

Standard Operating Procedure: Instron Universal Testing Machine

APPROVAL REQUIREMENTS

TITLE	DEPT	NAME (PRINTED)	SIGNATURE	DATE
Author	RES	Chris Kuncho		12-MAR-15
Supervisor	RES	Patrick Casey		12-MAR-15


DOCUMENT REVISION HISTORY


REV	DESCRIPTION OF CHANGES	RELEASED BY	DATE
A	Initial Release	Patrick Casey	13-MAR-15




TABLE OF CONTENTS

SAFETY3
INTRODUCTION4
 1.0 Purpose4
 2.0 Description4
 3.0 List of Related Internal Documents4
 4.0 List of Related External Documents4
OPERATION.....4
 5.0 Safety4
 6.0 Process Description6
 7.0 Maintenance 10
TRAINING CERTIFICATION CHECK SHEET 12

 This document should only serve as a reference. The Instron Universal Testing Machine should not be operated by anyone without express permission and proper training by approved personnel.

 The Instron Universal Testing Machine should never be left unattended while testing.

 PRIOR TO OPERATION, READ THE SAFETY PROVISIONS AND REVIEW THIS STANDARD OPERATING PROCEDURE IN ITS ENTIRETY.

SAFETY

The subsections below outline some of the obvious / major hazards that could exist during the operation of the Instron Universal Testing Machine, and are divided to bring a level of clarity to such hazards.

Electrical Hazards: Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel only. Do not block the main switch as potential risk of personal injury or equipment damage if the instrument cannot be turned off in an emergency.

Trip Hazards: The Instron Universal Testing Machine has installed components (wires, hoses, etc.) that could pose a tripping hazard. Such hazards should be identified and caution should be taken to avoid tripping over such components. Make sure to pick up and not drag your feet when working around the testing machine, and always pay attention to your path of movement to note any obstructions that could create a trip hazard. Be sure to clean up any test material as this could cause a slipping hazard for other personnel.

Mechanical Hazards: Keep hands and long hair away from moving parts and clamp sections. Fingers can be crushed or severed in the Instron Universal Testing Machine. All long hair should be tied back.

Lifting Hazards: The Instron Universal Testing Machine process involves lifting of heavy items that could lead to personal injury and damage to property. All personnel should be trained in the proper procedures for manually lifting. Evaluate an object's size and weight prior to lifting, and follow these general guidelines for lifting:

1. Assess the lift and know the object weight.
2. Bend at the knees and get a good grip.
3. Keep back straight and lift straight up with legs without twisting. It is important to lift with the legs and not the back.
4. If an object is too large or heavy, ask for help and do not attempt to lift by yourself. In the case that mechanical assistance (e.g. crane, forklift, etc.) is required to complete the lifting operations, all machine operators of such machinery should be fully trained and licensed.
5. Do not lift heavy items above shoulder level. Rolling platform ladders are provided and available and should be utilized in these applications.

Personal Protective Equipment (PPE): All personnel should utilize and implement proper PPE per OSHA requirements. Refer to OSHA requirements for proper use and implementation of PPE. The following items are suggested as a minimum to avoid injury based on the operation procedure outlined in this manual.

- Safety glasses
- Lab coat
- Long pants
- Lab coat
- Proper gloves (when required)
- Close-toed shoes

INTRODUCTION

1.0 Purpose

- 1.1** The purpose of this Standard Operating Procedure is to guide the user in the basic use of the Instron Universal Testing Machine.

2.0 Description

- 2.1** The Instron Universal Testing Machine is an instrument of generally simplistic design. The device possesses two mounting points (one fixed, one attached to a mobile cross head), which accept a variety of fixtures designed to interact with the sample in one of many ways. A load cell attached to one of the fixtures measures the applied force during the test. By accurately measuring the loads, and accounting for sample geometries and the nature of the applied force, a variety of mechanical properties may be ascertained.

3.0 List of Related Internal Documents

- 3.1** UMass Lowell Chemical Hygiene Plan
- 3.2** RES-07-001 ETIC Operations Manual

4.0 List of Related External Documents

- 4.1** OSHA Laboratory Safety Guidance
- 4.2** Instron Universal Testing Machine Manual
- 4.3** ASTM-D618
- 4.4** ASTM-D638
- 4.5** ASTM-D790
- 4.6** ASTM-E74

OPERATION

5.0 Safety

- 5.1** Safety glasses
- 5.2** Lab Coat
- 5.3** Long Pants
- 5.4** Close-toed shoes
- 5.5** Proper Gloves (when required)
- 5.6** UMass Lowell EEM CHP
- 5.7** Material Safety Data Sheet(s) (MSDS)

⚠ Before continuing all personnel should familiarize themselves with the Instron Universal Testing Machine (Figure 1).

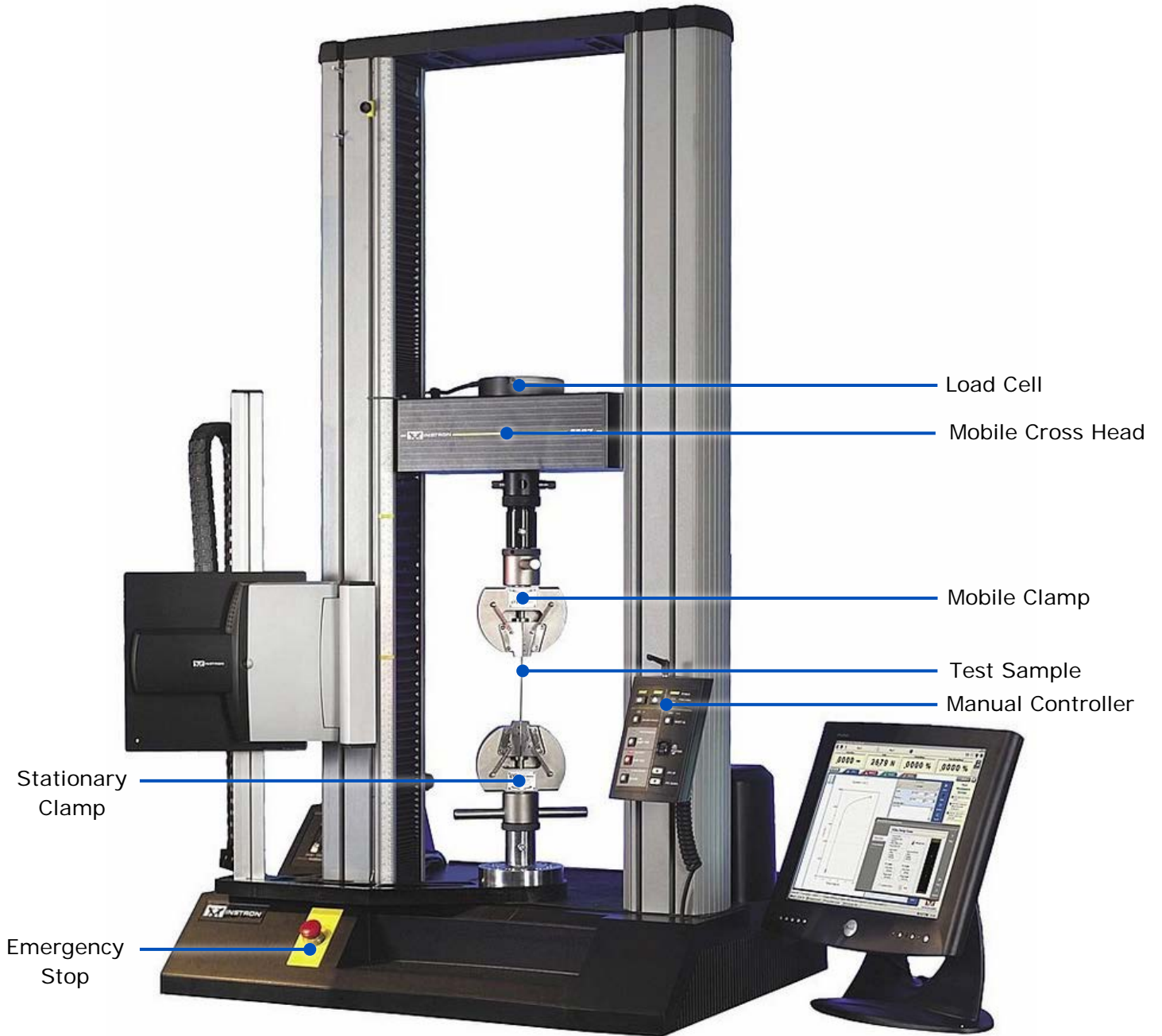
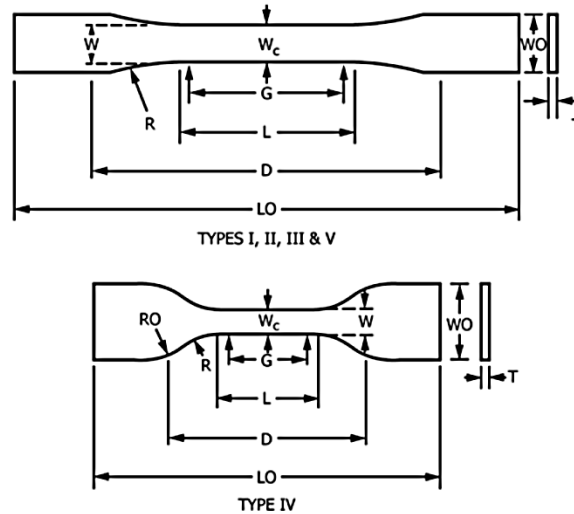


Figure 1 Instron Universal Testing Machine

6.0 Process Description

6.1 Sample Preparation

6.1.1 Geometry Considerations: Tensile Testing (Figure 2).



Specimen Dimensions for Thickness, T , mm (in.)^A

Dimensions (see drawings)	7 (0.28) or under		Over 7 to 14 (0.28 to 0.55), incl	4 (0.16) or under		Tolerances
	Type I	Type II	Type III	Type IV ^B	Type V ^{C,D}	
W —Width of narrow section ^{E,F}	13 (0.50)	6 (0.25)	19 (0.75)	6 (0.25)	3.18 (0.125)	± 0.5 (± 0.02) ^{B,C}
L —Length of narrow section	57 (2.25)	57 (2.25)	57 (2.25)	33 (1.30)	9.53 (0.375)	± 0.5 (± 0.02) ^C
WO —Width overall, min ^G	19 (0.75)	19 (0.75)	29 (1.13)	19 (0.75)	...	+ 6.4 (+ 0.25)
WO —Width overall, min ^G	...	...	...	...	9.53 (0.375)	+ 3.18 (+ 0.125)
LO —Length overall, min ^H	165 (6.5)	183 (7.2)	246 (9.7)	115 (4.5)	63.5 (2.5)	no max (no max)
G —Gage length ^I	50 (2.00)	50 (2.00)	50 (2.00)	...	7.62 (0.300)	± 0.25 (± 0.010) ^C
G —Gage length ^I	...	...	...	25 (1.00)	...	± 0.13 (± 0.005)
D —Distance between grips	115 (4.5)	135 (5.3)	115 (4.5)	65 (2.5) ^J	25.4 (1.0)	± 5 (± 0.2)
R —Radius of fillet	76 (3.00)	76 (3.00)	76 (3.00)	14 (0.56)	12.7 (0.5)	± 1 (± 0.04) ^C
RO —Outer radius (Type IV)	...	...	...	25 (1.00)	...	± 1 (± 0.04)

Figure 2 Tensile Specimen Geometry

6.1.2 Rigid and semi-rigid plastics:

- Type I is preferred for this material type with specimens 7mm or less.
- Type II is used when a type I specimen will not break in the narrow section.
- Type III specimen must be used for any material with thickness of 7mm or more.
- Type IV specimens may only be used for testing materials of different rigidities (non-rigid vs semi-rigid).
- Type V specimens are only usable where a material is 4mm thick or less.

6.1.3 Non-rigid plastics:

- Type III specimens must be used for all samples between 7mm and 14mm thick.
- Type IV samples must be used for all samples 4mm thick or less.

6.1.4 Reinforced composites:

- Only Type I specimens may be used for these materials.

6.2 Sample conditioning (per ASTM-D618)

9. Standard Procedures for Conditioning Prior to Test

9.1 *Procedure A*—Condition 40/23/50 for specimens 7 mm (0.25 in.) or under in thickness, 88/23/50 for specimens over 7 mm—Condition test specimens 7 mm or under in thickness in the standard laboratory atmosphere for a minimum of 40 h immediately prior to testing. Treat test specimens over 7 mm in thickness as above, except that the minimum time shall be 88 h. Provide adequate air circulation on all sides of the test specimens by placing them in suitable racks, hanging them from metal clips or laying them on wide-mesh, wire screen frames with at least 25 mm (1 in.) between the screen and the surface of the bench.

6.2.1 Flexural Testing:

- Sheet materials 1.6mm thick or greater
 - Length: $1.2 \times \text{Span}$ in mm, but no less than 6.4mm
 - Width: Samples less than 3.2mm thick will be 12.7mm wide. Samples greater than 3.2mm thick cannot have a width exceeding $0.25 \times \text{Span}$.
 - Span: 16 times the sample thickness in mm.
- Sheet materials less than 1.6mm
 - Length: 50.8mm
 - Width: 12.7mm
 - Span: 25.4mm
- Laminated thermosetting materials, sheet, and plate materials used for electrical insulation, including vulcanized rubber, and glass-bonded mica:
 - Paper/Fabric based materials
 - Thickness: 25.4mm
 - Glass/Nylon based materials
 - Thickness: 12.7mm
 - Span: $32 \times \text{thickness}$ in mm
- Molded Thermosets and thermoplastics (*recommended*):
 - Thickness: 3.2mm
 - Width: 12.7
 - Length: 127mm
 - Span: 51.2mm
- High strength reinforced composites, highly orthotropic laminates:
 - Span: $60 \times \text{thickness}$ in mm

6.3 Load Cell selection and installation

6.3.1 Load Cell Selection

6.3.1.1 The load cell selected should be such that the test is performed utilizing 50% of the load cell's capacity.

6.3.2 Load Cell Installation

- 6.3.2.1 Remove communication connection from the Instron.
- 6.3.2.2 Remove three lug screws from top of the load cell.
- 6.3.2.3 Using handle on the load cell, pull load cell from the top of the instrument.
- 6.3.2.4 Replace new load cell into socket taking care to line up lug holes.
- 6.3.2.5 Using lug screws secure new load cell to upper control arm, tightening screws in a star pattern to one quarter turn past finger tight.
- 6.3.2.6 Plug the communications cable into the Instron.

6.4 Fixture Selection and Installation

6.4.1 Fixture Selection by Test

- 6.4.1.1 Tensile Testing: For all tensile tests standard clamp type grips are used
- 6.4.1.2 Three point bend: For three-point bend tests a specialized simple supported three point bend fixture is required. Adjust your span to what is suitable for your sample's type and dimensions.

6.4.2 Fixture Installation

- 6.4.2.1 All clamps for the Instron Universal Testing machine are installed by use of pins and holes. Ensure that the holes are lined up such that the pins may be completely inserted, and that the fixtures are facing forward.

6.5 Startup

6.5.1 From a depowered state (both Instron and computer are off)

- 6.5.1.1 Flip toggle on Instron Universal Testing Machine. Wait for machine to completely start.
- 6.5.1.2 Start up the PC by normal means.
 - 6.5.1.2.1 Power on the Tower.
 - 6.5.1.2.2 Power on the Monitor.
- 6.5.1.3 Once Computer is fully booted and logged in press the IEEE 488 button on the control panel of the Instron.
- 6.5.1.4 Start Bluehill software (**Figure 3**).



Figure 3 Start Bluehill Software

6.6 Using the Software

6.6.1 After starting the software click Test (Figure 4).



Figure 4 Start Test Setup

6.6.2 Select and double click the test method from left panel. Test methods will reference the ASTM Methods they correspond to (Figure 5).

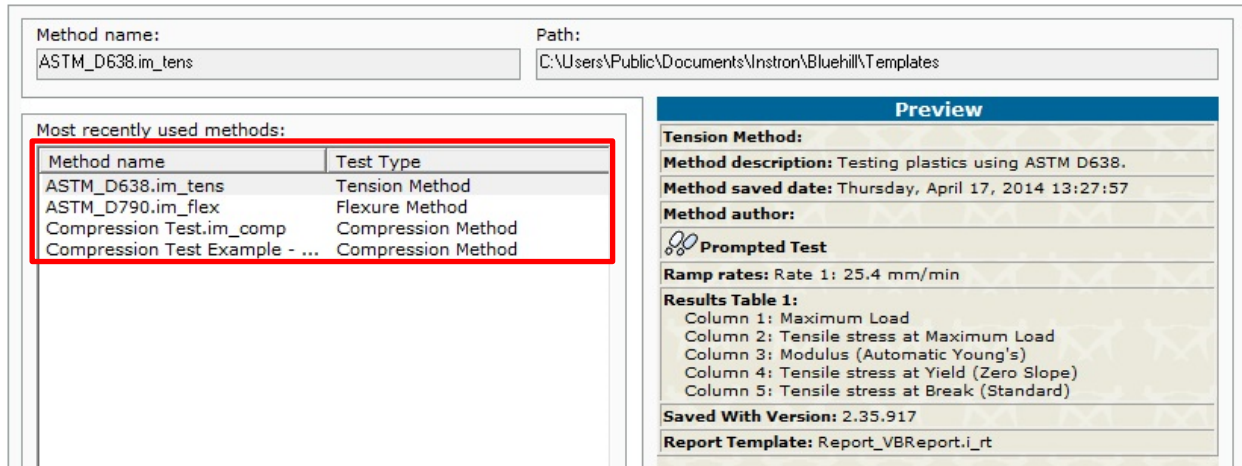


Figure 5 Select Test Method

6.6.3 Enter Operator Name and Material Type. Click Next (Figure 6).

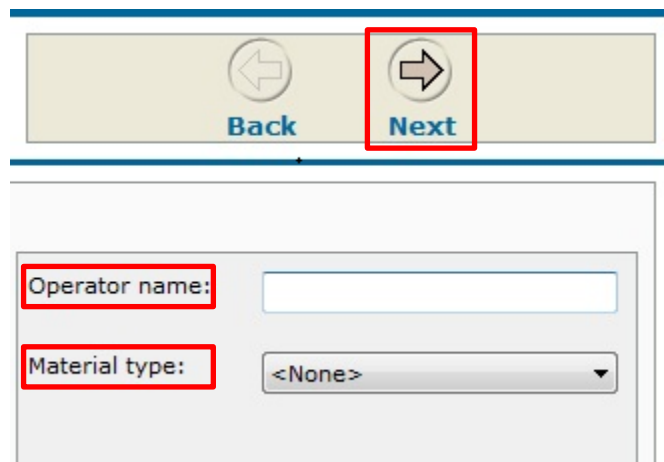


Figure 6 Enter Operator and Material

6.6.4 Enter your File Name and Output Folder. Click Next.

6.6.5 Click the **Method** tab at the top of the page. Click **Control** in the left column and then **Test** (Figure 7).



Figure 7 Setting the Test Method

6.6.6 Enter your **Testing Rate**. This is based on your ASTM (D638 or D790) and material. Click the **Test** tab. Measure and enter the test sample's **Width** and **Thickness**. Click **Next**.

6.6.7 Install your specimen in the fixture. Click **Start** (Figure 8).



Figure 8 Click Start

6.6.8 Repeat Step 6.5.6 to 6.6.7 as needed.

6.6.9 Click **Finish**. When asked if you want to finish the sample, or test more specimens, click **Finish Sample**.

7.0 Maintenance

7.1 Preventative Maintenance Instruction: See **External Documents**

7.2 Vendor Information:

Instron Worldwide Headquarters

825 University Ave

Norwood, MA 02062-2643

Tel: +1 800 877 6674

Service: +1 800 473 7838

TRAINING CERTIFICATION CHECK SHEET

	UCard ID	NAME (LAST, FIRST)	SIGNATURE	DATE
TRAINER				
TRAINEE				

OPERATION NUMBER	OPERATION DESCRIPTION	TRAINER INITIAL *
1	Can load software and add new test	
2	Can define test parameters and start test	
3	Understands the potential hazards associated with equipment	
4	Knows the location of the UML Chemical Hygiene Plan (CHP)	
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

* TRAINER'S INITIAL CONFIRMS THAT TRAINEE IS PROFICIENT *