



# ***Air Cylinder***

**Series *NCA1*** NFPA Interchangeable



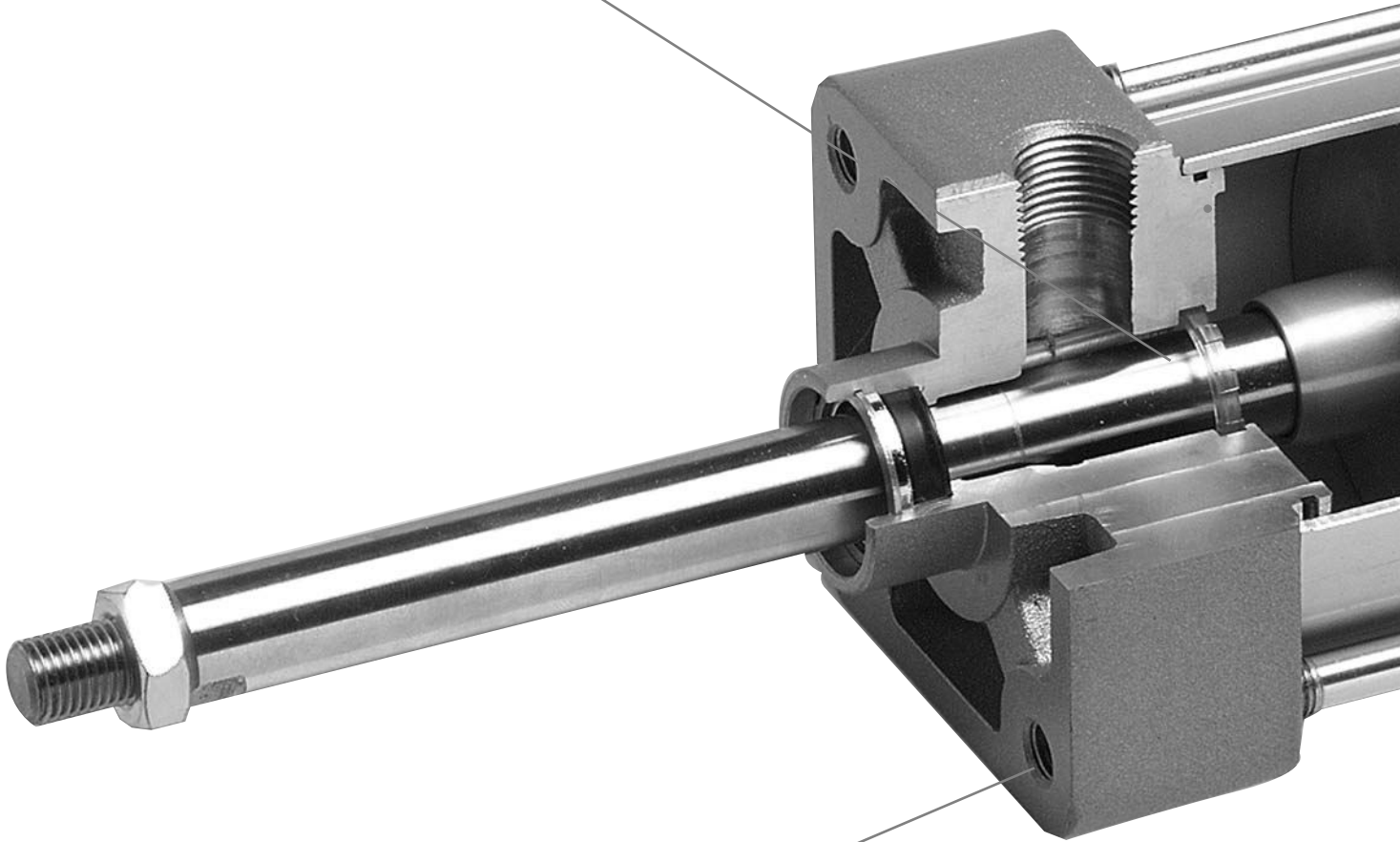
- Medium Duty 1.5" to 4" Bore
- 12 Different NFPA Mounting Options
- Non-Rotating Option
- Tandem Cylinder Option
- Auto Switch Capable

# ***Air Cylinder*** NFPA Interchangeable

## ***Series NCA1***

### **Improved cushion capacity**

"Floating" cushion seal design eliminates piston rod "bouncing" due to cracking pressure at beginning of stroke.



### **Compact and lightweight design**

The square covers are made of an aluminum die casting and provide a lower cost, lighter weight product.

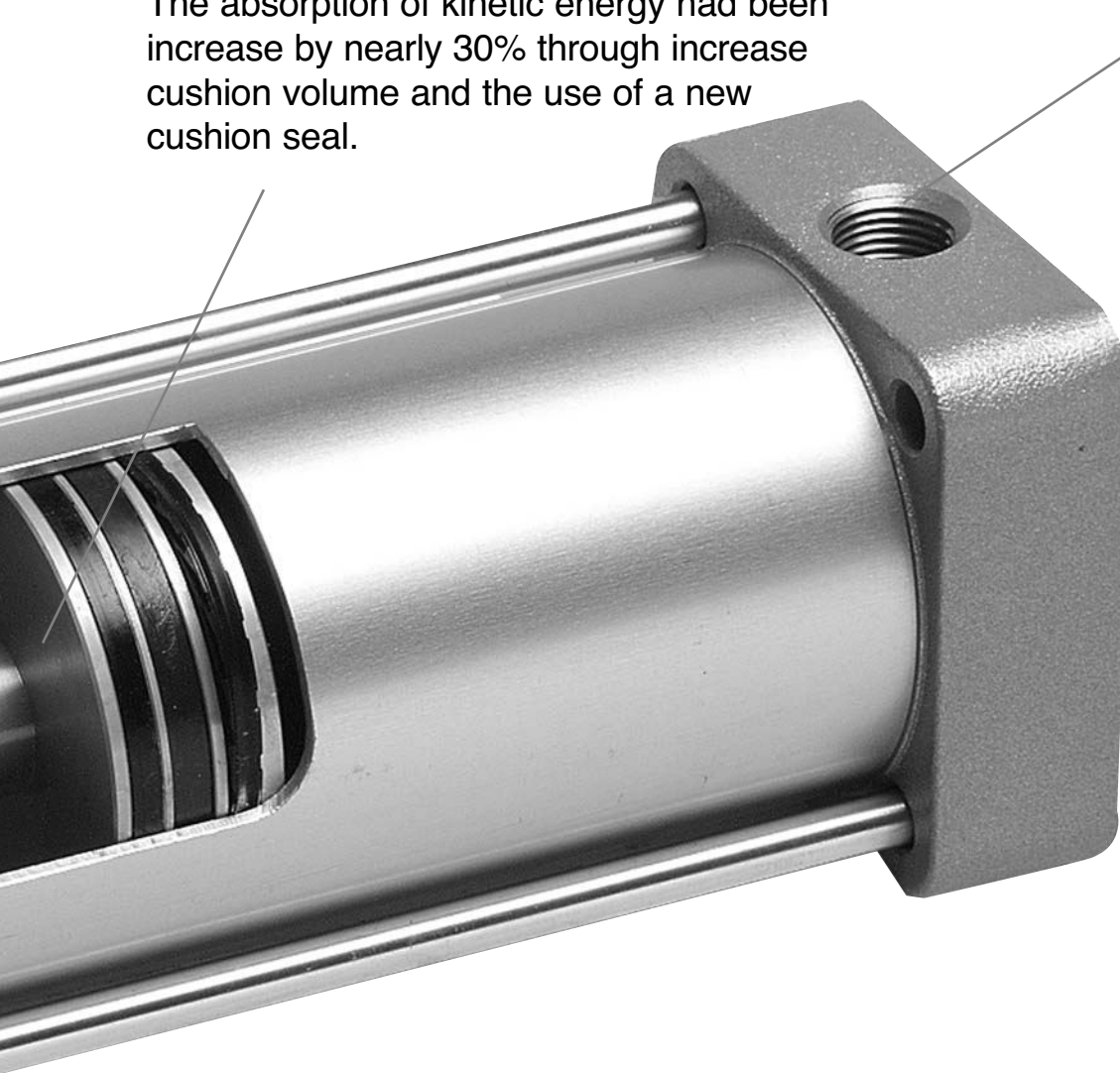
ø1.5", ø2", ø2.5", ø3.25", ø4"

## Increased kinetic energy absorption

The absorption of kinetic energy had been increase by nearly 30% through increase cushion volume and the use of a new cushion seal.

## Full port design

Allows for improved piston breakaway.



## Full range of NFPA interchangeable mounting configurations

Mounting Dimensions are in accordance with ANSI (NFPA) T3.6.7 R2-1996, Fluid Power Systems and Products - Square Head Industrial Cylinders - Mounting Dimensions.

# Table of Contents

|  |          |
|--|----------|
| How to Order .....   | 5        |
| Specifications .....   | 6        |
| Construction / Part List / Seal Kit .....                          | 7        |
| Basic Mounting .....   | 8        |
| Foot Mounting .....  | 8        |
| Front Flange Mounting .....  | 9        |
| Rear Flange Mounting .....   | 9        |
| Side Tapped Mounting .....   | 10       |
| Double Detachable Rear Clevis Mounting .....                       | 10       |
| Center Trunnion Mounting .....                                     | 11       |
| Single Detachable Rear Clevis Mounting .....                       | 11       |
| Double Rear Clevis Mounting .....                                  | 12       |
| Side Lug Mounting .....  | 12       |
| Rod Trunnion Mounting .....  | 13       |
| Head Trunnion Mounting.....  | 13       |
| Double Rod .....   | 14 to 16 |
| Non-Rotating Rod and Double Rod Non-Rotating .....                 | 17 to 24 |
| Stainless Steel Rod (XC6) Low Speed (XB9) .....                    | 25       |
| High Temperature (XB6) / Low Temperature (XB7) .....               | 26       |
| Special Trunnion Location (X46US) .....                            | 27 & 28  |
| Oversized Rod with Special Trunnion Location (XB5 - X46US) .....   | 29       |
| Stainless Steel Tie Rods / Tie Rod Nuts (X130US) .....             | 30       |
| Rod Boot .....   | 31       |
| Oversized Rod / Standard Rod and Non-Rotating (XB5 / X119US) ..... | 32 to 36 |
| Adjustable Stroke – Extended (XC8) .....                           | 37       |
| Adjustable Stroke – Return (XC9) .....                             | 38       |
| Dual Operation – Double Rod (XC10) .....                           | 39       |
| Dual Operation – Single Rod (XC11) .....                           | 40       |
| Special Rod End Modifications .....                                | 41       |
| Accessories .....  | 42       |
| Auto Switch Options .....  | 43 to 51 |
| Precautions .....  | 52 to 58 |

## How To Order

**NC D A1 B 150 - 04 00 - A51 - XB5**

**Auto Switch**

|     |                                    |
|-----|------------------------------------|
| Nil | Standard                           |
| D   | With Auto Switch (Magnetic Piston) |

**Model**

|     |                       |
|-----|-----------------------|
| Nil | Standard Cylinder     |
| K   | Non-Rotating Cylinder |
| W   | Double Rod            |
| M   | Male Rod Stud         |

**Mounting**

|   |     |                               |
|---|-----|-------------------------------|
| B | MX0 | Basic                         |
| L | MS1 | Foot                          |
| F | MF1 | Front Flange                  |
| G | MF2 | Rear Flange                   |
| R | MS4 | Side Tapped                   |
| D | MP2 | Double Detachable Rear Clevis |
| T | MT4 | Center Trunnion               |
| C | MP4 | Single Detachable Rear Clevis |
| X | MP1 | Double Rear Clevis            |
| S | MS2 | Side Lug                      |
| U | MT1 | Rod Trunnion                  |
| J | MT2 | Head Trunnion                 |

**Bore Size**

|     |       |
|-----|-------|
| 150 | 1.5"  |
| 200 | 2"    |
| 250 | 2.5"  |
| 325 | 3.25" |
| 400 | 4"    |

For larger bore size up to 32" bore. Please consult CAT: N304-EX.

**Standard Stroke**

Inches

**Stroke**

Hundredths of an Inch

**Options**

|        |  |
|--------|--|
| XB5    | Oversized Rod  |
| XB6    | High Temperature   |
| XB7    | Low Temperature  |
| XB9    | Low Speed  |
| XC6    | Stainless Steel Piston Rod   |
| XC8    | Adjustable Stroke Extended   |
| XC9    | Adjustable Stroke Return   |
| XC10   | Dual Operation/Double Rod  |
| XC11   | Dual Operation/Single Rod  |
| XC22   | Viton Seals  |
| XC35   | With Coil Scraper  |
| X46US  | Special Trunnion Location  |
| X119US | Non-Rotating Oversize Rod  |
| X130US | Stainless Steel Piston Rod, Tie Rod, Tie Rod Nut, Cushion Valve Needle |

For special rod end modifications please see page 41.

**No. of Switches**

|     |            |
|-----|------------|
| Nil | 2 Pieces   |
| S   | 1 Piece    |
| n   | "n" Pieces |

See Auto Switch Options pages

**Rod Boot**

|     |               |
|-----|---------------|
| Nil | Without Boot  |
| J   | Nylon Boot    |
| K   | Neoprene Boot |

**Air Cushion**

|     |           |
|-----|-----------|
| Nil | Both Ends |
| N   | None      |
| H   | Head End  |
| R   | Rod End   |

## Mounting Bracket Part Numbers

| Mounting Bracket / Bore | Part Number |           |            |             |           |
|-------------------------|-------------|-----------|------------|-------------|-----------|
|                         | 150 (1.5")  | 200 (2")  | 250 (2.5") | 325 (3.25") | 400 (4")  |
| Foot                    | NCA1-L150   | NCA1-L200 | NCA1-L250  | NCA1-L325   | NCA1-L400 |
| Flange                  | NCA1-F150   | NCA1-F200 | NCA1-F250  | NCA1-F325   | NCA1-F400 |
| Double Clevis (MP2)     | NCA1-D150   | NCA1-D200 | NCA1-D250  | NCA1-D325   | NCA1-D400 |
| Single Clevis           | NCA1-C150   | NCA1-C200 | NCA1-C250  | NCA1-C325   | NCA1-C400 |
| Side Lug                | NCA1-S150   | NCA1-S200 | NCA1-S250  | NCA1-S325   | NCA1-S400 |
| Double Clevis (MP1)     | NCA1-X150   | NCA1-X200 | NCA1-X250  | NCA1-X325   | NCA1-X400 |

\* These Kits are for Standard Single Rod/Double Acting Cylinders without Options. For Option Kits, please contact your local SMC sales office. One Kit required per cylinder.



The SMC NCA1 expanded series NFPA Industrial Interchangeable Pneumatic Cylinders are now available in bore sizes ranging from 5" to 8" Medium Duty, and 1.5" to 14" Heavy Duty.

The NCA1 Expanded Series Cylinders offer:

- Replaceable Rod Gland
- A full range of NFPA interchangeable mounting configurations
- Available in three construction types: Aluminum, Steel, and Stainless Steel
- Composite fiber tube optional
- Fully adjustable cushion

For further information, please consult your local SMC sales office.

## Specifications



| Type                    | Standard  | Double Rod   | Non-Rotating Rod  |
|-------------------------|---|--|---|
| Fluid                   | Air   | Air  | Air   |
| Lubrication             | Non-lube  | Non-lube   | Non-lube  |
| Max. Operating Pressure | 250psi (1.75MPa)  | 250 psi (1.75MPa)  | 250 psi* (1.75MPa)  |
| Min. Operating Pressure | 8 psi (0.06MPa)   | 8 psi (0.06MPa)  | 15 psi (0.1MPa)   |
| Ambient and Fluid Temp. | 40 to 140°F (5 to 60°C)   | 40 to 140°F (5 to 60°C)  | 40 to 140°F (5 to 60°C)   |
| Piston Speed            | 2 to 20in/s<br>(50 to 500mm/s)  | 2 to 20in/s<br>(50 to 500mm/s)                                   | 2 to 20in/s<br>(50 to 500mm/s)  |
| Mounting                | Basic, Foot<br>Front and Rear Flange<br>Side Tapped, Clevis<br>Center Trunnion, Side Lug<br>Rod and Head Trunnion | Basic , Foot<br>Flange<br>Side Tapped<br>Center and Rod Trunnion | Basic, Foot<br>Front and Rear Flange<br>Side Tapped, Clevis<br>Center Trunnion, Side Lug<br>Rod and Head Trunnion |
| Non-Rotating Accuracy   | n/a   | n/a  | ±0.50°  |

\* Rod and head trunnion maximum operating pressure for 325 and 400 bore is up to 150 psi

## Standard Strokes

(in)

| Bore Size | Standard Stroke   | Maximum Stroke |
|-----------|---|----------------|
| 1.5"      | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |                |
| 2", 2.5"  | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         | Consult SMC    |
| 3.25", 4" | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 |                |

## Base Material / Surface Treatment

| Description | Material       | Note          |
|-------------|----------------|---------------|
| Cover       | Aluminum alloy | Silver paint  |
| Tube        | Aluminum alloy | Hard alumite  |
| Seals       | Nitrile rubber | PLD, PLP      |
| Piston Rod  | Carbon steel   | Hard chromate |
| Piston      | Aluminum alloy | Hard alumite  |

## Weight / Aluminum Tube

(lbs)

| Bore Inch                       |                   | 150 (1.5") | 200 (2") | 250 (2.5") | 325 (3.25") | 400 (4") |
|---------------------------------|-------------------|------------|----------|------------|-------------|----------|
| Basic Weight                    | Basic type        | 1.58       | 2.35     | 3.19       | 6.03        | 7.79     |
|                                 | Foot mounting     | 1.95       | 2.86     | 3.80       | 7.45        | 10.1     |
|                                 | Flange mounting   | 2.30       | 3.22     | 4.34       | 8.85        | 11.66    |
|                                 | Clevis mounting   | 2.27       | 3.23     | 4.28       | 8.95        | 11.41    |
| Additional weight per 2" stroke | Trunnion mounting | 2.79       | 3.81     | 5.50       | 10.05       | 13.50    |
|                                 | For all mountings | 0.38       | 0.48     | 0.51       | 0.97        | 1.06     |

## Cylinder Bores and Forces: Push Stroke

| Bore (in) | Piston Area (in) | Forces (lbs); Push Stroke<br>Operating Medium Pressure (psi) |     |      |      |      |      |
|-----------|------------------|--|-----|------|------|------|------|
|           |                  | 50   | 60  | 80   | 100  | 200  | 250  |
| 1.5       | 1.767            | 88   | 106 | 141  | 177  | 353  | 442  |
| 2         | 3.142            | 157  | 188 | 251  | 314  | 628  | 785  |
| 2.5       | 4.909            | 245  | 295 | 393  | 491  | 982  | 1227 |
| 3.25      | 8.296            | 415  | 498 | 664  | 830  | 1659 | 2074 |
| 4         | 12.566           | 628  | 754 | 1005 | 1257 | 2513 | 3142 |

To calculate thrust forces not shown in the table, multiply operating pressure by piston area.

### How to use this table

- ① Locate column with desired operating pressure.
- ② Move down that column and locate the thrust value which is equal (or the next larger to the force to be delivered by the cylinder).
- ③ On that same line, locate in the first (left) column the bore size recommended for your application.

**Note:** These are *guide lines only*, which must be substantiated using additional data specific to your application.

## Cylinder Bores and Forces: Pull Stroke

| Piston Rod Diameter (in) | Piston Rod Area (in) | Forces (lbs); Pull Stroke (Deduct the listed thrusts corresponding to the rod size from push stroke pressure)<br>Operating Medium Pressure (psi) |    |     |     |     |     |
|--------------------------|----------------------|--|----|-----|-----|-----|-----|
|                          |                      | 50   | 60 | 80  | 100 | 200 | 250 |
| 0.625                    | 0.307                | 15   | 18 | 25  | 31  | 61  | 77  |
| 1                        | 0.785                | 39   | 47 | 63  | 79  | 157 | 196 |
| 1.375                    | 1.485                | 74   | 89 | 119 | 148 | 297 | 371 |

To calculate pull forces not shown in the table, use the following formula:

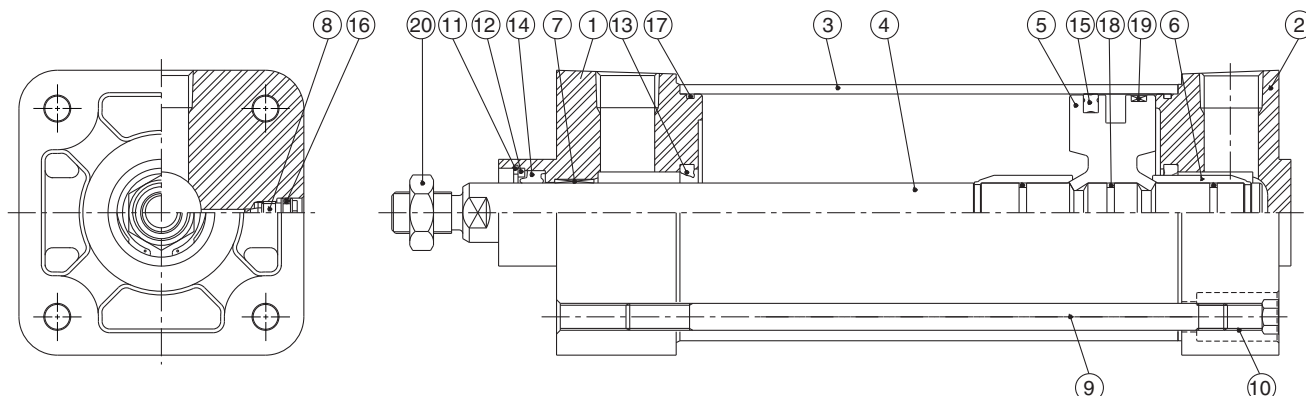
**Pull Force = (Piston Area-Rod Area) x Working Pressure**

### How to use this table

- ① To find the force on the pull stroke, locate the required piston rod diameter in the left most column.
- ② Moving to the right, locate the required working pressure.
- ③ Deduct the value shown at the intersection from the push stroke force value determined from the Push Stroke table. The resultant is the available pull stroke table.



## Construction / Parts List



## PartsList

| No. | Description          | Material       | 150   | 200               | 250               | 325               | 400               |
|-----|----------------------|----------------|---|-------------------|-------------------|-------------------|-------------------|
| 1   | Rod Cover            | Aluminum alloy | NCA150-02AQ6308-S   | NCA200-02AQ6309-S | NCA250-02AQ6310-S | NCA325-02AQ6311-S | NCA400-02AQ6312-S |
| 2   | Head Cover           | Aluminum alloy | NCA150-03-Q6308-S   | NCA200-03-Q6309-S | NCA250-03-Q6310-S | NCA325-03-Q6311-S | NCA400-03-Q6312-S |
| 3   | Cylinder Tube        | Aluminum alloy | Please see below for How to Order Cylinder Tube.  |                   |                   |                   |                   |
| 4   | Piston Rod           | Carbon steel   | Available only as an Assembled Item. Please see below for How to Order Piston Rod Assembly. |                   |                   |                   |                   |
| 5   | Piston               | Aluminum alloy | Available only as an Assembled Item. Please see below for How to Order Piston Rod Assembly. |                   |                   |                   |                   |
| 6   | Cushion Sphere       | Aluminum alloy | Available only as an Assembled Item. Please see below for How to Order Piston Rod Assembly. |                   |                   |                   |                   |
| 7   | Rod Bushing          | Bronze casting | Available only as an Assembly Item. Please see Rod/Head Cover.                              |                   |                   |                   |                   |
| 8   | Cushion Valve        | Carbon steel   | NC1A150-10-124  |                   |                   | NC1A325-10-125    |                   |
| 9   | Tie Rod              | Carbon steel   | Please see below for How to Order Tie Rod.  |                   |                   |                   |                   |
| 10  | Tie Rod Nut          | Carbon steel   | NCA150-13-Q6308   | NCA200-13-Q6309   |                   | NCA325-13-Q6311   | NCA325-13-Q6311   |
| 11  | Retaining Ring       | Carbon steel   | 5008-93   |                   |                   | 5008-131          |                   |
| 12  | Rod Seal Retainer    | Resin          | NCA150-31-Q6308   | NCA150-31-Q6308   | NCA150-31-Q6308   | NCA325-31-Q6311   | NCA325-31-Q6311   |
| 13* | Cushion Seal         | NBR            | Available only as an Assembled Item. Please see below for How to Order Seal Kit.            |                   |                   |                   |                   |
| 14* | Rod Seal             | NBR            | Available only as an Assembled Item. Please see below for How to Order Seal Kit.            |                   |                   |                   |                   |
| 15* | Piston Seal          | NBR            | Available only as an Assembled Item. Please see below for How to Order Seal Kit.            |                   |                   |                   |                   |
| 16* | Cushion Valve Seal   | NBR            | Available only as an Assembled Item. Please see below for How to Order Seal Kit.            |                   |                   |                   |                   |
| 17* | Cylinder Tube Gasket | NBR            | Available only as an Assembled Item. Please see below for How to Order Seal Kit.            |                   |                   |                   |                   |
| 18  | Piston Gasket        | NBR            | Available only as an Assembled Item. Please see below for How to Order Piston Rod Assembly. |                   |                   |                   |                   |
| 19  | Wear Ring            | Resin          | Available only as an Assembled Item. Please see below for How to Order Piston Rod Assembly. |                   |                   |                   |                   |
| 20  | Jam Nut              | Carbon steel   | JM-045  | JM-045            | JM-045            | JM-10             | JM-10             |

\*Components include in a seal kit.

## How To Order Seal Kits

**NC1A W 150 - PS -**

| Option | Bore | Special Options                         |
|--------|------|---|
| Nil    | 150  | XB5*** Over sized rod                   |
| W      | 200  | XB6*** High temperature                 |
| K*     | 250  | XB7*** Low temperature                  |
|        | 325  | XB5B6*** Oversized w/ high temperature* |
|        | 400  | XC11 Dual Operation/Single Rod**        |

\* available for 150, 200 and 250 bores only  
 \*\* use single rod designation when ordering XC11 kit  
 Note: XC10 seal kit order 2 single rod kits  
 \*\*\* not available with K option

## How To Order Cylinder Tube

### Double Acting Single Rod

**NC1A 150 - 04 - 0400**

| Bore | Stroke                               |
|------|--------------------------------------|
| 150  | (In Inches and Hundredths of Inches) |
| 200  |                                      |
| 250  |                                      |
| 325  |                                      |
| 400  |                                      |

## How To Order Piston Rod Assembly

### Double Acting Single Rod

**NCA1 150 - 26A - 0400**

| Bore | Stroke                               |
|------|--------------------------------------|
| 150  | (In Inches and Hundredths of Inches) |
| 200  |                                      |
| 250  |                                      |
| 325  |                                      |
| 400  |                                      |

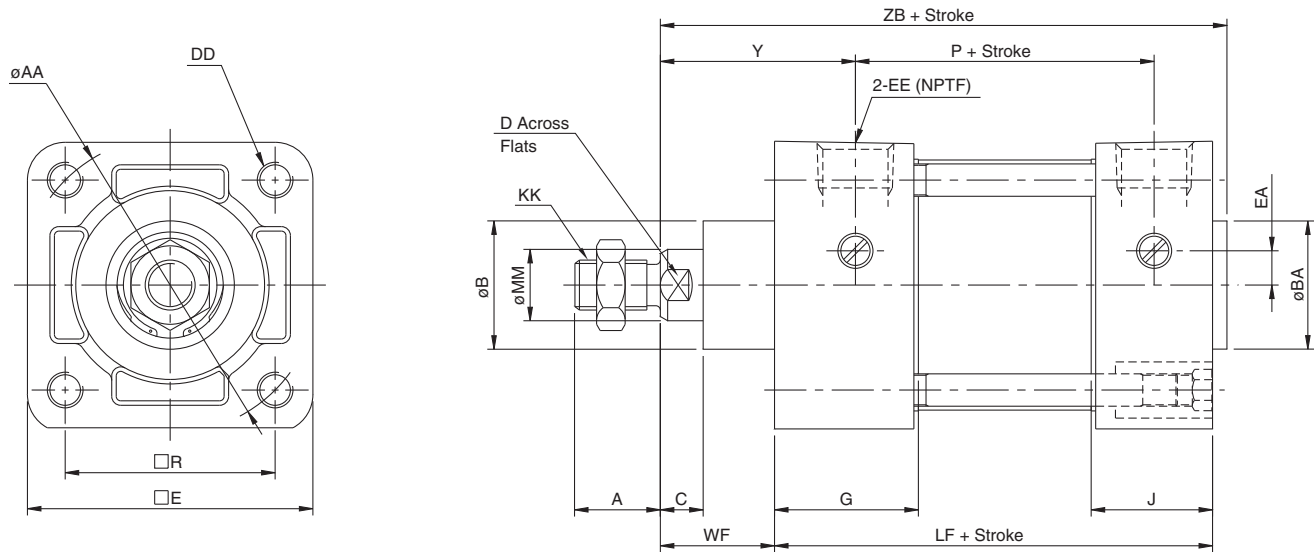
## How To Order Tie Rods

**NC1A 150 - 11 - 2759 - 0400**

| Applicable Bore | Bore | Tie Rod Size | Stroke                               |
|-----------------|------|--------------|--------------------------------------|
| 150             | 150  | 2759         | (In Inches and Hundredths of Inches) |
| 200             | 200  | 2760         |                                      |
| 250             | 200  | 2760         |                                      |
| 325             | 325  | 2761         |                                      |
| 400             | 325  | 2761         |                                      |

Note: Quantity is one piece. Not applicable for types: Double rod (W), Trunnion (T), XC8, XC9, XC10, XC11, Over sized rod (XB5) with front mounts. Please consult your local SMC sales office.

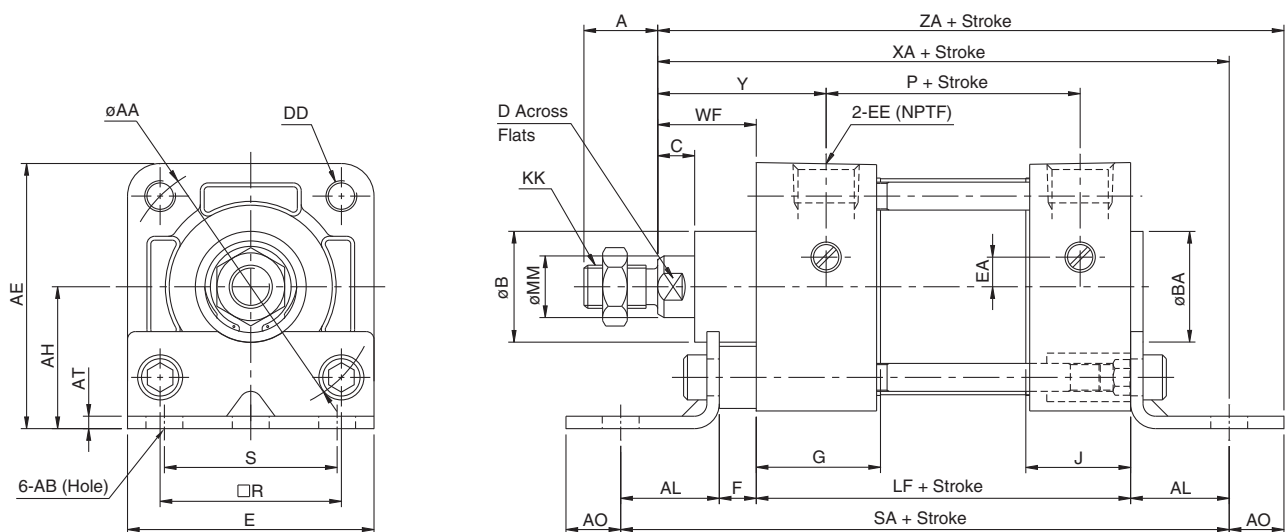
## Basic Mounting Type NC ■ A1B (MX0 Mounting Style)



(in)

| Bore (in)   | MM  | KK      | A     | AA   | B     | BA    | C   | D    | DD      | E     | EA  | EE  | G    | J    | R    | WF    | Y    | LF    | P    | ZB      |
|-------------|-----|---------|-------|------|-------|-------|-----|------|---------|-------|-----|-----|------|------|------|-------|------|-------|------|---------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 1.1  | 1.43 | 1     | 1.71 | 3 5/8 | 2.36 | 4 3/4   |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 1.06 | 1.84 | 1     | 1.71 | 3 5/8 | 2.4  | 4 3/4   |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 1.06 | 2.19 | 1     | 1.75 | 3 3/4 | 2.48 | 4 7/8   |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 1.18 | 2.76 | 1 3/8 | 2.34 | 4 1/4 | 2.72 | 5 53/64 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 1.18 | 3.32 | 1 3/8 | 2.34 | 4 1/4 | 2.72 | 5 53/64 |

## Foot Mounting Type NC ■ A1L (MS1 Mounting Style)

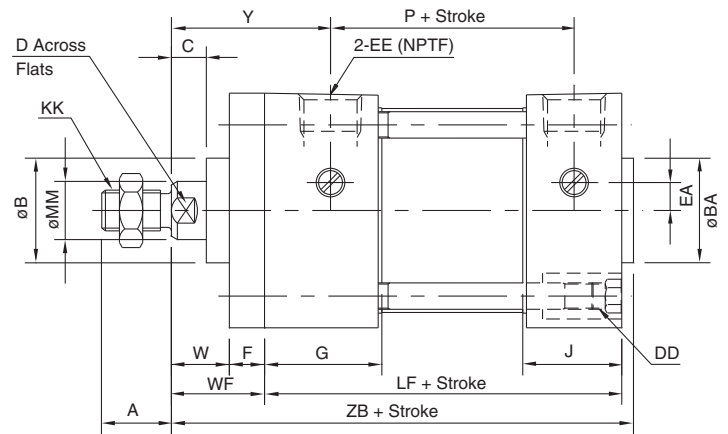
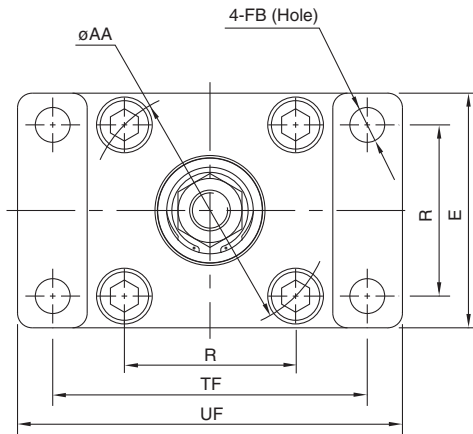


(in)

| Bore (in)   | MM  | KK      | A     | AA   | AB  | AE      | AH      | AL    | AO   | AT    | B     | BA    | C   | D    | DD      | E     | EA  | EE  | F   | G    | J    | R    | S     | WF    | Y    | P    | LF    | SA    | XA    | ZA     |
|-------------|-----|---------|-------|------|-----|---------|---------|-------|------|-------|-------|-------|-----|------|---------|-------|-----|-----|-----|------|------|------|-------|-------|------|------|-------|-------|-------|--------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 3/8 | 2 3/16  | 1 3/16  | 1     | 7/16 | 1/8   | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 3/8 | 1.26 | 1.1  | 1.43 | 1 1/4 | 1     | 1.71 | 2.36 | 3 5/8 | 6     | 5 5/8 | 6 1/16 |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 3/8 | 2 11/16 | 1 7/16  | 1     | 9/16 | 1/8   | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 1.26 | 1.06 | 1.84 | 1 3/4 | 1     | 1.71 | 2.4  | 3 5/8 | 6     | 5 5/8 | 6 3/16 |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 3/8 | 3 1/8   | 1 5/8   | 1     | 9/16 | 1/8   | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 1.3  | 1.06 | 2.19 | 2 1/4 | 1     | 1.75 | 2.48 | 3 3/4 | 6 1/8 | 5 3/4 | 6 5/16 |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1/2 | 3 13/16 | 1 15/16 | 1 1/4 | 3/4  | 11/64 | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 2.76 | 2 3/4 | 1 3/8 | 2.34 | 2.72 | 4 1/4 | 7 3/8 | 6 7/8 | 7 5/8  |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1/2 | 4 1/2   | 2 1/4   | 1 1/4 | 3/4  | 15/64 | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 3.32 | 3 1/2 | 1 3/8 | 2.34 | 2.72 | 4 1/4 | 7 3/8 | 6 7/8 | 7 5/8  |



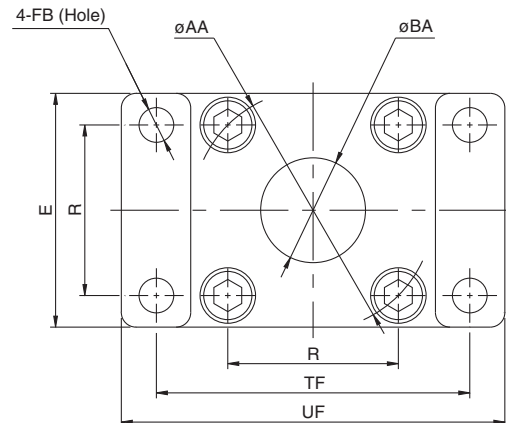
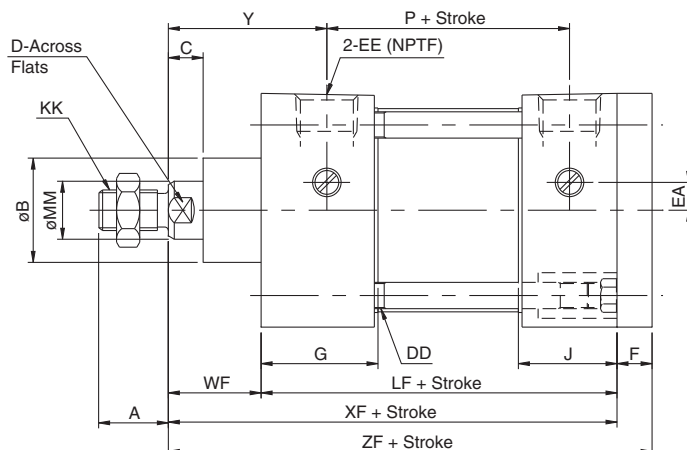
## Front Flange Mounting Type NC   A1F (MF1 Mounting Style)



(in)

| Bore (in)   | MM  | KK      | A     | AA   | B     | BA    | C   | D    | DD      | E     | EA  | EE  | F   | FB   | G    | J    | R    | TF      | UF    | W   | WF    | Y    | LF    | P    | ZB      |
|-------------|-----|---------|-------|------|-------|-------|-----|------|---------|-------|-----|-----|-----|------|------|------|------|---------|-------|-----|-------|------|-------|------|---------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 3/8 | 5/16 | 1.26 | 1.1  | 1.43 | 2 3/4   | 3 3/8 | 5/8 | 1     | 1.71 | 3 5/8 | 2.36 | 4 3/4   |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 3/8  | 1.26 | 1.06 | 1.84 | 3 3/8   | 4 1/8 | 5/8 | 1     | 1.71 | 3 5/8 | 2.4  | 4 3/4   |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 3/8  | 1.3  | 1.06 | 2.19 | 3 7/8   | 4 5/8 | 5/8 | 1     | 1.75 | 3 3/4 | 2.48 | 4 7/8   |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 7/16 | 1.57 | 1.18 | 2.76 | 4 11/16 | 5 1/2 | 3/4 | 1 3/8 | 2.34 | 4 1/4 | 2.72 | 5 53/64 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 7/16 | 1.57 | 1.18 | 3.32 | 5 7/16  | 6 1/4 | 3/4 | 1 3/8 | 2.34 | 4 1/4 | 2.72 | 5 53/64 |

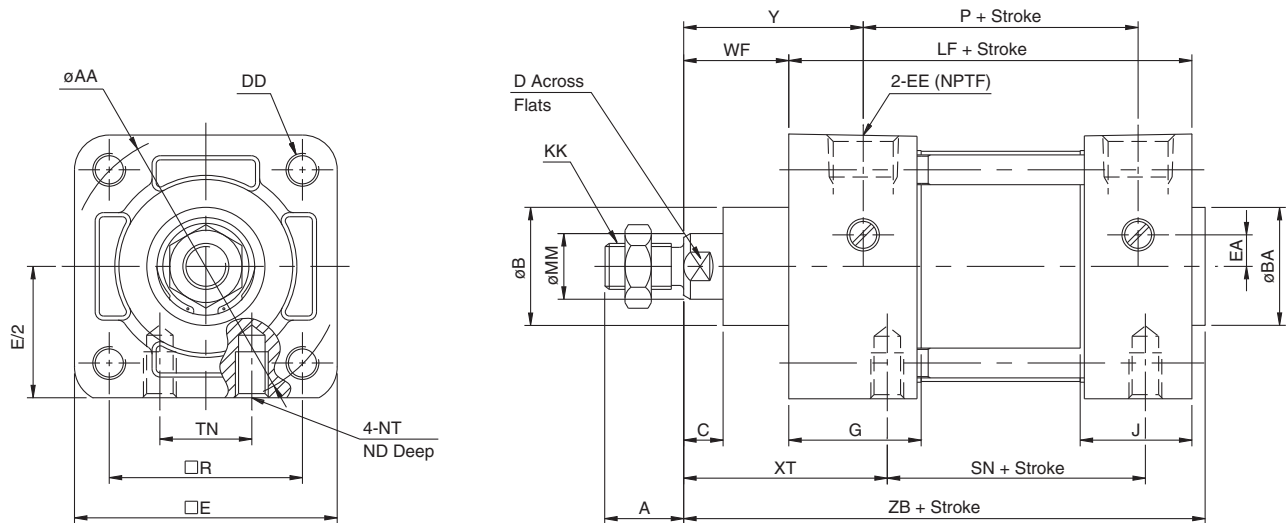
## Rear Flange Mounting Type NC   A1G (MF2 Mounting Style)



(in)

| Bore (in)   | MM  | KK      | A     | AA   | B     | BA    | C   | D    | DD      | E     | EA  | EE  | F   | FB   | G    | J    | R    | TF      | UF    | WF    | Y    | P    | XF    | ZF    |
|-------------|-----|---------|-------|------|-------|-------|-----|------|---------|-------|-----|-----|-----|------|------|------|------|---------|-------|-------|------|------|-------|-------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 3/8 | 5/16 | 1.26 | 1.1  | 1.43 | 2 3/4   | 3 3/8 | 1     | 1.71 | 2.36 | 4 5/8 | 5     |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 3/8  | 1.26 | 1.06 | 1.84 | 3 3/8   | 4 1/8 | 1     | 1.71 | 2.4  | 4 5/8 | 5     |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 3/8  | 1.3  | 1.06 | 2.19 | 3 7/8   | 4 5/8 | 1     | 1.75 | 2.48 | 4 3/4 | 5 1/8 |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 7/16 | 1.57 | 1.18 | 2.76 | 4 11/16 | 5 1/2 | 1 3/8 | 2.34 | 2.72 | 5 5/8 | 6 1/4 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 7/16 | 1.57 | 1.18 | 3.32 | 5 7/16  | 6 1/4 | 1 3/8 | 2.34 | 2.72 | 5 5/8 | 6 1/4 |

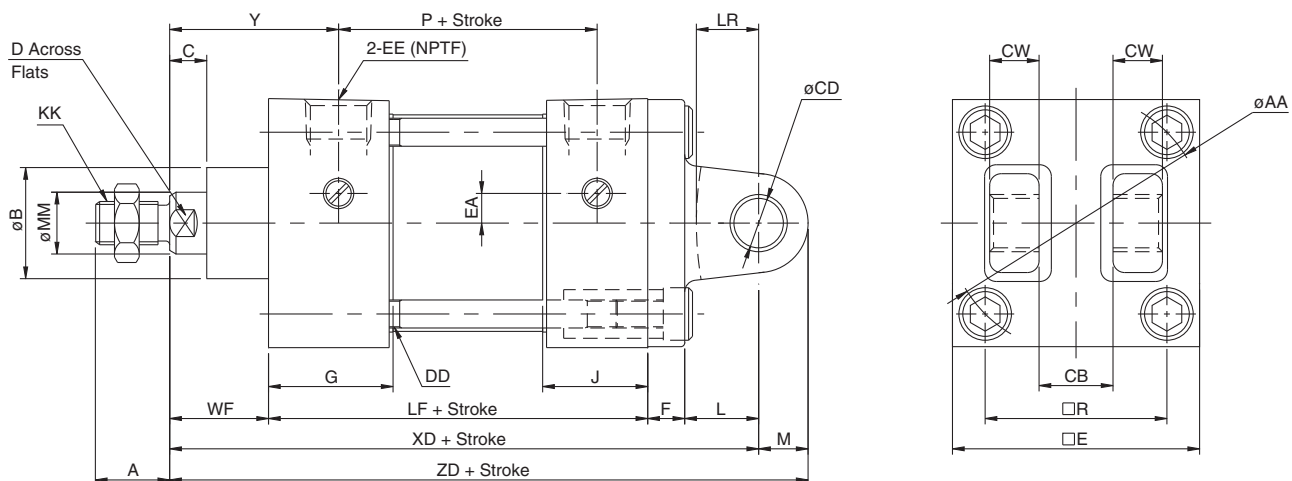
## Side Tapped Mounting Type NC ■ A1R (MS4 Mounting Style)



(in)

| Bore (in)   | MM  | KK      | A     | AA   | B     | BA    | C   | D    | DD      | E     | E/2   | EA  | EE  | G    | J    | ND    | NT      | R    | TN     | WF    | XT      | Y    | LF    | P    | SN    | ZB      |
|-------------|-----|---------|-------|------|-------|-------|-----|------|---------|-------|-------|-----|-----|------|------|-------|---------|------|--------|-------|---------|------|-------|------|-------|---------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 1     | 0.3 | 3/8 | 1.26 | 1.1  | 9/32  | 1/4-20  | 1.43 | 5/8    | 1     | 1 15/16 | 1.71 | 3 5/8 | 2.36 | 2 1/4 | 4 3/4   |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 1 1/4 | 0.3 | 3/8 | 1.26 | 1.06 | 7/16  | 5/16-18 | 1.84 | 7/8    | 1     | 1 15/16 | 1.71 | 3 5/8 | 2.4  | 2 1/4 | 4 3/4   |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 1 1/2 | 0   | 3/8 | 1.3  | 1.06 | 19/32 | 3/8-16  | 2.19 | 1 1/4  | 1     | 1 15/16 | 1.75 | 3 3/4 | 2.48 | 2 3/8 | 4 7/8   |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 1 7/8 | 0   | 1/2 | 1.57 | 1.18 | 5/8   | 1/2-13  | 2.76 | 1 1/2  | 1 3/8 | 2 7/16  | 2.34 | 4 1/4 | 2.72 | 2 5/8 | 5 53/64 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 2 1/4 | 0   | 1/2 | 1.57 | 1.18 | 5/8   | 1/2-13  | 3.32 | 2 1/16 | 1 3/8 | 2 7/16  | 2.34 | 4 1/4 | 2.72 | 2 5/8 | 5 53/64 |

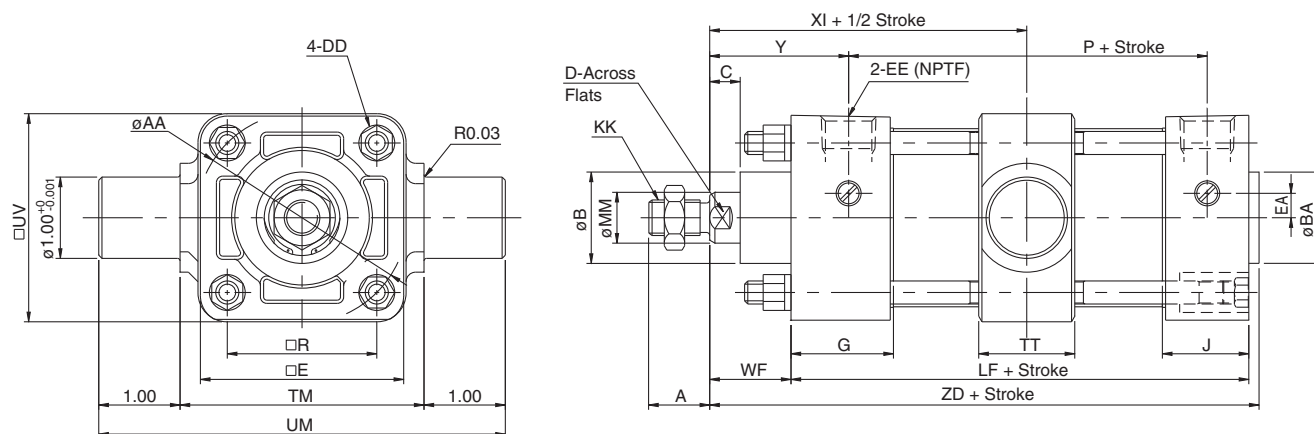
## Double Detachable Rear Clevis Mounting Type NC ■ A1D (MP2 Mounting Style)



(in)

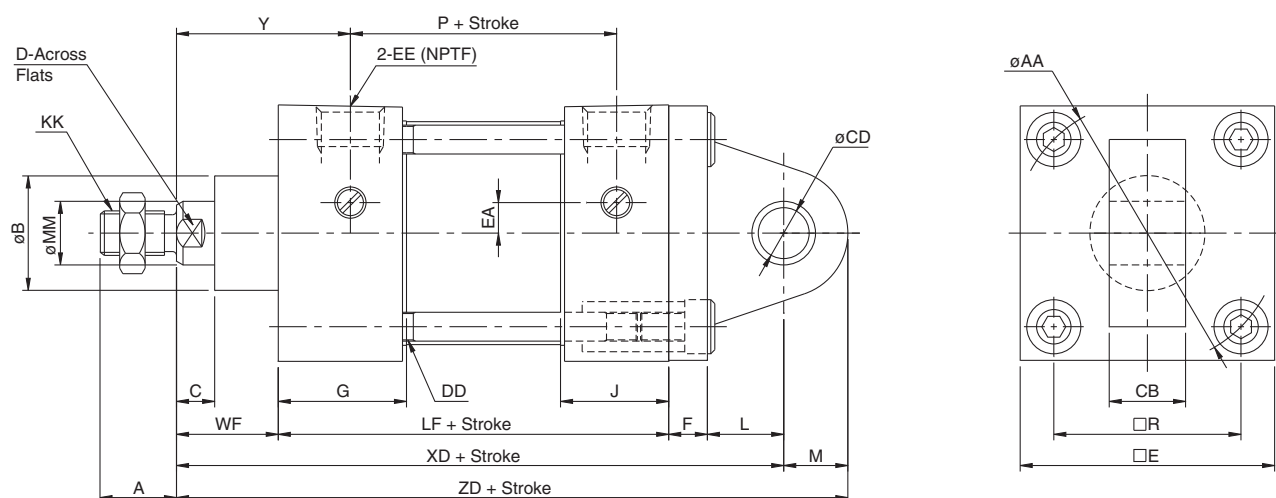
| Bore (in)   | MM  | KK      | A     | AA   | B     | C   | CB    | CD  | CW  | D    | DD      | E     | EA  | EE  | F   | G    | J    | L     | LR  | M   | R    | WF    | XD    | Y    | LF    | P    | ZD    |
|-------------|-----|---------|-------|------|-------|-----|-------|-----|-----|------|---------|-------|-----|-----|-----|------|------|-------|-----|-----|------|-------|-------|------|-------|------|-------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 3/8 | 3/4   | 1/2 | 1/2 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 3/8 | 1.26 | 1.1  | 3/4   | 5/8 | 1/2 | 1.43 | 1     | 5 3/4 | 1.71 | 3 5/8 | 2.36 | 6 1/4 |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 3/8 | 3/4   | 1/2 | 1/2 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 1.26 | 1.06 | 3/4   | 5/8 | 1/2 | 1.84 | 1     | 5 3/4 | 1.71 | 3 5/8 | 2.4  | 6 1/4 |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 3/8 | 3/4   | 1/2 | 1/2 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 1.3  | 1.06 | 3/4   | 5/8 | 1/2 | 2.19 | 1     | 5 7/8 | 1.75 | 3 3/4 | 2.48 | 6 3/8 |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1/2 | 1 1/4 | 3/4 | 5/8 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 1 1/4 | 1   | 3/4 | 2.76 | 1 3/8 | 7 1/2 | 2.34 | 4 1/4 | 2.72 | 8 1/4 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1/2 | 1 1/4 | 3/4 | 5/8 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 1 1/4 | 1   | 3/4 | 3.32 | 1 3/8 | 7 1/2 | 2.34 | 4 1/4 | 2.72 | 8 1/4 |

## Center Trunnion Mounting Type NC ■ A1T (MT4 Mounting Style)



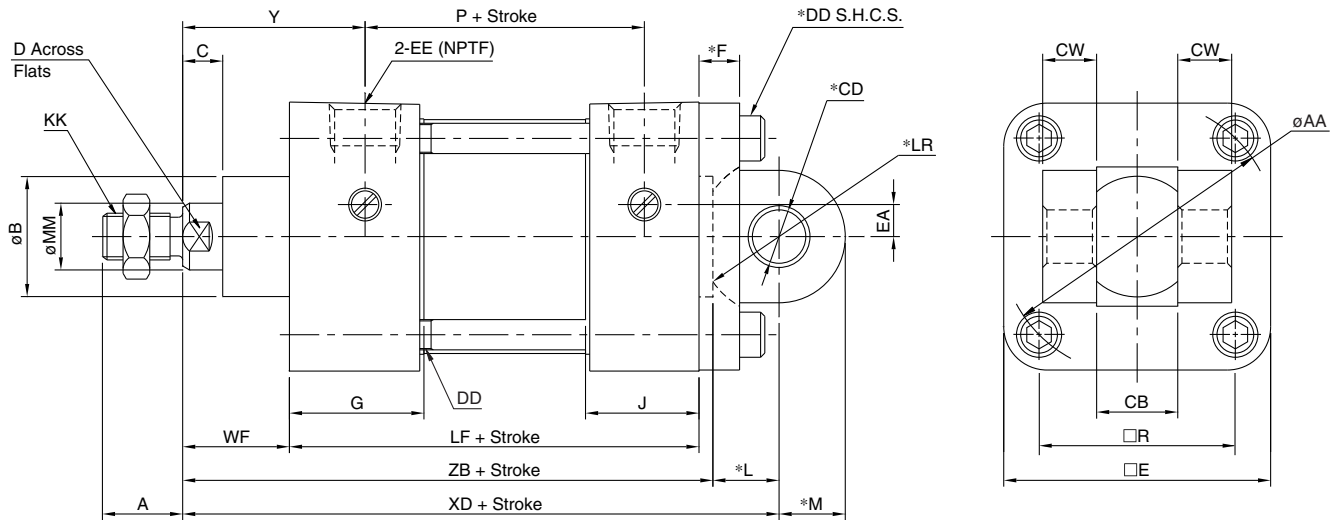
| Bore (in)   | MM  | KK      | A     | AA   | B     | BA    | C   | D    | DD      | E     | EA  | EE  | G    | J    | R    | TM   | TT   | UM   | UV   | WF    | Y    | P    | LF    | XI   | ZB      |
|-------------|-----|---------|-------|------|-------|-------|-----|------|---------|-------|-----|-----|------|------|------|------|------|------|------|-------|------|------|-------|------|---------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 1.1  | 1.43 | 2.5  | 1.18 | 4.5  | 2    | 1     | 1.71 | 2.36 | 3 5/8 | 2.89 | 4 3/4   |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 1.06 | 1.84 | 3    | 1.18 | 5    | 2.56 | 1     | 1.71 | 2.4  | 3 5/8 | 2.91 | 4 3/4   |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 1.06 | 2.19 | 3.5  | 1.18 | 5.5  | 3.39 | 1     | 1.75 | 2.48 | 3 3/4 | 2.99 | 4 7/8   |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 1.18 | 2.76 | 4.5  | 1.34 | 6.5  | 4.33 | 1 3/8 | 2.34 | 2.72 | 4 1/4 | 3.7  | 5 53/64 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 1.18 | 3.32 | 5.25 | 1.57 | 7.25 | 5.12 | 1 3/8 | 2.34 | 2.72 | 4 1/4 | 3.74 | 5 53/64 |

## Single Detachable Rear Clevis Mounting Type NC ■ A1C (MP4 Mounting Style)



| Bore (in)   | MM  | KK      | A     | AA   | B     | C   | CB    | CD  | D    | DD      | E     | EA  | EE  | F   | G    | J    | L     | M    | R    | WF    | XD    | Y    | LF    | P    | ZD    |
|-------------|-----|---------|-------|------|-------|-----|-------|-----|------|---------|-------|-----|-----|-----|------|------|-------|------|------|-------|-------|------|-------|------|-------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 3/8 | 3/4   | 1/2 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 3/8 | 1.26 | 1.1  | 3/4   | 0.63 | 1.43 | 1     | 5 3/4 | 1.71 | 3 5/8 | 2.36 | 6 3/8 |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 3/8 | 3/4   | 1/2 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 1.26 | 1.06 | 3/4   | 0.63 | 1.84 | 1     | 5 3/4 | 1.71 | 3 5/8 | 2.4  | 6 3/8 |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 3/8 | 3/4   | 1/2 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 1.3  | 1.06 | 3/4   | 0.63 | 2.19 | 1     | 5 7/8 | 1.75 | 3 3/4 | 2.48 | 6 1/2 |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1/2 | 1 1/4 | 3/4 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 1 1/4 | 0.87 | 2.76 | 1 3/8 | 7 1/2 | 2.34 | 4 1/4 | 2.72 | 8 3/8 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1/2 | 1 1/4 | 3/4 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 1 1/4 | 0.87 | 3.32 | 1 3/8 | 7 1/2 | 2.34 | 4 1/4 | 2.72 | 8 3/8 |

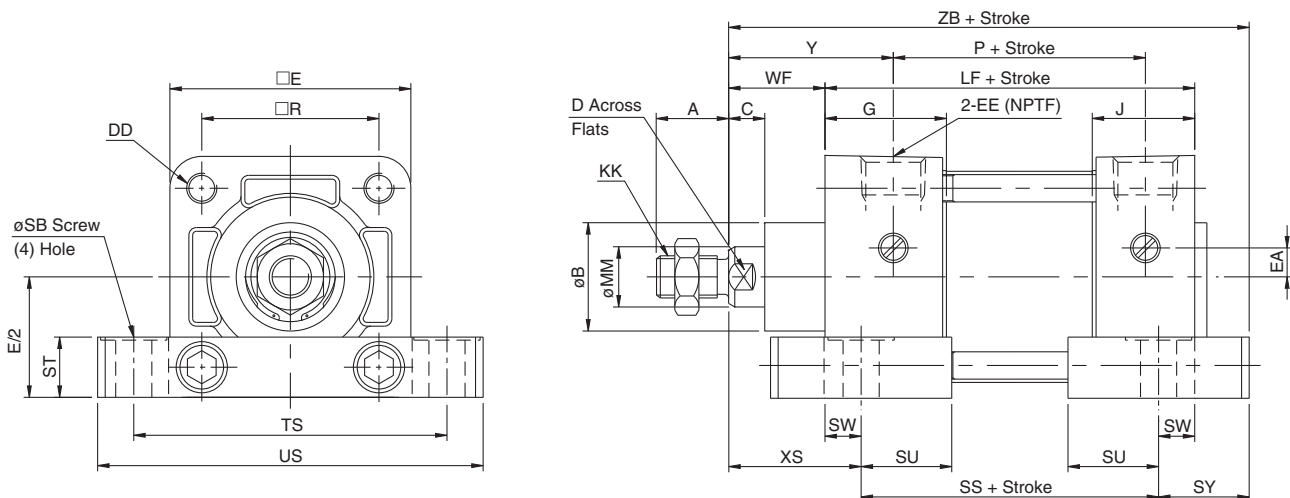
## Double Rear Clevis Mounting Type NC   A1X (MP1 Mounting Style)



| Bore (in)   | MM  | KK      | A     | AA   | B     | C   | CB    | CD  | CW  | D    | DD      | E     | EA  | EE  | F   | G    | J    | L    | LR   | R    | M    | WF    | XD    | Y    | LF    | P    | ZB   |
|-------------|-----|---------|-------|------|-------|-----|-------|-----|-----|------|---------|-------|-----|-----|-----|------|------|------|------|------|------|-------|-------|------|-------|------|------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 3/8 | 3/4   | 1/2 | 1/2 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 3/8 | 1.26 | 1.1  | 0.62 | 0.75 | 1.43 | 0.62 | 1     | 5 3/8 | 1.71 | 3 5/8 | 2.36 | 4.75 |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 3/8 | 3/4   | 1/2 | 1/2 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 1.26 | 1.06 | 0.62 | 0.75 | 1.84 | 0.62 | 1     | 5 3/8 | 1.71 | 3 5/8 | 2.4  | 4.75 |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 3/8 | 3/4   | 1/2 | 1/2 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 1.3  | 1.06 | 0.62 | 0.75 | 2.19 | 0.62 | 1     | 5 1/2 | 1.75 | 3 3/4 | 2.48 | 4.88 |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1/2 | 1 1/4 | 3/4 | 5/8 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 1.05 | 1.25 | 2.76 | 0.87 | 1 3/8 | 6 7/8 | 2.34 | 4 1/4 | 2.72 | 5.83 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1/2 | 1 1/4 | 3/4 | 5/8 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 1.05 | 1.25 | 3.32 | 0.87 | 1 3/8 | 6 7/8 | 2.34 | 4 1/4 | 2.72 | 5.83 |

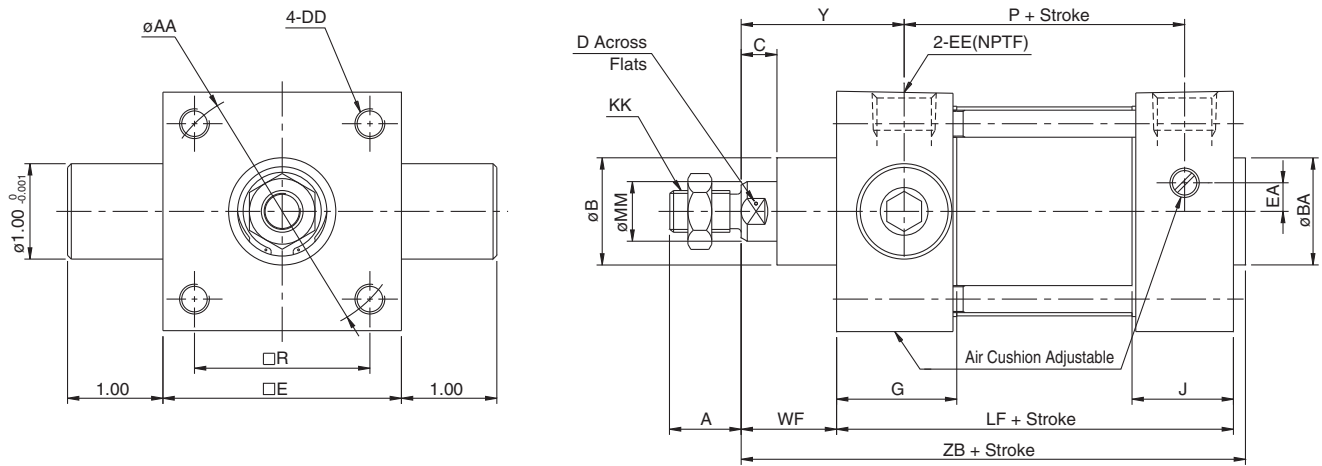
Note: Mounting dimensions are the same as NFPA (MP1) except where marked. (\*)

## Side Lug Mounting Type NC   A1S (MS2 Mounting Style)



| Bore (in)   | MM  | KK      | A     | B     | C   | D    | DD      | E     | EA  | EE  | G    | J    | LF   | P    | R    | SB  | SS   | ST  | SU   | SW  | SY   | TS   | US   | WF    | XS   | Y    | ZB   |
|-------------|-----|---------|-------|-------|-----|------|---------|-------|-----|-----|------|------|------|------|------|-----|------|-----|------|-----|------|------|------|-------|------|------|------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 1.1  | 3.63 | 2.36 | 1.43 | 3/8 | 2.88 | 5/8 | 0.94 | 3/8 | 0.94 | 2.75 | 3.50 | 1     | 1.38 | 1.71 | 5.19 |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 1.06 | 3.63 | 2.4  | 1.84 | 3/8 | 2.88 | 5/8 | 0.94 | 3/8 | 0.94 | 3.25 | 4    | 1     | 1.38 | 1.71 | 5.19 |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 1.06 | 3.75 | 2.48 | 2.19 | 3/8 | 3    | 3/4 | 0.94 | 3/8 | 0.94 | 3.75 | 4.50 | 1     | 1.38 | 1.75 | 5.31 |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 1.18 | 4.25 | 2.72 | 2.76 | 1/2 | 3.25 | 1   | 1.25 | 1/2 | 1.25 | 4.75 | 5.75 | 1 3/8 | 1.88 | 2.34 | 6.38 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 1.18 | 4.25 | 2.72 | 3.32 | 1/2 | 3.25 | 1   | 1.25 | 1/2 | 1.25 | 5.50 | 6.50 | 1 3/8 | 1.88 | 2.34 | 6.38 |

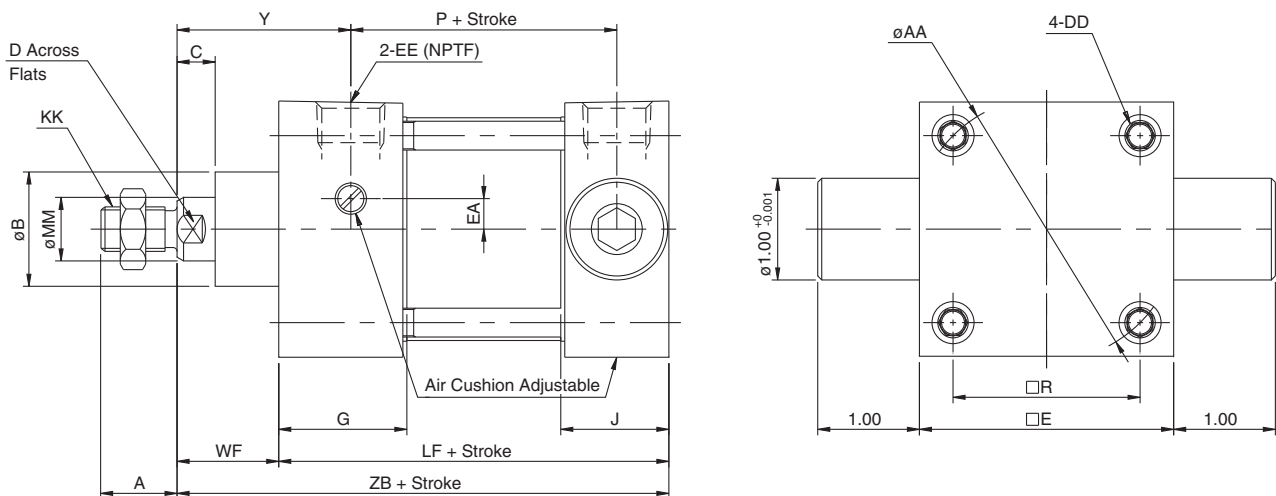
## Rod Trunnion Mounting Type NC   A1U (MT1 Mounting Style)



(in)

| Bore (in)   | MM  | KK      | A     | AA   | B     | BA    | C   | D    | DD      | E     | EA  | EE  | G    | J    | R    | WF    | Y    | LF    | P    | ZB   |
|-------------|-----|---------|-------|------|-------|-------|-----|------|---------|-------|-----|-----|------|------|------|-------|------|-------|------|------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 1.1  | 1.43 | 1     | 1.71 | 3 5/8 | 2.36 | 4.75 |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 1.06 | 1.84 | 1     | 1.71 | 3 5/8 | 2.4  | 4.75 |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 1.06 | 2.19 | 1     | 1.75 | 3 3/4 | 2.48 | 4.88 |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 1.18 | 2.76 | 1 3/8 | 2.34 | 4 1/4 | 2.72 | 5.83 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 1.18 | 3.32 | 1 3/8 | 2.34 | 4 1/4 | 2.72 | 5.83 |

## Head Trunnion Mounting Type NC   A1J (MT2 Mounting Style)



(in)

| Bore (in)   | MM  | KK      | A     | AA   | B     | C   | D    | DD      | E     | EA  | EE  | G    | J    | R    | WF    | Y    | LF   | P    | ZB   |
|-------------|-----|---------|-------|------|-------|-----|------|---------|-------|-----|-----|------|------|------|-------|------|------|------|------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 1.23 | 1.43 | 1     | 1.71 | 3.75 | 2.36 | 4.75 |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 1.19 | 1.84 | 1     | 1.71 | 3.75 | 2.4  | 4.75 |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 1.19 | 2.19 | 1     | 1.75 | 3.88 | 2.48 | 4.88 |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 1.38 | 2.76 | 1 3/8 | 2.34 | 4.45 | 2.72 | 5.83 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 1.38 | 3.32 | 1 3/8 | 2.34 | 4.45 | 2.72 | 5.83 |

## Specifications



- Standard with air cushion
- Auto-switch mounting available

| Bore size (inch)              | 1.5  | 2 | 2.5 | 3.25 | 4 |
|-------------------------------|--|---|-----|------|---|
| Media                         | Air  |   |     |      |   |
| Max. Operating Pressure       | 250 psi (17.5 kgf/cm <sup>2</sup> )                |   |     |      |   |
| Min. Operating Pressure       | 8 psi (0.5 kgf/cm <sup>2</sup> )                   |   |     |      |   |
| Ambient and Media Temperature | 40 to 140°F (5 to 60°C)                            |   |     |      |   |
| Piston Speed                  | 2 to 20 inch/sec (50 to 500mm/sec)                 |   |     |      |   |
| Cushion                       | Air Cushion Standard                               |   |     |      |   |
| Mounting Types                | Basic, Foot, Flange, Center Trunnion, Rod Trunnion |   |     |      |   |

## Standard Stroke List

(in)

| Bore size | Standard Stroke   |
|-----------|---|
| 1.5"      | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 2", 2.5"  | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 3.25", 4" | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 |

## How To Order

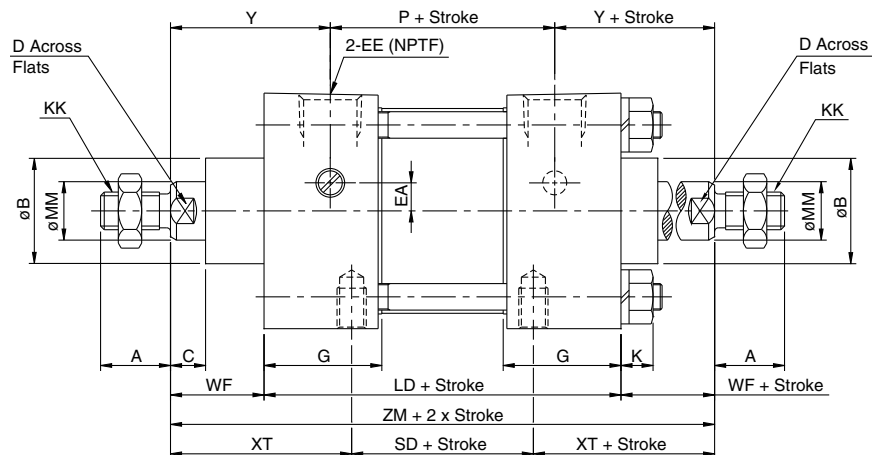
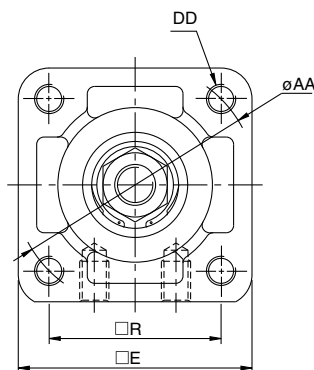
NCA1 W MOUNTING BORE - STROKE - SUFFIX

Ex: NCDA1WB 150-400

Auto-switch capable

Double Rod

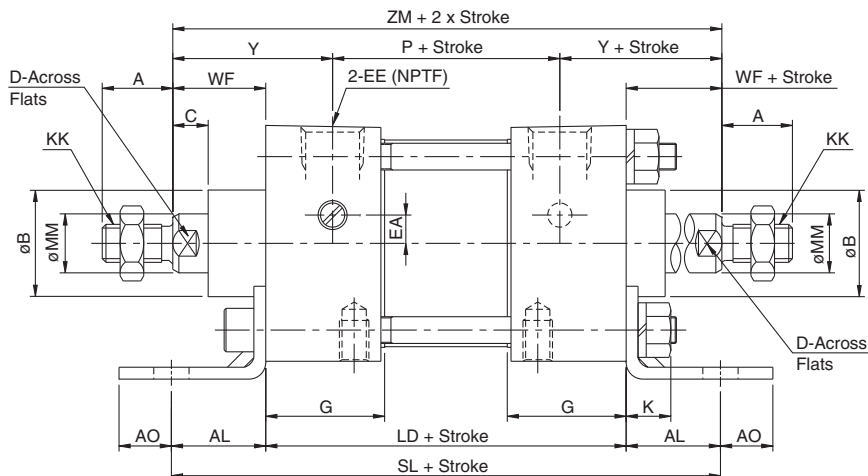
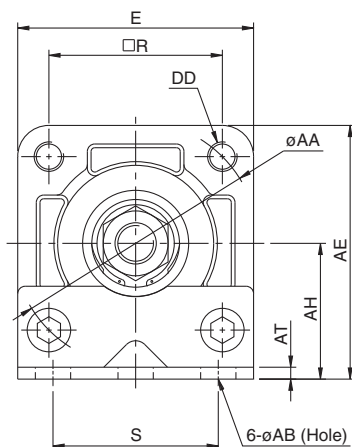
## Double Rod – Basic Mounting Type NC A1WB



(in)

| Bore (in)   | MM  | KK      | A     | AA   | B     | C   | D    | DD      | E     | EA  | EE  | G    | K    | LD   | P    | R    | WF    | Y    | ZM   | XT      | SD   |
|-------------|-----|---------|-------|------|-------|-----|------|---------|-------|-----|-----|------|------|------|------|------|-------|------|------|---------|------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 0.28 | 3.78 | 2.36 | 1.43 | 1     | 1.71 | 5.78 | 1 15/16 | 1.9  |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 0.34 | 3.82 | 2.4  | 1.84 | 1     | 1.71 | 5.82 | 1 15/16 | 1.94 |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 0.34 | 3.98 | 2.48 | 2.19 | 1     | 1.75 | 5.98 | 1 15/16 | 2.1  |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 0.42 | 4.64 | 2.72 | 2.76 | 1 3/8 | 2.34 | 7.4  | 2 7/16  | 2.52 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 0.42 | 4.64 | 2.72 | 3.32 | 1 3/8 | 2.34 | 7.4  | 2 7/16  | 2.52 |

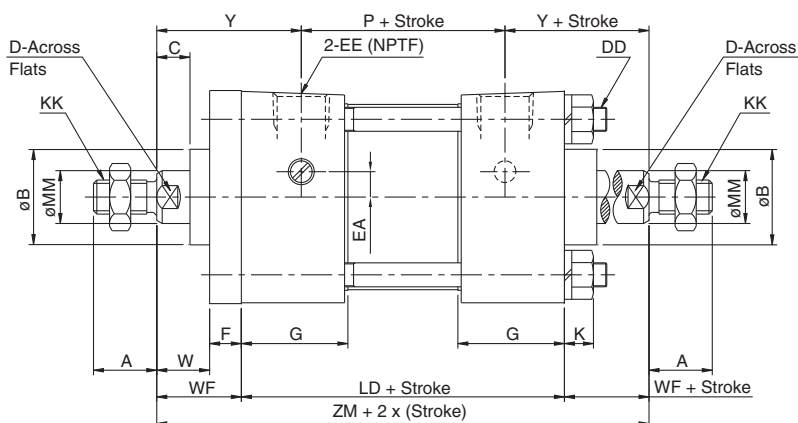
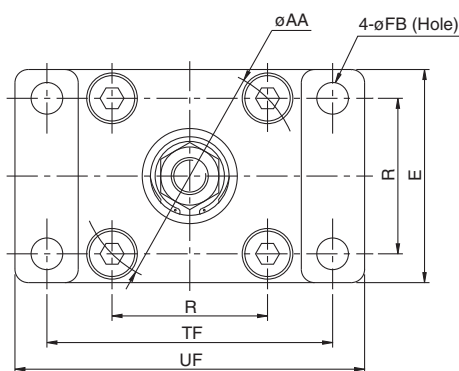
## Double Rod – Foot Mounting Type NC   A1WL



(in)

| Bore (in)   | MM  | KK      | A     | AA   | AB  | AE      | AH      | AL    | AO   | AT    | B     | C   | D    | DD      | E     | EA  | EE  | G    | K    | S     | WF    | Y    | P    | R    | LD   | SL   | ZM   |
|-------------|-----|---------|-------|------|-----|---------|---------|-------|------|-------|-------|-----|------|---------|-------|-----|-----|------|------|-------|-------|------|------|------|------|------|------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 3/8 | 2 3/16  | 1 3/16  | 1     | 7/16 | 1/8   | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 0.41 | 1 1/4 | 1     | 1.71 | 2.36 | 1.43 | 3.78 | 5.78 | 5.78 |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 3/8 | 2 11/16 | 1 7/16  | 1     | 9/16 | 1/8   | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 0.47 | 1 3/4 | 1     | 1.71 | 2.4  | 1.84 | 3.82 | 5.82 | 5.82 |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 3/8 | 3 1/8   | 1 5/8   | 1     | 9/16 | 1/8   | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 0.47 | 2 1/4 | 1     | 1.75 | 2.48 | 2.19 | 3.98 | 5.98 | 5.98 |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1/2 | 3 13/16 | 1 15/16 | 1 1/4 | 3/4  | 11/64 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 0.59 | 2 3/4 | 1 3/8 | 2.34 | 2.72 | 2.76 | 4.64 | 7.14 | 7.40 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1/2 | 4 1/2   | 2 1/4   | 1 1/4 | 3/4  | 15/64 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 0.65 | 3 1/2 | 1 3/8 | 2.34 | 2.72 | 3.32 | 4.64 | 7.14 | 7.40 |

## Double Rod – Front Flange Mounting Type NC   A1WF

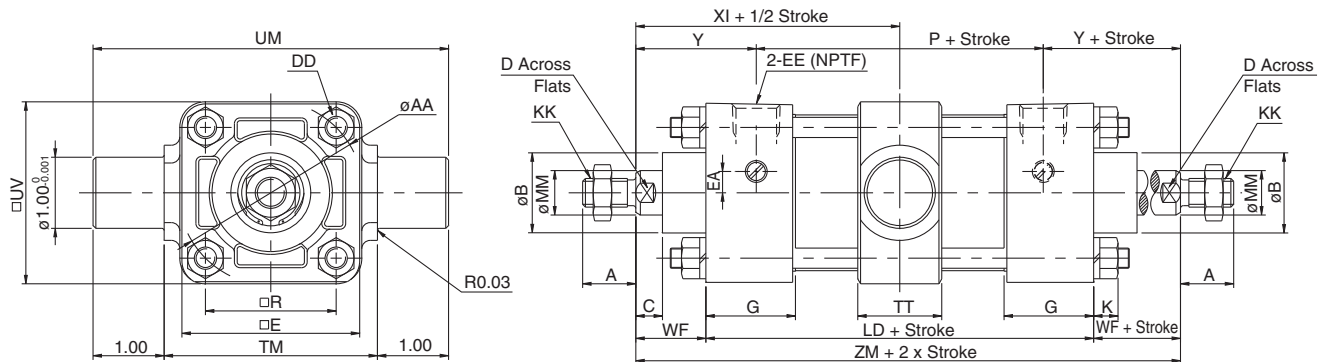


(in)

| Bore (in)   | MM  | KK      | A     | AA   | B     | C   | D    | DD      | E     | EA  | EE  | F   | FB   | G    | K    | R    | TF      | UF    | W   | WF    | Y    | LD   | P    | ZM   |
|-------------|-----|---------|-------|------|-------|-----|------|---------|-------|-----|-----|-----|------|------|------|------|---------|-------|-----|-------|------|------|------|------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 3/8 | 5/16 | 1.26 | 0.28 | 1.43 | 2 3/4   | 3 3/8 | 5/8 | 1     | 1.71 | 3.78 | 2.36 | 5.78 |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 3/8  | 1.26 | 0.34 | 1.84 | 3 3/8   | 4 1/8 | 5/8 | 1     | 1.71 | 3.82 | 2.4  | 5.82 |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 3/8  | 1.3  | 0.34 | 2.19 | 3 7/8   | 4 5/8 | 5/8 | 1     | 1.75 | 3.98 | 2.48 | 5.98 |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 7/16 | 1.57 | 0.42 | 2.76 | 4 11/16 | 5 1/2 | 3/4 | 1 3/8 | 2.34 | 4.64 | 2.72 | 7.40 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 7/16 | 1.57 | 0.42 | 3.32 | 5 7/16  | 6 1/4 | 3/4 | 1 3/8 | 2.34 | 4.64 | 2.72 | 7.40 |



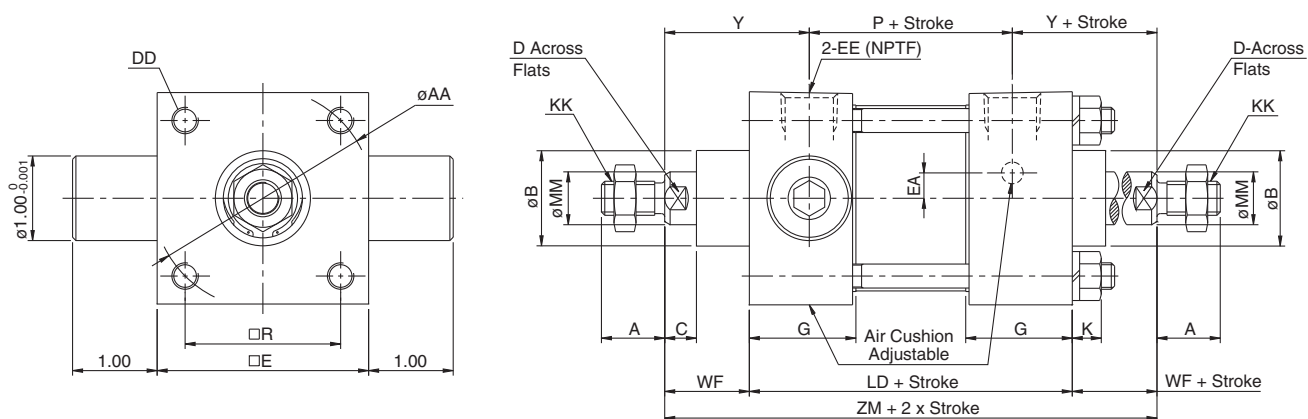
## Double Rod – Center Trunnion Mounting Type NC ■ A1WT



(in)

| Bore (in)   | MM  | KK      | A     | AA   | B     | C   | D    | DD      | E     | EA  | EE  | G    | K     | R    | TM   | TT   | UM   | UV   | WF    | Y    | P    | LD   | XI   | ZM   |
|-------------|-----|---------|-------|------|-------|-----|------|---------|-------|-----|-----|------|-------|------|------|------|------|------|-------|------|------|------|------|------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 0.281 | 1.43 | 2.5  | 1.18 | 4.5  | 2    | 1     | 1.71 | 2.36 | 3.78 | 2.89 | 5.78 |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 0.343 | 1.84 | 3    | 1.18 | 5    | 2.56 | 1     | 1.71 | 2.40 | 3.82 | 2.91 | 5.82 |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.30 | 0.343 | 2.19 | 3.5  | 1.18 | 5.5  | 3.39 | 1     | 1.75 | 2.48 | 3.98 | 2.99 | 5.98 |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1/2 | 7/8  | 3/8-16  | 3 3/4 | 0   | 1/2 | 1.57 | 0.421 | 2.76 | 4.5  | 1.34 | 6.5  | 4.33 | 1 3/8 | 2.34 | 2.72 | 4.64 | 3.70 | 7.40 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1/2 | 7/8  | 3/8-16  | 4 1/2 | 0   | 1/2 | 1.57 | 0.421 | 3.32 | 5.25 | 1.57 | 7.25 | 5.12 | 1 3/8 | 2.34 | 2.72 | 4.64 | 3.74 | 7.40 |

## Double Rod – Rod Trunnion Mounting Type NC ■ A1WU



(in)

| Bore (in)   | MM  | KK      | A     | AA   | B     | C   | D    | DD      | E     | EA  | EE  | G    | K     | R    | WF    | Y    | LD   | P    | ZM   |
|-------------|-----|---------|-------|------|-------|-----|------|---------|-------|-----|-----|------|-------|------|-------|------|------|------|------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 0.281 | 1.43 | 1     | 1.71 | 3.78 | 2.36 | 5.78 |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 0.343 | 1.84 | 1     | 1.71 | 3.82 | 2.40 | 5.82 |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 0.343 | 2.19 | 1     | 1.75 | 3.98 | 2.48 | 5.98 |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 0.421 | 2.76 | 1 3/8 | 2.34 | 4.64 | 2.72 | 7.40 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 0.421 | 3.32 | 1 3/8 | 2.34 | 4.64 | 2.72 | 7.40 |

## Specifications



- Non-rotating rod accuracy:  $\pm 0.5^\circ$
- Auto switch mounting available

| Bore size (inch)              | 1.5  | 2 | 2.5 |
|-------------------------------|--|---|-----|
| Media                         | Air  |   |     |
| Max. Operating Pressure       | 250 psi (17.5 kgf/cm <sup>2</sup> )  |   |     |
| Min. Operating Pressure       | 15 psi (1.05 kgf/cm <sup>2</sup> )   |   |     |
| Ambient and Media Temperature | 40 to 140°F (5 to 60°C)  |   |     |
| Piston Speed                  | 2 to 20 inch/sec (50 to 500mm/sec)   |   |     |
| Cushion                       | Air Cushion Standard   |   |     |
| Rotation Torque Range         | 3.9 Lbs. in or less  |   |     |
| Non-Rotating Rod Accuracy     | $\pm 0.5^\circ$  |   |     |
| Mounting Types                | Basic, Foot, Flange, Side Tapped<br>Center Trunnion, Rear Clevis, Side Lug |   |     |

## Standard Stroke List (in)

| Bore size | Standard Stroke                                 |
|-----------|---|
| 1.5"      | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24 |
| 2", 2.5"  | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24 |

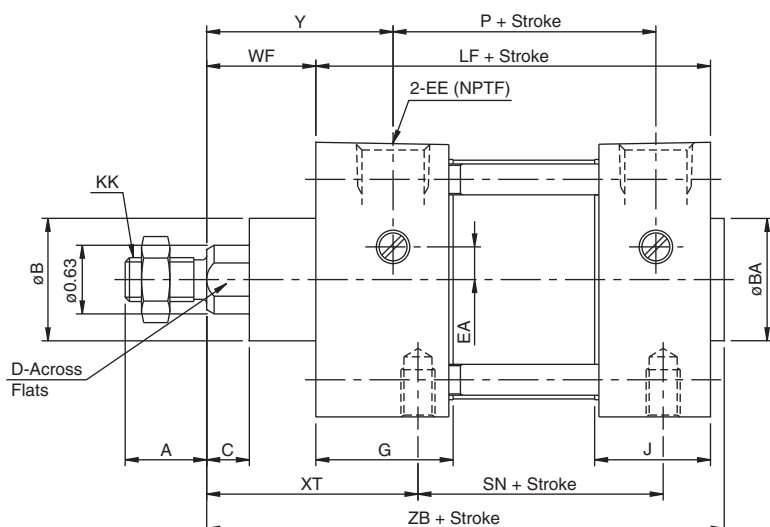
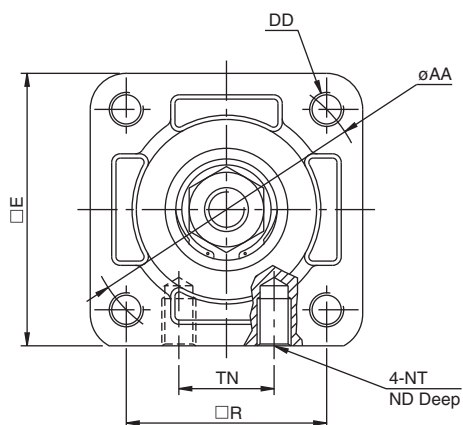
## How To Order

NCDA1 K MOUNTING BORE - STROKE - SUFFIX

Ex: NCDA1KB150-0400

Auto-switch capable

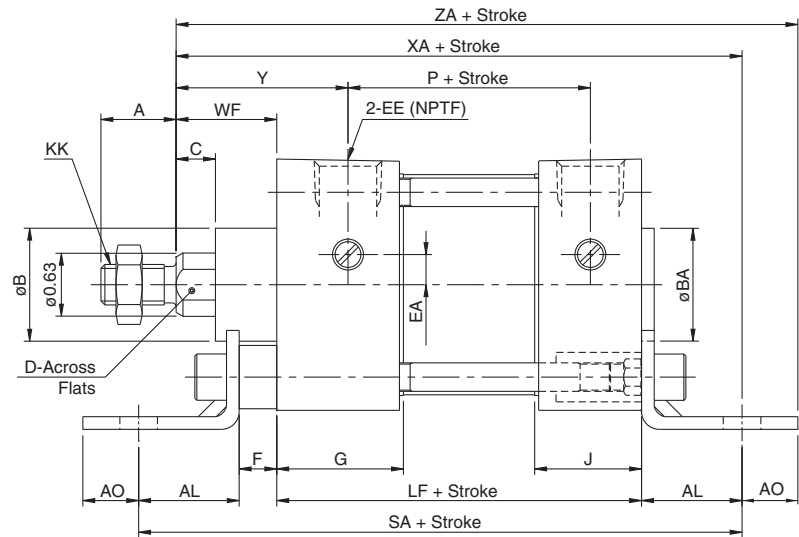
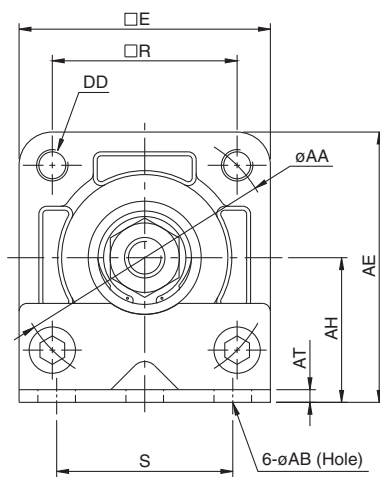
## Non-Rotating Rod – Basic Mounting Type NC A1KB



(in)

| Bore (in)  | KK      | A   | AA   | B     | BA    | C   | D     | DD      | E     | EA  | EE  | G    | J    | ND    | NT      | R    | WF | Y    | LF    | P    | ZB    | TN    | XT      | SN    |
|------------|---------|-----|------|-------|-------|-----|-------|---------|-------|-----|-----|------|------|-------|---------|------|----|------|-------|------|-------|-------|---------|-------|
| 150 (1.5") | 7/16-20 | 3/4 | 2.02 | 1 1/8 | 1 1/8 | 3/8 | 0.551 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 1.1  | 9/32  | 1/4-20  | 1.43 | 1  | 1.71 | 3 5/8 | 2.36 | 4 3/4 | 5/8   | 1 15/16 | 2 1/4 |
| 200 (2")   | 7/16-20 | 3/4 | 2.6  | 1 1/8 | 1 1/8 | 3/8 | 0.551 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 1.06 | 7/16  | 5/16-18 | 1.84 | 1  | 1.71 | 3 5/8 | 2.4  | 4 3/4 | 7/8   | 1 15/16 | 2 1/4 |
| 250 (2.5") | 7/16-20 | 3/4 | 3.1  | 1 1/8 | 1 1/8 | 3/8 | 0.551 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 1.06 | 19/32 | 3/8-16  | 2.19 | 1  | 1.75 | 3 3/4 | 2.48 | 4 7/8 | 1 1/4 | 1 15/16 | 2 3/8 |

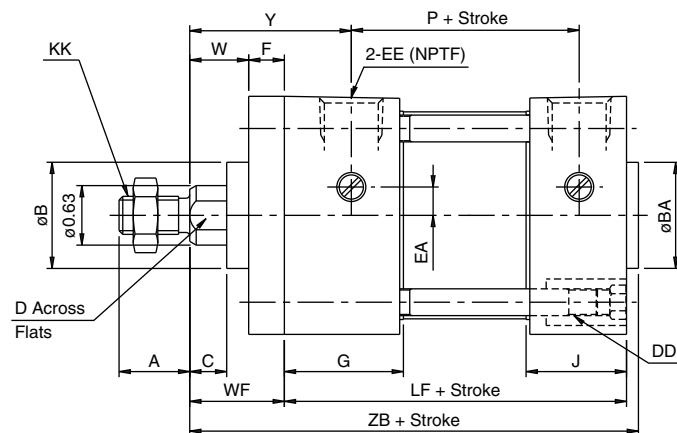
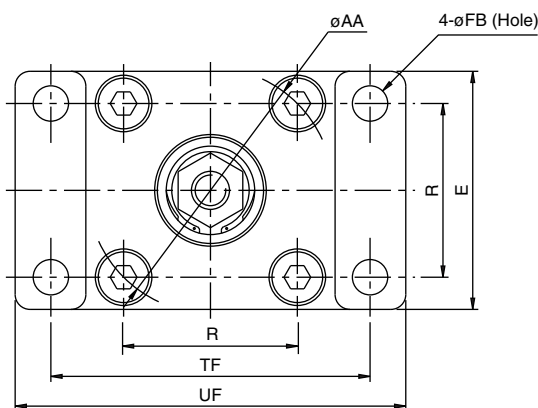
## Non-Rotating Rod – Foot Mounting Type NC ■ A1KL



(in)

| Bore (in)  | KK      | A   | AA   | AB  | AE      | AH     | AL | AO   | AT  | B     | BA    | C   | D     | DD      | E   | EA  | EE  | F   | J    | R    | S     | WF | Y    | P    | LF    | SA    | XA    | ZA    |
|------------|---------|-----|------|-----|---------|--------|----|------|-----|-------|-------|-----|-------|---------|-----|-----|-----|-----|------|------|-------|----|------|------|-------|-------|-------|-------|
| 150 (1.5") | 7/16-20 | 3/4 | 2.02 | 3/8 | 2 3/16  | 1 3/16 | 1  | 7/16 | 1/8 | 1 1/8 | 1 1/8 | 3/8 | 0.551 | 1/4-28  | 2   | 0.3 | 3/8 | 3/8 | 1.1  | 1.43 | 1 1/4 | 1  | 1.71 | 2.36 | 3 5/8 | 6     | 5 5/8 | 6.062 |
| 200 (2")   | 7/16-20 | 3/4 | 2.6  | 3/8 | 2 11/16 | 1 7/16 | 1  | 9/16 | 1/8 | 1 1/8 | 1 1/8 | 3/8 | 0.551 | 5/16-24 | 2.5 | 0.3 | 3/8 | 3/8 | 1.06 | 1.84 | 1 3/4 | 1  | 1.71 | 2.4  | 3 5/8 | 6     | 5 5/8 | 6.187 |
| 250 (2.5") | 7/16-20 | 3/4 | 3.1  | 3/8 | 3 1/8   | 1 5/8  | 1  | 9/16 | 1/8 | 1 1/8 | 1 1/8 | 3/8 | 0.551 | 5/16-24 | 3   | 0   | 3/8 | 3/8 | 1.06 | 2.19 | 2 1/4 | 1  | 1.75 | 2.48 | 3 3/4 | 6 1/8 | 5 3/4 | 6.321 |

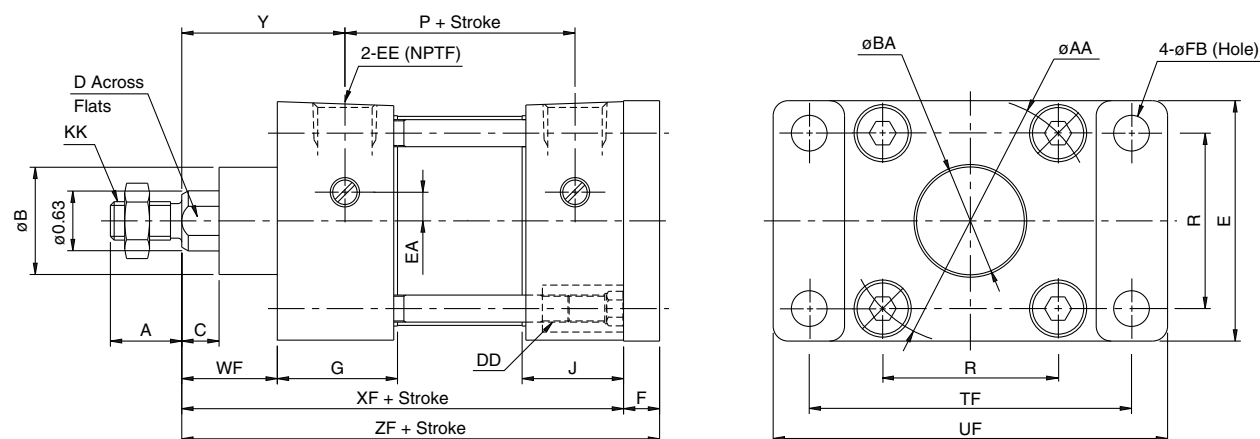
## Non-Rotating Rod – Front Flange Mounting Type NC ■ A1KF



(in)

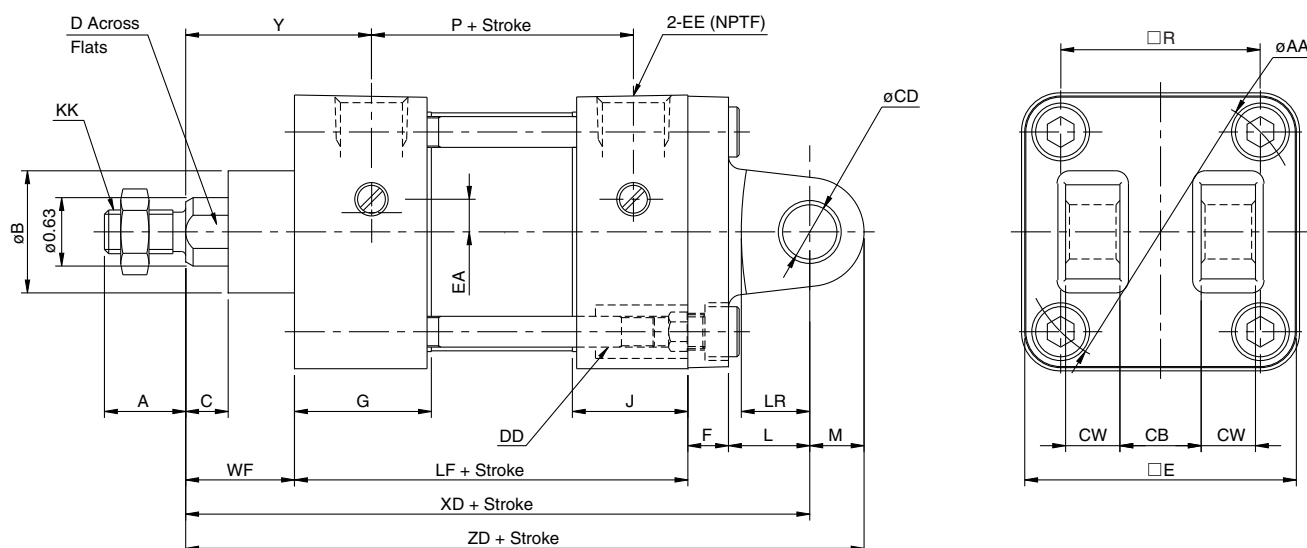
| Bore (in)  | KK      | A   | AA   | B     | BA    | C   | D     | DD      | E     | EA  | EE  | F   | FB   | G    | J    | R    | TF    | UF    | W   | WF | Y    | LF    | P    | ZB    |
|------------|---------|-----|------|-------|-------|-----|-------|---------|-------|-----|-----|-----|------|------|------|------|-------|-------|-----|----|------|-------|------|-------|
| 150 (1.5") | 7/16-20 | 3/4 | 2.02 | 1 1/8 | 1 1/8 | 3/8 | 0.551 | 1/4-28  | 2     | 0.3 | 3/8 | 3/8 | 5/16 | 1.26 | 1.1  | 1.43 | 2 3/4 | 3 3/8 | 5/8 | 1  | 1.71 | 3 5/8 | 2.36 | 4 3/4 |
| 200 (2")   | 7/16-20 | 3/4 | 2.6  | 1 1/8 | 1 1/8 | 3/8 | 0.551 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 3/8  | 1.26 | 1.06 | 1.84 | 3 3/8 | 4 1/8 | 5/8 | 1  | 1.71 | 3 5/8 | 2.4  | 4 3/4 |
| 250 (2.5") | 7/16-20 | 3/4 | 3.1  | 1 1/8 | 1 1/8 | 3/8 | 0.551 | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 3/8  | 1.3  | 1.06 | 2.19 | 3 7/8 | 4 5/8 | 5/8 | 1  | 1.75 | 3 3/4 | 2.48 | 4 7/8 |

## Non-Rotating Rod – Rear Flange Mounting Type NC ■ A1KG



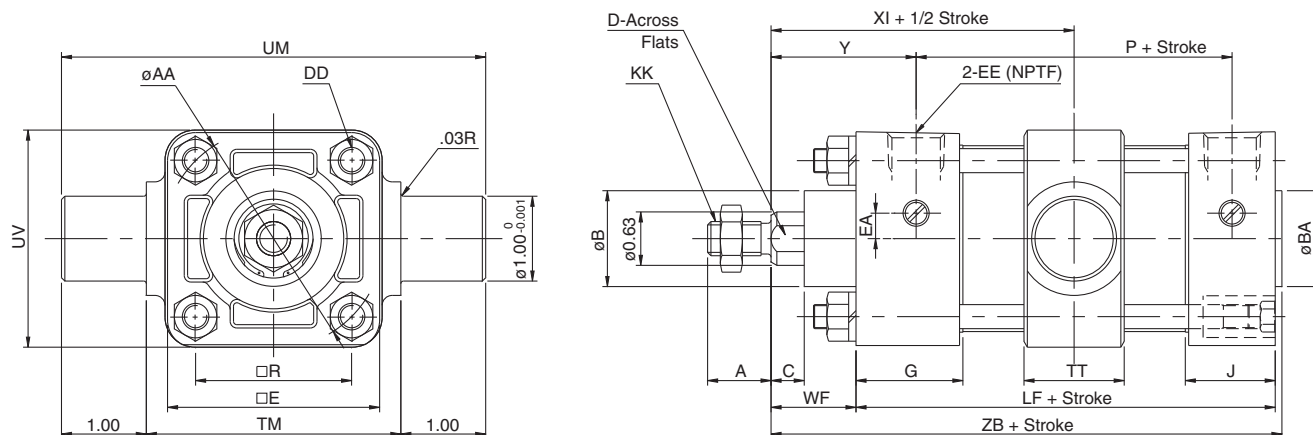
| Bore (in)  | KK      | A   | AA   | B     | BA    | C   | D     | DD      | E     | EA  | EE  | F   | FB   | G    | J    | R    | TF    | UF    | WF | Y    | P    | XF    | ZF    |
|------------|---------|-----|------|-------|-------|-----|-------|---------|-------|-----|-----|-----|------|------|------|------|-------|-------|----|------|------|-------|-------|
| 150 (1.5") | 7/16-20 | 3/4 | 2.02 | 1 1/8 | 1 1/8 | 3/8 | 0.551 | 1/4-28  | 2     | 0.3 | 3/8 | 3/8 | 5/16 | 1.26 | 1.1  | 1.43 | 2 3/4 | 3 3/8 | 1  | 1.71 | 2.36 | 4 5/8 | 5     |
| 200 (2")   | 7/16-20 | 3/4 | 2.6  | 1 1/8 | 1 1/8 | 3/8 | 0.551 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 3/8  | 1.26 | 1.06 | 1.84 | 3 3/8 | 4 1/8 | 1  | 1.71 | 2.4  | 4 5/8 | 5     |
| 250 (2.5") | 7/16-20 | 3/4 | 3.1  | 1 1/8 | 1 1/8 | 3/8 | 0.551 | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 3/8  | 1.3  | 1.06 | 2.19 | 3 7/8 | 4 5/8 | 1  | 1.75 | 2.48 | 4 3/4 | 5 1/8 |

## Non-Rotating Rod – Double Detachable Rear Clevis Mounting Type NC ■ A1KD



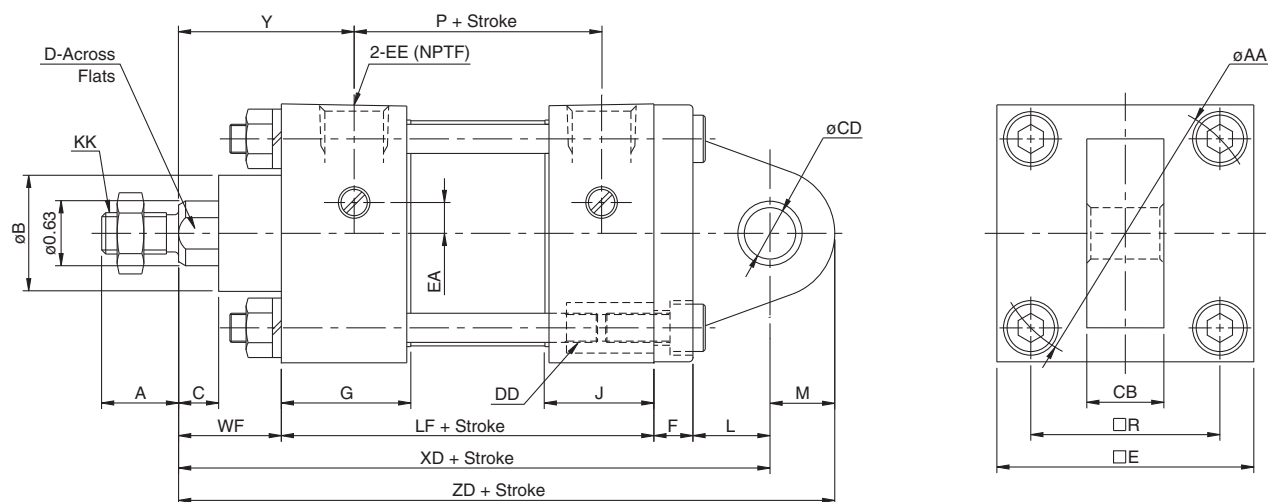
| Bore (in)  | KK      | A   | AA    | B     | C   | CB  | CD  | CW  | D     | DD      | E     | EA  | EE  | F   | G    | J    | L   | LR  | M   | R    | WF | XD    | Y    | LF    | P    | ZD    |
|------------|---------|-----|-------|-------|-----|-----|-----|-----|-------|---------|-------|-----|-----|-----|------|------|-----|-----|-----|------|----|-------|------|-------|------|-------|
| 150 (1.5") | 7/16-20 | 3/4 | 2.021 | 1 1/8 | 3/8 | 3/4 | 1/2 | 1/2 | 0.551 | 1/4-28  | 2     | 0.3 | 3/8 | 3/8 | 1.26 | 1.1  | 3/4 | 5/8 | 1/2 | 1.43 | 1  | 5 3/4 | 1.71 | 3 5/8 | 2.36 | 6 1/4 |
| 200 (2")   | 7/16-20 | 3/4 | 2.6   | 1 1/8 | 3/8 | 3/4 | 1/2 | 1/2 | 0.551 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 1.26 | 1.06 | 3/4 | 5/8 | 1/2 | 1.84 | 1  | 5 3/4 | 1.71 | 3 5/8 | 2.4  | 6 1/4 |
| 250 (2.5") | 7/16-20 | 3/4 | 3.1   | 1 1/8 | 3/8 | 3/4 | 1/2 | 1/2 | 0.551 | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 1.3  | 1.06 | 3/4 | 5/8 | 1/2 | 2.19 | 1  | 5 7/8 | 1.75 | 3 3/4 | 2.48 | 6 3/8 |

## Non-Rotating Rod – Center Trunnion Mounting Type NC A1KT



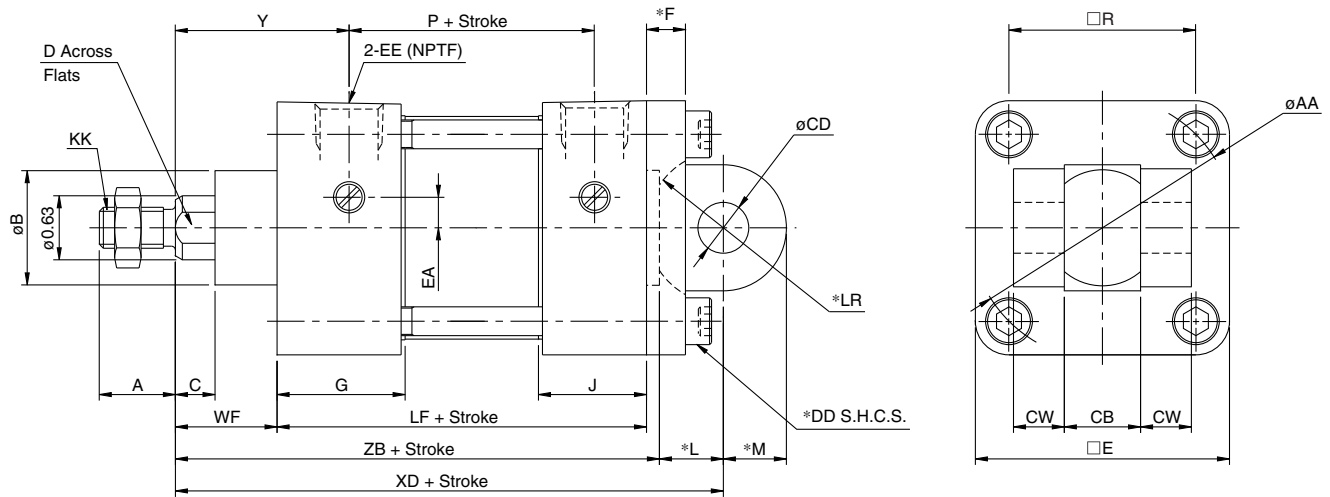
| Bore (in)  | KK      | A   | AA   | B     | BA    | C   | D     | DD      | E     | EA  | EE  | G    | J    | R    | TM  | TT   | UM  | UV   | WF | Y    | P    | LF    | XI   | ZB    |
|------------|---------|-----|------|-------|-------|-----|-------|---------|-------|-----|-----|------|------|------|-----|------|-----|------|----|------|------|-------|------|-------|
| 150 (1.5") | 7/16-20 | 3/4 | 2.02 | 1 1/8 | 1 1/8 | 3/8 | 0.551 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 1.1  | 1.43 | 2.5 | 1.18 | 4.5 | 2    | 1  | 1.71 | 2.36 | 3 5/8 | 2.89 | 4 3/4 |
| 200 (2")   | 7/16-20 | 3/4 | 2.6  | 1 1/8 | 1 1/8 | 3/8 | 0.551 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 1.06 | 1.84 | 3   | 1.18 | 5   | 2.56 | 1  | 1.71 | 2.4  | 3 5/8 | 2.91 | 4 3/4 |
| 250 (2.5") | 7/16-20 | 3/4 | 3.1  | 1 1/8 | 1 1/8 | 3/8 | 0.551 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 1.06 | 2.19 | 3.5 | 1.18 | 5.5 | 3.39 | 1  | 1.75 | 2.48 | 3 3/4 | 2.99 | 4 7/8 |

## Non-Rotating Rod – Single Detachable Rear Clevis Mounting Type NC A1KC



| Bore (in)  | KK      | A   | AA   | B     | C   | CB  | CD  | D     | DD      | E     | EA  | EE  | F   | G    | J    | L   | M   | P    | R    | WF | Y    | LF    | XD    | ZD    |
|------------|---------|-----|------|-------|-----|-----|-----|-------|---------|-------|-----|-----|-----|------|------|-----|-----|------|------|----|------|-------|-------|-------|
| 150 (1.5") | 7/16-20 | 3/4 | 2.02 | 1 1/8 | 3/8 | 3/4 | 1/2 | 0.551 | 1/4-28  | 2     | 0.3 | 3/8 | 3/8 | 1.26 | 1.1  | 3/4 | 5/8 | 2.36 | 1.43 | 1  | 1.71 | 3 5/8 | 5 3/4 | 6 3/8 |
| 200 (2")   | 7/16-20 | 3/4 | 2.6  | 1 1/8 | 3/8 | 3/4 | 1/2 | 0.551 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 1.26 | 1.06 | 3/4 | 5/8 | 2.4  | 1.84 | 1  | 1.71 | 3 5/8 | 5 3/4 | 6 3/8 |
| 250 (2.5") | 7/16-20 | 3/4 | 3.1  | 1 1/8 | 3/8 | 3/4 | 1/2 | 0.551 | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 1.3  | 1.06 | 3/4 | 5/8 | 2.48 | 2.19 | 1  | 1.75 | 3 3/4 | 5 7/8 | 6 1/2 |

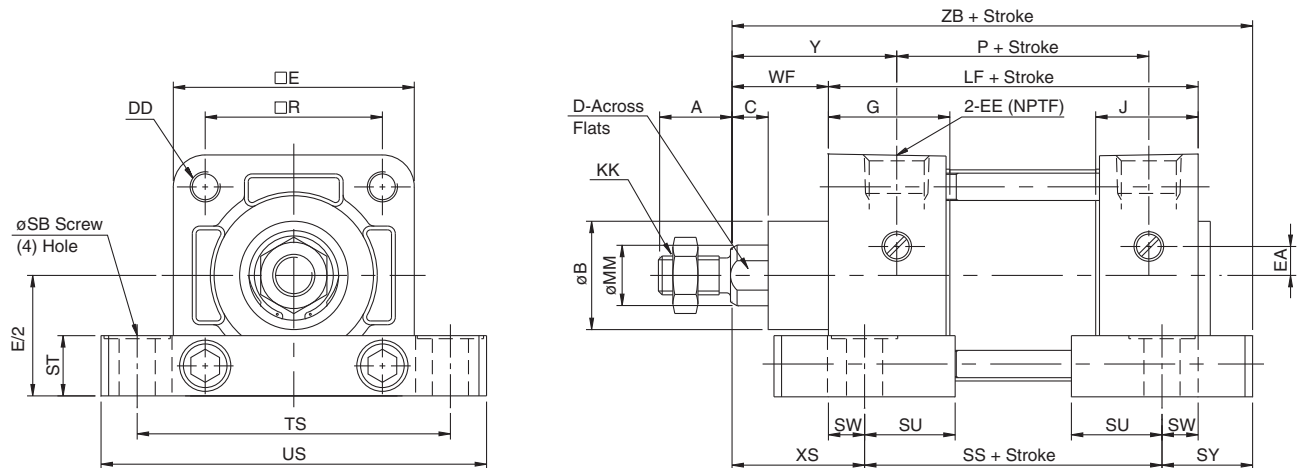
## Non-Rotating Rod – Double Rear Clevis Mounting Type NC A1KX



| Bore (in)  | KK      | A   | AA   | B     | C   | CB  | CD  | CW  | D     | DD      | E     | EA  | EE  | F   | G    | J    | L   | LR  | M   | P    | R    | WF | LF    | XD    | ZB    |
|------------|---------|-----|------|-------|-----|-----|-----|-----|-------|---------|-------|-----|-----|-----|------|------|-----|-----|-----|------|------|----|-------|-------|-------|
| 150 (1.5") | 7/16-20 | 3/4 | 2.02 | 1 1/8 | 3/8 | 3/4 | 1/2 | 1/2 | 0.551 | 1/4-28  | 2     | 0.3 | 3/8 | 3/8 | 1.26 | 1.1  | 5/8 | 3/4 | 5/8 | 2.36 | 1.43 | 1  | 3 5/8 | 5 3/8 | 4 3/4 |
| 200 (2")   | 7/16-20 | 3/4 | 2.6  | 1 1/8 | 3/8 | 3/4 | 1/2 | 1/2 | 0.551 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 1.26 | 1.06 | 5/8 | 3/4 | 5/8 | 2.4  | 1.84 | 1  | 3 5/8 | 5 3/8 | 4 3/4 |
| 250 (2.5") | 7/16-20 | 3/4 | 3.1  | 1 1/8 | 3/8 | 3/4 | 1/2 | 1/2 | 0.551 | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 1.3  | 1.06 | 5/8 | 3/4 | 5/8 | 2.48 | 2.19 | 1  | 3 3/4 | 5 1/2 | 4 7/8 |

Note: Mounting dimensions are the same as NFPA (MP1) except where marked (\*).

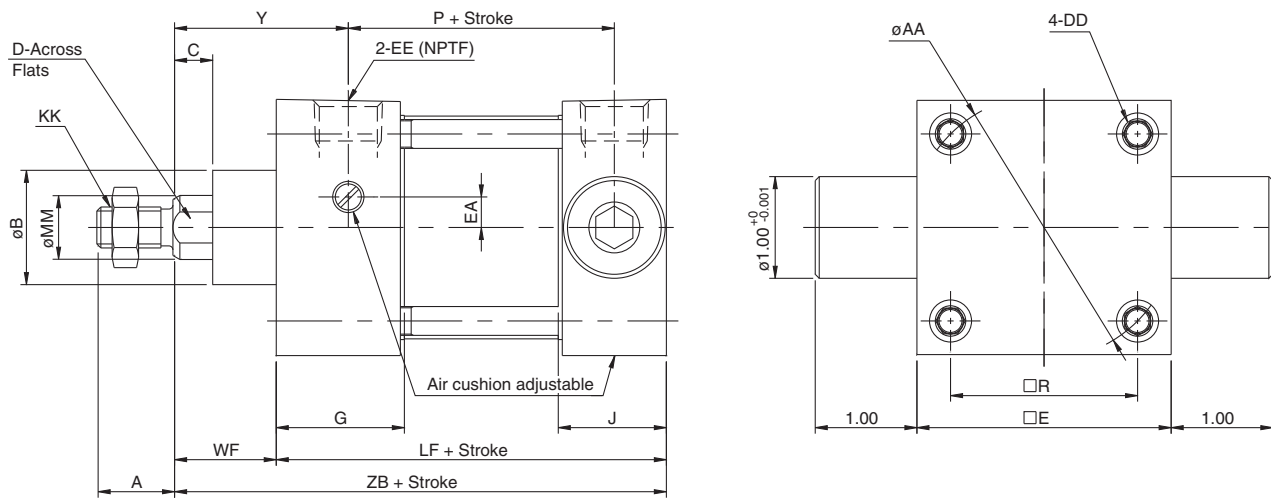
## Non-Rotating Rod – Side Lug Mounting Type NC A1KS



| Bore (in)  | MM  | KK      | A   | B     | C   | D     | DD      | E     | EA  | EE  | G    | J    | LF   | P    | R    | SB  | SS   | ST  | SU   | SW  | SY   | TS   | US   | WF | XS   | Y    | ZB   |
|------------|-----|---------|-----|-------|-----|-------|---------|-------|-----|-----|------|------|------|------|------|-----|------|-----|------|-----|------|------|------|----|------|------|------|
| 150 (1.5") | 5/8 | 7/16-20 | 3/4 | 1 1/8 | 3/8 | 0.551 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 1.1  | 3.63 | 2.36 | 1.43 | 3/8 | 2.88 | 5/8 | 0.94 | 3/8 | 0.94 | 2.75 | 3.50 | 1  | 1.38 | 1.71 | 5.19 |
| 200 (2")   | 5/8 | 7/16-20 | 3/4 | 1 1/8 | 3/8 | 0.551 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 1.06 | 3.63 | 2.4  | 1.84 | 3/8 | 2.88 | 5/8 | 0.94 | 3/8 | 0.94 | 3.25 | 4    | 1  | 1.38 | 1.71 | 5.19 |
| 250 (2.5") | 5/8 | 7/16-20 | 3/4 | 1 1/8 | 3/8 | 0.551 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 1.06 | 3.75 | 2.48 | 2.19 | 3/8 | 3    | 3/4 | 0.94 | 3/8 | 0.94 | 3.75 | 4.50 | 1  | 1.38 | 1.75 | 5.31 |

(in)

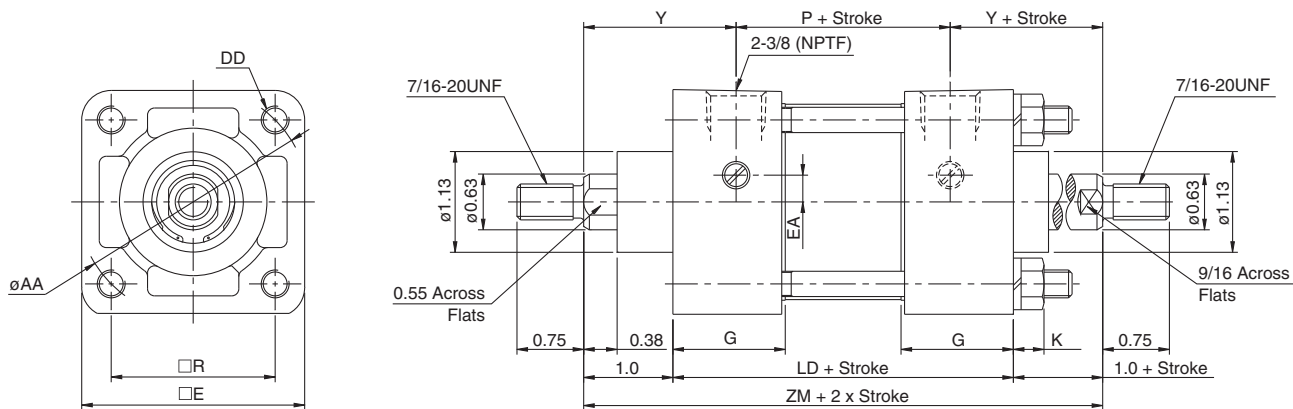
## Non-Rotating Rod – Head Trunnion Mounting Type NC A1KS



(in)

| Bore (in)  | MM  | KK      | A   | AA   | B     | C   | D     | DD      | E     | EA  | EE  | G    | J    | R    | WF | Y    | LF   | P    | ZB   |
|------------|-----|---------|-----|------|-------|-----|-------|---------|-------|-----|-----|------|------|------|----|------|------|------|------|
| 150 (1.5") | 5/8 | 7/16-20 | 3/4 | 2.02 | 1 1/8 | 3/8 | 0.551 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 1.23 | 1.43 | 1  | 1.71 | 3.75 | 2.36 | 4.75 |
| 200 (2")   | 5/8 | 7/16-20 | 3/4 | 2.6  | 1 1/8 | 3/8 | 0.551 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 1.19 | 1.84 | 1  | 1.71 | 3.75 | 2.4  | 4.75 |
| 250 (2.5") | 5/8 | 7/16-20 | 3/4 | 3.1  | 1 1/8 | 3/8 | 0.551 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 1.19 | 2.19 | 1  | 1.75 | 3.88 | 2.48 | 4.88 |

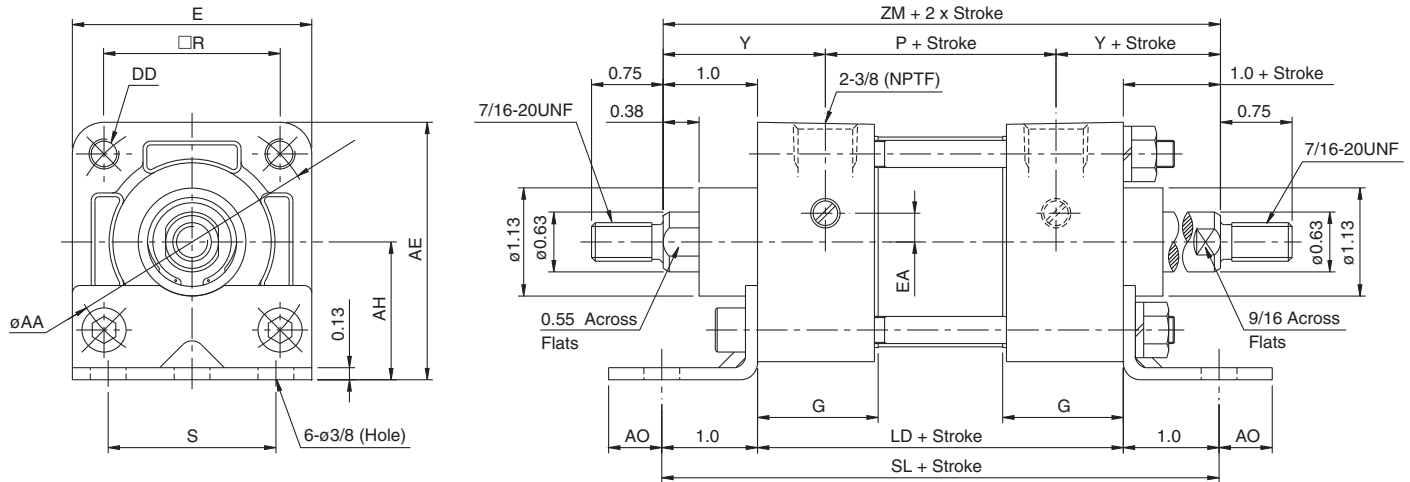
## Double Rod Non-Rotating – Basic Mounting Type NC A1KWB



| Bore (in)  | AA   | DD      | E     | EA  | G    | R    | Y    | LD   | P    | ZM   | K    |
|------------|------|---------|-------|-----|------|------|------|------|------|------|------|
| 150 (1.5") | 2.02 | 1/4-28  | 2     | 0.3 | 1.26 | 1.43 | 1.71 | 3.78 | 2.36 | 5.78 | 0.28 |
| 200 (2")   | 2.6  | 5/16-24 | 2 1/2 | 0.3 | 1.26 | 1.84 | 1.71 | 3.82 | 2.40 | 5.82 | 0.34 |
| 250 (2.5") | 3.1  | 5/16-24 | 3     | 0   | 1.3  | 2.19 | 1.75 | 3.98 | 2.48 | 5.98 | 0.34 |

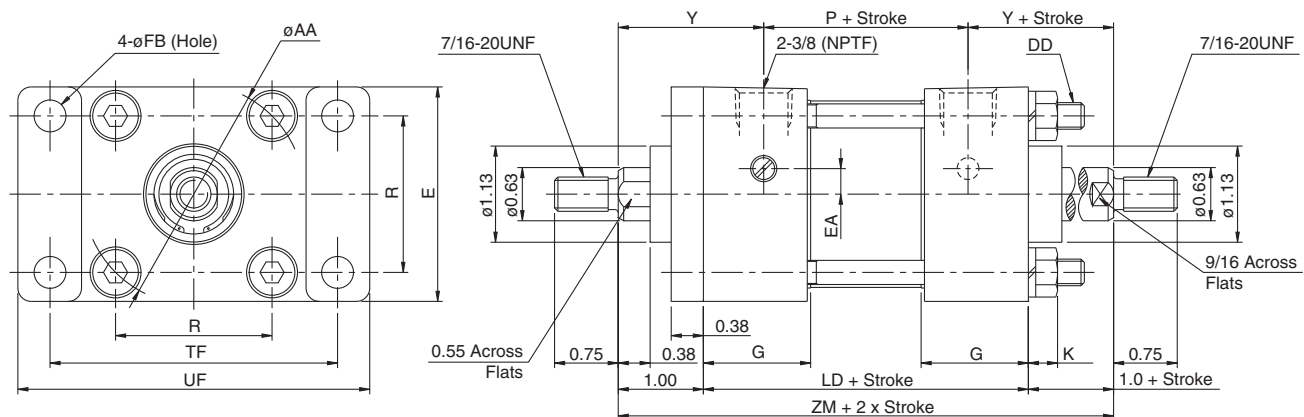


## Double Rod Non-Rotating – Foot Mounting Type NC   A1KWL



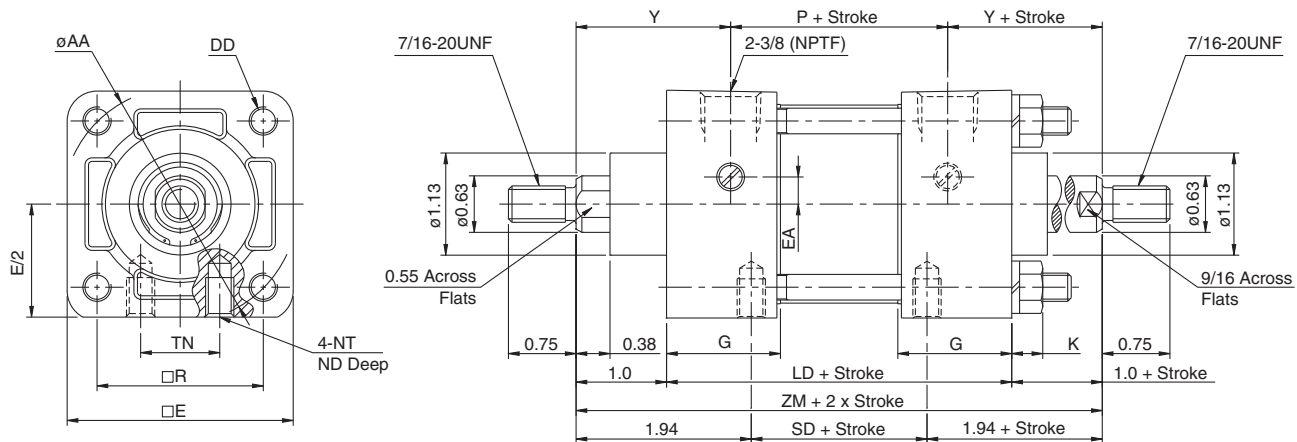
| Bore (in)  | AA   | E     | EA  | G    | AO   | Y    | LD   | P    | R    | ZM   | SL   | S    | AE   | AH   | DD      |
|------------|------|-------|-----|------|------|------|------|------|------|------|------|------|------|------|---------|
| 150 (1.5") | 2.02 | 2     | 0.3 | 1.26 | 0.44 | 1.71 | 3.78 | 2.36 | 1.43 | 5.78 | 5.78 | 1.25 | 2.19 | 1.19 | 1/4-28  |
| 200 (2")   | 2.6  | 2 1/2 | 0.3 | 1.26 | 0.56 | 1.71 | 3.82 | 2.40 | 1.84 | 5.82 | 5.82 | 1.75 | 2.69 | 1.44 | 5/16-24 |
| 250 (2.5") | 3.1  | 3     | 0   | 1.3  | 0.56 | 1.75 | 3.98 | 2.48 | 2.19 | 5.98 | 5.98 | 2.25 | 3.13 | 1.63 | 5/16-24 |

## Double Rod Non-Rotating – Front Flange Mounting Type NC   A1KWF



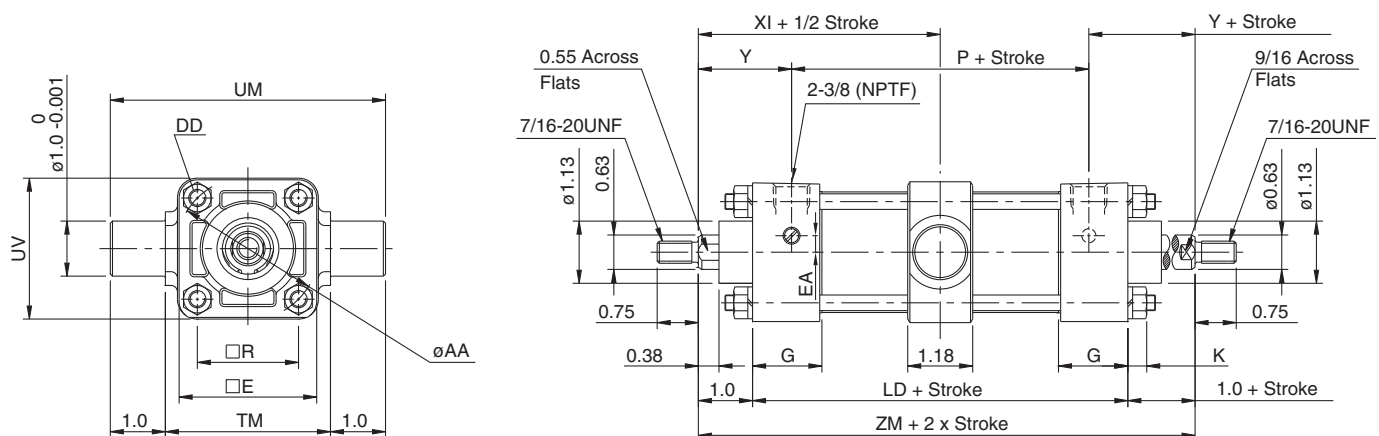
| Bore (in)  | AA   | DD      | E     | EA  | G    | R    | Y    | LD   | P    | ZM   | TF   | UF   | FB   | K    |
|------------|------|---------|-------|-----|------|------|------|------|------|------|------|------|------|------|
| 150 (1.5") | 2.02 | 1/4-28  | 2     | 0.3 | 1.26 | 1.43 | 1.71 | 3.78 | 2.36 | 5.78 | 2.75 | 3.38 | 0.31 | 0.28 |
| 200 (2")   | 2.6  | 5/16-24 | 2 1/2 | 0.3 | 1.26 | 1.84 | 1.71 | 3.82 | 2.40 | 5.82 | 3.38 | 4.13 | 0.38 | 0.34 |
| 250 (2.5") | 3.1  | 5/16-24 | 3     | 0   | 1.3  | 2.19 | 1.75 | 3.98 | 2.48 | 5.98 | 3.88 | 4.63 | 0.38 | 0.34 |

## Double Rod Non-Rotating – Side Tapped Mounting Type NC A1KWR



| Bore (in)  | AA   | DD      | E     | EA  | G    | R    | Y    | LD   | P    | SD   | ZM   | K    | TN   | ND    | NT      |
|------------|------|---------|-------|-----|------|------|------|------|------|------|------|------|------|-------|---------|
| 150 (1.5") | 2.02 | 1/4-28  | 2     | 0.3 | 1.26 | 1.43 | 1.71 | 3.78 | 2.36 | 1.90 | 5.78 | 0.28 | 0.63 | 9/32  | 1/4-20  |
| 200 (2")   | 2.6  | 5/16-24 | 2 1/2 | 0.3 | 1.26 | 1.84 | 1.71 | 3.82 | 2.40 | 1.94 | 5.82 | 0.34 | 0.88 | 7/16  | 5/16-18 |
| 250 (2.5") | 3.1  | 5/16-24 | 3     | 0   | 1.3  | 2.19 | 1.75 | 3.98 | 2.48 | 2.10 | 5.98 | 0.34 | 1.25 | 19/32 | 3/8-16  |

## Double Rod Non-Rotating – Center Trunnion Mounting Type NC A1KWT



| Bore (in)  | AA   | E     | EA  | G    | R    | Y    | LD   | P    | ZM   | UV   | TM  | K    | UM  | XI   | DD      |
|------------|------|-------|-----|------|------|------|------|------|------|------|-----|------|-----|------|---------|
| 150 (1.5") | 2.02 | 2     | 0.3 | 1.26 | 1.43 | 1.71 | 3.78 | 2.36 | 5.78 | 2.0  | 2.5 | 0.28 | 4.5 | 2.89 | 1/4-28  |
| 200 (2")   | 2.60 | 2 1/2 | 0.3 | 1.26 | 1.84 | 1.71 | 3.82 | 2.40 | 5.82 | 2.56 | 3   | 0.34 | 5   | 2.91 | 5/16-24 |
| 250 (2.5") | 3.10 | 3     | 0   | 1.3  | 2.19 | 1.75 | 3.98 | 2.48 | 5.98 | 3.39 | 3.5 | 0.34 | 5.5 | 2.99 | 5/16-24 |

## Stainless Steel Rod (XC6)



- Stainless Steel piston rod is used to protect in harsh or wet environments.
- Auto-switch mounting available.

### Specifications

| Bore size (inch)              | 1.5  | 2 | 2.5 | 3.25 | 4 |
|-------------------------------|--|---|-----|------|---|
| Media                         | Air  |   |     |      |   |
| Max. Operating Pressure       | 250 psi (17.5 kgf/cm <sup>2</sup> )  |   |     |      |   |
| Min. Operating Pressure       | 8 psi (0.5 kgf/cm <sup>2</sup> )   |   |     |      |   |
| Rod Material                  | SUS304   |   |     |      |   |
| Ambient and Media Temperature | 40 to 140°F (5 to 60°C)  |   |     |      |   |
| Piston Speed                  | 2 to 20 inch/sec (50 to 500mm/sec)   |   |     |      |   |
| Stroke Tolerance (mm)         | to 10.0: <sup>+1.0</sup> <sub>0</sub>  |   |     |      |   |
| Cushion                       | Air Cushion Standard   |   |     |      |   |
| Mounting Types                | Basic, Foot, Flange<br>Side Tapped, Clevis, Head Trunnion<br>Rod Trunnion, Center Trunnion, Side Lug |   |     |      |   |

### Standard Stroke List

| Bore size | Standard Stroke (in)                                    |
|-----------|---|
| 1.5"      | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 2", 2.5"  | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 3.25", 4" | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 |

### How To Order

NCDA1 MOUNTING BORE - STROKE SUFFIX - XC6

Ex: NCDA1B 150-0400-XC6

Auto-switch capable

Stainless Steel Rod

## Low Speed (XB9)



- Smooth movements even at 0.4 to 2 inch/sec
- Auto switch mounting available.

### Specifications

| Bore size (inch)              | 1.5  | 2 | 2.5 | 3.25 | 4 |
|-------------------------------|--|---|-----|------|---|
| Media                         | Air  |   |     |      |   |
| Max. Operating Pressure       | 250 psi (17.5 kgf/cm <sup>2</sup> )  |   |     |      |   |
| Min. Operating Pressure       | 8 psi (0.5 kgf/cm <sup>2</sup> )   |   |     |      |   |
| Ambient and Media Temperature | 40 to 140°F (5 to 60°C)  |   |     |      |   |
| Piston Speed                  | 0.4 to 2 inch/sec (10 to 50mm/sec)   |   |     |      |   |
| Cushion                       | None   |   |     |      |   |
| Mounting Types                | Basic, Foot, Flange<br>Side Tapped, Clevis, Head Trunnion<br>Rod Trunnion, Center Trunnion, Side Lug |   |     |      |   |

### Standard Stroke List

| Bore size | Standard Stroke (in)                                    |
|-----------|---|
| 1.5"      | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 2", 2.5"  | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 3.25", 4" | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 |

### How To Order

NC D A1 MOUNTING BORE - STROKE N - XB9

Ex: NCDA1B 150-0400-XB9

Auto-switch capable

Low Speed

Standard

### High Temperature (XB6)



- Use at high temperature up to 300°F.

#### Specifications

| Bore size (inch)              | 1.5   | 2 | 2.5 | 3.25 | 4 |
|-------------------------------|---|---|-----|------|---|
| Media                         | Air   |   |     |      |   |
| Max. Operating Pressure       | 250 psi (17.5 kgf/cm <sup>2</sup> )   |   |     |      |   |
| Min. Operating Pressure       | 8 psi (0.5 kgf/cm <sup>2</sup> )  |   |     |      |   |
| Ambient and Media Temperature | 14 to 300°F (–10 to –150°C)   |   |     |      |   |
| Seal Material                 | Fluro Rubber  |   |     |      |   |
| Piston Speed                  | 2 to 20 inch/sec (50 to 500mm/sec)  |   |     |      |   |
| Stroke Tolerance (mm)         | to 10.0 <sup>+1.0</sup> <sub>0</sub>  |   |     |      |   |
| Cushion                       | Air Cushion Standard  |   |     |      |   |
| Mounting Types                | Basic, Foot, Flange   |   |     |      |   |
|                               | Side Tapped, Clevis, Head Trunnion<br>Rod Trunnion, Center Trunnion, Side Lug |   |     |      |   |

#### Standard Stroke List

| Bore size | Standard Stroke   |
|-----------|---|
| 1.5"      | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 2", 2.5"  | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 3.25", 4" | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 |

#### How To Order

NCA1 MOUNTING BORE – STROKE SUFFIX – XB6

Ex: NCA1B 150-0400-XB6

Auto-switch capable not available High Temperature

### Low Temperature (XB7)



- Use at low temperature down to –22°F.

#### Specifications

| Bore size (inch)              | 1.5  | 2 | 2.5 | 3.25 | 4 |
|-------------------------------|--|---|-----|------|---|
| Media                         | Air  |   |     |      |   |
| Max. Operating Pressure       | 250 psi 17.5 kgf/cm <sup>2</sup>   |   |     |      |   |
| Min. Operating Pressure       | 8 psi (0.5 kgf/cm <sup>2</sup> )   |   |     |      |   |
| Ambient and Media Temperature | –22 to 140°F (–30 to 60°C)   |   |     |      |   |
| Seal Material                 | Low Durometer Nitril Rubber  |   |     |      |   |
| Piston Speed                  | 2 to 20 inch/sec (10 to 50mm/sec)  |   |     |      |   |
| Cushion                       | None   |   |     |      |   |
| Mounting Types                | Basic, Foot, Flange, Center Trunnion,<br>Side Tapped, Clevis, Side Lug<br>Rod and Head Trnnion |   |     |      |   |

#### Standard Stroke List

| Bore size | Standard Stroke   |
|-----------|---|
| 1.5"      | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 2", 2.5"  | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 3.25", 4" | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 |

#### How To Order

NCA1 MOUNTING BORE – STROKE N – XB7

Ex: NCA1B 150-0400-XB7

Auto-switch capable not available Low Temperature

## Special Trunnion Location (X46US)



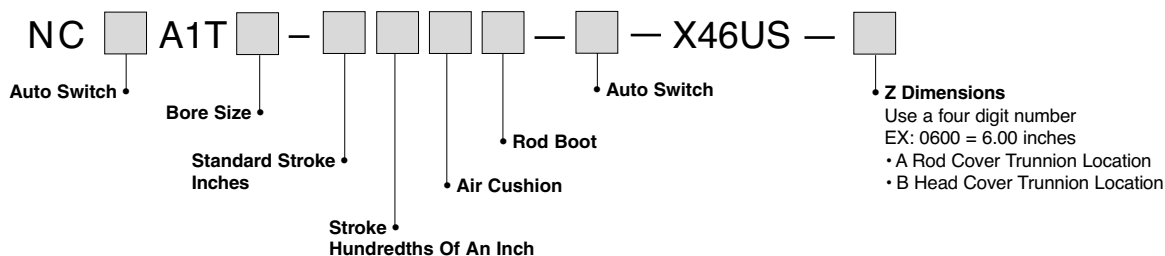
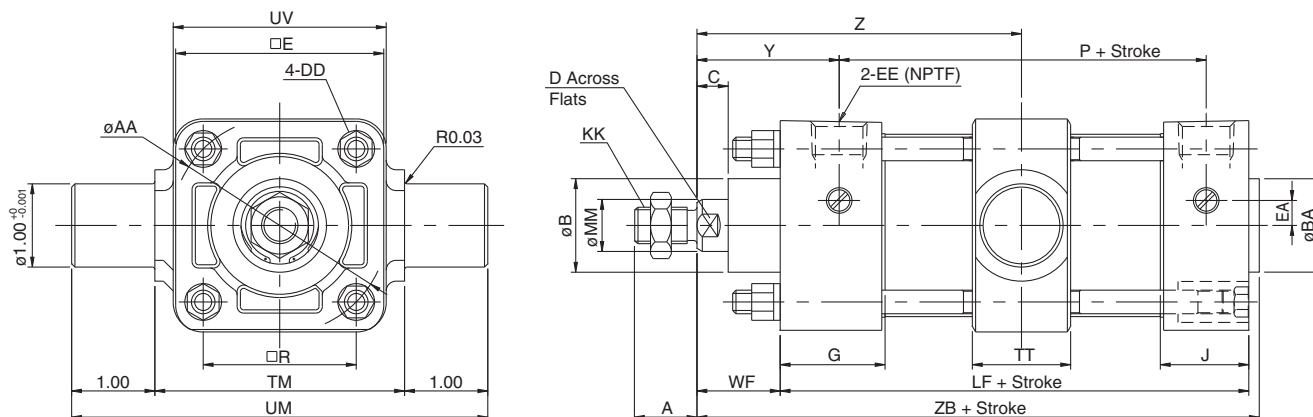
## Specifications

| Bore size (inch)              | 1.5                                 | 2 | 2.5 | 3.25 | 4 |
|-------------------------------|-------------------------------------|---|-----|------|---|
| Media                         | Air                                 |   |     |      |   |
| Max. Operating Pressure       | 250 psi (1.75 kgf/cm <sup>2</sup> ) |   |     |      |   |
| Min. Operating Pressure       | 8 psi (0.05 kgf/cm <sup>2</sup> )   |   |     |      |   |
| Ambient and Media Temperature | 40 to 140°F (5 to 60°C)             |   |     |      |   |
| Seal Material                 | Nitrile Rubber                      |   |     |      |   |
| Piston Speed                  | 2 to 20 inch/sec (50 to 500mm/sec)  |   |     |      |   |
| Cushion                       | Air Cushion Standard                |   |     |      |   |
| Mounting Type                 | Center Trunnion                     |   |     |      |   |

## Standard Stroke List

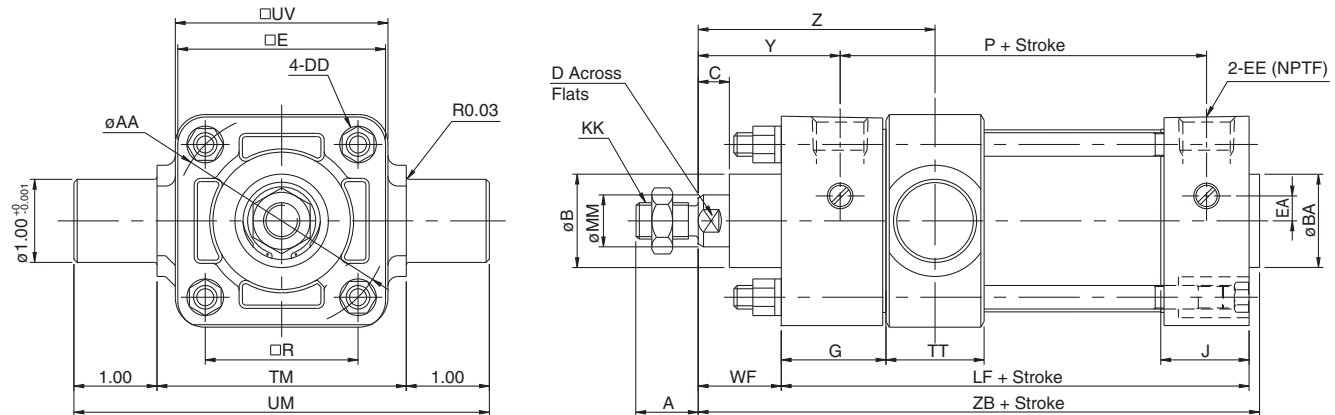
| Bore size | Standard Stroke (in)                                    |
|-----------|---|
| 1.5"      | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 2", 2.5"  | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 3.25", 4" | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 |

## How To Order

Special Rod Trunnion Location NC    A1T (150 to 400) - \*\*\*\* - X46US - \*\*\*\*

| Bore (in)   | MM  | KK      | A     | AA   | B     | BA    | C   | D    | DD      | E     | EA  | EE  | G    | J    | R    | TM   | TT   | UM   | UV   | WF    | Y    | P    | LF    | ZB      | Z RANGE Min. Max.  |
|-------------|-----|---------|-------|------|-------|-------|-----|------|---------|-------|-----|-----|------|------|------|------|------|------|------|-------|------|------|-------|---------|--------------------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 1.1  | 1.43 | 2.5  | 1.18 | 4.5  | 2    | 1     | 1.71 | 2.36 | 3 5/8 | 4 3/4   | 2.87 2.89 + Stroke |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 1.06 | 1.84 | 3    | 1.18 | 5    | 2.56 | 1     | 1.71 | 2.4  | 3 5/8 | 4 3/4   | 2.87 2.91 + Stroke |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 1.06 | 2.19 | 3.5  | 1.18 | 5.5  | 3.39 | 1     | 1.75 | 2.48 | 3 3/4 | 4 7/8   | 2.91 2.99 + Stroke |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 1.18 | 2.76 | 4.5  | 1.34 | 6.5  | 4.33 | 1 3/8 | 2.34 | 2.72 | 4 1/4 | 5 53/64 | 3.63 2.91 + Stroke |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 1.18 | 3.32 | 5.25 | 1.57 | 7.25 | 5.12 | 1 3/8 | 2.34 | 2.72 | 4 1/4 | 5 53/64 | 3.75 2.95 + Stroke |

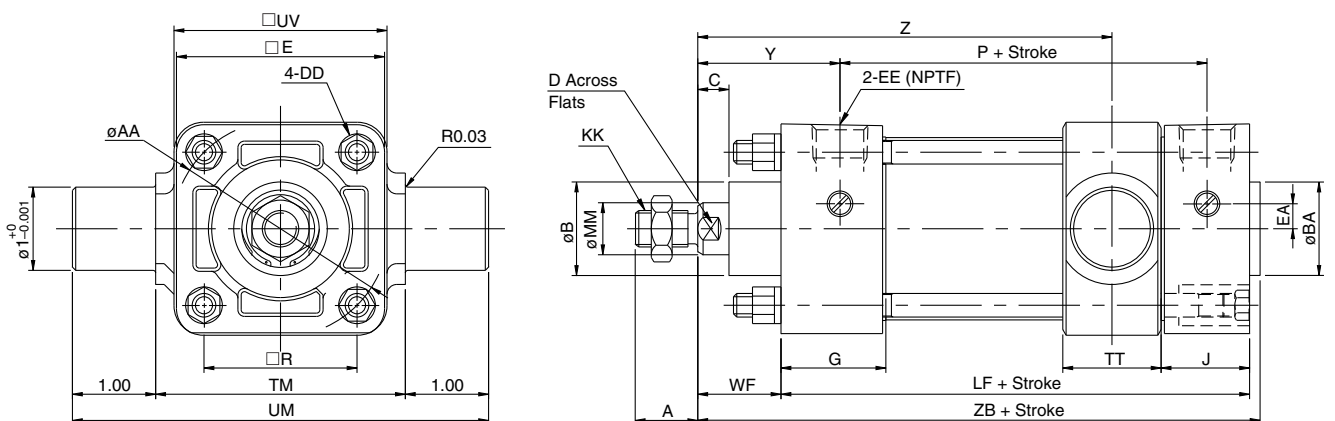
### Special Rod Trunnion Location NC ■ A1T (150 to 400) - \*\*\*\* - X46US - A



(in)

| Bore (in)   | MM  | KK      | A     | AA   | B     | BA    | C   | D    | DD      | E     | EA  | EE  | G    | J    | R    | TM   | TT   | UM   | UV   | WF    | Y    | P    | LF    | Z    | ZB      |
|-------------|-----|---------|-------|------|-------|-------|-----|------|---------|-------|-----|-----|------|------|------|------|------|------|------|-------|------|------|-------|------|---------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 1.1  | 1.43 | 2.5  | 1.18 | 4.5  | 2    | 1     | 1.71 | 2.36 | 3 5/8 | 2.81 | 4 3/4   |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 1.06 | 1.84 | 3    | 1.18 | 5    | 2.56 | 1     | 1.71 | 2.4  | 3 5/8 | 2.81 | 4 3/4   |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 1.06 | 2.19 | 3.5  | 1.18 | 5.5  | 3.39 | 1     | 1.75 | 2.48 | 3 3/4 | 2.85 | 4 7/8   |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 1.18 | 2.76 | 4.5  | 1.34 | 6.5  | 4.33 | 1 3/8 | 2.34 | 2.72 | 4 1/4 | 3.58 | 5 53/64 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 1.18 | 3.32 | 5.25 | 1.57 | 7.25 | 5.12 | 1 3/8 | 2.34 | 2.72 | 4 1/4 | 3.70 | 5 53/64 |

### Special Head Side Trunnion Location NC ■ A1T (150 to 400) - \*\*\*\* - X46US - B



(in)

| Bore (in)   | MM  | KK      | A     | AA   | B     | BA    | C   | D    | DD      | E     | EA  | EE  | G    | J    | R    | TM   | TT   | UM   | UV   | WF    | Y    | P    | LF    | ZB      | Z             |
|-------------|-----|---------|-------|------|-------|-------|-----|------|---------|-------|-----|-----|------|------|------|------|------|------|------|-------|------|------|-------|---------|---------------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 1.1  | 1.43 | 2.5  | 1.18 | 4.5  | 2    | 1     | 1.71 | 2.36 | 3 5/8 | 4 3/4   | 2.97 + Stroke |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 1.06 | 1.84 | 3    | 1.18 | 5    | 2.56 | 1     | 1.71 | 2.4  | 3 5/8 | 4 3/4   | 3.01 + Stroke |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 1.06 | 2.19 | 3.5  | 1.18 | 5.5  | 3.39 | 1     | 1.75 | 2.48 | 3 3/4 | 4 7/8   | 3.14 + Stroke |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 1.18 | 2.76 | 4.5  | 1.34 | 6.5  | 4.33 | 1 3/8 | 2.34 | 2.72 | 4 1/4 | 5 53/64 | 3.81 + Stroke |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 1.18 | 3.32 | 5.25 | 1.57 | 7.25 | 5.12 | 1 3/8 | 2.34 | 2.72 | 4 1/4 | 5 53/64 | 3.70 + Stroke |

Oversized Rod with Special Trunnion Location (XB5 - X46US)



Standard Stroke List

| Bore Size | Standard Stroke   |
|-----------|---|
| 2", 2.5"  | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 3.25", 4" | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 |

How To Order

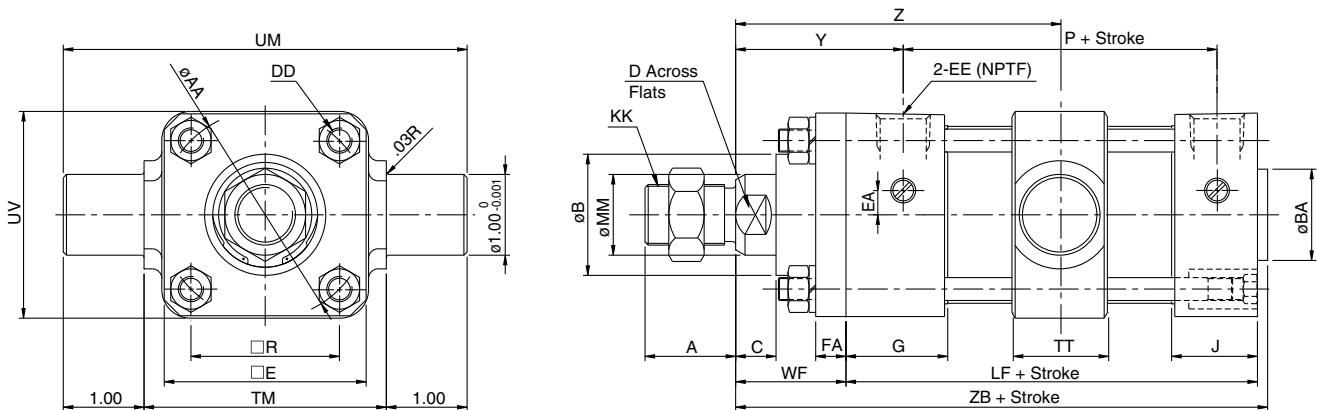
NC D A1 T BORE - STROKE XB5 - X46US - Z

Ex: NCDA1T 250-0400-XB5-X46US-0700

Auto-switch capable      Oversized Rod      Z Dimension

Z-Dimension use a four digit number

Special Trunnion Location NC A1T (200 to 400) - \*\*\*\* - XB5 - X46US - \*\*\*\*



| Bore (in)   | MM    | KK     | A     | AA  | B     | BA    | C   | D     | DD      | E     | EA  | EE  | FA  | G    | J    | R    | TM   | TT   | UM   | UV   | WF    | Y    | LF    | P    | ZB     | Z RANGE Min. | Max.          |
|-------------|-------|--------|-------|-----|-------|-------|-----|-------|---------|-------|-----|-----|-----|------|------|------|------|------|------|------|-------|------|-------|------|--------|--------------|---------------|
| 200 (2")    | 1     | 3/4-16 | 1 1/8 | 2.6 | 1 1/2 | 1 1/8 | 1/2 | 7/8   | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 1.26 | 1.06 | 1.84 | 3    | 1.18 | 5    | 2.56 | 1 3/8 | 2.09 | 3 5/8 | 2.4  | 5 1/8  | 3.25         | 3.29 + Stroke |
| 250 (2.5")  | 1     | 3/4-16 | 1 1/8 | 3.1 | 1 1/2 | 1 1/8 | 1/2 | 7/8   | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 1.3  | 1.06 | 2.19 | 3.5  | 1.18 | 5.5  | 3.39 | 1 3/8 | 2.13 | 3 3/4 | 2.48 | 5 1/4  | 3.28         | 3.37 + Stroke |
| 325 (3.25") | 1 3/8 | 1-14   | 1 5/8 | 3.9 | 2     | 1 1/2 | 5/8 | 1 1/4 | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 2.76 | 4.5  | 1.34 | 6.5  | 4.33 | 1 5/8 | 2.59 | 4 1/4 | 2.72 | 6 5/64 | 3.89         | 3.56 + Stroke |
| 400 (4")    | 1 3/8 | 1-14   | 1 5/8 | 4.7 | 2     | 1 1/2 | 5/8 | 1 1/4 | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 3.32 | 5.25 | 1.57 | 7.25 | 5.12 | 1 5/8 | 2.59 | 4 1/4 | 2.72 | 6 5/64 | 4.01         | 3.59 + Stroke |



## Stainless Steel Tie Rods / Tie Rod Nuts (X130US)



- Stainless steel piston rod is used to protect in harsh or wet environments
- Auto-switch mounting available

### Specifications

| Bore size (inch)              | 1.5   | 2 | 2.5 | 3.25 | 4 |
|-------------------------------|---|---|-----|------|---|
| Media                         | Air   |   |     |      |   |
| Max. Operating Pressure       | 250 psi (17.5 kgf/cm <sup>2</sup> )   |   |     |      |   |
| Min. Operating Pressure       | 8 psi (0.5 kgf/cm <sup>2</sup> )  |   |     |      |   |
| Ambient and Media Temperature | 40 to 140°F (5 to 60°C)   |   |     |      |   |
| Seal Material                 | Nitrile Rubber  |   |     |      |   |
| Piston Speed                  | 2 to 20 inch/sec (50 to 500mm/sec)  |   |     |      |   |
| Stroke Tolerance              | to 10.0: ±1.0   |   |     |      |   |
| Cushion                       | Air Cushion Both Ends   |   |     |      |   |
| Mounting Types                | Basic, Foot, Flange, Center Trunnion, Side Tapped, Clevis, Rod Trunnion, Head Trunnion, Center Trunnion, Side Lug |   |     |      |   |

### Standard Stroke List

| Bore Size | Standard Stroke   |
|-----------|---|
| 1.5"      | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 2", 2.5"  | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 3.25", 4" | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 |

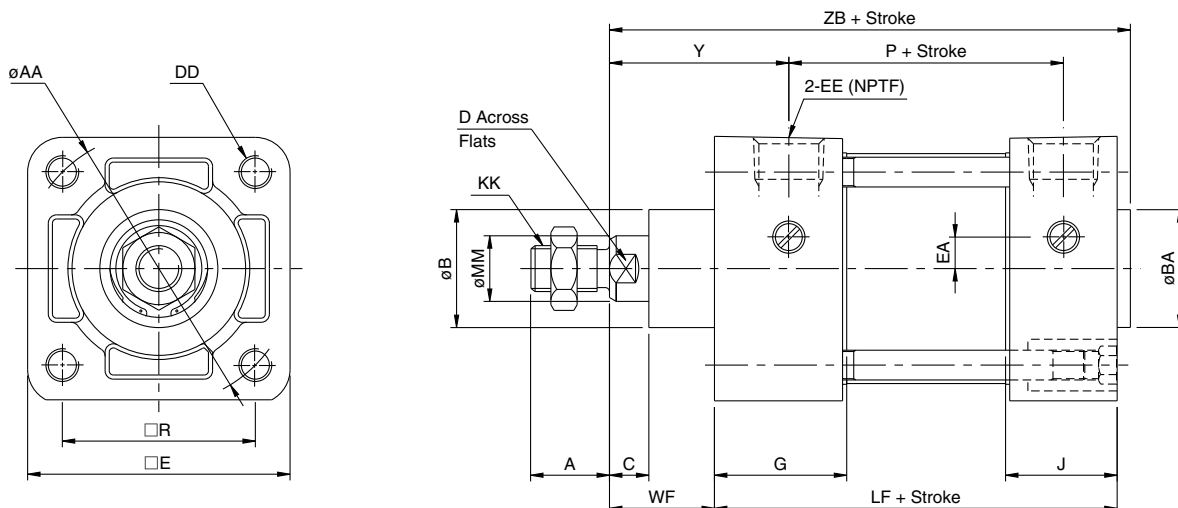
### How To Order

NCDA1 MOUNTING BORE - STROKE SUFFIX - X130US

Ex: NCDA1B 150-0100-X130US

Stainless Steel Piston Rod,  
Tie Rods, Tie Rod Nuts,  
and Cushion Valve Needle

## Basic Mounting Type NC A1B (MXO Mounting Style) - X130US

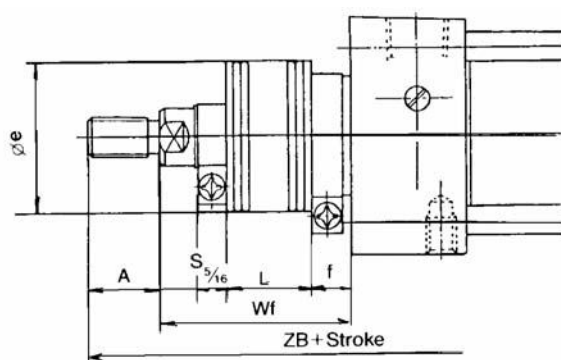


| Bore (in)   | MM  | KK      | A     | AA   | B     | BA    | C   | D    | DD      | E     | EA  | EE  | G    | J    | R    | WF    | Y    | P    | LF    | ZB      |
|-------------|-----|---------|-------|------|-------|-------|-----|------|---------|-------|-----|-----|------|------|------|-------|------|------|-------|---------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 1.1  | 1.43 | 1     | 1.71 | 2.36 | 3 5/8 | 4 3/4   |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 1.06 | 1.84 | 1     | 1.71 | 2.4  | 3 5/8 | 4 3/4   |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 1.06 | 2.19 | 1     | 1.75 | 2.48 | 3 3/4 | 4 7/8   |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 1.18 | 2.76 | 1 3/8 | 2.34 | 2.72 | 4 1/4 | 5 53/64 |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 1.18 | 3.32 | 1 3/8 | 2.34 | 2.72 | 4 1/4 | 5 53/64 |

## Rod Boot



Rod boots are used to protect the surface of a piston rod in harsh environments.



## Boot Material

| Suffix Code | Material | Max. Temperature |
|-------------|----------|------------------|
| J           | Nylon    | 140°F (60°C)     |
| K           | Neoprene | 230°F (110°C)*   |

\*Maximum temperature is for boot only.

## How To Order

NCA1 MOUNTING BORE — STROKE CUSHION BOOT

Ex: NCDA1B150-0200J

Auto-switch capable

Rod Boot  
J-Nylon Rod Boot  
K-Neoprene Rod Boot

## Rod Boot Dimensions

| Bore        | A     | $\phi e$ | f     | L (in) |          |          |          |           |            |            |            |            |            |
|-------------|-------|----------|-------|--------|----------|----------|----------|-----------|------------|------------|------------|------------|------------|
|             |       |          |       | 0 to 2 | 2.1 to 4 | 4.1 to 6 | 6.1 to 8 | 8.1 to 10 | 10.1 to 12 | 12.1 to 14 | 14.1 to 16 | 16.1 to 20 | 20.1 to 24 |
| 150 (1.5")  | 0.75  | 1.375    | 0.734 | 0.5    | 1        | 1.5      | 2        | 2.5       | 3          | 3.5        | 4          | 5          | —          |
| 200 (2")    | 0.75  | 1.375    | 0.734 |        |          |          |          |           |            |            |            |            | 6          |
| 250 (2.5")  | 0.75  | 1.375    | 0.734 |        |          |          |          |           |            |            |            |            | 6          |
| 325 (2.25") | 1.125 | 1.968    | 0.984 |        |          |          |          |           |            |            |            |            | 6          |
| 400 (4")    | 1.125 | 1.968    | 0.984 |        |          |          |          |           |            |            |            |            | 7          |

| Bore        | Wf (in) |          |          |          |           |            |            |            |            |            |            |
|-------------|---------|----------|----------|----------|-----------|------------|------------|------------|------------|------------|------------|
|             | 0 to 2  | 2.1 to 4 | 4.1 to 6 | 6.1 to 8 | 8.1 to 10 | 10.1 to 12 | 12.1 to 14 | 14.1 to 16 | 16.1 to 20 | 20.1 to 24 | 24.1 to 28 |
| 150 (1.5")  | 1.937   | 2.437    | 2.937    | 3.437    | 3.937     | 4.437      | 4.937      | 5.437      | 6.437      | —          | —          |
| 200 (2")    | 1.937   | 2.437    | 2.937    | 3.437    | 3.937     | 4.437      | 4.937      | 5.437      | 6.437      | 7.437      | —          |
| 250 (2.5")  | 1.937   | 2.437    | 2.937    | 3.437    | 3.937     | 4.437      | 4.937      | 5.437      | 6.437      | 7.437      | —          |
| 325 (2.25") | 2.312   | 2.812    | 3.312    | 3.812    | 4.312     | 4.812      | 5.312      | 5.812      | 6.812      | 7.812      | 8.812      |
| 400 (4")    | 2.312   | 2.812    | 3.312    | 3.812    | 4.312     | 4.812      | 5.312      | 5.812      | 6.812      | 7.812      | 8.812      |

| Bore        | ZB (in) |          |          |          |           |            |            |            |            |            |            |
|-------------|---------|----------|----------|----------|-----------|------------|------------|------------|------------|------------|------------|
|             | 0 to 2  | 2.1 to 4 | 4.1 to 6 | 6.1 to 8 | 8.1 to 10 | 10.1 to 12 | 12.1 to 14 | 14.1 to 16 | 16.1 to 20 | 20.1 to 24 | 24.1 to 28 |
| 150 (1.5")  | 5.687   | 6.187    | 6.687    | 7.187    | 7.687     | 8.187      | 8.687      | 9.187      | 10.187     | —          | —          |
| 200 (2")    | 5.687   | 6.187    | 6.687    | 7.187    | 7.687     | 8.187      | 8.687      | 9.187      | 10.187     | 11.187     | —          |
| 250 (2.5")  | 5.812   | 6.312    | 6.812    | 7.312    | 7.812     | 8.312      | 8.812      | 9.937      | 10.312     | 11.312     | —          |
| 325 (2.25") | 6.765   | 7.265    | 7.765    | 8.265    | 8.765     | 9.265      | 9.765      | 10.265     | 11.265     | 12.265     | 13.265     |
| 400 (4")    | 6.765   | 7.265    | 7.765    | 8.265    | 8.765     | 9.265      | 9.765      | 10.265     | 11.265     | 12.265     | 13.265     |

## Oversized Rod / Standard Rod and Non-Rotating (XB5 / X119US)



### Specifications

| Bore size (inch)              | 2   | 2.5 | 3.25 | 4 |
|-------------------------------|---|-----|------|---|
| Media                         | Air   |     |      |   |
| Max. Operating Pressure       | 250 psi (17.5 kgf/cm <sup>2</sup> )                         |     |      |   |
| Min. Operating Pressure       | 8 psi (0.5 kgf/cm <sup>2</sup> )                            |     |      |   |
| Ambient and Media Temperature | 40 to 140°F (5 to -60°C)                                    |     |      |   |
| Piston Speed                  | 2 to 20 inch/sec (50 to 500mm/sec)                          |     |      |   |
| Cushion                       | Air Cushion Standard  |     |      |   |
| Mounting Types                | Basic, Foot, Flange, Center Trunnion, Side Tapped, Side Lug |     |      |   |

### Specifications for X119US

|                             |  |
|-----------------------------|--|
| Max. Operating Pressure     | 150 psi  |
| Min. Operating Pressure     | 15 psi   |
| Operating Temperature Range | 40 to 140°F (5 to -60°C)                                       |
| Piston Speed Range          | 2 to 20 inch/sec (50 to 500mm/sec)                             |
| Cushion                     | Air Standard-Both ends   |
| Mounting                    | See "How to Order"   |
| Max. Rotating Torque        | 6.9lb-in (2.00" & 2.50" bore)<br>8.2lb-in (3.25" & 4.00" bore) |
| Non-rotating Rod Accuracy   | ±0.5" (2.00" & 2.50" bore)<br>±0.3 (3.25 & 4.00" bore)         |
| Additional Feature          | Oversized Piston Rod (XB5)                                     |

### How To Order Oversized Rod / Standard

NCA1 [MOUNTING] [BORE] - [STROKE] - XB5

Ex: NCDA1B 250-0200-XB5

Auto-switch capable

Oversized / Standard Rod

### How To Order Oversized Rod/Non-Rotating

NCA1 K [MOUNTING] [BORE] - [STROKE] - X119US

Ex: NCDA1KB 200-0100-X119US

Auto-switch capable

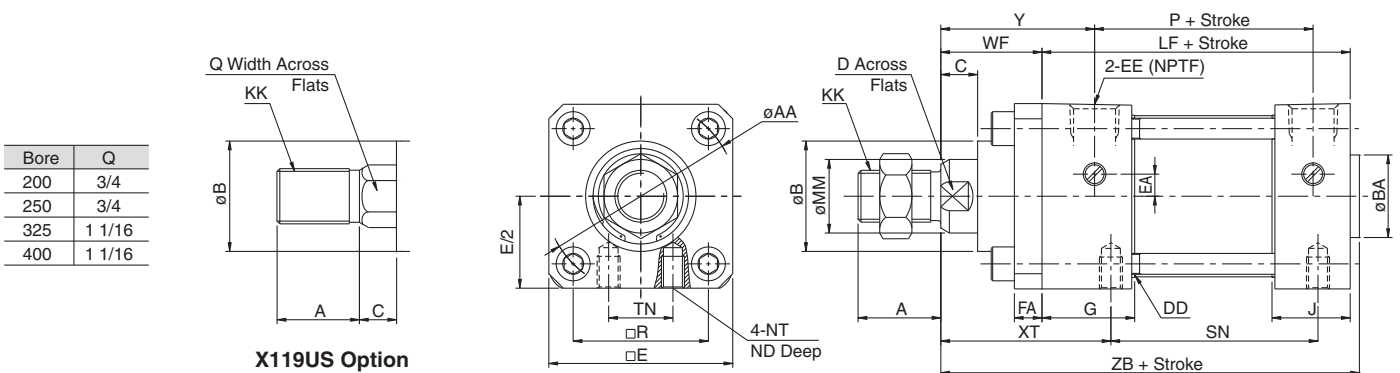
Oversized / Non-Rotating Rod

### Standard Stroke List

(in)

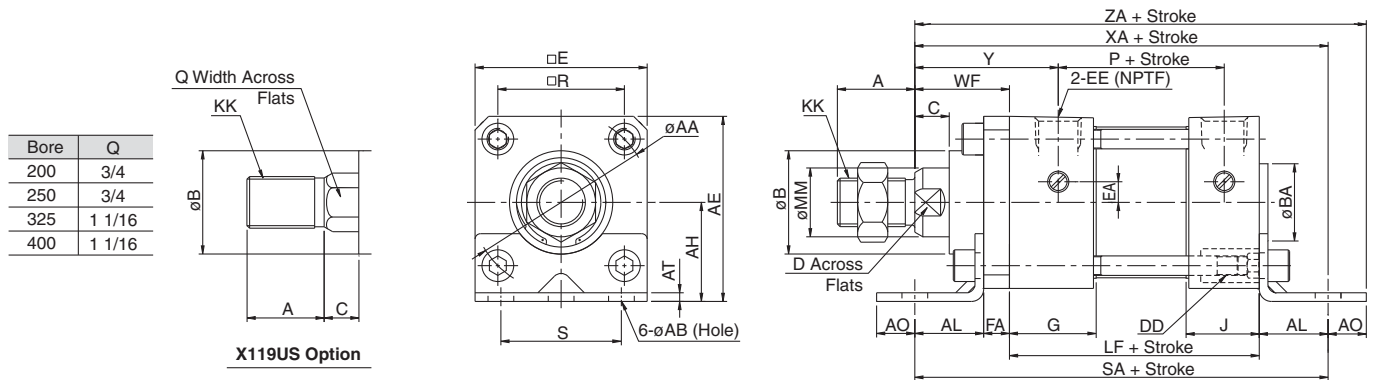
| Bore Size | Standard Stroke   |
|-----------|---|
| 2", 2.5"  | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 3.25", 4" | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 |

### Oversized Rod – Basic Type NC A1B (XB5)



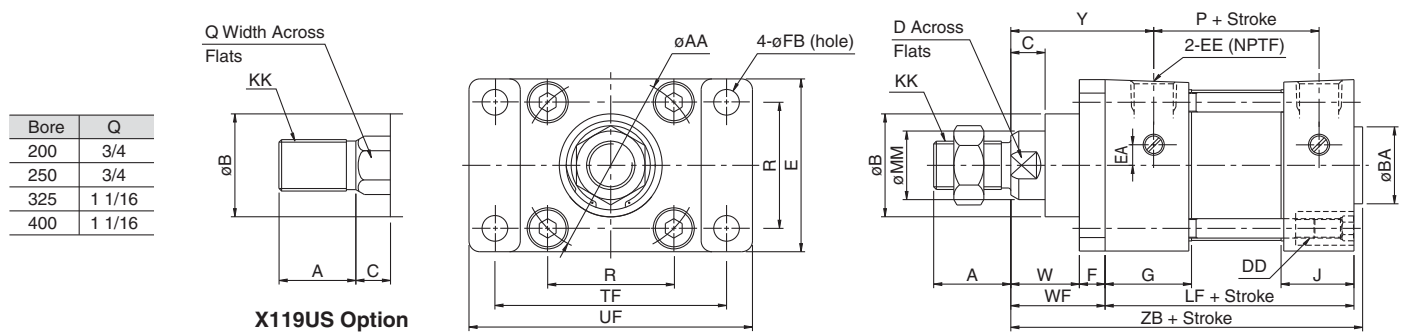
| Bore (in)   | MM    | KK     | A     | AA  | B   | BA    | C   | D     | DD      | E     | EA  | EE  | FA  | G    | J    | R    | ND    | NT      | TN    | WF    | XT      | Y    | LF    | P    | SN    | ZB     |
|-------------|-------|--------|-------|-----|-----|-------|-----|-------|---------|-------|-----|-----|-----|------|------|------|-------|---------|-------|-------|---------|------|-------|------|-------|--------|
| 200 (2")    | 1     | 3/4-16 | 1 1/8 | 2.6 | 1.5 | 1 1/8 | 1/2 | 7/8   | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 1.26 | 1.06 | 1.84 | 7/16  | 5/16-18 | 0.875 | 1 3/8 | 2 5/16  | 2.09 | 3 5/8 | 2.40 | 2 1/4 | 5 1/8  |
| 250 (2.5")  | 1     | 3/4-16 | 1 1/8 | 3.1 | 1.5 | 1 1/8 | 1/2 | 7/8   | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 1.30 | 1.06 | 2.19 | 19/32 | 3/8-16  | 1.25  | 1 3/8 | 2 5/16  | 2.13 | 3 3/4 | 2.48 | 2 3/8 | 5 1/4  |
| 325 (3.25") | 1 3/8 | 1-14   | 1 5/8 | 3.9 | 2   | 1 1/2 | 5/8 | 1 1/4 | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 2.76 | 5/8   | 1/2-13  | 1.5   | 1 5/8 | 2 11/16 | 2.59 | 4 1/4 | 2.72 | 2 5/8 | 6 5/64 |
| 400 (4")    | 1 3/8 | 1-14   | 1 5/8 | 4.7 | 2   | 1 1/2 | 5/8 | 1 1/4 | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 3.32 | 5/8   | 1/2-13  | 2.06  | 1 5/8 | 2 11/16 | 2.59 | 4 1/4 | 2.72 | 2 5/8 | 6 5/64 |

## Oversized Rod – Foot Mounting Type NC   A1L (XB5)



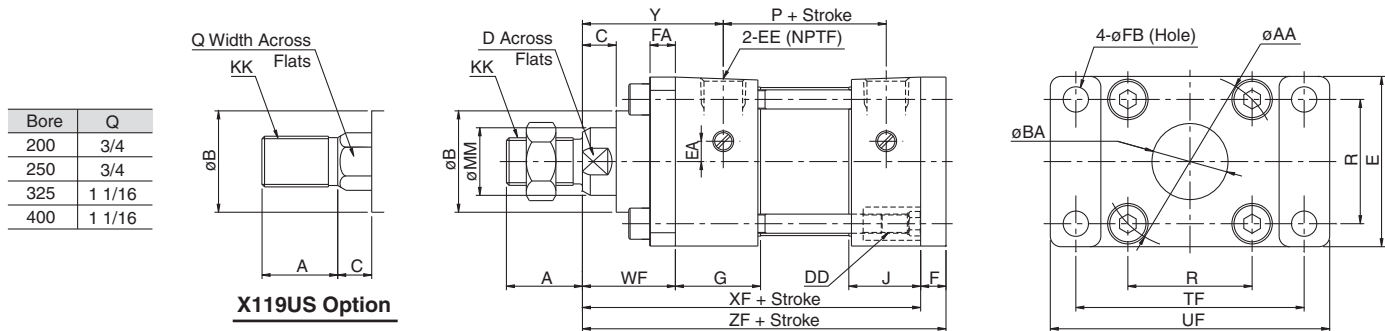
| Bore (in)   | MM    | KK     | A     | AA  | AB  | AE      | AH      | AL    | AO   | AT    | B   | BA    | C   | D     | DD      | E     | EA  | EE  | FA  | G    | J    | R    | S     | WF    | Y    | P    | LF    | SA    | XA    | ZA      |
|-------------|-------|--------|-------|-----|-----|---------|---------|-------|------|-------|-----|-------|-----|-------|---------|-------|-----|-----|-----|------|------|------|-------|-------|------|------|-------|-------|-------|---------|
| 200 (2")    | 1     | 3/4-16 | 1 1/8 | 2.6 | 3/8 | 2 11/16 | 1 7/16  | 1     | 9/16 | 1/8   | 1.5 | 1 1/8 | 1/2 | 7/8   | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 1.26 | 1.06 | 1.84 | 1 3/4 | 1 3/8 | 2.09 | 2.40 | 3 5/8 | 6     | 6     | 6 9/16  |
| 250 (2.5")  | 1     | 3/4-16 | 1 1/8 | 3.1 | 3/8 | 3 1/8   | 1 5/8   | 1     | 9/16 | 1/8   | 1.5 | 1 1/8 | 1/2 | 7/8   | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 1.30 | 1.06 | 2.19 | 2 1/4 | 1 3/8 | 2.13 | 2.48 | 3 3/4 | 6 1/8 | 6 1/8 | 6 11/16 |
| 325 (3.25") | 1 3/8 | 1-14   | 1 5/8 | 3.9 | 1/2 | 3 13/16 | 1 15/16 | 1 1/4 | 3/4  | 11/64 | 2   | 1 1/2 | 5/8 | 1 1/4 | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 2.76 | 2 3/4 | 1 5/8 | 2.59 | 2.72 | 4 1/4 | 7 3/8 | 7 3/8 | 7 7/8   |
| 400 (4")    | 1 3/8 | 1-14   | 1 5/8 | 4.7 | 1/2 | 4 1/2   | 2 1/4   | 1 1/4 | 3/4  | 11/64 | 2   | 1 1/2 | 5/8 | 1 1/4 | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 3.32 | 3 1/2 | 1 5/8 | 2.59 | 2.72 | 4 1/4 | 7 3/8 | 7 3/8 | 7 7/8   |

## Oversized Rod – Front Flange Mounting Type NC   A1F (XB5)



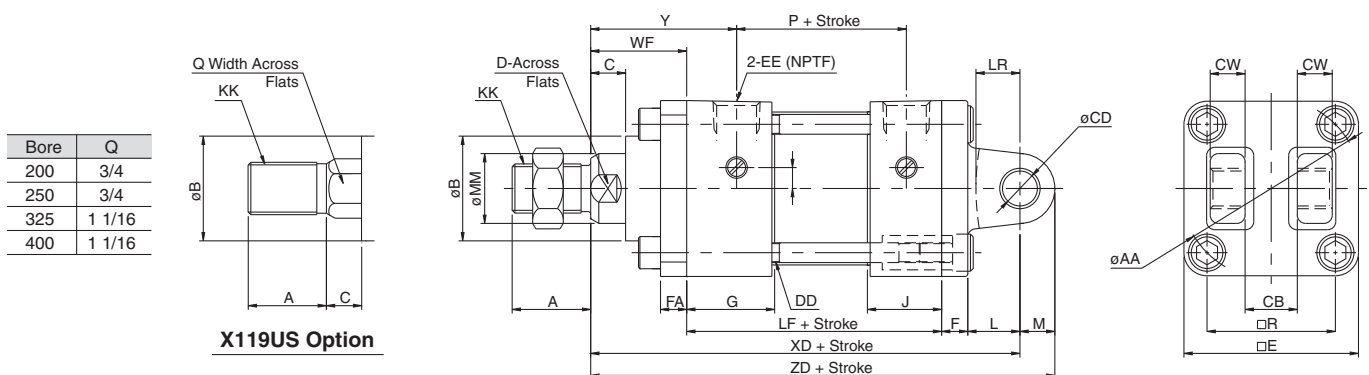
| Bore (in)   | MM    | KK     | A     | AA  | B   | BA    | C   | D     | DD      | E     | EA  | EE  | F   | FB   | G    | J    | R    | TF      | UF    | W | WF    | LF    | Y    | P    | ZB     |
|-------------|-------|--------|-------|-----|-----|-------|-----|-------|---------|-------|-----|-----|-----|------|------|------|------|---------|-------|---|-------|-------|------|------|--------|
| 200 (2")    | 1     | 3/4-16 | 1 1/8 | 2.6 | 1.5 | 1 1/8 | 1/2 | 7/8   | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 3/8  | 1.26 | 1.06 | 1.84 | 3 3/8   | 4 1/8 | 1 | 1 3/8 | 3 5/8 | 2.09 | 2.40 | 5 1/8  |
| 250 (2.5")  | 1     | 3/4-16 | 1 1/8 | 3.1 | 1.5 | 1 1/8 | 1/2 | 7/8   | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 3/8  | 1.30 | 1.06 | 2.19 | 3 7/8   | 4 5/8 | 1 | 1 3/8 | 3 3/4 | 2.13 | 2.48 | 5 1/4  |
| 325 (3.25") | 1 3/8 | 1-14   | 1 5/8 | 3.9 | 2   | 1 1/2 | 5/8 | 1 1/4 | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 7/16 | 1.57 | 1.18 | 2.76 | 4 11/16 | 5 1/2 | 1 | 1 5/8 | 4 1/4 | 2.59 | 2.72 | 6 5/64 |
| 400 (4")    | 1 3/8 | 1-14   | 1 5/8 | 4.7 | 2   | 1 1/2 | 5/8 | 1 1/4 | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 7/16 | 1.57 | 1.18 | 3.32 | 5 7/16  | 6 1/4 | 1 | 1 5/8 | 4 1/4 | 2.59 | 2.72 | 6 5/64 |

## Oversized Rod – Rear Flange Mounting Type NC   A1G (XB5)



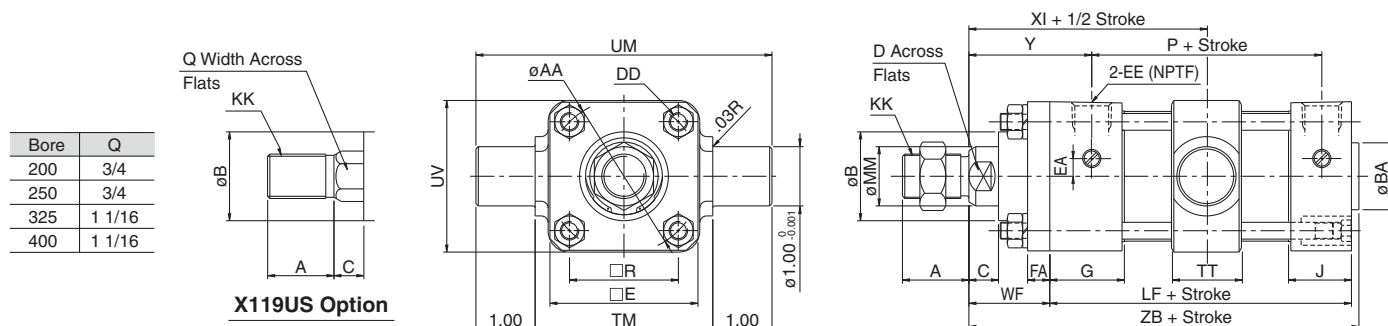
| (in)        |       |        |       |     |     |       |     |       |         |       |     |     |     |     |      |      |      |      |         |       |       |      |      |       |       |
|-------------|-------|--------|-------|-----|-----|-------|-----|-------|---------|-------|-----|-----|-----|-----|------|------|------|------|---------|-------|-------|------|------|-------|-------|
| Bore (in)   | MM    | KK     | A     | AA  | B   | BA    | C   | D     | DD      | E     | EA  | EE  | F   | FA  | FB   | G    | J    | R    | TF      | UF    | WF    | Y    | P    | XF    | ZF    |
| 200 (2")    | 1     | 3/4-16 | 1 1/8 | 2.6 | 1.5 | 1 1/8 | 1/2 | 7/8   | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 3/8 | 3/8  | 1.26 | 1.06 | 1.84 | 3 3/8   | 4 1/8 | 1 3/8 | 2.09 | 2.40 | 5     | 5 3/8 |
| 250 (2.5")  | 1     | 3/4-16 | 1 1/8 | 3.1 | 1.5 | 1 1/8 | 1/2 | 7/8   | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 3/8 | 3/8  | 1.30 | 1.06 | 2.19 | 3 7/8   | 4 5/8 | 1 3/8 | 2.13 | 2.48 | 5 1/8 | 5 1/2 |
| 325 (3.25") | 1 3/8 | 1-14   | 1 5/8 | 3.9 | 2   | 1 1/2 | 5/8 | 1 1/4 | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 5/8 | 7/16 | 1.57 | 1.18 | 2.76 | 4 11/16 | 5 1/2 | 1 5/8 | 2.59 | 2.72 | 5 7/8 | 6 1/2 |
| 400 (4")    | 1 3/8 | 1-14   | 1 5/8 | 4.7 | 2   | 1 1/2 | 5/8 | 1 1/4 | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 5/8 | 7/16 | 1.57 | 1.18 | 3.32 | 5 7/16  | 6 1/4 | 1 5/8 | 2.59 | 2.72 | 5 7/8 | 6 1/2 |

## Oversized Rod – Double Detachable Rear Clevis Mounting Type NC   A1D (XB5)



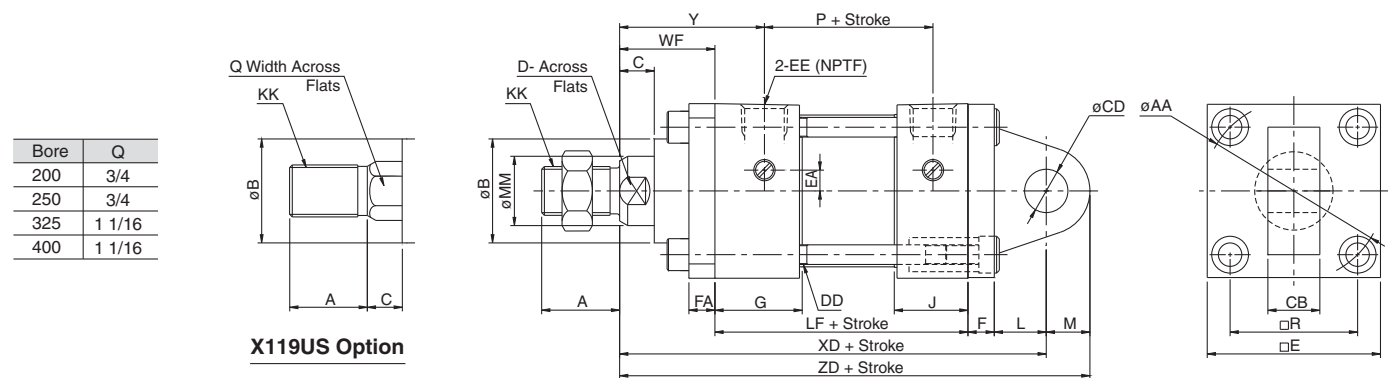
| (in)        |       |        |       |     |       |     |       |     |     |       |         |       |     |     |     |     |      |      |       |     |     |      |       |       |      |       |      |       |
|-------------|-------|--------|-------|-----|-------|-----|-------|-----|-----|-------|---------|-------|-----|-----|-----|-----|------|------|-------|-----|-----|------|-------|-------|------|-------|------|-------|
| Bore (in)   | MM    | KK     | A     | AA  | B     | C   | CB    | CD  | CW  | D     | DD      | E     | EA  | EE  | F   | FA  | G    | J    | L     | LR  | M   | R    | WF    | XD    | Y    | LF    | P    | ZD    |
| 200 (2")    | 1     | 3/4-16 | 1 1/8 | 2.6 | 1 1/2 | 1/2 | 3/4   | 1/2 | 1/2 | 7/8   | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 3/8 | 1.26 | 1.06 | 3/4   | 5/8 | 1/2 | 1.84 | 1 3/8 | 6 1/8 | 2.09 | 3 5/8 | 2.40 | 6 5/8 |
| 250 (2.5")  | 1     | 3/4-16 | 1 1/8 | 3.1 | 1 1/2 | 1/2 | 3/4   | 1/2 | 1/2 | 7/8   | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 3/8 | 1.30 | 1.06 | 3/4   | 5/8 | 1/2 | 2.19 | 1 3/8 | 6 1/4 | 2.13 | 3 3/4 | 2.48 | 6 3/4 |
| 325 (3.25") | 1 3/8 | 1-14   | 1 5/8 | 3.9 | 2     | 5/8 | 1 1/4 | 3/4 | 5/8 | 1 1/4 | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 5/8 | 1.57 | 1.18 | 1 1/4 | 1   | 3/4 | 2.76 | 1 5/8 | 7 3/4 | 2.59 | 4 1/4 | 2.72 | 8 1/2 |
| 400 (4")    | 1 3/8 | 1-14   | 1 5/8 | 4.7 | 2     | 5/8 | 1 1/4 | 3/4 | 5/8 | 1 1/4 | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 5/8 | 1.57 | 1.18 | 1 1/4 | 1   | 3/4 | 3.32 | 1 5/8 | 7 3/4 | 2.59 | 4 1/4 | 2.72 | 8 1/2 |

## Oversized Rod – Center Trunnion Mounting Type NC ■ A1T (XB5)



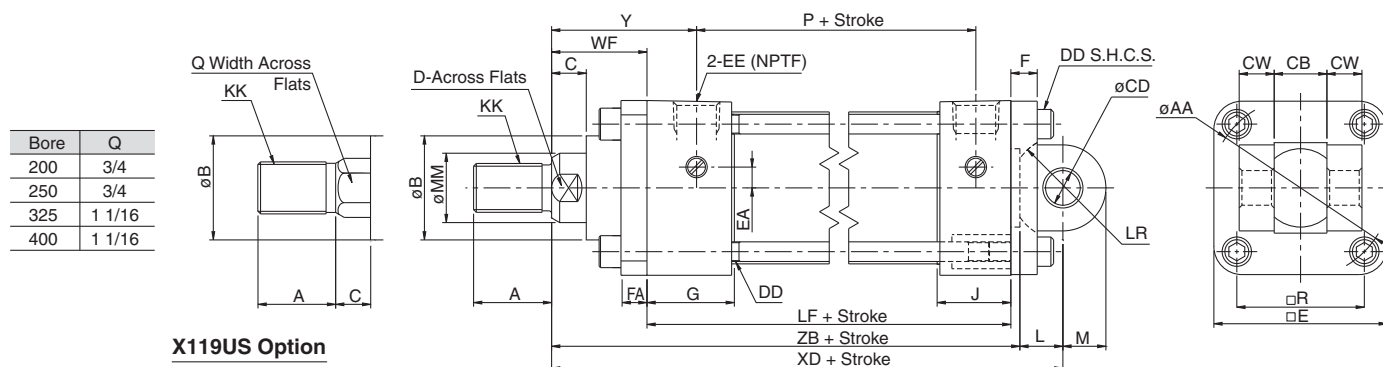
| Bore (in)   | MM    | KK     | A     | AA  | B     | BA    | C   | D     | DD      | E     | EA  | EE  | FA  | G    | J    | R    | TM    | TT   | UM    | UV   | WF    | Y    | LF    | P    | XI   | ZB     |
|-------------|-------|--------|-------|-----|-------|-------|-----|-------|---------|-------|-----|-----|-----|------|------|------|-------|------|-------|------|-------|------|-------|------|------|--------|
| 200 (2")    | 1     | 3/4-16 | 1 1/8 | 2.6 | 1 1/2 | 1 1/8 | 1/2 | 7/8   | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 1.26 | 1.06 | 1.84 | 3     | 1.18 | 5     | 2.56 | 1 3/8 | 2.09 | 3 5/8 | 2.40 | 3.29 | 5 1/8  |
| 250 (2.5")  | 1     | 3/4-16 | 1 1/8 | 3.1 | 1 1/2 | 1 1/8 | 1/2 | 7/8   | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 1.30 | 1.06 | 2.19 | 3 1/2 | 1.18 | 5 1/2 | 3.39 | 1 3/8 | 2.13 | 3 3/4 | 2.48 | 3.37 | 5 1/4  |
| 325 (3.25") | 1 3/8 | 1-14   | 1 5/8 | 3.9 | 2     | 1 1/2 | 5/8 | 1 1/4 | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 2.76 | 4 1/2 | 1.34 | 6 1/2 | 4.33 | 1 5/8 | 2.59 | 4 1/4 | 2.72 | 3.95 | 6 5/64 |
| 400 (4")    | 1 3/8 | 1-14   | 1 5/8 | 4.7 | 2     | 1 1/2 | 5/8 | 1 1/4 | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 3.32 | 5 1/4 | 1.57 | 7 1/4 | 5.12 | 1 5/8 | 2.59 | 4 1/4 | 2.72 | 3.99 | 6 5/64 |

## Oversized Rod – Single Detachable Rear Clevis Mounting Type NC ■ A1C (XB5)



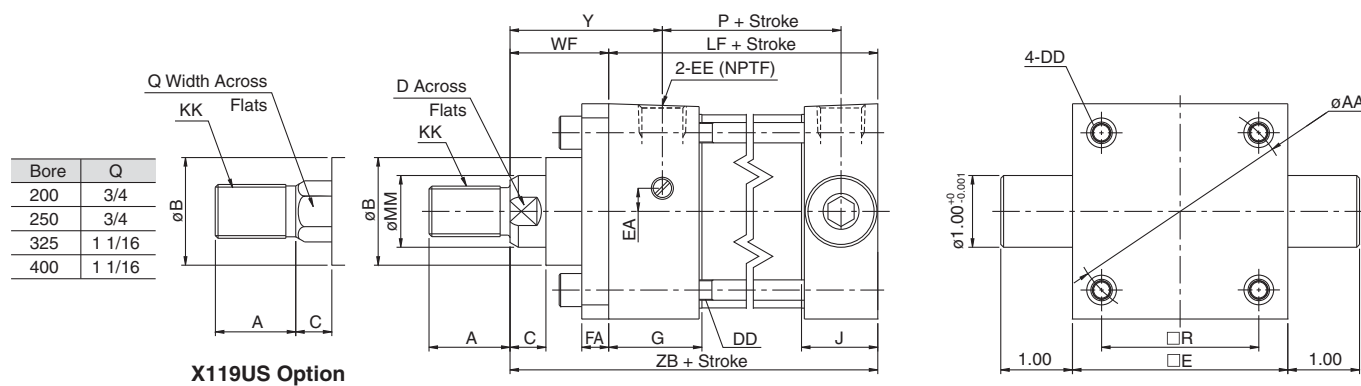
| Bore (in)   | MM    | KK     | A     | AA  | B     | C   | CB    | CD  | D     | DD      | E     | EA  | EE  | F   | FA  | G    | J    | L     | M   | R    | WF    | XD    | Y    | LF    | P    | ZD   |
|-------------|-------|--------|-------|-----|-------|-----|-------|-----|-------|---------|-------|-----|-----|-----|-----|------|------|-------|-----|------|-------|-------|------|-------|------|------|
| 200 (2")    | 1     | 3/4-16 | 1 1/8 | 2.6 | 1 1/2 | 1/2 | 3/4   | 1/2 | 7/8   | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 3/8 | 1.26 | 1.06 | 3/4   | 5/8 | 1.84 | 1 3/8 | 6 1/8 | 2.09 | 3 5/8 | 2.40 | 6.75 |
| 250 (2.5")  | 1     | 3/4-16 | 1 1/8 | 3.1 | 1 1/2 | 1/2 | 3/4   | 1/2 | 7/8   | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 3/8 | 1.30 | 1.06 | 3/4   | 5/8 | 2.19 | 1 3/8 | 6 1/4 | 2.13 | 3 3/4 | 2.48 | 6.88 |
| 325 (3.25") | 1 3/8 | 1-14   | 1 5/8 | 3.9 | 2     | 5/8 | 1 1/4 | 3/4 | 1 1/4 | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 5/8 | 1.57 | 1.18 | 1 1/4 | 7/8 | 2.76 | 1 5/8 | 7 3/4 | 2.59 | 4 1/4 | 2.72 | 8.63 |
| 400 (4")    | 1 3/8 | 1-14   | 1 5/8 | 3.9 | 2     | 5/8 | 1 1/4 | 3/4 | 1 1/4 | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 5/8 | 1.57 | 1.18 | 1 1/4 | 7/8 | 3.32 | 1 5/8 | 7 3/4 | 2.59 | 4 1/4 | 2.72 | 8.63 |

## Oversized Rod – Double Rear Clevis Mounting Type NC   A1X (XB5)



| Bore (in)   | MM    | KK     | A     | AA  | B     | C   | CB    | CD  | CW  | D     | DD      | E     | EA  | EE  | F   | FA  | G    | J    | L    | LR    | M   | R    | WF    | XD    | Y    | LF    | P    | ZB     |
|-------------|-------|--------|-------|-----|-------|-----|-------|-----|-----|-------|---------|-------|-----|-----|-----|-----|------|------|------|-------|-----|------|-------|-------|------|-------|------|--------|
| 200 (2")    | 1     | 3/4-16 | 1 1/8 | 2.6 | 1 1/2 | 1/2 | 3/4   | 1/2 | 1/2 | 7/8   | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 3/8 | 1.26 | 1.06 | 0.62 | 3/4   | 5/8 | 1.84 | 1 3/8 | 5 3/4 | 2.09 | 3 5/8 | 2.40 | 5 1/8  |
| 250 (2.5")  | 1     | 3/4-16 | 1 1/8 | 3.1 | 1 1/2 | 1/2 | 3/4   | 1/2 | 1/2 | 7/8   | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 3/8 | 1.30 | 1.06 | 0.62 | 3/4   | 5/8 | 2.19 | 1 3/8 | 5 7/8 | 2.13 | 3 3/4 | 2.48 | 5 1/4  |
| 325 (3.25") | 1 3/8 | 1-14   | 1 5/8 | 3.9 | 2     | 5/8 | 1 1/4 | 3/4 | 5/8 | 1 1/4 | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 5/8 | 1.57 | 1.18 | 1.05 | 1 1/4 | 7/8 | 2.76 | 1 5/8 | 7 1/8 | 2.59 | 4 1/4 | 2.72 | 6 5/64 |
| 400 (4")    | 1 3/8 | 1-14   | 1 5/8 | 4.7 | 2     | 5/8 | 1 1/4 | 3/4 | 5/8 | 1 1/4 | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 5/8 | 1.57 | 1.18 | 1.05 | 1 1/4 | 7/8 | 3.32 | 1 5/8 | 7 1/8 | 2.59 | 4 1/4 | 2.72 | 6 5/64 |

## Oversized Rod – Head Trunnion Mounting Type NC   A1J (XB5)



| Bore (in)   | MM    | KK     | A     | AA  | B     | C   | D     | DD      | E     | EA  | EE  | FA  | G    | J    | R    | WF    | Y    | LF    | P    | ZB     |
|-------------|-------|--------|-------|-----|-------|-----|-------|---------|-------|-----|-----|-----|------|------|------|-------|------|-------|------|--------|
| 200 (2")    | 1     | 3/4-16 | 1 1/8 | 2.6 | 1 1/2 | 1/2 | 7/8   | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 3/8 | 1.26 | 1.06 | 1.84 | 1 3/8 | 2.09 | 3 5/8 | 2.40 | 5 1/8  |
| 250 (2.5")  | 1     | 3/4-16 | 1 1/8 | 3.1 | 1 1/2 | 1/2 | 7/8   | 5/16-24 | 3     | 0   | 3/8 | 3/8 | 1.30 | 1.06 | 2.19 | 1 3/8 | 2.13 | 3 3/4 | 2.48 | 5 1/4  |
| 325 (3.25") | 1 3/8 | 1-14   | 1 5/8 | 3.9 | 2     | 5/8 | 1 1/4 | 3/8-24  | 3 3/4 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 2.76 | 1 5/8 | 2.59 | 4 1/4 | 2.72 | 6 5/64 |
| 400 (4")    | 1 3/8 | 1-14   | 1 5/8 | 4.7 | 2     | 5/8 | 1 1/4 | 3/8-24  | 4 1/2 | 0   | 1/2 | 5/8 | 1.57 | 1.18 | 3.32 | 1 5/8 | 2.59 | 4 1/4 | 2.72 | 6 5/64 |



## Adjustable Stroke - Extended (XC8)



- The extended stroke stop position is infinitely adjustable within the adjustable range.
- Auto switch capable

## Specifications

| Bore size (inch)        | 1.5   | 2 | 2.5 | 3.25 | 4 |
|-------------------------|---|---|-----|------|---|
| Media                   | Air   |   |     |      |   |
| Max. Operating Pressure | 250 psi (17.5 kgf/cm <sup>2</sup> )               |   |     |      |   |
| Min. Operating Pressure | 8 psi (0.5 kgf/cm <sup>2</sup> )                  |   |     |      |   |
| Ambient and Media Temp. | 40 to 140°F (5 to 60°C)                           |   |     |      |   |
| Piston Speed            | 2 to 20 inch/sec (50 to 500mm/sec)                |   |     |      |   |
| Cushion                 | Air Cushion Standard                              |   |     |      |   |
| Mounting Types          | Basic, Foot, Flange, Center Trunnion, Side Tapped |   |     |      |   |

## Standard Stroke List

(in)

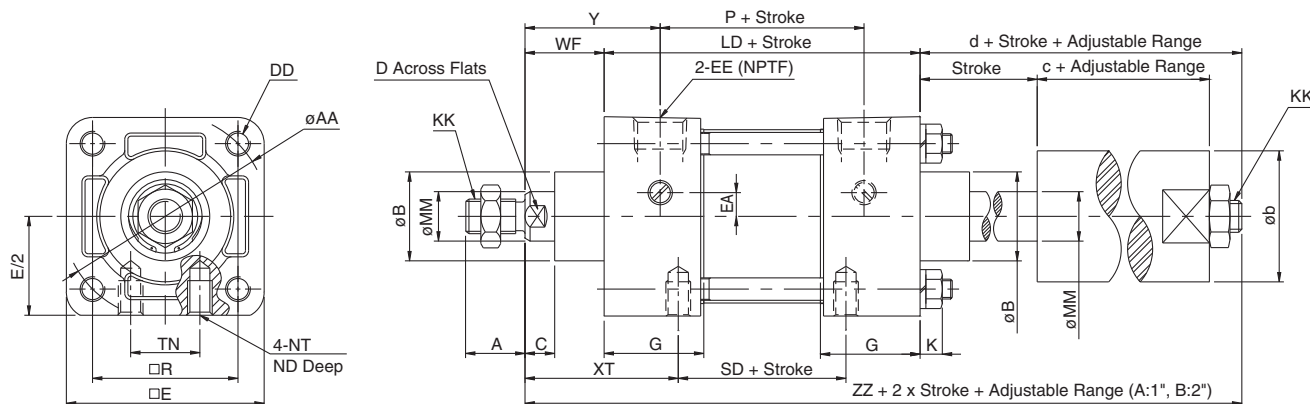
| Bore size | Standard Stroke   |
|-----------|---|
| 1.5"      | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 2", 2.5"  | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 3.25", 4" | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 |

## How To Order

NC **D** A1 **B** **150** — **0400** **A** — XC8

Auto Switch    Mounting    Bore    Stroke    Adjustment Range  
 A: 0~1"  
 B: 0~2"

## Dimensions



| Bore (in)   | MM  | KK      | A     | AA   | B     | C   | D    | DD      | E     | EA  | EE  | G    | K     | R    | WF    | Y    | LD   | P    | ZZ   | b       | c    | d    | SD   | NT      | ND    | TN     |
|-------------|-----|---------|-------|------|-------|-----|------|---------|-------|-----|-----|------|-------|------|-------|------|------|------|------|---------|------|------|------|---------|-------|--------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 9/32  | 1.43 | 1     | 1.71 | 3.78 | 2.36 | 6.58 | 1 1/2   | 1.25 | 1.80 | 1.9  | 1/4-20  | 9/32  | 5/8    |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 11/32 | 1.84 | 1     | 1.71 | 3.82 | 2.40 | 7.01 | 1 21/32 | 1.64 | 2.19 | 1.94 | 5/16-18 | 7/16  | 7/8    |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.30 | 11/32 | 2.19 | 1     | 1.75 | 3.98 | 2.48 | 7.17 | 1 21/32 | 1.64 | 2.19 | 2.1  | 3/8-16  | 19/32 | 1 1/4  |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 27/64 | 2.76 | 1 3/8 | 2.34 | 4.64 | 2.72 | 9.38 | 2 9/32  | 2.48 | 3.37 | 2.52 | 1/2-13  | 5/8   | 1 1/2  |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 27/64 | 3.32 | 1 3/8 | 2.34 | 4.64 | 2.72 | 9.38 | 2 9/32  | 2.48 | 3.37 | 2.52 | 1/2-13  | 5/8   | 2 1/16 |

(in)

## Adjustable Stroke - Return (XC9)



- The return stroke stop position is infinitely adjustable within the adjustable range.
- Auto switch capable

## Specifications

| Bore size (inch)        | 1.5   | 2 | 2.5 | 3.25 | 4 |
|-------------------------|---|---|-----|------|---|
| Media                   | Air   |   |     |      |   |
| Max. Operating Pressure | 250 psi (17.5 kgf/cm <sup>2</sup> )               |   |     |      |   |
| Min. Operating Pressure | 8 psi (0.5 kgf/cm <sup>2</sup> )                  |   |     |      |   |
| Ambient and Media Temp. | 40 to 140°F (5 to 60°C)                           |   |     |      |   |
| Piston Speed            | 2 to 20 inch/sec (50 to 500mm/sec)                |   |     |      |   |
| Cushion                 | Air Cushion Standard                              |   |     |      |   |
| Mounting Types          | Basic, Foot, Flange, Center Trunnion, Side Tapped |   |     |      |   |

## Standard Stroke List

| Bore size | Standard Stroke   |
|-----------|---|
| 1.5"      | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 2", 2.5"  | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 3.25", 4" | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 |

(in)

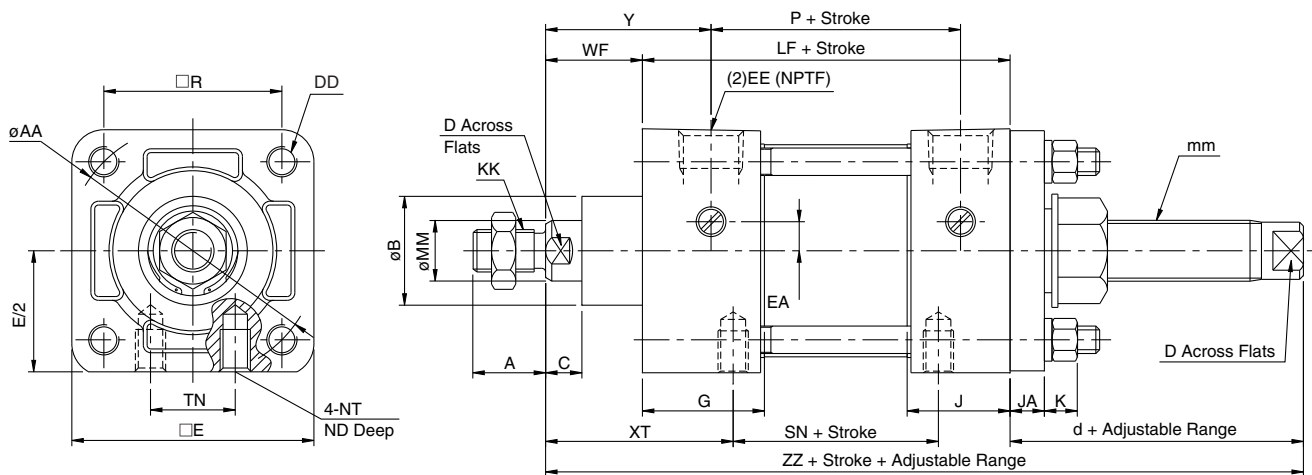
## How To Order

NC D A1 B 150 — 0400 A — XC9

Auto Switch      Mounting      Bore      Stroke      Adjustment Range  
A: 0~1"      B: 0~2"

Adjustable Stroke Retract

## Dimensions



(in)

| Bore (in)   | MM  | KK      | A     | AA   | B     | C   | D    | DD      | E     | EA  | EE  | G    | J    | JA    | K     | R    | WF    | Y    | LF    | P    | ZZ   | TN     | XT      | SN    | d    | mm        | NT      | ND    |
|-------------|-----|---------|-------|------|-------|-----|------|---------|-------|-----|-----|------|------|-------|-------|------|-------|------|-------|------|------|--------|---------|-------|------|-----------|---------|-------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 1.10 | 11/32 | 9/32  | 1.43 | 1     | 1.71 | 3 5/8 | 2.36 | 6.44 | 5/8    | 1 15/16 | 2 1/4 | 1.81 | M16 x 1.5 | 1/4-20  | 9/32  |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.6  | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 1.06 | 11/32 | 11/32 | 1.84 | 1     | 1.71 | 3 5/8 | 2.40 | 6.44 | 7/8    | 1 15/16 | 2 1/4 | 1.81 | M16 x 1.5 | 5/16-18 | 7/16  |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.30 | 1.06 | 11/32 | 11/32 | 2.19 | 1     | 1.75 | 3 3/4 | 2.48 | 6.44 | 1 1/4  | 1 15/16 | 2 3/8 | 1.69 | M16 x 1.5 | 3/8-16  | 19/32 |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 1.10 | 5/8   | 27/64 | 2.76 | 1 3/8 | 2.34 | 4 1/4 | 2.72 | 8.02 | 1 1/2  | 2 7/16  | 2 5/8 | 2.40 | M24 x 1.5 | 1/2-13  | 5/8   |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 1.10 | 5/8   | 27/64 | 3.32 | 1 3/8 | 2.34 | 4 1/4 | 2.72 | 8.02 | 2 1/16 | 2 7/16  | 2 5/8 | 2.40 | M24 x 1.5 | 1/2-13  | 5/8   |

## Dual Operation - Double Rod (XC10)



- 4 positions available from a single cylinder
- Auto switch capable

### Specifications

| Bore size (inch)        | 1.5   | 2 | 2.5 | 3.25 | 4 |
|-------------------------|---|---|-----|------|---|
| Media                   | Air   |   |     |      |   |
| Max. Operating Pressure | 250 psi (17.5 kgf/cm <sup>2</sup> )               |   |     |      |   |
| Min. Operating Pressure | 8 psi (0.5 kgf/cm <sup>2</sup> )                  |   |     |      |   |
| Ambient and Media Temp. | 40 to 140°F (5 to 60°C)                           |   |     |      |   |
| Piston Speed            | 2 to 20 inch/sec (50 to 500mm/sec)                |   |     |      |   |
| Cushion                 | Air Cushion Standard                              |   |     |      |   |
| Mounting Types          | Basic, Foot, Flange, Center Trunnion, Side Tapped |   |     |      |   |

### Standard Stroke List

| Bore Size | Standard Stroke (in)                                    |
|-----------|---|
| 1.5"      | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 2", 2.5"  | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 3.25", 4" | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 |

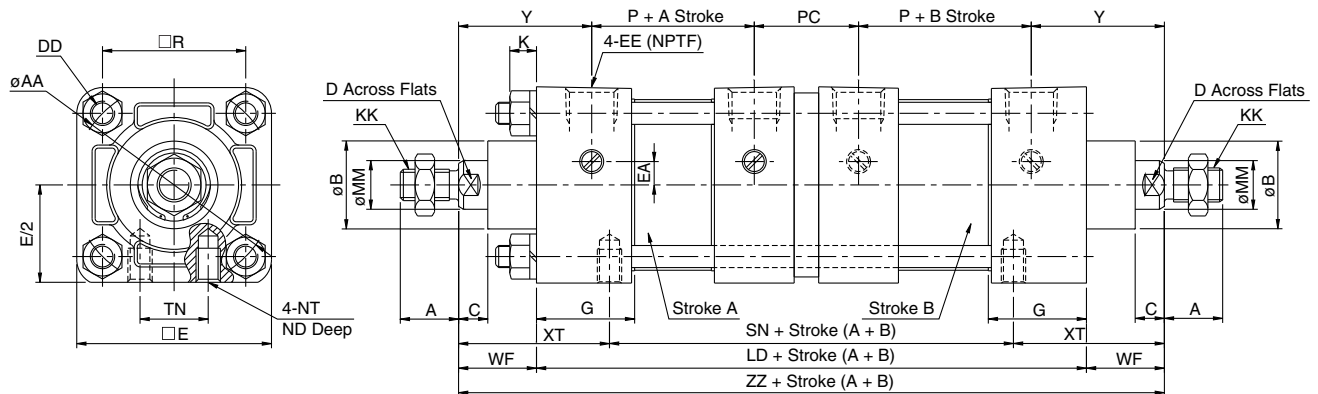
### How To Order

NC D A1 B 150 — 0400 N — 0200 R XC10

Auto Switch      Mounting      Bore      Stroke A      Stroke B      Dual Operation Double Rod

Cushions  
- Both Ends  
N w/o Cushions  
H Head End  
R Rod End

### Dimensions



| Bore (in)   | MM  | KK      | A     | AA   | B     | C   | D    | DD      | E     | EA  | EE  | G    | K     | R    | WF    | Y    | LD   | P    | PC   | ZZ    | SN   | TN     | XT      | NT      | ND    |
|-------------|-----|---------|-------|------|-------|-----|------|---------|-------|-----|-----|------|-------|------|-------|------|------|------|------|-------|------|--------|---------|---------|-------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 9/32  | 1.43 | 1     | 1.71 | 7.44 | 2.36 | 1.30 | 9.44  | 5.56 | 5/8    | 1 15/16 | 1/4-20  | 9/32  |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.60 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 11/32 | 1.84 | 1     | 1.71 | 7.52 | 2.40 | 1.30 | 9.52  | 5.64 | 7/8    | 1 15/16 | 5/16-18 | 7/16  |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.30 | 11/32 | 2.19 | 1     | 1.75 | 7.76 | 2.48 | 1.30 | 9.76  | 5.88 | 1 1/4  | 1 15/16 | 3/8-16  | 19/32 |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 27/64 | 2.76 | 1 3/8 | 2.34 | 8.94 | 2.72 | 1.57 | 11.69 | 6.82 | 1 1/2  | 2 7/16  | 1/2-13  | 5/8   |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 27/64 | 3.32 | 1 3/8 | 2.34 | 8.94 | 2.72 | 1.57 | 11.69 | 6.82 | 2 1/16 | 2 7/16  | 1/2-13  | 5/8   |

## Dual Operation - Single Rod (XC11)



- 3 positions can be obtained from a single cylinder.
- Twice the force is available for the extended stroke.
- Auto switch capable

## Specifications

| Bore size (inch)        | 1.5   | 2 | 2.5 | 3.25 | 4 |
|-------------------------|---|---|-----|------|---|
| Media                   | Air   |   |     |      |   |
| Max. Operating Pressure | 250 psi (17.5 kgf/cm <sup>2</sup> )               |   |     |      |   |
| Min. Operating Pressure | 8 psi (0.5 kgf/cm <sup>2</sup> )                  |   |     |      |   |
| Ambient and Media Temp. | 40 to 140°F (5 to 60°C)                           |   |     |      |   |
| Piston Speed            | 2 to 20 inch/sec (50 to 500mm/sec)                |   |     |      |   |
| Cushion                 | Air Cushion Standard                              |   |     |      |   |
| Mounting Types          | Basic, Foot, Flange, Clevis Side Lug, Side Tapped |   |     |      |   |

## Standard Stroke List

| Bore Size | Standard Stroke (in)                                    |
|-----------|---|
| 1.5"      | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 2", 2.5"  | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24         |
| 3.25", 4" | 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 |

Example: NCDA1B150-0200R+0300H-XC11 will stroke 2" then an additional 3" for a total stroke of 5". The front cylinder B (rod end) must be equal to 5" to allow the full stroke.

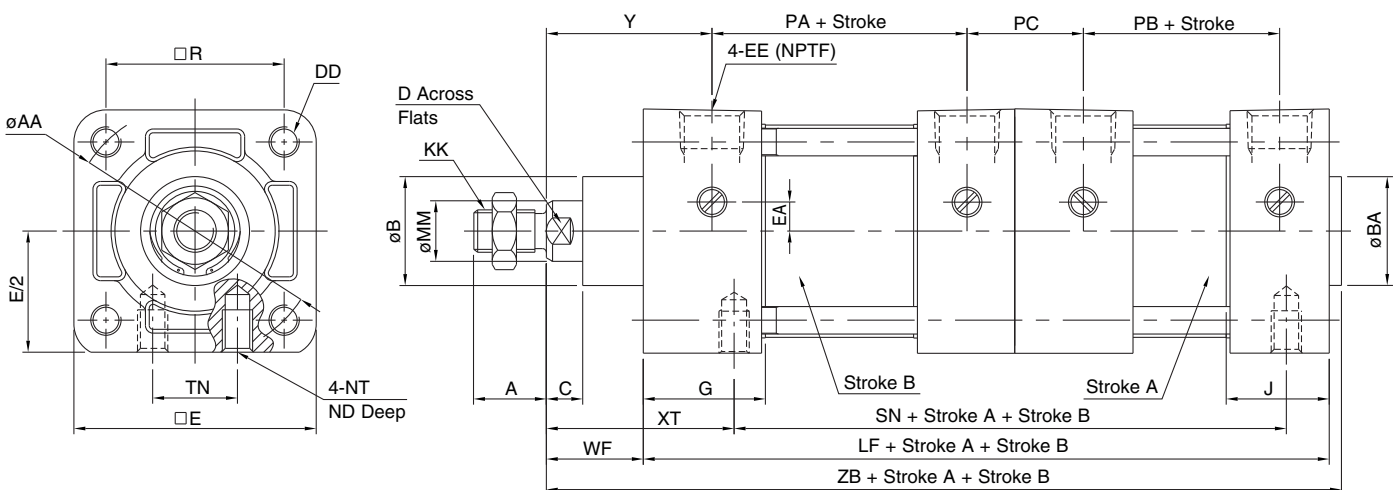
## How To Order

NC **D** A1 **B** 150 - 0200 **R** + 0300 **H** XC11

Auto Switch    Mounting    Bore    Stroke A    Stroke B-A    Dual Operation Single Rod

Cushions  
- Both Ends  
N w/o Cushions  
H Head End  
R Rod End

## Dimensions



| Bore (in)   | MM  | KK      | A     | AA   | B     | BA    | C   | D    | DD      | E     | EA  | EE  | G    | J    | NT      | R    | TN     | WF    | XT      | Y    | LF   | PA   | PB   | PC   | SN   | ZB   | ND    |
|-------------|-----|---------|-------|------|-------|-------|-----|------|---------|-------|-----|-----|------|------|---------|------|--------|-------|---------|------|------|------|------|------|------|------|-------|
| 150 (1.5")  | 5/8 | 7/16-20 | 3/4   | 2.02 | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 1/4-28  | 2     | 0.3 | 3/8 | 1.26 | 1.1  | 1/4-20  | 1.43 | 5/8    | 1     | 1 15/16 | 1.71 | 7.26 | 2.36 | 2.40 | 1.24 | 5.89 | 8.39 | 9/32  |
| 200 (2")    | 5/8 | 7/16-20 | 3/4   | 2.60 | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 2 1/2 | 0.3 | 3/8 | 1.26 | 1.06 | 5/16-18 | 1.84 | 7/8    | 1     | 1 15/16 | 1.71 | 7.26 | 2.40 | 2.44 | 1.20 | 5.89 | 8.38 | 7/16  |
| 250 (2.5")  | 5/8 | 7/16-20 | 3/4   | 3.1  | 1 1/8 | 1 1/8 | 3/8 | 9/16 | 5/16-24 | 3     | 0   | 3/8 | 1.3  | 1.06 | 3/8-16  | 2.19 | 1 1/4  | 1     | 1 15/16 | 1.75 | 7.38 | 2.48 | 2.52 | 1.12 | 6.01 | 8.50 | 19/32 |
| 325 (3.25") | 1   | 3/4-16  | 1 1/8 | 3.9  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 3 3/4 | 0   | 1/2 | 1.57 | 1.18 | 1/2-13  | 2.76 | 1 1/2  | 1 3/8 | 2 7/16  | 2.34 | 8.52 | 2.72 | 2.76 | 1.51 | 6.89 | 10.1 | 5/8   |
| 400 (4")    | 1   | 3/4-16  | 1 1/8 | 4.7  | 1 1/2 | 1 1/2 | 1/2 | 7/8  | 3/8-24  | 4 1/2 | 0   | 1/2 | 1.57 | 1.18 | 1/2-13  | 3.32 | 2 1/16 | 1 3/8 | 2 7/16  | 2.34 | 8.52 | 2.72 | 2.76 | 1.51 | 6.89 | 10.1 | 5/8   |

## Special Rod End Modifications

### How to Order

The NCA1 series cylinders are available with a variety of special rod end modifications to suit your application through our Simple Special ordering process. The Simple Special System is a global effort to quickly and efficiently respond to our customer requests for a non-standard catalog option. The chart below outlines the applicable types available. To order the correct rod end modification, please contact your local SMC Sales Office or SMC Technical Sales Representative.

### Rod End Shape

|                        |                        |                        |                        |                        |
|------------------------|------------------------|------------------------|------------------------|------------------------|
| <b>Symbol: A1</b><br>  | <b>Symbol: A2</b><br>  | <b>Symbol: A3</b><br>  | <b>Symbol: A4</b><br>  | <b>Symbol: A5</b><br>  |
| <b>Symbol: A6</b><br>  | <b>Symbol: A7</b><br>  | <b>Symbol: A8</b><br>  | <b>Symbol: A9</b><br>  | <b>Symbol: A10</b><br> |
| <b>Symbol: A11</b><br> | <b>Symbol: A12</b><br> | <b>Symbol: A13</b><br> | <b>Symbol: A14</b><br> | <b>Symbol: A15</b><br> |
| <b>Symbol: A16</b><br> | <b>Symbol: A17</b><br> | <b>Symbol: A18</b><br> | <b>Symbol: A19</b><br> | <b>Symbol: A20</b><br> |
| <b>Symbol: A21</b><br> | <b>Symbol: A22</b><br> | <b>Symbol: A23</b><br> | <b>Symbol: A24</b><br> | <b>Symbol: A25</b><br> |
| <b>Symbol: A26</b><br> | <b>Symbol: A27</b><br> | <b>Symbol: A28</b><br> | <b>Symbol: A29</b><br> | <b>Symbol: A30</b><br> |

Note) Series CQ2 is not available.

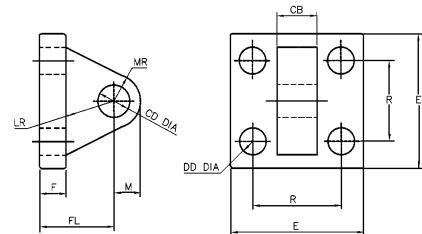
Note) Series CQ2 is not available.

## Accessories

### Eye Brackets

| Part No    | CB    | CD    | DD     | E     | F     | FL    | LR    | M     | MR     | R    |
|------------|-------|-------|--------|-------|-------|-------|-------|-------|--------|------|
| NCA1-P150  | 3/4   | 1/2   | 13/32  | 2 1/2 | 3/8   | 1 1/8 | 3/4   | 1/2   | 9/16   | 1.63 |
| NCA1-P325  | 1 1/4 | 3/4   | 17/32  | 3 1/2 | 5/8   | 1 7/8 | 1 1/4 | 3/4   | 7/8    | 2.56 |
| NCA1-P800  | 1 1/2 | 1     | 21/32  | 4 1/2 | 3/4   | 2 1/4 | 1 1/2 | 1     | 1 1/4  | 3.25 |
| NCA1-P1000 | 2     | 1 3/8 | 21/32  | 5     | 7/8   | 3     | 2 1/8 | 1 3/8 | 1 5/8  | 3.81 |
| NCA1-P1200 | 2 1/2 | 1 3/4 | 29/32  | 6 1/2 | 7/8   | 3 1/8 | 2 1/4 | 1 3/4 | 2 1/8  | 4.95 |
| NCA1-P1400 | 2 1/2 | 2     | 1 1/16 | 7 1/2 | 1     | 3 1/2 | 2 1/2 | 2     | 2 7/16 | 5.75 |
| NCA1-P1401 | 3     | 2 1/2 | 1 3/16 | 8 1/2 | 1 3/4 | 4 3/4 | 2 5/8 | 2 1/2 | 3      | 6.58 |
| NCA1-P1402 | 3     | 3     | 1 5/16 | 9 1/2 | 2     | 5 1/4 | 2 7/8 | 2 3/4 | 3 1/4  | 7.50 |

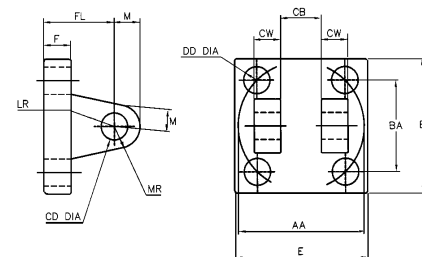
Note: Pivot Pin is not included.



### Clevis Brackets

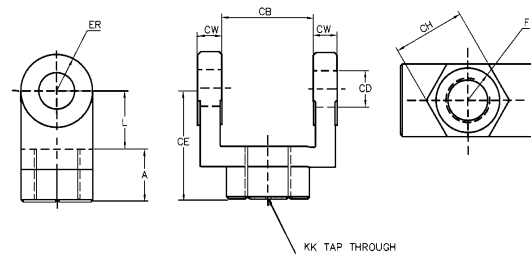
| Part No     | AA   | BA      | CB    | CD    | CW    | DD        | E     | F   | FL    | LR     | M     | MR     |
|-------------|------|---------|-------|-------|-------|-----------|-------|-----|-------|--------|-------|--------|
| NCA1-CB150  | 2.3  | 1 5/8   | 0.785 | 1/2   | 1/2   | 3/8 -24   | 2 1/2 | 3/8 | 1 1/8 | 1/2    | 1/2   | 9/16   |
| NCA1-CB325  | 3.6  | 2 9/16  | 1.265 | 3/4   | 5/8   | 1/2 -20   | 3 1/2 | 5/8 | 1 7/8 | 1 1/16 | 3/4   | 1 1/16 |
| NCA1-CB800  | 4.6  | 3 1/4   | 1.515 | 1     | 3/4   | 5/8 -18   | 4 1/2 | 3/4 | 2 1/4 | 1 1/4  | 1     | 1 1/8  |
| NCA1-CB1000 | 5.4  | 3 13/16 | 2.032 | 1 3/8 | 1     | 5/8 -18   | 5     | 7/8 | 3     | 1 7/8  | 1 3/8 | 1 3/4  |
| NCA1-CB1200 | 7    | 4 15/16 | 2.531 | 1 3/4 | 1 1/4 | 7/8 -14   | 6 1/2 | 7/8 | 3 1/8 | 2      | 1 3/4 | 1 7/8  |
| NCA1-CB1400 | 8.1  | 5 3/4   | 2.531 | 2     | 1 1/4 | 1 -14     | 7 1/2 | 1   | 3 1/2 | 2 1/8  | 2     | 2 1/8  |
| NCA1-CB1401 | 9.3  | 6 19/32 | 3.032 | 2 1/2 | 1 1/2 | 1 1/8 -12 | 8 1/2 | 1   | 4     | 2 5/8  | 2 1/2 | 2 1/2  |
| NCA1-CB1402 | 10.6 | 7 1/2   | 3.032 | 3     | 1 1/2 | 1 1/4 -12 | 9 1/2 | 1   | 4 1/4 | 2 7/8  | 2 3/4 | 2 3/4  |

Note: Pivot Pin is not included.



### Rod Clevises

| Part No | CB    | CD    | CE    | CH      | CW    | F       | L     | A     | KK        | ER    |
|---------|-------|-------|-------|---------|-------|---------|-------|-------|-----------|-------|
| NY-150  | 0.765 | 0.5   | 1 1/2 | 1       | 1/2   | 1       | 3/4   | 3/4   | 7/16-20   | 1/2   |
| NY-325  | 1.265 | 0.75  | 2 3/8 | 1 3/8   | 5/8   | 1 1/4   | 1 1/4 | 1 1/8 | 3/4-16    | 3/4   |
| NY-800  | 1.515 | 1     | 3 1/8 | 1 1/2   | 3/4   | 1 1/2   | 1 1/2 | 1 5/8 | 1 -14     | 1     |
| NY-1000 | 2.032 | 1 3/8 | 4 1/8 | 2       | 1     | 2       | 2 1/8 | 2     | 1 1/4 -12 | 1 3/8 |
| NY-1200 | 2.531 | 1 3/4 | 4 1/2 | 2 3/8   | 1 1/4 | 2 3/8   | 2 1/4 | 2 1/4 | 1 1/2 -12 | 1 3/4 |
| NY-1400 | 2.531 | 2     | 5 1/2 | 2 15/16 | 1 1/4 | 2 15/16 | 2 1/2 | 3     | 1 7/8 -12 | 2     |
| NY-1401 | 3.032 | 2 1/2 | 6 1/2 | 3 1/2   | 1 1/2 | 3 1/2   | 3     | 3 1/2 | 2 1/4 -12 | 2 1/2 |
| NY-1402 | 3.032 | 3     | 6 3/4 | 3 7/8   | 1 1/2 | 3 7/8   | 3 1/4 | 3 1/2 | 2 1/2 -12 | 2 3/4 |



### Order to Match Rod Thread

#### Rod Eyes

| Part No | A     | CA      | CB    | CD    | ER      | KK        |
|---------|-------|---------|-------|-------|---------|-----------|
| NI-150  | 3/4   | 1 1/2   | 3/4   | 1/2   | 5/8     | 7/16 20   |
| NI-325  | 1 1/8 | 2 1/16  | 1 1/4 | 3/4   | 7/8     | 3/4 -16   |
| NI-800  | 1 5/8 | 2 13/16 | 1 1/2 | 1     | 1 3/16  | 1 -14     |
| NI-1000 | 2     | 3 7/16  | 2     | 1 3/8 | 1 9/16  | 1 1/4 -12 |
| NI-1200 | 2 1/4 | 4       | 2 1/2 | 1 3/4 | 2       | 1 1/2 -12 |
| NI-1400 | 3     | 5       | 2 1/2 | 2     | 2 1/2   | 1 7/8 -12 |
| NI-1401 | 3 1/2 | 5 13/16 | 3     | 2 1/2 | 2 13/16 | 2 1/4 -12 |
| NI-1402 | 3 1/2 | 6 1/8   | 3     | 3     | 3 1/4   | 2 1/2 -12 |

#### Pivot Pin

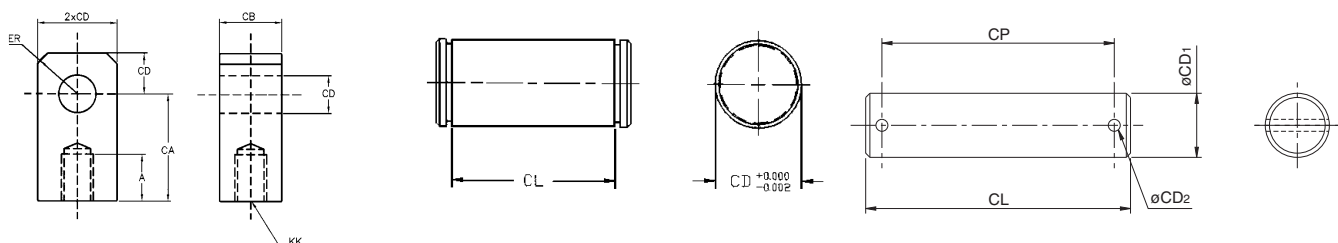
| Part No   | CD    | CL    |
|-----------|-------|-------|
| NCA1-150  | 1/2   | 1 7/8 |
| NCA1-325  | 3/4   | 2 5/8 |
| NCA1-800  | 1     | 3 1/8 |
| NCA1-1000 | 1 3/8 | 4 1/8 |
| NCA1-1200 | 1 3/4 | 5 1/8 |
| NCA1-1400 | 2     | 5 1/8 |
| NCA1-1401 | 2.5   | 6.19  |
| NCA1-1402 | 3     | 6.25  |

Note: Retainer Rings are included.

#### Pivot Pin

| Part No  | CD <sub>1</sub>                    | CD <sub>2</sub> | CL   | CP   |
|----------|------------------------------------|-----------------|------|------|
| NCDP-150 | .500 <sup>0</sup> <sub>-.002</sub> | .106            | 2.28 | 1.94 |
| NCDP-325 | .750 <sup>0</sup> <sub>-.002</sub> | .140            | 3.10 | 2.72 |

Note: Cotter Pins are included.



## How to Order Auto Switches

### Wire Lead Type

D - 

For standard part number please see applicable auto switches on page 41 to 47.

| Lead wire length |                   |
|------------------|-------------------|
| Nil              | 0.5 (m) (1.64 ft) |
| L                | 3 (m) (9.84 ft)   |
| Z                | 5 (m) (16.4 ft)   |

### Connector Type

D -  PC

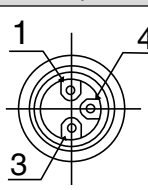
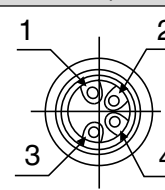
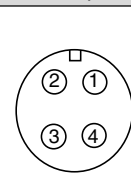
For standard part number please see applicable auto switches on page 41 to 47.

| Lead wire length |         |
|------------------|---------|
| S                | 0.5 (m) |
| M                | 1.0 (m) |
| L                | 3.0 (m) |

| Connector type |            |
|----------------|------------|
| A              | M8-3 pins  |
| B              | M8-4 Pins  |
| D              | M12-4 Pins |

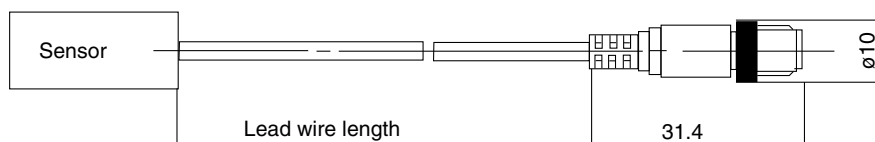
### Auto Switch Mounting Bracket / Part No.

| Bore Model No. | 150 (1.5") | 200 (2") | 250 (2.5") | 325 (3/25") | 400 (4") |
|----------------|------------|----------|------------|-------------|----------|
| D-A5, D-F5     | NBT-150    | NBT-200  | NBT-200    | NBT-325     | NBT-325  |
| D-A6, D-J5     |            |          |            |             |          |

| Connector Style         | M8-3pins   | M8-4pins  | M12-4pins  |
|-------------------------|--|---|--|
| Pin arrangement         |  |  |  |
| Applicable standards    | JIS C 4524, JIS C 4525, IEC 947-5-2, NECA 0402                                     |   |  |
| Impact resistant        | 300m/s <sup>2</sup>  |   |  |
| IP degree of protection | IP-67 (IEC529 standard)  |   |  |
| Insulation resistance   | 100MΩ or more at 500VDC meg.   |   |  |
| Withstand voltage       | 1500VAC 1 minute (between contacts), leakage current 1mA or less.                  |   |  |

| Sensor type         | Lead wire color |        |       |       | Meaning of contact No. |                   |         |         |
|---------------------|-----------------|--------|-------|-------|------------------------|-------------------|---------|---------|
|                     | 1 pin           | 2 pin  | 3 pin | 4 pin | 1 pin                  | 2 pin             | 3 pin   | 4 pin   |
| DC 2-wire           | Brown           | -      | -     | Blue  | OUT (+)                | -                 | -       | OUT (-) |
| DC 2-wire non-polar | -               | -      | Brown | Blue  | -                      | -                 | OUT (+) | OUT (±) |
| DC 3-wire           | Brown           | -      | Blue  | Black | DC (+)                 | -                 | DC (-)  | OUT     |
| DC 4-wire           | Brown           | Orange | Blue  | Black | DC (+)                 | Diagnostic Output | DC (-)  | OUT     |

- Connector  
M8-3 pins / 4 pins



## Grommet



## Specifications

PLC: Programmable Logic Controller

### D-A5 (With indicator light)

| Auto switch model number    | D-A53                             | D-A54     |           |             | D-A56        |
|-----------------------------|-----------------------------------|-----------|-----------|-------------|--------------|
| Application                 | PLC                               | Relay/PLC |           |             | IC circuit   |
| Load voltage                | 24VDC                             | 24VDC     | 100VAC    | 200VAC      | 4 to 8VDC    |
| Max. load current and range | 5 to 50mA                         | 5 to 50mA | 5 to 25mA | 5 to 12.5mA | 20mA         |
| Contact protection circuit  | None                              | Built-in  |           |             | None         |
| Internal voltage drop       | 2.4V                              |           |           |             | 0.8V or less |
| Indicator light             | ON: When red light emitting diode |           |           |             |              |

### D-A6 (Without indicator light)

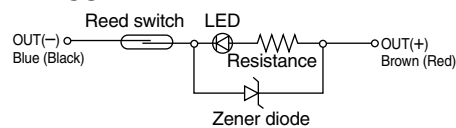
| Auto switch model number   | D-A64              |        | D-A67                                   |
|----------------------------|--------------------|--------|---|
| Application                | Relay/PLC          |        | PLC/IC circuit                          |
| Load voltage               | $\leq 24V_{AC/DC}$ | 100VAC | 200VAC                                  |
| Max. load current          | 50mA               | 25mA   | 12.5mA                                  |
| Contact protection circuit | Built-in           |        | None                                    |
| Internal resistance        | $\leq 10\Omega$    |        | $\leq 1\Omega$ (Including 3m lead wire) |

- Lead wire — Oilproof vinyl heavy insulation cable,  $\phi 4$ , 0.3mm<sup>2</sup>, 2 cores (Brown, Blue), 0.5m or  $\phi 4$ , 0.2mm<sup>2</sup>, 3 cores (Brown, Black, Blue), 0.5m
- Refer to common specifications and lead wire length on page 48.

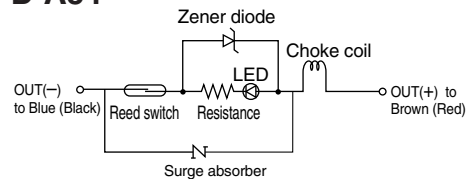
## Internal Circuit

( ) : If not applicable for IEC Standard

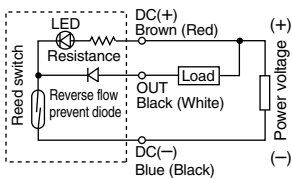
### D-A53



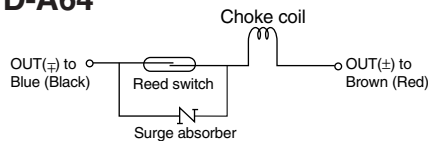
### D-A54



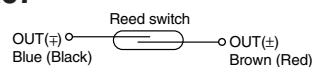
### D-A56



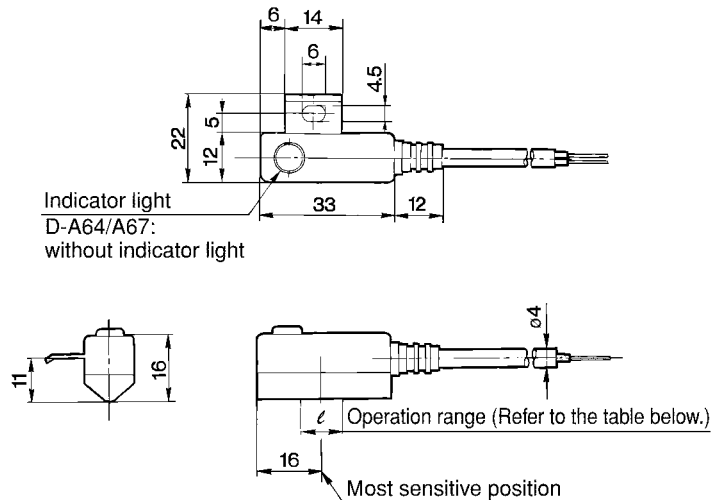
### D-A64



### D-A67



## Dimensions



## Operation Range (ℓ Dimension)

(in)

| Actuator series | Bore size |      |       |       |      |
|-----------------|-----------|------|-------|-------|------|
|                 | 1 1/2     | 2    | 2 1/2 | 3 1/4 | 4    |
| <b>NCA1</b>     | .354      | .393 | .433  | .433  | .433 |

Note: Average value at normal temperature including hysteresis. (Tolerance  $\pm 30\%$ )



## Grommet

The suitable operating point can be indicated with a green light.  
(Red → Green ← Red)



## Specifications

PLC: Programmable Logic Controller

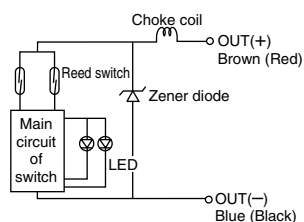
| D-A59W (With indicator light) |   |
|-------------------------------|---|
| Auto switch model number      | <b>D-A59W</b>   |
| Application                   | Relay/PLC   |
| Load voltage                  | 24VDC   |
| Load current range            | 5 to 40mA   |
| Contact protection circuit    | Built-in  |
| Internal voltage drop         | ≤ 4V  |
| Indicator light               | Operating point: Red light emitting diode<br>Suitable operating point: Green light emitting diode |

- Lead wire — Oilproof vinyl heavy insulation cable,  $\phi 4$ , 0.3mm<sup>2</sup>, 2 cores (Brown, Blue), 0.5m
- Refer to common specifications and lead wire length on page 48.

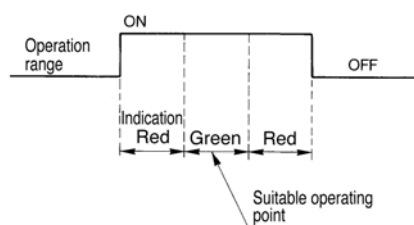
## Internal Circuit

( ): If not applicable for IEC Standard

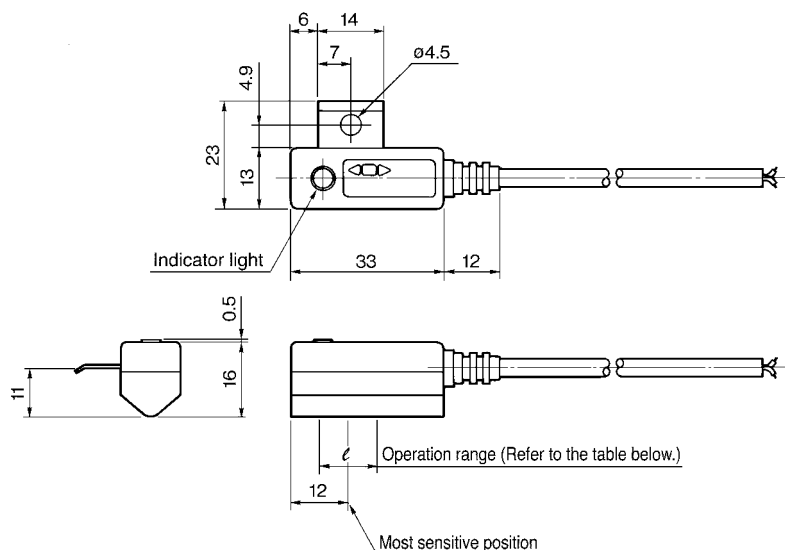
### D-A59W



### Indicator light/Operation



## Dimensions



## Operation Range (ℓ Dimension) (in)

| Actuator series | Bore size |      |       |       |      |
|-----------------|-----------|------|-------|-------|------|
|                 | 1 1/2     | 2    | 2 1/2 | 3 1/4 | 4    |
| <b>NCA1</b>     | .354      | .393 | .433  | .433  | .433 |

Note: Average value at normal temperature including hysteresis. (Tolerance ± 30%)

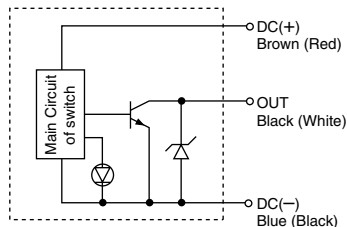
## Grommet



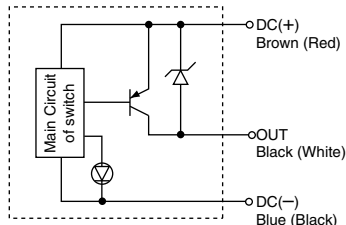
## Internal Circuit

( ): If not applicable for IEC Standard

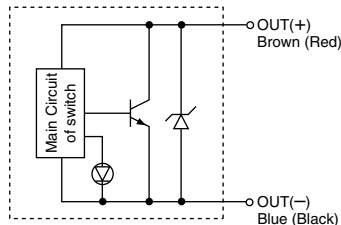
### D-F59



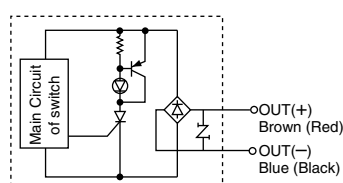
### D-F5P



### D-J59



### D-J51



## Specifications

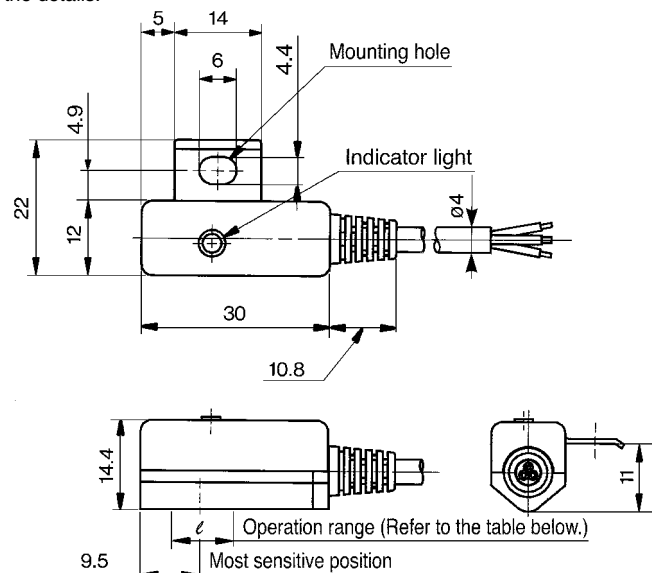
PLC: Programmable Logic Controller

| D-F5□/D-J5□              |  |              |                     |                                       |
|--------------------------|--|--------------|---------------------|---------------------------------------|
| Auto switch model number | D-F59  | D-F5P        | D-J59               | D-J51                                 |
| Wiring                   | 3 wire   |              | 2 wire              |                                       |
| Output                   | NPN  | PNP          | —                   | —                                     |
| Application              | IC circuit/Relay/PLC                                   |              | 24VDC Relay/PLC     | AC Relay/PLC                          |
| Power voltage            | 5/12/24VDC (4.5 to 28VDC)                              |              | —                   | —                                     |
| Current consumption      | ≤ 10mA   |              | —                   | —                                     |
| Load voltage             | ≤ 28VDC  | —            | 24VDC (10 to 28VDC) | 80 to 260VAC                          |
| Load current             | ≤ 40mA   | ≤ 80mA       | 5 to 40mA           | 5 to 80mA                             |
| Internal voltage drop    | 1.5V or less<br>(0.8V or less at 10mA of load current) | 0.8V or less | 4V or less          | 14V or less                           |
| Current leakage          | ≤ 100μA at 24VDC                                       |              | ≤ 0.8mA at 24VDC    | ≤ 1mA at 100 VDC<br>≤ 1.5mA at 200VDC |
| Indicator light          | ON: When red light emitting diode                      |              |                     |                                       |

- Lead wire — Oilproof vinyl heavy insulation cable,  $\phi 4$ , 0.3mm<sup>2</sup>, 3 cores (Brown, Black, Blue), 2 cores (Brown, Blue), 0.5m
- Refer to common specifications and lead wire length on page 48.

## Dimensions

\*D-J51 differs in the shape, most sensitive position and operation range from other switches. Contact SMC for the details.



## Operation Range (ℓ Dimension) (in)

| Actuator series | Bore size |      |       |       |      |
|-----------------|-----------|------|-------|-------|------|
|                 | 1 1/2     | 2    | 2 1/2 | 3 1/4 | 4    |
| NCA1            | .354      | .393 | .433  | .433  | .433 |

Note: Average value at normal temperature including hysteresis. (Tolerance ± 30%)

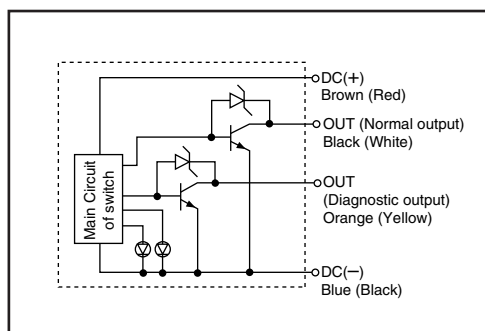
## Grommet

The output signal can be detected in an unsteady detecting area.



## Internal Circuit

( ): If not applicable for IEC Standard



## Specifications

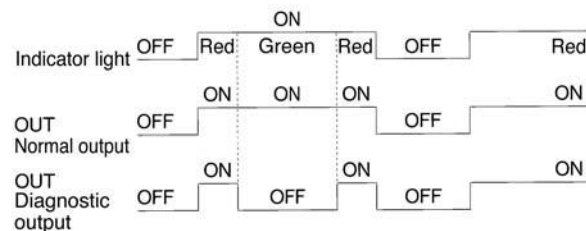
PLC: Programmable Logic Controller

| D-F59F                   |   |
|--------------------------|---|
| Auto switch model number | D-F59F  |
| Wiring                   | 4 wire  |
| Output                   | NPN   |
| Diagnostic output        | Normal operation  |
| Application              | IC circuit/Relay/PLC  |
| Power voltage            | 5/12/24VDC (4.5 to 28VDC)   |
| Current consumption      | ≤ 10mA  |
| Load voltage             | ≤ 28VDC   |
| Load current             | ≤ 40mA  |
| Internal voltage drop    | ≤ 1.5V (≤ 0.8V at 10mA)   |
| Current leakage          | ≤ 100μA at 24VDC  |
| Indicator light          | Operating point: Red light emitting diode<br>Suitable operating point: Green light emitting diode |

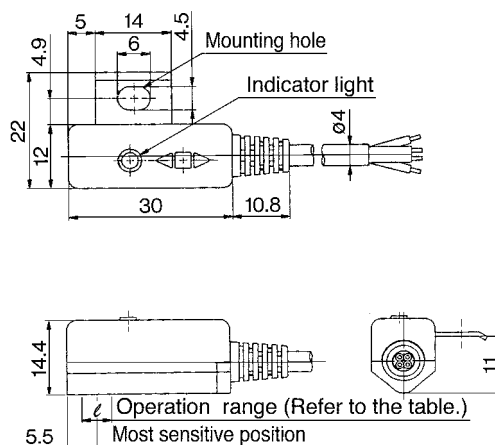
- Lead wire — Oilproof vinyl heavy insulation cable,  $\phi 4$ , 0.2mm<sup>2</sup>, 4 cores (Brown, Black, Orange, Blue), 0.5m
- Refer to common specifications and lead wire length on page 48.

## Diagnostic Output Operation

The diagnostic output is detected when detecting position remains at unsteady area only, not available at the most suitable operating area, that is to say, diagnostic signal can be output only when the detecting position is far from the suitable position for normal operation.



## Dimensions



## Operation Range (l Dimension) (in)

| Actuator series | Bore size |      |       |       |      |
|-----------------|-----------|------|-------|-------|------|
|                 | 1 1/2     | 2    | 2 1/2 | 3 1/4 | 4    |
| NCA1            | .354      | .393 | .433  | .433  | .433 |

Note: Average value at normal temperature including hysteresis. (Tolerance  $\pm 30\%$ )

## Grommet

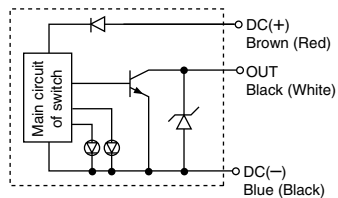
The suitable operating point can be indicated with a green light.  
(Red→Green←Red)



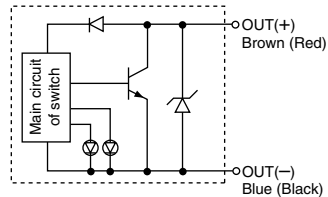
## Internal Circuit

( ): If not applicable for IEC Standard

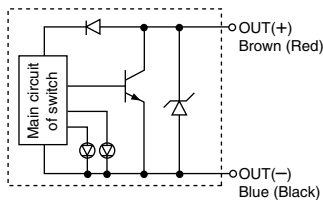
### D-F59W



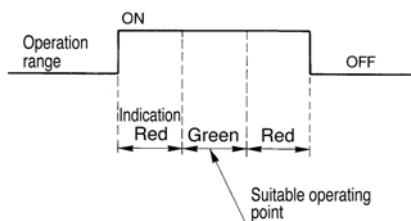
### D-F5PW



### D-J59W



## Indicator light/Operation



## Specifications

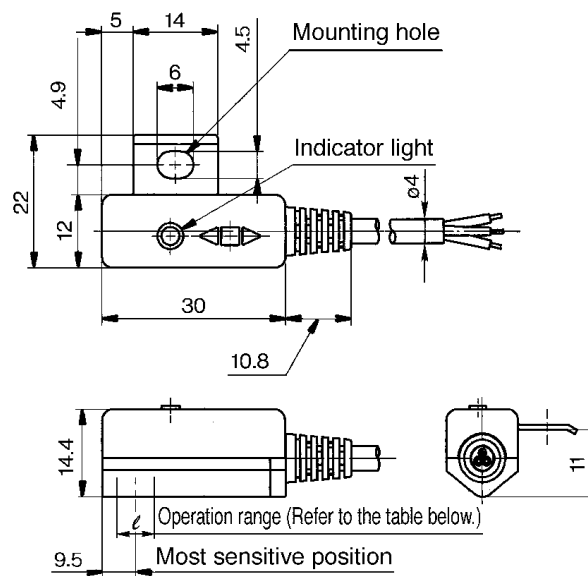
PLC: Programmable Logic Controller

### D-F5□W/D-J59W (With indicator light)

| Auto switch model number | D-F59W  | D-F5PW | D-J59W              |
|--------------------------|---|--------|---------------------|
| Wiring                   | 3 wire  |        | 2 wire              |
| Output                   | NPN   | PNP    | —                   |
| Application              | IC circuit/Relay/PLC  |        | 24VDC Relay/PLC     |
| Power voltage            | 5/12/24VDC (4.5 to 28VDC)   |        | —                   |
| Current consumption      | 10mA  |        | —                   |
| Load voltage             | ≤ 28VDC   | —      | 24VDC (10 to 28VDC) |
| Load current             | ≤ 40mA  | ≤ 80mA | 5 to 40mA           |
| Internal voltage drop    | ≤ 1.5V<br>(≤ 0.8V at 10mA load current)   | ≤ 0.8V | ≤ 4V                |
| Current leakage          | ≤ 100μA at 24VDC  |        | ≤ 0.8mA at 24VDC    |
| Indicator light          | Operating point: Red light emitting diode<br>Suitable operating point: Green light emitting diode |        |                     |

- Lead wire — Oilproof vinyl heavy insulation cable, ø4, 0.3mm<sup>2</sup>, 3 cores (Brown, Black, Blue), 2 cores (Brown, Blue), 0.5m
- Refer to common specifications and lead wire length on page 48.

## Dimensions



## Operation Range (ℓ Dimension)

(in)

| Actuator series | Bore size |      |       |       |      |
|-----------------|-----------|------|-------|-------|------|
|                 | 1 1/2     | 2    | 2 1/2 | 3 1/4 | 4    |
| NCA1            | .354      | .393 | .433  | .433  | .433 |

Note: Average value at normal temperature including hysteresis. (Tolerance ± 30%)

## Grommet

Water (coolant) resistant performance



## Caution

### Precautions

Consult SMC if using coolant liquid other than water based solution.

## Specifications

PLC: Programmable Logic Controller

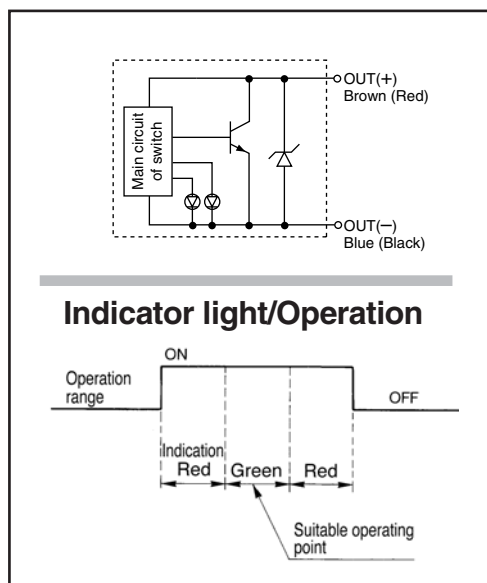
### D-F5BAL (With indicator light)

| Auto switch model number | D-F5BAL   |
|--------------------------|---|
| Wiring                   | 2 wire  |
| Output                   | —   |
| Application              | 24VDC Relay/PLC   |
| Power voltage            | —   |
| Current consumption      | —   |
| Load voltage             | 24VDC (10 to 28VDC)   |
| Load current             | ≤ 5 to 40mA   |
| Internal voltage drop    | ≤ 4V  |
| Current leakage          | ≤ 0.8mA at 24VDC  |
| Indicator light          | Operating point: Red light emitting diode<br>Suitable operating point: Green light emitting diode |

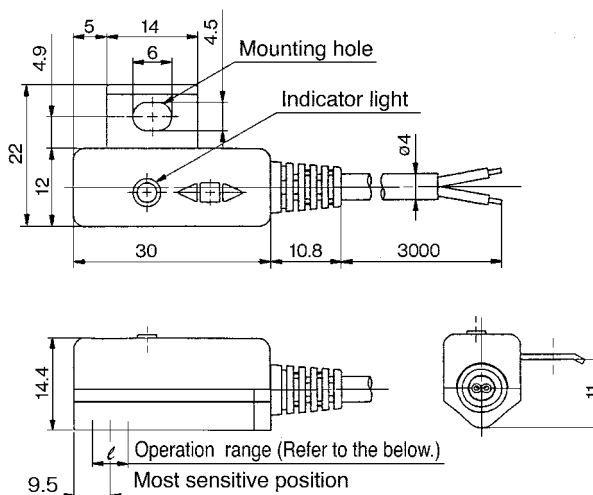
- Lead wire — Oilproof vinyl heavy insulation cable,  $\phi 4$ , 0.3mm<sup>2</sup>, 2 cores (Brown, Blue), 3m (Standard)
- Refer to common specifications and lead wire length on page 48.

## Internal Circuit

( ): If not applicable for IEC Standard



## Dimensions



## Operation Range (ℓ Dimension)

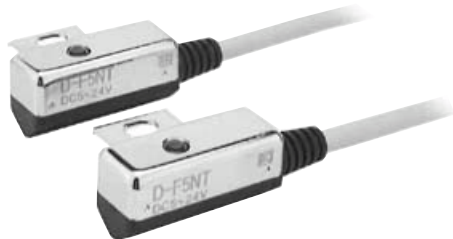
(in)

| Actuator series | Bore size |      |       |       |      |
|-----------------|-----------|------|-------|-------|------|
|                 | 1 1/2     | 2    | 2 1/2 | 3 1/4 | 4    |
| NCA1            | .354      | .393 | .433  | .433  | .433 |

Note: Average value at normal temperature including hysteresis. (Tolerance ± 30%)

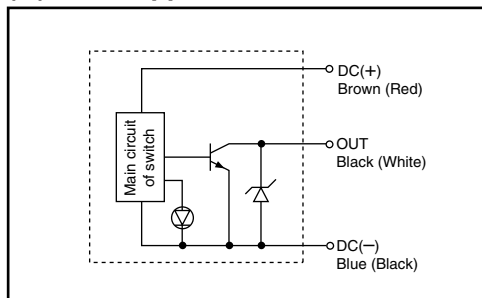
## Grommet

With built-in OFF-delay timer  
(200ms)



## Internal Circuit

( ): If not applicable for IEC Standard



## Specifications

PLC: Programmable Logic Controller

### D-F5NTL (With indicator light)

| Auto switch model number | D-F5NTL                           |
|--------------------------|-----------------------------------|
| Wiring                   | 3 wire                            |
| Output                   | NPN                               |
| Output operation         | Off-delay                         |
| Operation time           | ≤ 1ms                             |
| Off-delay time           | 200±50ms                          |
| Application              | IC circuit/Relay/PLC              |
| Power voltage            | 5/12/24VDC (4.5 to 28VDC)         |
| Current consumption      | ≤ 10mA                            |
| Load voltage             | ≤ 28VDC                           |
| Load current             | ≤ 80mA                            |
| Internal voltage drop    | ≤ 1.5V (≤ 0.8V at 10mA)           |
| Current leakage          | ≤ 100μA at 24VDC                  |
| Indicator light          | ON: When red light emitting diode |

- Lead wire — Oilproof vinyl heavy insulation cable, ø4, 0.3mm<sup>2</sup>, 3 cores (Brown, Black, Blue), 3m (Standard)
- Refer to common specifications and lead wire length on page 48.

## Timer Operation

### Detection of immediate positioning for high-speed cylinder

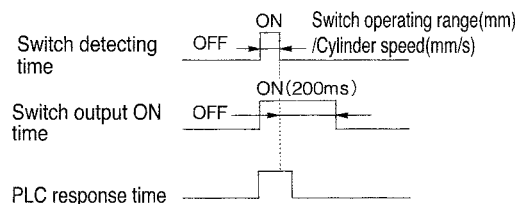
Detecting point dispersion occurs due to response time of PLC (sequencer);  
e. g. scanning.

Ex.) Cylinder speed-1000 mm/sec.

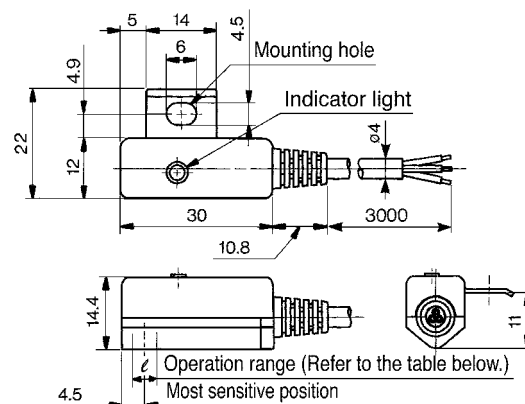
Sequencer response time-0.1 sec.

Detecting point dispersion-Within  
100mm (=1000mm/sec. x 0.1sec.)

Take PLC response time into consideration when using.



## Dimensions



### Operation Range (ℓ Dimension)

| Actuator series | Bore size (in) |      |       |       |      |
|-----------------|----------------|------|-------|-------|------|
|                 | 1 1/2          | 2    | 2 1/2 | 3 1/4 | 4    |
| NCA1            | .354           | .393 | .433  | .433  | .433 |

(Note) Average value at normal temperature including hysteresis. (Tolerance ± 30%)

## Auto Switch Specification

### Auto Switch Common Specifications

| Auto switch style       | Reed switch  | Solid state switch                               |
|-------------------------|--|--|
| Current leakage         | None   | 3-wire: 100 $\mu$ A or less, 2-wire: 1mA or less |
| Operating time          | 1.2ms  | 1ms or less <sup>Note 3)</sup>                   |
| Shock resistance        | 300m/s <sup>2</sup>  | 1000m/s <sup>2</sup>                             |
| Insulation resistance   | 50 M $\Omega$ or more at 500MVDC (between lead wire and the case)              |  |
| Withstand voltage       | 1500VAC/min.<br>(between lead wire and the case) <sup>Note 1)</sup>            | 1000VAC/min.<br>(between lead wire and the case) |
| Ambient temperature     | -10 to 60°C  |  |
| Protective construction | IEC529 Standard IP67,<br>Waterproof construction (JISC0920) <sup>Note 2)</sup> |  |

Note 1) Connector style (D-A73C/A80C/C73C/C80C) and D-9/9□A/A9/A9□V style: 1000VAC/min. (between lead wire and the case)

Note 2) IEC529 Standard IP63, Rainproof construction (JISC0920) for Terminal conduit style (D-A3/A3□A/A3□C/G39/G39A/G39C/K39/K39A/K39C) and DIN terminal style (D-A44/A44A/A44C).

Note 3) Except solid state switch with timer (D-M5□TL, G5NTL, F7NTL, F5NTL) and **Auto switch for strong magnetic field resistance (D-P5DWL)**.  
D-J51: 5ms or less

## Lead Wire Length

D-A73 **L**

• Lead wire length

|     |      |
|-----|------|
| Nil | 0.5m |
| L   | 3m   |
| Z   | 5m   |
| N*  | None |

\* Applicable for the connector style (D- \*\* C) only

- Applicable auto switch with 5 meter lead wire ("Z") Reed switch: D-B53/B54, D-C73 (C)/C80C, D-A73(C)(H)/A80C, D-A53/A54, D-Z73, D-90/97/90A/93A  
Solid state switch: Manufactured upon receipt of order as standard (Except D-F9/F9IV)
- The standard lead wire length of solid state switch with timer or with water resistant 2-color indication is 3 meters. (Not available 0.5m)
- The standard lead wire length of strong magnetic field resistant solid state switch is 3 or 5 meters. (Not available 0.5m)

### Part No. of lead wire with connector

(Available for connector style only.)


| Part No. | Lead wire length |
|----------|------------------|
| D-LC05   | 0.5m             |
| D-LC30   | 3m               |
| D-LC50   | 5m               |





## Series NCA1

# Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by a label of "**Caution**", "**Warning**" or "**Danger**". To ensure safety, be sure to observe ISO 4414 Note 1), JIS B 8370 Note 2) and other safety practices.

 **Caution** : Operator error could result in injury or equipment damage.

 **Warning** : Operator error could result in serious injury or loss of life.

 **Danger** : In extreme conditions, there is a possible result of serious injury or loss of life.

Note 1) ISO 4414: Pneumatic fluid power – Recommendations for the application of equipment to transmission and control systems

Note 2) JIS B 8370: General Rules for Pneumatic Equipment

### **Warning**

**1. The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.**

Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.

**2. Only trained personnel should operate pneumatically operated machinery and equipment.**

Compressed air can be dangerous if handled incorrectly. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.

**3. Do not service machinery/equipment or attempt to remove components until safety is confirmed.**

1. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc. (Bleed air into the system gradually to create back pressure.)

**4. Contact SMC if the product is to be used in any of the following conditions:**

1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.



# Series NCA1

## Actuator Precautions 1

Be sure to read before handling.

### Design

#### Warning

1. **There is a possibility of danger of sudden action by air cylinders if sliding parts of machinery are twisted, due to external forces, etc.**

In such cases, human injury may occur; e.g., by catching hands or feet in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be adjusted to operate smoothly and designed to avoid such dangers.

2. **A protective cover is recommended to minimize the risk of personal injury.**

If a stationary object and moving parts of a cylinder are in close proximity, personal injury may occur. Design the structure to avoid contact with the human body.

3. **Securely tighten all stationary parts and connected parts so that they will not become loose.**

Especially when a cylinder operates with high frequency or is installed where there is a lot of vibration, ensure that all parts remain secure.

4. **A deceleration circuit or shock may be required.**

When a driven object is operated at high speed or the load is heavy, a cylinder's cushion will not be sufficient to absorb the impact. Install a deceleration circuit to reduce the speed before cushioning, or install an external shock absorber to relieve the impact. In this case, the rigidity of the machinery should also be examined.

5. **Consider a possible drop in circuit pressure due to a power outage, etc.**

When a cylinder is used in a clamping mechanism, there is a danger of work pieces dropping if there is a decrease in clamping force due to a drop in circuit pressure caused by a power outage, etc. Therefore, safety equipment should be installed to prevent damage to machinery and/or human injury. Suspension mechanisms and lifting devices also require consideration for drop prevention.

6. **Consider a possible loss of power source.**

Measures should be taken to protect against bodily injury and equipment damage in the event that there is a loss of power to equipment controlled by pneumatics, electricity or hydraulics, etc.

7. **Design circuit that will prevent the driven object from shooting out.**

The driven object will shoot out at a high speed if one side of the cylinder is pressurized after the air inside the cylinder is exhausted; for example, when the cylinder is driven with exhaust center directional control valves or when it is started after the residual pressure inside the circuit is exhausted.

Such an event can possibly lead to bodily injury, by, for example catching in human limbs, or damage to the machinery. Therefore, select equipment and design circuits to prevent shoot-outs.

8. **Consider emergency stops.**

Design so that human injury and/or damage to machinery and equipment will not be caused when machinery is stopped by a safety device under abnormal conditions, a power outage or a manual emergency stop.

9. **Consider the action when operation is restarted after an emergency stop or abnormal stop.**

Design the machinery so that human injury or equipment damage will not occur upon restart of operation. When the cylinder has to be reset at the starting position, install safe manual control equipment.

### Selection

#### Warning

1. **Check the specifications.**

The products featured in this catalog are designed for use in industrial compressed air systems. If the products are used in conditions where pressure and/or temperature are outside range of specification, damage and/or malfunction may occur. Do not use in these conditions. (Refer to specifications.)

Consult SMC if you use a fluid other than compressed air.

2. **Intermediate stops**

When intermediate stopping of a cylinder piston is performed with a 3 position closed center type directional control valve, it is difficult to achieve stopping positions as accurate and precise as with hydraulic pressure due to the compressibility of air.

Furthermore, since valves and cylinders, etc., are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for an extended period of time. Contact SMC in case it is necessary to hold a stopped position for an extended period.

#### Caution

1. **Operate within the limits of the maximum usable stroke.**

The piston rod will be damaged if operated beyond the maximum stroke. Refer to the cylinder model selection procedure for the maximum useable stroke.

2. **Operate the piston within a range such that collision damage will not occur at the stroke end.**

The operation range should prevent damage from occurring when a piston, having inertial force, stop by striking the cover at the stroke end. Refer to the cylinder model selection procedure for the maximum useable stroke.

3. **Use a speed controller to adjust the cylinder drive speed, gradually increasing from a low speed to the desired speed setting.**

4. **Provide intermediate supports for long stroke cylinders.**

An intermediate support should be provided in order to prevent damage to a cylinder having a long stroke, due to problems such as sagging of the rod deflection of the cylinder tube, vibration and external load.

# Series NCA1

## Actuator Precautions 2

Be sure to read before handling.

### Mounting

#### ⚠Caution

1. **Be certain to match the rod shaft center with the load and direction of movement when connecting.**

When not properly matched, problem may arise with the rod and tube, and damage may be caused due to friction on areas such as the inner tube surface, bushings, rod surface, and seals.

2. **When an external guide is used, connect the rod end and the load in such a way that there is no interference at any point within the stroke.**

3. **Do not scratch or gouge the sliding parts of the cylinder tube or piston rod by striking or grasping them with other objects.**

Cylinder bores are manufactured to precise tolerances, so that even a slight deformation may cause faulty operation.

Moreover scratches or gouges, etc., in the piston rod may lead to damaged seals and cause air leakage.

4. **Prevent the seizure of rotating parts.**

Prevent the seizure of rotating parts (pins, etc.) by applying grease.

5. **Do not use until you can verify that equipment can operate properly.**

After mounting, repairs, or modification, etc., connect the air supply and electric power, and then confirm proper mounting by means of appropriate function and leak tests.

6. **Instruction manual**

The product should be mounted and operated after the instruction manual is thoroughly read and its contents are understood.

Keep the instruction manual where it can be referred to as needed.

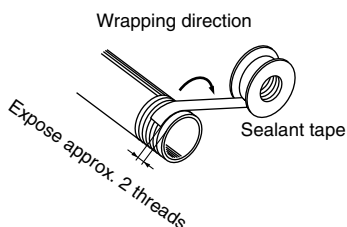
1. **Preparation before piping**

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.

2. **Wrapping of pipe tape**

When screwing together pipes and fittings, etc., be certain that chips from the pipe threads and sealing material do not get inside the piping.

Also, when sealant tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.



### Cushion

#### ⚠Caution

1. **Readjust using the cushion needle.**

Cushions are adjusted at the time of shipment, however, the cushion needle on the cover should be readjusted when the product is put into service, based upon factors such as the size of the load and the operating speed. When the cushion needle is turned clockwise, the restriction becomes smaller and the cushion's effectiveness is increased. Tighten the lock nut securely after adjustment is performed.

2. **Do not use the cushion needle fully closed.**

This will cause damage to the seals.

#### ⚠Warning

1. **Use clean air.**

Do not use compressed air which includes chemicals, synthetic oils containing organic solvents, salt or corrosive gases, etc., as it can cause damage or malfunction.

#### ⚠Caution

1. **Install air filters.**

Install air filters at the upstream side of valves. The filtration degree should be 5 $\mu$ m or finer.

2. **Install an after cooler, air dryer or water separator, etc.**

Air that includes excessive drainage may cause malfunction of valves and other pneumatic equipment. To prevent this, install an after cooler, air dryer or water separator, etc.

3. **Use the product within the specified range of fluid and ambient temperature.**

Take measures to prevent freezing, since moisture in circuits can be frozen under 5°C, and this may cause damage to seals and lead to malfunction.

Refer to SMC's "Air Cleaning Equipment" catalog for further details on compressed air quality.

### Maintenance

#### ⚠Warning

1. **Removal of equipment, and supply/exhaust of compressed air.**

Before any machinery or equipment is removed, first ensure that the appropriate measures are in place to prevent the fall or erratic movement of driven objects and equipment, then cut off the electric power and reduce the pressure in the system to zero. Only then should you proceed with the removal of any machinery and equipment.

When machinery is restarted, proceed with caution after confirming measures to prevent cylinder lurching.

#### ⚠Caution

1. **Drain flushing**

Remove drainage from air filters regularly. (Refer to specifications.)

# Series NCA1

## Auto Switch Precautions 1

Be sure to read before handling.

### Design & Selection

#### ⚠ Warning

##### 1. Confirm the specifications.

Read the specifications carefully and use this product appropriately. The product may be damaged or malfunction if it is used outside the range of specifications for current load, voltage, temperature or impact.

##### 2. Take precautions when multiple cylinders are used close together.

When multiple auto switch cylinders are used in close proximity, magnetic field interference may cause the switches to malfunction. Maintain a minimum cylinder separation of 40mm.

##### 3. Pay attention to the length of time that a switch is ON at an intermediate stroke position.

When an auto switch is placed at an intermediate position of the stroke and a load is driven at the time the piston passes, the auto switch will operate, but if the speed is too great the operating time will be shortened and the load may not operate properly. The maximum detectable piston speed is:

$$V \text{ (mm/s)} = \frac{\text{Auto switch operating range (mm)} \times 1000}{\text{Time load applied (ms)}}$$

##### 4. Keep wiring as short as possible.

###### <Reed switches>

As the length of the wiring to a load gets longer, the rush current at switching ON becomes greater, and this may shorten the product's life. (The switch will stay ON all the time.)

Use a contact protection box when the wire length is 5m or longer.

###### <Solid state switches>

Although wire length should not affect switch function, use a wire 100m or shorter.

##### 5. Pay attention to the internal voltage drop of the switch.

###### <Reed switches>

1) Switches with an indicator light (Except D-Z76)

- If auto switches are connected in series as shown below, take note that there will be a large voltage drop because of internal resistance in the light emitting diodes. (Refer to internal voltage drop in the auto switch specifications.)

[The voltage drop will be "n" times larger when "n" auto switches are connected.]

Even though an auto switch operates normally, the load may not operate.



#### ⚠ Warning

- In the same way, when operating under a specified voltage, although an auto switch may operate normally, the load may not operate. Therefore, the formula below should be satisfied after confirming the minimum operating voltage of the load.

$$\text{Supply voltage} - \text{Internal voltage drop of switch} > \text{Minimum operating voltage of load}$$

2) If the internal resistance of a light emitting diode causes a problem, select a switch without an indicator light (Model D-Z80).

###### <Solid state switches>

3) Generally, the internal voltage drop will be greater with a 2 wire solid state auto switch than with a reed switch. Take the same precautions as in 1).

Also, note that a 12VDC relay is not applicable.

##### 6. Pay attention to leakage current.

###### <Solid state switches>

With a 2 wire solid state auto switch, current (leakage current) flows to the load to operate the internal circuit even when in the OFF state.

$$\text{Operating current of load (OFF condition)} > \text{Leakage current}$$

If the criteria given in the above formula are not met, it will not reset correctly (stays ON). Use a 3 wire switch if this specification will not be satisfied.

Moreover, leakage current flow to the load will be "n" times larger when "n" auto switches are connected in parallel.

##### 7. Do not use a load that generates surge voltage.

###### <Reed switches>

If driving a load such as a relay that generates a surge voltage, use a contact protection box.

###### <Solid state switches>

Although a zener diode for surge protection is connected at the output side of a solid state auto switch, damage may still occur if the surge is applied repeatedly. When a load, such as a relay or solenoid which generates surge is directly driven, use a type of switch with a built-in surge absorbing element.

##### 8. Cautions for use in an interlock circuit

When an auto switch is used for an interlock signal requiring high reliability, devise a double interlock system to avoid trouble by providing a mechanical protection function, or by also using another switch (sensor) together with the auto switch.

Also perform periodic maintenance and confirm proper operation.

##### 9. Ensure sufficient clearance for maintenance activities.

When designing an application, be sure to allow sufficient clearance for maintenance and inspections.

# Series NCA1

## Auto Switch Precautions 2

Be sure to read before handling.

### Mounting & Adjustment

#### ⚠ Warning

##### 1. Do not drop or bump.

Do not drop, bump or apply excessive impacts (300m/s<sup>2</sup> or more for reed switches and 1000m/s<sup>2</sup> or more for solid state switches) while handling. Although the body of the switch may not be damaged, the inside of the switch could be damaged and cause a malfunction.

##### 2. Do not carry a cylinder by the auto switch lead wires.

Never carry a cylinder by its lead wires. This may not only cause broken lead wires, but it may cause internal elements of the switch to be damaged by the stress.

##### 3. Mount switches using the proper tightening torque.

If a switch is tightened beyond the range of tightening torque, the mounting screws or switch may be damaged.

On the other hand, tightening below the range of tightening torque may allow the switch to slip out of position. (Refer to switch mounting instructions for each series for switch mounting, moving, and tightening torque, etc.)

##### 4. Mount a switch at the center of the operating range.

Adjust the mounting position of an auto switch so that the piston stops at the center of the operating range (the range in which a switch is ON). (The mounting position shown in the catalog indicates the optimum position at stroke end.) If mounted at the end of the operating range (around the borderline of ON and OFF), operation will be unstable.

### Wiring

#### ⚠ Warning

##### 1. Avoid repeatedly bending or stretching lead wires.

Broken lead wires will result from repeatedly applying bending stress or stretching force to the lead wires.

##### 2. Be sure to connect the load before power is applied.

###### <2 wire type>

If the power is turned ON when an auto switch is not connected to a load, the switch will be instantly damaged because of excess current.

##### 3. Confirm proper insulation of wiring.

Be certain that there is no faulty wiring insulation (contact with other circuits, ground fault, improper insulation between terminals, etc.). Damage may occur due to excess current flow into a switch.

##### 4. Do not wire with power lines or high voltage lines.

Wire separately from power lines or high voltage lines, avoiding parallel wiring or wiring in the same conduit with these lines. Control circuits containing auto switches may malfunction due to noise from these other lines.

### Wiring

#### ⚠ Warning

##### 5. Do not allow short circuit of loads.

###### <Reed switches>

If the power is turned ON with a load in a short circuited condition, the switch will be instantly damaged because of excess current flow into the switch.

###### <Solid state switches>

All models of PNP output type switches do not have built-in short circuit protection circuits.

Note that if a load is short circuited, the switch will be instantly damaged as in the case of reed switches.

\*Take special care to avoid reverse wiring with the brown (red) power supply line and the black (white) output line on 3 wire type switches.

##### 6. Avoid incorrect wiring.

###### <Reed switches>

A 24VDC switch with indicator light has polarity. The brown (red) lead wire is (+), and the blue (black) lead wire is (-).

1) If connections are reversed, a switch will operate, however, the light emitting diode will not light up.

Also note that a current greater than that specified will damage a light emitting diode and it will no longer operate.

Applicable models: D-Z73

###### <Solid state switches>

1) If connections are reversed on a 2 wire type switch, the switch will not be damaged if protected by a protection circuit, but the switch will always stay in an ON state. However, it is still necessary to avoid reversed connections, since the switch could be damaged by a load short circuit in this condition.

\*2) If connections are reversed (power supply line + and power supply line -) on a 3 wire type switch, the switch will be protected by a protection circuit. However, if the power supply line (+) is connected to the blue (black) wire and the power supply line (-) is connected to the black (white) wire, the switch will be damaged.

#### \* Lead wire color changes

Lead wire colors of SMC switches and related products have been changed in order to meet NECA (Nippon Electric Control Equipment Industries Association) Standard 0402 for production beginning September, 1996 and thereafter. Please refer to the tables provided.

Special care should be taken regarding wire polarity during the time that the old colors still coexist with the new colors.

##### 2 wire

|            | Old   | New   |
|------------|-------|-------|
| Output (+) | Red   | Brown |
| Output (-) | Black | Blue  |

##### Solid state with diagnostic output

|                   | Old    | New    |
|-------------------|--------|--------|
| Power supply      | Red    | Brown  |
| GND               | Black  | Blue   |
| Output            | White  | Black  |
| Diagnostic output | Yellow | Orange |

##### 3 wire

|              | Old   | New   |
|--------------|-------|-------|
| Power supply | Red   | Brown |
| GND          | Black | Blue  |
| Output       | White | Black |

##### Solid state with latch type diagnostic output

|                              | Old    | New    |
|------------------------------|--------|--------|
| Power supply                 | Red    | Brown  |
| GND                          | Black  | Blue   |
| Output                       | White  | Black  |
| Latch type diagnostic output | Yellow | Orange |

# Series NCA1

## Auto Switch Precautions 3

Be sure to read before handling.

### Operating Environment

#### Warning

**1. Never use in an atmosphere of explosive gases.**

The structure of auto switches is not intended to prevent explosion. Never use in an atmosphere with an explosive gas since this may cause a serious explosion.

**2. Do not use in an area where a magnetic field is generated.**

Auto switches will malfunction or magnets inside cylinders will become demagnetized. (Consult SMC regarding the availability of a magnetic field resistant auto switch.)

**3. Do not use in an environment where the auto switch will be continually exposed to water.**

Although switches satisfy IEC standard IP67 construction (JIS C 0920: watertight structure), do not use switches in applications where continually exposed to water splash or spray. Poor insulation or swelling of the potting resin inside switches may cause malfunction.

**4. Do not use in an environment with oil or chemicals.**

Consult SMC if auto switches will be used in an environment with coolant, cleaning solvent, various oils or chemicals. If auto switches are used under these conditions for even a short time, they may be adversely affected by improper insulation, malfunction due to swelling of the potting resin, or hardening of the lead wires.

**5. Do not use in an environment with temperature cycles.**

Consult SMC if switches are used where there are temperature cycles other than normal temperature changes, as there may be adverse effects inside the switches.

**6. Do not use in an environment where there is excessive impact shock.**

**<Reed switches>**

When excessive impact (300m/s<sup>2</sup> or more) is applied to a reed switch during operation, the contact point will malfunction and generate or cut off a signal momentarily (1ms or less). Consult SMC regarding the need to use a solid state switch depending upon the environment.

**7. Do not use in an area where surges are generated.**

**<Solid state switches>**

When there are units (solenoid type lifter, high frequency induction furnace, motor, etc.) which generate a large amount of surge in the area around cylinders with solid state auto switches, this may cause deterioration or damage to the switch. Avoid sources of surge generation and disorganized lines.

**8. Avoid accumulation of iron waste or close contact with magnetic substances.**

When a large amount of iron waste such as machining chips or spatter is accumulated, or a magnetic substance (something attracted by a magnet) is brought into close proximity with an auto switch cylinder, it may cause the auto switch to malfunction due to a loss of the magnetic force inside the cylinder.

### Maintenance

#### Warning

**1. Perform the following maintenance periodically in order to prevent possible danger due to unexpected auto switch malfunction.**

**1) Secure and tighten switch mounting screws.**

If screws become loose or the mounting position is dislocated, retighten them after readjusting the mounting position.

**2) Confirm that there is no damage to lead wires.**

To prevent faulty insulation, replace switches or repair lead wires, etc., if damage is discovered.

**3) Confirm the lighting of the green light on the 2 color indicator type switch.**

Confirm that the green LED is on when stopped at the established position. If the red LED is on, the mounting position is not appropriate. Readjust the mounting position until the green LED lights up.

### Other

#### Warning

**1. Consult SMC concerning water resistance, elasticity of lead wires, and usage at welding sites, etc.**

### Limited Cylinder Warranty - Terms and Conditions of Sale....

---

SMC warrants that for **18 months or 1800 service miles\***, whichever occurs first from date of purchase, it will replace or make adjustment at SMC's option, of any defective cylinder sold if the cylinder product is returned with SMC's prior written consent, transportation prepaid by the original buyer, and received by SMC at its place of business within the warranty period.

SMC shall have the right to inspect, prior to return, at the buyer's facility, any products claimed to be defective.

This warranty is limited exclusively to cylinder products which, in the opinion of SMC, have not been subjected to modification, misuse, negligence, misapplication, repairs or alterations. Damage caused by fire, theft, riot, explosion or acts of Gods are excluded

from this warranty. The foregoing constitutes the sole exclusive remedy of the buyer and the only liability of SMC and is in lieu of any and all other warranties, expressed or implied, or statutory as to merchantability, fitness for purpose sold, description, quality, productiveness or any other matter. SMC shall not be liable for loss of use, or profit, or special or consequential damages.

SMC assumes no responsibility for engineering technical advice pertaining to any manufactured item to which SMC's products or goods have been attached. No agent, employee, distributor, or representative of SMC has the authority to extend the scope of this warranty or to make any other promises, warranties or guarantees concerning the manufacture, sale or application of SMC's products.

*\*Service Miles = (inches/stroke) x (2 strokes/cycle) x (no of cycles) x [1 mile / 63,360 inches]*



# Global Manufacturing, Distribution and Service Network

## Worldwide Subsidiaries

### EUROPE

**AUSTRIA**  
SMC Pneumatik GmbH (Austria)

**BELGIUM**  
SMC Pneumatics N.V./S.A.

**BULGARIA**  
SMC Industrial Automation Bulgaria EOOD

**CROATIA**  
SMC Industrijska Automatika d.o.o.

**CZECH**  
SMC Industrial Automation CZ s.r.o.

**DENMARK**  
SMC Pneumatik A/S

**ESTONIA**  
SMC Pneumatics Estonia

**FINLAND**  
SMC Pneumatics Finland OY

**FRANCE**  
SMC Pneumatique S.A.

**GERMANY**  
SMC Pneumatik GmbH

**GREEK**  
SMC Hellas EPE

**HUNGARY**  
SMC Hungary Ipari Automatizálási Kft.

**IRELAND**  
SMC Pneumatics (Ireland) Ltd.

**ITALY**  
SMC Italia S.p.A.

**LATVIA**  
SMC Pneumatics Latvia SIA

**LIETUVA**  
SMC Pneumatics Lietuva, UAB

**NETHERLANDS**  
SMC Pneumatics BV

**NORWAY**  
SMC Pneumatics Norway A/S

**POLAND**  
SMC Industrial Automation Polska Sp.z.o.o.

**ROMANIA**  
SMC Romania S.r.l.

**RUSSIA**  
SMC Pneumatik LLC.

**SLOVAKIA**  
SMC Priemyselná Automatizácia, s.r.o.

**SLOVENIA**  
SMC Industrijska Avtomatika d.o.o.

**SPAIN/PORTUGAL**  
SMC España, S.A.

**SWEDEN**  
SMC Pneumatics Sweden AB

**SWITZERLAND**  
SMC Pneumatik AG

**UK**  
SMC Pneumatics (U.K.) Ltd.

### ASIA

**CHINA**  
SMC (China) Co., Ltd.

**HONG KONG**  
SMC Pneumatics (Hong kong) Ltd.

**INDIA**  
SMC Pneumatics (India) Pvt. Ltd.

**JAPAN**  
SMC Corporation

**MALAYSIA**  
SMC Pneumatics (S.E.A.) Sdn. Bhd.

**PHILIPPINES**  
SMC Pneumatics (Philippines), Inc.

**SINGAPORE**  
SMC Pneumatics (S.E.A.) Pte. Ltd.

**SOUTH KOREA**  
SMC Pneumatics Korea Co., Ltd.

**TAIWAN**  
SMC Pneumatics (Taiwan) Co., Ltd.

**THAILAND**  
SMC Thailand Ltd.

### NORTH AMERICA

**CANADA**  
SMC Pneumatics (Canada) Ltd.

**MEXICO**  
SMC Corporation (Mexico) S.A. DE C.V.

**USA**  
SMC Corporation of America

### SOUTH AMERICA

**ARGENTINA**  
SMC Argentina S.A.

**BOLIVIA**  
SMC Pneumatics Bolivia S.R.L.

**BRAZIL**  
SMC Pneumaticos do Brazil Ltda.

**CHILE**  
SMC Pneumatics (Chile) S.A.

**VENEZUELA**  
SMC Neumatica Venezuela S.A.

### OCEANIA

**AUSTRALIA**  
SMC Pneumatics (Australia) Pty. Ltd.

**NEW ZEALAND**  
SMC Pneumatics (N.Z.) Ltd.

## U.S. & Canadian Sales Offices

### EAST

Atlanta  
Boston  
Charlotte  
Nashville  
New Jersey  
Richmond  
Rochester  
Tampa

### WEST

Austin  
Dallas  
Los Angeles  
Phoenix  
Portland  
San Francisco

### MIDWEST

Chicago  
Cincinnati  
Cleveland  
Detroit  
Indianapolis  
Milwaukee  
Minneapolis  
St. Louis

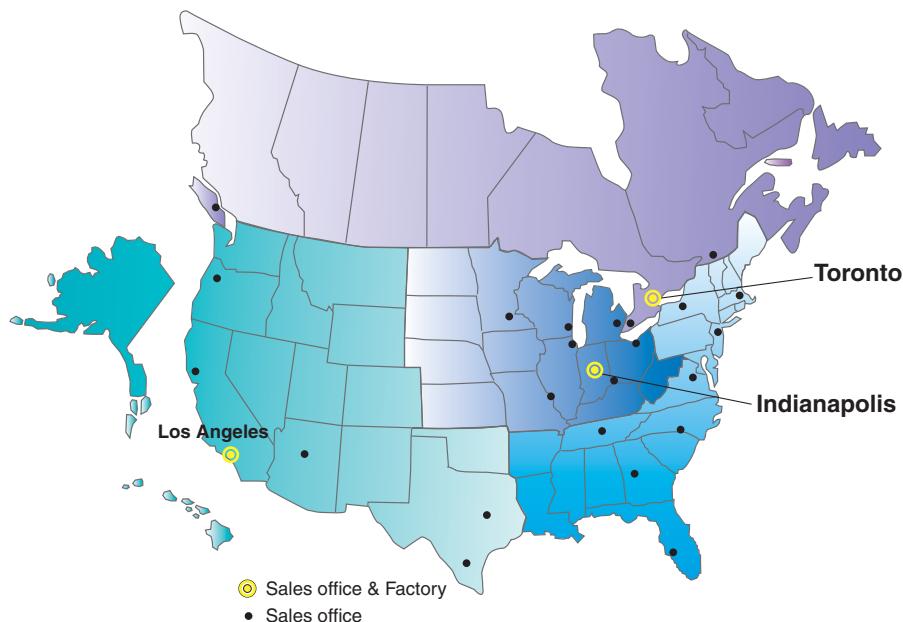
### CANADA

**Montreal**  
Tel: (514) 733-9595  
Fax: (514) 733-1771

**Toronto**  
Tel: (905) 812-0400  
Fax: (905) 812-8686

**Vancouver**  
Tel: (604) 517-1646  
Fax: (604) 517-1647

**Windsor**  
Tel: (519) 944-0555  
Fax: (519) 944-1870



**SMC Corporation of America**  
3011 N. Franklin Road  
Indianapolis, IN 46226

**(800) 762-7621 (SMC.SMC1)**  
[www.smcusa.com](http://www.smcusa.com)  
**For International Inquires: [www.smcworld.com](http://www.smcworld.com)**

**SMC Pneumatics (Canada) Ltd.**  
6768 Financial Drive Mississauga  
Ontario, L5N 7J6 Canada

**(905) 812-0400**  
[www.smcpcneumatics.ca](http://www.smcpcneumatics.ca)

© 2008 SMC Corporation of America, All Rights Reserved.

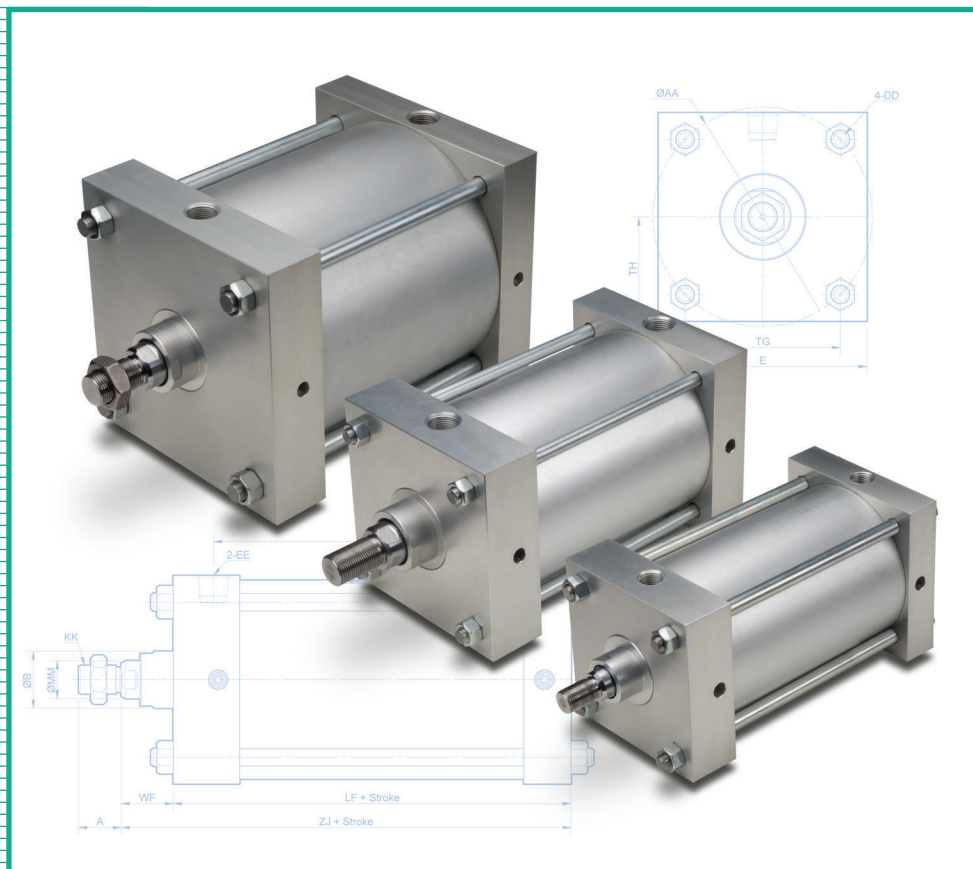
All reasonable efforts to ensure the accuracy of the information detailed in this catalog were made at the time of publishing. However, SMC can in no way warrant the information herein contained as specifications are subject to change without notice.

MU-10M-PP



# Series *NCA1*

## Air Cylinder NFPA Interchangeable Large Bore Size



### Features

- Medium duty 5", 6" and 8" bores
- 11 different NFPA mounting options
- Standard with adjustable air cushion
- Auto switch capable



Contents

|  |      |
|--|------|
|  | page |
| How to order .....   | 3    |
| Auto Switches .....  | 3    |
| Specifications .....                                       | 4    |
| Construction .....   | 5    |
| Replacement Kits .....                                     | 5    |
| <br><b>Mounting styles</b>                                 |      |
| B    MX0    basic style .....                              | 6    |
| BA   MX1    tie rod extended - both ends .....             | 6    |
| BB   MX2    tie rod extended - head end .....              | 7    |
| BC   MX3    tie rod extended - rod cover end .....         | 7    |
| F    MF1    rod side rectangular flange .....              | 8    |
| G    MF2    head side rectangular flange .....             | 8    |
| L    MS1    foot style .....                               | 9    |
| R    MS2    side tapped style .....                        | 9    |
| S    MS4    side lug style .....                           | 10   |
| X    MP1    double head clevis style .....                 | 10   |
| D    MP2    double detachable head side clevis style ..... | 11   |
| Dimension Changes (XB5, XC3 Options) .....                 | 11   |
| Accessories .....  | 12   |
| Warranty and Precautions .....                             | 14   |



## How to Order

NC **D** A1 **B** **500** - **04** **00** - **XB5**

**Built in magnet** •

|     |                                       |
|-----|---------------------------------------|
| Nil | None                                  |
| D   | Auto switch capable (magnetic option) |

**Bore size** •

|     |    |
|-----|----|
| 500 | 5" |
| 600 | 6" |
| 800 | 8" |

**Option** •

|      |                            |
|------|----------------------------|
| Nil  | No option                  |
| XB5  | Oversized rod              |
| XB6  | High temperature           |
| XB7  | Low temperature            |
| XC3  | Rotated ports *            |
| XC6  | Stainless steel piston rod |
| XC35 | With coil scraper          |

**Mounting style** •

|     |     |  |
|-----|-----|--|
| B   | MX0 | Basic style                              |
| BA  | MX1 | Tie rod extended - both ends             |
| BB  | MX2 | Tie rod extended - head end              |
| BC  | MX3 | Tie rod extended - rod cover end         |
| F * | MF1 | Rod side rectangular flange              |
| G * | MF2 | Head side rectangular flange             |
| L   | MS1 | Foot style                               |
| S   | MS2 | Side lug style                           |
| R   | MS4 | Side tapped style                        |
| X   | MP1 | Double head clevis style                 |
| D   | MP2 | Double detachable head side clevis style |

**Standard stroke** •

Inches

**Stroke** •

Hundredths of an inch

**Air Cushion** •

|     |           |
|-----|-----------|
| Nil | Both ends |
| N   | None      |
| H   | Head end  |
| R   | Rod end   |

Notes:

- Low temperature option does not include air cushions. When using this option, specify "N" in part number for air cushion.
- Auto switch capable not available with options XB6 & XB7
- High temperature option for bore 6" and 8" does not include air cushions. When using this option, specify "N" in part number for air cushion.
- External cushioning recommended for cylinder without standard air cushioning.  
(Refer to kinetic energy absorption warning)
- Limit of two X-options per standard model. XB6 and XB7 can not be combined.

\* Refer to page 11 for order details.

\* Not available on 8" bore

## Auto switches

| Type               | Special function                           | Indicator light | Wiring (output)         | Load voltage |             | Auto switch model | Lead wire length (m) |       |       |       | Pre-wired Connector | Applicable load |
|--------------------|--|-----------------|-------------------------|--------------|-------------|-------------------|----------------------|-------|-------|-------|---------------------|-----------------|
|                    |  |                 |                         | DC           | AC          |                   | 0.5 (Nil)            | 1 (M) | 3 (L) | 5 (Z) |                     |                 |
| Solid state switch | Diagnostic indication (2-color indication) | Yes             | 3 wire (NPN)            | 24 V         | 5 V         | M9N               | •                    | •     | •     | •     | ○                   | IC circuit      |
|                    |  |                 | 3 wire (PNP)            | -            | 12 V        | M9P               | •                    | •     | •     | •     | ○                   |                 |
|                    |  |                 | 2 Wire                  | 12 V         | -           | M9B               | •                    | •     | •     | •     | ○                   |                 |
|                    |  |                 | 3 wire (NPN)            | 5 V          | 12 V        | M9NW              | •                    | •     | •     | •     | ○                   |                 |
|                    | Water Resistant (2-color indication)       | Yes             | 3 wire (PNP)            | 24 V         | 12 V        | M9PW              | •                    | •     | •     | •     | ○                   | IC circuit      |
|                    |  |                 | 2 Wire                  | 12 V         | -           | M9BW              | •                    | •     | •     | •     | ○                   |                 |
|                    |  |                 | 3 wire (NPN)            | 5 V          | 12 V        | M9NA              | ○                    | ○     | •     | •     | ○                   |                 |
|                    |  |                 | 3 wire (PNP)            | 12 V         | -           | M9PA              | ○                    | ○     | •     | •     | ○                   |                 |
| Reed switch        | -  | Yes             | 2 Wire                  | 12 V         | -           | M9BA              | ○                    | ○     | •     | •     | ○                   | -               |
|                    |  |                 | 3 Wire (NPN equivalent) | -            | 5 V         | A96               | •                    | -     | •     | -     | -                   |                 |
|                    |  |                 | 2 Wire                  | 24 V         | 12 V        | A93               | •                    | -     | •     | -     | -                   |                 |
|                    |  |                 | 2 Wire                  | 24 V         | 5 V or less | A90               | •                    | -     | •     | -     | -                   |                 |

\* With pre-wired connector is available for solid state autoswitches.  
For details, refer to Best Pneumatics No. 2

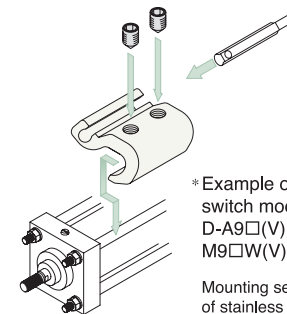
## Operating Range

| Auto switch model | Bore size |      |      |
|-------------------|-----------|------|------|
|                   | Ø5        | Ø6   | Ø8   |
| D-A9□/A9□V        | 12        | 12.5 | 11.5 |
| D-M9□/M9□V        | 6         | 6.5  | 6.5  |
| D-M9□W/M9□WV      |           |      |      |
| D-M9□AL/M9□AVL    |           |      |      |

\* Since this is a guideline including hysteresis, it is not meant to be guaranteed. (Assuming approximately ±30% dispersion.)  
In some cases it may vary substantially depending on the ambient environment.

## Switch Mounting Bracket Part No.

| Auto switch model | Bore size (in) |         |         |
|-------------------|----------------|---------|---------|
|                   | Ø5             | Ø6      | Ø8      |
| D-A9□/A9□V        | BS5-125        | BS5-125 | BS5-160 |
| D-M9□/M9□V        |                |         |         |
| D-M9□W/M9□WV      |                |         |         |
| D-M9□AL/M9□AVL    |                |         |         |



\* Example of mounting switch models:  
D-A9□(V), M9□(V),  
M9□W(V), M9□A(V)L  
Mounting set screws made of stainless steel

## Series NCA1 Cylinder

Large Bore

### Specifications

|                               |                                |
|-------------------------------|--------------------------------|
| Type                          | Double acting, single rod      |
| Fluid                         | Air                            |
| Lubrication                   | Non-lube                       |
| Minimum operating pressure    | 8 psi (0.06 Mpa)               |
| Maximum operating pressure    | 250 psi (1.75 Mpa)             |
| Ambient and Fluid Temperature | 40 - 140°F (5 - 60°C)          |
| Piston speed                  | 2 ~ 20 in/sec (50 ~ 500mm/sec) |
| Cushion                       | Standard, both ends            |
| Maximum stroke                | 36 in                          |
| Industry specification        | ANSI/(NFPA) T3.6.7 R3          |

### Kinetic Energy Absorbed

| Bore size | Effective Cushion Length (in) | Absorbable Kinetic Energy (ft-lb) |
|-----------|-------------------------------|-----------------------------------|
| Ø5"       | 0.85                          | 23.49                             |
| Ø6"       | 1.06                          | 38.48                             |
| Ø8"       | 1.03                          | 65.25                             |

### ⚠ Warning

A deceleration circuit or shock absorber may be required. When a driven object is operated at high speed or the load is heavy, a cylinder's cushion will not be sufficient to absorb the shock. Install a deceleration circuit to reduce the speed before cushioning, or install an external shock absorber to relieve the shock. In this case, the rigidity of the machinery should also be examined.

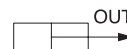
### Weight / Aluminum Tube

| Bore Size (inch)                |   | 500 (5") | 600 (6") | 800 (8") |
|---------------------------------|---|----------|----------|----------|
| Basic weight                    | B/R - basic type (MX0/MS4)                      | 13.41    | 21.38    | 36.57    |
|                                 | BA/BB - Tie rod extended - either end (MX1/MX2) | 13.65    | 21.63    | 37.25    |
|                                 | BC - Tie rod extended - both ends (MX3)         | 13.89    | 21.86    | 37.75    |
|                                 | F/G - Flange Mounting (MF1/MF2)                 | 19.63    | 31.57    | N/A      |
|                                 | L - Foot mounting (MS1)                         | 16.66    | 25.55    | 41.64    |
|                                 | S - Side lug (MS2)                              | 15.41    | 23.76    | 40.21    |
|                                 | X - Clevis mounting (MP1)                       | 18.05    | 30.65    | 52.74    |
|                                 | D - Double detachable head side clevis          | 18.73    | 29.58    | 54.73    |
|                                 | Additional weight for magnet (NCDA1)            | 0.04     | 0.05     | 0.06     |
|                                 | Additional weight for oversize rod (XB5)        | 0.91     | 1.54     | 1.57     |
| Additional weight per 2" stroke | Standard piston rod                             | 1.22     | 1.61     | 2.30     |
|                                 | Oversize piston rod (XB5)                       | 1.61     | 2.13     | 2.81     |

Calculation example: NCDA1B500-0600-XB5 (Basic mount, auto switch capable, Ø5" bore, 6" stroke, oversized rod)

|                                   |                   |   |          |
|-----------------------------------|-------------------|---|----------|
| basic weight                      | 13.41lb + 0.91 lb | = | 14.32 lb |
| add auto switch magnet            | 0.036 lb          | = | 0.04 lb  |
| additional weight based on stroke | 1.61 lb (6"/2")   | = | 4.84 lb  |
|                                   |                   |   | 19.20 lb |

### Cylinder Bores and Forces: Push Stroke (Extend)



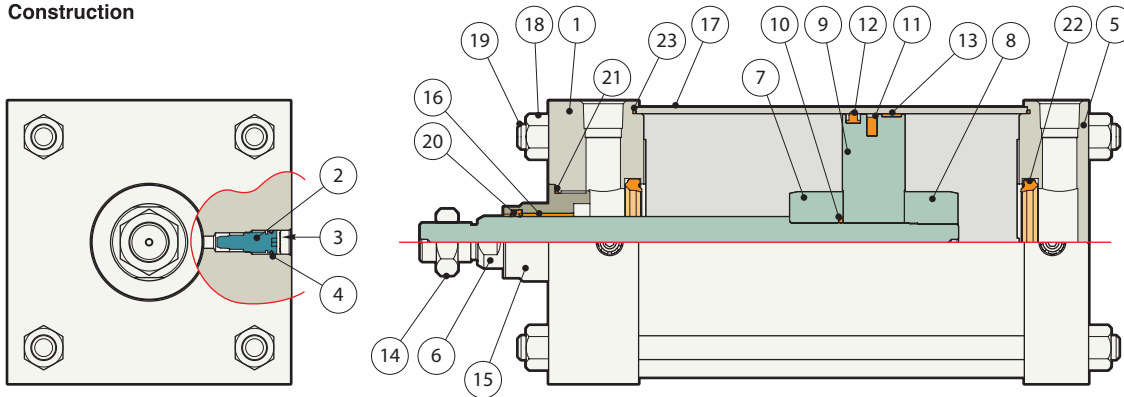
| Operating Pressure (psi) |             | 50                 | 60   | 80   | 100  | 200   | 250   |
|--------------------------|-------------|--------------------|------|------|------|-------|-------|
| Bore Size                | Piston Area | Force output (lbs) |      |      |      |       |       |
| 5"                       | 19.63       | 982                | 1178 | 1571 | 1963 | 3927  | 4909  |
| 6"                       | 28.27       | 1414               | 1696 | 2262 | 2827 | 5655  | 7069  |
| 8"                       | 50.27       | 2513               | 3016 | 4021 | 5027 | 10053 | 12566 |

### Cylinder Bores and Forces: Pull Stroke (Retract)



| Operating Pressure (psi) |             | 50                 | 60   | 80   | 100  | 200  | 250   |
|--------------------------|-------------|--------------------|------|------|------|------|-------|
| Bore Size                | Piston Area | Force output (lbs) |      |      |      |      |       |
| 5"                       | 18.85       | 942                | 1131 | 1508 | 1885 | 3770 | 4712  |
| 5" XB5                   | 18.15       | 908                | 1089 | 1452 | 1815 | 3630 | 4538  |
| 6"                       | 26.79       | 1339               | 1607 | 2143 | 2679 | 5358 | 6697  |
| 6" XB5                   | 25.87       | 1293               | 1552 | 2070 | 2587 | 5174 | 6467  |
| 8"                       | 48.78       | 2439               | 2927 | 3902 | 4878 | 9756 | 12195 |
| 8" XB5                   | 47.86       | 2393               | 2872 | 3829 | 4786 | 9572 | 11965 |

## Construction



### How to Order Seal Kits

NCA 500 - PS -

| Bore | Special options                     |
|------|-------------------------------------|
| 500  | Nil Standard                        |
| 600  | XB5 Oversized rod                   |
| 800  | XB6 High temperature                |
|      | XB7 Low temperature                 |
|      | XB5B6 Oversized W/ high temperature |
|      | XB5B7 Oversized W/ low temperature  |

Seal kits include the following parts:

|                          |                        |
|--------------------------|------------------------|
| 1 - Rod seal             | 2 - Cushion valve seal |
| 1 - Piston seal          | 2 - Grease pack        |
| 1 - Gland seal           | 1 - Loctite 243        |
| 2 - Cylinder tube gasket |                        |

\* Cushion seal is not included for XB6, XB5B6, XB7, and XB5B7 over ø5" bore

### How to Order Cylinder Tube - Double Acting, Single Rod

NCA 500 - 04 - 0400

| Bore | Stroke                     |
|------|----------------------------|
| 500  | (In inches and hundredths) |
| 600  |                            |
| 800  |                            |

### How to Order Gland Kits

NCA 500 - RG -

| Bore | Special options                  | Gland kits Include: |
|------|----------------------------------|---------------------|
| 500  | Nil Standard                     | 1 - Gland           |
| 600  | XB5 Oversized rod                | 1 - Bushing         |
| 800  | XC35 Coil scraper                | * Scraper with XC35 |
|      | XB5C35 Oversized W/ Coil scraper |                     |

### How to Order Piston Rod Assembly - Double Acting, Single Rod

| Magnet           | Bore | Stroke                     | Special options                     |
|------------------|------|----------------------------|-------------------------------------|
| Nil - Non-Magnet | 500  | (In inches and hundredths) | Nil Standard                        |
| D - With Magnet  | 600  |                            | XB5 Oversized rod                   |
|                  | 800  |                            | XB6 High temperature                |
|                  |      |                            | XB7 Low temperature                 |
|                  |      |                            | XB5B6 Oversized W/ high temperature |
|                  |      |                            | XB5B7 Oversized W/ low temperature  |
|                  |      |                            | XC3 Stainless steel piston rod      |

### Component parts

| Component               | Material       | Qty. | Note                       |
|-------------------------|----------------|------|----------------------------|
| 1 Rod cover             | Aluminum alloy | 1    | Anodized                   |
| 2 Cushion valve         | Rolled steel   | 2    | Electroless nickel plating |
| 3 Snap ring             | Spring steel   | 2    | Phosphate coated           |
| 4 Cushion valve seal    | NBR            | 2    |                            |
| 5 Head cover            | Aluminum alloy | 1    | Anodized                   |
| 6 Piston rod            | Carbon steel   | 1    |                            |
| 7 Cushion A             | Aluminum alloy | 1    | Anodized                   |
| 8 Cushion B             | Aluminum alloy | 1    | Anodized                   |
| 9 Piston                | Aluminum alloy | 1    |                            |
| 10 Piston gasket        | NBR            | 1    |                            |
| 11 Magnet               | -              | (1)  |                            |
| 12 Piston seal          | NBR            | 1    |                            |
| 13 Wear ring            | Resin          | 1    |                            |
| 14 Jam nut              | Rolled steel   | 1    | Nickel plating             |
| 15 Gland                | Aluminum alloy | 1    | Anodized                   |
| 16 Bushing              | Composite      | 1    |                            |
| 17 Cylinder tube        | Aluminum alloy | 1    | Hard anodized              |
| 18 Tie rod nut          | Rolled steel   | 8    | Nickel plated              |
| 19 Tie rod              | Carbon steel   | 4    | Zinc chromated             |
| 20 Rod seal             | NBR            | 1    |                            |
| 21 Gland seal           | NBR            | 1    |                            |
| 22 Cushion seal         | Urethane       | 2    |                            |
| 23 Cylinder tube gasket | NBR            | 2    |                            |

### How to Order Tie Rods - Double Acting, Single Rod

|     |                     |                                       |                            |
|-----|---------------------|---------------------------------------|----------------------------|
| NCA | <div>B</div>        | <div>500</div> - 11 - <div>0400</div> |                            |
|     | <div>Mounting</div> | <div>Bore</div>                       | <div>Stroke</div>          |
| B   | L                   | 500                                   | (In inches and hundredths) |
| BA  | S                   | 600                                   |                            |
| BB  | R                   | 800                                   |                            |
| BC  | X                   |                                       |                            |
| F   | D                   |                                       |                            |
| G   |                     |                                       |                            |

Note: Tie rod length varies by mounting style.  
Quantity one set (4 pcs) of tie rods by mounting

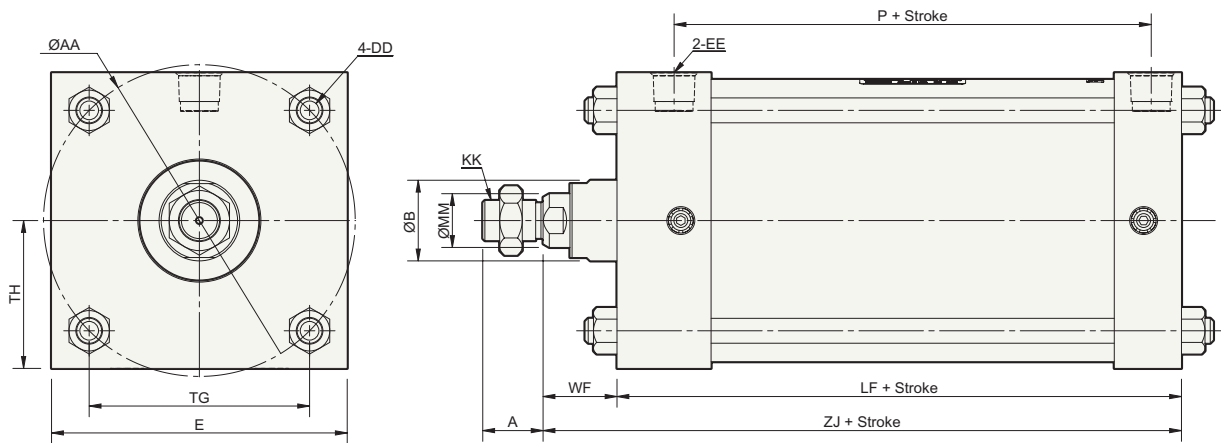
Note: Tie rod length varies by mounting style. Quantity one set (4 pcs) of tie rods by mounting

Series NCA1 Cylinder

Large Bore

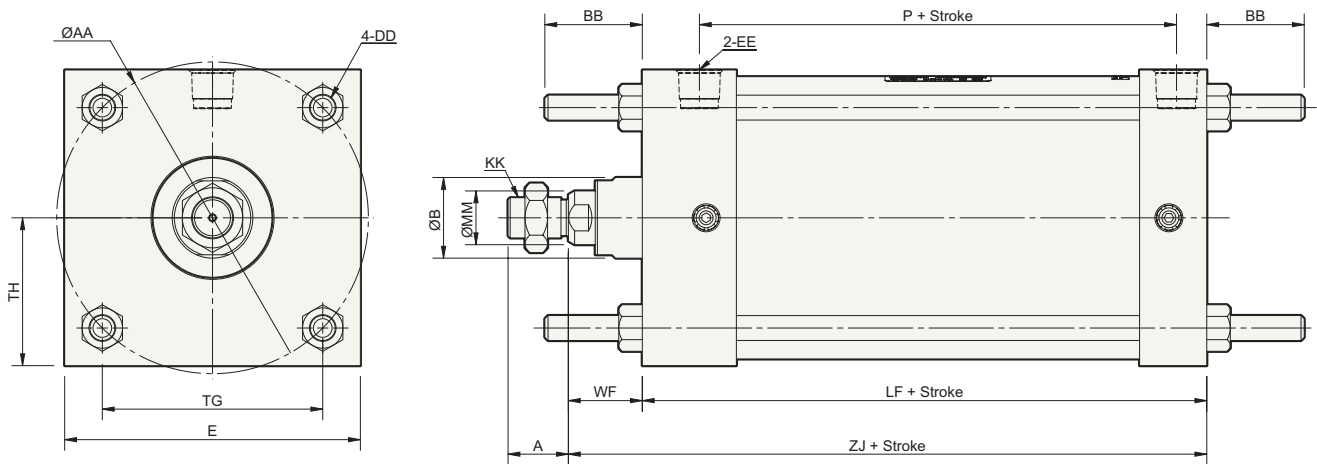
Dimension Drawings

MX0 - Basic style (B)



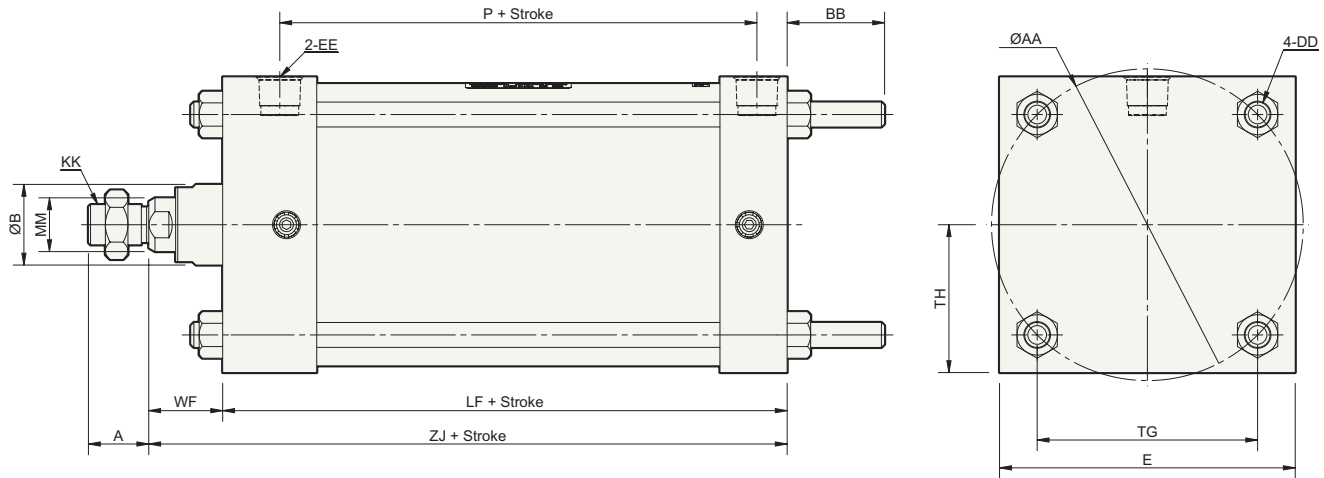
| Bore Size (in) | ØMM   | KK     | A    | AA   | ØB    | DD     | E    | EE      | LF+  | P+   | TG   | TH   | WF   | ZJ+  |
|----------------|-------|--------|------|------|-------|--------|------|---------|------|------|------|------|------|------|
| 500 (5")       | 1.000 | 3/4-16 | 1.13 | 5.80 | 1.500 | 1/2-20 | 5.50 | 1/2NPT  | 4.50 | 2.88 | 4.10 | 2.75 | 1.38 | 5.88 |
| 600 (6")       | 1.375 | 1-14   | 1.63 | 6.90 | 2.000 | 1/2-20 | 6.50 | 3/4 NPT | 5.00 | 3.13 | 4.88 | 3.25 | 1.63 | 6.63 |
| 800 (8")       | 1.375 | 1-14   | 1.63 | 9.10 | 2.000 | 5/8-18 | 8.50 | 3/4 NPT | 5.13 | 3.25 | 6.44 | 4.25 | 1.63 | 6.75 |

MX1 - Tie rod extended - both ends (BA)



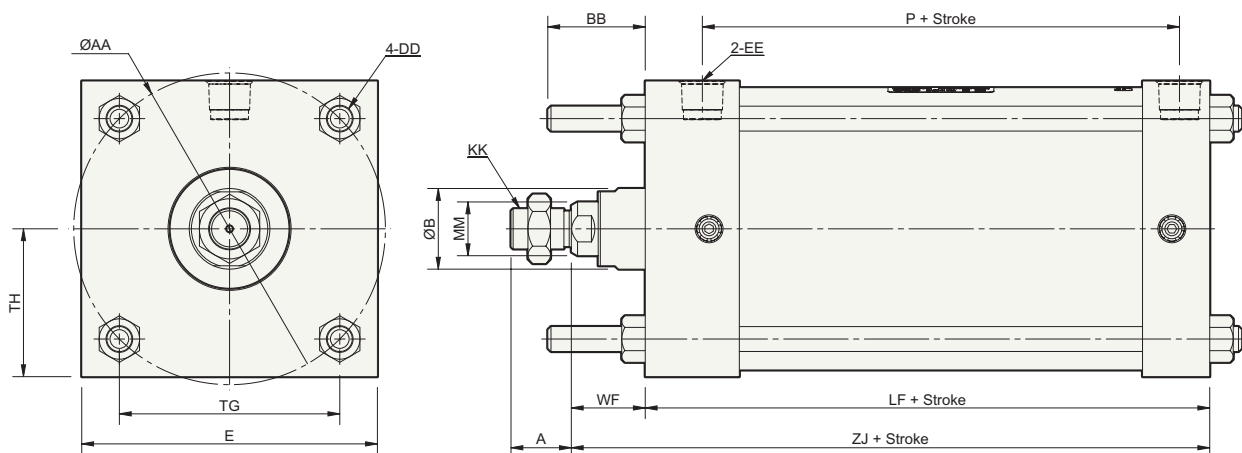
| Bore Size (in) | ØMM   | KK     | A    | AA   | ØB    | BB   | DD     | E    | EE      | LF+  | P+   | TG   | TH   | WF   | ZJ+  |
|----------------|-------|--------|------|------|-------|------|--------|------|---------|------|------|------|------|------|------|
| 500 (5")       | 1.000 | 3/4-16 | 1.13 | 5.80 | 1.500 | 1.81 | 1/2-20 | 5.50 | 1/2 NPT | 4.50 | 2.88 | 4.10 | 2.75 | 1.38 | 5.88 |
| 600 (6")       | 1.375 | 1-14   | 1.63 | 6.90 | 2.000 | 1.81 | 1/2-20 | 6.50 | 3/4 NPT | 5.00 | 3.13 | 4.88 | 3.25 | 1.63 | 6.63 |
| 800 (8")       | 1.375 | 1-14   | 1.63 | 9.10 | 2.000 | 2.31 | 5/8-18 | 8.50 | 3/4 NPT | 5.13 | 3.25 | 6.44 | 4.25 | 1.63 | 6.75 |

### MX2 - Tie rod extended - head end (BB)



| Bore Size (in) | ØMM   | KK     | A    | AA   | ØB    | BB   | DD     | EE      | E    | LF+  | P+   | TG   | TH   | WF   | ZJ+  |
|----------------|-------|--------|------|------|-------|------|--------|---------|------|------|------|------|------|------|------|
| 500 (5")       | 1.000 | 3/4-16 | 1.13 | 5.80 | 1.500 | 1.81 | 1/2-20 | 1/2 NPT | 5.50 | 4.50 | 2.88 | 4.10 | 2.75 | 1.38 | 5.88 |
| 600 (6")       | 1.375 | 1-14   | 1.63 | 6.90 | 2.000 | 1.81 | 1/2-20 | 3/4 NPT | 6.50 | 5.00 | 3.13 | 4.88 | 3.25 | 1.63 | 6.63 |
| 800 (8")       | 1.375 | 1-14   | 1.63 | 9.10 | 2.000 | 2.31 | 5/8-18 | 3/4 NPT | 8.50 | 5.13 | 3.25 | 6.44 | 4.25 | 1.63 | 6.75 |

### MX3 - Tie rod extended - rod cover end (BC)



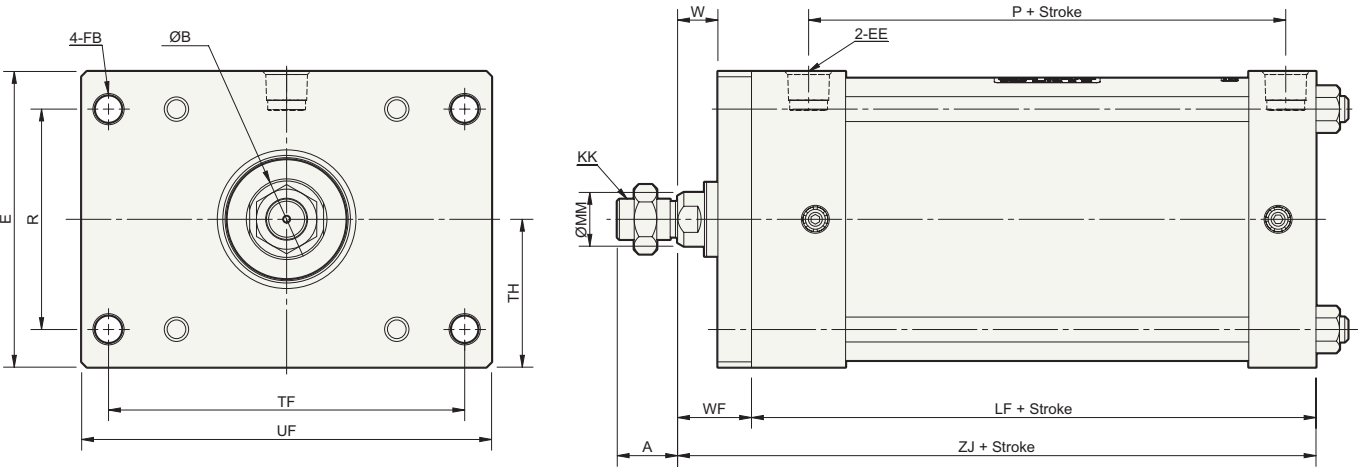
| Bore Size (in) | ØMM   | KK     | A    | AA   | ØB    | BB   | DD     | EE      | E    | LF+  | P+   | TG   | TH   | WF   | ZJ+  |
|----------------|-------|--------|------|------|-------|------|--------|---------|------|------|------|------|------|------|------|
| 500 (5")       | 1.000 | 3/4-16 | 1.13 | 5.80 | 1.500 | 1.81 | 1/2-20 | 1/2 NPT | 5.50 | 4.50 | 2.88 | 4.10 | 2.75 | 1.38 | 5.88 |
| 600 (6")       | 1.375 | 1-14   | 1.63 | 6.90 | 2.000 | 1.81 | 1/2-20 | 3/4 NPT | 6.50 | 5.00 | 3.13 | 4.88 | 3.25 | 1.63 | 6.63 |
| 800 (8")       | 1.375 | 1-14   | 1.63 | 9.10 | 2.000 | 2.31 | 5/8-18 | 3/4 NPT | 8.50 | 5.13 | 3.25 | 6.44 | 4.25 | 1.63 | 6.75 |

Series NCA1 Cylinder

Large Bore

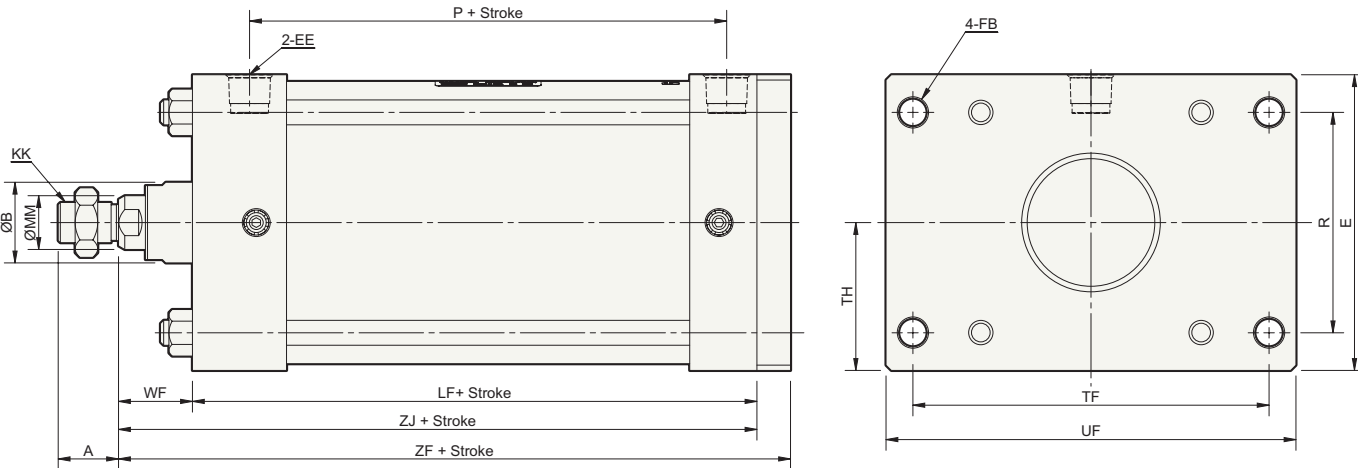
Dimension Drawings

MF1 - Rod side rectangular flange (F)



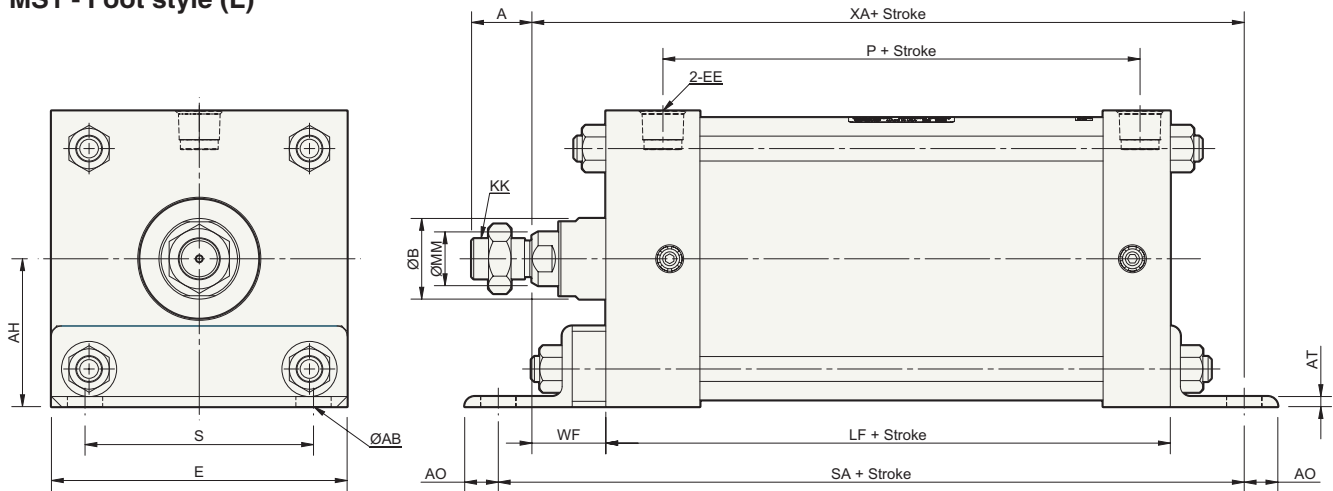
| Bore Size (in) | ØMM   | KK     | A    | ØB    | E    | EE      | ØFB | LF+  | P+   | R    | TF   | TH   | UF   | W   | WF   | ZJ+  |
|----------------|-------|--------|------|-------|------|---------|-----|------|------|------|------|------|------|-----|------|------|
| 500 (5")       | 1.000 | 3/4-16 | 1.13 | 1.500 | 5.50 | 1/2 NPT | .50 | 4.50 | 2.88 | 4.10 | 6.63 | 2.75 | 7.63 | .75 | 1.38 | 5.88 |
| 600 (6")       | 1.375 | 1-14   | 1.63 | 2.000 | 6.50 | 3/4 NPT | .50 | 5.00 | 3.13 | 4.88 | 7.63 | 3.25 | 8.63 | .88 | 1.63 | 6.63 |

MF2 - Head side rectangular flange (G)



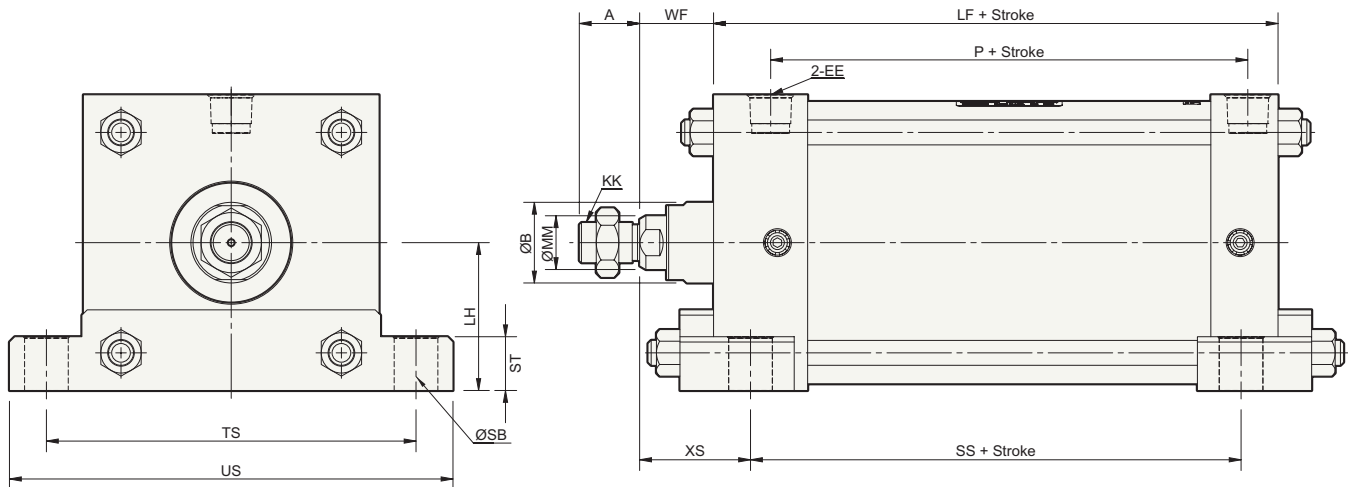
| Bore Size (in) | ØMM   | KK     | A    | ØB    | E    | EE      | ØFB | LF+  | P+   | R    | TF   | TH   | UF   | WF   | ZF+  | ZJ+  |
|----------------|-------|--------|------|-------|------|---------|-----|------|------|------|------|------|------|------|------|------|
| 500 (5")       | 1.000 | 3/4-16 | 1.13 | 1.500 | 5.50 | 1/2 NPT | .50 | 4.50 | 2.88 | 4.10 | 6.63 | 2.75 | 7.63 | 1.38 | 6.50 | 5.88 |
| 600 (6")       | 1.375 | 1-14   | 1.63 | 2.000 | 6.50 | 3/4 NPT | .50 | 5.00 | 3.13 | 4.88 | 7.63 | 3.25 | 8.63 | 1.63 | 7.38 | 6.63 |

## MS1 - Foot style (L)



| Bore Size (in) | ØMM   | KK     | A    | ØAB | AH   | AO  | AT  | ØB    | E    | EE      | LF+  | P+   | S    | SA+  | WF   | XA+  |
|----------------|-------|--------|------|-----|------|-----|-----|-------|------|---------|------|------|------|------|------|------|
| 500 (5")       | 1.000 | 3/4-16 | 1.13 | .63 | 2.75 | .63 | .19 | 1.500 | 5.50 | 1/2 NPT | 4.50 | 2.88 | 4.25 | 7.88 | 1.38 | 7.25 |
| 600 (6")       | 1.375 | 1-14   | 1.63 | .75 | 3.25 | .63 | .19 | 2.000 | 6.50 | 3/4 NPT | 5.00 | 3.13 | 5.25 | 8.50 | 1.63 | 8.00 |
| 800 (8")       | 1.375 | 1-14   | 1.63 | .75 | 4.25 | .69 | .25 | 2.000 | 8.50 | 3/4 NPT | 5.13 | 3.25 | 7.13 | 8.75 | 1.63 | 8.56 |

## MS2 - Side lug style (S)



| Bore Size (in) | ØMM   | KK     | TS   | A    | ØB    | US    | ST   | EE      | LF+  | XS   | SS+  | P+   | LH   | WF   | ØSB  |
|----------------|-------|--------|------|------|-------|-------|------|---------|------|------|------|------|------|------|------|
| 500 (5")       | 1.000 | 3/4-16 | 6.88 | 1.13 | 1.500 | 8.25  | 1.00 | 1/2 NPT | 4.50 | 2.06 | 3.13 | 2.88 | 2.75 | 1.38 | 0.75 |
| 600 (6")       | 1.375 | 1-14   | 7.88 | 1.63 | 2.000 | 9.25  | 1.00 | 3/4 NPT | 5.00 | 2.31 | 3.63 | 3.13 | 3.25 | 1.63 | 0.75 |
| 800 (8")       | 1.375 | 1-14   | 9.88 | 1.63 | 2.000 | 11.25 | 1.00 | 3/4 NPT | 5.13 | 2.31 | 3.75 | 3.25 | 4.25 | 1.63 | 0.75 |

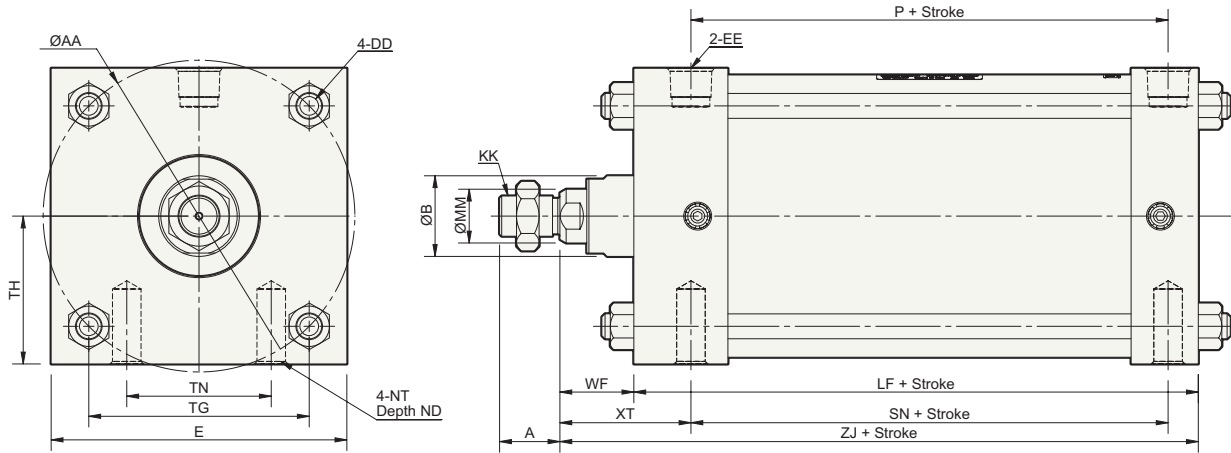


## Series NCA1 Cylinder

Large Bore

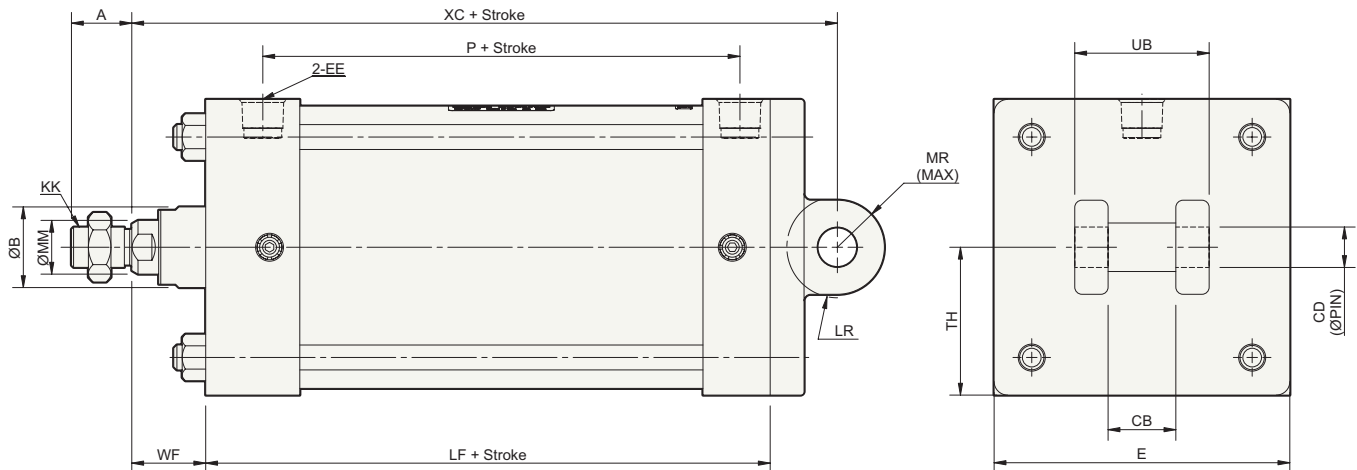
Dimension Drawings

### MS4 - Side tapped style (R)



| Bore Size (in) | ØMM   | KK     | A    | AA   | ØB    | DD     | E    | EE     | LF+  | ND   | NT     | P+   | SN+  | TG   | TH   | TN   | WF   | XT   | ZJ+  |
|----------------|-------|--------|------|------|-------|--------|------|--------|------|------|--------|------|------|------|------|------|------|------|------|
| 500 (5")       | 1.000 | 3/4-16 | 1.13 | 5.80 | 1.500 | 1/2-20 | 5.50 | 1/2NPT | 4.50 | .75  | 5/8-11 | 2.88 | 2.88 | 4.10 | 2.75 | 2.68 | 1.38 | 2.44 | 5.88 |
| 600 (6")       | 1.375 | 1-14   | 1.63 | 6.90 | 2.000 | 1/2-20 | 6.50 | 3/4NPT | 5.00 | .88  | 3/4-10 | 3.13 | 3.13 | 4.88 | 3.25 | 3.25 | 1.63 | 2.81 | 6.63 |
| 800 (8")       | 1.375 | 1-14   | 1.63 | 9.10 | 2.000 | 5/8-18 | 8.50 | 3/4NPT | 5.13 | 1.13 | 3/4-10 | 3.25 | 3.25 | 6.44 | 4.25 | 4.50 | 1.63 | 2.81 | 6.75 |

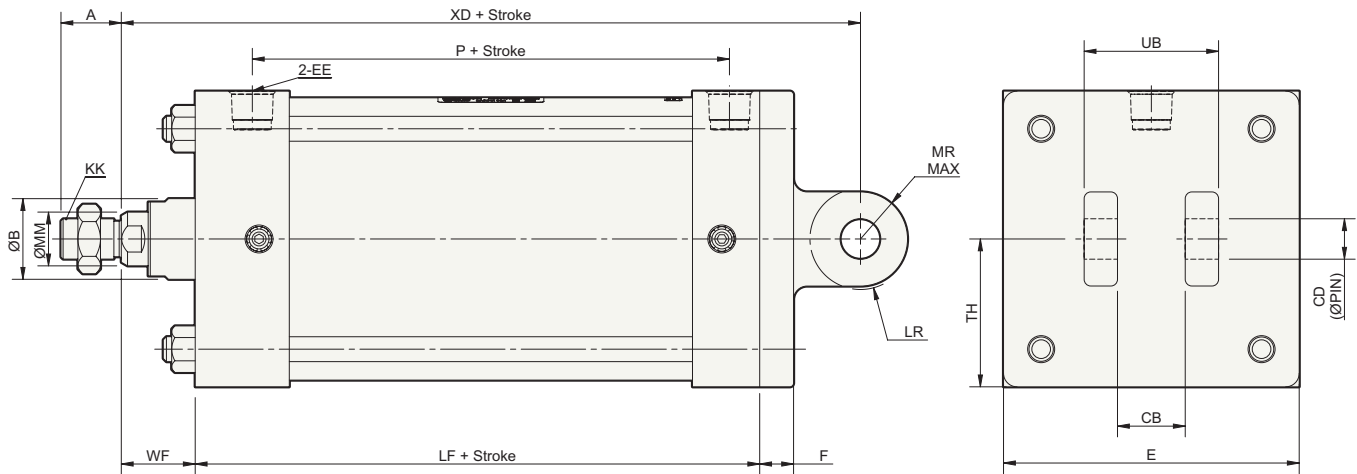
### MP1 - Double head clevis style (X)



| Bore Size (in) | ØMM   | KK     | A    | ØB    | CB    | CD    | E    | EE      | LF+  | LR   | MR   | P+   | TH   | UB    | WF   | XC+  |
|----------------|-------|--------|------|-------|-------|-------|------|---------|------|------|------|------|------|-------|------|------|
| 500 (5")       | 1.000 | 3/4-16 | 1.13 | 1.500 | 1.280 | .750  | 5.50 | 1/2 NPT | 4.50 | .94  | .95  | 2.88 | 2.75 | 2.500 | 1.38 | 7.13 |
| 600 (6")       | 1.375 | 1-14   | 1.63 | 2.000 | 1.530 | 1.000 | 6.50 | 3/4 NPT | 5.00 | 1.31 | 1.32 | 3.13 | 3.25 | 3.000 | 1.63 | 8.13 |
| 800 (8")       | 1.375 | 1-14   | 1.63 | 2.000 | 1.530 | 1.000 | 8.50 | 3/4 NPT | 5.13 | 1.31 | 1.32 | 3.25 | 4.25 | 3.000 | 1.63 | 8.25 |

Note: Pivot and cotter pins are included.

## MP2 - Double detachable head side clevis style (D)

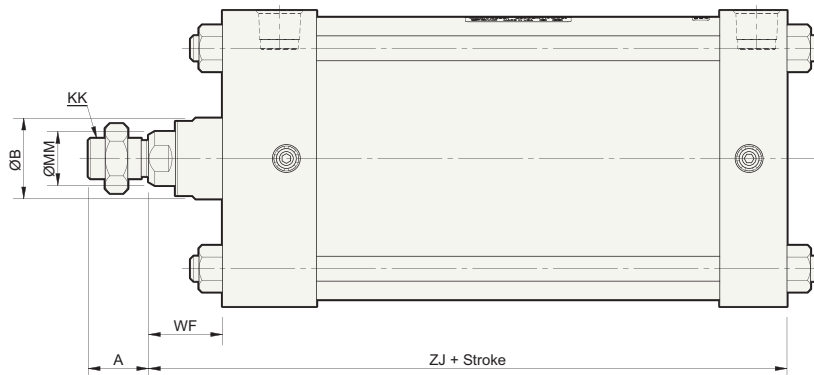


| Bore Size (in) | ØMM   | KK     | A    | ØB    | CB    | CD    | E    | EE      | F   | LF+  | LR   | MR   | P+   | TH   | UB    | WF   | XD+  |
|----------------|-------|--------|------|-------|-------|-------|------|---------|-----|------|------|------|------|------|-------|------|------|
| 500 (5")       | 1.000 | 3/4-16 | 1.13 | 1.500 | 1.280 | .750  | 5.50 | 1/2 NPT | .63 | 4.50 | .94  | .95  | 2.88 | 2.75 | 2.500 | 1.38 | 7.75 |
| 600 (6")       | 1.375 | 1-14   | 1.63 | 2.000 | 1.530 | 1.000 | 6.50 | 3/4 NPT | .75 | 5.00 | 1.31 | 1.32 | 3.13 | 3.25 | 3.000 | 1.63 | 8.88 |
| 800 (8")       | 1.375 | 1-14   | 1.63 | 2.000 | 1.530 | 1.000 | 8.50 | 3/4 NPT | .75 | 5.13 | 1.31 | 1.32 | 3.25 | 4.25 | 3.000 | 1.63 | 9.00 |

Note: Pivot and cotter pins are included.

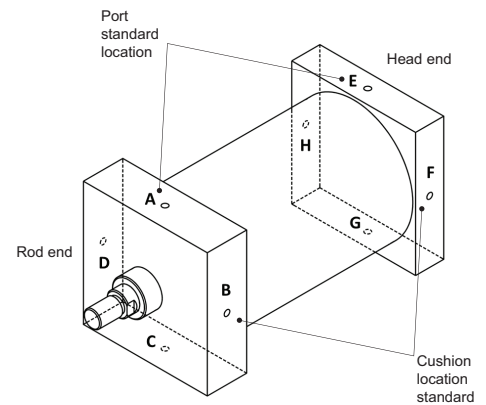
## Dimension changes for Options

### Oversized rod (XB5 Option)



| Bore Size (in) | ØMM   | KK       | A    | ØB    | WF   | ZJ+  |
|----------------|-------|----------|------|-------|------|------|
| 500 (5")       | 1.375 | 1-14     | 1.63 | 2.00  | 1.63 | 6.13 |
| 600 (6")       | 1.75  | 1 1/4-12 | 2.00 | 2.375 | 1.88 | 6.88 |
| 800 (8")       | 1.75  | 1 1/4-12 | 2.00 | 2.375 | 1.88 | 7.00 |

### Rotated Ports (XC3 Option)



#### How to Order: -XC3 Port Cushion

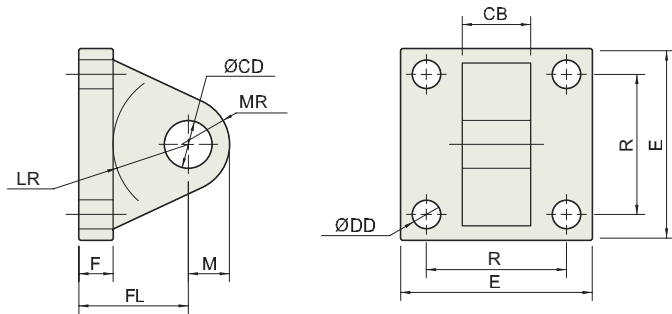
- Standard Part Number Location. AB (A=port, B=cushion)
- Available on standard, XB5, XB6, XB7, XC6, and XC35
- Ports and cushions in same location on rod and head ends
- Standard available configurations: XC3BC, XC3CD, XC3DA, XC3AC, XC3DB, XC3AD, XC3BA, XC3CB, XC3DC
- Ports and cushions NOT aligned between Rod and Head ends available via RFS

Example: NCA1B500-0400-XC3BC (B = port, C = cushion)

## Series NCA1 Cylinder

Large Bore

### Eye Bracket

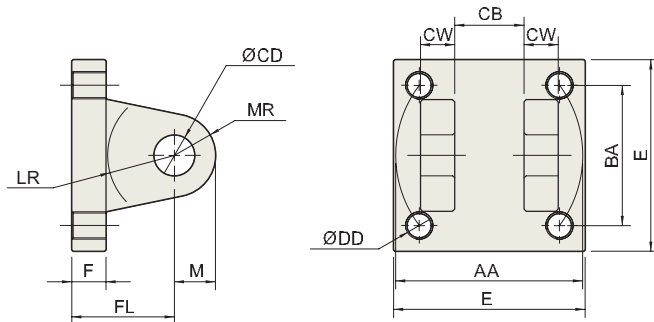


#### Dimensions

| Part No.   | CB    | CD    | DD    | E     | F   | FL    | LR    | M     | MR    | R    | Weight (lbs) |
|------------|-------|-------|-------|-------|-----|-------|-------|-------|-------|------|--------------|
| NCA1-P325  | 1 1/4 | 3/4   | 17/32 | 3 1/2 | 5/8 | 1 7/8 | 1 1/4 | 3/4   | 7/8   | 2.56 | 3.11         |
| NCA1-P800  | 1 1/2 | 1     | 21/32 | 4 1/2 | 3/4 | 2 1/4 | 1 1/2 | 1     | 1 1/4 | 3.25 | 5.80         |
| NCA1-P1000 | 2     | 1 3/8 | 21/32 | 5     | 7/8 | 3     | 2 1/8 | 1 3/8 | 1 5/8 | 3.81 | 10.42        |

Note: Pivot pin is not included

### Clevis Bracket

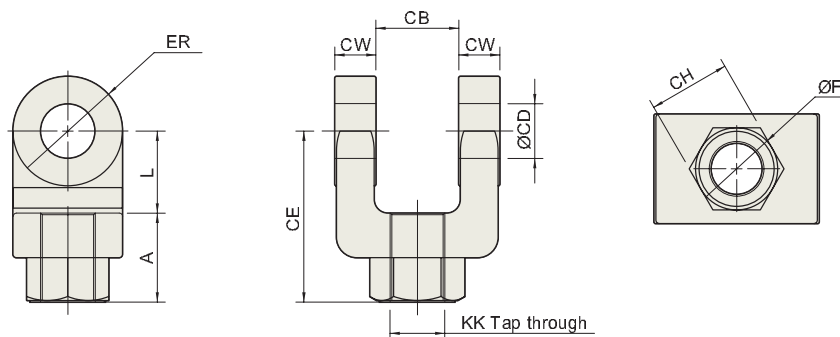


#### Dimensions

| Part No.    | AA  | BA      | CB    | CD    | CW  | DD     | E     | F   | FL    | LR     | M     | MR     | Weight (lbs) |
|-------------|-----|---------|-------|-------|-----|--------|-------|-----|-------|--------|-------|--------|--------------|
| NCA1-CB325  | 3.6 | 2 9/16  | 1.265 | 3/4   | 5/8 | 1/2-20 | 3 1/2 | 5/8 | 1 7/8 | 1 1/16 | 3/4   | 1 1/16 | 2.79         |
| NCA1-CB800  | 4.6 | 3 1/4   | 1.515 | 1     | 3/4 | 5/8-18 | 4 1/2 | 3/4 | 2 1/4 | 1 1/4  | 1     | 1 1/8  | 5.45         |
| NCA1-CB1000 | 5.4 | 3 13/16 | 2.032 | 1 3/8 | 1   | 5/8-18 | 5     | 7/8 | 3     | 1 7/8  | 1 3/8 | 1 3/4  | 9.89         |

Note: Pivot pin is not included.

### Rod Clevis

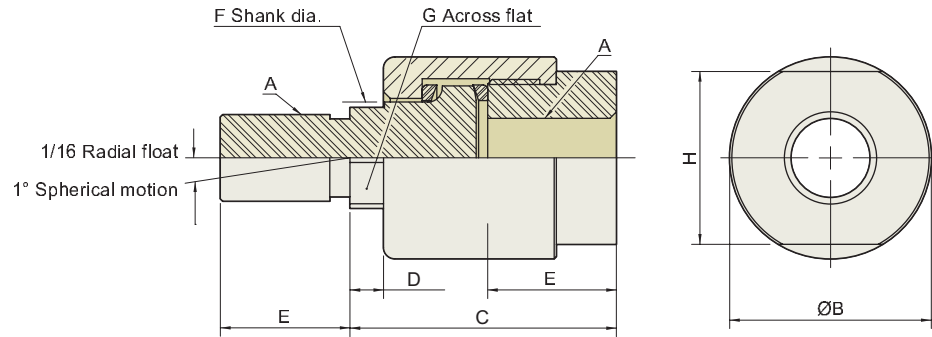


#### Dimensions

| Part No. | CB    | CD    | CE    | CH    | CW  | F     | L     | A     | KK       | ER    | Weight (lbs) |
|----------|-------|-------|-------|-------|-----|-------|-------|-------|----------|-------|--------------|
| NY-325   | 1.265 | 0.75  | 2 3/8 | 1 3/8 | 5/8 | 1 1/4 | 1 1/4 | 1 1/8 | 3/4-16   | 3/4   | 1.50         |
| NY-800   | 1.515 | 1     | 3 1/8 | 1 1/2 | 3/4 | 1 1/2 | 1 1/2 | 1 5/8 | 1-14     | 1     | 3.78         |
| NY-1000  | 3.032 | 1 3/8 | 4 1/8 | 2     | 1   | 2     | 2 1/8 | 2     | 1 1/4-12 | 1 3/8 | 9.32         |

Note: Jam nut, pivot, and cotter pins are included.

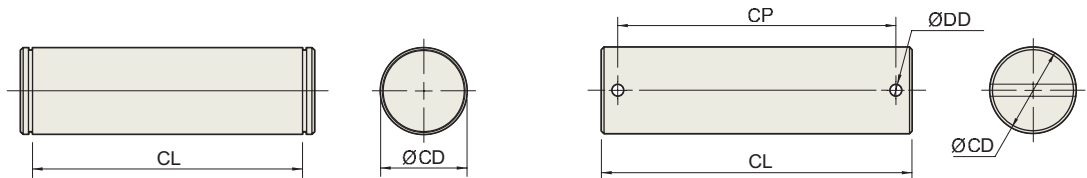
## Alignment Coupler



### Dimensions

| Part No.    | A        | B     | C       | D    | E     | F      | G     | H     |
|-------------|----------|-------|---------|------|-------|--------|-------|-------|
| NCA1-AC325  | 3/4-16   | 1 3/4 | 2 5/16  | 5/16 | 1 1/8 | 3 1/32 | 7/8   | 1 1/2 |
| NCA1-AC800  | 1-14     | 2 1/2 | 2 15/16 | 1/2  | 1 5/8 | 1 3/8  | 1 1/4 | 2 1/4 |
| NCA1-AC1000 | 1 1/4-12 | 2 1/2 | 2 15/16 | 1/2  | 1 5/8 | 1 3/8  | 1 1/4 | 2 1/4 |

## Pivot Pins



### Dimensions

| Part No.  | CD    | CL    |
|-----------|-------|-------|
| NCA1-325  | 3/4   | 2 5/8 |
| NCA1-800  | 1     | 3 1/8 |
| NCA1-1000 | 1 3/8 | 4 1/8 |

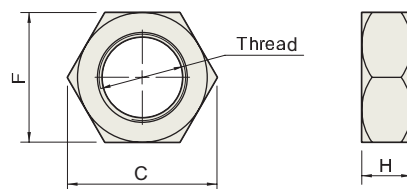
Note: Retainer rings are included.

### Dimensions

| Part No.  | CD    | DD   | CL   | CP   |
|-----------|-------|------|------|------|
| NCDP-325  | 3/4   | .140 | 3.10 | 2.72 |
| NCDP-800  | 1     | .140 | 3.60 | 3.22 |
| NCDP-1000 | 1 3/8 | .173 | 4.66 | 4.25 |

Note: Cotter pins are included.

## Rod Jam Nut

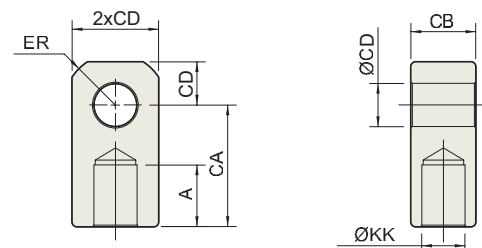


### Dimensions

| Part No. | C     | F     | H     | Thread      |
|----------|-------|-------|-------|-------------|
| JM-10    | 1.299 | 1 1/8 | 27/64 | 3/4-16UNF   |
| JM-800   | 1.732 | 1 1/2 | 35/64 | 1-14UNF     |
| JM-1000  | 2.165 | 1 7/8 | 23/32 | 1 1/4-12UNF |

Dimensions per ASME B18.2.2 1987 (1999)

## Rod Eye



### Dimensions

| Part No. | A     | CA      | CB    | CD    | ER     | KK       | Weight (lbs) |
|----------|-------|---------|-------|-------|--------|----------|--------------|
| NI-325   | 1 1/8 | 2 1/16  | 1 1/4 | 3/4   | 7/8    | 3/4-16   | 0.39         |
| NI-800   | 1 5/8 | 2 13/16 | 1 1/2 | 1     | 1 3/16 | 1-14     | 1.04         |
| NI-1000  | 2     | 3 7/16  | 2     | 1 3/8 | 1 9/16 | 1 1/4-12 | 2.37         |

Note: Jam nut is included.



## Series NCA1

# Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by a label of "**Caution**", "**Warning**" or "**Danger**". To ensure safety, be sure to observe ISO 4414 Note 1), JIS B 8370 Note 2) and other safety practices.

**⚠ Caution :** Operator error could result in injury or equipment damage.

**⚠ Warning :** Operator error could result in serious injury or loss of life.

**⚠ Danger :** In extreme conditions, there is a possible result of serious injury or loss of life.

Note 1) ISO 4414: Pneumatic fluid power – Recommendations for the application of equipment to transmission and control systems

Note 2) JIS B 8370: General Rules for Pneumatic Equipment

### **⚠ Warning**

**1. The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.**

Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.

**2. Only trained personnel should operate pneumatically operated machinery and equipment.**

Compressed air can be dangerous if handled incorrectly. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.

**3. Do not service machinery/equipment or attempt to remove components until safety is confirmed.**

1. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc. (Bleed air into the system gradually to create back pressure.)

**4. Contact SMC if the product is to be used in any of the following conditions:**

1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

# Series NCA1

## Actuator Precautions 1

Be sure to read before handling.

### Design

#### ⚠ Warning

1. **There is a possibility of danger of sudden action by air cylinders if sliding parts of machinery are twisted, due to external forces, etc.**

In such cases, human injury may occur; e.g., by catching hands or feet in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be adjusted to operate smoothly and designed to avoid such dangers.

2. **A protective cover is recommended to minimize the risk of personal injury.**

If a stationary object and moving parts of a cylinder are in close proximity, personal injury may occur. Design the structure to avoid contact with the human body.

3. **Securely tighten all stationary parts and connected parts so that they will not become loose.**

Especially when a cylinder operates with high frequency or is installed where there is a lot of vibration, ensure that all parts remain secure.

4. **A deceleration circuit or shock may be required.**

When a driven object is operated at high speed or the load is heavy, a cylinder's cushion will not be sufficient to absorb the impact. Install a deceleration circuit to reduce the speed before cushioning, or install an external shock absorber to relieve the impact. In this case, the rigidity of the machinery should also be examined.

5. **Consider a possible drop in circuit pressure due to a power outage, etc.**

When a cylinder is used in a clamping mechanism, there is a danger of work pieces dropping if there is a decrease in clamping force due to a drop in circuit pressure caused by a power outage, etc. Therefore, safety equipment should be installed to prevent damage to machinery and/or human injury. Suspension mechanisms and lifting devices also require consideration for drop prevention.

6. **Consider a possible loss of power source.**

Measures should be taken to protect against bodily injury and equipment damage in the event that there is a loss of power to equipment controlled by pneumatics, electricity or hydraulics, etc.

7. **Design circuit that will prevent the driven object from shooting out.**

The driven object will shoot out at a high speed if one side of the cylinder is pressurized after the air inside the cylinder is exhausted; for example, when the cylinder is driven with exhaust center directional control valves or when it is started after the residual pressure inside the circuit is exhausted.

Such an event can possibly lead to bodily injury, by, for example catching in human limbs, or damage to the machinery. Therefore, select equipment and design circuits to prevent shoot-outs.

8. **Consider emergency stops.**

Design so that human injury and/or damage to machinery and equipment will not be caused when machinery is stopped by a safety device under abnormal conditions, a power outage or a manual emergency stop.

9. **Consider the action when operation is restarted after an emergency stop or abnormal stop.**

Design the machinery so that human injury or equipment damage will not occur upon restart of operation. When the cylinder has to be reset at the starting position, install safe manual control equipment.

### Selection

#### ⚠ Warning

1. **Check the specifications.**

The products featured in this catalog are designed for use in industrial compressed air systems. If the products are used in conditions where pressure and/or temperature are outside range of specification, damage and/or malfunction may occur. Do not use in these conditions. (Refer to specifications.)

Consult SMC if you use a fluid other than compressed air.

2. **Intermediate stops**

When intermediate stopping of a cylinder piston is performed with a 3 position closed center type directional control valve, it is difficult to achieve stopping positions as accurate and precise as with hydraulic pressure due to the compressibility of air.

Furthermore, since valves and cylinders, etc., are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for an extended period of time. Contact SMC in case it is necessary to hold a stopped position for an extended period.

#### ⚠ Caution

1. **Operate within the limits of the maximum usable stroke.**

The piston rod will be damaged if operated beyond the maximum stroke. Refer to the cylinder model selection procedure for the maximum useable stroke.

2. **Operate the piston within a range such that collision damage will not occur at the stroke end.**

The operation range should prevent damage from occurring when a piston, having inertial force, stop by striking the cover at the stroke end. Refer to the cylinder model selection procedure for the maximum useable stroke.

3. **Use a speed controller to adjust the cylinder drive speed, gradually increasing from a low speed to the desired speed setting.**

4. **Provide intermediate supports for long stroke cylinders.**

An intermediate support should be provided in order to prevent damage to a cylinder having a long stroke, due to problems such as sagging of the rod deflection of the cylinder tube, vibration and external load.

# Actuator Precautions 2

Be sure to read before handling.

## Mounting

### ⚠ Caution

1. **Be certain to match the rod shaft center with the load and direction of movement when connecting.**

When not properly matched, problem may arise with the rod and tube, and damage may be caused due to friction on areas such as the inner tube surface, bushings, rod surface, and seals.

2. **When an external guide is used, connect the rod end and the load in such a way that there is no interference at any point within the stroke.**

3. **Do not scratch or gouge the sliding parts of the cylinder tube or piston rod by striking or grasping them with other objects.**

Cylinder bores are manufactured to precise tolerances, so that even a slight deformation may cause faulty operation.

Moreover scratches or gouges, etc., in the piston rod may lead to damaged seals and cause air leakage.

4. **Prevent the seizure of rotating parts.**

Prevent the seizure of rotating parts (pins, etc.) by applying grease.

5. **Do not use until you can verify that equipment can operate properly.**

After mounting, repairs, or modification, etc., connect the air supply and electric power, and then confirm proper mounting by means of appropriate function and leak tests.

6. **Instruction manual**

The product should be mounted and operated after the instruction manual is thoroughly read and its contents are understood.

Keep the instruction manual where it can be referred to as needed.

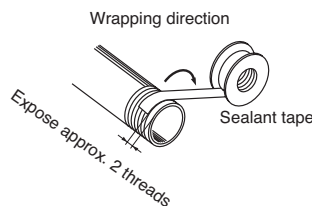
1. **Preparation before piping**

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.

2. **Wrapping of pipe tape**

When screwing together pipes and fittings, etc., be certain that chips from the pipe threads and sealing material do not get inside the piping.

Also, when sealant tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.



## Cushion

### ⚠ Caution

1. **Readjust using the cushion needle.**

Cushions are adjusted at the time of shipment, however, the cushion needle on the cover should be readjusted when the product is put into service, based upon factors such as the size of the load and the operating speed. When the cushion needle is turned clockwise, the restriction becomes smaller and the cushion's effectiveness is increased. Tighten the lock nut securely after adjustment is performed.

2. **Do not use the cushion needle fully closed.**

This will cause damage to the seals.

### ⚠ Warning

1. **Use clean air.**

Do not use compressed air which includes chemicals, synthetic oils containing organic solvents, salt or corrosive gases, etc., as it can cause damage or malfunction.

### ⚠ Caution

1. **Install air filters.**

Install air filters at the upstream side of valves. The filtration degree should be 5μm or finer.

2. **Install an after cooler, air dryer or water separator, etc.**

Air that includes excessive drainage may cause malfunction of valves and other pneumatic equipment. To prevent this, install an after cooler, air dryer or water separator, etc.

3. **Use the product within the specified range of fluid and ambient temperature.**

Take measures to prevent freezing, since moisture in circuits can be frozen under 5°C, and this may cause damage to seals and lead to malfunction.

Refer to SMC's "Air Cleaning Equipment" catalog for further details on compressed air quality.

## Maintenance

### ⚠ Warning

1. **Removal of equipment, and supply/exhaust of compressed air.**

Before any machinery or equipment is removed, first ensure that the appropriate measures are in place to prevent the fall or erratic movement of driven objects and equipment, then cut off the electric power and reduce the pressure in the system to zero. Only then should you proceed with the removal of any machinery and equipment.

When machinery is restarted, proceed with caution after confirming measures to prevent cylinder lurching.

### ⚠ Caution

1. **Drain flushing**

Remove drainage from air filters regularly. (Refer to specifications.)

# Auto Switch Precautions 1

Be sure to read before handling.

## Design & Selection

### ⚠ Warning

#### 1. Confirm the specifications.

Read the specifications carefully and use this product appropriately. The product may be damaged or malfunction if it is used outside the range of specifications for current load, voltage, temperature or impact.

#### 2. Take precautions when multiple cylinders are used close together.

When multiple auto switch cylinders are used in close proximity, magnetic field interference may cause the switches to malfunction. Maintain a minimum cylinder separation of 40mm.

#### 3. Pay attention to the length of time that a switch is ON at an intermediate stroke position.

When an auto switch is placed at an intermediate position of the stroke and a load is driven at the time the piston passes, the auto switch will operate, but if the speed is too great the operating time will be shortened and the load may not operate properly. The maximum detectable piston speed is:

$$V \text{ (mm/s)} = \frac{\text{Auto switch operating range (mm)} \times 1000}{\text{Time load applied (ms)}}$$

#### 4. Keep wiring as short as possible.

##### <Reed switches>

As the length of the wiring to a load gets longer, the rush current at switching ON becomes greater, and this may shorten the product's life. (The switch will stay ON all the time.)

Use a contact protection box when the wire length is 5m or longer.

##### <Solid state switches>

Although wire length should not affect switch function, use a wire 100m or shorter.

#### 5. Pay attention to the internal voltage drop of the switch.

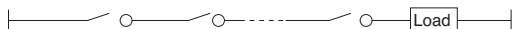
##### <Reed switches>

- 1) Switches with an indicator light (Except D-Z76)

- If auto switches are connected in series as shown below, take note that there will be a large voltage drop because of internal resistance in the light emitting diodes. (Refer to internal voltage drop in the auto switch specifications.)

[The voltage drop will be "n" times larger when "n" auto switches are connected.]

Even though an auto switch operates normally, the load may not operate.



### ⚠ Warning

- In the same way, when operating under a specified voltage, although an auto switch may operate normally, the load may not operate. Therefore, the formula below should be satisfied after confirming the minimum operating voltage of the load.

$$\text{Supply voltage} - \text{Internal voltage drop of switch} > \text{Minimum operating voltage of load}$$

- 2) If the internal resistance of a light emitting diode causes a problem, select a switch without an indicator light (Model D-Z80).

##### <Solid state switches>

- 3) Generally, the internal voltage drop will be greater with a 2 wire solid state auto switch than with a reed switch. Take the same precautions as in 1).

Also, note that a 12VDC relay is not applicable.

#### 6. Pay attention to leakage current.

##### <Solid state switches>

With a 2 wire solid state auto switch, current (leakage current) flows to the load to operate the internal circuit even when in the OFF state.

$$\text{Operating current of load (OFF condition)} > \text{Leakage current}$$

If the criteria given in the above formula are not met, it will not reset correctly (stays ON). Use a 3 wire switch if this specification will not be satisfied.

Moreover, leakage current flow to the load will be "n" times larger when "n" auto switches are connected in parallel.

#### 7. Do not use a load that generates surge voltage.

##### <Reed switches>

If driving a load such as a relay that generates a surge voltage, use a contact protection box.

##### <Solid state switches>

Although a zener diode for surge protection is connected at the output side of a solid state auto switch, damage may still occur if the surge is applied repeatedly. When a load, such as a relay or solenoid which generates surge is directly driven, use a type of switch with a built-in surge absorbing element.

#### 8. Cautions for use in an interlock circuit

When an auto switch is used for an interlock signal requiring high reliability, devise a double interlock system to avoid trouble by providing a mechanical protection function, or by also using another switch (sensor) together with the auto switch.

Also perform periodic maintenance and confirm proper operation.

#### 9. Ensure sufficient clearance for maintenance activities.

When designing an application, be sure to allow sufficient clearance for maintenance and inspections.



# Auto Switch Precautions 2

Be sure to read before handling.

## Mounting & Adjustment

### ⚠ Warning

#### 1. Do not drop or bump.

Do not drop, bump or apply excessive impacts (300m/s<sup>2</sup> or more for reed switches and 1000m/s<sup>2</sup> or more for solid state switches) while handling. Although the body of the switch may not be damaged, the inside of the switch could be damaged and cause a malfunction.

#### 2. Do not carry a cylinder by the auto switch lead wires.

Never carry a cylinder by its lead wires. This may not only cause broken lead wires, but it may cause internal elements of the switch to be damaged by the stress.

#### 3. Mount switches using the proper tightening torque.

If a switch is tightened beyond the range of tightening torque, the mounting screws or switch may be damaged.

On the other hand, tightening below the range of tightening torque may allow the switch to slip out of position. (Refer to switch mounting instructions for each series for switch mounting, moving, and tightening torque, etc.)

#### 4. Mount a switch at the center of the operating range.

Adjust the mounting position of an auto switch so that the piston stops at the center of the operating range (the range in which a switch is ON). (The mounting position shown in the catalog indicates the optimum position at stroke end.) If mounted at the end of the operating range (around the borderline of ON and OFF), operation will be unstable.

## Wiring

### ⚠ Warning

#### 1. Avoid repeatedly bending or stretching lead wires.

Broken lead wires will result from repeatedly applying bending stress or stretching force to the lead wires.

#### 2. Be sure to connect the load before power is applied.

<2 wire type>

If the power is turned ON when an auto switch is not connected to a load, the switch will be instantly damaged because of excess current.

#### 3. Confirm proper insulation of wiring.

Be certain that there is no faulty wiring insulation (contact with other circuits, ground fault, improper insulation between terminals, etc.). Damage may occur due to excess current flow into a switch.

#### 4. Do not wire with power lines or high voltage lines.

Wire separately from power lines or high voltage lines, avoiding parallel wiring or wiring in the same conduit with these lines. Control circuits containing auto switches may malfunction due to noise from these other lines.

## Wiring

### ⚠ Warning

#### 5. Do not allow short circuit of loads.

<Reed switches>

If the power is turned ON with a load in a short circuited condition, the switch will be instantly damaged because of excess current flow into the switch.

<Solid state switches>

All models of PNP output type switches do not have built-in short circuit protection circuits.

Note that if a load is short circuited, the switch will be instantly damaged as in the case of reed switches.

\*Take special care to avoid reverse wiring with the brown (red) power supply line and the black (white) output line on 3 wire type switches.

#### 6. Avoid incorrect wiring.

<Reed switches>

A 24VDC switch with indicator light has polarity. The brown (red) lead wire is (+), and the blue (black) lead wire is (-).

1) If connections are reversed, a switch will operate, however, the light emitting diode will not light up.

Also note that a current greater than that specified will damage a light emitting diode and it will no longer operate.

Applicable models: D-Z73

<Solid state switches>

1) If connections are reversed on a 2 wire type switch, the switch will not be damaged if protected by a protection circuit, but the switch will always stay in an ON state. However, it is still necessary to avoid reversed connections, since the switch could be damaged by a load short circuit in this condition.

\*2) If connections are reversed (power supply line + and power supply line -) on a 3 wire type switch, the switch will be protected by a protection circuit. However, if the power supply line (+) is connected to the blue (black) wire and the power supply line (-) is connected to the black (white) wire, the switch will be damaged.

#### \* Lead wire color changes

Lead wire colors of SMC switches and related products have been changed in order to meet NECA (Nippon Electric Control Equipment Industries Association) Standard 0402 for production beginning September, 1996 and thereafter. Please refer to the tables provided.

Special care should be taken regarding wire polarity during the time that the old colors still coexist with the new colors.

#### 2 wire

|            | Old   | New   |
|------------|-------|-------|
| Output (+) | Red   | Brown |
| Output (-) | Black | Blue  |

#### Solid state with diagnostic output

|                   | Old    | New    |
|-------------------|--------|--------|
| Power supply      | Red    | Brown  |
| GND               | Black  | Blue   |
| Output            | White  | Black  |
| Diagnostic output | Yellow | Orange |

#### 3 wire

|              | Old   | New   |
|--------------|-------|-------|
| Power supply | Red   | Brown |
| GND          | Black | Blue  |
| Output       | White | Black |

#### Solid state with latch type diagnostic output

|                              | Old    | New    |
|------------------------------|--------|--------|
| Power supply                 | Red    | Brown  |
| GND                          | Black  | Blue   |
| Output                       | White  | Black  |
| Latch type diagnostic output | Yellow | Orange |

# Auto Switch Precautions 3

Be sure to read before handling.

## Operating Environment

### Warning

#### 1. Never use in an atmosphere of explosive gases.

The structure of auto switches is not intended to prevent explosion. Never use in an atmosphere with an explosive gas since this may cause a serious explosion.

#### 2. Do not use in an area where a magnetic field is generated.

Auto switches will malfunction or magnets inside cylinders will become demagnetized. (Consult SMC regarding the availability of a magnetic field resistant auto switch.)

#### 3. Do not use in an environment where the auto switch will be continually exposed to water.

Although switches satisfy IEC standard IP67 construction (JIS C 0920: watertight structure), do not use switches in applications where continually exposed to water splash or spray. Poor insulation or swelling of the potting resin inside switches may cause malfunction.

#### 4. Do not use in an environment with oil or chemicals.

Consult SMC if auto switches will be used in an environment with coolant, cleaning solvent, various oils or chemicals. If auto switches are used under these conditions for even a short time, they may be adversely affected by improper insulation, malfunction due to swelling of the potting resin, or hardening of the lead wires.

#### 5. Do not use in an environment with temperature cycles.

Consult SMC if switches are used where there are temperature cycles other than normal temperature changes, as there may be adverse effects inside the switches.

#### 6. Do not use in an environment where there is excessive impact shock.

##### <Reed switches>

When excessive impact (300m/s<sup>2</sup> or more) is applied to a reed switch during operation, the contact point will malfunction and generate or cut off a signal momentarily (1ms or less). Consult SMC regarding the need to use a solid state switch depending upon the environment.

#### 7. Do not use in an area where surges are generated.

##### <Solid state switches>

When there are units (solenoid type lifter, high frequency induction furnace, motor, etc.) which generate a large amount of surge in the area around cylinders with solid state auto switches, this may cause deterioration or damage to the switch. Avoid sources of surge generation and disorganized lines.

#### 8. Avoid accumulation of iron waste or close contact with magnetic substances.

When a large amount of iron waste such as machining chips or spatter is accumulated, or a magnetic substance (something attracted by a magnet) is brought into close proximity with an auto switch cylinder, it may cause the auto switch to malfunction due to a loss of the magnetic force inside the cylinder.

## Maintenance

### Warning

#### 1. Perform the following maintenance periodically in order to prevent possible danger due to unexpected auto switch malfunction.

##### 1) Secure and tighten switch mounting screws.

If screws become loose or the mounting position is dislocated, retighten them after readjusting the mounting position.

##### 2) Confirm that there is no damage to lead wires.

To prevent faulty insulation, replace switches or repair lead wires, etc., if damage is discovered.

##### 3) Confirm the lighting of the green light on the 2 color indicator type switch.

Confirm that the green LED is on when stopped at the established position. If the red LED is on, the mounting position is not appropriate. Readjust the mounting position until the green LED lights up.

## Other

### Warning

#### 1. Consult SMC concerning water resistance, elasticity of lead wires, and usage at welding sites, etc.

## Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”.  
Read and accept them before using the product.

### Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.<sup>Note)</sup>  
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided. This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

**Note) Vacuum pads are excluded from this 1 year warranty.**

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered. Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

### Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of an SMC product to another country, assure that all local rules governing that export are known and followed.



**SMC Corporation of America**  
10100 SMC Blvd., Noblesville, IN 46060

[www.smcusa.com](http://www.smcusa.com)

**SMC Pneumatics (Canada) Ltd.**

[www.smcpcanada.com](http://www.smcpcanada.com)

**(800) SMC.SMC1 (762-7621)**

**e-mail: [sales@smcusa.com](mailto:sales@smcusa.com)**

**For International inquiries: [www.smcworld.com](http://www.smcworld.com)**

© 2015 SMC Corporation of America, All Rights Reserved.

All reasonable efforts to ensure the accuracy of the information detailed in this catalog were made at the time of publishing. However, SMC can in no way warrant the information herein contained as specifications are subject to change without notice.

Courtesy of Steven Engineering, Inc - (800) 258-9200 - [sales@steveneng.com](mailto:sales@steveneng.com) - [www.stevenengineering.com](http://www.stevenengineering.com)