INSTRON

Instron
Series 4460
Table Top Load Frames

Reference Manual - Equipment

M10-24400-1 Revision D

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Electromagnetic Compatibility

Where applicable, this equipment is designed to comply with International Electromagnetic Compatibility (EMC) standards.

To ensure reproduction of this EMC performance, connect this equipment to a low impedance ground connection. Typical suitable connections are a ground spike or the steel frame of a building.

Proprietary Rights Notice

Trademarks

Amendment Incorporation Record

Amendment No.	Brief Description of Content	ECR No.	Person Incorporating Amendment
1	Correct Speed Specification	B3218	KD
2	Changed table and illustrations for Voltage Selection - Pages 3-10 to 3-14	B3920	NCW
3	Changed Table 7-3 to correct part numbers for Items 4 and 6	B4640	NCW
4			
5			
6			
7			
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Amendment Incorporation Record

Amendment No.	Brief Description of Content	ECR No.	Person Incorporating Amendment
11			
12			
13			
14			
15			

Revision Record

Revision	ECR No.

General Safety Precautions

Materials testing systems are potentially hazardous.

Materials testing involves inherent hazards from high forces, rapid motions and stored energy. You must be aware of all moving and operating components which are potentially hazardous, particularly the actuator in a servohydraulic testing system or the moving crosshead in an electromechanical testing system.

Always be fully aware of the possible hazards involved when operating and maintaining these systems. You must not operate any materials testing equipment unless you are thoroughly familiar with its function and operation. Unfamiliarity with a materials testing system can lead to unexpected actuator or crosshead motion with the consequent risk of injury and damage.

Carefully read all relevant manuals and observe all WARNINGS and CAUTIONS. The term WARNING is used where a hazard may lead to injury or death. The term CAUTION is used where a hazard may lead to damage to equipment or to loss of data.

Ensure that the test set-up to be followed and the actual test to be performed on materials, assemblies or structures constitutes no hazard to operating personnel.

Make full use of all mechanical and electronic limits features. These are supplied for your safety to enable you to prevent movement of the actuator piston beyond desired regions of operation.

The following pages detail various general warnings that you must heed at all times while using materials testing equipment. More specific warnings and cautions

will be found in the text whenever your attention needs to be drawn to a potential hazard.

Your best safety precautions are to gain a thorough understanding of the equipment by reading your instruction manuals and to always use good judgement.

Warning

Disconnect the electrical power supply before removing the covers to electrical equipment.

You must disconnect the equipment from the electrical power supply before removing any electrical safety covers or replacing fuses. Do not reconnect the main power source while the covers are removed unless you are specifically instructed to do so in the manual. Refit covers as soon as possible.

Disconnect power supplies before removing the covers to rotating machinery.

You must disconnect the equipment from all power supplies before removing any cover which gives access to rotating machinery, e.g. belts, screws or shafts. Do not reconnect any power supply while the covers are removed unless you are specifically instructed to do so in the manual. If the equipment needs to be operated to perform maintenance tasks with the covers removed, ensure that all loose clothing, long hair, etc. is tied back. Refit covers as soon as possible.

Warning

Shut down the hydraulic power supply and discharge hydraulic pressure before disconnecting any hydraulic fluid coupling.

Do not disconnect any hydraulic coupling without first shutting down the hydraulic power supply and discharging stored pressure to zero. Tie down or otherwise secure all pressurized hoses to prevent movement during system operation and to prevent the hose from whipping about in the event of a rupture.

Shut off the supply of compressed gas and discharge residual gas pressure before disconnecting any compressed gas coupling

Do not release gas connections without first disconnecting the gas supply and discharging any residual pressure to zero.

Warning

Use protective shields or screens if any possibility exists of a hazard from the failure of a specimen, assembly or structure under test.

Protective shields should be used whenever a risk of injury to operators and observers exists from the failure of a test specimen, assembly or structure, particularly where explosive disintegration may occur. Due to the wide range of specimen materials, assemblies or structures that may be tested using materials testing equipment, any hazard resulting from the failure of a test specimen, assembly or structure is entirely the responsibility of the owner and the user of the equipment.

Protect electrical cables from damage and inadvertent disconnection

The sudden loss of controlling and feedback signals which can result from a disconnected or damaged cable causes an open loop condition which may drive the actuator or crosshead rapidly to its extremes of motion. All electrical cables, particularly transducer cables, must be protected from damage. Never route cables across the floor without protection, nor suspend cables overhead under excessive strain. Use padding to avoid chafing where cables are routed around corners or through wall openings.

Warning

Wear protective clothing when handling equipment at extremes of temperature.

Materials testing is often carried out at non-ambient temperatures using ovens, furnaces or cryogenic chambers. Extreme temperature means an operating temperature exceeding 60 °C (140 °F) or below 0 °C (32 °F). You must use protective clothing, such as gloves, when handling equipment at these temperatures. A warning notice concerning low or high temperature operation must be displayed whenever temperature control equipment is in use. You should note that the hazard from extreme temperature can extend beyond the immediate area of the test.

Take care when installing or removing a specimen, assembly or structure.

Installation or removal of a specimen, assembly or structure involves working inside the hazard area between the grips or fixtures. Keep clear of the jaws of a grip or fixture at all times. Keep clear of the hazard area between the grips or fixtures during actuator or crosshead movement. Ensure that all actuator or crosshead movements necessary for installation or removal are slow and, where possible, at a low force setting.

Warning

Do not place a testing system offline from computer control without first ensuring that no actuator or crosshead movement will occur upon transfer to manual control.

The actuator or crosshead will immediately respond to manual control settings when the system is placed offline from computer control. Before transferring to manual control, make sure that the control settings are such that unexpected actuator or crosshead movement cannot occur.

Keep clear of the operating envelope of a robotic device unless the device is de-activated.

The robot in an automated testing system presents a hazard because its movements are hard to predict. The robot can go instantly from a waiting state to high speed operation in several axes of motion. During system operation , keep away from the operating envelope of the robot. Deactivate the robot before entering the envelope for any purpose, such as reloading the specimen magazine.

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Chapter 1
Introduction

Outline

This chapter introduces you to your Series 4400 Load Frame and describes many of its components. Illustrations and tables will show you where these components are located, and provide a brief description of each. Since load cells are the key element in load measurement, a more detailed discussion is given on these important devices.

By the end of this chapter, you will have learned:

- to identify most of the components of the load frame
- where to find these components
- how they function in the load frame
- how load cells are a key part of the measurement system

Purpose

The Instron Series 4400 Load Frames are the mechanical loading structures that form a part of the Series 4400 Electromechanical Materials Testing System, which is used for testing a wide range of materials in tension or compression. The two load frames covered in this manual are designed to be placed on a table top or work bench for use at a convenient working height.

The load frame is designed to secure a test specimen between the rigid frame base and the moving crosshead. The drive system moves the crosshead in an upward or downward direction to apply a tensile or compressive load to the specimen. The applied load is measured by a load transducer (load cell) mounted between the specimen and the crosshead. The load cell is interchangeable with others of different capacities to provide a range of load measurement capabilities.

Control of the testing system is by a Control Console attached to one of the load frame columns. Test parameters and other test setup information, as well as test results and statistics reported, are all selected by pushbuttons on the front panel of the console.

Descriptions of functions and details of operation are contained in a separate Operating Instructions manual. Descriptions of the hardware - the load frame and its components, grips and fixtures, and accessories - are contained in printed manuals such as this one. This manual describes the preliminary setup, operation, maintenance, and illustrated parts breakdown for the load frame itself.

About this Manual

The purpose of this manual is to provide a basic understanding of the Load Frame and its principles of operation. It contains specifications, cable installation, component and control descriptions, operating details for both basic and optional features, and maintenance.

In addition to this manual, there is also a manual covering the installation, operation, maintenance, and parts list for the system Control Console. Accessories, such as the strip chart and X-Y recorders, printer, and most grips and extensometers, come with their own separate instruction manuals.

Product Support

If you encounter any problems with using or maintaining your testing instrument, or if you want to order accessories or parts, you can obtain answers to your questions or place orders by calling Instron Service, using the list below:

In the United States:	1-800-473-7838
In Canada:	1-800-461-9123
In all other regions of the world:	Nearest Instron Service Office

A listing of international Instron Sales and Service offices, including addresses and telephone numbers, can be found on the back cover of this manual.

Description

Basic Functions

The basic operation of the instrument consists of selecting a load cell for your particular application, mounting the cell in the moving crosshead on the load frame, setting test parameters at the computer, then setting a specimen in position so that a load can be applied and measured.

Generally, the specimen is held by grips for tension testing, or is table-mounted for compression testing. Special fixturing may be used for other applications, such as flexure testing. If strain measurement is required, an optional strain gauge extensometer is attached to the specimen, or specialized, non-contact extensometers may be used.

Structural Design

The load frames covered by this manual are available in 5, 10, 30, and 50 kN load capacities, and as options, are also available in extra-height and extra-width versions. They can also be fitted with higher-speed/lower capacity or higher-capacity/lower speed gearing.

The Series 4400 Load Frame is a structure consisting of two vertical leadscrews, a moving crosshead, and a baseplate which is the structural foundation of the frame. When a specimen has been affixed in the gripping device (specimen grips or compression platen), tensile or compressive forces are applied to the specimen by the moving crosshead, driven by the two rotating vertical leadscrews.

The leadscrews are a highly efficient ball screw type which are protected from dust and testing debris by collapsible covers. All testing is done below the moving crosshead.

Additional supporting structure includes two column covers which enclose the leadscrews, and a fixed top plate which is the leadscrew upper bearing carrier. The entire assembly is installed on a base which encloses the mechanical drive train for the leadscrews, a printed circuit card cage, and a connector panel which provides interfacing with system components such as the computer and the load cell.

Crosshead Drive - Mechanical

The mechanical drive train for the moving crosshead is located within the support base. It consists of a d.c. servomotor coupled by a toothed belt to a series of timing belts and pulleys to the leadscrew drive pulleys. The use of timing belts between the pulleys provides synchronization of the driving force to the leadscrews that maintains horizontal alignment of the moving crosshead.

System Power and Cabling

Main power to the Series 4400 system is applied through a cable attached to the base of the frame. A connector panel is located on the left rear corner of the frame base. This panel assembly contains all cabling connections to the frame from external components. Located within this assembly is a frame-to-control console interface board.

A power transformer, part of the main d.c. power supply, is mounted in the base of the frame. It has several taps for primary voltages from 110 to 240 V a.c for different power source voltages.

Crosshead Position Control

Control of the moving crosshead is developed from a commanded testing speed and direction, selected at the control console, which begins to generate a crosshead positional demand or command signal when the test starts.

The control loop for the crosshead drive motor is closed by the use of an incremental encoder that is mounted on the shaft of the main drive motor. The encoder is a rotational measurement device that provides feedback information using timing pulses. These pulses indicate the direction and angle of motor shaft rotation, which is proportional to crosshead displacement. This signal is subtracted from the command signal, and the difference is expressed as an error signal.

The error signal is applied to the servo power amplifier in the load frame. This unit is a self-contained, pulse-width modulated device which controls the amplitude and sign (+/-) of the d.c. voltage applied to the drive motor. The motor drives the crosshead, at the preset speed, to minimize the error signal.

Crosshead jog controls are located on a crosshead control unit, mounted on one of the columns. These jog pushbuttons are used for incremental control of the crosshead direction and distance.

An emergency stop button is located on the front apron of the load frame.

Identification Of Components

Load Frame

The main components of the Series 4400 Load Frame are shown in Figure 1-1 and are identified and described below.

1. **OVERTRAVEL LIMIT SWITCHES** - these are first and second level limit switches which stop the moving crosshead. When a first level limit switch is actuated, the crosshead stops, an action similar to pressing the STOP key, and a status message appears on the computer. To restore operation, slide the limit stop on the rod away from the actuator or press a function key, UP/DOWN JOG, to drive the crosshead away from the stop.
   The second level switch acts as a fail-safe device if a first level switch does not function. When a second level switch is actuated, the drive motor relay is de-energized and the crosshead stops. A status message appears on the computer as an indication of this condition. To reset the system after contacting a second level switch, power down the system, then slide the limit stop away from the actuator to release the switch.

2. **PULLEY BRACKET ASSEMBLY** - an adjustable assembly which is set to maintain an optimum tension on the main drive belts.

3. **POWER SUPPLY ASSEMBLY** - this assembly contains a d.c. power supply and servo power amplifier for the crosshead drive motor. Mounted on an inside panel of this assembly is a motor relay which disables the

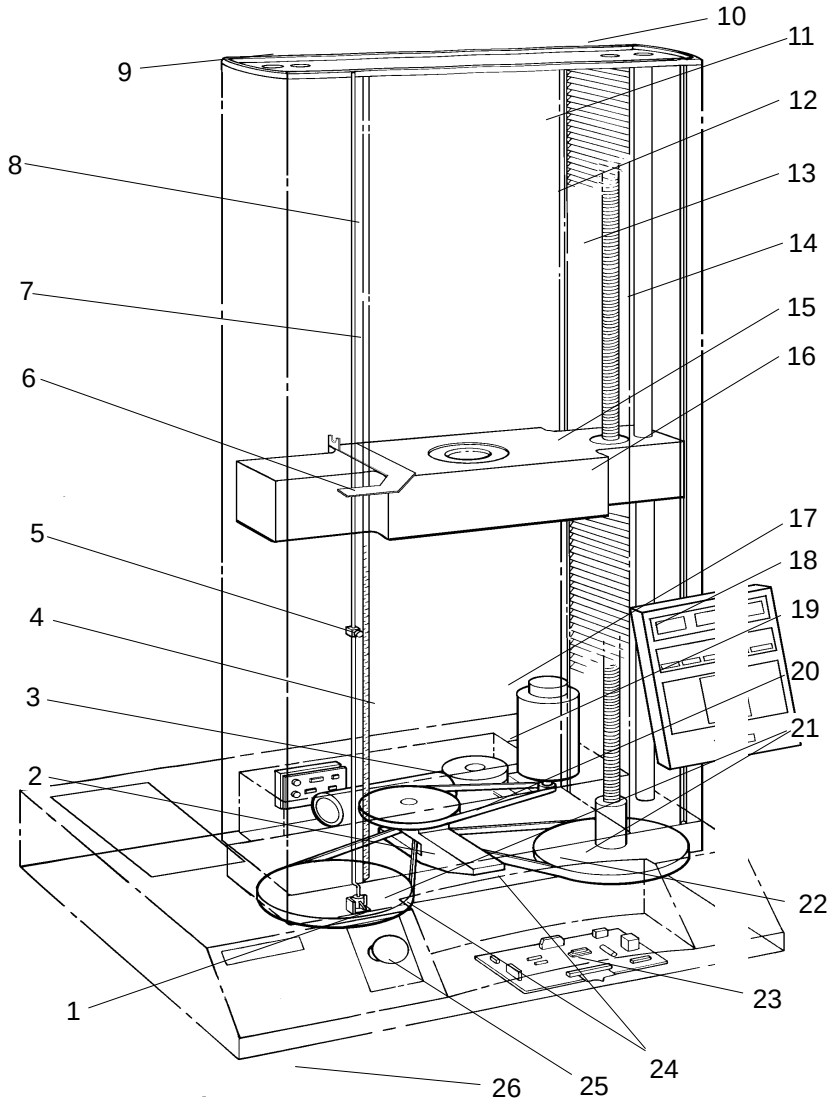

Figure 1-1. Load Frame Main Components

drive motor during Standby, or when a fault condition exists.

4. **MARKER STRIP** - located on the left-hand column cover, this strip can be used to estimate the approximate position of the moving crosshead. The limit switch actuator arm acts as a pointer.

5. **ADJUSTABLE LOWER LIMIT STOP** - when this stop is contacted, an overtravel limit switch is actuated and the crosshead stops. Before a test, set this stop to a point just beyond the expected maximum travel (extension) in the DOWN direction when compression testing, or just below the starting position (gauge length) when tension testing.

6. **LIMIT SWITCH ACTUATOR** - a plate on the moving crosshead that contacts the upper and lower limit stops.

7. **LIMIT SWITCH ROD** - a rod which supports the crosshead travel limit stops and actuates the overtravel limit switches.

8. **ADJUSTABLE UPPER LIMIT STOP** - when this stop is contacted, an overtravel limit switch is actuated and the crosshead stops. Before a test, set this stop to a point just beyond the expected maximum travel (extension) in the UP direction when tension testing, or just above the starting position (gauge length) when compression testing.

9. **TOP PLATE** - a non-load bearing plate that provides bearing support for the leadscrews and rigidity to the frame structure.

10. **TOP LEADSCREW BEARING** - these bearings are permanently lubricated and do not require maintenance.

11. **LEADSCREW COVER** - protective multi-fold curtains mounted in the column covers that shield the leadscrews from debris due to specimen breakage and from accidental contact by an operator or fixtures, while still providing access to the leadscrews.

12. **LEADSCREWS** - threaded rods which turn at commanded speeds and drive the crosshead. The leadscrews are a ballscrew type.

13. **GUIDE COLUMN -** a cylindrical bar extending from the base plate to the fixed top plate, that provides a rigid contact surface for maintaining crosshead guidance and a close alignment tolerance during heavy loading. A guide column is located at each end of the crosshead.

14. **COLUMN COVER** - extruded aluminum covers that enclose both the leadscrews and the guide columns on both sides of the load frame. These covers are also used to mount testing accessories by utilizing the grooves molded into the covers.

15. **BALLSCREW NUTS** -ball cage nuts mounted in the crosshead which contain the recirculating balls by which the ballscrews impart vertical motion to the crosshead.

16. **MOVING CROSSHEAD** - the moving element within the load frame which applies a load to the test specimen at commanded speeds.

17. **ENCODER** - this device, attached to the top of the drive motor, generates an output proportional to the revolutions of the motor shaft by which it is driven. The output, which is a proportional measurement of the moving crosshead displacement, is used as feedback to maintain the commanded speed of the crosshead and to indicate extension of the specimen during a test.

18. **CONTROL CONSOLE -** this unit contains the operator controls and test readouts for setting up and running materials tests.

19. **DRIVE MOTOR** - electric d.c. servomotor that provides the main drive power to the leadscrews and moving crosshead.

20. **MOTOR BELT** - this belt connects the drive motor to an idler assembly, and then to the main drive belts.

21. **LEADSCREW DRIVE PULLEYS** - these pulleys, driven by the main drive belts, are mechanically connected to the leadscrews and complete the drive train from the motor.

22. **BALLSCREW BEARING** - this is the lower bearing carrier for the leadscrews.

23. **FRAME INTERFACE BOARD** - printed circuit board that provides the interface between the Control Console and the load frame.

24. **MAIN DRIVE BELTS** - two cogged belts that provide power to the leadscrew pulleys.

25. **EMERGENCY STOP BUTTON** - this switch is used to stop a test quickly in the event the test does

not proceed as expected. Once activated, the system cannot be restarted until the Stop button has been released. To restart the system, clear the problem that caused the button to be pressed, rotate the EMERGENCY STOP button clockwise, and press an UP or DOWN arrow button on the control console.

26. **LEVELING PAD** - four pads are used for leveling the load frame at installation. An adjustable pad is located at each corner of the frame base.

System Control Console

The System Control Console is the panel where all data entry and test setup selections are made. It contains push-buttons and indicators that provide the control functions and readouts for all tests. The Operating Instructions manual for the Series 4400 Testing System contains detailed descriptions of all controls and indicators on the Control Console, and describes how to use them. For a description of these controls and operating procedures, see Manual M10-94400-1.

Crosshead Control Unit

A hand-held Crosshead Control Unit (Figure 1-2) is attached to a flexible cable to allow the crosshead to be moved manually. It's components are described below.

1. **UP ARROW KEY** - Pressing the UP arrow key causes the crosshead to move up (⇑), or in a tension direction. If the key is held down, the crosshead speed increases exponentially until the key is released.
2. **DOWN ARROW KEY** - Pressing the DOWN arrow key causes the crosshead to move down (⇓), or in a compression direction. If the key is held, the crosshead speed increases exponentially until the key is released.

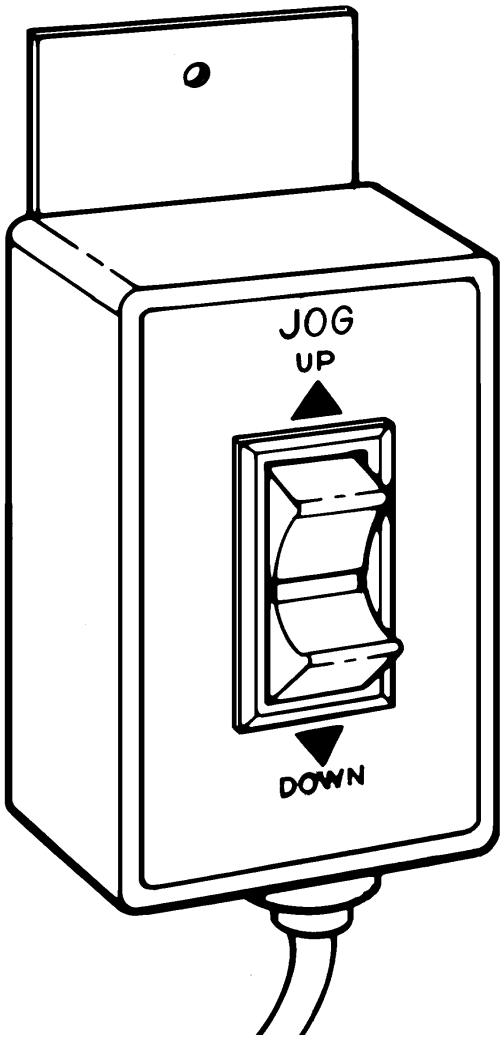

Figure 1-2. Crosshead Control Unit

Load Cells

General Characteristics

Instron Load Cells are precision force transducers containing strain gauges bonded to internal load bearing structures which are stressed during a materials test by applied tension or compression forces. Three basic designs are used for the load cells which, depending upon the type, are bending beam, axial stress, and shear. The load cells function with the highly sensitive load weighing system incorporated in all Instron Universal Testing Instruments. The complete line of existing Instron Load Cells, either electrically or manually calibrated and within the maximum load capacity of the frame, is adaptable to the Series 4400 Testing Instrument.

The active element in each load cell is a balanced Wheatstone bridge employing strain gauges supplied with an excitation voltage from the signal conditioner on the Load Conditioner Card. When a load is applied to the cell, the element is deformed and the bridge becomes unbalanced. The result is an electrical signal directly proportional to the deformation of the element and thus, the applied load.

The 2525 Series Load Cells, usable on the Series 4400 system, are electrically calibrated. When you initiate this process at the Control Console, a signal is generated from the cell caused by unbalancing the bridge with a special switched-in shunt resistor. The imbalance is designed to be equal to the required calibration load. The switching action is initiated by a console command to a relay mounted in the cell or its connector. Hence, calibration, after you initiate it, is completely automatic.

Calibration of a load cell is a two-point function based on zero (no-load) and the calibration point. The calibration point, established for each cell during manufacture, occurs at approximately one-half the rated capacity of the cell.

Each load cell contains a special resistor with a resistance value unique to each type. This resistor enables a cell to be automatically identified by the testing system.

Instron load cells are ruggedly made, but, as with any transducer, should be handled with care. Each cell is labelled as to its rated capacity, and all cells are equipped with a convenient carrying handle and storage container.

Load Cell Stability

There are two primary factors controlling the stability of load cells: change of balance point with temperature, and change of balance as a result of an application or change of load (creep).

Careful temperature compensation is made during manufacture, with the result that all Instron load cells have a coefficient of less than 0.002% of full rated output per degree F. The balance shift due to temperature change becomes proportionately less at the higher end. Therefore, if you are running a very long test requiring maximum stability, use a cell where the loading is at the higher end of its range whenever a choice is possible.

The creep of a cell can be observed as a gradual and very small shift in a recorder reading after a high load has been quickly applied, or as a small shift in the balance point after a load has been quickly removed. For most cells the creep coefficient is less than 0.05% of full

rated output, although for a 500 gram cell this may be as high as 0.5% because of its more sensitive design.

The above discussion regarding stability refers only to the shift in balance point due to temperature or creep, its effect being to move the whole scale of a recorder up or down by the amount concerned. The calibration, or the scale sensitivity, of a cell is not affected by these variations and remains constant for all normal conditions.

Electrical Calibration

Calibrating a load cell electrically eliminates handling and applying precision dead weights to the cell for calibration purposes. This method is as accurate and stable as the dead weight method except that the mechanics of the cell are not checked. In addition to the stability consideration discussed on Page 1-16, two other factors influence the operation of these cells: modulus compensating resistors and electrical calibration resistors.

Modulus compensation is provided to prevent temperature-induced modulus changes from affecting the calibration or sensitivity of the cell. While the magnitude of this effect is very small, the sensitivity of an electrically calibrated load cell must be exactly the same as that of the electrical calibration signal, and this agreement must exist under environmental conditions which may be different from those that existed in the laboratory at the time of calibration.

Each load cell contains a special calibration resistor so that when calibration is initiated, an electrical signal is produced which is equivalent to applying a precision

dead weight to the cell. The accuracy of this comparison is better than 0.1% of the actual signal.

Series 2525 Load Cells

The Instron Series 2525-800 Load Cells are designed for accurate load measurement and precise load control. These cells are calibrated in S.I. units, but the choice of operating in either English (U.S. Customary) or metric units is easily selected at the control console to meet application requirements. The cells are interchangeable so that forces from 1 gram to the full capacity of the load frame can be accurately measured and recorded.

Other features of the Series 2525-800 Load Cells are a 2 mV/V rationalized output, self-identification by the Series 4400 system, and complete electrical calibration and balancing.

The Series 2525-800 Load Cells are designed for general tension and compression testing. Each cell has a clevis pin attachment, optimized for its load range, that allows quick connection of grips and fixtures.

Load Cell Adapters

Load cells require coupling adapters for the attachment of specimen grips for tension testing, or anvils and tables for compression testing. A number of types and sizes of these adapters are available for use with Instron Load Cells on Series 4400 Load Frames; several types and sizes are shown in Figures 1-3 and 1-4, and listed in Tables 1-1 and 1-2. These tables and figures are not a complete listing of all of the types of adapters available. If you need assistance in determining your grip and

adapter requirements, please contact your regional Instron Sales and Service Office or the factory.

There are two categories of coupling adapters: self-aligning and rigid. A self-aligning coupling is a clevis cou-

Table 1-1. Tension Couplings

SELF-ALIGN COUPLING CATALOG NO.	RIGID COUPLING CATALOG NO.	MAXIMUM CAPACITY	RETAINING PIN DIAMETER	COUPLING INNER DIAMETER	USE ON LOAD CELL 2525-8XX
2501-115	—-	100 N 10 kg 20 lb	0.187 in.	0.500 in.	-807 -808
2501-094	2501-133	10 kN 1000 kg 2000 lb	0.250 in.	0.625 in.	-804 -805 -806
2501-090	2501-092	100 kN 10000 kg 22000 lb	0.50 in.	1.25 in.	-801 -802
2501-091	2501-093	10 kN 1000 kg 2000 lb	0.50 in.	1.25 in.	-804 -805 -806

pling that provides a swivel connection and always joins pin-type interfaces. It utilizes a clevis pin that passes through holes in both the male and female parts of the coupling, and is often held in place with a retaining spring. The pin diameter increases as the design load capacity becomes greater.

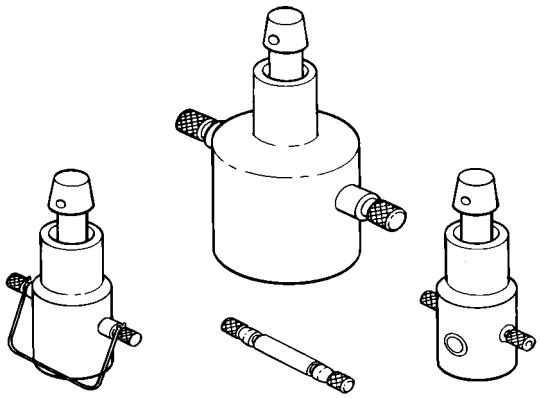

Figure 1-3. Typical Tension Couplings

A rigid coupling adapter is also a pin-type coupling, but uses a checknut, which jams against the grip, to provide a backlash-free coupling between the grip and the load cell. Because it is rigid, this type of coupling adapter is not self-aligning; load string alignment is dependent on the accuracy of alignment of the load cell within the load frame. A rigid coupling adapter can convert between pin-type interfaces.

Note *Rigid couplings are required for the Series 2714 and 2734 Cord and Yarn Grips, the Series 2714 Wire Tire Cord Grips, and the Series 2715 Capstan Grips.*

Because of the seemingly endless variety of grips, load cells, adapters, and couplings available, it is not possible in this manual to cover all possibilities, and the foregoing is just a sampling. If you need help in selecting load string

Table 1-2. Compression Anvils

CATALOG NO.	MAXIMUM CAPACITY	ANVIL AREA
2501-107	50 N, 5 kg, 10 lb	2 sq. in.
2501-108	50 N, 5 kg, 10 lb	4 sq. in.
2501-104	10 kN, 1000 kg, 2000 lb	2 sq. in.
2501-121	10 kN, 1000 kg, 2000 lb	4 sq. in.
2501-106	10 kN, 1000 kg, 2000 lb	20 sq. in.

items, or to merely find out what is available, talk to your nearest Instron Sales Engineer. Give him as much detail as you can about the types of material you want to test, the type of testing you want to do, the expected load range of your tests, and any other information you feel is pertinent to your tests. He will then be in a position to advise you on the best components for your particular testing application.

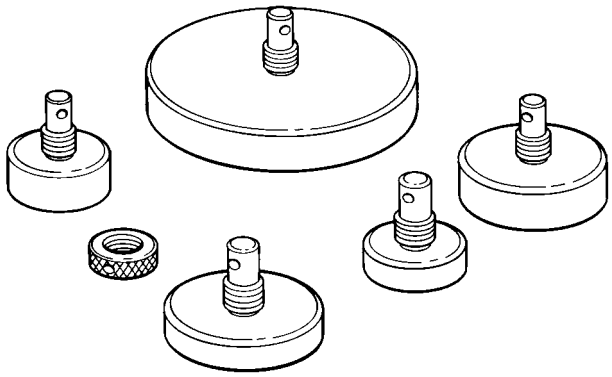

Figure 1-4. Typical Compression Anvils

Chapter 2
Specifications

Outline

This chapter covers physical and electrical specifications for the Series 4460 Table-Top Load Frames. It also gives physical dimensions for both the standard load frames and load frames with special configuration options.

Specifications

The specifications given in this section cover all of the Series 4460 Load Frames between Models 4464 and 4469 inclusive. These are all table-top load frames, designed for relatively low-force laboratory and quality control testing applications. Larger, floor-standing models in the 4400 Series are covered in separate publications.

In addition, there are several configuration options for the table-top load frames. These include an extra-wide version, an extra-height version, and a second test space option. This latter option is a load frame that can test specimens above the moving crosshead, as well as below the crosshead. All of these options are described more fully in Chapter 8 of this manual, where you will also find specifications and dimensions that are unique to the particular option.

The specifications in this chapter cover the standard load frame only; refer to Chapter 8 for configuration option specifications. System specifications for control, data acquisition, test setup and so on are covered in operating instructions manuals.

Table 2-1. Series 4460 Load Frame Specifications

	Load Frame Model				
	4464	**4465**	**4466**	**4467**	**4469**
Load Capacity kN kgf lbf	 2 200 450	 5 500 1125	 10 1000 2250	 30 3000 6750	 50 5000 11240
Maximum Speed mm/min in/min	 2500 100	 1000 40	 500 20	 500 20	 500 20
Minimum Speed mm/min in/min	 0.05 0.002	 0.01 0.0004	 0.005 0.0002	 0.005 0.0002	 0.01 0.0004
Maximum Force @ Full Speed	1kN (225 lbf)	5kN (1125 lbf)	10 kN (2250lbf)	30 kN (6750 lbf)	50 kN (11240lbf)
Maximum Speed @ Full Load mm/min in/min	 1000 40	 1000 40	 500 20	 500 20	 250 10
Return Speed mm/min in/min	 2500 100	 1200 48	 600 24	 600 24	 500 20
Speed Accuracy	± 0.1% steady state, measured over 100 mm or 30 sec, whichever is greater, no load				
Position Measurement Accuracy	±0.01 mm or 0.15% of displacement of displayed reading (whichever is greater)				
Position Repeatability	±0.05 mm (0.002 in.)				
Load Weighing Accuracy	±0.5% of full scale to 1/50 of load cell capacity, or ±1 count on the display, whichever is greater				
Strain Measurement Accuracy	0.6% of reading ±25% of calibration point ±1 count on the display, whichever is greater				
Total Crosshead Travel	1135 mm (44.7 in)	1135 mm (44.7 in)	1135 mm (44.7 in)	1135 mm (44.7 in)	1135 mm (44.7 in)

Table 2-1. Series 4460 Load Frame Specifications (continued)

	Load Frame Model				
	4464	**4465**	**4466**	**4467**	**4469**
Total Vertical Test Space *	1192 mm (46.9 in)	1192 mm (46.9 in)	1192 mm (46.9 in)	1192 mm (46.9 in)	1192 mm (46.9 in)
Space Between Columns	420 mm (16.5 in)	420 mm (16.5 in)	420 mm (16.5 in)	420 mm (16.5 in)	420 mm (16.5 in)
Testing Type	Tension, Compression, Reverse Stress Single Space below Moving Crosshead				
Basic Control Mode	Position Control Loop, closed around crosshead drive				
Crosshead Position Control Resolution	0.000236 mm/pulse (8 µ in)	0.000118 mm/pulse (4 µ in)	0.000057 mm/pulse (2 µ in)	0.000054 mm/pulse (2 µ in)	0.0000625 mm/pulse(2.5 µ in)
Crosshead Position Repeatability	> ±0.05 mm (0.002 in)				
Acceleration Time, 0 to top speed	150 msec				
Emergency Stop Time	100 ms	100 ms	100 ms	300 ms	320 ms
Axial Stiffness	40 kN/mm (225,000 lb/in)	40 kN/mm (225,000 lb/in)	40 kN/mm (225,000 lb/in)	100 kN/mm (562,500 lb/in)	163 kN/mm (930,800 lb/in)
Height	1597 mm (62.7 in)	1597 mm (62.7 in)	1597 mm (62.7 in)	1597 mm (62.7 in)	1597 mm (62.7 in)
Width	909 mm (35.6 in)	909 mm (35.6 in)	909 mm (35.6 in)	909 mm (35.6 in)	909 mm (35.6 in)
Depth	700 mm (27.5 in)	700 mm (27.5 in)	700 mm (27.5 in)	700 mm (27.5 in)	700 mm (27.5 in)
Weight	136 kg (300 lb)	136 kg (300 lb)	136 kg (300 lb)	182 kg (400 lb)	240 kg (530 lb)

* Total vertical test space = distance from top surface of base platen to fixture attachment point on load cell.

Table 2-1. Load Frame Dimensions

	Load Frame Model				
	4464	**4465**	**4466**	**4467**	**4469**
Power Requirements Max Power Voltage Frequency	300 VA 100/120/ 220/240 VAC, +10/-5% 47 to 63 Hz	300 VA 100/120/ 220/240 VAC, ±10% 47 to 63 Hz	300 VA 100/120/ 220/240 VAC, ±10% 47 to 63 Hz	600 VA 100/120/ 220/240 VAC, ±10% 47 to 63 Hz	700 VA 100/120/ 220/240 VAC, ±10% 47 to 63 Hz
Operating Temperature	+10°C to +38°C (+50°F to +86°F)				
Storage Temperature	-40°C to +66°C (-40°F to +150°F)				
Humidity	10% to 90% (non-condensing)				

Dimensions

Load Frame Dimensions

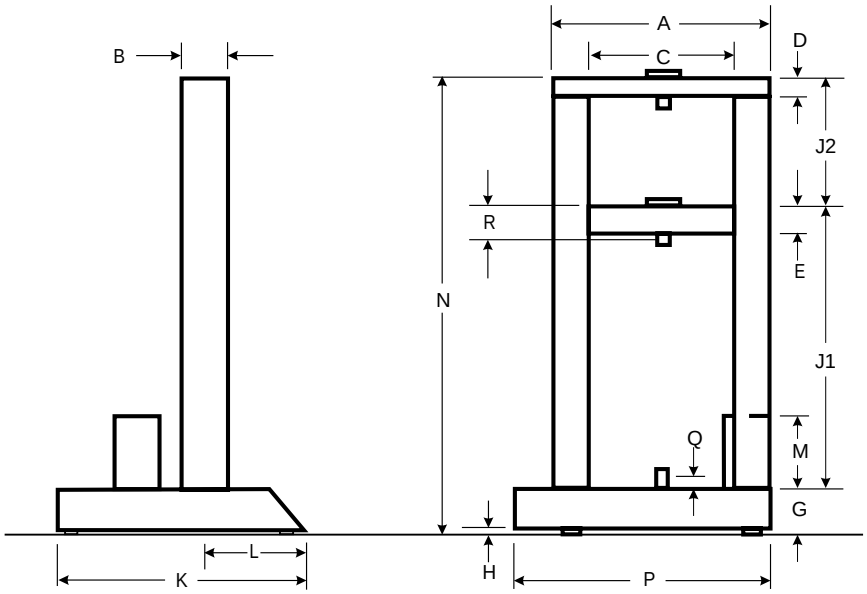

Figure 2-1. Load Frame Dimensions

Table 2-2. Load Frame Dimensions

Designation	Description	Dimension mm (inch)
A	Across Columns	720 (28.3)
B	Column Depth	140 (5.5)
C	Horizontal Test Daylight	420 (16.5)
D	Top Plate Thickness	36 (1.4)
E	Crosshead Thickness	Models 4464/65/66 76 (3.0) Model 4467/4469 120 (4.7)
F	Card Cage Height	120 (4.7)
G	Platen Height from Table	180 (7.1)
H	Gap for Feet	25 (1.0) nominal setting
J1	Crosshead Position	Min 190 (7.5) Max 1325 (52.1)
J2	Used only for Second Test Space Option	
K	Overall Depth	700 (27.5)
L	Front of Base to Test Center	245 (9.6)
M	Motor Pod Height	215 (8.5)
N	Overall Height	1597 (62.9)
P	Overall Width	909 (35.8)

Table 2-2. Load Frame Dimensions (continued)

Designation	Description	Dimension mm (inch)
Q	Coupling Pin to Base	59 (2.3)
R	Load Cell Pin to Crosshead	133 (5.2) with 2525-800 Series Load Cells to 10 kN 142 (5.6) with 2525-800 Series 30 kN Load Cell

Accessory Mounting Dimensions

Numerous testing accessories and test fixtures can be attached to the load frame for specialized testing purposes. Some of these accessories are manufactured by Instron, while others are custom fabricated by users. The following diagrams show standard mounting holes in both the load frame base plate and in both the fixed and moving crossheads.

You are advised to use these standard mounting holes whenever possible to mount your accessories; to drill and tap new holes is time-consuming, expensive, and may weaken or otherwise compromise the integrity of the load frame.

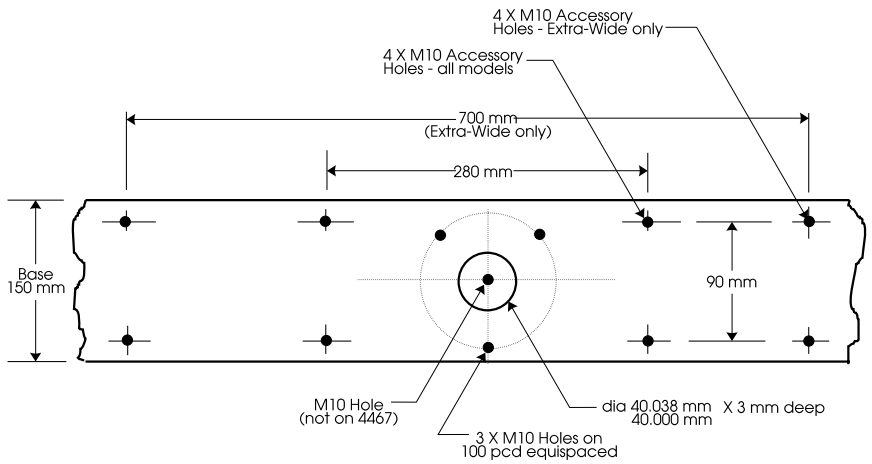

Figure 2-2. Moving Crosshead Accessory Mounting

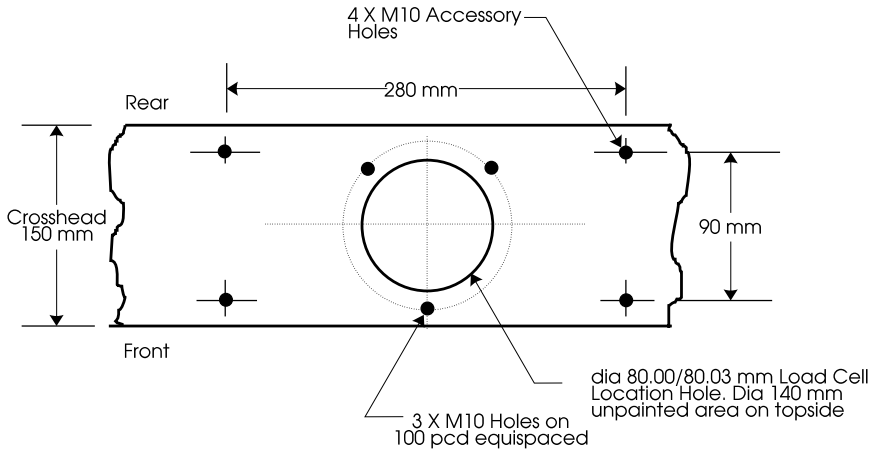

Figure 2-3. Top Plate Accessory Mounting Dimensions

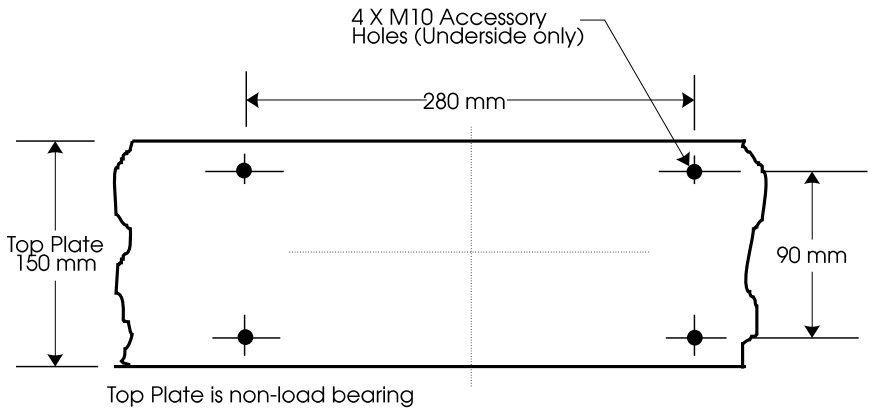

Figure 2-4. Top Plate Accessory Mounting Dimensions

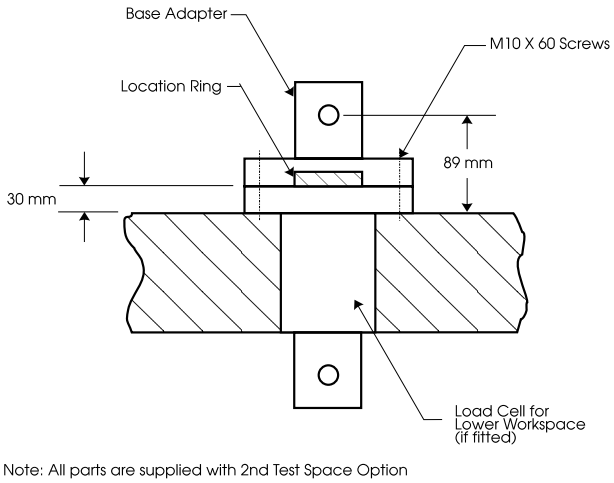

Figure 2-5. Second Test Space Accessory Mounting Dimensions

Chapter 3
Installation

Outline

In this chapter, you will learn how to unpack, move, and install your new Series 4400 testing system. Because the load frame is heavy, special moving and transporting techniques are required.

By the end of this chapter, you will know how to:

- unpack and inventory your system
- transport the system to its operating location
- install and cable the system

Unpacking

The Instron Series 4400 Testing Instrument is carefully packed for shipment. The load frame is bolted to a wooden skid in an upright position (for export shipment, it is crated in a horizontal position), and is protected by a shrink-wrap vapor barrier.

After removing the container, use the packing list to inventory all items. Note that some accessories may be packed in the container with the load frame, or may be packaged separately. Retain all packing material until the system is satisfactorily installed and all parts, assemblies, and accessories have been accounted for.

Do not remove the wooden skid until you have decided what method will be used to transport the testing system to its operating location (see “Transporting”, page 3). The skid will make it easier to move the load frame without damage.

Transporting

The load frame can be moved to a different location by using a forklift, with a 275 kg (600 lb) capacity, under the shipping skid.

Caution

If the shipping skid has been removed, do not lift the frame with a fork lift underneath the base. Lifting the frame in this manner will damage the underside of the frame.

Similarly, do not lift the load frame by the top plate. This plate is not designed to support the weight of the frame, and it might break.

Use one of the following methods to lift the load frame for removing the skid and for transporting:

(a) Using a forklift with padded forks, carefully insert the forks under the moving crosshead between the columns, or

(b) Use a rope or nylon strap sling around the moving crosshead having a 275 kg (600 lb) capacity.

(c) Four leveling feet are supplied for the load frame. After removing the skid, thread a leveling foot into each corner of the base before placing the frame on a table.

Installation

Preliminary Considerations

The Series 4400 Testing Instrument is designed to be set up on a table or workbench. The load frame should be set up in a semi-permanent location that will support the weight of the load frame (which can weigh up to 240 kg (530 pounds), depending on the particular model. Other units of the system, such as the computer and any recorders and printers, may be placed alongside the load frame, or placed on a roll-around cart. Be sure the table or cart provides a comfortable working height for the computer.

Leveling of Load Frame

After setting the instrument in its operating position, level the load frame. Place a bubble level on the frame base near the center of the space between the two columns. Then, adjust the four leveling pads, using the spanner wrench pkrovided, until the frame is level in both the side-to-side and front-to-back directions.

Mounting the Control Console

The Control Console is already mounted on one of the load frame columns when the system is shipped from the factory. If you wish to move the console from one side of the load frame to the other, you can do it without the use of tools. While referring to Figure 3-1 , use the following procedure:

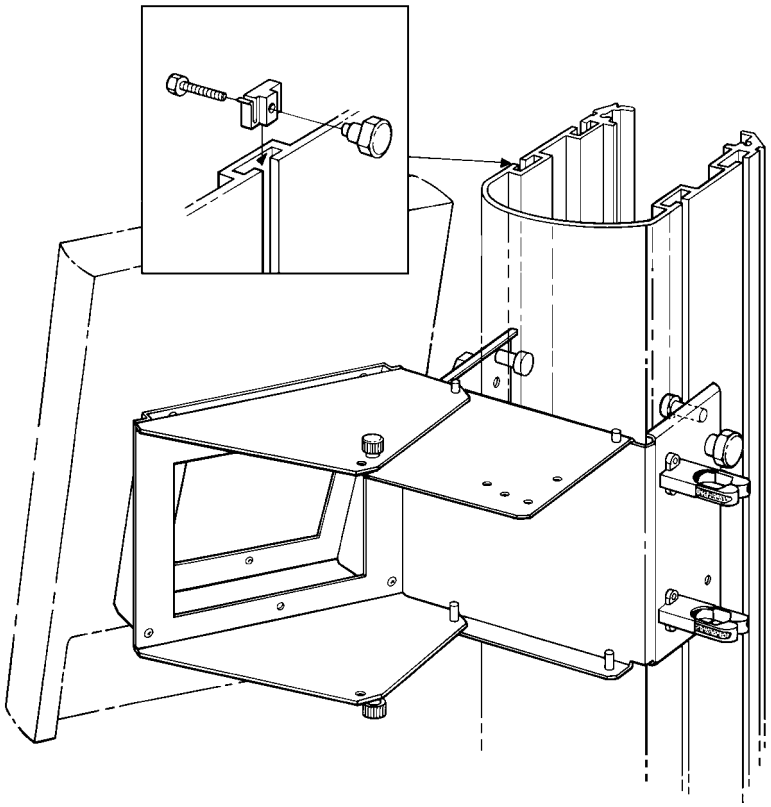

Figure 3-1. Console Mounting Bracket

(a) Lift the console and its pivot bracket up and off of the sliding bracket. Temporarily set the console aside on the load frame base platen.

(b) Loosen, but do not remove, the three knobs on the side of the sliding bracket. Slide the bracket all the way to the top of the load frame column, then out of

the slots in the column. The three knobs and their T-Nuts will come out of the slots with the bracket.

(c) With the sliding bracket removed from the load frame, move the three knobs and T-Nuts to the corresponding holes in the opposite side of the sliding bracket.

(d) Move the two cable clips to the corresponding holes in the opposite side of the bracket. Tighten the screws snugly.

(e) Place the sliding bracket at the top of the column on which you wish to mount the console. Align the bearing studs with the vertical slots in the load frame column cover and slide the bracket a short way down the column. When the first bearing stud has entered the slot, align the T-Nuts with the slot, then slide the bracket the rest of the way into the column.

(f) Adjust the bracket for a comfortable working height and tighten the three knobs.

(g) Lift the console and pivot bracket up and over the sliding bracket while aligning the pins in the holes of the pivot bracket. Remember that you will be using the pins and holes on the opposite side of the bracket from the ones that were used originally.

(h) Adjust the viewing angle of the console by lifting the console slightly and pivoting it to a new angle. Lower the console while aligning the locating pins in the nearest holes.

(i) Place all cables in the cable clips, and dress the cables away from the work space.

Interconnection of Units

The cabling necessary to interconnect the Series 4400 system consists of a cable to connect the control console to the load frame and a cable to connect the load cell to the Load Controller. Other cabling for optional accessories that may be included with the original equipment is supplied with that equipment.

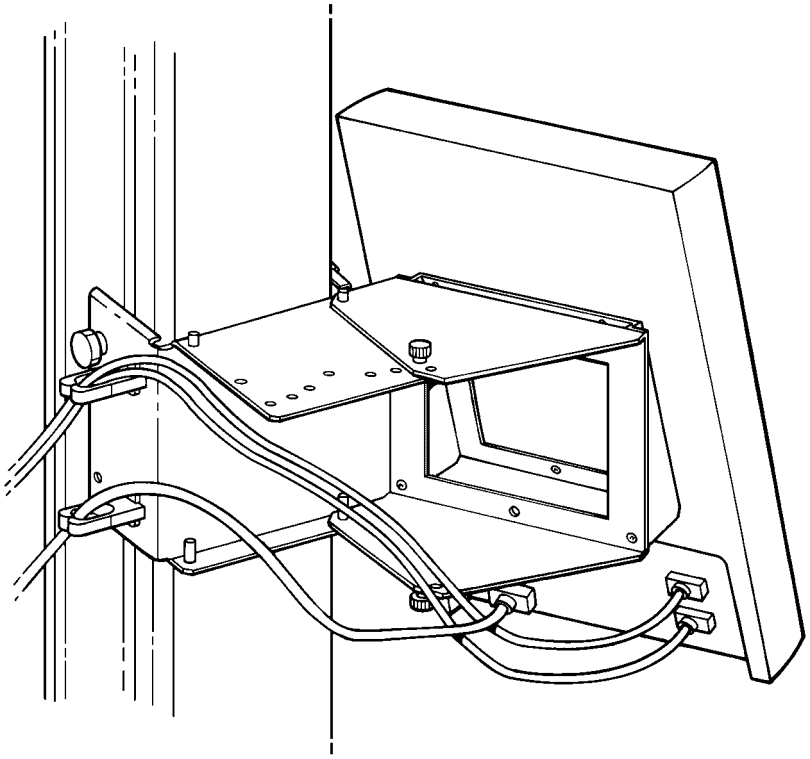

Figure 3-2. Control Console Cable Routing

Figure 3-2 shows how the cabling is routed and dressed to keep cables out of the testing area work space. Always use the cable clips for all cables. Figure 3-3 is a diagram of cable connector locations on the rear panel.

Note *If installation of an optional recorder, printer, or strain measuring accessories requires additional cabling, refer to the instruction manuals for these devices.*

Install cabling to the load frame as follows:

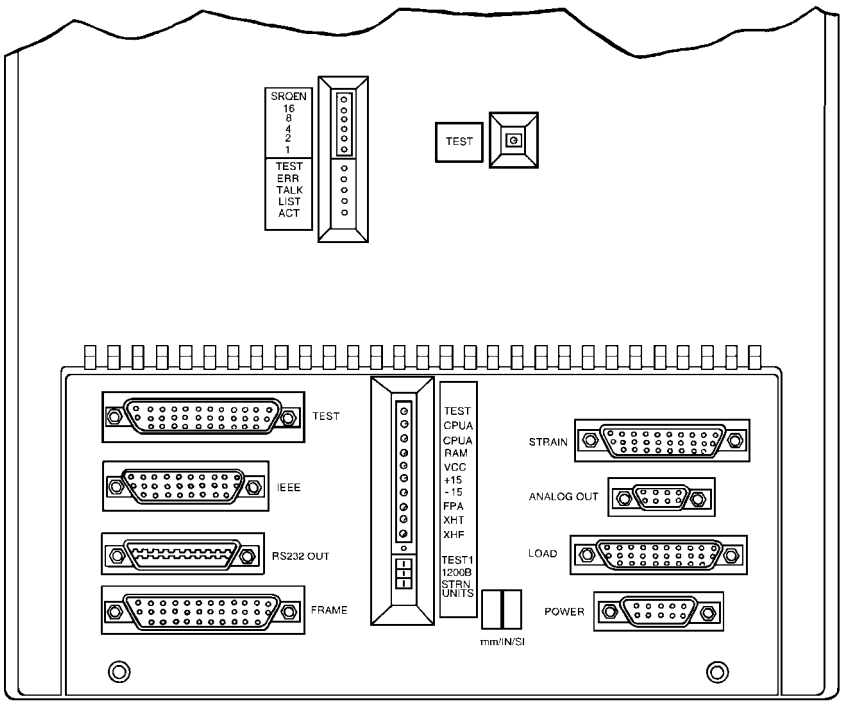

Figure 3-3. Rear Panel Connectors

(a) Connect the Frame-to-Console Interface cable to the interface connector on the rear of the frame. Connect the other end of the cable to the system interface connector on the back of the control console. Ensure that the connectors are fully engaged in their sockets and are clamped with the connector screws.

(b) Connect the Load Cell cable to the LOAD connector on the rear of the control console. Press the load cell cable into the cable clamp on the crosshead.

Main Power Supply Connection

The Series 4400 instrument is set at the factory to accept the main power input voltage specified on your order; a 10-foot, 3-wire power cable for this voltage is included. If the power source to be used is not the voltage originally specified, follow the instructions below:

The power input connector on right side of the load frame base can be altered to accept other line voltages in the range of 100 to 240 V.a.c., 47 to 63 Hz (refer to Table 3-1).

Caution

Ensure that a 3-wire, grounded main power cable is used for the Series 4400 Load Frame. This instrument operates from a single phase, two-wire grounded power source that applies 250 volts rms or less between the supply conductors or between the ungrounded supply conductor and earth ground.

Note *If the Series 4400 Load Frame is to be adapted for 220-240 V.a.c. operation, and the power cable supplied with your system does not fit your power source outlet, a male plug that is specified for that outlet must be added to the cable. Observe the following CEE wire color code for the cable:*

Brown - high (live)
Light blue - low (neutral)
Green & yellow - earth ground

Table 3-1. Line Voltage Selection

Voltage Selector Marking	Frame Operating Voltage Range
100 V	90 V to 110 V
120 V	108 V to 132 V
220 V or 230 V	198 V to 242 V
240 V	216 V to 264 V

Note *On some line voltage selector units, the 220 V marking on the external face and the internal card may read "230 V". These units are interchangeable and can be used as if the marking were "220 V".*

To adapt the Series 4400 system for a different main power voltage, change the voltage selection on the line input connector on the right side of the load frame as follows:

Warning

Disconnect the electrical power cable from its source before changing the line voltage selector

(a) Inspect the line input connector. There are four holes in a vertical line at the right side of the connector, each corresponding to a different line voltage. The current voltage setting is indicated by a white plastic pin visible in one of the holes. (see Figure 3-4).

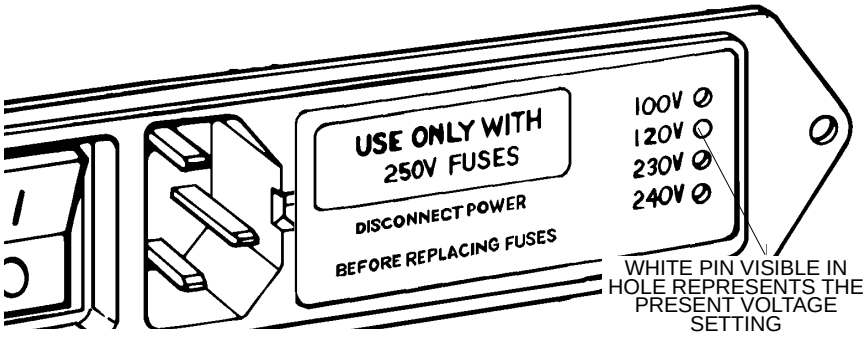

Figure 3-4. Input Line Voltage Adapter

(b) Insert a small screwdriver into the middle of the connector and pry out the fuse holder, as shown in Figure 3-5. Remove the fuse holder from the line input connector, as shown in Figure 3-6

(c) Remove the voltage selector card using long nose pliers as shown in Figure 3-7.

(d) Orient the voltage selector card so that the indicator pin is pointing upwards (see Figure 3-8). Holding the pin in this orientation, rotate the card until the re-

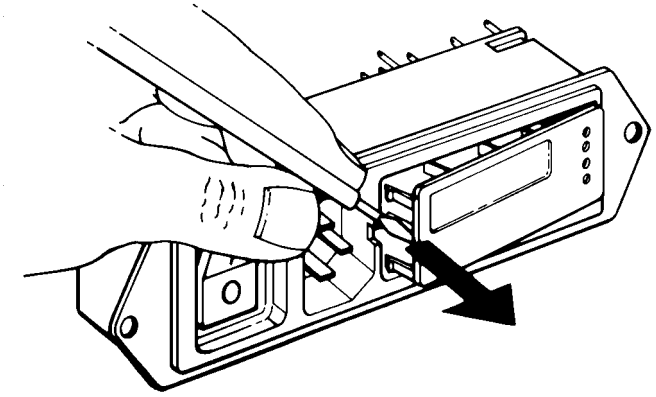

Figure 3-5. Prying Out Fuse Housing

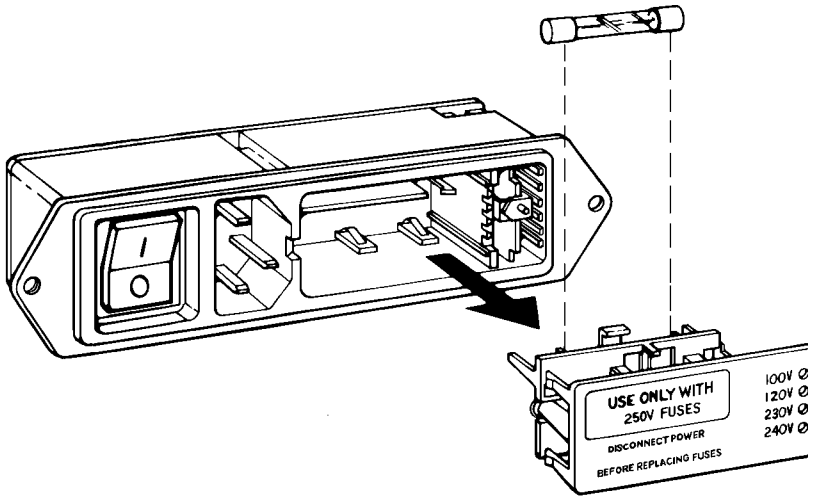

Figure 3-6. Removing Fuse Housing

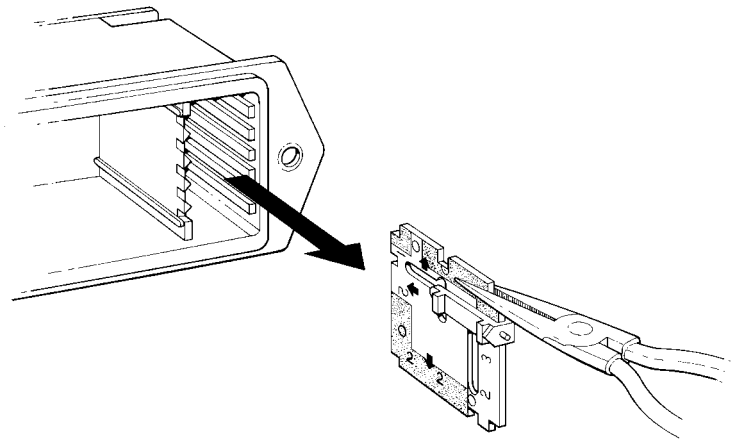

Figure 3-7. Removal of the Voltage Selector Card

quired voltage setting, determined from Table 3-10, is showing at the bottom of the card, as shown in Figure 3-8.

(e) Reinsert the card into the connector, with the edge showing the selected voltage leading and the printed numbers toward the center of the connector (see Figure 3-7). Ensure the card is fully seated.

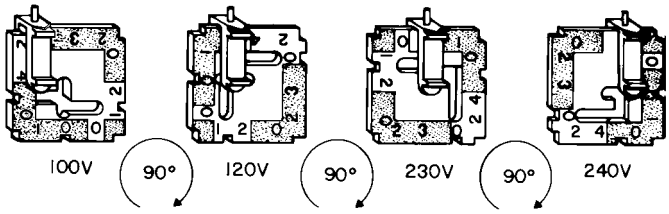

Figure 3-8. Selecting the Line Voltage

(f) Change the fuse in the holder, if required (refer to Note below).

(g) Install the fuse housing into the connector. Check that the indicator pin now indicates the correct input voltage.

Note *The fuse in the connector should be a 6.25 amp, 3 AB type (Instron Part No. 27-2-46) Spare fuses are supplied with the system.*

Main Power Connection

Check that the main power switch on the right side of the load frame is OFF. Plug the Input Power cable into a convenient wall outlet of the correct voltage.

Warning

Ensure that the power cable grounding conductor is properly connected to earth ground to avoid electrical shock.

The Series 4400 system installation procedure is complete at this point. Become familiar with the testing instrument and its controls and operating procedures before turning it on.

Chapter 4
Preparation For Use

Outline

Preparing the Series 4400 System for a materials test involves selecting the proper load cell, installing grips for the type of specimen to be tested, and choosing and installing any accessories needed. This chapter presents some guidelines for accomplishing these tasks.

When you have finished this chapter, you will know how to:

- select the proper load cell for your test application
- install load cells in several configurations
- select and install grips and fixtures

Selecting Load Cells

The selection of a load cell is the first step in preparing for a tension or compression test. If the approximate tensile (or compressive) strength of the specimen is known, the choice of load cell is simplified. If the tensile strength is not known, refer to a Properties of Materials handbook to obtain a close figure.

To calculate the tensile strength in force units for a specimen, multiply its tensile strength by its cross-sectional area. For example:

$$psi \times in^2 = lbf\ (pounds - force)$$

$$^{kg}/_{m^2} \times m^2 = kgf\ (Kilogram\text{-}\ force)$$

$$Pascals \times m^2 = newtons$$

EXAMPLE:

Specimen geometry:	standard ASTM tensile
Material:	Lexan
Tensile Strength:	5200 psi (from materials handbook)
Specimen area: = 0.063 in^2	0.502 in. wide x 0.125 in. thick
Tensile strength:	5200 psi x 0.063 in^2 = 328 lbf

Therefore, in this example, the 5 kN (1000 lb, 500 kg) capacity load cell should be installed.

If an approximate value of tensile strength cannot be obtained, then always use the highest capacity load cell at first, and perform a preliminary test at a very slow speed to determine the load range required. If the results of this test so indicate, you can then choose a lower capacity load cell to obtain better load resolution.

Use the following general guidelines when choosing a load cell:

(a) The load cell capacity should be greater than the maximum expected testing load, and the maximum expected testing load should be greater than 2% of the load cell maximum capacity.

(b) If a choice is possible between two different cells because of overlapping ranges:

(1) Select a higher-capacity load cell whenever a minimum of deflection is desired.

(2) Select a lower-capacity load cell whenever a maximum long term balance or stability is desired.

Installing Load Cells

Installation of a Series 2525 Load Cell

Testing on a Series 4400 load frame is always done below the moving crosshead. Figure 4-0 shows a typical load cell being installed.

When using a Series 2525 tension-compression load cell, it is usually installed in the crosshead and a grip or anvil attached to the clevis which extends below the crosshead. The load cell can also be mounted on the baseplate for certain special testing applications.

Installing a Series 2525 Cell in the Crosshead

To install a Series 2525 load cell in the crosshead:

(a) Carefully lower the cell into the center hole of the crosshead with its cable towards the rear. Align the holes in the flange of the cell with the tapped holes in the crosshead (see Figure 4-0.

(b) Fasten the cell using three M10 SHCS (socket head cap screws) provided (use an 8 mm hex key wrench). Torque the screws to 50 Nm (37 ft-lb).

Note *For tension testing, you don't* need *to bolt down the cell. For convenience, you can just place the cell into the crosshead without bolts. However, for some applications where the cell must be held rigid, use the bolts. For example, bolts might be needed, if you are testing at very low loads, to remove any non-linearities of the loading rates as the load cell "beds down" on the mounting surface.*

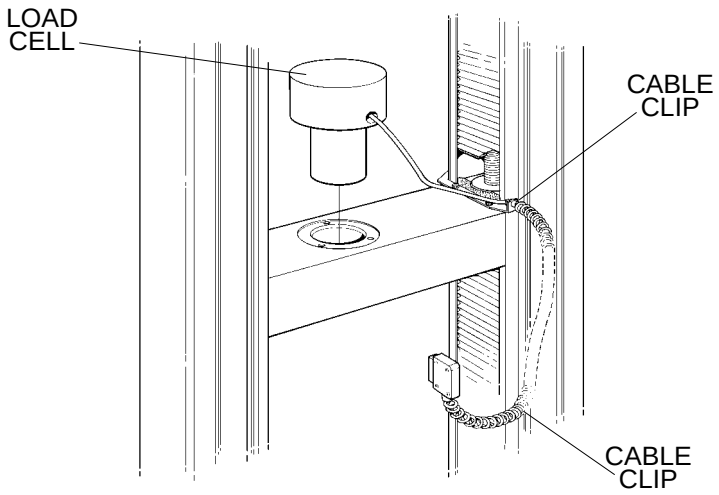

Figure 4-1. Installing a Typical Load Cell

(c) Plug the load cell cable into the LOAD CELL connector on the card cage. Hook the upper end of the cable into the bracket on the rear of the crosshead, and press the lower end of the cable into the adjustable clip on the rear of the column cover.

Installing a Series 2525 Cell on the Baseplate

(a) Remove the base grip adapter: remove the M10 socket head cap screw (SHCS) from the center of the adapter; or remove three M10 SHCS from the adapter flange on load frames so equipped.

(b) Remove the mat from the baseplate. Mount the load cell in the center of the plate and align the flange

with the three M10 tapped holes. Fasten the cell using three M10 SHCS and torque the screws to 50 Nm (37 ft-lb).

(c) Replace the workspace mat on the baseplate.

(d) Plug the load cell cable into the LOAD connector on the rear of the Control Console.

Installing Other Load Cells

An extensive line of Instron load cells that have maximum capacities within the range of the Series 4400 System, and certain older load cells that you may have on hand, are capable of being adapted to the instrument. Consult your regional Instron Sales Engineer on how to adapt these load cells to the load frame for your specific application.

Installing Grips And Fixtures

Selecting Grips and Fixtures

The selection of grips depends on the material, geometry, and strength of the test specimen, but the tensile strength of the specimen is the primary consideration. If, for example, a material has a tensile strength of 500 lbf, then pneumatic grips would not be used because these grips are designed for loads less than 200 lbf. Always determine the capacity of the grips before using them in a test, and do not overload the fixtures.

In tension testing, the test specimen is held securely in the jaws of upper and lower grips. The upper grip is usually attached to the load cell (which, in turn, is attached to the moving crosshead), and the lower grip is attached to the fixed base plate of the load frame. The jaws in most types of grips are designed to tighten even more firmly on the specimen as tensile loads increase.

When compression testing, the specimen is placed on a table (called a platen), and the loading is applied by an anvil coupled to the load cell. In this case, the diameter (or area) of the anvil is important, as well as its maximum loading capacity.

Examples of gripping techniques are shown in Table 4-1. In many cases, you will have to experiment with several gripping techniques to eliminate or minimize slippage of the specimen in the grips. For grips with interchangeable jaw faces, such as screw-action and pneumatic-action types, the serrated, flat, and rubber-coated faces can be tried to determine the best method.

It is of particular importance that the rated loading capacity of the grips and fixtures exceeds, with a reasonable safety factor, the loading expected during a test. Grips

Table 4-1. Examples of Gripping Techniques

SPECIMEN MATERIAL	SPECIMEN GEOMETRY	MAX. BREAK LOAD (LB)	TYPES OF GRIPS AND FACES
Paper	25 mm (1 in.) wide	100	Screw- or Pneumatic-action (25 x 50 mm flat faces)
Plastic Films	25 mm (1 in.) wide	100	Same as above. Also, line contact faces can be used.
Rigid Plastics	25 mm wide x 12.5 mm thick (1 in. wide x 0.5 in. thick)	1000	Wedge-action or screw-action with serrated faces.
Wire and Sheet Metal	.5 to 1.5 mm diameter (.002 to .060 in.)	200	Screw-action or pneumatic-action with 25 mm x 50 mm flat or serrated faces.
Cord and Yarn	.5 to 4.8 mm diameter	350	Pneumatic cord and yarn grips.
Fabrics	25 mm or 100 mm wide strip (1 in. or 4 in.)	1000	Screw-action or pneumatic-hydraulic action with flat faces.
Elastomers.	3 mm to 6 mm wide (.125 to .25 in.)	150	Elastomeric grips.

and compression fixtures to meet a variety of needs, both standard and special, are available from Instron. Contact your regional Sales and Service Office for information on availability and assistance in determining your requirements.

Installing Grips for Tension Testing

The standard method for mounting grips is by the use of an adapter coupling for attaching the upper grip to the load cell, and by the use of a base grip adapter for attaching the lower grip.

To install the upper grip, attach a coupling to the load cell using the retaining pin provided with the cell. Then attach the upper grip to the coupling using the pin provided with the coupling. This type of double-pin mounting allows the upper grip to be self-aligning.

The base grip adapter supplied with a Series 4400 Load Frame includes a retaining pin and a compression (preload) spring. The spring supports the weight of the lower grip under compression, which prevents a discontinuity in the initial loading applied to a specimen. For best results, always ensure the spring is in place. When installing the lower grip (Figure 4-0), push down to compress the spring inside the adapter and then insert the retaining pin.

Note *The installation of Instron pneumatic grips requires additional procedures for mounting an Air Kit. Complete instructions are included with the kit.*

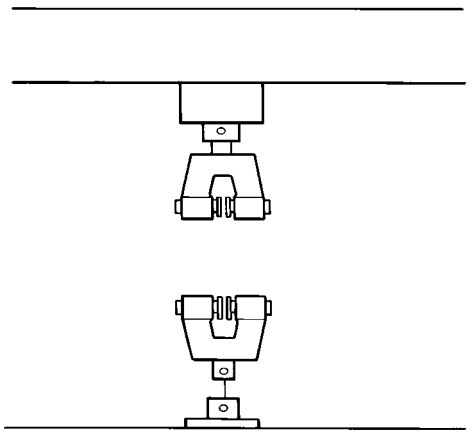

Figure 4-2. Typical Grips Installation

Installing Fixtures for Compression Testing

The optional compression anvils include a locknut and a bar wrench. Before installing an anvil on a load cell or on the base adapter, thread the locknut completely onto the anvil.

Install the anvil in the load cell coupling, or in the base adapter, using the retaining pin provided. Turn the locknut firmly up against the coupling adapter, in order to tighten the connection. This action will remove any discontinuity in loading caused by a loose pin. When removing the anvil after testing, use the bar wrench to loosen the locknut if it is jammed.

Chapter 5
Operation

Outline

This chapter gives instructions on basic operation of the Series 4400 Testing System: how to turn it on, how to set safety limits, how to start a test, how to stop a test (both during the test run and at the test conclusion), and how to shut off the system.

By the end of this chapter, you will be able to:

- turn on the system
- set safety limits
- start a test run
- stop a test run
- shut off the system

Turning On The System

To turn on the system and get it ready for operation, perform the following steps:

(a) Check that all cables are properly installed and securely connected.

(b) Turn on the system by setting the main power switch on the frame base next to the power cord to 1 (ON). This powers up the load frame and system control console. Turn on any accessories, such as recorders and printers, by using their own power switches.

(c) Calibrate the system and then allow a warm-up period of at least 15 minutes to assure system stability. Then, re-calibrate. A similar warm-up period is also necessary whenever a load cell is changed, or when a strain gauge extensometer is initially connected.

(d) Set testing parameters at the control console in accordance with your test program requirements. Refer to the on-line test information on the computer screen for details about the system and running a test.

(e) If it becomes necessary to move the crosshead when setting up a test or installing test specimens, use the JOG buttons on the control panel to move the crosshead in the desired direction.

Set Crosshead Travel Limits

The crosshead travel limit stops are a safety feature that you should set every time you use the testing system for a test. The limits should be set after you establish the test gauge length, but before you start the test.

The crosshead limits are two adjustable blocks mounted on an actuator rod alongside the left-hand column of the load frame, as shown in Figure 5-1. These blocks have thumbscrews that can be tightened and released by hand, and can be moved to any position on the actuating rod. An actuator plate on the moving crosshead comes into contact with these blocks when the crosshead reaches the extreme of travel set by the blocks. The rod is then moved and actuates microswitches that stop crosshead motion.

Warning

Always set the limit stops before starting a test to prevent injury from unexpected crosshead motion, and possible damage to test fixtures.

To set the limit stops:

(a) Set the upper limit stop to a point just beyond the expected maximum travel in the UP direction when tension testing, or just before gauge length when compression testing. Use the vertical measurement strip along the left-hand column to find the approxi-

mate set point. Tighten the stop securely on the limit switch rod.

(b) Set the lower limit stop to a point just beyond the expected maximum travel in the DOWN direction when compression testing, or just before gauge length when tension testing. Use the vertical measurement strip along the left-hand column to find the approximate set point. Tighten the stop securely on the limit switch rod.

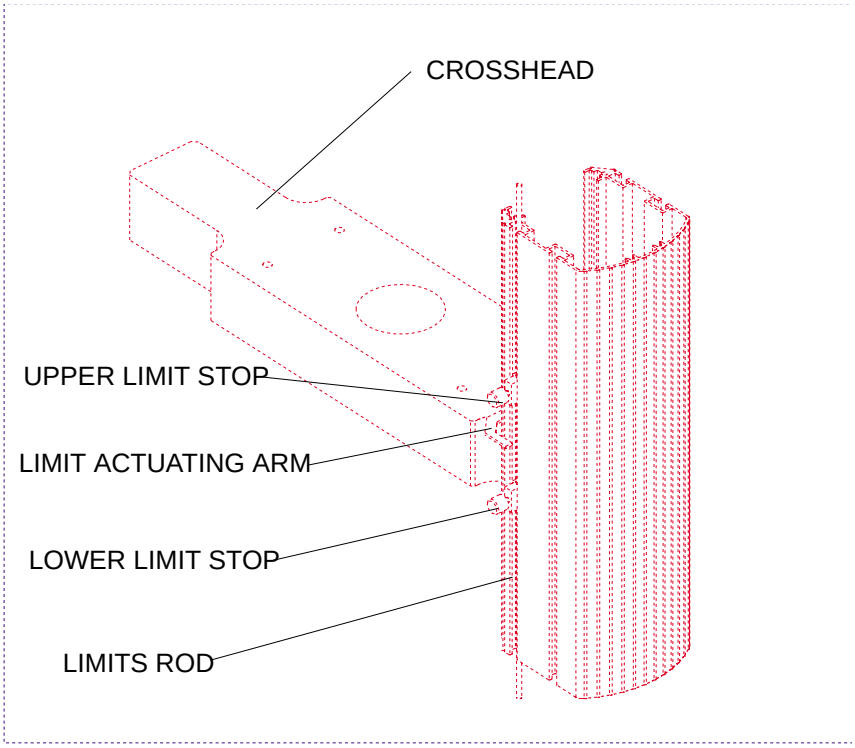

Figure 5-3. Load Frame Limit Stops

Starting A Test

Warning

Set the overtravel limits before starting a test

Before starting a materials test, make sure that you have carried out all the actions required for your particular test from Chapter 4, Preparation for Use. In particular, make sure that the overtravel limits are set to ensure your safety and to eliminate the risk of specimen or equipment damage.

To start a test, press the UP or DOWN arrow button on the control console The direction you choose will be the direction in which the test will initially start.

Stopping A Test

Emergency Stop Button

The Emergency Stop Button is a large, round, red button on the lower front apron of the load frame that is used to stop crosshead movement whenever a condition develops during a test that could affect the safety of persons operating the system, or could result in damage to the specimen or test fixtures. Pressing the Emergency Stop Button disables the power connection to the drive motor.

The Emergency Stop Button latches into the STOP position when it has been pressed, and the test cannot be restarted until it is released. After the system problem has been cleared, turn the button clockwise to release it and restart the system.

STOP Button

The STOP Button on the control console stops the test at the point to which the test program had progressed when the button was activated. This is the normal way to stop the test, and the crosshead will remain at its current position.

RETURN Button

The RETURN Button on the control console stops the test and returns the crosshead to gauge length. This is similar to the STOP button above, but the crosshead returns to the gauge length you set in the pretest setup.

Limit Action

The test will stop if the crosshead comes into contact with either the upper or lower limit stops. If this happens, move the crosshead away from the limit by pressing the UP or DOWN Jog buttons on the crosshead control unit. You can also move the crosshead away from the limit by momentarily pressing the RETURN button on the control console.

Break Action

If the Break Detector is activated and the Break Action is set to Stop or Return, the test will stop when the specimen fractures. The Stop and Return actions are the same as for the STOP and RETURN buttons on the control console.

Shutting Off The System

The Load Frame is shut off by setting the POWER ON/OFF switch next to the main power cord on the base of the load frame to 0 (OFF). System peripherals, such as recorders, and printers, must be shut off separately by their own power switches.

Power to the load frame can be shut off at any time without harm, but you should wait until the system completes all active tasks before shutting it off. The system may be engaged in recalculations or printing tasks after the test has run, so be sure it is finished before shutting off or disconnecting electrical power.

Chapter 6
Maintenance

Outline

This chapter describes the major components of the Series 4400 Load Frame and details routine preventive and corrective maintenance procedures. It describes lubrication procedures, and tells describes how to gain access to interior components. It goes on to describe component replacement, and corrective maintenance procedures for the crosshead drive system. It concludes with a the troubleshooting of load cells.

Introduction to Maintenance

General

The Series 4400 Load Frame is a precision electromechanical device that is designed to support a variety of testing applications. These frames require minimal maintenance, which can be easily performed by anyone with basic mechanical and electrical knowledge. Parts replacement, in some cases, however, should be done by skilled personnel.

The purpose of this chapter is to familiarize you with the load frame assembly and its routine preventive maintenance. If the frame does malfunction, the information in this chapter will assist you in isolating the problem to an assembly or component.

Special Maintenance Recommendations

The load frame contains several specialized components requiring replacement procedures and adjustments which should be undertaken only with factory supervision or on an overhaul basis. These critical items include the moving crosshead, leadscrews and drive pulleys. If you need help with any maintenance problem concerned with your Series 4400 Load Frame, contact the factory or your regional Instron Sales and Service Center.

Preventive Maintenance

Warning

Disconnect electrical power to the frame before opening or removing protective covers. Dangerous voltages and moving machinery are present. Unqualified personnel should not attempt repairs.

Preventive maintenance for the load frame consists of routine inspection, cleaning, and lubrication of key areas, performed on a periodic basis. The following sections give some guidelines for preventive maintenance routines.

Inspection

Many operational and mechanical problems can be discovered before they cause a failure by a regular, routine inspection of the operating components of the system. Pay particular attention to the following items:

- Every six to twelve months, remove the covers from the base of the load frame and visually inspect interior components for obvious wear, misalignment, and adjustment.
- Check the main drive belts and the motor belt for signs of wear, misalignment, and fraying. Also check the belts for proper tension (refer to page 6-19 for tension adjustment).

- Check all electrical connectors for tightness.
- Operate the crosshead to the extremes of its motion. Check that it moves smoothly, without any unusual noise, or rough and erratic motion.

Cleaning

Cleaning the load frame consists of wiping exterior surfaces with a moistened cloth, and blowing or vacuuming accumulations of dust out of printed circuit cards. When performing these tasks, keep in mind the following:

- Do not use solvents for cleaning. Avoid harsh or abrasive cleaners, and be aware that some household or commercial cleaners can react with painted surfaces and panel markings. If in doubt, test the cleaner on an unobtrusive or interior surface before using it for general cleaning.
- If you are using pressurized air for blowing out dust, use only low pressure, and do not direct the air stream directly at sensitive components.
- Clean the leadscrews and guide columns, if necessary, by wiping the exposed surfaces with a clean, dry cloth. Do not use oil on the leadscrews, since they will be lubricated by the ballnuts when operation of the load frame resumes.

Lubrication

The only lubrication required on the load frame is to apply grease to the leadscrew ballnuts. The top and bottom leadscrew bearings are sealed and should never need lubrication.

The leadscrews are self-lubricating with the grease contained in the ballscrew nuts. The normal action of moving the crosshead up and down is sufficient to spread a thin film of grease on the leadscrews as they pass through the ballscrew nuts. Grease fitting nipples on the ballscrew nuts (see Figure 6-1) provide a means to replenish the grease in the nuts, and this should be done every 1000 hours of operating time, or every 36 months, as shown in Table 6- 1. Keep in mind that operating time

Table 6-1. Load Frame Lubrication

LOCATION	RECOMMENDED LUBRICANT	INTERVAL	INSTRON PART NUMBER
Ballnuts	Lithium based water resisting grease - NLGI Class 2 (DIN51825 class K2k LS 2	1000 hours or 36 months	105-1-1017 (this part no. is for 4 kg can of BP Energrease LS 2)
	Equivalents: Mobil: Mobilux® 2 BP: Energrease® LS 2 Shell: Alvania® R2		

Notes:

1. *When instrument usage is above average (100 hours/month), inspect lubricated area periodically and increase lubrication frequency as required.*
2. *When instrument is used regularly for high-load cycling tests, inspect leadscrews and lubricate more frequently than recommended.*

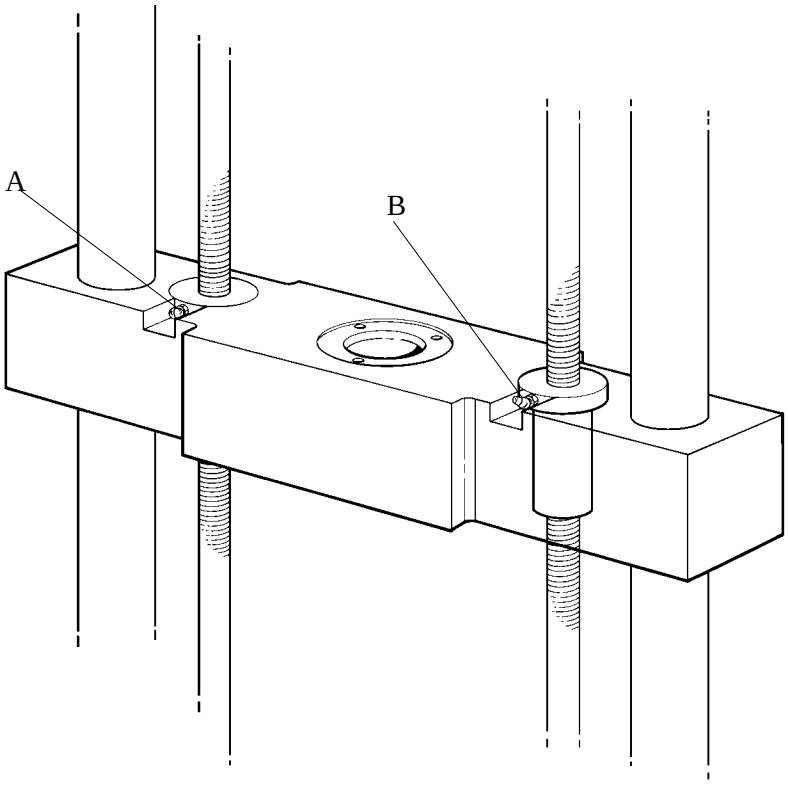

Figure 6-1. Load Frame Lubrication Points

refers to crosshead movement, not the length of time the system has been energized.

Note also that if the testing system is subjected to long-term, continuous movement of the crosshead, if the system is operated in a hostile or dirty environment, or if testing operation is high-load or high-speed, the interval between lubrications should be shortened.

Apply the grease with a grease gun to the ballnut nipple. When the ballnut is full, grease will begin to squeeze out from under the wiper at the top of the nut. When both nuts have been lubricated, drive the crosshead up and down the full stroke of the load frame. This both distributes the grease within the nut and coats the exposed lead-screw shaft.

The guide columns do not require any lubrication, but should be kept clean. Wipe periodically with a clean, dry cloth.

Access To Components

Access to Leadscrews and Guide Columns

The leadscrews in the Series 4400 load frames are of the recirculating ball type and have permanently lubricated bearings at the top and bottom plates, but the leadscrews require lubrication as specified in Table 6-1.

The leadscrews and guide columns are protected from dirt and debris by four leadscrew covers (they resemble folded blinds) that are held in place by Velcro® fastener strips at the upper and lower surfaces of the crosshead. For access to leadscrews and guide columns for inspection and lubrication, pry the Velcro® apart and push the covers back out of the way. Restore the covers to their original position, and press the Velcro® into place prior to resuming testing operations.

Internal Access to Load Frame Base

The load frame base has a set of covers which can be removed to inspect internal parts. It is not necessary to raise the load frame or tip it over to gain access to interior parts. To expose the interior of the frame, remove the covers as shown in Figure 6-2.

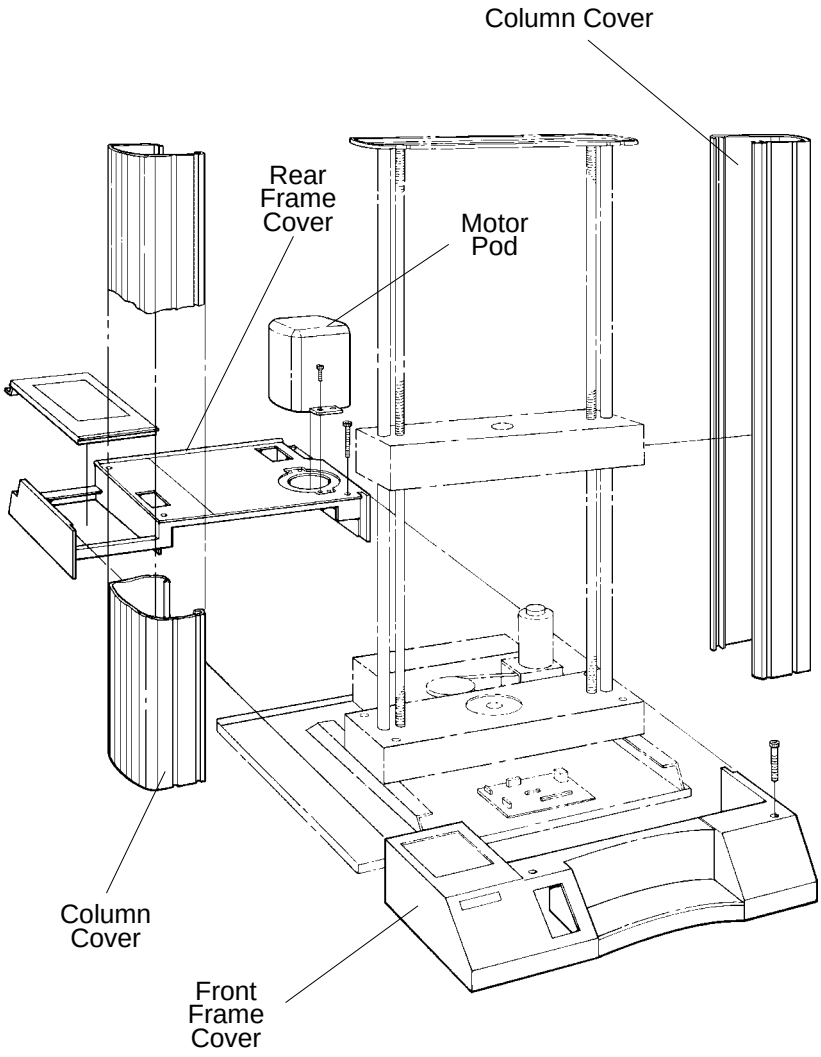

Figure 6-2. Load Frame Access Covers

Warning

Disconnect electrical power to the frame before opening or removing protective covers. Dangerous voltages and moving machinery are present. Unqualified personnel should not attempt repairs.

When removing covers, keep the following points in mind:

- It is not necessary to remove all covers when working on the frame base. Remove only the covers in the area where you will be working.
- When removing the rear frame cover, it is not necessary to remove the motor enclosure separately.
- After completing any work in the interior of the base, reinstall all covers removed before turning on the system. Be sure to use all fastening hardware.

Fuse Replacement

The only fuses in the system are the input power line fuses. The power line is protected by a fuse mounted in the power cord connector unit on the right side of the frame base. Table 6-2 shows the proper fuse size for the power line fuse.

Warning

Always shut off main power and remove the power cable before replacing a fuse.

Caution

Always replace a fuse with the same type and size as the original.

Table 6-1. Power Line Fuses

SYMBOL	LOAD FRAME MODELS	DESCRIPTION	INSTRON PART NO.
F1	4464, 4465, 4466, 4467, 4469	Fuse: 6.25A, 250 V Littelfuse 3AB	27-2-46

Crosshead Drive Components

General

The crosshead of the Series 4400 load frame is driven by leadscrews rotating through recirculating ball nuts set in the crosshead. Each leadscrew mounts on a rigid common beam inside the frame base. The beam contains lubricated bearings, and a pulley that extends below the beam is mounted on the end of each leadscrew. The leadscrew pulleys are driven by cogged timing belts that are connected to a drive motor through a separate belt and pulley. An encoder, mounted directly on the motor shaft, provides crosshead position information to the control console.

All components used in driving the crosshead are located within the base, except the drive motor, which is located in a housing on the rear of the baseplate. Replaceable components, such as belts and encoder, are accessible by removing covers from the top side of the frame base as described on Page 9.

Servo Amplifier

Description

Electronic circuitry to drive the motor is contained on a d.c. power supply and a servo amplifier located at the right rear of the load frame. The power supply is located under a safety cover beneath the rear frame cover, while the servo amplifier is located on a panel that can be opened for access to its components. The basic function of the drive motor control circuitry contained in these two units is briefly described below.

The power supply converts a.c. line voltage to d.c. for application to the servo amplifier, which in turn controls the polarity and level of the drive voltage to the crosshead drive motor. The d.c. output level of the servo amplifier is determined by the crosshead position error signal. The motor control circuitry is factory-set and does not require any user adjustments.

Replacing the Servo Amplifier

Warning

Always shut off main power and remove the power cable before opening the servo amplifier panel.

The Servo Amplifier printed circuit board is located on the rear of the load frame, mounted on a removeable panel (see Figures 6-3 and 6-4). Servicing individual components of the Servo Amplifier is not recommended, and repair is limited to replacing the entire board.

Note *The servo amplifier can be removed from either the top of the frame base or from the rear of the base. Removal from the rear of the frame base is easier unless space behind the load frame is restricted. Removal from the top of the base is possible unless the topside is obstructed by testing accessories.*

To replace the Servo Amplifier from the rear of the frame base:

(a) Remove two screws from the rear panel and pull out the panel.

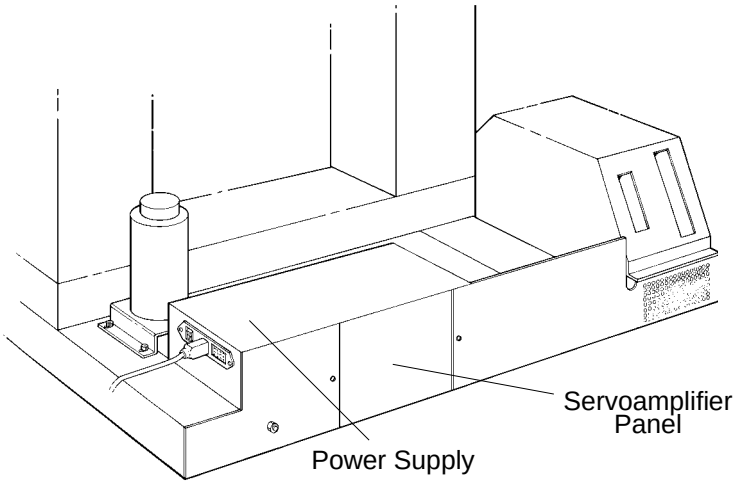

Figure 6-3. Rear View of Load Frame

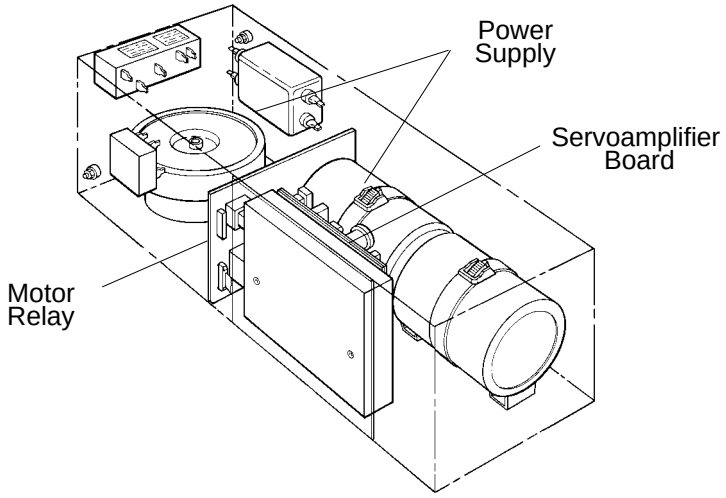

Figure 6-4. Power Supply and Servo Amplifier

(b) Disconnect two cable connectors from the left side of the board.

(c) Remove and retain the four screws securing the board to the back of the panel.

(d) Install a new Servo Amplifier by reversing the above procedure.

(e) Close the Servo Amplifier panel and install the retaining screws before turning on the system.

To remove the servo amplifier from the top of the load frame base:

(a) Remove the rear load frame cover.

(b) Remove the safety cover from the d.c. power supply at the right rear of the load frame base.

(c) Disconnect two cable connectors from the left side of the board.

(d) Remove and retain the four screws securing the board to the back of the panel.

(e) Install a new Servo Amplifier by reversing the above procedure.

(f) Close the Servo Amplifier panel and install the retaining screws before turning on the system.

Frame Interface Board

Description

The function of the Frame Interface Board is to provide signal interfacing between the computer and components in the frame. The Frame Interface Board is universally used in all of the Series 4400 load frames, and the only difference in its components for each type of frame is an integrated circuit chip containing a unique digital code that allows the frame to be automatically recognized by the computer control program. This identification enables the correct electronic setting of system load limits and automatic calibration values in the control program.

Replacing the Frame Interface Board

Warning

Always shut off main power and remove the power cable before removing any frame covers.

To gain access to the Frame Interface Board, remove the front frame base cover by removing the two screws, as shown in Figure 6-2.

Disconnect and replace the Frame Interface Board as follows (see Figure 6-5 for location):

(a) Disconnect all cables from the board and remove two screws securing it to the base tray.

(b) Remove the board.

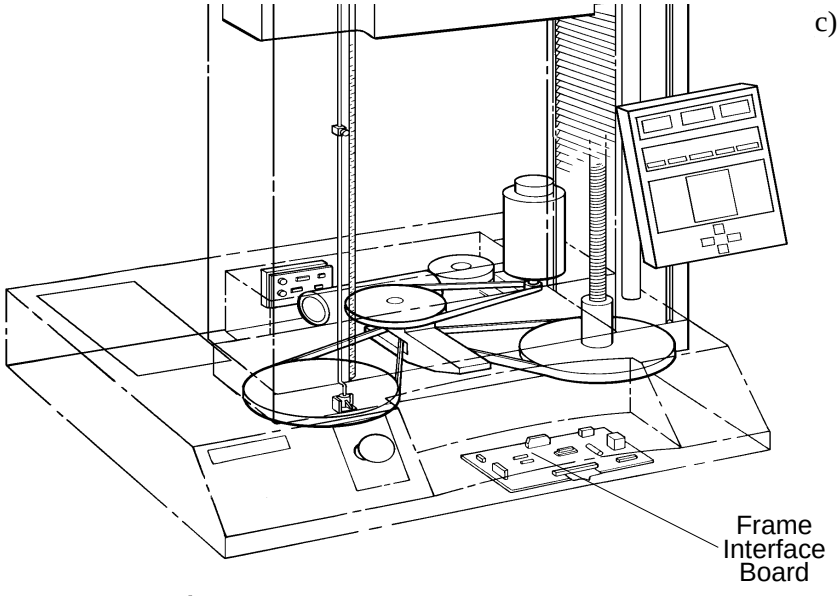

Figure 6-5. Frame Interface Board Location

Install the new board, using the screws removed previously, and connect all cables.

(d) Replace the frame base cover and install all retaining screws before turning on the system.

Drive Motor Servicing

The crosshead drive motor is a d.c. motor, sized for the capacity of the load frame. The unit requires no maintenance other than inspection of brushes. To gain access to the motor, remove the motor enclosure which is held by two screws as shown in Figure 6-2. The brushes are located behind two circular plate caps on the side of the motor near the top.

Warning

Always shut off main power and remove the power cable before performing maintenance on the drive motor.

Replacing Motor Brushes

To inspect or replace motor brushes:

(a) Shut off main power and remove the power cable.

(b) Unscrew the two circular plate caps on the side of the motor.

(c) Withdraw the brushes, which are attached to the plate caps.

(d) If the brushes show excessive wear (they are worn down to less than 1/4 inch or 6.3 mm in height), replace them with new ones.

(e) Insert the brushes into the side of the motor, observing proper orientation.

(f) Screw the brush caps into place. Do not overtighten.

Note *If you are not replacing the brushes, reinstall the originals in exactly the same orientation as you found them.*

Crosshead Drive Belts

General

The three belts used in the crosshead drive system (two main drive belts and a motor belt) will run trouble-free for an extremely long period, but check them periodically for tension and excessive wear when the system is under heavy usage. The front and rear frame base covers must be removed to inspect the belts (refer to Page 6-9).

Adjusting Main Belt Tension

The main drive belts are designed to have very little or no stretch in normal use. Belt tension is set when the load frame is assembled at the factory, and should not normally need further adjustment unless the belts are removed or replaced. Belt tension on the main drive belts is adjusted by moving the layshaft bracket, and is obtained on both belts simultaneously.

(a) Apply hand pressure on each of the main drive belts at approximately 150 mm (6 inches) from the center of the leadscrew pulleys, as shown at “A” in Figure 6-6. Deflection distances “A” and “B” are “free play” from the normal position to the point where the belt is firmly taut. The values for distances “A” and “B” are shown in Table 6-3.

(b) If the tension needs adjusting, loosen the layshaft bracket by loosening the two M10 bolts in the center of the base table just enough to allow the layshaft bracket to move. Do not allow the layshaft bracket to

slide forward so far that the main belts fall off of the leadscrew pulleys

(c) Apply tension on the belts by sliding the layshaft bracket toward the rear of the load frame. It is best to check for proper belt tension at “A” on the left-hand belt (as viewed from the front of the load frame) first. The other belt will automatically be tensioned to a similar value, but this value will typically be slightly larger. This is normal, and no cause for concern.

(d) When the belt tension is correct, tighten the bolts securing the layshaft bracket. These bolts do not need to be heavily torqued. Nominal torque value is 10 Nm (13 ft-lb).

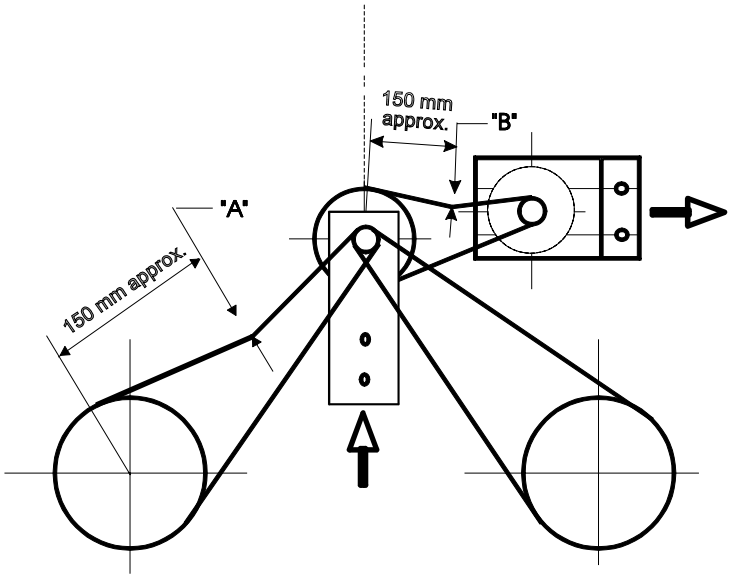

Figure 6-6. Adjusting Drive Belt Tension

Table 6-2. Main Belt Tension Determination

Load Frame	Dimension “A”	Dimension “B”
5 kN, 10 kN	8 to 10 mm	8 to 10 mm
30 kN	6 to 8 mm	8 to 10 mm

Adjusting Motor Belt Tension

(a) If it has not already been done, loosen, but do not remove, the three screws securing the motor bracket.

(b) Refer to Figure 6-6. Push the motor bracket in a direction away from the layshaft to apply tension to the motor belt, then lightly tighten the bracket screws.

(c) Check the belt tension by pressing against the belt approximately 150 mm (6 inches) from the center of the layshaft pulley (Point “B” in Figure 6-6). The belt should deflect by the amount shown in Table 6-3.

(o) Reinstall the rear frame cover.

Load Cells

Troubleshooting Load Cells

Note *The factory assembly process of the load cell is quite intricate, involving special jigs and compensation techniques. Therefore, the load cell should never be disassembled in the field. Except for making minor repairs to the electrical connector, always return a load cell to the factory if repairs are needed.*

Figure 6-7 is a schematic diagram of Instron Series 2525 load cells, which are electrically calibrated, self-identifying and rationalized. Approximate resistances are given which can be used to check for a possible broken gauge, or a faulty connector or cable. Note that the Series 2525 cells have calibration and rationalization components located in the cable connector, rather than in the load cell itself.

If a strain gauge in a cell has been badly overstressed, but still maintains its electrical continuity, the cell may show a higher than normal amount of creep. If a gauge has become improperly bonded due to degradation in use, the cell may exhibit a combination of general instability in its balance point, together with a large amount of creep. Difficulties of this sort rarely appear as an instability in the calibration of the cell.

If a cell has been badly overloaded, the load-sensitive member may be permanently deformed to the extent that the proper dimensional alignments inside the cell are no longer maintained. For example, if the position of the central spindle is changed, this can result in the balance

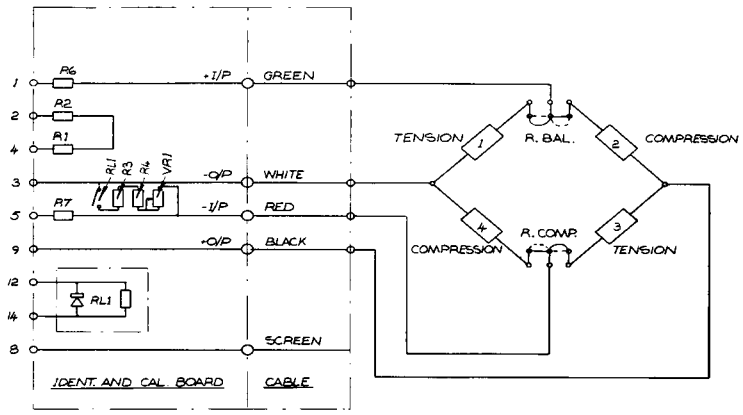

Figure 6-7. Series 2525 Load Cell Schematic

point shifting abruptly as the cell is loaded or unloaded. This often shows up after a specimen has ruptured, in that the recorder pen will not return exactly to its original zero. This effect can usually be detected on lower capacity cells if you press sideways with your finger against the spindle of the cell.

If you suspect that a cell may be defective, always substitute another cell, if possible, and recheck the results carefully. Many of the symptoms described above can also arise from a faulty load sensor conditioner or recorder, or possibly a mechanical adjustment. In order to save unnecessary expense and delay, do not return a cell to the factory for repair until it is definitely known that it is at fault.

Chapter 7
Illustrated Parts

Outline

This chapter provides illustrations and listings of the parts and assemblies that make up the Series 4400 Load Frame. You can use the information in this chapter as a reference for obtaining replacement parts.

At the end of this chapter, you will have:

- an illustrated parts breakdown of all major assemblies in the system
- parts ordering information for replacement parts

General

To use the information in this chapter for parts identification, first locate the part on an illustration, and then refer to its item number in the associated table.

Please note the following:

- Generally, a subassembly that is normally supplied and replaced as an assembly is not broken down into its component parts.
- Subassemblies that have replaceable parts are broken down with all parts indented in the table under its main assembly.
- The description column lists the common name for the item, and may give the manufacturer's part number when appropriate. These parts will have both a manufacturer's part number and an Instron part number.
- The PART NO. column lists the Instron part number only.
- The quantity listed in the QTY column is for this subassembly only. Quantities for similar parts used elsewhere are shown in separate listings.
- The USED ON column indicates on which model of load frame the part is used. Table 7-1 shows a cross-reference between the letter designations and the specific model of load frame.

When ordering parts from Instron, be sure to include the Part Number, Description, and Quantity of the parts you need. Also include the Model or Catalog Number of your Load Frame, as well as its Serial Number. This information will help Instron's Customer Support Center to determine the correct part for your system.

Table 7-1. USED ON Column Designations

USED ON Column Designation	Load Frame Model
A	All Load Frames
B	5 kN and 10 kN Frames
C	30 kN Frames
D	5 kN Frames only
E	10 kN Frames only
F	5 kN and 10 kN High Speed Frames
G	50 kN Frames only

Main Assembly Components

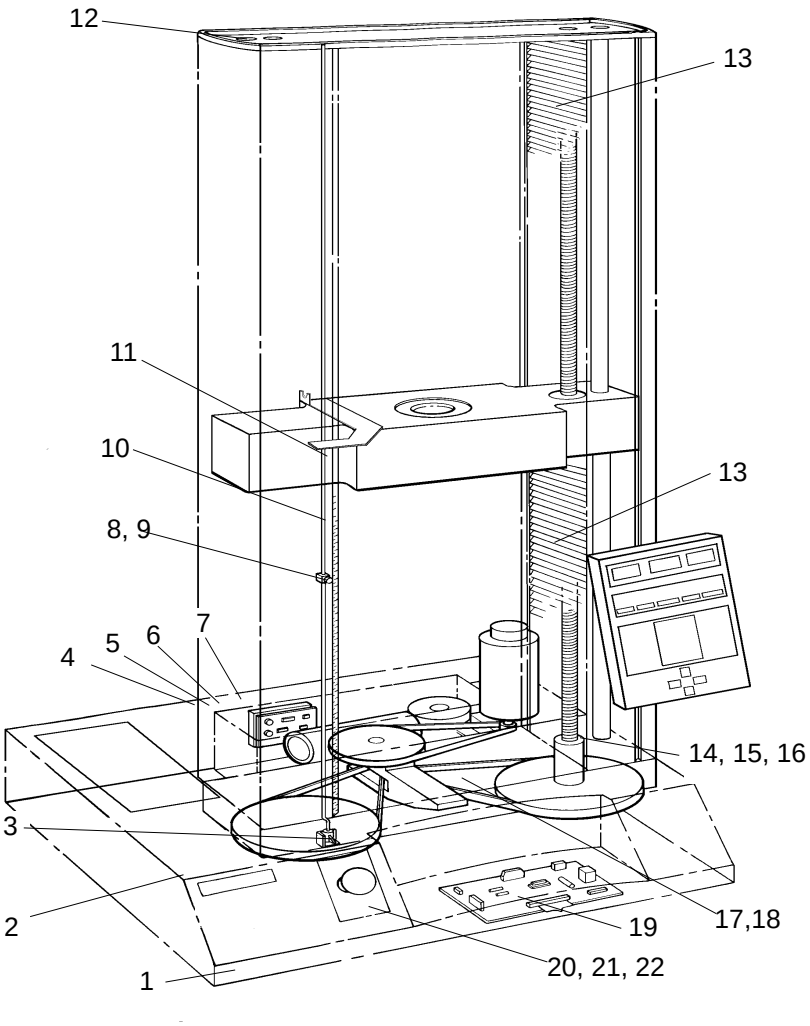

Figure 7-1. Main Assembly Components

See Figure 7-1

Table 7-2. Main Assembly Parts List

Item No.	Used On	Description	Part No.	Qty
1	A	Leveling Foot, 40 mm	9-7-57	4
2	A	Base Tray	T563-43	1
3	A	Limits Switch Assembly	A563-6	1
4	B,C,F	Serial Number Nameplate	T563-45	1
	G	Serial Number Nameplate	T563-130	1
5	A	Electrical Hazard Warning Label	T1550-1144	2
6	A	Rotating Machinery Warning Label	T1550-1145	1
7	A	Label - Other Information -	T563-48	1
8	A	Limits Stop Knob	T563-17	2
9	A	Limits Stop	T563-21	2
10	A	Limits Actuator Rod	T563-20	1
11	A	Limits Actuator Arm	T563-23	1
12	A	Top Plate	T563-3	1
13	A	Leadscrew Cover, Blinds	T563-44	4
14	B	Ball Bearing, Angular, 42x15x13T	4-1-104	4
	C	Ball Bearing, Angular, 62x25x17T	4-1-103	4
	G	Ball Bearing, Angular, 7305BECB	4-1-108	4
15	B	Bearing Seal	4-1-105	4
	C,G	Bearing Seal	4-1-106	4
16	B	Locknut, M15x1	52-53-8	2
	C,G	Locknut, M25x1.5	52-53-7	2

Table 7-2. Main Assembly Parts List (continued)

Item No.	Used On	Description	Part No.	Qty
17	B,C	Base Grip Adapter, 1/2 in. (not shown)	T563-28	1
	G	Crosshead Grip Adapter (not shown)	T1209-1138	1
18	B	Base Adapter Screw, Socket Head Cap Screw, M10x50	201V58	1
	C,G	Base Adapter Screw, Socket Head Cap Screw, M10x30	201V55	6
19	A	Frame Interface Board PCB Assembly	A563-47	1
20	A	Emergency Stop Button Bracket	T563-88	1
21	A	Emergency Stop Pushbutton, red, Telemecanique B2BS54	65-3-147	1
22	A	Contact Block, Telemecanique B2-BZ102	65-3-148	1

Frame Covers

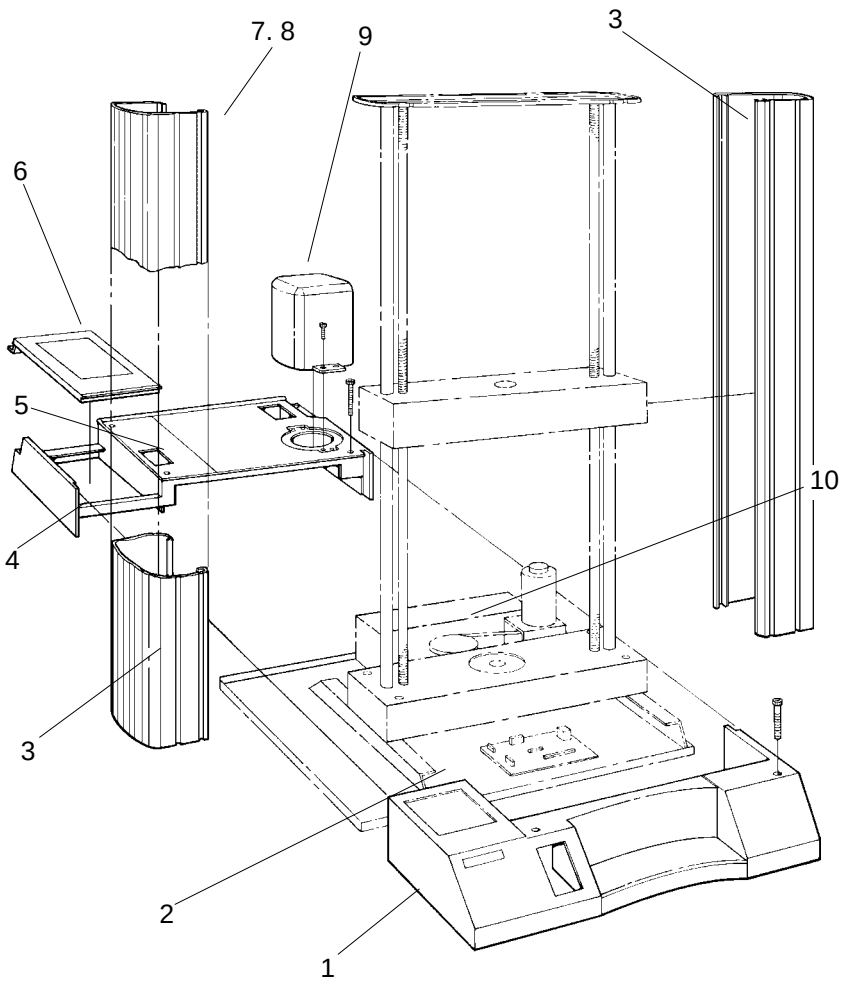

Figure 7-2. Frame Covers Components

See Figure 7-2

Table 7-3. Frame Covers Parts List

Item No.	Used On	Description	Part No.	Qty
1	A	Front Cover	T563-86	1
2	A	Workspace Cover/Mat (not shown)	T563-39	1 set
3	A	Column Cover, Extrusion	T563-6	2
4	A	Rear Cover	T563-85	1
5	A	Accessories Cover Plate	T563-110	1
6	A	Auxiliary Cover	T570-29	1
7	A	Measurement Strip	T563-27	1
8	A	Position Marker	T563-112	2
9	A	Motor Pod	T563-33	1
10	A	Power Supply Cover	T563-40	1

Drive Components

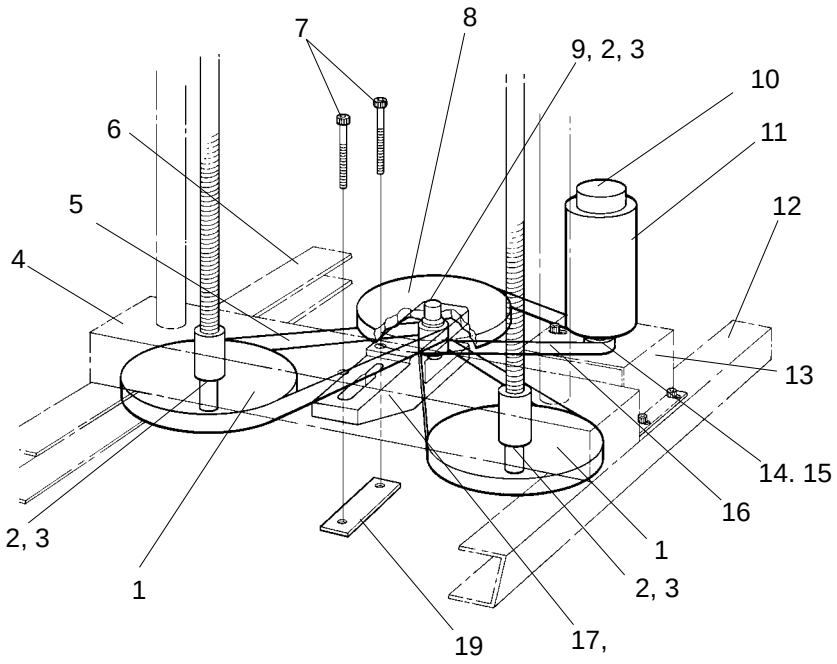

Figure 7-3. Drive Components

See Figure 7-3

Table 7-4. Drive Components Parts List

Item No.	Used On	Description	Part No.	Qty
1	B	Leadscrew Pulley, 5M Htd	T563-13	2
	C,G	Leadscrew Pulley, 5M Htd	T563-67	2
	F	Leadscrew Pulley, 5M Mtd	T563-56	2
2	B	Shaft Mounting, Keyless, 12ID	23-2-54	3
	C,G	Shaft Mounting, Keyless, 18ID	23-2-56	2
3	B	Retainer Ring, Internal, 32 mm	60-52-1059	2
	C,G	Retainer Ring, Internal, 40 mm	60-52-1060	2
4	B	Base Beam	T563-2	1
	C	Base Beam	T563-60	1
	G	Base Beam	T563-282	1
5	B	Timing Belt, 5 Pitch, 9x850 mm	15-5-116	2
	C,G	Timing Belt, 5 Pitch, 15x950 mm	15-5-117	2
	F	Timing Belt, 5 Pitch, 9x740 mm	15-5-119	2
6	B,C,F	Base Leg, LH	T563-92	1
	G	Base Leg, LH	T563-230	1
7	A	Bracket Adjuster Screw, Socket Head Cap Screw, M12 x 30	201U66	2
8	C,G	Layshaft Pulley, 5M Mtd	T563-64	1
	D	Layshaft Pulley, 3M Htd	T563-52	1
	E	Layshaft Pulley, 3M Htd	T563-10	1
	F	Layshaft Pulley, 3M Htd	T563-52	1
9	B	Layshaft Assembly	A563-7	1
	C,G	Layshaft Assembly	A563-27	1
10	A	Encoder, 1000 Line	94-1-55	1

Table 7-4. Drive Components Parts List (continued)

Item No.	Used On	Description	Part No.	Qty
11	B	Drive Motor, 0.7 Nm	48-1-22	1
	C	Drive Motor, 2.0 Nm	48-1-21	1
	G	Drive Motor, 3.0 Nm	48-1-26	1
12	B,C,F	Base Leg, RH	T563-93	1
	G	Base Leg, RH	T563-231	1
13	B	Motor Support	T563-14	1
	C, G	Motor Support	T563-68	1
14	B	Motor Pulley, 3M HTD	T563-9	1
	C	Motor Pulley, 5M MTD	T563-63	1
	G	Motor Pulley, 5P, 28T, HTD	T563-288	1
15	B	Shaft Mounting, Keyless 9ID	23-2-53	1
	C,G	Shaft Mounting, Keyless 12ID	23-2-54	2
16	C	Timing Belt, 5 Pitch, 9x890 mm	15-5-118	1
	D	Timing Belt, 3 Pitch, 6x711 mm	15-5-114	1
	E	Timing Belt, 3 Pitch, 6x843 mm	15-5-115	1
	F	Timing Belt, 3 Pitch, 6x711 mm	15-5-114	1
	G	Timing Belt, 5 Pitch, 9x980 mm	15-5-120	1
17	B	Layshaft Bracket	T563-11	1
	C,G	Layshaft Bracket	T563-66	1
18	A	Bracket Mounting Screw, Socket Head Cap Screw, M10 x 100	201U63	2
19	A	Clamping Plate	T563-76	1

Crosshead Components

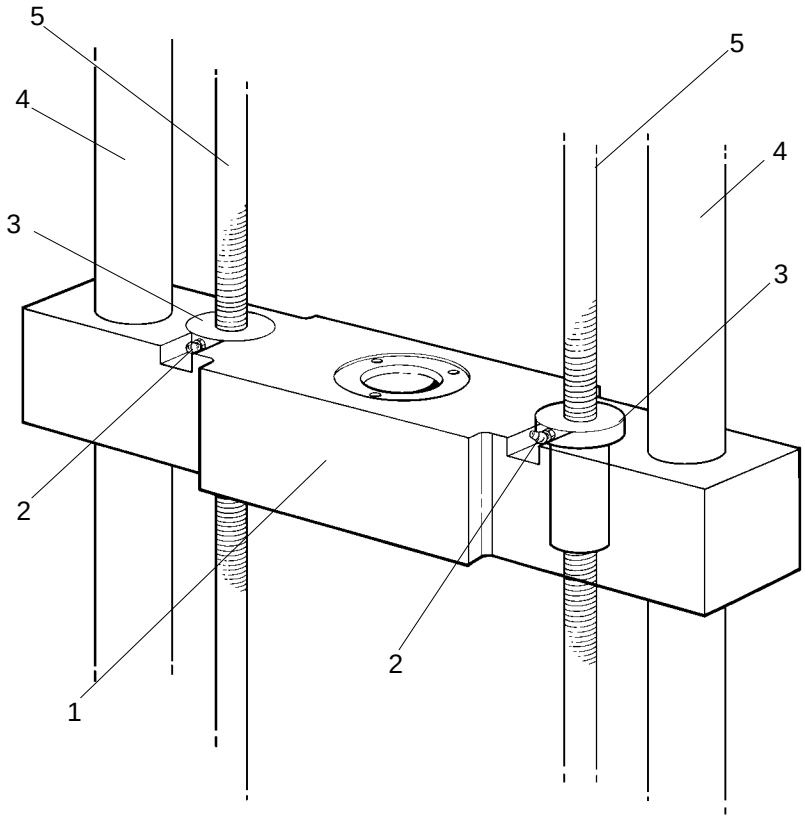

Figure 7-4. Crosshead Components

See Figure 7-4

Table 7-5. Crosshead Components Parts List

Item No.	Used On	Description	Part No.	Qty
1	B	Moving Crosshead, 5 kN and 10 kN Systems	A563-118	1
	C	Moving Crosshead, 30 kN Systems	A563-119	1
	G	Moving Crosshead, 50 kN Systems	A563-116	1
2	A	Grease Nipple, 90 deg, M6	35-3-1003	2
3	A	Ballnut Screw, Socket Head Cap Screw, M6x25	201V35	8
4	A	Guide Column	T563-5	2
5	B	Leadscrew, Ball Type (includes ballnut)	T563-4	1 pr.
	C	Leadscrew, Ball Type (includes ballnut)	T563-61	1 pr.
	G	Leadscrew, Ball Type (includes ballnut)	T563-285	1 pr.

Mainframe Power Supply

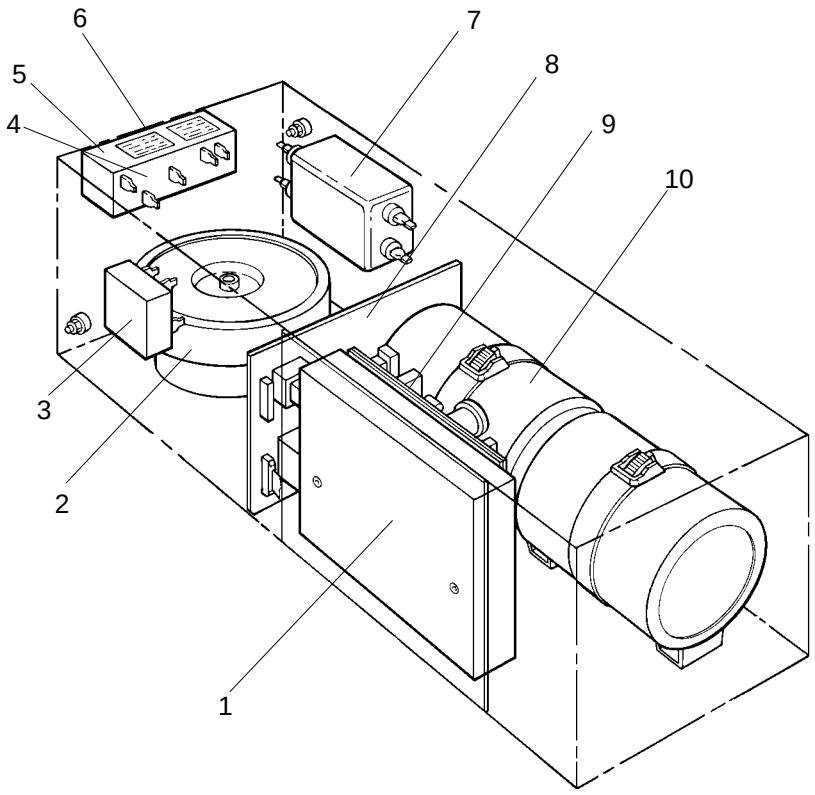

Figure 7-5. Mainframe Power Supply Components

See Figure 7-5

Table 7-6. Mainframe Power Supply Parts List

Item No.	Used On	Description	Part No.	Qty
1	A	Power Amplifier Plate	T563-78	1
2	B	Transformer, Toroidal	73-1-1119	1
	C,G	Transformer, Toroidal	73-1-1120	
3	A	Bridge Rectifier, Motorola MDA2504 or equiv.	58-2-41	1
4	A	Not Used		
5	A	Power Line Switch/Plug Module	124-1-1004	1
6	A	Fuse, 6.25 amp, Slo-Blo	27-2-46	1
		or		
	A	Fuse, 3 amp, Slo-Blo	27-2-40	1
7	B,C,F	Line Filter, 6 amp	103-1-10	1
	G	Line Filter, 10 amp	103-1-11	1
8	A	Relay Board PCB Assembly	A563-45	1
9	B	Servo Amplifier	125-1-61	1
	C	Servo Amplifier	125-1-62	1
	G	Servo Amplifier	125-1-67	1
10	B	Capacitor, 22000 µf, 100v	201-2-1071	1
	C,G	Capacitor, 56000 µf, 100v	201-2-1072	1

Control Console Mounting

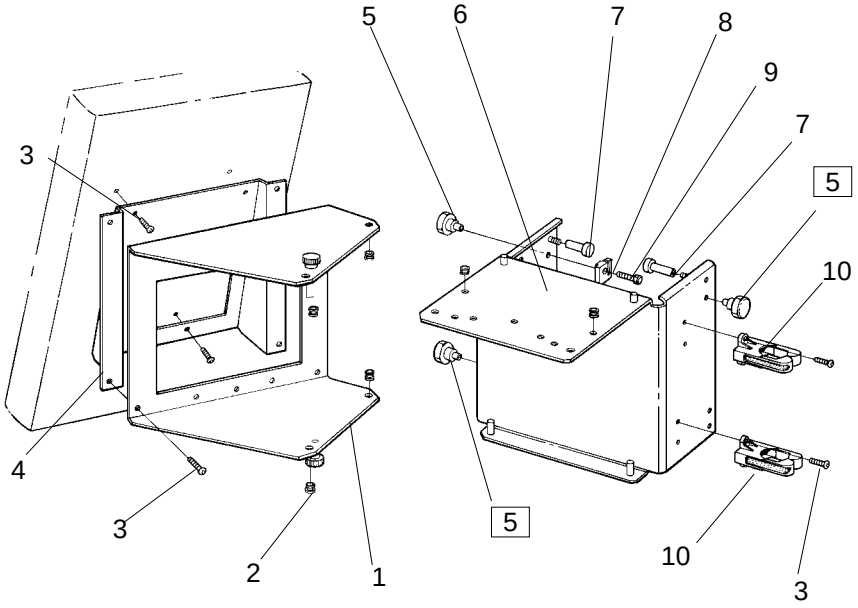

Figure 7-6. Control Console Mounting Components

See Figure 7-6

Table 7-7. Control Console Mounting Components Parts List

Item No.	Used On	Description	Part No.	Qty
1	A	Pivot Bracket	T570-31	1
2	A	Flanged Bearing, Nylon, 6.35 mm ID	5-4-16	8
3	A	Machine Screw, M4x10	204F124	11
4	A	Tilt Bracket	T570-43	1
5	A	Knob, Female, M6	39-1-63	3
6	A	Sliding Bracket	T570-30	1
7	A	Bearing Stud	T570-28	4
8	A	T-Nut	T1697-1307	3
9	A	Cap Screw, Socket Head M6x25	201U35	3
10	A	Cable Clip, Elastic, 19 mm	11-6-61	2

Crosshead Control Unit

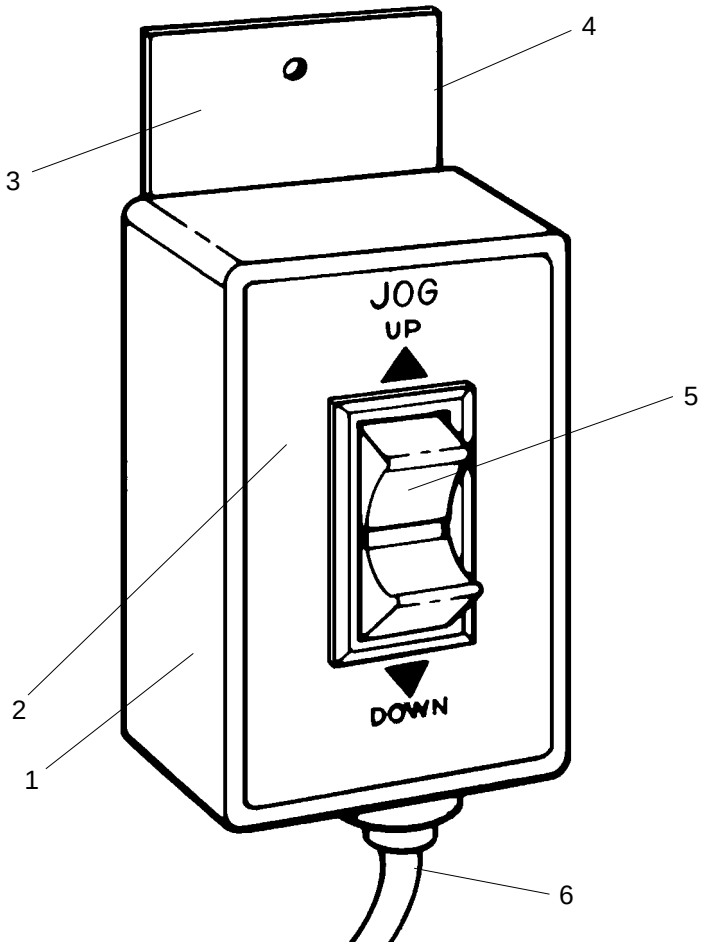

Figure 7-7. Crosshead Control Unit Components

See Figure 7-7

Table 7-8. Crosshead Control Unit Parts List

Item No.	Used On	Description	Part No.	Qty
1	A	Box, Plastic	T570-32	1
2	A	Jog Overlay	T570-33	1
3	A	Plate, Jog Mounting	T570-35	1
4	A	Magnetic Rubber	T570-55	1
5	A	Rocker Switch, Single pole, Center off	65-12-1054	1
6	A	Cable, Handset	A570-4	1
–	A	T-Nut (not shown)	T1697-1307	1
–	A	Knob, Female, M6 (not shown)	39-1-63	1
–	A	Cap Screw, Socket Head, M6x25 (not shown)	201U35	1

Note *The parts in the following table are supplied with each testing system, but are not shown on the parts diagrams.*

Table 7-9. Ancillary Parts and Spare Parts List

Item No.	Used On	Description	Part No.	Qty
1	A	Retaining Pin, Grip Coupling	T29-515	1
2	A	Retaining Pin Retainer Clip	T1223-1053	2
3	A	Compression Spring	66-4-5	1
4	A	Accessories Slot T-Nut	T1597-1053	3
5	A	Fuse, 3.5A	27-2-116	2
6	A	Fuse, 6.25A Slo-Blo	27-2-46	2
7	A	Hex Wrench Key Set, 1.5 to 10mm, Ball End	80-1-1011	1
8	A	Open End Wrench (Spanner), 12/13 mm	80-4-25	1
9	A	Test Specimen	T563-229	5
10	A	Cord Set, non-U.S. Style	16-2-16	1
11	A	Power Cord, U.S. Style	27-2-116	1

Chapter 8
Frame Options

Outline

This chapter describes several load frame physical options that are available for special testing applications. Load frames in this series are available in extra width and extra height configurations that allow testing of large assemblies or unusually long specimens. An option for mounting test specimens in the space above the moving crosshead is also available.

Introduction

The Series 4460 Load Frames are available with a variety of frame options for specialized testing applications. The frame can be obtained in an extra-wide version to accommodate testing of wide assemblies or in an extra-height version to accommodate specimens of unusual length. Also, the frame can be equipped with a second test space option that allows testing above the moving crosshead.

Certain combinations of these options are possible, but others are not. Table 8-1 shows which options are available for each model of load frame, and shows which options may be combined.

Table 8-1. Frame Option Availability

Load Frame Model	4464	4465	4466	4467	4469
Extra Width	No	Yes	Yes	Yes	No
Extra Height	Yes	Yes	Yes	Yes	Yes
Second Test Space	Yes	Yes	Yes	Yes	No
Extra Width + Extra Height	No	Yes	Yes	Yes	No
Extra Height + Second Test Space	Yes	Yes	Yes	Yes	No
Extra Width + Second Test Space	No	No	No	No	No

Dimensions

The physical dimensions of the various load frame options are given in Tables 8-2 and 8-3. These dimensions are for the load frame options only. See Chapter 2 for dimensions and specifications for standard load frames. The letter designations in both tables are keyed to the letter dimensions shown in Figure 8-0

Table 8-2. Extra-Width Load Frame Dimensions

Designation	Description	Dimension - mm (inch)
A	Across Columns	1247 (49.1)
B	Column Depth	140 (5.5)
C	Horizontal Test Daylight	946 (37.2)
D	Top Plate Thickness Fixed Crosshead Thickness (2nd Test Space)	19 (0.75) 75 (3.0)
E	Crosshead Thickness	125 (4.9)
F	Not Used	
G	Platen Height from Table	230 (9.1)
H	Gap for Feet	25 (1.0)
J1	Crosshead Position	Min 140 (5.5) Max 1275 (50.2)
J2	Crosshead Position (with 2nd Test Space)	Min 131 (5.2) Max 1266 (49.8)
K	Overall Depth	700 (27.5)

Table 8-2. Extra-Width Load Frame Dimensions (continued)

Designation	Description	Dimension - mm (inch)
L	Front of Base to Test Center	245 (9.6)
M	Motor Pod Height	215 (8.5)
N	Overall Height	Std Height 1580 (62.2) Extra Height 2105 (82.9)
P	Overall Width	1427 (56.2)
Q	Coupling Pin to Base	59 (2.3)
R	Load Cell Pin to Crosshead	133 (5.2) with 2525-800 Series Load Cells to 10 kN 142 (5.6) with 2525-800 Series 30 kN Load Cell

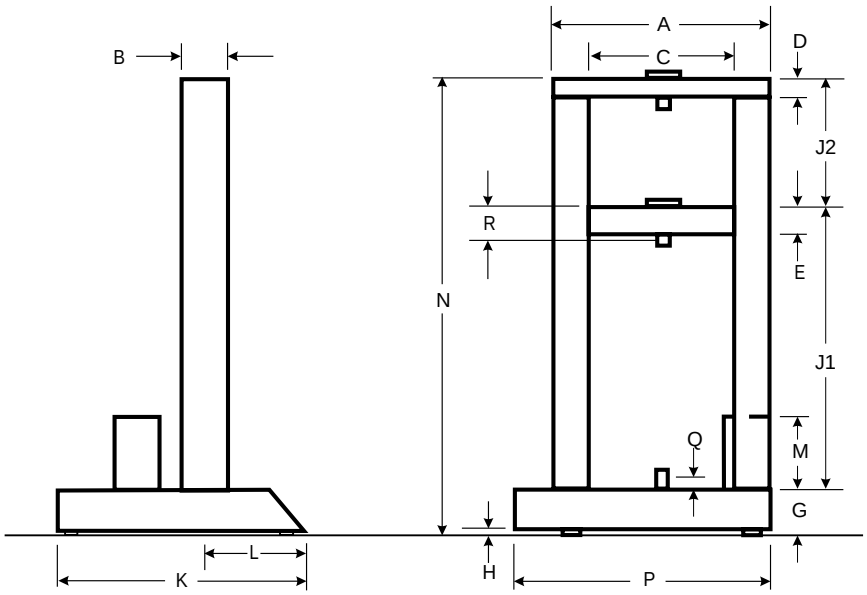

Figure 8-1. Load Frame Options Dimensional Outline

Table 8-3. Extra Height Load Frame Dimensions

Designation	Description	Dimension - mm (inch)
A	Across Columns	720 (28.31)
B	Column Depth	140 (5.5)
C	Horizontal Test Daylight	420 (16.5)
D	Top Plate Thickness Fixed Crosshead Thickness (2nd Test Space)	36 (1.4) 75 (3.0)
E	Crosshead Thickness	Model 5564/65/66 76 (3.0) Model 5567/69 120 (4.7)
F	Not Used	
G	Platen Height from Table	180 (7.1)
H	Gap for Feet	25 (1.0)
J1	Crosshead Position	Min 190 (7.5) Max 1825 (71.8) Max - Extra Height & Extra Width 1775 (69.9)
J2	Crosshead Position (with 2nd Test Space)	Min 156 (6.1) Max 1791 (70.5)
K	Overall Depth	700 (27.5)
L	Front of Base to Test Center	245 (9.6)
M	Motor Pod Height	215 (8.5)

Table 8-3. Extra Height Load Frame Dimensions (continued)

Designation	Description	Dimension - mm (inch)
N	Overall Height	Std Height 2122 (83.5) with 2nd Test Space - Std Height 1636 (64.4)* Extra Height 2161 (85.1)*
P	Overall Width	1427 (56.2)
Q	Coupling Pin to Base	59 (2.3)
R	Load Cell Pin to Crosshead	133 (5.2) with 2525-800 Series Load Cells to 10 kN 142 (5.6) with 2525-800 Series 30 kN Load Cell
* Add 30 (1.2) with load cell fitted. Allow additional 200 (8.0) space above Crosshead for removal/installation access.		

Extra-Width Option

Series 4460 Load Frames with the Extra-Width Option are used for testing large assemblies that will not fit in a standard load frame. This option is available on the three larger frames in the series (Models 4465, 4466, and 4467) but is not available on the smallest and largest frames in the series (4464 and 4469).

Load frames with the Extra-Width Option use many of the same components as the standard load frames. The leadscrews, column covers, drive motor, power amplifier, drive system, and power supply are all standard, but the moving crosshead, base and covers, and top plate are all unique to the extra-width frame. In addition, the drive belts, as well as being longer, are also somewhat wider.

Specifications for the extra-wide load frame are the same as for the standard frame, with the exceptions noted below and in Table 8-2:

Axial Stiffness	Models 4465, 4466: 33 kN/mm (185,600 lb/in)
	Model 4467: 69 kN/mm (338,125 lb/in)
Weight	Models 4465, 4466: 330 kg (725 lbs)
	Model 4467 425 kg (935 lbs)

Extra-Height Option

The Extra-Height Option allows testing of especially long specimens or large assemblies. The load frame height has been increased, but all other dimensions are standard (see the dimensions table for the Extra-Height Option).

Load frames with the Extra-Height Option use many of the same components as the standard load frames. The moving crosshead, base and covers, top plate, drive motor, power amplifier, drive system, and power supply are all standard, but the leadscrews, column covers, and other column components are unique to the extra-height frame.

Specifications for the extra-height load frame are the same as for the standard frame, with the exceptions noted below and in Table 8-3:

Weight	Models 4464, 4465, 4466 151 kg (333 lbs)
	Model 4467 200 kg (440 lbs)
	Model 4469 263 kg (580 lbs)

Second Test Space Option

The Second Test Space Option allows testing in the space above the moving crosshead. In this case, the load cell is mounted in the fixed top plate of the load frame, and the specimen is gripped between the top plate and the moving crosshead.

As with the other frame options, many of the load frame components are standard, but with this option, the top plate has been replaced with a fixed crosshead, drilled to accept a load cell or a grip adapter.

Specifications for the second test space load frame are the same as for the standard frame, with the exceptions noted below and in Table 8-3:

Weight	Models 4464, 4465, 4466 154 kg (340 lbs)
	Model 4467 248 kg (547 lbs)

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