



Tire Plunger / Bead Unseating Test Machine

Model 70 Mark IV

- ◆ Available as a New Machine or Upgrade Kit for Existing RJS Model 70 Plunger / Bead Unseating Test Machines
- ◆ New PC Based System with Servo-Hydraulic Speed and Positioning Control
- ◆ Computerized Data Acquisition. Menu Driven Setup for Sequence Control and Data Acquisition
- ◆ Provides and Displays Measurements in Both Free Mode and Peak Hold - Captures, Freezes, and Displays Peak Values of Load, Energy, and Deflection / Penetration
- ◆ Automatically Creates an Excel Spreadsheet Test Report



RJS-70-IV-2203

GENERAL DESCRIPTION

Model 70 Mark IV Tire Plunger and Bead Unseating Test Machine

performs the United States Department of Transportation (D.O.T.) Federal Motor Vehicle Safety Standards 109/119 for tire plunger energy and bead unseating, and incorporates flexibility to allow user-designed tests to be conducted.

The F.M.V. Safety Standards 109/119 describe the required tests of tire strength as measured by "plunger energy", and the force or load required to unseat the bead of a tire from the rim or wheel upon which it is mounted.

The FMVSS requires reporting the plunger energy average of five tests on a specific specimen, and the unseating force (or load) average of five tests on a specific specimen.

Is selectively operable in English, Systeme International (SI), and meter-kilogram-second (mks) units.

The Instrumentation selectively reports in:

SYSTEM	FORCE OR LOAD	DEFLECTION/PENETRATION	ENERGY	PRESSURE
English	lb	in	in-lb	Psi
SI	N	mm	N-m	kPa
Mks	kg	mm	kg-cm	Kg/cm ² (ksc)

MACHINE DESCRIPTION

The Model 70 Mark IV machine is constructed in a "C" configuration of fabricated steel, and is provided with both a removable rotatable spindle and a flat anvil (Figure). The rotatable spindle is movable fore and aft to permit the centering of the plunger probe over the tire specimen.

Rims with hubs are conveniently mounted by use of adaptors directly on the rotatable spindle. The spindle, with the tire specimen, is manually rotatable in the frame of the machine for the five required test ruptures, or alternatively, five tests conducted at pre-set values of plunger energy without rupture.

The removable flat anvil supplied with the machine is interchangeable in the machine frame with the rotatable spindle, and provides the means to test tires mounted on rims without hubs. When using the flat anvil for this purpose, a radius shoe (provided) may be used.

A second purpose of the flat anvil is to provide a flat surface upon which a calibrating instrument may be set. When used for calibration, the radius shoe is removed.

TYPE OF OPERATION

Hydraulically operated.

The pressure source is a low-noise hydraulic gear pump, the flow of which is controlled by a proportional servo valve for closed loop control for accurate selectable test speeds.

The plunger travel rate is adjustable between 1 inch (25.4mm)/min and 15 inch (381mm)/min. (2 inch (50.8mm)/min is the DOT standard.) The rapid-travel rate is about 20 inches (508 mm)/min down; 30 inches (762mm)/min up, and is also adjustable.

CONTROLS

The machine is controlled by servo-hydraulic speed and positioning controls, controlled by software and allowing remote test start.

POWER

The machine motor is 3 horsepower, 3 phase 50 or 60 Hz. any standard voltage, as selected by the customer.

TIRE SIZE CAPABILITY AND MAXIMUM TEST LOAD

The Model 70 Mark IV will accept tires of 56 inch (1422 mm) maximum outside diameter, and 21 inch (533 mm) maximum cross-section.

One rim adaptor (for passenger car wheels) is furnished with the complete Model 70 Mark IV as "standard", but other adaptors can be supplied optionally to the user's requirements. In such cases, the user must supply dimensional information relative to the test rim or wheels intended to be used so that the special adaptor can be manufactured.

An optional conical quick-change rim adaptor is offered for use with passenger car rim sizes. See list of optional accessories.

The maximum working load capability of the machine is 22,000 lb. (10 metric tons). Maximum ram travel is 19 1/2" (495 mm).

INSTRUMENTATION

The Mark IV incorporates a dedicated servo controller that controls the speed and position of the plunger and performs the back end data acquisition. The servo controller is connected to a Windows based PC via a single Ethernet cable. The PC does all the sequence control and the front-end data calculations and data storage. The PC comes with software specifically tailored to conveniently conduct the plunger energy and bead unseating tests while at the same time providing flexibility to perform other tests which the user may require.

Such additional requirements, for example, may include applying specific loads for flat plate deflection measurements for which a flat plate attachment is provided as a standard accessory.

Additionally, the software calculates both DOT plunger energy and actual (integrated) plunger energy expended when deflecting or penetrating a specimen.

LOAD/FORCE data on the Mark IV is measured by a strain gage load cell while the DEFLECTION/PENETRATION is by a digital linear encoder.

CALCULATIONS

1. D.O.T. PLUNGER ENERGY: $W = F \times P / 2$

(D.O.T. ENERGY = FORCE X PENETRATION/2)

2. ENERGY (ACTUAL): Integrates the area under the curve defined by the force vs. deflection/penetration.

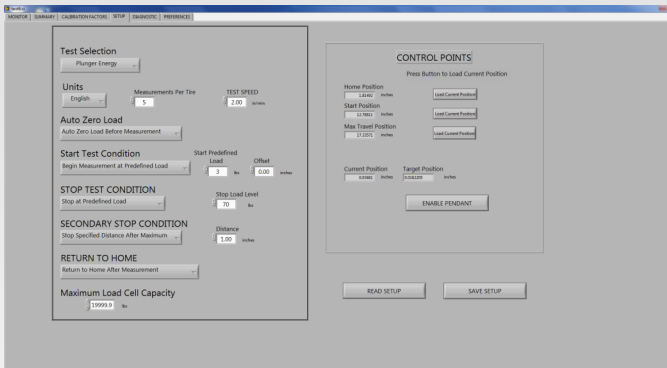
3. AVERAGES the successive measurements of both D.O.T. and integrated energy (Plunger Test) and load (Bead Unseating Test).

SOFTWARE

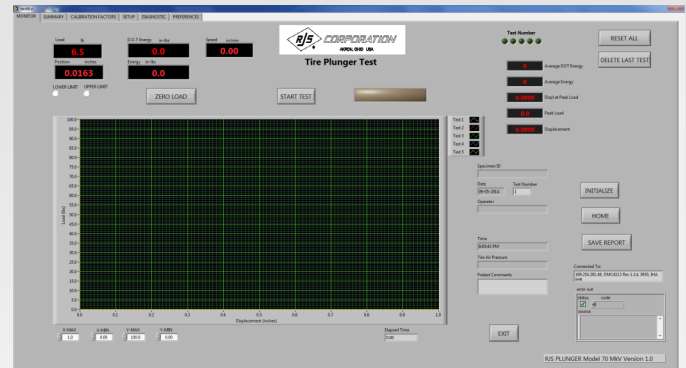
The Mark IV software gives complete computer control of the plunger, display of the test results and archive of the test results.

Control of the Plunger – The system has three teach points that must be set on the system via a hand held pendant. These points are the HOME POSITION, START POSITION and the MAXIMUM TRAVEL POSITION.

The HOME POSITION is the position that the plunger returns to after the test. This position should be set high enough so that it is easy to remove or install a tire.



Test Selection



Test

The START POSITION is the position that the plunger is moved to just before measurement. Depending on the START MODE SETTING, the measurement will begin at this point, the plunger will move to the START POSITION and then move downward to a specified load and then begin the measurement or plunger will move to the START POSITION and then the operator will be allowed to fine tune the position via the hand held pendant before the measurement begins.

The MAXIMUM TRAVEL POSITION is a plunger travel limit that should be set so that the plunger does not damage the tire rim or other associated test tooling.

MEASUREMENT SETTING

Auto zeroing the plunger before the start of each measurement can be selected.

START MODE

MOVE TO START POSITION - DEFLECTION/PENETRATION is zeroed at START POSITION.

START AT SPECIFIED LOAD - DEFLECTION/PENETRATION is zeroed at specified load.

ALLOWS OPERATOR TO ADJUSTED START POSITION - DEFLECTION/PENETRATION is zeroed after operator adjustment.

STOP MODE

- Stop at a predefined DOT Energy.
- Stop at a predefined Energy Level
- Stop at a predefined displacement
- Stop at a predefined load

In addition the test can always be stopped by hitting the stop button.

SECONDARY STOP MODE

- None
- Load drops after a specified percentage.
- Load does not increase after a specified displacement.

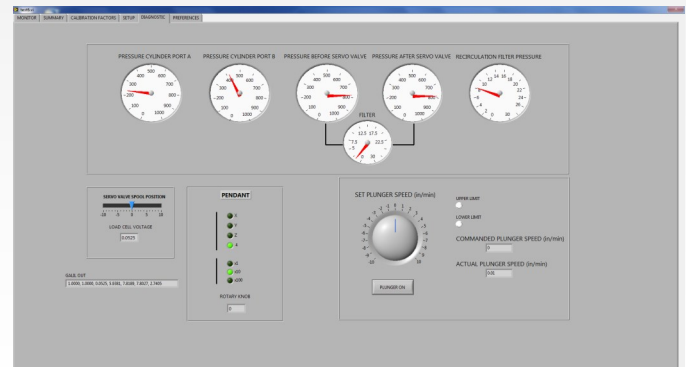
AUTO RETURN

Plunger will automatically return to home position after the test.

The plunger configuration can be saved with a unique file name and recalled when needed.

CALIBRATION

LOAD/FORCE calibration is performed by first installing the flat anvil into the machine frame and placing the instrumentation in calibration mode. The operator can select between a two, three or five point calibration. For each calibration point the operator applies a force from the ram to a known standard (such as a load ring), enters the applied load and presses a



Diagnostics

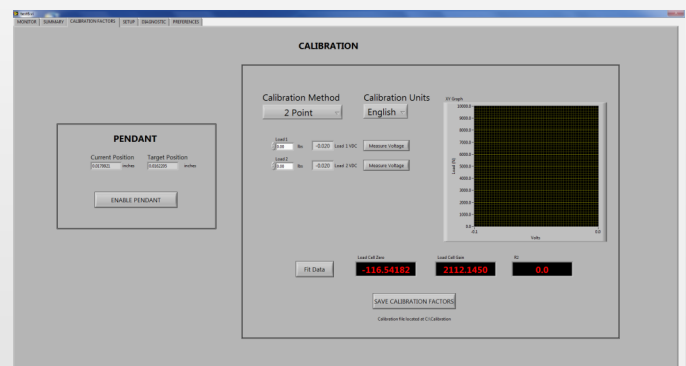
button on the computer screen for the system to read the load cell voltage. Zero load can be one of the points. Once all of the points are measured (2, 3 or 5 calibration points) the operator can have the system automatically calculate the calibration factors by applying a linear least squares fit to the calibration data points. The calibration factors are automatically saved to the computer and is automatically recalled when the system is restarted.

Adjustment or calibration for the DEFLECTION/PENETRATION is not required nor available.

Values for DEFLECTION/PENETRATION are positive for ram downward from zero.

The LOAD/FORCE can be zeroed at any time or automatically zeroed (when auto zero is turned on) at the start of the measurement.

The DEFLECTION/PENETRATION is zeroed at the beginning of the measurement. This position is dependent on the start mode of the measurement.



Calibration

STANDARD ACCESSORIES PROVIDED with the MODEL 70

One each 3/4 inch diameter, and 1-1/4 inch diameter plunger probe.

One Radius Shoe of 5 inch radius made to RJS drawing

B-70-030. Other Radius Shoes at extra cost.

One Flat Plate Attachment, for taking foot-prints of loaded tires. The plate supplied is 13 inch X 18 inch (330mm x 457mm).

One Wheel Adaptor (B-102-030) for wheels with 4 or 5 mounting holes on a 4-1/2 inch (114.3 mm) bolt circle.

OPTIONAL ACCESSORIES AVAILABLE

1. The Model 100 Bead Unseating Fixture

The Bead Unseating Fixture is used to measure the load required to force a passenger car tire bead off a rim under certain conditions of test specified by Federal Motor Vehicle Safety Standard 109.

The Unseating Fixture is an optional extra, and is used in cooperation with the Plunger Machine when performing the bead unseating test.

The Model 100 Bead Unseating Fixture conforms dimensionally to Federal standard 109, and is adjustable to receive wheels of sizes 10 inch through 24 inch, maximum tire outside diameter of 39 1/2" (1003 mm). However, the Unseating Fixture will be supplied only with adaptor rings for 13, 14, and 15 inch rims, rim adaptor sizes are 11 inch, 12 inch, 16 inch, 17 inch, 18 inch, 20 inch, 21 inch and 22 inch (10 inch rims are mounted directly on the Fixture structure.) Includes the Fig. 2A Block.



*Model 100
Bead Unseating Fixture*

2. Alternative Bead Unseating Blocks

Type 2B (ASTM & BNFT) and Type 2C (ASTM & BNFT), to accommodate testing of low profile tires.

3. Conical Quick-Change Adaptor for Passenger Car Tire Rims

4. 1-1/2" Diameter Plunger Probe

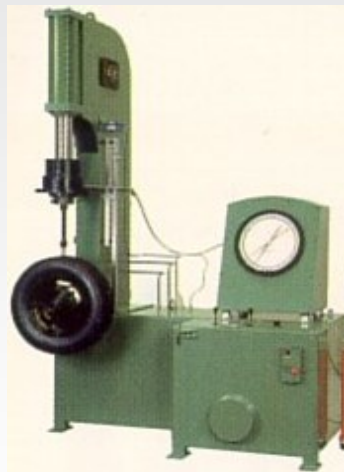
5. 5/16" Diameter Plunger Probe

6. Piston Upgrade Kit for 6" bore hydraulic cylinder with new style piston and seals (to replace obsolete style seals).

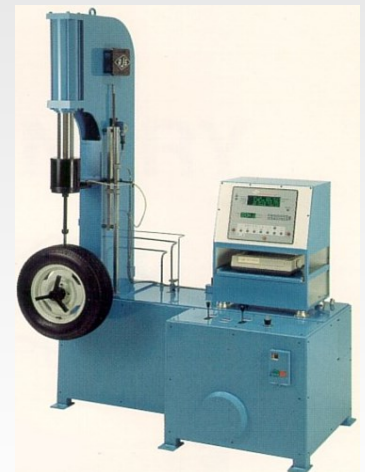
UPGRADING OF EARLIER MACHINES

If the user's earlier Model 70 Plunger Machine is in good mechanical condition, upgrading of the machine should be considered.

The older Model 70 may be upgraded in several possible ways, including installation by User –or– Plunger Machine shipped to RJS for installation depending on the requirements of the user.



Mark II



Mark III

Mark IV instrumentation is supplied to replace existing manual control valves and Mark III instrumentation and electronic load cell or hydraulic load cell and dial indicator.

Upgrade to Mark IV configuration (Pictured on Cover) requires the following new components (by RJS):

- a. PC-based computerized data acquisition system with menu driven set up, PC, MS Office and RJS standard Plunger test software, touch monitor on extendable reach arm, keyboard & mouse.
- b. Electronic load cell and load cell housing to supply LOAD data Existing electronic or hydraulic load cell and housing discarded. The mounting holes of the new cabinet match the holes of the old cabinet.
- c. Displacement Assembly, digital encoder, track assembly, limit sensors & hand wheel control for DEFLECTION / PENETRATION data.
- d. Servo-hydraulic speed and positioning controls controlled by software.
- e. Updated hydraulic system including 3HP motor, gear pump, accumulator, new tank (new cover & breather filter, proportional servo valve (closed loop control of test speeds) and electrical controls.
- f. Wiring harnesses with plug-type connections, hydraulic lines and Mark IV cover panels for existing plunger base.
- g. RJS standard software, with 1 year free upgrade.
- h-1. Instructions for installation by user.
or
h-2. Installation by RJS on our factory floor.

For safety purposes, remote test start is available so operator is not required to be near machine during testing.

Mark IV Features

- ◆ PC-Based system, input by touch screen or standard PC keyboard
- ◆ Menu driven setup and computerized data acquisition
- ◆ Many modes of operation and sequence
- ◆ Automatic start/end of test using servo valves, formerly manual control
- ◆ Automatically creates an excel spreadsheet test report
- ◆ Upgrade uses existing mounting holes to accept new components and provides wiring harnesses with plug-type connections and pre-formed hydraulic lines to simplify installation
- ◆ For safety purposes, remote test start is available so operator is not required to be near machine during testing
- ◆ Selectable test speeds and positioning speeds
- ◆ Auto shut-down of pump (and auto start when test is initiated)
- ◆ Includes Handwheel Controller for teaching set points and calibration



Hydraulic Components



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