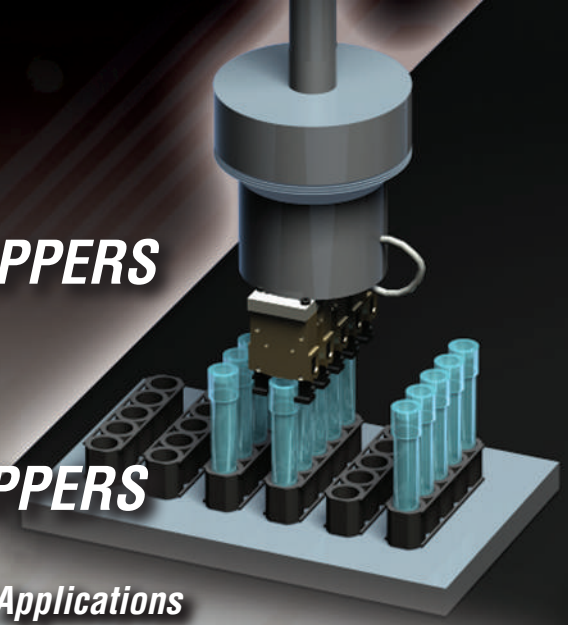
GRA SERIES GRA PARALLEL GRIPPERS

GRV SERIES GRV ANGULAR GRIPPERS



Compact Precision Grippers Ideal for a Wide Range of Applications

Series GRA Parallel

Series GRV Angular

ISO-9001 CERTIFIED
Quality Management System Certified

GRAV01

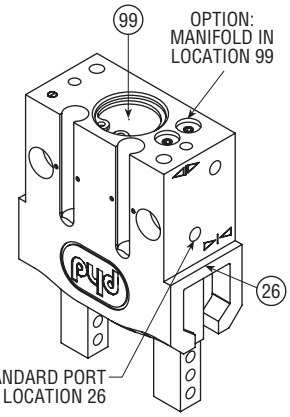
PHD is a member of the MAC Distributor Network

phd® SOLUTIONS FOR INDUSTRIAL AUTOMATION

www.phdinc.com

ORDERING DATA: SERIES GRA PARALLEL GRIPPERS

TO ORDER SPECIFY:
Product, Design No., Size, Minimum Total Jaw Travel, and any options required.



OPTIONS (Omit if not required)
MANIFOLD OPTION
L11-UB99 - Manifold option in location 99
MOUNTING OPTION
GR9 - Mounting flange in location 99
FLUID COMPATIBILITY
V1 - Fluoro-Elastomer Seals and Lubricants
LUBRICATION
Y4 - Cleanroom Grade Lubricant

DESIGN NO.
5 - Metric

GRA - 5 - 6 x 4 - L11-UB99

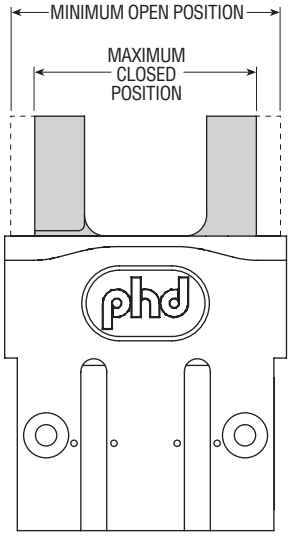
For Series GRV Angular data, see page 8.

PRODUCT
Small Profile Precision Jaw Movement Parallel Gripper

NOTE: Design No. indicates metric mountings, dowel pin holes, and ports.

PRODUCT SIZE	BORE DIA. mm	BORE DIA. inch	MINIMUM TOTAL JAW TRAVEL Total Travel Per Bore Size mm	MINIMUM TOTAL JAW TRAVEL Total Travel Per Bore Size inch equivalent
6	6	.236	**4**	**.157**
10	10	.394	**5**	**.197**
16	16	.630	**9**	**.354**
20	20	.787	**13**	**.512**

MINIMUM JAW TRAVEL = MINIMUM OPEN POSITION - MAXIMUM CLOSED POSITION



SERIES JC1SD MAGNETIC SWITCHES

PART NO.	SWITCH DESCRIPTION
JC1SDP-5	PNP (Source), Solid State, 10-30 VDC, 5 meter cable
JC1SDP-K	PNP (Source), Solid State, 10-30 VDC, Quick Connect
JC1SDN-5	NPN (Sink), Solid State, 10-30 VDC, 5 meter cable
JC1SDN-K	NPN (Sink), Solid State, 10-30 VDC, Quick Connect

Includes one switch and installation directions

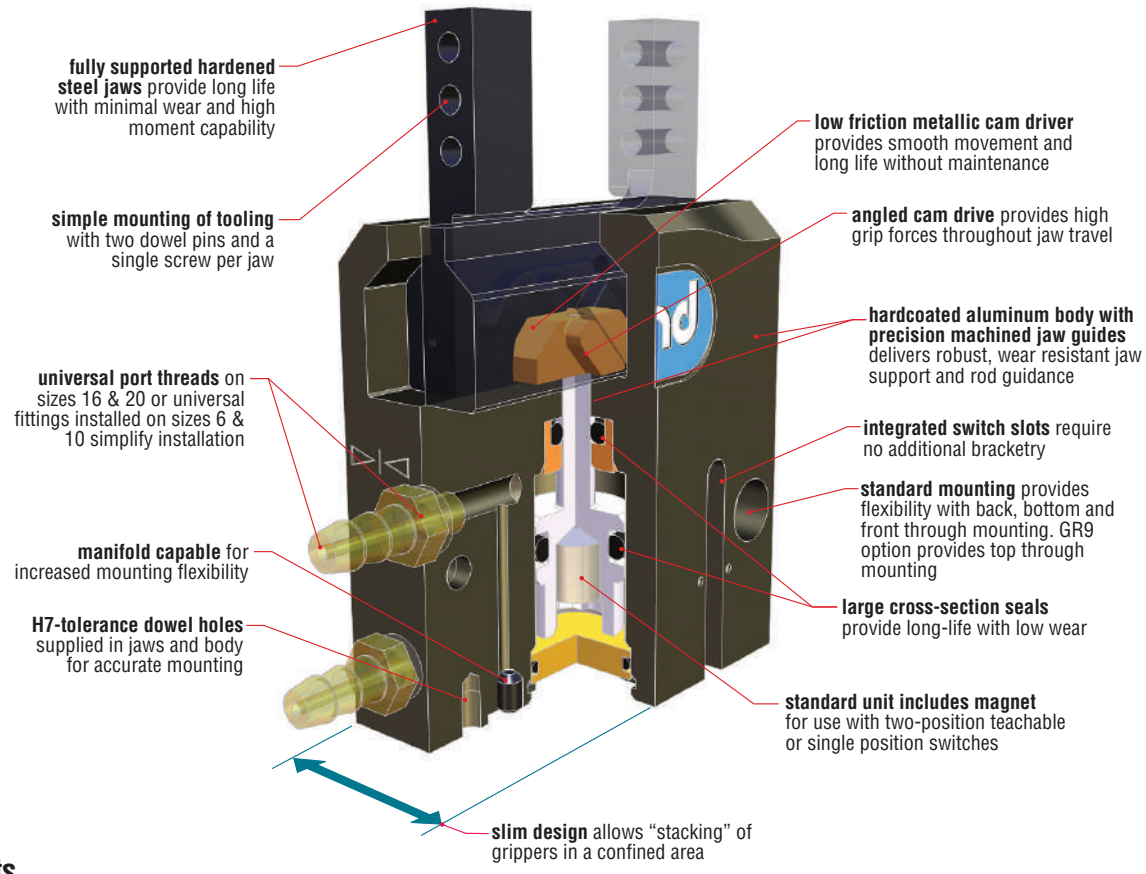
SERIES JC1ST TWO POSITION TEACHABLE MAGNETIC SWITCHES

PART NO.	SWITCH DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

Includes one switch and installation directions

(800) 624-8511
www.phdinc.com/grv www.phdinc.com/gra

LOW PROFILE WITH CONSISTENT JAW MOVEMENT



Major Benefits

- Series GRA Gripper's compact, flexible design provides large moment capacities and long tooling lengths.
- Factory set jaw guide system minimizes jaw "free-play" and reduces jaw deflection when gripping or moving loads.
- Robust construction ensures long operating life.
- True parallel jaw motion simplifies jaw tooling and is ideal for centering parts of various sizes.
- H7-tolerance dowel pin holes included for accurate alignment of tooling and gripper mounting.
- Double acting for use in both internal and external gripping applications.
- Manifold porting capability allows for nested gripper installation.
- Mounting provided from top (with option GR9), bottom, front, and back of gripper.
- Internal speed control is standard, no external speed control required.
- Standard with imperial / metric porting, metric mounting threads and dowel holes for global appeal.
- Supplied "switch-ready" for easy integration of optional magnetic position sensing switches.
- Magnetic sensing two-teachable position switch available to simplify set-up and integration.
- Standard four working day delivery reduces integration time.

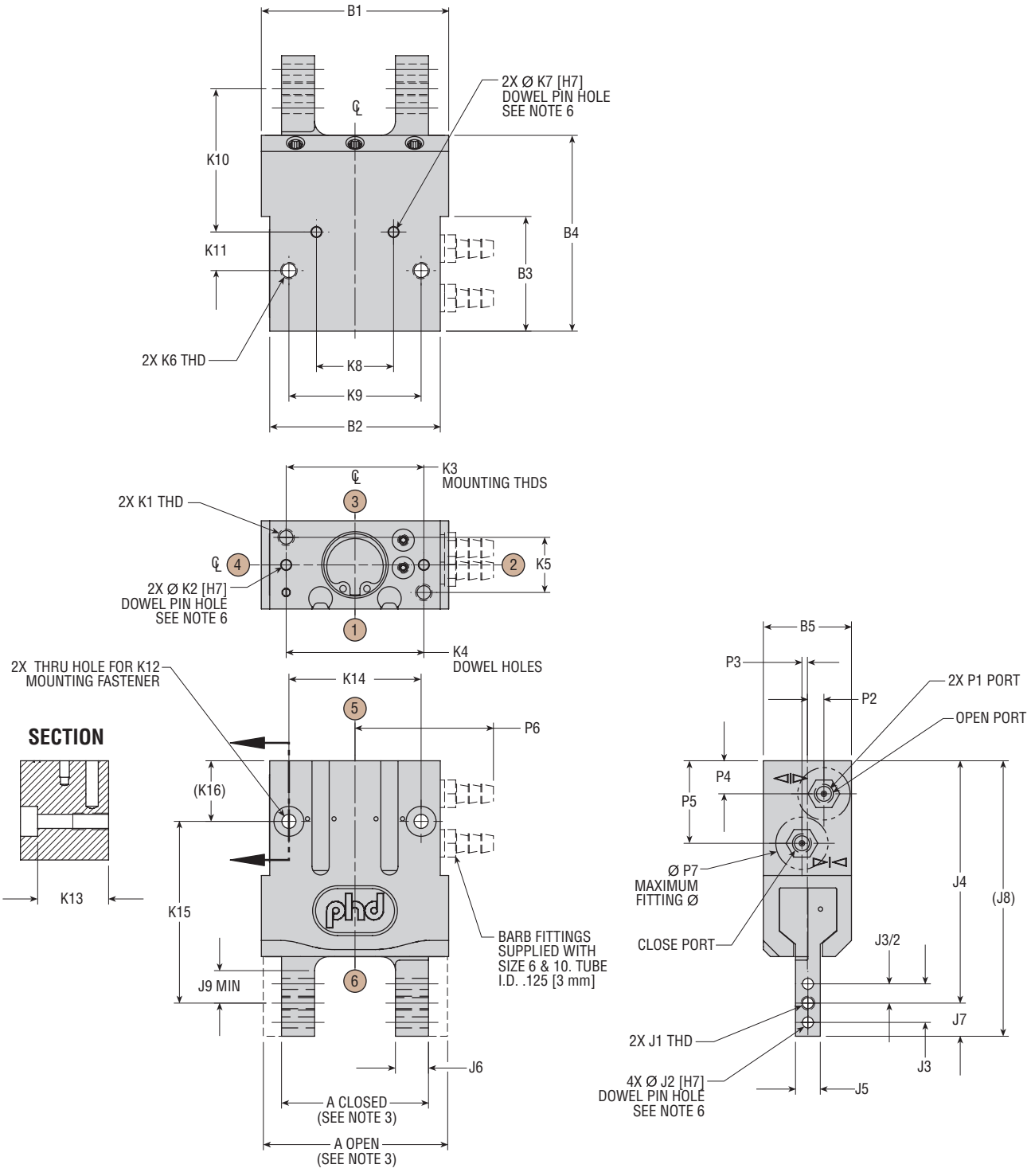
Industry/Process Uses

- Medical device manufacture
- Semiconductor manufacture
- Laboratory processing applications
- Clamping and fixturing during assembly operations
- Centering and registration of parts
- Incorporation into space restricted processing and manufacturing equipment

Consistent Jaw Movement Over Life of Unit

10 Million Cycle Life in a Robust, Compact Design

Flexible Mounting Capability


B1
2X Ø K7 [H7]
DOWEL PIN HOLE
SEE NOTE 6
K10
K11
B4
B3
2X K6 THD
K8
K9
B2
K3
MOUNTING THDS
2X K1 THD
K5
2X Ø K2 [H7]
DOWEL PIN HOLE
SEE NOTE 6
K4
DOWEL HOLES
2X THRU HOLE FOR K12
MOUNTING FASTENER
K14
P6
SECTION
(K16)
K13
K15
J9 MIN
BARB FITTINGS
SUPPLIED WITH
SIZE 6 & 10. TUBE
I.D. .125 [3 mm]
J6
A CLOSED
(SEE NOTE 3)
A OPEN
(SEE NOTE 3)
B5
P3
P2
2X P1 PORT
OPEN PORT
P4
P5
Ø P7
MAXIMUM
FITTING Ø
CLOSE PORT
J4
(J8)
J3/2
J7
2X J1 THD
J3
4X Ø J2 [H7]
DOWEL PIN HOLE
SEE NOTE 6
J5

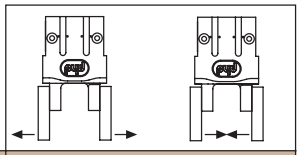
DIMENSIONS: SERIES GRA PARALLEL GRIPPERS

LETTER DIM	SIZE 6 in	6 mm	10 in	10 mm	16 in	16 mm	20 in	20 mm
NOMINAL TOTAL JAW TRAVEL	.157	4.0	.198	5.0	.353	9.0	.511	13.0
A CLOSED	.985	25.0	1.063	27.0	1.339	34.0	1.418	36.0
A OPEN	1.142	29.0	1.261	32.0	1.692	43.0	1.929	49.0
B1	1.220	31.0	1.339	34.0	1.772	45.0	2.008	51.0
B2	N/A	N/A	N/A	N/A	1.496	38.0	1.811	46.0
B3	N/A	N/A	N/A	N/A	1.0191	25.9	1.221	31.0
B4	1.355	34.4	1.518	38.6	1.784	45.3	2.110	53.6
B5	.394	10.0	.630	16.0	.866	22.0	1.102	28.0
J1	M1.6 x 0.35		M2.5 x 0.45		M4 x 0.7		M5 x 0.8	
J2	1.5		2.0		2.5		3.0	
J3	.1969	5.00	.2756	7.00	.3937	10.00	.4724	12.00
J4	1.535	39.0	1.850	47.0	2.224	56.5	2.618	66.5
J5	.118	3.0	.177	4.5	.276	7.0	.335	8.5
J6	.197	5.0	.236	6.0	.354	9.0	.394	10.0
J7	.177	4.5	.236	6.0	.315	8.0	.354	9.0
J8	1.713	43.5	2.087	53.0	2.540	64.5	2.972	75.5
J9 MIN	.172	4.4	.215	5.5	.288	7.3	.359	9.1
K1	M2.5 x 0.45 x 5 DP		M3 x 0.5 x 6.5 DP		M3 x 0.5 x 6.5 DP		M4 x 0.7 x 8 DP	
K2	2.0 x 3.0 DP		2.0 x 3.0 DP		3.0 x 4.0 DP		4.0 x 4.0 DP	
K3	.945	24.0	.984	25.0	1.260	32.0	1.417	36.0
K4	.6890	17.50	.9843	25.00	1.2598	32.00	1.4173	36.00
K5	.177	4.5	.394	10.0	.591	15.0	.748	19.0
K6	M3 x 0.5 x 6 DP		M3 x 0.5 x 6.5 DP		M4 x 0.7 x 8 DP		M5 x 0.8 x 10 DP	
K7	2.0 x 3.0 DP		2.0 x 3.0 DP		3.0 x 4.0 DP		4.0 x 4.0 DP	
K8	.5120	13.00	.5512	14.00	.7874	20.00	.8661	22.00
K9	.945	24.0	1.063	27.0	1.181	30.0	1.417	36.0
K10	.827	21.0	1.024	26.0	1.378	35.0	1.595	40.5
K11	.295	7.5	.315	8.0	.315	8.0	.354	9.0
K12	M2.5		M2.5		M3		M4	
K13	.289	7.3	.507	12.9	.708	18.0	.925	23.5
K14	.945	24.0	1.063	27.0	1.181	30.0	1.417	36.0
K15	1.112	28.25	1.339	34.0	1.693	43.0	1.949	49.5
K16	.413	10.5	.512	13.0	.531	13.5	.669	17.0
P1	M3 x 0.5 x 3 DP		M3 x 0.5 x 3 DP		M5 x 0.8 x 4.5 DP		M5 x 0.8 x 4.5 DP	
P2	.059	1.5	.118	3.0	.158	4.0	.197	5.0
P3	.039	1.0	.019	.5	.138	3.5	.158	4.0
P4	.256	6.5	.236	6.0	.295	7.5	.354	9.0
P5	.610	15.5	.709	18.0	.750	19.1	.945	24.0
P6	.990	25.1	1.050	26.7	N/A	N/A	N/A	N/A
P7	.256	6.5	.374	9.5	.512	13.0	.512	13.0

NOTES:

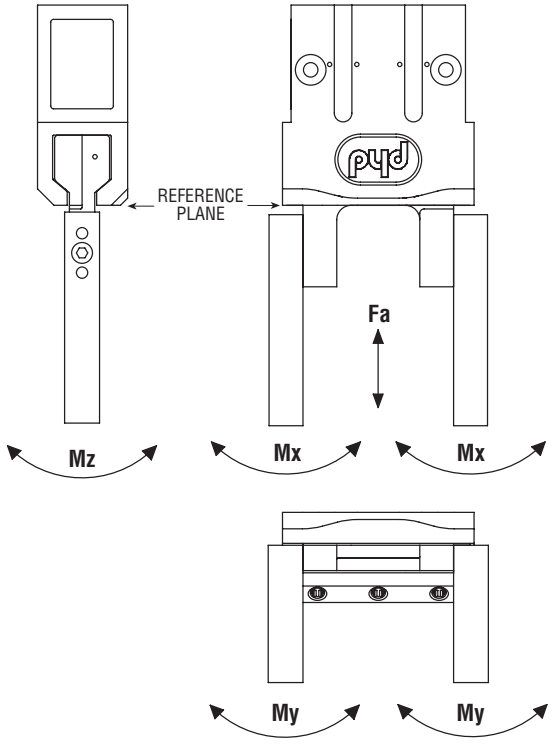
1) ALL DIMENSIONS ARE REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED
2) METRIC INFORMATION SHOWN IN [ ] DESIGNATED mm
3) A OPEN REFLECTS SMALLEST POSSIBLE OPEN DIMENSION (+.052/-.000 [+1.3 mm/-.0 mm])
   A CLOSED REFLECTS LARGEST POSSIBLE CLOSED DIMENSION (+.000/-.024 [+.0 mm/-.6 mm])
4) CIRCLED NUMBERS INDICATE POSITIONS
5) DESIGNATED ℄ IS CENTERLINE OF UNIT
6) DOWEL PINS OR SPRING PINS OF THE SAME DIAMETER ARE RECOMMENDED. THIS PROVIDES A SMALL PRESS TO SLIGHT SLIP FIT DURING ASSEMBLY. PHD RECOMMENDS THE USE OF ANTI-SEIZE COMPOUNDS DURING ASSEMBLY.

SPECIFICATIONS	SERIES GRA	
	IMPERIAL	METRIC
OPERATING AIR PRESSURE	30 psi min. to 120 psi max. air	2 bar min. to 8.3 bar max. air
OPERATING TEMPERATURE	-20°F min. to +180°F max.	-28°C min. to +82°C max.
GRIP REPEATABILITY	± .0004 inch of original position	± .01 mm of original position
RATED LIFE	10 million cycles	
LUBRICATION	Factory lubricated for rated life	



SIZE	MINIMUM TOTAL JAW TRAVEL		TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar]		GRIPPER WEIGHT		DISPLACEMENT		CLOSE OR OPEN TIME AT 87 psi [6 bar]	MAXIMUM TOOLING LENGTH		GRIP FORCE FACTOR			
												INTERNAL GRIP		EXTERNAL GRIP	
	in	mm	lb	N	lb	kg	in^3	cm^3	sec	in	mm	IMP	MET	IMP	MET
6	.158	4.0	2.55	11	0.08	0.036	0.005	0.08	.030	1.18	30	0.024	1.5	0.029	1.89
10	.197	5.0	8.2	37	0.163	0.074	0.016	0.26	.030	1.77	45	0.080	5.2	0.094	6.10
16	.354	9.0	18.2	81	0.36	0.16	0.063	1.03	.040	3.15	80	0.167	10.8	0.209	13.5
20	.512	13.0	27.7	123	0.62	0.28	0.134	2.20	.105	3.94	100	0.254	16.4	0.318	20.5

SIZE	AXIAL FORCE Fa		MAXIMUM INDIVIDUAL MOMENTS Mx		My		Mz	
	lb	N	in-lb	Nm	in-lb	Nm	in-lb	Nm
6	3.25	14	3.50	0.40	1.70	0.19	1.70	0.19
10	12	53	10.0	1.1	5.0	0.56	5.0	0.56
16	25	111	25	2.8	25	2.8	20	2.3
20	40	178	45	5.1	45	5.1	30	3.4



Fa: Total for both jaws
Mx: Maximum allowable moment per jaw, relative to the reference plane
My: Maximum allowable moment per jaw, relative to the geometric center of the jaw finger
Mz: Maximum allowable moment per jaw, relative to the reference plane

When calculating the value for Fa, include the tooling weight, part weight, external forces, and accelerations. When calculating values for Mx, My, and Mz, include the grip force per jaw, tooling weight, part weight, external forces, and accelerations as applicable.

RECOMMENDATIONS

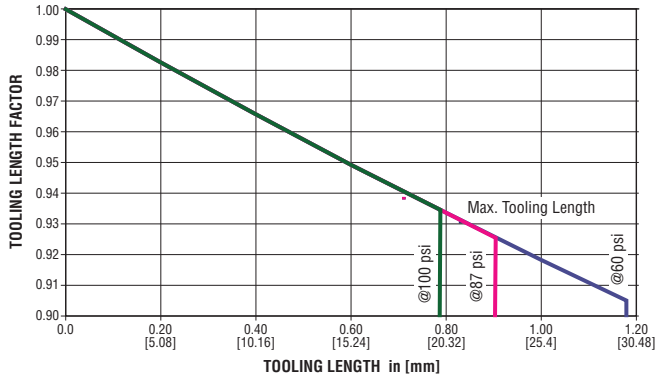
Design tooling so that the grip point is as close to the gripper surfaces as possible. The grip force factor (Gf) values given in the table on page 7 are for zero tooling length. As the grip point is moved away from the jaw surface, the applied moment causes jaw friction to increase, resulting in reduced effective grip force. Use the tooling length factor chart on the following page to calculate the effective grip force for a specific grip point.

The maximum load that grippers can handle will vary based on: size of the part being picked up, shape of the part, texture of the part, speed at which the part is transferred, working pressure, shape of the fingers, etc.

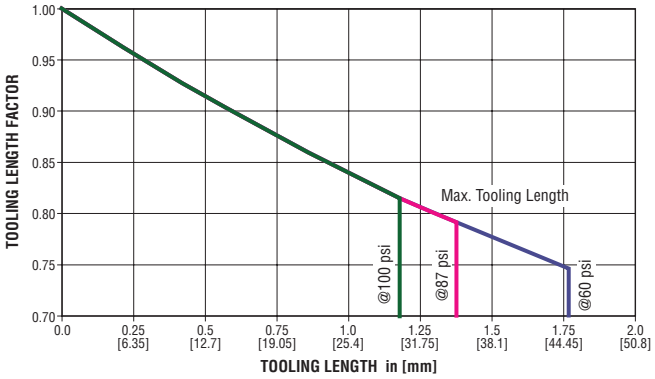
TOOLING LENGTH FACTOR

As the grip point is moved away from the jaw surface, the grip force is reduced due to additional friction generated by the grip induced moment. The tooling length factor allows calculation of the grip force at any grip point. The graph also indicates the maximum tooling length for each gripper size.

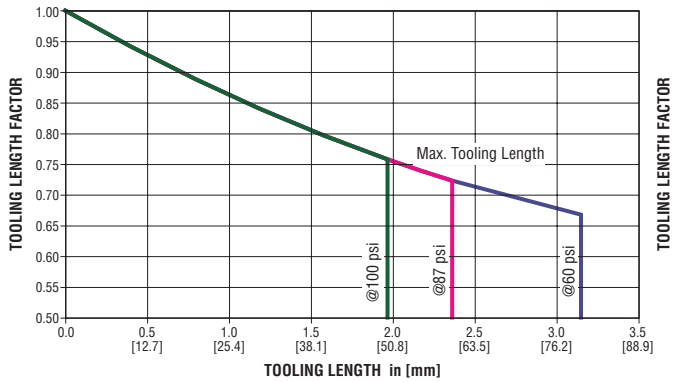
GRA 6



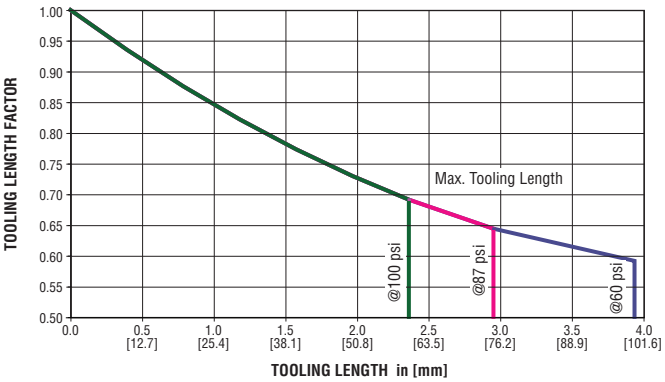
GRA 10



GRA 16



GRA 20



GRIP FORCE CALCULATION EQUATIONS:

IMPERIAL:

Total Grip Force [lb] = (Pressure [psi] x Gf) x Tooling Length Factor

METRIC:

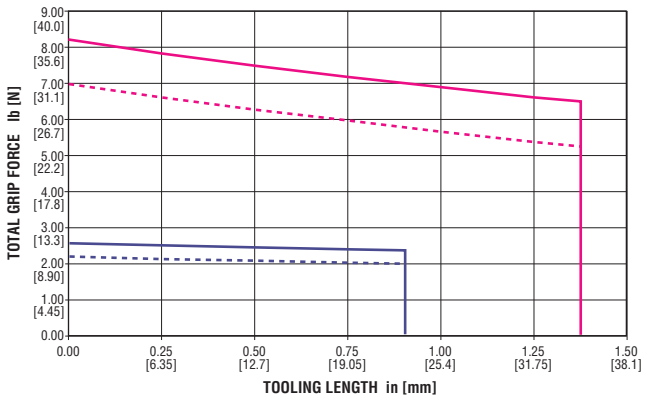
Total Grip Force [N] = (Pressure [bar] x Gf) x Tooling Length Factor

GRIP FORCE

Total gripping force relative to tooling length is shown below at 87 psi [6 bar] pressure. Grip force per jaw equals the total grip force divided by two. The graphs also indicate the maximum tooling length for each gripper size.

GRA 6 & 10

Grip Force at 87 psi [6 bar]



GRA 16 & 20

Grip Force at 87 psi [6 bar]