

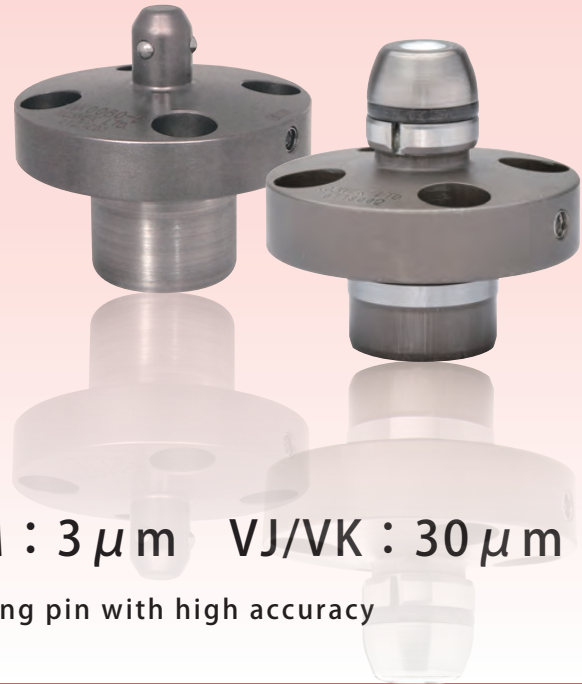
Hydraulic Expansion Locating Pin

Model VL

Model VM

Model VJ

Model VK

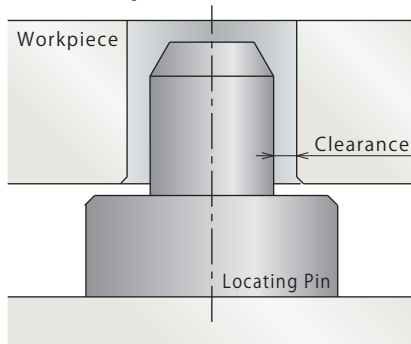


Locating Repeatability VL/VM : $3 \mu\text{m}$ VJ/VK : $30 \mu\text{m}$

Zero clearance between reference hole, locating pin with high accuracy

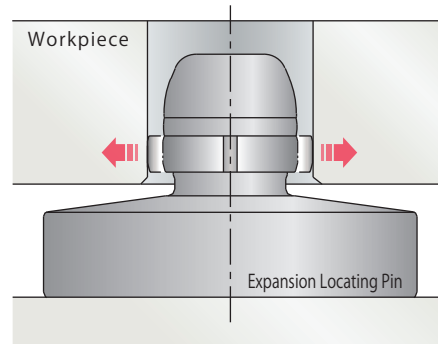
Hydraulic expansion locating pin powered locates workpiece or pallet with high accuracy by **expanding and released diameter.**

The general locating pin have some clearance between pin and reference hole.



Expanding locating pin have **ZERO clearance** between pin and reference hole!!

High accuracy, Cutting down the operation time, Total cost reduced

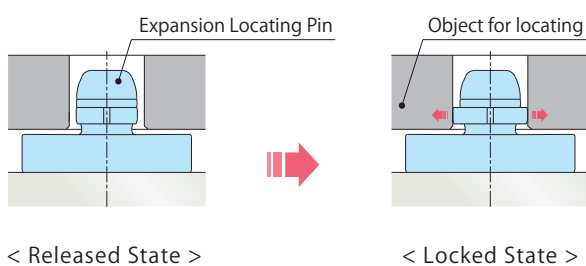


The expanding and reducing function of pin diameter (world-first locating mechanism)

When expanded : the clearance between pin and reference hole get become zero and it leads to locate with high accuracy.

When released : at the time when the work piece is loaded and unloaded, reducing diameter makes enough clearance for changeover and makes it easier.

Action Description

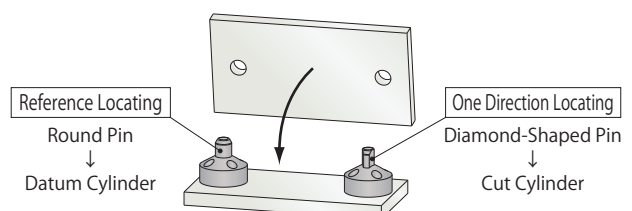


< Released State >

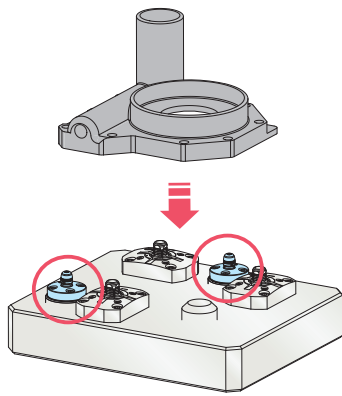
< Locked State >

※This action description above is the case where VL is used.

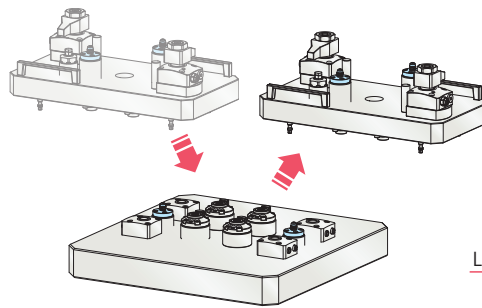
Two types of locating pins (Round & Diamond-shaped pins)
Expansion locating pin consisting of Datum-D ' Cut-C cylinder.



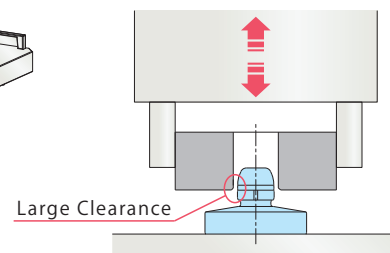
Application Examples



For casting core holes location



For pallet change over location & transfer



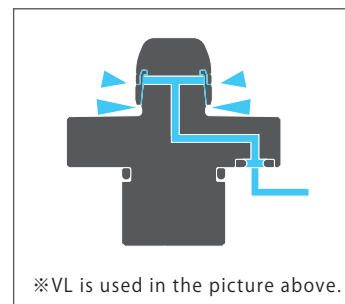
Large Clearance

When it is released, the clearance is so large enough to load and unload work piece, hence most appropriate for automation.





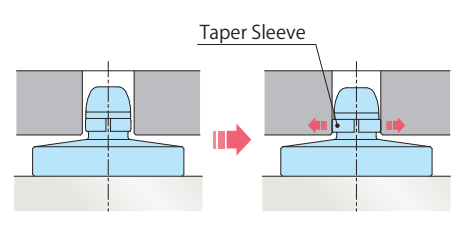
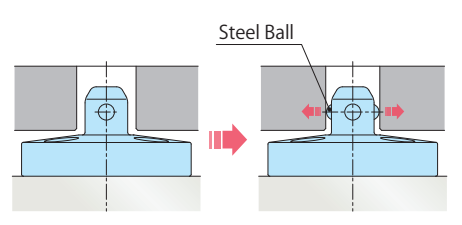
Function

• Air Blow Function

Air blow prevent foreign substances from coming in.



※VL is used in the picture above.

Low Pressure MAX 7MPa				
	Model VL → P.775	Model VM → P.775	Model VJ → P.787	Model VK → P.787
Locating Repeatability	3 μm		3 0 μm	
Control Method	Single Action (Spring Lock/Hydraulic Release)	Double Action (Hydraulic Lock/Hydraulic Release)	Single Action (Hydraulic Lock/Spring Release)	Double Action (Hydraulic Lock/Hydraulic Release)
Operating Pressure Range	2.5 ~ 7 MPa		2.5 ~ 7 MPa	1.5 ~ 7 MPa
Action	 <p>Taper sleeve expands.</p>		 <p>Steel balls come out from the pin.</p>	
Sample Reference	Finishing Line / Dividing Line		Locating Casting Core Holes	

- High-Power Series
- Pneumatic Series
- Hydraulic Series**
- Valve / Coupler Hydraulic Unit
- Manual Operation Accessories
- Cautions / Others

- Hole Clamp
 - SFA
 - SFC

- Swing Clamp
 - LHA
 - LHC
 - LHS
 - LHW
 - LT/LG
 - TLA-2
 - TLB-2
 - TLA-1

- Link Clamp
 - LKA
 - LKC
 - LKW
 - LM/LJ
 - TMA-2
 - TMA-1

- Work Support
 - LD
 - LC
 - TNC
 - TC

- Air Sensing Lift Cylinder
 - LLW

- Compact Cylinder
 - LL
 - LLR
 - LLU
 - DP
 - DR
 - DS
 - DT

- Block Cylinder
 - DBA
 - DBC

- Control Valve
 - BZL
 - BZT
 - BZX/JZG

- Pallet Clamp
 - VS
 - VT

- Expansion Locating Pin**
 - VL**
 - VM**
 - VJ**
 - VK**

- Pull Stud Clamp
 - FP
 - FQ

- Customized Spring Cylinder
 - DWA/DWB

PAT. Hydraulic Expansion Locating Pin

Model VL/VM

Hydraulic Pressure • Single Action/Double Action

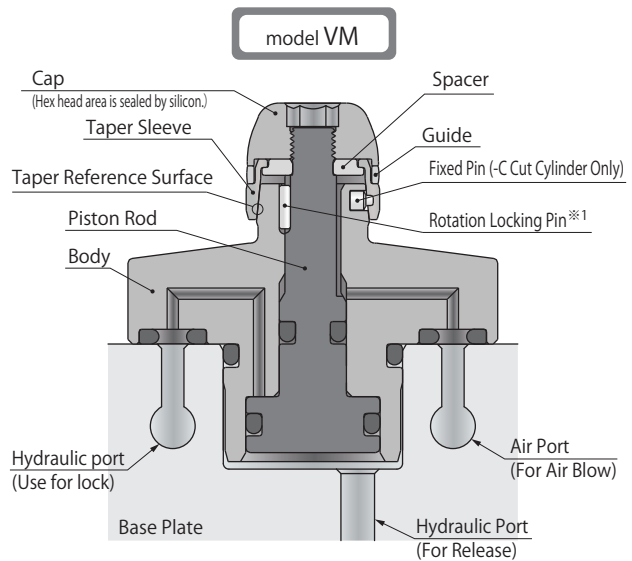
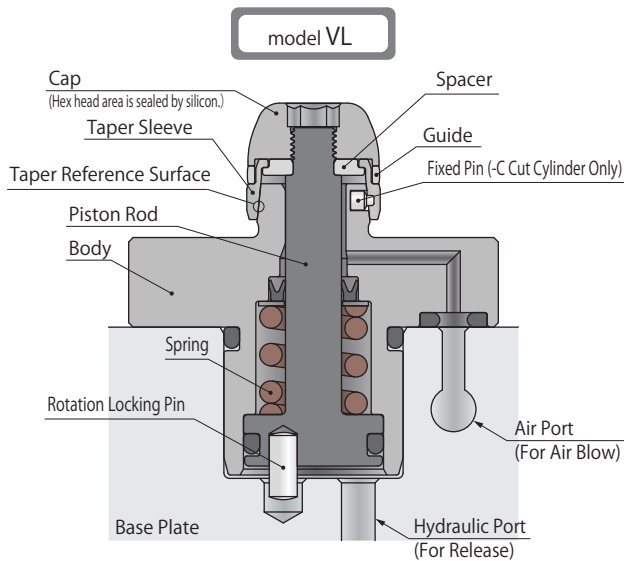
Locating Repeatability : 3 μ m



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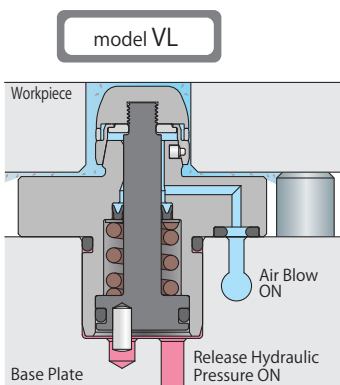
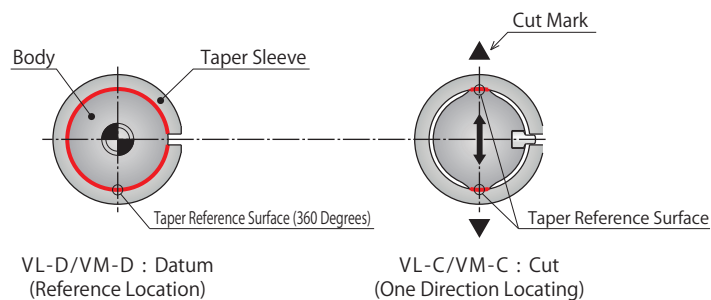
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Action Description	P.776
System References and Essential Matters	P.777
VL Model No. Indication / Specifications	P.779
VL External Dimensions	P.781
VM Model No. Indication / Specifications	P.783
VM External Dimensions	P.785
Cautions	
• Notes for Hydraulic Expansion Locating Pin	P.797
• Cautions (Common)	P.1043
<ul style="list-style-type: none"> • Installation Notes • Hydraulic Fluid List • Notes on Hydraulic Cylinder Speed Control Circuit • Notes on Handling • Maintenance/Inspection • Warranty 	

Action Description



Note ※1. Mounting location of rotation locking pin varies depending on model number.

Taper Sleeve and Taper Reference Surface



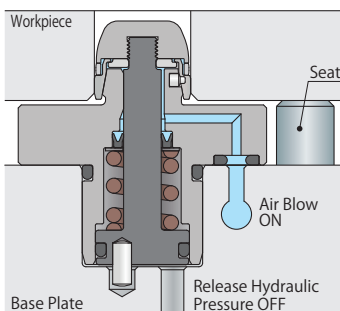
- Piston rod rises by release of hydraulic pressure. Taper sleeve expands together with piston rod, and shrinks using its own elasticity.
- Air blow prevents debris contamination.
- Regarding cap/guide/taper sleeve: the shape is designed to load work piece smoothly and prevent scratches.

When loading workpiece

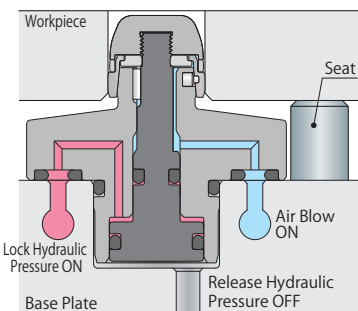
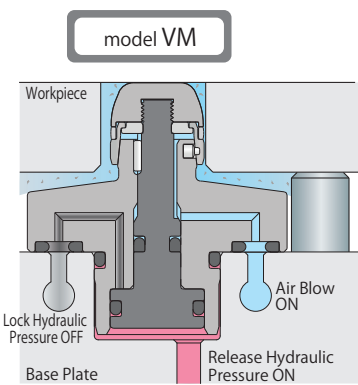
When unloading workpiece



When locating



- VL: when releasing hydraulic pressure is turned off, piston rod is pulled down by spring force, and taper sleeve expands to position the work piece. VM: piston is pulled down by hydraulic pressure once releasing pressure is off. ((For Z-axis, seat is also required))



High-Power Series

Pneumatic Series

Hydraulic Series

Valve / Coupler Hydraulic Unit

Manual Operation Accessories

Cautions / Others

Hole Clamp

SFA
SFC

Swing Clamp

LHA
LHC
LHS
LHW
LT/LG
TLA-2
TLB-2
TLA-1

Link Clamp

LKA
LKC
LKW
LM/LJ
TMA-2
TMA-1

Work Support

LD
LC
TNC
TC

Air Sensing Lift Cylinder

LLW

Compact Cylinder

LL
LLR
LLU
DP
DR
DS
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Block Cylinder

DBA
DBC

Control Valve

BZL
BZT
BZX/JZG

Pallet Clamp

VS
VT

Expansion Locating Pin

VL
VM
VJ
VK

Pull Stud Clamp

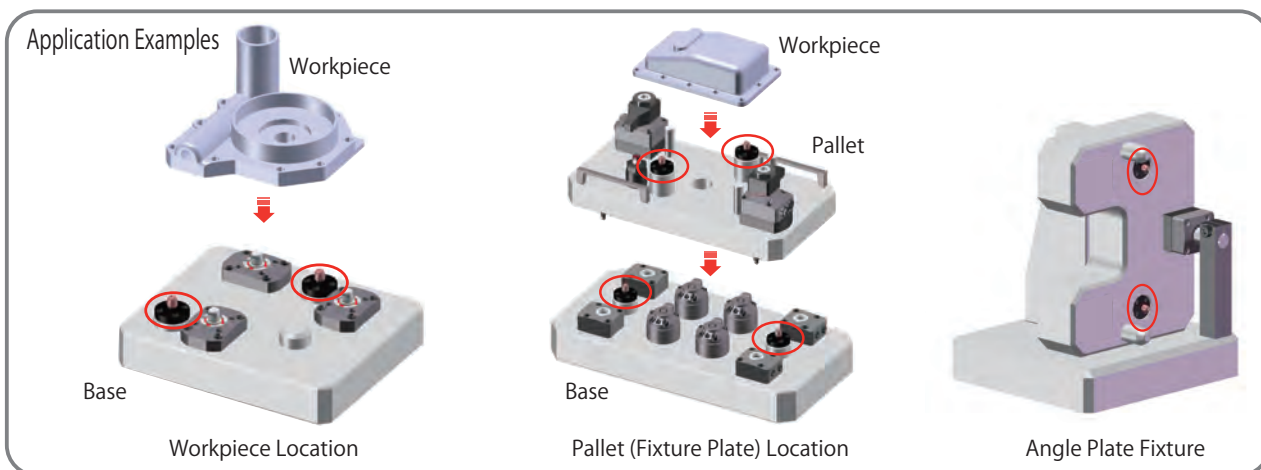
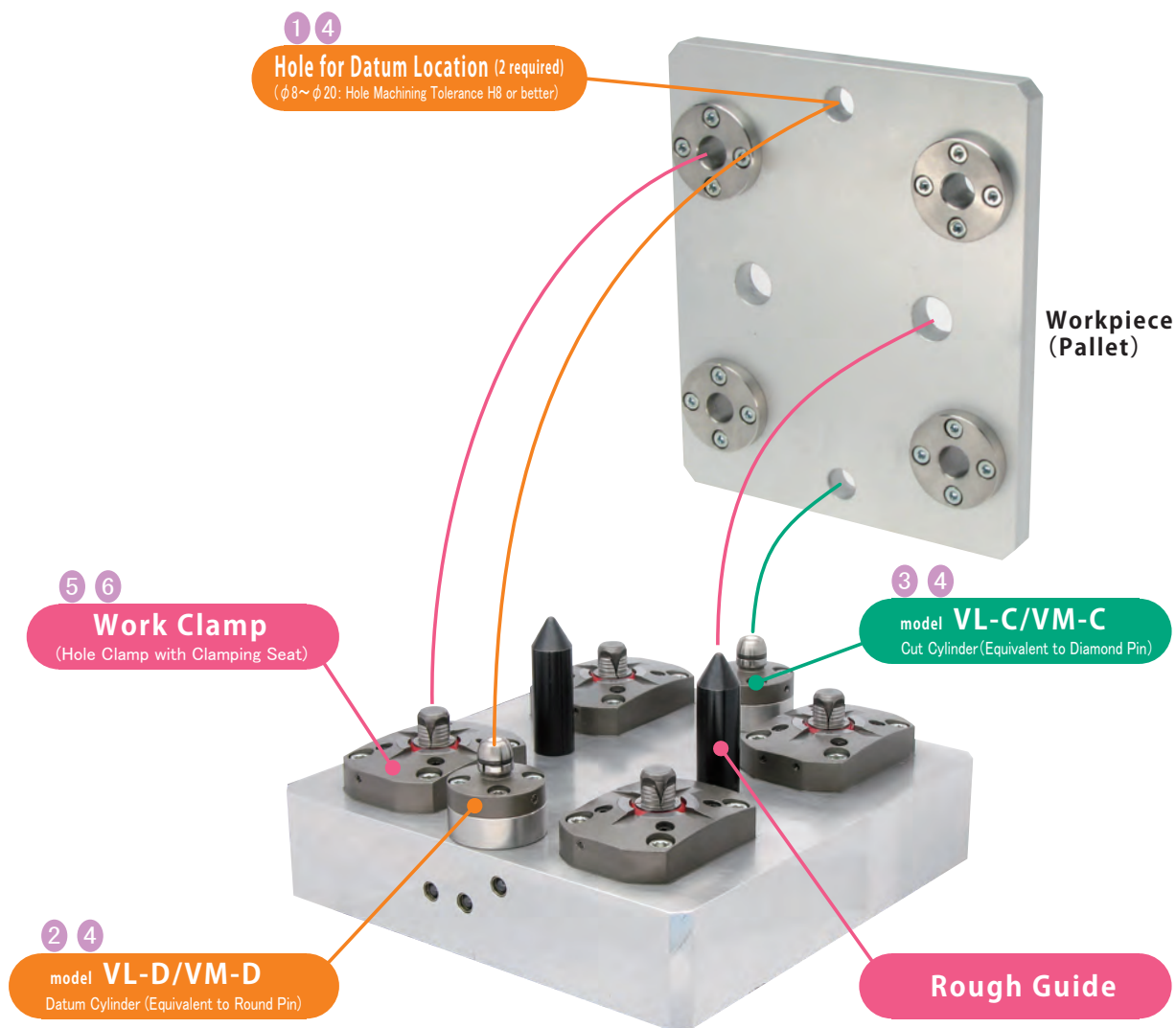
FP
FQ

Customized Spring Cylinder

DWA/DWB

System References

- Repeated locating accuracy of 3 μm (One step locating **reduces setup time!**)
- **Avoid deterioration of workpiece accuracy** when changing pallets to perform multiple operations.
- 5 axis machining is **possible by combining** datum cylinder with hole clamp or ball lock clamp.



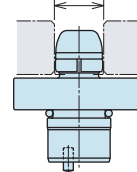
Essential Points

1 Workpiece Hole for Locating

- Available in diameters between 8 and 20mm (in 0.1mm increments).
- Hole machining tolerance H8 or better.

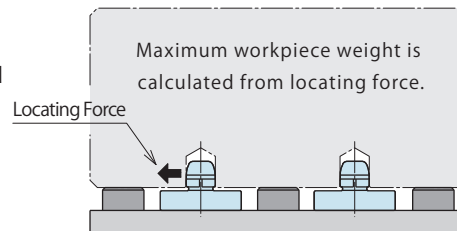
Workpiece Hole Diameter

$\phi 8 \sim 20H8$



2 Locating Force

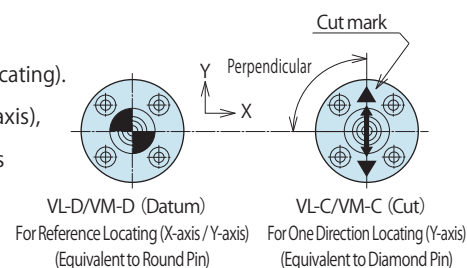
- Workpiece weight that expansion locating pin is able to locate with is calculated from locating force.
- Locating force is the force with which the expansion locating pin pushes out (expands) against the workpiece.
- The specification helps you find out how to calculate each model's locating force and the weight of workpiece.



3 Cut Cylinder's Mounting Phase

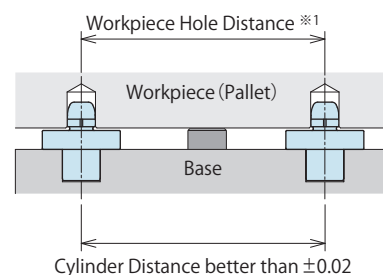
- The reference position (origin) is determined by VL-D/VM-D (Datum: for reference locating).
- VL-C/VM-C (Cut: for one direction locating) position locates in one direction (Y-axis), so phasing is necessary. When mounting, ensure the VL-C/VM-C (cut) cut mark is perpendicular to VL-D/VM-D (datum).

(There is a cut mark (▲) on top of the flange on the VL-C/VM-C unit that shows the locating direction.)



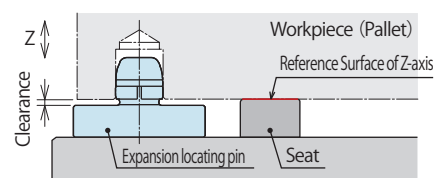
4 Distance accuracy between cylinders and between workpiece holes

- The distance accuracy for expansion locating pin should be within $\pm 0.02\text{mm}$.
- ※1. The distance accuracy of workpiece holes (pallet holes) should be within allowable difference (JIS B 0613 Grade 2). (Refer to "Notes for Design".)



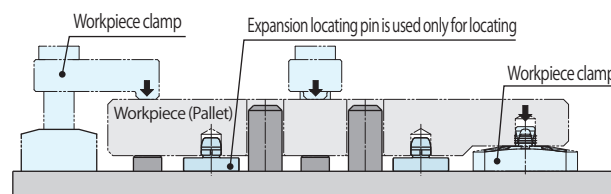
5 Seat Setting

- Expansion locating pin locates only in X- and Y-axis. For Z-axis location, prepare additional seat block.
- Make sure there is a clearance between the top of the flange on the datum cylinder and the workpiece (pallet). (Recommended Clearance : 0.5~1mm)



6 Setting Additional Work Clamps

- Expansion locating pin has no clamping function.
- Additional clamps should be added to clamp workpiece.



High-Power Series

Pneumatic Series

Hydraulic Series

Valve / Coupler Hydraulic Unit

Manual Operation Accessories

Cautions / Others

Hole Clamp

SFA

SFC

Swing Clamp

LHA

LHC

LHS

LHW

LT/LG

TLA-2

TLB-2

TLA-1

Link Clamp

LKA

LKC

LKW

LM/LJ

TMA-2

TMA-1

Work Support

LD

LC

TNC

TC

Air Sensing Lift Cylinder

LLW

Compact Cylinder

LL

LLR

LLU

DP

DR

DS

DT

Block Cylinder

DBA

DBC

Control Valve

BZL

BZT

BZX/JZG

Pallet Clamp

VS

VT

Expansion Locating Pin

VL

VM

VJ

VK

Pull Stud Clamp

FP

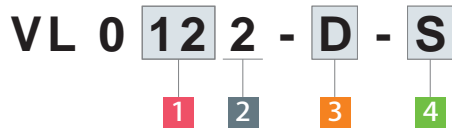
FQ

Customized Spring Cylinder

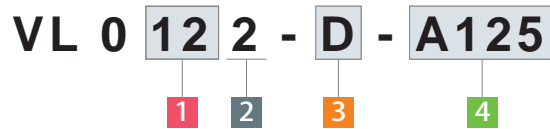
DWA/DWB

Model No. Indication

Workpiece Hole Diameter (Standard Diameter)



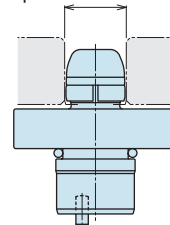
Workpiece Hole Diameter (Substandard Diameter)



1 Workpiece Hole Diameter (Standard)

- 08 : $\phi 8^{H8}_{+0.022}$ mm
- 09 : $\phi 9^{H8}_{+0.022}$ mm
- 10 : $\phi 10^{H8}_{+0.022}$ mm
- 12 : $\phi 12^{H8}_{+0.027}$ mm
- 13 : $\phi 13^{H8}_{+0.027}$ mm
- 15 : $\phi 15^{H8}_{+0.027}$ mm
- 16 : $\phi 16^{H8}_{+0.027}$ mm
- 18 : $\phi 18^{H8}_{+0.027}$ mm
- 20 : $\phi 20^{H8}_{+0.033}$ mm

Workpiece Hole Diameter

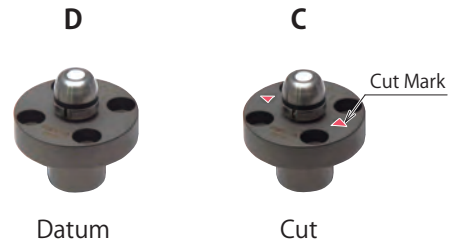


2 Design No.

2 : Revision Number

3 Functions

- D : Datum (for Reference Locating)
- C : Cut (for One Direction Locating)



4 Applicable Workpiece Hole Diameter

- S : Standard Diameter
- A□□□ : Substandard Diameter

※Example

Example 1 : VL0122-D-A125

VL0122-D with Workpiece Hole Diameter of $\phi 12.5H8^{+0.027}_0$

Example 2 : VL0092-C-A093

VL0092-C with Workpiece Hole Diameter of $\phi 9.3H8^{+0.022}_0$

Example 3 : VL0182-D-S

VL0182-D with Workpiece Hole Diameter of $\phi 18H8^{+0.027}_0$

Model No.	S: Standard Diameter	A□□□: Substandard Diameter
VL0082	$8H8^{+0.022}_0$	$8.1H8^{+0.022}_0 \sim 8.8H8^{+0.022}_0$
VL0092	$9H8^{+0.022}_0$	$8.9H8^{+0.022}_0 \sim 9.9H8^{+0.022}_0$
VL0102	$10H8^{+0.022}_0$	$10.1H8^{+0.027}_0 \sim 11.3H8^{+0.027}_0$
VL0122	$12H8^{+0.027}_0$	$11.4H8^{+0.027}_0 \sim 12.7H8^{+0.027}_0$
VL0132	$13H8^{+0.027}_0$	$12.8H8^{+0.027}_0 \sim 14.2H8^{+0.027}_0$
VL0152	$15H8^{+0.027}_0$	$14.3H8^{+0.027}_0 \sim 15.7H8^{+0.027}_0$
VL0162	$16H8^{+0.027}_0$	$15.8H8^{+0.027}_0 \sim 16.9H8^{+0.027}_0$
VL0182	$18H8^{+0.027}_0$	$17.0H8^{+0.027}_0 \sim 17.9H8^{+0.027}_0$
		$18.1H8^{+0.033}_0 \sim 18.4H8^{+0.033}_0$
VL0202	$20H8^{+0.033}_0$	$18.5H8^{+0.033}_0 \sim 19.9H8^{+0.033}_0$

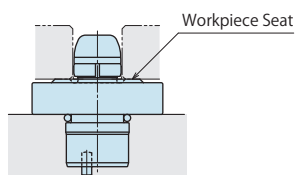
Notes

- Custom diameters are available in increments of 0.1mm.
- When workpiece hole diameter is $\phi 9.5H8^{+0.022}_0$, Model No. is "VL0092-D-A095".
- Please contact us if above work hole diameter is larger or smaller than standard.
(The accuracy of work piece hole diameter machining should be greater than H8.)

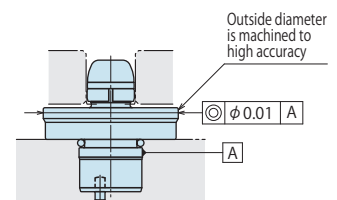
Other Special Options (Reference)

For below options, please contact us.

Used when seat cannot be installed separately.



If it is not possible to measure the datum hole pitch, it can be measured indirectly (specially machined outside diameter of VL).



Specifications

Model No.	VL0082	VL0092	VL0102	VL0122	VL0132	VL0152	VL0162	VL0182	VL0202
Workpiece Standard Diameter mm	8H8 ^{+0.022}	9H8 ^{+0.022}	10H8 ^{+0.022}	12H8 ^{+0.027}	13H8 ^{+0.027}	15H8 ^{+0.027}	16H8 ^{+0.027}	18H8 ^{+0.027}	20H8 ^{+0.033}
Hole Diameter Substandard Diameter ^① mm	8.1~8.8	8.9~9.9	10.1~11.3	11.4~12.7	12.8~14.2	14.3~15.7	15.8~16.9	17.0~18.4	18.5~19.9
Locating Repeatability mm	0.003								
Offset Tolerance (C:Cut) mm	±0.05	±0.05	±0.10	±0.10	±0.10	±0.10	±0.15	±0.15	±0.15
Locating Force ^{※2} N	260	260	260	260	260	260	290	290	290
Allowable Thrust Load ^{※3} kN	1.5	1.5	2.0	2.5	2.5	2.5	3.0	3.0	3.5
Cylinder Capacity (Release Side) cm ³	0.06	0.06	0.06	0.06	0.06	0.06	0.15	0.15	0.15
Max. Operating Pressure MPa	7.0								
Min. Operating Pressure MPa	2.5								
Operating Temperature °C	0~70								
Usable Fluid	General Hydraulic Oil Equivalent to ISO-VG-32								
Mass g	80	80	80	85	85	90	105	110	115

- Notes
- ※ 1. Custom diameters are available in increments of 0.1mm. The accuracy of workpiece hole diameter machining should be greater than H8.
 - ※ 2. Locating force is the force with which the expansion locating pin pushes out (expands) against the workpiece.
The value assumes that coolant has been applied. [Reference values]
(The relationship between locating force and the weight of workpiece is shown the graph below.)
 - ※ 3. The allowable thrust load means the maximum thrust load that can be applied to this product.

About Locating Force and Workpiece Weight

Workpiece (Pallet) Weight Calculation - Horizontal Attitude

$$\text{Workpiece Weight} \leq \frac{\text{Locating Force per One Piece of Expansion Locating Pin}}{\text{Friction Coefficient of Workpiece Seat Face}}$$

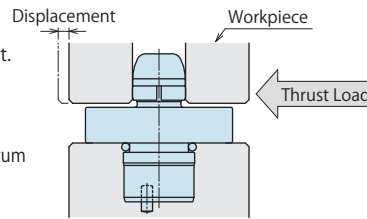
Workpiece (Pallet) Weight Calculation - Vertical Attitude

$$\text{Workpiece Weight} \leq \text{Locating Force per One Piece of Expansion Locating Pin}$$

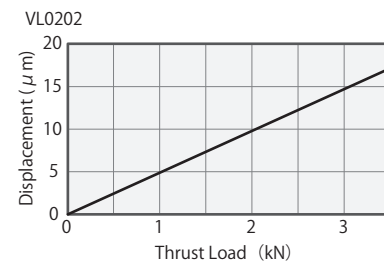
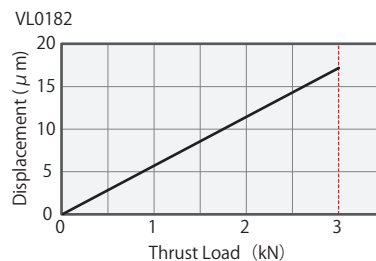
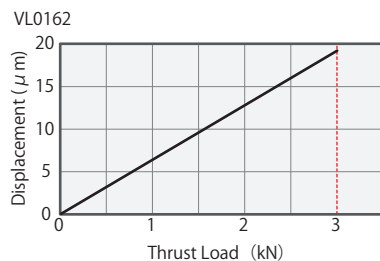
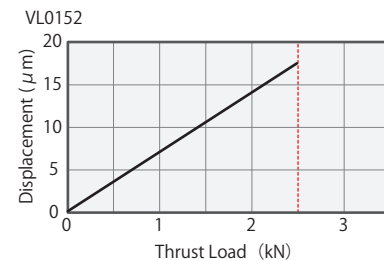
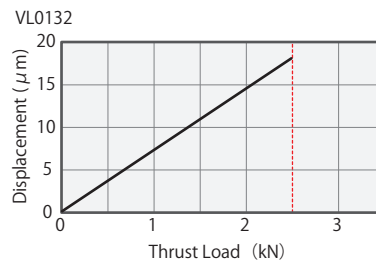
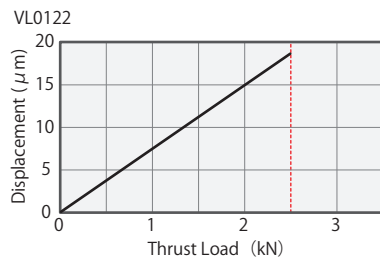
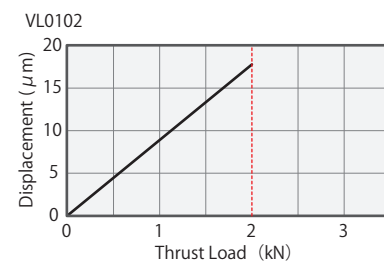
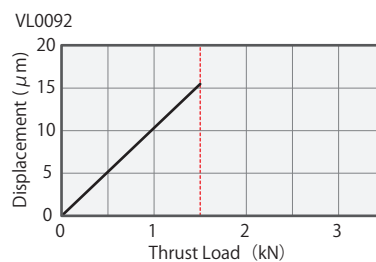
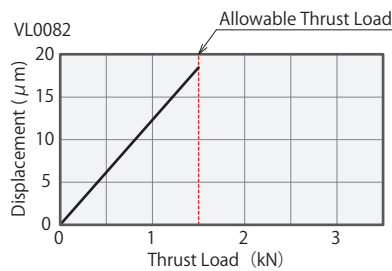
Load / Displacement Curve

This graph shows the relationship between load and displacement. Thrust load is the perpendicular load on the center of the VL (Expansion locating pin) axis.

Note This graph shows the thrust load (static load) on a single datum (VL-D) cylinder that is not used with any clamp cylinders.



(How to read the load/displacement curve)
(Example) When using VL162 Requirement : When a 2 kN thrust load displaced on an expanded VL0162 the displacement will be about 13 μm.



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- Hydraulic Series
- Valve / Coupler Hydraulic Unit
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- Cautions / Others

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 - SFC

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 - LHC
 - LHS
 - LHW
 - LT/LG
 - TLA-2
 - TLB-2
 - TLA-1

- Link Clamp
 - LKA
 - LKC
 - LKW
 - LM/LJ
 - TMA-2
 - TMA-1

- Work Support
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 - LC
 - TNC
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- Air Sensing Lift Cylinder
 - LLW

- Compact Cylinder
 - LL
 - LLR
 - LLU
 - DP
 - DR
 - DS
 - DT

- Block Cylinder
 - DBA
 - DBC

- Control Valve
 - BZL
 - BZT
 - BZX/JZG

- Pallet Clamp
 - VS
 - VT

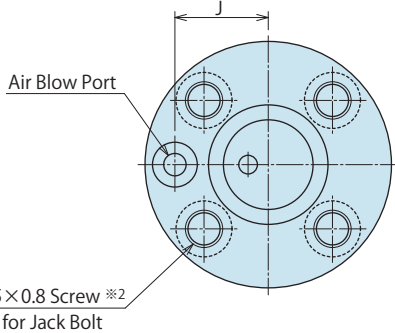
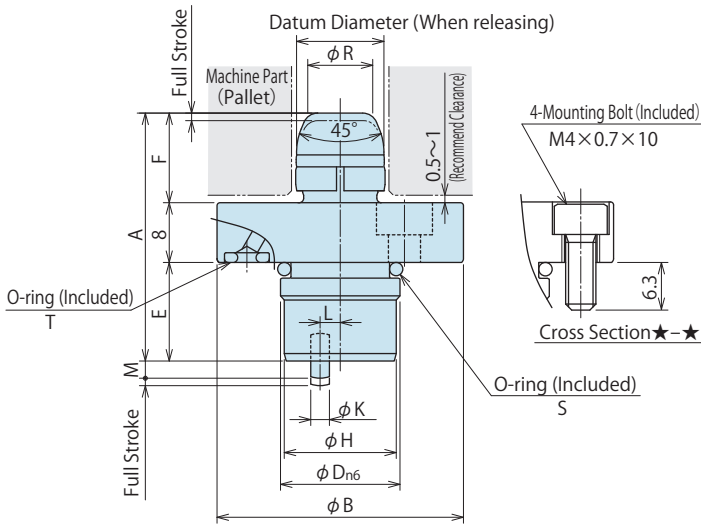
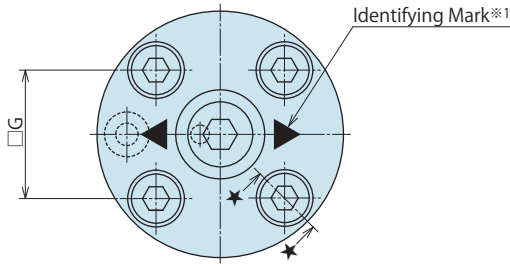
- Expansion Locating Pin
 - VL
 - VM
 - VJ
 - VK

- Pull Stud Clamp
 - FP
 - FQ

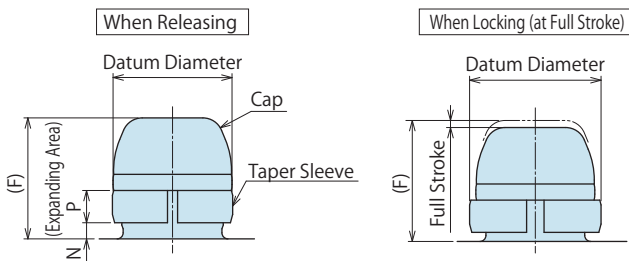
- Customized Spring Cylinder
 - DWA/DWB

External Dimensions

※ This drawing shows the released state of VL-C.
(When supplying release hydraulic pressure)



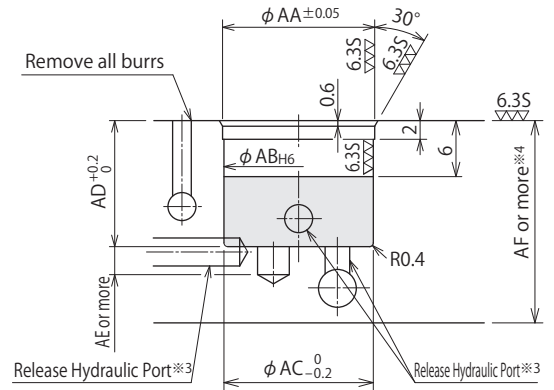
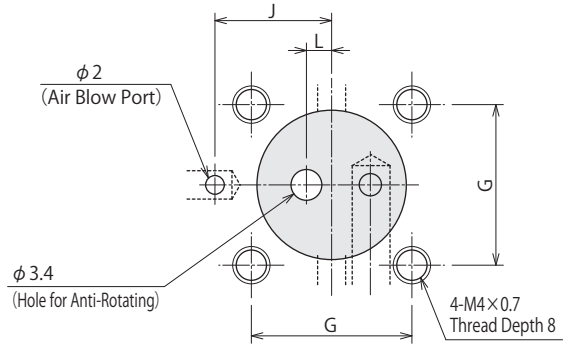
※ Expanding Area Detail



Note

- ※ 1. The identification mark is only found on -C: Cut. Refer to ◀ ▶ marking, locating direction.
- ※ 2. The M5 x 0.8 threads are used when removing the datum cylinder. (See P.800 for usage.)

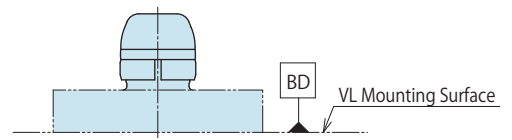
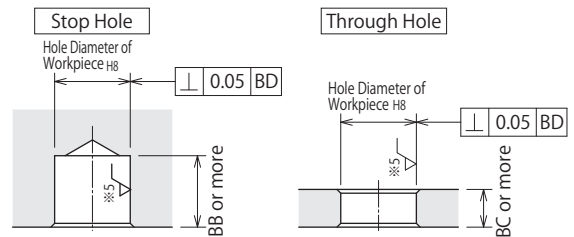
Machining Dimensions of Mounting Area



Notes

- 1. There should be no burrs at the intersection of processed hole.
- ※ 3. The release hydraulic port is within □ range. The port size is not specified.
- ※ 4. Base thickness (AF) is for when the base material is S50C.

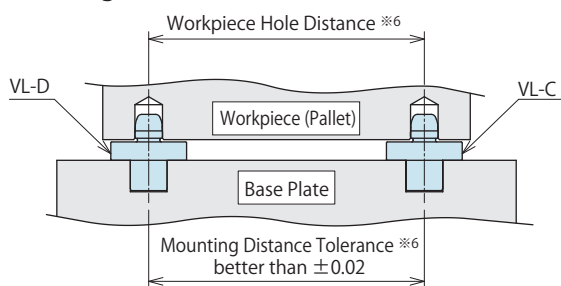
Workpiece (Pallet) Machining Dimensions



Note

- ※ 5. When the same object, such as a pallet, is to be repeatedly positioned, the recommended surface correlation is 6.35.

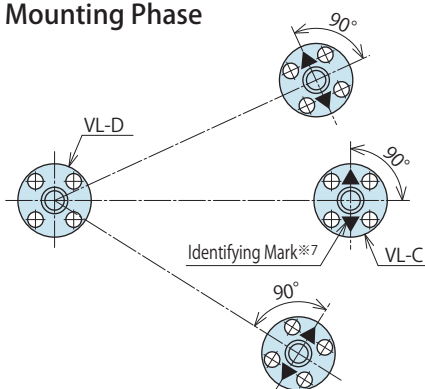
● Mounting Distance Tolerance



Note

※6. Please ensure the distance tolerance between each locating cylinder is better than ± 0.02 mm. The distance accuracy of each workpiece hole should be within the allowable tolerance. (Please refer to table under JIS B 0613 Class 2 on P.799).

● VL-C Mounting Phase



Note

※7. Attach the VL-C identification mark perpendicular to the line which runs through the center of VL-D and VL-C.

● External Dimensions and Machining Dimensions for Mounting

(mm)

Model No.	VL0082	VL0092	VL0102	VL0122	VL0132	VL0152	VL0162	VL0182	VL0202	
Hole diameter of Workpiece	Standard mm	8H8 ^{+0.022}	9H8 ^{+0.022}	10H8 ^{+0.022}	12H8 ^{+0.027}	13H8 ^{+0.027}	15H8 ^{+0.027}	16H8 ^{+0.027}	18H8 ^{+0.027}	20H8 ^{+0.033}
	Substandard ※8 mm	8.1~8.8	8.9~9.9	10.1~11.3	11.4~12.7	12.8~14.2	14.3~15.7	15.8~16.9	17.0~18.4	18.5~19.9
Datum Diameter (Standard)	When Releasing (MAX) mm	7.94	8.94	9.94	11.92	12.92	14.92	15.89	17.89	19.89
	When Full Stroke(MIN) mm	8.05	9.05	10.05	12.05	13.05	15.05	16.08	18.08	20.08
Datum Diameter (Substandard)	When Releasing (MAX) mm	Workpiece Hole Diameter - 0.06			Workpiece Hole Diameter - 0.08			Workpiece Hole Diameter - 0.11		
	When Full Stroke(MIN) mm	Workpiece Hole Diameter + 0.05			Workpiece Hole Diameter + 0.05			Workpiece Hole Diameter + 0.08		
Full Stroke	mm	0.6	0.6	0.6	0.7	0.7	0.7	1.0	1.0	1.0
Offset Tolerance(C:Cut)	mm	±0.05	±0.05	±0.10	±0.10	±0.10	±0.10	±0.15	±0.15	±0.15
A		32.7			33.2			38.7		
B		33			33			37		
D		16n6 ^{+0.023} _{+0.012}			16n6 ^{+0.023} _{+0.012}			19n6 ^{+0.028} _{+0.015}		
E		13.2			13.2			14.7		
F		11.5			12			16		
G		17.2			17.2			19.6		
H		15.7			15.7			18.7		
J		12.5			12.5			14.5		
K		2.5			2.5			3		
L		2.7			2.7			3		
M		About 2.5			About 2.5			About 4.2		
N		2.0	2.0	1.8	1.6	1.6	1.6	2.2	2.2	2.2
P		2.6	2.6	2.8	3.2	3.2	3.2	4.5	4.5	4.5
R	Standard Datum Diameter	4.8	5.8	6.8	8.7	9.7	11.7	11.3	13.3	15.3
	Substandard Datum Diameter	Workpiece Hole Diameter -3.2			Workpiece Hole Diameter -3.3			Workpiece Hole Diameter -4.7		
O-ring S		AS568-014(90°)			AS568-014(90°)			AS568-016(90°)		
O-ring T		AS568-005(70°)			AS568-005(70°)			AS568-005(70°)		
AA		16.1			16.1			19.1		
AB		16H6 ^{+0.011}			16H6 ^{+0.011}			19H6 ^{+0.013}		
AC		16			16			19		
AD		13.5			13.5			15		
AE		3			3			5		
AF※4		20			20			25		
BB		12			12.5			16.5		
BC		5			5			7		

Note ※8. Custom diameters are available in increments of 0.1mm. The accuracy of workpiece hole diameter machining should be greater than H8.

- High-Power Series
- Pneumatic Series
- Hydraulic Series**
- Valve / Coupler Hydraulic Unit
- Manual Operation Accessories
- Cautions / Others

- Hole Clamp
 - SFA
 - SFC

- Swing Clamp
 - LHA
 - LHC
 - LHS
 - LHW
 - LT/LG
 - TLA-2
 - TLB-2
 - TLA-1

- Link Clamp
 - LKA
 - LKC
 - LKW
 - LM/LJ
 - TMA-2
 - TMA-1

- Work Support
 - LD
 - LC
 - TNC
 - TC

- Air Sensing Lift Cylinder
 - LLW

- Compact Cylinder
 - LL
 - LLR
 - LLU
 - DP
 - DR
 - DS
 - DT

- Block Cylinder
 - DBA
 - DBC

- Control Valve
 - BZL
 - BZT
 - BZX/JZG

- Pallet Clamp
 - VS
 - VT

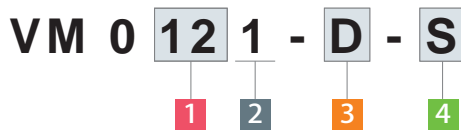
- Expansion Locating Pin**
 - VL**
 - VM
 - VJ
 - VK

- Pull Stud Clamp
 - FP
 - FQ

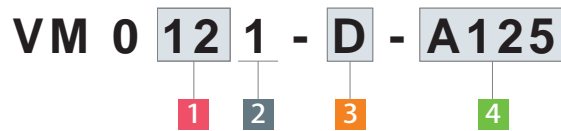
- Customized Spring Cylinder
 - DWA/DWB

Model No. Indication

Workpiece Hole Diameter (Standard Diameter)



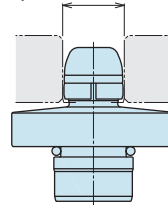
Workpiece Hole Diameter (Substandard Diameter)



1 Workpiece Hole Diameter (Standard)

- 08 : $\phi 8^{H8}_{+0.022}$ mm
- 09 : $\phi 9^{H8}_{+0.022}$ mm
- 10 : $\phi 10^{H8}_{+0.022}$ mm
- 12 : $\phi 12^{H8}_{+0.027}$ mm
- 13 : $\phi 13^{H8}_{+0.027}$ mm
- 15 : $\phi 15^{H8}_{+0.027}$ mm
- 16 : $\phi 16^{H8}_{+0.027}$ mm
- 18 : $\phi 18^{H8}_{+0.027}$ mm
- 20 : $\phi 20^{H8}_{+0.033}$ mm

Workpiece Hole Diameter

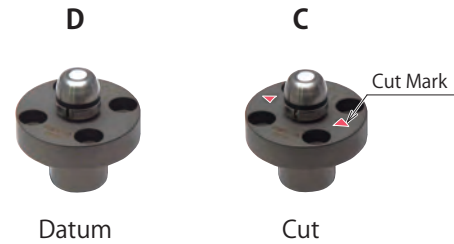


2 Design No.

1 : Revision Number

3 Functions

- D : Datum (for Reference Locating)
- C : Cut (for One Direction Locating)



4 Applicable Workpiece Hole Diameter

- S : Standard Diameter
- A□□□ : Substandard Diameter

※Example

Example 1 : VM0121-D-A125

VM0121-D with Workpiece Hole Diameter of $\phi 12.5H8_{+0.027}$

Example 2 : VM0091-C-A093

VM0091-C with Workpiece Hole Diameter of $\phi 9.3H8_{+0.022}$

Example 3 : VM0181-D-S

VM0181-D with Workpiece Hole Diameter of $\phi 18H8_{+0.027}$

Model No.	S: Standard Diameter	A□□□: Substandard Diameter
VM0081	$8H8_{+0.022}$	$8.1H8_{+0.022} \sim 8.8H8_{+0.022}$
VM0091	$9H8_{+0.022}$	$8.9H8_{+0.022} \sim 9.9H8_{+0.022}$
VM0101	$10H8_{+0.022}$	$10.1H8_{+0.027} \sim 11.3H8_{+0.027}$
VM0121	$12H8_{+0.027}$	$11.4H8_{+0.027} \sim 12.7H8_{+0.027}$
VM0131	$13H8_{+0.027}$	$12.8H8_{+0.027} \sim 14.2H8_{+0.027}$
VM0151	$15H8_{+0.027}$	$14.3H8_{+0.027} \sim 15.7H8_{+0.027}$
VM0161	$16H8_{+0.027}$	$15.8H8_{+0.027} \sim 16.9H8_{+0.027}$
VM0181	$18H8_{+0.027}$	$17.0H8_{+0.027} \sim 17.9H8_{+0.027}$
		$18.1H8_{+0.033} \sim 18.4H8_{+0.033}$
VM0201	$20H8_{+0.033}$	$18.5H8_{+0.033} \sim 19.9H8_{+0.033}$

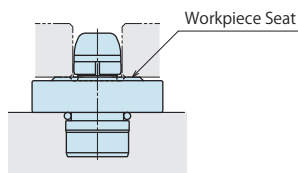
Notes

- Custom diameters are available in increments of 0.1mm.
- When workpiece hole diameter is $\phi 9.5H8_{+0.022}$, Model No. is "VM0091-D-A095".
- Please contact us if above work hole diameter is larger or smaller than standard.
(The accuracy of work piece hole diameter machining should be greater than H8.)

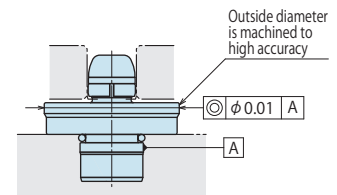
Other Special Options (Reference)

For below options, please contact us.

Used when seat cannot be installed separately.



If it is not possible to measure the datum hole pitch, it can be measured indirectly (specially machined outside diameter of VM).



Specifications

Model No.	VM0081	VM0091	VM0101	VM0121	VM0131	VM0151	VM0161	VM0181	VM0201
Workpiece Standard Diameter mm	8H8 ^{+0.022}	9H8 ^{+0.022}	10H8 ^{+0.022}	12H8 ^{+0.027}	13H8 ^{+0.027}	15H8 ^{+0.027}	16H8 ^{+0.027}	18H8 ^{+0.027}	20H8 ^{+0.033}
Hole Diameter Substandard Diameter ^① mm	8.1~8.8	8.9~9.9	10.1~11.3	11.4~12.7	12.8~14.2	14.3~15.7	15.8~16.9	17.0~18.4	18.5~19.9
Locating Repeatability mm	0.003								
Offset Tolerance (C:Cut) mm	±0.05	±0.05	±0.10	±0.10	±0.10	±0.10	±0.15	±0.15	±0.15
Locating Force ^{※2} N	At 2.5MPa	260	260	260	260	260	290	290	290
	At 5.0MPa	430	430	430	430	430	470	470	470
	At 7.0MPa	510	510	510	510	510	550	550	550
Allowable Thrust Load ^{※3} kN	1.5	1.5	2.0	2.5	2.5	2.5	3.0	3.0	3.5
Cylinder Capacity (Lock Side) cm ³	0.05	0.05	0.05	0.05	0.05	0.05	0.11	0.11	0.11
Cylinder Capacity (Release Side) cm ³	0.06	0.06	0.06	0.06	0.06	0.06	0.15	0.15	0.15
Max. Operating Pressure MPa	7.0								
Min. Operating Pressure MPa	2.5								
Operating Temperature °C	0~70								
Usable Fluid	General Hydraulic Oil Equivalent to ISO-VG-32								
Mass g	90	90	90	95	95	100	115	120	125

- Notes
- ※ 1. Custom diameters are available in increments of 0.1mm. The accuracy of workpiece hole diameter machining should be greater than H8.
 - ※ 2. Locating force is the force with which the expansion locating pin pushes out (expands) against the workpiece. The value assumes that coolant has been applied. [Reference values] (The relationship between locating force and the weight of workpiece is shown the graph below.)
 - ※ 3. The allowable thrust load means the maximum thrust load that can be applied to this product.

About Locating Force and Workpiece Weight

Workpiece (Pallet) Weight Calculation - Horizontal Attitude

$$\text{Workpiece Weight} \leq \frac{\text{Locating Force per One Piece of Expansion Locating Pin}}{\text{Friction Coefficient of Workpiece Seat Face}}$$

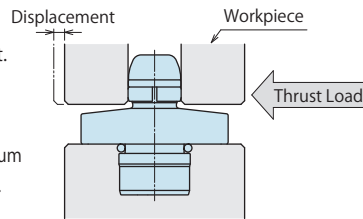
Workpiece (Pallet) Weight Calculation - Vertical Attitude

$$\text{Workpiece Weight} \leq \text{Locating Force per One Piece of Expansion Locating Pin}$$

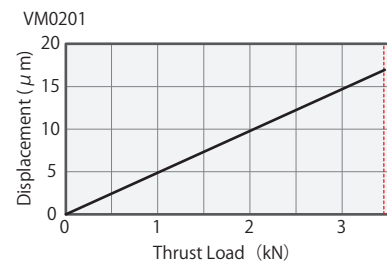
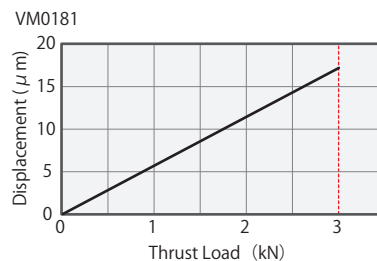
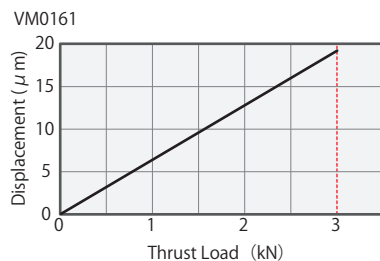
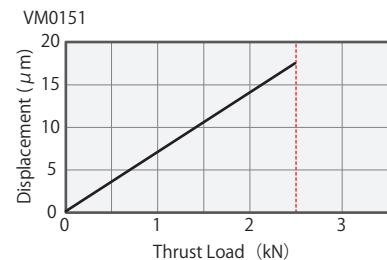
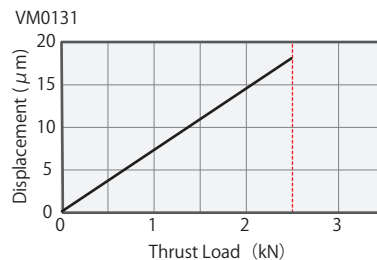
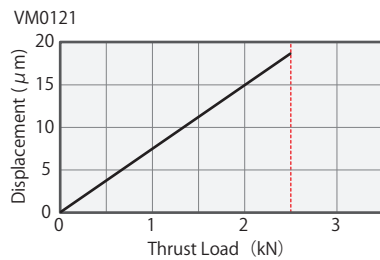
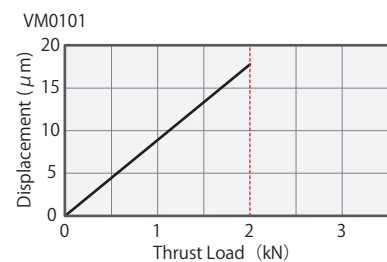
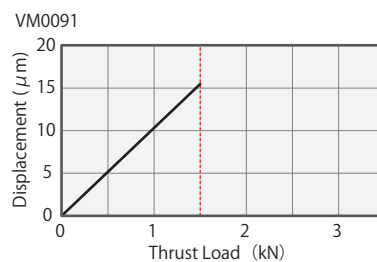
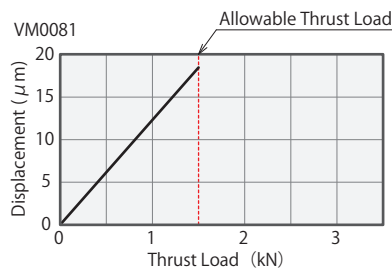
Load / Displacement Curve

This graph shows the relationship between load and displacement. Thrust load is the perpendicular load on the center of the VM (Expansion locating pin) axis.

Note This graph shows the thrust load (static load) on a single datum (VM-D) cylinder that is not used with any clamp cylinders.



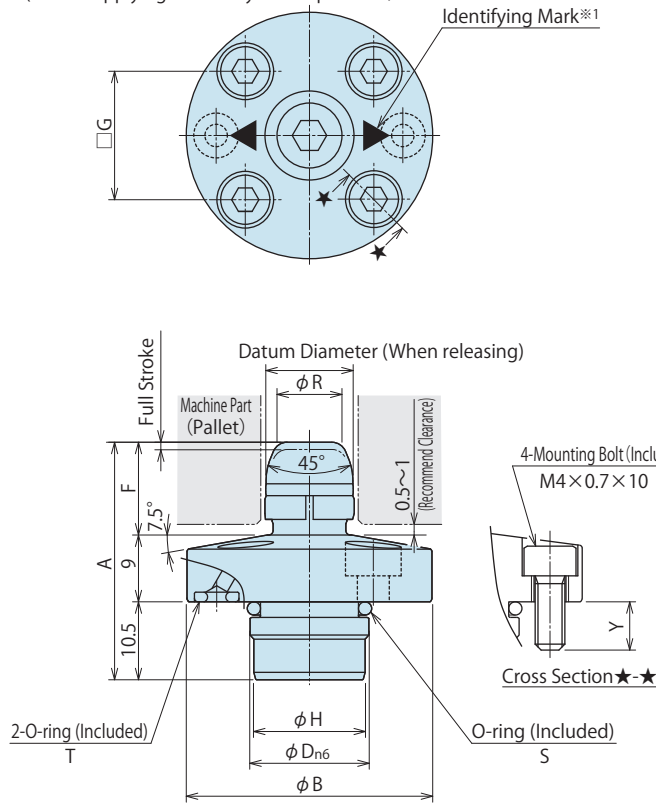
(How to read the load/displacement curve)
(Example) When VM0161 is used. Requirement : When a 2 kN thrust load displaced on an expanded VM0161 the displacement will be about 13 μm.



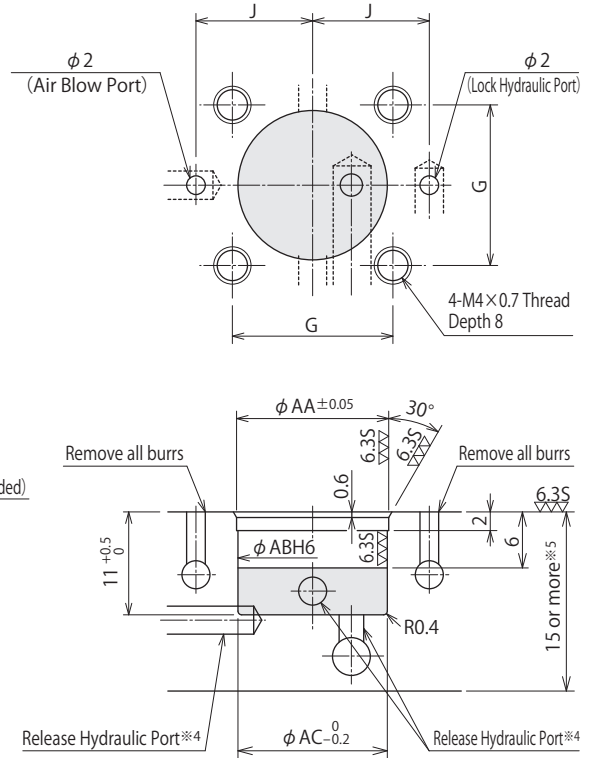
- High-Power Series
- Pneumatic Series
- Hydraulic Series
- Valve / Coupler Hydraulic Unit
- Manual Operation Accessories
- Cautions / Others
- Hole Clamp
 - SFA
 - SFC
- Swing Clamp
 - LHA
 - LHC
 - LHS
 - LHW
 - LT/LG
 - TLA-2
 - TLB-2
 - TLA-1
- Link Clamp
 - LKA
 - LKC
 - LKW
 - LM/LJ
 - TMA-2
 - TMA-1
- Work Support
 - LD
 - LC
 - TNC
 - TC
- Air Sensing Lift Cylinder
 - LLW
- Compact Cylinder
 - LL
 - LLR
 - LLU
 - DP
 - DR
 - DS
 - DT
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 - DBA
 - DBC
- Control Valve
 - BZL
 - BZT
 - BZX/JZG
- Pallet Clamp
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 - VT
- Expansion Locating Pin
 - VL
 - VM
 - VJ
 - VK
- Pull Stud Clamp
 - FP
 - FQ
- Customized Spring Cylinder
 - DWA/DWB

External Dimensions

※This drawing shows the released state of VM-C.
(When supplying release hydraulic pressure)

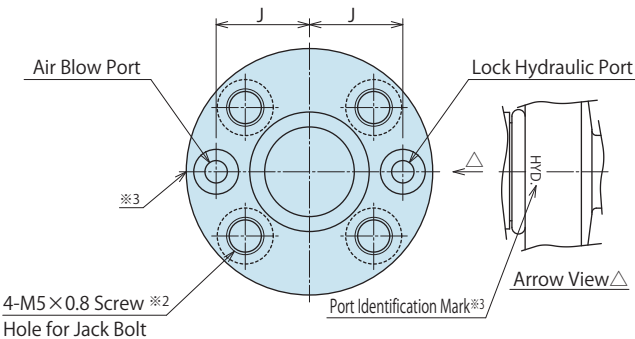


Machining Dimensions of Mounting Area

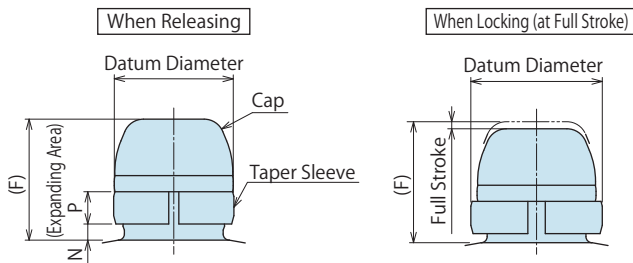


Notes

- 1. There should be no burrs at the intersection of processed hole.
- ※ 4. The release hydraulic port is within range.
The port size is not specified.
- ※ 5. Base thickness (15mm) is for when the base material is S50C.



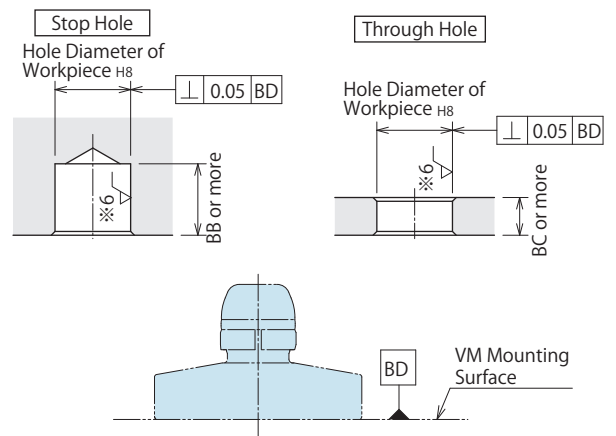
Expanding Area Detail



Notes

- ※ 1. The identification mark is only found on -C. Cut.
Refer to ◀ ▶ marking, locating direction.
- ※ 2. The M5 x 0.8 threads are used when removing the datum cylinder.
(See P.800 for usage.)
- ※ 3. The port name is imprinted on the side.
(HYD: Lock hydraulic port, BLOW: Air blow port)

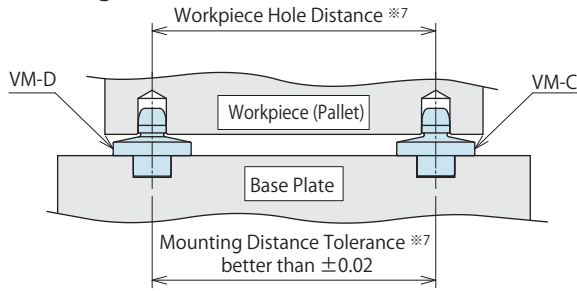
Workpiece (Pallet) Machining Dimensions



Notes

- ※ 6. When the same object, such as a pallet, is to be repeatedly positioned, the recommended surface correlation is $\sqrt{0.635}$

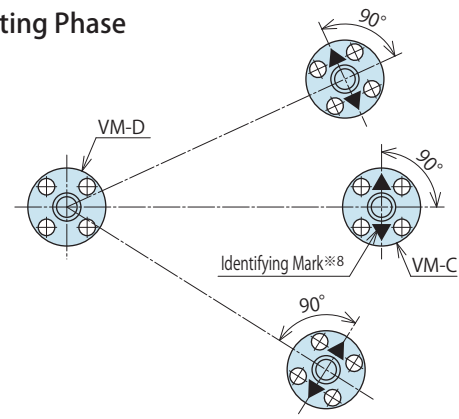
● Mounting Distance Tolerance



Note

※7. Please ensure the distance tolerance between each locating cylinder is better than ± 0.02 mm.
The distance accuracy of each workpiece hole should be within the allowable tolerance.
(Please refer to table under JIS B 0613 Class 2 on P.799).

● VM-C Mounting Phase



Note

※8. Attach the VL-C identification mark perpendicular to the line which runs through the center of VM-D and VM-C.

● External Dimensions and Machining Dimensions for Mounting

Model No.		VM0081	VM0091	VM0101	VM0121	VM0131	VM0151	VM0161	VM0181	VM0201
Hole diameter of Workpiece	Standard mm	8H8 ^{+0.022} ₀	9H8 ^{+0.022} ₀	10H8 ^{+0.022} ₀	12H8 ^{+0.027} ₀	13H8 ^{+0.027} ₀	15H8 ^{+0.027} ₀	16H8 ^{+0.027} ₀	18H8 ^{+0.027} ₀	20H8 ^{+0.033} ₀
	Substandard※9 mm	8.1~8.8	8.9~9.9	10.1~11.3	11.4~12.7	12.8~14.2	14.3~15.7	15.8~16.9	17.0~18.4	18.5~19.9
Datum Diameter (Standard)	When Releasing (MAX) mm	7.94	8.94	9.94	11.92	12.92	14.92	15.89	17.89	19.89
	When Full Stroke(MIN) mm	8.05	9.05	10.05	12.05	13.05	15.05	16.08	18.08	20.08
Datum Diameter (Substandard)	When Releasing (MAX) mm	Workpiece Hole Diameter - 0.06			Workpiece Hole Diameter - 0.08			Workpiece Hole Diameter - 0.11		
	When Full Stroke(MIN) mm	Workpiece Hole Diameter + 0.05			Workpiece Hole Diameter + 0.05			Workpiece Hole Diameter + 0.08		
Full Stroke	mm	0.6	0.6	0.6	0.7	0.7	0.7	1.0	1.0	1.0
Offset Tolerance (C:Cut)	mm	±0.05	±0.05	±0.10	±0.10	±0.10	±0.10	±0.15	±0.15	±0.15
A		31.5			32			36		
B		33			33			37		
D		16 _{n6} ^{+0.023} _{+0.012}			16 _{n6} ^{+0.023} _{+0.012}			19 _{n6} ^{+0.028} _{+0.015}		
F		12			12.5			16.5		
G		17.2			17.2			19.6		
H		15.7			15.7			18.7		
J		12.5			12.5			14.5		
N		2.5	2.5	2.3	2.1	2.1	2.1	2.7	2.7	2.7
P		2.6	2.6	2.8	3.2	3.2	3.2	4.5	4.5	4.5
R	Standard Datum Diameter	4.8	5.8	6.8	8.7	9.7	11.7	11.3	13.3	15.3
	Substandard Datum Diameter	Workpiece Hole Diameter -3.2			Workpiece Hole Diameter -3.3			Workpiece Hole Diameter -4.7		
	O-ring S	AS568-014(90°)			AS568-014(90°)			AS568-016(90°)		
	O-ring T	AS568-005(70°)			AS568-005(70°)			AS568-005(70°)		
	Y	6.7			6.5			6.5		
	AA	16.1			16.1			19.1		
	AB	16H6 ₀ ^{+0.011}			16H6 ₀ ^{+0.011}			19H6 ₀ ^{+0.013}		
	AC	16			16			19		
	BB	12.5			13			17		
	BC	5.5			5.5			7.5		

Note ※9. Custom diameters are available in increments of 0.1mm. The accuracy of workpiece hole diameter machining should be greater than H8.

- High-Power Series
- Pneumatic Series
- Hydraulic Series**
- Valve / Coupler Hydraulic Unit
- Manual Operation Accessories
- Cautions / Others
- Hole Clamp
 - SFA
 - SFC
- Swing Clamp
 - LHA
 - LHC
 - LHS
 - LHW
 - LT/LG
 - TLA-2
 - TLB-2
 - TLA-1
- Link Clamp
 - LKA
 - LKC
 - LKW
 - LM/LJ
 - TMA-2
 - TMA-1
- Work Support
 - LD
 - LC
 - TNC
 - TC
- Air Sensing Lift Cylinder
 - LLW
- Compact Cylinder
 - LL
 - LLR
 - LLU
 - DP
 - DR
 - DS
 - DT
- Block Cylinder
 - DBA
 - DBC
- Control Valve
 - BZL
 - BZT
 - BZX/JZG
- Pallet Clamp
 - VS
 - VT
- Expansion Locating Pin**
 - VL
 - VM**
 - VJ
 - VK
- Pull Stud Clamp
 - FP
 - FQ
- Customized Spring Cylinder
 - DWA/DWB

Hydraulic Expansion Locating Pin

Model VJ/VK

Hydraulic Pressure • Single Action/Double Action

Locating Repeatability : 30 μm

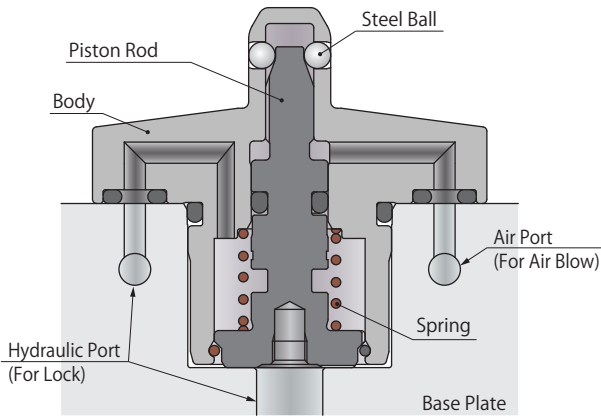


Index

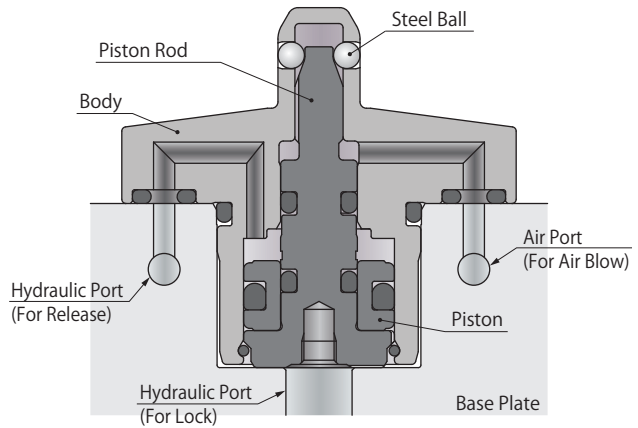
Expansion Locating Pin Digest	P.773
Action Description	P.788
VJ Model No. Indication / Specifications	P.789
VJ External Dimensions	P.791
VK Model No. Indication / Specifications	P.793
VK External Dimensions	P.795
Cautions	
• Notes for Hydraulic Expansion Locating Pin	P.797
• Cautions (Common)	P.1043
• Installation Notes • Hydraulic Fluid List • Notes on Hydraulic Cylinder Speed Control Circuit	
• Notes on Handling • Maintenance/Inspection • Warranty	

Action Description

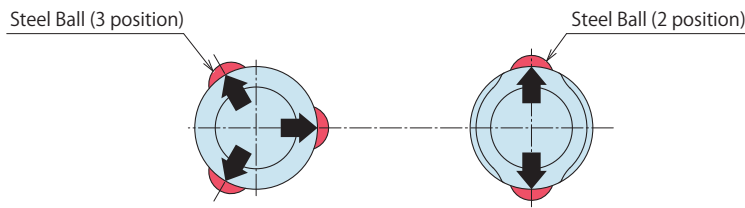
model VJ



model VK



Taper Sleeve and Taper Reference Surface

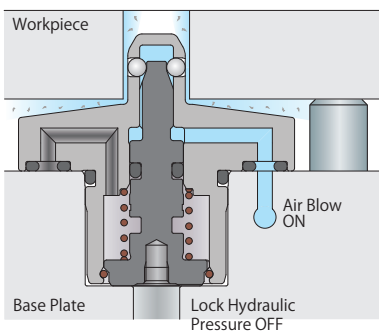


VJ-D/VK-D: Datum ^{※1}
(Reference Location)

VJ-C/VK-C: Cut
(One Direction Locating)

Note ^{※1}. Locating force varies according to phase.

model VJ



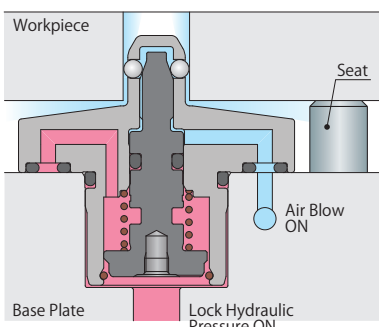
- When hydraulic oil pressure is turned off, piston rod is pulled down by spring and release is activated. (speaking of VK, when release hydraulic pressure is turned ON and locking hydraulic pressure is OFF, do the same action as VS by hydraulic pressure)
- Air blow prevents debris contamination.

When loading workpiece

When unloading workpiece

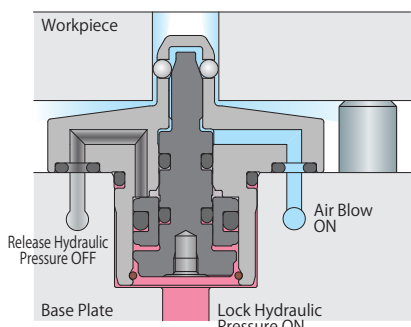
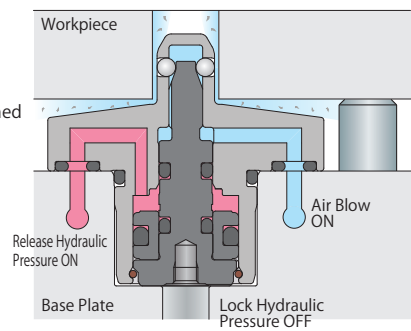


When locating



- Piston rod rises by supplying lock port with oil. The steel ball comes out from the pin and locates work piece. (For Z-axis, seat is also required)

model VK



- High-Power Series
- Pneumatic Series
- Hydraulic Series**
- Valve / Coupler Hydraulic Unit
- Manual Operation Accessories
- Cautions / Others

Hole Clamp

- SFA
- SFC

Swing Clamp

- LHA
- LHC
- LHS
- LHW
- LT/LG
- TLA-2
- TLB-2
- TLA-1

Link Clamp

- LKA
- LKC
- LKW
- LM/LJ
- TMA-2
- TMA-1

Work Support

- LD
- LC
- TNC
- TC

Air Sensing Lift Cylinder

- LLW

Compact Cylinder

- LL
- LLR
- LLU
- DP
- DR
- DS
- DT

Block Cylinder

- DBA
- DBC

Control Valve

- BZL
- BZT
- BZX/JZG

Pallet Clamp

- VS
- VT

Expansion Locating Pin

- VL
- VM
- VJ**
- VK**

Pull Stud Clamp

- FP
- FQ

Customized Spring Cylinder

- DWA/DWB

Model No. Indication

VJ 0 **09** 0 - **D**

1 2 3

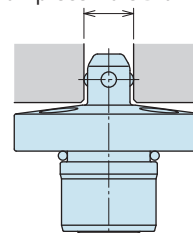
1 Workpiece Hole Diameter

08 : $\phi 7.6\sim 8.5$ mm

09 : $\phi 8.5\sim 9.5$ mm

10 : $\phi 9.5\sim 10.8$ mm

Workpiece Hole Diameter



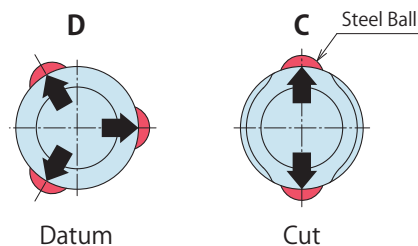
2 Design No.

0 : Revision Number

3 Functions

D : Datum (for Reference Locating)

C : Cut (for One Direction Locating)



Specifications

Model No.	VJ0080	VJ0090	VJ0100	
Workpiece Hole Diameter (Standard)	mm	$\phi 7.6\sim 8.5$	$\phi 8.5\sim 9.5$	$\phi 9.5\sim 10.8$
Locating Repeatability	mm	0.030		
Offset Tolerance (C:Cut)	mm	± 0.4	± 0.4	± 0.5
Allowable Thrust Load *1	kN	0.45	0.6	0.8
Cylinder Capacity (Lock Side)	cm ³	0.07	0.08	0.10
Return Spring Force	N	21.5 ~ 24.6	20.4 ~ 24.6	19.6 ~ 24.6
Max. Operating Pressure	MPa	7.0		
Min. Operating Pressure	MPa	2.5		
Withstanding Pressure	MPa	10.5		
Air Blow Pressure	MPa	0.4~0.5		
Operating Temperature	°C	0~70		
Usable Fluid		General Hydraulic Oil Equivalent to ISO-VG-32		
Mass	g	90	90	100

Note

※1. "Allowable thrust load" has been calculated from "Pressure of contacted surface" on steel ball part.

In case an extra load force is applied than the above table value, will cause workpiece hole deformation or unsatisfied locating function.

Locating Force Curve

Supply Hydraulic Pressure (MPa)	Locating Force (kN)	
	Phase 1	Phase 2
7.0	0.39	0.21
6.5	0.36	0.19
6.0	0.33	0.18
5.5	0.30	0.16
5.0	0.27	0.14
4.5	0.24	0.13
4.0	0.21	0.11
3.5	0.18	0.09
3.0	0.15	0.08
2.5	0.12	0.06
Calculation Formula	$F = 0.062 \times P - 0.04$	$F = 0.033 \times P - 0.021$

Notes

- The graphs show the relationship between locating force F (kN) and supply hydraulic pressure P (MPa).
- Locating force F (kN) can be calculated by inputting operating hydraulic pressure P (MPa) in the formula above.
- Locating force indicates when the friction coefficient is $\mu=0.1$ between workpiece hold surface and cylinder ball.
- In case that the material thickness is thin around locating hole, expansion force may deform the hole. It may cause unsatisfied locating accuracy.
- The maximum use hydraulic pressure is 7 MPa and minimum at 2.5MPa.

Phase 1 and Phase 2

- [phase1][phase2] in the graph above indicates the locating force in the case where workpiece is slid toward the arrow in the graph at right side.
- Expansion locating pin has no clamping function. Additional clamps should be added to secure workpiece.

About Locating Force and Workpiece Weight

Workpiece (Pallet) Weight Calculation - Horizontal Attitude

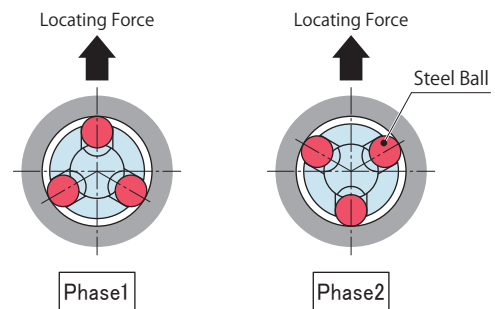
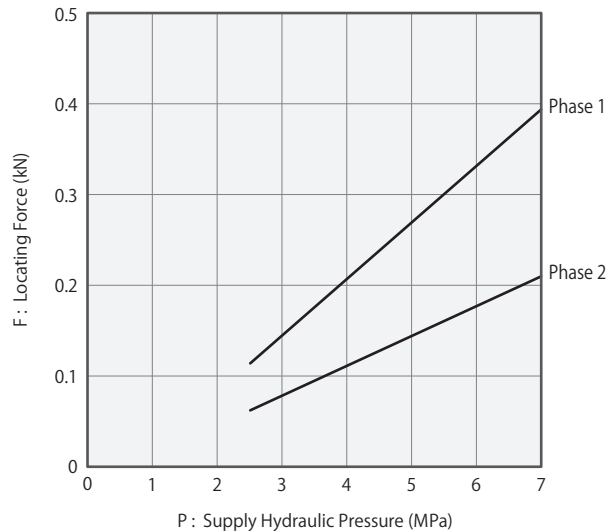
$$\text{Workpiece weight} \leq \frac{\text{Locating Force per One Piece of Expansion Locating Pin}}{\text{Friction Coefficient of Workpiece Seat Face}}$$

(How to calculate the weight of workpiece)

(Example) The condition where operating hydraulic pressure 7.0MPa is supplied to VJ and the friction coefficient on workpiece's seating area is set up at $\mu=0.1$.

The locating force is 0.21kN in phase 2 → The maximum weight of workpiece is around 210 kg in the condition (Set the workpiece in horizontal position).

The locating force is 0.39 kN → The maximum weight of workpiece is around 39 kg in the condition (Set the workpiece in vertical position and lay out the VJ as it is like phase 1).



High-Power Series

Pneumatic Series

Hydraulic Series

Valve / Coupler Hydraulic Unit

Manual Operation Accessories

Cautions / Others

Hole Clamp

SFA
SFC

Swing Clamp

LHA
LHC
LHS
LHW
LT/LG
TLA-2
TLB-2
TLA-1

Link Clamp

LKA
LKC
LKW
LM/LJ
TMA-2
TMA-1

Work Support

LD
LC
TNC
TC

Air Sensing Lift Cylinder

LLW

Compact Cylinder

LL
LLR
LLU
DP
DR
DS
DT

Block Cylinder

DBA
DBC

Control Valve

BZL
BZT
BZX/JZG

Pallet Clamp

VS
VT

Expansion Locating Pin

VL
VM
VJ
VK

Pull Stud Clamp

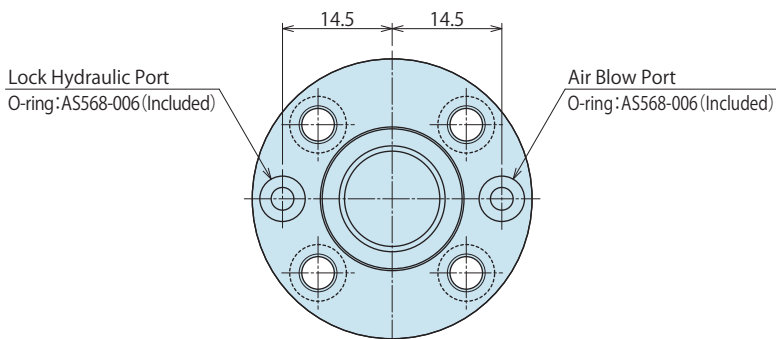
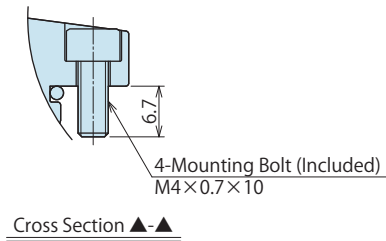
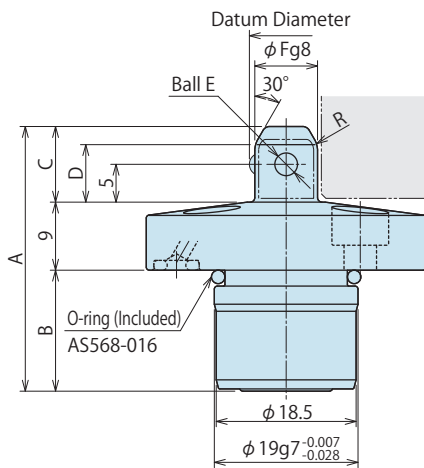
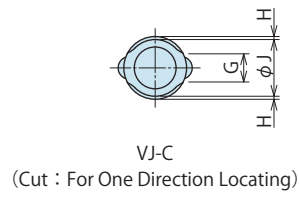
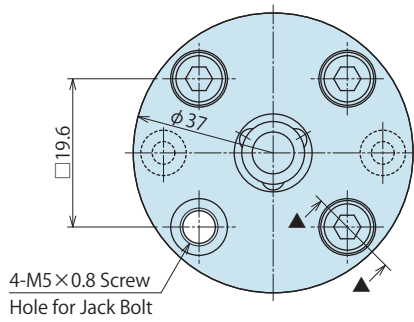
FP
FQ

Customized Spring Cylinder

DWA/DWB

External Dimensions

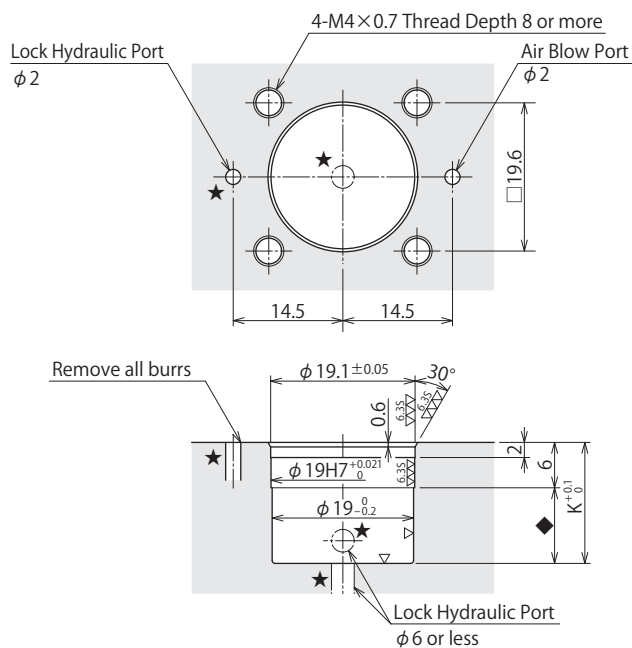
※This drawing shows VJ-D (Datum : For Reference Locating)



Note

1. Tighten 4 bolts evenly (grade 12.9) when mounting.
Remove mounting bolt. Insert jack bolt and tighten evenly to lift it.

● Machining Dimensions of Mounting Area



Notes

- Hydraulic pressure can be supplied through either the port on flange, through the side or bottom (★mark) of the clamp hole in the manifold.
In the event of the use of the side clamp hole, make sure to machine the port in between ◆ range.
- Roughness of mounting surface (O-ring seal surface) should be 6.3S or less.

● External Dimensions and Machining Dimensions for Mounting

(mm)

Model No.	VJ0080	VJ0090	VJ0100
Workpiece Hole Diameter (Standard Diameter) mm	φ7.6~8.5	φ8.5~9.5	φ9.5~10.8
Datum Diameter mm	At Releasing (Max.)	φ7.5 or less	φ8.3 or less
	At Full Stroke (Min.)	φ8.5 or more	φ9.5 or more
Stroke mm	1.8	2.2	2.6
A	34.0	35.0	35.5
B	15.5	16.0	16.0
C	9.5	10.0	10.5
D	7.2	7.6	7.8
E	2.5	3.0	3.5
F	7.5 ^{-0.005} _{-0.027}	8.3 ^{-0.005} _{-0.027}	9.3 ^{-0.005} _{-0.027}
G	3.5	4.0	4.5
H	0.4	0.4	0.5
J	6.7	7.5	8.3
K	15.5	16.0	16.0
R	R2.5	R3	R3

High-Power
Series

Pneumatic Series

Hydraulic Series

Valve / Coupler
Hydraulic UnitManual Operation
Accessories

Cautions / Others

Hole Clamp

SFA
SFC

Swing Clamp

LHA
LHC
LHS
LHW
LT/LG
TLA-2
TLB-2
TLA-1

Link Clamp

LKA
LKC
LKW
LM/LJ
TMA-2
TMA-1

Work Support

LD
LC
TNC
TCAir Sensing
Lift Cylinder

LLW

Compact Cylinder

LL
LLR
LLU
DP
DR
DS
DT

Block Cylinder

DBA
DBC

Control Valve

BZL
BZT
BZX/JZG

Pallet Clamp

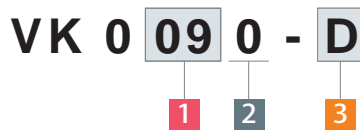
VS
VTExpansion
Locating PinVL
VM
VJ
VK

Pull Stud Clamp

FP
FQCustomized
Spring Cylinder

DWA/DWB

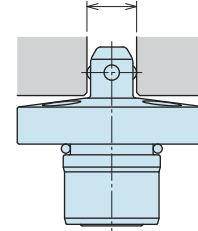
Model No. Indication



1 Workpiece Hole Diameter

- 08 : φ 7.6~8.5 mm
- 09 : φ 8.5~9.5 mm
- 10 : φ 9.5~10.8 mm

Workpiece Hole Diameter

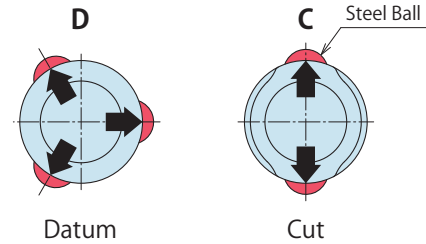


2 Design No.

0 : Revision Number

3 Functions

- D : Datum (for Reference Locating)
- C : Cut (for One Direction Locating)



Specifications

Model No.		VK0080	VK0090	VK0100
Workpiece Hole Diameter (Standard)	mm	φ7.6~8.5	φ8.5~9.5	φ9.5~10.8
Locating Repeatability	mm	0.030		
Offset Tolerance (C:Cut)	mm	±0.4	±0.4	±0.5
Allowable Thrust Load ※1	kN	0.45	0.6	0.8
Cylinder Capacity	Lock Side	0.28	0.34	0.40
	Release Side	0.21	0.25	0.30
Max. Operating Pressure	MPa	7.0		
Min. Operating Pressure	MPa	1.5		
Withstanding Pressure	MPa	10.5		
Air Blow Pressure	MPa	0.4~0.5		
Operating Temperature	°C	0~70		
Usable Fluid		General Hydraulic Oil Equivalent to ISO-VG-32		
Mass	g	95	95	100

Note

※1. "Allowable thrust load" has been calculated from "Pressure of contacted surface" on steel ball part.
 In case an extra load force is applied than the above table value, will cause workpiece hole deformation or unsatisfied locating function.

Locating Force Curve

Supply Hydraulic Pressure (MPa)	Locating Force (kN)	
	Phase 1	Phase 2
7.0	0.43	0.23
6.5	0.40	0.21
6.0	0.37	0.20
5.5	0.34	0.18
5.0	0.31	0.17
4.5	0.28	0.15
4.0	0.25	0.13
3.5	0.22	0.12
3.0	0.19	0.10
2.5	0.16	0.08
2.0	0.12	0.07
1.5	0.09	0.05
Calculation Formula	$F = 0.062 \times P$	$F = 0.033 \times P$

Notes

- The graphs show the relationship between locating force F (kN) and operating hydraulic pressure P (MPa).
- Locating force F (kN) can be calculated by inputting operating hydraulic pressure P (MPa) in the formula above.
- Locating force indicates when the friction coefficient is $\mu=0.1$ between workpiece hold surface and cylinder ball.
- In case that the material thickness is thin around locating hole, expansion force may deform the hole. It may cause unsatisfied locating accuracy.
- The maximum use hydraulic pressure is 7 MPa and minimum at 1.5MPa.

Phase 1 and Phase 2

- [phase1][phase2] in the graph above indicates the locating force in the case where workpiece is slid toward the arrow in the graph at right side.
- Expansion locating pin has no clamping function. Additional clamps should be added to secure workpiece.

About Locating Force and Workpiece Weight

Workpiece (Pallet) Weight Calculation - Horizontal Attitude

$$\text{Workpiece weight} \leq \frac{\text{Locating Force per One Piece of Expansion Locating Pin}}{\text{Friction Coefficient of Workpiece Seat Face}}$$

Workpiece (Pallet) Weight Calculation - Vertical Attitude

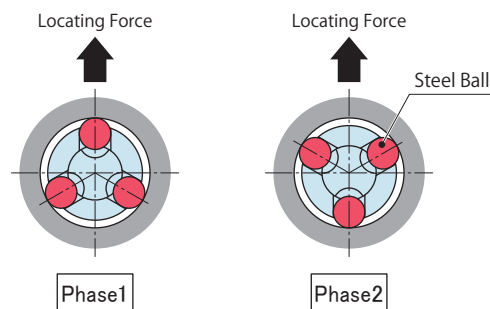
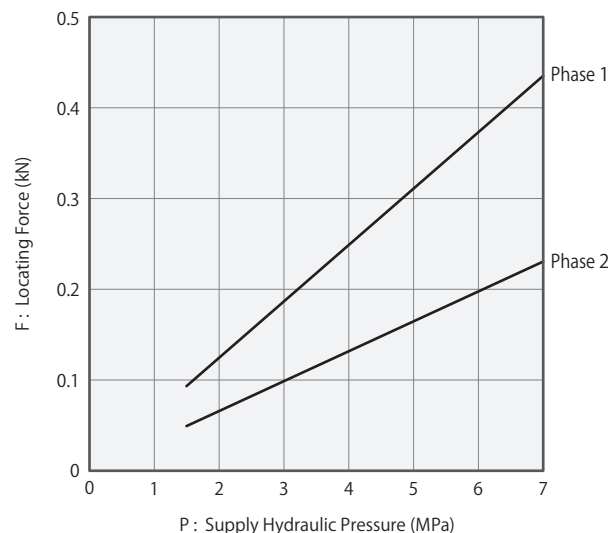
$$\text{Workpiece Weight} \leq \text{Locating Force per One Piece of Expansion Locating Pin}$$

(How to calculate the weight of workpiece)

(Example) The condition where operating hydraulic pressure 7.0MPa is supplied to VK and the friction coefficient on workpiece's seating area is set up at $\mu=0.1$.

The locating force is 0.23kN in phase 2 → The maximum weight of workpiece is around 230 kg in the condition (Set the workpiece in horizontal position).

The locating force is 0.43 kN → The maximum weight of workpiece is around 43 kg in the condition (Set the work piece in vertical position and lay out the VK as it is like phase 1).



High-Power Series

Pneumatic Series

Hydraulic Series

Valve / Coupler Hydraulic Unit

Manual Operation Accessories

Cautions / Others

Hole Clamp

SFA
SFC

Swing Clamp

LHA
LHC
LHS
LHW
LT/LG
TLA-2
TLB-2
TLA-1

Link Clamp

LKA
LKC
LKW
LM/LJ
TMA-2
TMA-1

Work Support

LD
LC
TNC
TC

Air Sensing Lift Cylinder

LLW

Compact Cylinder

LL
LLR
LLU
DP
DR
DS
DT

Block Cylinder

DBA
DBC

Control Valve

BZL
BZT
BZX/JZG

Pallet Clamp

VS
VT

Expansion Locating Pin

VL
VM
VJ
VK

Pull Stud Clamp

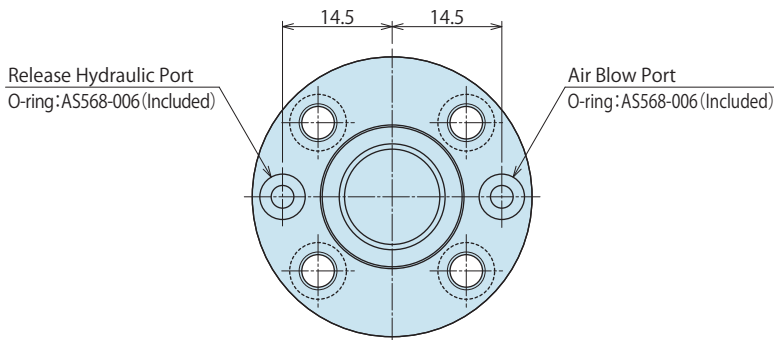
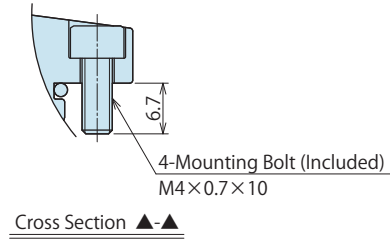
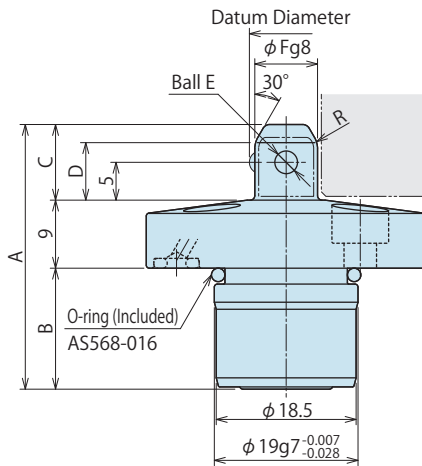
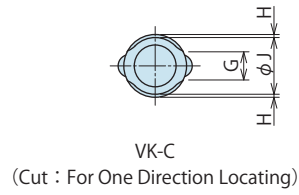
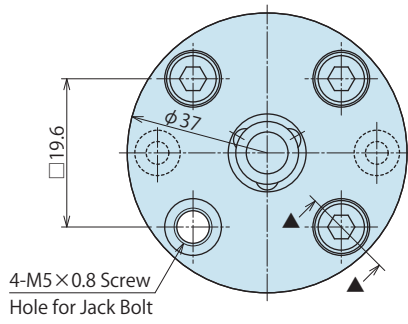
FP
FQ

Customized Spring Cylinder

DWA/DWB

External Dimensions

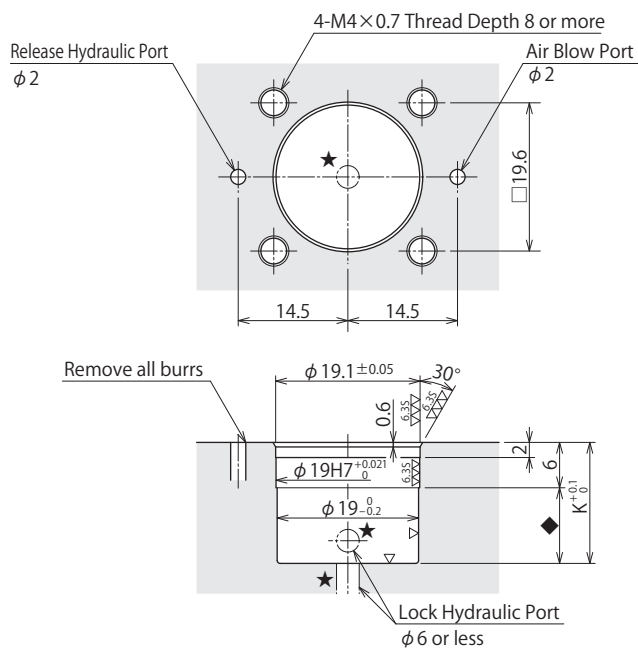
※This drawing shows VK-D (Datum : For Reference Locating)



Note

1. Tighten 4 bolts evenly (grade 12.9) when mounting.
Remove mounting bolt. Insert jack bolt and tighten evenly to lift it.

Machining Dimensions of Mounting Area



Notes

- Hydraulic pressure can be supplied through either the port on flange, through the side or bottom (★mark) of the clamp hole in the manifold.
In the event of the use of the side clamp hole, make sure to machine the port in between ◆ range.
- Roughness of mounting surface (O-ring seal surface) should be 6.3S or less.

External Dimensions and Machining Dimensions for Mounting

(mm)

Model No.	VK0080	VK0090	VK0100
Workpiece Hole Diameter (Standard Diameter) mm	φ7.6~8.5	φ8.5~9.5	φ9.5~10.8
Datum Diameter mm	At Releasing (Max.)	φ7.5 or less	φ8.3 or less
	At Full Stroke (Min.)	φ8.5 or more	φ9.5 or more
Stroke mm	1.8	2.2	2.6
A	34.0	35.0	35.5
B	15.5	16.0	16.0
C	9.5	10.0	10.5
D	7.2	7.6	7.8
E	2.5	3.0	3.5
F	7.5 ^{-0.005} / _{-0.027}	8.3 ^{-0.005} / _{-0.027}	9.3 ^{-0.005} / _{-0.027}
G	3.5	4.0	4.5
H	0.4	0.4	0.5
J	6.7	7.5	8.3
K	15.5	16.0	16.0
R	R2.5	R3	R3

High-Power
Series

Pneumatic Series

Hydraulic Series

Valve / Coupler
Hydraulic UnitManual Operation
Accessories

Cautions / Others

Hole Clamp

SFA
SFC

Swing Clamp

LHA
LHC
LHS
LHW
LT/LG
TLA-2
TLB-2
TLA-1

Link Clamp

LKA
LKC
LKW
LM/LJ
TMA-2
TMA-1

Work Support

LD
LC
TNC
TCAir Sensing
Lift Cylinder

LLW

Compact Cylinder

LL
LLR
LLU
DP
DR
DS
DT

Block Cylinder

DBA
DBC

Control Valve

BZL
BZT
BZX/JZG

Pallet Clamp

VS
VTExpansion
Locating PinVL
VM
VJ
VK

Pull Stud Clamp

FP
FQCustomized
Spring Cylinder

DWA/DWB

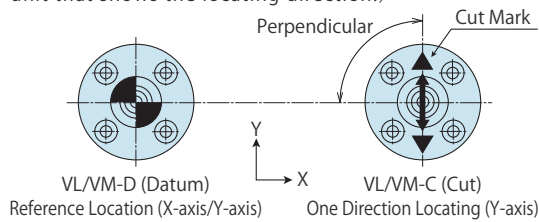
Cautions

● Notes for Design VL/VM/VJ/VK common

- 1) Check Specifications
 - Please use each product according to the specifications.
 - VL locates with spring and releases with hydraulic pressure.
 - VM locates and releases with hydraulic pressure.
 - VJ locates with hydraulic pressure and releases with spring.
 - VK locates and releases with hydraulic pressure.
- 2) Setting Up the Clamps
 - The datum cylinder is a positioning cylinder and has no clamping mechanism. A clamp must be provided separately.
- 3) It is recommended to use the air flow path over $\phi 6\text{mm}$.
- 4) Clamp Mounting Direction (Phase)
 - The reference position (origin) is determined by VL-D/VM-D (Datum: for Reference Locating). VL-C/VM-C (Cut: for One Direction Locating) locates in one direction (Y-axis), so phasing is necessary.

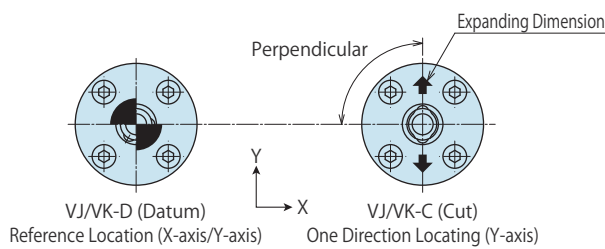
In the case of VL/VM

When you mount it, make sure the VL-C/VM-C (cut) cut mark is perpendicular to VL-D/VM-D (datum).
 (There is a cut mark (▲) on top of the flange on the VL-C/VM-C unit that shows the locating direction.)

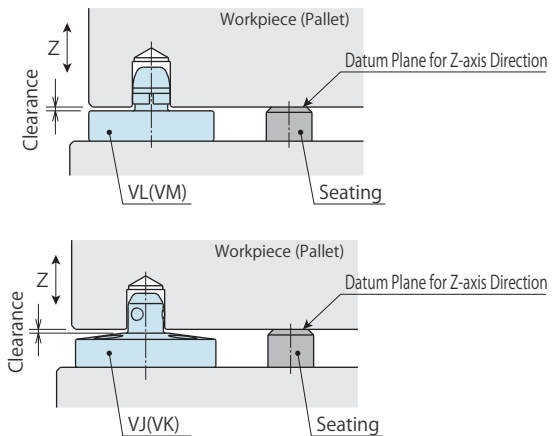


In the case of VJ/VK

Please mount this product VJ-C(VK-C) steel ball is perpendicular (90 degree) to VJ-D(VK-D).

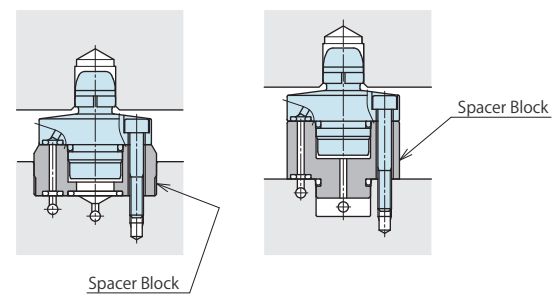


- 5) Reference Surface towards Z-axis
 - Datum cylinder has no seat face (Z axis datum face). Please prepare the seat separately for proper Z axis direction positioning. Make sure there is a clearance between the top of the flange on the datum cylinder and the workpiece (pallet). (Recommended clearance : 0.5 ~ 1mm)



- 6) Adjusting Height of Datum Cylinder
 - For applications where the seat face is high and the height of datum cylinder is not enough, the height of datum cylinder is adjustable using a spacer block under the datum cylinder.

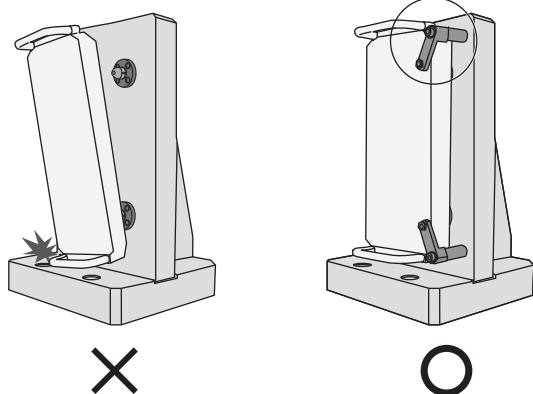
Example of Height Adjustment



7) When the workpiece (pallet) is in vertical position.

- When the workpiece (pallet) is being set, make sure it is in proper proximity and square to the clamps.
If it is locked out of position, the machine or clamps may be damaged.
- As the workpiece (pallet) may fall down during releasing, it is recommended to set up the latching mechanism to prevent it from falling down.
- When the workpiece (pallet) is used in vertical position (hanging on the wall), the internal moving parts tend to wear out.
Confirm the positioning precision in a regular manner. In case the allowed range is exceeded, change the machine.

Example of Latching Mechanism



8) Workpiece (Pallet) Weight

- The Workpiece (Pallet) Weight Calculation - Horizontal Attitude:

$$\text{Workpiece Weight} \leq \frac{\text{Locating Force per One Piece of Expansion Locating Pin}}{\text{Friction Coefficient of Workpiece Seat Face}}$$

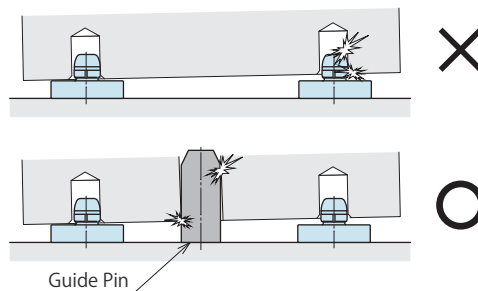
- The Workpiece (Pallet) Weight Calculation - Vertical Attitude:

$$\text{Workpiece Weight} \leq \text{Locating Force per One Piece of Expansion Locating Pin}$$

- Please contact us in case the pallet is in other positions.

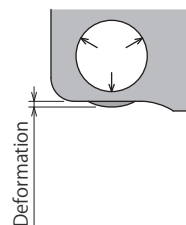
9) Incline in the Z-axis direction.

- If workpiece (pallet) is loaded/unloaded on tilted condition, expanded part of datum cylinder and workpiece hole can become stuck and damage to cylinder and workpiece is possible.
Workpiece (pallet) should be loaded and unloaded with less than 4/100 ~ 5/100 (approx. 2 ~ 3°) of tilt between workpiece and datum cylinder plane.
- If necessary, provide guide pins to keep the pallet level during loading and unloading. Please prepare guide pin (rough guide) etc.



10) Thickness around the Workpiece Hole

- In case that the material thickness is thin around locating hole, expansion force may deform the hole. It may cause unsatisfied locating accuracy.
Please do trial testing and adjust to proper pneumatic pressure.



High-Power Series
Pneumatic Series
Hydraulic Series
Valve / Coupler Hydraulic Unit
Manual Operation Accessories
Cautions / Others
Hole Clamp
SFA
SFC
Swing Clamp
LHA
LHC
LHS
LHW
LT/LG
TLA-2
TLB-2
TLA-1
Link Clamp
LKA
LKC
LKW
LM/LJ
TMA-2
TMA-1
Work Support
LD
LC
TNC
TC
Air Sensing Lift Cylinder
LLW
Compact Cylinder
LL
LLR
LLU
DP
DR
DS
DT
Block Cylinder
DBA
DBC
Control Valve
BZL
BZT
BZX/JZG
Pallet Clamp
VS
VT
Expansion Locating Pin
VL
VM
VJ
VK
Pull Stud Clamp
FP
FQ
Customized Spring Cylinder
DWA/DWB

● Cautions

● Notes for Design Regarding to VL/VM

- 1) Distance Accuracy of VL/VM
- Distance accuracy of the VL/VM's mounting hole should be within $\pm 0.02\text{mm}$.
The distance accuracy of each workpiece hole (Pallet Hole) should be within the allowable tolerance. Please refer to below table under JIS B 0613 Class 2.

Offset Tolerance (C:Cut) \geq Datum Cylinder Distance Accuracy
+ Workpiece Hole Distance Accuracy
(Listed in JIS B 0613)

[JIS B 0613 Excerpt]		unit : mm
Center Distance Classification		Center Distance Accuracy
Greater than	or less	class 2
50	80	± 0.023
80	120	± 0.027
120	180	± 0.032
180	250	± 0.036
250	315	± 0.041
315	400	± 0.045
400	500	± 0.049
500	630	± 0.055
630	800	± 0.063
800	1000	± 0.070

● Notes for Design Regarding to VJ/VK

- 1) Distance Accuracy of VJ/VK
- Distance accuracy between VJ/VK mounting hole (-D/-C) and between workpiece (palette) has to be machined corresponding with the offset tolerance (VJ/VK-C:Cut).
- 2) Taper Angle of Hole on Workpiece
- Allowable taper angle should be within 5° or inclination should be within 2.5° . In addition to that, please adjust the seating block level (Z axis level) to make the hole diameter within catalogue range.

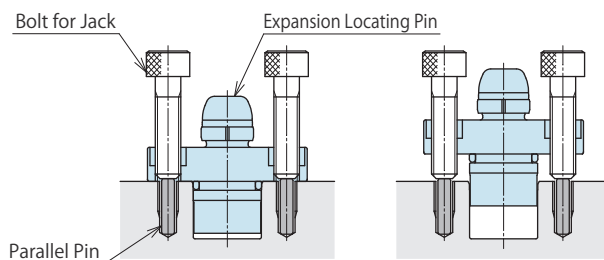
● Installation Notes

- 1) Check the Usable Fluid
 - Please use the appropriate fluid by referring to the Hydraulic Fluid List (P.1043).
- 2) Mounting Cylinder
 - Use all bolts with hex holes (grade 12.9) and tighten the body with a torque wrench as shown in the table below.
Tighten them evenly to prevent twisting or jamming.

Model No.	Thread Size	Tightening Torque (N·m)
VL VM VJ VK	M4×0.7	3.2

3) Removing Cylinder

- Remove with torque wrench in a parallel fashion when detaching.
- Protect the screw parts with parallel pins as shown in the graph below in order for the bolts used for jack not to damage the surface of mounting screws.



4) Port Location of Datum Cylinder

- Each port name is marked at the VJ/VK's flange area and at the side of VM's flange. Be careful of installation direction.

VM : HYD : Hydraulic Lock Port、 BLOW : Air Blow Port
Hydraulic pressure is supposed to be supplied from lock port

VJ : HYD : Hydraulic Lock Port、 BLOW : Air Blow Port
Regarding lock port, it is supposed to be supplied either from hydraulic lock port or from cylinder bottom surface area.

VK : HYD : Hydraulic Release Port、 BLOW : Air Blow Port
Hydraulic lock pressure is supplied from the bottom of cylinder.

※ VL doesn't have a mark of HYD, BLOW.

- 5) Please use air blow circuit with outside diameter.
 - φ 6 (inside diameter φ 4) or larger.
 - To do an effective air blow, it is recommended to use air piping with outside diameter φ 6 (inside diameter φ 4) or larger.

※ Please refer to P.1043 for common cautions.

• Installation Notes • Hydraulic Fluid List • Notes on Hydraulic Cylinder Speed Control Circuit
• Notes on Handling • Maintenance/Inspection • Warranty

High-Power
Series

Pneumatic Series

Hydraulic Series

Valve / Coupler
Hydraulic Unit

Manual Operation
Accessories

Cautions / Others

Hole Clamp

SFA
SFC

Swing Clamp

LHA
LHC
LHS
LHW
LT/LG
TLA-2
TLB-2
TLA-1

Link Clamp

LKA
LKC
LKW
LM/LJ
TMA-2
TMA-1

Work Support

LD
LC
TNC
TC

Air Sensing
Lift Cylinder

LLW

Compact Cylinder

LL
LLR
LLU
DP
DR
DS
DT

Block Cylinder

DBA
DBC

Control Valve

BZL
BZT
BZX/JZG

Pallet Clamp

VS
VT

Expansion
Locating Pin

VL
VM
VJ
VK

Pull Stud Clamp

FP
FQ

Customized
Spring Cylinder

DWA/DWB

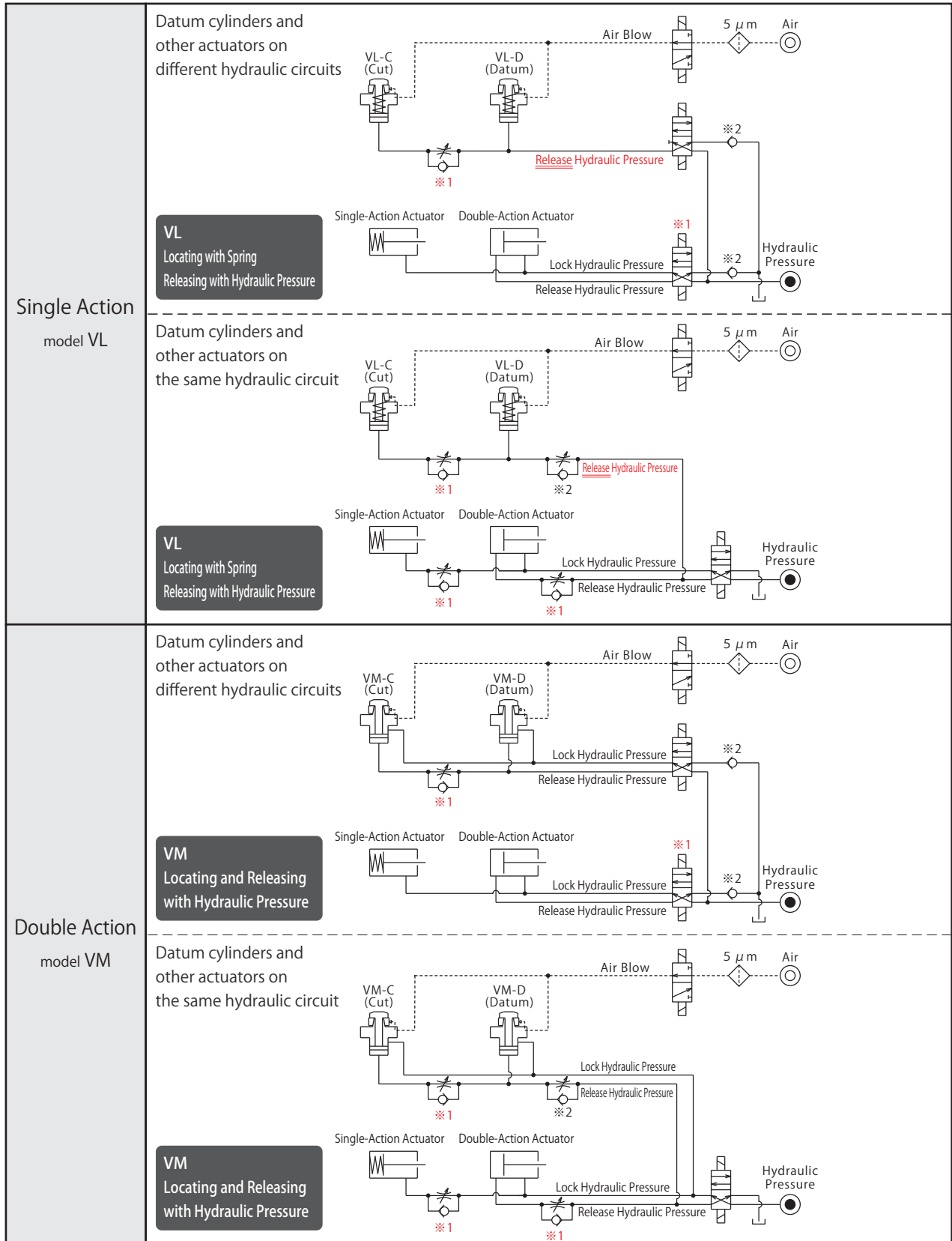
Cautions

● Notes on Hydraulic Cylinder Speed Control Unit Regarding to VL/VM



Please pay attention to the cautions below. Design the hydraulic circuit for controlling the action speed of hydraulic cylinder. Improper circuit design may lead to malfunctions and damages. Please review the circuit design in advance.

Circuit Reference



Notes

※1. Process order during LOCK operation should be " VL-D/VM-D (Datum)"→" VL-C/VM-C (Cut)"→ other actuator.

※2. When back pressure is produced in the tank port use a check valve (recommended cracking pressure: 0.04 MPa or less).

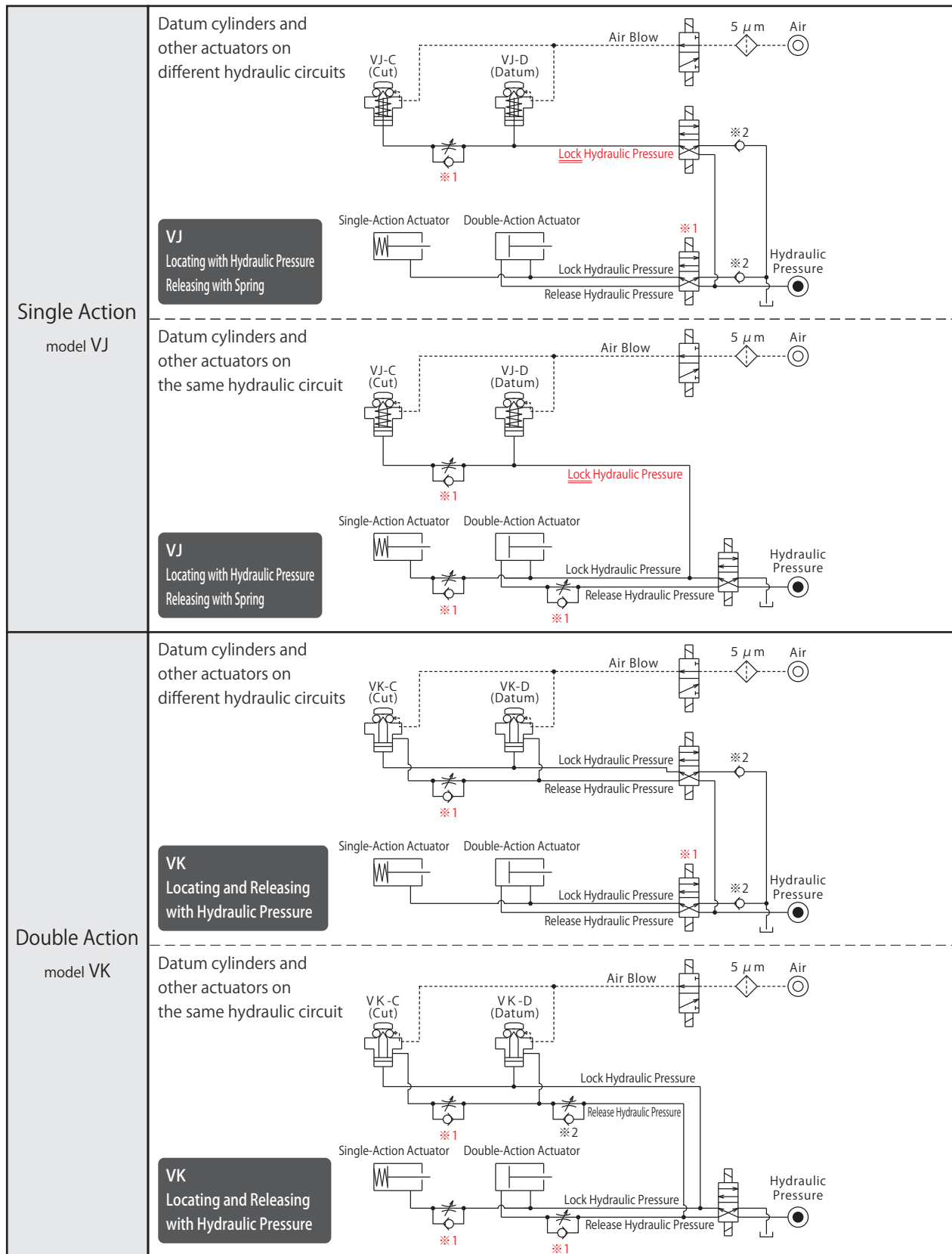
High-Power Series
Pneumatic Series
Hydraulic Series
Valve / Coupler Hydraulic Unit
Manual Operation Accessories
Cautions / Others
Hole Clamp
SFA
SFC
Swing Clamp
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DS
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Block Cylinder
DBA
DBC
Control Valve
BZL
BZT
BZX/JZG
Pallet Clamp
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Expansion Locating Pin
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VM
VJ
VK
Pull Stud Clamp
FP
FQ
Customized Spring Cylinder
DWA/DWB

● Notes on Hydraulic Cylinder Speed Control Unit Regarding to VJ/VK



Please pay attention to the cautions below. Design the hydraulic circuit for controlling the action speed of hydraulic cylinder. Improper circuit design may lead to malfunctions and damages. Please review the circuit design in advance.

Circuit Reference



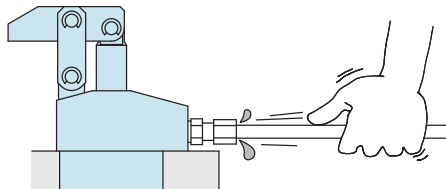
Notes

- ※1. Process order during LOCK operation should be " VJ-D/VK-D (Datum)"→" VJ-C/VK-C (Cut)"→ other actuator.
- ※2. When back pressure is produced in the tank port use a check valve (recommended cracking pressure: 0.04 MPa or less).

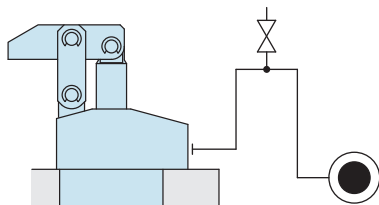
● Cautions

● Installation Notes (For Hydraulic Series)

- 1) Check the Usable Fluid
 - Please use the appropriate fluid by referring to the Hydraulic Fluid List.
- 2) Procedure before Piping
 - The pipeline, piping connector and fixture circuits should be cleaned by thorough flushing.
 - The dust and cutting chips in the circuit may lead to fluid leakage and malfunction.
 - There is no filter provided with Kosmek' s product except for a part of valves which prevents foreign materials and contaminants from getting into the circuit.
- 3) Applying Sealing Tape
 - Wrap with tape 1 to 2 times following the screw direction.
 - Pieces of the sealing tape can lead to oil leakage and malfunction.
 - In order to prevent a foreign substance from going into the product during the piping work, it should be carefully cleaned before working.
- 4) Air Bleeding of the Hydraulic Circuit
 - If the hydraulic circuit has excessive air, the action time may become very long. If air enters the circuit after connecting the hydraulic port or under the condition of no air in the oil tank, please perform the following steps.
 - ① Reduce hydraulic pressure to less than 2MPa.
 - ② Loosen the cap nut of pipe fitting closest to the clamp by one full turn.
 - ③ Wiggle the pipeline to loosen the outlet of pipe fitting.
Hydraulic fluid mixed with air comes out.



- ④ Tighten the cap nut after bleeding.
- ⑤ It is more effective to bleed air at the highest point inside the circuit or at the end of the circuit.
(Set an air bleeding valve at the highest point inside the circuit.)



5) Checking Looseness and Retightening

- At the beginning of the machine installation, the bolt and nut may be tightened lightly. Check the looseness and re-tighten as required.

● Hydraulic Fluid List

Maker	ISO Viscosity Grade ISO-VG-32	
	Anti-Wear Hydraulic Oil	Multi-Purpose Hydraulic Oil
Showa Shell Sekiyu	Tellus S2 M 32	Morlina S2 B 32
Idemitsu Kosan	Daphne Hydraulic Fluid 32	Daphne Super Multi Oil 32
JX Nippon Oil & Energy	Super Hyrando 32	Super Mulpus DX 32
Cosmo Oil	Cosmo Hydro AW32	Cosmo New Mighty Super 32
ExxonMobil	Mobil DTE 24	Mobil DTE 24 Light
Matsumura Oil	Hydol AW-32	
Castrol	Hyspin AWS 32	

Note As it may be difficult to purchase the products as shown in the table from overseas, please contact the respective manufacturer.

- High-Power Series
- Pneumatic Series
- Hydraulic Series
- Valve / Coupler Hydraulic Unit
- Manual Operation Accessories
- Cautions / Others

Cautions

- Installation Notes (For Hydraulic Series)
- Hydraulic Fluid List
- Notes on Hydraulic Cylinder Speed Control Circuit
- Notes on Handling
- Maintenance/Inspection
- Warranty

Company Profile

- Company Profile
- Our Products
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- Search by Alphabetical Order

Sales Offices

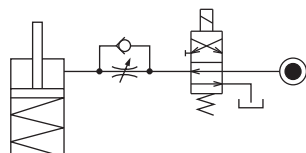
● Notes on Hydraulic Cylinder Speed Control Unit



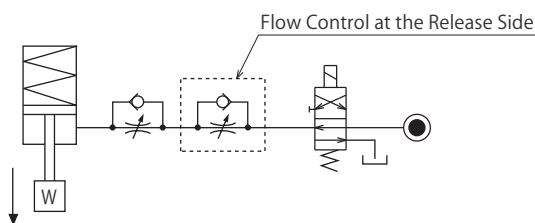
Please pay attention to the cautions below. Design the hydraulic circuit for controlling the action speed of hydraulic cylinder. Improper circuit design may lead to malfunctions and damages. Please review the circuit design in advance.

● Flow Control Circuit for Single Acting Cylinder

For spring return single acting cylinders, restricting flow during release can extremely slow down or disrupt release action. The preferred method is to control the flow during the lock action using a valve that has free-flow in the release direction. It is also preferred to provide a flow control valve at each actuator.



Accelerated clamping speed by excessive hydraulic flow to the cylinder may sustain damage. In this case add flow control to regulate flow. (Please add flow control to release flow if the lever weight is put on at the time of release action when using swing clamps.)



● Flow Control Circuit for Double Acting Cylinder

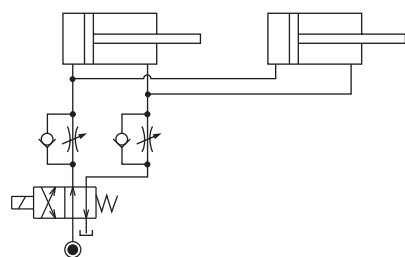
Flow control circuit for double acting cylinder should have meter-out circuits for both the lock and release sides. Meter-in control can have adverse effect by presence of air in the system.

However, in the case of controlling LKE, TMA, TLA, both lock side and release side should be meter-in circuit.

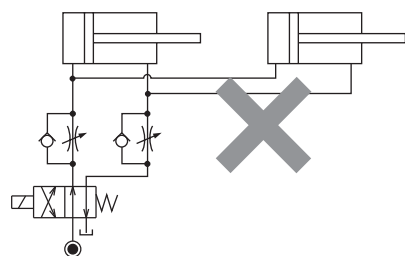
Refer to P.47 for speed adjustment of LKE.

For TMA and TLA, if meter-out circuit is used, abnormal high pressure is created, which causes oil leakage and damage.

【Meter-out Circuit】 (Except LKE/TMA/TLA)

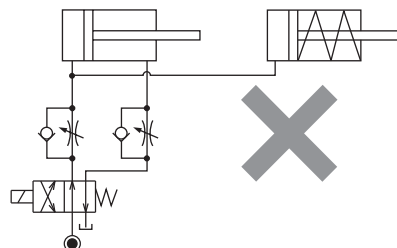


【Meter-in Circuit】 (LKE/TMA/TLA must be controlled with meter-in.)



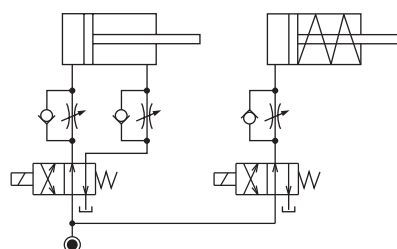
In the case of meter-out circuit, the hydraulic circuit should be designed with the following points.

- ① Single acting components should not be used in the same flow control circuit as the double acting components. The release action of the single acting cylinders may become erratic or very slow.

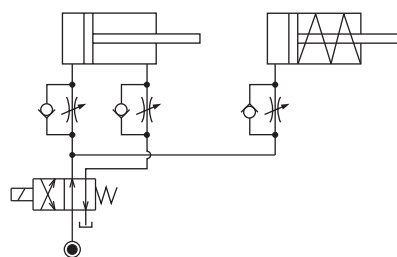


Refer to the following circuit when both the single acting cylinder and double acting cylinder are used together.

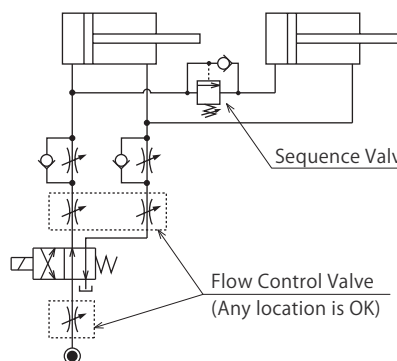
- Separate the control circuit.



- Reduce the influence of double acting cylinder control unit. However, due to the back pressure in tank line, single action cylinder is activated after double action cylinder works.



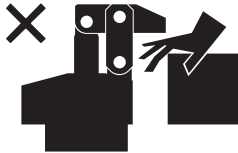
- ② In the case of meter-out circuit, the inner circuit pressure may increase during the cylinder action because of the fluid supply. The increase of the inner circuit pressure can be prevented by reducing the supplied fluid beforehand via the flow control valve. Especially when using sequence valve or pressure switches for clamping detection. If the back pressure is more than the set pressure then the system will not work as it is designed to.



● Cautions

● Notes on Handling

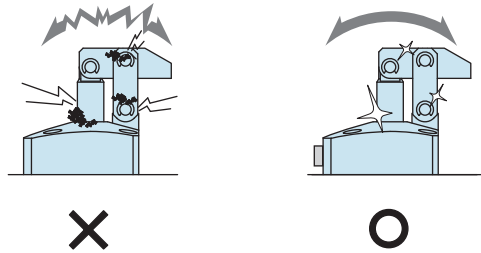
- 1) It should be handled by qualified personnel.
 - The hydraulic machine and air compressor should be handled and maintained by qualified personnel.
- 2) Do not handle or remove the machine unless the safety protocols are ensured.
 - ① The machine and equipment can only be inspected or prepared when it is confirmed that the preventive devices are in place.
 - ② Before the machine is removed, make sure that the above-mentioned safety measures are in place. Shut off the air of hydraulic source and make sure no pressure exists in the hydraulic and air circuit.
 - ③ After stopping the machine, do not remove until the temperature cools down.
 - ④ Make sure there is no abnormality in the bolts and respective parts before restarting the machine or equipment.
- 3) Do not touch clamps (cylinder) while clamps (cylinder) is working. Otherwise, your hands may be injured due to clinching.



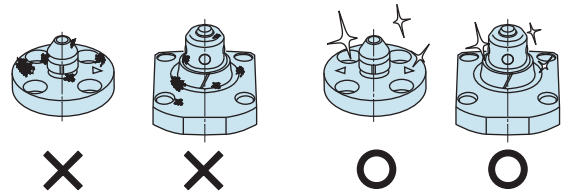
- 4) Do not disassemble or modify.
 - If the equipment is taken apart or modified, the warranty will be voided even within the warranty period.

● Maintenance and Inspection

- 1) Removal of the Machine and Shut-off of Pressure Source
 - Before the machine is removed, make sure that the above-mentioned safety measures are in place. Shut off the air of hydraulic source and make sure no pressure exists in the hydraulic and air circuit.
 - Make sure there is no abnormality in the bolts and respective parts before restarting.
- 2) Regularly clean the area around the piston rod and plunger.
 - If it is used when the surface is contaminated with dirt, it may lead to packing seal damage, malfunctioning, fluid leakage and air leaks.



- 3) Please clean out the reference surface regularly (taper reference surface and seating surface) of locating machine. (VS/VT/VL/VM/VJ/VK/WVS/WM/WK/VX/VXF)
 - Location products, except VX/VXF model, can remove contaminants with cleaning functions. When installing pallets make sure there is no thick sludge like substances on pallets.
 - Continuous use with dirt on components will lead to locating functions not work properly, leaking and malfunction.



- 4) If disconnecting by couplers on a regular basis, air bleeding should be carried out daily to avoid air mixed in the circuit.
- 5) Regularly tighten nuts, bolts, pins, cylinders and pipe line to ensure proper use.
- 6) Make sure the hydraulic fluid has not deteriorated.
- 7) Make sure there is smooth action and no abnormal noise.
 - Especially when it is restarted after left unused for a long period, make sure it can be operated correctly.
- 8) The products should be stored in the cool and dark place without direct sunshine or moisture.
- 9) Please contact us for overhaul and repair.

● Warranty

1) Warranty Period

- The product warranty period is 18 months from shipment from our factory or 12 months from initial use, whichever is earlier.

2) Warranty Scope

- If the product is damaged or malfunctions during the warranty period due to faulty design, materials or workmanship, we will replace or repair the defective part at our expense.

Defects or failures caused by the following are not covered.

- ① If the stipulated maintenance and inspection are not carried out.
- ② If the product is used while it is not suitable for use based on the operator's judgment, resulting in defect.
- ③ If it is used or handled in inappropriate way by the operator.
(Including damage caused by the misconduct of the third party.)
- ④ If the defect is caused by reasons other than our responsibility.
- ⑤ If repair or modifications are carried out by anyone other than Kosmek, or without our approval and confirmation, it will void warranty.
- ⑥ Other caused by natural disasters or calamities not attributable to our company.
- ⑦ Parts or replacement expenses due to parts consumption and deterioration.
(Such as rubber, plastic, seal material and some electric components.)

Damages excluding from direct result of a product defect shall be excluded from the warranty.

Sales Offices

Sales Offices across the World

Japan	TEL. +81-78-991-5162	FAX. +81-78-991-8787
Overseas Sales	KOSMEK LTD. 1-5, 2-chome, Murotani, Nishi-ku, Kobe-city, Hyogo, Japan 651-2241 〒651-2241 兵庫県神戸市西区室谷2丁目1番5号	
USA	TEL. +1-630-241-3465	FAX. +1-630-241-3834
KOSMEK (USA) LTD.	1441 Branding Avenue, Suite 110, Downers Grove, IL 60515 USA	
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KOSMEK (CHINA) LTD. 考世美(上海)貿易有限公司	21/F, Orient International Technology Building, No.58, Xiangchen Rd, Pudong Shanghai 200122., P.R.China 中国上海市浦东新区向城路58号东方国际科技大厦21F室 200122	
Thailand	TEL. +66-2-715-3450	FAX. +66-2-715-3453
Thailand Representative Office	67 Soi 58, RAMA 9 Rd., Suanluang, Suanluang, Bangkok 10250, Thailand	
Taiwan (Taiwan Exclusive Distributor)	TEL. +886-2-82261860	FAX. +886-2-82261890
Full Life Trading Co., Ltd. 盈生貿易有限公司	16F-4, No.2, Jian Ba Rd., Zhonghe District, New Taipei City Taiwan 23511 台湾新北市中和區建八路2號 16F-4 (遠東世紀廣場)	
Philippines (Philippines Exclusive Distributor)	TEL.+63-2-310-7286	FAX. +63-2-310-7286
G.E.T. Inc, Phil.	Victoria Wave Special Economic Zone Mt. Apo Building, Brgy. 186, North Caloocan City, Metro Manila, Philippines 1427	
Europe (Europe Exclusive Distributor)	TEL. +43-463-287587-10	FAX. +43-463-287587-20
KOS-MECH GmbH	Schleppeplatz 2 9020 Klagenfurt Austria	
Indonesia (Indonesia Exclusive Distributor)	TEL. +62-21-5818632	FAX. +62-21-5814857
P.T PANDU HYDRO PNEUMATICS	Ruko Green Garden Blok Z- II No.51 Rt.005 Rw.008 Kedoya Utara-Kebon Jeruk Jakarta Barat 11520 Indonesia	

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Osaka Sales Office	〒651-2241 兵庫県神戸市西区室谷2丁目1番5号	
Overseas Sales		
Tokyo Sales Office	TEL.048-652-8839	FAX.048-652-8828
	〒331-0815 埼玉県さいたま市北区大成町4丁目81番地	
Nagoya Sales Office	TEL.0566-74-8778	FAX.0566-74-8808
	〒446-0076 愛知県安城市美園町2丁目10番地1	
Fukuoka Sales Office	TEL.092-433-0424	FAX.092-433-0426
	〒812-0006 福岡県福岡市博多区上牟田1丁目8-10-101	

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Asia Detailed Map



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