# INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

**MATERIALS MANAGEMENT DIVISION**

**Powai, Mumbai 400076**

## Technical Specifications for Accessories Required for Instron 8852 system of 100kN/1000Nm Capacity

The party to provide the following in the quote:

1. Support of hardware and spare for 10 years and more after the End-of-Life of the model.
2. Guarantee and warranty of the product for a minimum of 3 years.
3. To provide details of accessories installed on Instron 8852 or similar system of Instron over the last 10 years of at least 5 users in India (specifically in IIT's, IISc, NIT's and reputed national labs like DMRL, NAL etc.) and abroad from reputed institutions/organizations for getting first hand feedback from them about the product and service experience.
4. The price quote should include the cost of 1-year annual maintenance contract (AMC).
5. The firm should be equipped with well-trained engineers to offer post warranty maintenance and service support. Number of service engineers employed in this region by manufacturer should be mentioned.
6. Details of service support in India that the firm can offer should be given along with the NABL calibration facility.
7. Nearest service centre to Mumbai is to be mentioned
8. OEM (original equipment manufacturer) engineer should install not by the agent in India.

### 1. Extended Wedge Action Hydraulic Grips :

**1.1.** Axial Water cooled Extended Wedge action hydraulic grips of 100kN Capacity.

**1.2.** Suitable to use with Environmental Chamber, as per specification mentioned item no 2.

**1.3.** The grip head will be capable of operating at loads of up to 100kN from -70degC to +350degC.

**1.4.** Should Include a water flow switch assembly and connecting cable to the chamber to shut-down the chamber in the event of cooling water failure.

**1.5.** Should work with Instron existing Grip manifold on the frame, to avoid additional External pump which occupy additional space of Lab and consume additional Electricity.

**1.6.** Should be able to use Jaw faces of Instron existing grips, to minimise the inventory.

**1.7.** Should able connect to Instron Load cell & Actuator.

### 2. Environmental Chamber & Controller:

**2.1.** **Temperature Range :** The minimum temperature range for the Environmental chamber should be - 150 °C to +350 °C

**2.2.** **External Dimension :** To accommodate in the existing frame with column space 660mm and Vertical space of 1900mm, with minimum Width of 550mm, Height 800mm and Depth 850mm or higher External Width, Height or Depth.

**2.3.** **Internal Dimension :** The chamber should accommodate the Extended hydraulic Grips, as specified above with Min separation of 200mm and Maximum separation of 400mm, so that minimum Width 400mm, Height 650mm and Depth 400 or better Internal Width, Height or Depth.

**2.4.** Should also accommodate Existing Three point bend fixture with span of 250mm.

**2.5.** The chamber should have Left-hand hinged door with optical-quality heated glass window, sufficiently big size min 360mm Height and 125 mm width for use with Non-contact video extensometers.

**2.6.** The glass window should have built in heating arrangement for 'frost' free operation at -30°C.

**2.7.** The chamber should incorporates outer skin cooling to prevent excessive outer skin temperatures.

**2.8.** The chamber should have Internal light arrangement.

**2.9.** **Removable wedge-ports** : The chamber should have Instrumentation cut-out & removable wedge ports, to facilitate to push back chamber without removing with Extended grips from the frame.

**2.10.** The chamber should work with voltage 200-240 V AC single phase, 50/60 Hz and total power consumption should not be more than 6.5 kW

**2.11.** The chamber should have built in fan to minimize the temperature gradient, the fan should have Selectable slow speed to improves testing of delicate specimens at low forces by reducing air turbulence

**2.12.** The chamber should have an exhaust port to aid the ducting of potentially harmful gases away from the test area /lab.

**2.13.** **Roller Carriage :** Suitable to Instron frame to push back the chamber, when not in use.

**2.14.** **Temperature Controller :** Suitable PID Controller with

2.14.1. The temperature stability for the chamber should be ±2 ºC or better.
2.14.2. The Temperature Gradient for the chamber should be ±1% of set point after 10 minutes stability time, or ±2°C, whichever is greater.
2.14.3. The Maximum Temperature Overshoot for chamber should be 2ºC or lower
2.14.4. The Heat up time to maximum temperature +350 ºC should be 35 minutes or better.
2.14.5. The cooling time to minimum temperature -150 ºC should be 40 minutes or better.
2.14.6. The controller should have Programmable 8 segment ramp/dwell function for use independently from a PC
2.14.7. For compatibility with Existing software, the controller should have facility, to provide temperature data logging facility through Instron WaveMatrix Software. appropriate cables for interfacing to PC to be offered.
2.14.8. For safety of operator the chamber should have Interlock , which can disconnect the heating/cooling and fan power when the door is opened, for minimizing non-ambient air reaching the operator.
2.14.9. The chamber should be provided with an over temperature alarm function for protecting the specimen or for optional connection of an external device such as a water flow switch to switch off chamber if water supply fails for water-cooled grips.

## 3. <u>4 point bend:</u>

**3.1.** **Conversion kit :** Conversion kit for existing Instron 3 point bend fixture to four point bend

**3.2.** The Upper span should be adjustable from 25 to 90mm

**3.3.** Should Include: Upper rollers, 25 mm Diameter

**3.4. Pushrods :** Push rods to be used with existing Instron 3 point bend fixture, with end fitting of M30X2 right hand female threading, to be used inside chamber, as specified in item no 2.

## 4. Non-Contact Video Extensometer :

### 4.1. General

4.1.1. The device must be capable of measuring axial strain and transverse strain during both tensile and cyclic tests.
4.1.2. All extensometer measurements should be output as calibrated displacement.
4.1.3. Maximum following speed of at least 2500 mm/min must be achievable for static tensile tests and 500mm/s for cyclic and fast monotonic tests.
4.1.4. The extensometer should enable the test machine to perform axial strain control tests up to 20Hz cyclic frequency, for ambient test.
4.1.5. The maximum data rate shall be 490Hz.
4.1.6. The extensometer should determine strain over a gauge length by "tracking" the position of two contrasting marks applied to the test specimen.
4.1.7. The extensometer should automatically recognize mark location.
4.1.8. The extensometer should follow the centre of the marks (minimizing errors due to distortion of the mark).
4.1.9. The device must be capable of controlling the air between the camera and specimen to eliminate noise caused by unwanted air currents.
4.1.10. Illumination shall be provided from a high intensity low voltage LED system with features to eliminate reflection and glare from external light sources, making it highly tolerant to ambient lighting conditions and specimen surface brightness.
4.1.11. The camera sensor should be an integral part of the video controller board and feature on-board high speed processing. Signal processing should not use the system controller pc.
4.1.12. It should be able to measure strains in a temperature chamber with optical grade
4.1.13. It should measure both extension and strain to failure for almost any material, including plastics, metals, composites, textiles, films, elastomers, paper, components, and bio-materials.
4.1.14. It should be suitable for tests conforming to testing standards ISO 527 and ASTM D638.

### 4.2. Specimen Marking & Setup

4.2.1. A simple multipoint calibration method should be incorporated using a precision 2D calibration grid.
4.2.2. In general it should recognize the white marks on metals and dark plastics and black marks on light colored plastics.
4.2.3. The device shall be compatible with ink or adhesive tape dot targets (axial and transverse). Marks may be white or black. Specially printed targets shall not be required.
4.2.4. Dot sizes should be as small as 1mm diameter for detailed grid placement. Dot size should be set-up dependent. i.e., use on larger systems with larger field of view lenses requires dots between 3mm and 6 mm diameter.

### 4.3. Mounting & Integration with Test Systems

4.3.1. The camera system should be rigidly mount to the test frame of the system and should not use tripod. It should also not come on the way for installing or removing of the specimen.
4.3.2. For compatibility with existing system, the device shall be fully integrated into Instron Bluehill 3 testing software for static tests and WaveMatrix software for cyclic tests.
4.3.3. Gauge length measurement and data synchronization shall be automatic and will not require additional user intervention.
4.3.4. For cyclic tests, a recorded data lag <1ms must be achieved.
4.3.5. The video display software set-up should be integrated with the test system PC.
4.3.6. It should also be easily use onto 3rd party systems as a standalone device.
4.3.7. It should provide two analog outputs for axial and transverse measurements. Each can be independently scaled for a full-scale output (+/-10V) of the selected percentage strain.

### 4.4. Camera Lens Accuracy & Measurement – Static Testing

4.4.1. The camera system must accommodate specimens of multiple gauge lengths and varied elongations through the use of up to 4 interchangeable lenses – 6 mm, 9 mm, 16 mm and 35 mm.

4.4.2. The device must cover field of views from 100 mm to 620 mm for static testing. The field of view is determined by the lenses purchased.

4.4.3. Measurement resolution of the extensometer should range from 0.5µm for smallest field of view lens to 3.0 µm for highest field of view.

4.4.4. The device shall be able to measure axial gauge lengths and transverse gauge widths as small as 5 mm for the smallest field of view lens, or as small as 15 mm with the largest field of view.

4.4.5. Axial and transverse measurement accuracy of the extensometer shall range from ±1 µm or ±0.5 % of reading (whichever is greater) for smallest field of view, to ±9 µm or ±1% of reading (whichever is greater) for the largest field of view.

4.4.6. The device shall meet the ISO 9513 requirements of class 0.5 using the 35 mm or 16 mm lens for static tests.

4.4.7. The device shall meet the ASTM E83 requirements of class B-1 using the 35 mm and 16 mm lens for G.L > 10 mm for static tests.

### 4.5. Camera Lens Accuracy & Measurement – Dynamic & Cyclic Testing

4.5.1. The device must provide a field of view of up to 240 mm for dynamic and cyclic tests.

4.5.2. The device shall be able to measure axial and transverse gauge length, width as small as 6 mm.

4.5.3. Measurement resolution should be a minimum of ±2.5 µm, with an accuracy of 0.5 µm.

4.5.4. The device shall meet the ISO 9513 requirements of class 2 for dynamic and cyclic tests and meet ASTM E83 requirements of class B-2 for G.L > 25 mm.

### 4.6. 2D Digital Image Correlation (DIC)

4.6.1. The device shall be capable of capturing images for use with DIC on Instron systems with Bluehill 3.

4.6.2. DIC images captured shall be synchronized with measurement values from the test frame including time, force, and stress.

4.6.3. The DIC program (DIC Replay) must run on the same computer as the system application software.

4.6.4. Continuous camera image data collection should be provided at a user selectable rate for synchronized post-test replay, or post-test strain map analysis including on-screen selectable point distance measurement with DIC Replay software.

### 5. 2D Digital Image Correlation (DIC) software:

5.1.1. The DIC should use video camera and image capture from the Video Extensometer specified in item no 4 and it should use same PC used for Instron software.

5.1.2. The DIC should be synchronous with the load and position data of the existing system.

5.1.3. Digital Image Correlation (DIC) optical technique should compare images of a tested specimen's surface and it should generate full-field strain and displacement maps. In other words, it should be able to provide an FEA-style picture to visualize strain and displacement over the full two dimensional surface of the test specimen.

5.1.4. DIC Replay Software should be a self-contained 2D DIC package. The software should use images and calibration data saved by video extensometer and it should work in a post-processing mode.

5.1.5. The user interface should have tabbed style and graphical user interface.

5.1.6. Full-field strain and displacement maps should provide graphical plot for axial strain (Eyy), axial displacement (dy), transverse strain (Exx), transverse displacement (dx), shear strain (Exy), maximum normal strain, minimum normal strain, vs load data or test time of the existing system

5.1.7. The software should able produce poisson's ratio.

5.1.8. Should have facility to produce stain data as if virtual strain gauge mounted at particular location or a virtual Extensometer.

**6. Self Pressurizing Dewar Flask & Coolant Hose**

**6.1.** Automatic self pressurizing Dewar Flask for LN2 Coolant. 120 litres capacity. With suitable fitting and Coolant hose to attach with Environmental Chamber item No. 2 above for achieving -150 Deg C Temperature.