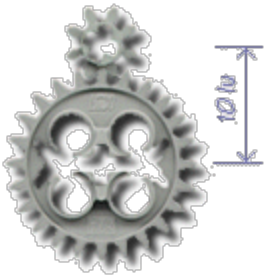

See also:
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Pneumatics

Welcome to my geartrain design page (no implied affiliation with the Lego Group).

MESHING TABLE

This table lists all useful ways to position LEGO gears so they mesh properly. There are exactly 12 perfect configurations (8 horizontal, 2 vertical and 2 diagonal; shown in yellow), two near-perfect (blue), 15 "close enough" (green) and two dozens marginal ones (brown). I tested most of them and do not recommend using configurations from the last group (especially tight ones marked with *) in main drive geartrains - they can skip or bind. The table can also be useful to position worm gears: they have the same radius as 8-tooth gear but due to their spatial configuration they cannot be used with diagonal variants from the table.

Axles Distance (lu)	5	7.5	10	12.5	15	17.5	20	25
Reduction	1	2	1 3	1 1/2	1 5	2 1/2	1 2/3	1
Gears	8t/8t	16t/8t	16t/16t 24t/8t	24t/16t	24t/24t 40t/8t	40t/16t	40t/24t	40t/40t
Perfect meshing (err = 0)	1:0	1#:0	2:0 0:1=	2#:0 1#:1=	3:0	3#:0	4:0 0:3-	5:0 3:3-
err < 0.1lu							4:0-	5:0-
0.1lu-0.15lu					3:0- 1:2-*	3#:0-		3#:3 1#:4
0.15lu-0.16lu				2#:0-	2#:1-*		3#:1= #:3-	
0.16lu-0.2lu			2:0-			1#:2= 2#:2*		
0.2lu-0.3lu		1#:0-		#:2		2:2-*		
0.3lu-0.32lu		1:1	#:1=	2:1-			2#:2=	5:0= 2#:3=
0.32lu-0.4lu	1:0-		1#:1*				4:0=	4#:1=*
0.4lu-0.5lu						3#:0=		1:4*
0.5lu		0:1-		1:2 0:2*		3:1-* 0:3	1#:3*	4#:2
0.5lu-0.6lu					3:0=	3:1=	3:2- 2:3 2#:3	

Lego Unit: 1 lu = 1.6mm

Diagonal positions are given in Horizontal units (1 stud spacing = 5 lu) versus Vertical units (1 beam height = 6 lu); i.e. 2:3 means 2 stud spacings vs. 3 beam heights. Diesis signs (#) in horizontal units are half-intervals (2.5 lu), bars in vertical units are thin plates (2 lu). Half-intervals can be obtained by using special two-hole 1x2 or single-hole 1x1 beams available in some Technic sets. Alternative way is to use Technic beams or narrow plates that can be put on top of other beams with half-hole offset - they will bind with holes in studs.

* Pairs marked this way are closer than ideal by the distance given in the left column

Example: 4#:1=* means "axles are separated by $4^1/_2$ holes horizontally and 1 brick and two plates vertically; the resulting distance is smaller than ideal".

Errors more than 0.3 lu may damage your teeth...