

Pinion with Straight Teeth

(Interface : Curvic Plate / EN ISO 9409-I-A)

Quality DIN 4 / Alloy Steel

Tooth Thickness Tolerance : e24

Straight Teeth

Case-Hardened and Teeth Ground

Bolt Circle Ø50

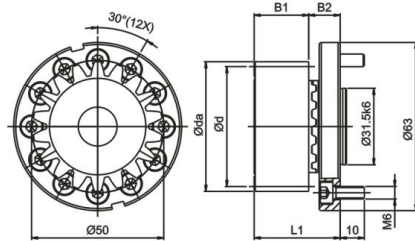


Fig. A

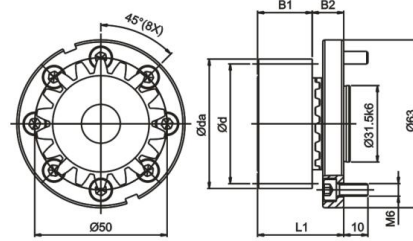


Fig. B

Mn	z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	B1	B2	L1	L ⁽⁶⁾	Fig	Order Code	
											Set	Pinion only
2	21	0.5	48	42	44	26	15	41	131.947	A	A02121A050	A02121
										B	A02121B050	

Bolt Circle Ø63

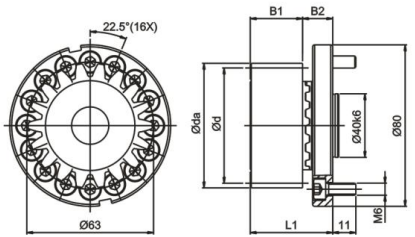


Fig. A

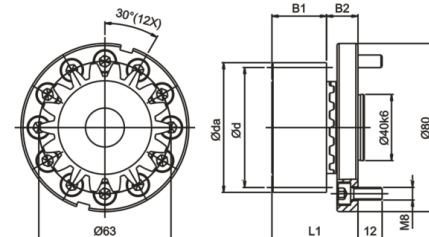


Fig. C

Mn	z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	B1	B2	L1	L ⁽⁶⁾	Fig	Order Code	
											Set	Pinion only
2	21	0.5	48	42	44	26	15	41	131.947	A	A02121A063	A02121
							19.5	45.5		C	A02121C063	

Bolt Circle Ø80

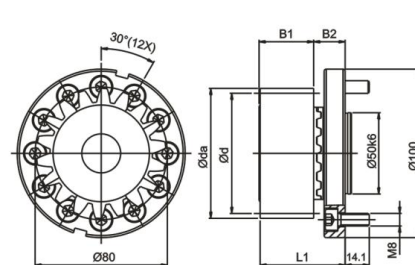


Fig. A

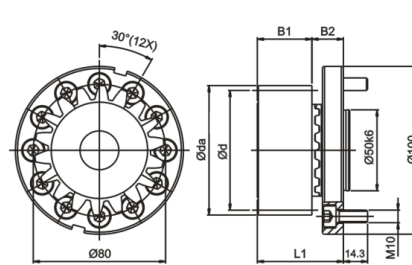


Fig. C

Mn	z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	B1	B2	L1	L ⁽⁶⁾	Fig	Order Code	
											Set	Pinion only
3	19	0.1667	64	57	58	31	21.5	52.5	179.071	A	A03119A080	A03119
										C	A03119C080	

- (1) Number of teeth (2) Profile modification factor (3) Diameter of addendum circle (4) Pitch circle diameter
 (5) Working pitch circle diameter (6) Pitch circle length $L = \pi \times d$

Pinion with Straight Teeth

(Interface : Curvic Plate / EN ISO 9409-I-A)

Quality DIN 4 / Alloy Steel
Tooth Thickness Tolerance : e24
Straight Teeth
Case-Hardened and Teeth Ground

Bolt Circle Ø125

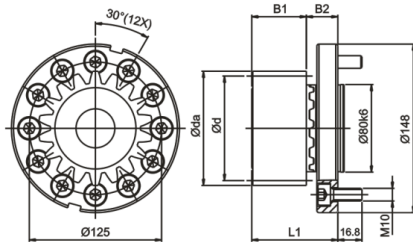


Fig. A

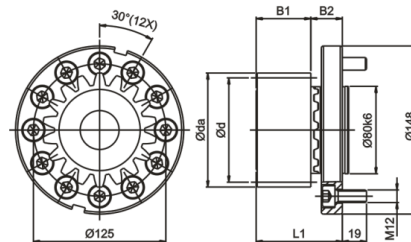


Fig. C

Mn	z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	B1	B2	L1	L ⁽⁶⁾	Fig	Order Code	
											Set	Pinion only
4	19	0.6875	89.5	76	81.5	41	29	70	238.761	A	A04119A125	A04119
										C	A04119C125	

Bolt Circle Ø140 / Ø145

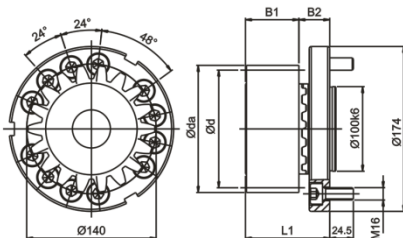


Fig. A

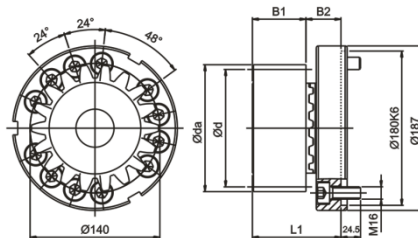


Fig. B

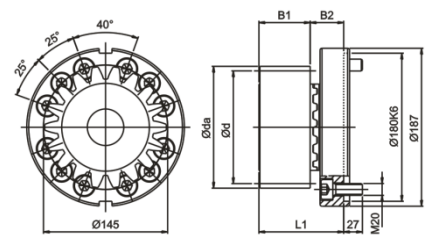


Fig. C

Mn	z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	B1	B2	L1	L ⁽⁶⁾	Fig	Order Code	
											Set	Pinion only
5	19	0.3	108	95	98	51	38	89	298.451	A	A05119A140	A05119
										B	A05119B140	
										C	A05119C145	

Quality DIN 4 / Alloy Steel
Tooth Thickness Tolerance : e24
Straight Teeth
Case-Hardened and Teeth Ground

Bolt Circle Ø160 / Ø166

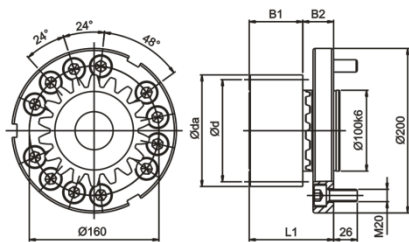


Fig. A

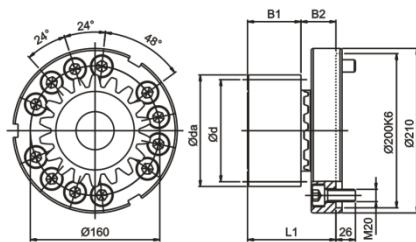


Fig. B

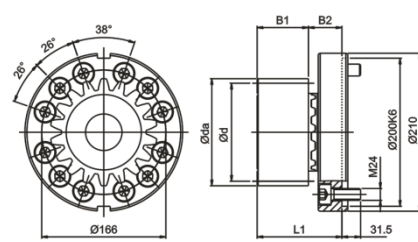
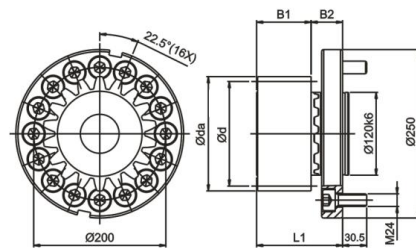


Fig. C

Mn	z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	B1	B2	L1	L ⁽⁶⁾	Fig	Order Code	
											Set	Pinion only
6	19	0.25	129	114	117	61	49	110	358.142	A	A06119A160	A06119
										B	A06119B160	
										C	A06119C166	

Bolt Circle Ø200



Mn.	z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	B1	B2	L1	L ⁽⁶⁾	Order Code	
										Set	Pinion only
8	16	0.3125	149	128	133	81	50	131	402.124	A08116A200	A08116

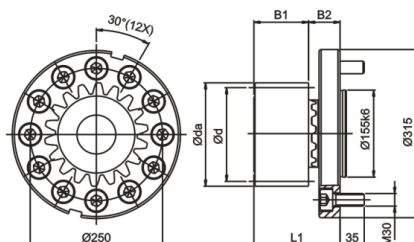
(1) Number of teeth (2) Profile modification factor (3) Diameter of addendum circle (4) Pitch circle diameter
(5) Working pitch circle diameter (6) Pitch circle length $L = \pi \times d$

Pinion with Straight Teeth

(Interface : Curvic Plate / EN ISO 9409-I-A)

Quality DIN 4 / Alloy Steel
Tooth Thickness Tolerance : e24
Straight Teeth
Case-Hardened and Teeth Ground

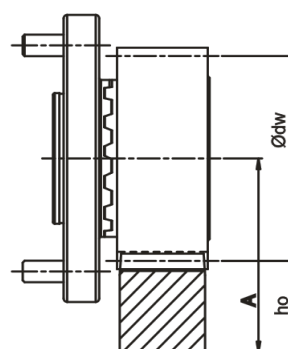
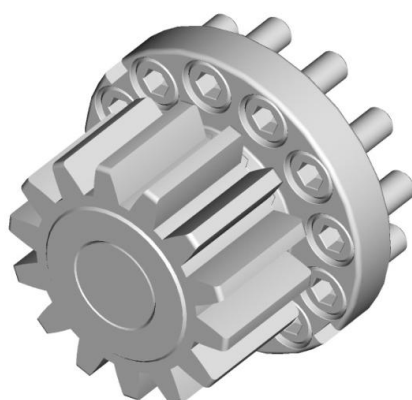
Bolt Circle Ø250



Mn.	z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	B1	B2	L1	L ⁽⁶⁾	Order Code	
										Set	Pinion only
10	15	0.45	179	150	159	101	62	163	471.239	A10115A250	A10115

(1) Number of teeth (2) Profile modification factor (3) Diameter of addendum circle (4) Pitch circle diameter
(5) Working pitch circle diameter (6) Pitch circle length $L = \pi * d$

Pinion material carburized, the surface hardness reaches to 60 HRc after case hardening
Teeth surface ground in order to reduce noise and improve wear resistance
Accessories include hexagon socket head cap screws (Strength 12.9 , DIN 912)



$$A = h_o + \frac{\phi dw}{2}$$

In Table 7, the maximum permissible torque of the Curvic Plate pinion and the rack is calculated on the basis of a speed of 1.5 m/s and providing good lubrication (using an automatic lubrication system or manually applied grease every day), the tooth root strength factor $S_F \geq 1.4$, tooth surface strength coefficient $S_H \geq 1$, the safety factor $S_B \approx 1$, and the required service life of 20,000 hours. By higher speed, the max. permissible torque reduced. The user needs to increase the safety factor for the application. Backlash changes by different center height. Please contact APEX under WWW.APEXDYNA.COM.

Table 7. The max. permitted torque and feed-force of pinion with Curvic Plate

Pinion \ Rack			Quality	Q4	Q5H	Q5		Q6	Q6M	Q8H	Q8	Q9	Q10
			Material	Carbon Steel	Alloy Steel		Carbon Steel	Carbon Steel	Carbon Steel	Q&T Alloy Steel	Carbon Steel	Stainless Steel	Carbon Steel
			Heat Treatment	Induction Hardening	Case Hardening	Carburized Induction	Induction Hardening	Induction Hardening	Induction Hardening	Quenched Tempered	Normalizing	Solution	Induction Hardening
Mn	z ⁽¹⁾	dw ⁽⁵⁾	Max. Torque * and Feed-Force										
2	21	44	F _{2T} ⁽⁸⁾ (N)		7,857	7,857		6,429	6,429	1,905	1,190	714	4,048
			T _{2B} ⁽⁹⁾ (Nm)		165	165		135	135	40	25	15	85
3	19	58	F _{2T} ⁽⁸⁾ (N)		14,211	14,211		13,860	13,860	7,018	3,684	1,754	9,825
			T _{2B} ⁽⁹⁾ (Nm)		405	405		395	395	200	105	50	280
	21	66	F _{2T} ⁽⁸⁾ (N)		14,921	14,921		12,381	12,381	4,444	2,540	1,270	9,683
			T _{2B} ⁽⁹⁾ (Nm)		470	470		390	390	140	80	40	305
4	19	81.5	F _{2T} ⁽⁸⁾ (N)		27,105		26,974	26,711	26,711	13,289	7,500	3,026	20,921
			T _{2B} ⁽⁹⁾ (Nm)		1,030		1,025	1,015	1,015	505	285	115	795
5	19	98	F _{2T} ⁽⁸⁾ (N)	44,316	44,316		44,316	44,211	44,211		14,316	5,263	36,211
			T _{2B} ⁽⁹⁾ (Nm)	2,105	2,105		2,105	2,100	2,100		680	250	1,720
6	19	117	F _{2T} ⁽⁸⁾ (N)	63,333	63,333		63,246	63,246	63,246		22,982	9,474	54,123
			T _{2B} ⁽⁹⁾ (Nm)	3,610	3,610		3,605	3,605	3,605		1,310	540	3,085
8	16	133	F _{2T} ⁽⁸⁾ (N)	93,125	93,125		93,125	93,125	93,125		34,531		76,563
			T _{2B} ⁽⁹⁾ (Nm)	5,960	5,960		5,960	5,960	5,960		2,210		4,900
10	15	159	F _{2T} ⁽⁸⁾ (N)	144,000	144,000		144,000	144,000	144,000		54,000		131,467
			T _{2B} ⁽⁹⁾ (Nm)	10,800	10,800		10,800	10,800	10,800		4,050		9,860

* The Maximal Driving Torque is also to be understood as the Maximal Acceleration Torque T_{2B}.

The Emergency Stop Torque T_{2NOT} = 2 × T_{2B}, under the condition limited 1000 times in the whole service period.

(1) Number of Teeth (5) Working Pitch Circle Diameter (in mm) (8) Maximum Feed-Force (9) Maximum Driving Torque

Pinion with Straight Teeth

(Interface : Welded Plate / EN ISO 9409-I-A)

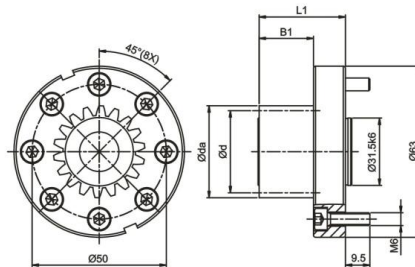
Quality DIN 4 / Alloy Steel

Tooth Thickness Tolerance : e24

Straight Teeth

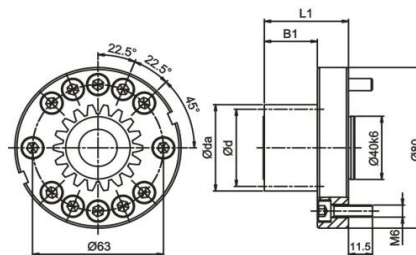
Case-Hardened and Teeth Ground

Bolt Circle Ø 50



Mn	z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	Bl	Ll	L ⁽⁶⁾	Order Code
2	13	0.366	31.464	26	27.464	26	41	81.681	B02113A050
	17	-0.012	37.952	34	33.952	26	41	106.814	B02117A050

Bolt Circle Ø 63

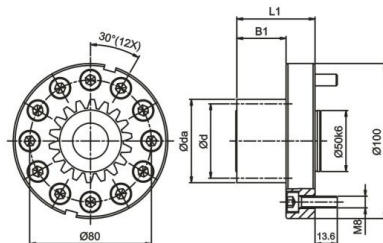


Mn	z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	Bl	Ll	L ⁽⁶⁾	Order Code
2	13	0.366	31.464	26	27.464	26	41	81.681	B02113A063
	17	-0.012	37.952	34	33.952	26	41	106.814	B02117A063
	24	0.202	52.808	48	48.808	26	41	150.796	B02124A063
3	13	0.366	47.196	39	41.196	32.5	47.5	122.522	B03113A063

(1) Number of teeth (2) Profile modification factor (3) Diameter of addendum circle (4) Pitch circle diameter
 (5) Working pitch circle diameter (6) Pitch circle length $L = \pi \times d$

Quality DIN 4 / Alloy Steel
Tooth Thickness Tolerance : e24
Straight Teeth
Case-Hardened and Teeth Ground

Bolt Circle Ø 80



Mn	z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	BI	LI	L ⁽⁶⁾	Order Code
2	13	0.366	31.464	26	27.464	26	46	81.681	B02113A080
	24	0.202	52.808	48	48.808	26	46	150.796	B02124A080
3	13	0.366	47.196	39	41.196	32.5	52.5	122.522	B03113A080
	20	0.08	66.48	60	60.48	32.5	52.5	188.496	B03120A080
4	13	0.366	62.928	52	54.928	45	65	163.363	B04113A080

Bolt Circle Ø 125

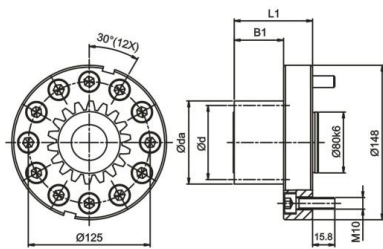


Fig. A

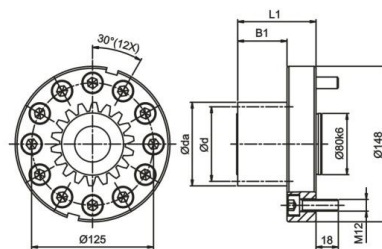


Fig. C

Mn	z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	BI	LI	L ⁽⁶⁾	Fig	Order Code
3	13	0.366	47.196	39	41.196	32.5	57.5	122.522	A	B03113A125
									C	B03113C125
	20	0.08	66.48	60	60.48	32.5	57.5	188.496	A	B03120A125
									C	B03120C125
	27	0.294	88.764	81	82.764	32.5	57.5	254.469	C	B03127C125
4	13	0.366	62.928	52	54.928	45	70	163.363	A	B04113A125
									C	B04113C125
	20	0.19	89.52	80	81.52	45	70	251.327	A	B04120A125
									C	B04120C125
	21	0.11	92.88	84	84.88	45	70	263.894	A	B04121A125
									C	B04121C125
	24	0.202	105.616	96	97.616	45	70	301.593	A	B04124A125
									C	B04124C125
5	13	0.366	78.66	65	68.66	55	80	204.204	A	B05113A125
									C	B05113C125
	17	-0.012	94.88	85	84.88	55	80	267.035	C	B05117C125
	19	0.049	105.49	95	95.49	55	80	298.451	A	B05119A125
									C	B05119C125
6	13	0.366	94.392	78	82.392	65	90	245.044	A	B06113A125
									C	B06113C125
	14	0.397	100.764	84	88.764	65	90	263.894	A	B06114A125
	16	-0.042	107.496	96	95.496	65	90	301.593	A	B06116A125

Pinion with Straight Teeth

(Interface : Welded Plate / EN ISO 9409-I-A)

Quality DIN 4 / Alloy Steel

Tooth Thickness Tolerance : e24

Straight Teeth

Case-Hardened and Teeth Ground

Bolt Circle Ø140

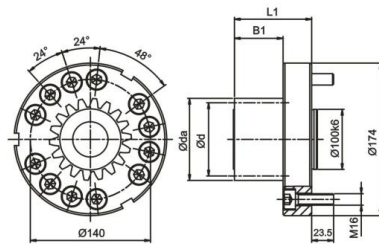


Fig. A

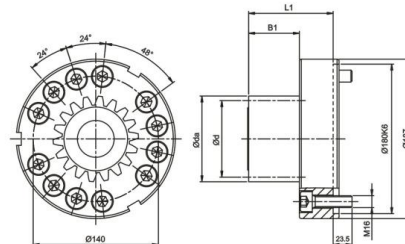


Fig. B

Mn	z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	BI	LI	L ⁽⁶⁾	Fig	Order Code
4	13	0.366	62.928	52	54.928	45	79	163.363	A	B04113A140
									B	B04113B140
	20	0.19	89.52	80	81.52	45	79	251.327	A	B04120A140
									B	B04120B140
	21	0.11	92.88	84	84.88	45	79	263.894	A	B04121A140
									B	B04121B140
5	15	0.227	87.27	75	77.27	55	89	235.619	A	B05115A140
									B	B05115B140
	20	0.08	110.8	100	100.8	55	89	314.159	A	B05120A140
									B	B05120B140
6	13	0.366	94.392	78	82.392	65	99	245.044	A	B06113A140
									B	B06113B140
	17	-0.012	113.856	102	101.856	65	99	320.442	A	B06117A140
									B	B06117B140

Quality DIN 4 / Alloy Steel
Tooth Thickness Tolerance : e24
Straight Teeth
Case-Hardened and Teeth Ground

Bolt Circle Ø160

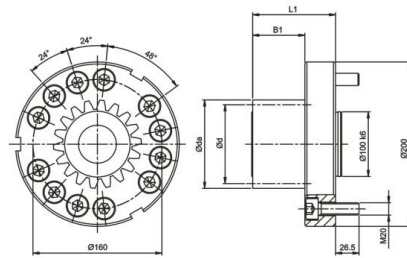


Fig. A

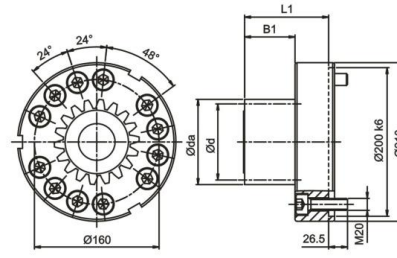


Fig. B

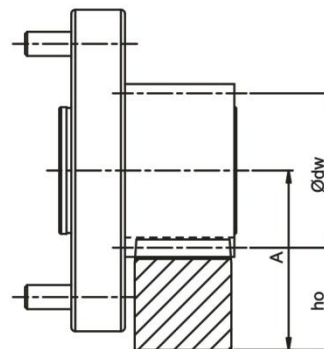
Mn	z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	BI	LI	L ⁽⁶⁾	Fig	Order Code
5	13	0.366	78.66	65	68.66	55	100	204.204	A	B05113A160
									B	B05113B160
	20	0.08	110.8	100	100.8	55	100	314.159	A	B05120A160
									B	B05120B160
6	13	0.366	94.392	78	82.392	65	110	245.044	A	B06113A160
									B	B06113B160
	17	-0.012	113.856	102	101.856	65	110	320.442	A	B06117A160
									B	B06117B160
	19	0.049	126.588	114	114.588	65	110	358.142	A	B06119A160
									B	B06119B160
8	13	0.366	125.856	104	109.856	85	130	326.726	A	B08113A160
									B	B08113B160

(1) Number of teeth (2) Profile modification factor (3) Diameter of addendum circle (4) Pitch circle diameter
(5) Working pitch circle diameter (6) Pitch circle length $L = \pi \times d$

Pinion material carburized, the surface hardness reached 60 HRC

Teeth surface ground in order to reduce noise and improve wear resistance

Accessories include hexagon socket head cap screws (Strength 12.9 , DIN 912)



$$A = h_o + \frac{\phi dw}{2}$$

In Table 8, the maximum permissible torque of the pinion Welded Plate and the rack is calculated on the basis of a speed of 1.5 m/s and providing good lubrication (using an automatic lubrication system or manually applied grease every day), the tooth root strength factor $S_F \geq 1.4$, tooth surface strength coefficient $S_H \geq 1$, the safety factor $S_B \geq 1$, and the required service life of 20,000 hours. By higher speed, the max. permissible torque reduced. The user needs to increase the safety factor for the application. Backlash changes by different center height. Please contact APEX under WWW.APEXDYNA.COM.

Pinion with Straight Teeth

(Interface : Welded Plate / EN ISO 9409-I-A)

Table 8. The max. permitted torque and feed-force of pinion Welded Plate

Pinion Rack			Quality	Q4	Q5H	Q5		Q6	Q6M	Q8H	Q8	Q9	Q10
			Material	Carbon Steel	Alloy Steel		Carbon Steel	Carbon Steel	Carbon Steel	Q&T Alloy Steel	Carbon Steel	Stainless Steel	Carbon Steel
			Heat Treatment	Induction Hardening	Case Hardening	Carburized Induction	Induction Hardening	Induction Hardening	Induction Hardening	Quenched Tempered	Normalizing	Solution	Induction Hardening
Mn	z ⁽¹⁾	dw ⁽⁵⁾	Max. Torque * and Feed-Force										
2	13	27.264	F _{2T} ⁽⁸⁾ (N)		4,231	4,231		4,231	4,231	1,538	769	385	1,923
			T _{2B} ⁽⁹⁾ (Nm)		55	55		55	55	20	10	5	25
	17	33.952	F _{2T} ⁽⁸⁾ (N)		5,000	5,000		5,000	5,000	2,353	1,471	588	2,059
			T _{2B} ⁽⁹⁾ (Nm)		85	85		85	85	40	25	10	35
	24	48.808	F _{2T} ⁽⁸⁾ (N)		8,333	8,333		6,875	6,875	2,292	1,458	833	3,542
			T _{2B} ⁽⁹⁾ (Nm)		200	200		165	165	55	35	20	85
3	13	41.196	F _{2T} ⁽⁸⁾ (N)		8,462	8,462		8,462	8,462	3,333	2,051	1,025	4,615
			T _{2B} ⁽⁹⁾ (Nm)		165	165		165	165	65	40	20	90
	20	60.48	F _{2T} ⁽⁸⁾ (N)		14,833	14,833		13,333	13,333	4,500	2,333	1,333	10,000
			T _{2B} ⁽⁹⁾ (Nm)		445	445		400	400	135	70	40	300
	27	82.764	F _{2T} ⁽⁸⁾ (N)		15,679	15,679		13,086	13,086	7,654	4,074	1,728	9,630
			T _{2B} ⁽⁹⁾ (Nm)		635	635		530	530	310	165	70	390
4	13	54.928	F _{2T} ⁽⁸⁾ (N)		16,154		16,154	16,154	16,154	7,692	3,846	1,923	10,192
			T _{2B} ⁽⁹⁾ (Nm)		420		420	420	420	200	100	50	265
	20	81.52	F _{2T} ⁽⁸⁾ (N)		28,250		24,375	24,000	24,000	10,125	4,375	2,375	19,500
			T _{2B} ⁽⁹⁾ (Nm)		1,130		975	960	960	405	175	95	780
	21	84.88	F _{2T} ⁽⁸⁾ (N)		28,690		24,643	24,286	24,286	11,190	5,000	2,500	19,167
			T _{2B} ⁽⁹⁾ (Nm)		1,205		1,035	1,020	1,020	470	210	105	805
5	24	97.616	F _{2T} ⁽⁸⁾ (N)		28,542		24,479	24,063	24,063	13,542	6,979	2,813	18,854
			T _{2B} ⁽⁹⁾ (Nm)		1,370		1,175	1,155	1,155	650	335	135	905
	13	68.66	F _{2T} ⁽⁸⁾ (N)	26,461	26,461		26,461	25,846	25,846		7,385	3,231	18,462
			T _{2B} ⁽⁹⁾ (Nm)	860	860		860	840	840		240	105	600
	15	77.27	F _{2T} ⁽⁸⁾ (N)	30,533	30,533		30,533	29,867	29,867		9,867	3,867	22,133
			T _{2B} ⁽⁹⁾ (Nm)	1,145	1,145		1,145	1,120	1,120		370	145	830
6	17	84.88	F _{2T} ⁽⁸⁾ (N)	31,647	31,647		31,647	30,941	30,941		12,706	4,471	22,706
			T _{2B} ⁽⁹⁾ (Nm)	1,345	1,345		1,345	1,315	1,315		540	190	965
	19	95.49	F _{2T} ⁽⁸⁾ (N)	39,368	39,368		39,368	38,947	38,947		15,052	5,158	31,053
			T _{2B} ⁽⁹⁾ (Nm)	1,870	1,870		1,870	1,850	1,850		715	245	1,745
	20	100.8	F _{2T} ⁽⁸⁾ (N)	38,900	43,400		38,900	38,500	38,500		9,700	3,800	32,500
			T _{2B} ⁽⁹⁾ (Nm)	1,945	2,170		1,945	1,925	1,925		485	190	1,625
8	13	82.392	F _{2T} ⁽⁸⁾ (N)	38,974	38,974		38,974	38,462	38,462		12,179	4,872	29,487
			T _{2B} ⁽⁹⁾ (Nm)	1,520	1,520		1,520	1,500	1,500		475	190	1,150
	14	88.764	F _{2T} ⁽⁸⁾ (N)	44,286	44,286		44,286	43,929	43,929		13,690	6,548	34,881
			T _{2B} ⁽⁹⁾ (Nm)	1,860	1,860		1,860	1,845	1,845		575	275	1,465
	16	95.496	F _{2T} ⁽⁸⁾ (N)	39,271	39,271		39,271	38,646	38,646		17,917	6,979	29,792
			T _{2B} ⁽⁹⁾ (Nm)	1,885	1,885		1,885	1,855	1,855		860	335	1,430
17	101.856		F _{2T} ⁽⁸⁾ (N)	46,176	46,176		46,176	45,784	45,784		20,294	8,039	36,471
			T _{2B} ⁽⁹⁾ (Nm)	2,355	2,355		2,355	2,335	2,335		1,035	410	1,860
8	13	109.856	F _{2T} ⁽⁸⁾ (N)	70,769	70,769		70,769	70,769	70,769		25,962		59,615
			T _{2B} ⁽⁹⁾ (Nm)	3,680	3,680		3,680	3,680	3,680		1,350		3,100

* The Maximal Driving Torque is also to be understood as the Maximal Acceleration Torque T_{2B}.

The Emergency Stop Torque T_{2NOT} = 2 x T_{2B}, under the condition limited 1000 times in the whole service period.

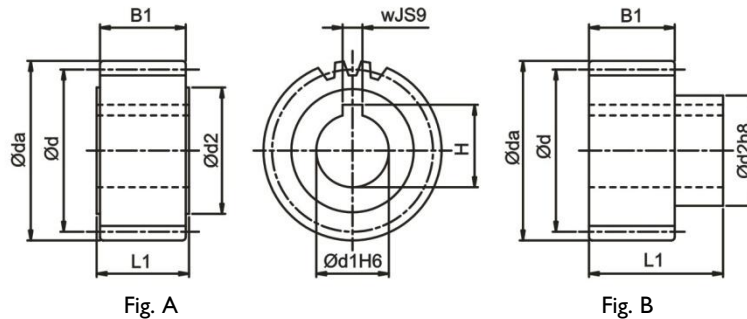
(1) Number of Teeth (5) Working Pitch Circle Diameter (in mm) (8) Maximum Feed-Force (9) Maximum Driving Torque

Note : The strength of screws is a limitation of the max. transmission torque. For Pinion Welded Plate, please refer to Page.40.

Pinion with Straight Teeth

(Interface : Keyway)

Quality DIN 5 / Alloy Steel
Tooth Thickness Tolerance : e25
Straight Teeth
Case-Hardened and Teeth Ground



Module 2

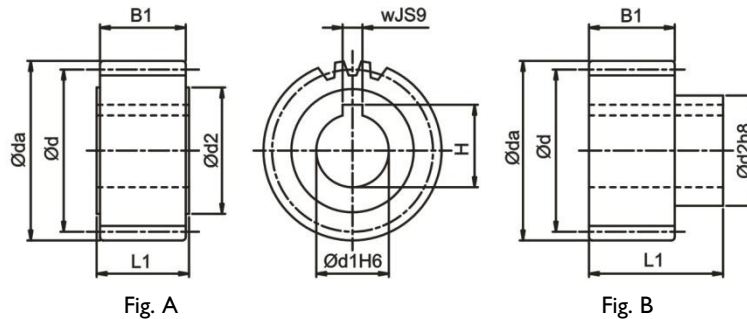
z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	d1 H6	d2	B1	L1	w JS9	H	L ⁽⁶⁾	Fig	Order code	
													Pinion	Shrink disc
16	0	36	32	32	15	25	28	30	5	17.3	100.531	A	F02116A15	
18	0	40	36	36	15	28	28	30	5	17.3	113.097	A	F02118A15	
18	0	40	36	36	20	28	28	30	6	22.8	113.097	A	F02118A20	
20	0	44	40	40	15	25	28	30	5	17.3	125.664	A	F02120A15	
20	0	44	40	40	19	30	28	30	6	21.8	125.664	A	F02120A19	
20	0	44	40	40	19	30	28	56	6	21.8	125.664	B	F02120B19	SSD-30
20	0	44	40	40	20	30	28	30	6	22.8	125.664	A	F02120A20	
20	0	44	40	40	22	30	28	30	6	24.8	125.664	A	F02120A22	
20	0	44	40	40	22	36	28	56	6	24.8	125.664	B	F02120B22	SSD-36
22	0	48	44	44	15	25	28	30	5	17.3	138.23	A	F02122A15	
22	0	48	44	44	19	30	28	30	6	21.8	138.23	A	F02122A19	
22	0	48	44	44	19	30	28	56	6	21.8	138.23	B	F02122B19	SSD-30
22	0	48	44	44	20	30	28	30	6	22.8	138.23	A	F02122A20	
22	0	48	44	44	22	30	28	30	6	24.8	138.23	A	F02122A22	
22	0	48	44	44	22	36	28	56	6	24.8	138.23	B	F02122B22	SSD-36
22	0	48	44	44	25	36	28	30	8	28.3	138.23	A	F02122A25	
25	0	54	50	50	15	25	28	30	5	17.3	157.08	A	F02125A15	
25	0	54	50	50	16	30	28	54	5	18.3	157.08	B	F02125B16	SSD-30
25	0	54	50	50	19	30	28	30	6	21.8	157.08	A	F02125A19	
25	0	54	50	50	19	30	28	56	6	21.8	157.08	B	F02125B19	SSD-30
25	0	54	50	50	20	30	28	30	6	22.8	157.08	A	F02125A20	
25	0	54	50	50	22	30	28	30	6	24.8	157.08	A	F02125A22	
25	0	54	50	50	22	36	28	56	6	24.8	157.08	B	F02125B22	SSD-36
25	0	54	50	50	25	36	28	30	8	28.3	157.08	A	F02125A25	
25	0	54	50	50	30	44	28	30	8	33.3	157.08	A	F02125A30	
28	0	60	56	56	15	25	28	30	5	17.3	175.929	A	F02128A15	
28	0	60	56	56	19	30	28	30	6	21.8	175.929	A	F02128A19	
28	0	60	56	56	19	30	28	56	6	21.8	175.929	B	F02128B19	SSD-30
28	0	60	56	56	20	30	28	30	6	22.8	175.929	A	F02128A20	
28	0	60	56	56	22	30	28	30	6	24.8	175.929	A	F02128A22	
28	0	60	56	56	22	36	28	56	6	24.8	175.929	B	F02128B22	SSD-36
28	0	60	56	56	25	36	28	30	8	28.3	175.929	A	F02128A25	
28	0	60	56	56	30	45	28	30	8	33.3	175.929	A	F02128A30	
28	0	60	56	56	30	50	28	60	8	33.3	175.929	B	F02128B30	SSD-50
28	0	60	56	56	35	48	28	30	10	38.3	175.929	A	F02128A35	

(1) Number of teeth (2) Profile modification factor (3) Diameter of addendum circle (4) Pitch circle diameter
(5) Working pitch circle diameter (6) Pitch circle length $L = \pi \times d$

Pinion with Straight Teeth

(Interface : Keyway)

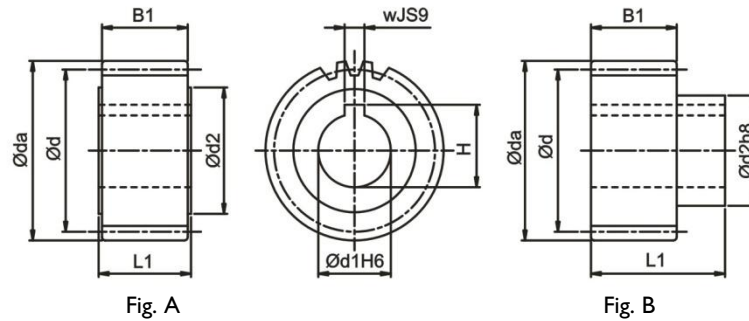
Quality DIN 5 / Alloy Steel
Tooth Thickness Tolerance : e25
Straight Teeth
Case-Hardened and Teeth Ground



Module 2

z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	d1 H6	d2	B1	L1	w JS9	H	L ⁽⁶⁾	Fig	Order code	
													Pinion	Shrink disc
32	0	68	64	64	15	36	28	30	5	17.3	201.062	A	F02132A15	
32	0	68	64	64	16	30	28	54	5	18.3	201.062	B	F02132B16	SSD-30
32	0	68	64	64	20	30	28	30	6	22.8	201.062	A	F02132A20	
32	0	68	64	64	22	30	28	30	6	24.8	201.062	A	F02132A22	
32	0	68	64	64	22	36	28	56	6	24.8	201.062	B	F02132B22	SSD-36
32	0	68	64	64	25	36	28	30	8	28.3	201.062	A	F02132A25	
32	0	68	64	64	30	45	28	30	8	33.3	201.062	A	F02132A30	
32	0	68	64	64	30	50	28	60	8	33.3	201.062	B	F02132B30	SSD-50
32	0	68	64	64	32	55	28	65	10	35.3	201.062	B	F02132B32	SSD-55
32	0	68	64	64	35	48	28	30	10	38.3	201.062	A	F02132A35	
36	0	76	72	72	20	30	28	30	6	22.8	226.195	A	F02136A20	
36	0	76	72	72	25	36	28	30	8	28.3	226.195	A	F02136A25	
36	0	76	72	72	30	45	28	30	8	33.3	226.195	A	F02136A30	
36	0	76	72	72	35	48	28	30	10	38.3	226.195	A	F02136A35	
36	0	76	72	72	40	62	28	65	12	43.3	226.195	B	F02136B40	SSD-62
36	0	76	72	72	45	58	28	30	14	48.8	226.195	A	F02136A45	
40	0	84	80	80	15	36	28	30	5	17.3	251.327	A	F02140A15	
40	0	84	80	80	20	30	28	30	6	22.8	251.327	A	F02140A20	
40	0	84	80	80	25	36	28	30	8	28.3	251.327	A	F02140A25	
40	0	84	80	80	30	45	28	30	8	33.3	251.327	A	F02140A30	
40	0	84	80	80	32	55	28	65	10	35.3	251.327	B	F02140B32	SSD-55
40	0	84	80	80	35	48	28	30	10	38.3	251.327	A	F02140A35	
40	0	84	80	80	40	62	28	65	12	43.3	251.327	B	F02140B40	SSD-62
40	0	84	80	80	45	58	28	30	14	48.8	251.327	A	F02140A45	
40	0	84	80	80	45	68	28	65	14	48.8	251.327	B	F02140B45	SSD-68
45	0	94	90	90	20	30	28	30	6	22.8	282.743	A	F02145A20	
45	0	94	90	90	25	36	28	30	8	28.3	282.743	A	F02145A25	
45	0	94	90	90	35	48	28	30	10	38.3	282.743	A	F02145A35	
45	0	94	90	90	45	58	28	30	14	48.8	282.743	A	F02145A45	
50	0	104	100	100	20	30	28	30	6	22.8	314.159	A	F02150A20	
50	0	104	100	100	25	36	28	30	8	28.3	314.159	A	F02150A25	
50	0	104	100	100	35	48	28	30	10	38.3	314.159	A	F02150A35	
50	0	104	100	100	45	58	28	30	14	48.8	314.159	A	F02150A45	
50	0	104	100	100	45	68	28	65	14	48.8	314.159	B	F02150B45	SSD-68
56	0	116	112	112	25	36	28	30	8	28.3	351.858	A	F02156A25	
56	0	116	112	112	35	48	28	30	10	38.3	351.858	A	F02156A35	
63	0	130	126	126	25	36	28	30	8	28.3	395.841	A	F02163A25	
71	0	146	142	142	35	48	28	30	10	38.3	446.106	A	F02171A35	
80	0	164	160	160	35	48	28	30	10	38.3	502.655	A	F02180A35	
90	0	184	180	180	45	58	28	30	14	48.8	565.487	A	F02190A45	

Quality DIN 5 / Alloy Steel
Tooth Thickness Tolerance : e25
Straight Teeth
Case-Hardened and Teeth Ground



Module 3

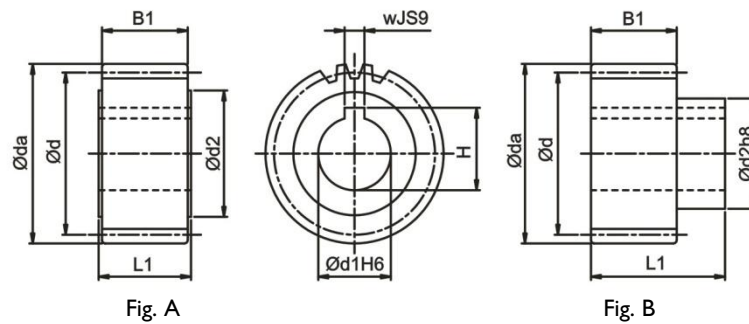
z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	d1 _{H6}	d2	B1	L1	w _{JS9}	H	L ⁽⁶⁾	Fig	Order code	
													Pinion	Shrink disc
18	0	60	54	54	25	36	28	30	8	28.3	169.646	A	F03118A25	
20	0	66	60	60	25	36	28	30	8	28.3	188.496	A	F03120A25	
20	0	66	60	60	30	45	28	30	8	33.3	188.496	A	F03120A30	
20	0	66	60	60	35	48	28	30	10	38.3	188.496	A	F03120A35	
22	0	72	66	66	22	36	28	56	6	24.8	207.345	B	F03122B22	SSD-36
22	0	72	66	66	25	36	28	30	8	28.3	207.345	A	F03122A25	
22	0	72	66	66	25	44	28	60	8	28.3	207.345	B	F03122B25	SSD-44
22	0	72	66	66	30	45	28	30	8	33.3	207.345	A	F03122A30	
22	0	72	66	66	30	50	28	60	8	33.3	207.345	B	F03122B30	SSD-50
22	0	72	66	66	32	55	28	65	10	35.3	207.345	B	F03122B32	SSD-55
22	0	72	66	66	35	48	28	30	10	38.3	207.345	A	F03122A35	
22	0	72	66	66	35	55	28	65	10	38.3	207.345	B	F03122B35	SSD-55
22	0	72	66	66	40	62	28	65	12	43.3	207.345	B	F03122B40	SSD-62
25	0	81	75	75	25	36	28	30	8	28.3	235.619	A	F03125A25	
25	0	81	75	75	30	45	28	30	8	33.3	235.619	A	F03125A30	
25	0	81	75	75	32	55	28	65	10	35.3	235.619	B	F03125B32	SSD-55
25	0	81	75	75	35	48	28	30	10	38.3	235.619	A	F03125A35	
25	0	81	75	75	40	62	28	65	12	43.3	235.619	B	F03125B40	SSD-62
25	0	81	75	75	45	58	28	30	14	48.8	235.619	A	F03125A45	
28	0	90	84	84	22	36	28	56	6	24.8	263.894	B	F03128B22	SSD-36
28	0	90	84	84	25	36	28	30	8	28.3	263.894	A	F03128A25	
28	0	90	84	84	25	44	28	60	8	28.3	263.894	B	F03128B25	SSD-44
28	0	90	84	84	30	45	28	30	8	33.3	263.894	A	F03128A30	
28	0	90	84	84	30	50	28	60	8	33.3	263.894	B	F03128B30	SSD-50
28	0	90	84	84	32	55	28	65	10	35.3	263.894	B	F03128B32	SSD-55
28	0	90	84	84	35	48	28	30	10	38.3	263.894	A	F03128A35	
28	0	90	84	84	35	55	28	65	10	38.3	263.894	B	F03128B35	SSD-55
28	0	90	84	84	40	62	28	65	12	43.3	263.894	B	F03128B40	SSD-62
28	0	90	84	84	45	58	28	30	14	48.8	263.894	A	F03128A45	
28	0	90	84	84	45	68	28	65	14	48.8	263.894	B	F03128B45	SSD-68

(1) Number of teeth (2) Profile modification factor (3) Diameter of addendum circle (4) Pitch circle diameter
(5) Working pitch circle diameter (6) Pitch circle length $L = \pi \times d$

Pinion with Straight Teeth

(Interface : Keyway)

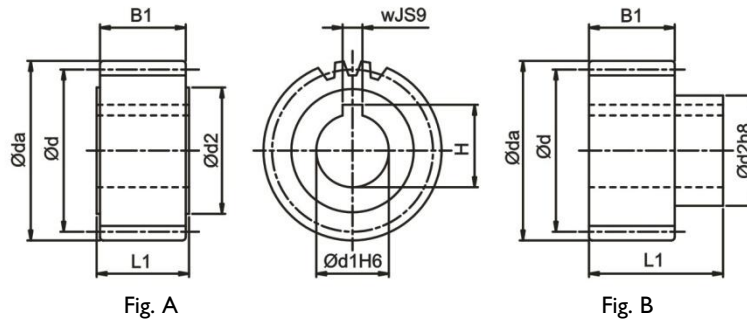
Quality DIN 5 / Alloy Steel
Tooth Thickness Tolerance : e25
Straight Teeth
Case-Hardened and Teeth Ground



Module 3

z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	d1 H6	d2	B1	L1	w JS9	H	L ⁽⁶⁾	Fig	Order code	
													Pinion	Shrink disc
32	0	102	96	96	25	36	28	30	8	28.3	301.593	A	F03132A25	
32	0	102	96	96	30	45	28	30	8	33.3	301.593	A	F03132A30	
32	0	102	96	96	32	55	28	65	10	35.3	301.593	B	F03132B32	SSD-55
32	0	102	96	96	35	48	28	30	10	38.3	301.593	A	F03132A35	
32	0	102	96	96	40	62	28	65	12	43.3	301.593	B	F03132B40	SSD-62
32	0	102	96	96	45	58	28	30	14	48.8	301.593	A	F03132A45	
32	0	102	96	96	60	80	28	30	18	64.4	301.593	A	F03132A60	
36	0	114	108	108	25	36	28	30	8	28.3	339.292	A	F03136A25	
36	0	114	108	108	35	48	28	30	10	38.3	339.292	A	F03136A35	
36	0	114	108	108	45	58	28	30	14	48.8	339.292	A	F03136A45	
36	0	114	108	108	45	68	28	65	14	48.8	339.292	B	F03136B45	SSD-68
36	0	114	108	108	60	80	28	30	18	64.4	339.292	A	F03136A60	
40	0	126	120	120	25	36	28	30	8	28.3	376.991	A	F03140A25	
40	0	126	120	120	35	48	28	30	10	38.3	376.991	A	F03140A35	
40	0	126	120	120	45	58	28	30	14	48.8	376.991	A	F03140A45	
40	0	126	120	120	60	80	28	30	18	64.4	376.991	A	F03140A60	
45	0	141	135	135	25	36	28	30	8	28.3	424.115	A	F03145A25	
45	0	141	135	135	35	48	28	30	10	38.3	424.115	A	F03145A35	
45	0	141	135	135	45	58	28	30	14	48.8	424.115	A	F03145A45	
45	0	141	135	135	60	80	28	30	18	64.4	424.115	A	F03145A60	
50	0	156	150	150	35	48	28	30	10	38.3	471.239	A	F03150A35	
50	0	156	150	150	45	58	28	30	14	48.8	471.239	A	F03150A45	
56	0	174	168	168	45	58	28	30	14	48.8	527.788	A	F03156A45	
63	0	195	189	189	45	58	28	30	14	48.8	593.761	A	F03163A45	
63	0	195	189	189	60	80	28	30	18	64.4	593.761	A	F03163A60	

Quality DIN 5 / Alloy Steel
Tooth Thickness Tolerance : e25
Straight Teeth
Case-Hardened and Teeth Ground



Module 4

z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	d1 H ₆	d2	B1	L1	w _{JS9}	H	L ⁽⁶⁾	Fig	Order code	
													Pinion	Shrink disc
20	0	88	80	80	32	55	40	75	10	35.3	251.327	B	F04120B32	SSD-55
20	0	88	80	80	35	52	40	50	10	38.3	251.327	A	F04120A35	
20	0	88	80	80	35	55	40	75	10	38.3	251.327	B	F04120B35	SSD-55
20	0	88	80	80	40	62	40	75	12	43.3	251.327	B	F04120B40	SSD-62
20	0	88	80	80	45	65	40	50	14	48.8	251.327	A	F04120A45	
22	0	96	88	88	35	52	40	50	10	38.3	276.46	A	F04122A35	
22	0	96	88	88	45	65	40	50	14	48.8	276.46	A	F04122A45	
22	0	96	88	88	45	68	40	75	14	48.8	276.46	B	F04122B45	SSD-68
25	0	108	100	100	32	55	40	75	10	35.3	314.159	B	F04125B32	SSD-55
25	0	108	100	100	35	52	40	50	10	38.3	314.159	A	F04125A35	
25	0	108	100	100	35	55	40	75	10	38.3	314.159	B	F04125B35	SSD-55
25	0	108	100	100	40	62	40	75	12	43.3	314.159	B	F04125B40	SSD-62
25	0	108	100	100	45	65	40	50	14	48.8	314.159	A	F04125A45	
25	0	108	100	100	55	80	40	80	16	59.3	314.159	B	F04125B55	SSD-80
28	0	120	112	112	35	52	40	50	10	38.3	351.858	A	F04128A35	
28	0	120	112	112	45	65	40	50	14	48.8	351.858	A	F04128A45	
28	0	120	112	112	45	68	40	75	14	48.8	351.858	B	F04128B45	SSD-68
32	0	136	128	128	35	52	40	50	10	38.3	402.124	A	F04132A35	
32	0	136	128	128	45	65	40	50	14	48.8	402.124	A	F04132A45	
32	0	136	128	128	55	80	40	80	16	59.3	402.124	B	F04132B55	SSD-80
32	0	136	128	128	75	110	40	100	20	79.9	402.124	B	F04132B75	SSD-110
40	0	168	160	160	45	65	40	50	14	48.8	502.655	A	F04140A45	
40	0	168	160	160	60	80	40	50	18	64.4	502.655	A	F04140A60	
40	0	168	160	160	75	110	40	100	20	79.9	502.655	B	F04140B75	SSD-110

Module 5

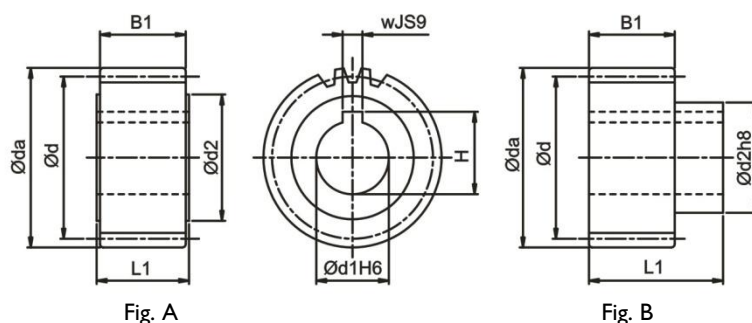
z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	d1 H ₆	d2	B1	L1	w _{JS9}	H	L ⁽⁶⁾	Fig	Order code	
													Pinion	Shrink disc
21	0	115	105	105	45	68	50	85	14	48.8	329.867	B	F05121B45	SSD-68
21	0	115	105	105	55	80	50	90	16	59.3	329.867	B	F05121B55	SSD-80
25	0	135	125	125	45	68	50	85	14	48.8	392.699	B	F05125B45	SSD-68
25	0	135	125	125	55	80	50	90	16	59.3	392.699	B	F05125B55	SSD-80
25	0	135	125	125	75	110	50	110	20	79.9	392.699	B	F05125B75	SSD-110

(1) Number of teeth (2) Profile modification factor (3) Diameter of addendum circle (4) Pitch circle diameter
(5) Working pitch circle diameter (6) Pitch circle length $L = \pi \times d$

Pinion with Straight Teeth

(Interface : Keyway)

Quality DIN 5 / Alloy Steel
Tooth Thickness Tolerance : e25 **
Straight Teeth
Case-Hardened and Teeth Ground



Module 6

z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	d1 H6	d2	B1	L1	w JS9	H	L ⁽⁶⁾	Fig	Order code	
													Pinion	Shrink disc
21	0	138	126	126	55	80	60	100	16	59.3	395.841	B	F06121B55	SSD-80
21	0	138	126	126	75	110	60	120	20	79.9	395.841	B	F06121B75	SSD-110
25	0	162	150	150	55	80	60	100	16	59.3	471.239	B	F06125B55	SSD-80
25	0	162	150	150	75	110	60	120	20	79.9	471.239	B	F06125B75	SSD-110

Module 8

z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	d1 H6	d2	B1	L1	w JS9	H	L ⁽⁶⁾	Fig	Order code	
													Pinion	Shrink disc
20	0	176	160	160	75	110	80	140	20	79.9	502.655	B	F08120B75	SSD-110
20	0	176	160	160	85	125	80	145	22	90.4	502.655	B	F08120B85	SSD-125

Module 10

z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	d1 H6	d2	B1	L1	w JS9	H	L ⁽⁶⁾	Fig	Order code	
													Pinion	Shrink disc
20	0	220	200	200	85	125	100	165	22	90.4	628.319	B	F10120B85	SSD-125

** By Module 8 or 10, the Tooth Thickness Tolerance = f 23.

(1) Number of teeth (2) Profile modification factor (3) Diameter of addendum circle

(4) Pitch circle diameter (5) Working pitch circle diameter (6) Pitch circle length $L = \pi \times d$

Pinion material carburized, the surface hardness reached 60 HRc
 Teeth surface ground in order to reduce noise and improve wear resistance
 Accessories include hexagon socket head cap screws (Strength 12.9 , DIN 912)



In Table 9, the maximum permissible torque of pinion with Keyway, and the rack is calculated on the basis of a speed of 1.5 m/s and providing good lubrication (using an automatic lubrication system or manually applied grease every day), the tooth root strength factor $S_F \geq 1.4$, tooth surface strength coefficient $S_H \geq 1$, the safety factor $S_B \approx 1$, and the required service life of 20,000 hours. By higher speed, the max. permissible torque reduced. The user needs to increase the safety factor for the application. Backlash changes by different center height. Please contact APEX under WWW.APEXDYNA.COM.

Pinion with Straight Teeth

(Interface : Keyway)

Table 9. The max. permitted torque and feed-force of pinion with Keyway

Pinion Rack			Quality	Q4	Q5H	Q5		Q6	Q6M	Q8H	Q8	Q9	Q10
			Material	Carbon Steel	Alloy Steel		Carbon Steel	Carbon Steel	Carbon Steel	Q&T Alloy Steel	Carbon Steel	Stainless Steel	Carbon Steel
			Heat Treatment	Induction Hardening	Case Hardening	Carburized Induction	Induction Hardening	Induction Hardening	Induction Hardening	Quenched Tempered	Normalizing	Solution	Induction Hardening
Mn	z ⁽¹⁾	dw ⁽⁵⁾	Max. Torque * and Feed-Force										
2	16	32	F _{2T} ⁽⁸⁾ (N)		4,375	4,375		4,375	4,375	1,875	1,250	625	1,563
			T _{2B} ⁽⁹⁾ (Nm)		70	70		70	70	30	20	10	25
	18	36	F _{2T} ⁽⁸⁾ (N)		5,556	5,556		5,556	5,556	1,944	1,389	556	1,944
			T _{2B} ⁽⁹⁾ (Nm)		100	100		100	100	35	25	10	35
	20	40	F _{2T} ⁽⁸⁾ (N)		5,250	5,250		7,000	7,000	1,500	1,000	500	2,250
			T _{2B} ⁽⁹⁾ (Nm)		105	105		140	140	30	20	10	45
	22	44	F _{2T} ⁽⁸⁾ (N)		8,182	8,182		7,045	7,045	1,591	1,136	682	2,273
			T _{2B} ⁽⁹⁾ (Nm)		180	180		155	155	35	25	15	50
	25	50	F _{2T} ⁽⁸⁾ (N)		8,400	8,400		7,200	7,200	2,000	1,200	800	2,200
			T _{2B} ⁽⁹⁾ (Nm)		210	210		180	180	50	30	20	55
	28	56	F _{2T} ⁽⁸⁾ (N)		8,571	8,571		7,143	7,143	2,143	1,429	714	2,321
			T _{2B} ⁽⁹⁾ (Nm)		240	240		200	200	60	40	20	65
	32	64	F _{2T} ⁽⁸⁾ (N)		8,594	8,594		7,188	7,188	2,656	1,719	781	2,188
			T _{2B} ⁽⁹⁾ (Nm)		275	275		230	230	85	55	25	70
	36	72	F _{2T} ⁽⁸⁾ (N)		8,611	8,611		7,222	7,222	3,472	2,083	694	2,222
			T _{2B} ⁽⁹⁾ (Nm)		310	310		260	260	125	75	25	80
	40	80	F _{2T} ⁽⁸⁾ (N)		8,750	8,750		7,125	7,125	3,375	2,250	750	2,125
			T _{2B} ⁽⁹⁾ (Nm)		350	350		285	285	135	90	30	85
	45	90	F _{2T} ⁽⁸⁾ (N)		8,667	8,667		7,111	7,111	3,333	2,333	667	2,111
			T _{2B} ⁽⁹⁾ (Nm)		390	390		320	320	150	105	30	95
	50	100	F _{2T} ⁽⁸⁾ (N)		8,700	8,700		7,000	7,000	3,200	2,300	700	2,100
			T _{2B} ⁽⁹⁾ (Nm)		435	435		350	350	160	115	35	105
	56	112	F _{2T} ⁽⁸⁾ (N)		8,750	8,750		6,964	6,964	3,214	2,321	714	2,054
			T _{2B} ⁽⁹⁾ (Nm)		490	490		390	390	180	130	40	115
	63	126	F _{2T} ⁽⁸⁾ (N)		8,889	8,889		6,825	6,825	3,016	2,222	714	2,063
			T _{2B} ⁽⁹⁾ (Nm)		560	560		430	430	190	140	45	130
	71	142	F _{2T} ⁽⁸⁾ (N)		9,085	9,085		6,901	6,901	3,169	2,254	704	2,042
			T _{2B} ⁽⁹⁾ (Nm)		645	645		490	490	225	160	50	145
	80	160	F _{2T} ⁽⁸⁾ (N)		9,313	9,313		7,000	7,000	3,250	2,313	750	2,063
			T _{2B} ⁽⁹⁾ (Nm)		745	745		560	560	260	185	60	165
	90	180	F _{2T} ⁽⁸⁾ (N)		9,444	9,444		7,167	7,167	3,389	2,333	722	2,056
			T _{2B} ⁽⁹⁾ (Nm)		850	850		645	645	305	210	65	185
3	18	54	F _{2T} ⁽⁸⁾ (N)		11,481	11,481		11,111	11,111	4,630	2,222	1,296	3,704
			T _{2B} ⁽⁹⁾ (Nm)		310	310		300	300	125	60	35	100
	20	60	F _{2T} ⁽⁸⁾ (N)		13,667	13,667		13,333	13,333	2,833	1,833	1,000	5,167
			T _{2B} ⁽⁹⁾ (Nm)		410	410		400	400	85	55	30	155
	22	66	F _{2T} ⁽⁸⁾ (N)		15,152	15,152		13,636	13,636	3,333	1,970	1,061	6,667
			T _{2B} ⁽⁹⁾ (Nm)		500	500		450	450	110	65	35	220
25	75	F _{2T} ⁽⁸⁾ (N)		15,600	15,600		13,600	13,600	4,800	2,400	1,333	6,667	
		T _{2B} ⁽⁹⁾ (Nm)		585	585		510	510	180	90	50	250	

* The Maximal Driving Torque is also to be understood as the Maximal Acceleration Torque T_{2B}.

The Emergency Stop Torque T_{2NOT} = 2 x T_{2B}, under the condition limited 1000 times in the whole service period.

(1) Number of Teeth (5) Working Pitch Circle Diameter (in mm) (8) Maximum Feed-Force (9) Maximum Driving Torque

Table 9. The max. permitted torque and feed-force of pinion with Keyway

Pinion Rack			Quality	Q4	Q5H	Q5		Q6	Q6M	Q8H	Q8	Q9	Q10
			Material	Carbon Steel	Alloy Steel		Carbon Steel	Carbon Steel	Carbon Steel	Q&T Alloy Steel	Carbon Steel	Stainless Steel	Carbon Steel
			Heat Treatment	Induction Hardening	Case Hardening	Carburized Induction	Induction Hardening	Induction Hardening	Induction Hardening	Quenched Tempered	Normalizing	Solution	Induction Hardening
Mn	z ⁽¹⁾	dw ⁽⁵⁾	Max. Torque * and Feed-Force										
3	28	84	F _{2T} ⁽⁸⁾ (N)		15,833	15,833		13,690	13,690	6,310	2,738	1,429	6,429
			T _{2B} ⁽⁹⁾ (Nm)		665	665		575	575	265	115	60	270
	32	96	F _{2T} ⁽⁸⁾ (N)		16,146	16,146		13,646	13,646	8,438	3,542	1,354	6,146
			T _{2B} ⁽⁹⁾ (Nm)		775	775		655	655	405	170	65	295
	36	108	F _{2T} ⁽⁸⁾ (N)		16,389	16,389		13,704	13,704	8,981	4,722	1,389	5,833
			T _{2B} ⁽⁹⁾ (Nm)		885	885		740	740	485	255	75	315
	40	120	F _{2T} ⁽⁸⁾ (N)		16,500	16,500		13,833	13,833	9,000	6,167	1,333	5,833
			T _{2B} ⁽⁹⁾ (Nm)		990	990		830	830	540	370	80	350
	45	135	F _{2T} ⁽⁸⁾ (N)		16,593	16,593		14,148	14,148	9,259	6,667	1,333	5,852
			T _{2B} ⁽⁹⁾ (Nm)		1,120	1,120		955	955	625	450	90	395
	50	150	F _{2T} ⁽⁸⁾ (N)		16,733	16,733		14,400	14,400	9,533	6,800	1,400	5,933
			T _{2B} ⁽⁹⁾ (Nm)		1,255	1,255		1,080	1,080	715	510	105	445
4	20	80	F _{2T} ⁽⁸⁾ (N)		26,125		25,000	24,625	24,625	7,125	3,625	1,750	1,187
			T _{2B} ⁽⁹⁾ (Nm)		1,045		1,000	985	985	285	145	70	475
	22	88	F _{2T} ⁽⁸⁾ (N)		29,091		25,114	24,659	24,659	8,864	4,091	2,045	11,932
			T _{2B} ⁽⁹⁾ (Nm)		1,280		1,105	1,085	1,085	390	180	90	525
	25	100	F _{2T} ⁽⁸⁾ (N)		29,300		25,200	24,800	24,800	11,900	5,300	2,200	11,300
			T _{2B} ⁽⁹⁾ (Nm)		1,465		1,260	1,240	1,240	595	265	110	565
	28	112	F _{2T} ⁽⁸⁾ (N)		29,375		25,268	24,821	24,821	15,089	6,518	2,143	11,161
			T _{2B} ⁽⁹⁾ (Nm)		1,645		1,415	1,390	1,390	845	365	120	625
	32	128	F _{2T} ⁽⁸⁾ (N)		30,000		25,781	25,391	25,391	16,953	8,594	2,188	11,250
			T _{2B} ⁽⁹⁾ (Nm)		1,920		1,650	1,625	1,625	1,085	550	140	720
	40	160	F _{2T} ⁽⁸⁾ (N)		31,188		26,813	26,438	26,438	17,813	12,438	2,250	11,563
			T _{2B} ⁽⁹⁾ (Nm)		2,495		2,145	2,115	2,115	1,425	995	180	925
5	21	105	F _{2T} ⁽⁸⁾ (N)	39,333	44,762		39,333	39,048	39,048		17,813	3,238	23,714
			T _{2B} ⁽⁹⁾ (Nm)	2,065	2,350		2,065	2,050	2,050		390	170	1,245
	25	125	F _{2T} ⁽⁸⁾ (N)	40,160	46,640		40,160	39,760	39,760		10,640	3,440	23,280
			T _{2B} ⁽⁹⁾ (Nm)	2,510	2,915		2,510	2,485	2,485		665	215	1,455
6	21	126	F _{2T} ⁽⁸⁾ (N)	57,143	64,206		57,143	57,143	57,143		13,651	4,921	40,794
			T _{2B} ⁽⁹⁾ (Nm)	3,600	4,045		3,600	3,600	3,600		860	310	2,570
	25	150	F _{2T} ⁽⁸⁾ (N)	59,133	66,533		59,133	59,067	59,067		20,067	5,200	41,333
			T _{2B} ⁽⁹⁾ (Nm)	4,435	4,990		4,435	4,430	4,430		1,505	390	3,100
8	20	160	F _{2T} ⁽⁸⁾ (N)	103,750	110,250		103,750	103,750	103,750		27,938		81,250
			T _{2B} ⁽⁹⁾ (Nm)	8,300	8,820		8,300	8,300	8,300		2,235		6,500
10	20	200	F _{2T} ⁽⁸⁾ (N)	165,400	169,200		165,400	165,300			55,850		145,200
			T _{2B} ⁽⁹⁾ (Nm)	16,540	16,920		16,540	16,530			5,585		14,520

* The Maximal Driving Torque is also to be understood as the Maximal Acceleration Torque T_{2B}.

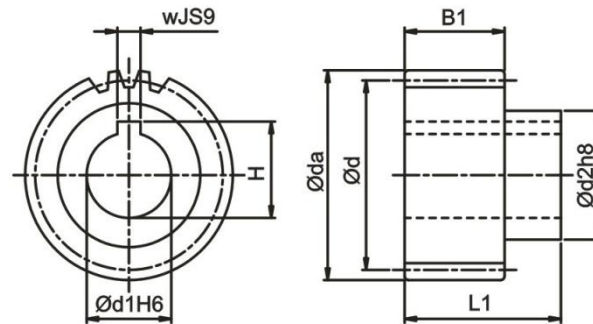
The Emergency Stop Torque T_{2NOT} = 2 × T_{2B}, under the condition limited 1000 times in the whole service period.

(1) Number of Teeth (5) Working Pitch Circle Diameter (in mm) (8) Maximum Feed-Force (9) Maximum Driving Torque

Pinion with Straight Teeth

(Interface : Keyway / CP System)

Quality DIN 5 / Alloy Steel
Tooth Thickness Tolerance : e25
Straight Teeth
Case-Hardened and Teeth Ground



Pitch 5 (Module : 1.591)

z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	d1 H6	d2	B1	L1	w JS9	H	L ⁽⁶⁾	Order code	
												Pinion	Shrink disc
25	0	42.971	39.788	39.788	16	30	25	51	5	18.3	124.996	FIK125B16	SSD-30
30	0	50.928	47.745	47.745	22	36	25	54	6	24.8	149.995	FIK130B22	SSD-36
40	0	66.843	63.66	63.66	25	44	25	56	8	28.3	199.994	FIK140B25	SSD-44

Pitch 10 (Module : 3.183)

z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	d1 H6	d2	B1	L1	w JS9	H	L ⁽⁶⁾	Order code	
												Pinion	Shrink disc
20	0	70.028	63.661	63.662	22	36	31	60	6	24.8	200	F3B120B22	SSD-36
25	0	85.944	79.578	79.578	25	44	31	62	8	28.3	250	F3B125B25	SSD-44
25	0	85.944	79.578	79.578	32	55	31	68	10	35.3	250	F3B125B32	SSD-55

Pitch 13.33 (Module : 4.244)

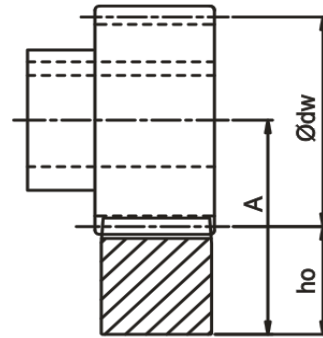
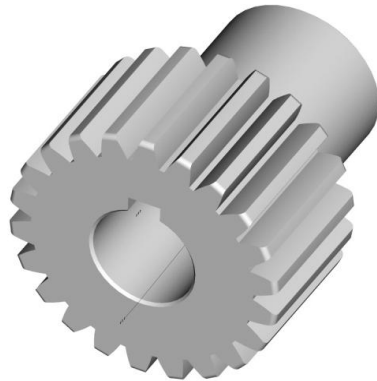
z ⁽¹⁾	x ⁽²⁾	da ⁽³⁾	d ⁽⁴⁾	dw ⁽⁵⁾	d1 H6	d2	B1	L1	w JS9	H	L ⁽⁶⁾	Order code	
												Pinion	Shrink disc
20	0	93.368	84.88	84.88	32	55	40	77	10	35.3	266.658	F4D120B32	SSD-55
25	0	114.588	106.1	106.1	40	62	40	77	12	43.3	333.323	F4D125B40	SSD-62

(1) Number of teeth (2) Profile modification factor (3) Diameter of addendum circle (4) Pitch circle diameter
(5) Working pitch circle diameter (6) Pitch circle length $L = \pi \times d$

Pinion material carburized, the surface hardness reached 60 HRC

Teeth surface ground in order to reduce noise and improve wear resistance

Accessories include hexagon socket head cap screws (Strength 12.9 , DIN 912)



$$A = h_o + \frac{\phi dw}{2}$$

In Table 10, the maximum permissible torque of CP pinion, and the rack is calculated on the basis of a speed of 1.5 m/s and providing good lubrication (using an automatic lubrication system or manually applied grease every day), the tooth root strength factor $S_F \geq 1.4$, tooth surface strength coefficient $S_H \geq 1$, the safety factor $S_B \doteq 1$, and the required service life of 20,000 hours. By higher speed, the max. permissible torque reduced. The user needs to increase the safety factor for the application. Backlash changes by different center height. Please contact APEX under WWW.APEXDYNA.COM.

Table 10. The max. permitted torque and feed-force of CP pinion with Keyway

Rack Pinion			Teeth Width (in mm)	Quality	Q6	Q8
				Material	Carbon Steel	Carbon Steel
Pitch	z ⁽¹⁾	dw ⁽⁵⁾		Heat Treatment	Induction Hardening	Normalizing
Max. Torque and Feed-Force						
5	25	39.788	19 (Q6)	F _{2T} ⁽⁸⁾ (N)	4,524	754
			20 (Q8)	T _{2B} ⁽⁹⁾ (Nm)	90	15
			24 (Q6)	F _{2T} ⁽⁸⁾ (N)	5,781	1,005
			25 (Q8)	T _{2B} ⁽⁹⁾ (Nm)	115	20
	30	47.745	19 (Q6)	F _{2T} ⁽⁸⁾ (N)	4,398	1,047
			20 (Q8)	T _{2B} ⁽⁹⁾ (Nm)	105	25
			24 (Q6)	F _{2T} ⁽⁸⁾ (N)	5,864	1,257
			25 (Q8)	T _{2B} ⁽⁹⁾ (Nm)	140	30
	40	63.66	19 (Q6)	F _{2T} ⁽⁸⁾ (N)	4,398	1,414
			20 (Q8)	T _{2B} ⁽⁹⁾ (Nm)	140	45
			24 (Q6)	F _{2T} ⁽⁸⁾ (N)	5,655	1,728
			25 (Q8)	T _{2B} ⁽⁹⁾ (Nm)	180	55
10	20	63.662	29 (Q6)	F _{2T} ⁽⁸⁾ (N)	14,451	2,042
			30 (Q8)	T _{2B} ⁽⁹⁾ (Nm)	460	65
	25	79.578	29 (Q6)	F _{2T} ⁽⁸⁾ (N)	14,451	2,765
			30 (Q8)	T _{2B} ⁽⁹⁾ (Nm)	575	110
13.33	20	84.88	39 (Q6)	F _{2T} ⁽⁸⁾ (N)	26,272	4,123
			40 (Q8)	T _{2B} ⁽⁹⁾ (Nm)	1,115	175
	25	106.1	39 (Q6)	F _{2T} ⁽⁸⁾ (N)	26,390	6,221
			40 (Q8)	T _{2B} ⁽⁹⁾ (Nm)	1,400	330

* The Maximal Driving Torque is also to be understood as the Maximal Acceleration Torque T_{2B} .

The Emergency Stop Torque $T_{2NOT} = 2 \times T_{2B}$, under the condition limited 1000 times in the whole service period.

(1) Number of Teeth (5) Working Pitch Circle Diameter (in mm) (8) Maximum Feed-Force (9) Maximum Driving Torque