Efficiency Curve

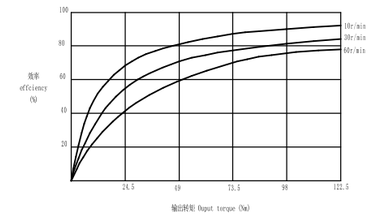


SHPR-450E效率曲线
Efficiency Curve

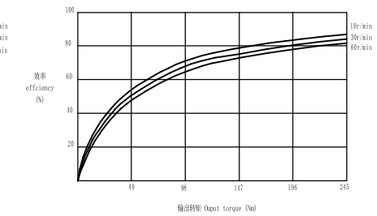


SHPR-C 效率曲线

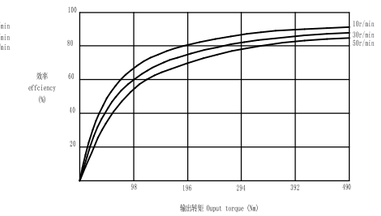
SHPR-10C效率曲线
Efficiency Curve



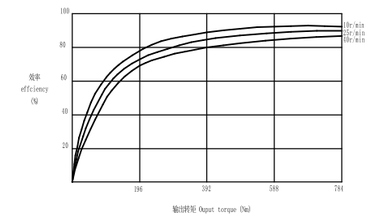
SHPR-27C效率曲线
Efficiency Curve



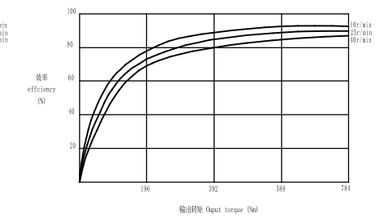
SHPR-50C效率曲线
Efficiency Curve



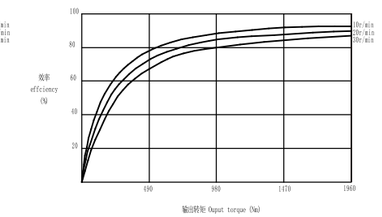
SHPR-100C效率曲线
Efficiency Curve



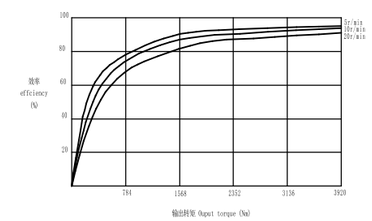
SHPR-120C效率曲线
Efficiency Curve



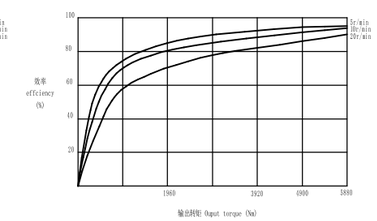
SHPR-200C效率曲线
Efficiency Curve



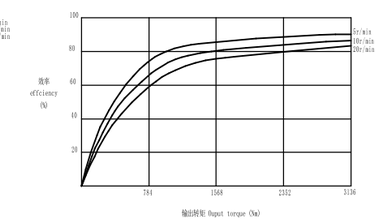
SHPR-320C效率曲线
Efficiency Curve



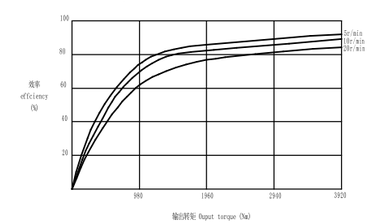
SHPR-500C效率曲线
Efficiency Curve



SHPR-260CA效率曲线
Efficiency Curve



SHPR-320CA效率曲线
Efficiency Curve



Installation and assembly in SHPR

SHPR 设计方面注意事项

装配精度 Assembly accuracy

型号 Model	同心度公差 Concentricity tolerance a（mm）	型号 Model	同心度公差 Concentricity tolerance a（mm）
SHPR-6E	MAX0.03	SHPR-80E	MAX0.03
SHPR-20E	MAX0.03	SHPR-110E	MAX0.03
SHPR-35E	MAX0.03	SHPR-160E	MAX0.05
SHPR-40E	MAX0.03	SHPR-320E	MAX0.05
SHPR-65E	MAX0.03	SHPR-450E	MAX0.05

各型号减速机装配时，其安装侧部件请按以下精度进行设计。如果安装精度不良，则易产生振动、噪音、齿隙。

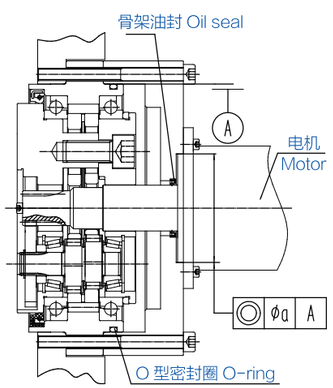
Design motor flange within tolerance as follows. Poor assembly accuracy causes vibration, noise and so on.

型号 Model	中心距离公差 Tolerance of center-to-center distance X (mm)	同心度公差 Concentricity tolerance a (mm)	平行度公差 Tolerance of parallelism b (mm)
SHPR-10C	±0.03	MAX0.03	MAX0.03
SHPR-27C			
SHPR-50C			
SHPR-100C			
SHPR-120C			
SHPR-200C			
SHPR-320C			
SHPR-500C			
SHPR-260CA			
SHPR-320CA			

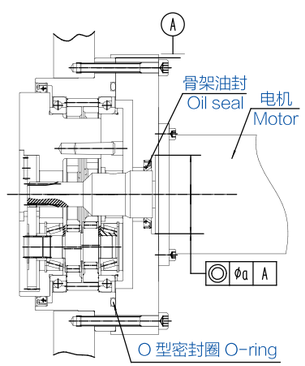
O 型圈的安装 Installation example of O-ring

下图表示了两种系列的“O”型圈密封位置，请在参照表 1 的基础上在安装侧进行密封设计，若结构上无法使用“O”型圈，请使用表 2 中的液体填料等密封剂。

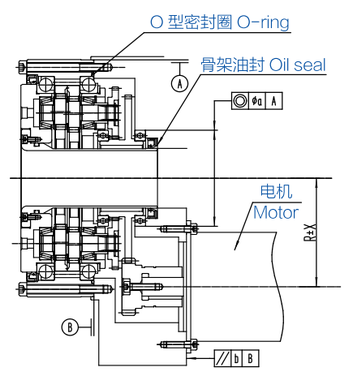
Be sure that seals are used between mating parts on the input side in below picture, refer to the O-ring seal installation illustrated in table 1.If use of an O-ring seal is impossible because of the design, use Gasket sealant shown in table 2.



SHPR-80E 及以下型号装配精度及密封示意图
The assembly accuracy and seal diagram of SHPR-80E and the other types as below



SHPR-110E 及以上型号装配精度及密封示意图
The assembly accuracy and seal diagram of SHPR-110E and the other types as below



C 系列减速机装配精度及密封示意图
The assembly accuracy and seal diagram of SHPR-C

表1 “O”型圈选型
Table 1 Applicable O-ring seal

型号 Model	适用“O”型圈 Applicable O-ring seal(II)	型号 Model	适用“O”型圈（I） Applicable O-ring seal(III)	适用“O”型圈（II） Applicable O-ring seal(I)
SHPR-6E	S100	SHPR-10C	AS(ARP)568-048	CO 0625
SHPR-20E	S120	SHPR-27C	AS(ARP)568-163	CO 0634
SHPR-35E	S120	SHPR-50C	AS(ARP)568-169	CO 0634
SHPR-40E	AS(ARP)568-258	SHPR-100C	AS(ARP)568-173	S70
SHPR-65E	AS(ARP)568-258	SHPR-120C	AS(ARP)568-173	S70
SHPR-80E	AS(ARP)568-263	SHPR-200C	AS(ARP)568-277	JIS B2401 G95
SHPR-110E	JIS B2401-G190	SHPR-320C	AS(ARP)568-281	JIS B2401 G135
SHPR-160E	JIS B2401-G220	SHPR-500C	JIS B2401-G460	JIS B2401 G145
SHPR-320E	JIS B2401-G270	SHPR-260CA	GS335	ASK
SHPR-450E	JIS B2401-G300	SHPR-320CA	AS(ARP)568-281	ASK

*320E3与320E采用相同规格O型圈

表2 标准推荐液状密封剂
Table 2 Recommended Gasket sealant

名称（制造商） Manufacturer	性质、用途 Character & Name
Three Bond 1211 (Three Bond)	● 硅系无溶剂型 Silicon is not solvent ● 半干性填密片 Half dry packing piece
HERME SEAL SS-60F (Nihon-Hermetics)	● 无溶剂弹性密封剂 Solvent-free elastic sealant ● 金属接触面（法兰面）的密封 Contact surface of metal seal ● 与 three bond 1211 为同类产品 The same as three bond 1211

螺栓紧固转矩、允许传递转矩 Bolt tightening torque, allowing transfer torque

关于 SHPR 减速机的紧固请使用内六角螺栓，并按以下紧固扭矩进行紧固。另外，为了防止内六角螺栓的松动以及螺栓表座的擦伤，建议使用内六角螺栓用碟簧垫圈。

Use hexagonal socket bolts to assemble the SHPR reduction gear and tighten to the torque as specified below. The serrated lock washer is recommended to prevent the bolt from loosening and protect the bolt seat face from flaws.

内六角螺栓 公称 × 节距 Hexagonal socket bolt nominal size×pitch (mm)	紧固转矩 Tightening torque (Nm)	紧固力 (R) Tightening force（N）	使用螺栓各个部件 Bolt specification
M5×0.8	9.01±0.49	9310	● 内六角螺栓 GB/T 70.1-2008 ● 强度划分 GB/T 3098.12.9 ● 螺丝Thread GB/T 197 6g
M6×1.0	15.6±0.78	13180	
M8×1.25	37.2±1.86	23960	
M10×1.5	73.5±3.43	38080	
M12×1.75	128.4±6.37	55100	
M14×2.0	204.8±10.2	75860	
M16×2.0	318.5±15.9	103410	
M18×2.5	441.0±22.1	126720	

螺栓的允许传递转矩计算公式
Calculation of allowable transmission torque of bolts:

$$T_1 = F \times \frac{D_1}{2} \times \mu \times n_1$$

T_1：螺栓允许传递转矩 bolt allowable transmission torque（Nmm）
F：螺栓紧固力 bolt tightening force（N）
D_1：螺栓安装 P.C.D. bolt P.C.D.（mm）
μ：摩擦系数 Friction，μ=0.15（吻合面附着润滑脂的情况 where lubricants remained），μ=0.2（吻合面脱脂的情况 where left dried with no lubricant）
n_1：螺栓根数 number of bolts

安装输入轴（齿轮）Installation of input(center) gear

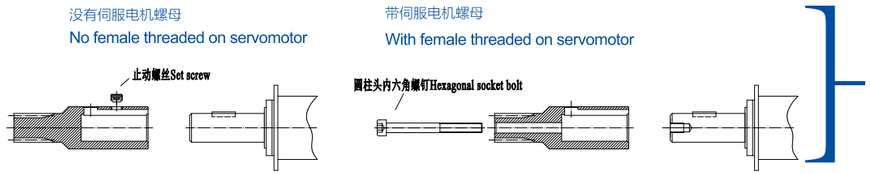
标准输入轴(齿轮)是指未进行伺服电机安装孔加工的产品。减速机的输入轴(齿轮)与不同形状的电机轴安装示例如下，请参考下图进行设计(止动螺丝、牵引螺丝、圆柱头内六角螺钉由贵公司准备 ）。

The standard-sized input(center) gear comes from the factory without holes drilled for motor shafts. The following are reference drawings for installation of input shafts. Customers must provide set screw, hexagonal socket bolt, or hexagonal nut and draw bolt.

SHPR-E

没有伺服电机螺母
No female threaded on servomotor

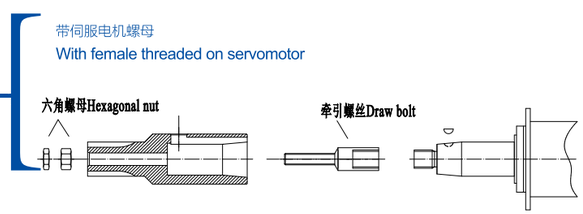
带伺服电机螺母
With female threaded on servomotor



电机轴为直轴
Straight Shaft

电机轴为锥形轴Taper Shaft

带伺服电机螺母
With female threaded on servomotor



SHPR-C

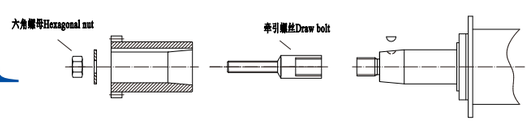
没有伺服电机螺母
No female threaded on servomotor

带伺服电机螺母
With female threaded on servomotor

电机轴为直轴
Straight Shaft

电机轴为锥形轴Taper Shaft

带伺服电机螺母
With female threaded on servomotor



润滑 Lubrication

减速机运行时，根据油脂的老化情况，其标准更换时间为20000小时。若油脂被污染或在环境温度超过40℃的恶劣情况下使用，请检查油脂的老化、被污染情况，并提前更换油脂。

According to the aging condition of grease,the standard replacement time is 20,000 hours whlie the reducer was run.
If the grease is polluted or used under the severe circumstances that ambient temperature exceeds 40℃，please check the aging and polluted condition of the grease and replace the grease in advance.

在封入油脂实施磨合运转时，减速机有时会发生异响和转矩不均匀现象。如果这些现象在实施磨合运转30分钟以上（减速机的表面温度达到50℃左右）后消失，则没有质量问题。

Sometimes, when the reducer is in-running in grease, the phenomenon of abnormal noise and uneven torque may occur. If these phenomena disappear after running in for more than 30 minutes （the surface temperature of the reducer reaches about 50℃），then the reducer has no quality problem.

润滑脂封入量
The quantity of grease required for the SHPR reducer

SHPR 减速机在出厂时未填充润滑脂，在安装时，请按左表中的注入量填充。

The SHPR reducer is not greased when it is shipped from the plant, the user must ensure that necessary amount of recommended grease is charged when installing the SHPR reducer.

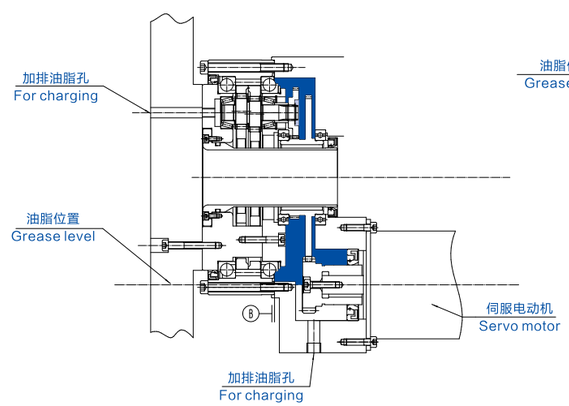
	型号 Model	注入量（g） Quantity(g)	型号 Model	注入量（g） Quantity(g)
安装水平轴 Horizontal installation	SHPR-6E	38	SHPR-10C	128
	SHPR-20E	76	SHPR-27C	231
	SHPR-35E	92	SHPR-50C	433
	SHPR-40E	170	SHPR-100C	658
	SHPR-65E	206	SHPR-120C	686
	SHPR-80E	333	SHPR-200C	1593
	SHPR-110E	376	SHPR-320C	3076
	SHPR-160E	548	SHPR-500C	5163
	SHPR-320E	905	SHPR-260CA	ASK
	SHPR-450E	1389	SHPR-320CA	ASK
安装垂直轴 Vertical installation	SHPR-6E	43	SHPR-10C	145
	SHPR-20E	87	SHPR-27C	265
	SHPR-35E	105	SHPR-50C	497
	SHPR-40E	178	SHPR-100C	746
	SHPR-65E	215	SHPR-120C	786
	SHPR-80E	382	SHPR-200C	1593
	SHPR-110E	431	SHPR-320C	3521
	SHPR-160E	604	SHPR-500C	6003
	SHPR-320E	1038	SHPR-260CA	ASK
	SHPR-450E	1593	SHPR-320CA	ASK

*320E3与320E油脂注入量一致

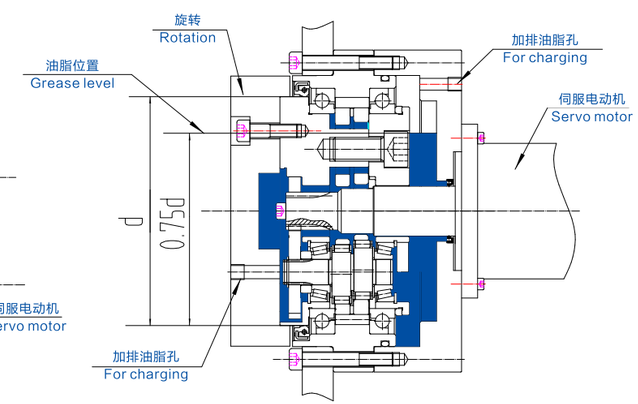
润滑脂注入位置
Grease level in SHPR reducer

（蓝色区域为润滑脂填充部分）
（The blue area is the filling part of grease）

安装水平轴
Horizontal installation

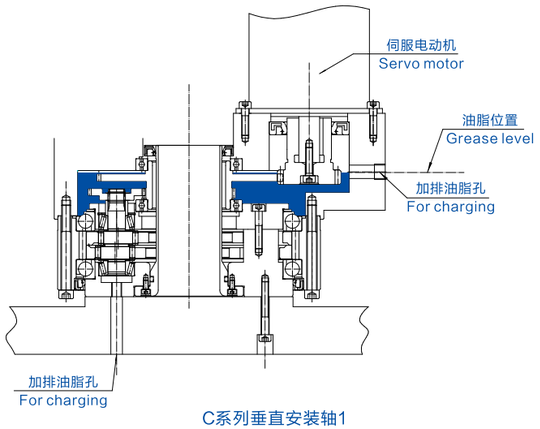


C系列水平安装轴

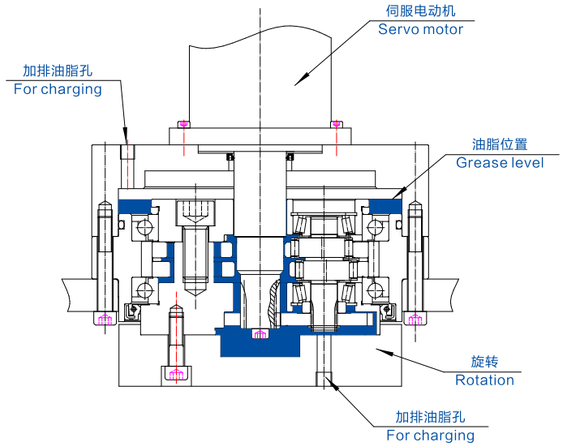


E系列水平安装轴

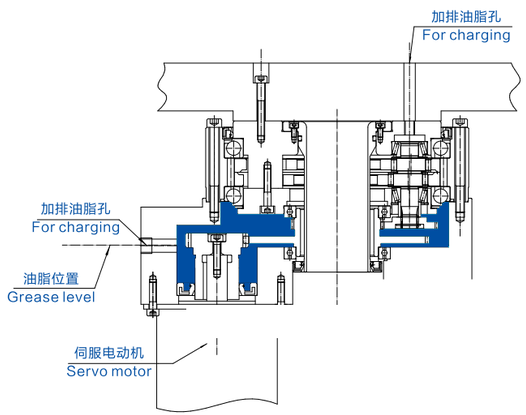
安装垂直轴
Vertical installation



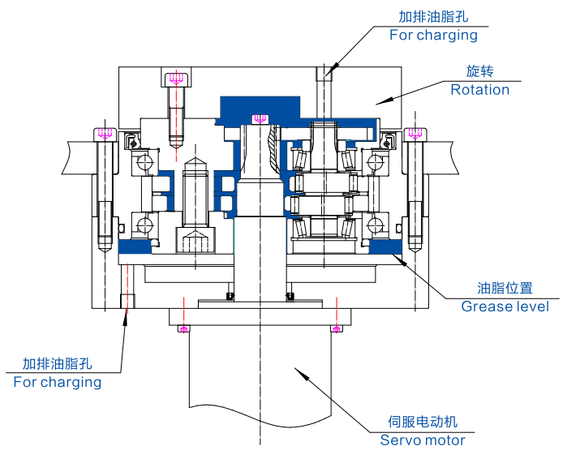
C系列垂直安装轴1



E系列垂直安装轴1



C系列垂直安装轴2



E系列垂直安装轴2

☐ 润滑脂更换时间
Interval between grease changes

润滑脂更换的标准时间为 20000 小时。若润滑脂污损或在周围温度条件（40℃以上）恶劣的环境下使用时，请及时检查润滑脂老化、污损情况并更换。

Change grease at a standard interval of 20000 hours. If grease is contaminated for any reason or used at an ambient temperature of 40℃ or more, check the grease for contamination and deterioration, to determine the proper maintenance interval.

Ordering parameters confirm
订购减速机的相关技术参数确认表

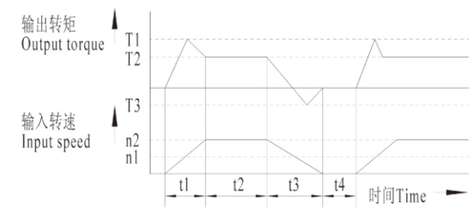
1. 使 用 行 业 Application area：☐ Robot ☐ 机 床 Machine tools ☐机械设备 Mechanical equipment ☐ AGV ☐ RGV ☐液压与气动 Fluid drive ☐工程机械 Project machine ☐其他 others _____

设备名称 Device name：_____

应用场合 Applications：_____

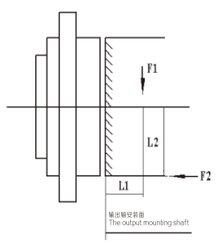
2. 选用型号 Choose model：_____

3. 负载条件 Conditions of load：_____



	启动 Start	稳定 Stable	停止 Stop	间歇时 interval
负载转矩 (Nm) Load torque(Nm)	T1: ____	T2: ____	T3: ____	
转速 (r/min) Speed(r/min)	n1: ____	n2: ____	n3: ____	
时间 (sec) Time(sec)	t1: ____	t2: ____	t3: ____	t4: ____

4. 外部负载 External load conditions：



F1：_____

F2：_____

L1：_____

L2：_____

5. 使用环境 Temperature：环境温度 Env Environment temperature _____ ℃

6. 安装方式 Installation：☐水平安装 Horizontal ☐垂直安装（电机在上）Vertical（upper motor）☐垂直安装（电机在下）Vertical（lower motor）

安装图
Illustration for installation：

7. 输入轴 Input gear：☐ 标准 Standard；
☐ 非标 Non-standard
（长度 length：____；直径 diameter：____ ）

输入轴要求尺寸图
Required dimension of input gear：

8. 驱动参数 Driving portion：功率 Capacity：____ kw；
额定转矩 Rated torque：____ Nm；
转速 Speed：____ r/min；
☐伺服电机 Servo motor
☐直流伺服电机 DC Servo motor

电机轴尺寸图
The motor shaft：