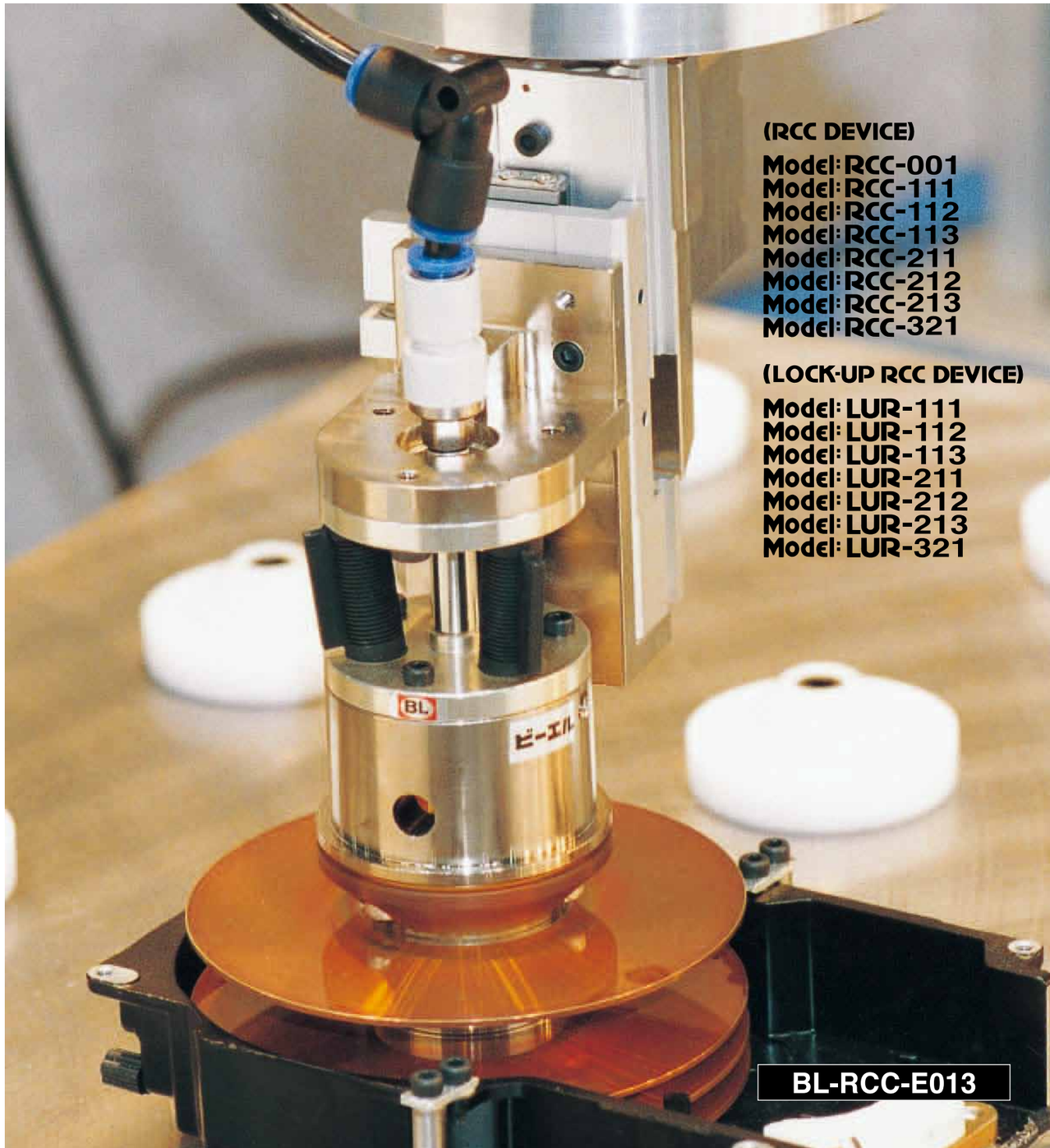
BL AUTOTEC

BL WRIST COMPLIANCER™
(Remote Center Compliance)

Catalog



http://www.bl-autotec.co.jp

BANDO BANDO GROUP

BL AUTOTEC, LTD.

3-17, Meiwa-dori, 3-chome, Hyogo-ku, Kobe, 652-0883, Japan
TEL +81-78-682-2611 FAX +81-78-682-2614
E-mail : info@bl-autotec.co.jp

2011.9

■For orders, contact the following distributor:

11C0910

(RCC DEVICE)

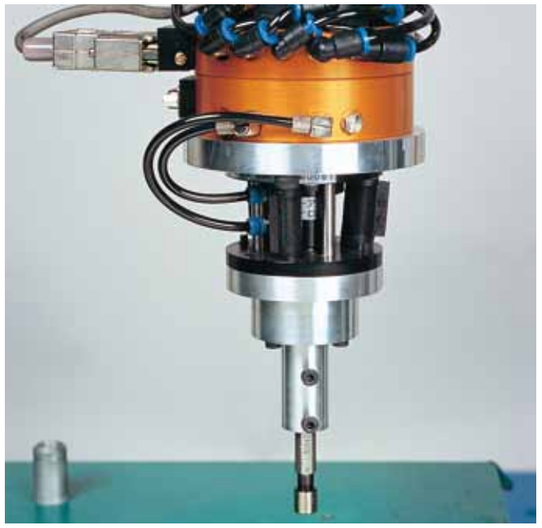
The RCC Device is designed to perform remote compliance functions, incorporating durable, yet flexible rubber mount elements. The device, which is installed between the robot arm (or other automated assembly equipment) and the gripper, simplifies assembly because the device corrects lateral, cocking (diagonal) and/or torsional positional misaligment. The device reduces the number of assembly defects and lost time due to misalignment, and helps prevent equipment damage. The result is improved product quality and manufacturing productivity.

Model: ❶RCC-001-BS RC❷112-BS RCC-2❷BS RCC-321-R❷

(LOCK-UP RCC DEVICE)

The Lock-up RCC Device is a device for correcting positional misalignment when robots or other automated assembly equipment are used for insertion tasks. The LUR Series incorporates a pneumatic lockup mechanism in a modified RCC Device which stops lateral vibration of the shaft when the robot arm moves. This allows for greater speed and acceleration in the operation and reduces cycle time, as the robot does not need to wait for the lateral vibration to stop before performing the insertion function.

Model: ❶LUR-111 L❷-212 LUR-❷1



Applications

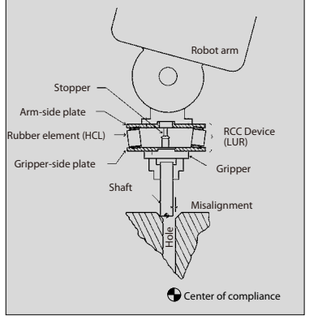
Assembly

- ■VTR heads
- ■Magnetic disc equipment
- ■CD players
- ■Motors
- ■LSI inspection equipment
- ■PCB
- ■Engine valves
- ■Automatic transmission valves
- ■Alternators
- ■Car air-conditioning units
- ■Car stereos
- ■Medical equipment

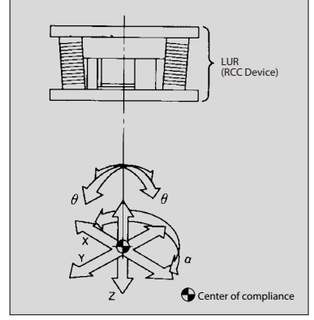
Non-assembly

- ■Aircraft body plate riveting
- ■Aircraft body plate grinding and deburring
- ■Reaming
- ■Tool changing and positioning
- ■Automated measuring (inspection)
- ■Mold positioning

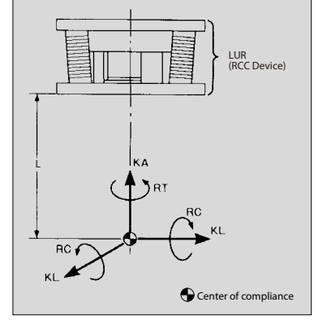
(Installation)



(Positional error correction direction)



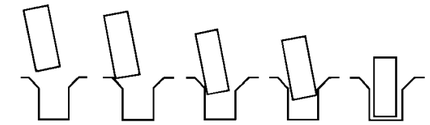
(Stiffness in each direction)



Guide to Model Selection

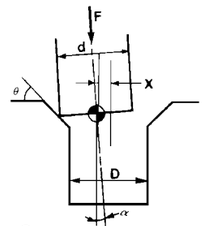
Lateral stiffness (K_L) and cocking stiffness (R_C) are the two most important properties in selecting a suitable device. The values K_L and R_C required for correct assembly can be determined using the basic principles of dynamics. The following example of the insertion of a shaft into a hole demonstrates the significance of the values K_L and R_C.

1. From initial approach to complete insertion of the shaft



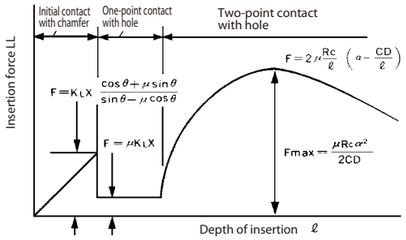
(a) Approach (b) Initial contact with chamfer (c) One-point contact with hole (d) Two-point contact with hole (e) Complete insertion

2. Defining misalignment and other terms



F: Insertion force (kgf) X: Lateral misalignment (cm)
α : Cocking misalignment (rad) D: Hole diameter (cm)
d: Shaft diameter (cm) μ : Coefficient of friction
θ : Chamfer angle (deg) C: Clearance ratio (D-d)/D

3. Relationship between insertion force and depth of insertion



4. Determination of the K_L and R_C values required for complete insertion

These values can be calculated using the following equations.

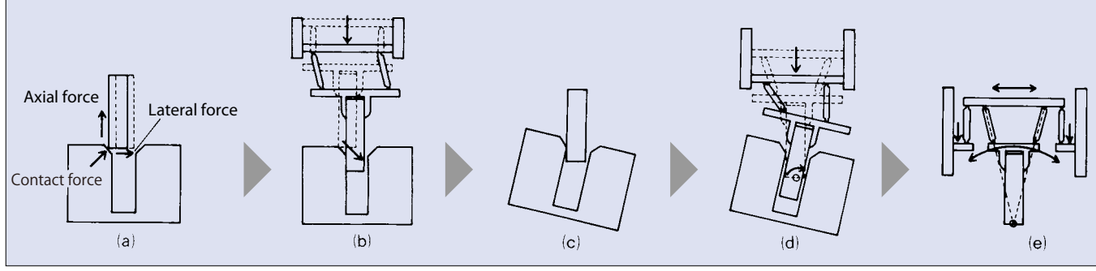
$$K_L = \frac{F}{X}\left(\frac{\sin\theta - \mu\cos\theta}{\cos\theta + \mu\sin\theta}\right) \qquad R_C = \frac{2CDF}{\mu\alpha^2}$$

※Complete insertion can only be achieved if the selected device has actual values for K_L and R_C which are less than the theoretical values calculated using the equations above. Taking this into consideration, as well as other factors such as dimensions and weight, choose the most suitable model for your requirement.

How the Remote Center Compliance (RCC) Works

The idea of Remote Center Compliance was developed at the Charles Stark Draper Research Laboratory of M.I.T. (Massachusetts, U.S.A.) in 1977.
The following explanation, with sketches below, describes how an assembly or insertion takes place when an RCC is used.

(a) Lateral error in position between the hole and shaft exerts a horizontal force on the leading end of the shaft as a result of the chamfer.
(b) Acting approximately through the center of compliance, the horizontal force causes the shaft to translate laterally into the hole, permitting easy insertion.
(c) Now, let's suppose the axis of the hole is not parallel with the axis of the shaft.
(d) Positioning itself laterally, the shaft will enter the hole. However, the leading edge will contact one side of the hole and the edge of the leading hole will contact the other side of the shaft, thus causing a moment. Rotation about the compliant center will allow the shaft to line up with the hole and be easily inserted.
(e) By combining the two modes of freedom a usefully compliant device has been developed.



(RCC DEVICE) Specifications

Model		RCC-001-BSL ※1	RCC-001-BS	RCC-111-BS	RCC-112-BS	RCC-113-BS	RCC-211- RH RS BH BS	RCC-212- RH RS BH BS	RCC-213- RH RS BH BS	RCC-321- RH RS
Axial force capacity	Compression N (kgf)	294 (30)	294 (30)	1,274 (130)	490 (50)	1,274 (130)	1,323 (135)	637 (65)	1,323 (135)	2,646 (270)
	Tension N (kgf)	49 (5)	49 (5)	137 (14)	137 (14)	225 (23)	137 (14)	137 (14)	225 (23)	264 (27)
Maximum payload (ref) ※2 N (kg)		19.6 (2)	19.6 (2)	49 (5)	49 (5)	88 (9)	49 (5)	49 (5)	88 (9)	98 (10)
L mm		—	40	91	52	46	163	114	107	160
Stiffness	KL: Lateral (X・Y) kgf/cm	4.6	8.5	11.6	7.4	26.8	17.9	9.8	30.4	32.1
	RC: Cocking (θ) kgf・cm/rad	—	430	4,020	1,300	4,470	4,720	2,760	7,600	20,700
	KA: Axial (Z) kgf/cm	730	720	2,420	890	2,980	3,210	1,340	3,210	5,360
	RT: Torsional (α) kgf・cm/rad	12	10	29	22	81	86	63	240	310
Device weight g		80	80	160	160	160	230～270	230～270	230～270	420～460
Error Correction Capacity (Maximum allowable displacement)	Lateral (X・Y) mm	±2.5	±2.5	±2.8	±2.8	±2.8	±3.8	±3.8	±3.8	±5.1
	Cocking (θ) deg	—	±2.0	±1.1	±2.0	±2.0	±1.0	±1.3	±1.4	±1.4
	Torsional (α) deg	—	—	±7.5	±7.5	±7.5	±7.0	±7.0	±7.0	±8.5
Maximum torque (α) [torsional direction] N・m(kgf・cm)		—	—	4.4 (45)	4.4 (45)	4.4 (45)	6.8 (70)	6.8 (70)	8.3 (85)	11.2 (115)
Allowable temperature and humidity ranges		0～55℃, 0～90% (Non-condensing)								

Note : 1. L is the distance between the tool gripper and the center of compliance.
2. The values for rigidity in the table above are at the center of elasticity.
3. Both the plates and the stopper are made of aluminium.
4. The amount of each angle error correction applies only when the insertion is carried out at the center of the compliance.

RCC Device Code

RCC-□□□-□□

- Gripper-side plate
  H= Large locating hole
  S= Small locating hole
- Arm-side plate
  R= Small locating hole
  B= Small locating lip
- Rubber element (HCL) type
  01=HCL-01 , 11=HCL-11
  12=HCL-12 , 13=HCL-13
  21=HCL-21
- Outside diameter of device
  0 = 45mm , 1 = 61mm
  2 = 89mm , 3 = 98mm
- Remote Center Compliance

Notes on Installation

- Ensure that the tip of the object to be inserted coincides with the center of compliance.
- To prevent possible damage to the device, do not displace the device beyond the error correction range in each direction and do not torque it in the rotational direction.
- The RCC-001-BSL and RCC-001-BS are structured so as to be equipped with only one stopper, with no control over displacements in the rotation direction. This means that extra care should be taken to not give rotational displacement more than 14 degrees.
- Please contact BL Autotec for special application use.

※1 The RCC-001-BSL corrects only horizontal errors.
※2 The speed acceleration/reduction caused by the movement of the robot or the like may roll the rubber element of the RCC device. (If the robot movement produces speed acceleration/reduction, then use the Lock-up RCC device.)

WRIST COMPLIANCER™

(LOCK-UP RCC DEVICE) Specifications

Model		LUR-111	LUR-112	LUR-113	LUR-211	LUR-212	LUR-213	LUR-321
Axial force capacity	Compression N (kgf)	1,274 (130)	490 (50)	1,274 (130)	1,274 (130)	490 (50)	1,274 (130)	2,646 (270)
	Tension N (kgf)	137 (14)	137 (14)	225 (23)	137 (14)	137 (14)	225 (23)	264 (27)
Maximum payload N (kg)		49 (5)	49 (5)	88 (9)	49 (5)	49 (5)	88 (9)	98 (10)
L mm		107	60	55	163	114	107	160
Stiffness	KL: Lateral (X・Y) kgf/cm	13.2	7.6	26.8	17.9	9.8	30.4	32.1
	RC: Cocking (θ) kgf・cm/rad	4,110	1,830	6,220	4,720	2,760	7,600	20,700
	KA: Axial (Z) kgf/cm	2,480	900	2,990	3,210	1,340	3,210	5,360
	RT: Torsional (α) kgf・cm/rad	39	29	105	86	63	240	310
Positional Error Correction Capacity (Maximum allowable displacement)	Lateral (X・Y) mm	±2						
	Cocking (θ) deg	±1°						
	Axial (Z) mm	±0.5						
	Torsional (α) deg	±6°						
Device weight g		270			380			560
Lock up mechanism	Axial lock up	Lateral, cocking directions						
	Lock pneumatic port	M3×1						
	Unlock pneumatic port	M3×1						
	Air pressure Mpa(kgf/cm²)	0.39～0.68（4～7）						
Repeatability mm		±0.1						
Allowable temperature and humidity ranges		0～55℃, 0～90% (Non-condensing)						

Note : 1. L is the distance between the tool gripper and the center of compliance.
2. The values for rigidity in the table above are at the center of elasticity.
3. Both the plates and the stopper are made of aluminium.
4. The amount of each angle error correction applies only when the insertion is carried out at the center of the compliance.

LUR Code

LUR-□□□

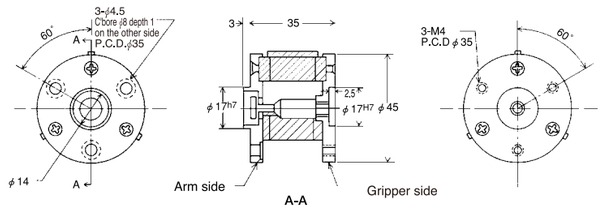
- Rubber element (HCL) type
  11=HCL-11 , 12=HCL-12
  13=HCL-13 , 21=HCL-21
- Outside diameter of device
  1=65mm , 2=89mm
  3=98.5mm
- Lock-up RCC Device

Note on Installation

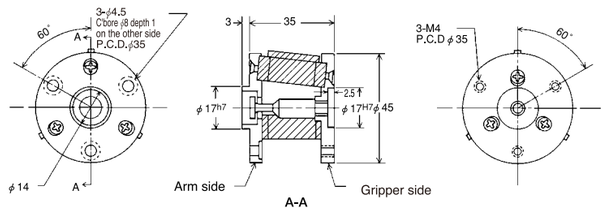
- Ensure that the tip of the object to be inserted coincides with the center of compliance.
- To prevent possible damage to the device, do not displace the device beyond the error correction range in each direction and do not torque it in the rotational direction.
- To lock/unlock the floated device, switch between the lock and unlock port using pneumatic pressure. Lock the device before each insertion and unlock the device before moving it.
- Take note that the lockup axis works in the horizontal and angular (when the axis is vertically oriented) directions, but not in the rotational direction.

(RCC DEVICE)Dimensions

RCC-001-BSL

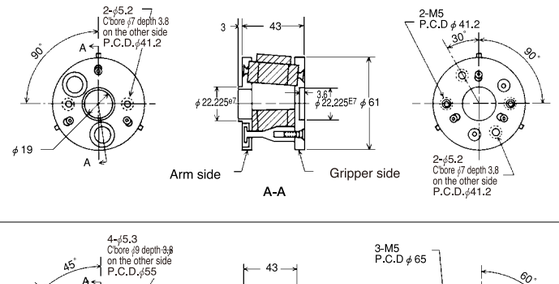


RCC-001-BS

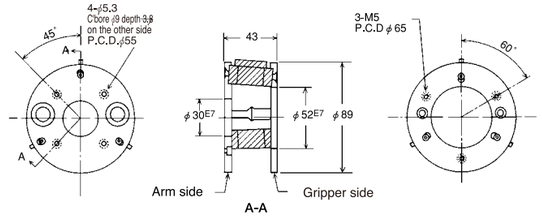


RCC-111-BS
RCC-112-BS
RCC-113-BS

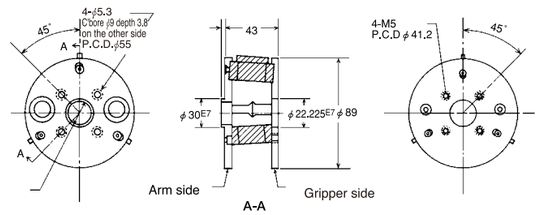
Note: 5-M5 bolts are
provided with the products.



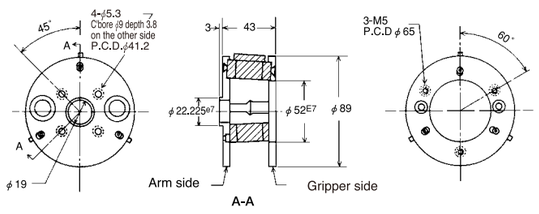
RCC-211-RH
RCC-212-RH
RCC-213-RH



RCC-211-RS
RCC-212-RS
RCC-213-RS



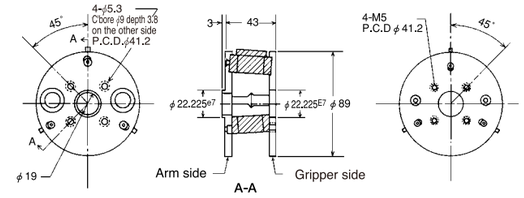
RCC-211-BH
RCC-212-BH
RCC-213-BH



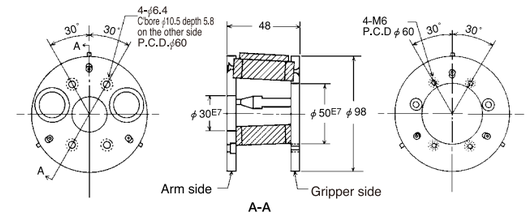
BL WRIST COMPLIANCER™

(RCC DEVICE)Dimensions

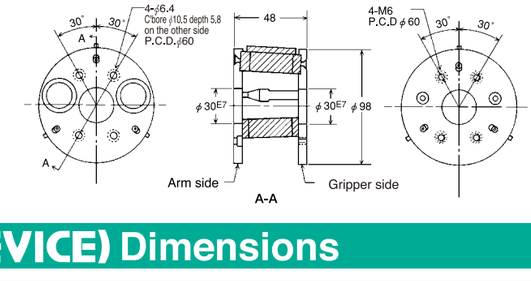
RCC-211-BS
RCC-212-BS
RCC-213-BS



RCC-321-RH

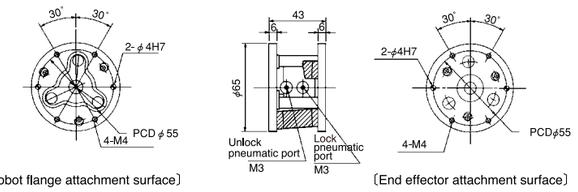


RCC-321-RS

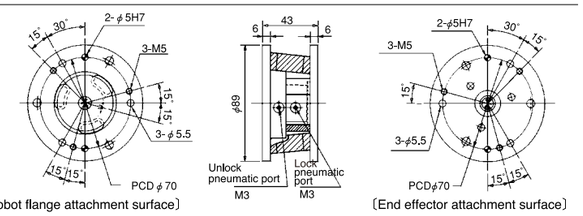


(LOCK-UP RCC DEVICE) Dimensions

LUR-111
LUR-112
LUR-113



LUR-211
LUR-212
LUR-213



LUR-321