

**INSTRUCTION MANUAL  
FOR  
SHIMADZU UNIVERSAL TESTING MACHINE  
UH-A·C SERIES  
Models 100kN~1000 kN  
Models 10tf~100 tf  
COMPUTER CONTROLLED HYDRAULIC SERVO SYSTEM**

**PLEASE READ CAREFULLY  
AND SAVE THIS MANUAL**

**SHIMADZU CORPORATION  
KYOTO JAPAN**

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## Product Warranty

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The warranty terms are as follows:

1. What is covered : During the warranty period, Shimadzu Corporation will correct any defects in material or workmanship, or any failure of the system to conform to the specifications, by repairing or replacing the defective parts free of charge.
2. What is not covered : Shimadzu does not warrant or cover:
  - 1) Damage caused by abuse, misuse, mishandling, or misapplication.
  - 2) Damage caused by unauthorized modifications.
  - 3) Damage caused by a peripheral or device other than supplied by Shimadzu Corporation.
  - 4) Damage caused by use under an undesirable environmental condition such as high temperature, and high humidity, corrosive gas, dust, or supply voltage fluctuations beyond the rating.
  - 5) Damage caused by a disaster such as fire, earthquake, or flood.
  - 6) Damage during relocation after installation or shipment other than original shipment to the purchaser.
  - 7) Consumable parts such as fuses, relays, and switches.
  - 8) The case when installation condition that our company sets was not protected.
  - 9) The case that maintenance that our company sets did not have carried out.
3. The guarantee content is given preference a kind of device that guarantee condition is particularly indicated.

## For Safe Use

Shimadzu Universal Testing Machine performs tension, compression, transverse, and bending tests on metallic materials.

Please observe the following items to assure safety use of the unit.

1. Never use the unit for any purpose other than that mentioned above.
2. Make sure to follow the procedures explained in the instruction manual
3. Make sure to observe warnings and cautions.
4. Never disassemble or modify the unit without our permission.
5. Make sure to ask our Sales Division or sales representative for repair of the inside of the unit.

In this instruction manual, warning and caution are specified as follows.

### WARNING

Death or severe injury may be resulted in if an event is not avoided.

### CAUTION

Slight injury or physical damage may be resulted in if an event is not avoided.

## CAUTION Label on the Unit

①



### ⚠ WARNING

To avoid finger pinch,  
do not put hands inside the crossheads  
when opening and closing the grips.

②



### ⚠ CAUTION

To avoid injury by the fractured specimen pieces,  
keep away from the loading unit  
when the test is doing.

③



### ⚠ CAUTION

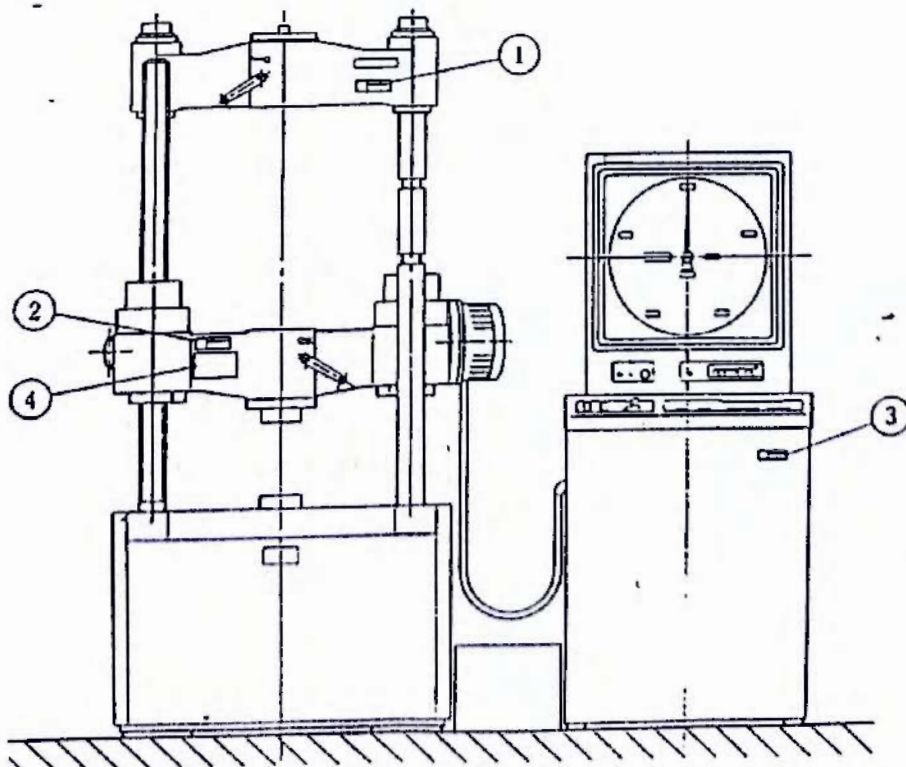
#### HAZARDOUS VOLTAGE

To avoid electric shock, turn off the power supply  
before removing the power cable.

④

### CAUTION

- To avoid the handles with a fall by fractured shock,  
remove the upper and lower handles when the test is doing.
- Do not put unnecessary the things on the table  
and the crossheads of the loading unit.
- Be sure that no obstacles before moving the crossheads.



(iii)

# Cautionary Instructions

This testing machine has a wide range of applications to perform various tests. Be careful when setting and removing specimens, mounting and dismounting test devices, and operating the loading unit.

Normally, a single worker operates the machine. When more than one worker is engaged in the operation, ensure safety through positive communication and cooperation.

## 1 Loading Unit

### 1.1 Operational precautions

- (1) When raising the lower crosshead (5), check that there is no obstacle between the upper and lower crosshead or between the table (4) and the lower crosshead (5).
- (2) Use a solid and stable platform for repositioning the upper crosshead (6). Models 500·1000kN[50·100tf]
- (3) If the metal fixture (16) and set ring (17) of the upper crosshead (6) are covered with oil, they may be accidentally dropped. Wipe them with a clean cloth before mounting them. Models 500·1000kN[50·100tf]

### 1.2 Handling of test devices

Use a chain block whenever possible for mounting and dismounting heavy test devices.

#### 1) Handling of tension test grips

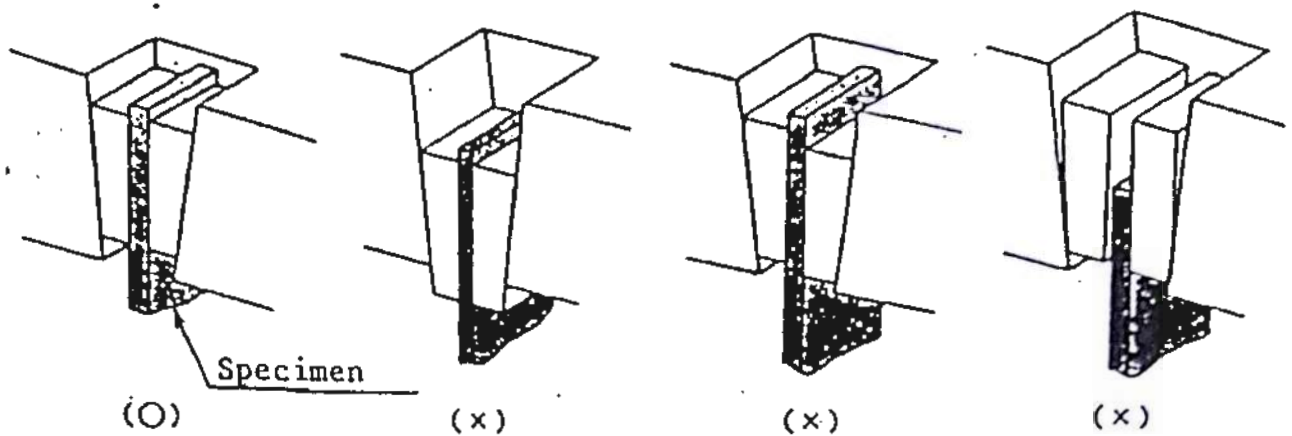
- (1) Do not place the inset grip holders (43) and lines (47)/(48) on the crosshead or any other elevated location after removing them. Take them down before replacing the insert grips (44).
- (2) Be sure to tighten the bolts when refitting the insert grip ? hold-down plate and specimen leap prevention plate (51).
- (3) Place a wooden box on the table (4) to protect the tables' top from fractured specimen pieces.

#### 2) Gripping a tension-test specimen

See the figure below.

Pay attention to the positions of the insert grip holders (44) and the specimen. The entire rear area of the insert grip holders (44) must be in contact with the crosshead inside walls or liners (47)/(48).

A specimen must be long enough to contact the entire face of each insert grip.



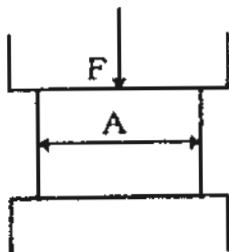
### 3) Handling of compression plates for compression tests

(1) Set the lower crosshead (5) at a low position for mounting and dismounting the upper compression plate (64).

(2) Use a protective cover in cases where a specimen scatters.

(3) Permission aspect pressure of compression plate is  $200 \text{ N/mm}^2 [20 \text{ kgf/mm}^2]$ .

There is a fear connected with damage, when above-mentioned load is added to compression plate, this.



$$\sigma_c = F / A$$

$\sigma_c$  : Surface Pressure  $\text{N/mm}^2 [\text{kgf/mm}^2]$

F : Loading Force  $\text{N} [\text{kgf}]$

A : Osculating plane to the compression plate  
of specimen  $\text{mm}^2$

## 2 Control Unit

### 2.1 Handling of load display meter

- (1) Using the ram, zero-adjust the load within +10 mm of its initial position when the READY lamp lights.
- (2) Never load over 100% of the full scale for each load range.
- (3) The display meter is factory-adjusted before shipment; do not unnecessarily touch the adjustable parts.

### 2.2 Handling of automatic load control unit

- (1) Always confirm the set test conditions on the display (149) before START.
- (2) Never change load ranges on the load meter in the middle of load control.
- (3) Never change the ductilometer ranges in the middle of strain control.
- (4) Keep the load control knob (129) set to HOLD during automatic control.
- (5) Do not operate a constant-value control over 30 minutes unless an optional hydraulic oil cooling device is installed. If operated, the hydraulic oil overheats.
- (6) In winter, or immediately after the pump is turned ON, the unit may not operate due to low oil temperature. If this occurs, raise the oil temperature above 20°C before starting control.

Control



2.3 Handling attention of memory card (Case Model UH-C)

- ① Inserting the memory card when the power of the control unit is turned OFF may reduce the life of the battery. It is recommended that the battery should be inserted only just before starting operation for loading data into the card or to the main unit, and taken out after such operation.
- ② The memory card must be handled in accordance with the following:



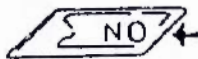
Do not expose the card to sun-lights and keep it away from any heater to prevent the card from being damaged.



Do not bend or drop the card.



Do not allow the card to become wet or disassemble it.



Touching the connector part of the card may cause a failure in operation.



Put the card into the attached case when carrying or storing it. Also, keep the card away from static electricity or dust.



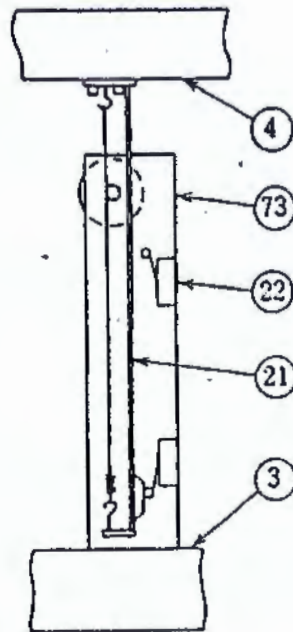
Do not throw the card into a fire.

## Safeguards

### 1) Ram stroke limiter

The pump motor stops when the limit switch actuating rod attached to the table contacts the ram stroke limit switch on the stand mounted upright on the bed.

To operate again, press pump ON switch and turns on the pump motor.



- (3) Bed
- (4) Table
- (21) Limit switch actuating rod
- (22) Ram stroke limit switch
- (73) Ram stroke detector stand

Fig. Ram Stroke Limiter

### 2) Overload limiter

Stops the pump motor when the test load exceeds 102% of the full scale.

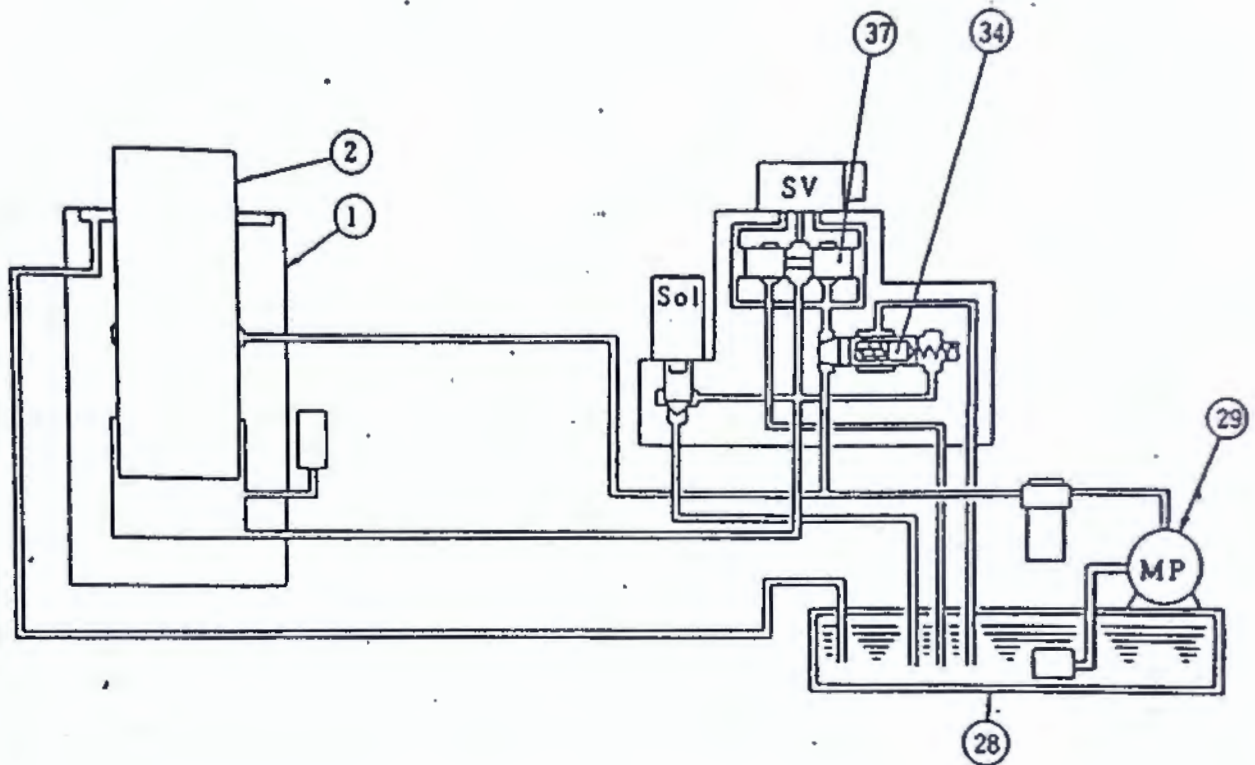
To operate again, press pump ON switch and turns on the pump motor.

## CAUTION

When the automatic load range switch-over function is turned off, Overload limiter does not operate until the load range shifts to the lowest factor.

### 3) Safety valve

Opens Safety valve when the oil pressure exceeds established value(105% of the full scale),and protect the system.



( 1 ) Loading cylinder

( 2 ) Ram

(28) Oil Tank

(29) Loading pump

(34) Safety valve

(37) Electrohydraulic servo-valve

Fig. Safety valve

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## Introduction

Congratulations on purchasing a UH Series Shimadzu Universal Testing Machine.

Read this manual carefully for proper handling; this machine operates with high accuracy, guaranteeing a long service life.

### 1. General Description

This universal testing machine performs tension, compression, transverse, and bending tests on metallic materials. It is a state-of-the-art hydraulic-system universal testing machine that is developed based on the latest mechatronics and Shimadzu Corporation's long experience in manufacturing testing machines.

Combined with optional testing equipment, the machine can perform tests on wood, concrete, ceramics, rubber, plastic, and many other materials.

The machine's hydraulic loading system has a wide control range of loading speeds and permits smooth loading.

An electrohydraulic servo valve precisely controls the flow rate of pressurized oil pumped out of a loading pump for feeding oil to a loading cylinder.

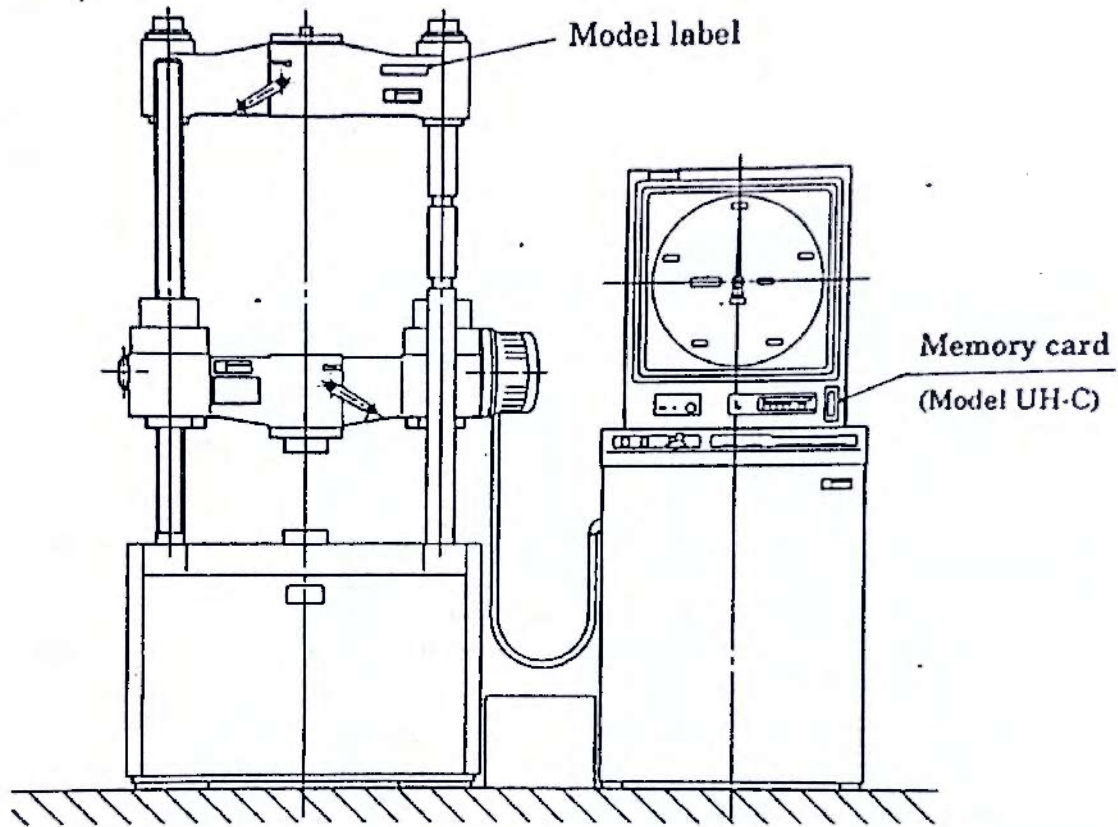
A load applied to a specimen is detected as an oil pressure change in the loading cylinder, and translated into a voltage signal by a high-precision pressure cell and high-performance amplifier. This analog signal is then converted into a digital signal, which is then computed in terms of the full scale. Thus, the load measuring system provides both the digital and analog displays of the applied load in the unit of kN[tf].

In addition, the automatic load control unit excels in ease of operation. It incorporates a microprocessor to control the closed-loop-system electrohydraulic servo valve for accurate and efficient load control in metal-tension testing specified in JIS, ASTM, and others, as well as for constant-speed regulation of ram stroke, load, and strain.

Handling of universal testing machine of the model UH-A and the model UH-C is explained in this instruction manual.

- Model UH-A: Very accurate universal testing machine that belonged automatic control
- Model UH-C: Very accurate universal testing machine that expanded control range the model UH-A and adopted memory card

Confirm which form test opportunity to use is, in form label attached to a loading unit and, please read this operation manual.



Shimadzu Universal Testing Machines are all available in two types of the SI unit type and the Gravitational unit type. In this manual, the both units are shown as follows.

Example Model 500 kN [50tf]

└─ Gravitational unit: with brackets [ ]  
└─ SI unit

#### < Model UH-C >

The memory card has the following two types of mode:

ONE CARD ONE CONDITION MEMORY mode capable of storing 1 type of condition in a card using one-touch key operation.

ONE CARD TEN CONDITIONS MEMORY mode capable of storing ten types of condition in a card.

As mode setting is done just before installation by a service engineer, please indicate him the mode you desire.

## 2. Composition

This testing machine comprises the following equipment and parts:

2.1	Testing Machine		1 unit
(1)	Loading unit	1 unit	
(2)	Hydraulic unit for loading	1 unit	
(3)	Grips for tension tests	1 set	
(4)	Top/lower compression plates for compression tests	1 set	
(5)	Transverse/bending test system	1 set	
2.2	Control/Measuring Unit		1 unit
(1)	Load display meter	1 unit	
(2)	Automatic load control unit	1 unit	
2.3	Standard Accessories		1 set
(1)	Table top protective mat (for the entire surface and for use in compression tests)	1 for each	
(2)	Hydraulic oil for loading ISO VG 180 (18 liters/can)	2	
(3)	Grip open-close handle	2	
(4)	Filter element	1	
(5)	Hexagonal open-end wrench set	1 set	
(6)	Foundation bolts		
	for the loading unit	4	
	for the control unit	3	
(7)	Foundation wedges (for the loading and control units)	8 for each	
(8)	Foundation liner plates (for the load- ing and control units)	4 for each	
(9)	Operation manual	1 copy	
(10)	Memory card	3 pcs	

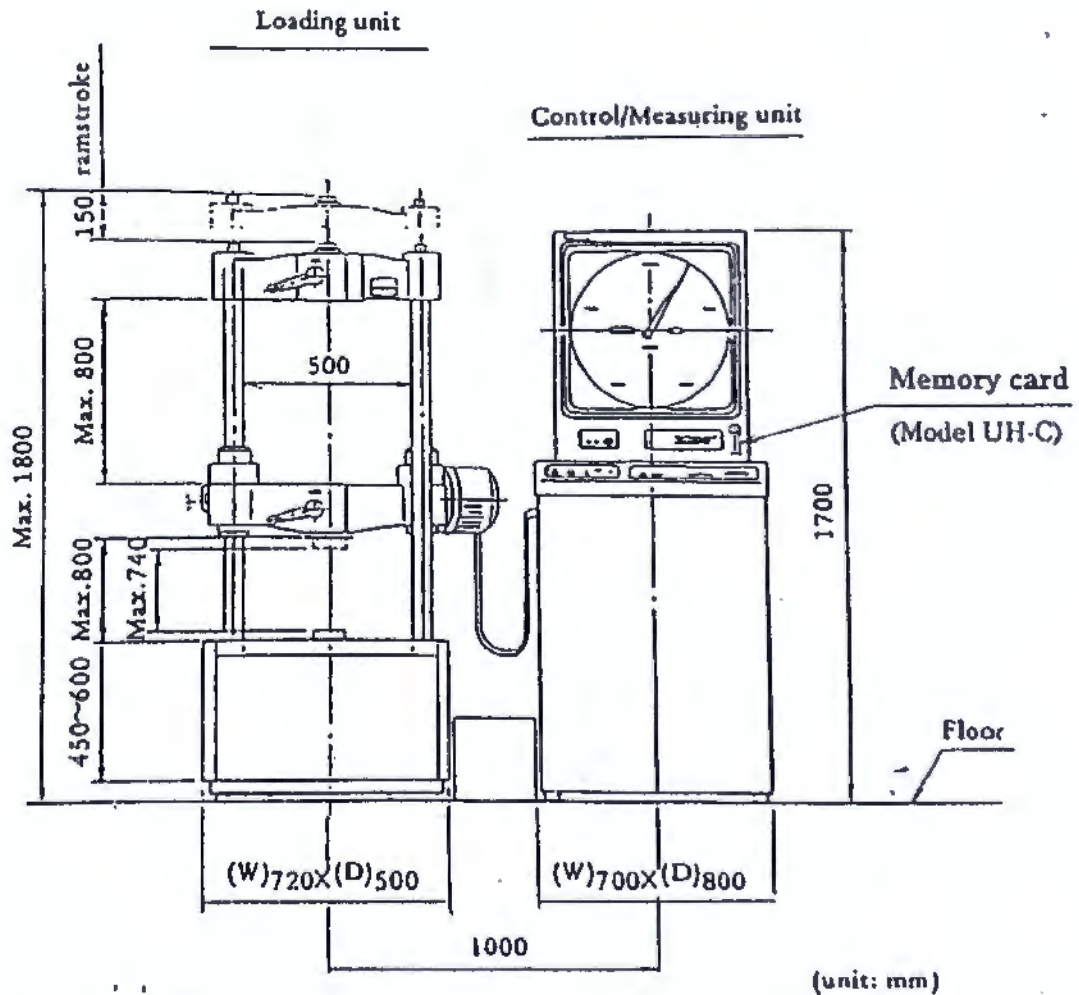
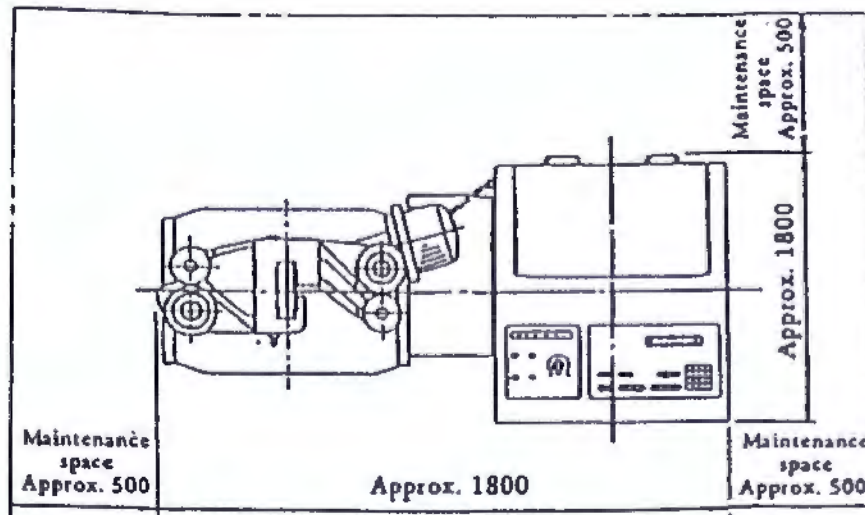


Fig 2.1 Model UH-100kNA Model UH-100kNC Appearance  
 [ Model UH-10A ] [ Model UH-10C ]

(unit: mm)



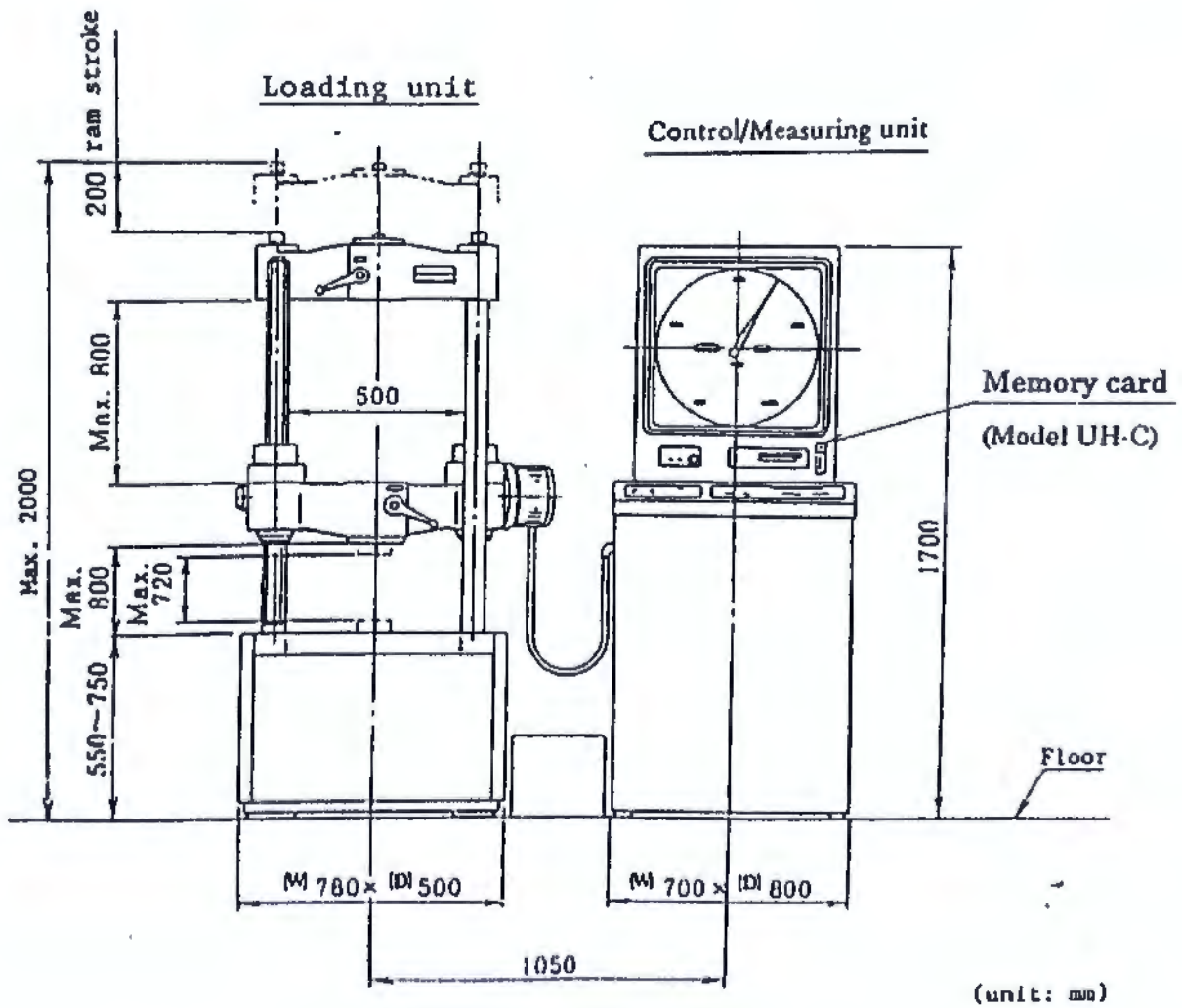
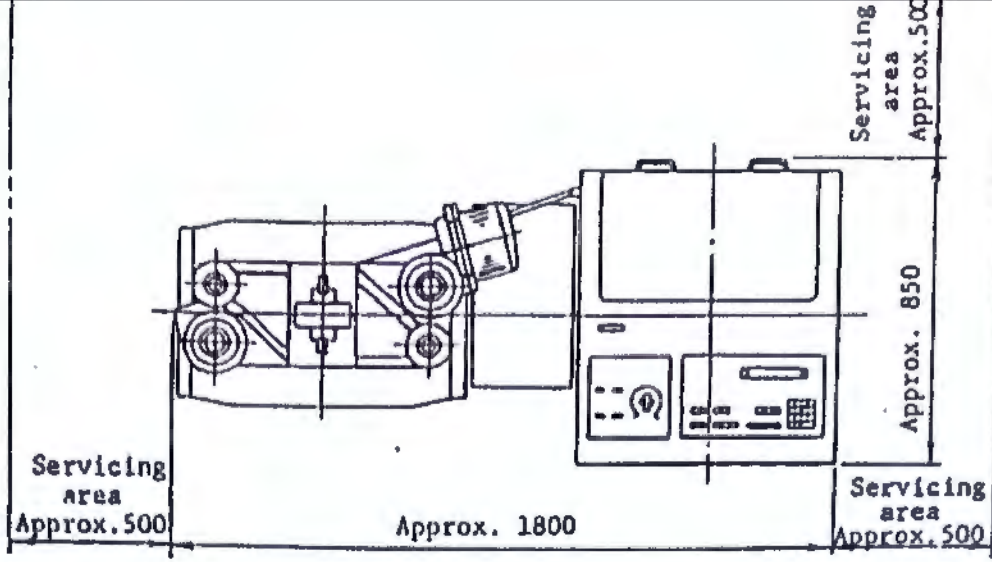


Fig 2.2 Model UH-200kNA Model UH-200kNC Appearance  
 [ Model UH-20A ] [ Model UH-20C ]

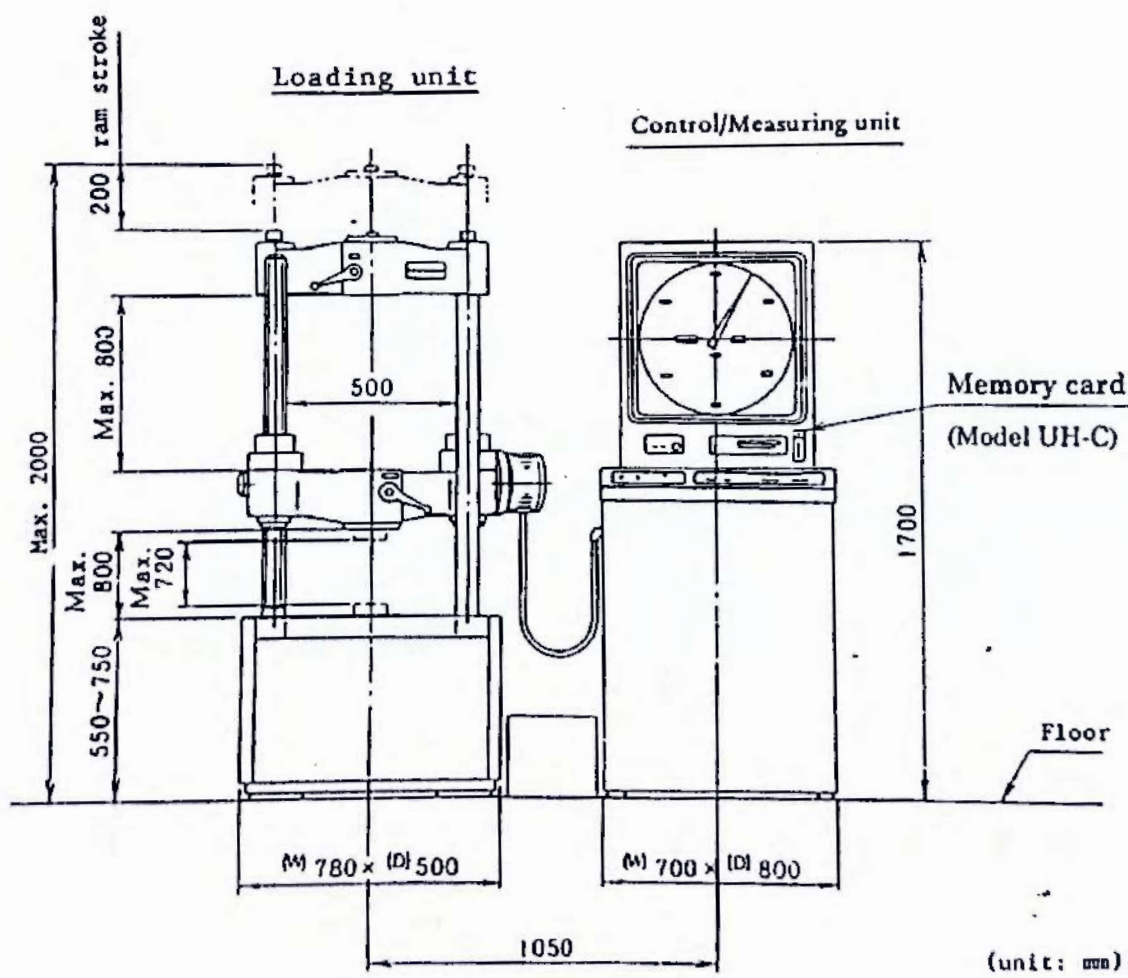
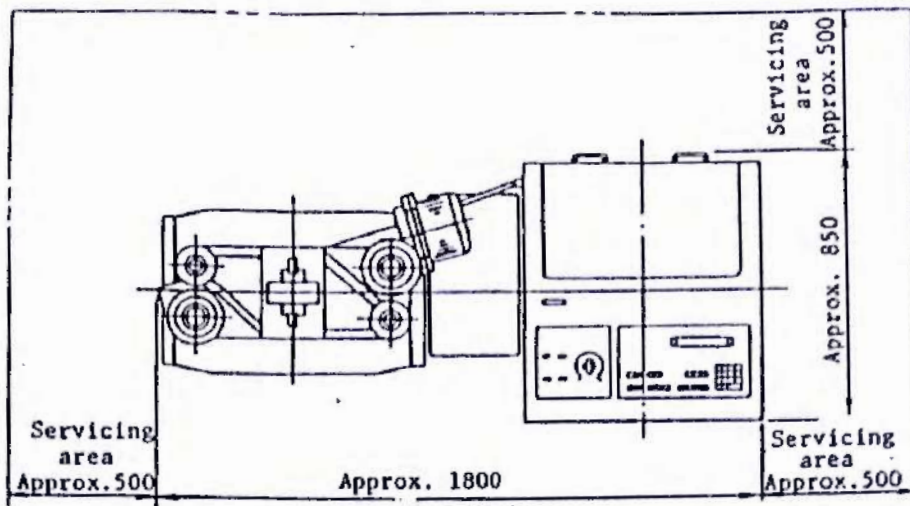


Fig 2.3 Model UH-300kNA Model UH-300kNC Appearance  
 [ Model UH-30A ] [ Model UH-30C ]

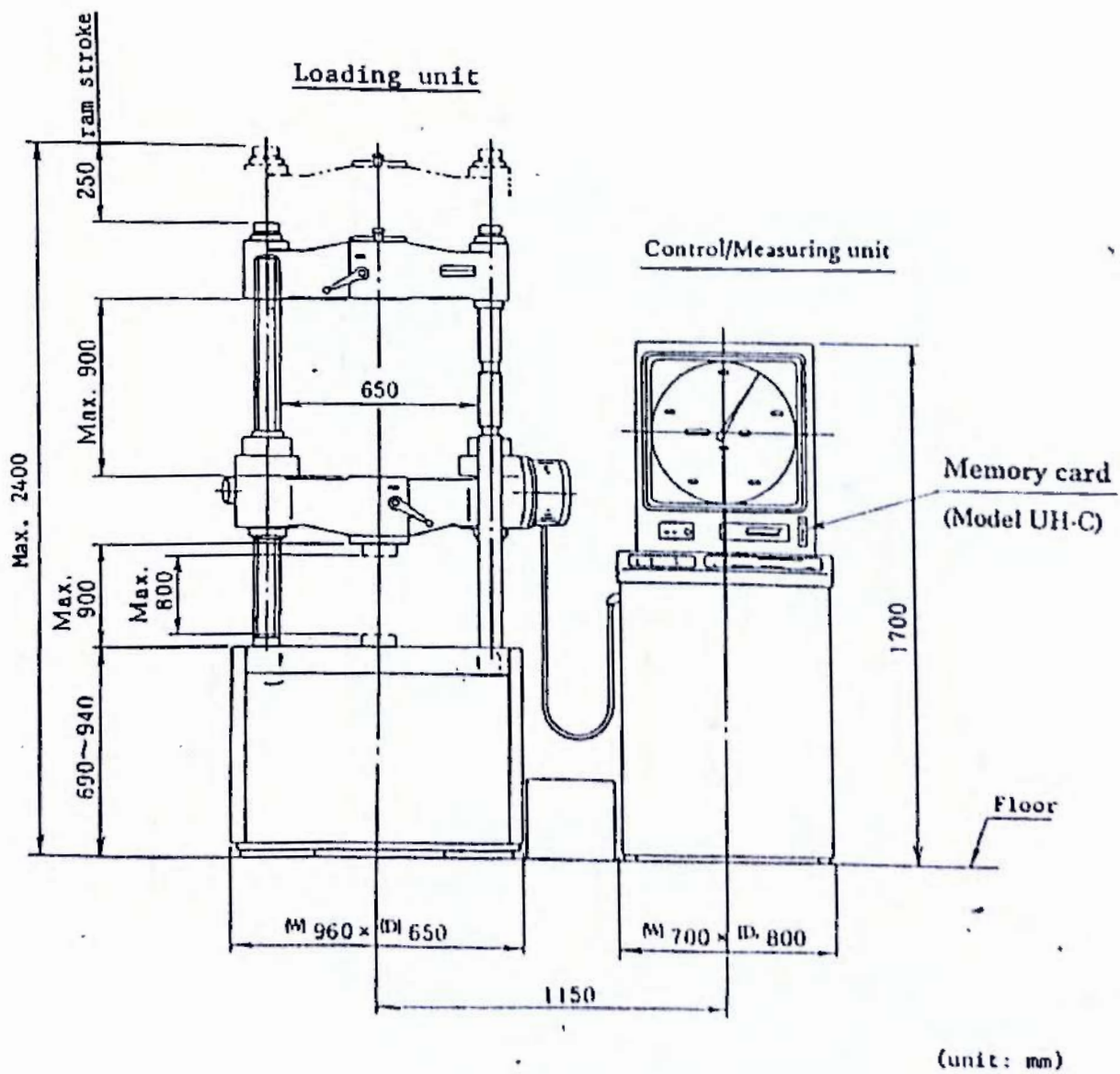
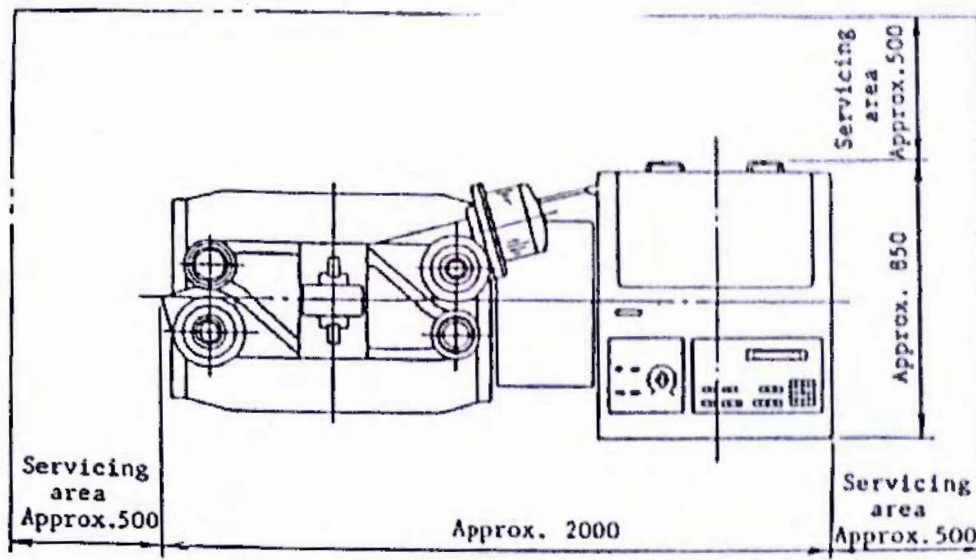


Fig 2.4 Model UH-500kNA Model UH-500kNC Appearance  
 [ Model UH-50A ] [ Model UH-50C ]

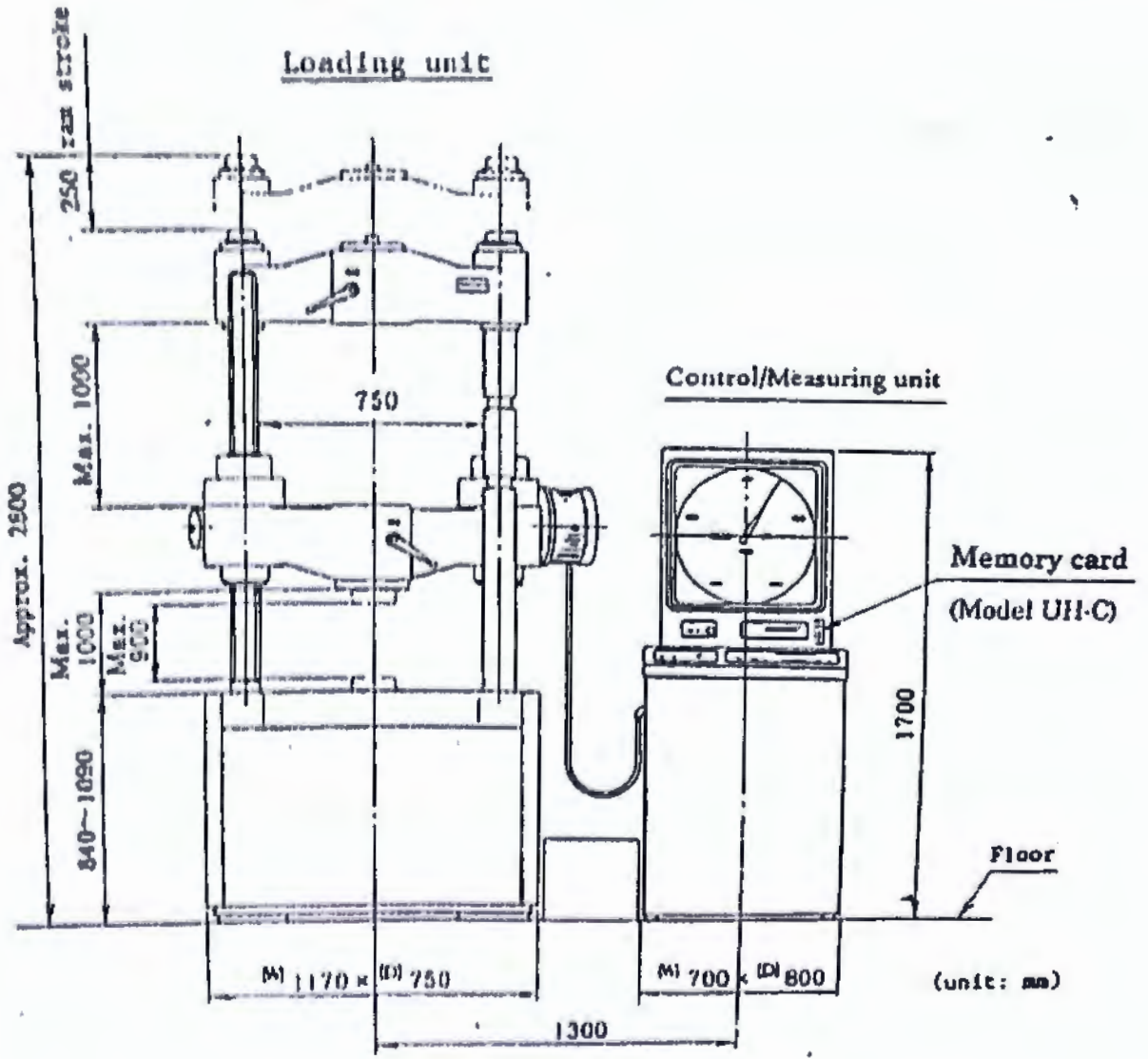
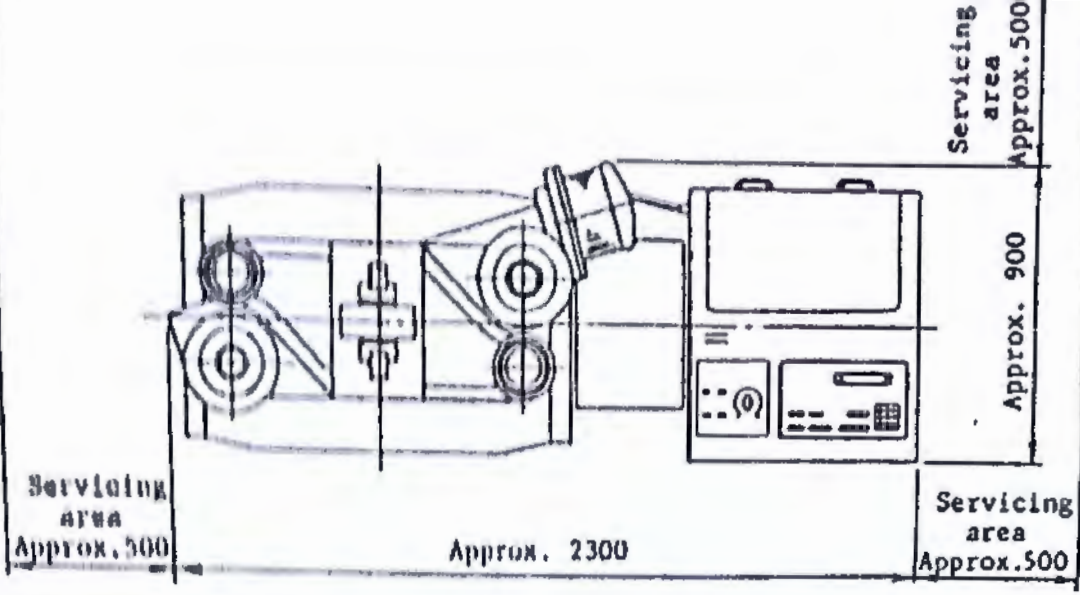


Fig 2.5 Model UH-1000kNA Model UH-1000kNC Appearance  
 [ Model UH-100A ] [ Model UH-100C ]

### 3. Construction and Components

#### 3.1 Testing Machine

##### 3.1.1 Loading unit

Figures 3.1, 3.2 and 3.3 show the loading unit's construction.

##### 1) Fixed frame assembly

This solid frame assembly consists of a bed (3), a lower crosshead (5), and two drive screws (7). The bed is fixed to the concrete foundation with foundation bolts.

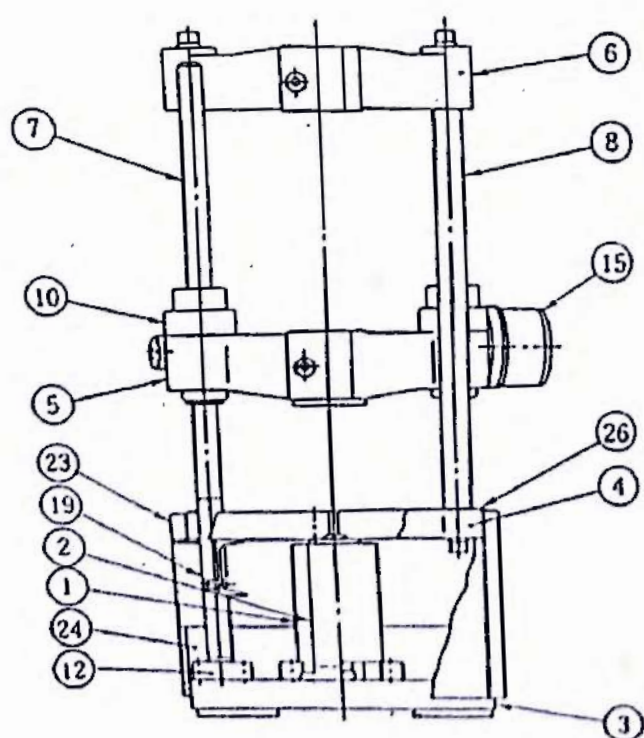
##### 2) Movable frame assembly

This solid frame assembly comprises a table (4), an upper crosshead (6), and two columns (8), and is mounted across the fixed frame assembly. The table is coupled to a ram (2).

##### 3) Loading cylinder

A loading cylinder (1) is centered on the bed (3). The ram (2) coupled to the table (4) is fitted to this cylinder.

Thus, when pressurized oil is pumped into this loading cylinder, the ram (2) and the movable frame assembly ascend. They descend when pressurized oil is pumped back into the oil tank.



- ① Loading cylinder
- ② Ram
- ③ Bed
- ④ Table
- ⑤ Lower crosshead
- ⑥ Upper crosshead
- ⑦ Drive screw
- ⑧ Column
- ⑩ Tension nut cap
- ⑪ Drive screw fixed nut
- ⑫ Elevation motor
- ⑬ Table guide roller
- ⑭ Table cover
- ⑮ Bed cover
- ⑯ Table top protective mat (for the entire surface)

Fig. 3.1 Model 100kN [10tf] Loading Unit

### 3. Construction and Components

#### 3.1 Testing Machine

##### 3.1.1 Loading unit

Figures 3.1, 3.2 and 3.3 show the loading unit's construction.

##### 1) Fixed frame assembly

This solid frame assembly consists of a bed (3), a lower crosshead (5), and two drive screws (7). The bed is fixed to the concrete foundation with foundation bolts.

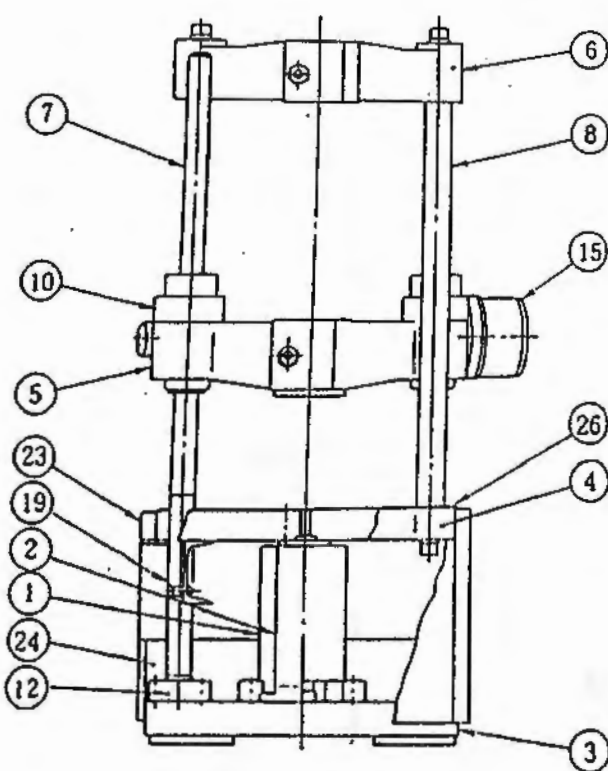
##### 2) Movable frame assembly

This solid frame assembly comprises a table (4), an upper crosshead (6), and two columns (8), and is mounted across the fixed frame assembly. The table is coupled to a ram (2).

##### 3) Loading cylinder

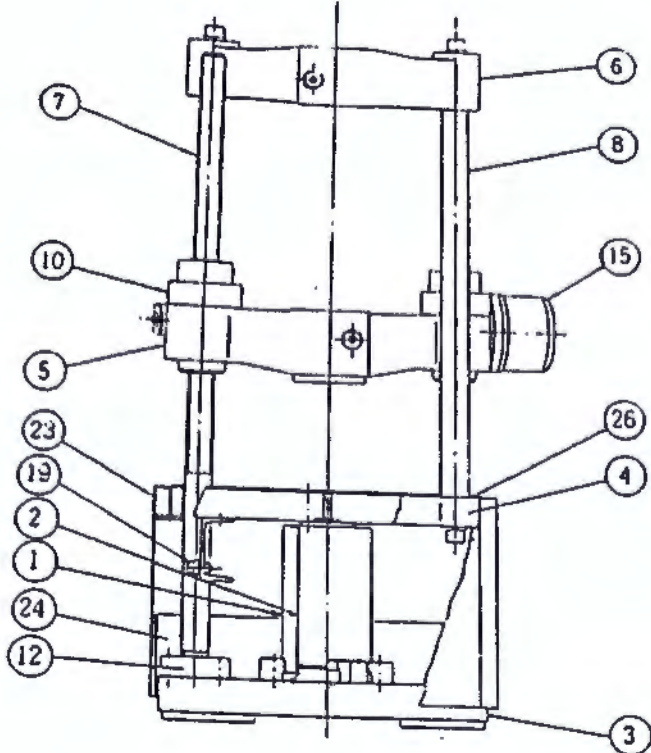
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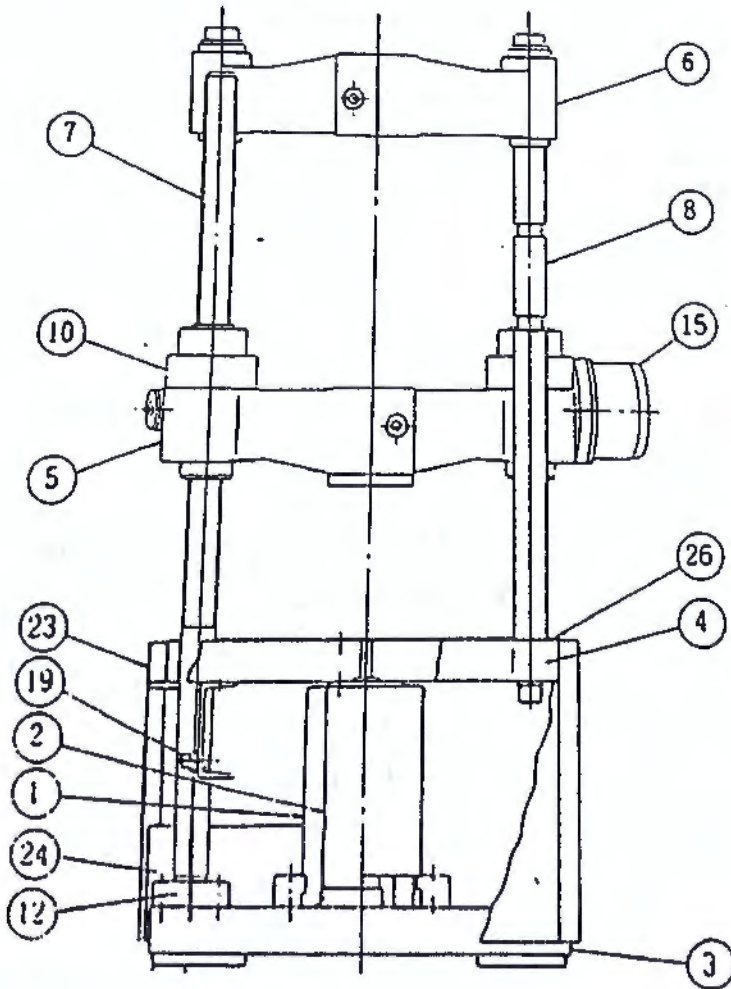
- ① Loading cylinder
- ② Ram
- ③ Bed
- ④ Table
- ⑤ Lower crosshead
- ⑥ Upper crosshead
- ⑦ Drive screw
- ⑧ Column
- ⑩ Tension nut cap
- ⑫ Drive screw fixed nut
- ⑬ Elevation motor
- ⑰ Table guide roller
- ⑳ Table cover
- ㉑ Bed cover
- ㉒ Table top protective mat (for the entire surface)

Fig. 3.1 Model 100kN [10tf] Loading Unit



- ① Loading cylinder
- ② Ram
- ③ Bed
- ④ Table
- ⑤ Lower crosshead
- ⑥ Upper crosshead
- ⑦ Drive screw
- ⑧ Column
- ⑩ Tension nut cap
- ⑬ Drive screw fixing nut
- ⑮ Elevation motor
- ⑰ Table guide roller
- ⑲ Table cover
- ⑳ Bed cover
- ㉔ Table top protective mat (for the entire surface)

Fig.3.2 Models 200kN, 300kN Loading Unit [20tf], [30tf]

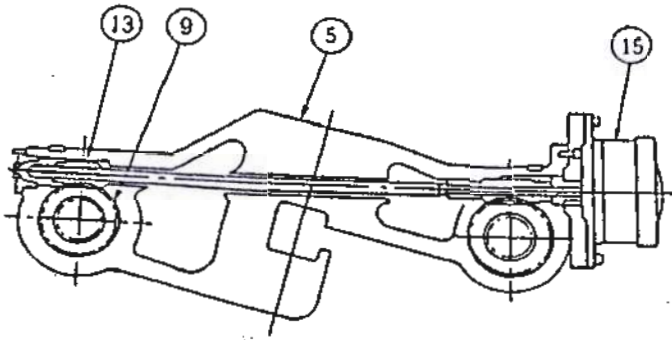


- ① Loading cylinder
- ② Ram
- ③ Bed
- ④ Table
- ⑤ Lower crosshead
- ⑥ Upper crosshead
- ⑦ Drive screw
- ⑧ Column
- ⑩ Tension nut cap
- ⑫ Drive screw fixing nut
- ⑮ Elevation motor
- ⑰ Table guide roller
- ⑲ Table cover
- ㉔ Bed cover
- ㉔ Table top protective mat (for the entire surface)

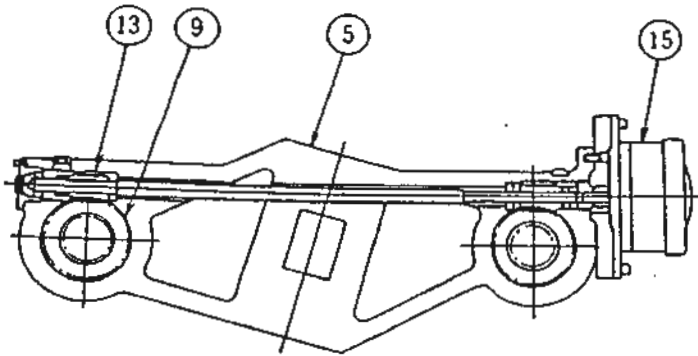
Fig.3.3 Models 500kN, 1000kN Loading Unit [50tf], [100tf]

4) Lower crosshead up-down system (Fig.3.4)

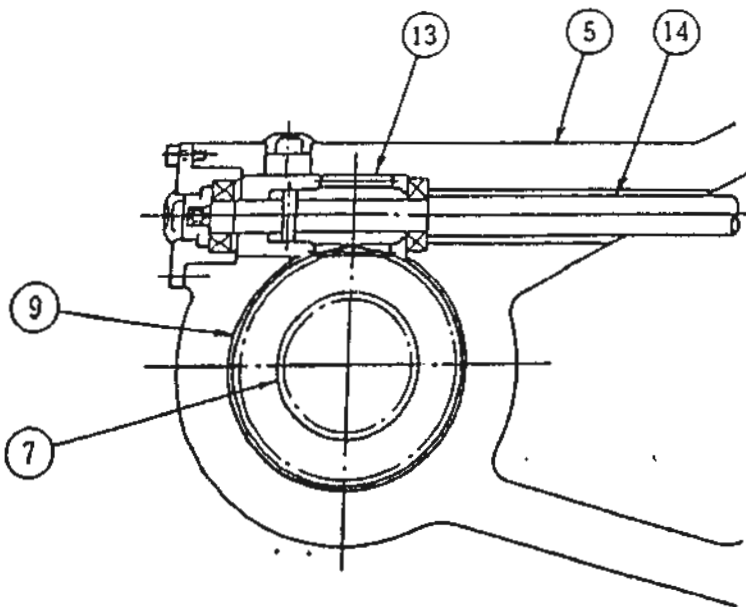
Tension nuts ⑨ of the lower crosshead ⑤ of the fixed frame assembly are fit onto the drive screws ⑦, and rotated by the elevation motor ⑮ via a worm ⑬ and worm shaft ⑭ to lift the lower crosshead for a test space adjustment.



Model 100kN  
[10tf]



Models 200kN ~ 1000kN  
[20tf] ~ [100tf]



- ⑤ Lower crosshead
- ⑦ Drive screw
- ⑨ Tension nut
- ⑬ Worm
- ⑭ Worm shaft
- ⑮ Elevation motor

Fig.3.4 Lower Crosshead Up-Down System



5) Lower crosshead backlash elimination system (Fig. 15)

The system raises the lower crosshead (5) when loading. If there is any backlash in the threads of the drive screws (7) and tension nuts (9) even a small amount of play momentarily interrupts loading, preventing smooth loading. As such, the lower crosshead is lifted by springs to eliminate backlash.

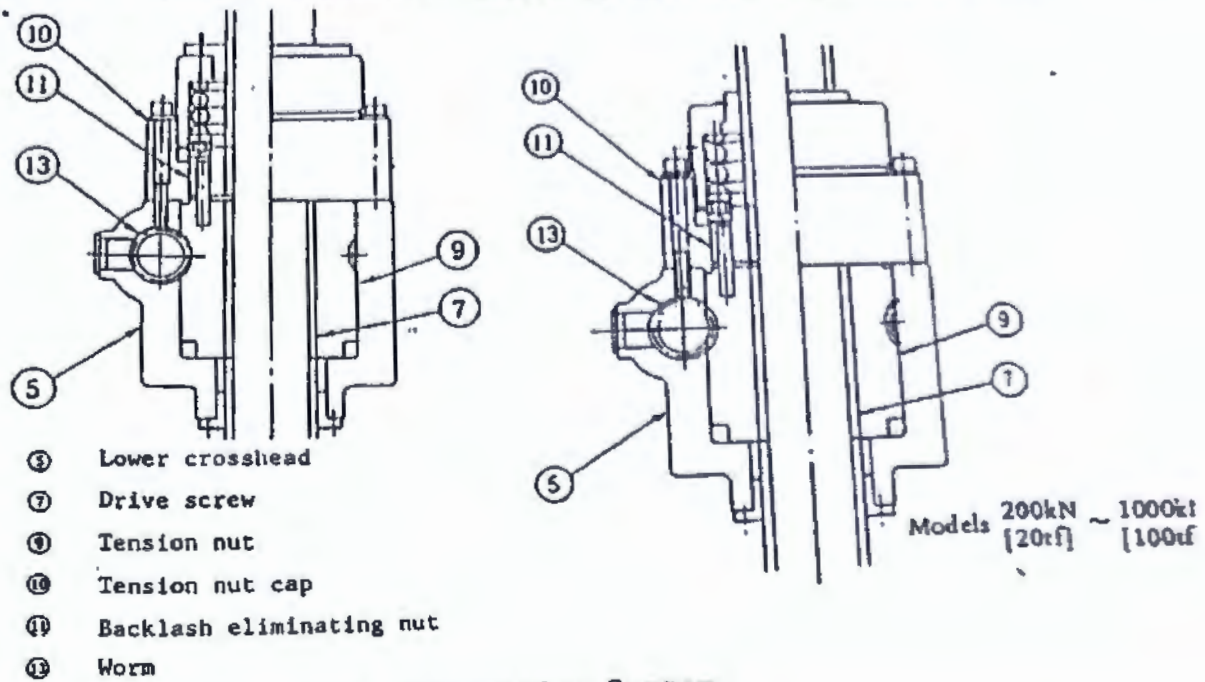


Fig. 3.5 Backlash Elimination System

6) Upper crosshead positioning system: Models 500kN[50tf], 1000kN[100tf] (Fig. 16)

The recessed parts of the columns allow the upper crosshead to be repositioned by refitting the metal fixture (16) and set ring (17). This makes possible, for maximum ease of operation, adjustment of a test space according to a specimen length.

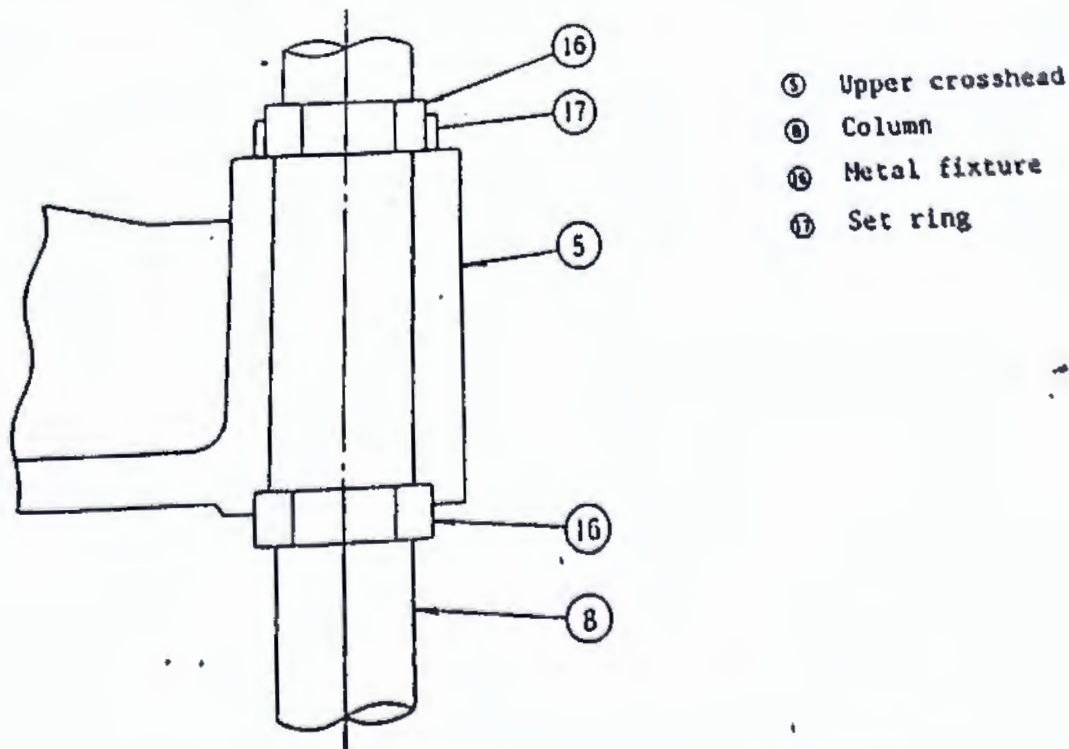


Fig. 3.6 Upper Crosshead Positioning System

7) Table rotation prevention system (Fig. 3.7)

The guide rollers (19) mounted on the table (4) bottom hold the lower unthreaded part of the drive screw (7) to prevent the movable frame assembly from rotating.

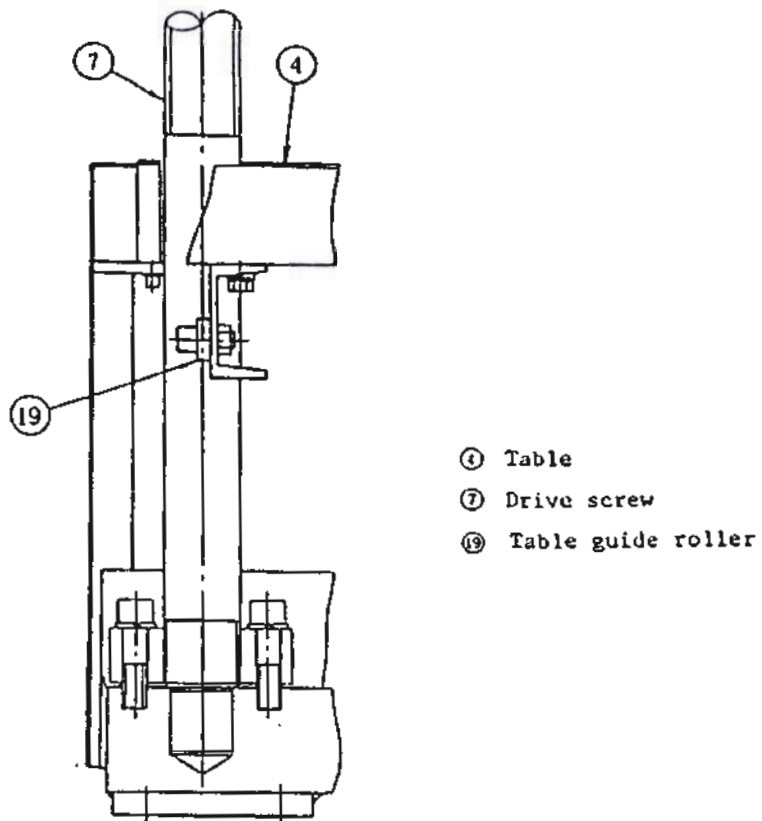
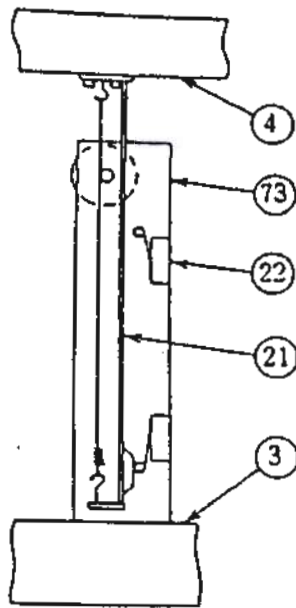


Fig. 3.7 Table Rotation Prevention System

8) Ram stroke limiter (Fig. 3.8)

A limit switch actuating rod (21) fixed to the table (4) contacts a ram stroke limit switch (22) on the stand (73) which rises on the bed (3). This stops the pump motor.



- ③ Bed
- ④ Table
- ②① Limit switch actuating rod
- ②② Ram stroke limit switch
- ②③ Ram stroke detector stand

Fig. 3.8 Ram Stroke Limiter

3.1.2 Hydraulic Unit for Loading (Fig. 3.9)

An oil tank (28), a loading pump (29), a pump motor (30), a filter (32), a hydraulic control valve (33), and an electrohydraulic servo valve (37) are housed in the bottom part of the control unit, and piped to the loading cylinder (1) by high-pressure rubber hoses (38) and (39).

1) Oil tank (28)

The steel plate tank has an oil gauge and an oil supply port with a breather.

2) Loading pump (29)

The stable high-pressure gear pump is mounted on the oil tank.

3) Filter (32)

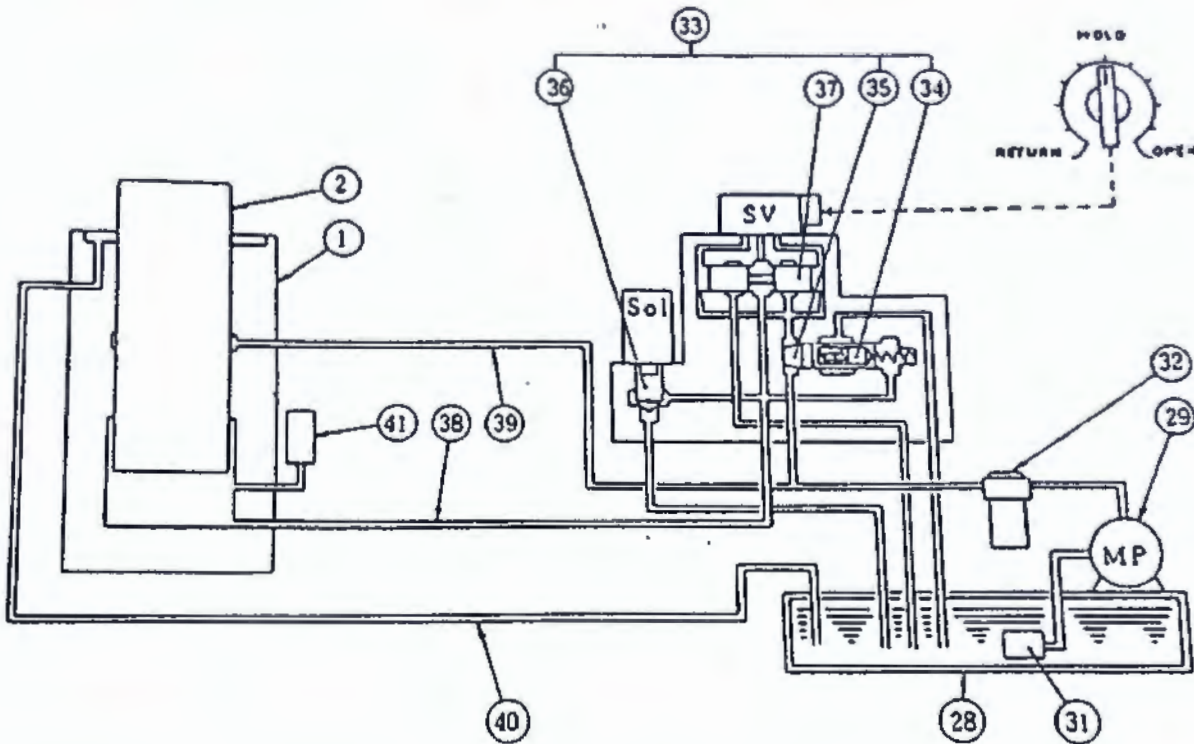
The filter is installed along the suction line of the electrohydraulic servo valve (37) to remove dirt from the hydraulic circuit.

4) Hydraulic control valve (33)

The hydraulic control valve comprises a safety valve (34), a pressure regulator valve (35), and a ram return valve (36). It regulates pressurized oil pumped out of the loading pump (29), and the amount of oil to be returned from the loading cylinder (1) to the oil tank (28) when unloading.

5) Electrohydraulic servo valve (37)

This load control valve is developed for exclusive use in universal testing machines. The closed-loop microprocessor control system permits both automatic and manual load controls.



- |                           |                                |
|---------------------------|--------------------------------|
| ① Loading cylinder        | ⑮ Pressure regulator valve     |
| ② Ram                     | ⑯ Ram return valve             |
| ③ Oil tank                | ⑰ Electrohydraulic servo valve |
| ④ Loading pump            | ⑱ High-pressure rubber hose A  |
| ⑤ Suction strainer        | ⑲ High-pressure rubber hose B  |
| ⑥ Filter                  | ⑳ Vinyl tube                   |
| ⑦ Hydraulic control valve | ㉑ Pressure cell                |
| ⑧ Safety valve            |                                |

Fig. 3.9 Hydraulic System

### 3.1.3 Grips for tension tests

#### 1) Models 20 to 100 (Figs. 3.10, 3.11)

The grips are constructed of insert grip holders (43), insert grips (44), insert grip hold-down plates (45), and rubber plates (46) in the tapered holes of the upper crosshead (6) and lower crosshead (5) centers. The grips are opened and closed by operating the pinion shaft (49) geared to the insert grip holders with a grip open-close handle (42).

An upper liner (47) and a lower liner (48) are used to adjust the grip-opened allowance according to the specimen size.

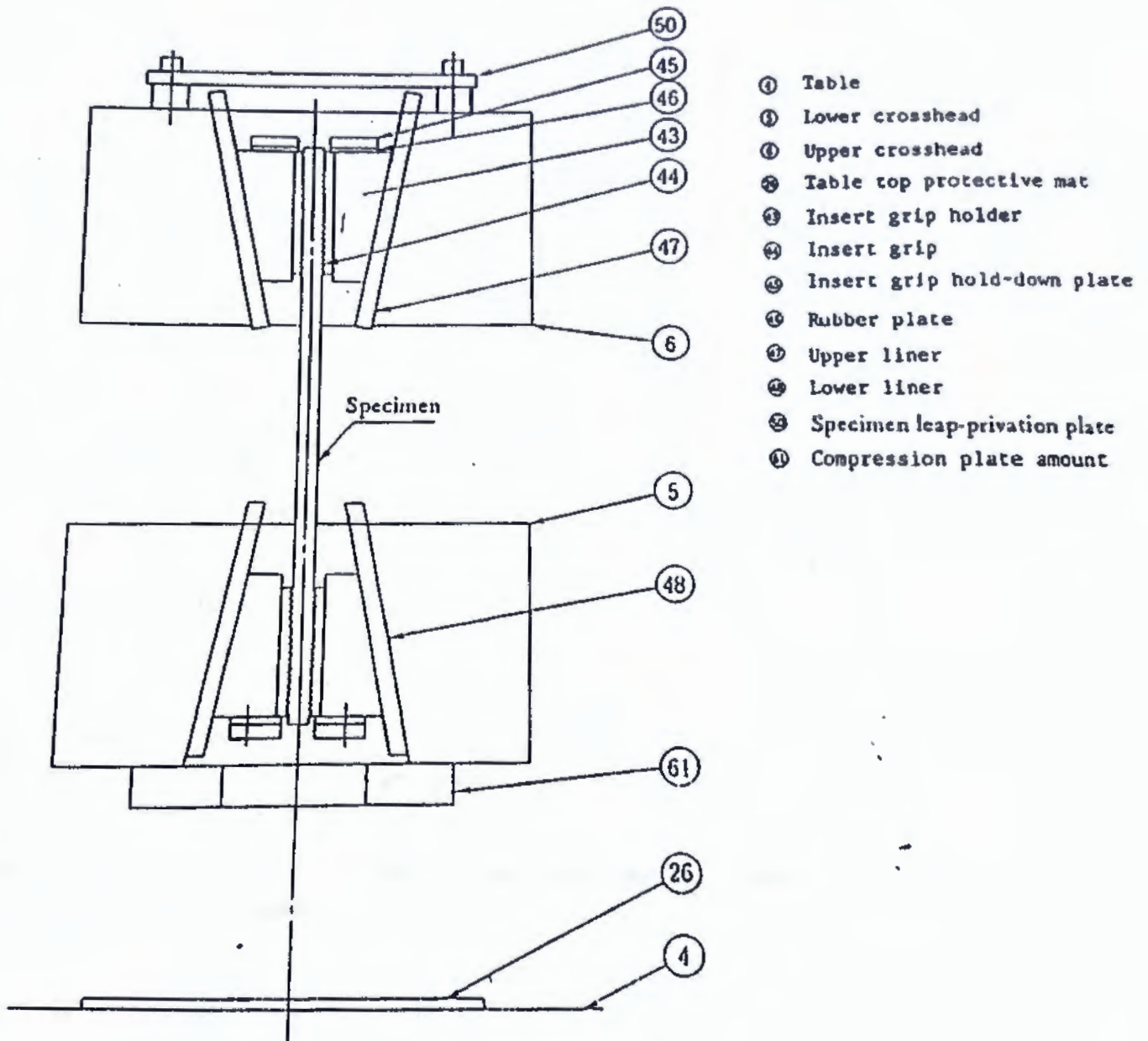
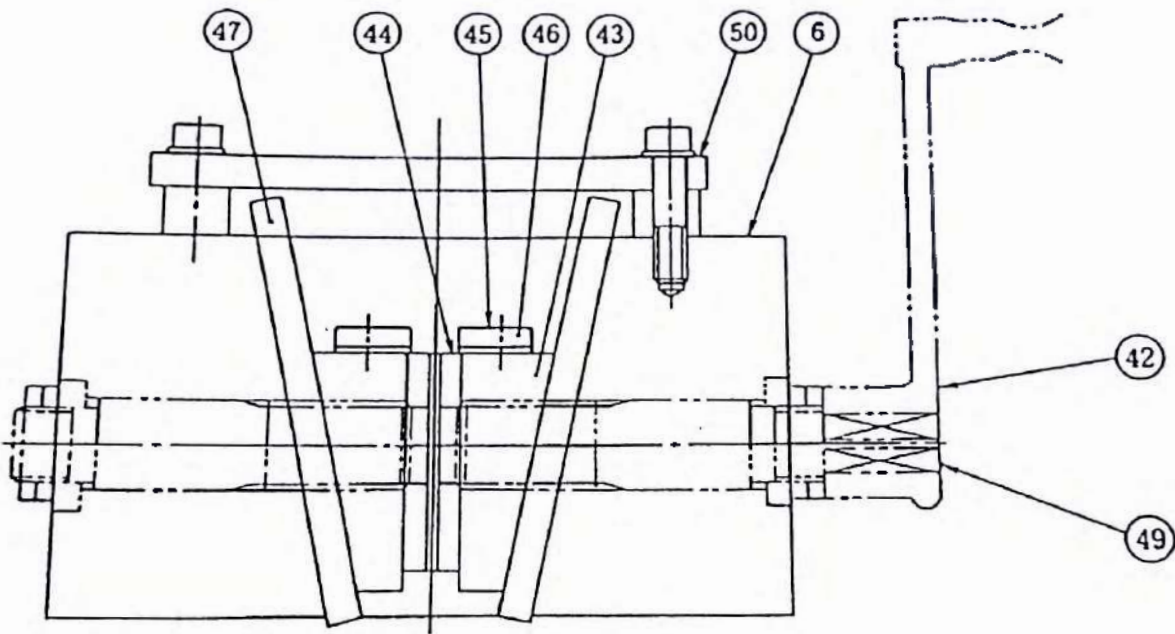
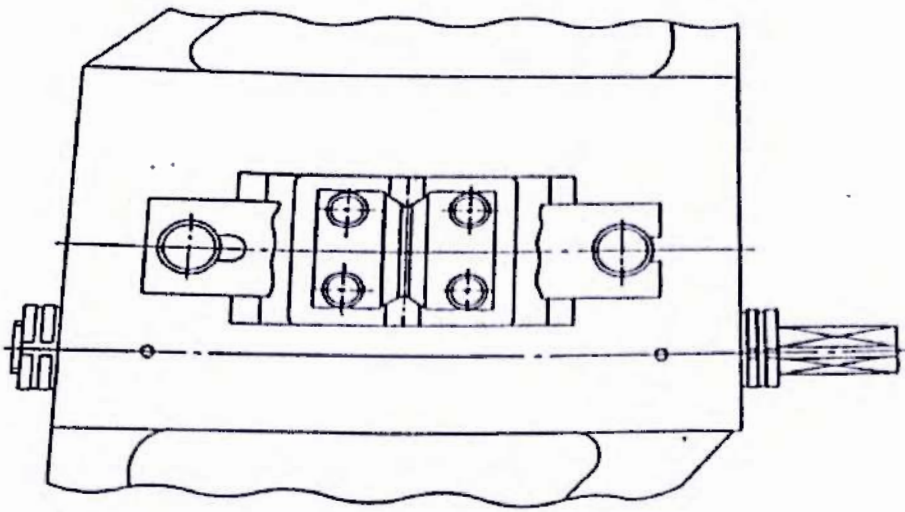


Fig. 3.10 Grips for Tension Tests



- |                                |                                   |
|--------------------------------|-----------------------------------|
| ⑥ Upper crosshead              | ④⑤ Rubber plate                   |
| ④② Grip open-close handle      | ④⑦ Upper liner                    |
| ④③ Insert grip holder          | ④⑨ Pinion                         |
| ④④ Insert grip                 | ⑤⑩ Specimen leap-prevention plate |
| ④⑤ Insert grip hold-down plate |                                   |

Fig. 3.11 Grips for Tension Tests (Models 20 to 100)

### 3.1.4 Compression plates for compression tests (Fig. 3.12)

Set the upper and lower compression plates (64)/(65) on the lower crosshead (5) and table (4), respectively.

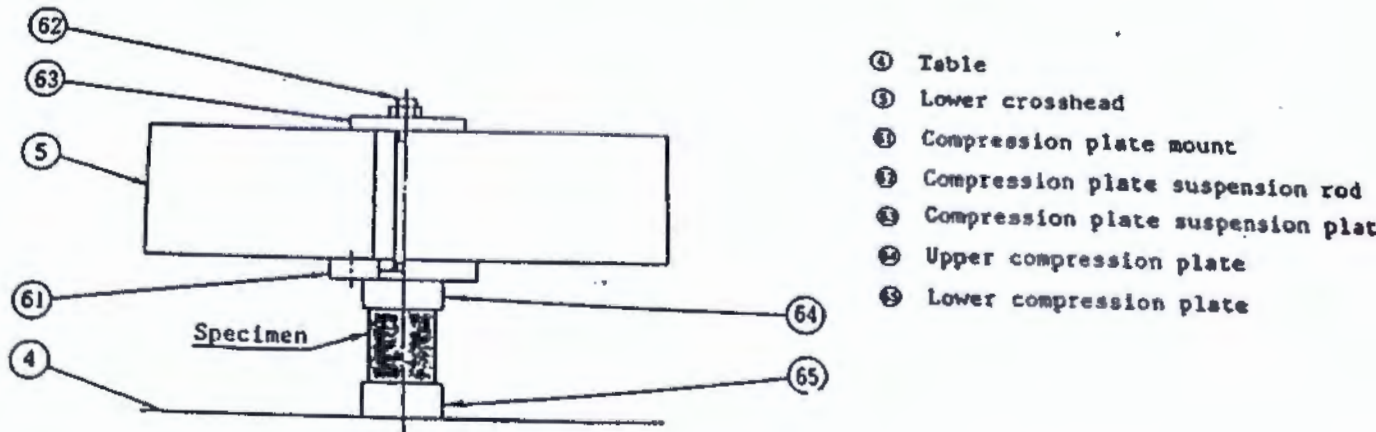


Fig. 3.12 Compression Plates for Compression Tests

### 3.1.5 Transverse/Bending test system

#### 1) Transverse test (Fig. 3.13)

Fit a transverse-bending punch (69) to the lower crosshead (5), and set a transverse-bending table (66), with two fulcrum stands (67) and rollers (68), on the table.

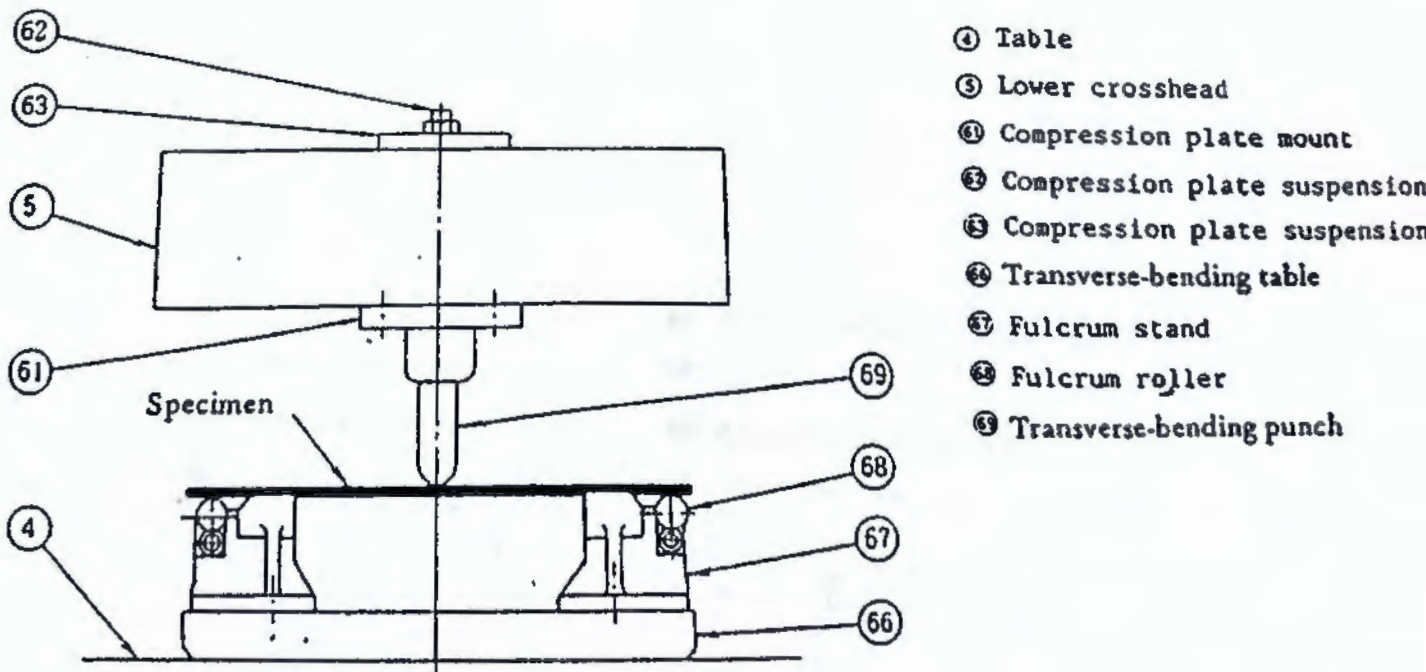
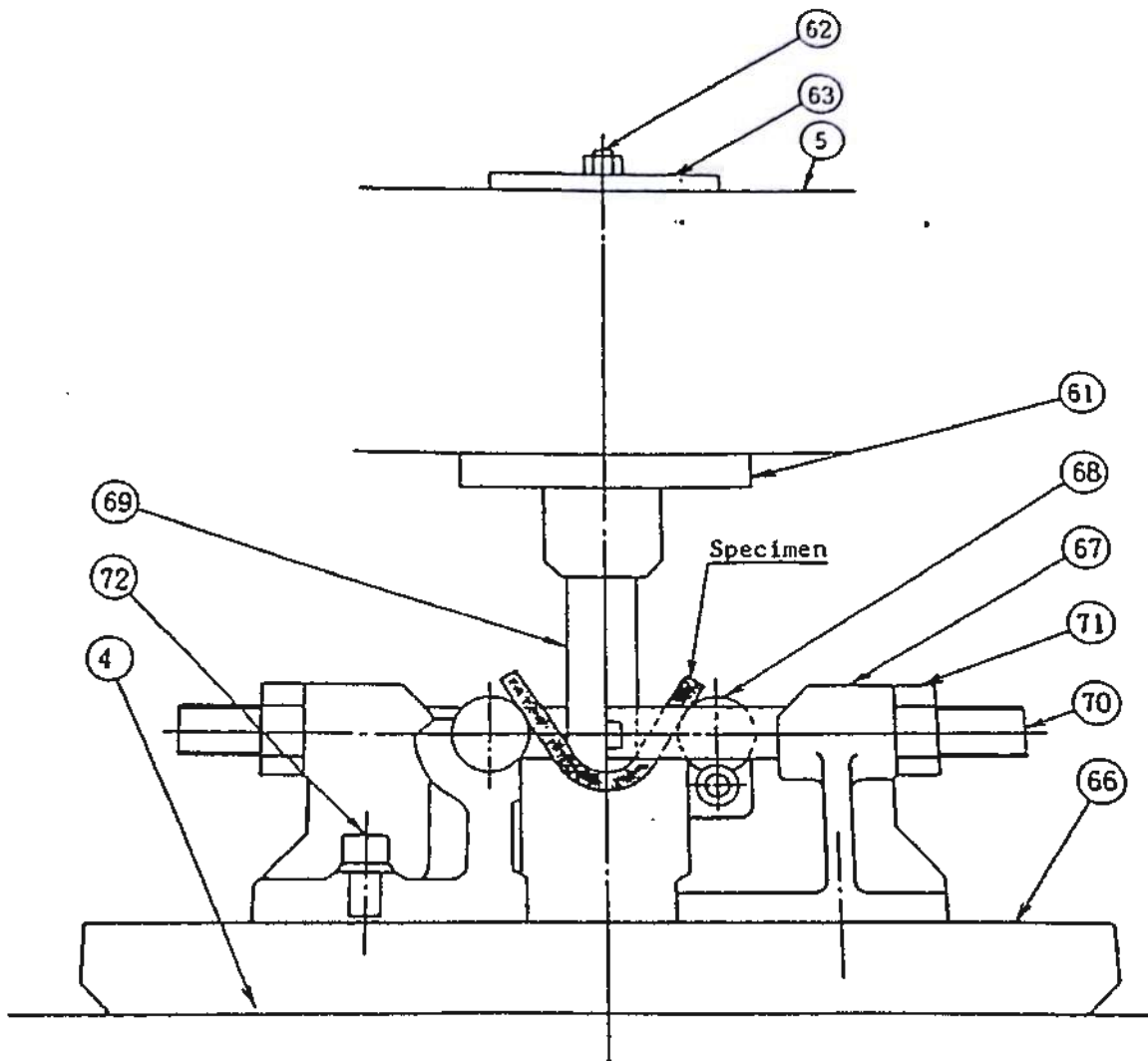


Fig. 3.13 Transverse/Bending Test System (Transverse Test)

2) Bending test (Fig.3.14)

Fit the transverse-bending punch (69) to the lower crosshead (5), and set the transverse-bending table (66) on the table (4).

In addition, a coupling rod (70) and fixing nuts (71) must be installed for this test.



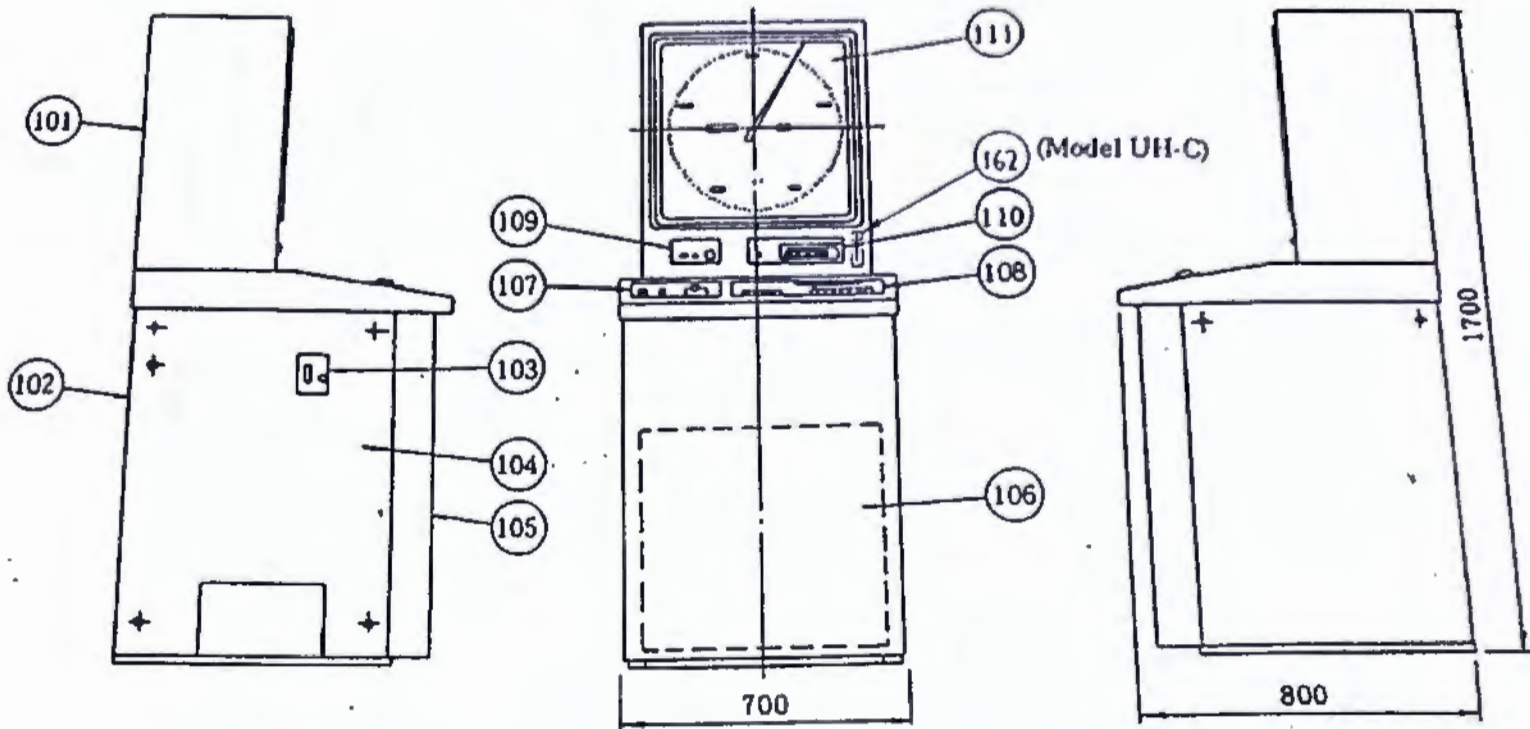
- |                                       |                          |
|---------------------------------------|--------------------------|
| ④ Table                               | ⑥7 Fulcrum stand         |
| ⑤ Lower crosshead                     | ⑥8 Fulcrum roller        |
| ⑥1 Compression plate mount            | ⑥9 Flexure-bending punch |
| ⑥2 Compression plate suspension rod   | ⑦0 Coupling rod          |
| ⑥3 Compression plate suspension plate | ⑦1 Fixing nut            |
| ⑥4 Transverse-bending table           | ⑦2 Fixing bolt           |

Fig. 3.14 Transverse/Bending Test System (Bending Test)



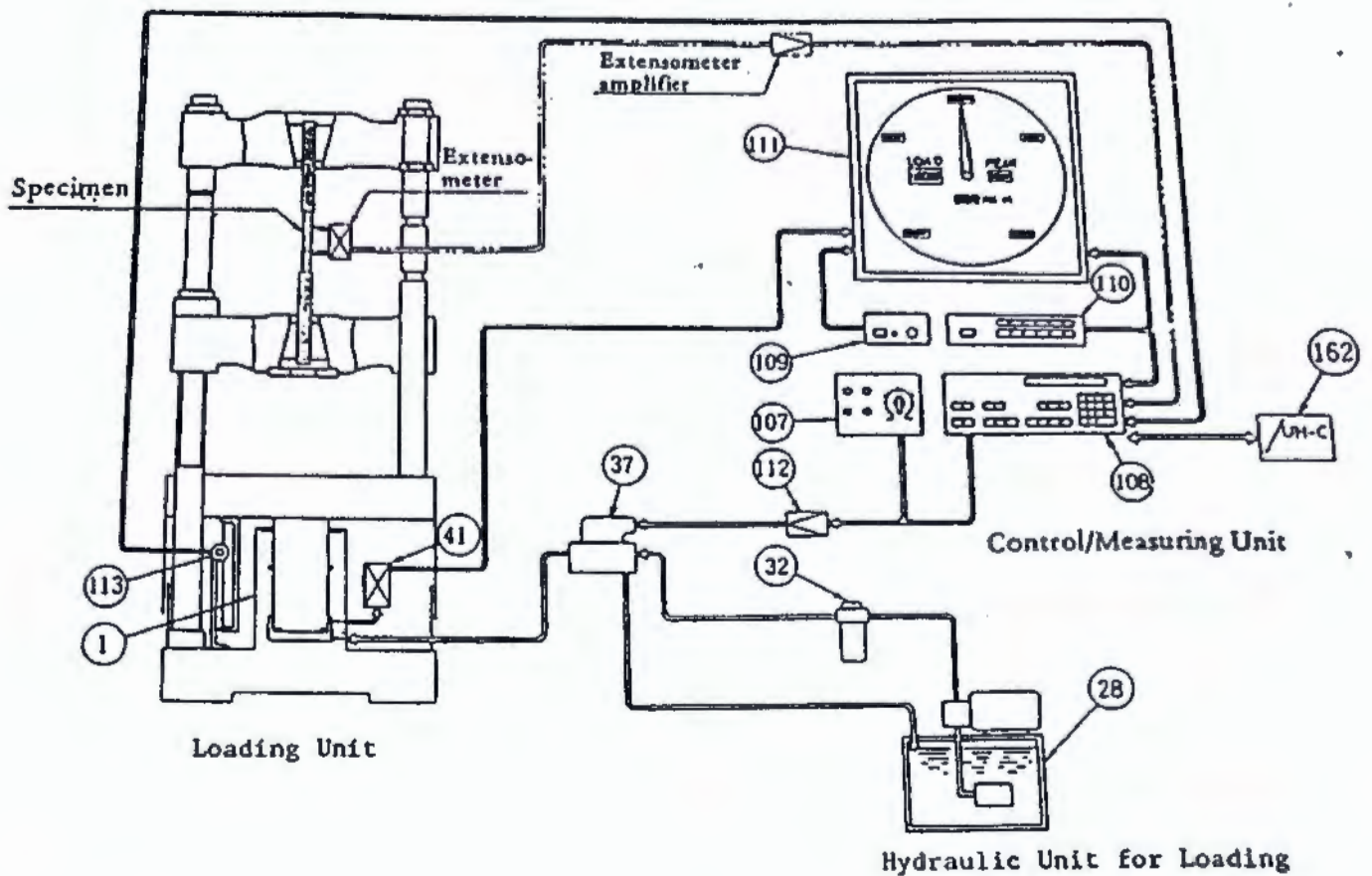
### 3.2 Control/Measuring Unit

Fig 3.15, 3.16, and 3.17 show the appearance, operation system, and block diagram of the control unit, respectively.



- |                      |                              |
|----------------------|------------------------------|
| ① Upper rear cover   | ⑦ Manual operation panel     |
| ② Lower rear cover   | ⑧ Automatic control panel    |
| ③ Power switch       | ⑨ Zero-span adjustment panel |
| ④ Casing             | ⑩ Load range selector panel  |
| ⑤ Front cover        | ⑪ Load display meter         |
| ⑥ Power control unit | ⑫ Memory card (Model UH-C)   |

Fig. 3.15 Control/Measuring Unit: Appearance



- |                                |                              |
|--------------------------------|------------------------------|
| ① Loading cylinder             | ⑩ Manual operation panel     |
| ② Oil tank                     | ⑪ Automatic control panel    |
| ③ Filter                       | ⑫ Zero-span adjustment panel |
| ④ Electrohydraulic servo valve | ⑬ Load range selector        |
| ⑤ Pressure cell                | ⑭ Load display meter         |
|                                | ⑮ Servo amplifier            |
|                                | ⑯ Stroke detector            |
|                                | ⑰ Memory card (Model UH-C)   |

Fig. 3.16 Control/Measuring Unit: Operation System

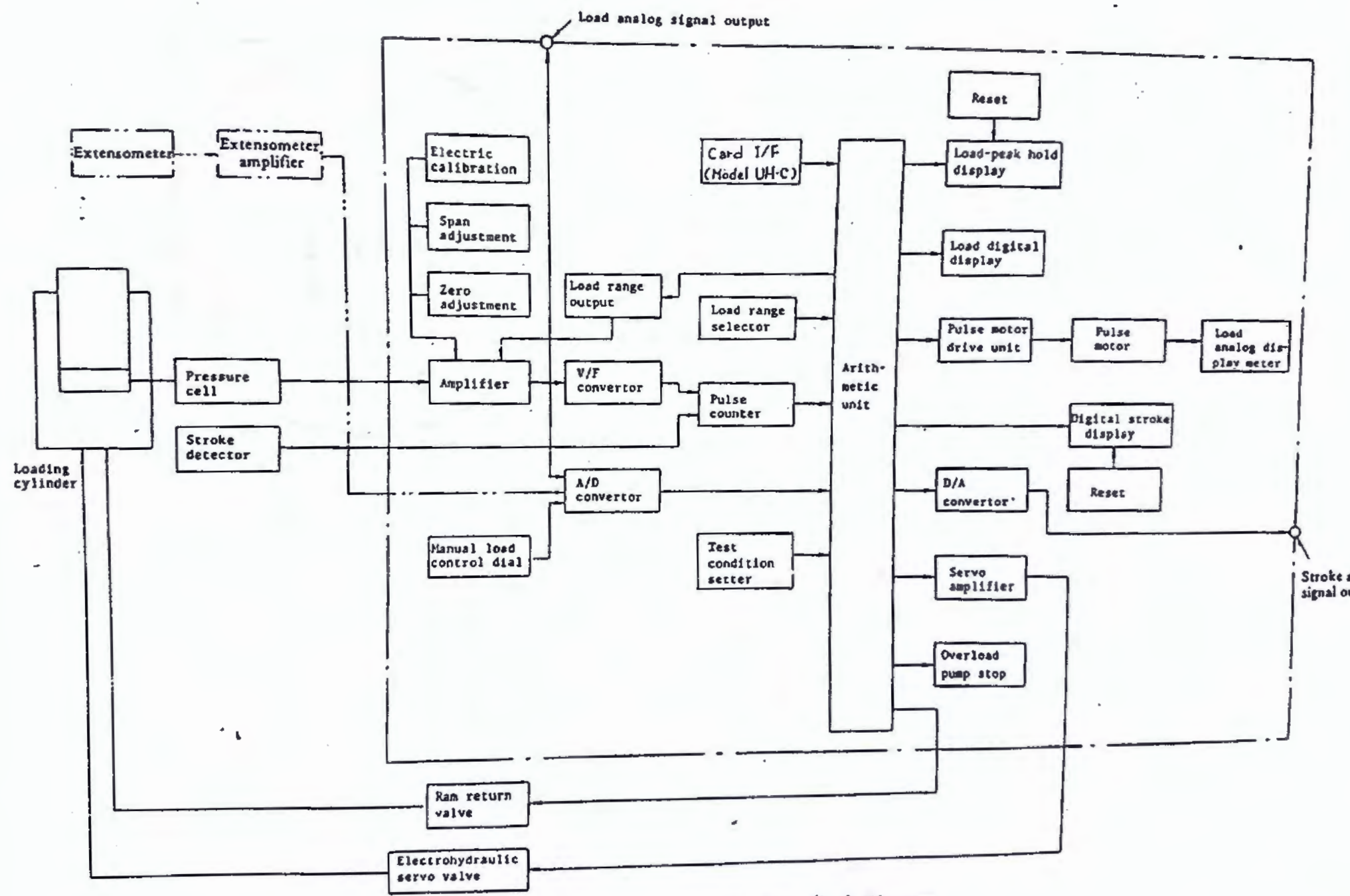


Fig. 3.17 Control/Measuring Unit: Block Diagram

### 3.2.1 Load display meter

#### 1) Pressure cell (41)

This high-precision pressure transducer translates pressure changes, due to loading in the loading cylinder, into electric signals. It is mounted on a loading cylinder wall.

#### 2) Load display (Fig. 3.18)

Tables 1,2 and 3 show digital load displays and minimum increments for each load range.

##### (1) Load display (114)

Digitally displays a current load.

##### (2) Load peak hold display (115)

Holds a current peak load for digital display.

##### (3) Minimum increment display (116)

Digitally displays a single increment value.

##### (4) Scale indicator display (117)

Digitally displays equally-distanced indicators at five points (six points with model 300kN [30tf] of the full scale).

##### (5) Load pointer (118)

Provides an analog display of a current load.

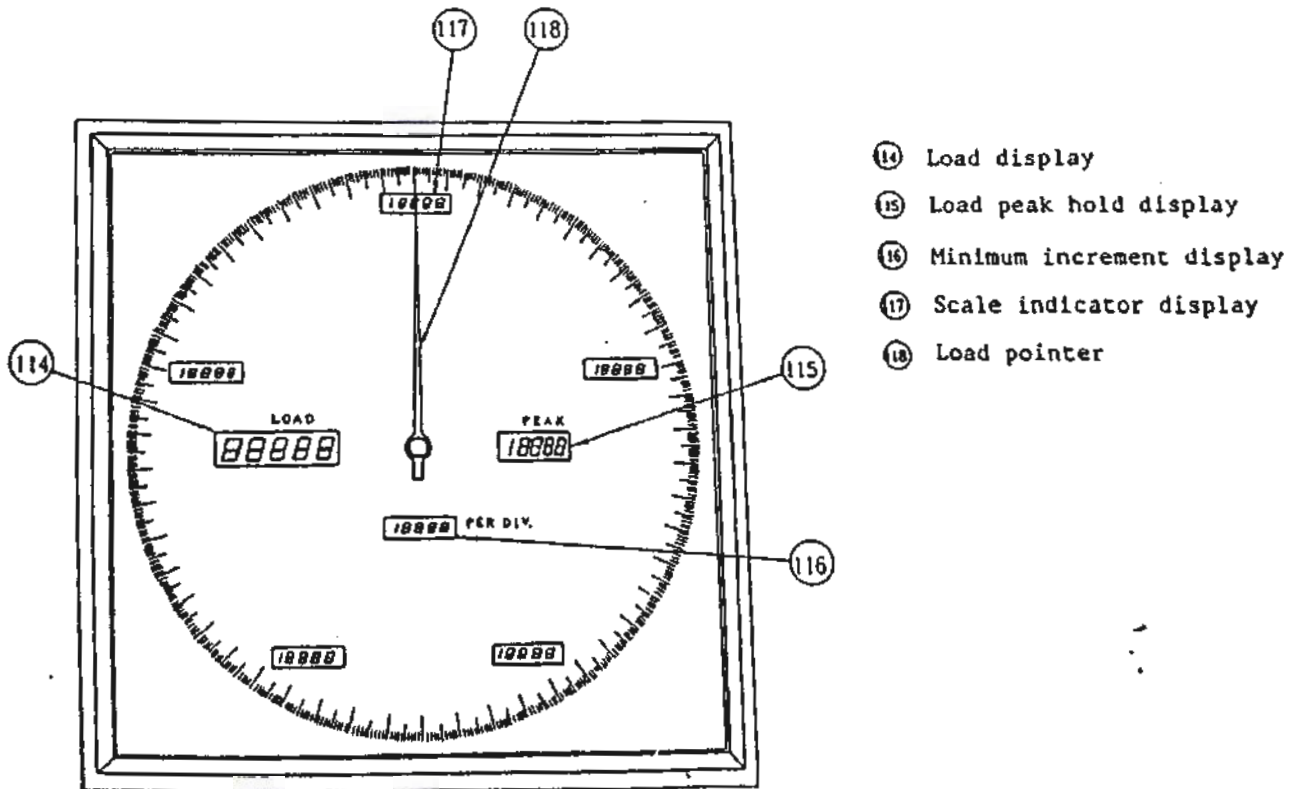


Fig. 3.18 Load Display Meter: Appearance

Table 1 UH Series - SI Unit Load Displays

	Unit: kN				
	UH-100kN	UH-200kN	UH-300kN	UH-500kN	UH-1000kN
1st-step load range (X1)	20.00 40.00 60.00 80.00 100.00	40.0 80.0 120.0 160.0 200.0	50.0 100.0 150.0 200.0 250.0 300.0	100.0 200.0 300.0 400.0 500.0	200.0 400.0 600.0 800.0 1000.0
2nd-step load range (X2)	10.00 20.00 30.00 40.00 50.00	20.00 40.00 60.00 80.00 100.00	25.00 50.00 75.00 100.00 125.00 150.00	50.0 100.0 150.0 200.0 250.0	100.0 200.0 300.0 400.0 500.0
3rd-step load range (X5)	4.00 8.00 12.00 16.00 20.00	8.00 16.00 24.00 32.00 40.00	10.00 20.00 30.00 40.00 50.00 60.00	20.00 40.00 60.00 80.00 100.00	40.0 80.0 120.0 160.0 200.0
4th-step load range (X10)	2.000 4.000 6.000 8.000 10.000	4.00 8.00 12.00 16.00 20.00	5.00 10.00 15.00 20.00 25.00 30.00	10.00 20.00 30.00 40.00 50.00	20.00 40.00 60.00 80.00 100.00
5th-step load range (X20)	1.000 2.000 3.000 4.000 5.000	2.000 4.000 6.000 8.000 10.000	2.500 5.000 7.500 10.000 12.500 15.000	5.00 10.00 15.00 20.00 25.00	10.00 20.00 30.00 40.00 50.00
6th-step load range (X50)	0.400 0.800 1.200 1.600 2.000	0.800 1.600 2.400 3.200 4.000	1.000 2.000 3.000 4.000 5.000 6.000	2.000 4.000 6.000 8.000 10.000	4.00 8.00 12.00 16.00 20.00

- Notes 1) Numeric values in the table are expressed in kN.  
 2) The 0 on the left of the decimal points is not displayed (0.400 is displayed as .400).

Table 2 UH Series Gravitational Unit Load Displays

Unit: tf

	UH-10	UH-20	UH-30	UH-50	UH-100
1st-step load range (X1)	2.000 4.000 6.000 8.000 10.000	4.00 8.00 12.00 16.00 20.00	5.00 10.00 15.00 20.00 25.00 30.00	10.00 20.00 30.00 40.00 50.00	20.00 40.00 60.00 80.00 100.00
2nd-step load range (X2)	1.000 2.000 3.000 4.000 5.000	2.000 4.000 6.000 8.000 10.000	2.500 5.000 7.500 10.000 12.500 15.000	5.00 10.00 15.00 20.00 25.00	10.00 20.00 30.00 40.00 50.00
3rd-step load range (X5)	0.400 0.800 1.200 1.600 2.000	0.800 1.600 2.400 3.200 4.000	1.000 2.000 3.000 4.000 5.000 6.000	2.000 4.000 6.000 8.000 10.000	4.00 8.00 12.00 16.00 20.00
4th-step load range (X10)	0.2000 0.4000 0.6000 0.8000 1.0000	0.400 0.800 1.200 1.600 2.000	0.500 1.000 1.500 2.000 2.500 3.000	1.000 2.000 3.000 4.000 5.000	2.000 4.000 6.000 8.000 10.000
5th-step load range (X20)	0.1000 0.2000 0.3000 0.4000 0.5000	0.2000 0.4000 0.6000 0.8000 1.0000	0.2500 0.5000 0.7500 1.0000 1.2500 1.5000	0.500 1.000 1.500 2.000 2.500	1.000 2.000 3.000 4.000 5.000
6th-step load range (X50)	0.0400 0.0800 0.1200 0.1600 0.2000	0.0800 0.1600 0.2400 0.3200 0.4000	0.1000 0.2000 0.3000 0.4000 0.5000 0.6000	0.2000 0.4000 0.6000 0.8000 1.0000	0.400 0.800 1.200 1.600 2.000

- Notes 1) Numeric values in the table are expressed in tf.  
 2) The 0 on the left of the decimal point is not displayed (0.1000 is displayed as .1000).

Table 3 UH Series Load Displays

Series	Load range	Minimum change	Change of rightmost digit
1	1.0000 10.000 100.00 1000.0	0.0005 0.005 0.05 0.5	0 → 5 → 0 → 5 → 0
1.5	1.5000 15.000 150.00 1500.0	0.0005 0.005 0.05 0.5	0 → 5 → 0 → 5 → 0
2	0.2000 2.000 20.00 200.0 2000	0.0001 0.001 0.01 0.1 1	0 → 1 → 2 → 3 ..... 8 → 9 → 0
2.5	2.500 25.00 250.0	0.001(25) 0.01(25) 0.1(25)	0 → 1(.25) → 2(.5) → 3(.75) → 5 → 6(.25) → 7(.5) → 8(.75) → 0
3	3.000 30.00 300.0 3000	0.001 0.01 0.1 1	0 → 1 → 2 → 3 ..... 8 → 9 → 0
4	0.4000 4.000 40.00 400.0 4000	0.0002 0.002 0.02 0.2 2	0 → 2 → 4 → 6 → 8 → 0
5	0.5000 5.000 50.00 500.0	0.0002(5) 0.002(5) 0.02(5) 0.2(5)	0 → 2 → 5 → 7 → 0
6	0.6000 6.000 60.00 600.0	0.0002 0.002 0.02 0.2	0 → 2 → 4 → 6 → 8 → 0
8	8.000 80.00 800.0	0.004 0.04 0.4	0 → 4 → 8 → 2 → 6 → 0

Note 1) Values in parentheses are not displayed.

3) Load range selector panel (Fig. 3.19)

(1) Load range selector (119)

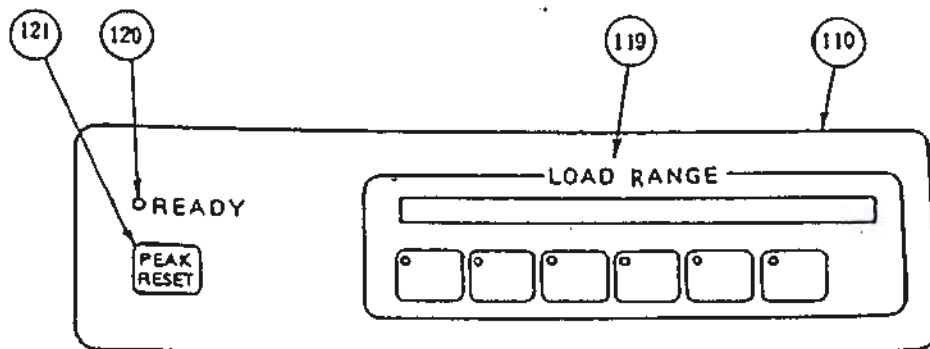
The selector switches change the full scale loads.

(2) READY lamp (120)

Lights when the ram is returned.

(3) Load peak hold display reset switch (121)

Press this reset switch of the load peak hold display to release a current load peak.



- (110) Load range selector panel
- (119) Load range selector
- (120) Ready lamp
- (121) Load peak hold display reset switch

Fig. 3.19 Load Range Selector Panel



4) Zero-span adjustment panel (Fig. 3.20)

(1) Load zeroing dial (122)

Turn this load zeroing dial clockwise to increase a load displayed, and counterclockwise to decrease it.

(2) Load span adjustment switch (123)

Press this load span adjustment switch to display a load approximate to the full scale of a load range.

(3) Load span adjustment knob (124)

This knob is for gain adjustment of the load amplifier. With the load span adjustment switch (123) held down, use the knob to adjust a displayed load exactly to the full scale of a load range.

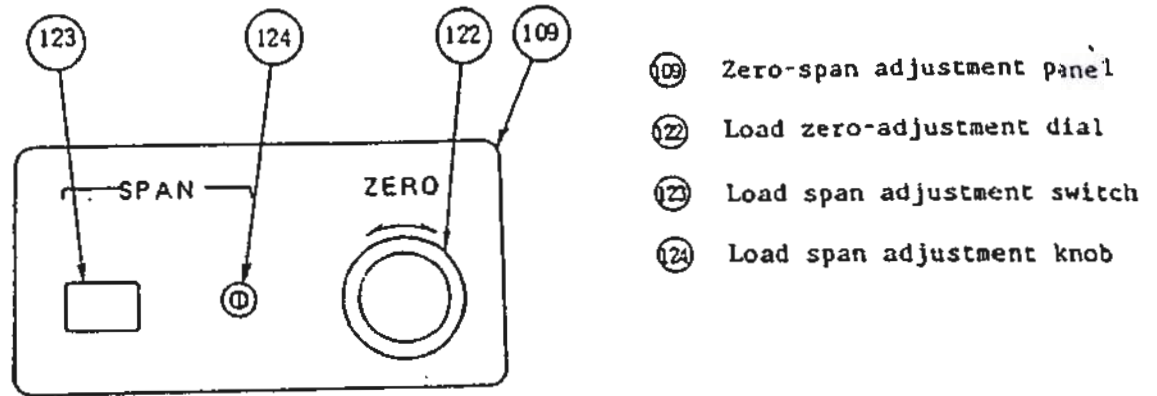


Fig. 3.20 Zero-Span Adjustment Panel

### 3.2.2 Manual control panel (Fig.3.2i)

#### 1) Loading pump switch

##### (1) ON switch (125)

Press this switch to turn on the pump motor. The pilot lamp lights.

##### (2) OFF switch (126)

Press this switch to turn off the pump motor.

#### 2) Crosshead elevation switch

##### (1) UP switch (127)

Depress this switch, and the lower crosshead elevation motor (15) rotates, raising the lower crosshead.

When released, this switch automatically turns off, stopping the crosshead. This switch is effective only while held down.

##### (2) DOWN switch (128)

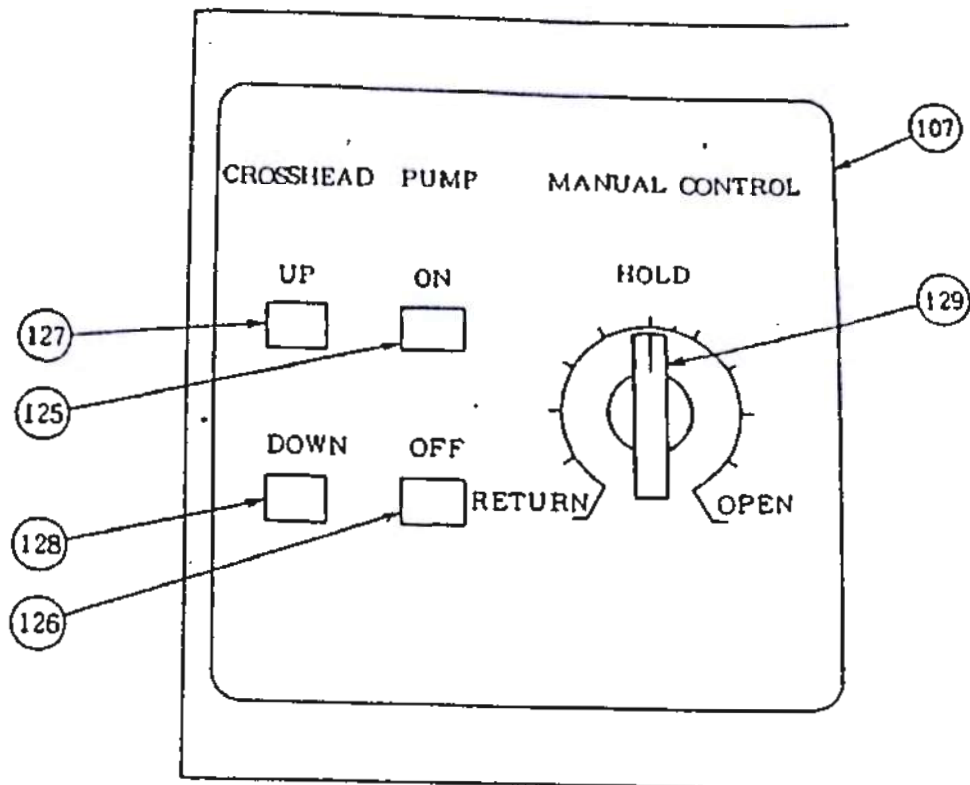
Depress this switch, and the lower crosshead elevation motor (15) rotates, lowering the lower crosshead.

When released, this switch automatically turns off, stopping the crosshead. This switch is effective only while held down.

#### 3) Load control knob (129)

This knob is for manual operation of the load control valve. Turn the knob over the range of RETURN to OPEN on the panel to load, hold, and unload for testing.

Always set the knob to RETURN after testing. When starting the machine, check that the knob is set at RETURN before pressing the pump ON switch.



- |    |                      |    |                       |
|----|----------------------|----|-----------------------|
| ⑩⑦ | Manual control panel | ⑩⑦ | Crosshead UP switch   |
| ⑩⑤ | Pump ON switch       | ⑩⑧ | Crosshead DOWN switch |
| ⑩⑥ | Pump OFF switch      | ⑩⑨ | Load control knob     |

Fig.3.2| Manual Control Panel

### CAUTION

- Please confirm crosshead in going up and down that there is not an obstacle in a perimeter.
- Please load control knob certainly do in RETURN location at the time of test completion. Also, please push PUMP ON switch after confirming the matter in RETURN location at the time of test triggering.


### 3.2.3 Automatic control panel (Fig. 3.22)


The control unit generates reference signals based on preprogrammed control modes and conditions, and compares them with current values to discern deviations. It then computes output values equivalent to resulting deviations, and outputs them to the electrohydraulic servo valve to perform automatic control in the programmed control mode.


#### (1) AUTO/MAN. selector switch

##### ① key ⑬0

The manual mode is set at power up.

Press  to light the LED, thus setting the automatic mode.



Press  again to out the LED, thus setting the manual mode.


The automatic and manual modes switch from one to the other at each press of .

#### (2) AUX./INT. selector key

##### ① key ⑬1

The internal signal control mode (INT) is set at power up.

Press  to light the LED, thus setting the external signal control mode (AUX). Press  again to out the LED, setting

the internal signal control mode. The internal and external signal control modes switch from one to the other at each press of .

#### (3) Control mode setting keys

##### ① key ⑬2

Use this key to set a constant-speed load control mode.

##### ② key ⑬3

Use this key to set a constant-speed strain control mode.

##### ③ key ⑬4

Use this key to set a constant-speed ram stroke control mode.

(4) Operation switches

①  key (135)

Use this key to start automatic control.

②  key (136)

Use this key to stop automatic control.

③  key (137)

Use this key to hold any desired value for constant-value control during operation.

④  key (138)

Use this key to return the ram after testing. This switch works in any of the  ,  ,  , and tension test control modes. Press this switch, and the ram returns to its initial position (then the READY lamp (120) lights), and stops there when the ram return position detector limit switch is actuated.

(5) Stroke setting switch

①  key (139)

Use this switch to zero a stroke on the display and an analog stroke output signal.

②  key (140)

Use this switch to set a stroke span. Key in a required value of the input range between 4 mm to maximum ram stroke.

(6) File setting switches

①  key (141)

This testing machine can store up to 10 preset test conditions. Use this switch to set file numbers.

②  key (142)

Use this switch to call a file number to be run from the preset test conditions in storage. See 6.1.10 or 6.1.11 for details of the file features.

(7) GAIN setting switches

key (143)

Use this key to separately set load gains (for each range), strain gains (for each range), and stroke gains of the servo system. See 6.1.12 for details.

(8) Function keys

key (144)

Use this key to set the JIS tension test mode and automatic load range selection mode.

<input type="button" value="FUNC"/>	<input type="button" value="0"/>	<input type="button" value="ENTER"/>	..... C RAM clear
<input type="button" value="FUNC"/>	<input type="button" value="1"/>	<input type="button" value="ENTER"/>	..... Automatic load range selection (See 6.1.3)
<input type="button" value="FUNC"/>	<input type="button" value="2"/>	<input type="button" value="ENTER"/>	..... JIS tension test (See 6.1.8)
<input type="button" value="FUNC"/>	<input type="button" value="9"/>	<input type="button" value="ENTER"/>	..... Card initialization (Model UH-C)

(9) Adjustment keys

key (145)

Use this key to set adjustments.

<input type="button" value=""/>	<input type="button" value="1"/>	<input type="button" value="ENTER"/>	..... Setting an integration constant (See 6.1.13)
<input type="button" value=""/>	<input type="button" value="2"/>	<input type="button" value="ENTER"/>	..... Display of each input voltage
<input type="button" value=""/>	<input type="button" value="3"/>	<input type="button" value="ENTER"/>	..... Setting an initial stroke speed (See 6.1.14)
<input type="button" value=""/>	<input type="button" value="5"/>	<input type="button" value="ENTER"/>	..... Manual HOLD position adjustment procedure (See 6.1.15)
<input type="button" value=""/>	<input type="button" value="9"/>	<input type="button" value="ENTER"/>	..... Load pointer zero adjustment (See 5.2.4)

(10) Numeral setting key

①  -  keys (146)

Use these keys to input and set numerals for loading speeds and control ranges.

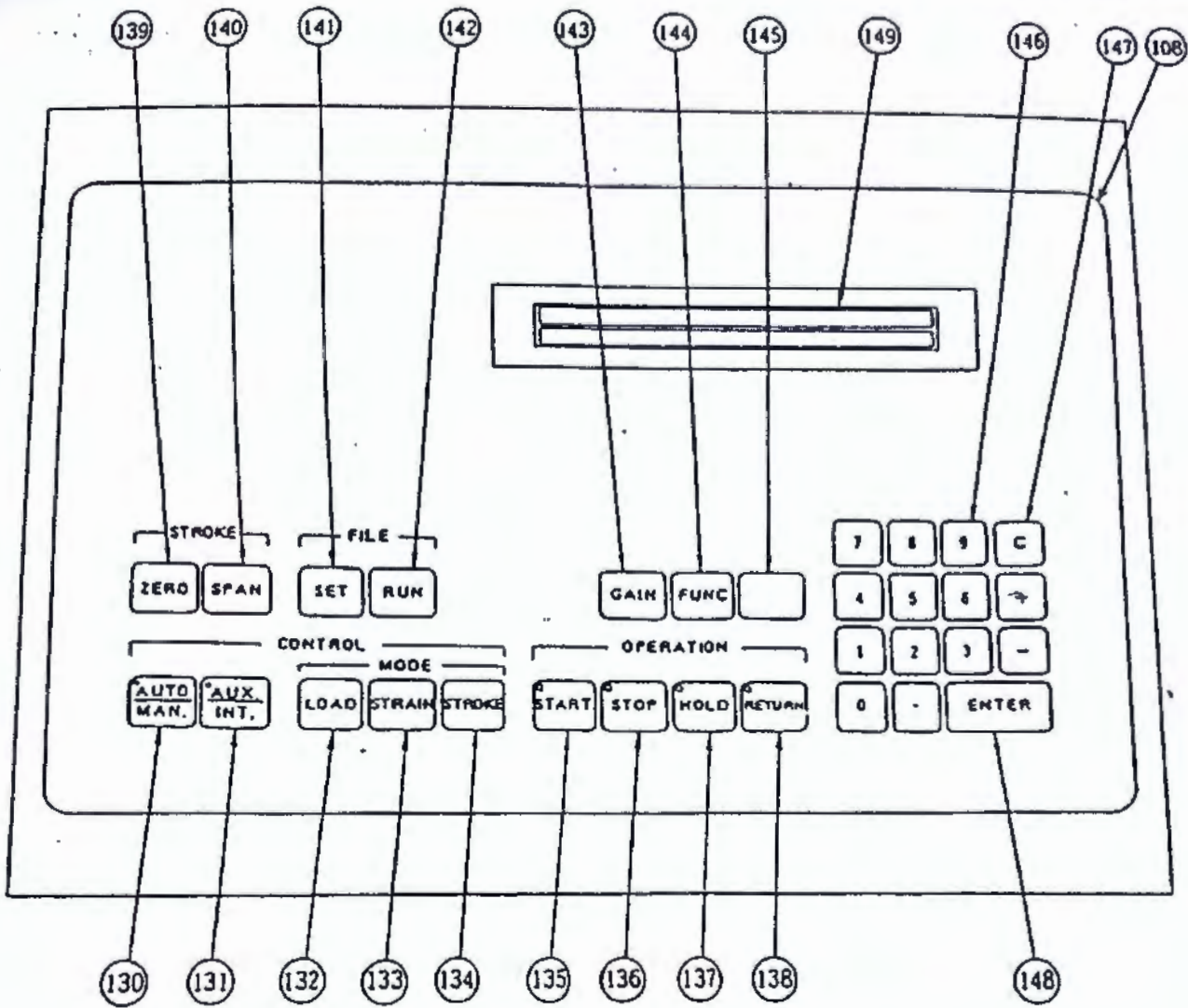
②  key (147)

Use this keys to cancel settings made with the  through  keys.

③  key (148)

Use this key to store settings made with the  through  keys in memory.

This display is for                     ing the automatic control unit.  
 It displays input conditions when setting test conditions as  
 well as displaying control modes and ram strokes during operation.



- |                           |                            |
|---------------------------|----------------------------|
| ⑩ Automatic control panel | ④⑥ Stroke SPAN setting key |
| ⑬⑭ AUTO/MAN. selector key | ④① File number SET key     |
| ⑮ AUX./INT selector key   | ④② File number RUN key     |
| ⑯ Load mode setting key   | ④③ GAIN setting key        |
| ⑰ STRAIN mode setting key | ④④ FUNCTION key            |
| ⑱ STROKE mode setting key | ④⑤ Adjustment key          |
| ⑲ START key               | ④⑥ Numeral setting keys    |
| ⑳ STOP key                | ④⑦ Cancel key              |
| ㉑ HOLD key                | ④⑧ ENTER key               |
| ㉒ RETURN key              | ④⑨ Display                 |
| ㉓ Stroke ZERO reset key   |                            |

Fig.3.22 Automatic Control Panel

### 3.2.4 Input/Output panel (Fig. 3.23)

(1) Fuse (151)

This fuse protects the control unit from an overcurrent; it has a rating of 2A.

(2) Timer (152)

Displays operating hours of the control unit.

(3) Receptacle (153)

This has a capacity of 3A, and connects the external 100V AC power source.

(4) Ground terminal (154)

This terminal connects the ground wire.

(5) Strain signal input connector (155)

Connect the output cord of the ductilometer amplifier to this connector for STRAIN control.

(6) Ductile fracture signal input connector (156)

Connect the output cord of the ductile fracture device to this connector.

(7) External control signal input connector (157)

Connect the output cord of any optional peripheral to this connector for input of setting signals to perform external control.

(8) Deviation signal input connector (158)

Connect the output cord of any optional peripheral to this connector for input of external deviation signals.

(9) Ram stroke encoder output connector (159)

Use this connector to output A-phase and B-phase pulse output signals from the ram encoder.

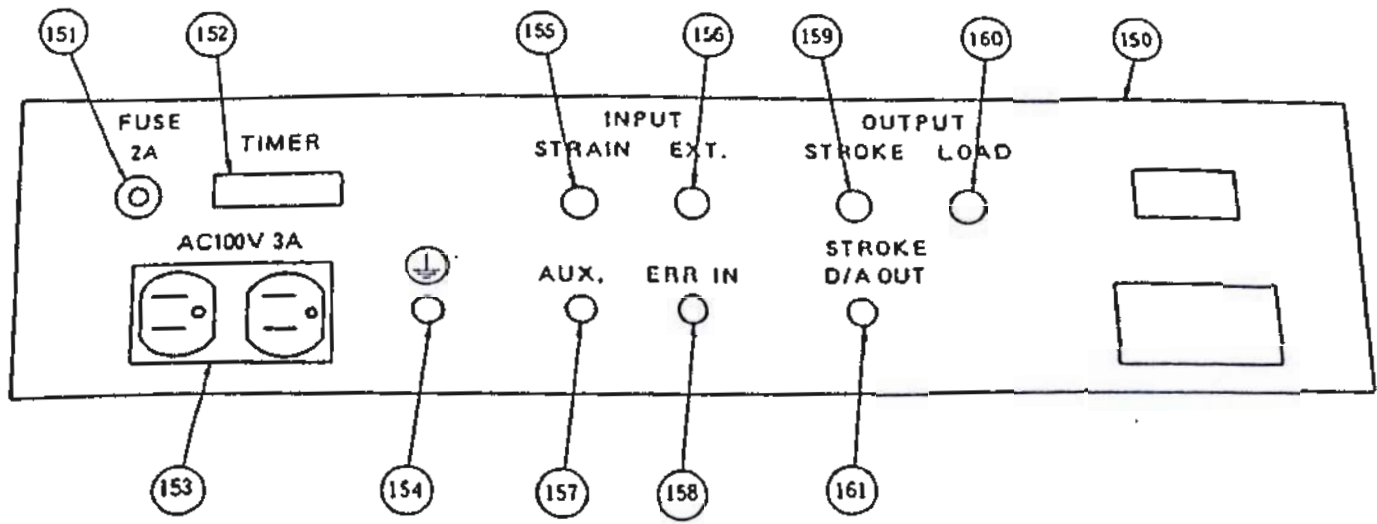
(10) Load output connector (160)

Use this connector to output load analog signals. (0 to 5V DC)

(11) Ram stroke analog output connector (161)

Use this connector to output ram stroke analog signals. (0 to 5V DC)





- |                                   |   |
|-----------------------------------|---|
| ①⑤① Input/output panel            | ①⑤⑥ Ductile fracture signal input connector |
| ①⑤② Fuse                          | ①⑤⑦ External control signal input connector |
| ①⑤③ Timer                         | ①⑤⑧ Deviation signal input connector        |
| ①⑤④ Receptacle                    | ①⑤⑨ Ram stroke encoder output connector     |
| ①⑤⑤ Ground terminal               | ①⑥① Load output connector                   |
| ①⑤⑥ Strain signal input connector | ①⑥② Ram stroke analog output connector      |

Fig. 3.23 Input/Output Panel

### 3.2.5 Ram stroke detector (Fig.3.24)

This detector converts ram stroke changes into pulse signals in terms of 0.002 mm per pulse for use in stroke control. It is installed inside the loading unit table cover.

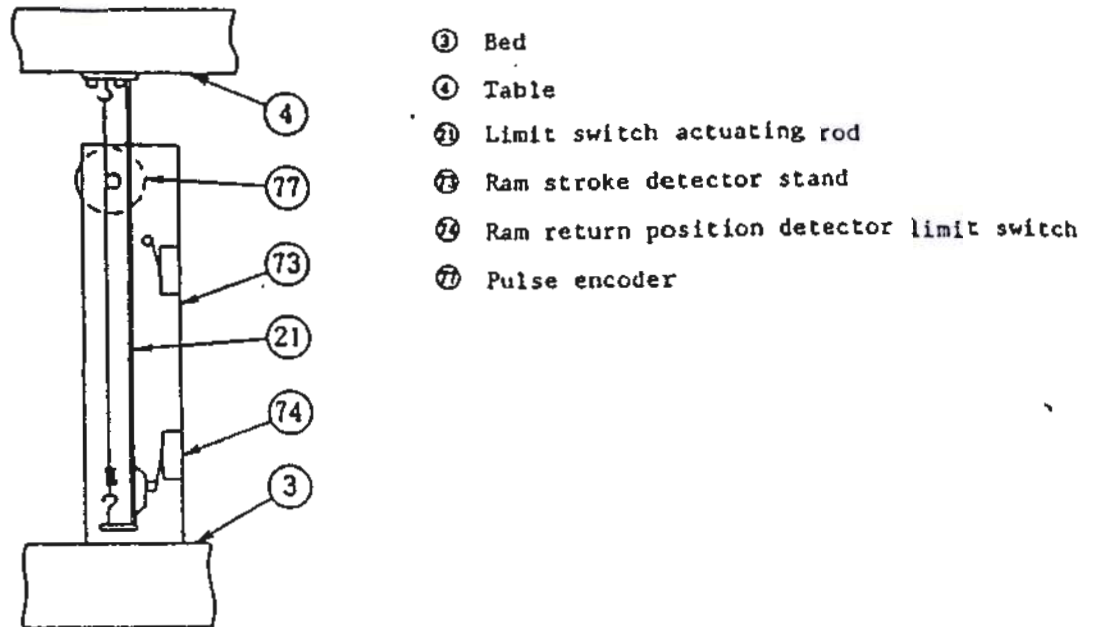


Fig.3.24 Ram Stroke Detector

SI unit	• Model	UH-100kNA,C			UH-200kNA,C			UH-300kNA,C			UH-500kNA,C			UH-1000kNA,C		
	• Load range (KN)	100	50	20	200	100	40	300	150	60	500	250	100	1000	500	200
	6-step selection	10	5	2kN	20	10	4kN	30	15	6kN	50	25	10kN	100	50	20kN
Gravitational unit	• Model	UH-10A,C			UH-20A,C			UH-30A,C			UH-50A,C			UH-100A,C		
	• Loading range (tf)	10	5	2	20	10	4	30	15	6	50	25	10	100	50	20
	6-step selection	1	0.5	0.2tf	2	1	0.4tf	3	1.5	0.6tf	5	2.5	1tf	10	5	2tf
1. Tensile test	• Max.grip-to-grip distance	800mm			800mm			800mm			900mm			100mm		
	• Grips for rods (mm)	One pair of 6 - 28 dia. (With liner)			One pair of 8 - 40 dia. (With liner)			One pair of 8 - 40 dia. (With liner)			One pair of 12 - 50 dia. (With liner)			One pair of 12 - 70 dia. (With liner)		
	• Grips for plates (mm)	One pair of 0 - 20 (44 wide)			One pair of 0 - 35 (50 wide)			One pair of 0 - 35 (50 wide)			One pair of 0 - 45 (60 wide)			One pair of 0 - 65 (70 wide)		
2. Compression test	• Max.plate-to-plate distance (mm)	740			720			720			800			900		
	• Compression plate diameter (mm)	90 dia.			100 dia.			100 dia.			120 dia.			160 dia.		
3. Transverse and bending test	• Max.dog-to-dog distance (mm)	500			500			500			600			800		
	• Dog dia.x dog width (mm)	30x110			30x130			30x130			50x160			50x160		
	• Punch tip radius (mm)	15			15			15			25			25		
	• Punch width (mm)	110			130			130			160			160		
4. Loading speed (Motor spec.)	(60Hz)	About 0 - 100mm/min (3φ, 15KW)			About 0 - 100mm/mit (3φ, 15KW)			About 0 - 100mm/mit (3φ, 15KW)			About 0 - 80mm/mit (3φ, 15KW)			About 0 - 70mm/mit (3φ, 22KW)		
5. Ram stroke	(mpt)	150			200			200			250			250		
6. Crosshead speed (Motor spec.)	(60Hz)	About 480mm/min (3φ, 400W)			About 380mm/min (3φ, 400W)			About 380mm/min (3φ, 400W)			About 450mm/min (3φ, 750W)			About 400mm/min (3φ, 15kW)		
7. Column-to-column distance	(mm)	500			500			500			650			750		
8. Effective table area (Width x Depth)	(mm)	500x500			500x500			500x500			650x650			750x750		
9. Power consumption (3 phase 200/220V, 50/60Hz)		About 3.5kVA			About 3.5kVA			About 3.5kVA			About 4kVA			About 6kVA		
10 Dimensions (Width x Depth Height)	• Loading unit (mm)	720x500x1800			780x500x2000			780x500x2000			960x650x2400			1170x750x2800		
	• Dynamometer (mm)	700x800x1700 (Oil tank incorporated)			700x800x1700 (Oil tank incorporated)			700x800x1700 (Oil tank incorporated)			700x800x1700 (Oil tank incorporated)			700x800x1700 (Oil tank incorporated)		
Weight	• Loading unit (kg)	600			900			900			1650			3500		
	• Dynamometer (kg)	150 (Oil tank incorporated)			150 (Oil tank incorporated)			150 (Oil tank incorporated)			150 (Oil tank incorporated)			150 (Oil tank incorporated)		
Overall dimensions	(mm)	1800x850x1800			1800x850x2000			1800x850x2400			2000x850x2400			2300x900x2800		

Note The loading speeds given are those under zero load and 20°C oil temperature.

## 4.2 Control/Measuring Unit

### 4.2.1 Load display meter

- |                               |  |
|-------------------------------|--|
| 1) Measuring system           | Measurement of the cylinder inner pressure with a high-precision pressure cell |
| 2) Load range                 | 1, 2, 5, 10, 20, 50 times (6 steps)  |
| 3) Display system             | Digital and analog   |
| 4) Load range selector system | Key operation  |
- Note: Load ranges can be changed even during operation, excluding the time under automatic load and stress control.
- |   |   |
|---|---|
| 5) Digits in digital display            | 4 1/2 digits in kN[tf]  |
| 6) Minimum division in analog display   | 1/1000th of each load range<br>(1/600th with Model 300kN{30tf}) |
| 7) Load peak hold display               | Digital display : 4 1/2 digits in kN[tf]                        |
| 8) Electric load calibration device     | Standard attachment   |
| 9) Automatic load range selector system | Standard attachment   |
- Note: If set before operation, the selector system automatically changes the load ranges at 95% of the full scale load under automatic stroke and strain control. It does not operate under automatic load and stress control.
- |                                    |   |
|------------------------------------|---|
| 10) Automatic overload stop system | Standard attachment   |
| 11) Load accuracy                  | Within $\pm 1\%$ in the upper 80% of the full scale in each load range<br>(The manufacturer guarantees the load accuracy specified in JIS B 7721 tensile testing machines.) |

#### 4.2.2 Automatic Load Control Unit

- 1) Control system  
Computer-programmed servo control system  
Closed-loop electrohydraulic servo system
- 2) Automatic control valve  
Electrohydraulic servo valve
- 3) Control mode
  - (1) Constant-speed ram stroke control  
Speed-setting range 0.5 ~ 50.0 mm/min (Model UH-A)  
0.5 ~ 100.0 mm/min (Model UH-C)  
Control range Ram return position ~ Max. ram stroke position
  - (2) Constant-speed load control  
Speed-setting range 0.1 ~ 2.0 full scale/min (Model UH-A)  
0.1 ~ 5.0 full scale/min (Model UH-C)  
Control range 5 ~ 100% of the full scale
  - (3) Constant-speed strain control  
Speed-setting range 0.1 ~ 50.0 %/min (Model UH-A)  
0.1 ~ 80.0 %/min (Model UH-C)  
Control range 5 ~ 100% of the full scale elongation  
Gauge length 5.0 ~ 1000 mm  
Full scale elongation 0.1 ~ 100 mm  
(Note: An optional gauge length extensometer must be separately purchased.)
  - (4) Tension test of metallic materials according to JIS Z 2241  
Stress speed control 1 ~ 50 MPa/s or 1 ~ 50 N/mm<sup>2</sup>·s  
[0.1 ~ 5 kgf/mm<sup>2</sup>·s]  
Constant-speed ram stroke control: 0.5 ~ 50.0 mm/min (Model UH-A)  
0.5 ~ 100.0 mm/min (Model UH-C)  
Control speed switching One touch of key  
Ram return control One touch of key  
Automatic stopping when the specimen is broken.
- 4) Setting of testing parameters Keyboard entry through a dialog system
- 5) Display of testing parameters 40 alphanumeric X 2 lines on a liquid crystal display
- 6) Display of ram stroke 4-digit display in mm unit  
Reset function is provided.
- 7) Testing parameter setting  
Control speed: 1 point (2 points in tensile test)  
Holding point: 1 point (at another point by manual operation)  
Gage length: 1 point (in strain-controlled test)  
Specimen cross-sectional area: Up to 20 points (in stress-speed control test)
- 8) Storage of testing parameters Internal memory In up to 10 files  
Memory card In up to 10 files/card
- 9) Automatic emergency stop Operates when the deviation reaches ±10% of the full scale

- 10) Others  
Analog output of ram stroke signal: DC 0 ~ 5V/stroke span  
(The stroke span is adjustable.)  
Initial stroke speed is adjustable.
- 11) Constant-value control actuator system during operation  
Changeable to constant-value control via key operation
- 12) Automatic control stop system  
Automatically operates at  $\pm 10\%$  of the control deviation full scale.
- 13) Hydraulic oil cooling device  
A hydraulic oil cooling device is required for continuous execution of constant hold control over 30 minutes (at room temperature of 25°C or lower).
- Note: The hydraulic oil cooling device shall be purchased separately.

### CAUTION

Hydraulic oil cooling device <of option> becomes a necessity by establishment condition, use condition sometimes. (ex. In case continuing a certain holding control above 30 minute and carrying out)

## 5.1 Loading Unit

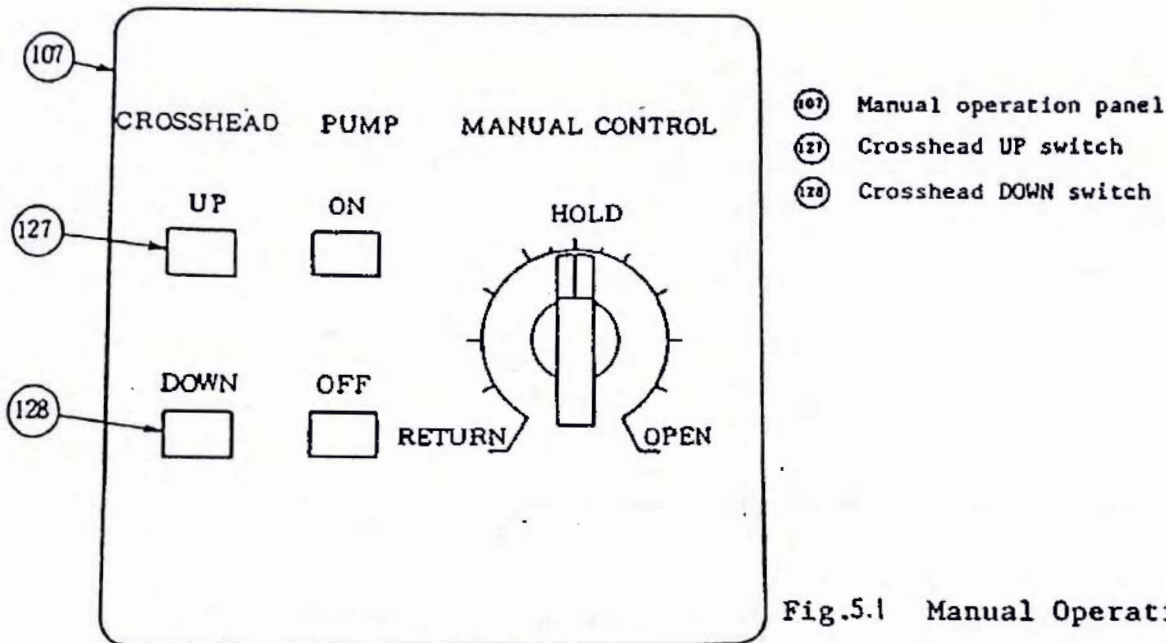
### 1) Lower crosshead elevation

Press the crosshead elevation switch (UP) (127) to raise the lower crosshead (5), and the crosshead elevation switch (DOWN) (128) to lower it.

This switch works only while held down. While pressing this switch, always check that nothing contacts the top and bottom of the crosshead.

### CAUTION

Please operate while pushing push-button switch carefully whether there is the one which certainly makes contact with the aspect and under aspect on crosshead.



### 2) Repositioning the upper crosshead

The upper crosshead can be repositioned with models 50 and 100 or with special-designed models 10 to 30, all of which use recessed columns.

- (1) Put a wooden plate on the lower crosshead (5) top, and raise it close to the upper crosshead.
- (2) Remove the metal fixture (16) and set ring (17) from the upper crosshead top.
- (3) Raise the lower crosshead to force up the upper crosshead slightly.
- (4) Remove the metal fixture (16) from the upper crosshead bottom.
- (5) Raise the lower crosshead until the upper crosshead rises the recessed portion higher than the prescribed position.
- (6) Fit the bottom metal fixture to the column (8).

- (7) Lower the metal crosshead until the bottom metal fixture is located within the upper crosshead  
Fit the upper metal fixture to the column (8) and install the set ring (17), then fix the ring with a setscrew.

### 3) Tension test grip installation

#### • Upper tension test grips

- (1) Select the rod or plate insert grips (44) appropriate for the specimen, and fit them to the insert grip holders (43). First remove 2 bolts from the holder end to detach the insert grip hold-down plate (45) and rubber plate (46). Next, insert the grip (44) from the end with line marks (for plates) or character marks (for rods) into the holder. Make sure that the teeth catch the specimen. Then refit the insert grip hold-down plate and rubber plate, and retighten the bolts.
- (2) Fit the grip open-close handle (42) to the pinion shaft (49) in the upper crosshead front.
- (3) Set the insert grip holders (43) into the square hole from above the upper crosshead.
- (4) Turn the handle clockwise to lower the insert grip holder.
- (5) If the paired insert grips are not horizontally aligned, turn the handle counterclockwise to raise the grips until the racks are disengaged. Lower the grips after you hear a clattering sound.
- (6) Use the liners shown below according to the specimen diameter or thickness.

Model/ Grip Liner	Models 200, 300kN [20, 30rf]		Model 500kN [50rf]		Model 1000kN [100rf]	
	For rods	For plates	For rods	For plates	For rods	For plates
Thick liner used	8-18	0-12	12-24	0-15	12-13	0-22
Thin liner used	18-28	12-24	24-36	15-30	30-50	22-44
No liner	28-40	24-35	36-50	30-45	50-70	44-65

(Unit: mm)

Set the longer liner in the upper crosshead from above. A square cutout is made on one side of the liner so as not to obstruct the pinion shaft. Insert the liner from above so that its chamfered sides contact the rounded corners of the crosshead square hole.



(7) When chucking a flat-plate specimen, carefully align the center lines of the testing machine and the specimen for proper vertical chucking.

(8) Check that the specimen leap prevention plate (5) is secured on the upper crosshead.

• Lower tension test grips

(1) Fit the grip open-close handle (42) to the pinion shaft (49) in the lower crosshead front.

(2) Set one of the paired lower insert grip holders (43) in the square hole from above the lower crosshead, and lower it all the way down.

(3) Insert the other holder into the hole until it stops at the pinion shaft.

(4) Turn the handle clockwise to raise the previously set insert grip holder until the rack is disengaged.

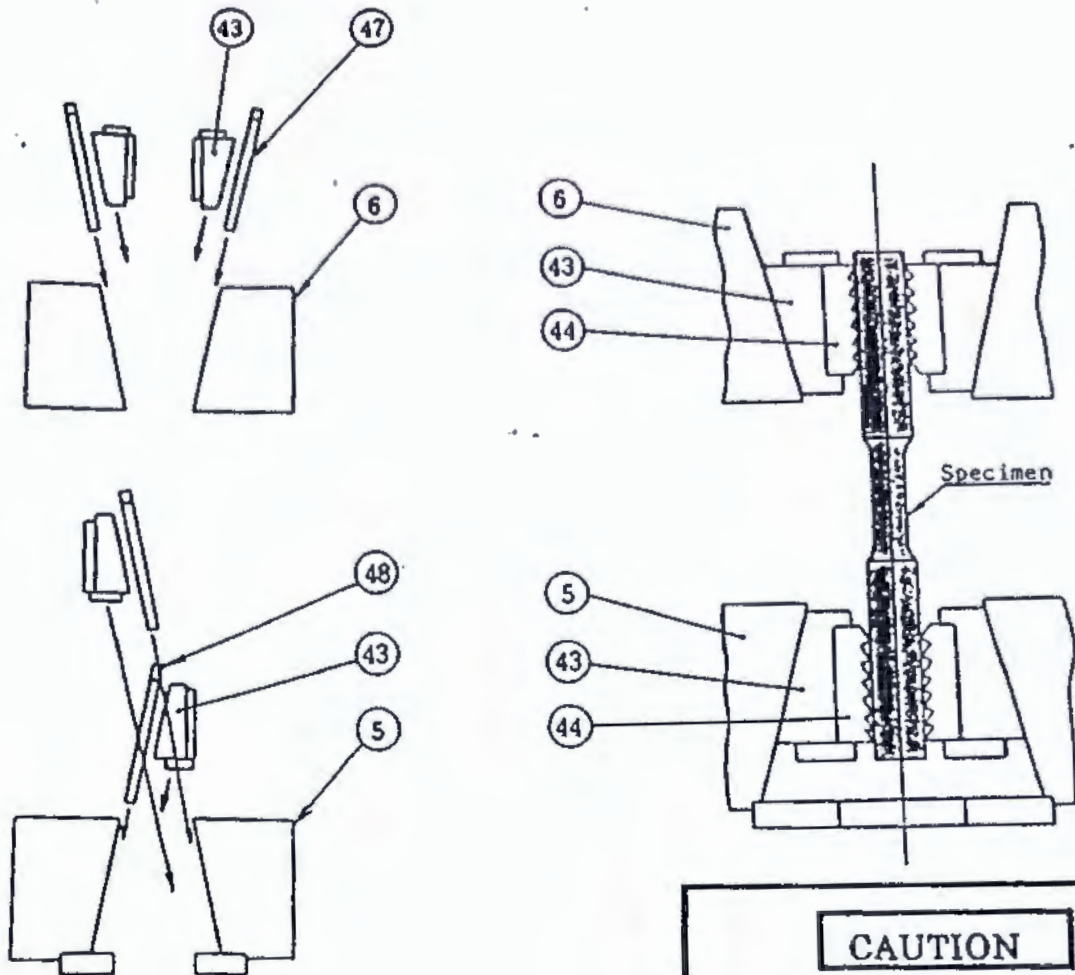
(5) When both the holders are horizontally aligned, turn the handle counterclockwise to lower them. Forcefully turn the handle further in the same direction to provide a clearance between the back of the insert grip holder and the crosshead square hole wall.

(6) Fit the lower liner (48).

• Tension test grip removal

(1) Follow the above steps in the reversed order.

(2) To remove the lower grips, raise the paired insert grip holders, hold one of them, and lower the other before removing the insert grip and holder. Then similarly remove the other insert grip and holder.



• Insertion direction of insert grip holders and liners

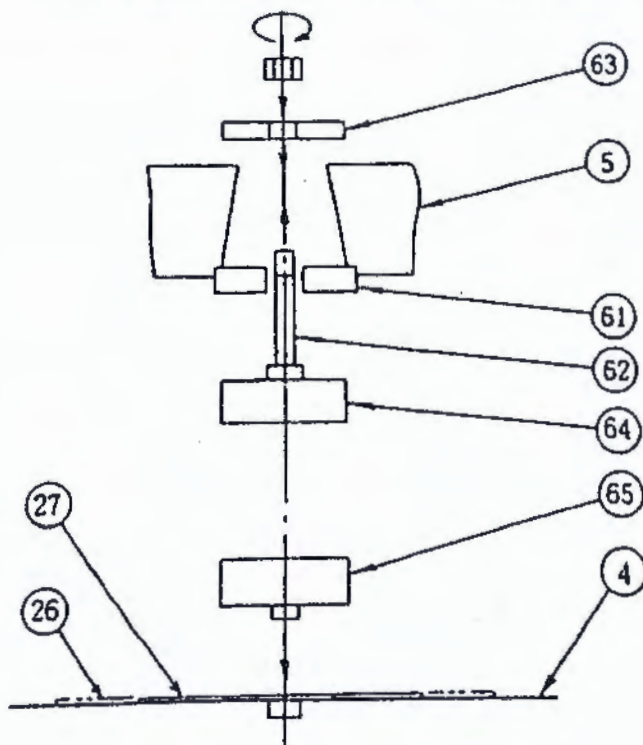
**CAUTION**  
Set the insert grips so that their teeth catch the specimen.

- ⑤ Lower crosshead
- ⑥ Upper crosshead
- ④ Insert grip holder
- ④ Insert grip
- ④ Upper liner
- ④ Upper liner

Fig. 5.2 Grip Installation (Models 20 to 100)

#### 4) Installation of compression plates for compression testing

- (1) Remove the table top protective mat (26), and set the compression test table top protective mat (27) on the table after first cleaning the table with a clean cloth. Then mount the lower compression plate so that the knock pin fits inside the knock pin hole in the center of the table.
- (2) Screw the compression plate suspension rod (62) into the upper compression plate (64), and place the upper compression plate onto the lower compression plate.
- (3) Press the crosshead elevation switch (DOWN) (128) to lower the lower crosshead (5) close to the upper compression plate (64).
- (4) Fit the small protrusion of the upper compression plate 64 into the compression plate mount (61) on the lower crosshead (5). When this is done, the compression plate suspension rod 62 protrudes above the lower crosshead (5).
- (5) Fit the compression plate suspension plate (63) to the compression plate suspension rod (62) end, and secure them with a nut.

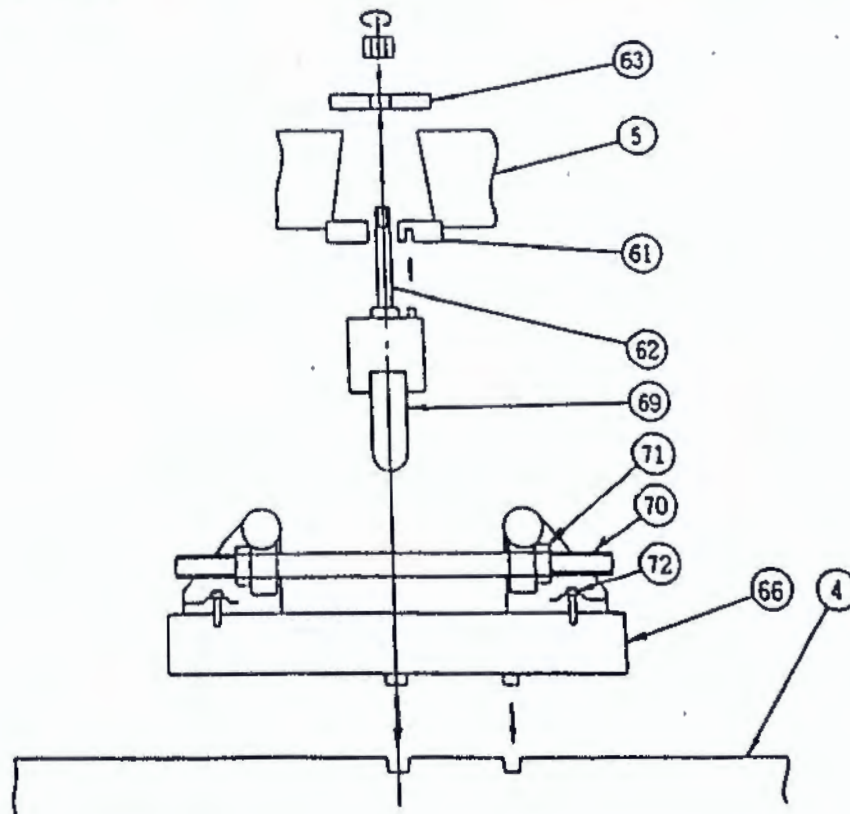


- |   |                                       |
|---|---------------------------------------|
| ④ Table   | ⑥② Compression plate suspension rod   |
| ⑤ Lower crosshead   | ⑥③ Compression plate suspension plate |
| ②⑥ Table top protective mat<br>(for the entire surface)       | ⑥④ Upper compression plate            |
| ②⑦ Table top protective mat<br>(for use in compression tests) | ⑥⑤ Lower compression plate            |
| ⑥① Compression plate mount                                    |                                       |

Fig. 5.3 Installation of Compression Plates for Compression Testing

6) Installation of flexure/bending test system

- (1) Remove the table top protective mat (26), clean the surface of the table with a clean cloth, and mount the flexure-bending table (66) so that the knock pins fit inside the knock pin holes located on the table (4). The flexure-bending table can be mounted either in alignment with or (45) degrees diagonally to the front-to-back line of the table (4). When mounted diagonally at (45) degrees, the operator controlling the load has a clear view of the specimen being tested.
- (2) Symmetrically place a pair of fulcrum stands (67) with fulcrum rollers (68) on the flexure-bending table, and secure them with the fixing bolts (72).
- (3) Install the flexure-bending punch (69) using the same procedure as for the compression test system.
- (4) Firmly secure the fulcrum stands with the coupling rod (70), fixing nuts (71) and fixing bolts (72) to prevent the stands from moving due to the specimen reaction force when performing a bending test.



- |                                       |                          |
|---------------------------------------|--------------------------|
| ④ Table                               | ⑥⑥ Flexure-bending table |
| ⑤ Lower crosshead                     | ⑥⑨ Flexure-bending punch |
| ⑥① Compression plate mount            | ⑦⑦ Coupling rod          |
| ⑥② Compression plate suspension rod   | ⑦① Fastening nut         |
| ⑥③ Compression plate suspension plate | ⑦② Fastening bolt        |

Fig. 5.4 Installation of Flexure/Bending Test System

## 5.2 Control/Measuring Unit

### 1) Power Up

After checking that no obstacle exists around the testing machine, turn the power on as per the following procedure.

(1) Check that the three-phase power is supplied to the primary winding of the testing machine power source.

(2) Set the power switch (103) ON.

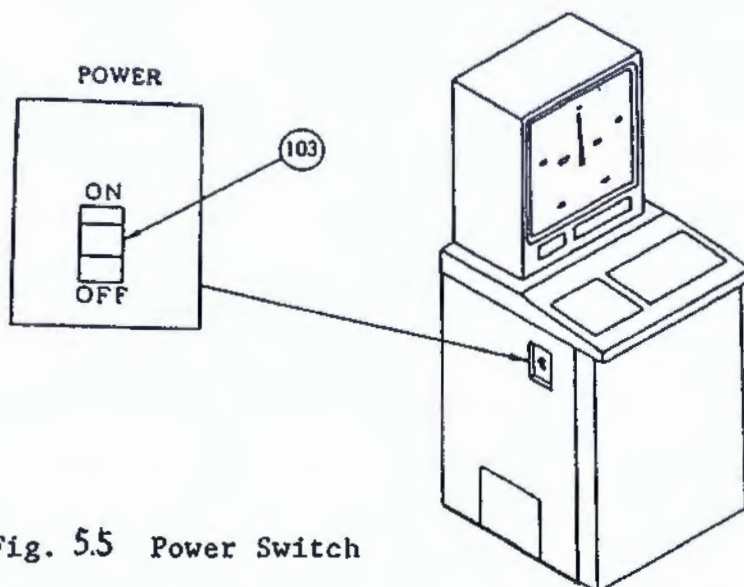
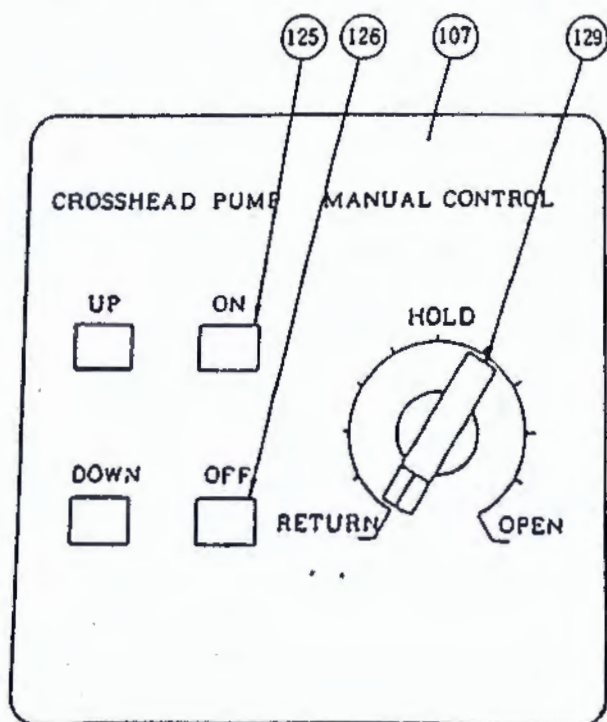


Fig. 5.5 Power Switch

### 2) Loading pump actuation

After checking that the load control knob (129) is set at RETURN, press the pump switch (ON) (125).



- (107) Manual control panel
- (125) Pump switch (ON)
- (126) Pump switch (OFF)
- (129) Load control knob

Fig. 5.6 Manual Control Panel

3) Load control knob

RETURN, HOLD, and OPEN are indicated around the load control knob (129) located on the panel.

**OPEN:** To load or raise the ram, turn the control knob clockwise. The closer the knob turns toward OPEN when past HOLD, the more hydraulic oil the pump feeds to increase the ram speed. When the knob is at OPEN, the ram reaches maximum speed.

**RETURN:** To unload or lower the ram, turn the control knob to RETURN.

**HOLD:** To hold the ram at a given position, set the knob to HOLD. However, since an effective HOLD setting position slightly varies with the load and oil temperature, check the load display to locate the optimum position.

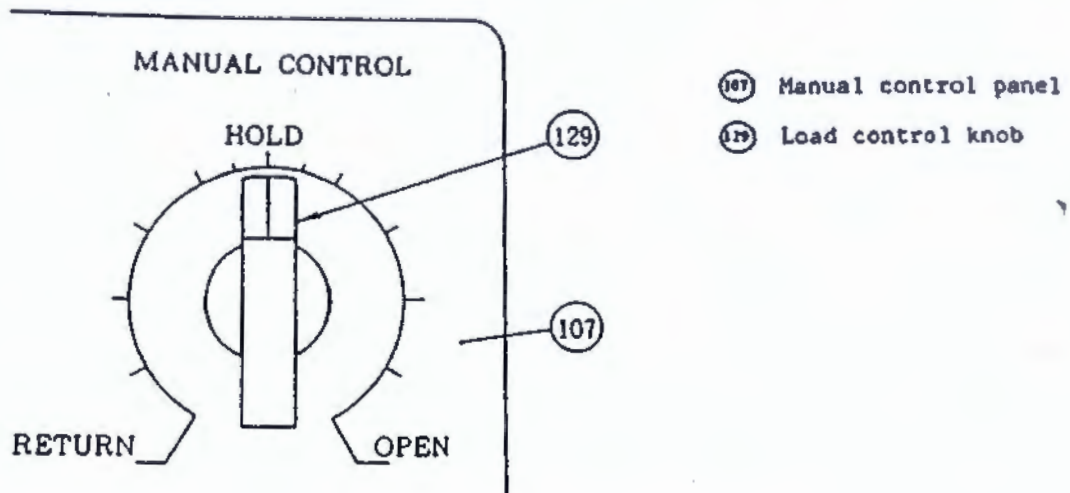


Fig. 5.7 Load Control Knob

4) Load zero adjustment

Set the load range selector (119) to the minimum load range, and adjust the digital load display to zero with the load zero-adjustment dial (122).

Make this adjustment while the ram is at its initial position (up to approx. 10 mm from the bottom) with the READY lamp lit.

If the digital load display and the load pointer deviate from each other, adjust the load pointer to zero as follows.

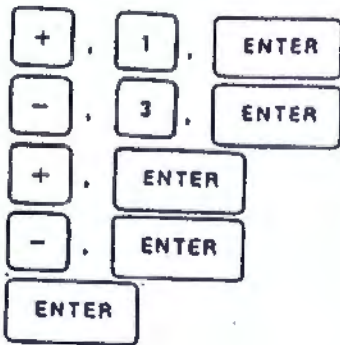
(1) Adjust the digital load display to zero with the load zeroing dial.

Next, press  9  ENTER in the AUTO mode to display the followi

INDICATOR

(2) In this status, enter numerals, +, and - to adjust the load pointer to zero.

Example



- ..... Pointer moves 1 divisions clockwise.
- ..... Pointer moves 3 divisions counterclockwise.
- ..... Pointer moves 1/5 division (1/8 division with the 300kN[30tf] system) clockwise.
- ..... Pointer moves 1/5 division (1/8 division with the 300kN[30tf] system) counterclockwise.
- ..... Terminates the load pointer adjustment mode.

(3) Enter numerals after + and - to adjust over 1 division, and enter just + and - to adjust within 1 division as shown above. After checking that the digital load display and load pointer are adjusted to zero, terminate the adjustment mode with

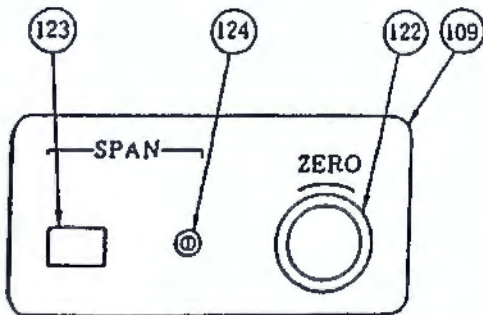


### 5) Load span adjustment

After load zeroing, adjust span as follows.

Press the span adjustment switch (123) to display a value close to the full scale of a load range onto the load display.

Adjust the displayed value to exactly the full scale of the load range with the load span adjustment knob (124).



- (109) Zero-span adjustment panel
- (122) Load zeroing dial
- (123) Load span adjustment switch
- (124) Load span adjustment knob

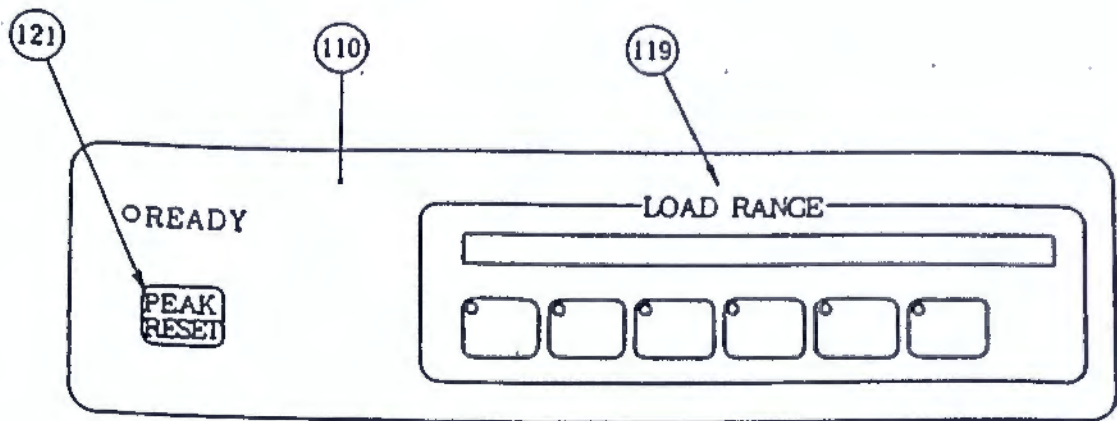
Fig. 5.8 Zero-Span Adjustment Panel

### 6) Load range selection

Set the full scale load range for use in a test with the load range selector (119).

7) Load peak release

Press the load peak hold display reset switch (121) to release the displayed load peak.



- (110) Load range selector panel
- (119) Load range selector
- (120) Load peak hold display reset switch

Fig. 5.9 Load Range Selector Panel



## 6. Automatic Load Control Unit

### 6.1 Basic Operation and Functions

#### 6.1.1 Power Up

Set the control unit power switch (103) to ON.  
When turned on, the display shows the following.

\*\*\* SHIMADZU UH-A SERIES Ver. xx.x \*\*\*

The unit displays the above for 3 seconds at start-up and runs the UH program.

After execution of the UH program, the unit displays the following.

MANUAL MODE STROKE xxx.x mm

In this status, the unit is set in the manual control mode.  
If the ram is at its lowest position, press the pump ON switch (125). Then set the load control knob to OPEN to lift the ram before setting the knob to HOLD.

#### 6.1.2 Automatic/manual control selection

Press  AUTO  MAN. to light the LED and change the control mode into the automatic control mode.  
The display shows the following.

AUTO INT. MODE STROKE xxx.x mm

#### 6.1.3 Automatic load range selector

The standard automatic load range selector is available when the unit performs stroke control or strain control. This selector can be turned on or off by means of key operation.

If turned on, the automatic load range selector automatically switches the current load range into the next range when the load exceeds 95% of the full scale of the current range.

To turn the automatic load range selector on and off, operate the keys as follows.

Press  FUNC  I and  ENTER to turn on the selector, [A] then appears on the upper right of the display.

Press **FUNC** **1** and **ENTER** again to turn off the selector, [A] then disappears.

#### 6.1.4 Stroke span setting

The **SPAN** key is for setting stroke analog signal output spans. Any required value of a range between 4 mm and maximum ram stroke can be entered. If 100 mm is entered as a span, the unit outputs 5V DC analog signals via the STROKE D/A OUT terminal every 100 mm stroke. Enter the keys as follows.

Press **SPAN** **100**

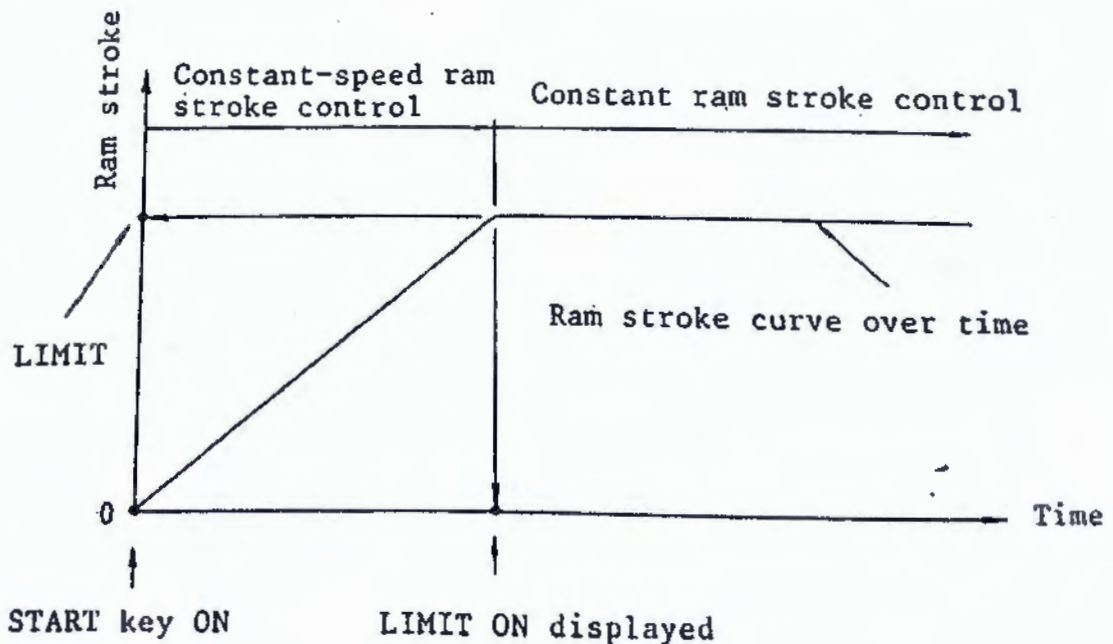
STROKE SPAN  $\times\times\times\times$  mm  
-

Enter the required value in a range between 4 mm and the maximum ram stroke.

Next, set a control mode. Basic operations and functions for each mode are explained below.

- 1 Constant-speed ram stroke control → 6.1.5
- 2 Constant-speed load control → 6.1.6
- 3 Constant-speed strain control → 6.1.7
- 4 Tension test control → 6.1.8

#### 6.1.5 Constant-speed ram stroke control



① Press **STROKE** (134) to enter the constant-speed ram stroke control mode.

The display shows the following. At the same time, the cursor lights, enabling input of settings.

```
MODE STROKE
SPEED xx.x mm/min
```

② First set a stroke speed.

• Model UH-A: Within 3 digits (XX.X) setting range between 0.5~50.0 mm/min.

The unit does not accept more than 3 digits.

• Model UH-C: Within 4 digits (XXX.X) setting range between 0.5~100.0 mm/min.

The unit does not accept more than 4 digits.

After the speed is set and registered, the display shows the following.

```
MODE STROKE
LIMIT xxx.x mm
```

③ Set a stroke LIMIT. The unit performs constant-speed stroke control up to this LIMIT, and starts constant ram stroke control past the LIMIT using this value.

A stroke limit is to be set within 4 digits (xxx.x) in a range between 1.0 mm and the maximum ram stroke.

After a limit value is set and registered, the display alternately shows the following 2 messages.

```
MODE STROKE    SPEED xx.x mm/min
LIMIT xxx.x mm
```

```
START SW ?    STROKE xxx.x mm
```

④ Press **ZERO** (139) to zero a displayed stroke.

After checking set conditions on the display, press **START** (135).

The unit starts a constant ram stroke control, and the display shows the following including a stroke value.

```
MODE STROKE    STROKE xxx.x mm
```

At this point, if a registered LIMIT is invalid, the display shows the following.

```
MODE STROKE
LIMIT IS NOT VALID !!
```

If this occurs, reperform the procedure beginning from the setting of the control mode.

- ⑤ When a ram stroke reaches a LIMIT during ram stroke control, the unit automatically switches from the constant-speed to the constant ram stroke control, showing LIMIT ON on the display.

MODE STROKE      STROKE  $xxxx.x$  mm  
LIMIT ON

- ⑥ In the above status, the unit allows the next control mode to be set.

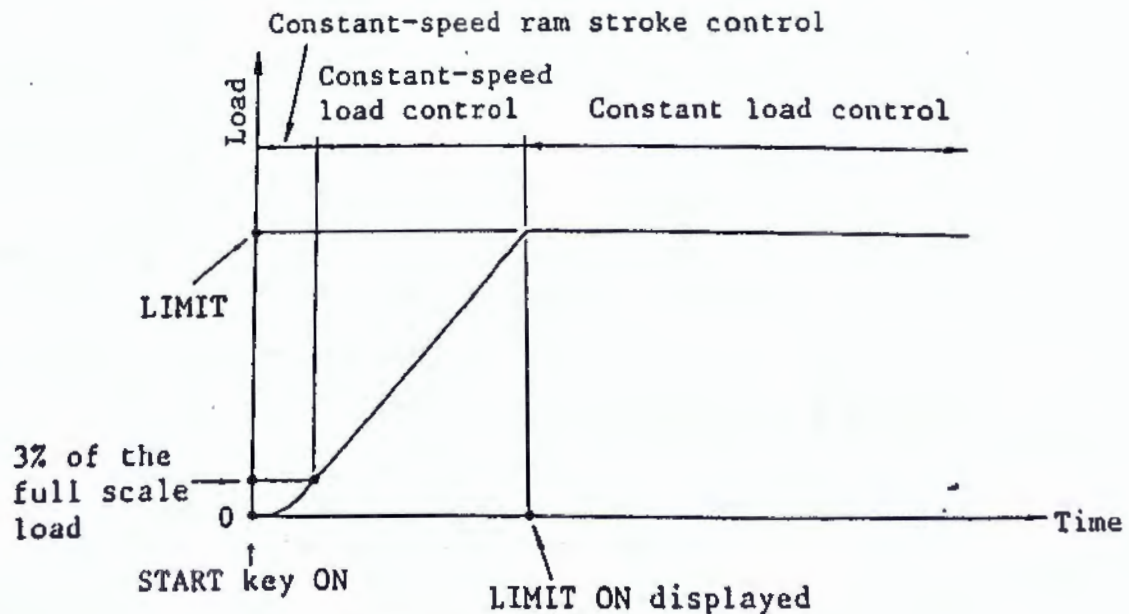
Press STOP (136) to stop testing. This releases the control mode, and the automatic control valve returns to neutral. The display shows the following.

RETURN SW ?      STROKE  $xxxx.x$  mm

- ⑦ Press RETURN (138), and the ram automatically starts returning until the limit switch activates. The READY lamp (120) then lights. The unit allows the next mode to be set, showing the following on the display.

AUTO INT. MODE      STROKE  $xxxx.x$  mm

#### 6.1.6 Constant-speed load control



Constant-Speed Load Control (Chart)

- ① Press **LOAD** **(132)** to enter the constant-speed load control mode. The display shows the following, and the cursor lights, permitting input of settings.

```
MODE LOAD
SPEED x.x FS/min
```

- ② First set a loading speed in terms of full scale/min within 2 digits (X.X). (Loading speed is relative to the full scale of each load range, and expressed in terms of full scale per min.)

- Model UH-A : Setting range between 0.1~2.0 full scale/min.
- Model UH-C : Setting range between 0.1~5.0 full scale/min.

After the loading speed is set and registered, the display shows the following.

```
MODE LOAD
LIMIT xxx.x kN
```

- ③ Next, set a load limit (LIMIT) for a constant-speed load control. The unit performs a constant-speed load control up to this LIMIT.

- SI unit type Set a limit in kN within 5 digits (XXXX.X)
- Gravitational unit type: Set a limit in tf within 5 digits (XXX.XX) does not accept more than 5 digits.

The setting range is from 5% to 100% of the full scale load.

```
MODE LOAD      SPEED x.x FS/min
LIMIT xxx.x kN
```

```
START SW ?    STROKE xxx.x mm
```

- ④ Press **ZERO** **(139)** to zero a stroke on the display.

After checking set conditions on the display, press **START** **(135)** to start a constant-speed load control.

Note that the unit performs a constant-speed ram stroke control using a preset stroke speed up to 3% of the full scale load (see 6.1.14). The unit automatically switches to a constant-speed load control when the load reaches 3% of the full scale.

The display shows the following including a ram stroke value.

MODE LOAD                      STROKE ××××.× mm

At this point, if a registered LIMIT is invalid, the display shows the following.

MODE LOAD  
LIMIT IS NOT VALID !!

If this occurs, reperform the procedure beginning from the setting of the control mode.

- ⑤ When the load reaches a LIMIT, the unit automatically switches to a constant load control, showing LIMIT ON on the display.

MODE LOAD                      STROKE ××××.× mm  
LIMIT ON

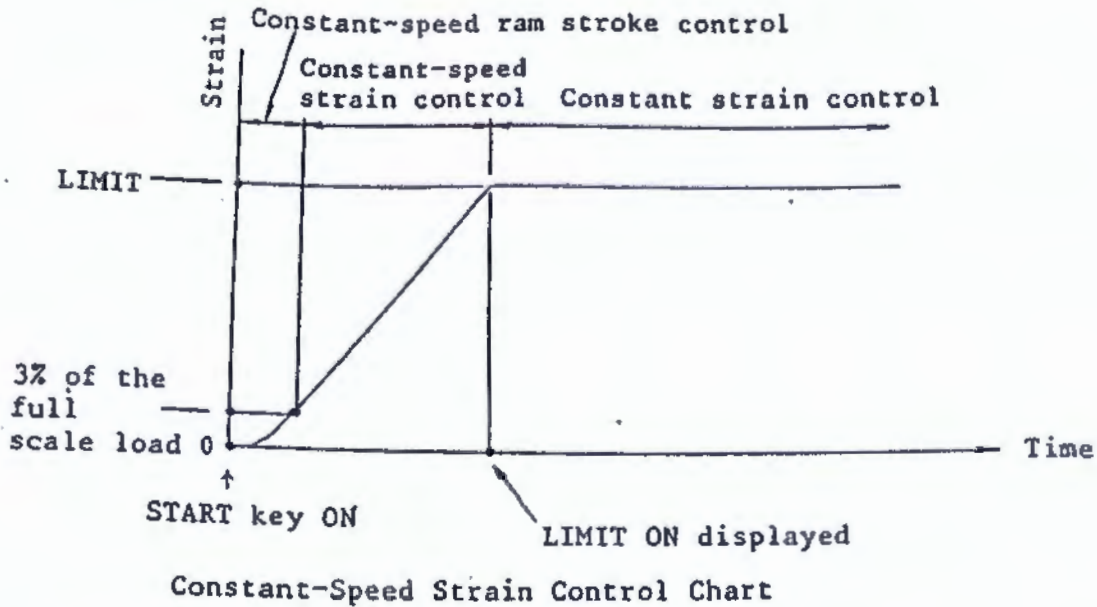
- ⑥ In this status, the unit allows the next control mode to be set. Press  (136) to stop the test. This releases the control mode. The automatic control valve returns to neutral. The display shows the following.

RETURN SW ?                      STROKE ·××××.× mm

- ⑦ Press  (138). The ram automatically returns until the limit switch is activated. Then the READY lamp (120) lights, and the ram stops. The display shows the following, and the unit allows the next control mode to be set.

AUTO INT. MODE                      STROKE ××××.× mm

### 6.1.7 Constant-speed strain control



A gauge-length ductilometer is required to perform this control.

- ① First check that the ductilometer is set up against a specimen. Press STRAIN 133 to enter the constant-speed strain control mode. The display shows the following, and the cursor lights, permitting input of settings.

MODE STRAIN  
SPEED  $\times\times.\times$  %/min

- ② Set a strain speed in %/min within 3 digits (XX.X).  
(A strain speed is the percentage of strain relative to the gauge length of the extensometer, and which is computed in % per min.)

- Model UH-A : Setting range between 0.1~50 full scale/min.
- Model UH-C : Setting range between 0.1~80 full scale/min.

After the strain speed is set and registered, the display shows the following.

MODE STRAIN  
FS ELONG  $\times\times.\times$  mm

- ③ Set the full scale of a ductilometer in mm within 3 valid digits (xx.x).

After a full scale elongation is registered, the display shows the following.

MODE STRAIN  
GAGE xxx.x mm

- ④ Next, set the gauge length of a ductilometer in mm within 4 (xxx.x).

After a set ductilometer gauge length is registered, the display shows the following.

MODE STRAIN  
LIMIT xx.x %

- ⑤ Set a strain limit (LIMIT) for a constant-speed strain control in % within 3 digits in a range between 5.0 and 99.9% of the full scale elongation. The unit performs a constant-speed strain control up to this LIMIT. (A limit strain is the percentage relative to a full scale elongation, FS ELONG.) After a set LIMIT is registered, the display alternately shows the following 2 messages.

MODE STRAIN      SPEED xx.x %/min  
LIMIT xx.x %      ELONG xx.x mm      GAGE xxx.x mm

START SW ?      STROKE xxx.x mm

- ⑥ Press  (139) to zero a stroke on the display.

After checking set conditions on the display, press  (135)

to start a constant-speed strain control.

Note that the unit performs a constant-speed ram stroke control using a preset stroke speed up to 3% of the full scale load (see 6.1.14). The unit automatically switches to the constant-speed strain control when the load reaches 3% of the full scale load.

The display shows the following including a ram stroke value.

MODE STRAIN      STROKE xxx.x mm

At this point, if the registered LIMIT is invalid, the display shows the following.

MODE STRAIN  
LIMIT IS NOT VALID !!



If this occurs, reperform the procedure beginning from the setting of the control mode.

- ⑦ When a strain reaches a LIMIT during strain control, the unit automatically switches to a constant strain control using this strain LIMIT, showing LIMIT ON on the display.

MODE STRAIN                  STROKE ××××.× mm  
LIMIT ON

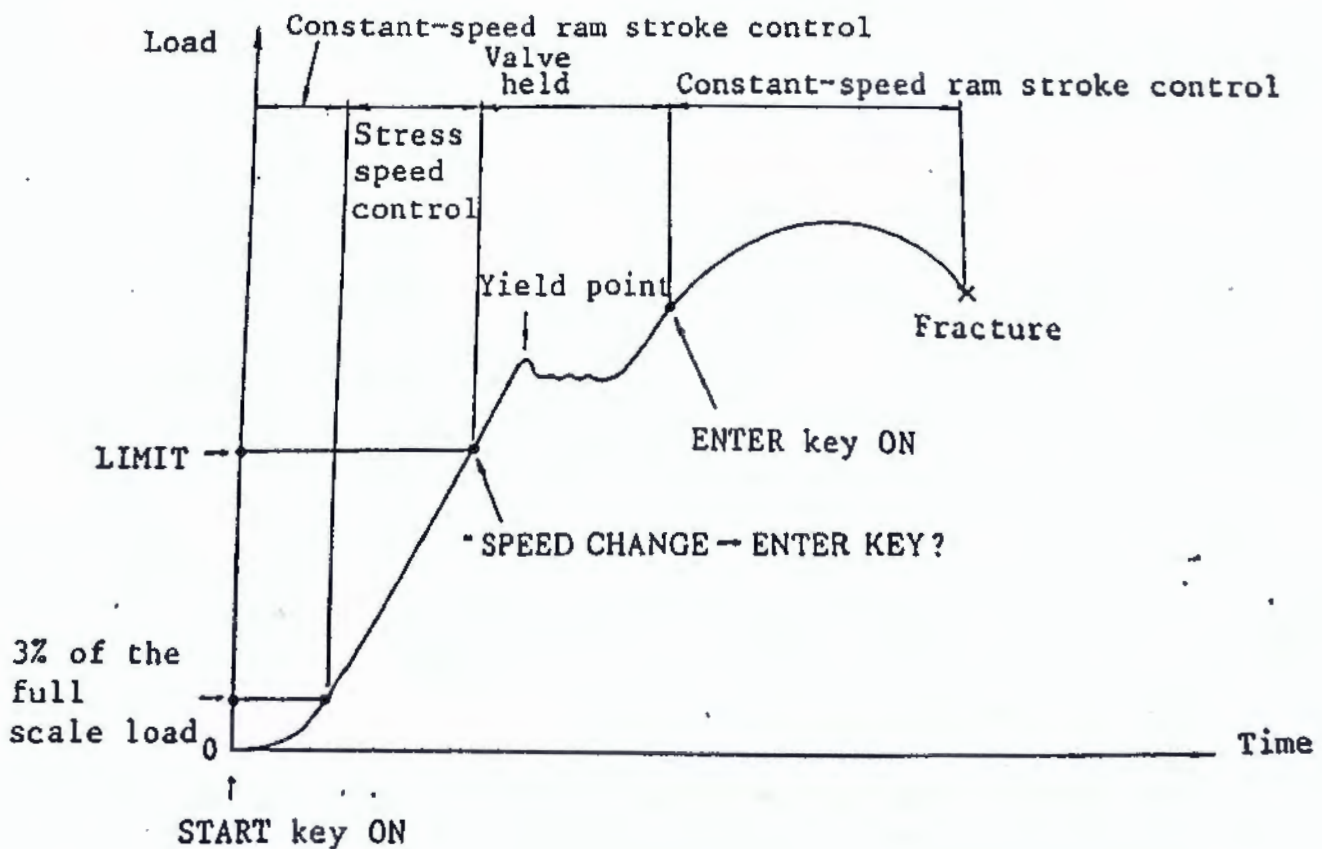
- ⑧ In this status, the unit allows the next mode to be set. Press  (136) to stop the test. This releases the control mode. The automatic control valve returns to neutral. The display shows the following.

RETURN SW ?

- ⑨ Press  (138), and the ram automatically returns until the limit switch is activated. The READY lamp (120) then lights, and the ram stops. The display shows the following, and the unit allows the next control mode to be set.

AUTO INT. MODE              STROKE ××××.× mm

### 6.1.8 Tension test control



Tension Test Control (Chart)

This control mode is for automatic performance of tension tests specified in JIS Z 2241.

- ① Press **FUNC** **2** and **ENTER** to enter the tension test control mode.

The cursor lights, and the unit permits input of settings. The display shows the following.

```
MODE TENSION
SPEED xx MPa/s
```

- ② First set a stress speed

- SI unit type: Set a stress speed in MPa/s or N/mm<sup>2</sup>·s (whichever is specified), within 2 digits (XX) setting range between 1 ~ 50MPa/s (or N/mm<sup>2</sup>·s).
- Gravitational unit type: Set a stress speed in kgf/mm<sup>2</sup>·s within 2 digits (X.X), setting range between 0.1 ~ 5.0kgf/mm<sup>2</sup>·s.

When a set stress speed is registered, the display shows the following.

```
MODE TENSION
SPEED xx.x mm/min
```

- ③ After measuring a yield point or strength, set a ram stroke speed in mm/min for a constant-speed ram stroke control.

- Model UH-A : Within 3 digits (XX.X) setting range between 0.5~50.0 mm/min.

The unit does not accept more than 3 digits.

- Model UH-C : Within 4 digits (XXX.X) setting range between 0.5~100.0 mm/min.

The unit does not accept more than 4 digits.

When a set ram stroke speed is registered, the display shows the following.

```
MODE TENSION
AREA-01 xxxx mm2
```

- ④ Enter the sectional area of a specimen in mm<sup>2</sup> within 4 valid digits (xxx.x to xxxx).

The unit can register sectional areas of up to 20 specimens. After the sectional area of the first specimen is registered, the display shows the following.

```
MODE TENSION
AREA-02 xxxx mm2
```

Enter the sectional area of the second specimen in mm<sup>2</sup>. The unit allows up to 20 sectional areas to be entered. When registering 5 specimens, for example, enter 0 when the unit asks the sectional area of the sixth specimen. When 20 sectional areas are registered or 0 is entered, the unit judges that input of sectional areas has been completed, showing the following on the display.

MODE TENSION	-
LIMIT x x x MPa	

- ⑤ Set a LIMIT for a stress speed control.
- SI unit type: Set a stress in MPa or N/mm<sup>2</sup> (whichever is specified), within 3 digits (x x x).
  - Gravitational unit type: Set a stress in kgf/mm<sup>2</sup> within 3 digits (x x .x).
- The unit performs a stress speed control up to the LIMIT set. Past the LIMIT, the unit continues control, holding the valve flow rate when the LIMIT is reached.
- Set a LIMIT in a range between 1/2 and 2/3 of the yield stress or strength under normal condition.
- When the LIMIT is registered, the display alternately shows the following 2 messages.

MODE TENSION	SPEED x x	x x .x
LIMIT x x x	AREA-01	x x x .x

START SW ?	STROKE x x x x .x mm
------------	----------------------

- ⑥ Press **ZERO** (139) to zero a stroke on the display.
- After checking set conditions on the display, press **START** (315).
- The unit starts the tension test control. Note that the unit performs a constant-speed ram stroke control using a preset stroke speed up to 3% of the full scale load (see 6.1.14). The unit automatically switches to the constant-speed stress control when the load reaches 3% of the full scale load.
- The display shows the following including a ram stroke value.

MODE TENSION	STROKE x x x x .x mm
--------------	----------------------

At this point, if the registered LIMIT is invalid, the display shows the following.

MODE TENSION
LIMIT IS NOT VALID !!

If this occurs, reperform the procedure from setting the control mode.

- ⑦ When the stress reaches the LIMIT during this control, the unit performs the control, maintaining the resulting valve flow rate.

The display then shows SPEED CHANGE ----> ENTER KEY? as below.

MODE TENSION	STROKE xxx.x mm
SPEED CHANGE ----	ENTER KEY ?

- ⑧ In this status, measure the yield point and strength. After checking that the yield point and strength have been measured, press  ⑭. The unit starts the constant-speed ram stroke control. The display shows the following.

MODE TENSION	STROKE xxx.x mm
--------------	-----------------

- ⑨ When a specimen fractures, the unit automatically stops the control, and the automatic control valve returns to neutral. The display shows the following.

RETURN SW ?	** TP RUPT **
-------------	---------------

- ⑩ After removing the fractured specimen, press  ⑮. The ram returns until the limit switch is activated, and stops when the READY lamp lights. At this point, if the sectional area of the next specimen is registered, the display shows the set conditions for that specimen, that is, the following 2 messages and alternately displayed.

MODE TENSION	SPEED xx	xx.x
LIMIT xxx	AREA-02 xxx.x	

START SW ?
------------

At this point, set the next specimen on the testing machine. Press the stroke  key ⑯ and then  ⑰ to continue the tension test control. Similarly, the unit can continuously perform the tension test control for up to 20 specimens in procedures ⑦ through ⑩. After testing the set number of specimens or if the sectional area of the next specimen is not registered, the display shows the following, allowing the control mode to be reset.

AUTO INT. MODE	STROKE xxx.x mm
----------------	-----------------

### 6.1.9 Test condition setting

Set test conditions with numeric keys  to  (146). The display shows the numerals entered. Press  (147) to clear any incorrect numerals entered. Note that the unit does not accept more than a predetermined number of valid digits for each setting item. After entering numerals, press  (148). The unit checks that set values are within the respective setting ranges, and registers the values if they are. If they are outside the setting ranges, the unit displays ERROR on the display as below.

MODE STROKE
SPEED xx.x mm/min      ERROR

(When setting a speed for constant-speed ram stroke control)

If this occurs, reset a value after pressing  (148).

Table 6.1 Test Conditions (Model UH-A)

Control mode	Item	Unit	Setting range	Number of digits
STROKE	SPEED	mm/min	0.5~50.0	××.×
	LIMIT	mm	1.0~Max. Ram stroke (zero at the ram return position)	×××.×
LOAD	SPEED	FS/min	0.1~2.0	×.×
	LIMIT	kN [tf]	5% or more of full scale	××××.× [×××.××]
STRAIN	SPEED	Strain %/min	0.1~50.0	××.×
	LIMIT	%/Full scale elongation	5.0~99.9	××.×
	GL	mm	5.0~999.9	×××.×
	Full scale elongation	mm	0.1~99.9	××.×
TENSION	STRESS	MPa/s or N/mm <sup>2</sup> ·s	1~50	××
	SPEED	[kgf/mm <sup>2</sup> ·s]	[0.1~5.0]	[×.×]
	STRESS	MPa or N/mm <sup>2</sup>	1~999	×××
	LIMIT	[kgf/mm <sup>2</sup> ]	[1.0~99.9]	[××.×]
	STRAIN SPEED	mm/min	0.5~50.0	××.×
	AREA	mm <sup>2</sup>	0.1~9999	×××.×~××××

Note: Ram strokes vary depending on the model.

Stress units are shown in MPa or N/mm<sup>2</sup> whichever is specified.

Table 6.2 Test Conditions (Model UH-C)

Control mode	Item	Unit	Setting range	Number of digits
STROKE	SPEED	mm/min	0.5~100.0	××.×
	LIMIT	mm	1.0~Max. Ram stroke (zero at the ram return position)	×××.×
LOAD	SPEED	FS/min	0.1~5.0	×.×
	LIMIT	kN [tf]	5% or more of full scale	××××.× [×××.××]
STRAIN	SPEED	Strain %/min	0.1~80.0	××.×
	LIMIT	%/Full scale elongation	5.0~99.9	××.×
	GL	mm	5.0~999.9	×××.×
	Full scale elongation	mm	0.1~99.9	××.×
TENSION	STRESS	MPa/s or N/mm <sup>2</sup> ·s	1~50	××
	SPEED	[kgf/mm <sup>2</sup> ·s]	[0.1~5.0]	[×.×]
	STRESS	MPa or N/mm <sup>2</sup>	1~999	×××
	LIMIT	[kgf/mm <sup>2</sup> ]	[1.0~99.9]	[××.×]
	STRAIN SPEED	mm/min	0.5~50.0	××.×
	AREA	mm <sup>2</sup>	0.1~9999	×××.×~××××

Note: Ram strokes vary depending on the model.

Stress units are shown in MPa or N/mm<sup>2</sup> whichever is specified.

## 6.1.10 Filing

This testing machine can store up to 10 files of preset test conditions in memory.

### 1) SET

- ① Sets a test mode to start testing.

After setting conditions, press   to show the following on the display.

```
1.S 2.N 3.N 4.N 5.N 6.N 7.N 8.N 9.N 10N
SET FILE NO ?
```

- ② Enter any number with an N on the right.

To use file 2, press  .

An S on the right of a number indicates that the file of that number is already used. Consequently, if the same number is entered, the display shows the following error message and the unit waits for reentry of a new number. Enter the correct number.

```
1.S 2.N 3.N 4.N 5.N 6.N 7.N 8.N 9.N 10N
DOUBLE FILE!!
```

- ③ To erase a file content, press   and then  .

The display shows the following.

```
1.S 2.N 3.N 4.N 5.N 6.N 7.N 8.N 9.N 10N
CANCEL FILE NO ?
```

- ④ Enter a file number to be cancelled.

To cancel file 1, the example, press  .

To stop cancelling or executing the set test mode, press

.

### 2) RUN

- ① To select a test condition from the preset condition in the memory, press  . The display shows the following.

```
1.S 2.N 3.N 4.N 5.N 6.N 7.N 8.N 9.N 10N
RUN FILE NO ?
```

② Enter the required number with an S on the right.

To use file 1, for example, press  .

An N on the right of a number indicates that the file of this number stores no data. If a number with an N on the right is entered, the display shows the following error message and the unit waits for reentry of a new number. Enter the correct number.

```
1.S 2.N 3.N 4.N 5.N 6.N 7.N 8.N 9.N 10N
NO FILE !!
```

③ To stop executing the RUN mode, press   again.



### 6.1.11 Filing ( Model UH-C )

The filing function can perform storing [SET] and calling [RUN] of the setting test conditions. The memory built-in the control unit can store up 10 test conditions. In the case of application of a memory card, 10 test conditions can be stored in a card, separately from the internal memory. In the case of ONE CARD ONE CONDITION MEMORY mode, a test condition can be stored in a card.

#### 1) File registration [SET]

Insert a card and set the TEST mode so that a test can be started.

After the test condition is set and pressing  (141), the display shows the following.

```
SELECT FILE ?      1. INT.      2. CARD
```

For registration of a test condition into the internal memory of the control unit, press   . For its registration into the memory card, press   . However, in the case of the ONE CARD ONE CONDITION mode, or in the case of noninsertion of a card, this display does not appear, but the following display appears.

(I) In the case of selection of the CARD;

```
1. S 2. N 3. N 4. N 5. N 6. N 7. N 8. N 9. N 10. N
SET CARD NO. ?
```

(II) In the case of selection of the INT. or noninsertion of a card;

```
1. S. 2. N 3. N 4. N 5. N 6. N 7. N 8. N 9. N 10. N
SET FILE NO. ?
```

(III) In the case of the ONE CARD ONE CONDITION mode;

```
SET CARD ?      1. YES      2. NO
```

In the case of (I) and (II);

Input a number with N on its back.

For example, for the 2nd storage, press   .

If the number has S on its back, it is an already stored number.

So inputting it displays the error message as shown in the figure below, and creates a number input stand-by status. Therefore input a correct number through key operation.

```
1. S 2. N 3. N 4. N 5. N 6. N 7. N 8. N 9. N 10. N
DOUBLE FILE !
```

In the case of (III);

In the case of registration of the condition into the card, press   . For stopping the registration, press   , thereby making a return to the status before pressing  .

If the conditions has been already stored in the card, the error message as shown in figure below is displayed. So perform registration after file erasing.

SET CARD ? 1. YES 2. NO  
DOBLE FILE !

### 2) File erasing

For erasing the file content, press   . And for selection of the internal memory, press   , or for selection of the card, press   .

Then press   , the display shows the following.

(I) In the case of selection of the CARD;

1. S 2. N 3. N 4. N 5. N 6. N 7. N 8. N 9. N 10. N  
CANCEL CARD NO. ?

(II) In the case of selection of the INT. or noninsertion of a card;

1. S 2. N 3. N 4. N 5. N 6. N 7. N 8. N 9. N 10. N  
CANCEL FILE NO. ?

(III) In the case of the ONE CARD ONE CONDITION mode;

CANCEL CARD ? 1. YES 2. NO

In the case of (I) and (II);

Input the file number to be canceled.

For example, to cancel the 1st storage, press   .

To interrupt the canceling execution, or to interrupt the setting execution, individually press  or  .

In the case of (III);

Press   to cancel. For stopping to cancel, press   , thereby making a return to the status before pressing  .

### 3) File calling [RUN]

To call the test condition from the stored test conditions, insert a card and then

press   , the display shows the following.

SELECT FILE ? 1. INT. 2. CARD

For calling a test condition from the internal memory of the control unit, press

. For calling its from the memory card, press   .

However, in the case of the ONE CARD ONE CONDITION mode, or in the case of noninsertion of a card, this display does not appear, but the following display appears.

(I) In the case of selection of the CARD;

1. S 2. N 3. N 4. N 5. N 6. N 7. N 8. N 9. N 10. N  
RUN CARD NO. ?

(II) In the case of selection of the INT. or noninsertion of a card;

1. S 2. N 3. N 4. N 5. N 6. N 7. N 8. N 9. N 10. N  
RUN FILE NO. ?

(III) In the case of the ONE CARD ONE CONDITION mode;  
The set test conditions is appeared.

In the case of (I) and (II);

Input a number with S on its back.

For example, for the 1st storage, press  .

If the number has N on its back, it is not store number. So inputting it displays the error message as shown in the figure below, and creates a number input standby status. Therefore input a correct number through key operation.

1. S 2. N 3. N 4. N 5. N 6. N 7. N 8. N 9. N 10. N  
NO FILE !

To interrupt the running execution, press   again.

In the case of (III);

In the case of the ONE CARD ONE CONDITION mode, pressing only  enables the set test conditions to be called.

#### 4) Error display of the memory card

(1) The memory card LED has three types of lighting status:  
lighting-out, red lighting and green lighting.

LED display	Status
1. Lighting-out	No card insertion
2. Red lighting	Card battery running-down
3. Green lighting	The card battery is normal

The red lighting of LED means that the card battery has run down or battery voltage has dropped. Replace the battery with new one.

(2) LCD error display

① Card error

If the card is selected for registration or calling of the file, and the card can not be detected, the following messages are displayed.

SELECT FILE ? 1. INT. 2. CARD  
NO CARD !

At this time, pressing  returns the screen to the status just before  or  is pressed. Insert a card and repress  or .

② Card battery voltage drop

If the card is selected for registration or calling of the file, and the card battery voltage has dropped, the following messages are displayed.

SELECT FILE ? 1. INT. 2. CARD  
CARD BAT. DOWN !

At this time, pressing  returns the screen to the status just before  or  is pressed. Replace the card battery with new one, and repress  or .

③ Card writing-in error

If the card is selected for registration of the file, and WRITE PROTECT (Writing-in inhibition) of the card is set, the following error messages are displayed.

SELECT FILE ? 1. INT. 2. CARD  
WRITE PROTECT !

At this time, pressing  returns the screen to the status just before  is pressed. Release the WRITE PROTECT of the card, and repress  or .

5) Card initialization

To initialize a card, press   , thereby the display shows the following.

CARD CLEAR ? 1. YES 2. NO

To execute the initialization of the card, press  .

To stop the initialization of the card, press  .

Checking for initialization execution error is conducted for ① card error, ② card battery voltage drop and ③ card writing-in error in subject 4)-(2).

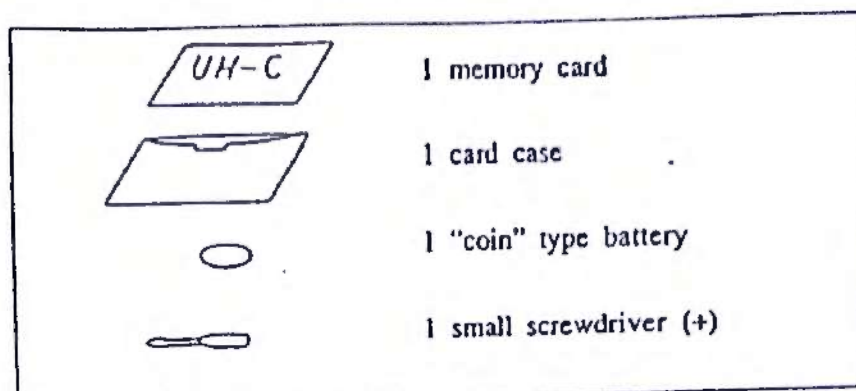
If an error message appears, pressing  returns the screen to the status just before pressing   . After conducting the countermeasures for error, repress   .

In the case of noninsertion of a card, even if    are pressed, the screen makes a return to the original status without non-execution.

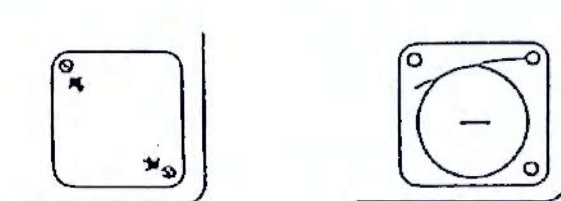
6) Handling of memory cards

(1) Installing battery

Check that the following parts are in the memory card box.



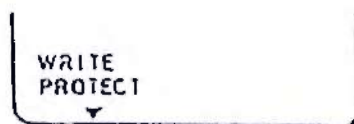
The "coin" type battery must be mounted to the memory card. Open the rear cover of the card with the attached small screwdriver, and mount the battery to the card as shown below.



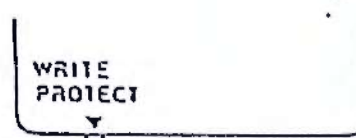
The life of the battery is approximately three years. When the battery is exhausted or has not been mounted to the card, MEMORY CARD LED indication (37) lights red (normally green) upon inserting the card into the window. In such a case, you must replace the battery with a new one. (Ex. Lithium battery: Toshiba CR2016 3V)

(2) Setting of write-protection

A write-protection switch is provided with the memory card. Set the write-protection switch after loading the test conditions, the stored can then be protected. If you try to load other data into the card which has stored the test condition, the card indicates an error because the write-protection switch actuates. The write-protection switch is located on the opposite side of the connector.

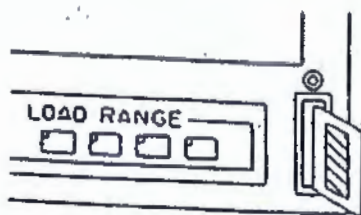


Write-protection OFF



Write-protection ON

- (3) The memory card has a space on the back where you can write the title of the card. If you would like to write the title on the front surface to easily check the title, you may attach any label at the position shown below.



Front surface of memory card

### 6.1.12 GAIN setting

Compensate the servo system gains in a range between 1/2 and 2 times the reference gains by entering a number from 1 to 9 as follows..

The key numbers from 1 to 9 represent the compensation magnifications against the reference gains as shown in the table below.

Key numbers	1	2	3	4	5	6	7	8	9
Compensation magnifications	1/2	1/1.6	1/1.3	1/1.1	1	1.25	1.5	1.75	2

Though gains are factory-set, change the settings as per the following procedure if required for optimum test conditions.

Press **GAIN** (143) to show the following on the display.

MODE ?

Press one of **LOAD** (132), **STRAIN** (133) and **STROKE** (134).

- ① If **LOAD** (132) is pressed, the display shows the following.

LOAD GAIN xxx RANGE = x

Enter the most appropriate number from 1 to 9, and press

**ENTER** (148).

Upon entering the first number, the display asks a GAIN of the next RANGE. Set a GAIN as above.

When GAINS of all the RANGES are set, the display returns to the first screen.

- ② If   is pressed, the display shows the following.

STROKE GAIN = x

Enter the most appropriate number from 1 to 9, and press

. A STROKE GAIN is set, and the display returns to the first screen.

- ③ If   is pressed, the display shows the following.

STRAIN GAIN xx RANGE = x

Enter the most appropriate number from 1 to 9, and press

. Upon entering the first number, the display asks a GAIN of the next range. Set a GAIN as above. When GAINS of all the RANGES are set, the display returns to the first screen.

- ④ In any of , , and  modes, press   only to maintain the previous GAINS. When this is done, the display goes to the next range without changing the gain of the current range.

#### 6.1.13 Integration constant setting

Set the servo system integration constants as follows.

Press >, , and  to show the following on the display

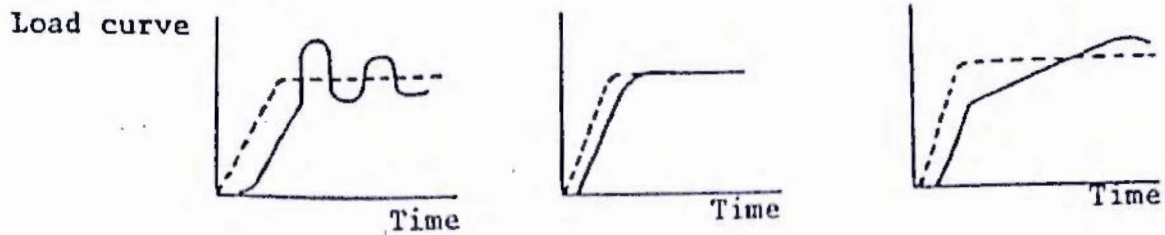
I. ACT. CONST. x

Press x and  (x represents a number from 1 to 9).

Integration constant

An integration constant determines a value which is to be added to a deviation (a set value - a feedback value). An integration constant ( $2^{-n}$ ) varies with the entered number (n). Therefore, a deviation is calculated from the formula; (a set value - a feedback value) x (1 +  $2^{-n}$ ).

Key numbers 1 ← Optimum number → 9



\* A dashed line shows a set signal, and a solid line a real load signal.

The smaller the key number entered for the integration constant, the larger the deviation, and the faster the response of the servo system. However, hunting may result. On the other hand, the larger the key number entered, the smaller the deviation, and the slower the response of the servo system. (See the figure above.)

Select the most appropriate key number so that an optimum load curve may be produced as in the above figure.

#### 6.1.14 Initial stroke speed setting

In the constant-speed load, constant-speed strain, and tension test control modes, the unit performs the constant-speed ram stroke control using the initial stroke speed up to 3% of the full scale load after starting a test.

Set an initial stroke speed as follows.

Press    and  to show the following on the display.

INITIAL STROKE SPEED ××.× mm/min

① Enter an initial stroke speed. (Example:    )

The default of an initial stroke speed is 5.0 mm/min.

· Model UH-A : Setting range between 0.5~50.0 mm/min.

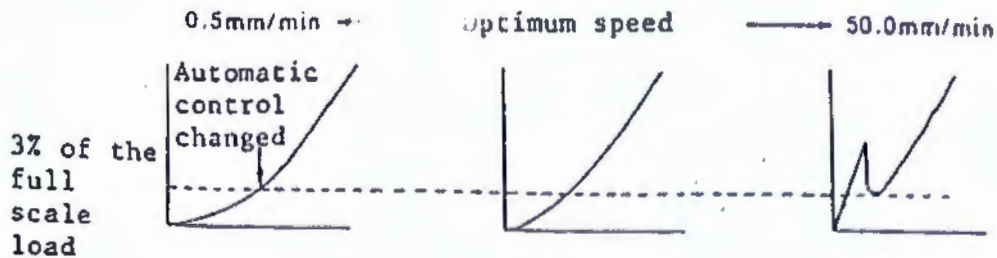
· Model UH-C : Setting range between 0.5~100.0 mm/min.

When a numeric value is set, the display returns to the first screen.

② If a specimen has a low strain resistance, set a low speed. If a specimen has a high strain resistance, set a high speed.

③ Initial stroke speed entered and real load signal obtained





### 6.1.15 Manual HOLD point adjustment

When a maximum load is applied in the manual control mode, adjust a HOLD point as follows.

#### CAUTION

Be impose a burden by manual operation knob and, please certainly adjust HOLD location in carrying out load hold.

- ① Apply a maximum rated load between the compression plates in the MAN. mode.  
Adjust the manual control knob so that the load remains constant or slightly declines.
- ② Press  to enter the automatic mode.  
When this is done, the load falls, but do not touch the manual control knob.
- ③ Press  ,  , and  to show the following on the display.

HOLD OK? 1. YES 2. NO 3. INITIAL

—

If OK, press  . and  . This replaces the previously set value with a new value which was output in the MAN. mode by adjusting the manual control knob. The unit stores the new setting as a compensation for the HOLD point, and provides a C-RAM backup for this compensation. It maintains the backup until the C-RAM is cleared or the compensation is initialized. A HOLD point compensation changes proportionately with the load.

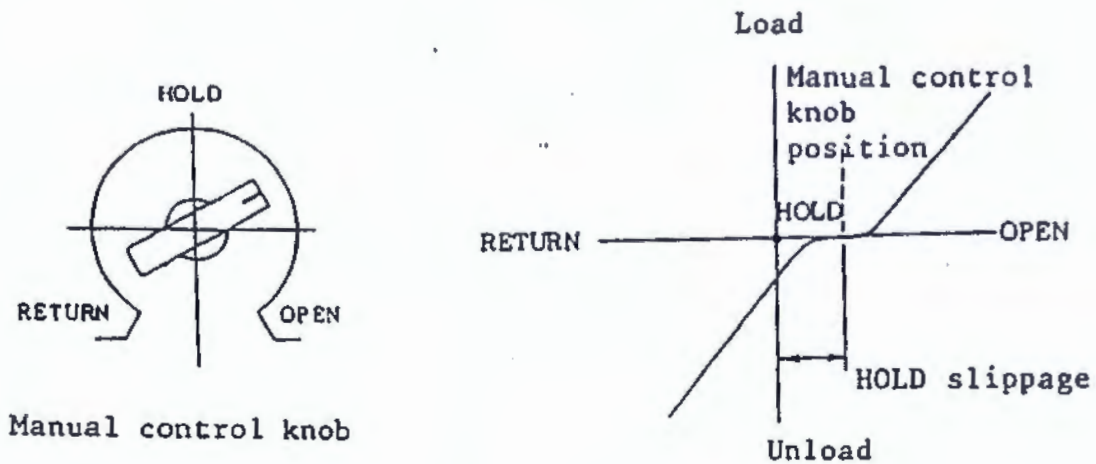
If not OK, press  . and  to maintain the previous HOLD point instead of compensating it.

Press  , and  to zero a current HOLD point compensation.

- ④ After setting, always set the manual control knob to HOLD.
- ⑤ After checking that the manual control knob is set at HOLD, press  to enter the manual mode.

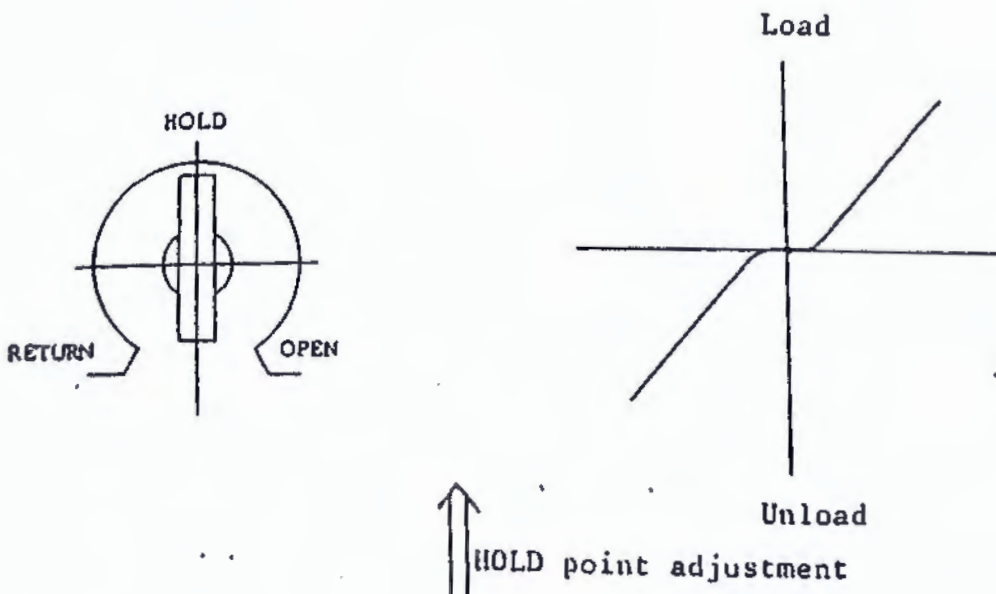
- ⑥ When set in the manual mode, the unit compensates the HOLD point.
- ⑦ If the HOLD point is not adjusted, it can be difficult to hold the load while loading with the manual control knob.
- ⑧ Manual control knob positions and servo valve hold points

1. Phenomena seen at high oil temperature



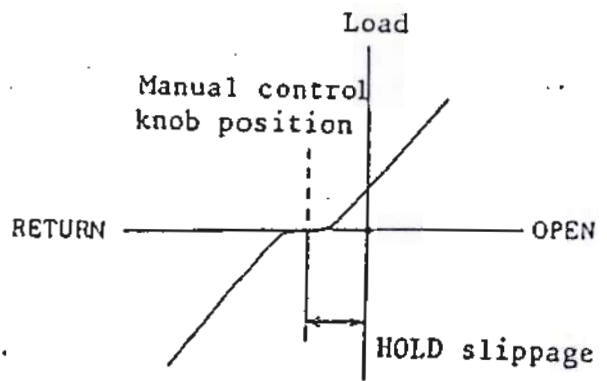
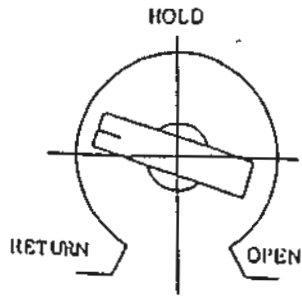
⇓ HOLD point adjustment

2. After adjustment



⇑ HOLD point adjustment

3. Phenomena seen at low oil temperature



## 7. Tests

### 7.1 Test Standards

Use the specimens and test procedures that conform to JIS, ASTM, DIN, BS, and other major standards.

The Japan Industrial Standards (JIS) on metallic material tests include the following.

#### (1) Tension tests

JIS G 0303 General rules of steel inspection  
JIS H 0321 General rules of nonferrous metal inspection  
JIS Z 2201 Metal specimens for tension tests  
JIS Z 2241 Procedures of metal tension tests

#### (2) Flexure/bending tests

JIS Z 2203 Metal specimens for flexure tests  
JIS Z 2204 Metal specimens for bending tests  
JIS Z 2248 Procedures of metal bending tests

### 7.2 Test Operation Procedures

The standard operation procedures of the testing machine are described below.

#### 7.2.1 Standard operation procedure for tension tests Part 1: Manual control

- (1) Set the power switch (103) ON.
- (2) After checking that the load control knob (129) is at RETURN, press the pump ON switch (125).
- (3) Set the load control knob (129) alternately to RETURN and OPEN a few times to move the ram 100 mm vertically for smooth lubrication between the ram and cylinder.
- (4) To return the ram to its initial position, either set the load control knob (129) to RETURN and then to HOLD when the READY lamp (120) lights, or press  (138) with the load control knob at HOLD. (When the ram is returned to its initial position, the READY lamp lights.)
- (5) In the minimum-load range, zero-adjust the load display and load pointer before making the load-span adjustment. <See 5.2, 4) and 5) for procedures.>

- (6) Press AUTO  
MAN. (130) to enter the manual mode.
- (7) Mount grips suitable for the specimen's shape and size. <See 5.1, 3) and 4) for precedures.>
- (8) Insert the specimen between the upper insert grips (44) and firmly grip it by turning the grip open-close handle (42) in the direction indicated by an arrow (clockwise).
- (9) After zero-adjusting the load display (cancelling the specimen weight), select a load range.
- (10) Reset the load peak hold display (115).
- (11) Press the stroke ZERO key (139) to zero a stroke on the display.
- (12) After checking that the lower grips are open, press the lower crosshead elevation switch (UP) (127) to raise the lower crosshead (5) to a suitable height for the grips to grip the specimen.
- (13) Turn the lower grip open-close handle (42) clockwise to firmly grip the specimen.
- (14) Slowly turn the load control knob (129) toward OPEN to load while checking the load pointer (118). When the load pointer starts moving, always remove the upper and lower handles.
- (15) Slowly turn the load control knob (129) toward OPEN to load while checking the load pointer.
  - The load pointer turns counterclockwise at a yield point. At this moment, the load peak hold display shows a yield point load.
  - The load increases again past the yield point. The specimen fractures after undergoing a maximum load.
- (16) Reset the load control knob to HOLD after the specimen has fractured.
- (17) Fit the grip open-close handles (42) to the pinion shafts, and turn the handles counterclockwise to open the grips. Then remove the fractured specimen pieces.
- (18) Press RETURN (148) with the load control knob (129) at HOLD.
  - The ram descends until the READY lamp lights, stopping at its initial position.
- (19) Read a maximum load on the load peak hold display (115).
- (20) To perform another test, start with step (7).

- Please do not insert a hand in crosshead during the time of the opening and closing of a zipper.

### CAUTION

- Make sure to remove the upper and lower grip open-close handles when a load is applied to a specimen.
- Please prepare protection cover, when a fragment scatters by the kind of specimen.
- Certainly make load control knob (129) RETURN location and, please hang ram in most under location in finishing a test.
- Please specimen leap-privation plate (50) of upper crosshead confirm to set surely on the occasion of a test.
- Please put a proper wooden box on table (4) aspect that the fragment of specimen falls and damages table aspect.

#### 7.2.2 Standard operation procedure for tension tests Part 2: Automatic control TEN mode

- (1) Set the power switch (103) ON.
- (2) After checking that the load control knob (129) is at RETURN, press the pump ON switch (125).
- (3) Set the load control knob (129) alternately to RETURN and OPEN a few times to move the ram 100 mm vertically for smooth lubrication between the ram and cylinder.
- (4) To return the ram to its initial position, either set the load control knob (129) to RETURN and then to HOLD when the READY lamp (120) lights, or press RETURN (138) with the load control knob at HOLD. (When the ram is returned to its initial position, the READY lamp lights.)
- (5) In the minimum-load range, zero-adjust the load display and load pointer before making the load-span adjustment. <See 5.2, 4) and 5) for procedures.>
- (6) Mount grips suitable for the specimen's shape and size. <See 5.1, 3) and 4) for procedures.>
- (7) Insert the specimen between the upper insert grips (44), and firmly grip it by turning the grip open-close handle (42) in the direction indicated by an arrow (clockwise).
- (8) After zero-adjusting the load display (cancelling the specimen weight), select a load range.
- (9) Set an initial stroke speed according to the specimen's characteristics. <See 6.1.14 for procedures.>
- (10) Press FUNC , 7 , and ENTER to enter the TENSION mode.

(The display (149) shows MODE TENSION.)

- (11) Enter test conditions with numeric keys (146).
  - a) Stress speed ; MPa/s or N/mm<sup>2</sup>·s [kgf/mm<sup>2</sup>·s], whichever is specified.
  - b) Ram stroke speed ; mm/min
  - c) Specimen sectional area ; mm<sup>2</sup>, up to 20 specimens
  - d) Stress speed control range ; MPa or N/mm<sup>2</sup> [kgf/mm<sup>2</sup> ], whichever is specified.  
<See 6.1.8 for procedures.>
- (12) Reset the load peak hold display 115.
- (13) Press the stroke  key (139) to zero a stroke on the display.
- (14) After checking that the lower grips are open, press the lower crosshead elevation switch (UP) (127) to raise the lower crosshead (5) to suitable height for the grips to grip the specimen.
- (15) Firmly grip the specimen by turning the lower grip open-close handle (42) clockwise.
- (16) Press  (135).
  - The unit starts loading at a preset stroke speed.
  - The unit switches to a set stress speed control at 3% of the full scale load.
  - When the stress on the specimen reaches the set stress speed control range, the unit continues the control while maintaining the resulting valve flow rate.
  - The load pointer turns counterclockwise at a yield point. The load peak hold display shows a yield point load at this moment.
- (17) After checking that a yield point has been measured, press  (148).
  - The unit starts a constant-speed ram stroke control.
  - The unit automatically stops loading if a specimen is fractured after undergoing a maximum load.
- (18) Fit the grip open-close handles (42) to the pinion shafts, and turn the handles counterclockwise to open the grips. Then remove the fractured specimen pieces.
- (19) Press  (138).
  - The ram descends until the READY lamp lights, and stops at its initial position.
- (20) Read a maximum load on the load peak hold display (115).
- (21) To perform another test, start with step (6). If specimen sectional areas are already registered, jump to (12) after proceeding with steps (6) to (9).

## WARNING

- Please do not insert a hand in crosshead at the time of the opening and closing of a zipper.

## CAUTION

- Make sure to remove the upper and lower grip open-close handles when a load is applied to a specimen.
- Please prepare protection cover, when a fragment scatters by the kind of specimen.
- Certainly make load control knob (129) RETURN location and, please hang ram in most under location in finishing a test.
- Please specimen leap-privation plate (50) of upper crosshead confirm to set surely on the occasion of a test.
- Please put a proper wooden box on table (4) aspect that the fragment of specimen falls and damages table aspect.

### 7.2.3 Standard operation procedure for compression tests (Manual control mode)

- (1) Set the power switch (103) ON.
- (2) After checking that the load control knob (129) is set at RETURN, press the pump ON switch (125).
- (3) Set the load control knob (129) alternately to RETURN and OPEN a few times to move the ram 100 mm vertically for smooth lubrication between the ram and cylinder.
- (4) To return the ram to its initial position, either set the load control knob (129) to RETURN and then to HOLD when the READY lamp (120) lights, or press  (138) with the load control knob at HOLD. (When the ram is returned to its initial position, the READY lamp lights.)
- (5) In the minimum-load range, zero-adjust the load display and load pointer before making the load-span adjustment. <See 5.2, 4) and 5) for procedures.>
- (6) Mount the compression plates for compression tests. <See 5.1, 5) for procedures.>
- (7) Center a specimen on the lower compression plate (54) using a mark line as the reference point.
- (8) After zero-adjusting the load display (cancelling the lower compression plate and specimen weights), select a load range.



- (9) Reset the load peak display (115).
- (10) Press the stroke  key (139) to zero a stroke on the display.
- (11) Press the lower crosshead elevation switch (DOWN) (128) to lower the lower crosshead until there is a clearance of 2 to 3 mm between the upper compression plate and the specimen top.

### CAUTION

- Please pay attention that upper compression plate should not make contact with specimen.

- (12) Slowly turn the load control knob (129) toward OPEN to load while checking the load pointer.
- The unit loads faster for a compression test than for a tension test, and may, at times, load too quickly. Therefore, be careful when operating the load control knob.
- (13) If a specimen is fractured, set the load control knob to HOLD and press  (138).
- The ram descends until the READY lamp lights, and stops at its initial position.
- (14) Remove the fractured specimen pieces.
- (15) Read a maximum load on the load peak hold display (115).
- (16) To perform another test, start with step 7.

### CAUTION

- The unit loads faster for a compression test than for a tension test, and may, at times, load too quickly. Therefore, be careful when operating the load control knob.
- Please prepare protection cover, when a fragment scatters by the kind of specimen.
- Certainly make load control knob (129) RETURN location and, please hang ram in most under location in finishing a test.

#### 7.2.4 Standard operation procedure for flexure tests (Manual control mode)

- (1) Set the power switch (103) ON.
- (2) After checking that the load control knob (129) is set at RETURN, press the pump ON switch (125).
- (3) Set the load control knob (129) alternately to RETURN and OPEN a few times to move the ram 100 mm vertically for smooth lubrication between the ram and cylinder.

- (4) To return the ram to its initial position, either set the load control knob (129) to RETURN and then to HOLD when the READY lamp (120) lights, or press  (138) with the load control knob at HOLD. (When the ram is returned to its initial position, the READY lamp lights.)
- (5) In the minimum-load range, zero-adjust the load display and load pointer before making the load-span adjustment. <See 5.2, 4 > and 5) for procedures.>
- (6) Mount the flexure-bending test device. <See 5.1, 6) for procedures.>
- (7) Center a specimen on the fulcrum roller of the flexure-bending test device using a mark line as the reference point.
- (8) After zero-adjusting the load display (cancelling the device and specimen weights), select a load range.
- (9) Reset the load peak hold display (115).
- (10) Press the stroke  key (139) to zero a stroke on the display.
- (11) Press the lower crosshead elevation switch (DOWN) (128) to lower the lower crosshead until there is a clearance of 2 to 3 mm between the punch (69) and the specimen top.

### CAUTION

- When doing this, never allow the punch to contact the specimen.

- (12) To load slowly turn the load control knob (129) toward OPEN while watching the load pointer.
- (13) When the specimen is fractured, set the load control knob to HOLD and press  (138).
  - The ram descends until the READY lamp lights, stopping at its initial position.
- (14) Remove the fractured specimen pieces.
- (15) Read a maximum load on the load peak hold display (115).
- (16) To perform another test, start with step (7).

### CAUTION

- Please prepare protection cover, when a fragment scatters by the kind of specimen.
- Certainly make load control knob (129) RETURN location and, please hang ram in most under location in finishing a test.

7.2.5 Standard operation procedure for bending tests (Manual control mode)

- (1) Set the power switch (103) ON.
- (2) After checking that the load control knob (129) is set to RETURN, press the pump ON switch (125).
- (3) Alternately set the load control knob (129) to RETURN and OPEN a few times to vertically move the ram 100 mm to allow smooth lubrication between the ram and cylinder.
- (4) To return the ram to its initial position, either set the load control knob (129) to RETURN and then to HOLD when the READY lamp (120) lights, or press  (138) with the load control knob at HOLD. (When the ram is returned to its initial position, the READY lamp lights.)
- (5) In the minimum-load range, zero-adjust the load display and load pointer before making the load-span adjustment. <See 5.2, 4) and 5) for procedures.>
- (6) Mount the flexure-bending test device. <See 5.1, 6) for procedures.>
- (7) Center a specimen on the fulcrum roller of the flexure-bending test device using a mark line as a reference point.
- (8) After zero-adjusting the load display (cancelling the device and specimen weights), select a load range.
- (9) Reset the load peak hold display (15).
- (10) Press the stroke  key (139) to zero a stroke on the display.
- (11) Press the lower crosshead elevation switch (DOWN) (128) to lower the lower crosshead until there is a clearance of 2 to 3 mm between the punch (69) and the specimen top.

**CAUTION**

• When doing this, never allow the punch to contact the specimen.

- (12) To load, slowly turn the load control knob (129) toward OPEN while watching the load pointer.
- (13) When the specimen bending angle is approximately 170°, set the load control knob to HOLD and press  (138).
  - The ram descends until the READY lamp lights, stopping at its initial position.

- (14) Remove the flexure-bending test device, and mount the compression plates for compression tests.
- (15) Set a metal strip equivalent in length to twice the radius of the punch inside the specimen, and bend it 180° using the compression plates. (See 7.2.3 Standard operation procedure for compression tests for the procedure.)
- (16) Inspect the surface of the bent part for tears and other damage. If none, the material is acceptable.
- (17) To perform another test, start with step ⑥.

**CAUTION**

- Certainly make load control knob ⑫ RETURN location and, please hang ram in most under location in finishing a test.

## 8. Maintenance

### 8.1 Loading Unit

#### 8.1.1 Cleaning the Periphery of Testing Machine

This testing machine consists of many precision parts and especially the loading cylinder units, drive screw unit, inside of measurement control unit, etc. are very sensitive to dust and foreign matters. Be specially careful about the dust and ensure that the dust will not rise from the floor surface, and therefore keep the floor clean at all times.

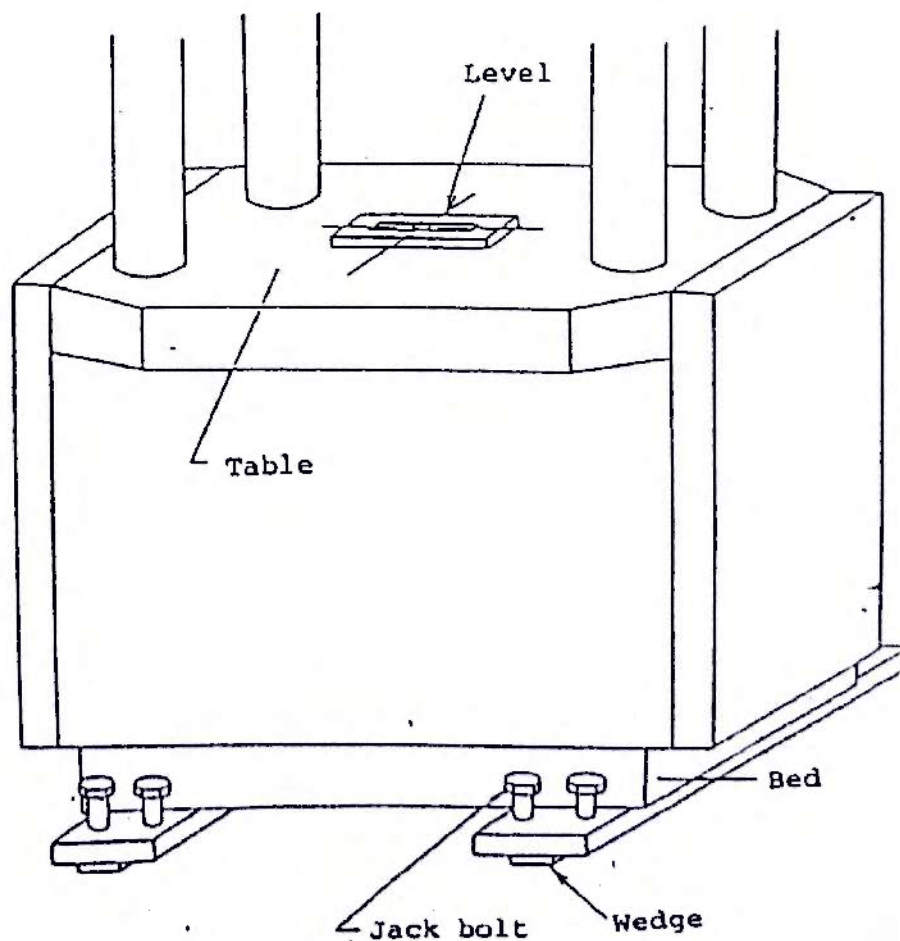
#### 8.1.2 Checking horizontally of Loading Unit

Periodically check the horizontality of the loading unit once in 3 months or 6 months.

##### 1) Horizontality of table

Set a level at the center of the upper surface of table, check the inclination in the back and forth, and left and right directions and if any error is found, correct the horizontality by adjusting the jack bolts at both sides of bed and the wedges set under the bottom surface. (Within 0.1mm/1000mm)

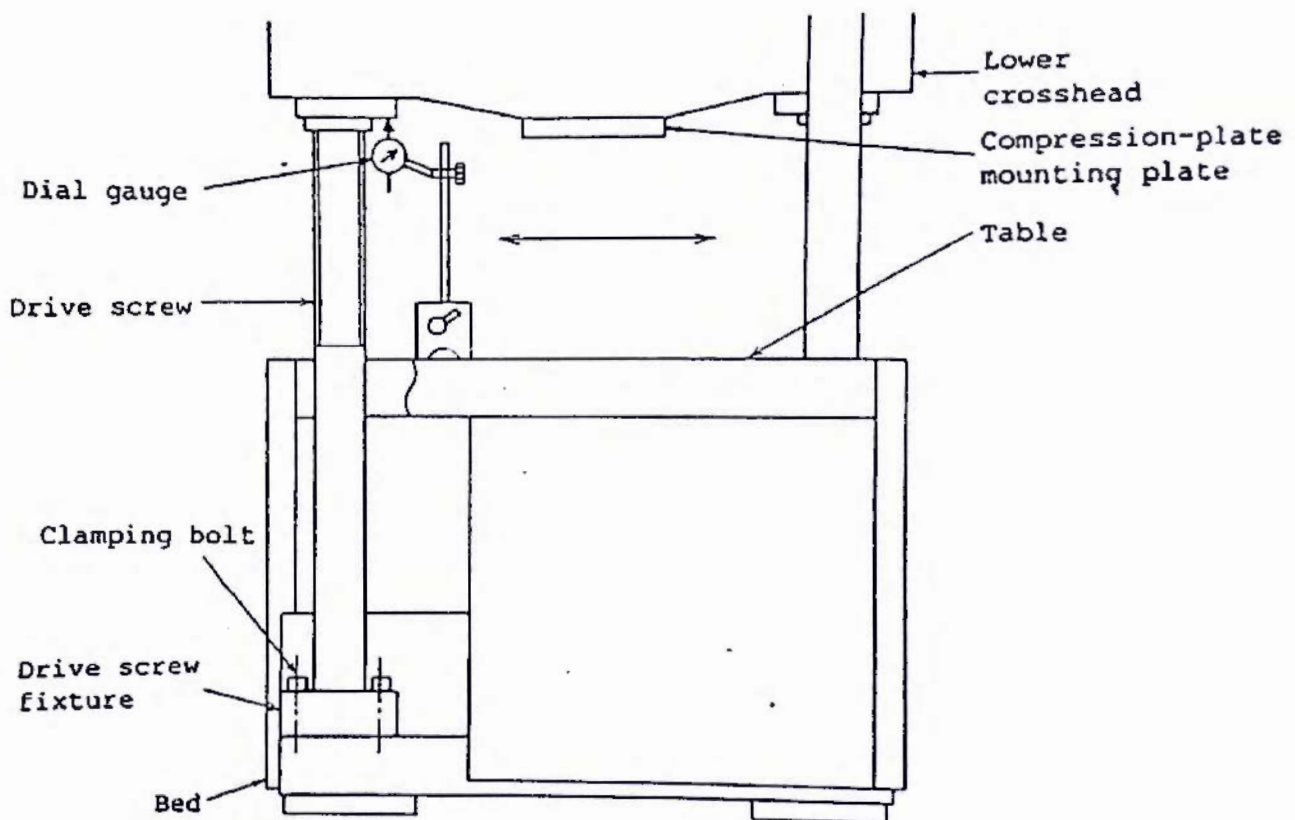
Make sure that all four wedges are firmly fitted.



## 2) Checking horizontality of lower crosshead

Set the dial gauge with a stand on the upper surface of table, vertically set the end of dial gauge on the lower surface of the lower crosshead and check the horizontality by moving the dial gauge back and forth, and left and right. If any error is found, check to see if the clamping bolt of the drive screw fixture connecting the bed and drive screw is loose or not.

The standard left-right parallelism should be within 0.1 mm. After checking, be sure to apply rust-preventive agent to the measured surface.

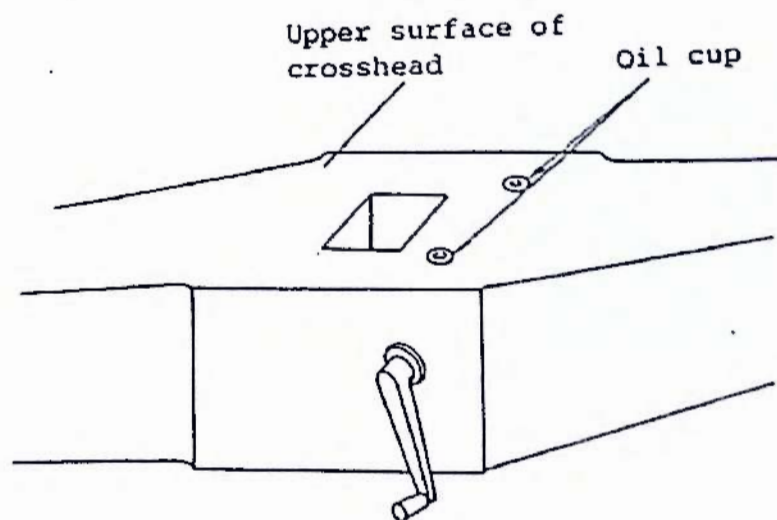


### 8.1.3 Maintenance of testing machine

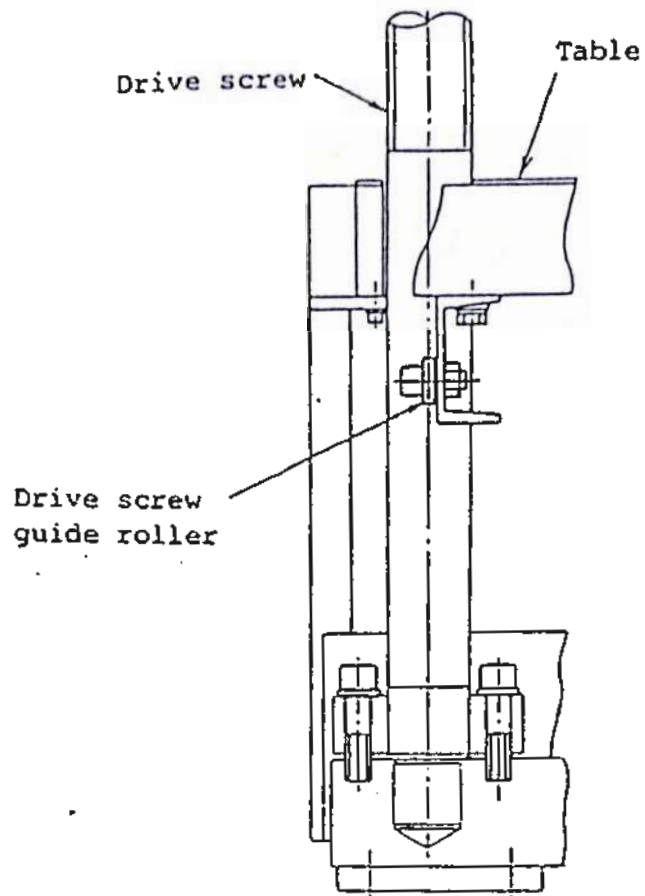
- 1) The painted surface should be cleaned off dust by wiping with a cloth.
- 2) Wipe off the dust from the cut surface and apply machine oil or spindle oil on the surface.
- 3) Apply oil or grease on the sliding surface.
  - (1) Apply grease on the drive screw. Be sure to wipe off the old grease before applying new grease.

Recommended grease: Lithium molybdenum disulfide grease  
(Every month)

- (2) Occasionally apply machine oil to the grip open-close pinion from the oil cup on the upper surface of crosshead. (Once a month)

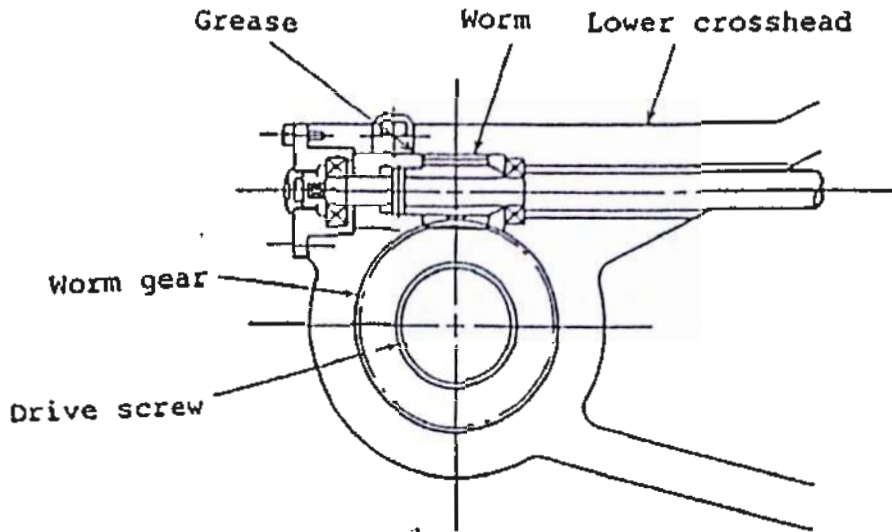


- (3) Occasionally apply machine oil or spindle oil to the table guide rollers and bearings of drive screw guide rollers.

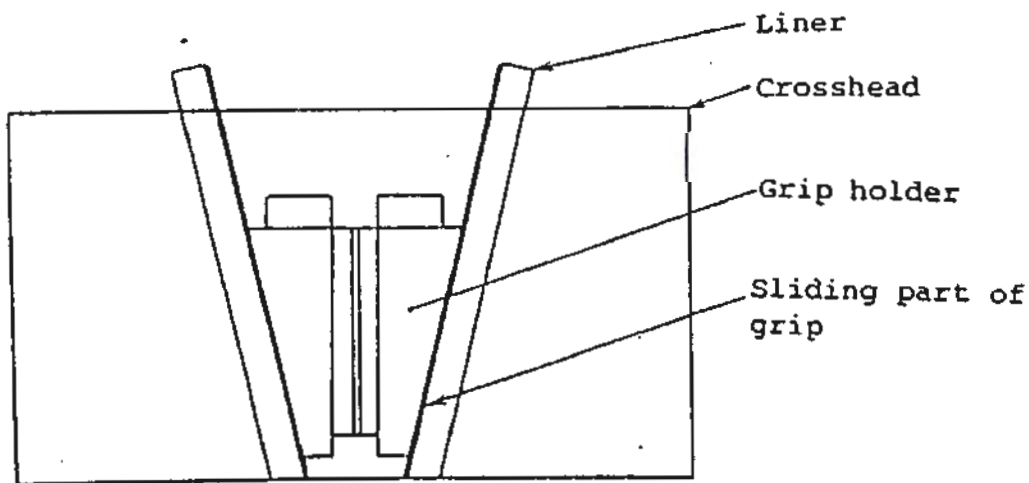




(4) Apply the above grease to the worm gear of the lower crosshead lifting system. (Every 3 months)



4) Make sure the sliding part of grip of the tensile testing device is kept clean all the times. Black skin of test piece may be embedded into this surface and the grip holder and the sliding surface of liner are damaged or the gripping balance becomes uneven, thus damaging the grip. Make sure the sliding surfaces of grip holder and liner are carefully cleaned. After cleaning, apply the above grease to the side and back surfaces of grip holder and to two sides of the liner.



## 8.1.4 Maintenance of Hydraulic Unit

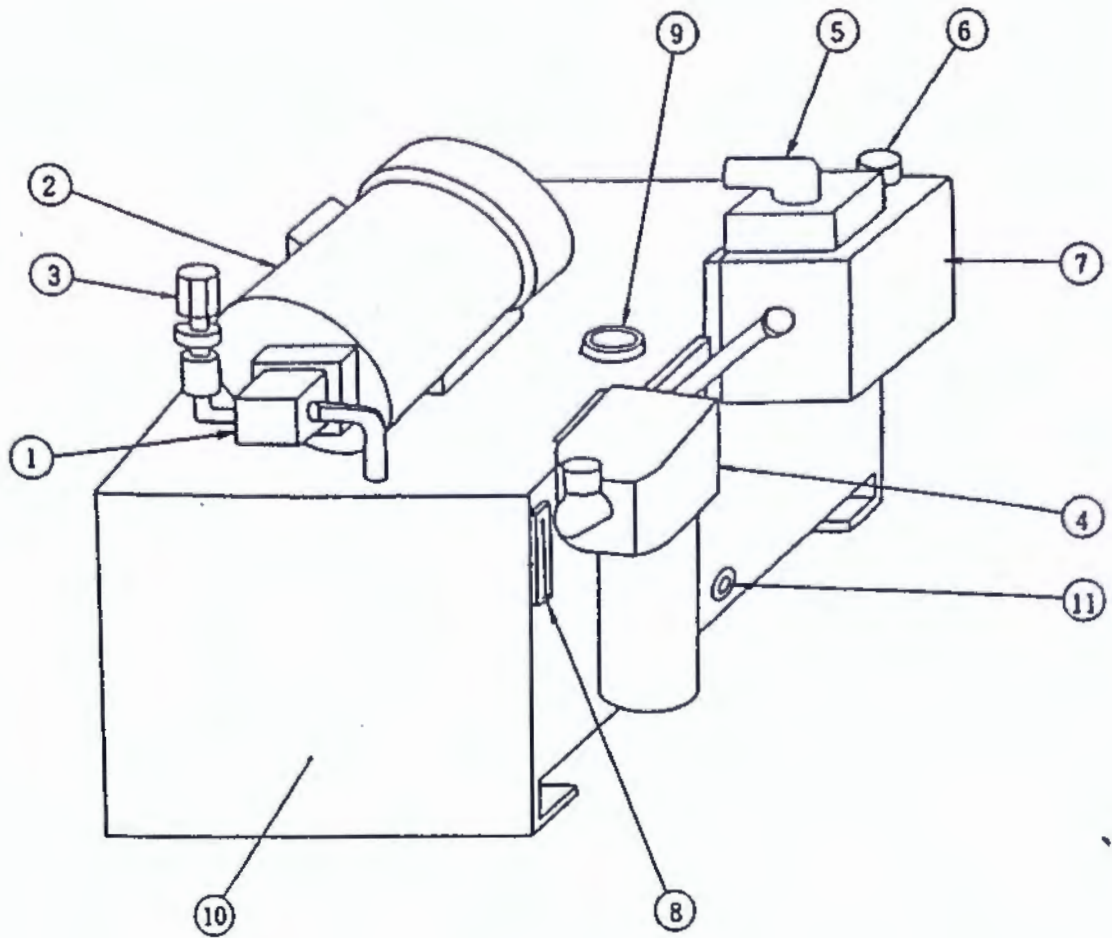
### 1) Introduction

This unit is a high-pressure constant discharge type hydraulic unit using a high pressure gear pump. This unit consists of the load pump and pump motor loaded on the tank and the required control unit combined with them. For the protection of the electro-hydraulic servo valve, the ABS filter of 10 microns is used.

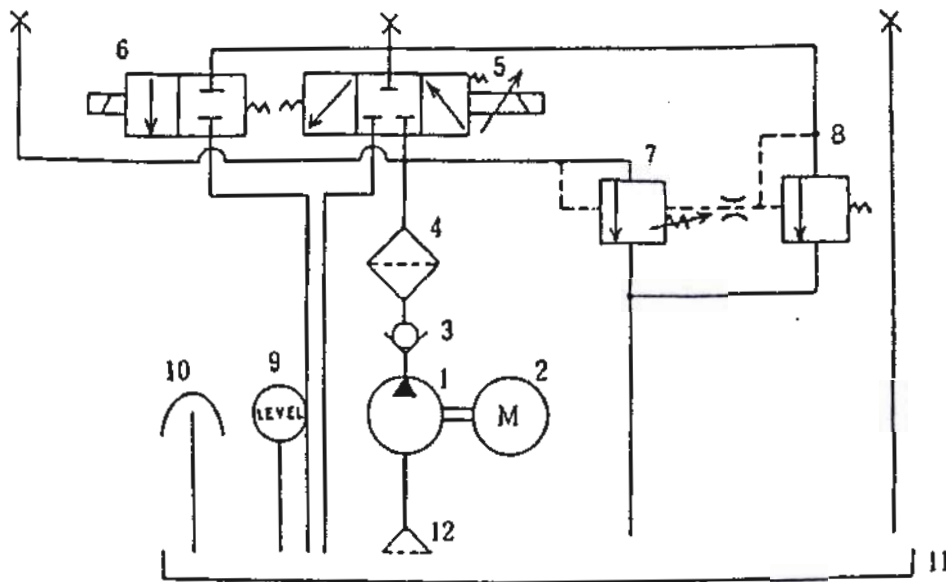
### 2) Specification

Models		100, 200, 300 and 500 kN [ 10, 20, 30 and 50 tf]	1000kN [ 100 tf]
Discharge (lit./min)	50 Hz area	2.1	3.2
	60 Hz area	2.7	4.1
Continuous rated pressure (kgf/cm <sup>2</sup> )		230	
Hydraulic oil		ISO VG 180	
Loading pump		Constant discharge type high pressure pump	
Filter		Absolute rejection ratio: 10 microns	
Pump motor (Totally-enclosed fan-cooled type)		1.5kW 4P	2.2kW 4P
Supply voltage		Three-phase, 200/220V (50/60Hz area)	
Tank capacity		40 lit.	
Noise (approx. dB) *) (under max. load)		75	
Outside dimensions of main body (approx. mm) Width × Depth × Height		550 × 550 × 700	

\*) Measuring place 1m distance in front of machine



- |                                 |                                     |
|---------------------------------|-------------------------------------|
| ① Loading pump                  | ⑦ Hydraulic control valve           |
| ② Pump motor                    | ⑧ Oil gauge                         |
| ③ Check valve                   | ⑨ Oil filler port with air breather |
| ④ Filter                        | ⑩ Oil tank                          |
| ⑤ Electro-hydraulic servo valve | ⑪ Drain oil port                    |
| ⑥ Ram return valve              |                                     |



- |                                 |                                     |
|---------------------------------|-------------------------------------|
| ① Loading pump                  | ⑦ Pressure adjustment valve         |
| ② Pump motor                    | ⑧ Safety valve                      |
| ③ Check valve                   | ⑨ Oil gauge                         |
| ④ Filter                        | ⑩ Oil filler port with air breather |
| ⑤ Electro-hydraulic servo valve | ⑪ Oil tank                          |
| ⑥ Ram return valve              | ⑫ Suction strainer                  |

### 3) Maintenance control

#### (1) Hydraulic oil

Poor control of hydraulic oil may cause trouble and faulty operation. Attention is generally paid to the parts such as pump and valves, but little care is taken to hydraulic oil. The hydraulic unit plays an important part in the lubrication of the parts such as pump and valves as well as the transmission of power. Therefore, due consideration is taken into the maintenance control of hydraulic oil.

a) Oil leak

Periodically and visually check that no oil is leaking. When an oil level in the oil tank is abnormally reduced due to oil leak, cavitation may occur, causing damage to the pump or an increase in oil temperature. Oil leaks also should be prevented against disasters.

b) Oil level

Observe the oil gauge, and always keep an oil level near the standard oil level.

If the oil level becomes below the standard oil level, it may cause the occurrence of bubbles, rise in oil temperature, deterioration of oil and other accidents.

c) Replacement of hydraulic oil

After draining the old hydraulic oil and cleaning the inside of the oil tank, fill the tank with the same brand hydraulic oil to the standard oil level. If a different brand hydraulic oil is unavoidably used, sufficiently execute flushing with a flushing oil of the hydraulic oil before replacement.

Recommended hydraulic oil: Shell Tellus C180 (Showa Shell Oil) or equivalent

Absolutely avoid mixing oils of a different kind.

(2) Pump

The pump in normal operation produces a clear sound. When any abnormal sound other than that in normal operation is produced, stop the operation and check the pump.

(3) Replacement of filter

Replace the filter element once a year or every two years according to working frequency of the testing machine. Below is described the replacing method. (The filter element is disposable.)

(a) Remove the drain plug, and extract oil from the filter.

(b) Turn the lower cover (counterclockwise) to remove it from the filter.

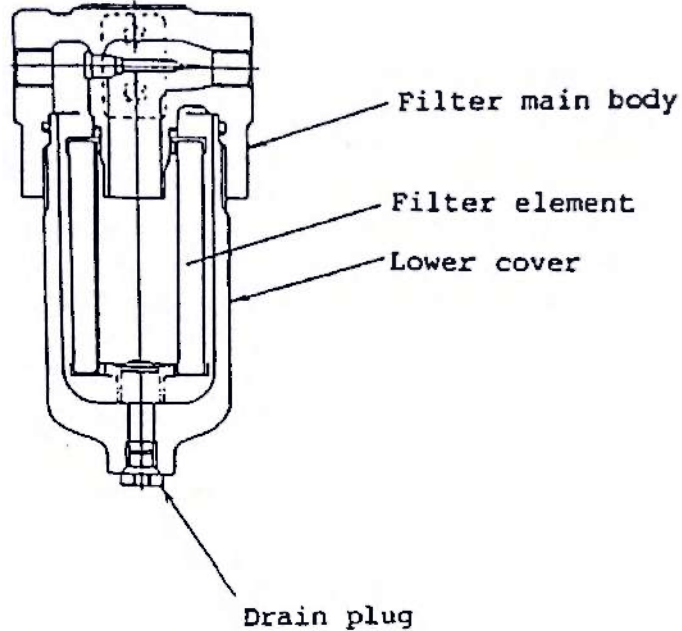
(c) Pull down the filter element.

(d) Put in a new filter element.

(e) Turn the lower cover (clockwise) to install the filter element into the filter.

(f) Tighten up the drain plug.

Note: Be sure to replace the filter element with the hydraulic unit turned off (pressing the pump OFF switch).



#### (4) Cleaning the suction strainer

When replacing oil, take out the suction strainer, remove clogging with compressed air, and clean it with light oil before re-attachment.

If the suction strainer is used in the clogged condition, cavitation may occur, causing the occurrence of abnormal sound and a trouble in the pump.

(5) Check list

	Daily	Every week	Every month	Every three months	Every twelve months
Oil level	o				
Oil leak	o				
Sound of pump	o				
Replacement of filter					o
Looseness of bolts			o		
Cleaning in the oil tank					o
Replacement of oil					o

(Note) The above check list shows the standard check positions and frequency in checking at steady operation of the hydraulic power unit. Therefore, properly add the check positions and frequency in checking at the start of operation. Taking into consideration operating condition and environment, prepare a check list as minutely as possible and take good care to maintain performance and increase life.

## 8.2 Control/Measuring Unit

### 8.2.1 Checking Accuracy of load Indicating Device

Check the accuracy of load with the load tester once in 6 months or one year, depending on the condition. Our service man will be dispatched to the customer and he will check the trouble, if requested (the customer is requested to pay the cost for the repair).

### 8.1.2 Checking Automatic Load Control Unit

Check the electro-hydraulic servo valve and the ram stroke detector for loose screws once in 6 months or one year, depending on the application condition.

### 8.3 Maintenance parts list

#### 8.3.1 LOADING UNIT

No	PARTS NAME	PARTS NUMBER			
		Model 100kN [10tf]	Model 200·300kN [20·30tf]	Model 500kN [50tf]	Model 1000kN [100tf]
1	Insert Grip Holder	343-78264	343-71299	343-71248	343-71378
2	Insert Grip (for Plate)	343-02518-01	343-02254-01	343-02255-01	343-02256-01
3	" (for Rod)	343-02518-02	343-02254-02	343-02255-02	343-02256-02
4	Upper Liner (Thin)	343-78267 <sup>-01</sup> <sub>-02</sub>	343-71302 <sup>-01</sup> <sub>-02</sub>	343-71251 <sup>-01</sup> <sub>-02</sub>	343-71381 <sup>-01</sup> <sub>-02</sub>
5	" (Thick)	343-78267 <sup>-03</sup> <sub>-04</sub>	343-71302 <sup>-03</sup> <sub>-04</sub>	343-71251 <sup>-03</sup> <sub>-04</sub>	343-71381 <sup>-03</sup> <sub>-04</sub>
6	Lower Liner (Thin)	343-78268 <sup>-01</sup> <sub>-02</sub>	343-71303 <sup>-01</sup> <sub>-02</sub>	343-71252 <sup>-01</sup> <sub>-02</sub>	343-71382 <sup>-01</sup> <sub>-02</sub>
7	" (Thick)	343-78268 <sup>-03</sup> <sub>-04</sub>	343-71303 <sup>-03</sup> <sub>-04</sub>	343-71252 <sup>-03</sup> <sub>-04</sub>	343-71382 <sup>-03</sup> <sub>-04</sub>
8	Pinion Shaft	343-22372	343-76473	343-76188	343-76427
9	Upper Compression Plate	343-58660	343-58310	343-58580	343-58074
10	Lower Compression Plate	343-76512	343-76476	343-76233	343-76430
11	Fulcrum Roller	343-58882	343-58907	343-58927	343-58952
12	Transverse-Bending Punch	343-58885	343-58910	343-58931	343-58955
13	Cylinder O ring	(1BG130) 036-12124	(1BG130) 036-12124	(1BG165) 036-12132	(1BG240) 036-12144
14	Bearing (Tension Nut)	(# 51113) 030-60013	(# 51117) 030-60017	(# 51120) 030-60020	(# 51126) 340-20509-03
15	Bearing (Worm Shaft)	(# 7202 A) 030-40202	(# 7202 A) 030-40202	(# 7204 A) 030-40204	(# 7305 A) 030-43005
16	" ( " )	(# 6202) 030-04002	(# 6202) 030-04002	(# 6204) 030-04004	(# 6305) 036-06005
17	" (Revolution Stopper)	(# 6203 ZZ) 030-05003	(# 6203 ZZ) 030-05003	(# 6204ZZ) 030-05004	(# 6205 ZZ) 030-05005
18	Handle	(SQ15) 340-25505-03	(SQ19) 340-25505-01	(SQ19) 340-25505-01	(SQ22) 340-25505-02
19	Table top protective mat (for the entire surface)	343-76509-01	343-76465-01	343-76182	343-76418
20	Table top protective mat (for use in compression tests)	343-76681-01	343-76681-02	343-76681-03	343-76681-04



No.	PARTS NAME	PARTS NUMBER			
		Model 100kN [10tf]	Model 200-300kN [20-30tf]	Model 500kN [50tf]	Model 1000kN [100tf]
1	Hydraulic Oil (18ℓ6can)	( ISO VG 180 ) 340-14501-23			
2	Filter Element	( P-3502 ) 340-26646-12			
3	High-pressure Rubber Hose (Main Circuit)	(IB 210×1.2MT) 340-24026-87	(IB 210×1.2MT) 340-24028-11	(IB 210×1.3MT) 340-24028-09	(IB 210×1.4MT) 340-24028-12
4	High-pressure Rubber Hose (Medium Pressure Circuit)	(IB 210×1.3MT) 340-24028-14	(IB 210×1.3MT) 340-24028-15	(IB 210×1.4MT) 340-24028-13	(IB 210×1.5MT) 340-24028-16
5	Vinyl Hose (Leakage Oil Return Circuit)	( ID 19×2 ) 016-31628			
6	Loading Pump and Motor for Pump (One Body type)	(TFP100/1.7) 340-26809-01	(TFP100/1.7) 340-26809-01	(TFP100/1.7) 340-26809-01	(TFP100/2.6) 340-26809-02
7	Electrohydraulic Servo Valve	( 403F-7.5L ) 340-26141-02	( 403F-7.5L ) 340-26141-02	( 403F-15L ) 340-26141-03	( 403F-30L ) 340-26141-04
8	Ram Returning Valve	( JSC-C01 ) 340-26143-01			
9	O ring (in Control valve)	(1A P5) 036-10203			
10	" ( " )	(1A P10) 036-10208			
11	" ( " )	(1A P24) 036-10225			
12	" ( " )	(1A P36) 036-10239			
13	Back-up Ring ( " )	( B P24 ) 036-20015			

8.3.3 CONTROL/MEASURING UNIT

No	PARTS NAME	PARTS NUMBER				
		Model 100kN [10tf]	Model 200kN [20tf]	Model 300kN [30tf]	Model 500kN [50tf]	Model 1000kN [100tf]
1	Pressure Cell	340-43040-06	340-43040-04	340-43040-06		
2	Pulse Encoder	340-43605-08				
3	Ram Stroke Limiter	064-30155				
4	Ram Stroke Detector wire	340-16037-03	340-16037-04	340-16037-02	340-16037-05	
5	Pulse Motor	343-76195				
6	Timing Belt	340-21610-01				
7	Bearing	(# 626Z) 030-00805				
8	CPU Printed Circuit Board	344-25256-02				
9	I/O Printed Circuit Board	343-01440-02				
10	Load Amp. Printed Circuit Board	343-00601-01				
11	Load Amp. Sub. Printed Circuit Board	343-01441				
12	Display Printed Circuit Board	343-01443-01	343-01443-02	343-01443-01		
13	K.B. Printed Circuit Board (Load Selection Panel)	343-01442-01				
14	K.B. Printed Circuit Board (Automatic Load Control Panel)	343-01442-02				
15	Power Surge Printed Circuit Board	343-01468				
16	Fuse (I/O Panel)	Type:F7161(2A,125V) 072-01025				
17	Timer (I/O Panel)	( 10000H ) 340-33910-37				
18	Switch (Load Calibration Panel)	( SPAN ) 064-56091-07				
19	Volume ( " )	( SPAN ) 340-30202				
20	" ( " )	( ZERO ) 340-03120-12				
21	" (Manual Control Panel)	( MANUAL CONTROL ) 054-03111-02				
22	Switch ( " )	( UP, DOWN, ON ) 340-33261-01				
23	Switch ( " )	( OFF ) 340-33261-02				
24	Memory Card (Model UH-C)	340-31435				
25	Board CARD I/F (Model UH-C)	343-02616				
26	Board Memory Card (Model UH-C)	345-23379				

## 9. Parts Identification

1	Loading cylinder	26	Table top protective mat (for the entire surface)
2	Ram	27	Table top protective mat (for use in compression tests)
3	Bed	28	Oil tank
4	Table	29	Loading pump
5	Lower crosshead	30	Pump motor
6	Upper crosshead	31	Suction strainer
7	Drive screw	32	Filter
8	Column	33	Hydraulic control valve
9	Tension nut (Worm wheel)	34	Safety valve
10	Tension nut cap	35	Pressure regulator valve
11	Backlash eliminating nut	36	Ram return valve
12	Drive screw fixing nut	37	Electrohydraulic servo valve
13	Worm	38	High-pressure rubber hose A
14	Worm shaft	39	High-pressure rubber hose B
15	Elevation motor	40	Vinyl hose
16	Metal fixture	41	Pressure cell
17	Set ring	42	Grip open-close handle
18	Fixing bolt	43	Insert grip holder
19	Table guide roller	44	Insert grip
21	Limit switch actuating rod	45	Insert grip hold-down plate
22	Ram stroke limit switch	46	Rubber plate
23	Table cover	47	Upper liner
24	Bed cover	48	Lower liner
25	Pipe cover	49	Pinion shaft

50	Specimen leap-prevention plate	101	Upper rear cover
		102	Lower rear cover
61	Compression plate mount	103	Power switch
62	Compression plate suspension rod	104	Casing
63	Compression plate suspension plate	105	Front cover
64	Upper compression plate	106	Power control panel
65	Lower compression plate	107	Manual control panel
66	Flexure-bending table	108	Automatic control panel
67	Fulcrum stand	109	Zero-span adjustment panel
68	Fulcrum roller	110	Load range selector panel
69	Flexure-bending punch	111	Load display meter
70	Coupling rod	112	Servo amplifier
71	Fixing nut	113	Stroke detector
72	Fixing bolt	114	Load display
73	Ram stroke detector stand	115	Load peak hold display
74	Ram return position detection limit switch	116	Minimum increment display
75	Pulley	117	Scale indicator display
76	Ram stroke detection wire	118	Load pointer
77	Pulse encoder	119	Load range selector
		120	READY lamp
		121	Load peak hold display reset switch
		122	Load zero-adjustment dial
		123	Load span adjustment switch
		124	Load span adjustment dial
		125	Pump ON switch

126	Pump OFF switch	151	Fuse
127	Crosshead UP switch	152	Timer
128	Crosshead DOWN switch	153	Receptacle
129	Load control knob	154	Ground terminal
130	AUTO/MAN selector switch	155	Strain signal input connector
131	AUX/INT selector switch	156	Ductile fracture signal input connector
132	LOAD mode setting key	157	External control signal input connector
133	STRAIN mode setting key	158	Deviation signal input connector
134	STROKE mode setting key	159	Ram stroke encoder output connector
135	START key	160	Load output connector
136	STOP key	161	Ram stroke analog output connector
137	HOLD key	162	Memory card (Model UH-C)
138	RETURN key		
139	Stroke zero reset key		
140	Stroke span setting key		
141	File number setting key		
142	File number access key		
143	GAIN setting key		
144	Function key		
145	Adjustment key		
146	Numerical setting key		
147	Cancel key		
148	ENTER key		
149	Display		
150	Input/output panel		



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**INSTRUCTION MANUAL  
FOR  
SHIMADZU UNIVERSAL TESTING MACHINE  
UH-A·C SERIES  
Models 100kN~1000 kN  
Models 10tf~100 tf  
COMPUTER CONTROLLED HYDRAULIC SERVO SYSTEM**

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AND SAVE THIS MANUAL**

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