

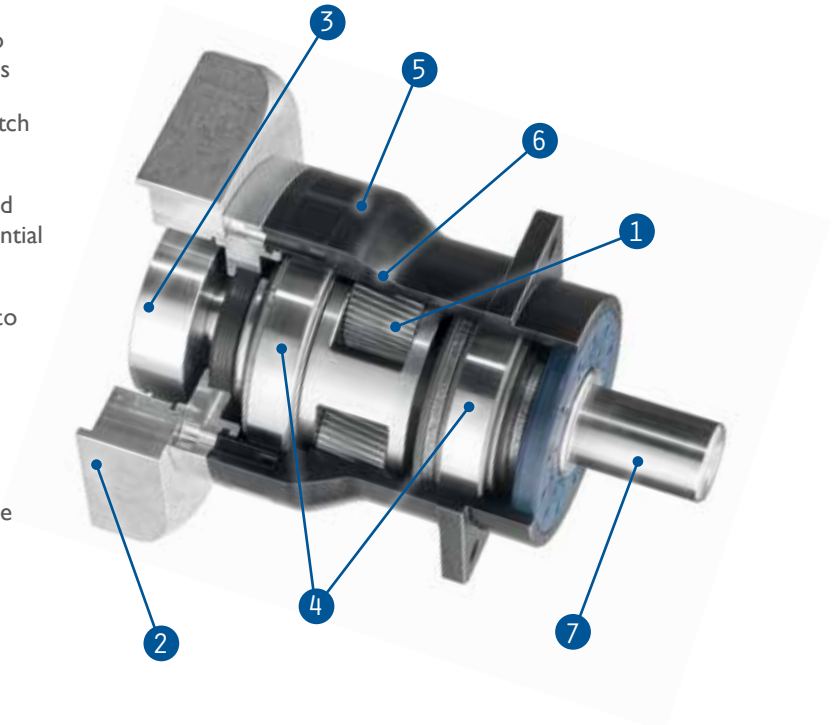


## ▶ HIGHEST PERFORMANCE: SPH SERIES

The SPH series features helical gearing which brings a whole new level of power and precision to GAM's already extensive portfolio of gear reducer technology. With special attention paid to every aspect during development, the SPH gracefully combines design and engineering, to deliver our best inline planetary gear reducer yet.

For dynamic and demanding servo applications where performance is critical, the SPH is highly powerful and efficient, yet smooth and quiet.

1. **Helical Gears** Precision cut and ground to quietly deliver higher torques and accuracies
2. **Adapter Flange** Custom machined to match any motor for easy installation
3. **Input Clamping Element** Low inertia and balanced for high speeds with a single tangential screw ensures a secure motor connection
4. **Bearings** Optimized taper roller bearings to accommodate high radial and axial loads
5. **Housing** Sleek and contoured steel housing with black oxide treatment for maximum durability
6. **Ring Gear** Machined directly into the single piece housing for maximum stiffness
7. **Output Shaft** Offered smooth or keyed and can be easily shortened if required

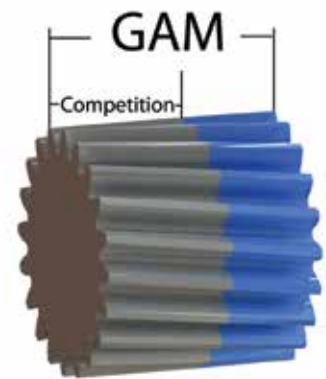


### Helical gears make the difference

The helical gear profile is cut at an angle that allows for gradual tooth engagement allowing for smooth, accurate, and quiet transmission. GAM's SPH gears are cut at the optimal helix angle to minimize resultant axial forces and they have a larger tooth width to maximize torque carrying capacity compared to the competition.

### It all starts with the gears

The SPH's helical gears are produced to an extremely high level of quality and ground for further precision. With state of the art testing and measuring instruments and qualified personnel, we assure that the SPH will meet and exceed your requirements. With the SPH, every detail counts.



The SPH is GAM's highest performing inline gear reducer

Designed for **dynamic**  
& **cyclic** applications

Can be optimized for **high speed**  
and **continuous** applications



# ▶ HIGHEST PERFORMANCE: SPH SERIES

Available configurations for simple and compact machine integration



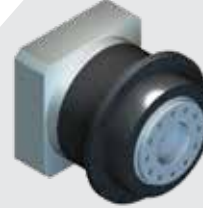
**SPH-W**  
Shaft output design for mounting to pulleys and rack and pinion systems. Available with a smooth or keyed output shaft.



**SPH-K**  
Features a bellows coupling on the output for maximum stiffness and the best results in highly dynamic applications. An output housing comes standard with custom housings available.



**SPH-C**  
Same benefits as the SPH-K models without the housing on the output. Plug the gearbox directly into your machine and achieve a more compact design.



**SPH-F**  
Flange output design for direct mounting of pinions and other machine elements. The latest addition to the SPH product line.



**SPH-SP**  
Splined-Shaft output with GAM Helical Pinion. Use with GAM Helical Rack for a complete linear system

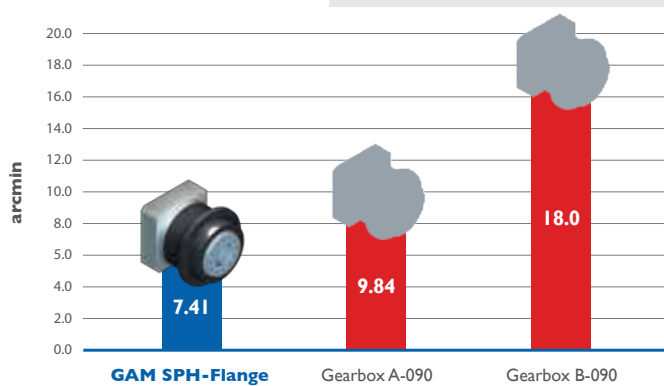


SPH

## When your application is demanding...demand GAM's SPH

	LOW	HIGH	SUPERIOR	WHY GAM SPH?
<b>Flexibility</b>	Competition A		<b>SPH</b>	Configured to meet the application, not the other way around!
	Competition B			
<b>Modifications &amp; Customizations</b>	Competition A		<b>SPH</b>	Flexible manufacturing and experienced engineering
	Competition B			
<b>Performance</b>			<b>SPH</b>	95 years of gear manufacturing experience
			Competition A	
			Competition B	
<b>Quality</b>			<b>SPH</b>	State of the art testing and measuring machines. ISO 9001 Certified
			Competition A	
			Competition B	

## Limit Lost Motion with the SPH Flange



Lost Motion (LM) in arcmin, was calculated using the following formula:  $LM = (1/Ct)^j \cdot Ta + j$

Where: Ct= Torsional Rigidity (Nm/arcmin)  
Ta= Application Torque (Nm)  
j= Output Backlash - Standard (arcmin)

Backlash and Torsional Rigidity are both important values to consider when selecting a high precision gearbox as they both affect lost motion.

In this example, the SPH Flange (size 75, 5:1 ratio, standard backlash <3 arcmin, rigidity 34 Nm/arcmin) was compared to two equivalent standard backlash flange gearboxes available on the market.

Using an application torque value of 150Nm, gearbox A-090 and gearbox B-090 exhibit 33% and 143% more lost motion respectively than the SPH Flange.

### SPH-F Low Backlash

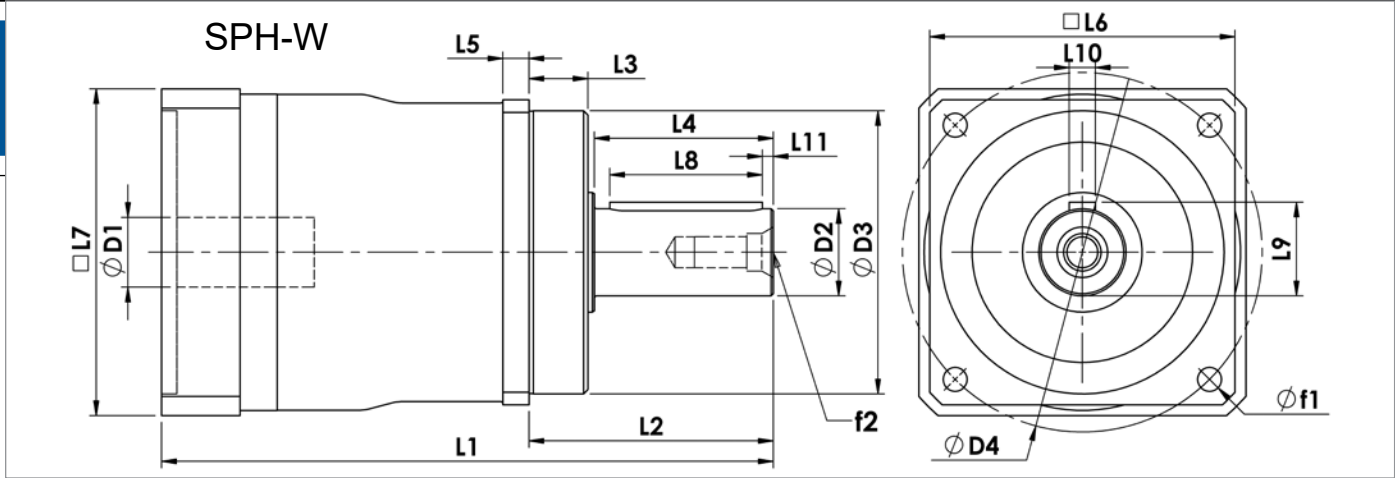
<3 arc-min standard  
<1 arc-min reduced



# ▶ HIGHEST PERFORMANCE: SPH SERIES - SPH-W

SPH-W		60	75	100	140	180			
All Ratios Available									
Nominal Output Torque ( $T_{2n}$ )	Nm (lb-in)	3:1-5:1	60 (531)	100 (885)	250 (2213)	450 (3983)	900 (7966)		
		7:1	40 (354)	80 (708)	180 (1593)	420 (3717)	800 (7081)		
		10:1	30 (266)	65 (575)	110 (974)	240 (2124)	450 (3983)		
		12:1-40:1	60 (531)	100 (885)	250 (2213)	450 (3983)	900 (7966)		
		50:1	40 (354)	80 (708)	250 (2213)	450 (3983)	900 (7966)		
		70:1	40 (354)	80 (708)	180 (1593)	420 (3717)	800 (7081)		
		100:1	30 (266)	65 (575)	110 (974)	240 (2124)	450 (3983)		
Max Acceleration Output Torque ( $T_{2B}$ )	Nm (lb-in)	1.5 x Nominal ( $T_{2n}$ )							
Emergency Output Torque ( $T_{2not}$ )	Nm (lb-in)	3.5 x Nominal ( $T_{2n}$ )							
Nominal Input Speed ( $n_{1n}$ )	RPM	-	4500	4500	4000	3800	2000		
Max Input Speed ( $n_{1max}$ )		-							
Standard Output Backlash (j)	arcmin	1-stage	<4	<4	<4	<4	<4		
		2-stage	<6	<6	<6	<6	<6		
Reduced Output Backlash (j)	arcmin	1-stage	<2	<2	<2	<2	<2		
		2-stage	<4	<4	<4	<4	<4		
Allowable Radial Load ( $F_{rad}$ )1	N (lbf)	-	3,500 (787)	4,500 (1012)	8,000 (1798)	12,000 (2698)	20,000 (4496)		
Allowable Axial Load ( $F_{axial}$ )	N (lbf)	-	1,600 (360)	2,400 (540)	2,400 (540)	6,000 (1349)	10,000 (2248)		
Torsional Stiffness ( $C_{t21}$ )	Nm/arcmin (lb-in/arcmin)	1-stage	4.0 (35)	12 (106)	32 (283)	54 (478)	168 (1487)		
		2-stage	4.0 (35)	12 (106)	32 (283)	54 (478)	168 (1487)		
Mass Moment of Inertia ( $J_1$ )	kg-cm <sup>2</sup> (lb-in <sup>2</sup> )	3:1	0.42 (0.144)	1.26 (0.431)	4.00 (1.367)	12.90 (4.408)	62.30 (21.29)		
		4:1	0.29 (0.099)	0.95 (0.325)	2.90 (0.991)	8.45 (2.888)	38.90 (13.29)		
		5:1	0.22 (0.075)	0.79 (0.270)	2.20 (0.752)	6.20 (2.119)	25.90 (8.850)		
		7:1	0.17 (0.058)	0.68 (0.232)	1.81 (0.619)	4.66 (1.592)	18.40 (6.288)		
		10:1	0.15 (0.051)	0.62 (0.212)	1.60 (0.547)	3.86 (1.319)	13.60 (4.647)		
		12-16:1	0.18 (0.062)	0.62 (0.212)	1.46 (0.499)	3.40 (1.162)	12.90 (4.408)		
		20-25:1	0.14 (0.048)	0.53 (0.181)	1.20 (0.410)	2.45 (0.837)	8.69 (2.970)		
		28-40:1	0.13 (0.044)	0.50 (0.171)	1.10 (0.376)	2.10 (0.718)	6.99 (2.389)		
Weight (m)	kg (lbs)	1-stage	(2.2) (4.9)	3.6 (7.9)	7.3 (16)	17.4 (38)	38 (84)		
		2-stage	(2.9) (6.4)	4.9 (11)	9.1 (20)	23.3 (51)	48 (106)		
Noise Level ( $L_{pA}$ )	dB(A)	1-stage	<60	<63	<64	<65	<65		
		2-stage	<60	<61	<62	<63	<64		
Efficiency at Load	1-stage: 98% 2-stage: 96%								
Service Life	>20,000 hours								
Lubrication	Lifetime lubrication with synthetic oil								
Protection Rating	IP64 (IP65/IP66 available on request)								
Operating Temperature Range	-25°C to +80°C (short term: 100°C)								

1) Load applied at center of output shaft @ 100 RPM

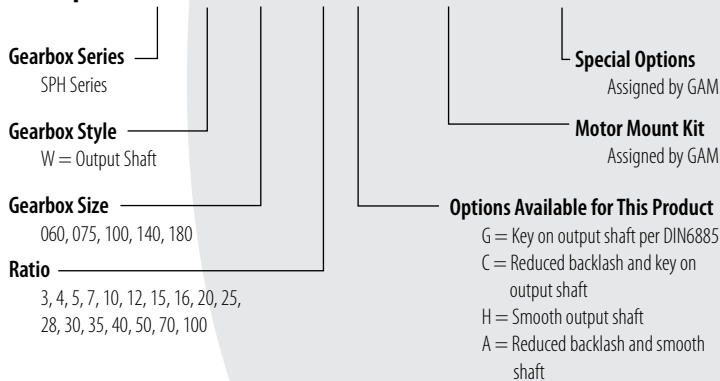


SPH-W		60		75		100		140		180	
		mm	(in)	mm	(in)	mm	(in)	mm	(in)	mm	(in)
D1 <sub>max</sub> Standard	Motor Shaft Diameter	14	(0.551)	19	(0.748)	24	(0.945)	32	(1.260)	38	(1.496)
D1 <sub>max</sub> Available <sup>1</sup>		19	(0.748)	24	(0.945)	32	(1.260)	38	(1.496)	48	(1.890)
D1 <sub>max</sub> 2-stage	Output Shaft Diameter	14	(0.551)	19	(0.748)	24	(0.945)	32	(1.260)	38	(1.496)
D2 k6		16	(0.630)	22	(0.866)	32	(1.260)	40	(1.575)	55	(2.165)
D3 g6	Pilot Diameter	60	(2.362)	70	(2.756)	90	(3.543)	130	(5.118)	160	(6.299)
D4	Output Bolt Circle	68	(2.677)	85	(3.346)	120	(4.724)	165	(6.496)	215	(8.465)
f1	Mounting Holes	6	(0.236)	6.6	(0.260)	9	(0.354)	11	(0.433)	13	(0.512)
f2	Shaft End Thread	M5		M8		M12		M16		M20	
L1 <sup>2</sup>	Overall Gearbox Length	150	(5.906)	165	(6.496)	220	(8.661)	280	(11.024)	330	(12.992)
L1 <sub>2-stage</sub> <sup>2</sup>		190	(7.480)	210	(8.268)	270	(10.630)	345	(13.583)	420	(16.535)
L2	Shaft Length	48	(1.890)	56	(2.205)	88	(3.465)	112	(4.409)	112	(4.409)
L3	Pilot Height	18	(0.709)	18	(0.709)	28	(1.102)	27	(1.063)	27	(1.063)
L4	Usable Shaft Length	28	(1.102)	36	(1.417)	58	(2.283)	82	(3.228)	82	(3.228)
L5	Flange Thickness	6	(0.236)	7	(0.276)	10	(0.394)	12	(0.472)	18	(0.709)
L6	Output Square	61	(2.402)	75	(2.953)	100	(3.937)	140	(5.512)	180	(7.087)
L7 <sup>2</sup>	Input Square	75	(2.953)	90	(3.543)	120	(4.724)	150	(5.906)	210	(8.268)
L8	Key Length	25	(0.984)	32	(1.260)	50	(1.969)	70	(2.756)	70	(2.756)
L9	Key Height	18	(0.709)	24.5	(0.965)	35	(1.378)	43	(1.693)	59	(2.323)
L10	Key Width	5	(0.197)	6	(0.236)	10	(0.394)	12	(0.472)	16	(0.630)
L11	Key End	1.5	(0.059)	2	(0.079)	4	(0.157)	5	(0.197)	6	(0.236)

- 1) For larger motor shaft diameters, please contact GAM.
- 2) Depending on the motor, value can vary.

### TYPE CODES FOR SPH SERIES (SPH-W)

**Example: SPH - W - 075 - 005 G - [115 - A01] - S111**



Tolerance (mm)		
Size	k6	g6
Over 6	+0.010	-0.005
Thru 10	+0.001	-0.014
Over 10	+0.012	-0.006
Thru 18	+0.001	-0.017
Over 18	+0.015	-0.007
Thru 30	+0.002	-0.020
Over 30	+0.018	-0.009
Thru 50	+0.002	-0.025
Over 50	+0.021	-0.010
Thru 80	+0.002	-0.029
Over 80	+0.025	-0.012
Thru 120	+0.003	-0.034
Over 120	+0.028	-0.014
Thru 180	+0.003	-0.037