ACE Hardware Zimbabwe

Bolt Hole Circle (PCD) Chart

X-Y coordinates for 3 to 12 holes on any pitch circle, hole spacing factors, and ASME Class 150 / EN PN16 flange drilling.

Workshop Reference Charts
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Hole coordinates on a pitch circle

How to use

1. Find the table for your number of holes.
2. Multiply the X and Y factors by the pitch circle diameter (PCD). Coordinates are from the circle centre, with hole 1 on the +X axis and angles measured anticlockwise.
3. To start with a hole somewhere else, add your start angle to every angle. Flanges are normally drilled with holes **straddling** the centre lines: add half the spacing.
4. To check a pattern with callipers: distance between neighbouring hole centres = PCD × chord factor.

> **Example:** 6 holes on 125 mm PCD. Hole 2: X = 0.25 × 125 = 31.25, Y = 0.43301 × 125 = 54.13 mm. Hole spacing = 125 × 0.5 = 62.5 mm.

Hole-to-hole distance

Holes	Spacing°	Chord factor
3	120	0.86603
4	90	0.70711
5	72	0.58779
6	60	0.50000
7	51.429	0.43388
8	45	0.38268
9	40	0.34202
10	36	0.30902
11	32.727	0.28173
12	30	0.25882
13	27.692	0.23932
14	25.714	0.22252
15	24	0.20791
16	22.5	0.19509
17	21.176	0.18375
18	20	0.17365
19	18.947	0.16459
20	18	0.15643
21	17.143	0.14904
22	16.364	0.14231
23	15.652	0.13617
24	15	0.13053

3 holes - spacing 120°

Hole	Angle°	X × PCD	Y × PCD
1	0	+0.50000	+0.00000
2	120	-0.25000	+0.43301
3	240	-0.25000	-0.43301

4 holes - spacing 90°

Hole	Angle°	X × PCD	Y × PCD
1	0	+0.50000	+0.00000
2	90	+0.00000	+0.50000
3	180	-0.50000	+0.00000
4	270	-0.00000	-0.50000

5 holes - spacing 72°

Hole	Angle°	X × PCD	Y × PCD
1	0	+0.50000	+0.00000
2	72	+0.15451	+0.47553
3	144	-0.40451	+0.29389
4	216	-0.40451	-0.29389
5	288	+0.15451	-0.47553

6 holes - spacing 60°

Hole	Angle°	X × PCD	Y × PCD
1	0	+0.50000	+0.00000
2	60	+0.25000	+0.43301
3	120	-0.25000	+0.43301
4	180	-0.50000	+0.00000
5	240	-0.25000	-0.43301
6	300	+0.25000	-0.43301

7 holes - spacing 51.429°

Hole	Angle°	X × PCD	Y × PCD
1	0	+0.50000	+0.00000
2	51.43	+0.31174	+0.39092
3	102.86	-0.11126	+0.48746
4	154.29	-0.45048	+0.21694
5	205.71	-0.45048	-0.21694
6	257.14	-0.11126	-0.48746
7	308.57	+0.31174	-0.39092

8 holes - spacing 45°

Hole	Angle°	X × PCD	Y × PCD
1	0	+0.50000	+0.00000
2	45	+0.35355	+0.35355
3	90	+0.00000	+0.50000
4	135	-0.35355	+0.35355
5	180	-0.50000	+0.00000
6	225	-0.35355	-0.35355
7	270	-0.00000	-0.50000
8	315	+0.35355	-0.35355

9 holes - spacing 40°

Hole	Angle°	X × PCD	Y × PCD
1	0	+0.50000	+0.00000
2	40	+0.38302	+0.32139
3	80	+0.08682	+0.49240
4	120	-0.25000	+0.43301
5	160	-0.46985	+0.17101
6	200	-0.46985	-0.17101
7	240	-0.25000	-0.43301
8	280	+0.08682	-0.49240
9	320	+0.38302	-0.32139

10 holes - spacing 36°

Hole	Angle°	X × PCD	Y × PCD
1	0	+0.50000	+0.00000
2	36	+0.40451	+0.29389
3	72	+0.15451	+0.47553
4	108	-0.15451	+0.47553
5	144	-0.40451	+0.29389
6	180	-0.50000	+0.00000
7	216	-0.40451	-0.29389
8	252	-0.15451	-0.47553
9	288	+0.15451	-0.47553
10	324	+0.40451	-0.29389

11 holes - spacing 32.727°

Hole	Angle°	X × PCD	Y × PCD
1	0	+0.50000	+0.00000
2	32.73	+0.42063	+0.27032
3	65.45	+0.20771	+0.45482
4	98.18	-0.07116	+0.49491
5	130.91	-0.32743	+0.37787
6	163.64	-0.47975	+0.14087
7	196.36	-0.47975	-0.14087
8	229.09	-0.32743	-0.37787
9	261.82	-0.07116	-0.49491
10	294.55	+0.20771	-0.45482
11	327.27	+0.42063	-0.27032

12 holes - spacing 30°

Hole	Angle°	X × PCD	Y × PCD
1	0	+0.50000	+0.00000
2	30	+0.43301	+0.25000
3	60	+0.25000	+0.43301
4	90	+0.00000	+0.50000
5	120	-0.25000	+0.43301
6	150	-0.43301	+0.25000
7	180	-0.50000	+0.00000
8	210	-0.43301	-0.25000
9	240	-0.25000	-0.43301
10	270	-0.00000	-0.50000
11	300	+0.25000	-0.43301
12	330	+0.43301	-0.25000

Flange drilling

ASME B16.5 Class 150 flanges

NPS	OD in	OD mm	PCD in	PCD mm	Holes	Hole in	Bolt
1/2"	3.5	89	2.38	60.5	4	0.62	1/2"
3/4"	3.88	99	2.75	69.8	4	0.62	1/2"
1"	4.25	108	3.12	79.2	4	0.62	1/2"
1-1/4"	4.62	117	3.5	88.9	4	0.62	1/2"
1-1/2"	5	127	3.88	98.6	4	0.62	1/2"
2"	6	152	4.75	120.6	4	0.75	5/8"
2-1/2"	7	178	5.5	139.7	4	0.75	5/8"
3"	7.5	190	6	152.4	4	0.75	5/8"
4"	9	229	7.5	190.5	8	0.75	5/8"
5"	10	254	8.5	215.9	8	0.88	3/4"
6"	11	279	9.5	241.3	8	0.88	3/4"
8"	13.5	343	11.75	298.4	8	0.88	3/4"
10"	16	406	14.25	361.9	12	1	7/8"
12"	19	483	17	431.8	12	1	7/8"

EN 1092-1 PN16 flanges

Size	OD mm	PCD mm	Holes	Hole mm	Bolt
DN15	95	65	4	14	M12
DN20	105	75	4	14	M12
DN25	115	85	4	14	M12
DN32	140	100	4	18	M16
DN40	150	110	4	18	M16
DN50	165	125	4	18	M16
DN65	185	145	8	18	M16
DN80	200	160	8	18	M16
DN100	220	180	8	18	M16
DN125	250	210	8	18	M16
DN150	285	240	8	22	M20
DN200	340	295	12	22	M20
DN250	405	355	12	26	M24
DN300	460	410	12	26	M24

PN16 DN65 is 8 holes as standard; 4-hole flanges are also made by agreement (and in cast iron). Class 150 and PN16 flanges do not mate: always check OD, PCD and hole count before ordering gaskets or mating flanges.

Guide values for general workshop use. Always follow the equipment or fastener maker's figure where one is given, and check critical work against the relevant standard.

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