

Specifications for Sector 1 MTS hydraulic system

Summary: This is an MTS model 858 system, with a customized baseplate. The baseplate is customized to allow the unit to be placed on a manipulator system, such that samples can be arbitrarily moved relative to the x-ray beam for *in situ* studies. Samples can be loaded in monotonic tension/compression and fatigue. Various sample grips exist, others are under consideration as detailed herein, and users are encouraged to consult/collaborate with sector1 staff if further custom designs are needed. The system is designed with a heat shield for elevated temperature applications. Sample heating can be provided with an sector1-owned infrared heater (from Research Incorporated) which is nominally rated to ~1100C (actual max temperature is geometry-dependent), or with customized heaters developed by users. The system can be operated in 2 locations, either inside the x-ray hutch (1-ID-C) or just upstream of the hutch.

1. Details of model 858 system

see http://www.mts.com/stellent/groups/public/documents/library/dev_002083.pdf for further info

1.1 Load frame, model 359S.

- Nominal dynamic load rating: ± 25 kN ($\pm 5,500$ lbs).
- Overall Weight: 1,979.46 N (445lbs.)
- Overall height maximum: 1,686.6 mm (48.758 inches).
- Base dimensions:
- Width: 625 mm (24.6 inches).
- Depth: 254 mm (10.0 inches).
- X-ray beam location: 234.95 mm (9.25 inches) above bottom of base plate
- Custom designed T-slotted base plate to attach grips and bend fixture.

1.2 15 kN Actuator, 4 in. Stroke, M12x1.25 mm Mounting Threads

- This actuator provides 15 kN, 10 kN or 5 kN force capacity at 21 MPa, 14 MPa or 7 MPa pump pressure respectively.
- Position Transducer, 100mm

1.3 661.19F-01 Axial Load Cell

- Force capacity 15 kN, fatigue rated

1.4 661.18F-01 Axial Load Cel

- Force capacity 1 kN, fatigue rated
- Can be installed in series with 661.19F-01 axial load cell for low-load applications

1.5 Manifold Assembly-Proportional Standard, Axial

- Close-coupled accumulators allowing maximum high frequency response of servovalve(s).
- Maximum operating pressure: 21 MPa (3000 psi).
- Off/Low/High pressure control.
- Slow pressure turn on.
- Fast emergency unload for system depressurization.
- Optional pilot pressure available.

1.6 252.23G-04, 5 gpm (19 lpm) 5 port High Response Servovalve

1.7 Model 505.07 Hydraulic Power Unit

- Silent Flo Series.
- 60 db(A) noise fully compensated.
- 6 GPM (22.7 LPM) nominal flow rating.
- 3000 PSI (21 MPa)

- 220 VAC, 3 PH, 50 HZ incoming power.
- 24 VDC control.
- Water cooled.
- 46 gallon reservoir.
- 3 micron return filtration.



1.8 MTS control software and hardware:

- FlexTest SE Controller - PLUS

1.8.1 MTS Model 493.02 FlexTest SE 1-Channel Chassis

- The MTS FlexTest SE digital controller is a flexible and easy-to-use servo-controller for general testing applications.
- FlexTest SE hardware is VME-based including an MVME processor to provide real-time closed-loop control. The controller includes one analog input for high level data signal or external program, three analog outputs, and four digital inputs and four digital outputs (one pair dedicated for interlock).
- The Basic model can operate stand-alone (without PC) or with PC automation. A dedicated PC is included as a standard feature with the Plus model. The Plus model also features a higher performance controller processor, capable of update rates up to 6KHz
- The higher performance processor is available as an option on the Basic model controller. If a stand-alone controller is desired for low-cost initial use, and TestWorks 4 or other application software is anticipated in the future, the Basic model should be ordered with the 6KHz processor.
- Capabilities include:
- Function generation of monotonic ramps and cyclic waveforms using sine, square and triangular shapes can be generated.
- Graphic color display with optional general purpose scope; meters, which provide digital displays of specified measurements.
- Auto zero, bumpless start, hydraulics on mode-switching.
- Ability to save and restore PID tuning settings.
- Adaptive controls compensation; Peak-Valley and Null Pacing.



1.8.2 Multi-position Handle

1.8.3 MTS Model 493.25 Universal Conditioner

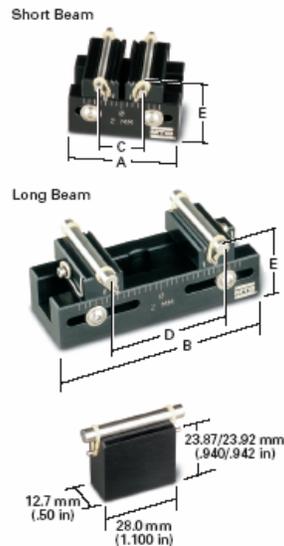
- Provides transducer conditioning for AC or DC transducers.
- Normalized with an on board reference for easy portability of calibrations.
- Low noise, low drift, high accuracy signal conditioning.
- Computer control of range, transducer zero, excitation, filter.
- Designed for full range calibrations.

- Shunt calibration for 100% range.
 - Supports strain gage bridge completion.
 - Excitation loss detection.
 - Computer controlled limit detection.
 - Excitation frequency: 9.83 kHz.
- 1.8.4 MTS Model 493.47 Encoder Interface Board
- 1.8.5 493.14 Two Stage Valve Driver
- Provides servovalve drive signal for 2-stage servovalves.
 - Supports single or dual MTS Model 252 style servovalves.
 - Digitally controlled fault protection logic.
 - 16 bit resolution on valve D/A.
- 1.8.6 Acceleration Compensation Module
- Provides signal conditioning with line current source for compensated load cell.
- 1.8.7 Remote Station Control Panel
- Provides signal control away from the personal controller. This is ideal for controllers enclosed in X-ray regions.
- 1.8.8 Remote E-Stop
- Provides emergency shutdown of system away from the personal controller. This is ideal for controllers enclosed in X-ray regions.
- 1.8.9 FlexTest SE PC Automation Kit
- This kit includes the MTS computer referenced elsewhere in this document. Installed on the computer is Model 793.00 Software and 100MBPS Ethernet network card / cable.
 - Enables use of Basic TestWare to setup and run cyclic and monotonic tests, and acquire and store test data.
- 1.8.10 Compaq Pentium IV / 2.66 GHz
- Compaq/HP Pentium IV/2.66 GHz
 - 512MB SDRAM Memory, 512KB L2 CACHE Memory.
 - 40GB SMART III Ultra ATA/100 Hard Drive, 1.44MB Diskette Drive.
 - CD/RW, X48
 - Windows XP.
- 1.8.11 793.10 MultiPurpose TestWare (FTSE/TSIIs)
- Multi-Purpose TestWare enables integration of function generation, data acquisition, and test sequencing with data stored to disk in ASCII format for analysis with third party tools such as Excel (TM).
 - Multi-Purpose TestWare functions include:
 - Data acquisition (Timed, Peak/Valley, Level Crossing, Max/Min, Cyclic/Logarithmic).
 - Function generation up to 100 Hz on all channels.
 - Sine, square, triangle, ramp, hold, processes, and ability to play digitized profiles.
 - Soft start/stop available on all channels.
 - Limit sensing, sequencing triggers, and interface to 32 Digital I/O (16 in/16 out).
- 1.8.12 MTS Model 493.25 Universal Conditioner (Strain)
- Provides transducer conditioning for AC or DC transducers.
 - Normalized with an on board reference for easy portability of calibrations.
 - Low noise, low drift, high accuracy signal conditioning.
 - Computer control of range, transducer zero, excitation, filter.
 - Designed for full range calibrations.
 - Shunt calibration for 100% range.
 - Supports strain gage bridge completion.
 - Excitation loss detection.
 - Computer controlled limit detection.
 - Excitation frequency: 9.83 kHz.
- 1.8.13 Cable To Epsilon Extensometer and Factory Calibration
- 1.8.14 Model 493.45 Analog Input with BNC adapter leads
- Provides set of 6 auxiliary input channels for high level (+/- 10V) analog signals which can be used for control and data acquisition.
 - Includes adapter supporting BNC connectors on six 'pig-tail' leads.
 - Limit of 1 module per controller.
- 1.9. Grips
- 1.9.1 One Set of Custom Fatigue Grips for Threaded samples, M10 threads.
- Unimet construction

- Rated to 1000C
- See section 4 for sketch

1.9.2 Model 642.001A-02 3 & 4 Point Bend Fixture

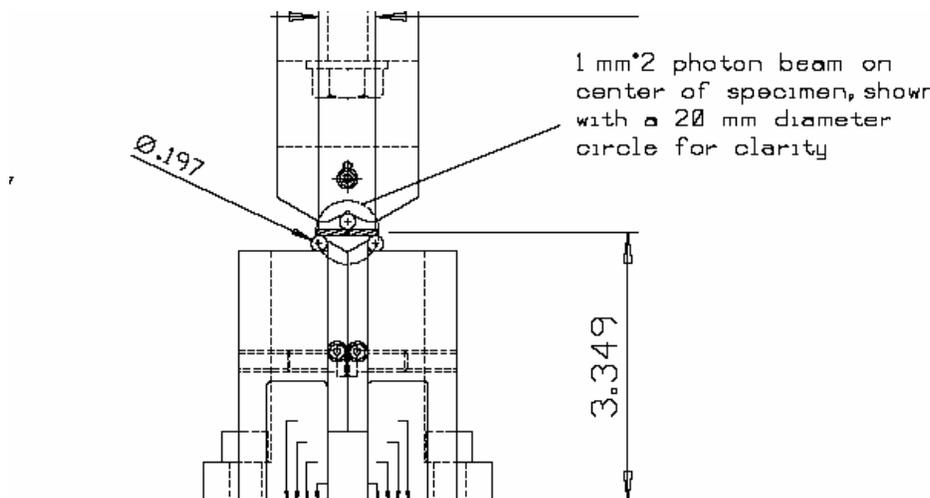
- 170 to 880 N Dynamic Force Capacity, 570 N to 2.89 kN Static Force Capacity, depending on roller diameter.
- 25 mm specimen width.
- ASTM D-790, ASTM D-2344 Compliant.
- Assembly includes 1, 2, 3, 4 and 5 mm rollers.
- Lower Span: 4 to 50 mm (1 mm roller), 13.7 to 59.7 mm (5 mm roller).
- Upper Span: 4 to 15.4 mm (1 mm roller), 13.7 to 25 mm (5 mm roller).
- Temperature Range: -130 to 177 deg C.
- Includes M6x1 Cap Screws for Mounting.
- More info: http://www.mts.com/downloads/642.001_low.pdf



1.10. Additional options, not yet purchased

1.10.1 Custom High Temperature Bend Fixture

- Size to be determined by ANL and MTS.
- Adapter will be able to accept multiple sized beams and sizes in the future. One set of four anvils included.
- Temperature to 1000 C.

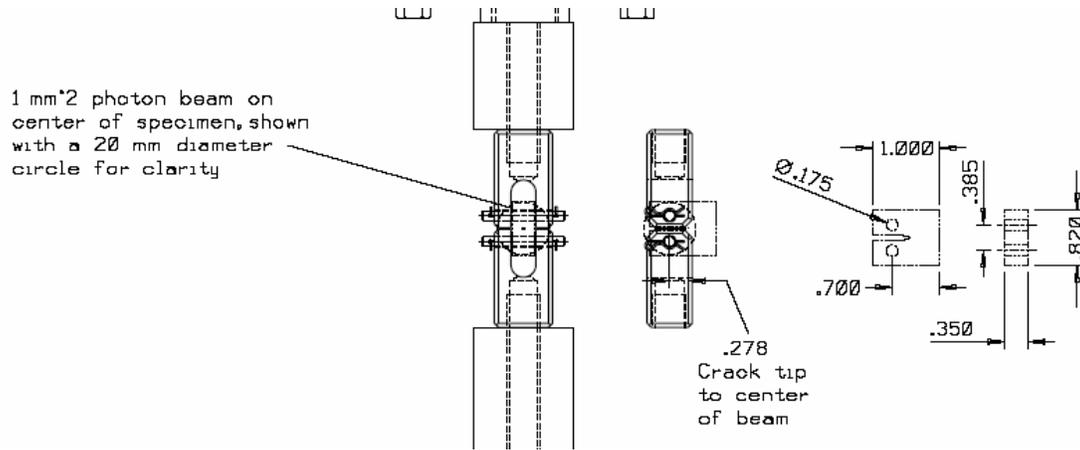


Note: Design to be confirmed with customer prior to building the grip.

1.10.2 Custom High Temperature Clevis Grips

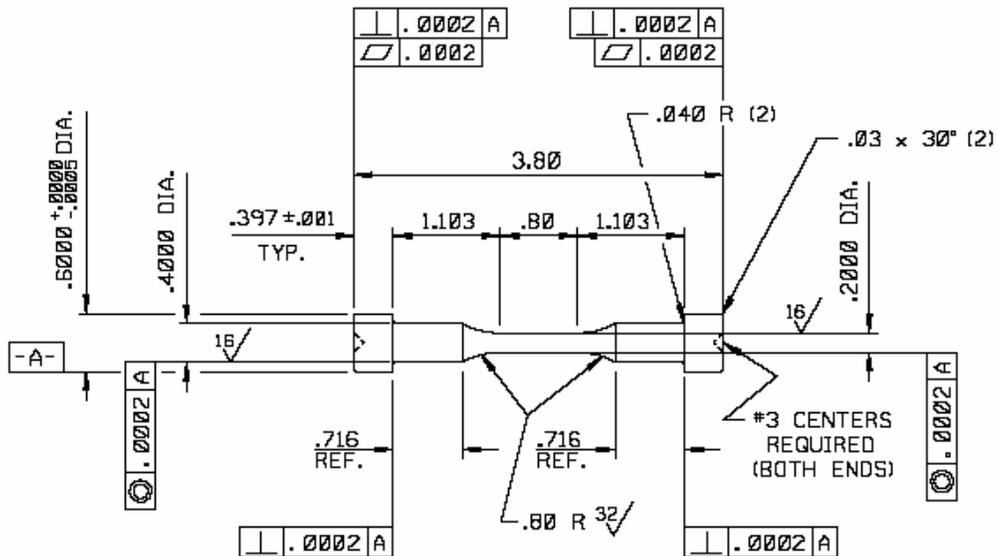
- Proposed sample size:

- 0.175" (4.45 mm) Pin Diameter
- 0.350" (8.89 mm) Thick
- 1.000" (25.40 mm) Front to Back
- 0.820" (20.83 mm) Height
- 0.385" (9.78 mm) Pin-to-Pin
- Temperature to 1000 C.



1.10.3 High Temperature Buttonhead Fixture

- Custom high temperature buttonhead fixture to 1000 C.



NOTE: grips not shown, sample only.

2. MTS manipulator

- One angular rotation (ϕ)
 - o Huber 420
 - o 360 degree rotation.
 - o Huber 420.
- 4 translations (X1, Z1, X2, Y).
 - o X1/Z1 allow sample to be positioned within center of ϕ rotation (COR).
 - From THK.
 - Linear encoders
 - Resolution 1 micron
 - o Y gives vertical translation
 - Custom built
 - Positional encoder to be added
 - o X2 used to put x-ray beam on COR.
 - From THK
 - Linear encoder
 - Resolution 1 micron
- Additional tilt can be added (± 5 degrees, Huber stage)

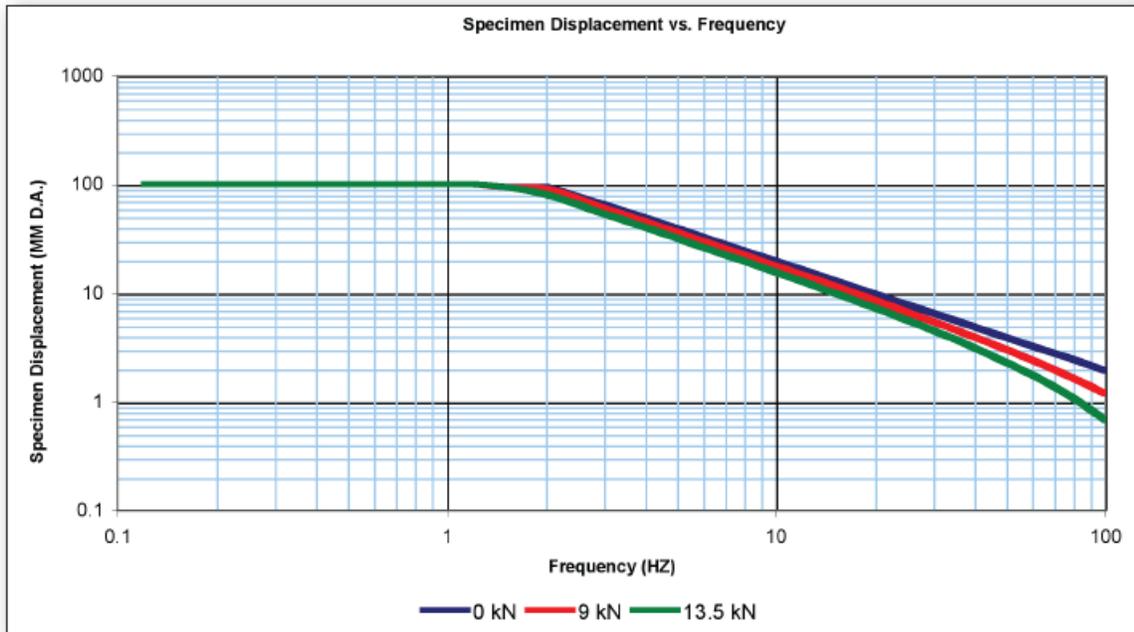
3. Theoretical performance specs of MTS

- NOTE: MTS does not guarantee these specs for the custom configuration used here. Rather, these can be treated as 'best case' scenario.
- The following information can be found at:
- http://www.mts.com/stellent/groups/public/documents/library/dev_002083.pdf

From MTS:

The graphs on the following pages illustrate the dynamic performance characteristics of a sampling of configurations available for the 810 and 858 systems. Actual performance will depend upon the

specimen under test, grips and fixtures employed, and the components selected in your system. MTS can assist you in configuring a system to meet your test requirements.

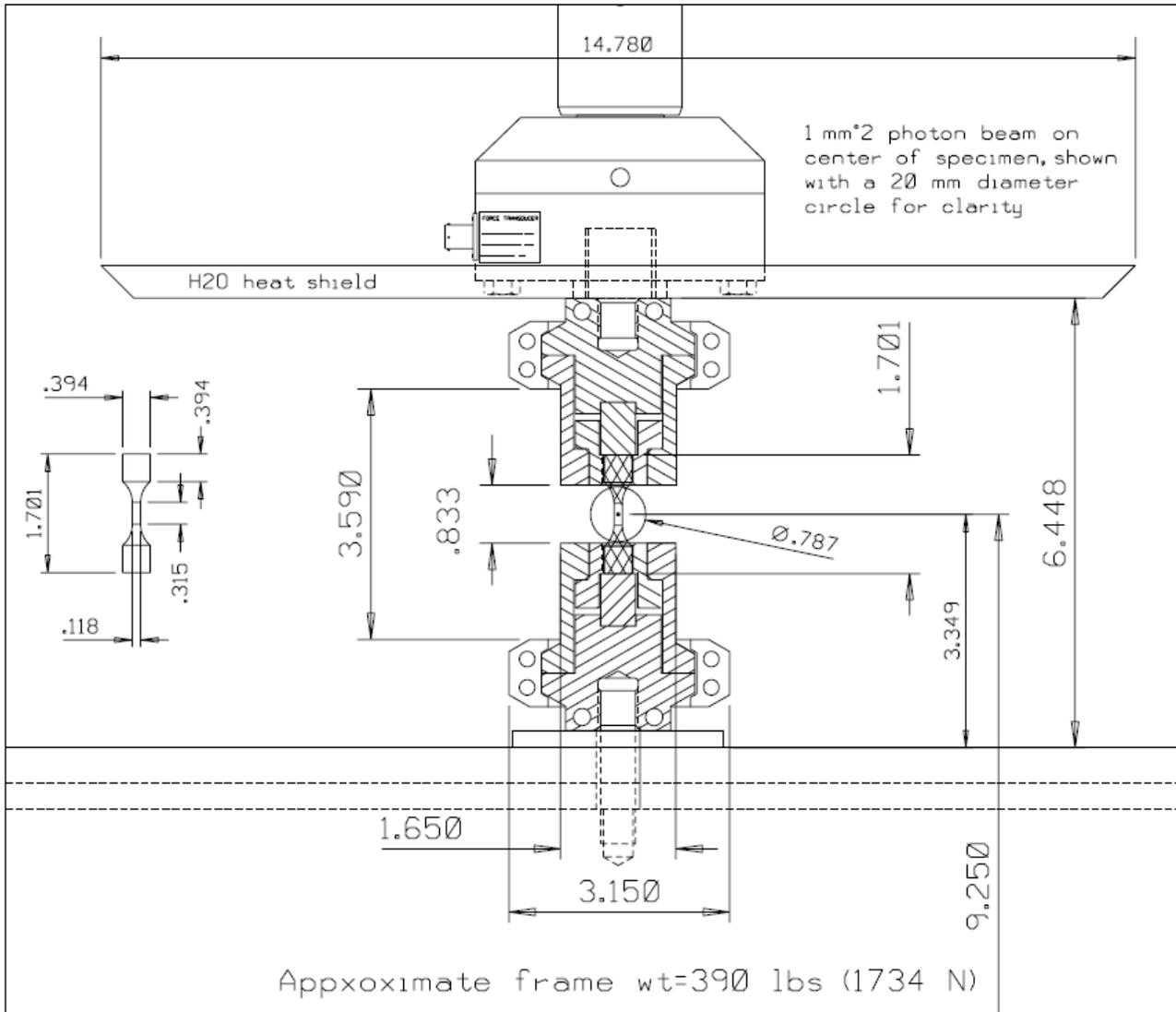


Load Frame Model: 359
Actuator Static Force: 25 kN (5.5 kip)
Actuator Nominal Stroke: 15 kN (3.3 kip)
System Oil Pressure: 100 mm (4 inches)
 210 bar (3000 psi)

Servo Valve(s): 252.23G x (1) 19 lpm (5 gpm)
Grip: 647.01 4.1 kg (9.0 lbs.)
HPU: 505.07 60 Hz 26.5 lpm (7 gpm)

4. Additional schematics and photos

4.1. Details of grip assembly for custom threaded samples



4.3 Photos of unit & manipulator, April 2007



