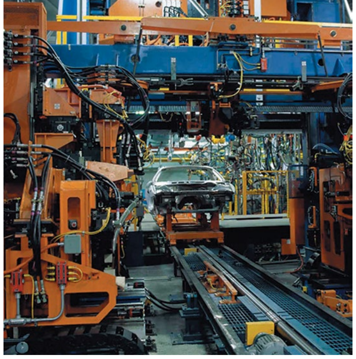
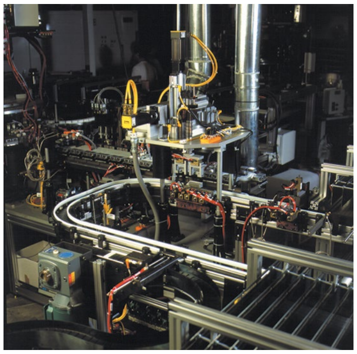
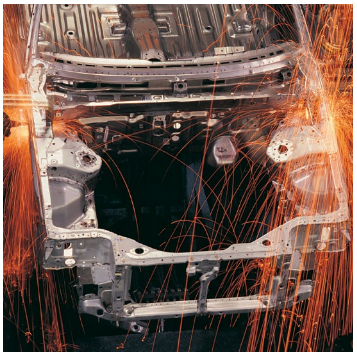


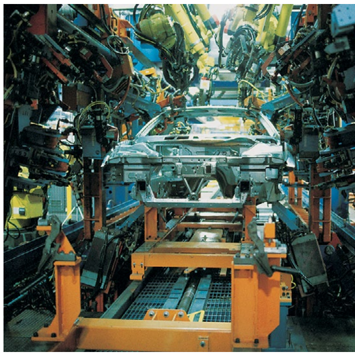


aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding



Extreme Force Electromechanical Cylinder

Series XFC



Parker

ENGINEERING YOUR SUCCESS.

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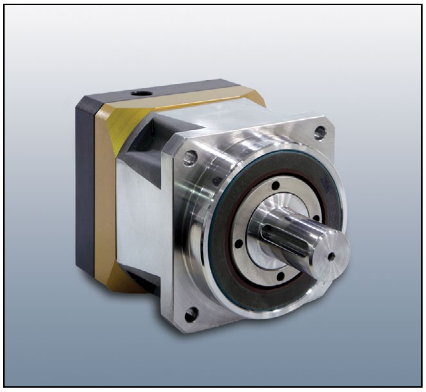
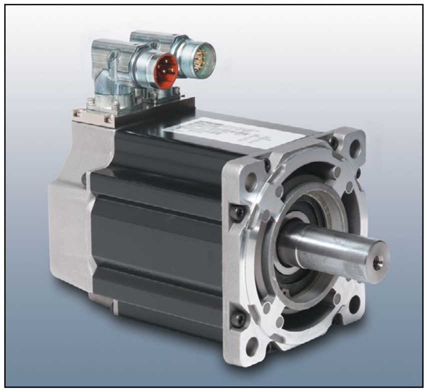
High Performance Components

Parker's XFC Extreme Force Electromechanical actuator proudly features heavy duty components designed for industrial applications. These are the preferred products to accompany the XFC product for long, reliable service.



Our Generation II Stealth® Series provides higher radial load, increased service life and easier mounting than comparably sized planetary gearheads. The Stealth Generation II Helical Planetary Gearheads incorporate design enhancements to provide superior performance for the most demanding high performance applications. Generation II models are available in 60 to 142 mm and NEMA 23 to 42 frame sizes.



The MaxPlusPlus (MPP) family of brushless servo motors is redefining performance, flexibility, and reliability. The industry's highest-performing servo motor uses eightpole segmented lamination technology, which produces more torque in a shorter package. Use MaxPlusPlus motors for higher torque applications, customization options, or when high performance is required.

With its high performance and modular design, the Compax3 family of industrial servo drives and drive/controllers offers a new level of servo performance and flexibility. Available in single- or multi-axis configurations, with numerous expansion options, all models are rated for 120-480 VAC input, continuous current output from 2.5 A (rms) to 155 A (rms), and are CE (EMC &LVD) and UL compliant.

⚠ WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from the Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having expertise. It is important that you analyze all aspects of your application, including consequences of any failure and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

Offer of Sale

The items described in this document are hereby offered for sale by Parker Hannifin Corporation, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by provisions stated on a separate page of the document entitled 'Offer of Sale'.

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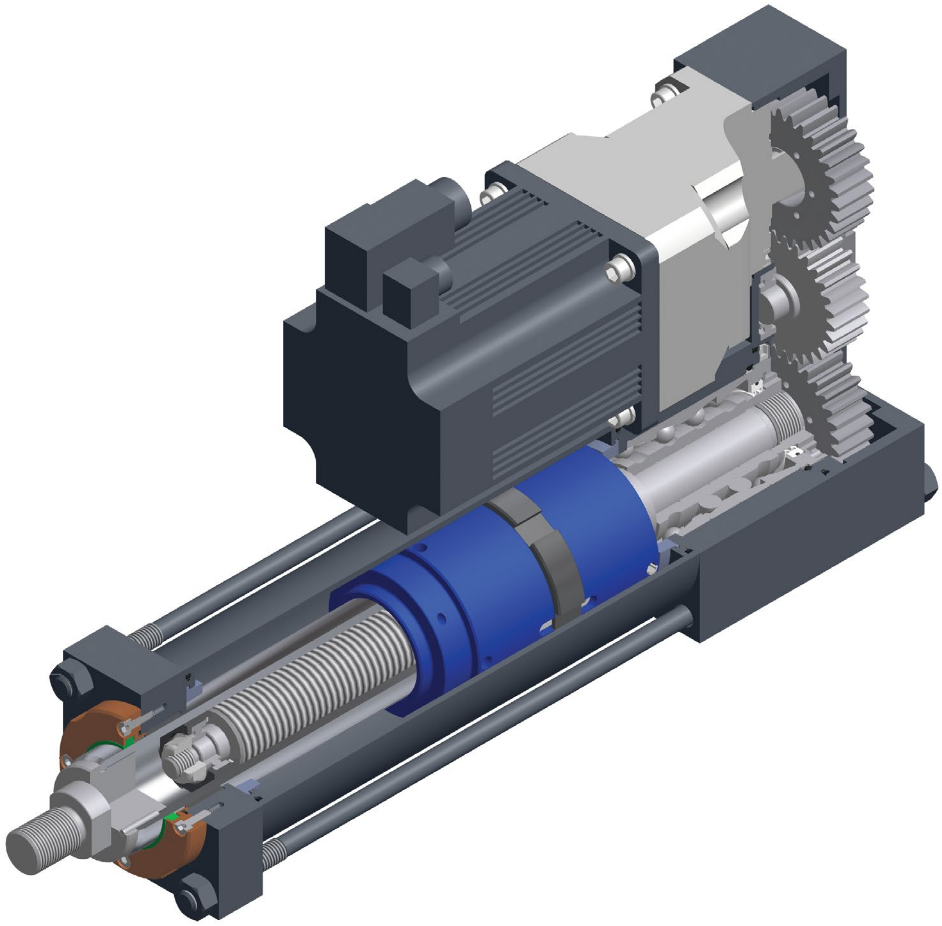

Provide machinery builders with a High Force Electromechanical cylinder solution yielding high durability, long life, minimal maintenance, and low operating cost by utilizing heavy duty steel construction and high load capacity roller screws combined with Parker's premier customer service.

XFC Frame Size	Force (kN)	Force (lbs.)
075	20.0	4,500
090	33.4	7,500
115	53.4	12,000
140	80.0	17,500
165	120.0	26,500
190	178.0	40,000

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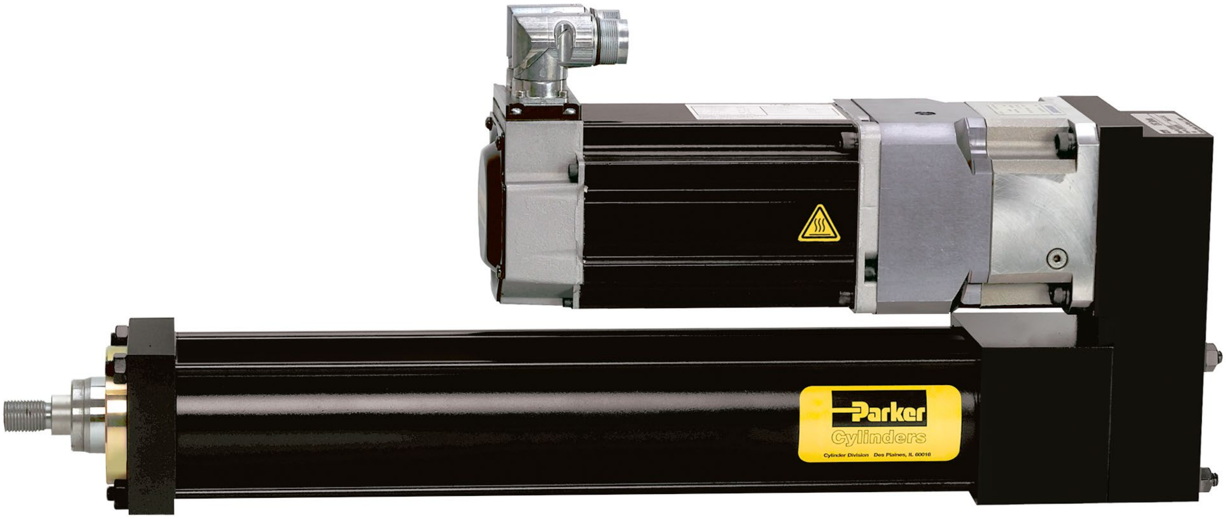

Features	Benefits
All Steel Construction	High Durability
Elastomeric Seals Throughout	Completely Sealed (No Gaskets used)
Standard Metric Hydraulic Type Tie Rod Construction	Structural Rigidity
Opposed Preloaded Angular Contact Bearings	Increased Accuracy and Durability Bi-Directional Force Capabilities
Roller Screw Drive System	Increased Load, Life, and Shock Loading Capabilities compared to traditional Ball Screw designs
Inline and Parallel Gear Drive Configurations	Positive Engagement between Motor and Load No Belts to Break, Skip Teeth or Maintain
Speeds up to 40 Inches per Second	Cycle Time Reduction
Continuous thrust ratings up to 178 kN (40,000 pounds)	Hydraulic Replacement Capabilities
Stealth family advanced series of planetary gearheads from Parker Bayside direct mounted to actuator	Standard Reduction options from 3:1 – 10:1 Higher Ratios up to 100:1 Available
Parker MPP Max Plus Plus Motors Standard	Complete Parker System Solution (Cylinder, Gearhead, Motor, Drive, Controls)
No “Standard” Stroke Lengths (Order in mm increments)	Customized stroke lengths for optimal design at no additional cost
Rod wiper and seal based on proven TS2000 design and composite rod bearing	Designed to survive rugged environments with minimal maintenance for the life of the actuator

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Parker Hannifin's Latest Electromechanical Extreme Force Cylinder

The Series XFC Roller Screw Cylinder

Parker is pleased to introduce a new level of Electric High Thrust cylinders featuring roller screw drive technology – Series XFC. The Series XFC Extreme Force Electromechanical Cylinder is designed to provide heavy machine builders a high force electromechanical solution offering long life, minimal maintenance and low operating costs while maintaining structural rigidity. All this while still providing world class customer service and industry leading delivery times.

As a worldwide leader in fluid power cylinder products, Parker has combined the best of both worlds into one unique product. All the benefits of electromechanical control and cleanliness combined with the structural rigidity and durability of a traditional hydraulic tie rod cylinder.

Flexibility & Programmability:

In applications where high loads and/or high speed motion are required, roller screws offer a very attractive solution. Servo Motors and controls feature simplified programming with auto-tuning capabilities reducing installation start up time and expenses.

Electromechanical control systems utilizing servo motor technology provide infinite programmability along with some advantages not easily obtainable with other solutions such as multiple move profiles, adjustable acceleration and deceleration, force control, and absolute positioning capabilities. These features allow the system to be easily adaptable to changing application conditions and performance requirements with minimal modification.

Maintenance & Installation:

Roller screw cylinder systems require little or no maintenance when compared to their fluid power alternatives, while still delivering long life and high performance. Due to the small number of components required for a complete system, the commissioning time required for operation is significantly reduced. This allows system builders to quickly install, troubleshoot, and test system capabilities faster and more reliably than other alternatives.

Environmental Considerations:

With electromechanical system technology, fluid leaks, filter changes, and air bleeding are a thing of the past. Simply mount the cylinder, plug in the cables, download a program and you are up and running in record time.

Anti-Rotation:

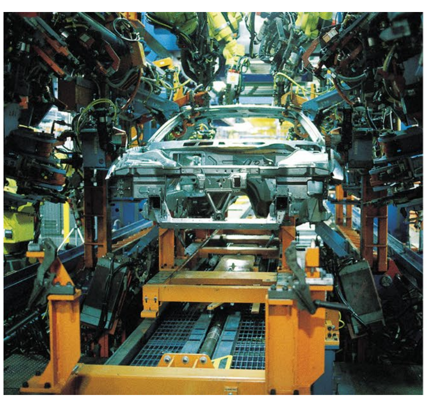
As a result of the steel round body cylinder design, internal anti-rotation of the thrust tube is not available in standard XFC Cylinders. Applications must be designed to prevent thrust tube rotation during operation. Refer to performance overview charts for torque values or consult factory for non-rotating options.

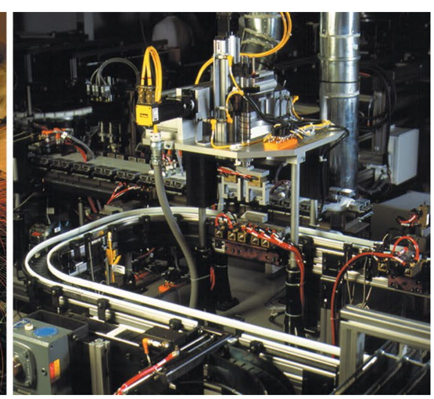
Parker's Capabilities:

With Hydraulic, Pneumatic, and now Electromechanical technologies Parker can provide the best solution for a specific application regardless of requirements with an unmatched offering of cylinder products to more than 100 industrial markets worldwide.

Lubrication:

XFC actuators are designed to be low maintenance with the factory installed full synthetic lubrication. For high duty cycle applications, (>50%) oil filled actuators are available with ports for recirculation as required.





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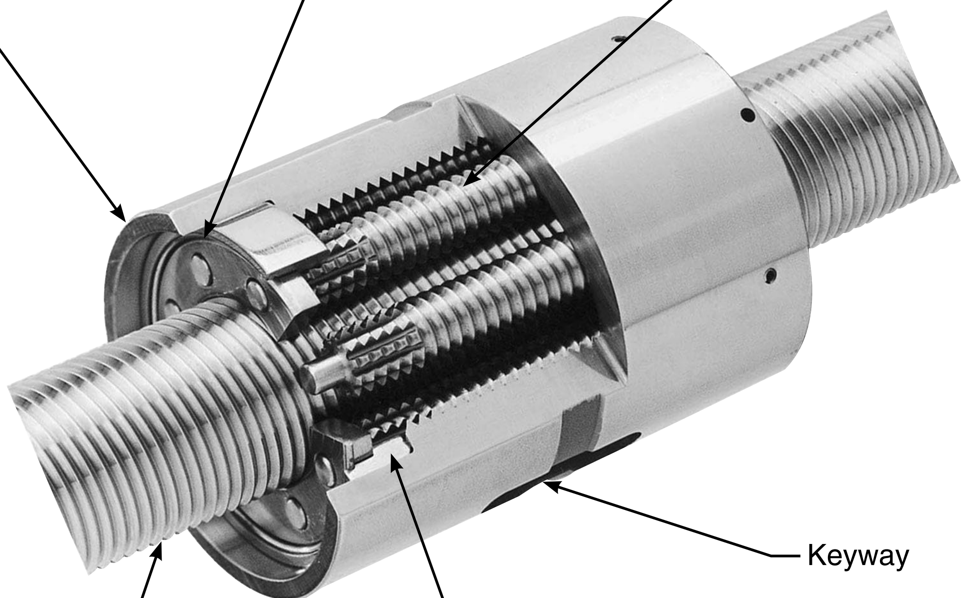

Roller Screw Technology

Planetary Roller Screws offer distinct benefits over more traditional Ball Screw and Lead Screw mechanisms, as well as added features not easily attainable with Hydraulic or Pneumatic Linear Motion.

The key to the Roller Screw design is in the utilization of planetary rollers in the place of ball bearings as the primary rolling elements. The rollers provide an increased number of contact surfaces between the external shaft of the screw and the internal threads of the roller nut. In simple terms, the expanded number of contact points between the screw and the nut allow enhanced load carrying capabilities, higher speeds, and extended life when compared to a similarly sized ball screw of the same size.

Roller Screw Advantages

Thrust Capacity and Life:

A Planetary Roller Screw transmits rotary motion into linear motion very similarly to a ball or lead screw but, due to the expanded number of contact points the roller screw does so with an enhanced thrust capacity and greatly extended life. These advantages typically amount to a 5 times increase in thrust and a 10 times increase in life over a traditional ball screw.

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XFC Model Code

XFC	075	LA	05	J	N	A	A	N
Series	Frame Size	Configuration	Screw Lead	Primary Mount	Secondary Mount	Rod End	Lubrication Code	Options

Frame Size
- 075 – 75mm
- 090 – 90mm
- 115 – 115mm
- 140 – 140mm
- 165 – 165mm
- 190 – 190mm

Screw Lead
- 05 – 5mm Lead (XFC075, 090, 115, 140)
- 10 – 10mm Lead (XFC075, 090, 115, 140, 165, 190)
- 20 – 20mm Lead (XFC165, 190)

Configuration

Inline Motor
- LA – Mounting Position A
- LB – Mounting Position B
- LC – Mounting Position C
- LD – Mounting Position D

Parallel Motor
- PA – Mounting Position A
- PB – Mounting Position B
- PC – Mounting Position C
- PD – Mounting Position D

Primary / Secondary Mount

Inline or Parallel
- J – Front Flange
- C – Foot
- T – Rear Trunnion
- K – Extended Tie Rods - Front
- N – No Secondary

Parallel Only
- H – Rear Flange
- B – Rear Clevis
- L – Extended Tie Rods - Rear
- M – Extended Tie Rods - Both
- N – No Secondary

Rod End
- A – Male Thread Metric
- B – Male Thread Imperial
- C – Rod Eye
- X – Special

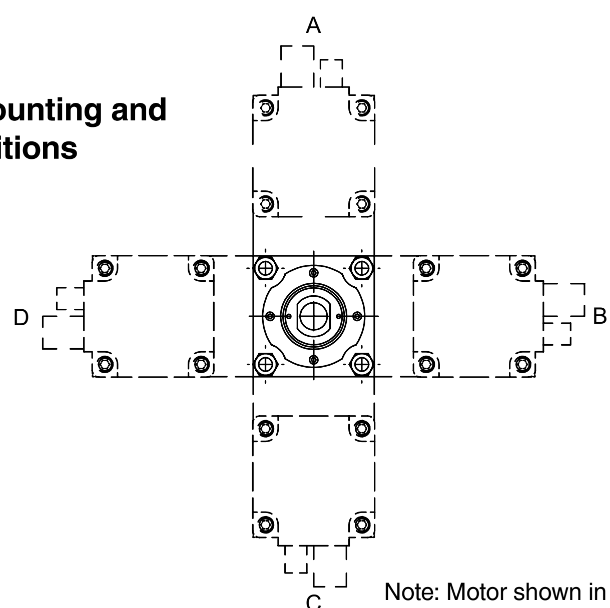
Lubrication Code
- A – Oil Filled Port Position A
- B – Oil Filled Port Position B
- C – Oil Filled Port Position C
- D – Oil Filled Port Position D
- E – Grease Filled

Note: Oil Port position must be different than motor position on parallel configurations.

Options
- A – Prepped for switches
- B – Fluorocarbon Seals
- C – Fluorocarbon Seals and Switch ready
- N – None

Note: Options A and C area available with XFC sizes 075, 090, 115 and grease-filled only

Motor Mounting and Port Positions



Note: Motor shown in position "A" for all mounting dimension pages.

XFC Model Code

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XXXX – A 03 – A09A A 1 – A

Stroke Length

- XXXX – mm
- 50 - 2000mm
- (Stroke <50 or >2000 Consult Factory)

Gearhead Frame Size[1]

- A – PS90 Frame (XFC075, 090)
- B – PS115 Frame (XFC075, 090, 115)
- C – PS142 Frame (XFC115, 140, 165)
- D – PS180 Frame (XFC140, 165, 190)
- E – PS220 Frame (XFC190)
- X – Special
- N – No Gearhead (Motor only)

Gearhead Ratio

- 00 – No Gearhead
- 03 – 3:1
- 04 – 4:1
- 05 – 5:1
- 07 – 7:1
- 10 – 10:1
- XX – Custom gear ratio

Motor Selection[1]

- A09A – MPP0921C (240VAC)
- A09B – MPP0921R (460VAC)
- A09C – MPP0922D (240VAC)
- A09D – MPP0922R (460VAC)
- A09E – MPP0923D (240VAC)
- A09F – MPP0923R (460VAC)
- A10A – MPP1002D (240VAC)
- A10B – MPP1002R (460VAC)
- A10C – MPP1003C (240VAC)
- A10D – MPP1003R (460VAC)
- A11A – MPP1152D (240VAC)
- A11B – MPP1152R (460VAC)
- A11C – MPP1153C (240VAC)
- A11D – MPP1153R (460VAC)
- A11E – MPP1154B (240VAC)
- A11F – MPP1154P (460VAC)
- A14A – MPP1422C (240VAC)
- A14B – MPP1422R (460VAC)
- A14C – MPP1424C (240VAC)
- A14D – MPP1424R (460VAC)
- A14E – MPP1426B (240VAC)
- A14F – MPP1426P (460VAC)
- A14G – MPP1428Q (460VAC)
- A19A – MPP1904P (460VAC)
- A19B – MPP1906B (240VAC)
- A19C – MPP1906P (460VAC)
- A19D – MPP1908P (460VAC)
- A27A – MPP2706P (460VAC)
- A27B – MPP2708N (460VAC)
- X00X – Special

Motor Feedback[2]

- A – 2000 Count Encoder (1E)
- B – 2000 Count Encoder – Serial Interface (3E)
- C – Single Speed Resolver (41)
- D – Multi-Turn Absolute Encoder (6S)
- E – Single-Turn Absolute Encoder (9S)
- N – No Motor or Special Motor

Motor Options[2]

- 1 – No Brake
- 2 – 24 VDC Brake (B)
- 3 – Shaft Seal (V)
- 4 – 24 VDC Brake (B) and Shaft Seal (V)
- 0 – No Motor or Special Motor

Revision Identifier

- A – Standard Cylinder

[1] Includes proper mounting surface for selected gearhead and motor.

[2] Select option -N- in the "Motor Feedback" and -0- in the "Motor Options" for customer supplied motors which are not provided by Parker Cylinder.

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Performance Overview

XFC Frame Size	075	090	115	140	165	190
Continuous Thrust kN (lbs)	20 (4500)	34 (7,500)	54 (12,000)	80 (17,500)	120 (26,500)	178 (40,000)
Maximum Thrust kN (lbs)	40 (9,000)	68 (15,000)	108 (24,000)	160 (35,000)	240 (53,000)	356 (80,000)
Maximum Acceleration mm/sec^2 (in/sec^2)	19,600 (773)	19,600 (773)	19,600 (773)	19,600 (773)	19,600 (773)	19,600 (773)
Maximum Stroke mm (in)[1]	1150 (55.12)	1700 (66.93)	2,000 (78.75)	2,000 (78.75)	2,000 (78.75)	2,000 (78.75)
Suggested Maximum Stroke Lengths of Unsupported Cylinders[3]	750 (29.53)	750 (29.53)	750 (29.53)	1,000 (39.37)	1,000 (39.37)	1,250 (49.21)

System Characteristics

XFC Frame Size	075	090	115	140	165	190
Accuracy mm (in)	0.08 (0.003)	0.08 (0.003)	0.08 (0.003)	0.08 (0.003)	0.13 (0.005)	0.13 (0.005)
Repeatability mm (in)	0.03 (0.001)	0.03 (0.001)	0.03 (0.001)	0.03 (0.001)	0.05 (0.002)	0.05 (0.002)
Backlash mm (in)	0.03 (0.001)	0.03 (0.001)	0.03 (0.001)	0.03 (0.001)	0.03 (0.001)	0.03 (0.001)

Screw Properties

XFC Size	Screw Diameter	Lead[2] (per rev)	Efficiency	Ca Rating kN (lbf)	Thrust Tube Torque mN-m/N (lb-in/lbf)	Max. Speed mm/sec (in/sec)
075	21 mm	5 mm (0.197 in)	88.78%	40.4 (9,082)	0.889 (0.035)	508 (20.0)
		10 mm (0.394 in)	91.17%	44.6 (10,026)	1.752 (0.069)	1016 (40.0)
090	30 mm	5 mm (0.197 in)	87.05%	73.6 (16,546)	0.914 (0.036)	356 (14.0)
		10 mm (0.394 in)	90.38%	74.4 (16,726)	1.752 (0.069)	712 (28.0)
115	39 mm	5 mm (0.197 in)	85.18%	103.4 (23,245)	0.939 (0.037)	274 (10.8)
		10 mm (0.394 in)	89.37%	116.5 (26,190)	1.778 (0.070)	548 (21.6)
140	48 mm	5 mm (0.197 in)	82.50%	158.5 (35,632)	0.965 (0.038)	222 (8.7)
		10 mm (0.394 in)	88.34%	171.2 (38,487)	1.803 (0.071)	444 (17.4)
165	60 mm	10 mm (0.394 in)	87.05%	238.6 (53,639)	1.829 (0.072)	356 (14.0)
		20 mm (0.787 in)	90.38%	238.6 (53,639)	3.531 (0.139)	712 (28.0)
190	75 mm	10 mm (0.394 in)	85.45%	356.5 (80,144)	1.854 (0.073)	284 (11.2)
		20 mm (0.787 in)	90.97%	356.5 (80,144)	3.658 (0.144)	568 (22.4)

[1] Consult factory for non-standard stroke lengths [2] Consult factory for non-standard leads
[3] Secondary support required for longer stroke lengths (consult factory)

Temperature Ratings

Actuator temperature ratings	
Standard seals	-10°F - 165°F (-23°C - 73°C)
Fluorocarbon seals	-10°F - 230°F (-23°C - 110°C)

Verify motor and gear box performance at higher temperatures.

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XFC Series Applications Worksheet

Please provide as much information as possible

Completed form can be returned via email to cylproductinfo@parker.com or faxed to (800) 892-1008.

Customer Information

Company Name (Customer #) ____________________

Contact: ____________________

Phone: __________ **Fax:** __________

E-Mail: ____________________

Address: ____________________

____

Cylinder Information:

Quantity: __________

Move Distance: ______ in. ______ mm

or

Overall Stroke: ______ in. ______ mm

Rod End: Male / Female / Rod Eye / Other: __________ — English / Metric

Mounting

Primary: ____________________

Secondary: ____________________

Rod Orientation: Horizontal / Up / Down — Angle: ______ Degrees

Environmental: ____________________

(Temperature, Humidity, Washdown, etc.)

Application Information:

Force Required: ______ lbs / kN

External Applied Force: ______ lbs / kN

Load/Fixture Weight: ______ lbs / kN

Speed:

Maximimum: ______ in./sec. ______ mm/sec.

Minimum: ______ in./sec. ______ mm/sec.

Move Time: ______ seconds

Total Cycle Time: ______ seconds

Repeatability: ______ in. ______ mm

Accuracy: ______ in. ______ mm

Load Guided? Yes No

Rod Side Loading? Yes No

Value: ______ lbs.

Motor Mounting: Inline or Parallel

AC Drive Power: 230V / 1 — 460V / 3 — 50 Hz

230V / 3 — Other: ______ — 60 Hz

Expected Life: ____________________

Cycles or Years

Applications Sketch and Notes:

Parker Hannifin Corporation
Industrial Cylinder Division
Des Plaines, Illinois

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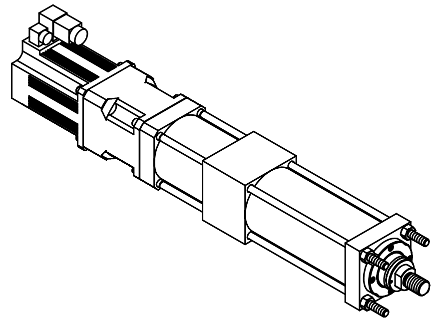
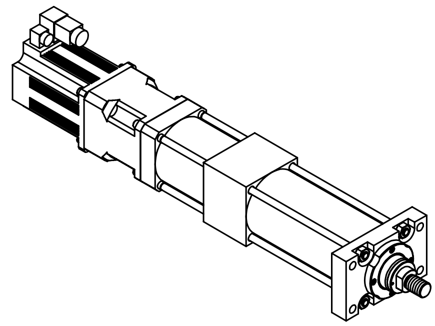
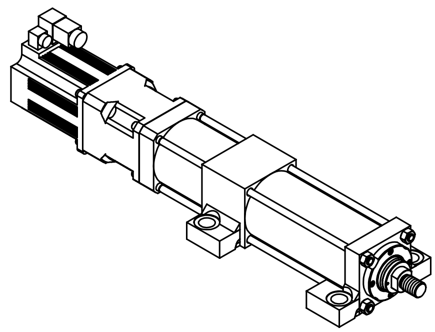
Inline – "K" Extended Tie Rod Mount
Cylinders with Extended Tie Rods are suitable for straight line force applications, and are particularly useful where space is limited.



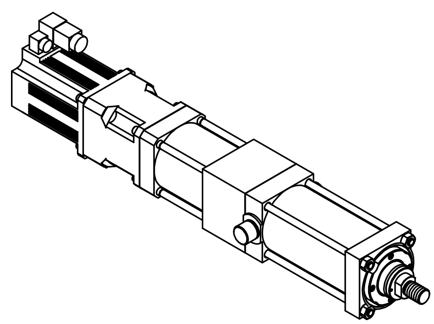
Inline – "J" Integral Front Flange Mount
These cylinders are suitable for use on straight line force transfer applications.



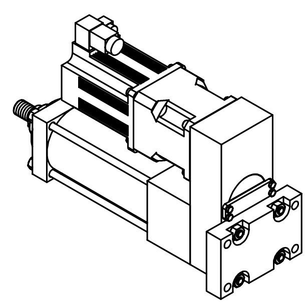
Inline – "C" Foot Mount
Foot mounted cylinders do not absorb forces along their centerline. As a result, the application of force by the cylinder produces a moment which attempts to rotate the cylinder about its mounting bolts. It is therefore very important that the cylinder be firmly secured to the mounting surface and the load should be rigidly guided to avoid side loads being applied to the cylinder bearings.



Inline – "T" Rear Trunnion Mount
Trunnion mounting is used for rotary or arc-line motion and offer flexibility when designing applications that are not confined to linear movements. Consult factory to review specific applications for stroke and configuration.



Parallel – "H" Rear Flange Mount
These cylinders are suitable for use on straight line force transfer applications.



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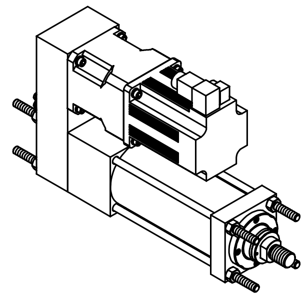
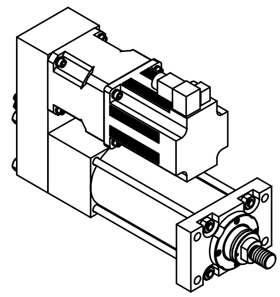
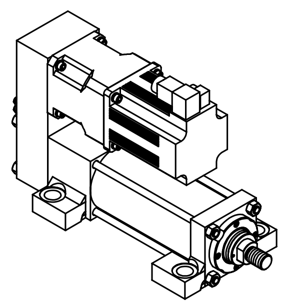
Parallel – “K”, “L”, “M” Extended Tie Rod Mounts
Cylinders with Extended Tie Rods are suitable for straight line force applications, and are particularly useful where space is limited. Front, rear and both ends are available with parallel configurations.



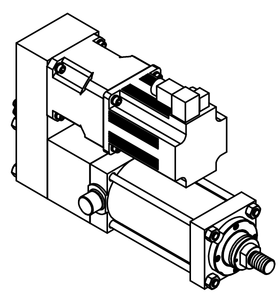
Parallel – “J” Integral Front Flange Mount
These cylinders are suitable for use on straight line force transfer applications.



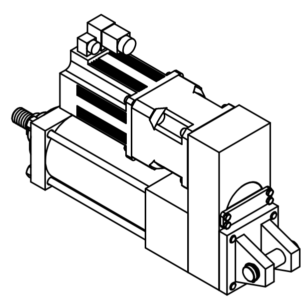
Parallel – “C” Foot Mount
Foot mounted cylinders do not absorb forces along their centerline. As a result, the application of force by the cylinder produces a moment which attempts to rotate the cylinder about its mounting bolts. It is therefore very important that the cylinder be firmly secured to the mounting surface and the load should be rigidly guided to avoid side loads being applied to the cylinder bearings.



Parallel – “T” Rear Trunnion Mount
Trunnion mounting is used for rotary or arc-line motion and offer flexibility when designing applications that are not confined to linear movements. Consult factory to review specific applications for stroke and configuration.



Parallel – “B” Rear Clevis Mount
Cylinders with pivot mountings, which absorb forces on their centerlines should be used where the machine member to be moved travels in a curved path. Pivot mountings may be used in tension (pull) or compression (push) applications. Cylinders using a fixed clevis may be used if the curved path of the thrust tube travels in a single plane.



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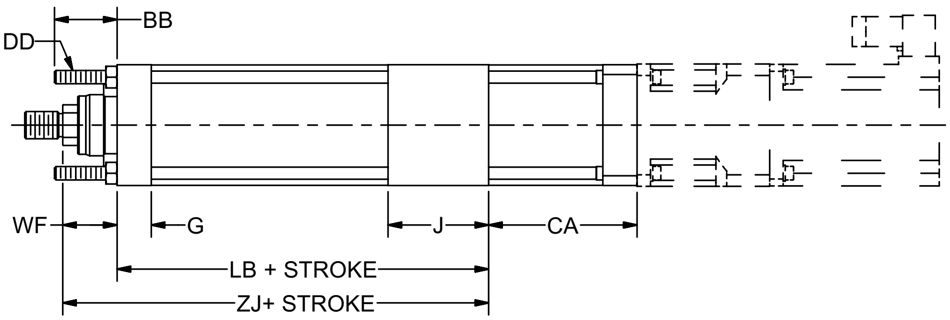
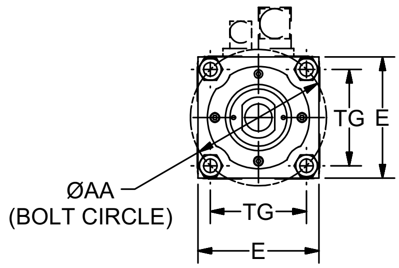
Inline "K" Extended Tie Rod Mount

FIRST ANGLE VIEW PROJECTION





XFC Size	AA Ø	BB	DD	E	G
075	83 (3.27)	30 (1.18)	M8x1	76.2 (3.00)	22 (0.87)
090	100 (3.94)	35 (1.38)	M10x1.5	88.9 (3.50)	25 (0.98)
115	127 (5.00)	40 (1.57)	M12x1.25	114.3 (4.50)	30 (1.18)
140	155 (6.10)	50 (1.97)	M16x1.5	139.7 (5.50)	35 (1.38)
165	185 (7.28)	60 (2.36)	M22x1.5	165.1 (6.50)	40 (1.57)
190	215 (8.46)	75 (2.95)	M22x1.5	190.5 (7.50)	50 (1.97)

XFC Size	J	TG	WF	ADD STROKE	
				LB	ZJ
075	62 (2.44)	58.69 (2.31)	38 (1.50)	205.5 (8.09)	243.5 (9.59)
090	74 (2.91)	70.71 (2.78)	40 (1.57)	248 (9.76)	288 (11.34)
115	91 (3.58)	89.80 (3.54)	45 (1.77)	293 (11.54)	338 (13.31)
140	108 (4.25)	109.60 (4.32)	45 (1.77)	348 (13.70)	393 (15.47)
165	123 (4.84)	130.81 (5.15)	60 (2.36)	417 (16.42)	477 (18.78)
190	152 (5.98)	152.03 (5.99)	62 (2.44)	503 (19.80)	565 (22.24)

XFC Size	Motor or Gearhead	CA
075	PS090	113 (4.45)
	PS115	115 (4.53)
	MPP115	98 (3.86)
	MPP142	109 (4.29)
090	PS090	115 (4.53)
	PS115	117 (4.61)
	MPP115	100 (3.94)
	MPP142	111 (4.37)
115	PS115	130 (5.12)
	PS142	158 (6.22)
	MPP142	113 (4.45)
	MPP190	136 (5.35)

XFC Size	Motor or Gearhead	CA
140	PS142	161 (6.34)
	PS180	190 (7.48)
	MPP190	139 (5.47)
165	PS142	164 (6.46)
	PS180	193 (7.60)
	MPP270	183 (7.20)
190	PS180	194 (7.64)
	PS220	214 (8.43)

Dimensions in mm (inches)

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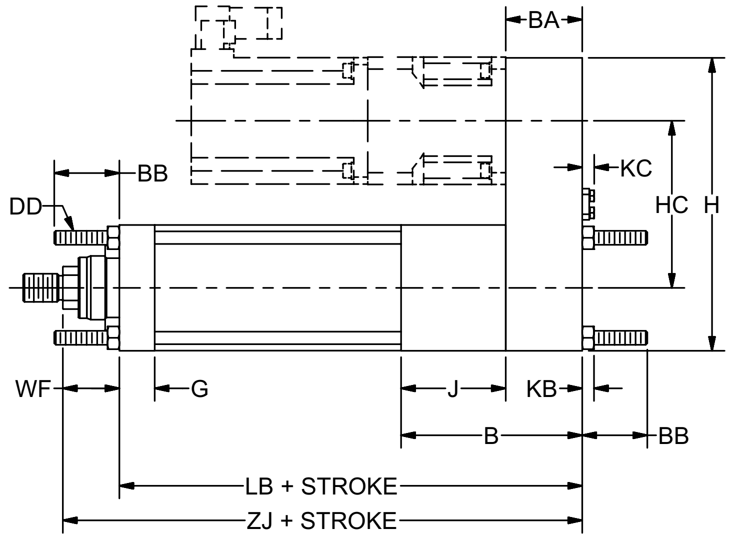
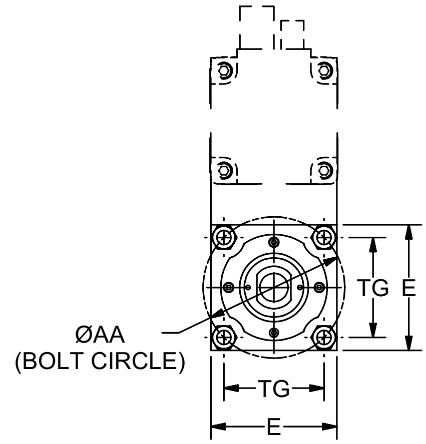
Parallel “K”, “L”, “M” Extended Tie Rod Mounts

FIRST ANGLE VIEW PROJECTION





XFC Size	AA Ø	B	BA	BB	DD	E	G	H
075	83 (3.27)	106 (4.17)	44 (1.73)	30 (1.18)	M8x1	76.2 (3.00)	22 (0.87)	174.2 (6.86)
090	100 (3.94)	128 (5.04)	54 (2.13)	35 (1.38)	M10x1.5	88.9 (3.50)	25 (0.98)	206.9 (8.15)
115	127 (5.00)	154 (6.06)	63 (2.48)	40 (1.57)	M12x1.25	114.3 (4.50)	30 (1.18)	271 (10.67)
140	155 (6.10)	180 (7.09)	72 (2.83)	50 (1.97)	M16x1.5	139.7 (5.50)	35 (1.38)	332.2 (13.08)
165	185 (7.28)	211 (8.31)	88 (3.46)	60 (2.36)	M22x1.5	165.1 (6.50)	40 (1.57)	379.1 (14.93)
190	215 (8.46)	252 (9.92)	100 (3.94)	75 (2.95)	M22x1.5	190.5 (7.50)	50 (1.97)	455.5 (17.93)

XFC Size	HC	J	KB	KC	TG	WF	ADD STROKE	
							LB	**ZJ**
075	98 (3.86)	62 (2.44)	6.5 (0.26)	6.93 (0.27)	58.69 (2.31)	38 (1.50)	249.5 (9.82)	287.5 (11.32)
090	118 (4.65)	74 (2.91)	8 (0.31)	8.65 (0.34)	70.71 (2.78)	40 (1.57)	302 (11.89)	342 (13.46)
115	156 (6.14)	91 (3.58)	10 (0.39)	10.15 (0.40)	89.80 (3.54)	45 (1.77)	356 (14.02)	401 (15.79)
140	192.5 (7.58)	108 (4.25)	13 (0.51)	13.65 (0.54)	109.60 (4.32)	45 (1.77)	420 (16.54)	465 (18.31)
165	224 (8.82)	123 (4.84)	18 (0.71)	13.65 (0.54)	130.81 (5.15)	60 (2.36)	505 (19.88)	565 (22.24)
190	265 (10.43)	152 (5.98)	18 (0.71)	17.18 (0.68)	152.03 (5.99)	62 (2.44)	603 (23.74)	665 (26.18)

Dimensions in mm (inches)

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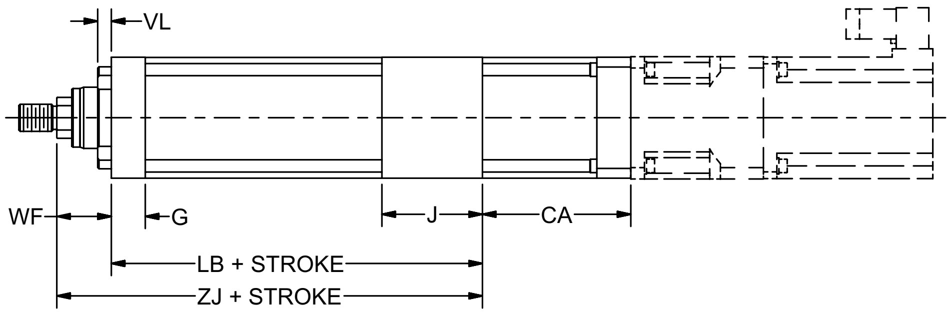
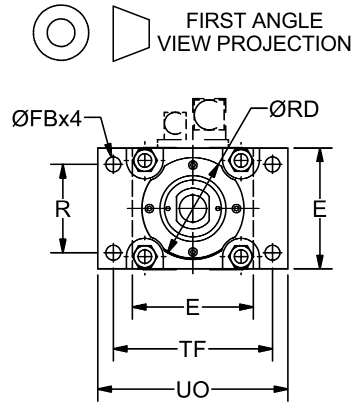
Inline "J" Front Flange Mount





XFC Size	E	FB Ø	G	J	R	RD Ø f8
075	76.2 (3.00)	9 (0.35)	22 (0.87)	62 (2.44)	52 (2.05)	65 (2.559)
090	88.9 (3.50)	11 (0.43)	25 (0.98)	74 (2.91)	65 (2.56)	75 (2.953)
115	114.3 (4.50)	14 (0.55)	30 (1.18)	91 (3.58)	83 (3.27)	95 (3.740)
140	139.7 (5.50)	18 (0.71)	35 (1.38)	108 (4.25)	107 (4.21)	110 (4.331)
165	165.1 (6.50)	21 (0.83)	40 (1.57)	123 (4.84)	120 (4.72)	135 (5.315)
190	190.5 (7.50)	22 (0.87)	50 (1.97)	152 (5.98)	155 (6.10)	155 (6.102)

XFC Size	TF	UO	VL	WF	ADD STROKE	
					LB	ZJ
075	105 (4.13)	125 (4.92)	10 (0.39)	38 (1.50)	205.5 (8.09)	243.5 (9.59)
090	117 (4.61)	139.7 (5.50)	10 (0.39)	40 (1.57)	248 (9.76)	288 (11.34)
115	149 (5.87)	175 (6.89)	12 (0.47)	45 (1.77)	293 (11.54)	338 (13.31)
140	172 (6.77)	210 (8.27)	12 (0.47)	45 (1.77)	348 (13.70)	393 (15.47)
165	215 (8.46)	260 (10.24)	14 (0.55)	60 (2.36)	417 (16.42)	477 (18.78)
190	253 (9.96)	300 (11.81)	16 (0.63)	62 (2.44)	503 (19.80)	565 (22.24)

Dimensions in mm (inches)

XFC Size	Motor or Gearhead	CA
075	PS090	113 (4.45)
	PS115	115 (4.53)
	MPP115	98 (3.86)
	MPP142	109 (4.29)
090	PS090	115 (4.53)
	PS115	117 (4.61)
	MPP115	100 (3.94)
	MPP142	111 (4.37)
115	PS115	130 (5.12)
	PS142	158 (6.22)
	MPP142	113 (4.45)
	MPP190	136 (5.35)

XFC Size	Motor or Gearhead	CA
140	PS142	161 (6.34)
	PS180	190 (7.48)
	MPP190	139 (5.47)
165	PS142	164 (6.46)
	PS180	193 (7.60)
	MPP270	183 (7.20)
190	PS180	194 (7.64)
	PS220	214 (8.43)

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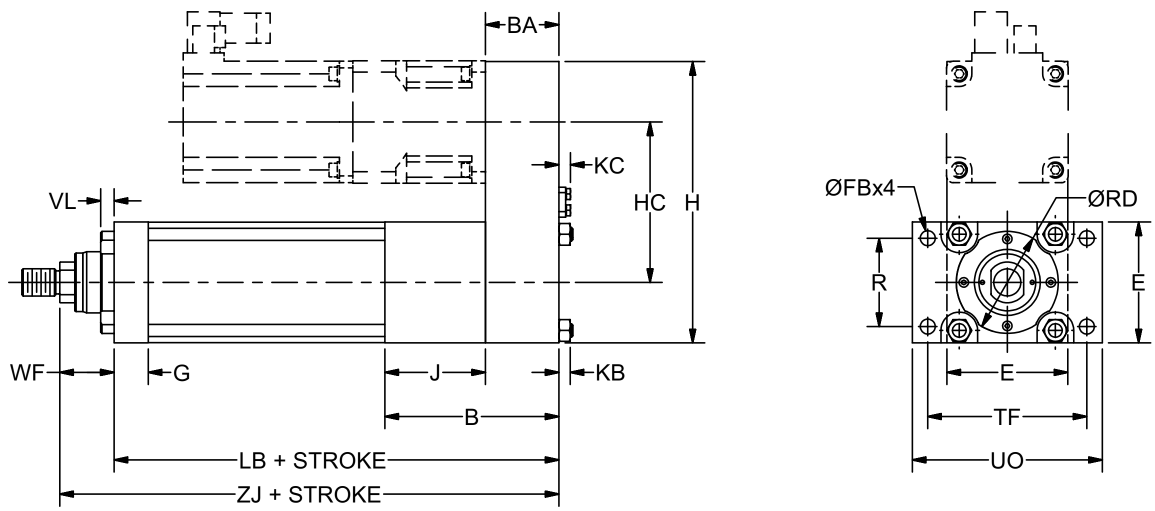
Parallel "J" Front Flange Mount

FIRST ANGLE VIEW PROJECTION



XFC Size	B	BA	E	FB Ø	G	H	HC	J	KB
075	106 (4.17)	44 (1.73)	76.2 (3.00)	9 (0.35)	22 (0.87)	174.2 (6.86)	98 (3.86)	62 (2.44)	6.5 (0.26)
090	128 (5.04)	54 (2.13)	88.9 (3.50)	11 (0.43)	25 (0.98)	206.9 (8.15)	118 (4.65)	74 (2.91)	8 (0.31)
115	154 (6.06)	63 (2.48)	114.3 (4.50)	14 (0.55)	30 (1.18)	271 (10.67)	156 (6.14)	91 (3.58)	10 (0.39)
140	180 (7.09)	72 (2.83)	139.7 (5.50)	18 (0.71)	35 (1.38)	332.2 (13.08)	192.5 (7.58)	108 (4.25)	13 (0.51)
165	211 (8.31)	88 (3.46)	165.1 (6.50)	21 (0.83)	40 (1.57)	379.1 (14.93)	224 (8.82)	123 (4.84)	18 (0.71)
190	252 (9.92)	100 (3.94)	190.5 (7.50)	22 (0.87)	50 (1.97)	455.5 (17.93)	265 (10.43)	152 (5.98)	18 (0.71)

XFC Size	KC	R	RD Ø f8	TF	UO	VL	WF	ADD STROKE	
								LB	ZJ
075	6.93 (0.27)	52 (2.05)	65 (2.559)	105 (4.13)	125 (4.92)	10 (0.39)	38 (1.50)	249.5 (9.82)	287.5 (11.32)
090	8.65 (0.34)	65 (2.56)	75 (2.953)	117 (4.61)	139.7 (5.50)	10 (0.39)	40 (1.57)	302 (11.89)	342 (13.46)
115	10.15 (0.40)	83 (3.27)	95 (3.740)	149 (5.87)	175 (6.89)	12 (0.47)	45 (1.77)	356 (14.02)	401 (15.79)
140	13.65 (0.54)	107 (4.21)	110 (4.331)	172 (6.77)	210 (8.27)	12 (0.47)	45 (1.77)	420 (16.54)	465 (18.31)
165	13.65 (0.54)	120 (4.72)	135 (5.315)	215 (8.46)	260 (10.24)	14 (0.55)	60 (2.36)	505 (19.88)	565 (22.24)
190	17.18 (0.68)	155 (6.10)	155 (6.102)	253 (9.96)	300 (11.81)	16 (0.63)	62 (2.44)	603 (23.74)	665 (26.18)

Dimensions in mm (inches)

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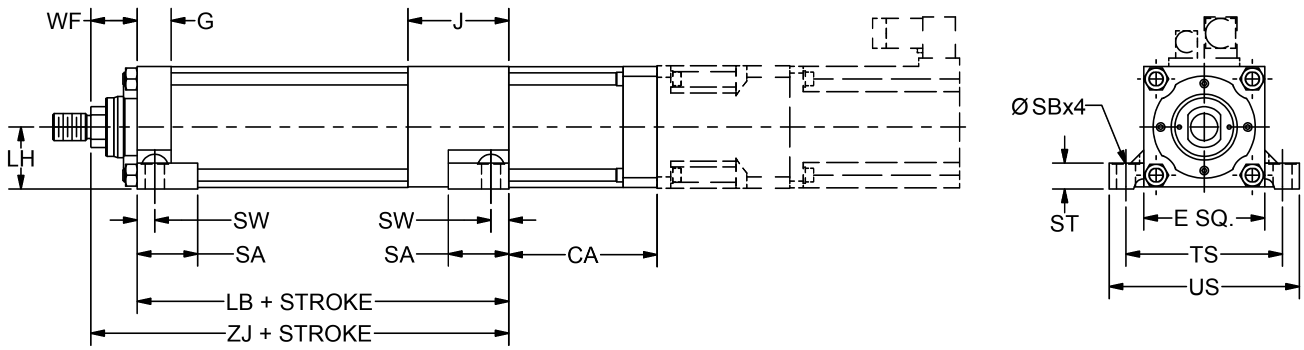
Inline "C" Foot Mount

FIRST ANGLE VIEW PROJECTION



XFC Size	E	G	J	LH h10	SA	SB Ø	ST
075	76.2 (3.00)	22 (0.87)	62 (2.44)	39 (1.535)	33.3 (1.31)	11 (0.43)	12.7 (0.50)
090	88.9 (3.50)	25 (0.98)	74 (2.91)	45.5 (1.791)	44.5 (1.75)	14 (0.55)	19.1 (0.75)
115	114.3 (4.50)	30 (1.18)	91 (3.58)	58 (2.283)	57.2 (2.25)	18 (0.71)	25.4 (1.00)
140	139.7 (5.50)	35 (1.38)	108 (4.25)	71 (2.795)	57.2 (2.25)	18 (0.71)	25.4 (1.00)
165	165.1 (6.50)	40 (1.57)	123 (4.84)	83.5 (3.287)	73.0 (2.87)	22 (0.87)	31.8 (1.25)
190	190.5 (7.50)	50 (1.97)	152 (5.98)	96.5 (3.799)	92.1 (3.63)	26 (1.02)	38.1 (1.50)

XFC Size	SW	TS	US	WF	+ STROKE	
					LB	ZJ
075	11 (0.43)	97 (3.82)	114.3 (4.50)	38 (1.50)	205.5 (8.09)	243.5 (9.59)
090	13 (0.51)	115 (4.53)	139.7 (5.50)	40 (1.57)	248 (9.76)	288 (11.34)
115	15 (0.59)	155 (6.10)	184.2 (7.25)	45 (1.77)	293 (11.54)	338 (13.31)
140	18 (0.71)	175 (6.89)	209.6 (8.25)	45 (1.77)	348 (13.70)	393 (15.47)
165	20 (0.79)	210 (8.27)	254 (10.00)	60 (2.36)	417 (16.42)	477 (18.78)
190	25 (0.98)	260 (10.24)	304.8 (12.00)	62 (2.44)	503 (19.80)	565 (22.24)

XFC Size	Motor or Gearhead	CA
075	PS090	113 (4.45)
	PS115	115 (4.53)
	MPP115	98 (3.86)
	MPP142	109 (4.29)
090	PS090	115 (4.53)
	PS115	117 (4.61)
	MPP115	100 (3.94)
	MPP142	111 (4.37)
115	PS115	130 (5.12)
	PS142	158 (6.22)
	MPP142	113 (4.45)
	MPP190	136 (5.35)

XFC Size	Motor or Gearhead	CA
140	PS142	161 (6.34)
	PS180	190 (7.48)
	MPP190	139 (5.47)
165	PS142	164 (6.46)
	PS180	193 (7.60)
	MPP270	183 (7.20)
190	PS180	194 (7.64)
	PS220	214 (8.43)

Dimensions in mm (inches)

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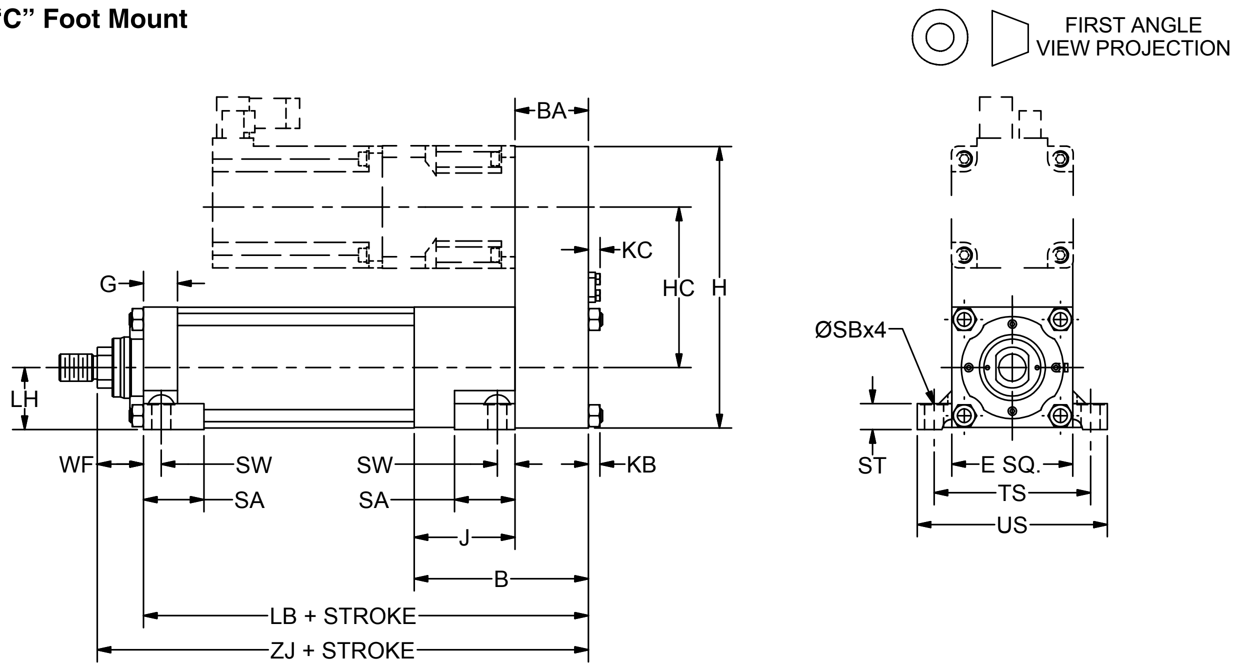
Parallel "C" Foot Mount



XFC Size	B	BA	E	G	H	HC	J	KB	KC	LH h10
075	106 (4.17)	44 (1.73)	76.2 (3.00)	22 (0.87)	174.2 (6.86)	98 (3.86)	62 (2.44)	6.5 (0.26)	6.93 (0.27)	39 (1.535)
090	128 (5.04)	54 (2.13)	88.9 (3.50)	25 (0.98)	206.9 (8.15)	118 (4.65)	74 (2.91)	8 (0.31)	8.65 (0.34)	45.5 (1.791)
115	154 (6.06)	63 (2.48)	114.3 (4.50)	30 (1.18)	271 (10.67)	156 (6.14)	91 (3.58)	10 (0.39)	10.15 (0.40)	58 (2.283)
140	180 (7.09)	72 (2.83)	139.7 (5.50)	35 (1.38)	332.2 (13.08)	192.5 (7.58)	108 (4.25)	13 (0.51)	13.65 (0.54)	71 (2.795)
165	211 (8.31)	88 (3.46)	165.1 (6.50)	40 (1.57)	379.1 (14.93)	224 (8.82)	123 (4.84)	18 (0.71)	13.65 (0.54)	83.5 (3.287)
190	252 (9.92)	100 (3.94)	190.5 (7.50)	50 (1.97)	455.5 (17.93)	265 (10.43)	152 (5.98)	18 (0.71)	17.18 (0.68)	96.5 (3.799)

XFC Size	SA	SB Ø	ST	SW	TS	US	WF	+ STROKE	
								LB	ZJ
075	33.3 (1.31)	11 (0.43)	12.7 (.50)	11 (0.43)	97 (3.82)	114.3 (4.50)	38 (1.50)	249.5 (9.82)	287.5 (11.32)
090	44.5 (1.75)	14 (0.55)	19.1 (.75)	13 (0.51)	115 (4.53)	139.7 (5.50)	40 (1.57)	302 (11.89)	342 (13.46)
115	57.2 (2.25)	18 (0.71)	25.4 (1.00)	15 (0.59)	155 (6.10)	184.2 (7.25)	45 (1.77)	356 (14.02)	401 (15.79)
140	57.2 (2.25)	18 (0.71)	25.4 (1.00)	18 (0.71)	175 (6.89)	209.6 (8.25)	45 (1.77)	420 (16.54)	465 (18.31)
165	73 (2.88)	22 (0.87)	31.8 (1.25)	20 (0.79)	210 (8.27)	254 (10.00)	60 (2.36)	505 (19.88)	565 (22.24)
190	92.1 (3.63)	26 (1.02)	38.1 (1.50)	25 (0.98)	260 (10.24)	304.8 (12.00)	62 (2.44)	603 (23.74)	665 (26.18)

Dimensions in mm (inches)

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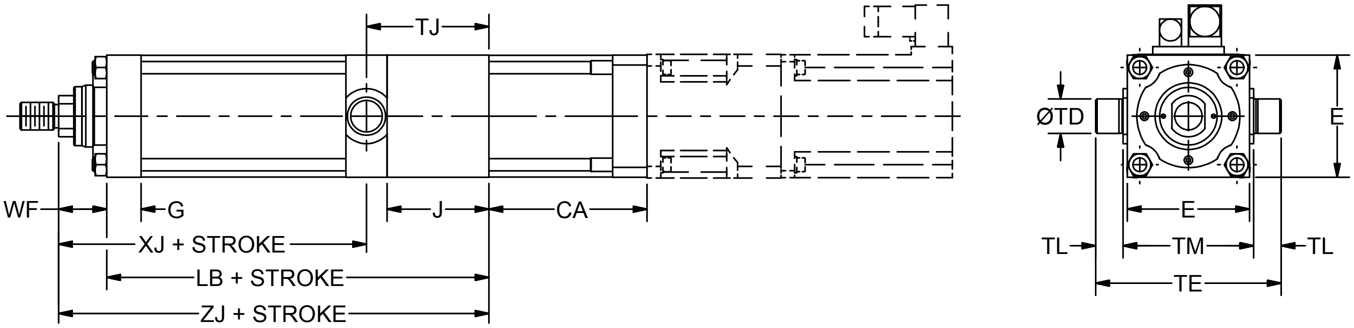
Inline "T" Rear Trunnion Mount

FIRST ANGLE VIEW PROJECTION



XFC Size	E	TD Ø f8	G	J	TJ
075	76.2 (3.00)	20 (0.787)	22 (0.87)	62 (2.44)	74.5 (2.93)
090	88.9 (3.50)	25 (0.984)	25 (0.98)	74 (2.91)	89 (3.50)
115	114.3 (4.50)	32 (1.260)	30 (1.18)	91 (3.58)	111 (4.37)
140	139.7 (5.50)	40 (1.575)	35 (1.38)	108 (4.25)	132 (5.20)
165	165.1 (6.50)	50 (1.969)	40 (1.57)	123 (4.84)	152 (5.98)
190	190.5 (7.50)	63 (2.480)	50 (1.97)	152 (5.98)	188 (7.40)

XFC Size	TL	TM	TE	WF	ADD STROKE		
					LB	ZJ	XJ
075	16 (.63)	80 (3.15)	112 (4.41)	38 (1.50)	205.5 (8.09)	243.5 (9.59)	169 (6.65)
090	20 (.79)	95 (3.74)	135 (5.32)	40 (1.57)	248 (9.76)	288 (11.34)	199 (7.83)
115	25 (.98)	120 (4.72)	170 (6.69)	45 (1.77)	293 (11.54)	338 (13.31)	227 (8.94)
140	32 (1.26)	145.4 (5.72)	209.4 (8.244)	45 (1.77)	348 (13.70)	393 (15.47)	261 (10.28)
165	40 (1.57)	170 (6.69)	250 (9.84)	60 (2.36)	417 (16.42)	477 (18.78)	325 (12.80)
190	50 (1.97)	195.4 (7.69)	295.4 (11.63)	62 (2.44)	503 (19.80)	565 (22.24)	377 (14.84)

Dimensions in mm (inches)

XFC Size	Motor or Gearhead	CA
075	PS090	113 (4.45)
	PS115	115 (4.53)
	MPP115	98 (3.86)
	MPP142	109 (4.29)
090	PS090	115 (4.53)
	PS115	117 (4.61)
	MPP115	100 (3.94)
	MPP142	111 (4.37)
115	PS115	130 (5.12)
	PS142	158 (6.22)
	MPP142	113 (4.45)
	MPP190	136 (5.35)

XFC Size	Motor or Gearhead	CA
140	PS142	161 (6.34)
	PS180	190 (7.48)
	MPP190	139 (5.47)
165	PS142	164 (6.46)
	PS180	193 (7.60)
	MPP270	183 (7.20)
190	PS180	194 (7.64)
	PS220	214 (8.43)

Parker Hannifin Corporation
Industrial Cylinder Division
Des Plaines, Illinois

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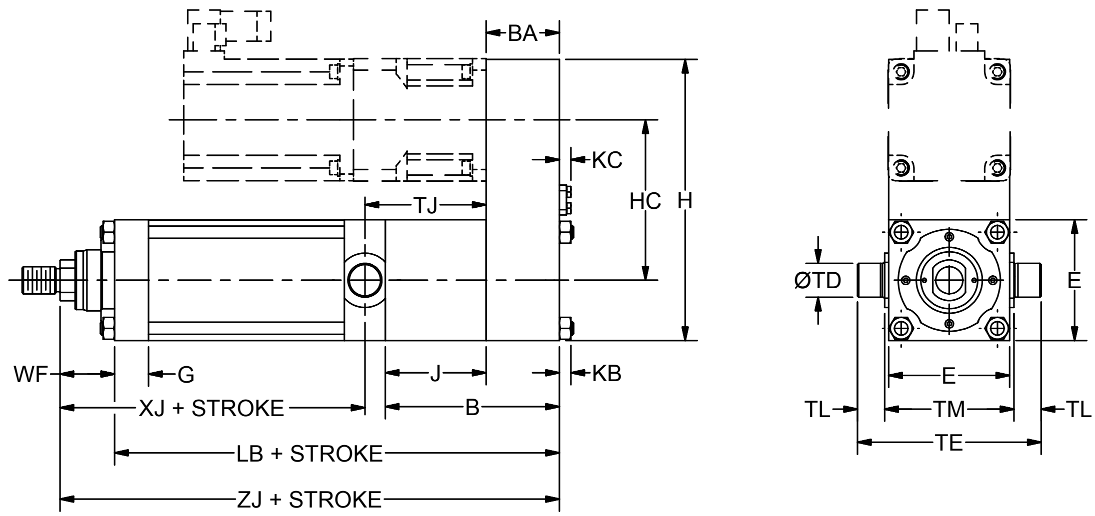
Parallel "T" Rear Trunnion Mount

FIRST ANGLE VIEW PROJECTION



XFC Size	B	BA	E	TD Ø f8	G	H	HC	J	KB
075	106 (4.17)	44 (1.73)	76.2 (3.00)	20 (0.787)	22 (0.87)	174.2 (6.86)	98 (3.86)	62 (2.44)	6.5 (0.26)
090	128 (5.04)	54 (2.13)	88.9 (3.50)	25 (0.984)	25 (0.98)	206.9 (8.15)	118 (4.65)	74 (2.91)	8 (0.31)
115	154 (6.06)	63 (2.48)	114.3 (4.50)	32 (1.260)	30 (1.18)	271 (10.67)	156 (6.14)	91 (3.58)	10 (0.39)
140	180 (7.09)	72 (2.83)	139.7 (5.50)	40 (1.575)	35 (1.38)	332.2 (13.08)	192.5 (7.58)	108 (4.25)	13 (0.51)
165	211 (8.31)	88 (3.46)	165.1 (6.50	50 (1.969)	40 (1.57)	379.1 (14.93)	224 (8.82)	123 (4.84)	18 (0.71)
190	252 (9.92)	100 (3.94)	190.5 (7.50)	63 (2.480)	50 (1.97)	455.5 (17.93)	265 (10.43)	152 (5.98)	18 (0.71)

XFC Size	KC	TJ	TL	TM	TE	WF	+ STROKE		
							LB	**ZJ**	**XJ**
75	6.93 (0.27)	74.5 (2.93)	16 (.63)	80 (3.15)	112 (4.41)	38 (1.50)	249.5 (9.82)	287.5 (11.32)	169 (6.65)
90	8.65 (0.34)	89 (3.50)	20 (.79)	95 (3.74)	135 (5.32)	40 (1.57)	302 (11.89)	342 (13.46)	199 (7.83)
115	10.15 (0.40)	111 (4.37)	25 (.98)	120 (4.72)	170 (6.69)	45 (1.77)	356 (14.02)	401 (15.79)	227 (8.94)
140	13.65 (0.54)	132 (5.20)	32 (1.26)	145.4 (5.72)	209.4 (8.244)	45 (1.77)	420 (16.54)	465 (18.31)	261 (10.28)
165	13.65 (0.54)	152 (5.98)	40 (1.57)	170 (6.69)	250 (9.84)	60 (2.36)	505 (19.88)	565 (22.24)	325 (12.80)
190	17.18 (0.68)	188 (7.40)	50 (1.97)	195.4 (7.69)	295.4 (11.63)	62 (2.44)	603 (23.74)	665 (26.18)	377 (14.84)

Dimensions in mm (inches)

Parker Hannifin Corporation
Industrial Cylinder Division
Des Plaines, Illinois

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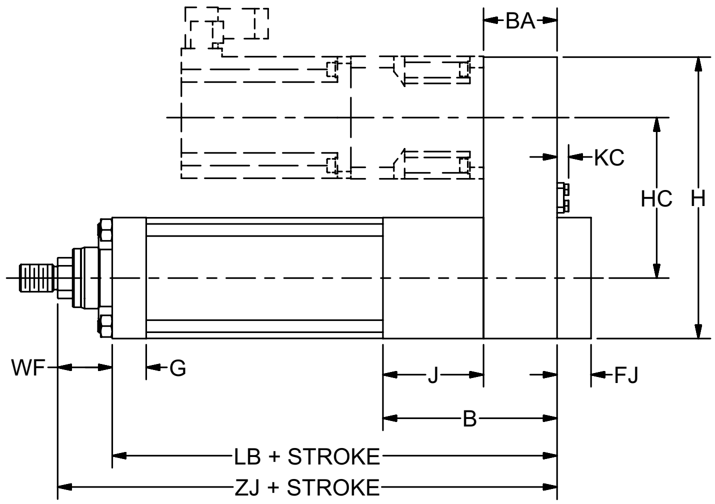
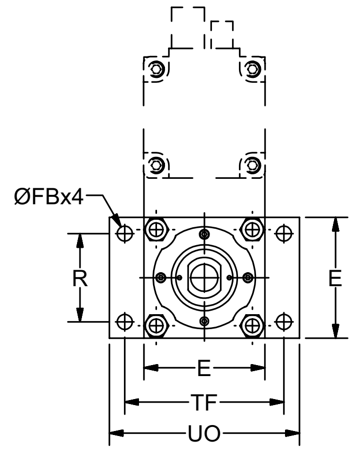
Parallel "H" Rear Flange Mount

FIRST ANGLE VIEW PROJECTION





XFC Size	B	BA	E	FB Ø	FJ	G	H	HC
075	106 (4.17)	44 (1.73)	76.2 (3.00)	9 (0.35)	12 (0.47)	22 (0.87)	174.2 (6.86)	98 (3.86)
090	128 (5.04)	54 (2.13)	88.9 (3.50)	11 (0.43)	14 (0.55)	25 (0.98)	206.9 (8.15)	118 (4.65)
115	154 (6.06)	63 (2.48)	114.3 (4.50)	14 (0.55)	16 (0.63)	30 (1.18)	271 (10.67)	156 (6.14)
140	180 (7.09)	72 (2.83)	139.7 (5.50)	18 (0.71)	20 (0.79)	35 (1.38)	332.2 (13.08)	192.5 (7.58)
165	211 (8.31)	88 (3.46)	165.1 (6.50)	21 (0.83)	25 (0.98)	40 (1.57)	379.1 (14.93)	224 (8.82)
190	252 (9.92)	100 (3.94)	190.5 (7.50)	22 (0.87)	30 (1.18)	50 (1.97)	455.5 (17.93)	265 (10.43)

XFC Size	J	KC	R	TF	UO	WF	+ STROKE	
							LB	ZJ
075	62 (2.44)	6.93 (0.27)	52 (2.05)	105 (4.13)	125 (4.92)	38 (1.50)	249.5 (9.82)	287.5 (11.32)
090	74 (2.91)	8.65 (0.34)	65 (2.56)	117 (4.61)	139.7 (5.50)	40 (1.57)	302 (11.89)	342 (13.46)
115	91 (3.58)	10.15 (0.40)	83 (3.27)	149 (5.87)	175 (6.89)	45 (1.77)	356 (14.02)	401 (15.79)
140	108 (4.25)	13.65 (0.54)	107 (4.21)	172 (6.77)	210 (8.27)	45 (1.77)	420 (16.54)	465 (18.31)
165	123 (4.84)	13.65 (0.54)	120 (4.72)	215 (8.46)	260 (10.24)	60 (2.36)	505 (19.88)	565 (22.24)
190	152 (5.98)	17.18 (0.68)	155 (6.10)	253 (9.96)	300 (11.81)	62 (2.44)	603 (23.74)	665 (26.18)

Dimensions in mm (inches)

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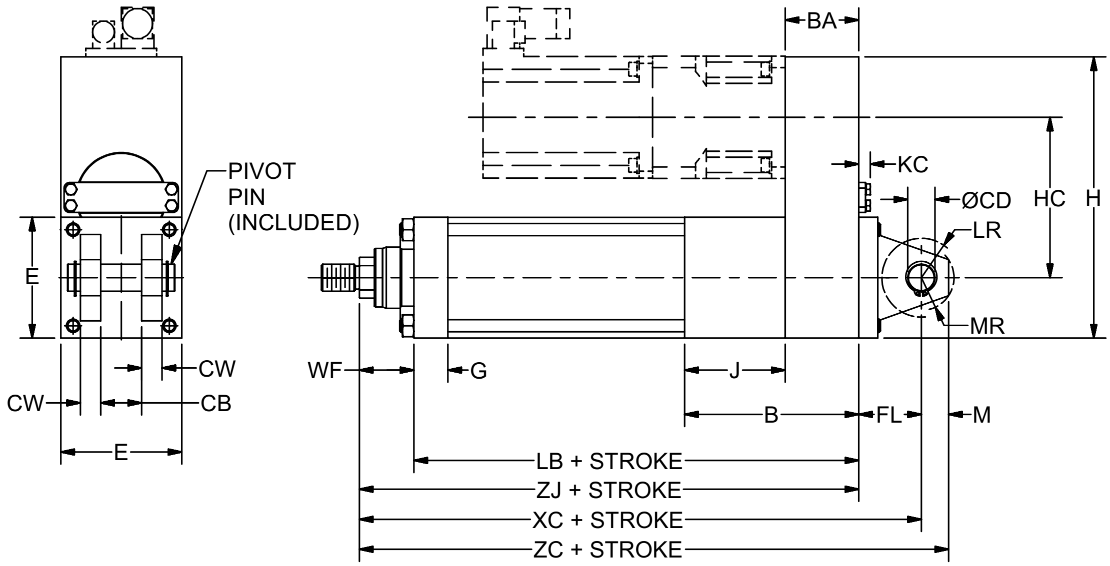
Parallel "B" Rear Clevis Mount

FIRST ANGLE VIEW PROJECTION



XFC Size	B	BA	CB	CD Ø H9	CW	E	FL	G	H	HC
075	106 (4.17)	44 (1.73)	20 (0.79)	14 (0.551)	10 (0.39)	76.2 (3.00)	31 (1.22)	22 (0.87)	174.2 (6.86)	98 (3.86)
090	128 (5.04)	54 (2.13)	30 (1.18)	20 (0.787)	15 (0.59)	88.9 (3.50)	46 (1.81)	25 (0.98)	206.9 (8.15)	118 (4.65)
115	154 (6.06)	63 (2.48)	30 (1.18)	20 (0.787)	15 (0.59)	114.3 (4.50)	48 (1.89)	30 (1.18)	271 (10.67)	156 (6.14)
140	180 (7.09)	72 (2.83)	40 (1.57)	28 (1.102)	20 (0.79)	139.7 (5.50)	59 (2.32)	35 (1.38)	332.2 (13.08)	192.5 (7.58)
165	211 (8.31)	88 (3.46)	50 (1.97)	36 (1.417)	25 (0.98)	165.1 (6.50)	79 (3.11)	40 (1.57)	379.1 (14.93)	224 (8.82)
190	252 (9.92)	100 (3.94)	60 (2.36)	45 (1.772)	30 (1.18)	190.5 (7.50)	87 (3.43)	50 (1.97)	455.5 (17.93)	265 (10.43)

XFC Size	J	KC	LR	M	MR	WF	+ STROKE			
							LB	**XC**	**ZJ**	**ZC**
075	62 (2.44)	6.93 (0.27)	17 (0.67)	14 (0.55)	17 (0.67)	38 (1.50)	249.5 (9.82)	318.5 (12.54)	287.5 (11.32)	332.5 (13.09)
090	74 (2.91)	8.65 (0.34)	29 (1.14)	20 (0.79)	25 (0.98)	40 (1.57)	302 (11.89)	388 (15.28)	342 (13.46)	408 (16.06)
115	91 (3.58)	10.15 (0.40)	29 (1.14)	20 (0.79)	25 (0.98)	45 (1.77)	356 (14.02)	449 (17.68)	401 (15.79)	469 (18.46)
140	108 (4.25)	13.65 (0.54)	34 (1.34)	28 (1.10)	34 (1.34)	45 (1.77)	420 (16.54)	524 (20.63)	465 (18.31)	552 (21.73)
165	123 (4.84)	13.65 (0.54)	50 (1.97)	36 (1.42)	45 (1.77)	60 (2.36)	505 (19.88)	644 (25.35)	565 (22.24)	680 (26.77)
190	152 (5.98)	17.18 (0.68)	53 (2.09)	45 (1.77)	54 (2.13)	62 (2.44)	603 (23.74)	752 (29.61)	665 (26.18)	797 (31.38)

Dimensions in mm (inches)

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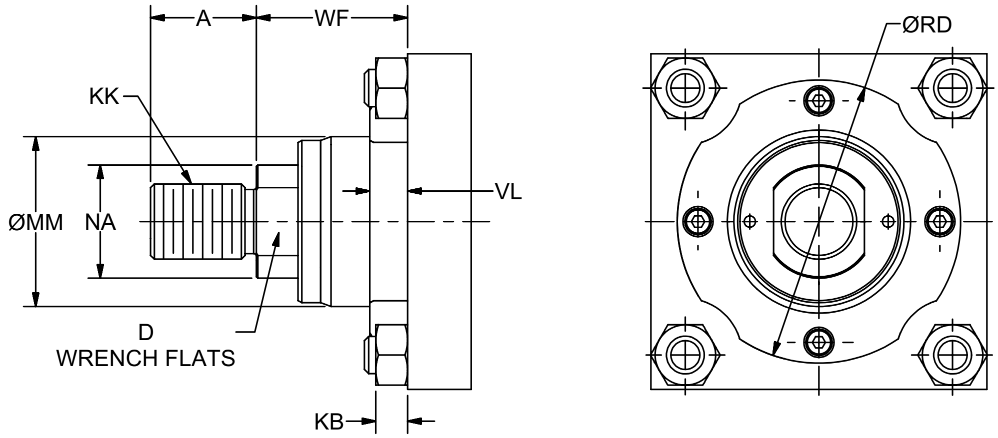
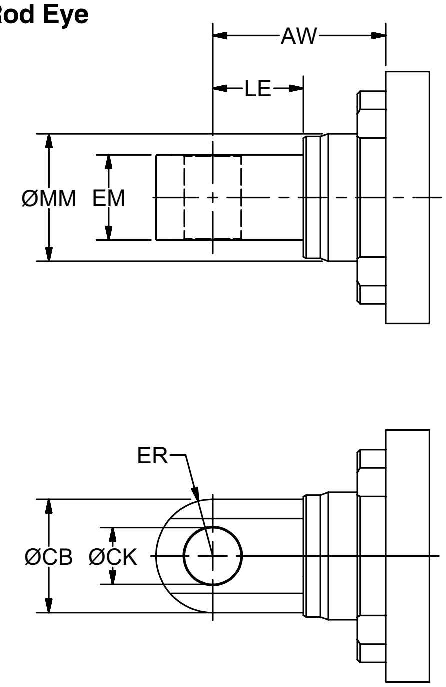
Male Rod End

FIRST ANGLE VIEW PROJECTION



XFC Size	A	D	KB	KK		MM Ø	NA	RD Ø f8	VL	WF
				A	B					
075	22 (0.87)	19 (0.75)	6.5 (0.26)	M16x1.5	5/8-18	36 (1.42)	24 (0.94)	65 (2.558)	10 (0.39)	38 (1.50)
090	28 (1.10)	24 (0.94)	8 (0.31)	M20x1.5	3/4-16	45 (1.77)	30 (1.18)	75 (2.952)	10 (0.39)	40 (1.57)
115	36 (1.42)	32 (1.26)	10 (0.39)	M27x2	1-14	56 (2.20)	40 (1.57)	95 (3.739)	12 (0.47)	45 (1.77)
140	45 (1.77)	39 (1.54)	13 (0.51)	M33x2	1 1/4-12	70 (2.76)	49 (1.93)	110 (4.329)	12 (0.47)	45 (1.77)
165	56 (2.21)	48 (1.89)	18 (0.71)	M42x2	1 1/2-12	90 (3.54)	60 (2.36)	135 (5.313)	14 (0.55)	60 (2.36)
190	63 (2.48)	55 (2.17)	18 (0.71)	M48x2	1 3/4-12	110 (4.33)	70 (2.76)	155 (6.101)	16 (0.63)	62 (2.44)

Rod Eye



XFC Size	AW	CB Ø	CK Ø H9	EM h13	ER MAX	LE	MM Ø
075	48 (1.89)	32 (1.26)	14 (0.551)	20 (0.787)	16 (0.63)	19 (0.75)	36 (1.42)
090	61 (2.40)	40 (1.57)	20 (0.787)	30 (1.181)	20 (0.79)	32 (1.26)	45 (1.77)
115	66 (2.60)	45 (1.77)	20 (0.787)	30 (1.181)	23 (0.89)	32 (1.26)	56 (2.20)
140	73 (2.87)	60 (2.36)	28 (1.102)	40 (1.575)	30 (1.18)	39 (1.53)	70 (2.76)
165	99 (3.90)	80 (3.15)	36 (1.417)	50 (1.969)	40 (1.57)	54 (2.13)	90 (3.54)
190	104 (4.09)	100 (3.94)	45 (1.772)	60 (2.362)	50 (1.97)	57 (2.24)	110 (4.33)

Dimensions in mm (inches)

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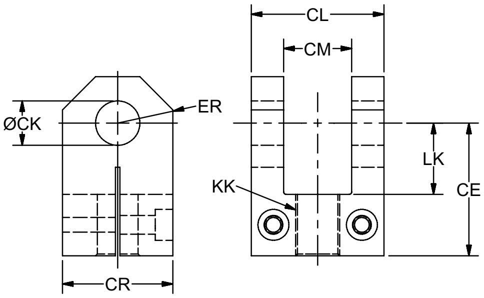
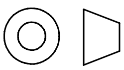
Rod Clevis

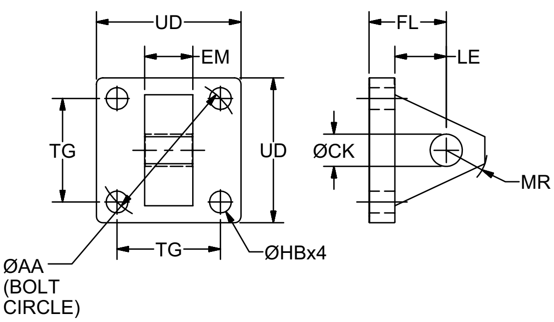


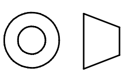


FIRST ANGLE VIEW PROJECTION

XFC Size Part No.	CE	CL	CM A16	CK Ø H9	CR	LK MIN	ER MAX	KK	Load Rating kN (lb)
075 0950250075	41 (1.61)	40 (1.57)	20 (0.787)	14 (0.551)	30 (1.18)	19 (0.75)	15.53 (0.61)	M16x1.5	20 (4,500)
090 0950250090	60 (2.36)	60 (2.36)	30 (1.181)	20 (0.787)	50 (1.97)	32 (1.26)	25.32 (1.00)	M20x1.5	34 (7,500)
115 0950250115	68 (2.68)	60 (2.36)	30 (1.181)	20 (0.787)	50 (1.97)	32 (1.26)	25.71 (1.01)	M27x2	54 (12,000)
140 0950250140	84 (3.31)	83 (3.27)	40 (1.575)	28 (1.102)	60 (2.36)	39 (1.54)	32.50 (1.28)	M33x2	80 (17,500)
165 0950250165	110 (4.33)	103 (4.06)	50 (1.969)	36 (1.417)	76 (2.99)	54 (2.13)	41.04 (1.62)	M42x2	120 (26,500)
190 0950250190	120 (4.72)	123 (4.84)	60 (2.362)	45 (1.772)	101.5 (4.00)	57 (2.24)	51.83 (2.04)	M48x2	178 (40,000)

Clevis Bracket



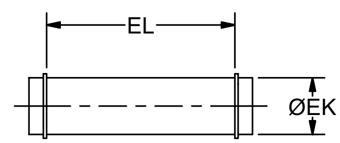


FIRST ANGLE VIEW PROJECTION

XFC Size Part No.	AA Ø	CK Ø H9	EM	FL	HB Ø	LE MIN	MR MAX	TG	UD
075 1448100000	59 (2.32)	14 (0.551)	20 (0.79)	29 (1.14)	9 (0.35)	19 (0.75)	17 (0.67)	41.7 (1.64)	64 (2.52)
090 1448110000	74 (2.91)	20 (0.787)	30 (1.18)	48 (1.89)	13.5 (0.53)	32 (1.26)	29 (1.14)	52.3 (2.06)	75 (2.95)
115 1448120000	91 (3.58)	20 (0.787)	30 (1.18)	48 (1.89)	13.5 (0.53)	32 (1.26)	29 (1.14)	64.3 (2.53)	90 (3.54)
140 1448130000	117 (4.61)	28 (1.102)	40 (1.58)	59 (2.32)	17.5 (0.69)	39 (1.54)	34 (1.34)	82.7 (3.26)	115 (4.53)
165 1448140000	137 (5.39)	36 (1.417)	50 (1.97)	79 (3.11)	17.5 (0.69)	54 (2.13)	50 (1.97)	96.9 (3.82)	127 (5.00)
190 1448150000	178 (7.01)	45 (1.772)	60 (2.36)	87 (3.43)	26 (1.02)	57 (2.24)	53 (2.09)	125.9 (4.96)	165 (6.50)

Dimensions in mm (inches)

Pivot Pin



XFC Size Part No.	EK Ø f8	EL
075 1434790000	14 (0.551)	45 (1.77)
090 1434800000	20 (0.787)	66 (2.60)
115 1434800000	20 (0.787)	66 (2.60)
140 1434810000	28 (1.102)	87 (3.43)
165 1434820000	36 (1.417)	107 (4.21)
190 1434830000	45 (1.772)	129 (5.08)

Parker Hannifin Corporation
Industrial Cylinder Division
Des Plaines, Illinois

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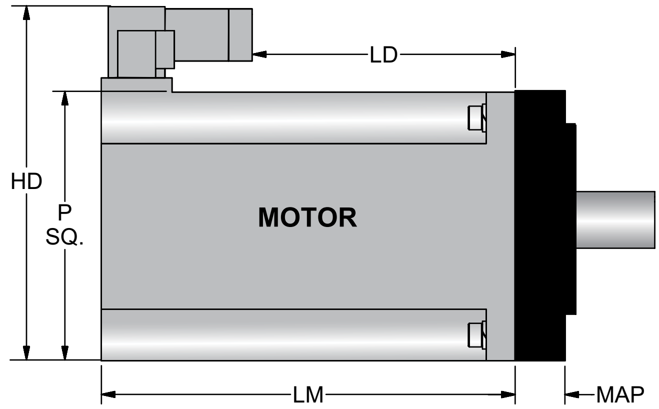
Motor Dimensions and Standard Configurations

Motor and gearhead selection is critical to the performance of the XFC electromechanical actuator and must be sized based on the application requirements. The following tables provide information on which motor or motor/gearhead combinations are appropriate and physically possible for a specific XFC size. A motor-only selection is typically used in high speed / low force applications where motor and gearbox combination is usually slow speed / high force. Standard configurations are available if there is a number (signifying the adapter plate width) where the row of the motor selection (or motor/gearhead) and column of the XFC size intersect. If the number is zero, that combination is possible but does not require an adapter plate. If the area is shaded, that particular combination is not available as a standard configuration. Consult the factory to inquire about other options or configurations.



MPP Motor		LM	LD	HD	P	MAP (Inline)						MAP (Parallel)					
Size	Length					075	090	115	140	165	190	075	090	115	140	165	190
115	2	152.4 (6.00)	89.2 (3.51)	159.0 (6.26)	113.0 (4.45)	0.0	0.0					12 (0.47)	12 (0.47)				
	3	177.8 (7.00)	115.2 (4.54)														
	4	203.2 (8.00)	140.2 (5.52)														
142	2	172.9 (6.81)	109.9 (4.33)	188.8 (7.43)	142.7 (5.62)	16 (0.63)	16 (0.63)	16 (0.63)					16 (0.63)	16 (0.63)			
	4	223.7 (8.81)	160.8 (6.33)														
	6	274.5 (10.81)	211.9 (8.34)														
	8	325.3 (12.81)	261.9 (10.31)														
190	4	224.0 (8.82)	110.3 (4.34)	260.1 (10.24)	184.9 (7.28)			25 (0.98)	25 (0.98)					25 (0.98)	25 (0.98)		
	6	275.0 (10.83)	161.3 (6.35)														
	8	325.3 (12.81)	211.3 (8.32)														
270	6	293.3 (11.55)	175.3 (6.90)	335.9 (13.22)	266.7 (10.50)				30 (1.18)	30 (1.18)						30 (1.18)	
	8	344.1 (13.55)	255.5 (10.06)														

Note: Make sure the output torque on the motor is sufficient for the application. MPP torque information can be found at www.parkermotion.com

Dimensions in mm (inches)

Motor Brake Option

For vertical applications, a static brake should be used to resist backdriving the screw mechanism. When a brake is used on the motor, the overall length of the motor will increase. See the table for the additional length of the motor. (Refer to MPP motor data at www.parkermotion.com for specific motor holding torque)

Additional Motor Length

Motor size	LM and LD Increase by
092	34.5 (1.36)
100	48.5 (1.91)
115	48.5 (1.91)
142	51.6 (2.03)
190	89.0 (3.50)
270	127.0 (5.00)

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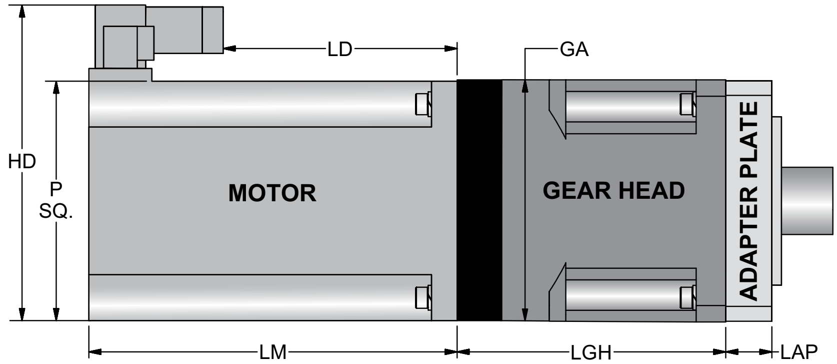

Gear size	MPP Motor Size	MPP Motor Length	LM	LD	HD	P	GA	LGH	LAP[1] 075	LAP[1] 090	LAP[1] 115	LAP[1] 140	LAP[1] 165	LAP[1] 190
PS90	092	1	127.2 (5.01)	64.2 (2.53)	136.4 (5.37)	88.8 (3.50)	90 (3.54)	89.5 (3.52)	19 (0.75)	0.0				
		2	152.6 (6.01)	90.2 (3.55)										
		3	178.0 (7.01)	115.2 (4.52)										
	100	2	149.1 (5.87)	86.2 (3.39)	143.8 (5.66)	97.8 (3.85)		98 (3.86)						
		3	174.5 (6.87)	111.2 (4.38)										
PS115	092	1	127.2 (5.01)	64.2 (2.53)	136.4 (5.37)	88.8 (3.50)	115 (4.53)	114.2 (4.50)	24 (0.94)	22 (0.87)	0.0			
		2	152.6 (6.01)	90.2 (3.55)										
		3	178.0 (7.01)	115.2 (4.52)										
	100	2	149.1 (5.87)	86.2 (3.39)	143.8 (5.66)	97.8 (3.85)								
		3	174.5 (6.87)	111.2 (4.38)										
	115	2	152.4 (6.00)	89.2 (3.51)	159.0 (6.26)	113.0 (4.45)								
		3	177.8 (7.00)	115.2 (4.54)										
		4	203.2 (8.00)	140.2 (5.52)										
PS142	100	2	149.1 (5.87)	86.2 (3.39)	143.8 (5.66)	97.8 (3.85)	142 (5.59)	133.7 (5.26)			29 (1.14)	5.0 (0.20)	5.0 (0.20)	
		3	174.5 (6.87)	111.2 (4.38)										
	115	2	152.4 (6.00)	89.2 (3.51)	159.0 (6.26)	113.0 (4.45)								
		3	177.8 (7.00)	115.2 (4.54)										
		4	203.2 (8.00)	140.2 (5.52)										
	142	2	172.9 (6.81)	109.9 (4.33)	188.8 (7.43)	142.7 (5.62)								
		4	223.7 (8.81)	160.8 (6.33)										
		6	274.5 (10.81)	211.9 (8.34)										
		8	325.3 (12.81)	261.9 (10.31)										
PS180	115	2	152.4 (6.00)	89.2 (3.51)	159.0 (6.26)	113.0 (4.45)	182 (7.17)	148.5 (5.85)				24 (0.94)	24 (0.94)	0.0
		3	177.8 (7.00)	115.2 (4.54)										
		4	203.2 (8.00)	140.2 (5.52)										
	142	2	172.9 (6.81)	109.9 (4.33)	188.8 (7.43)	142.7 (5.62)		151 (5.95)						
		4	223.7 (8.81)	160.8 (6.33)										
		6	274.5 (10.81)	211.9 (8.34)										
		8	325.3 (12.81)	261.9 (10.31)										
	190	4	224.0 (8.82)	110.3 (4.34)	260.1 (10.24)	184.9 (7.28)		192.5 (7.58)						
		6	275.0 (10.83)	161.3 (6.35)										
		8	325.3 (12.81)	211.3 (8.32)										
PS220	190	4	224.0 (8.82)	110.3 (4.34)	260.1 (10.24)	184.9 (7.28)	220 (8.66)	212 (8.35)						36 (1.42)
		6	275.0 (10.83)	161.3 (6.35)										
		8	325.3 (12.81)	211.3 (8.32)										
	270	6	293.3 (11.55)	175.3 (6.90)	335.9 (13.22)	266.7 (10.50)		252 (9.92)						
		8	344.1 (13.55)	255.5 (10.06)										

[1] LAP dimension is required for parallel mounting only and 0.0 means no adapter plate required. Inline configurations do not require adapter plates.

Note: Make sure the output torque on the gearbox is sufficient for the application. PS torque information can be found at www.parkermotion.com

Dimensions in mm (inches)

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Thrust Calculations

Calculate the thrust generated by the application. Total thrust generally consists of three components:

Acceleration Thrust $F_a = L/g \times V/T_a$

Thrust Due to Gravity $F_g = L\sin\alpha$
(Horizontal applications do not apply.)

Thrust Due to Friction $F_f = \mu_s L\cos\alpha$

Total Thrust $= F_t = F_a + F_g + F_f$

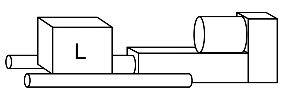
Terms used:

F_t = Total (maximum) Thrust Force (N, lb)
F_f = Friction Force (N, lb)
F_g = Force of Gravity (N, lb)
F_a = Acceleration Thrust (N, lb)
α = Angle of Inclination (see illustration below)
μ_s = Coefficient of Sliding Friction
L = Actual Weight (N, lb)
g = Acceleration due to Gravity (9800 mm/sec^2, 386 in/sec^2)
V = Velocity (mm/sec, inch/sec)
T_a = Acceleration Time (sec)
D = Move Distance (mm, in)
t = Move Time (sec)
A = Acceleration (mm/sec^2, inch/sec^2)

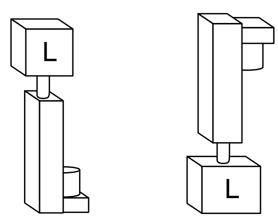
Cylinder Orientation

The terms used and their values depend upon the orientation of the cylinder. Refer to the illustrations and equations below to determine the form of the thrust equation.

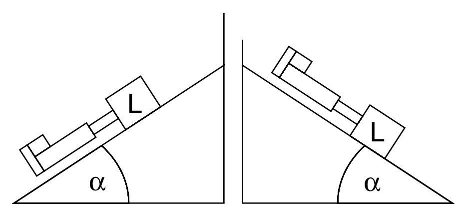
Horizontal



Vertical



Angular



Horizontal Equation

$F_t = F_a + F_f$

Vertical Equations

Upward

$F_t = F_a + F_g + F_f$

Downward

$F_t = F_a - F_g + F_f$

Angular Equations

Upward

$F_t = F_a + F_g + F_f$

Downward

$F_t = F_a - F_g + F_f$

Motor Speed Calculation

$$\textbf{Speed} = \frac{V_L \times \text{Ratio}}{\text{Lead}}$$

Where:

Lead = Screw lead mm/rev (in/rev)
V_L = Maximum linear velocity in mm/s (in/sec)
Ratio = Reduction ratio, if any (i.e. 3:1, Ratio = 3)
Speed = Required motor speed in rev/sec

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Motor Torque Calculations

$$T = \frac{\text{Thrust x Lead}}{\eta_s \text{ x } \eta_b \text{ x } 2\pi \text{ x Ratio}}$$

Where:

T = Input torque required, Nm (in-lb)
Lead = Screw lead in mm/rev (in/rev)
Thrust = Calculated thrust value in kN (lbf)
= $F_a + F_g + F_f$

F_a (Acceleration Thrust)
= Load / (9800mm/sec^2) × Velocity/Acceleration Time

F_g (Force of Gravity) = Load × sin α

F_f (Friction Force) = μ_s × Load × cos α

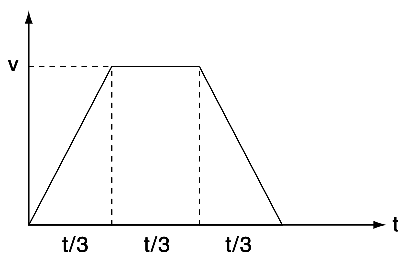
η_b = Gear Efficiency Coefficient:
for parallel driven versions, typically 0.95 (or 95%)
for inline versions use 1.0

η_s = Screw Efficiency Coefficient
Ratio = Drive Ratio (if reducer is used)

Friction Coefficients μ_s

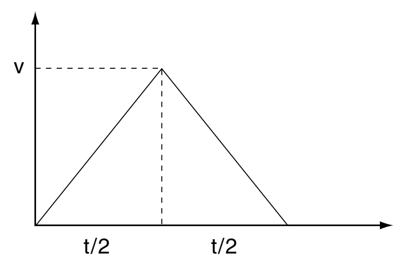
Material (dry contact unless noted)	μ_s
Steel on steel	0.80
Steel on steel (lubricated)	0.16
Aluminum on steel	0.45
Copper on steel	0.22
Brass on steel	0.35
PTFE on steel	0.04

Trapezoidal Motion Profile



V = 1.5 x D/t
A = 4.5 x D/t^2

Triangular Motion Profile



V = 2 x D/t
A = 4 x D/t^2

Acceleration $\leq$ ***1 g (9.8 m/sec^2)***

Common Equivalent units:

Mass – 1 kg = 2.2046 lb
Force – 1 kN = 224.81 lb_f
Length – 1 mm = 0.03937 in
Speed – 1 mm/sec = 0.03937 in/sec
Torque – 1 N-m = 0.7376 lb_f-ft
Power – 1kW = 1.341 hp
Inertia – 1kg-m^2 = 23.73 lb-ft^2

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Life Calculations

L_{10} Life ratings are based on 90% of similar actuators achieving the service life before showing signs of material failure. The service life of the actuator can be determined by known forces exerted on the actuator and mechanical system. Most often, the load is not constant across the range of motion the actuator experiences and these loading changes effect the life of the actuator. In order to determine the loading of the actuator, an equivalent load method is used to model loading on the system.

Life Calculations (Millions of Revolutions)

$$L_{10} = \left(\frac{C_a}{F_m} \right)^3$$

Life Calculations (Millions of mm)

$$L_{10} = \left(\frac{C_a}{F_m} \right)^3 \text{ x (Screw Lead)}$$

Note: Consult factory for advanced life calculations.

L_{10} = Life (Millions of Revolutions)

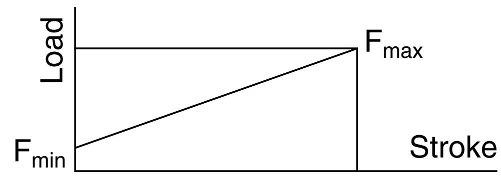
C_a = Basic Dynamic Load Rating (from page 8)

F_m = Equivalent Load (from equation to right)

Equivalent Load Calculations

Simple Load Calculation

$$F_m = \frac{F_{min} + 2F_{max}}{3}$$



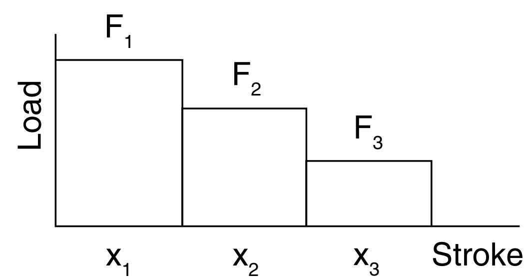
To model complex loads, the formula to calculate the equivalent load on the actuator is:

$$F_m = \sqrt[3]{\frac{(F_1^3 * x_1) + (F_2^3 * x_2) + (F_1^3 * x_3) + (F_n^3 * x_n) + \ldots}{(x_1 + x_2 + x_3 + x_n) + \cdots}}$$

F_m = Equivalent load used for life calculations

F_n = Force exerted over segment of distance x_n

x_n = Distance over which F_n is exerted



For Example:

An actuator that is subjected to 5 kN over 100 mm, 10 kN over the next 100 mm and 20 kN over the next 100 mm would have the equivalent load calculated by:

$$F_m = \sqrt[3]{\frac{(5kN^3 * 100mm) + (10kN^3 * 100mm) + (20kN^3 * 100mm)}{(100mm + 100mm + 100mm)}}$$

F_m = 14.489 kN

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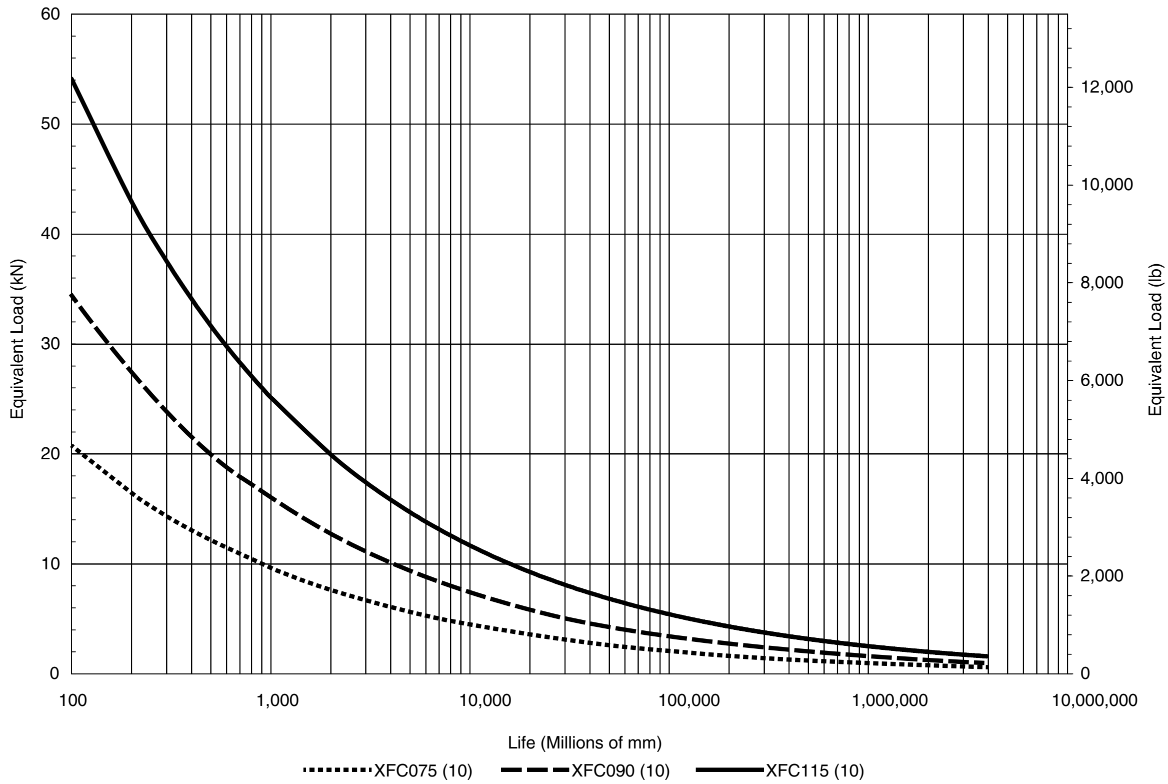
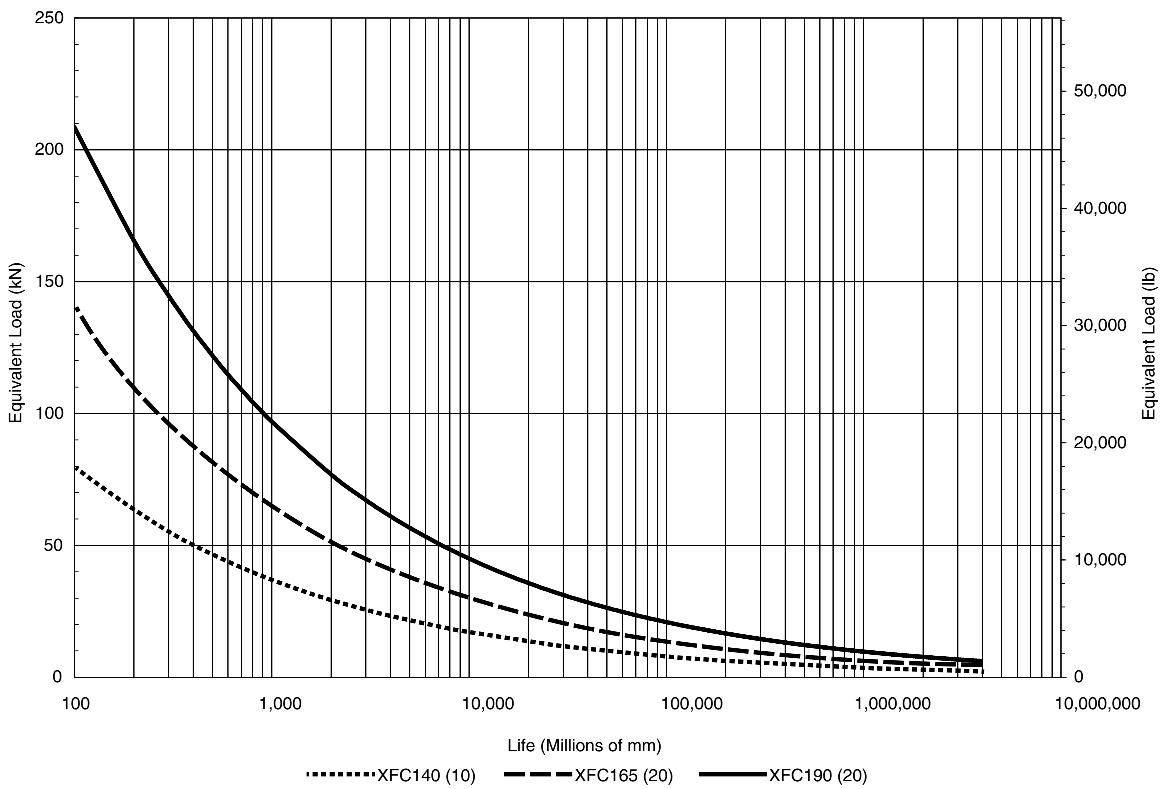
XFC 075 – 115 Life Chart



XFC 140 – 190 Life Chart



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Des Plaines, Illinois

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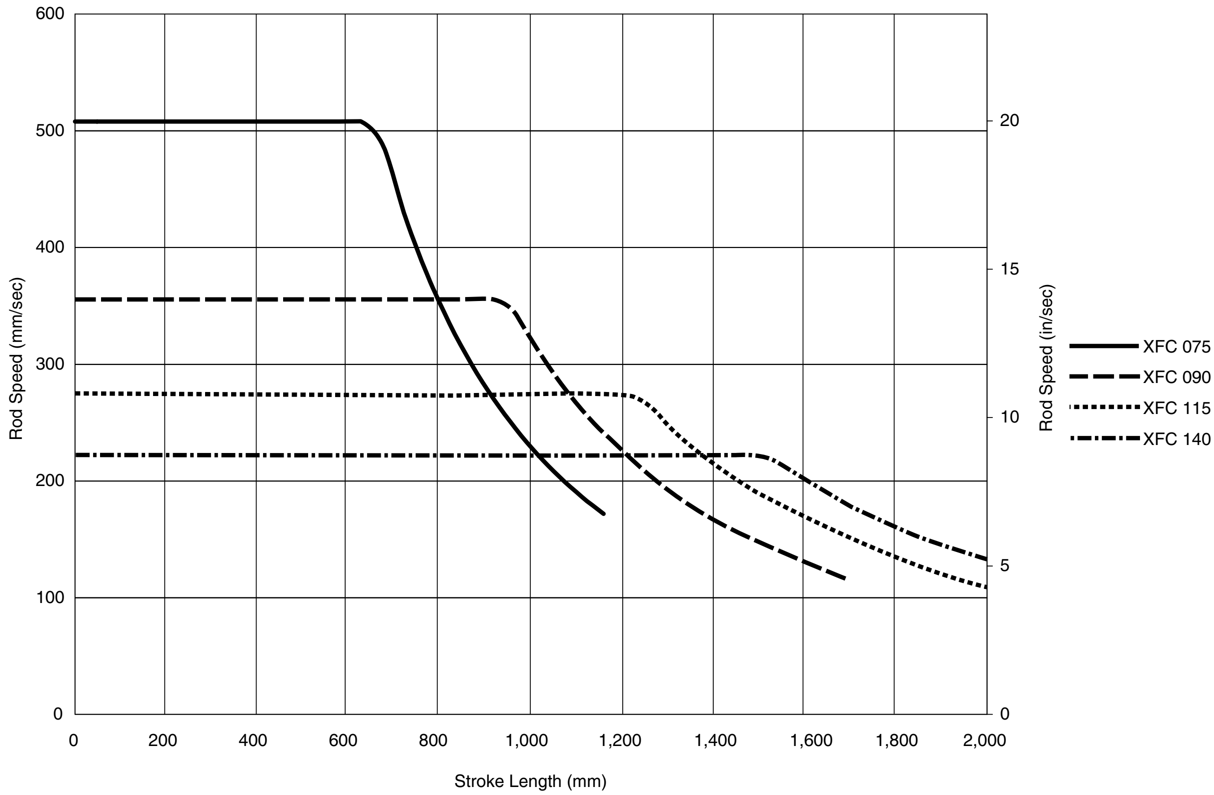
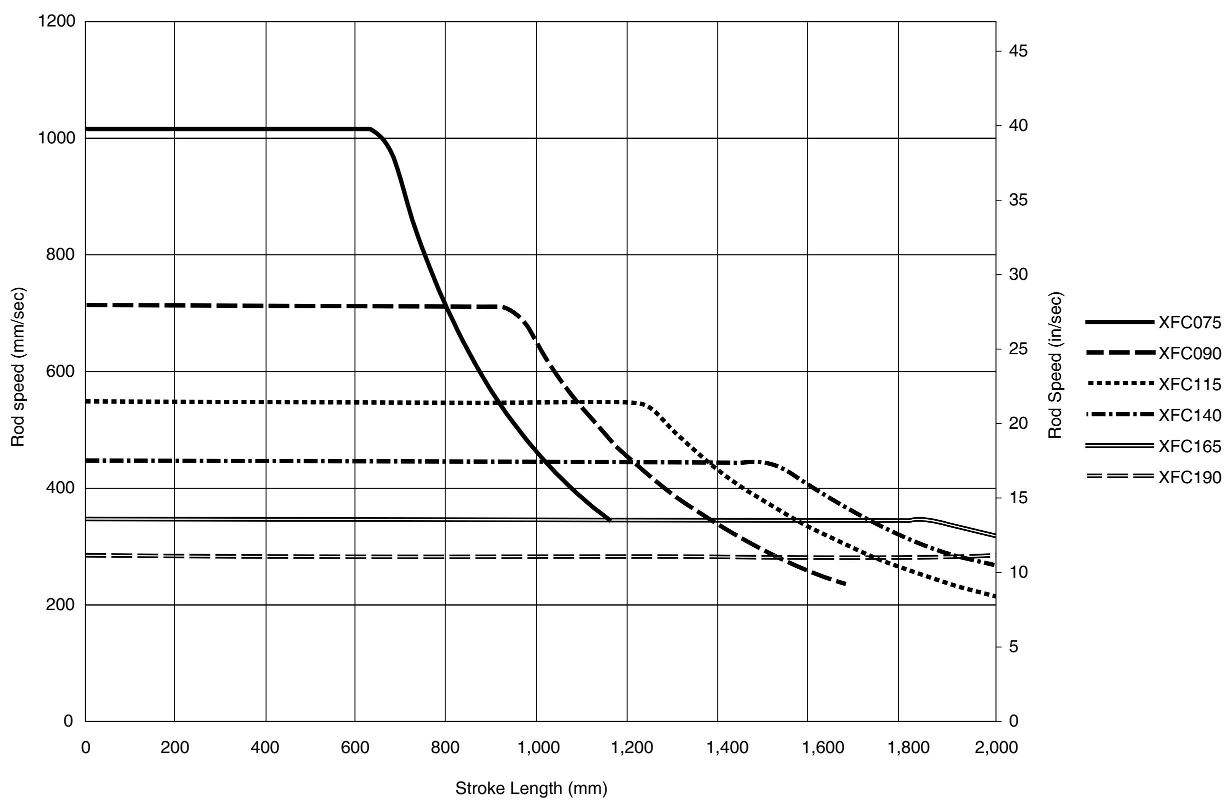
Maximum speeds (5 mm/rev)



Maximum speeds (10 mm/rev)



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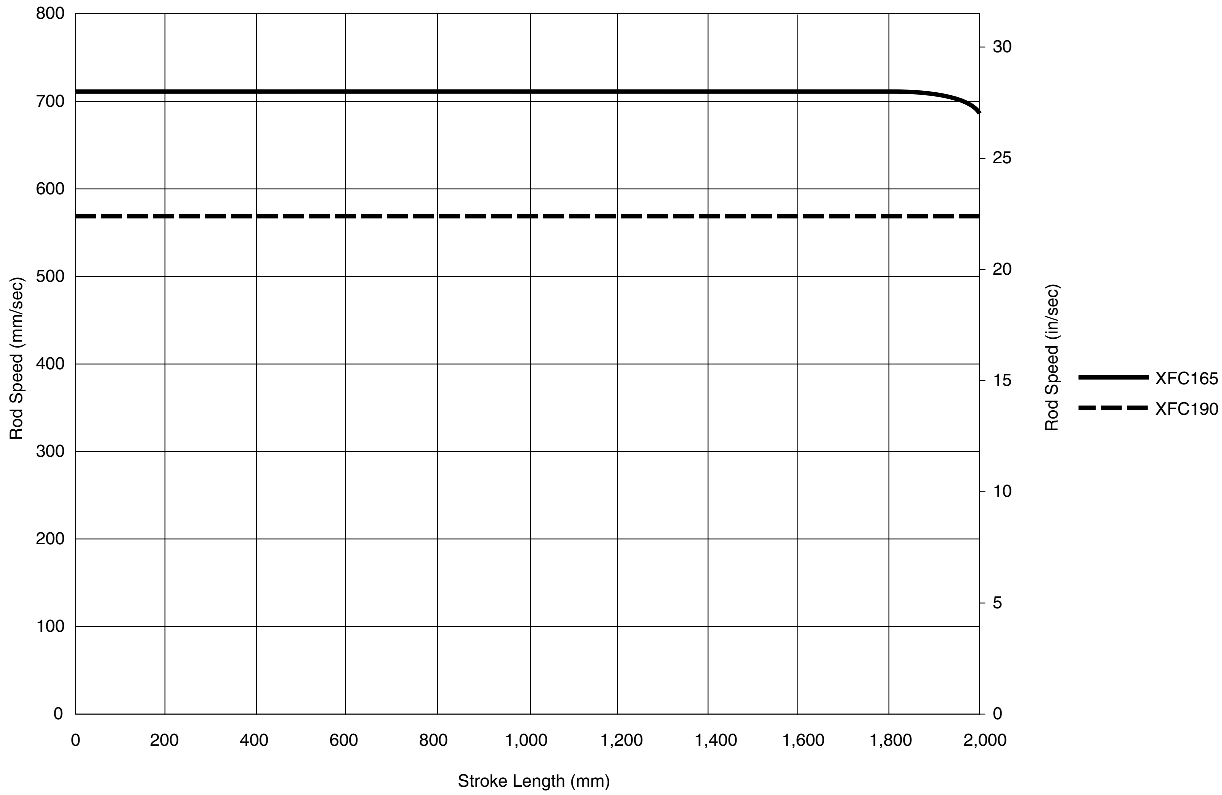
Maximum speeds (20 mm/rev)



Actuator Inertia

Inertia matching of the actuator assembly to the motor will improve the performance of the mechanical system. The inertia ratio of the actuator and load to the motor should be less than 10:1.

$$I_{Total} = I_{GearHead} + \frac{(I_{XFC} + I_{Mass})}{(GearHeadRatio)^2}$$

$$I_{Mass} = Mass_{Load}\ (kg) \left(\frac{Lead(mm)}{3141.6}\right)^2$$

PS Gearhead inertia information can be found at: www.parkermotion.com

XFC Inertia I (kg-m²)			
XFC Size	Inline (Zero stroke)	Parallel (Zero Stroke)	Stroke (Per 100 mm)
075	0.00008903	0.00037951	0.00001499
090	0.00031974	0.00089394	0.00006242
115	0.00107620	0.00349671	0.00017800
140	0.00229637	0.00923002	0.00040900
165	0.00655544	0.02428162	0.00099900
190	0.02702120	0.05552601	0.00244000

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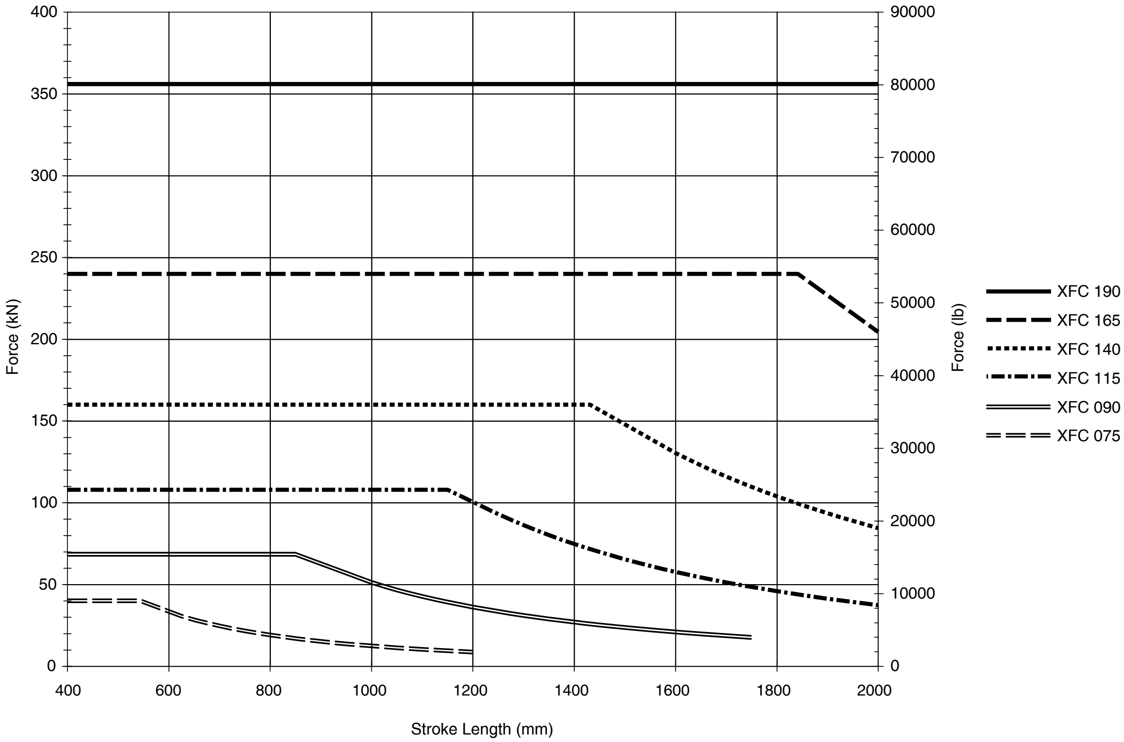
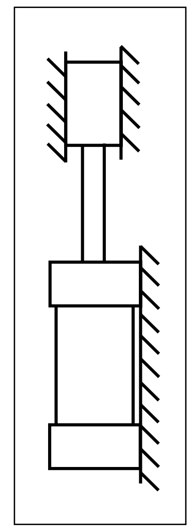
Buckling Strength

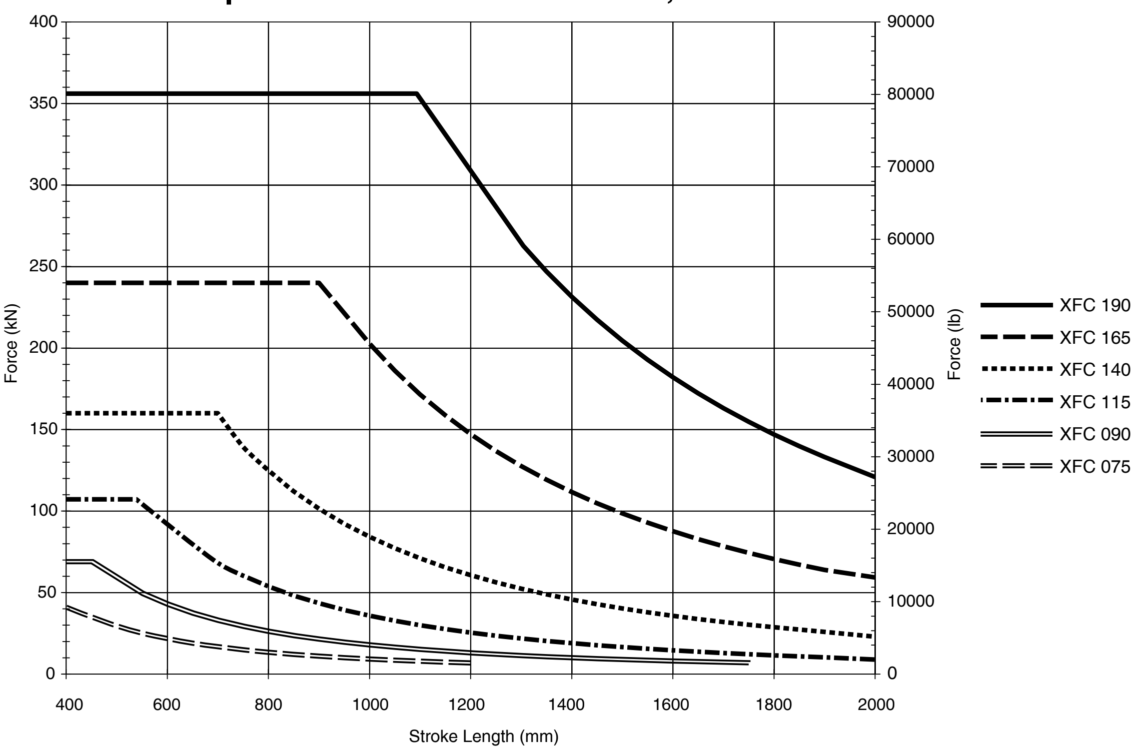
The Buckling strength of the actuator is the maximum compressive load able to be exerted through the actuator. These values are a function of the screw and thrust tube size and do not allow for specific motor or gearbox performance. The force value from the specific mounting class and length of stroke should not be exceeded to ensure safe mechanical performance. Tension loads are not subject to buckling strength restrictions.

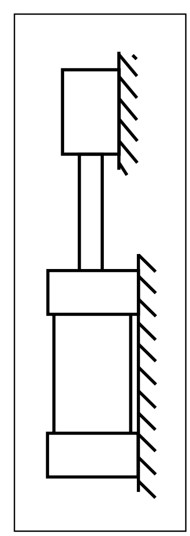
Maximum Compressive Force – Fixed Mount, Guided





Maximum Compressive Force – Fixed Mount, Not Guided





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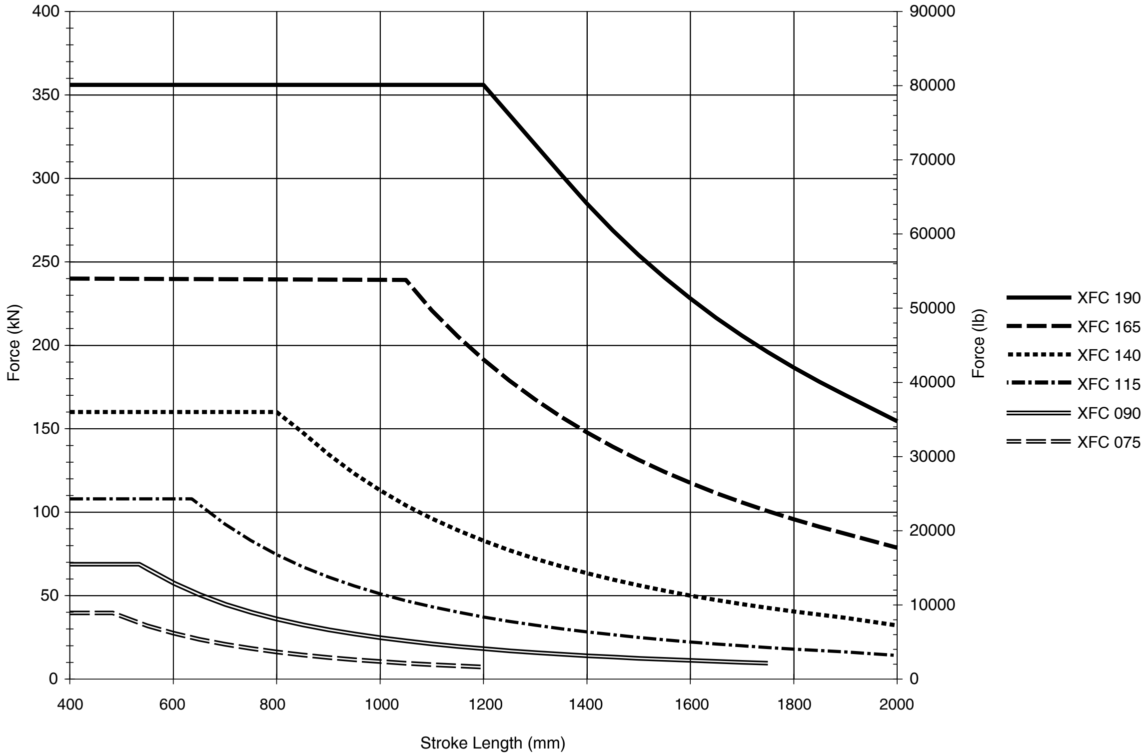
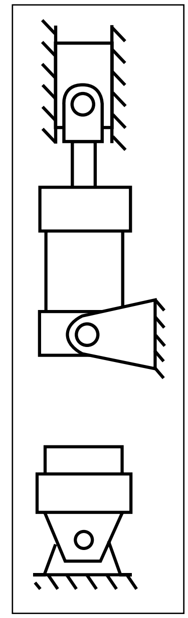
Maximum Compressive Force – Rear Pivot Mount, Guided





Actuator Weights in kg (lb)

Inline

XFC Size	Base Weight at Zero Stroke				Stroke (Per 100mm)
	J – Front Flange	C – Foot	D – Trunnion	K – Tie Rods	
075	9.1 (20)	9.1 (20)	9.5 (21)	8.6 (19)	1.41 (3.1)
090	14.5 (32)	14.1 (31)	14.5 (32)	14.1 (31)	1.93 (4.3)
115	27.7 (61)	27.7 (61)	28.1 (62)	26.8 (59)	3.08 (6.8)
140	48.1 (106)	47.6 (105)	49.4 (109)	46.7 (103)	4.53 (10.0)
165	103.4 (182)	102.1 (180)	104.3 (185)	100.2 (175)	7.17 (15.8)
190	132.9 (293)	131.5 (290)	134.3 (296)	127.0 (280)	9.48 (20.9)

Parallel

XFC Size	Base Weight at Zero Stroke						Stroke (Per 100mm)
	J – Front Flange	C – Foot	D – Trunnion	K, L, M – Tie Rods	H – Rear Flange	B – Rear Clevis	
075	11.3 (25)	10.9 (24)	11.3 (25)	10.9 (24)	11.3 (25)	11.3 (25)	1.41 (3.1)
090	17.7 (39)	17.2 (38)	17.7 (39)	17.2 (38)	18.1 (40)	18.6 (41)	1.93 (4.3)
115	34.0 (75)	34.0 (75)	34.9 (77)	33.1 (73)	35.4 (78)	35.4 (78)	3.08 (6.8)
140	59.4 (131)	58.5 (129)	60.3 (133)	57.6 (127)	61.7 (136)	62.1 (137)	4.53 (10.0)
165	103.4 (228)	102.1 (225)	104.3 (230)	100.2 (221)	107.0 (236)	110.7 (244)	7.17 (15.8)
190	163.7 (361)	162.4 (358)	170.6 (376)	158.8 (350)	171.5 (378)	171.9 (379)	9.48 (20.9)

Note: All weights above assume oil filled lubrication

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Standard Features

- Power range of 1kW…75kW
- 8 digital inputs, 4 digital outputs
- RS232 / RS485 – interfaces
- 2 analog inputs (+/-10V, 14 bits)
- 2 analog outputs (+/-10V, 8 bits)
- Encoder input or output
- **Motors supported:**
  - – Synchronous servo motors
  - – Asynchronous motors
  - – Linear motors
  - – Torque motors
- **Position sensing at the motor shaft via:**
  - – Resolver
  - – Rotary/linear encoder
  - – Sine-cosine feedback
  - – Hiperface interface
  - – EnDat 2.1 interface
  - – Compatible with most available feedback systems
- Support for SSI feedback

Extensions

- Real-time bus for axis coupling
- Scalable technology and control functions
- Integrated or external controls: C3 powerPLmC for combined machine logic and motion control functionality

Functions (summary)

- Programmable according to IEC61131-3
- Reg-related positioning, electronic gearing, dynamic positioning (motion superimposition) and torque-force control
- Cam – modular, with coupling and decoupling functions, cam switching mechanism

Technologies

- T10: Step/Direction and Analog Command Input
- T11: Positioning indexer
- T30: IEC61131-3 Positioning with function modules according to PLCopen
- T40: IEC61131-3 Positioning with Cam function modules

Compax3 Power Range

Compax3 device	Current A_{RMS}		Supply voltage
	I_{cont}	I_{peak}(<5s)	
S025V2	2.5	5.5	1Φ 230/240VAC
S063V2	6.3	12.6	
S100V2	10	20	3Φ 230/240VAC
S150V2	15	30	
S038V4[1]	3.8	9.0	3Φ 400/480VAC
S075V4[1]	7.5	15	
S150V4[1]	15	30	
S300V4[1]	30	60	
H050V4[1]	50	75	3Φ 400/480VAC
H090V4[1]	90	135	
H125V4[1]	125	187.5	
H155V4[1]	155	232.5	

[1]Rated at 400VAC

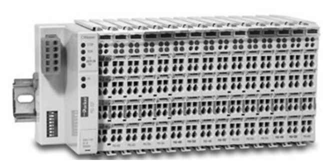
powerPLmC Machine Controller

C3 Power PLmC – C10[2]
– Integrated –
into the servo drive

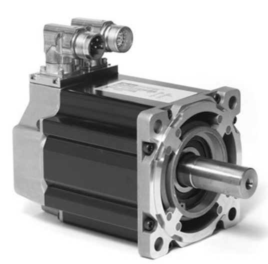
C3 *power*PL*m*C - E20
– standalone –
without servo drive

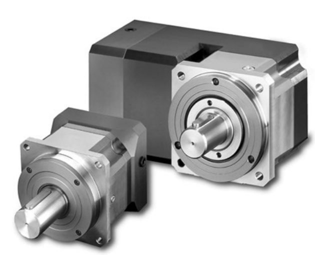
- 32-bit RISC processor: <100 µs for 1000 Icommands
- Programmable based on IEC61131-3 /PLCopen
- Simple integration of the servo axes due to Parker's Drive Interface
- Integrated motion control functions for dynamic, coordinated control of 32+ axes
- CoDeSys professional development tool
- Full machine logic capabilities
- Additional system components offered by Parker:

Parker offers HMI solutions for any application from simple push button replacement through sophisticated networking, multimedia and data logging requirements. Products range from entry level embedded displays through full Windows based Industrial PC solutions.



PIO: Parker digital and analog inputs / outputs – modular extensions





Parker offers a broad family of motors with unparalleled performance, a torque range of 1.2 in-lbs to 4000 in-lbs and complete customization capabilities. For higher torque requirements, Parker's Stealth gearheads are the perfect solution.

[2]Available as a custom product

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Ordering a Compax3 System

Table A – Compax3 Order Code

Continuous Current/Input Voltage
S025 V2 – 2.5 A (rms) / 120 - 240 VAC
S063 V2 – 6.3 A (rms) / 120 - 240 VAC
S100 V2 – 10 A (rms) / 120 - 240 VAC 3Φ
S150 V2 – 15 A (rms) / 120 - 240 VAC 3Φ
S038 V4 – 3.8 A (rms) / 208 - 480 VAC 3Φ
S075 V4 – 7.5 A (rms) / 208 - 480 VAC 3Φ
S150 V4 – 15 A (rms) / 208 - 480 VAC 3Φ
S300 V4 – 30 A (rms) / 208 - 480 VAC 3Φ
H050 V4 – 50 A (rms) / 400 - 480 VAC 3Φ
H090 V4 – 90 A (rms) / 400 - 480 VAC 3Φ
H125 V4 – 125 A (rms) / 400 - 480 VAC 3Φ
H155 V4 – 155 A (rms) / 400 - 480 VAC 3Φ

Motor Feedback
F10 – Resolver
F11 – Absolute encoder/SinCos®/ Stegmann/Hiperface
F12 – Quadrature encoder/SineCosine linear/Endat 2.1

Interface/Technology (Control) Level
I10 T10 – Drive only
I11 T11 – Basic positioning via digital inputs (requires M00)
I12 T11 – Advanced positioning via inputs and RS232/485 (requires M12)
I20 T11 – Positioning via Profibus DP
I21 T11 – Positioning via CANopen
I22 T11 – Positioning via DeviceNet
I30 T11 – Positioning/Interpolation via EPL
I31 T11 – Positioning via EtherCAT
I11 T30 – IEC with digital I/O
I20 T30 – IEC with Profibus DP
I21 T30 – IEC with CANopen
I22 T30 – IEC with DeviceNet
I30 T30 – IEC with EPL
I31 T30 – IEC with EtherCAT
I11 T40 – IEC Cam control w/digital I/O
I20 T40 – IEC Cam control w/Profibus DP
I21 T40 – IEC Cam control w/CANopen
I22 T40 – IEC Cam control w/DeviceNet
I30 T40 – IEC Cam control w/EPL
I31 T40 – IEC Cam with EtherCAT

Options
M00 – No options
M10 – Additional I/O with HEDA
M11 – HEDA
M12 – Additional I/O

Table B – Servo Motor Power/Feedback Cables – *As Easy as 1-2-3-!*

Compax3 PS Motor-Drive Cables

PS Feedback Cables		
1. Choose your Feedback Type	**2. Choose your Motor Family**	**3. Your Part Number is:**
Resolver	• MaxPlusPlus (MPP)	**F-2B1-xx**
SinCos/ Stegmann/ Hiperface	• MaxPlusPlus (MPP)	**F-2B1-xx**
Encoder/ Endat 2.1	• MaxPlusPlus (MPP)	**F-2C1-xx**

PS Motor Power Cables		
1. Choose your Motor Current	**2. Choose your Motor Family**	**3. Your Part Number is:**
Up to 6A RMS continuous (240VAC only)	Parker "MaxPlusPlus" MPP092 - MPP142 frame sizes	**P-1A1-xx**
Up to 20A RMS continuous (240 or 480V)	Parker "MaxPlusPlus" MPP092 - MPP142 frame sizes	**P-3B1-xx**
20A to 30A RMS (240 or 480V)	Parker "MaxPlusPlus" MPP092 - MPP142 frame sizes	**P-4B1-xx**
20A to 30A RMS (240 or 480V)	Parker "MaxPlusPlus" MPP190 - MPP270 frame sizes	**P-4B2-xx**
30A to 50A RMS (240 or 480V)	Parker "MaxPlusPlus" MPP190 - MPP270 frame sizes	**P-6B2-xx**
> 50A RMS	Contact factory	**Custom Product**

Compax3 Accessories

Digital I/O Breakout Module, 2 foot cable	VM15-FC-02
Compax3 Communication Cable	SSK1/02

-xx denotes cable length in feet; motor power and feedback cables available in standard lengths of 10, 25 and 50 feet (other lengths also available).

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Global Drop-In Solid State Switches

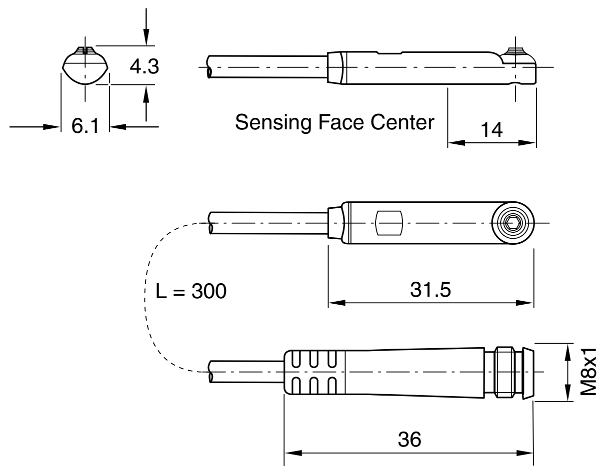
	PNP		NPN	
	Nomally Open	**Normally Closed**	**Nomally Open**	**Normally Closed**
3m Flying Leads	P8S-GPFLX	P8S-GQFLX	P8S-GNFLX	P8S-GMFLX
10m Flying Leads	P8S-GPFTX	---	P8S-GNFTX	---
0.3m Lead with 8mm connector	P8S-GPSHX	P8S-GQSHX	P8S-GNSHX	P8S-GMSHM
1m Lead with 8mm connector	P8S-GPSCX	---	P8S-GNSCX	---
Compax3 Compatible	Yes	Yes	No	No

8mm Threaded Cordset to flying leads: 086620T002 (2 meter), 086620T005 (5 meter)
Note: PNP needed for Compax3 Servo Drive.

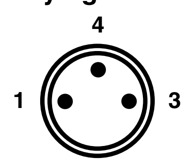
Specifications

Switch Classification	Standard PNP or NPN
Type	Electronic
Output Function	Normally Open/Closed
Switch Output	PNP/NPN
Operating Voltage	10 - 30VDC
Continuous Current	100 mA max.
Response Sensitivity	28 Gauss min.
Switching Frequency	5 KHz
Power Consumption	10 mA max.
Voltage Drop	2.5 VDC max.
Ripple	10% of Operating Voltage
Hysteresis	1.5 mm max.
Repeatability	0.1 mm max.
EMC	EN 60 947-5-2
Short-circuit Protection	Yes
Power-up Pulse Suppression	Yes
Reverse Polarity Protection	Yes
Enclosure Rating	IP68
Shock and Vibration Stress	30g, 11 ms, 10 to 55Hz, 1 mm
Operating Temperature Range	-25°C to +75°C (-13°F to +167°F)
Housing Material	PA 12 Black
Connector Cable	PVC
Connector	PUR

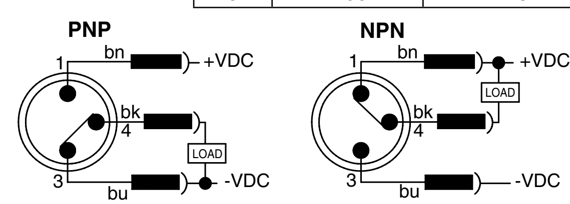
Global solid state switch outputs may be influenced by an external magnetic field. Care must be taken to avoid external magnetic field exposure.



Solid State Switch – Wiring Connection
Flying Lead or 8 mm Connector (shown)



Pin	Wire	Function
1	Brown	Operating Voltage (+VDC)
4	Black	Output signal (N.O.)
3	Blue	-VDC

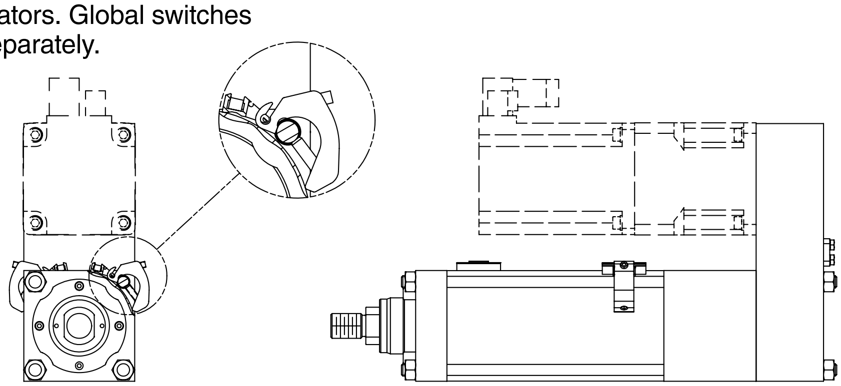


Tie Rod Bracket Assembly Part Number

Global switch bracket fits XFC 075-115 actuators. Global switches and bracket assemblies must be ordered separately.

Tie Rod Bracket Assembly	P8S-TMA0X

Refer to Accessory Catalog HY08-1300 for the latest dimensional information.



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Industrial Cylinder Division
Des Plaines, Illinois

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Safety Guide for Selecting and Using Hydraulic, Pneumatic Cylinders and Their Accessories

WARNING: ⚠ FAILURE OF THE CYLINDER, ITS PARTS, ITS MOUNTING, ITS CONNECTIONS TO OTHER OBJECTS, OR ITS CONTROLS CAN RESULT IN:

- **Unanticipated or uncontrolled movement of the cylinder or objects connected to it.**
- **Falling of the cylinder or objects held up by it.**
- **Fluid escaping from the cylinder, potentially at high velocity.**

THESE EVENTS COULD CAUSE DEATH OR PERSONAL INJURY BY, FOR EXAMPLE, PERSONS FALLING FROM HIGH LOCATIONS, BEING CRUSHED OR STRUCK BY HEAVY OR FAST MOVING OBJECTS, BEING PUSHED INTO DANGEROUS EQUIPMENT OR SITUATIONS, OR SLIPPING ON ESCAPED FLUID.

Before selecting or using Parker Hannifin Corporation (the Company) cylinders or related accessories, it is important that you read, understand and follow the following safety information. Training is advised before selecting and using the Company's products.

1.0 General Instructions

1.1 Scope – This safety guide provides instructions for selecting and using (including assembling, installing, and maintaining) cylinder products. This safety guide is a supplement to and is to be used with the specific Company publications for the specific cylinder products that are being considered for use.

1.2 Fail Safe – Cylinder products can and do fail without warning for many reasons. All systems and equipment should be designed in a fail-safe mode so that if the failure of a cylinder product occurs people and property won't be endangered.

1.3 Distribution – Provide a free copy of this safety guide to each person responsible for selecting or using cylinder products. Do not select or use the Company's cylinders without thoroughly reading and understanding this safety guide as well as the specific Company publications for the products considered or selected.

1.4 User Responsibility – Due to very wide variety of cylinder applications and cylinder operating conditions, the Company does not warrant that any particular cylinder is suitable for any specific application. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The hydraulic and pneumatic cylinders outlined in this catalog are designed to the Company's design guidelines and do not necessarily meet the design guideline of other agencies such as American Bureau of Shipping, ASME Pressure Vessel Code etc. The user, through its own analysis and testing, is solely responsible for:

- Making the final selection of the cylinders and related accessories.
- Determining if the cylinders are required to meet specific design requirements as required by the Agency(s) or industry standards covering the design of the user's equipment.
- Assuring that the user's requirements are met, OSHA requirements are met, and safety guidelines from the applicable agencies such as but not limited to ANSI are followed and that the use presents no health or safety hazards.
- Providing all appropriate health and safety warnings on the equipment on which the cylinders are used.

1.5 Additional Questions – Call the appropriate Company technical service department if you have any questions or require any additional information. See the Company publication for the product being considered or used, or call 1-847-298-2400, or go to www.parker.com, for telephone numbers of the appropriate technical service department.

2.0 Cylinder and Accessories Selection

2.1 Seals – Part of the process of selecting a cylinder is the selection of seal compounds. Before making this selection, consult the "seal information page(s)" of the publication for the series of cylinders of interest.

The application of cylinders may allow fluids such as cutting fluids, wash down fluids etc. to come in contact with the external area of the cylinder. These fluids may attack the piston rod wiper and or the primary seal and must be taken into account when selecting and specifying seal compounds.

Dynamic seals will wear. The rate of wear will depend on many operating factors. Wear can be rapid if a cylinder is mis-aligned or if the cylinder has been improperly serviced. The user must take seal wear into consideration in the application of cylinders.

2.2 Piston Rods – Possible consequences of piston rod failure or separation of the piston rod from the piston include, but are not limited to are:

- Piston rod and or attached load thrown off at high speed.
- High velocity fluid discharge.
- Piston rod extending when pressure is applied in the piston retract mode.

Piston rods or machine members attached to the piston rod may move suddenly and without warning as a consequence of other conditions occurring to the machine such as, but not limited to:

- Unexpected detachment of the machine member from the piston rod.
- Failure of the pressurized fluid delivery system (hoses, fittings, valves, pumps, compressors) which maintain cylinder position.
- Catastrophic cylinder seal failure leading to sudden loss of pressurized fluid.
- Failure of the machine control system.

Follow the recommendations of the "Piston Rod Selection Chart and Data" in the publication for the series of cylinders of interest. The suggested piston rod diameter in these charts must be followed in order to avoid piston rod buckling.

Piston rods are not normally designed to absorb bending moments or loads which are perpendicular to the axis of piston rod motion. These additional loads can cause the piston rod to fail. If these types of additional loads are expected to be imposed on the piston rod, their magnitude should be made known to our engineering department.

The cylinder user should always make sure that the piston rod is securely attached to the machine member.

On occasion cylinders are ordered with double rods (a piston rod extended from both ends of the cylinder). In some cases a stop is threaded on to one of the piston rods and used as an external stroke adjuster. On occasions spacers are attached to the machine member connected to the piston rod and also used as a stroke adjuster. In both cases the stops will create a pinch point and the user should consider appropriate use of guards. If these external stops are not perpendicular to the mating contact surface, or if debris is trapped between the contact surfaces, a bending moment will be placed on the piston rod, which can lead to piston rod failure. An external stop will also negate the effect of cushioning and will subject the piston rod to impact loading. Those two (2) conditions can cause piston rod failure. Internal stroke adjusters are available with and without cushions. The use of external stroke adjusters should be reviewed with our engineering department.

The piston rod to piston and the stud to piston rod threaded connections are secured with an anaerobic adhesive. The strength of the adhesive decreases with increasing temperature. Cylinders which can be exposed to temperatures above +250°F (+121°C) are to be ordered with a non studded piston rod and a pinned piston to rod joint.

2.3 Cushions – Cushions should be considered for cylinder applications when the piston velocity is expected to be over 4 inches/second.

Cylinder cushions are normally designed to absorb the energy of a linear applied load. A rotating mass has considerably more energy than the same mass moving in a linear mode. Cushioning for a rotating mass application should be reviewed by our engineering department.

2.4 Cylinder Mountings – Some cylinder mounting configurations may have certain limitations such as but not limited to minimum stroke for side or foot mounting cylinders or pressure de-ratings for certain mounts. Carefully review the catalog for these types of restrictions.

Always mount cylinders using the largest possible high tensile alloy steel socket head cap screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.

2.5 Port Fittings – Hydraulic cylinders applied with meter out or deceleration circuits are subject to intensified pressure at piston rod end.

The rod end pressure is approximately equal to:

$$\frac{\text{operating pressure x effective cap end area}}{\text{effective rod end piston area}}$$

Contact your connector supplier for the pressure rating of individual connectors.

3.0 Cylinder and Accessories Installation and Mounting

3.1 Installation

3.1.1 – Cleanliness is an important consideration, and cylinders are shipped with the ports plugged to protect them from contaminants entering the ports. These plugs should not be removed until the piping is to be installed. Before making the connection to the cylinder ports, piping should be thoroughly cleaned to remove all chips or burrs which might have resulted from threading or flaring operations.

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3.1.2 – Cylinders operating in an environment where air drying materials are present such as fast-drying chemicals, paint, or weld splatter, or other hazardous conditions such as excessive heat, should have shields installed to prevent damage to the piston rod and piston rod seals.

3.1.3 – Proper alignment of the cylinder piston rod and its mating component on the machine should be checked in both the extended and retracted positions. Improper alignment will result in excessive rod gland and/or cylinder bore wear. On fixed mounting cylinders attaching the piston rod while the rod is retracted will help in achieving proper alignment.

3.1.4 – Sometimes it may be necessary to rotate the piston rod in order to thread the piston rod into the machine member. This operation must always be done with zero pressure being applied to either side of the piston. Failure to follow this procedure may result in loosening the piston to rod-threaded connection. In some rare cases the turning of the piston rod may rotate a threaded head and loosen it from the cylinder body. Confirm that this condition is not occurring. If it does, re-tighten the head firmly against the cylinder body.

For double rod cylinders it is also important that when attaching or detaching the piston rod from the machine member that the torque be applied to the piston rod end of the cylinder that is directly attaching to the machine member with the opposite end unrestrained. If the design of the machine is such that only the rod end of the cylinder opposite to where the rod attaches to the machine member can be rotated, consult the factory for further instructions.

3.2 Mounting Recommendations

3.2.1 – Always mount cylinders using the largest possible high tensile alloy steel socket head screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.

3.2.2 – Side-Mounted Cylinders – In addition to the mounting bolts, cylinders of this type should be equipped with thrust keys or dowel pins located so as to resist the major load.

3.2.3 – Tie Rod Mounting – Cylinders with tie rod mountings are recommended for applications where mounting space is limited. Nuts used for this mounting style should be torqued to the same value as the tie rods for that bore size.

3.2.4 – Flange Mount Cylinders – The controlled diameter of the rod gland extension on head end flange mount cylinders can be used as a pilot to locate the cylinders in relation to the machine. After alignment has been obtained, the flanges may be drilled for pins or dowels to prevent shifting.

3.2.5 – Trunnion Mountings – Cylinders require lubricated bearing blocks with minimum bearing clearances. Bearing blocks should be carefully aligned and rigidly mounted so the trunnions will not be subjected to bending moments. The rod end should also be pivoted with the pivot pin in line and parallel to axis of the trunnion pins.

3.2.6 – Clevis Mountings – Cylinders should be pivoted at both ends with centerline of pins parallel to each other. After cylinder is mounted, be sure to check to assure that the cylinder is free to swing through its working arc without interference from other machine parts.

4.0 Cylinder and Accessories Maintenance, Troubleshooting and Replacement

4.1 Storage – At times cylinders are delivered before a customer is ready to install them and must be stored for a period of time. When storage is required the following procedures are recommended.

4.1.1 – Store the cylinders in an indoor area which has a dry, clean and noncorrosive atmosphere. Take care to protect the cylinder from both internal corrosion and external damage.

4.1.2 – Whenever possible cylinders should be stored in a vertical position (piston rod up). This will minimize corrosion due to possible condensation which could occur inside the cylinder. This will also minimize seal damage.

4.1.3 – Port protector plugs should be left in the cylinder until the time of installation.

4.1.4 – If a cylinder is stored full of hydraulic fluid, expansion of the fluid due to temperature changes must be considered. Installing a check valve with free flow out of the cylinder is one method.

4.1.5 – When cylinders are mounted on equipment that is stored outside for extended periods, exposed unpainted surfaces, e.g. piston rod, must be coated with a rust-inhibiting compound to prevent corrosion.

4.2 Cylinder Trouble Shooting

4.2.1 – **External Leakage**

4.2.1.1 – Rod seal leakage can generally be traced to worn or damaged seals. Examine the piston rod for dents, gouges or score marks, and replace piston rod if surface is rough.

Rod seal leakage could also be traced to bearing wear. If clearance is excessive, replace rod bearing and seal. Rod seal leakage can also be traced to seal deterioration. If seals are soft or gummy or brittle, check compatibility of seal material with lubricant used if air cylinder, or operating fluid if hydraulic cylinder. Replace with seal material, which is compatible with these fluids. If the seals are hard or have lost elasticity, it is usually due to exposure to temperatures in excess of 165°F. (+74°C). Shield the cylinder from the heat source to limit temperature to 350°F. (+177°C.) and replace with fluorocarbon seals.

4.2.1.2 – Cylinder body seal leak can generally be traced to a loose head. Torque the head to manufacturer's recommendation for that bore size.

Excessive pressure can also result in cylinder body seal leak. Determine maximum pressure to rated limits. Replace seals and retorque head as in paragraph above. Excessive pressure can also result in cylinder body seal leak. Determine if the pressure rating of the cylinder has been exceeded. If so, bring the operating pressure down to the rating of the cylinder and have the head replaced.

Pinched or extruded cylinder body seal will also result in a leak. Replace cylinder body seal and retorque as in paragraph above.

Cylinder body seal leakage due to loss of radial squeeze which shows up in the form of flat spots or due to wear on the O.D. or I.D. – Either of these are symptoms of normal wear due to high cycle rate or length of service. Replace seals as per paragraph above.

4.2.2 – **Internal Leakage**

4.2.2.1 – Piston seal leak (by-pass) 1 to 3 cubic inches per minute leakage is considered normal for piston ring construction. Virtually no static leak with lipseal type seals on piston should be expected. Piston seal wear is a usual cause of piston seal leakage. Replace seals as required.

4.2.2.2 – With lipseal type piston seals excessive back pressure due to over-adjustment of speed control valves could be a direct cause of rapid seal wear. Contamination in a hydraulic system can result in a scored cylinder bore, resulting in rapid seal wear. In either case, replace piston seals as required.

4.2.2.3 – What appears to be piston seal leak, evidenced by the fact that the cylinder drifts, is not always traceable to the piston. To make sure, it is suggested that one side of the cylinder piston be pressurized and the fluid line at the opposite port be disconnected. Observe leakage. If none is evident, seek the cause of cylinder drift in other component parts in the circuit.

4.2.3 – **Cylinder Fails to Move the Load**

4.2.3.1 – Pneumatic or hydraulic pressure is too low. Check the pressure at the cylinder to make sure it is to circuit requirements.

4.2.3.2 – Piston Seal Leak – Operate the valve to cycle the cylinder and observe fluid flow at valve exhaust ports at end of cylinder stroke. Replace piston seals if flow is excessive.

4.2.3.3 – Cylinder is undersized for the load – Replace cylinder with one of a larger bore size.

4.3 Erratic or Chatter Operation

4.3.1 – Excessive friction at rod bearing or piston bearing due to load misalignment – Correct cylinder-to-load alignment.

4.3.2 – Cylinder sized too close to load requirements – Reduce load or install larger cylinder.

4.3.3 – Erratic operation could be traced to the difference between static and kinetic friction. Install speed control valves to provide a back pressure to control the stroke.

4.4 Cylinder Modifications, Repairs, or Failed Component – Cylinders as shipped from the factory are not to be disassembled and or modified. If cylinders require modifications, these modifications must be done at company locations or by the Company's certified facilities. The Industrial Cylinder Division Engineering Department must be notified in the event of a mechanical fracture or permanent deformation of any cylinder component (excluding seals). This includes a broken piston rod, head, mounting accessory or any other cylinder component. The notification should include all operation and application details. This information will be used to provide an engineered repair that will prevent recurrence of the failure.

It is allowed to disassemble cylinders for the purpose of replacing seals or seal assemblies. However, this work must be done by strictly following all the instructions provided with the seal kits.

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Offer of Sale

The items described in this document and other documents and descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors ("Seller") are hereby offered for sale at prices to be established by Seller. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. All goods, services or work described will be referred to as "Products".

1. Terms and Conditions. Seller's willingness to offer Products, or accept an order for Products, to or from Buyer is subject to these Terms and Conditions or any newer version of the terms and conditions found on-line at www.parker.com/saleterms/. Seller objects to any contrary or additional terms or conditions of Buyer's order or any other document issued by Buyer.

2. Price Adjustments; Payments. Prices stated on Seller's quote or other documentation offered by Seller are valid for 30 days, and do not include any sales, use, or other taxes unless specifically stated. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2010). Payment is subject to credit approval and is due 30 days from the date of invoice or such other term as required by Seller's Credit Department, after which Buyer shall pay interest on any unpaid invoices at the rate of 1.5% per month or the maximum allowable rate under applicable law.

3. Delivery Dates; Title and Risk; Shipment. All delivery dates are approximate and Seller shall not be responsible for any damages resulting from any delay. Regardless of the manner of shipment, title to any products and risk of loss or damage shall pass to Buyer upon placement of the products with the shipment carrier at Seller's facility. Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyers' request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions.

4. Warranty. Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of eighteen months from the date of delivery to Buyer. The prices charged for Seller's products are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED HEREUNDER. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

5. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 10 days of delivery. No other claims against Seller will be allowed unless asserted in writing within 30 days after delivery. Buyer shall notify Seller of any alleged breach of warranty within 30 days after the date the defect is or should have been discovered by Buyer. Any action based upon breach of this agreement or upon any other claim arising out of this sale (other than an action by Seller for an amount due on any invoice) must be commenced within 12 months from the date of the breach without regard to the date breach is discovered.

6. LIMITATION OF LIABILITY. UPON NOTIFICATION, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE. **IN NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENT, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.**

7. User Responsibility. The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

8. Loss to Buyer's Property. Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, will be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer ordering the items manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Special Tooling. A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

10. Buyer's Obligation; Rights of Seller. To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement shall be deemed a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest.

11. Improper use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

12. Cancellations and Changes. Orders shall not be subject to cancellation or change by Buyer for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change product features, specifications, designs and availability with notice to Buyer.

13. Limitation on Assignment. Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

14. Force Majeure. Seller does not assume the risk and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.

15. Waiver and Severability. Failure to enforce any provision of this agreement will not waive that provision nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

16. Termination. Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days written notice of termination. Seller may immediately terminate this agreement, in writing, if Buyer: (a) commits a breach of any provision of this agreement (b) appointments a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or by a third party (d) makes an assignment for the benefit of creditors, or (e) dissolves or liquidates all or a majority of its assets.

17. Governing Law. This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.

18. Indemnity for Infringement of Intellectual Property Rights. Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this Agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

19. Entire Agreement. This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.

20. Compliance with Law, U. K. Bribery Act and U.S. Foreign Corrupt Practices Act. Buyer agrees to comply with all applicable laws and regulations, including both those of the United Kingdom and the United States of America, and of the country or countries of the Territory in which Buyer may operate, including without limitation the U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA") and the U.S. Anti-Kickback Act (the "Anti-Kickback Act"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that they are familiar with the provisions of the U. K. Bribery Act, the FCPA and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer shall not make any payment or give anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase products or otherwise benefit the business of Seller.

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