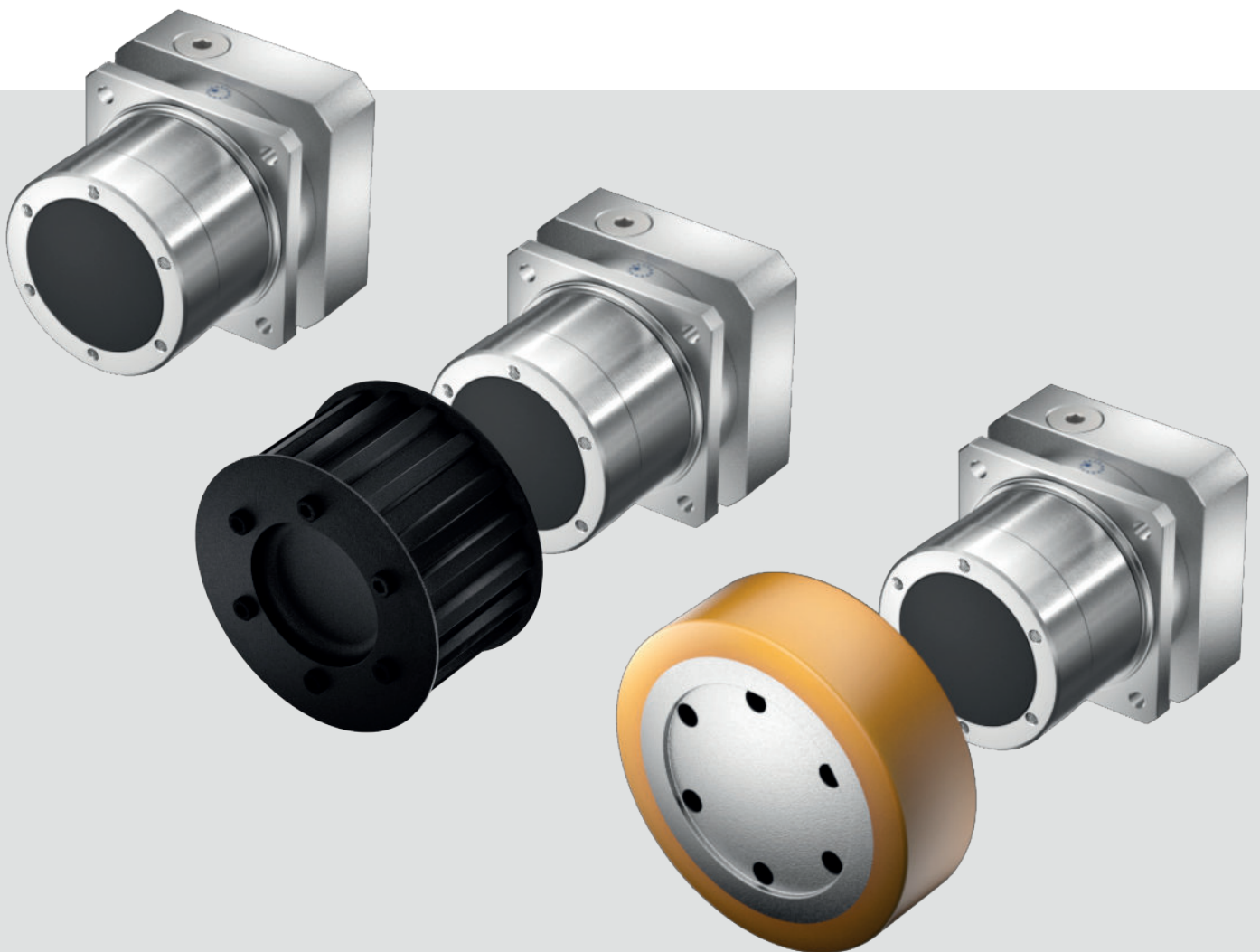




**APEX DYNAMICS**

# **NEW GENERATION PLANETARY GEARBOX**

## **GL / GLS - SERIES**



# Gearbox Series - GL

## ▶ Main Features:

- High radial load
- Rotating housing
- High efficiency
- Low noise
- Reduced backlash
- Optimized Inertia moment
- Limited temperature rise
- Long service life
- Optimized output torque



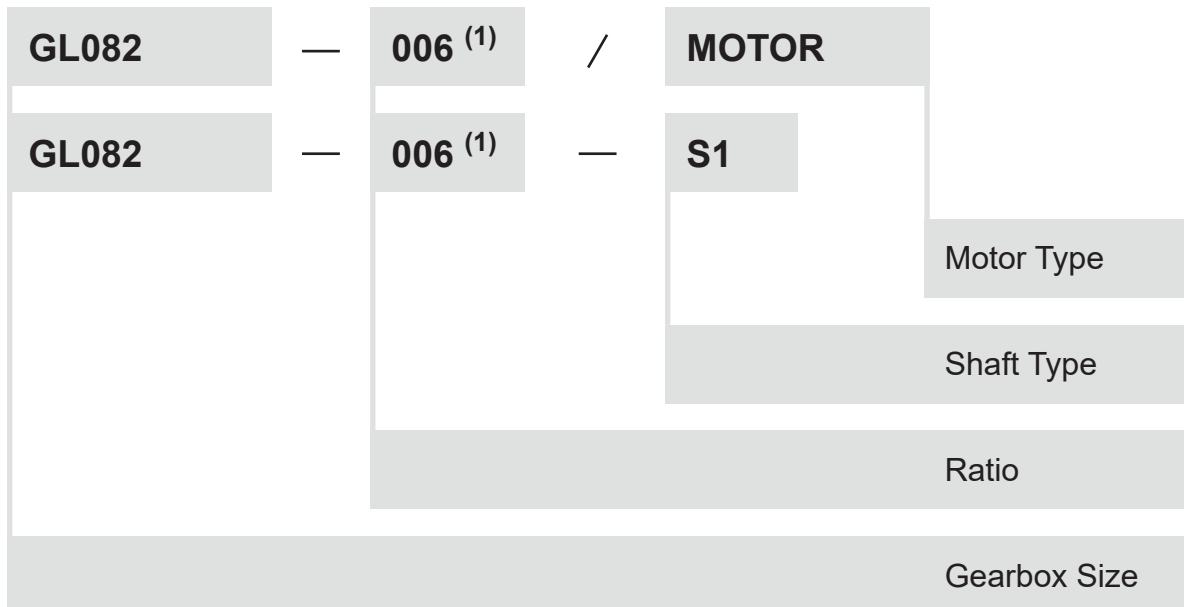
## About Apex Dynamics

The world is constantly changing. Also in the technical field, developments can hardly be kept up to date. In the world of automation and robotization, for example, yesterday's innovations are already commonplace today. As a result, many companies are caught between a shortage of personnel with deep substantive knowledge and a need for automation or technical innovation. How do we get the market moving forward?

Apex Dynamics supplies the essential parts for the mechanical drive of machines and robots. But that does not stop with gearboxes, racks and pinions. Apex Dynamics provides its customers and the market, where necessary, with the knowledge and expertise that will help you move forward. In addition, we take our responsibility when it comes to training new young specialists. With our innovative products, in-depth knowledge and years of experience, we do not only help the industry but also you further on a commercial and product-technical level.

We create opportunities for our customers, the technical industry and the world around us to move forward. Together we work on advanced solutions for the challenges of tomorrow. Apex Dynamics stands for a forward movement.

# Order Code GL / GLS Gearbox



GLS is the GL version with option input “SHAFT” instead of input “HUB”

For blackening as option on the housing and flange, please contact APEX

### Gearbox Size

GL 082 / 100 / 132  
 GLS 082 / 100 / 132

### Ratio <sup>(2)</sup>

GL 2 / 3 / 4 / 6 / 9  
 10 / 15 / 20 / 24 / 30 / 36 / 40 / 45 / 60 / 90  
 GLS 3 / 4 / 6 / 9  
 10 / 15 / 20 / 24 / 30 / 36 / 40 / 45 / 60 / 90

Shaft Type : S1 = Smooth Input Shaft  
 S2 = Input Shaft with Key

### Motor Type Manufacturer and Model

(1) Ratio ( $i=n_{in} / n_{out}$ )

(2) Please refer to the specifications for the ratios provided in each series



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# Performance - GL Gearbox

Model No.		Stage	Ratio <sup>1</sup>	GL082	GL100	GL132
Nominal Output T <sub>2N</sub>	Nm	1	2	60	102	280
			3	90	155	355
			4	83	168	308
			6	54	115	252
			9	21	50	145
		2	10	60	102	280
			15	90	155	355
			20	83	168	308
			24	54	115	252
			30	54	115	252
			36	21	50	145
			40	53	96	229
			45	21	50	145
			60	54	115	252
		90	21	50	145	
		Emergency Torque T <sub>2NOT</sub>	Nm	1,2	2~90	3 times of Nominal Torque T <sub>2N</sub>
Max. Torque T <sub>2B</sub>	Nm	1,2	2~90	1,5 times of Nominal Torque T <sub>2N</sub>		
No Load Torque <sup>2</sup>	Nm	1	2~9	0,45	0,7	1,4
		2	10~90	0,2	0,3	0,6
Backlash <sup>3</sup>	arcmin	1	2~9	≤ 3	≤ 3	≤ 3
		2	10~90	≤ 5	≤ 5	≤ 5
Torsional Rigidity	Nm/arcmin	1,2	2~90	8	22	60
Nominal Input Speed N <sub>1N</sub>	rpm	1	2~9	5.000	3.600	3.600
		2	10~90	5.000	4.600	4.600
Max. Input Speed N <sub>1B</sub>	rpm	1	2~9	7.000	6.000	6.000
		2	10~90	7.000	7.000	7.000
Max. Radial Load F <sub>2a1B</sub> <sup>4</sup>	N	1,2	2~90	2.860	3.400	7.200
Max. Axial Load F <sub>2a2B</sub> <sup>4</sup>	N	1,2	2~90	1.430	1.700	3.600
Max. Tilting Moment M <sub>2k</sub> <sup>4</sup>	N	1,2	2~90	117	155	452
Operating Temperature	°C	1,2	2~90	-10 °C ~ 90 °C		
Degree of Gearbox Protection		1,2	2~90	IP67		
Lubrication		1,2	2~90	Synthetic lubrication grease		
Mounting Position		1,2	2~90	all directions		
Running Noise <sup>2</sup>	dB(A)	1	2~9	≤ 58	≤ 59	≤ 64
		2	10~90	≤ 58	≤ 59	≤ 60
Efficiency	%	1	2~9	≥ 97%		
		2	10~90	≥ 94%		
Weight	kg	1	2~9			
		2	10~90			

(1) Ratio ( $i = n_{in} / n_{out}$ ), GLS ratio 2:1 is not available

(2) The dB values are measured by gearbox with ratio 9 (1-stage) or ratio 90 (2-stage), No loading at 3,000 RPM or at the respective Nominal Input Speed by bigger model size. By lower ratio and/or higher RPM, the noise level could be 3 to 5 dB(A) higher

(3) Backlash is measured at 2% of Nominal Output Torque T<sub>2N</sub>.

(4) Applied to the output flange center at 100 rpm. The calculation formula please refer to Fig 1.

(5) Continuous operation is not recommended.

# Inertia - GL Gearbox

Model No.		GL082		GL100		GL132	
Ø <sup>(A)</sup>		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
8	kg * cm <sup>2</sup>	-	0,1	-	-	-	-
11		0,21	0,16	-	0,17	-	-
14		0,24	0,2	0,54	0,21	-	0,42
19		0,64	-	0,79	0,6	2,51	0,66
24		-	-	4,06	-	4,78	3,94
28		-	-	-	-	6,15	-
32		-	-	-	-	8,03	-
35		-	-	-	-	14,72	-
38		-	-	-	-	17,38	-
42		-	-	-	-	-	-
48		-	-	-	-	-	-

A. Ø = Input shaft diameter.

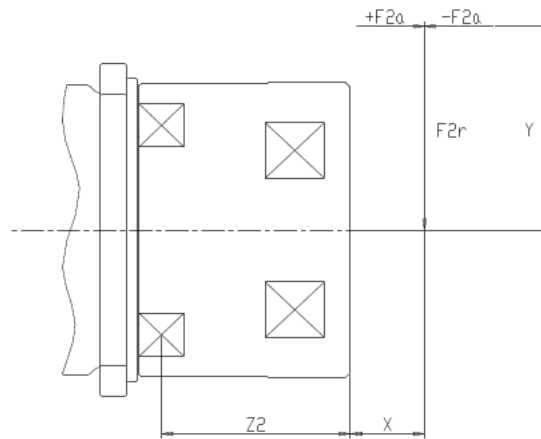


Fig.1

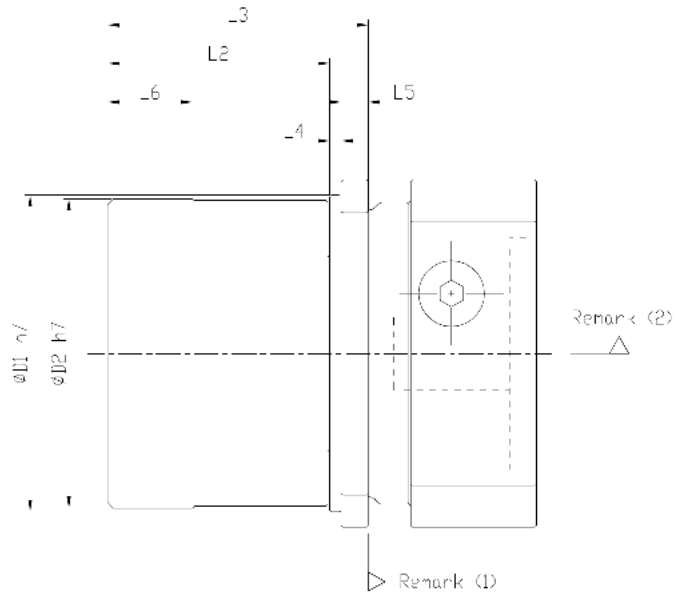
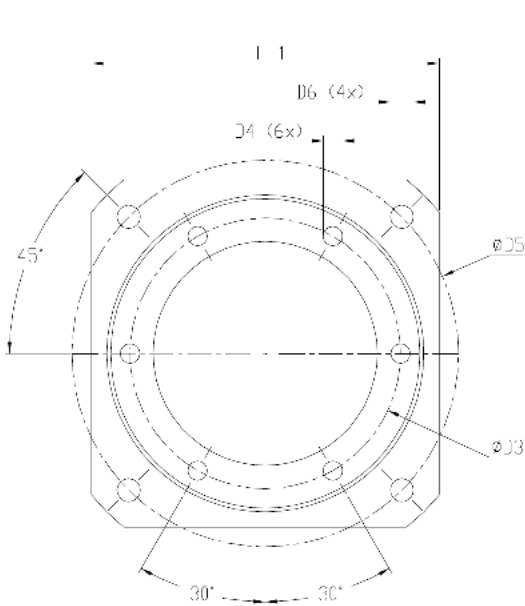
$$\text{Max. Tilting Moment } M_{2K} = \frac{F_{2a} * Y + F_{2r} * (X + Z2)}{1000}$$

$M_{2K} : [\text{Nm}]$   
 $F_{2a}, F_{2r} : [\text{N}]$   
 $X, Y, Z2 : [\text{mm}]$

GL	082	100	132
Z2 [mm]	51	57	78.5

Note : Applied to the output flange center at 100 rpm

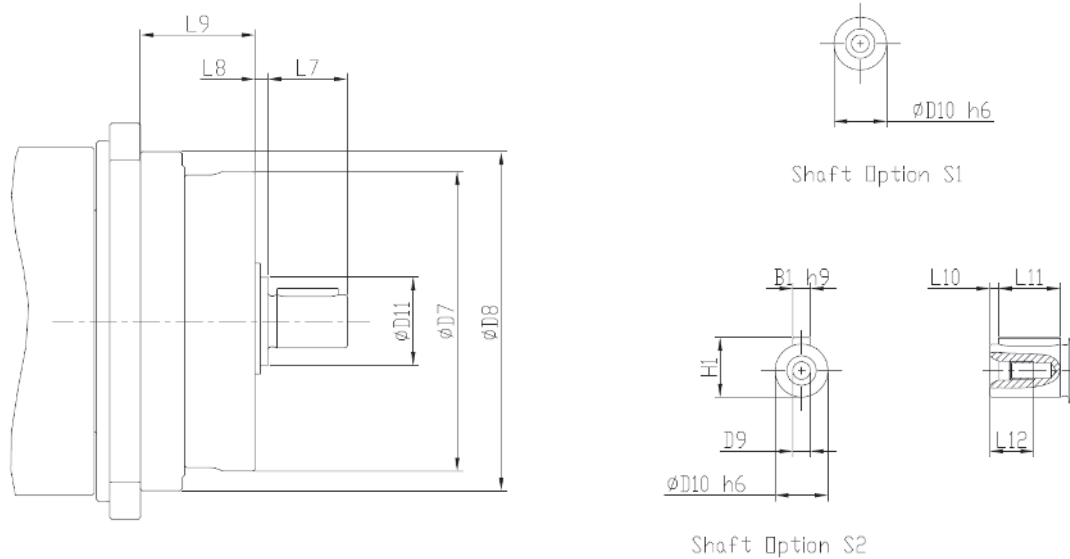
# Dimension - GL Gearbox



Dimensions	GL082	GL100	GL132
D1 <sub>h7</sub>	82	100	132
D2 <sub>h7</sub>	80	96	128
D3	70	84	114
D4 x Pitch x Deep	M5 x 0,8P x 8	M6 x 1,0P x 10	M8 x 1,25P x 12,5
D5	100	122	166
D6	M6 x 1,0P	M8 x 1,25P	M10 x 1,5P
L1	90	108	140
L2	57,5	62,5	85,5
L3	67,5	75,5	101,5
L4	3	3,5	4
L5	7	9,5	12
L6	22	24	34

- (1) Dimensions are related to motor interface. Please contact APEX for details.
- (2) As alternative to input "HUB", input "SHAFT" is also available, please find in page 06.

# Dimensions - GLS (Input Shaft as Option)



Dimensions	Stage	GLS082	GLS100	GLS132
D7	1	68	84	93
	2	60	68	84
D8	1,2	77	100	136
D9	1	M4 x 0,7P	M8 x 1,25P	M10 x 1,5P
	2	M3 x 0,5P	M4 x 0,7P	M8 x 1,25P
D10 <sub>h6</sub>	1	12	22	28
	2	10	12	22
D11	1	20	28	35
	2	17	20	28
L7	1	18	36	42
	2	15	18	36
L8	1	3	3	4
	2	3	3	3
L9	1	26	38	45,5
	2	44,5	54	67,5
L10	1	2	3	5
	2	2	2	3
L11	1	14	28	32
	2	10	14	28
L12	1	10	19	22
	2	9	10	19
B1 <sub>h9</sub>	1	4	6	8
	2	3	4	6
H1	1	13,5	24,5	31
	2	11,2	13,5	24,5

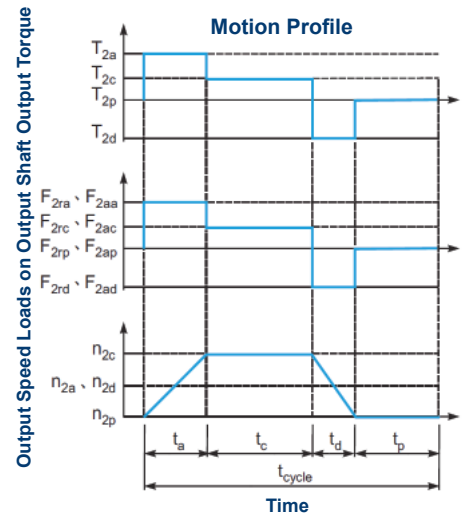
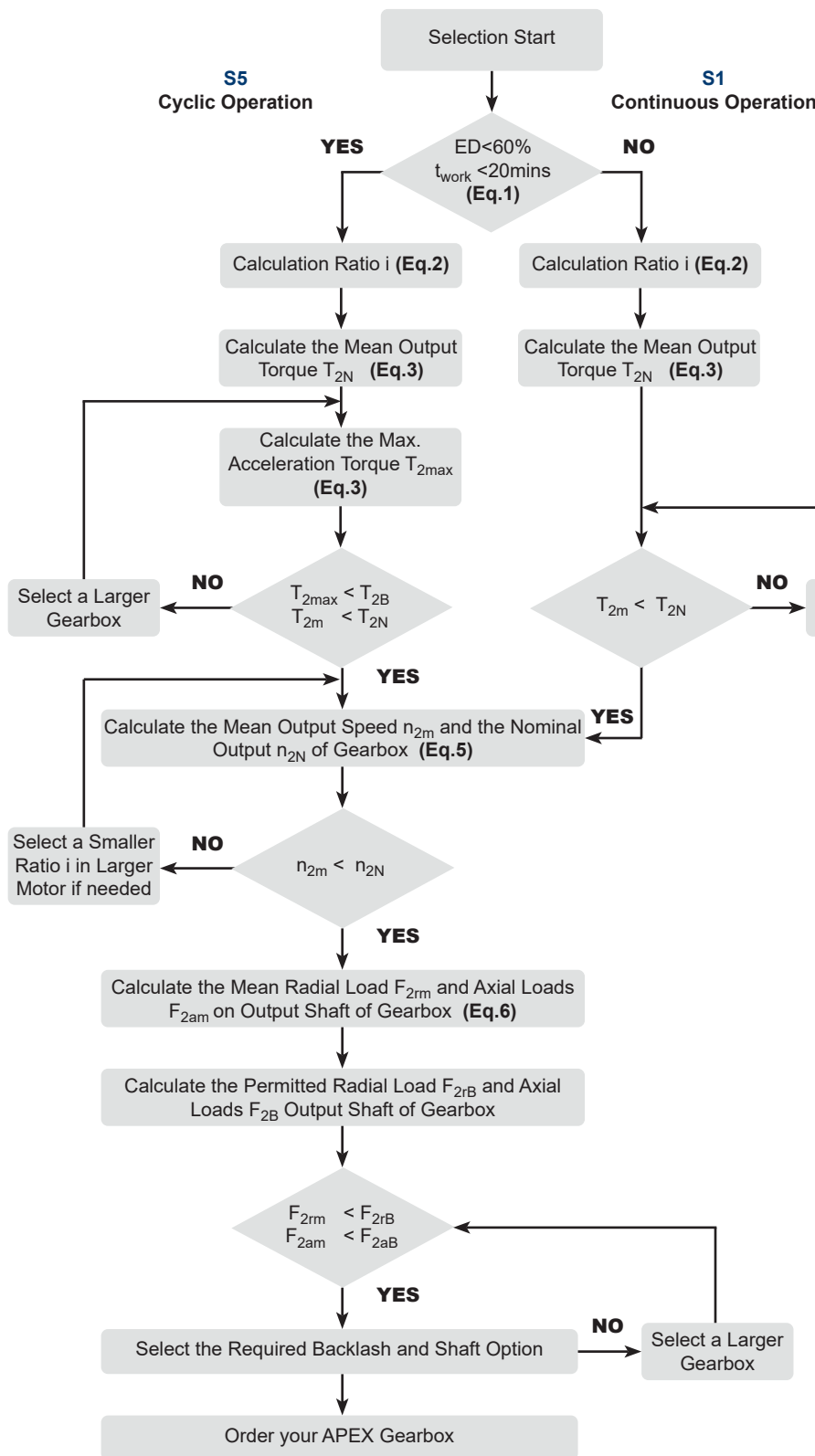
# Performance - GLS (Input Shaft as Option)

Model No.		Stage	Ratio <sup>1</sup>	GL082	GL100	GL132
Max. Radial Load F <sub>1rB</sub> <sup>(2)</sup>	rpm	1	3~9	460	600	800
		2	10~90	275	460	600
Max. Axial Load F <sub>1aB</sub> <sup>(2)</sup>	rpm	1	3~9	230	300	400
		2	10~90	137	230	300
Moment of Inertia	kg * cm <sup>2</sup>	1	3~10	0,19	0,62	1,78
		2	10~90	0,06	0,19	0,62

(1) Ratio ( $i = n_{in} / n_{out}$ )

(2) Applied to the output flange center at 100 rpm. The calculation formula please refer to Fig 1.

# Selection of the optimum Gearbox



Equations

1.  $ED = \frac{t_a + t_c + t_d}{t_{cycle}} \times 100\%$ ,  $t_{work} = t_a + t_c + t_d$   
 Index : a. Acceleration, c. Constant  
 d. Deceleration, p. Pause  
**(Eq.1)**

2.  $i \cong \frac{n_m}{n_{work}}$   
 $n_m$  Output Speed of the Motor  
 $n_{work}$  Working Speed  
**(Eq.2)**

3.  $T_{2m} = \sqrt[3]{\frac{n_{2a} \times t_a \times T_{2a}^3 + n_{2c} \times t_c \times T_{2c}^3 + n_{2d} \times t_d \times T_{2d}^3}{n_{2a} \times t_a + n_{2c} \times t_c + n_{2d} \times t_d}}$   
**(Eq.3)**

4.  $T_{2max} = T_{mB} \times i \times K_s \times \eta$   
 where  $K_s$  is

$K_s$	No. of Cycles / hr
1.0	0 ~ 1,000
1.1	1,000 ~ 1,500
1.3	1,500 ~ 2,000
1.6	2,000 ~ 3,000
1.8	3,000 ~ 5,000

$T_{mB}$  Max. Output Torque of the Motor  
 $\eta$  Efficiency of the Motor  
**(Eq.4)**

5.  $n_{2a} = n_{2d} = \frac{1}{2} \times n_{2c}$   
 $n_{2m} = \frac{n_{2a} \times t_a + n_{2c} \times t_c + n_{2d} \times t_d}{t_a + t_c + t_d}$   
 $n_{2N} = \frac{n_{1N}}{i}$   
**(Eq.5)**

6.  $F_{2m} = \sqrt[3]{\frac{n_{2a} \times t_a \times F_{2ra}^3 + n_{2c} \times t_c \times F_{2rc}^3 + n_{2d} \times t_d \times F_{2rd}^3}{n_{2a} \times t_a + n_{2c} \times t_c + n_{2d} \times t_d}}$   
 $F_{2am} = \sqrt[3]{\frac{n_{2a} \times t_a \times F_{2aa}^3 + n_{2c} \times t_c \times F_{2ac}^3 + n_{2d} \times t_d \times F_{2ad}^3}{n_{2a} \times t_a + n_{2c} \times t_c + n_{2d} \times t_d}}$   
**(Eq.6)**

**Recommended (for S5 Cycle Operation)**

The general design is given for

$\frac{J_L}{i^2} \leq 4 \times J_m$

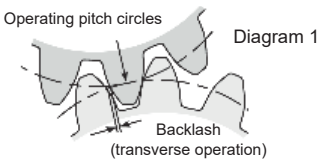
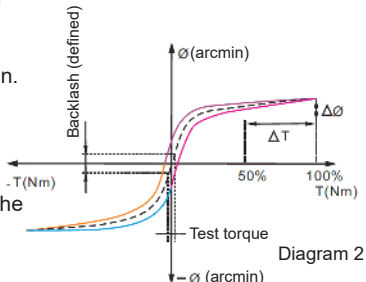
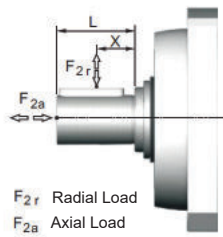
The optimal design is given for

$\frac{J_L}{i^2} \cong J_m$

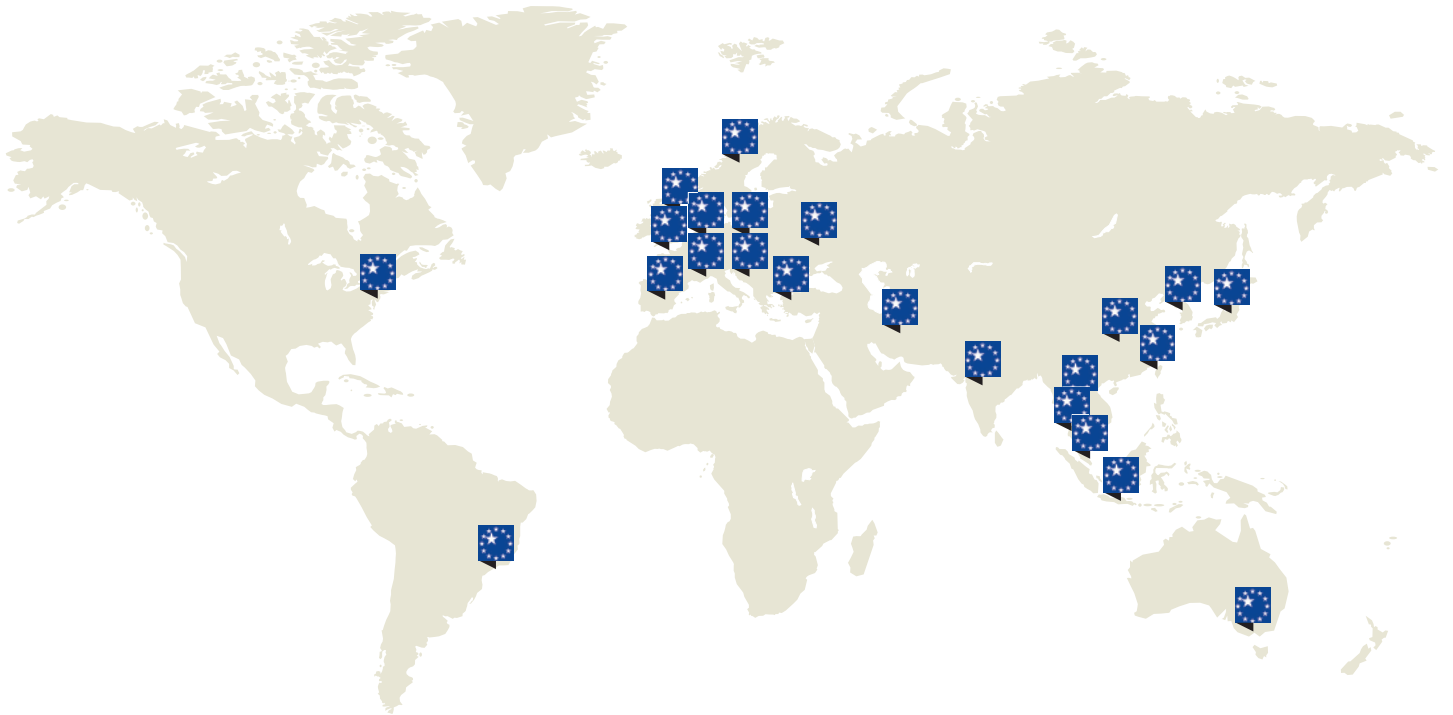
$J_L$  Load Inertia  
 $J_m$  Motor Inertia



# Glossary

Emergency Stop Torque $T_{2NOT}$	Nm	The Emergency Stop Torque is the maximum permitted torque at the output of gearbox. This may happen only occasionally and may not exceed 1,000 times during the whole service life.
Max. Acceleration Torque $T_{2B}$	Nm	Under the Cyclic Operation (S5), the Max. Acceleration Torque is the maximum torque which can be transmitted only briefly to the output of gearbox up to 1,000 cycles/hr.
No Load Running Torque	Nm	The No Load Running Torque is the min. torque to overcome the internal friction of a gearbox without loading*.
Nominal Input Speed $n_{1N}$	rpm	The Nominal Input Speed is the permitted input speed of gearbox by the Continuous Operation (S1) while the housing temperature does not exceed 90°C. This value is measured at environment temperature 25°C.
Max. Input Speed $n_{1B}$	rpm	The Max. Input Speed is the max. permitted input speed of gearbox by the Cyclic operation (S5). This value is measured at environment temperature 25°C and serves as the absolute limit of the gearbox.
Backlash	arcmin	<p>The Backlash is the maximum angular measurement between two teeth of gears when the transverse operation occurs (refer to Diagram 1). The arcmin is the measurement unit for the backlash. One arcmin equals 1/ 60 degree, symbolized as 1'.</p> 
Torsional Rigidity	Nm/arcmin	<p>Torsional Rigidity is the quotient (<math>\Delta T / \Delta\theta</math>) between the applied torque and resulting torsion angle. This value indicates how much torque is needed on the gearbox to rotate the output shaft for 1 arcmin. The Torsional Rigidity can be determined by Hysteresis Curve.</p> <p><b>Hysteresis Curve</b> When the input shaft is locked, increase torque at the output slowly up to <math>T_{2B}</math> in both directions and then release the torque gradually. According to the measured torque and torsion angle, a closed curve will be acquired as in the Diagram 2.</p> 
Radial Load And Axial Load	N	<p>The permitted radial and axial loads on output shaft of the gearbox depend on the design of the gearbox supporting bearings.</p> <p>For more information, please refer to APEX website.</p> 
Efficiency $\eta$	%	The transmission efficiency of the gears inside a gearbox (without friction).
Operating Temperature	°C	The Operating Temperature indicates the temperature of gearbox housing.
Degree of Protection		IP code stands for International Protection standard. The IP65 as example: the first IP number stands for protection degree against dust; the second IP number stands for protection against liquid.
Lubrication		APEX uses synthetic lubrication grease. Alternate greases are available, please contact APEX.
Running Noise		The Running Noise is measured depends on gearbox size, the ratio and the speed*. Higher speed usually induces higher noise level, while higher ratio induces lower noise level.
Moment of Inertia $J_1$		The Moment of Inertia $J_1$ is a measurement of the effort applied to an object to maintain its momentary condition at rest or rotating.
Breakaway Torque		The Breakaway Torque is the minimum torque to start the rotation from the input side of gearbox. Nm A smaller size or a higher ratio gearbox requests less Breakaway Torque.
Back Driving Torque		The Back Driving Torque is the minimum torque to start the rotation from the output side of gearbox. Nm A larger size or a higher ratio gearbox requires greater Back Driving Torque.

\* This value is measured at environment temperature 25°C and the input speed 3,000 rpm. If the Nominal Input Speed  $n_{1N}$  of gearbox is lower than 3,000 rpm, this value is measured by that specific Nominal Input Speed.



APEX is with 29 offices present in 25 countries worldwide!

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