



**FLEXIBLE DEVICE  
ENDURANCE TEST**

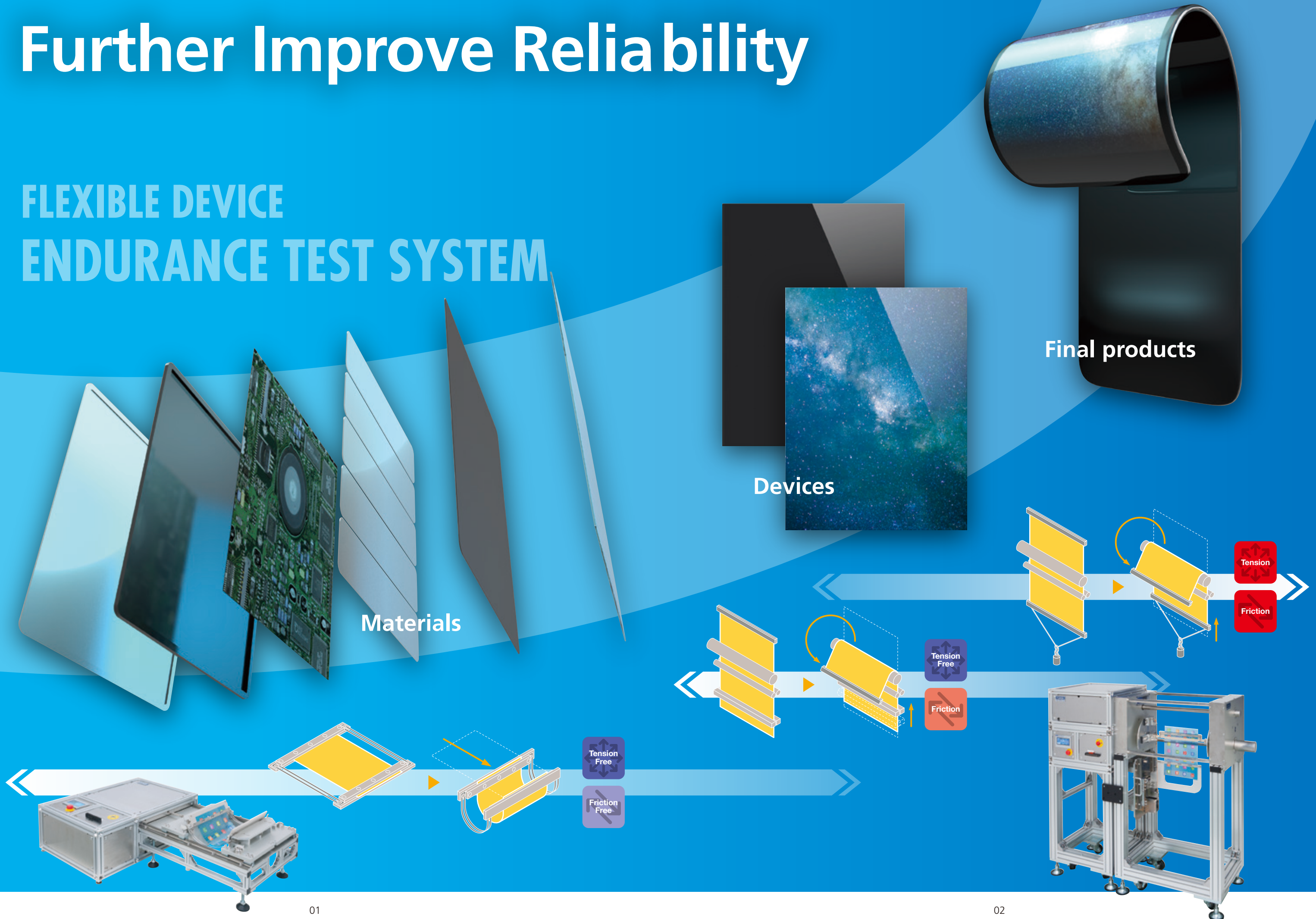


**ENVIRONMENTAL TEST**



# Further Improve Reliability

## FLEXIBLE DEVICE ENDURANCE TEST SYSTEM

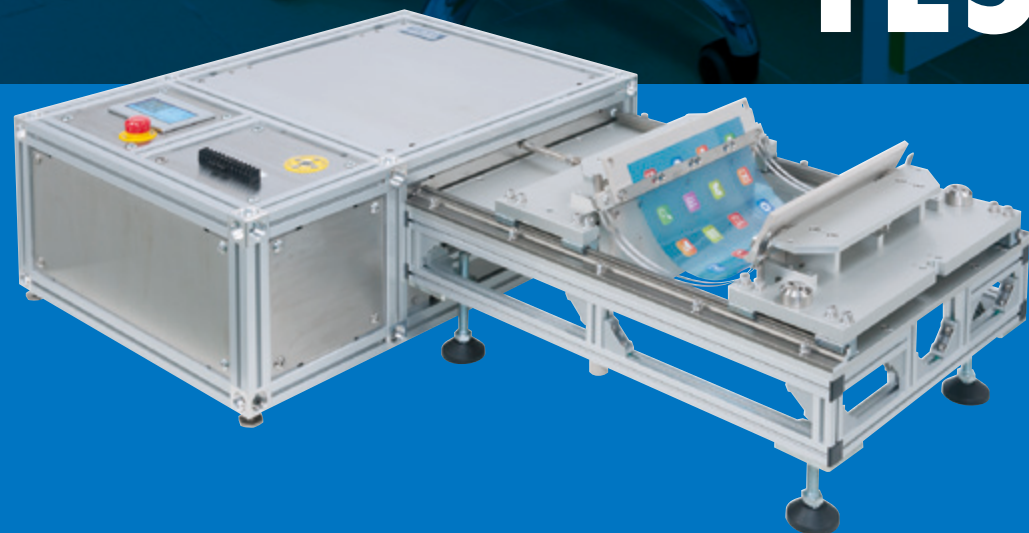




# New Standard

## ENDURANCE TEST

## ENVIRONMENTAL TEST





New Standard

**ENDURANCE  
TEST**

**ENVIRONMENTAL  
TEST**

# ENDURANCE TEST SYSTEM

Flexible Device Endurance Test

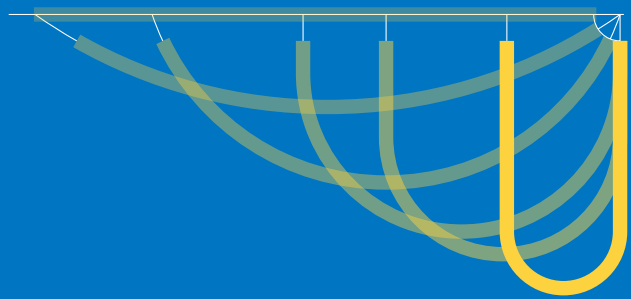
## Tension-Free U-shape Folding Test

Folding Test Without Tension and Friction.

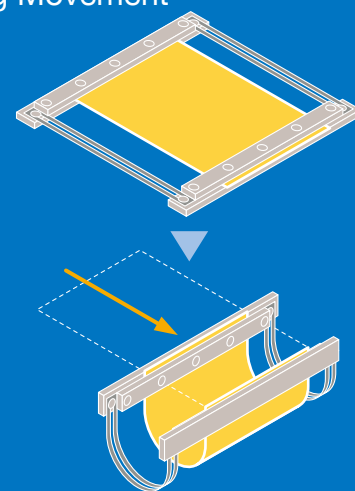
The bending load is applied by having one side of the sample move straight towards the other side. The sample only receives bending load so there are no applied tension or friction.



### Basic Movement



### Jig Movement



Set the sample flat on the tilt clamp. The equipment will repeat flat and bend motion. When bending, the tilt clamp moves downward so the sample would bend in natural U-shape. It is possible to perform vertical tests by setting the tilt clamp up right.

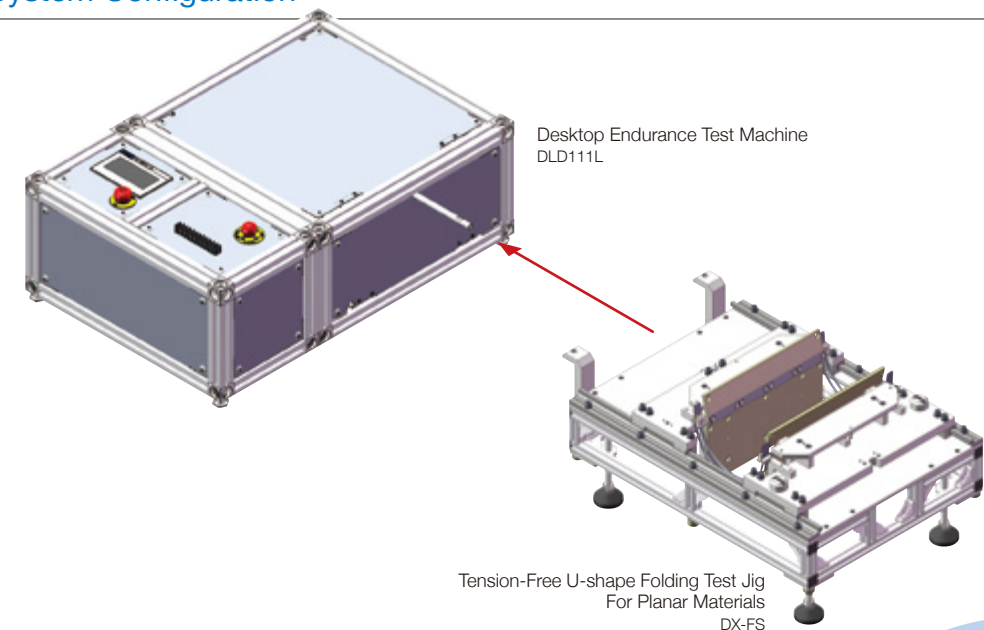
The Endurance Test System Which Realizes  
Tension-Free U-shape Folding Test

DLD-FS

Desktop Endurance Test Machine

Tension-Free U-shape Folding Test For Planar Materials

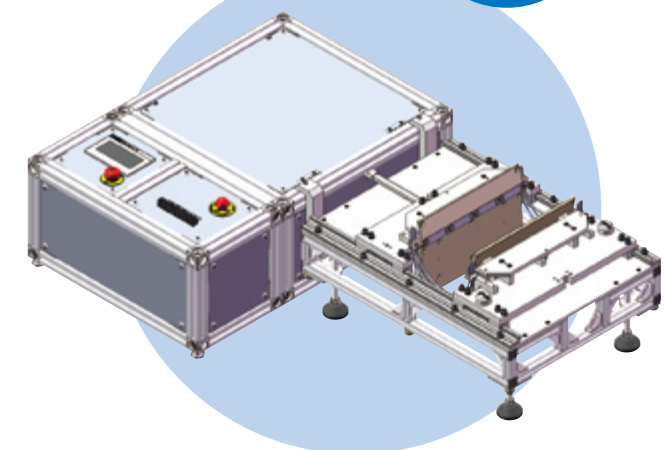
### System Configuration



Assembly  
Completed

Folding test without tension and friction on the sample.  
Folding test without tension and friction on planar samples such as film or FPC can be performed.

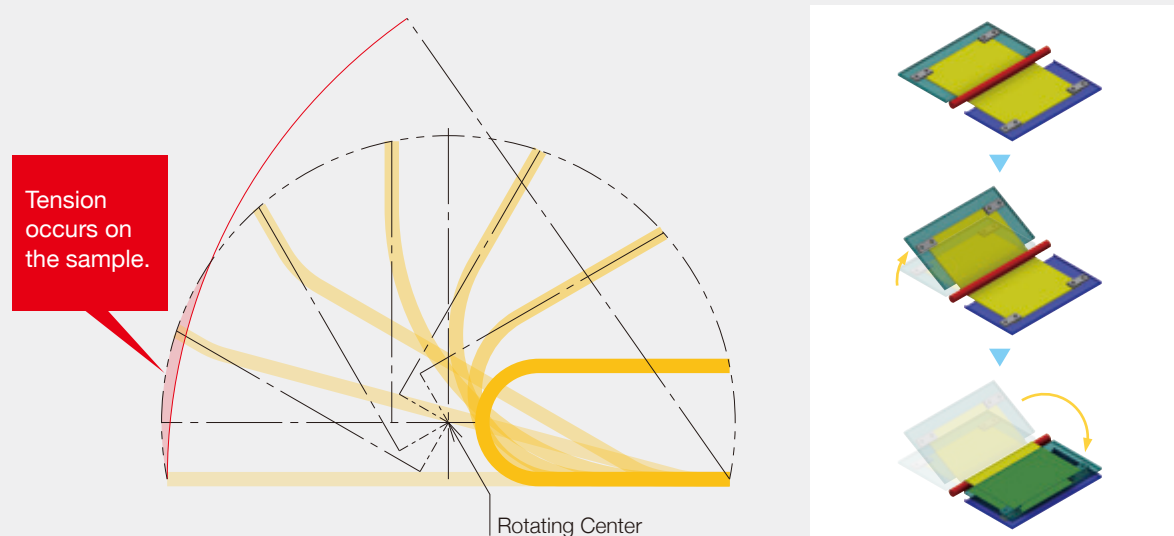
Perform natural folding test.  
This machine allows the sample to fold in natural form by utilizing the elasticity of the sample itself. Or it can create a folding with tiny radius using the guide plate.  
(Patent Pending)



A safety cover is available to protect the moving section.

### Issues During General Folding Test

When conducting tests with equipments shown in the right diagram, a large tension occurs on the sample when the test starts. The cause of this is clear when drawing a circle with radius the same length as the sample on the movement track of the test machine, shown on left. As shown in red in the diagram, the length of the sample is too short against the movement track of the clamp. If one uses a rod, this becomes more apparent. This causes the unexpected breaks and disperse in the test results in actual tests.





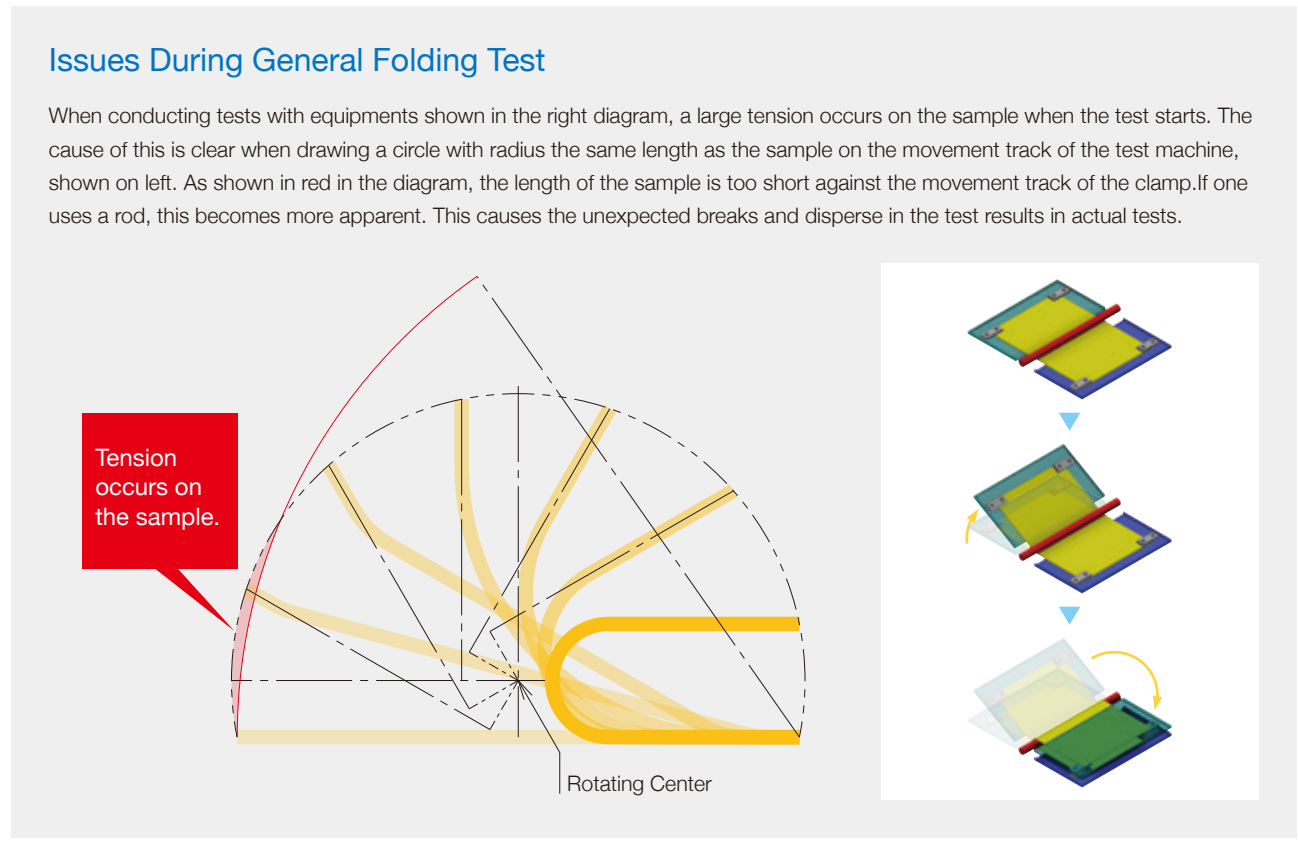
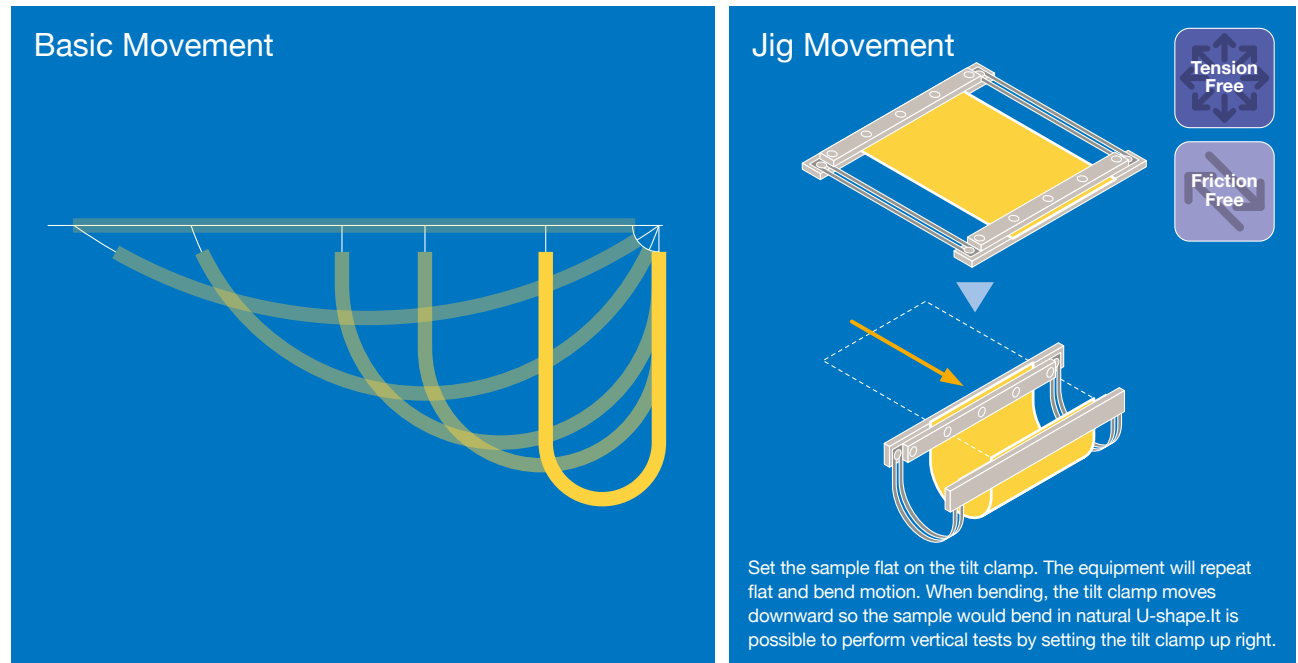
# ENDURANCE TEST

Flexible Device Endurance Test

## Tension-Free U-shape Folding Test

Folding Test Without Tension and Friction.

The bending load is applied by having one side of the sample move straight towards the other side. The sample only receives bending load so there are no applied tension or friction.



Environmental Endurance Test System Which Realizes Tension-Free U-shape Folding Test

CL09-typeD01-FSC90

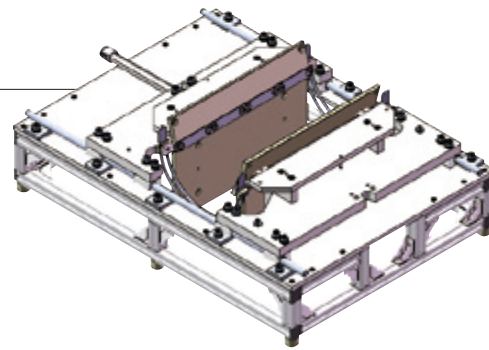
Constant Temperature and Humidity Environment Endurance Test Machine

Tension-Free U-shape Folding Environment Test For Planar Materials

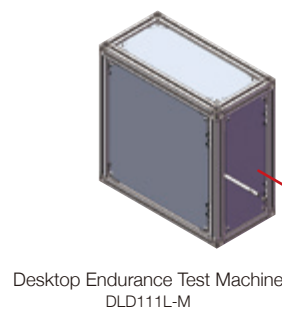
Test Jig

Tension-Free U-shape Folding Test Jig For Planar Materials

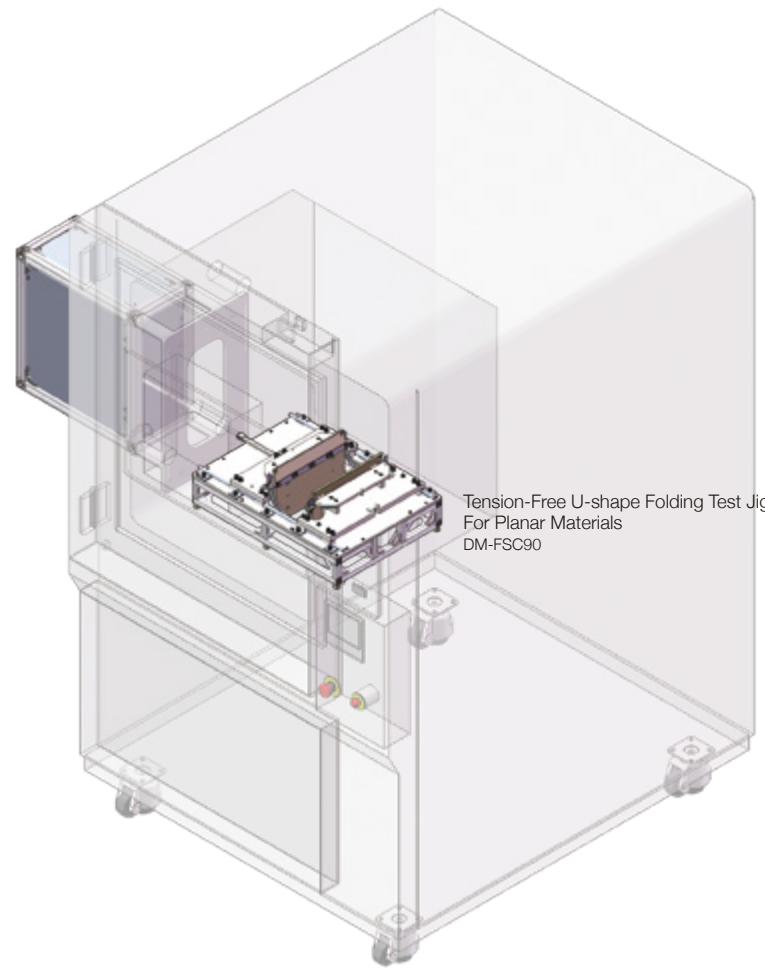
DM-FSC90



System Configuration



Jig to be attached to the Base Unit  
CL09-typeD01-CU

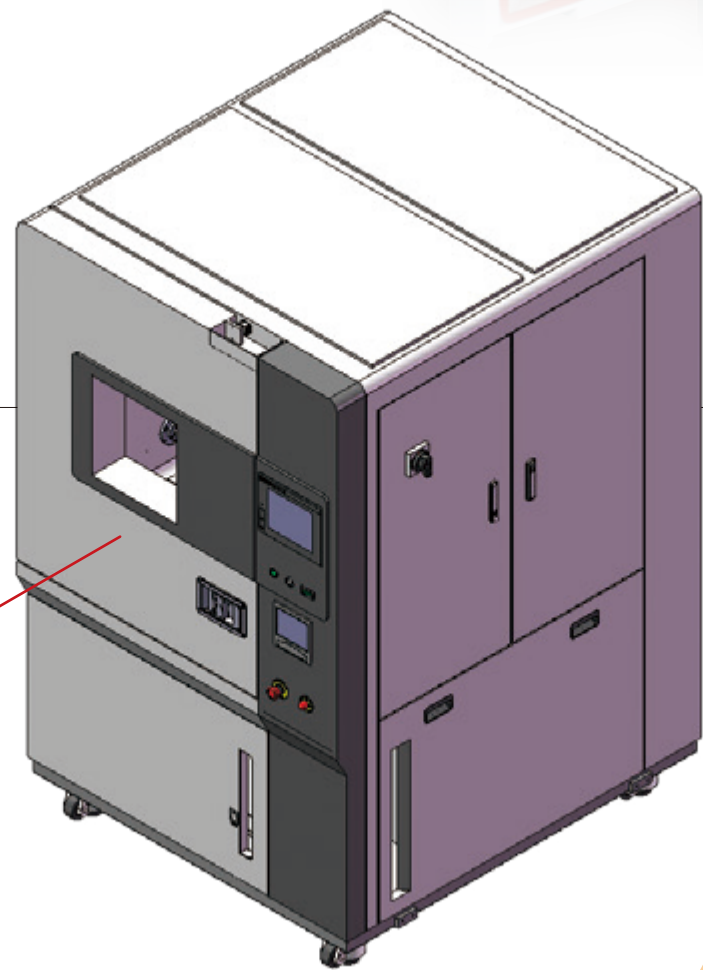


Folding test without tension and friction on the sample in constant temperature and humidity environment.

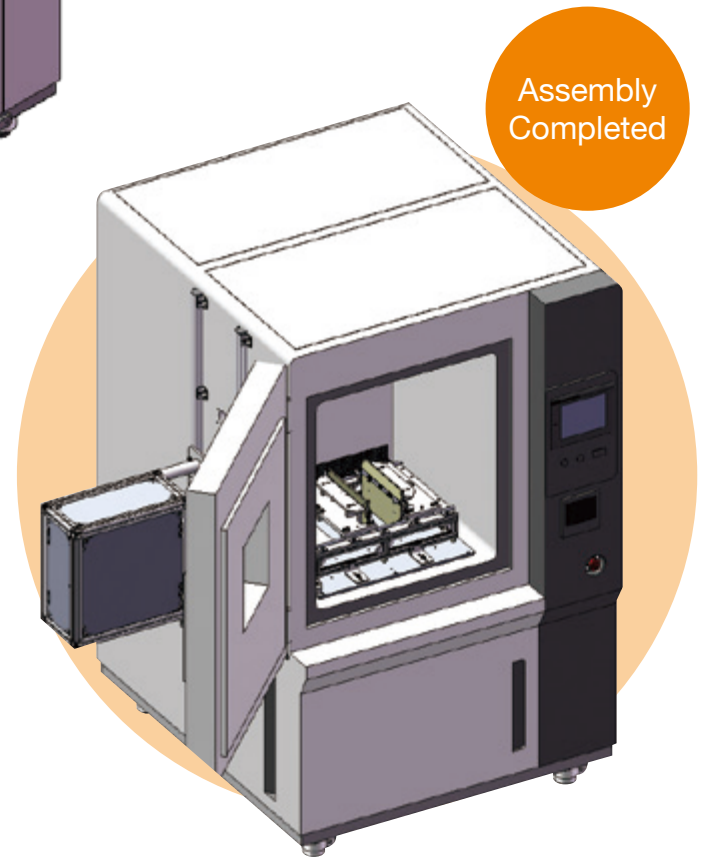
Folding test without tension and friction on planar samples such as film or FPC can be performed in constant temperature and humidity environment.

Perform natural folding test.

This machine allows the sample to fold in natural form by utilizing the elasticity of the sample itself. Or it can create a folding with tiny radius using the guide plate. (Patent Pending)



Thermo-hygrostat  
typeD01



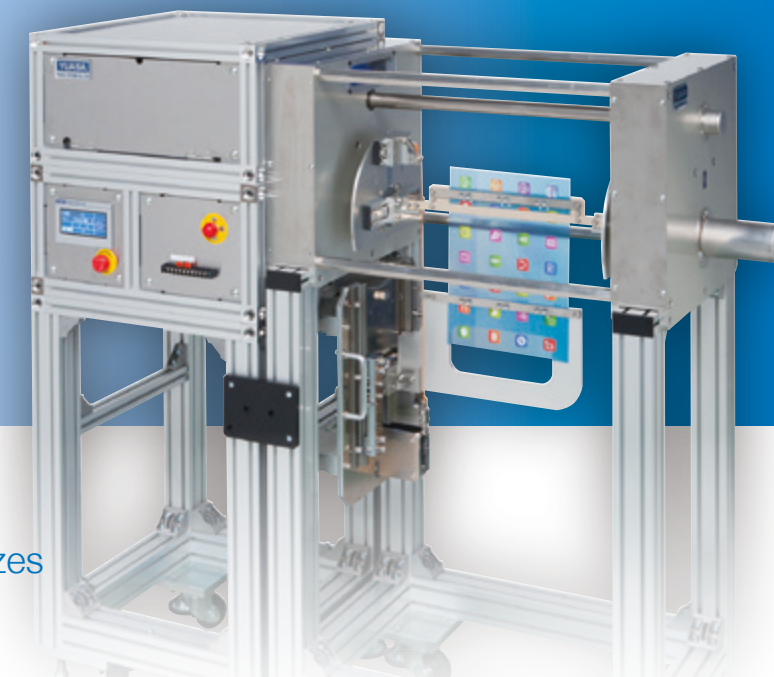
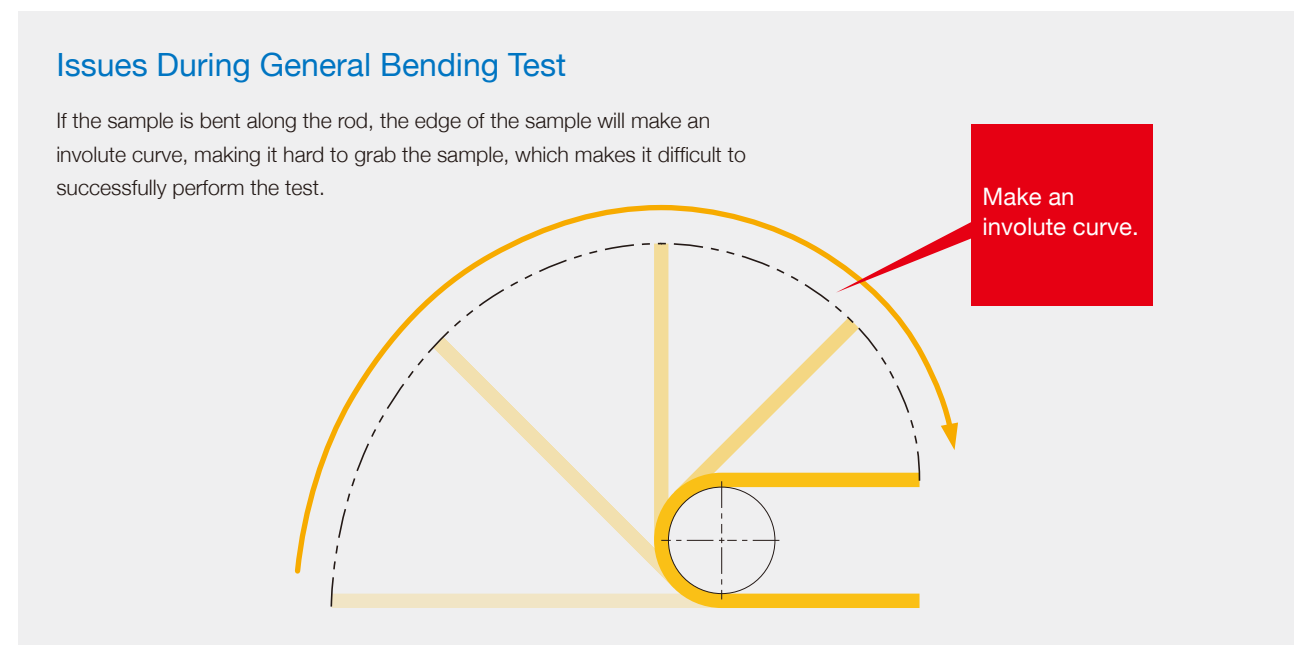
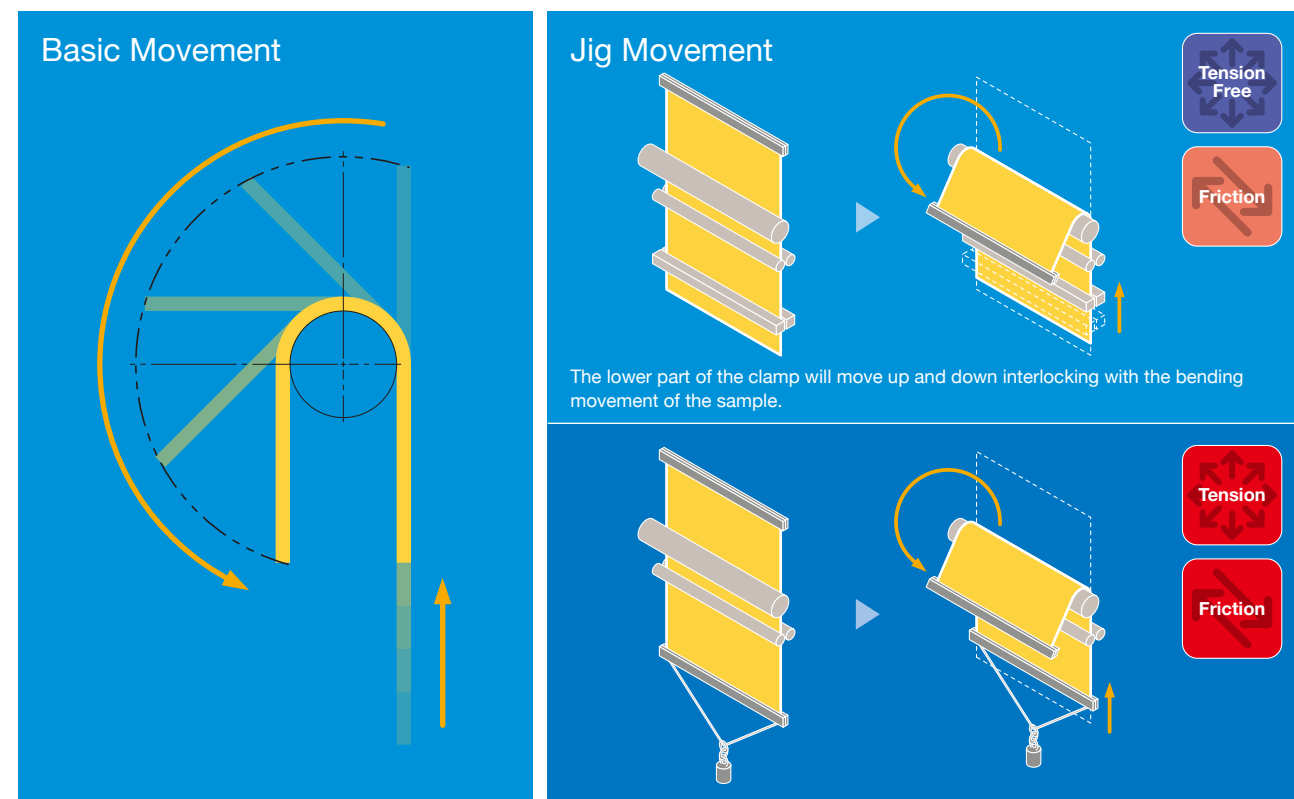
# ENDURANCE TEST SYSTEM

Flexible Device Endurance Test

## Tension-Free Bending Test

### Bending Test Without Tension (Constant Bending Radius)

This equipment uses a bending rod to keep the bending radius constant. The clamp moves in the circular motion having the same center point as the rod. The other end slides. There would be no tension applied to the sample.



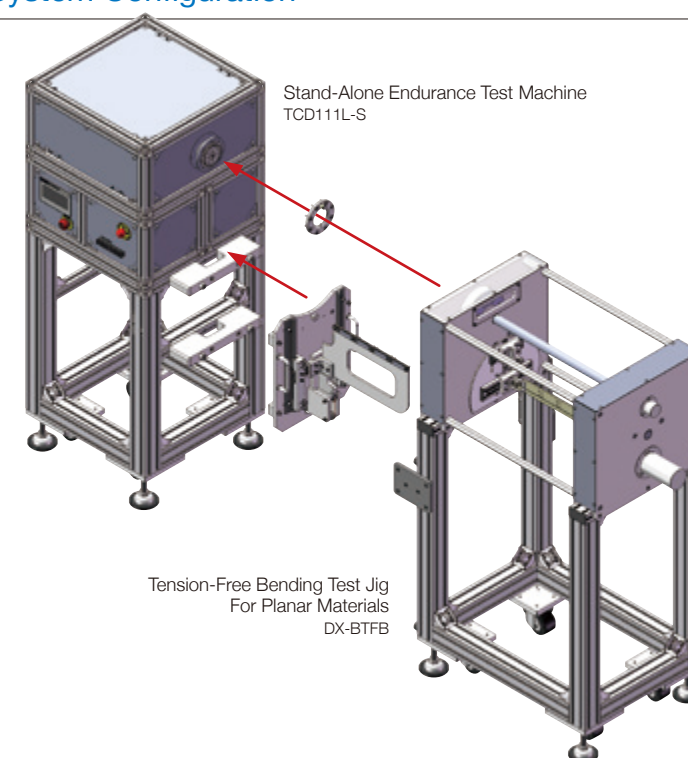
Endurance Test System Which Realizes Tension-Free Bending Test

TCD-BTFB

Stand-Alone Endurance Test Machine

Tension-Free Bending Test For Planar Materials

### System Configuration



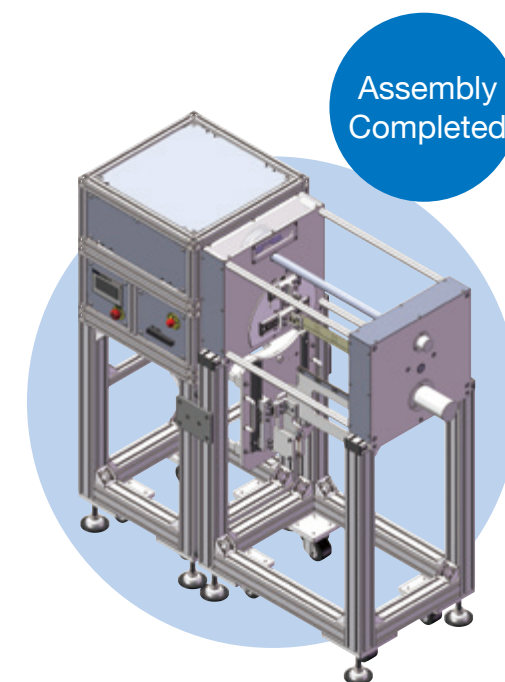
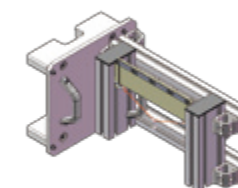
This machine makes it possible to perform tension-free bending test on a planar sample such as flexible device.

By changing the position of the clamp, one can perform tension-free bending test for planar materials that are card size to A4 size. Maximum bending angle is up to  $\pm 180^\circ$ . One can bend one side only or both right and left side.

One can also use a weight when performing the bending test.

By changing the tension-free test jig to the stabilizing jig, it will be possible to perform bending test using weights.

Bending Test Jig For Planar Materials DX-BFFB



The weight is not included.

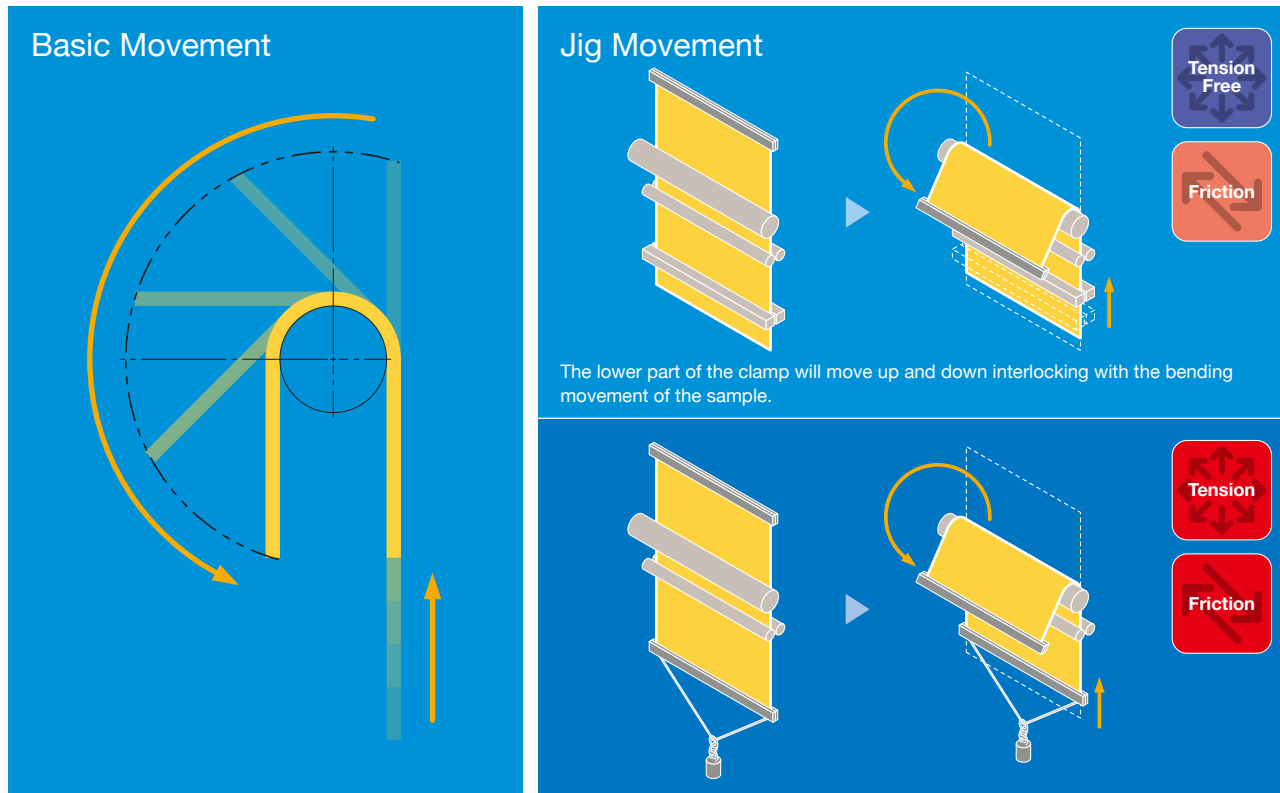


Flexible Device Endurance Test

## Tension-Free Bending Test

### Bending Test Without Tension (Constant Bending Radius)

This equipment uses a bending rod to keep the bending radius constant. The clamp moves in the circular motion having the same center point as the rod. The other end slides. There would be no tension applied to the sample.



Environmental Endurance Test System Which Realizes Tension-Free Bending Test

CR09-typeD01-BTFBC90

Constant Temperature and Humidity Environment Endurance Test Machine

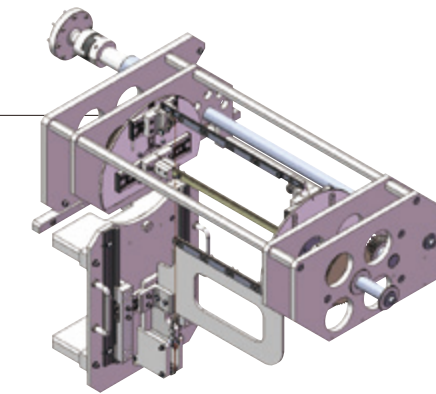
Tension-Free Bending Test For Planar Materials



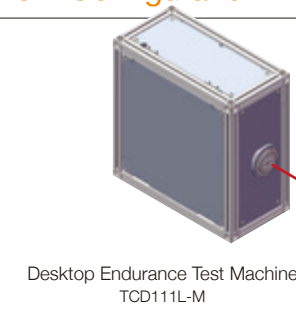
#### Test Jig

Tension-Free Bending Test Jig For Planar Materials

DX-BTFBC90

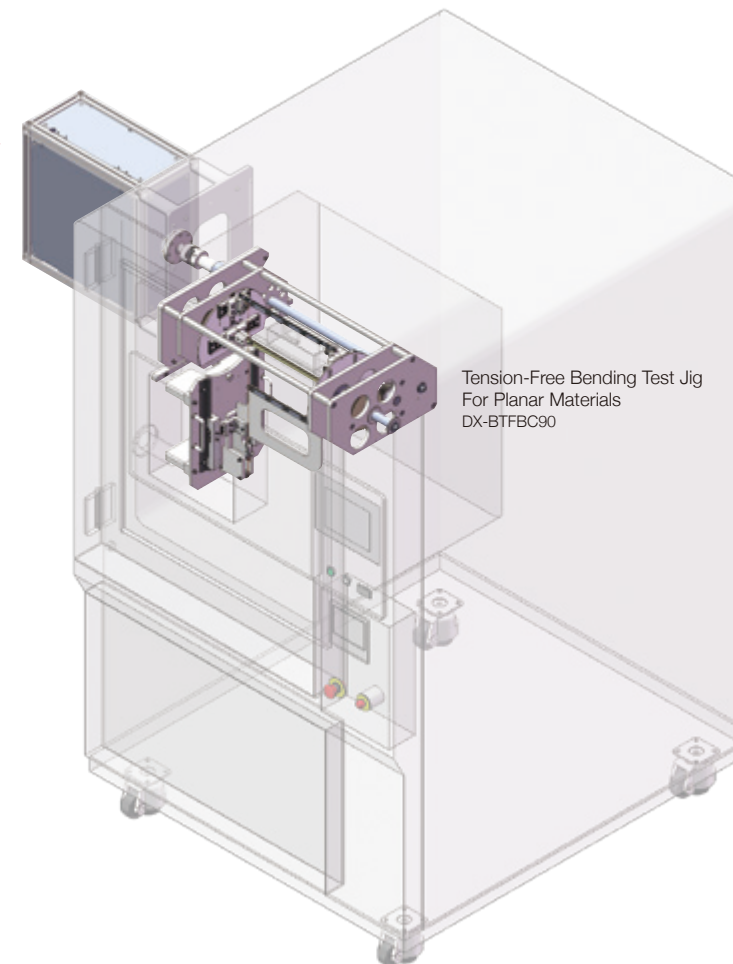


#### System Configuration



Desktop Endurance Test Machine  
TCD111L-M

Jig to be attached to the Base Unit  
CL09-typeD01-CU



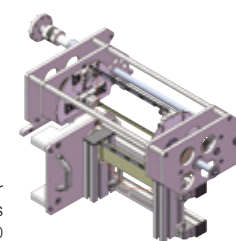
Tension-Free Bending Test Jig  
For Planar Materials  
DX-BTFBC90

This machine makes it possible to perform tension-free bending test on a planar sample such as flexible device in constant temperature and humidity environment.

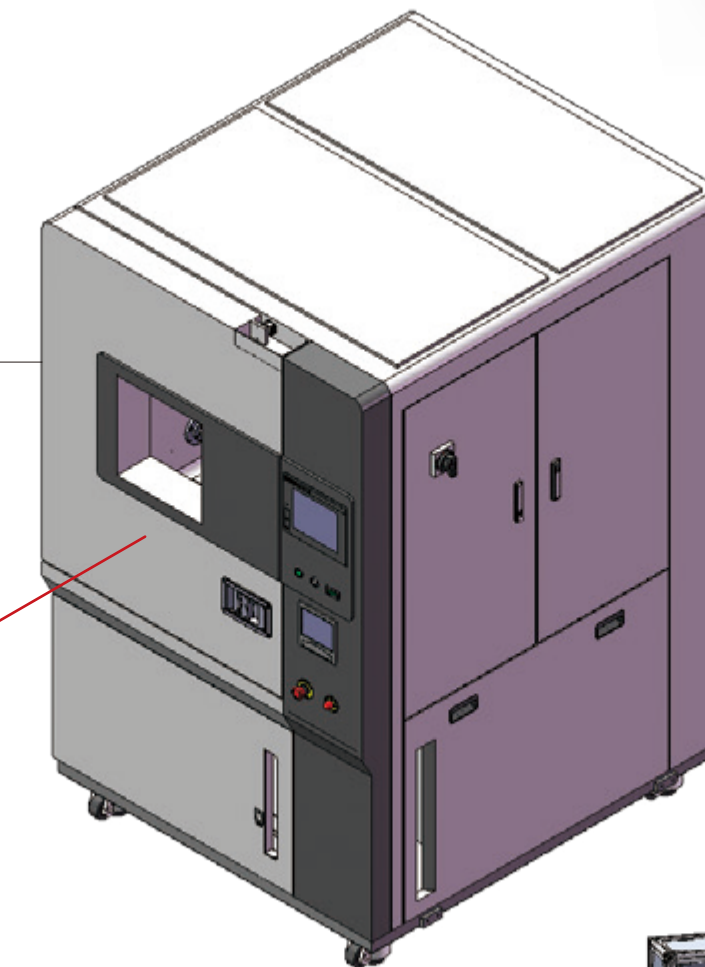
By changing the position of the clamp, in constant temperature and humidity environment, one can perform tension-free bending test for planar materials that are card size to A4 size. Maximum bending angle is up to  $\pm 180^\circ$ . One can bend one side only or both right and left side.

One can also use a weight when performing the bending test.

By changing the tension-free test jig to the stabilizing jig, it will be possible to perform bending test using weights



Bending Test Jig For  
Planar Materials  
DX-BFFBC90



Thermo-hygrostat  
typeD01

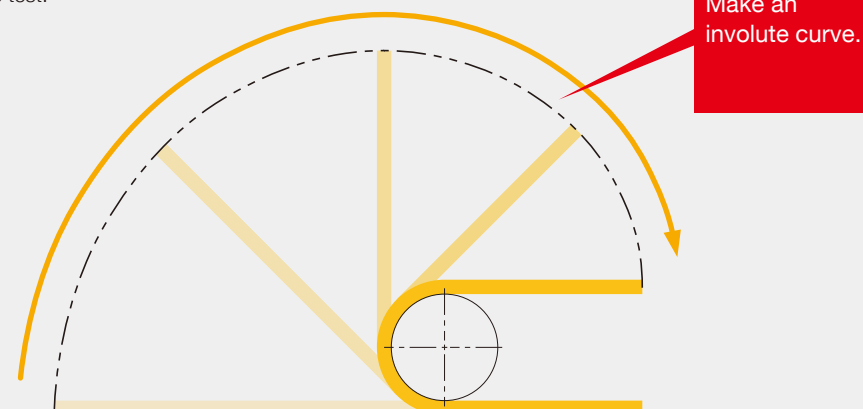


Assembly  
Completed

The weight is not included.

#### Issues During General Bending Test

If the sample is bent along the rod, the edge of the sample will make an involute curve, making it hard to grab the sample, which makes it difficult to successfully perform the test.





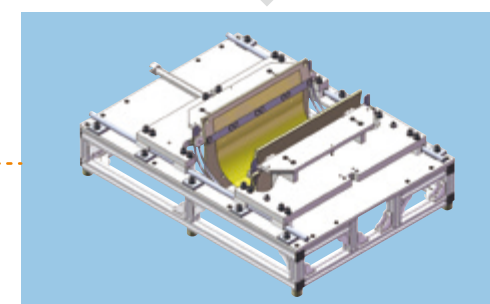
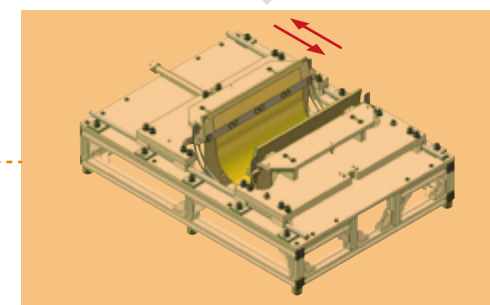
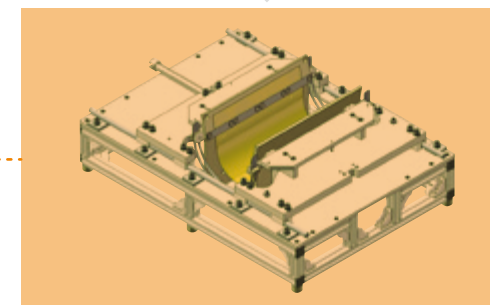
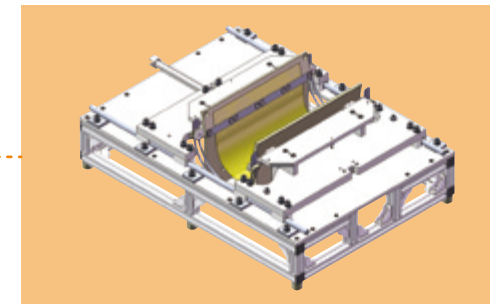
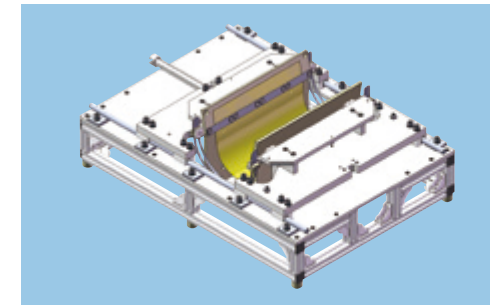
# ENDURANCE TEST × ENVIRONMENTAL TEST

Environment and Movement Interlocking Type Endurance Test System Which Realizes Various Endurance Tests In Constant Temperature and Humidity Environment.

PROGRAMMING (1/2) Mar/13/17 18:13 MENU									
PROGRAM EDIT		STEP INSERT	STEP DELETE	PROGRAM CLEAR			PROGRAM OPERATION		
STEP	DRIVE UNIT	TEST MODE	DYNAMIC		STATIC			CHAMBER	
			SPEED (rpm)	COUNT	POSITION			TEMP. (°C)	HUM. (%)
1	DISABLE							85.0	90.0
2	ENABLE	STATIC			REAR END	CENTER	FRONT END	2.0	85.0 90.0
3	ENABLE	DYNAMIC	60	100000				85.0	90.0
4	END	DISABLE						24.0	30.0
7									
8									
9									
10									
CHAMBER STATUS		ENABLE	LOOP SETTING	1	LOOP END CHAMBER CONTROL		STOP AFTER END	TEMP. (°C)	HUM. (%)
								0.0	0.0



Example Using Program Operation  
(Tension-Free U-shape Folding Environment Test For Planar Materials)



## STEP 1

Set thermo-hygrostat to 85°C/90%Rh.

## STEP 2

Wait 2 hours maintaining thermo-hygrostat at 85°C/90%Rh.

## STEP 3

Conduct the test 100,000 times with thermo-hygrostat set at 60 rounds/minute.

## STEP 4

Adjust the thermo-hygrostat to room temperature (24°C/30%Rh) and finish the operation.



# Base Unit Specifications

## Constant Temperature and Humidity Environment Endurance Test Machine

CL09-typeD01 / CR09-typeD01  
(Linear Reciprocation Specification) (Rotary Reciprocation Specification)

By combining the base endurance test machine and the test jig in the thermo-hygrostat, various endurance tests can be performed in constant temperature and humidity environment.

### Device Overview

#### Set Up Requirements

Electricity Supply	AC200V / 3 phase / 60A	Compressed Air	No
Cooling System	Cooler	Noise Level	Max.80dB
Water to Add Moisture	Purified Water	Maximum Amount of Heat Released	10,977 kcal/h
Ambient	Temperature: 21.1 - 29.4°C Humidity: 15.0 - 85.0%Rh (no condensation)		

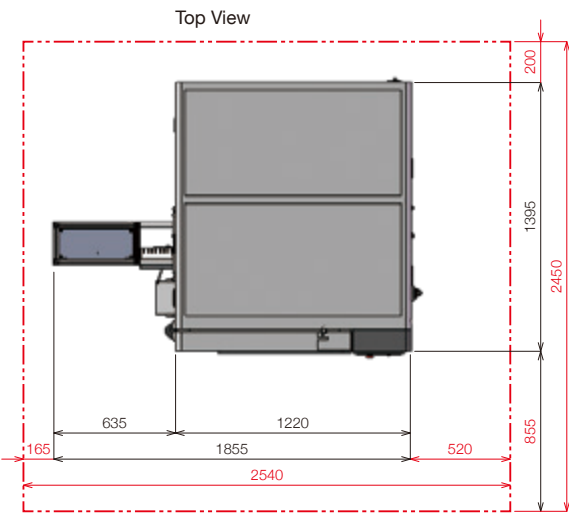
Mass approx.	800kg (Excluding test jig and sample)
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#### NOTE

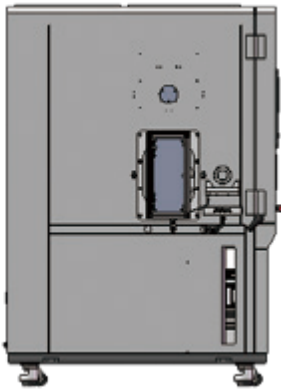
When conducting maintenance including exchanging of equipments, more than 500mm space surrounding the equipments is necessary.

#### WARNING

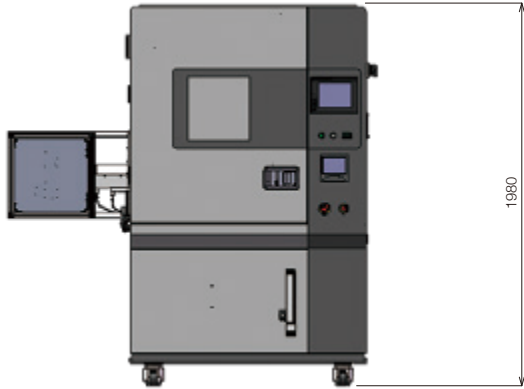
If the water which includes inpurities are used, inpurities precipitate in the humidity heater, which could cause malfunction or fire.



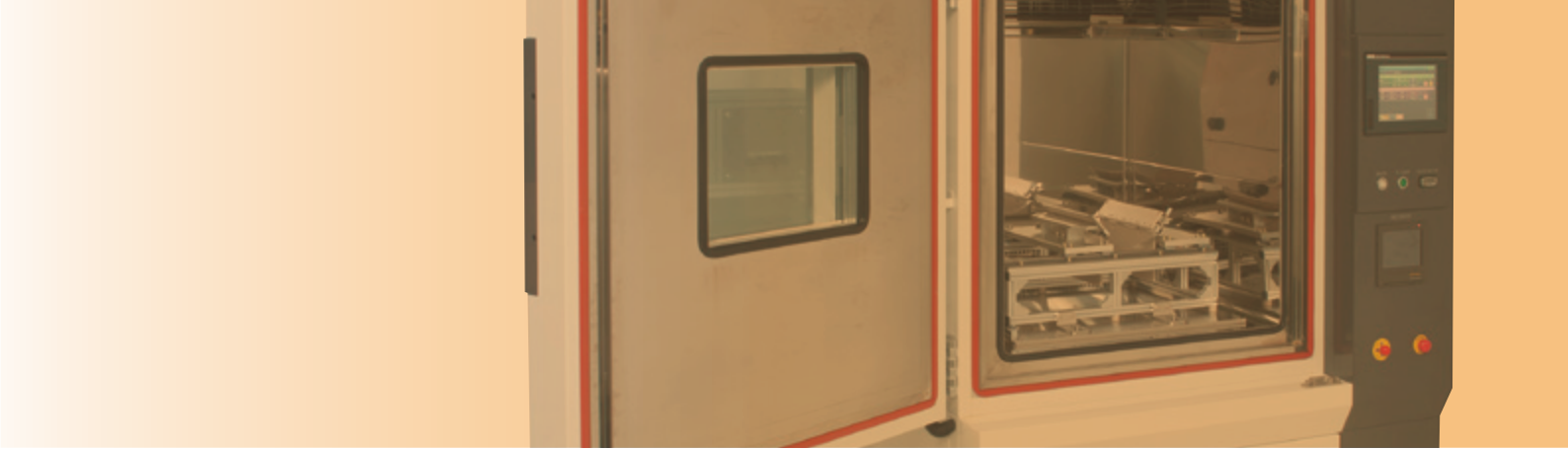
Side View



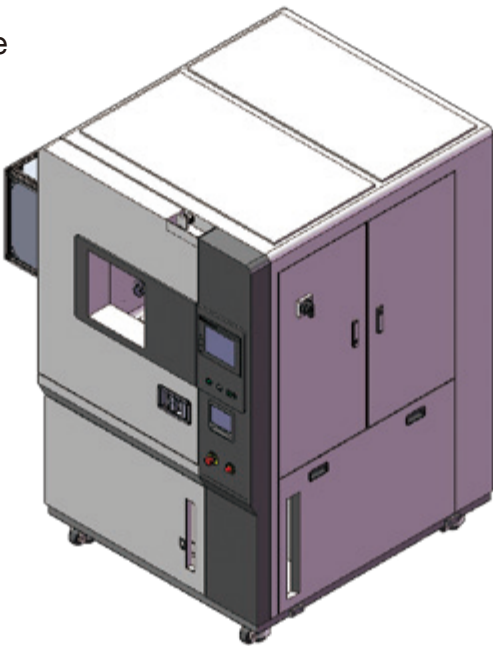
Front View



Drawing is CL09-typeD01.



### Appearance



**Thermo-hygrostat**  
The device controls set up environment of the test jig under various conditions. When test jig is moving, or inside is too hot, the door cannot be opened.

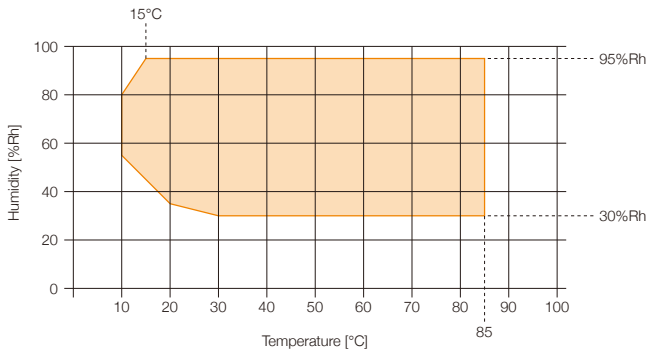
**Engine Unit (Linear Reciprocating Specifications)**  
Set linear reciprocating movement within the thermo-hygrostat.

**Engine Unit (Rotary Reciprocation Specification)**  
Set rotary reciprocating movement within the thermo-hygrostat.

### Specifications

#### Thermo-Hygrostat

Refrigerant	R404A, R23
Environment Control Range	Temperature: -40 ~ +150°C Humidity: 30.0 - 95.0%Rh



#### Engine Unit (Linear Reciprocating Specifications)

Reciprocating Times Count	8 digits (Comes with preset feature)	Reciprocating Speed	10 - 60 rounds/minutes.
Reciprocating Distance	0 - ±120mm	Driving Axis Output	Max. 400N 14000/st. [N] *Ex. st.=±60mm=120mm

#### Engine Unit (Rotary Reciprocation Specification)

Reciprocating Times Count	8 digits (Comes with preset feature)	Reciprocating Speed	10 - 60 rounds/minutes.
Reciprocating Angle	0 - ±180°	Engine Axis Output	Max. 10N·m 1620/st. [N·m] *Ex. st.=±60deg.=120deg.



# Further Improve Reliability

## YUASA SYSTEM ENDURANCE TEST SYSTEM



**Bending**



**Torsion**



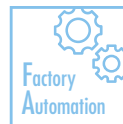
**Folding**



**Rolling**



**Tension**



## YUASA SYSTEM CO., LTD.

Our product information is also available on  
<https://www.yuasa-system.jp/en>



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**Safety Note** To ensure your safe and proper usage, please observe all the manuals before using these machines.