

PRECISION HARMONIC REDUCER





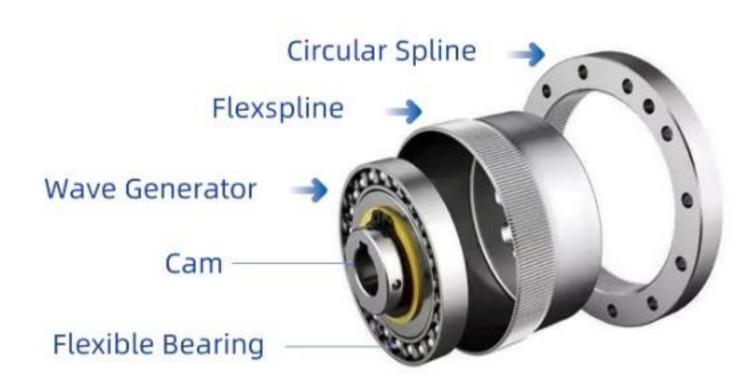
Sichuan FDRobot Co., Ltd.
FD Precision, Ultimate Transmission

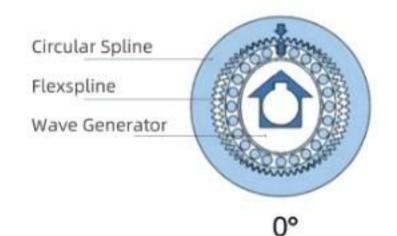


Components of a Harmonic Drive

The harmonic transmission device mainly consists of 3 basic components: wave generator, flexspline and circular spline.

- Wave Generator: It consists of an elliptical cam and a flexible bearing, which is usually connected to the input shaft. The inner ring of the flexible bearing is fixed to the cam, and the outer ring is elastically shaped into an ellipse by means of ball rollers.
- Flexspline: A metal elastomer part with a gear on the outer ring of the open part, which deforms with the rotation of the wave generator and is usually connected to the output shaft.
- Circular Spline: Rigid internal gear, generally 2 teeth more than the flexspline, usually fixed to the casing.





The circular spline engages the flexspline at the long axis of the ellipse.

The short axis is disengaged and the circular spline is fixed.



After 90° clockwise rotation of the cam, the flexspline elastically deformed engagement position rotate in sequence.



After 180° of clockwise rotation of the cam, the flexspline moves one tooth anticlockwise.

180°



After 360° of cam rotation, since the flexspline has two fewer teeth than the circular spline, the the flexspline will move 2 teeth counterclockwise.



Classification of a Harmonic Reducer

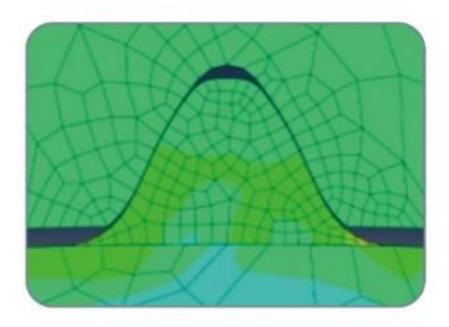
Classification by torque	Standard torque type、High torque type
Classification of flexspline structure	Hat type、Cup type
Classification according to the height of the corkscrew	Ultra-thin type、Standard type
Classification by installation and use	Combination type、Component type



Technical Advantage

Adopting finite element simulation analysis and virtual prototype technology, systematic design of tooth structure, tooth surface stress, thickness of flexible wheel, strength of flexible bearing and other indicators, to ensure the optimisation of the theoretical design indicators, and at the same time, through a large number of processing, trial production, test to make corrections to the theoretical design.

New multi-section arc "RS tooth shape"







(Contact stress simulation)

The "RS tooth profile" overcomes the shortcomings of the previous harmonic meshing tooth profile, and through a series of innovative designs, greatly improves the service life of the flex wheel, with the following advantages:



Optimised tooth height, optimum meshing distance to obtain a larger meshing volume, reducing the pressure on the tooth surface;



Optimised tooth root curvature, reducing the risk of fracture failure;



Smaller deformation of the flexure wheel required, resulting in a greatly increased flexure wheel life;



Significantly higher ratio of meshing teeth, increasing the stiffness.

Specially Developed Flexible Bearings

Flexible bearing is the weakest link in the life of harmonic reducer, and it is one of the biggest factors affecting the life of the reducer to ensure precision. We use special materials and heat treatment technology to perfectly solve the problem of the life of the flexible bearing, to achieve the flexible bearing wear rate of orders of magnitude lower, the real can compete with the highest international level of indicators.



Optimised bearing wear resistance design;



Optimised tribological design;



Optimised design of the retention bracket;



Special material selection and the best heat treatment technology.



Advanced Bearing Wear Resistance Technology

Wear-resistant technology was not applied:

The surface of the steel balls is worn and abrasive.

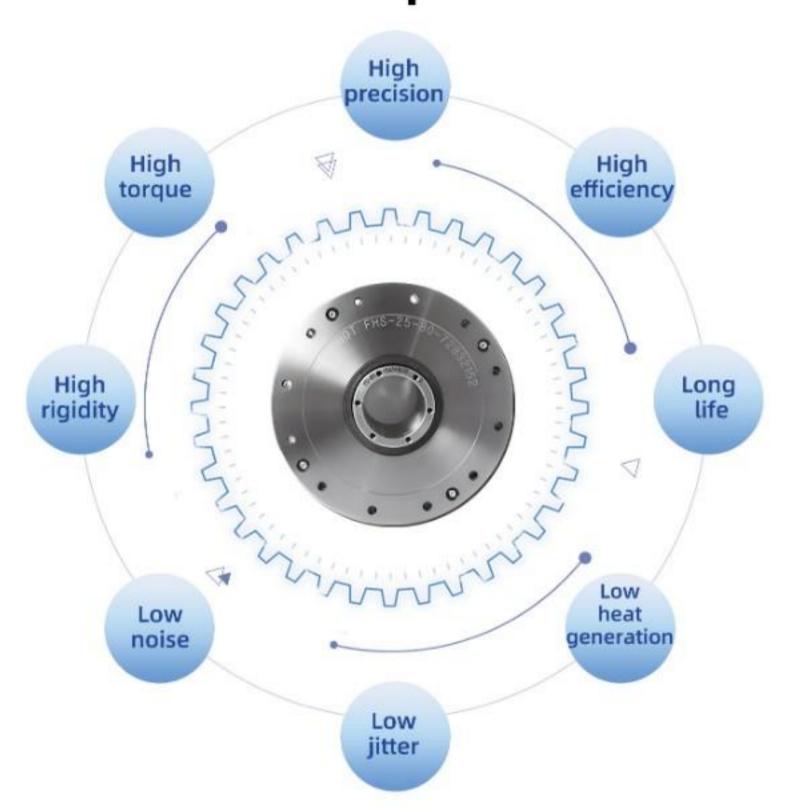


With wear-resistant technology:

The surface of the steel balls is virtually wear-free and as bright as new.

On the basis of PVD traditional film technology, self-developed materials and low-temperature process are used to generate a nano-scale reinforced coating on the workpiece, which is resistant to metal adhesion sintering. Bearing wear is significantly reduced after the implementation of wear-resistant technology.

Core Competence





Advanced theoretical design

Advanced design means, new RS tooth shape, optimised flexible bearing, optimised flexible wheel design.



Advanced R&D design

Special material selection, adequate tribological design, special heat treatment process, optimised wear resistance design.



Advanced Manufacturing

Innovative processing equipment, optimised process flow, rigorous inspection apparatus, scientific quality management.



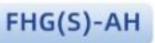
Common Reduction Ratios of Harmonic Reducer

Paradigm √: Yes/Customisable -: No

Structure Type	Model	Standard Torque Model Reduction Ratio						Hig	Customised				
	Size	30	50	80	100	120	160	50	80	100	120	160	Ratios
	3	V	V	V	V	-	-	=	-	-	-	20	√
	5	V	V	V	V	-	-	-	-	-			V
	8	V	V	V	V	-	-	5	-	-	71	170	V
	11	V	V	√	V	-	-	V	V	V	-	-	√
	14	V	V	V	V	-	-	1	V	V	=	-	V
	17	V	V	V	1	V	- 8	V	V	V	V	- 20	V
	20	V	V	V	1	V	V	V	V	V	V	V	V
	25	V	V	V	V	1	V	V	V	V	V	V	V
Standard	32	V	V	√	V	V	V	V	V	V	V	√	1
Model	40	-	V	1	V	V	V	1	V	V	V	V	V
	45	-	V	V	V	V	V	V	V	V	V	V	1
	50	-	V	V	V	V	V	V	V	V	V	V	V
	58	100	V	V	V	V	V	V	1	V	V	V	V
	65	744	V	V	V	V	V	V	V	V	V	V	√
	80	-	V	V	1	V	V	V	V	V	V	V	V
	90		V	V	V	V	V	V	V	V	V	V	1
	100	121	V	V	V	V	V	V	V	V	V	V	V
	5	V	V	V	V	-	-			-	-		V
	8	V	V	V	V	-	Α.	2	-	4	27	21	V
	11	V	V	V	1		-	-	-	-	- 80		V
	14		V	V	V	-	-	-	-	-	-	-1	V
Ultra-thin	17	-	V	√	V	V	-	-	-	-	- 1		1
Model	20	1 -	V	V	V	V	V	-	-	-	-		V
THE PROPERTY OF THE PARTY OF TH	25	=	V	V	V	V	V	_	=	-	-	= 1	V
	32	1=1	V	V	V	V	V	-	-	-	147	-	V
	40	-	V	V	V	1	V	-	-	-		-	V
	45	12	V	√	V	V	V	-	_	-	-		1
	50	-	V	1	V	V	V	-	-	-	т.	100	V

About customised ratios: For customised ratios, please consult our technical staff or authorised agents.







FHG(S)-AJ



FHG(S)-SJ



FHG(S)-SO



FHG(S)-SH



FCG(S)-AJ



Paradigm ⊚:Excellent ○:Good △:Well

				Product Characteristics									
			Variable	Torque	Torque ri	Rotational	Light weight	Flat shape	Hollow	Customised	Lifetime		
	Se	eries Name	Peak Torque (Nm)	Reduction Ratio	Torque:Weight ratio	Torque rigidityTorque rigidity	onal accuracy	/eight	ape	Hollow construction	nised	TO TO	
	FHS-CJ	Standard Cam hat Type	19 ~ 2650	50 ~ 160	0	0	0	0	0	-	0	0	
Ctandard	FHS-CO	Standard cross slide hat type	19 ~ 2650	50 ~ 160	0	0	0	0	0	-	0	0	
Standard component type	FCS-CJ	Standard cam cup type	19 ~ 2650	50 ~ 160	0	0	0	0	0	Δ	0	0	
	FCS-CO	Standard cross slide cup type	19 ~ 2650	50 ~ 160	0	0	0	0	0	Δ	0	0	
	FCD-C	Ultra-thin Cup	12 ~ 823	50 ~ 160	0	0	0	0	0	0	0	0	
	FHS-AH	Standard hollow hat type	19 ~ 2650	50 ~ 160	0	0	0	Δ	Δ	0	0	0	
	FHS-AJ	Standard hollow hat type	19 ~ 2650	50 ~ 160	0	0	0	Δ	Δ		0	0	
	FHS-SJ	Standard Cam hats	19 ~ 2650	50 ~ 160	0	0	0	0	0	-	0	0	
	FHS-SO	Standard cross slide hat type	19 ~ 2650	50 ~ 160	0	0	0	0	0	-	0	0	
Standard	FHS-SH	Standard Simple Hollow hat	19 ~ 2650	50~160	0	0	0	0	0	0	0	0	
combination	FCS-AJ	Standard cam cup type	19 ~ 2650	50 ~ 160	0	0	0	0	0	Δ	0	0	
type	FCS-AO	Standard cross slide cup type	19 ~ 2650	50 ~ 160	0	0	0	0	0	Δ	0	0	
combination type	FCD-AH	Ultra-thin Hollow Cup	12 ~ 453	50 ~ 160	0	0	0	0	0	0	0	0	
	FCD-AJ	Ultra-thin small diameter cup type	12 ~ 823	50 ~ 160	0	0	0	0	0	0	0	0	
	FHD-SH	Ultra-thin Simple Hollow Type	12 ~ 450	50 ~ 160	0	0	0	0	0	0	0	0	
	FHG-CJ	High torsion cam hat type	24 ~ 3400	50 ~ 160	0	0	0	0	0	_	0	0	
High-torque	FHG-CO	High torsion cross slide seat hat type	24 ~ 3400	50~160	0	0	0	0	0	-	0	0	
assembly	FCG-CJ	High-torque cam cup type	24 ~ 3400	50~160	0	0	0	0	0	Δ	0	0	
type	FCG-CO	High-torque cross slide seat cup type	24 ~ 3400	50 ~ 160	0	0	0	0	0	Δ	0	0	
	FHG-AH	High-torque hollow hat type	24 ~ 3400	50 ~ 160	0	0	0	Δ	Δ	0	0	0	
	FHG-AJ	High-torque centre shaft hat type	24 ~ 3400	50 ~ 160	0	0	0	Δ	Δ	_	0	0	
	FHG-SJ	High-torque cam hat type	24 ~ 3400	50~160	0	0	0	0	0	_	0	0	
High-torque	FHG-SO	High-torque cross slide hat type	24 ~ 3400	50 ~ 160	0	0	0	0	0		0	0	
combination type	FHG-SH	High-torque simple hollow hat type	24 ~ 3400	50 ~ 160	0	0	0	0	0	0	0	0	
	FCG-AJ	High-torque cam cup type	24~3400	50~160	0	0	0	0	0	Δ	0	0	
	FCG-AO	High-torque cross slide cup type	24 ~ 3400	50 ~ 160	0	0	0	0	0	Δ	0	0	













FCG(S)-AO FCG(S)-CJ

FCG(S)-CO

FCD-AJ

FCD-C

FHD-SH

Application Scenarios.







Harmonic reducer is widely used in various robotics fields due to its advantages of high precision, strong load carrying capacity, small backlash, light weight and large reduction ratio. In addition, harmonic reducers have a wide range of applications in precision drive systems for communication devices, large telescopes, meteorological equipment, optical manufacturing equipment, semiconductor manufacturing equipment, numerical control machine tools, medical equipment, instruments, aerospace machines, and radar and other kinds of satellite ground receiving equipment. Therefore, harmonic reducer plays an important role in many industries.











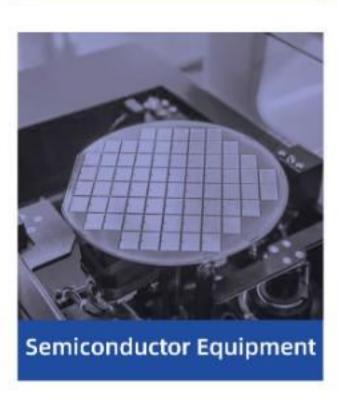


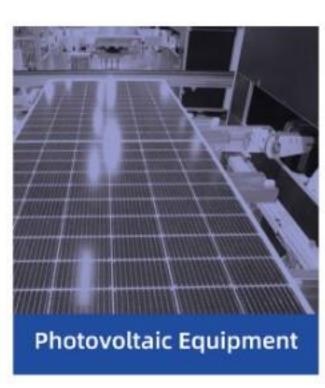


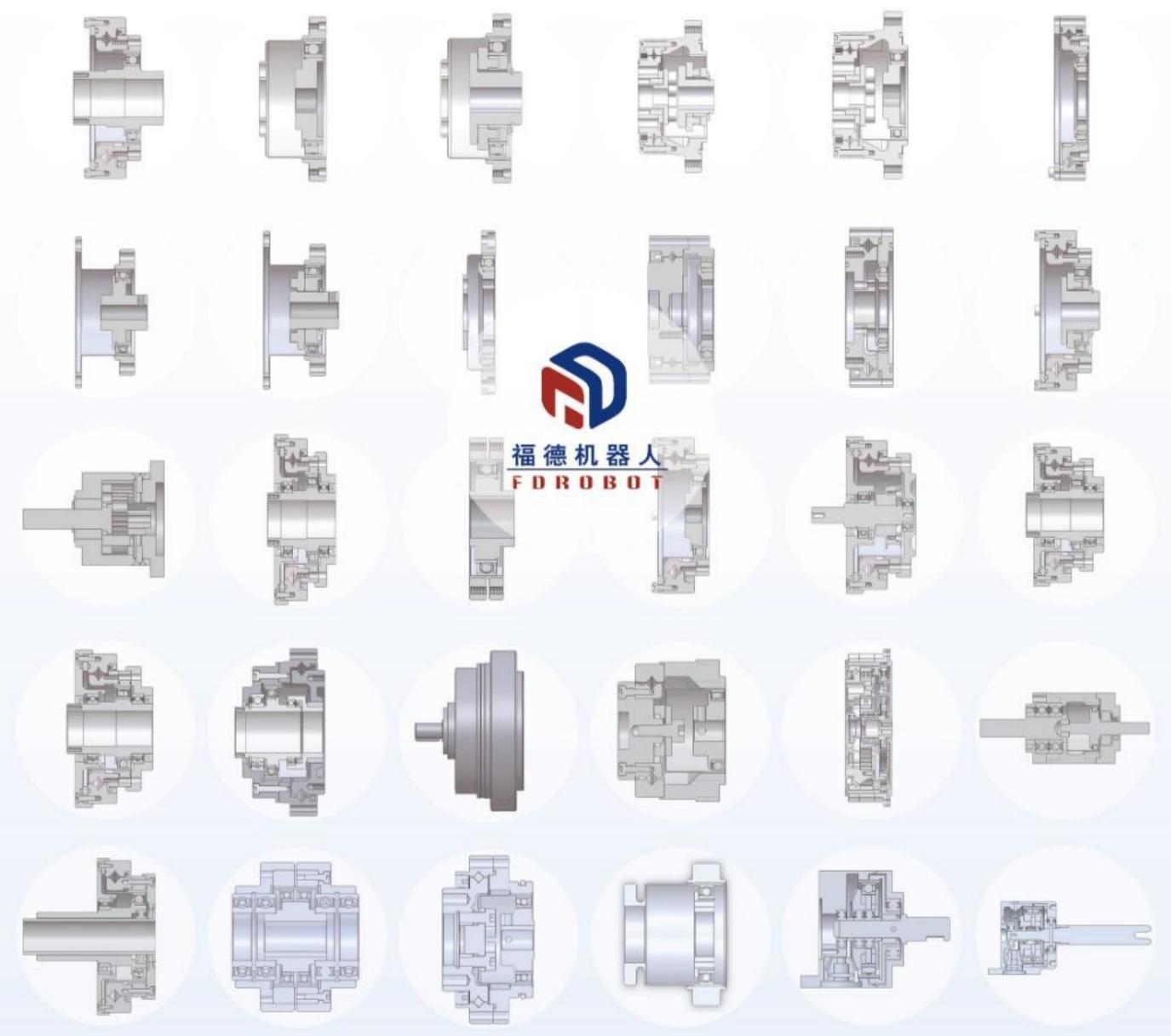












Sichuan FDRobot Co., Ltd. (835015)

The company is located in China Science and Technology City - Mianyang, Sichuan National High-tech Industrial Development Zone. It is a "specialized, special and new" high-tech enterprise in Sichuan Province.

FDRobot specializes in product research and development, design, manufacturing, sales and service of robots and core components. It has more than 150 patents and software copyrights and has obtained ISO9001-2015 international quality system certification. In particular, we have conducted continuous and in-depth research on the commercialization of precision harmonic reducers, mastered the core technology of precision harmonic reducers and their complete sets of manufacturing processes and equipment, and launched a series of products with independent intellectual property rights: Harmonic Reducers, Integrated Joints, Collaborative Robots, Humanoid Robots, Composite Robots, etc.

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in https://www.linkedin.com/company/fdrobot/?viewAsMember=true

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NO.240314 (EN)







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https://www.youtube.com/aFDROBCT

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http://en.fdrobat.com/

No. 10, South Sention of Hugo West Street, Mureuric High tech Zone, Sichum Province



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Components of a Harmonic Drive

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Classification of a Harmonic Reducer

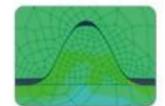
Classification by torque	Standard torque type, High torque type
Classification of flexspline structure	Hat type, Cup type
Classification according to the height of the corkscrew	Ultra-thin type., Standard type
Classification by installation and use	Combination type, Component type



Technical Advantage

Adopting finite element simulation analysis and virtual prototype technology, systematic design of tooth structure, tooth surface stress, thickness of flexible wheel, strength of flexible bearing and other indicators, to ensure the optimisation of the theoretical design indicators, and at the same time. through a large number of processing, trial production, test to make corrections to the theoretical

New multi-section arc "R5 tooth shape"





(Tooth shape simulation)

(Contact stress simulation)

The "RS tooth profile" overcomes the shortcomings of the previous harmonic meshing tooth profile. and through a series of impovative designs, greatly improves the service life of the flex wheel. with the following advantages:



Optimised tooth height, optimum meshing distance to obtain a larger meshing volume, reducing the pressure on the tooth surface;



Optimised tooth root curvature, reducing the risk of fracture failure;



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Optimised bearing wear resistance design;



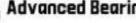
Optimised tribological design;



Optimised design of the retention bracket.



Special material selection and the best heat treatment technology.



Advanced Bearing Wear Resistance Technology

Wear-resistant technology was not applied:

The surface of the steel balls is wom and abrasive.

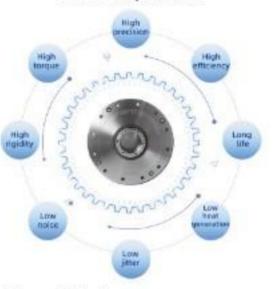


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Core Competence





Advanced theoretical design

Advanced design means, new RS tooth shape, optimised flexible bearing, aptimised flexible wheel design.



Advanced R&D design

Special material selection, adequate tribological design, special heat treatment process, optimised wear



Advanced Manufacturing

Innovative processing equipment, optimised process flow, rigorous inspection apparatus, scientific quality



Common Reduction Ratios of Harmonic Reducer

Paradigm /: Yes/Customisable -: No

Structure Type	Model Size	Standard Torque Model Reduction Ratio						Hig	Deliceses				
		30	50	80	100	120	160	50	80	100	120	160	Atrici
	. 3	4	1.0	10	10		-			-	-	-	- 4
	5	4	1	4	6								- 4
	8	4		4	Ŧ.								- 90
	31	4.		4	4		-	4.	4				4
	14	4.	11	+	¥			7	v.	4.			- 4
	17	1		4	4.	14			4		4		1
	20	4		4	7	1	CV	1.	4		V.	-	V
or corre-	25	4		4	1	1	4	1	4		+	18	4
Standard	32	4		¥.	3	V	¥	-1	4		4.	4	4
Model	40	-	4	1	16	1.7	32	4	4		V	4	- 6
	45			V	6	1	V	4	4		N.	U	4
	50			1	6	1.7	19	4	4		4	16	4
	58	-		4	1	17	69	V	4		4	16.	-7
	65			4	1	19	AV		4		V		- 87
	80	-		4	4	. 4	V	1	3		4		4
	.90	-		1	¥	1.7	.0	4	4.		4.	Ψ.	9.
	100			V	4	1	.5	1	4		1		- 2
	5	4.		4	1		10						4
	8	4		10	12								- 7
	11	4	1	30	6								4
	14	100	4	4	4								90
Ultra-thin	17			d'	4	1							- 4
Model	20	-		4	9	1.7	¥						- 2
	25	-		+	14	13.	4						- 6
	32			8	1	3	V						- 47
	40		7	4	4	4	.4						4
	45			W.		1	V						100
	50			10	1.0	1.8	1						- 6

About customized sproof. For currentised ratios, please consult our technical staff or authorised apents.













M Technical Data

Paradigm @:Excellent @:Good @:Well

Product Characteristics

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			Variable	Terqu	1	Bulati	Light wild!	That thispe	MO I DM	Custorniked	A STREET,					
	Se	eries Name	Peak Turque (Nm)	Reduction Natio	Torque: Weight ratio	Apple retained to the latest	Intational accuracy	arr girt	apa.	nation construction	ked					
	nacj.	Sundard Carri fut Spe	19-2653	50 - 160	0	0	D	(1)	o.	-	10	c				
Standarii	PHS-CD	Standard cross state her type	19 ~ 2650	50 - 160	0	0	b	13			10					
component	RCE-Q	manded saming upe	79 × 2650	50-160	0	0	0	0	0	Α	0	g				
	FE3-00	Strated even this tracture	79-2650	50 - 160			0	0		à	0					
	PCD-E	altra din luji	12 - 823	50 - 160	=	9		Ó		=		6				
	BB-AH	Nacional Nation has been	14-3450	50-160	=	.0		ā	Δ	2						
Standard combination	RIS-N	Stemand below hat been	79 - 2650	50-160		0	0	A	Α		0					
	FH6-5]	the board Carri buts	19 ~ 2650	50-160	0	0	0	0		=	0					
	96:30	District one the heroes.	99-2652	50-100		0	0	0			o					
	fris-sit	Stracket Simple Hotelet But	19-3650	50 - 160	0	0	9	10		0	10	ç				
	RES-AL	Service of the contract of the	19 - 2651	50 - 160	0	q	0	0	0	-	0	3				
type	#C5-AD	Standard even this out type	19 ~ 2650	50 - 160			0	Ó	0	A	a					
	PCD-4H	Minor the Indiana Days	12-455	50-160	0	0	0	0	0	0	43-					
	FCD:46	Unit fit and dente to the	12-523	50-360	0	0	0	.0	0	0	10					
	PHD-9H	(Fitter Print Streets Herbird Type	12-450	50 - 160	0		0	iii	10	10	10					
	RIG-Q	High territors care that type	24+3400	50 - 166	11	D	0	0	0	-	41	10				
High-torque	PHG-CO	HIGH BY HER CHILL HER HALF MY THE	24 - 3400	501-160	=	8	8	'n	=		10	d				
essembly	#C6-C)	registration can carrying	24-3400	50-160	=		0	0		4	0	6				
type	FEB-ED	migh furgion or you claim small read lyant	26+3000	50 - 100	0	0	0	0	0	4	6	0				
	FIG-AR	registration following by type:	24-3400	50 - 160	0	0	0	4	6	ш.	0	0				
	\$165-AL	that broke control with but you.	24 - 3400	50 - 160	n	0	0	A	-		0	9				
	140-9	High-basics care fail you	24 - 3400	50 - 760	0	0.	0	0	0		0	ď				
High-torque	PHG-50	High-bases consider furtype	24-2400	50 - 160		0	0	0			-	9				
type	PHO-5H	ingh carbia ianga kolon hartgai	26-3000	50-188	0	9	0	0	0	2	0	40				
1000	PEG-AL	High-Carper cars cut lyan-	24-3400	50-160	0		0	o	a	w	G	0				
	FC6-60	High times one obtaining the	24 - 3400	50 = 160			0	O		A	0	0				



















