INSTRUCTIONS

FOR

MODEL NO. HT-300S/500S Ver: 4.0

HARDNESS TESTER

Manual Release: 1.0

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I M P O R T A N T N O T I C E

THIS MODEL HT-300S/500S TABLET HARDNESS TESTER HAS BEEN EQUIPPED WITH NEWLY DESIGNED ELECTRONICS. THESE CHANGES ARE PRESENT IN ALL MODELS AFTER SERIAL NUMBER 4500. THE FUNCTION OF THE MACHINE IS UNCHANGED. HOWEVER, DUE TO THE NEW ELECTRONICS THE METHOD OF CALIBRATION AND UNITS SELECTION HAS BEEN CHANGED. THE CHANGES ARE DESCRIBED WITHIN THIS MANUAL.

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1. GENERAL DESCRIPTION

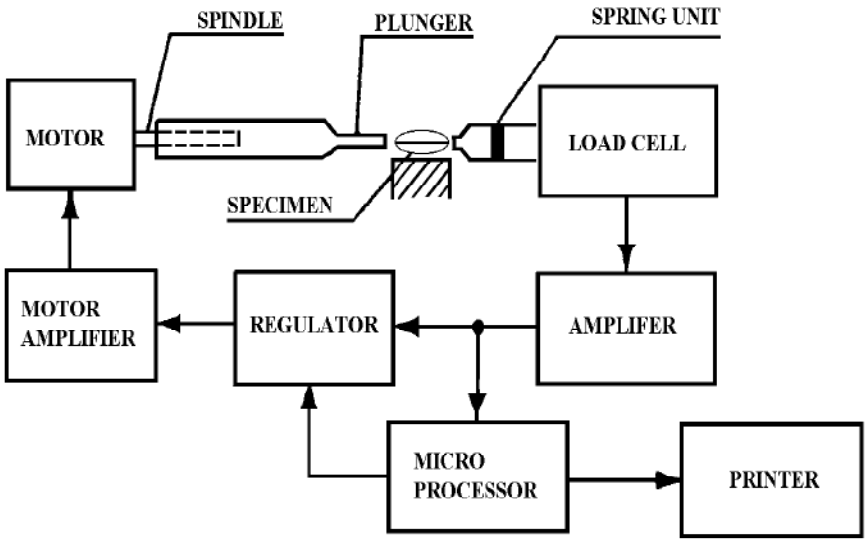
1.1 Introduction

The hardness tester model HT-300S/500S is a high performance instrument, which can accurately measure the tensile strength of tablets, ampoules, food and other articles, in either single or series operation. The tensile strength can be printed out in Kilo Ponds (KP), Strong Cobbs (SC) or Newtons (N), according to the operator's wish.

1.2 Specifications

SAMPLE		4 - 40 mm
STROKE		4 - 40 mm (externally adjustable)
CHART SPEED		3 mm/sec.
FORCE INCREASE		20 Newtons (N) per second
MEASURING RANGE	HT-300S	5 - 300 Newtons (N)
	HT-500S	8 - 500 Newtons (N)
MEASURED VALUE		Displayed on a 3-digit LED display and printed on the built-in printer
RESOLUTION		1 Newton (N)
ACCURACY		+/- 1% Full Scale (FS)
MEASURING JAWS		Interchangeable for different sample forms (i.e. tablets, ampoules etc.)
DIMENSIONS		530 mm x 274 mm x 216 mm (W x D x H)
MAINS CONNECTION		100 - 120 Volt, 50/60 Hz. switch selectable to 200 - 240 Volt, 50/60 Hz.
I/O INTERFACE		RS-232 Serial

1.3 Method Of Operation



After pressing the START key, the zero-offset value of the load cell is determined and stored in the microprocessor. If the value is within the permitted range, the motor, controlled by the regulator unit and the motor amplifier, causes the plunger to move at a constant speed towards the specimen. As soon as the plunger touches the specimen and produces a force on the load cell, the microprocessor switches the regulator on so that a linearly increasing force is produced via the control circuit (load cell - regulator - motor - specimen.) The spring unit in front of the load cell provides a smooth transition from the constant velocity phase of the plunger to the linear power increase phase. A decreasing signal from the load cell indicates to the microprocessor that the break has occurred. The microprocessor then subtracts the zero-offset value stored at the beginning of the test from this value and prints out the calculated value in the desired units (Newtons, Kilo Ponds or Strong Cobbs).

2. PUTTING INTO OPERATION

Before putting the instrument into operation, check the voltage setting (220-Volts/115 Volts) and make sure that the operating voltage corresponds to the local mains supply.

2.1 Wiring

- Connect the signal cables to any additional units
  (i.e. computer)
- Connect the power supply cable to the local mains supply

1. I/O Interface 25 pin, Sub-D male connector (RS-232 serial interface)
2. Mains input with fuse
   (250 mA for 220 Volt operation, 500 mA for 115 Volt operation)
3. Voltage selector - 220 volts/115 volts
   (make sure the correct fuse is installed in the mains connector)

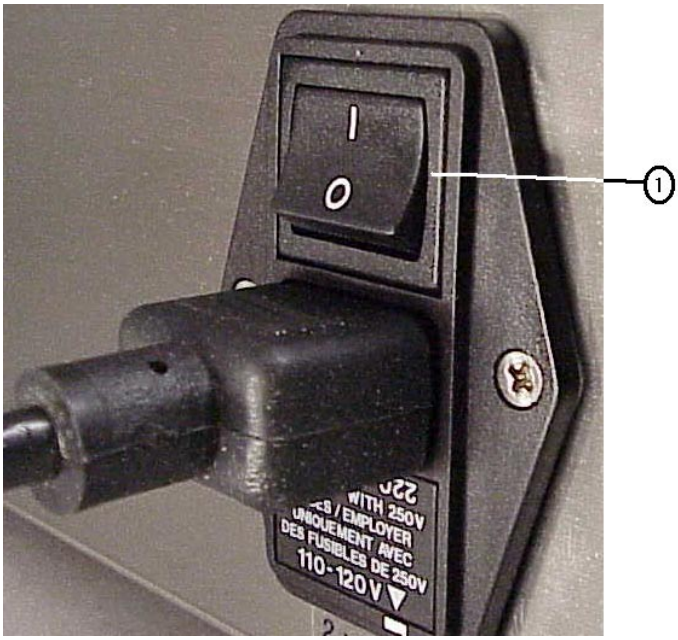
2.2 Inserting The Printer Paper

NOTE: THE INSTRUMENT SHOULD NEVER BE OPERATED WITHOUT PAPER.

To insert the paper, first open the clear plastic cover. Next, slide the paper, with the shiny side up, onto the spindle and insert the end of the paper into the printer infeed track. Finally, press the Paper Feed button.

3. OPERATING KEYBOARD

3.1 Operating Controls



(1) **POWER**

The POWER button (1) is used to switch the instrument on and off.

(2) PRINTER

If the printer should jam or the paper tear, wait until the printout is terminated and the printing paper has stopped moving. Move the paper release lever and this will release the paper tension bar and allow the paper to be removed from the bottom of the printer (2). The release lever must not be touched during printer operation. Failure to use the release lever when removing paper from the printer may cause serious damage to the printer.

When advancing the paper through the printer do not pull on the paper. Pulling on the paper may damage the print head or cause a paper jam. Use the Paper Feed button to advance the paper through the printer.

(3) DATA

When the DATA key (3) is activated (LED on), the individual hardness reading of the specimen will be printed on the printout. If switched off the individual hardness readings will not be printed. The DATA key is disabled during the normal testing cycle and will not function until the end of the testing cycle.

(4) CLEAR

If the X,σ key (6) is turned on (LED on), the last measured value can be deleted from the statistical calculation by pushing the CLEAR key (4) (i.e. faulty measurement). The display will show the value that has been cleared and the printer repeats the last line and prints an " = " sign behind the number and result to indicate that the result was cleared.

The CLEAR key (4) is enabled after the break of the specimen and will remain active until the start of the next testing sequence. The specimen that has been cleared will not be included in the statistical printout.

(5) CONT

The CONT key (5) is switched on (LED on) for continuous operation.

Display: "-" no continuous operation.
"1 - 9" Automatic start of next sample occurs from 1 to 9 seconds after the break of the previous specimen.

To change the delay, hold the CONT key (5). By keeping the key pressed the DISPLAY (7) will cycle through the continuous settings. When the setting required is displayed, release the CONT key (5) and the new setting will be in effect.

(6) X,σ

If statistics printout is desired, press the X,σ key (6) before the first measurement. The printer will print "00000000000000000000" and the LED will turn on. Test the specimens as normal. After the last specimen is tested press the X,σ key (6) again and the statistical report will be printed.

If the statistics report is selected, by pressing the X,σ key (6) (LED on) and the DATA key (3) is turned off (LED off) the statistical report will still print, however, the individual specimen readings will not be printed. If both the X,σ key (6) and the DATA (3) are turned on (both LEDs on), then both the individual specimen values and the statistical report will be printed.

The statistical report includes:

NR - Number of samples tested

XM - Mean Value = Sum of Result Values / Number of Samples = $\Sigma X / NR$

SD - Standard Deviation = $\sqrt{(\sum X^2 - NR * XM^2)} / (NR - 1)$

SREL - Relative Standard Deviation = SD / XM * 100%

RANGE - Difference between Minimum and Maximum results

XMIN - Lowest individual hardness value

XMAX - Highest individual hardness value

The instrument is ready to measure the next specimen as soon as the printout is completed. If the printer has a paper jam or cannot print, the instrument will lock up and no testing can be performed until the problem is solved.

To switch the statistics report mode off, press and hold the CLEAR key (4). While holding the CLEAR key (4), press the X,σ key (6), then release both keys and the LED will turn off.

(7) DISPLAY

The display shows the result of the last measured sample.

In addition the following states are displayed:

"0" after start up.

value the value cleared after a "CLEAR" command.

"-" 1 - 9 on selection of "CONT" operation.

"_" during the measuring procedure.

(8) START

CONT off: By pressing the START key (8), the single measuring procedure is started.

CONT on: By pressing the START key (8), a series of measuring procedures is started. Testing for each progressive specimen after the first will start after the number of seconds set using the CONT key (5) has elapsed.

(9) STOP

By pressing of the STOP key (9), the testing procedure can be interrupted at any time.

(10) PAPER FEED BUTTON

This button is used to advance the paper forward through the printer. Do not pull on the paper to advance it through the printer, as this may damage the print head of the printer or cause a paper jam.

4. TEST PROGRAM

NOTE: BEFORE STARTING THE TEST PROGRAM MAKE SURE THAT THE JAW-STROKE ADJUSTING KNOB HAS BEEN TURNED ALL THE WAY TOWARD THE LARGE CIRCLE. ONCE THIS IS DONE PRESS THE START KEY AND THEN PRESS THE STOP KEY TO CAUSE THE MOVING JAW TO RETURN TO THE NEUTRAL POSITION.

In order to select or change the units in which the tester measures, it is necessary to access the TEST PROGRAM. To enter into the TEST PROGRAM, the movable jaw must be in the home (neutral) position. First, press and hold the STOP key (9) and without releasing it, press the START key (8). The message "PTB-301 XX.XX/XX" will be printed on the printer. Next, release both keys. This number is the version number of the software programmed into the testers hardware and is needed for service and when asking questions about the unit. When this messages is printed, the unit is in TEST PROGRAM mode and all the keys on the keyboard assume new functions, as listed below:

STOP	-	Exits the TEST PROGRAM.
START	-	Units selection.
CONT	-	Display segment test procedure.
X,σ	-	Enters CALIBRATION mode.
DATA	-	Not Used.
CLEAR	-	Prints ZERO OFFSET value.

4.1 Units Selection

After entering the TEST PROGRAM, as described above, press and hold the START key. This will cause the display to cycle through a series of numbers, from zero (0) to three (3). Releasing the START key causes the number display to be selected. After selection, the unit's selected will be printed out on the printer. Each of these numbers represents one of the units of measurement, as listed below:

0	-	Newtons (N).
1	-	Kiloponds (KP).
2	-	Strong Cobbs (SC).
3	-	Digits (Used only for testing purposes).

4.2 Zero Offset

This is the internal value at which the load cell is set to indicate zero (neutral) pressure. This value must be between ten (10) and twenty (20). To verify that the ZERO OFFSET value is correct, press the CLEAR key (4) while the unit is in the TEST PROGRAM mode and the value will be printed on the printer. If the value is not within the specified range, the unit will not function properly and it is necessary to contact the Service Department at Key International, Inc.

5. CALIBRATION PROGRAM

The unit needs to be calibrated at least two times a year. Before proceeding with the calibration or validation of the unit it is necessary to have a class F certified weight kit. This kit contains a range of weights, from 5 N to a combined total of 98.066 N that are required for calibration and validation of the unit. The weight kit needs to be re-certified each year and is available from Key International, Inc.

As the certification of the calibration kit can be costly, the unit can be returned to Key International, Inc. for service and calibration. Returning the unit to Key International, Inc. for calibration by a qualified service technician assures that all the functions of the unit are operating correctly.

In order to calibrate the unit, it is necessary to first enter the TEST PROGRAM and then press the X,σ key. After the X,σ key has been pressed, the unit will print a list of the new keyboard functions and activate the CALIBRATION PROGRAM. The new functions are listed below:

STOP	-	Exits the CALIBRATION PROGRAM.
START	-	Validation of load cell.
X,σ	-	Print stored calibration settings in digits.
CONT	-	Prints load cell reading in digits.
CLEAR	-	Activate calibration zero reading. ** SEE NOTE
DATA	-	Activate calibration weight reading. ** SEE NOTE

NOTE: THESE KEYS ALTER THE INTERNAL CALIBRATION READINGS OF THE UNIT AND SHOULD NOT BE USED UNLESS THE VALIDATION READINGS OF THE UNIT ARE INCORRECT. THE PROCESS OF CALIBRATION REQUIRES THE USE OF CERTIFIED WEIGHTS AS DESCRIBED ABOVE.

Once the CALIBRATION PROGRAM has been started, remove the moving jaw by pulling it straight out of the socket. Next, remove the pedestal by unscrewing it from the base of the machine. Now remove the small jaw by pulling it out of the socket. Finally, turn the unit on its side so the black jaw stroke adjusting knob is pointing upward.

5.1 Validation

While in the CALIBRATION PROGRAM as described above it is possible to validate or test the accuracy of the system calibration. Is recommended that a range of weights be tested. The weights should include 0 N, 5 N, 10 N, 20 N, 30 N, 40 N, 50 N, 60 N, 70 N, 80 N and 98 N. Each weight or group of weights is placed on the load cell and the operator then presses the START key. This will cause the printer to print "VALIDATE = XXX N", where "XXX" is the value of the weight tested, in Newtons (N). If any of the values tested are not out of tolerance, the unit needs to be recalibrated.

5.2 Calibration

While in the CALIBRATION PROGRAM, it is necessary to first press the X,σ key. This will print the calibration data stored in the internal circuitry of the unit on the built-in printer. The internal circuitry of the tester measures all values in a unit known as digits. A digit is equal to approximately .348 N. The first line of the printout will show the number of digits for the 0 KP reading of the load cell and the second line will show the number of digits for the calibration weight value of 10 KP (98.066 N). This function should be performed before continuing with the calibration procedure.

Next, with no weight on the load cell, press the CLEAR key. This will cause the internal circuitry to store the new 0 KP value.

Now place the combined weight of 98.066 N on the load cell and press the DATA key. This will cause the internal circuitry to store the new 10 KP (98.066 N) value. The unit has now been calibrated. It is now recommended that the X,σ key be pressed and the new values be compared to the original ones printed at the beginning of the calibration procedure.

When the calibration procedure is finished, the unit must be validated again by following the instructions in the Validation section of this manual.

6. CLEANING PROCEDURE

NOTE: NEVER USE AGGRESSIVE CHEMICAL SOLVENTS THAT MIGHT FOG THE PLASTIC PARTS WHEN CLEANING THE UNIT.

(1) Before starting the cleaning procedure, make sure the unit is turned off. Next, turn the jaw stroke adjusting knob, on the left side of the machine, completely toward the large circle. Now turn the unit on. If the jaw does not move to the full open position press the START key. As soon as the jaw begins to move forward press the STOP key and the jaws should move to the full open position. Once the jaws are in the full open position, turn the unit off.

(2) Disconnect the power supply cord. **TO AVOID POSSIBLE ELECTRIC SHOCK DO NOT ATTEMPT TO CLEAN THE UNIT WHILE IT IS STILL CONNECTED TO THE POWER SUPPLY.**

(3) Remove the long jaw by pulling it out of its socket. Remove the pedestal by sliding it out of base of the machine. Remove the short jaw by pulling it out of it's socket. If tablet debris has been sticking to the jaws during testing, it may be necessary to polish the contact faces of the jaws.

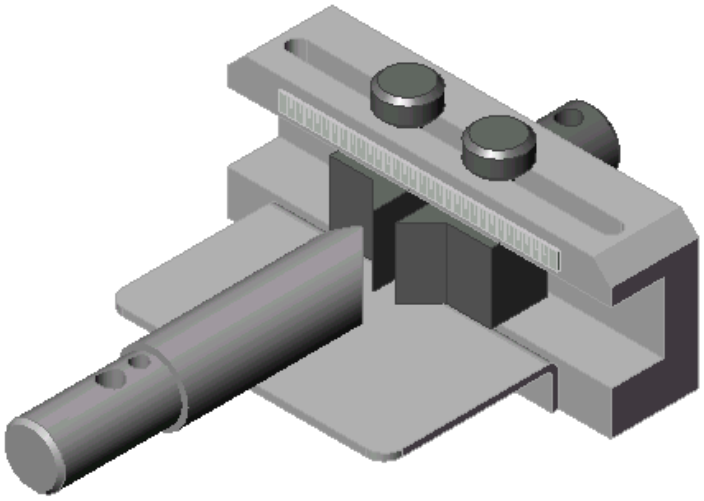
(4) When cleaning the unit, it is recommended that isopropyl alcohol be used. **DO NOT ALLOW THE CLEANER TO ENTER THE PRINTER OR REACH THE INTERNAL ELECTRONICS AS THIS MAY CAUSE DAMAGE TO THE UNIT.**

(5) After the unit has been cleaned, replace the small jaw in its socket. Then slide the pedestal back into the base of the machine and replace the long jaw in its socket.

7. VARI-FLEX JAW OPERATING INSTRUCTIONS

7.1 General Description

The "Vari-Flex Jaws" have been specifically designed for use with the Key International Model HT-300S and HT-500S Hardness Testers. They are designed to replace the standard jaw and pedestal arrangement normally supplied with the hardness testers to allow for using the "flexure" method of hardness testing. The two moveable jaws can be positioned as needed to suit a broad range of product sizes.



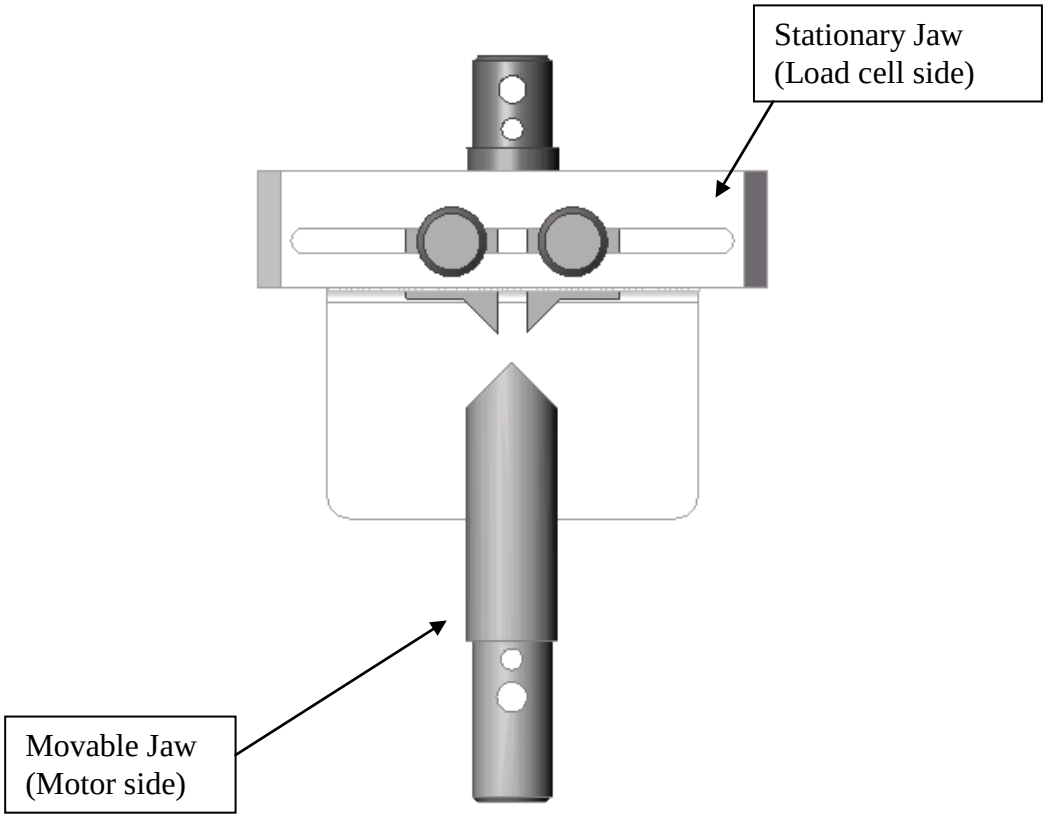
Vari-Flex Jaws

7.2 Installation

To install your Vari-Flex Jaws, you first must remove the standard jaws and pedestal from the unit. This is done by simply pulling the movable jaw out of its holding socket, sliding the pedestal out and pulling the stationary jaw out of its holding socket. Once these three items have been removed, you can proceed in installing the Vari-Flex Jaw Assembly by inserting it into the vacated socket on the stationary side of the test chamber.

Then insert the Vari-Flex "Movable Jaw" into the vacated socket on the movable side.

Top View



7.3 Setup

In order to setup the Vari-Flex Jaws, it is necessary to adjust the position of the two Pointed Pressure Blocks. This is done by loosening the two knurled thumbscrews, then spreading the two blocks apart. The recommended position for these blocks are as far apart as possible, while still maintaining contact with the flat back surface of the particular tablet. Also, it is required that the pressure blocks are positioned so they are equal distance from the center, so that when the movable jaw contacts the tablet, there is an equal amount of unsupported distance on either side of the tablet.

7.4 Operation

Once the Vari-Flex Jaw has been setup, it is possible to begin testing. The standard operating procedure for the hardness tester may be used from this point. Be certain that when testing, the break occurs in the center of the tablet. For the best data, we are looking for a clean break. If a piece of the tablet is chipped off, it is necessary to re-adjust the setup and clear the results.

8. TECHNICAL INFORMATION

8.1 Units Conversion List

The following list shows the relationship between the various units that the hardness tester is capable of measuring in:

1 Kilo Pond	=	9.8066 Newtons
1 Kilo Pond	=	1.4005 Strong Cobbs
1 Strong Cobb	=	0.714 Kilo Ponds
1 Strong Cobb	=	7.005 Newtons
1 Newton	=	0.102 Kilo Ponds
1 Newton	=	0.143 Strong Cobbs
1 Newton	=	2.2048 Lbs.

8.2 RS-232 Serial Port

The connector for the RS-232 serial port of the hardness tester is a 25 pin male Sub-D connector.

8.2.1 Interface

Baud Rate	2400
Parity	Even
Data Bits	7
Stop Bits	1
Handshake	Hardware RTS/CTS

8.2.2 Pin Assignments

Pin	Signal	Description
1	Protective Ground	
2	TXD	Transmit Data
3	RXD	Receive Data
4	RTS	Request to Send
5	CTS	Clear to Send
6	DSR	Data Set Ready
7	GND	Signal Ground
20	DTR	Data Terminal Ready

8.2.3 Data Output

All information printed on the built in printer is automatically sent to the serial port.

8.2.4 Data Input

The following is a list of commands that can be used to control the hardness tester via the serial port:

Command	Function
S	Start Test - same as pressing START key
A	Stop Test - same as pressing STOP key
P	Printer On - turn the printer on
N	Printer Off - turn the printer off

9. OPTIONAL AND SPARE PARTS LIST

Part No.	Description
04-168-0001	CALIBRATION KIT - 98.066 N
15-156-0002A	MEMBRANE COVER FOR KEYBOARD
15-156-0002N	SWITCH FOR KEYBOARD
15-156-0010	HT-500S LOAD CELL
15-156-0016	HT-300S LOAD CELL
15-156-0019	LIMIT SWITCH FOR MOTOR HOUSING
15-156-0020	ON/OFF ROCKER SWITCH
15-156-0023	STANDARD JAW SET
15-156-0047	ISOLATION COVER
15-156-0051	POWER CABLE
15-156-0055	VARI-FLEX JAWS
15-156-0056	AMPULE HOLDER
15-1561032	KEYBOARD (NEW STYLE)