ADDENDUM #1
ISSUE DATE: **February 23, 2023**

RE: **ENGINEERING HALL EXPERIMENTAL MECHANICS LAB RENOVATION**
UNIVERSITY OF WISCONSIN - MADISON
UWSA Project No. **A-22-006**

BID OPENING: For MEP BIDDERS: 2:00 P.M., THURSDAY, MARCH 02, 2023

For GENERAL PRIME CONTRACTORS: 2:00 PM, THURSDAY, MARCH 16, 2023

FROM: **Hammel, Green and Abrahamson, Inc. Architects and Engineers**
333 East Erie Street
Milwaukee, WI 53202

TO: Prospective Bidders

This addendum forms a part of the Contract Documents and modifies the original Contract Documents dated **February 1, 2023** as noted below. Acknowledge receipt of this Addendum by inserting the number and issue date of this addendum in the blank space provided on the Bid Form. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of 50 pages. This text document of two (2) pages and attached Lab Equipment Cutsheets of 48 pages for the total of 50 pages.

PREBID WALKTHROUGH (occurred on Friday, February 17, 1:00 p.m.) QUESTIONS AND ANSWERS:

1. Question was asked about clarifying the Material Identification Codes (Material IDs) on the Finish Plan (A261) and how to find the information that details the specific materials?
   Response: The Material IDs listed on the Finish Plans, Elevations and Details are all referenced on Sheet 010 – 'General Notes and Symbols.' This Sheet contains the 'Material Identification Code List' which outlines the ID Code, a description of the material, and the specification section number to reference full details and requirements of the product.
2. Question was asked if the architect could provide the Equipment Cut Sheets for the lab equipment listed on Sheet A241 – 'Equipment Plan'?
   Response: the equipment cutsheets are attached for reference/informational use as a pdf document in this Addenda.

CHANGES TO BIDDING REQUIREMENTS:

3. NONE in this Addendum

CHANGES TO SPECIFICATIONS (DIVISIONS 2 THRU 28):

1. 09 54 54 Linear Wood Ceiling <WD CLG-2>
   a. Page 095454-1, Section 2.1, Part A, add accepted manufacturer "ASI Linear."

CHANGES/ADDITIONS TO DRAWINGS:

1. NONE in this Addendum.

END OF ADDENDUM

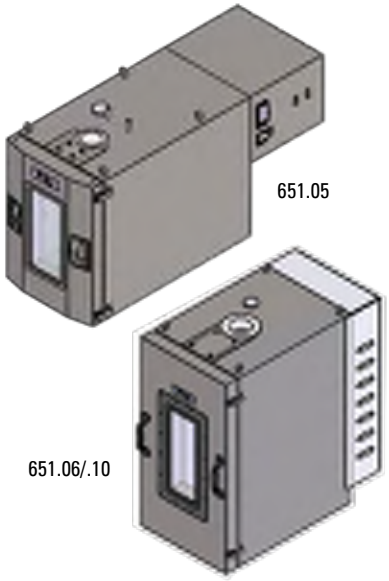
Hammel, Green and Abrahamson, Inc. Architects and Engineers
333 East Erie Street
Milwaukee, WI 53202

For the Board of Regents of the University of Wisconsin
On Behalf of the University of Wisconsin – Madison
1860 Van Hise Hall, 1220 Linden Drive
Madison, Wisconsin 53703

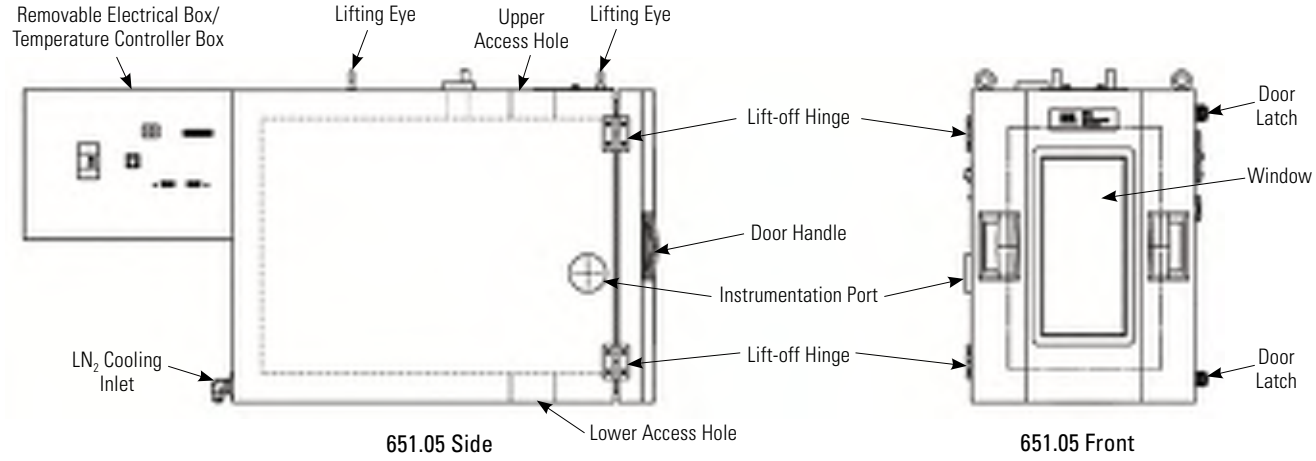
Engineered for Dependable Operation

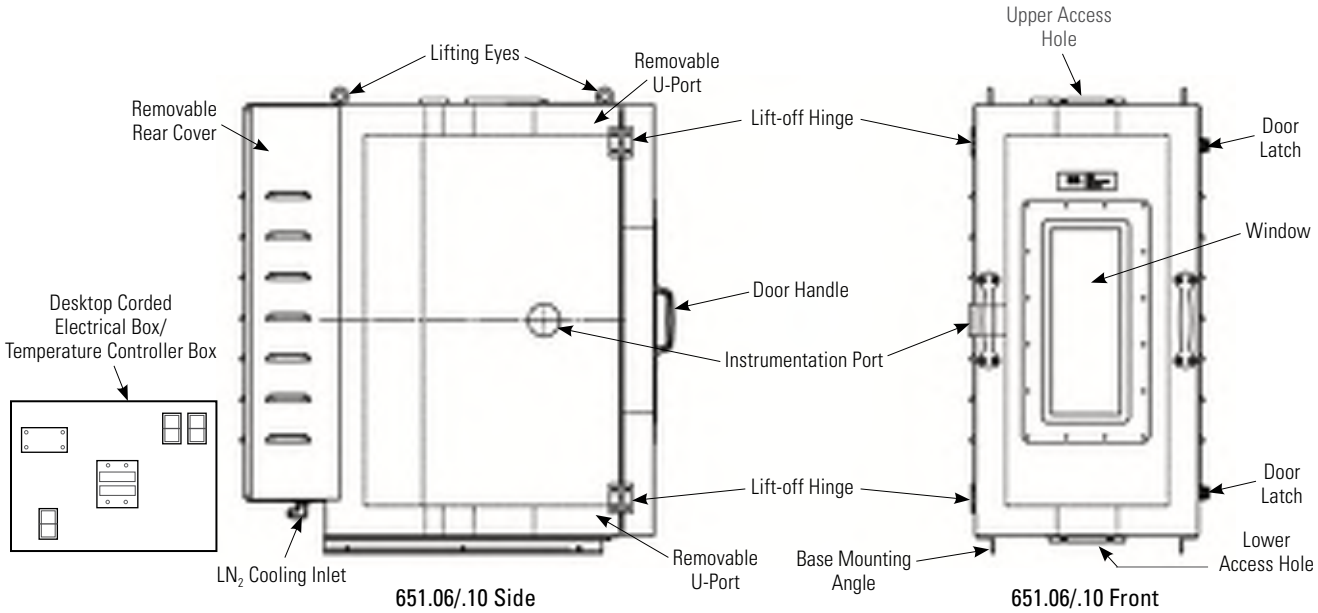
Every aspect of Series 651 Environmental Chambers was designed using decades of MTS experience developing test systems for numerous industries. These environmental chambers may include:

- Circulating fan helps ensures small specimen temperature gradients
- Removable "U-plug" sections allowing chambers to be moved into place after the specimen is mounted and instrumented
- Doors that open to 180° or can be lifted away for convenient specimen access
- Multi-panel, tempered optical quality glass windows are sealed to reduce fogging and frosting. If required for non-contacting strain measurement solutions or video monitoring, the chambers can be provided with optional defrost elements
- Internal light to illuminate the test area is supported by 651.05 & .06. 651.10 chambers have an external light mounted to the chamber window / door
- Mobile carts to prevent interference between chambers and the load frame



Generic Series 651 Schematic





Choose from an Extensive Portfolio

Series 651 chambers support a wide range of tests, applications and test system configurations.

Model 651.05F-01 works in a variety of general materials testing applications -151°C (-238°F) up to 350°C (662°F) with floor-standing models of the MTS Acumen test system.

Model 651.05F-02 is ideal for general materials testing applications -151°C (-238°F) up to 350°C (662°F) with tabletop models of the MTS Acumen test system.

Model 651.06E-03 handles general materials testing -129°C (-200°F) up to 315°C (600°F) with floor-standing MTS Landmark test systems.

Model 651.10E-04 offers support for general materials testing -129°C (-200°F) up to 540°C (1000°F) with floor-standing MTS Landmark test systems.

Model 651.06E-04 is designed to accommodate large specimens or specimens that require large grips within the chamber. Works -129°C (-200°F) up to 315°C (600°F) with floor-standing MTS Landmark test systems.

CUSTOM CHAMBER DESIGN

MTS can design and build custom chambers for use with mechanical refrigeration, humidity control, salt spray and other applications as well as in special sizes to suit unique testing requirements, including integration with other test systems. Contact MTS for more details.

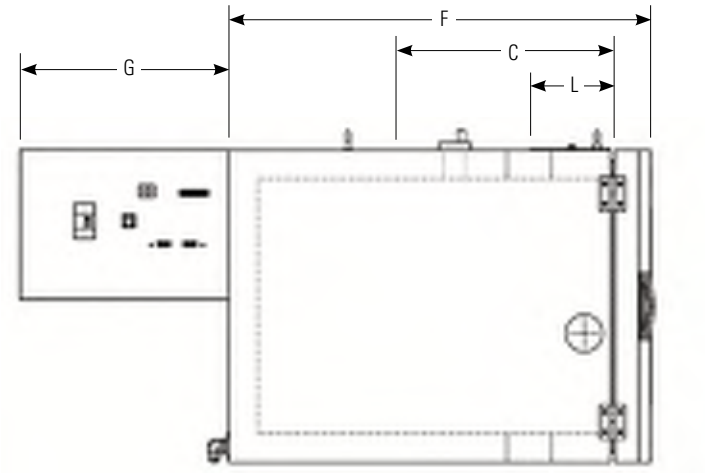
651.05F-02

651.05F-01

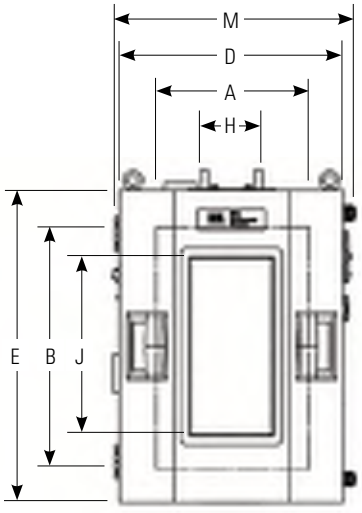
651.06/.10

Sized to Accommodate any Specimen

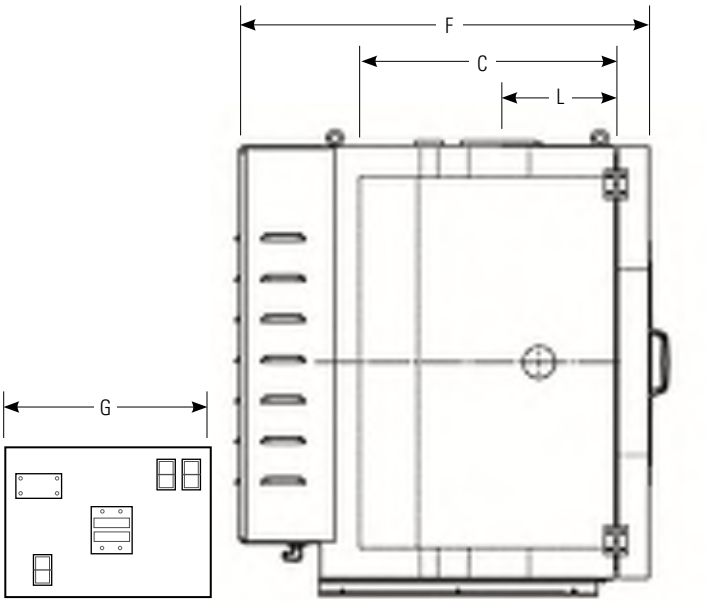
Series 651 chambers provide the sizes test teams need to perform accurate environmental testing on an array of specimens.



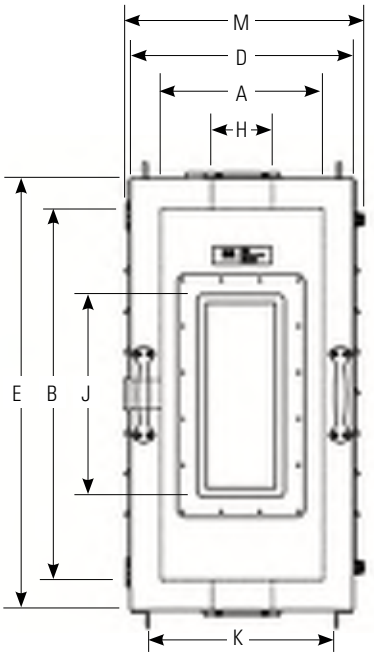
651.05 Side



651.05 Front



651.06/.10 Side



651.06/.10 Front

651 Dimensions

Model		A	B	C	D	E	F*	G*	H	J	K	L	M
651.05F-01	mm	216	228	228	343	356	968	254	64	152	–	122	381
	in	8.5	9	9	13.5	14	38.1	10	2.5	6	–	4.8	15
651.05F-02	mm	286	452	305	419	584	1173	388	78	330	–	152	457
	in	11.25	17.8	12	16.5	23	46.2	15.30	3.06	13	–	6	18
651.06E-03	mm	356	559	432	489	692	897	508	102	305	397	254	524
	in	14	22	17	19.25	27.25	35.31	20	4	12	15.64	10	20.63
651.06E-04	mm	356	813	432	489	946	897	508	102	406	397	254	524
	in	14	32	17	19.25	37.25	35.31	20	4	16	15.64	10	20.63
651.10E-04	mm	356	660	432	514	845	948	508	102	305	397	254	528
	in	14	26	17	20.25	33.25	37.31	20	4	12	15.64	10	20.79

** Dimensions shown are approximate Dimensions shown in millimeters are rounded to closest millimeter.*

MTS reserves the right to change dimensions without notice.

651 Specifications

Model	651.05F-01	651.05F-02	651.06E-03	651.06E-04	651.10E-04
Load Frame	Acumen 1 Acumen 3	Landmark Bionix Acumen 3	Landmark	Landmark	Landmark
Chamber part number	058-052-704 (US Plug) 058-052-703 (WW Plug)	058-052-702 (Acumen, US Plug) 058-052-701 (Acumen, WW Plug) 058-052-602 (w/table top legs, US Plug) 058-052-601 (w/table top legs, WW Plug)	100-639-950 (works with 494 FlexTest Controller 100-639-951 (works with 494 FlexTest Controller) *(will be supplied with defrosting elements for the window)*	100-639-952 (works with 494 FlexTest Controller 100-639-953 (works with 494 FlexTest Controller) *(will be supplied with defrosting elements for the window)*	100-639-954 (works with 494 FlexTest Controller 100-639-955 (works with 494 FlexTest Controller) *(will be supplied with defrosting elements for the window)*
Cart part number¶	100-294-319# 100-297-346	100-294-319# 100-297-346	100-160-646 100-213-156**	100-160-646 100-213-156**	100-160-646 100-213-156**
Test space (nominal)	216 mm W, 228 mm D, 228 mm H (8.5 in W, 9 in D, 9 in H)	286 mm W, 305 mm D, 457 mm H (11.25 in W, 12 in D, 18 in H)	356 mm W, 432 mm D, 559 mm H (14 in W, 17 in D, 22 in H)	356 mm W, 432 mm D, 813 mm H (14 in W, 17 in D, 32 in H)	356 mm W, 432 mm D, 660 mm H (14 in W, 17 in D, 26 in H)
Removable "U-Plug" sections	Not included	Included	Included	Included	Included
Typical application	Material testing, including fatigue and fracture, tension, compression, flex/bend, etc.				
Air temperature performance*					
Temperature Values (min & max)	-151°C (-238°F) to 350°C (662°F)	-151°C (-238°F) to 350°C (662°F)	-129°C (-200°F) to 315°C (600°F)	-129°C (-200°F) to 315°C (600°F)	-129°C (-200°F) to 540°C (1000°F)
Heating	Ambient to +350°C (+660°F) in 45 minutes	Ambient to +350°C (+660°F) in 45 minutes	Ambient to +315°C (+600°F) in 30 minutes	Ambient to +315°C (+600°F) in 30 minutes	Ambient to +540°C (+1000°F) in 70 minutes
LN_2 cooling	Ambient to -151°C (-238°F) in 45 minutes	Ambient to -151°C (-238°F) in 45 minutes	Ambient to -129°C (-200°F) in 26 minutes	Ambient to -129°C (-200°F) in 26 minutes	Ambient to -129°C (-200°F) in 26 minutes
Temperature gradient †, ‡	±3°C or less	±3°C or less	±2°C (±5°F)	±2°C (±5°F)	±2°C (±5°F) from -129° to 260°C (-200° to 500°F) ±5°C (±10°F) from 260° to 540°C (500° to 1000°F
Temperature stability †	±2°C (±5°F)	±2°C (±5°F)	±1°C (±3°F)	±1°C (±3°F)	±1°C (±3°F)
Cooling requirements					
LN_2 cooling inlet fitting	Male 1/2 in SAE 45° flare 90° angle tube fitting	Male 1/2 in SAE 45° flare 90° angle tube fitting	Male 1/2 in SAE 45° flare 90° angle tube fitting	Male 1/2 in SAE 45° flare 90° angle tube fitting	Male 1/2 in SAE 45° flare 90° angle tube fitting
LN_2 pressure	0.15 MPa (22 psi nominal) 0.21 MPa (30 psi max)	0.15 MPa (22 psi nominal) 0.21 MPa (30 psi max)	0.15 MPa (22 psi nominal) 0.21 MPa (30 psi max)	0.15 MPa (22 psi nominal) 0.21 MPa (30 psi max)	0.15 MPa (22 psi nominal) 0.21 MPa (30 psi max)
Heater circuit power	208/230 V AC	208/230 V AC	208/230 V AC	208/230 V AC	208/230 V AC
Requirements	50/60 Hz, single-phase; 20 A circuit	50/60 Hz, single-phase; 20 A circuit	50/60 Hz, single-phase; at least 25 A circuit	50/60 Hz, single-phase; at least 25 A circuit	50/60 Hz, single-phase; at least 35 A circuit
Weight	82 kg (180 lbs)	108 kg (250 lbs)	102 kg (225 lbs)	159 kg (350 lbs)	136 kg (300 lbs)
Light	None	120 V bulb (40 watt recommended)	115 V bulb (40 watt recommended)	115 V bulb (40 watt recommended)	External 115 V bulb (40 watt recommended)

** Performance data derived with chamber empty and access holes blocked. Consult MTS Systems Corporation for temperature performance for testing specimens having high thermal mass.*

*** For Landmark 370.50 only.*

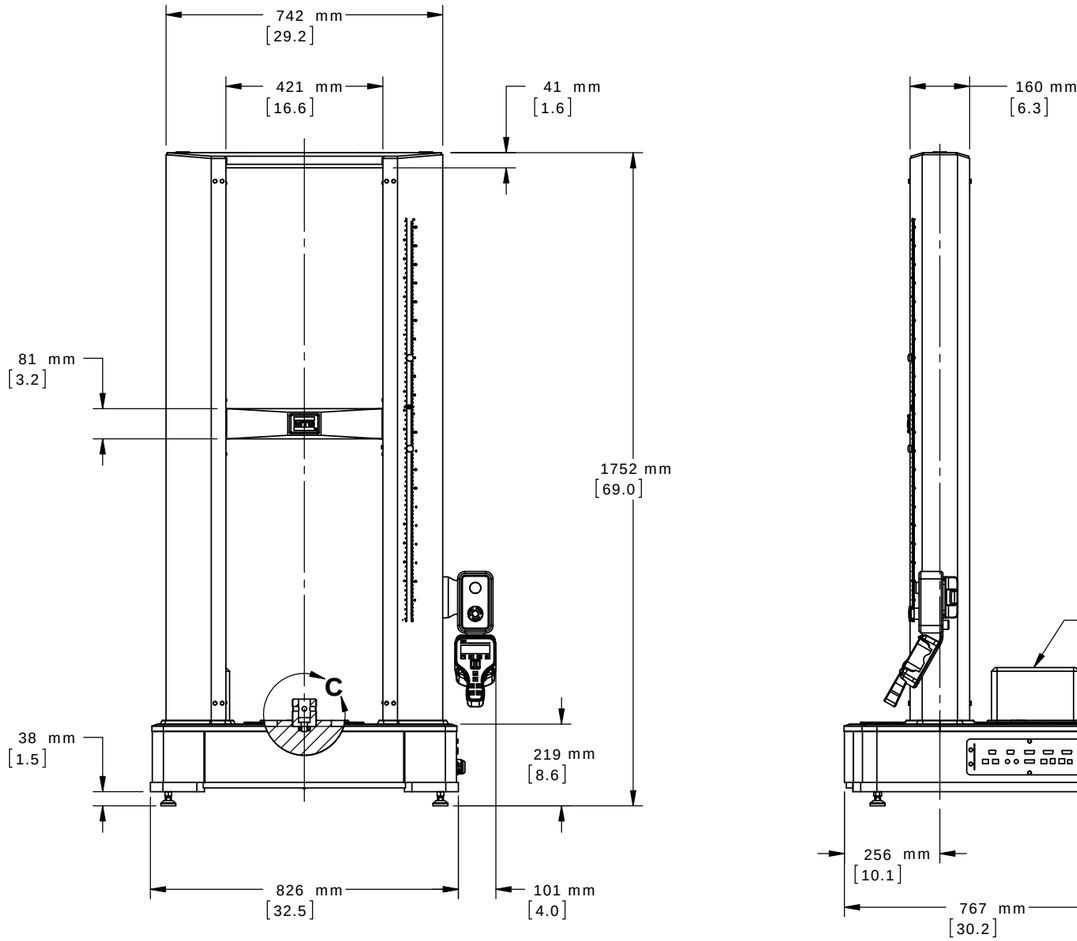
¶ Consult MTS for cart information specific to your configuration.

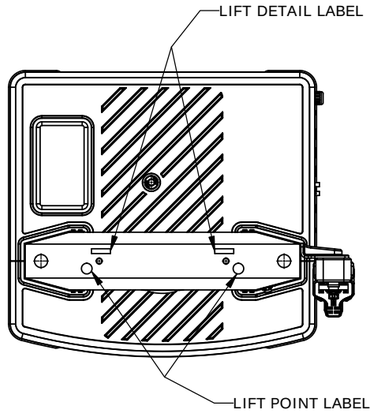
 # Cart stand for table top load units.

† After 30 minute stabilization time.

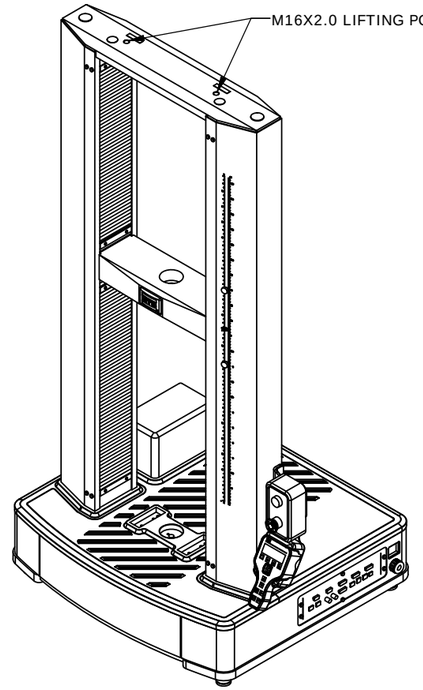
‡ Due to large variety of possible test setups an air gradient is given. Specimen gradient is much less.

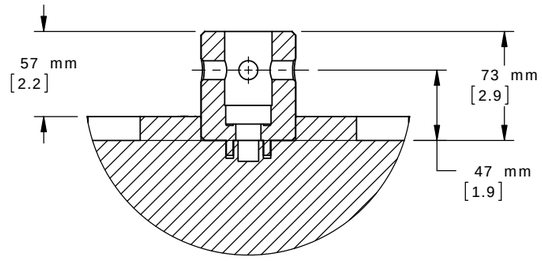
M002





TOP VIEW
SCALE 1 : 8





DETAIL C
SCALE 1 : 2

Includes:

1. Load frame
2. Controller
3. Handset
4. USB cable, handset cable
5. Enclosure jumper J11
6. Interlock jumper J14
7. Handset holder
8. Lower D clevis
9. D clevis pin (2)
10. J3 connector
11. Shipping Document binder
12. J5 to J12 jumper
13. Wrench
14. Rubber Mat
15. Loadcell Cable

REVISIONS

DESCRIPTION	DRAWN	ENGR	DATE	LETTER	ECN NO
-ADD MOUNTING DIMENSIONS FOR CROSSHEAD AND BASEPLATE. -ADD LOADCELL CABLE TO INCLUDES LIST.	RWF	JKS	4/22/13	B	500009391
REMOVED BOM FROM PART NUMBER BUT LEFT IT WITH A PLACEHOLDER TO CONTACT ERC IF QUESTIONS ARISE.	MAS	KJG	7/6/2015	C	500033922
-CHANGE LIFTING POINT TO M16X2.0 -ADDED LIFT LABELS -CHANGED TITLE IN TITLE BLOCK	TJA	SPS	8/30/16	D	500050982

-

SOURCE/REF DRAWING -

PROPRIETARY DATA

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UNLESS OTHERWISE SPECIFIED

MATERIAL DESCRIPTION: -----

MATERIAL SIZE: -----

FINISH: ----- MASK

- THREAD DEPTHS ARE TO MIN FULL THDS
- DRILL DEPTHS ARE TO FULL DIA
- REMOVE BURRS AND SHARP EDGES
- DO NOT SCALE PRINT

SCALE NONE

MACHINED SURFACES 180√

GENERAL TOLERANCES: ANGLE ±2° | X/Y ±1/4 | .X ±.1 | .XX ±.03 | .XXX ±.010

.XXX HOLE SIZE TOLERANCE: 0.000 TO .750 +.010/-.002; OVER .750 TO 1.500 +.015/-.003

THIRD ANGLE PROJ

MTS SYSTEMS CORPORATION
EDEN PRAIRIE, MINNESOTA U.S.A.

DRAWN	CHECK	ENGR	MFG
JJM	-	JKS	-
DATE 07-05-11	DATE -	DATE 07-05-11	DATE -

TITLE: WORKSTATION,E/M,50KN,C43.504

NEXT LEVEL: -----

SIZE: D

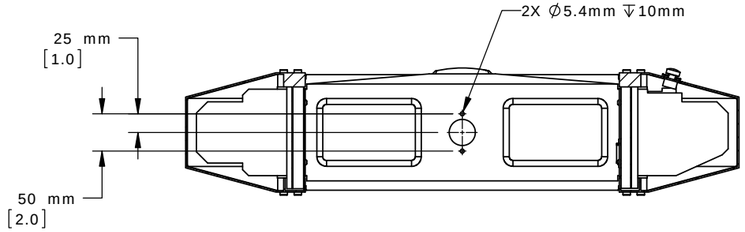
NUMBER: 100-230-704

REV: D

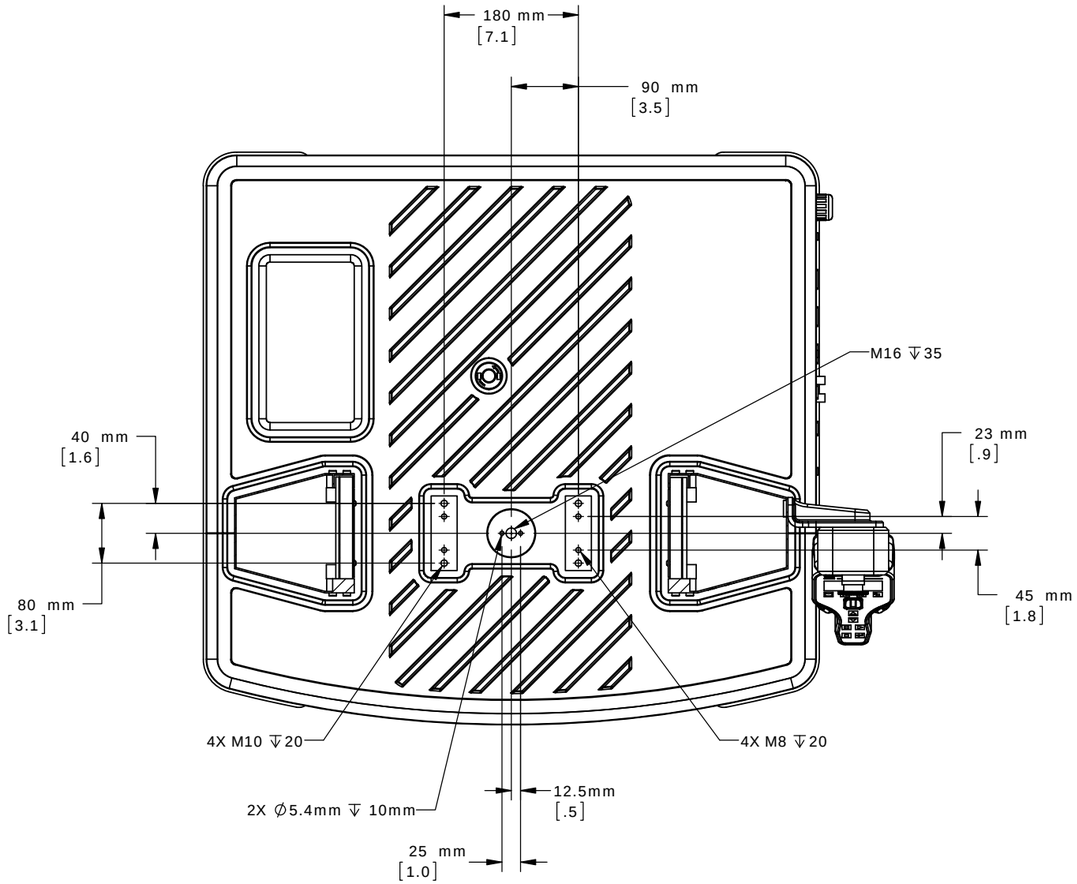
PRODUCT CODE: -----

SHEET 1 OF 2

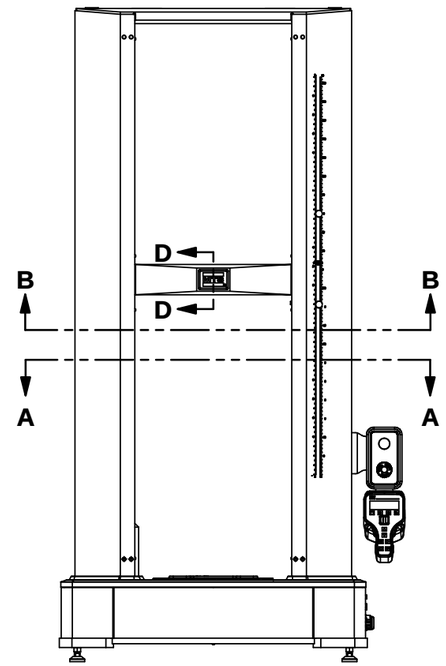
Model: C43.504		
Maximum Rated Force Capacity	kN,lbf	50 kN, 11000 lbf
Force Capacity Options	N, kN	100 N, 250 N, 500 N
		1 kN, 2.5 kN, 5 kN, 10 kN
		20kN, 30kN, 50 kN
	lbf	20, 50, 110, 220
		500, 1100, 2200
		4400, 6600, 11000
Frame Type	guide Columns	2
	loor-Standing/Bench-Top	Bench-Top
Test Zones	Single/Dual	Single
Maximum Test Speed	mm/min	750
	in/min	30
Minimum Test Speed	mm/min	0.005
	in/min	0.0002
Position resolution	mm	0.00006
	in	0.0000024
Power requirements	V AC	200 - 230 V AC,
		12 Amps,
		50 / 60 Hz,
		2400 W
	Phase	1
Space Between Columns	mm	420
	in	16.54
vertical Test Space		
Crosshead to Baseplate		
Standard Length	mm	1200
	in	47.2
Crosshead Travel		
Standard Length	mm	1000
	in	39.37
Frame Height		
Standard Length	mm	1739
	in	68.46
Frame Width	mm	826
	in	32.52
Frame Depth	mm	768
	in	30.24
Weight		
Standard Length	kg	328
	lb	722
Shipping information		
Standard length Frame Dimensions - Crated (estimated)	mm	1970 x 1100 x 1120
	in	77.56 x 43.31 x 44.09
Weight - Crated	kg	600
	lb	1320

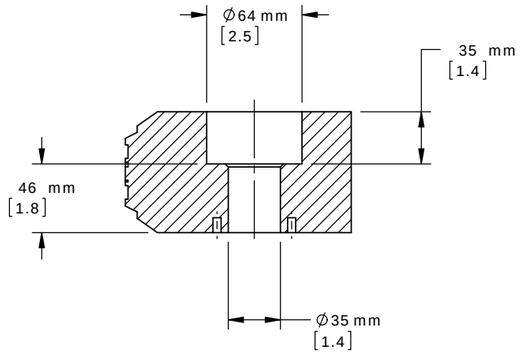


SECTION B-B
SCALE 1 : 4



SECTION A-A
SCALE 1 : 4





SECTION D-D
SCALE 1 : 2

M002

REVISIONS

DESCRIPTION	DRAWN	ENGR	DATE	LETTER	ECN NO
SEE SHEET 1					

-

SOURCE/REF DRAWING -

PROPRIETARY DATA

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UNLESS OTHERWISE SPECIFIED

MATERIAL DESCRIPTION -----

MATERIAL SIZE -----

FINISH ----- MASK

- THREAD DEPTHS ARE TO MIN FULL THDS
- DRILL DEPTHS ARE TO FULL DIA
- REMOVE BURRS AND SHARP EDGES
- DO NOT SCALE PRINT

SCALE NONE

MACHINED SURFACES 180√

.XXX HOLE SIZE TOLERANCE: 0.000 TO .750 +.010/-.002; OVER .750 TO 1.500 +.015/-.003

GENERAL TOLERANCES: ANGLE ±2°; X/Y ±1/4; .X ±.1; .XX ±.03; .XXX ±.010

THIRD ANGLE PROJ

	DRAWN	CHECK	ENGR	MFG
	JJM	-	JKS	-
DATE	07-05-11	-	07-05-11	-

TITLE: WORKSTATION,E/M,50KN,C43.504

NEXT LEVEL -----

PRODUCT CODE -----

SIZE D

NUMBER 100-230-704

REV D

SHEET 2 OF 2

MTS SYSTEMS CORPORATION
EDEN PRAIRIE, MINNESOTA U.S.A.

M003

MTS Bionix® Tabletop Test Systems

Flexible, easy-to-use servohydraulic test systems feature Model 370.02 load frames in axial and axial/torsional configurations for characterizing biomaterials and medical components

be certain.

Versatile Performance, Compact Design

Complete solutions designed for biomedical testing

Biomedical researchers and manufacturers rely on innovative biomaterials and components to help patients around the world achieve greater mobility and a higher quality of life. Before they are even used in clinical situations, these materials and components require rigorous testing to validate both performance and durability. Mechanical testing is also essential for ensuring compliance with industry and regulatory standards.

MTS Bionix® tabletop test systems are engineered to meet this need. These compact servohydraulic systems are particularly suited to evaluating the dynamic properties of an extensive range of biomedical materials and components. Highly versatile and easy to operate, Bionix tabletop test systems offer everything required to perform a full array of mechanical tests for biomedical applications, including highly stiff load frames, precise digital controls, proven software and a wide selection of grips, fixtures and extensometers.

Common Applications

BIOMATERIAL CHARACTERIZATION

- Yield and ultimate strength
- Creep and viscoelastic characteristics
- Fatigue characteristics
- Fracture toughness and fracture mechanics
- Modulus of elasticity
- Poisson's ratio
- Wear characteristics
- Coefficient of thermal expansion
- Response characteristics

BIOMECHANICAL COMPONENT TESTING

- Fatigue certification studies
- Bone, joint and soft tissue studies
- Implantable orthopaedic device studies
- External prostheses studies
- In vitro biomaterials studies

SIMULATION OF BIOLOGICAL FORCES

- Kinematic studies of the knee joint
- Wear studies of hip and knee implant materials
- Biaxial spine studies
- Upper body joint studies
- Dental wear simulation
- Biaxial fatigue of orthopaedic implants

Axial/Torsional

The axial/torsional configuration of the Bionix tabletop system enables biaxial testing, controlling torsional moments up to ±250 N·m (±2200 lbf·in) and total rotations of 270°. It is excellent for testing the durability and wear properties of components such as knee, hip and spine implants. When paired with specialized subsystems and accessories, it is capable of performing both simple and complex kinematics studies of skeletal tissue and orthopaedic constructs.

Axial

The axial configuration of the Bionix tabletop test system can be used to perform accurate and repeatable fatigue life and fracture growth studies, as well as tension, bending and compression tests of biomaterials. It runs tests up to ±25 kN (5.5 kip) with standard displacements of ±50 mm (± 2 in.), and can easily be configured for monotonic or fatigue testing.

Axial/Torsional Load Frame

Axial Load Frame

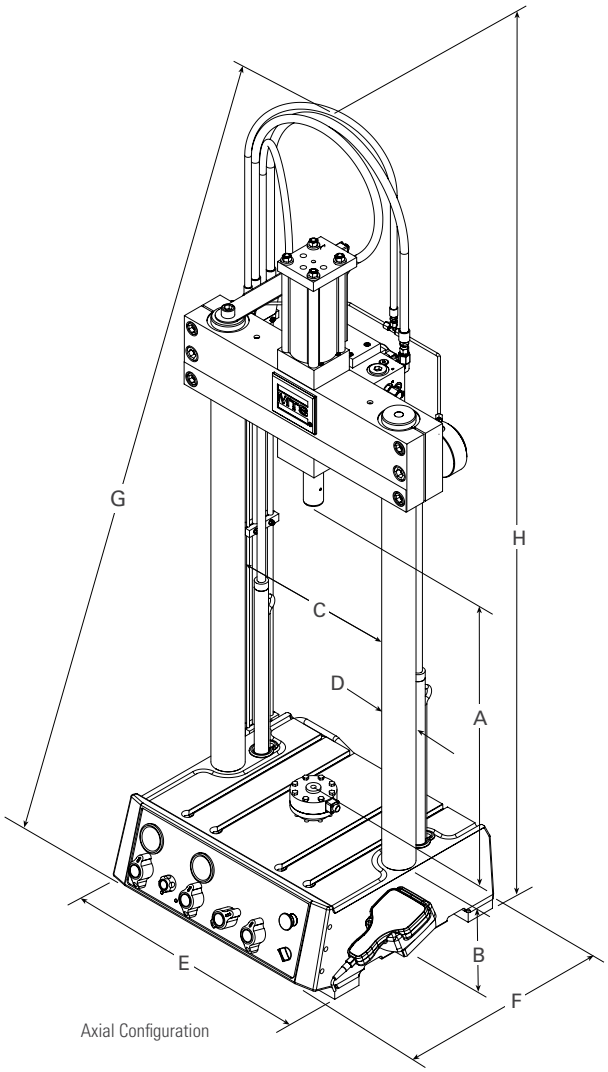
Expert Service and Support

Comprehensive assistance ensures smooth, efficient operation

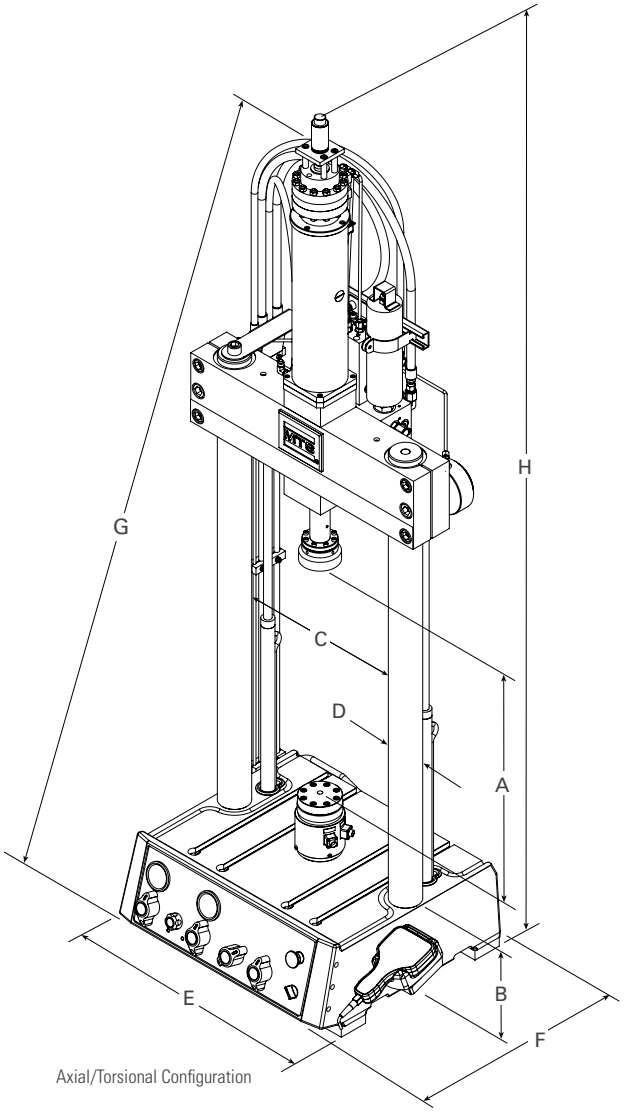
MTS fields one of the largest, most experienced service, support and consulting staff of any testing solution provider, to ensure your lab is quickly maximizing the utility of your system.

Trained technicians perform installation and operational checkout at your site and conduct informal, one-one-one training on operation and basic maintenance procedures. A software technical support and maintenance contract for your controller software is available with each system. A system warranty is included; with extended warranty contracts also available.

Depending on the plan you select, field service may include calibration, routine maintenance, extended system warranty service and priority technical support. MTS also provides extensive, regularly scheduled training programs conducted at MTS or your facility to ensure operators are familiar with all the capabilities of the hardware and software. To meet unique testing objectives, MTS testing expertise can help you develop custom test templates. In addition, our global service team also offers complete life cycle management to maximize the return on your technology investment and help you address new test requirements as cost-effectively as possible.



Axial Configuration



Axial/Torsional Configuration

Load Frame Specifications

Bionix tabletop test systems incorporate Model 370.02 load frames that are available in standard or extended heights.

			MODEL	
Load Frame Specifications	**Diagram Detail**	**Units**	**370.02 Axial**	**370.02 Axial / Torsional**
Force capacity (rated dynamic force)		kN	**25**	**25 kN / 250 N·m**
		(kip)	(5.5)	(5.5 kip / 2200 lbf·in)
Available actuator ratings[1]		kN	**15**, 25	**15 kN / 150 N·m**
				25 kN / 250 N·m
		(kip)	(**3.3**, 5.5)	**(3.3 kip / 1300 lbf·in)**
				(5.5 kip / 2200 lbf·in)
Actuator dynamic stroke[1]		mm	**100**, 150	**100 mm / 270°**
				150 mm / 270°
		(in)	(**4**, 6)	(**4**, 6)
Minimum vertical test space – standard height[2]	A	mm	144	30
		(in)	(5.7)	(1.2)
Maximum vertical test space – standard height[3]	A	mm	827	714
		(in)	(32.6)	(28.1)
Minimum vertical test space – extended height[2]	A	mm	398	284
		(in)	(15.7)	(11.2)
Maximum vertical test space – extended height[3]	A	mm	1335	1222
		(in)	(52.6)	(48.1)
Working height[4]	B	mm	230_{8}	230_{8}
		(in)	(9.1)	(9.1)
Column spacing (test space width)	C	mm	460	460
		(in)	(18.1)	(18.1)
Column diameter	D	mm	76.2	76.2
		(in)	(3)	(3)
Base width	E	mm	622	622
		(in)	(24.5)	(24.5)
Base depth	F	mm	577	577
		(in)	(22.7)	(22.7)
Diagonal clearance – standard height[5]	G	mm	1750_{8}	1750_{8}
		(in)	(68.9)	(68.9)
Diagonal clearance – extended height[5]	G	mm	2250_{8}	2250_{8}
		(in)	(88.6)	(88.6)
Overall height – standard height[6]	H	mm	1989_{8}	$2185_{8,9}$
		(in)	(78.3)	(86)
Overall height – extended height[6]	H	mm	2624_{8}	$2693_{8,9}$
		(in)	(103.3)	(106)
Stiffness[7]		N/m	345×10^{6}	345×10^{6}
		(lbf/in)	(1.95×10^{6})	(1.95×10^{6})
Weight		kg	248	322
		(lb)	(547)	(710)

1. All load frame specifications listed in this chart are based upon the actuator ratings and dynamic stroke values indicated by bold text.

2. Minimum Vertical Test Space: Span between load cell and piston rod face when fully retracted at beginning of the dynamic stroke; crosshead down, no alignment fixture.

3. Maximum Vertical Test Space: Span between load cell and piston rod face when fully retracted at beginning of the dynamic stroke; crosshead up, no alignment fixture.

4. Working Height: Tabletop to top of T-slot table; includes standard FabCell isolation.

5. Diagonal Clearance: Hose height to tip of foot with FabCell; crosshead down.

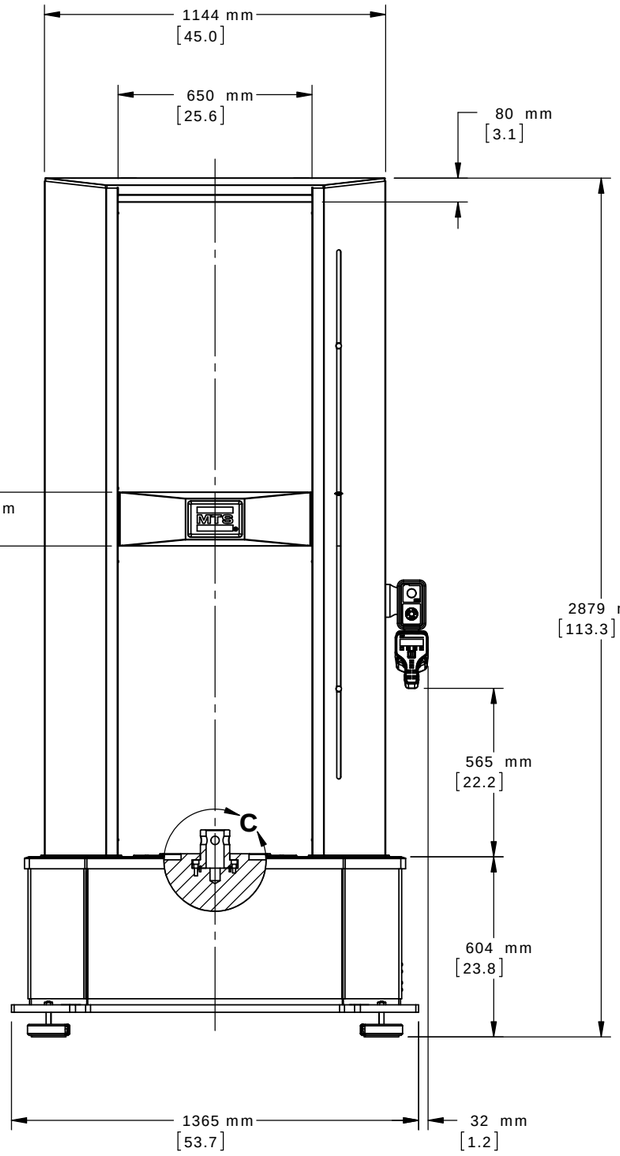
6. Overall Height: From tabletop surface, including standard FabCell isolation, to top of the hoses or highest point on actuator; crosshead fully raised.

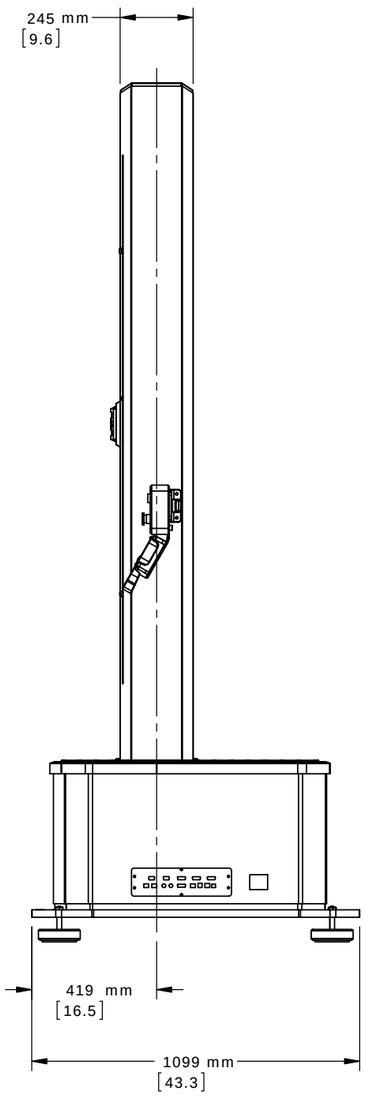
7. Measured at crosshead height of 600 mm (23.6 in).

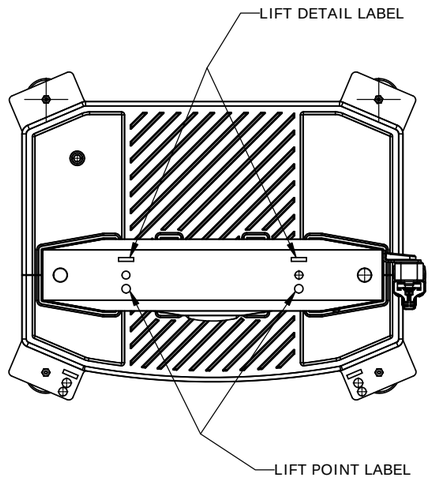
8. For load frames with optional pneumatic /elastomeric vibration isolation mounts, add 37 mm (1.44 in) to dimensions B, G, and H.

9. For axial/torsional frames, add 152 mm (6 in) to dimension H, for 150 mm (6 in) stroke actuator.

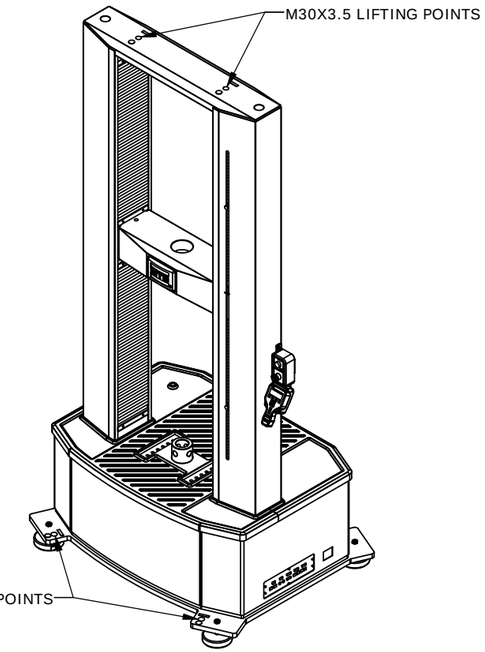
M004

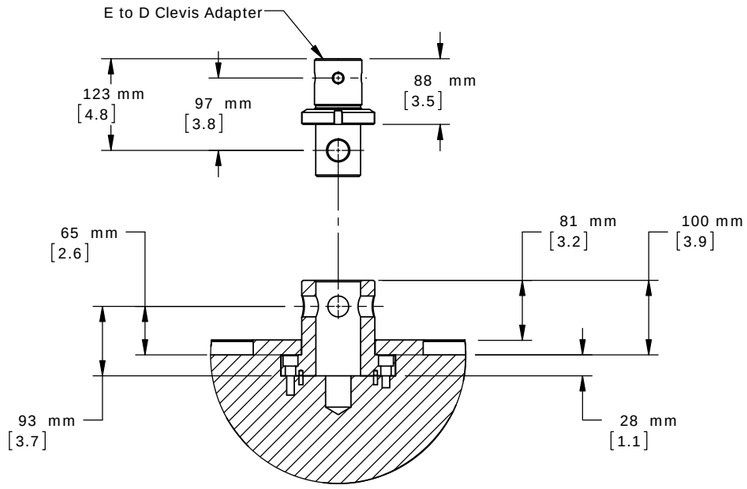






TOP VIEW
SCALE 1 : 10





DETAIL C
SCALE 1 : 4

Includes:

1. Load Frame
2. Controller
3. Handset
4. USB Cable, Handset Cable
5. Enclosure Jumper J11
6. Interlock Jumper J14
7. Handset Holder
8. Lower E Clevis
9. 2X E Clevis Pin
10. J3 Connector
11. Shipping Document binder
12. J5 to J12 jumper
13. E Clevis Wrench
14. Rubber Mat
15. Loadcell Cable
16. E to D Clevis Adapter

REVISIONS

DESCRIPTION	DRAWN	ENGR	DATE	LETTER	ECN NO
- ADD MOUNTING DIMENSIONS FOR CROSSHEAD AND BASEPLATE. -ADD LOADCELL CABLE/CLEVIS ADAPTER TO INCLUDES LIST.	RWF	JKS	4/22/13	B	500009391
- CHANGE LIFTING POINT TO M30X3.5 - ADDED TOP VIEW WITH LIFTING LABELS - CHANGED TITLE IN TITLE BLOCK -ADDED DETAIL VIEW E & F WITH LIFT LABELS AND M30X3.5 THRU	RWF	JKS	4/22/13	C	500050990

-

SOURCE/REF DRAWING -

PROPRIETARY DATA

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UNLESS OTHERWISE SPECIFIED

MATERIAL DESCRIPTION -----

MATERIAL SIZE -----

FINISH ----- MASK

- THREAD DEPTHS ARE TO MIN FULL THDS
- DRILL DEPTHS ARE TO FULL DIA
- REMOVE BURRS AND SHARP EDGES
- DO NOT SCALE PRINT

SCALE NONE

MACHINED SURFACES 180

THIRD ANGLE PROJ

.XXX HOLE SIZE TOLERANCE

0.000 TO .750 +.010/-.002	OVER .750 TO 1.500 +.015/-.003

GENERAL TOLERANCES

ANGLE	±2°
X/Y	±1/4
.X	±.1
.XX	±.03
.XXX	±.010

DRAWN	CHECK	ENGR	MFG
JJM	-	JKS	-
DATE	DATE	DATE	DATE
05-01-12	-	05-01-12	-

TITLE
WORKSTATION-
E/M,300KN,C45.305E

NEXT LEVEL -----

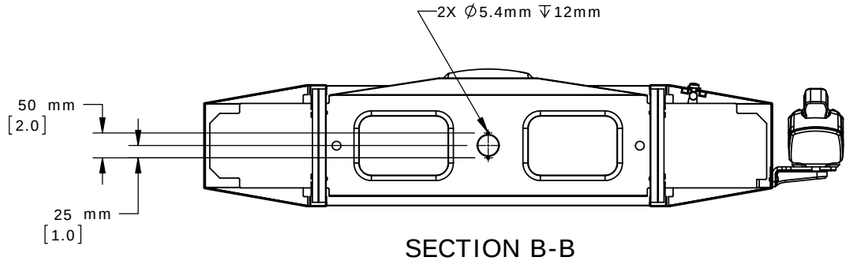
PRODUCT CODE -----

SIZE	NUMBER	REV
D	100-251-629	C

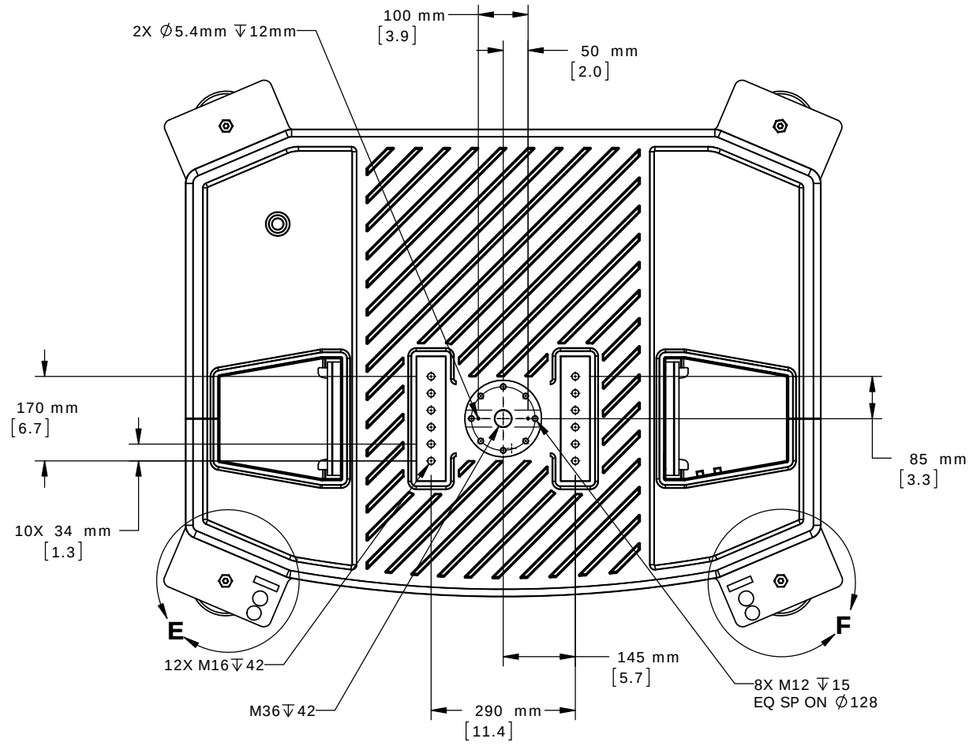
SHEET 1 OF 2

MTS SYSTEMS CORPORATION
EDEN PRAIRIE, MINNESOTA U.S.A.

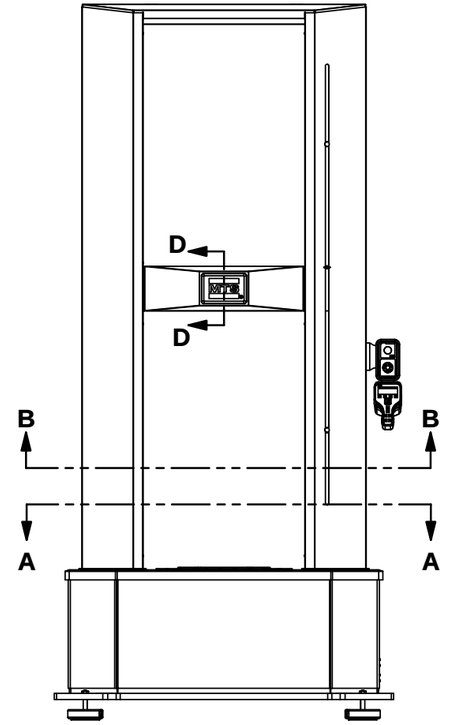
Model: C45.305E		
Maximum Rated Force Capacity	kN,lbf	300 kN, 66000 lbf
Force Capacity Options	N, kN	150 kN, 200 kN, 300kN
	lbf	33000, 44000, 66000
Frame Type	guide Columns	2
	floor-Standing/Bench-Top	Floor-Standing
Test Zones	Single/Dual	Single
Maximum Test Speed	mm/min	750
	in/min	29.53
Minimum Test Speed	mm/min	0.005
	in/min	0.0002
Position resolution	mm	0.000049
	in	0.0000019
Power requirements	V AC	380 - 480 V AC,
		20 Amps,
		50 / 60 Hz,
		9000 W
	Phase	3
Space Between Columns	mm	650
	in	25.59
vertical Test Space		
Baseplate to Crosshead		
Extended Length	mm	1840
	in	72.44
Crosshead Travel		
Extended Length	mm	1400
	in	55.12
Frame Height		
Extended Length	mm	2835
	in	111.61
Frame Width	mm	1365
	in	53.62
Frame Depth	mm	1100
	in	43.31
Weight		
Extended Length	kg	1695
	lb	3737
Shipping information		
Extended length Frame Dimensions - Crated (estimated)	mm	3220 x 1660 x 1660
	in	126.77 x 65.35 x 65.35
Weight - Crated	kg	2210
	lb	4862

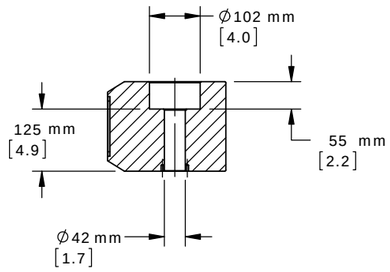


SECTION B-B
SCALE 1 : 6

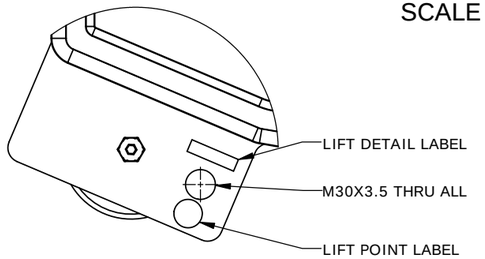


SECTION A-A
SCALE 1 : 6

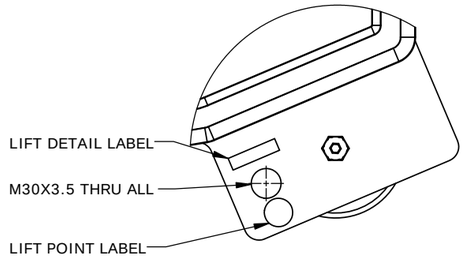




SECTION D-D
SCALE 1 : 6



DETAIL E
SCALE 1 : 3



DETAIL F
SCALE 1 : 3

M004

REVISIONS

DESCRIPTION	DRAWN	ENGR	DATE	LETTER	ECN NO
SEE SHEET 1					

-

SOURCE/REF DRAWING -

PROPRIETARY DATA

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UNLESS OTHERWISE SPECIFIED

MATERIAL DESCRIPTION -----

MATERIAL SIZE -----

FINISH ----- MASK

- THREAD DEPTHS ARE TO MIN FULL THDS
- DRILL DEPTHS ARE TO FULL DIA
- REMOVE BURRS AND SHARP EDGES
- DO NOT SCALE PRINT

SCALE NONE

MACHINED SURFACES 180√

.XXX HOLE SIZE TOLERANCE: 0.000 TO .750 +.010/-.002; OVER .750 TO 1.500 +.015/-.003

GENERAL TOLERANCES: ANGLE ±2° | X/Y ±1/4 | .X ±.1 | .XX ±.03 | .XXX ±.010

THIRD ANGLE PROJ

DRAWN	CHECK	ENGR	MFG
JJM	-	JKS	-
DATE 05-01-12	DATE -	DATE 05-01-12	DATE -

TITLE: WORKSTATION-E/M,300KN,C45.305E

NEXT LEVEL -----

PRODUCT CODE -----

SIZE D

NUMBER 100-251-629

REV C

SHEET 2 OF 2

MTS SYSTEMS CORPORATION
EDEN PRAIRIE, MINNESOTA U.S.A.

3832 Hardness Tester
DIGITAL ROCKWELL HARDNESS TESTER

Starrett®

METROLOGY SOLUTIONS

This Digital Rockwell Hardness Tester with fully automated load/unload procedures affords highly sensitive and accurate readings. Micro computer controlled Touch screen with USB data output. The 3832 Digital Rockwell Hardness tester offers programmable scale conversions, dwell times, statistical capabilities and test counter. Capable of testing in all of the regular Rockwell hardness scales.

3832

FEATURES

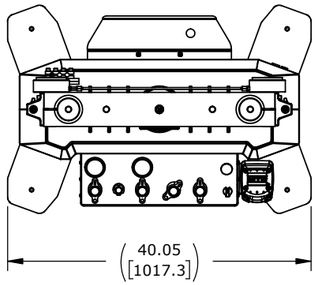
- Direct loading method with load-cell instead of dead-weight system
- High speed test cycle
- Extremely accurate loading control
- Cast iron body
- Touch screen controlled microcomputer
- Automatic conversions to HB, HV, Superficial Rockwell Scales
- USB data output

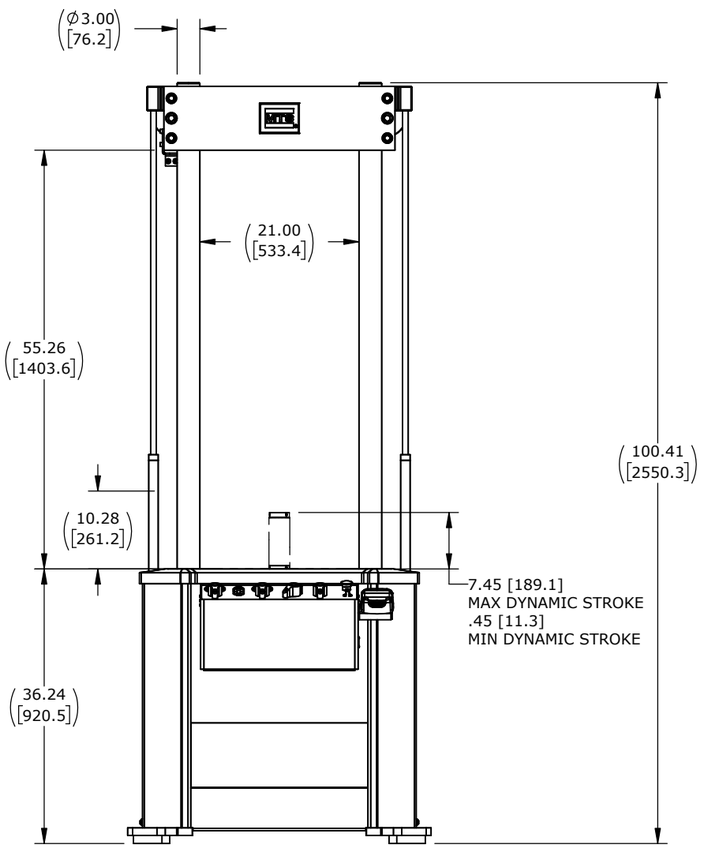
Accessories Included
C-scale Diamond Indentor
1/16" Ball Indentor
3- Certified HRC Test Blocks
1- Certified HRB Test Block
Test Table 5.87" (150mm)
Flat Anvil 2.5" (63mm)
Std. V-Anvil
Dust Cover
Accessory Case

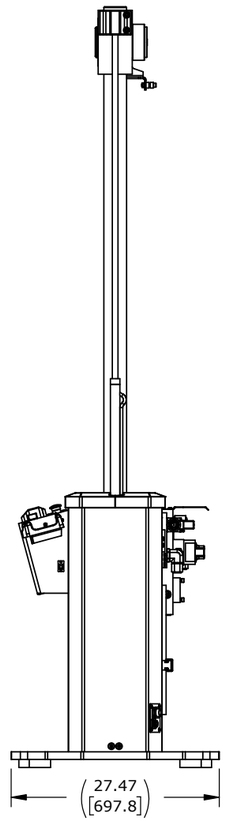
Digital Rockwell Hardness Tester		
Cat. No.	**EDP**	**Description**
3832	02042	3832 Hardness Tester

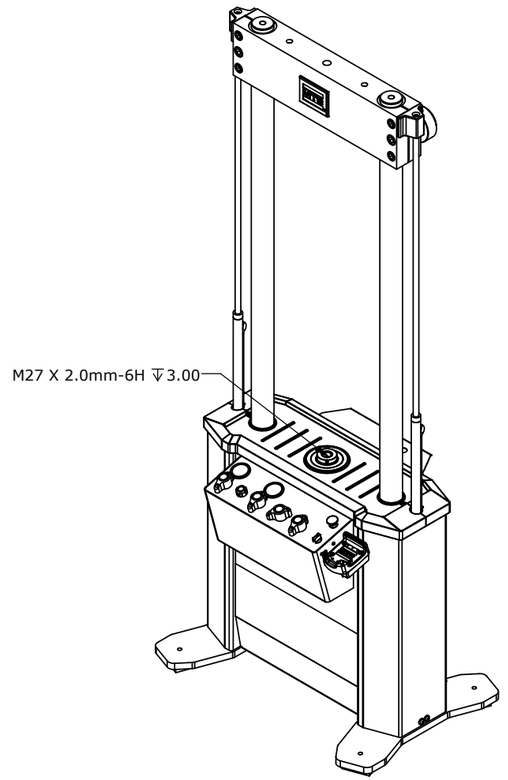
Specifications	
Minor Load	10 Kgf
Major Load	60 Kgf, 100 Kgf, 150 Kgf
Test Force Application	Load cell closed loop
Test Force Control	Motorized
Resolution	0.1HR
Vertical Capacity	8.0" (203mm)
Throat Depth	7.8" (198mm)
Upper/Lower Limits Setting & Alarming	Yes
Height	22" (560mm)
Width	8" (200mm)
Depth	31" (790mm)
Weight (Net/Shipping)	225lbs / 250lbs
Operation Temperature	50°-95°F (10°-35°C)
Power Supply	Single phase, AC, 110-220 with manual change, 50-60Hz, 4A

M006









NOTES:

1. USE EMBEDDED 3D MODEL FILE FOR ASSEMBLY INFORMATION. THIS DRAWING AND ITS EMBEDDED MODEL FILE ARE BOTH REQUIRED FOR COMPLETE INTERPRETATION OF ASSEMBLY.
2. UNLESS OTHERWISE SPECIFIED, LUBE AND TORQUE ALL FASTENERS PER MTS DOCUMENT 700-005-602, "STANDARD TORQUE VALUES FOR MECHANICAL ASSEMBLY".
3. APPROXIMATE WEIGHT: 1296 lbs. [588 kg].
4. ASSEMBLE AND TEST ACTUATOR/HSM PER DOCUMENT #'S 700-004-071 & 700-004-072.
5. ASSEMBLE AND TEST LOAD FRAME PER DOCUMENT #'S 700-004-075 & 700-004-077.
6. ALIGNMENT FIXTURE AND LOAD CELL MOUNTING HARDWARE NOT SHOWN. PACKAGE AND SHIP WITH FRAME FOR ONSITE INSTALLATION.

SPECIFICATIONS:

MODEL #: 370.10
TEST SPACE WIDTH:533
TEST HEIGHT MINIMUM:140mm
TEST HEIGHT MAXIMUM: 1283mm
LOAD FRAME RATED CAPACITY:100 kN
ACTUATOR FORCE CAPACITY: 100 kN
ACTUATOR DYNAMIC STROKE: 150mm
ACTUATOR TOTAL STROKE:176mm
ACTUATOR RATED FLOW: 227 LPM
MANIFOLD RATED FLOW: 114 LPM
ACTUATOR BEARING TYPE: NON-METALLIC STEPPED

REVISIONS

DESCRIPTION			LETTER	ECN NO
DRAWN	ENGR	DATE		

-

SOURCE/REF DRAWING 100-344-869

PROPRIETARY DATA

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UNLESS OTHERWISE SPECIFIED

MATERIAL DESCRIPTION: SEE BOM
MATERIAL SIZE: -----
FINISH: -----
MASK

- THREAD DEPTHS ARE TO MIN FULL THDS
- DRILL DEPTHS ARE TO FULL DIA
- REMOVE BURRS AND SHARP EDGES
- DO NOT SCALE PRINT

SCALE: NONE
MACHINED SURFACES 180√

.XXX HOLE SIZE TOLERANCE: 0.000 TO .750 +.010/-.002; OVER .750 TO 1.500 +.015/-.003

GENERAL TOLERANCES: ANGLE ±2°; X/Y ±1/4; .X ±.1; .XX ±.03; .XXX ±.010

THIRD ANGLE PROJ

DRAWN	CHECK	ENGR	MFG
BLH	-	AJS	-
DATE 1/6/17	DATE -	DATE 1/6/17	DATE -

TITLE: LOAD FRAME-370.10, NO L/C, 57491

NEXT LEVEL: -----
PRODUCT CODE: -----
SIZE: D
NUMBER: 100-348-722
REV: A
SHEET 1 OF 1

MTS SYSTEMS CORPORATION
EDEN PRAIRIE, MINNESOTA U.S.A.

Model 653 High-Temperature Furnaces

The right choice for easy, accurate high-temperature testing

- Capable of achieving temperatures up to 1000°C (1832°F) in validated testing conditions
- Multiple furnace heights accommodate diverse test requirements
- Up to three independently controlled temperature zones
- Stainless steel exterior with convenient clamshell design

To design products and components that perform reliably at the temperatures found in actual operating environments, engineers need to develop a detailed understanding of how material properties and behaviors change as temperatures rise and fall. MTS Model 653 High-Temperature Furnaces are a vital component of these test configurations. They offer the functionality operators need to generate accurate data, and a convenient design that optimizes productivity in the lab.

Model 653 furnaces are ideal for a wide variety of high-temperature tests, including tension, compression, bend and fatigue testing of metals, composites, ceramics and many other materials. The alumina and zirconia fiber insulation system minimizes heat loss and prolongs the life of the furnace. A center-split design enables easy access to both fixturing and specimens. Pivot bearings built into the mounting bracket ensure smooth opening and closing.

Each furnace includes the MTS digital PID Temperature Control System and a mounting bracket for load frames from MTS and other providers. These furnaces can be configured for one, two or three heating zones which can be independently controlled. In addition, all Model 653 furnaces can accommodate MTS high-temperature axial extensometers.

Easy Setup, Intuitive Operation

Model 653 high-temperature furnaces have a user-friendly design that helps operators perform setup tasks more quickly – without compromising test quality or accuracy. Features include:

Pre-cut insulation. Durable, low-maintenance insulation for Model 653.03 and 653.04 furnaces comes pre-cut, so there is no need to handle the material in the lab. The insulation works well with different styles of extension rods, so it fits tighter and lasts longer. It is also more effective, reducing heat loss and eliminating the need for wool.

Safety interlocks. The grip water cooling circuit has flow switches that are integrated with the Model 409 temperature controller. These switches shut down the furnace to protect equipment and specimens in the event of a water supply failure.

Clamshell design. Model 653 furnaces streamline test setup and specimen changeover with a clamshell design that allows operators to work from the front of the furnace at all times. This design also improves furnace alignment, which is critical to achieving proper gradients.

Thermal gradient verification kit. Model 653 furnaces are compatible with optional accessories that make it easy to analyze specimen thermal gradients before testing. These include Type K thermocouples, thermocoupled specimens and a thermal data acquisition tool that links directly to a PC.

MODEL 409.83 TEMPERATURE CONTROLLER

- Ergonomic design
- Multiple mounting options
- Compact design
- Multiple level, self-tuning PID control
- Includes SCR power relays
- Digital communications available

Superior Capabilities for High-Temperature Testing

Model 653.01

With a height of just 55 mm (2.2 in.), Model 653.01 is designed for tension, compression and fatigue testing of specimens as short as 100 mm (4 in.). The furnace incorporates a pair of silicon carbide heating elements arranged in a single zone. The temperature for this furnace ranges from 100°C to 1000°C (212°F to 1832°F)* in validated testing conditions.

Model 653.02

Model 653.02 has a height of 86 mm (3.4 in.) and is ideal for tension, compression and fatigue testing of specimens 150 mm (6 in.) or longer. The furnace uses two pairs of silicon carbide heating elements, which can be used to maintain one or two zones of control. An insulation plate between the upper and lower heating elements ensures reliable zone separation. The temperature for this model ranges from 100°C to 1000°C (212°F to 1832°F)* in validated testing conditions.

Model 653.03

Designed for tension, compression and fatigue testing of specimens 200 mm (8 in.) or longer, the Model 653.03 furnace has a height of 126 mm (5 in.). It features two pairs of silicon carbide heating elements, which can be used to maintain one or two zones of control. An insulation plate situated between the upper and lower elements helps ensure reliable zone separation. Pre-cut insulation reduces heat loss. This furnace is particularly well-suited for applications that require a lower thermal gradient on a tensile or fatigue specimen. The temperature for this furnace ranges from 100°C to 1000°C (212°F to 1832°F)* in validated testing conditions.

Model 653.04

Specify the Model 653.04 furnace for tension, compression, bend and fatigue testing of specimens that require hot grips or fixtures. Three pairs of silicon carbide heating elements are arranged in three zones of control. Insulation plates between the elements offer reliable zone separation, and pre-cut insulation helps reduce heat loss. This furnace is an ideal choice when test engineers need a very low thermal gradient on a tensile or fatigue specimen. The furnace is capable of achieving 100°C to 1000°C (212°F to 1832°F)* in validated testing conditions in validated testing conditions with MTS' standard high-temperature low-cycle and high-cycle fatigue solutions. Its height is 220 mm (8.7 in.).

**Temperatures may very depending on specimen geometry and material.*

Specifications

Model	Maximum Temperature*	Minimum Temperature	Control Point Stability	Total Height
653.01	1000°C (1832°F)	100°C (212°F)	±1°C = ±2°F	55 mm (2.2 in)
653.02	1000°C (1832°F)	100°C (212°F)	±1°C = ±2°F	85 mm (3.4 in)
653.03	1000°C (1832°F)	100°C (212°F)	±1°C = ±2°F	126 mm (5 in)
653.04**	1000°C (1832°F)	100°C (212°F)	±1°C = ±2°F	220 mm (8.7 in)

**Temperatures may vary depending on specimen geometry and material.*

*** Supports testing to ASTM E606-04e1, BSI 7270, JIS Z2279, AFNOR A03-403 or ISO 12106 requirements.*

Model	Hot Zone Height	Hot Zone Width x Depth	Number of Zones
653.01	19 mm (.75 in)	50 x 50 mm (2 x 2 in)	1
653.02	50 mm (2 in)	50 x 50 mm (2 x 2 in)	1 or 2
653.03	90 mm (3.6 in)	62.5 x 62.5 mm (2.46 x 2.46 in)	1 or 2
653.04	185 mm (7.3 in)	62.5 x 62.5 mm (2.46 x 2.46 in)	1 or 3

Temperature Gradient Verification Kit Components

Model	Part Number
Thermocouple Data Acquisition Kit	100-255-716
Type K Thermocouple Connector Kit	100-255-714
Thermocouple Specimen	057-743-803
Thermocouple Welding Kit	100-256-698

Utility Requirements

3 KVA @ 100-125 or 200-240 VAC, 50-60 Hz.
Voltage must be selected at time of order.

MTS Systems
14000 Technology Drive
Eden Prairie, MN 55344-2290 USA

Telephone: 1.952.937.4000
Toll Free: 1.800.328.2255

E-mail: info@mts.com
www.mts.com

ISO 9001 Certified QMS

Specifications subject to change without notice.

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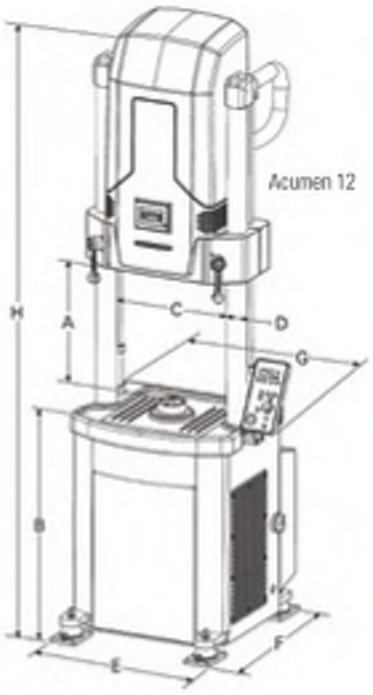
100-265-681c Furnace653 • Printed in U.S.A. • 12/21

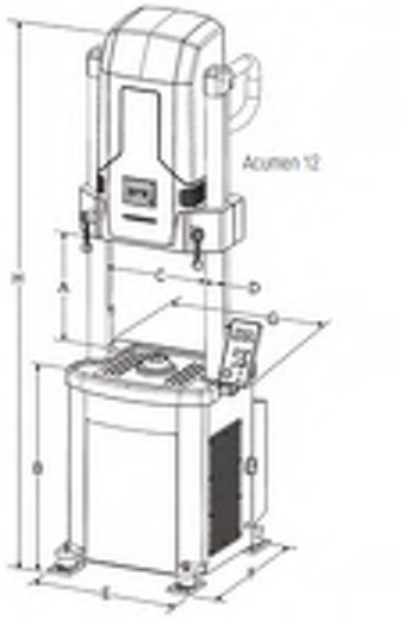
Load Frame Specifications[1]	Diagram Detail	MODEL [redacted]	Acumen 12 A/T
Dynamic force[2]			12000 N (2697 lbf)
Static force[2]			8500 N (1910 lbf)
Dynamic torque rating		–	±120 Nm (1066 in-lb)
Static torque rating		–	±84.8 Nm (746 in-lb)
Actuator dynamic stroke			70 mm (2.75 in)
Angular displacement		–	±135° ±20 revolutions 0.001 rpm - 100 rpm continuous rotation to 100 rpm
Dynamic performance			≤100 Hz
Minimum test space height[3]	A		0 mm (0.00 in)
Maximum test space height[4]	A		810 mm (31.9 in)
Working height[5]	B		815 mm (32.1 in)
Test space width *(measured between columns)*	C		460 mm (18.11 in)
Base plate design			T-Slot (industry standard: 14 mm)
Column diameter	D		76.2 mm (3 in)
Frame footprint width	E		651 mm (25.6 in)
Frame footprint depth[6]	F		817 mm (32.2 in)
Overall width[8] *(with frame-mounted controller)*	G		805 mm (31.7 in)
Overall height[7]	H		2810 mm (110.7 in)
Weight			1043 kg (2300 lb)
Noise level - typical[8]			62
Noise level - maximum[8]			78
Mounting			Floor: Vertical
Standard load cell			12 kN Accel Comp
Operating temperature			+5C° to +40C°
Cooling			Automated forced air & self contained water cooled
Electrical requirements[9]	Voltage - VAC Frequency - Hz Current - Amps Phase		200-240 50 - 60 38 Single

1. *Specifications subject to change without notice.*
2. *Verifiable with MTS compression spring test. Performance may vary depending on test type, test set-up, frequency, specimen, environment and other factors.*
3. *Assumes standard system load cell installed, crosshead fully lowered and actuator fully extended to end of the dynamic stroke.*
4. *Assumes standard system load cell installed, crosshead fully raised and actuator fully retracted to end of the dynamic stroke.*
5. *From table to top of work surface; without optional isolation pads.*
6. *For systems with optional test area enclosure, add 98 mm (3.8 in.) to dimension F and 45 mm (1.8 in) to dimension G for overall system dimensions.*
7. *Measured with crosshead fully raised, without optional isolation pad.*
8. *Typical usage at 1 m, free field. Noise level varies depending upon test type, specimen, environment and other factors.*
9. *Acumen 1 current rated at 100 (200) VAC. Acumen 3 current rated at 200 VAC.*



Load Frame Specifications[1]	Diagram Detail	MODEL			
		Acumen 3	Acumen 3 A/T	Acumen 12	Acumen 12 A/T
Dynamic force[2]		3000 N (670 lbf)	3000 N (670 lbf)	12000 N (2697 lbf)	12000 N (2697 lbf)
Static force[2]		2000 N (450 lbf)	2000 N (450 lbf)	8500 N (1910 lbf)	8500 N (1910 lbf)
Dynamic torque rating		–	±30 Nm (265 in-lb)	–	±120 Nm (1056 in-lb)
Static torque rating		–	±21 Nm (185 in-lb)	–	±84.8 Nm (746 in-lb)
Actuator dynamic stroke		70 mm (2.75 in)	70 mm (2.75 in)	70 mm (2.75 in)	70 mm (2.75 in)
Angular displacement		–	±135° ±20 revolutions 0.001 rpm - 100 rpm continuous rotation to 350 rpm	–	±135° ±20 revolutions 0.001 rpm - 100 rpm continuous rotation to 100 rpm
Dynamic performance		>100 Hz	>100 Hz	>100 Hz	>100 Hz
Minimum test space height[3]	A	26 mm (1.02 in)	0 mm (0.00 in)	55 mm (2.17 in)	0 mm (0.00 in)
Maximum test space height[4]	A	919 mm (32.24 in)	603 mm (23.74 in)	985 mm (38.8 in)	810 mm (31.9 in)
Working height[5]	B	133 mm (5.24 in)	133 mm (5.24 in)	815 mm (32.1 in)	815 mm (32.1 in)
Test space width (measured between columns)	C	460 mm (18.11 in.)	460 mm (18.11 in.)	460 mm (18.11 in.)	460 mm (18.11 in.)
Base plate design		T-Slot (industry standard: 8 mm)	T-Slot (industry standard: 8 mm)	T-Slot (industry standard: 14 mm)	T-Slot (industry standard: 14 mm)
Column diameter	D	63.5 mm (2.5 in)	63.5 mm (2.5 in)	76.2 mm (3 in)	76.2 mm (3 in)
Frame footprint width	E	634 mm (24.96 in)	634 mm (24.96 in)	651 mm (25.6 in)	651 mm (25.6 in)
Frame footprint depth[6]	F	501 mm (19.72 in)	501 mm (19.72 in)	817 mm (32.2 in)	817 mm (32.2 in)
Overall width[6] (with frame-mounted controller)	G	764 mm (30.08 in)	764 mm (30.08 in)	805 mm (31.7 in)	805 mm (31.7 in)
Overall height[7]	H	1726 mm (67.95 in)	1726 mm (67.95 in)	2810 mm (110.7 in)	2810 mm (110.7 in)
Weight		188 kg (415 lb)	230 kg (507 lb)	953 kg (2100 lb)	1043 kg (2300 lb)
Noise level - typical[8]		47 dbA	47 dbA	62	62
Noise level - maximum[8]		69 dbA	69 dbA	78	78
Mounting		Tabletop: Vertical	Tabletop: Vertical	Floor: Vertical	Floor: Vertical
Standard load cell		3 kN Accel Comp	3 kN Accel Comp	12 kN Accel Comp	12 kN Accel Comp
Operating temperature		+5C° to +40C°	+5C° to +40C°	+5C° to +40C°	+5C° to +40C°
Cooling		Automated forced air	Automated forced air	Automated forced air & self contained water cooled	Automated forced air & self contained water cooled
Electrical requirements[9]	Voltage - VAC Frequency - Hz Current - Amps Phase	200-240 50 - 60 10 Single	200-240 50 - 60 20 Single	200-240 50 - 60 38 Single	200-240 50 - 60 38 Single

1. Specifications subject to change without notice.
2. Verifiable with MTS compression spring test. Performance may vary depending on test type, test set-up, frequency, specimen, environment and other factors.
3. Assumes standard system load cell installed, crosshead fully lowered and actuator fully extended to end of the dynamic stroke.
4. Assumes standard system load cell installed, crosshead fully raised and actuator fully retracted to end of the dynamic stroke.
5. From table to top of work surface; without optional isolation pads.
6. For systems with optional test area enclosure, add 88 mm (3.8 in.) to dimension F and 45 mm (1.8 in) to dimension G for overall system dimensions.
7. Measured with crosshead fully raised, without optional isolation pad.
8. Typical usage at 1 m, free field. Noise level varies depending upon test type, specimen, environment and other factors.
9. Acumen 3 current rated at 100 (200) VAC. Acumen 3 current rated at 200 VAC.



Environmental Requirements

All MTS Acumen load frames are intended for indoor use only. This indoor environment must conform to the following environmental specifications.

Environmental Requirements

Parameter	Specification
Operating Temperature[1]	5° to 40° C (41° to 104° F)
Operating Humidity	5 to 85% Non-condensing
Storage Temperature	-18° to 49° C (0° to 120° F)
Maximum Storage Humidity	90% Non-condensing
Maximum Altitude	2000 m (6562 ft)
Pollution Degree	2
IP Rating	IP20
Overvoltage Category	II

[1]Take care when using heat producing accessories, such as ovens. Emitted heat from such devices may damage the MTS Acumen if not properly controlled.

Site Location

Before installation of the MTS Acumen system, ensure the final location meets the following requirements.

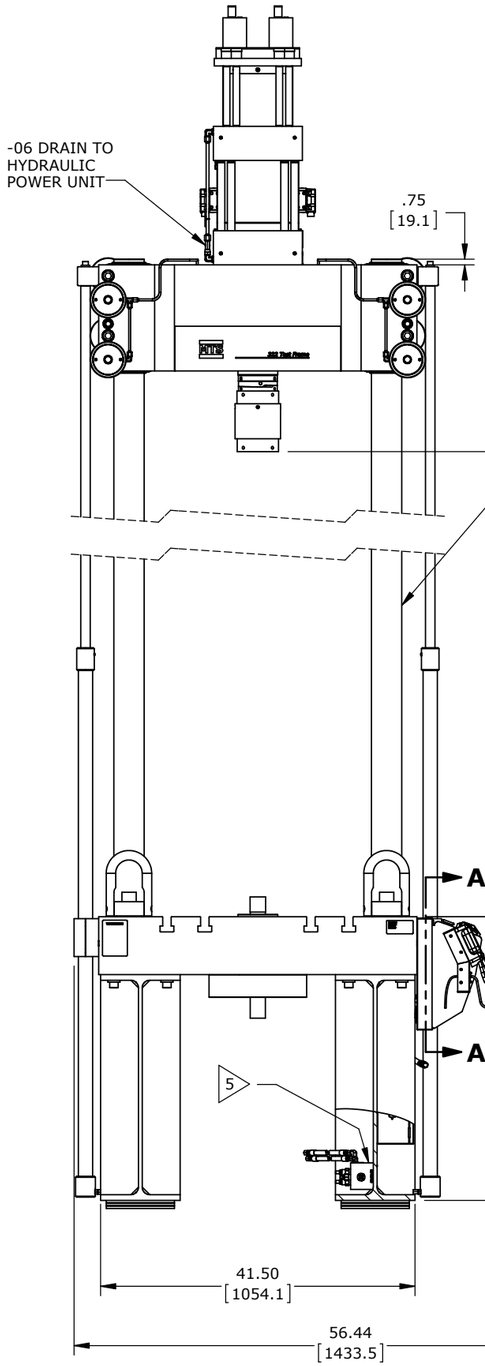
- The floor is able to support the weight of the frame (and the table for MTS Acumen 1 and MTS Acumen 3) and its computer components.
- The environment complies with the specifications for your specific model:
    - Operating temperature
    - Storage temperature
    - Humidity
    - Atmosphere
- The required power supply is available and is compatible with the electrical requirements for your specific model.
- Grounded electrical outlets are within the minimum distance requirement to the load frame location.
- A phone line or cell phone access is located within the general testing area so that users can call the MTS Service department directly from the testing area. It is also suggested that network drops, or digital phone lines, be within the general testing area.
- Ceiling clearance is adequate for the load frame, including the additional space necessary to lift and move the frame by either a forklift or crane.
- Location provides sufficient accessibility for routine maintenance: 1000 mm (3 ft).
- Employees are adequately trained to operate the load frame and its computer system.

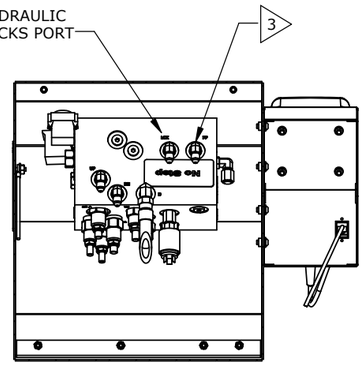
Transporting

Before transporting the MTS Acumen system, ensure the following requirements are met.

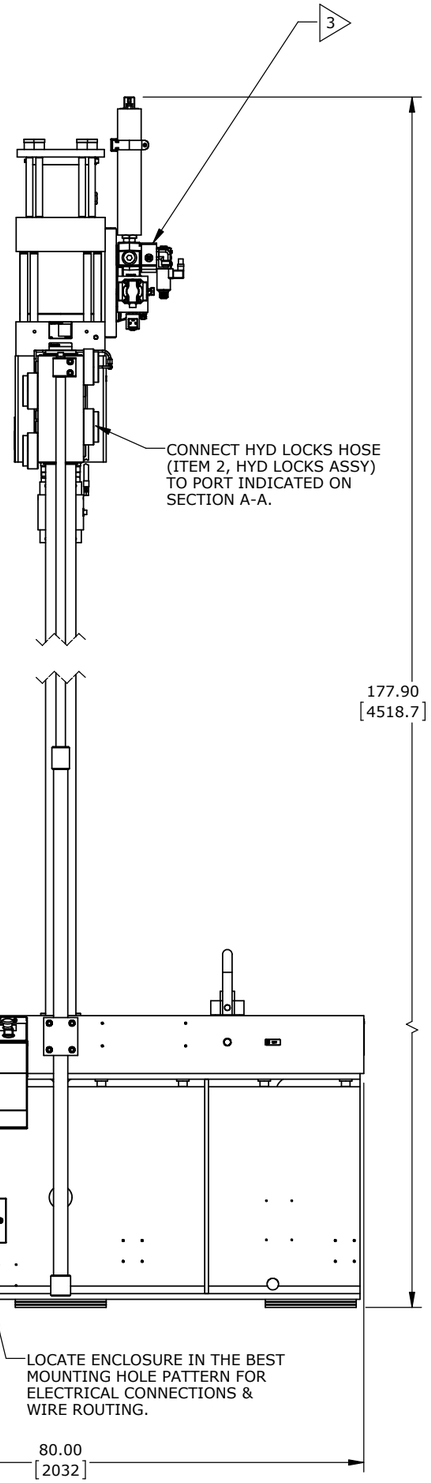
- You have the correct number of packing boxes as stated on the packing list.
- Insurance coverage is secured or verified.
- You have the required equipment for the chosen transporting method.
- You have the appropriate packaging to protect the load frame when moving or relocating it.
- The pathway from the loading dock to the final site location has sufficient width and height to fit the frame and forklift (or crane).
- The floor area along the pathway to the final site location is able to support the weight of the frame and forklift (or crane).
- There are no loose accessories on the shipping skid or frame.
- Your equipment operators have the appropriate licenses and have complied with your local safety standards (for example, the appropriate training required by OSHA in the U.S.).

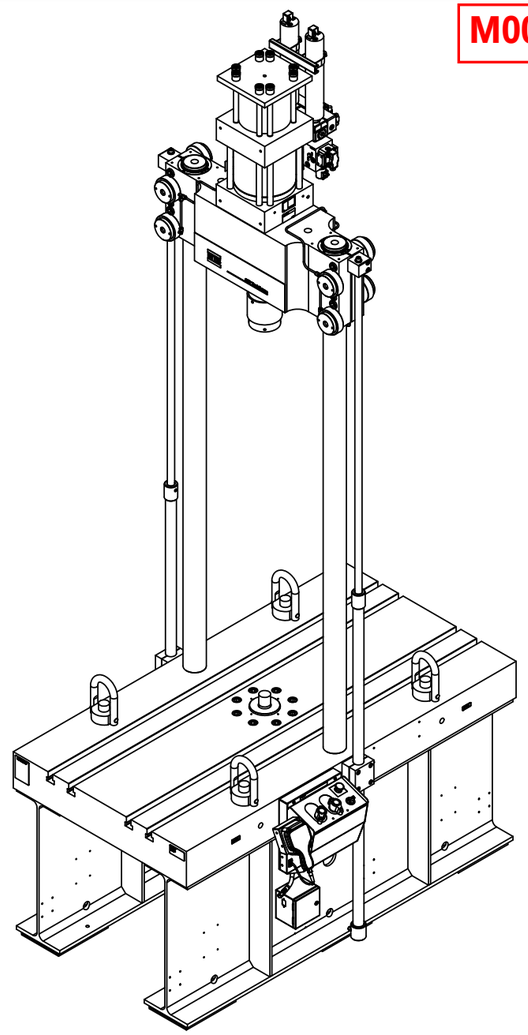
M009





SECTION A-A
SCALE 1 : 4





NOTES:

1. USE EMBEDDED 3D MODEL FILE FOR ASSEMBLY INFORMATION. THIS DRAWING AND ITS EMBEDDED MODEL FILE ARE BOTH REQUIRED FOR COMPLETE INTERPRETATION OF ASSEMBLY.
2. UNLESS OTHERWISE SPECIFIED, LUBE AND TORQUE ALL FASTENERS PER MTS DOCUMENT 700-005-602, "STANDARD TORQUE VALUES FOR MECHANICAL ASSEMBLY".
3. REPLACE PILOT PRESSURE (PP) FITTING WITH ELBOW (ITEM 19) SO PP HOSE (ITEM 18) ANGLES DOWN. ATTACH ITEM 18, PP HOSE TO PP PORTS ON ACTUATOR ASSY & LIFT-LOCK CONTROL MANIFOLD.
4. ALL DIMENSIONS ARE REFERENCE ONLY UNLESS OTHERWISE SPECIFIED.
5. LOCATE LIFT ASSY MANIFOLD IN ANY OF THE HOLE PATTERNS PROVIDED ON THE LEGS.
6. APPROX. WEIGHT: 11,067 lbs. [5,020 kg]

(18) PP HOSE

(19) PP ELBOW

REVISIONS

DESCRIPTION	DRAWN	ENGR	DATE	LETTER	ECN NO
BOM TO REV A. DRAWING TO DOD.	JLD	JJV	2-26-13	A	500008049

-

SOURCE/REF DRAWING 100-261-279

PROPRIETARY DATA

THE INFORMATION AND DESIGN(S) DISCLOSED HEREIN ARE CONFIDENTIAL AND THE PROPERTY OF MTS SYSTEMS CORPORATION AND MAY NOT BE USED, REPRODUCED OR DISCLOSED IN ANY FORM EXCEPT AS GRANTED IN WRITING BY MTS SYSTEMS CORPORATION. THIS RESTRICTION EXCLUDES INFORMATION THAT IS IN THE PUBLIC DOMAIN OR WAS LEGITIMATELY IN THE PRIOR POSSESSION OF THE RECIPIENT.

UNLESS OTHERWISE SPECIFIED

MATERIAL DESCRIPTION: -----

MATERIAL SIZE: -----

FINISH: ----- MASK

- THREAD DEPTHS ARE TO MIN FULL THDS
- DRILL DEPTHS ARE TO FULL DIA
- REMOVE BURRS AND SHARP EDGES
- DO NOT SCALE PRINT

SCALE NONE

MACHINED SURFACES 180√

.XXX HOLE SIZE TOLERANCE: 0.000 TO .750 +.010/-.002; OVER .750 TO 1.500 +.015/-.003

GENERAL TOLERANCES: ANGLE ±2° | X/Y ±1/4 | .X ±.1 | .XX ±.03 | .XXX ±.010

THIRD ANGLE PROJ

	DRAWN	CHECK	ENGR	MFG
	JLD	-	JJV	-
DATE	2-22-13	-	2-26-13	-

TITLE: LOAD FRAME-322.41, XHD MTG, 47330

NEXT LEVEL: -----

PRODUCT CODE: -----

SIZE: D

NUMBER: 100-271-035

REV: A

SHEET 1 OF 1

MTS SYSTEMS CORPORATION
EDEN PRAIRIE, MINNESOTA U.S.A.

M010

INSTRON®

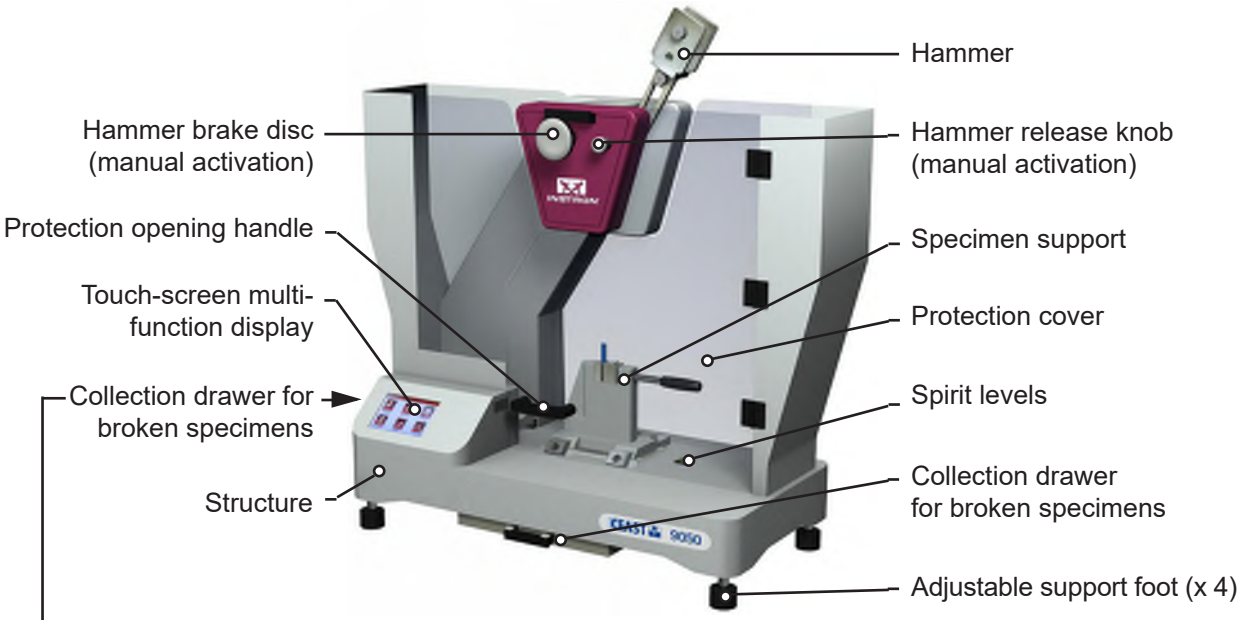
CEAST 9050 Pendulum Impact System

Operating Instructions M74-17123-EN rev. B

The difference is measurable®

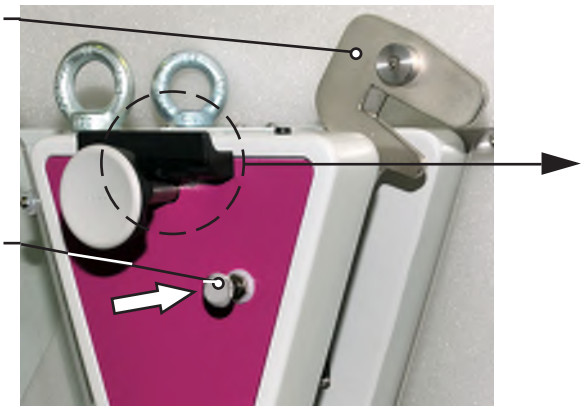
COMPONENT IDENTIFICATION

In the following pages, a number of figures of the instrument can be found with identification of the main parts.

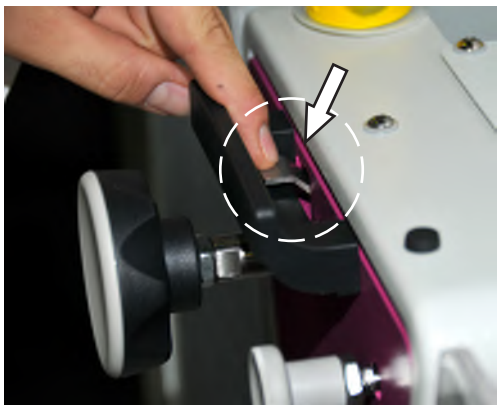


Instrument (model option 7614.000C1) with manual brake and hammer release devices.

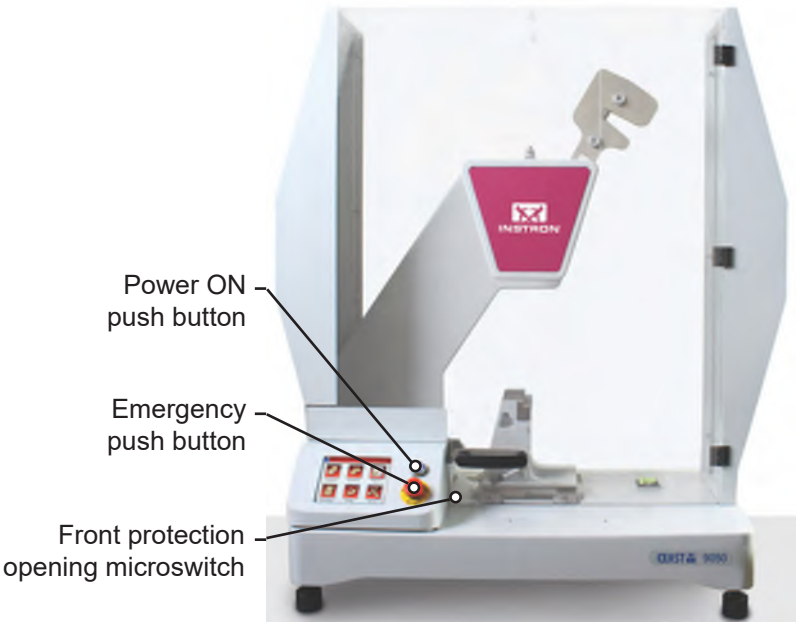
N.B.: during the impact test the drawer must remains closed.



Hammer positioning



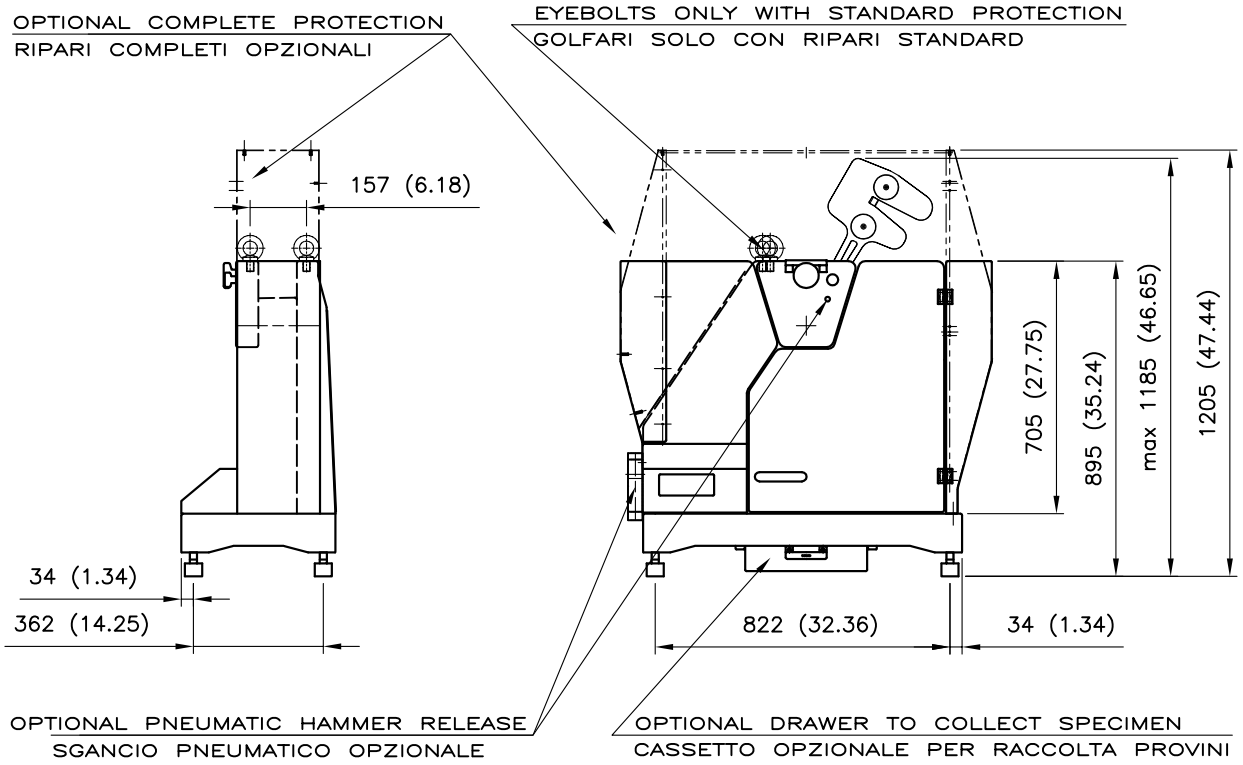
Detail of hammer release safety lever (models option 7614.000C1)

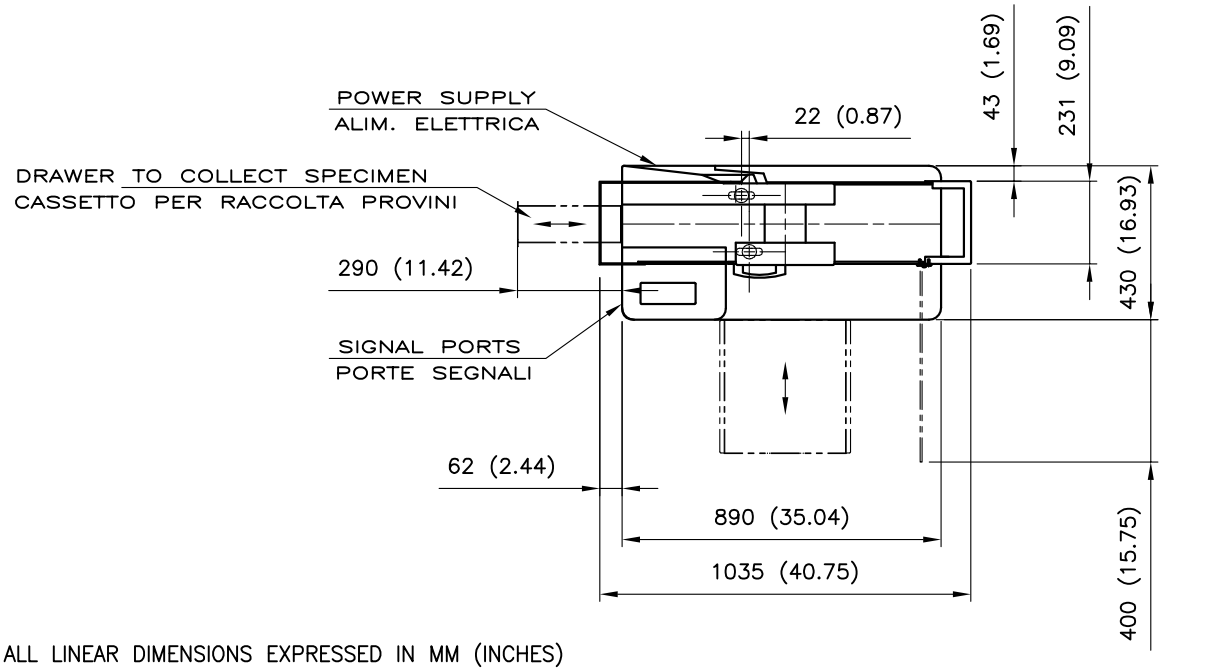


CEAST 9050 code 7615.000.
Instrument with pneumatic hammer brake/release devices and motorised hammer recovery system (model code 7614.000 can be equipped with the same microswitch on the front protection included on models option codes 7614.000C3...C7)

Additional plate (detail) for energies up to 50 J (option code 7610.010)

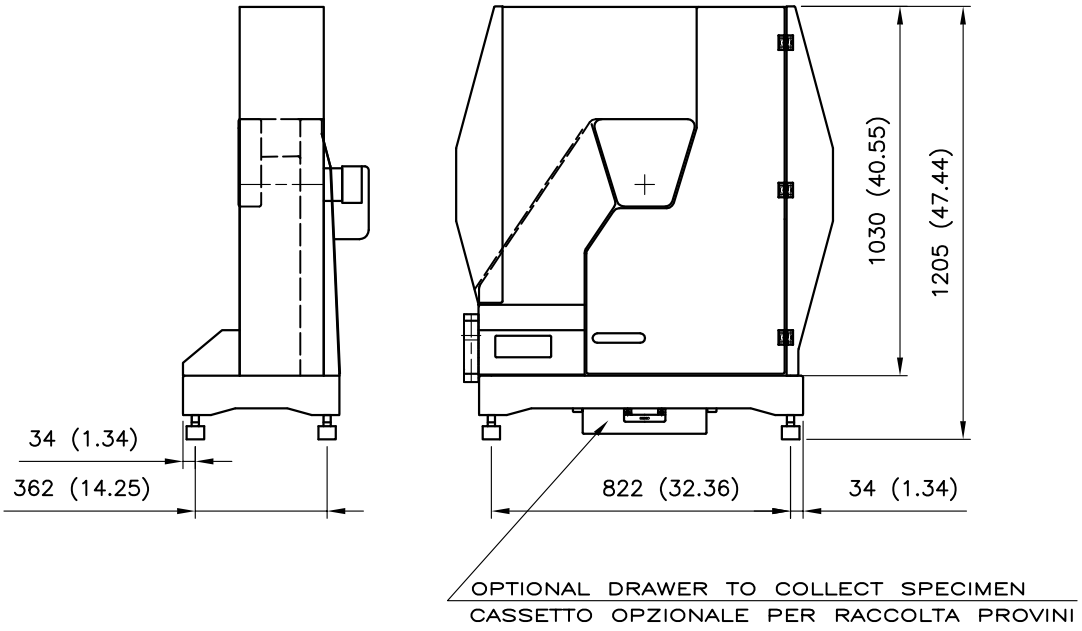
LAYOUT

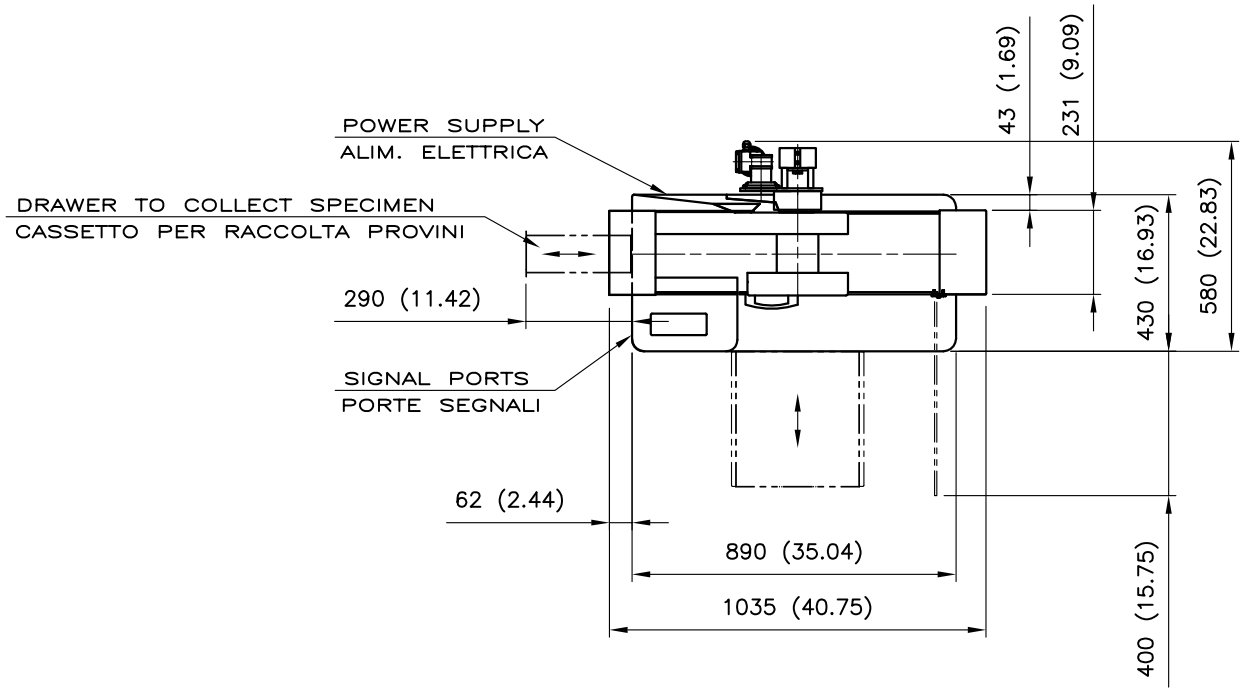




ALL LINEAR DIMENSIONS EXPRESSED IN MM (INCHES)
TUTTE LE DIMENSIONI LINEARI SONO ESPRESSE IN MM (INCHES)

CEAST 9050 - code 7614.000 - Manual version





ALL LINEAR DIMENSIONS EXPRESSED IN MM (INCHES)
TUTTE LE DIMENSIONI LINEARI SONO ESPRESSE IN MM (INCHES)

CEAST 9050 - code 7615.000 - Motorized version

POSITIONING

The instrument can operate according to the technical parameters specified if it is correctly placed and levelled on a USER's solid table or laboratory bench with a height between 700 and 900 mm.

CEAST 9050 total weight accounts for about 270 kg (2650 N) for the motorized version and, if supported by its four feet on a solid table, it can be used for testing with **0.5 J** to **25 J** hammers.

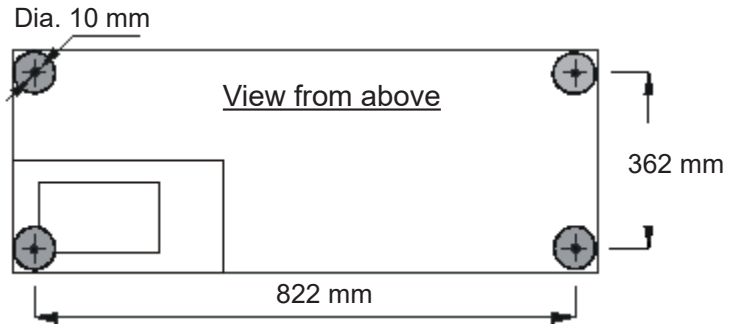
To enlarge the instrument operation field to **50 J** hammers, it must be solidly fastened to a block integral to the floor or increase its weight by installing the additional plate code 7610.010 under the base or using the optional table code 7610.015.

WEIGHT APPLIED ON THE SUPPORTS

CEAST 9050 ACTING WITH 0.5 TO 25 JOULES HAMMERS

The instrument (motorized version) weights about 270 kg (2650 N). Considering a uniform distribution of the weight, the load applied to each of the 4 feet is approx. 67.5 kg (665 N). The support diameter of each foot is 1 cm, which is equivalent to a surface area of 0.785 cm ^{2}.

CEAST 9050 for 0.5 to 25 Joule energy
The surface on which the instrument is placed must be able to support a minimum weight of 86 kg/cm^2 (845 N/cm^2) in correspondence of each support foot.



CEAST 9050. Support feet position

CEAST 9050 ACTING WITH 0.5 TO 50 JOULES HAMMERS

The instrument (motorized version) weights about 390 kg (3830 N) including the additional plate. Considering a uniform distribution of the weight, the load applied to each of the 4 feet is approx. 97.5 kg (960 N). The support diameter of each foot is 1 cm, which is equivalent to a surface area of 0.785 cm ^{2}.

CEAST 9050 for 0.5 to 50 J energy
The surface on which the instrument is placed must be able to support a minimum weight of 124 kg/cm^2 (1220 N/cm^2) in correspondence of each support foot.

LEVELLING

The instrument is provided for with four adjustable support feet and two spirit levels (see figures below) for levelling.
To perform this operation, follow instructions in the paragraphs below:

a) Take two 30-mm face spanners.

b) Open the instrument protective cover using the handle.

c) Visually inspect the position of longitudinal spirit level from the relevant reference lines.

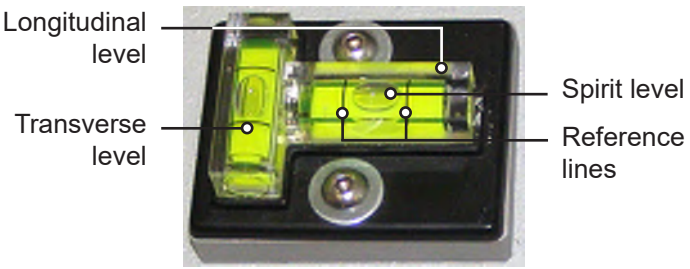
d) If the spirit level is not centred inside the lines, act on the feet on instrument left side, by using two 30-mm face spanner at the same time.

e) Lift protections and rotate two screws by the same number of revolutions to reach the level required.

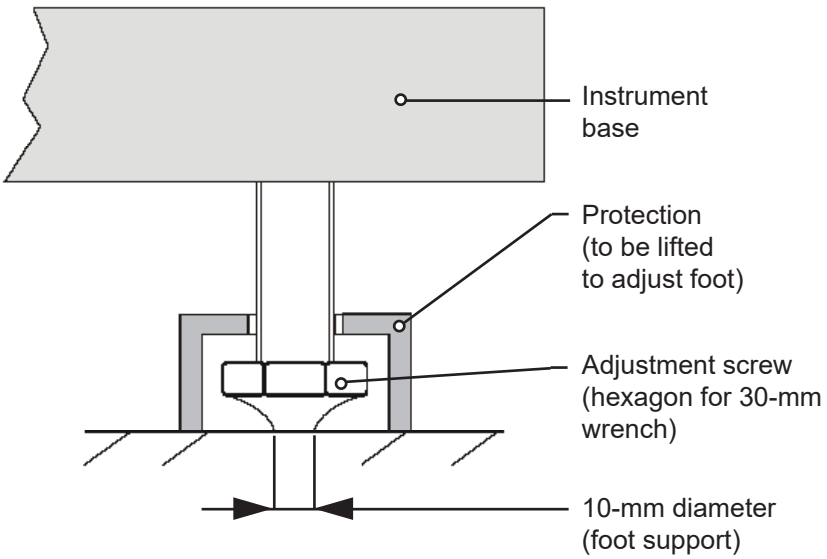
f) Repeat instructions from paragraph a) to e) included and modify the transverse level by acting on two front feet.

g) Once levelled, check that two spirit levels are centred inside the reference lines and the four feet are in contact with the support surface.

h) Calibrate the instrument using any hammer and verify that the value indicated by the hammer, when in release position, is 150.0°. Otherwise, adjust the support feet so as to obtain such value.



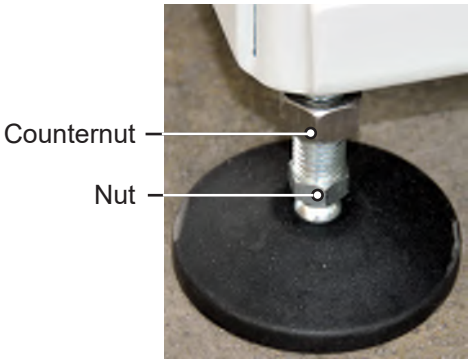
Double spirit level for instrument levelling



Detail of support foot

EQUIPMENT/TABLE (OPTION) CODE 7610.015 LEVELLING

If the equipment CEAST 9050 is placed and fastened onto the table (option) code 7610.015, level it using the double bubble level fitted at the bottom of the equipment and adjusting the table support feet (see figure on the right) following the instructions in paragraph Levelling.



Adjustable support foot (x4)

STABILITY

The instrument is stable if its base is placed on a flat surface.

The CUSTOMER is responsible for verifying that the resistance of the support surface is suitable for the instrument weight

CLEANING

It is not necessary to remove protective substances (such as grease or oil on surfaces) from the instrument.

Anyway, in case of external fouling during assembly operation, clean the surfaces with a soft cloth and non-corrosive, non-dangerous detergents, especially preventing any damage to the painted surfaces.

In any case, the safety standards provided for by the cleaning substance manufacturer must be strictly complied with.

For cleaning the instrument, follow the procedure described in “Maintenance” chapter.

MATERIALS AND PRODUCTS

The instrument mainly consists of iron, steel, copper and light alloys.

The electric components and cables comply with the international standards.

The instrument is not set up for operation with noxious or flammable materials. The CUSTOMER must check that the operating materials comply with this requirements.

Material disposal is under responsibility of the CUSTOMER in compliance with the environmental standards of the COUNTRY where the instrument is placed.

Don’t Litter. Recycle

COMMISSIONING

This chapter contains the instructions to be followed to operate the equipment before performing any type of test.

CONNECTION TO THE ELECTRIC LINE

Authorized personnel: **OPERATOR**

a) Check that the network frequency and voltage comply with specifications on the instrument's data plate (see Chapt 1).

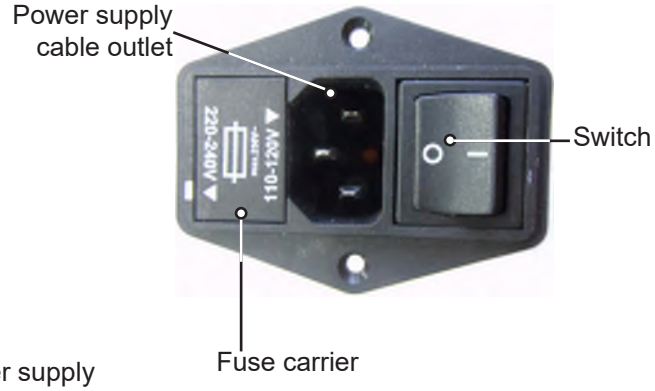
b) Check that the switch in the instrument back side is on "**O**" position.

c) Insert the power supply cable plug according to local standards into the instrument outlet.

d) Insert the instrument power supply cable plug into the electric line outlet.

e) Close the electric line (wall) safety switch.

Power supply cable (example)



CONNECTION TO THE PNEUMATIC LINE

Authorized personnel: **OPERATOR**

Please note: CEAST 9050 codes 7614.000C3/C6/C7 e 7615.000 are provided with pneumatic system.

a) Insert the compressed air delivery pipe in the air inlet fitting. To perform this operation: press with your fingers the (green) collar at the end of the fitting, insert the pipe and release the collar.

b) Set the pressure to 5,5 bar using the specific pressure regulator. To set the pressure:
   - release the regulator knob pushing it upward;
   - set the pressure to the required value rotating the knob clockwise or counterclockwise if the value is exceeded. The pressure value is indicated by the pressure gauge.
   - press on the knob to return it to the lock position.

Please note: the shut-off butterfly valve may be used to close the compressed air inlet and discharge the circuit of the instrument without disconnecting the pipe from the fitting.

When the butterfly of the shut-off valve is in “Closed” position, it can be locked in that position by means of a padlock. This solution ensures maximum safety for the personnel during maintenance works.

Pressure control and compressed air filtering unit

M011

MTS Exceed® E22 Series Pendulum Impact Test Systems for Metals

Highly reliable and stable impact testing for metals

Features

- Rugged cast iron frame absorbs shock and vibration
- Reliable disc brake for quick pendulum braking
- New pendulum structure design that helps prevent stuck samples
- Ergonomic control panel with touchscreen display
- High-resolution, frictionless encoder for accurate measurement of impact angle
- Safety enclosure with access switch that locks the pendulum if enclosure is opened during a test
- CE, USTC compliance

The rugged yet versatile MTS Exceed Pendulum Impact Test Systems for Metals are ideal for measuring impact resistance of metal specimens. With an easy-to-operate control system, stable transmission system, reliable disc brake, new pendulum and frame design, these systems execute accurate, reliable Charpy impact tests.

Conducting impact tests requires careful consideration of safety requirements, and these systems include several features to maximize safe and reliable operation. The transmission system uses precision bearings and two-stage reducer for smooth and steady pendulum operation. The system has an interlock feature that will stop the pendulum in the event of power loss, or if the machine enclosure is open.

The MTS Exceed Pendulum Impact Test Systems provide a solid foundation for establishing global standardized testing procedures. The multi-language interface and compliance with global safety and ergonomic standards make it a good choice for global institutions and corporations. These systems can be quickly configured, delivered and installed to meet your specific testing requirements; and all MTS Exceed systems are backed by the MTS global service and support team. This highly experienced team is committed to maintaining system uptime and operational efficiency.

By integrating a solid test frame with high-resolution electrical control and comprehensive safety features, the MTS Exceed E22 Series Pendulum Impact Test System for Metals provides highly reliable testing capabilities for QA/QC environments and various high strength tests.

Examples of metals material test standards that can be met with the MTS E22 Pendulum Impact Test System for Metals

Examples

Standard	Description
GB/T 229-2007	Charpy Pendulum Impact Tester Method
JJG 145-2007	Pendulum Impact Tester
ASTM E23-12c	Standard Test Methods for Notched Bar Impact Testing of Metallic Materials
ISO 148-1-2009	Metallic materials – Charpy pendulum impact test

Pendulum (without striker)

	Pendulum Energy	Pendulum Part Number
ISO	150J	100301699
ISO	300J	100301700
ISO	450J	100301702
ASTM	150J	100301699
ASTM	300J	100301700
ASTM	450J	100301702

Pendulum Striker

	Striker Part Number
ISO (R2 mm)	100304355
ISO (R8 mm)	100282954
ASTM	100304353

Specifications

	E22.452
Maximum impact energy	450J
Pendulum pre-elevation	150°
Minimum angle resolution	0.025°
Distance between pendulum center and impact point	750 mm
Impact speed	5.24 m/s
Dimension of the main tester (W x H x D)	2240 x 902 x 2145 mm
Weight	1000 kg
Impact test result, digital display	Impact energy (kJ) Impact strength (kJ/m²)
Functions	Friction loss correction Automatic calculation of the pendulum length Brake Linkable printer Linkable PC
Interface	RS 485
Power supply	200-240 V AC, 5A, 50/60 Hz, 1 kW, single phase

MTS Systems Corporation
14000 Technology Drive
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ISO 9001 Certified QMS

Specifications subject to change without notice

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Easy-to-Use Systems

MTS Exceed systems are equipped with many time-saving features. Floor-standing models have dual zone designs that save testing time by eliminating the need for fixture changes between tensile and compression tests. MTS TestSuite TW software facilitates the accurate and repeatable mechanical testing of materials, components and finished goods. It combines the versatility to address unique and complex test requirements along with ease-of-operation to provide a seamless testing experience.

Guided test setup

With MTS TestSuite TW Essential (TWS) software, test setup is extremely easy. Using a highly visual interface, the software guides the entire process from pre-test to post-test and allows the user to input specimen details and calculations along the way.

One-direction calibration

These systems require calibration in one direction only, which greatly minimizes the time and effort needed to maintain and calibrate the load frame.

Convenient, ergonomic handsets

MTS handsets facilitate streamlined test setup by enabling operators to perform standard system control functions such as start, stop, pause and crosshead positioning while standing close to the test specimen. The handset can display test status messages, system performance messages, and test results. Two programmable function keys are set up in the software as digital inputs, allowing users to define test functions such as start test, pause and hold position.

The handset features a compact, ergonomic design for both right-handed and left-handed operators, plus a large text display that provides information at a glance.

Exceptional Value in its Class

MTS Exceed 40 systems are capable of performing the heavy load of test tasks found in an industrial manufacturing environment. With features and control capabilities typically found on higher-end model load frames, these systems provide superior value for the investment.

System safety features

To help ensure operator well-being and compliance with the latest international safety directives, MTS Exceed systems are designed to accommodate a variety of safety features, including:

- Integrated control pod
- System status light – indicates whether the load frame drive is energized and ready for testing
- E-stop
- Test control handset
- Mechanically adjustable limits that stop the crosshead at predetermined points
- Motor overheat device that automatically turns off the motor power supply
- Limit-setting for load, extension, strain or any other data channel

Durable, easy-to-maintain test space

MTS Exceed systems feature durable, protective rubber matting to extend the life and enhance the maintainability and utility of the system test space. Series 40 systems include heavy work surface mats that are designed to protect the load frame base and facilitate easy test space cleanup and maintenance. Molded edges on the mats prevent tools from rolling off, and an integrated groove pattern channels spills and debris away from the work area.

Load cell savings

The dual-test zone design allows one load cell to be used for two types of test on the same load frame. This feature not only saves testing time, but it reduces overall load cell expense for the lab.

Electromechanical Universal Test Systems

Choose from a comprehensive line of compact and reliable electromechanical systems for low- to medium-force monotonic testing

MTS Exceed Series 40 systems feature a complete selection of universal test systems for meeting a wide range of monotonic production testing requirements. Highly reliable and easy to operate, these systems employ responsive, low-vibration MTS electromechanical drives and integrated, digital closed-loop controls to test in load, position and strain control at force capacities ranging from 5 N to 600 kN.

Series 40 systems are available in a variety of compact, high-stiffness single and dual column tabletop configurations for low- to medium-force testing, or robust dual column floor-standing configurations for medium- to high-force testing. Easy-to-use MTS TestSuite TW software, a large and growing library of standards-compliant test methods, and a full complement of accessories extend the utility of these systems across a broad spectrum of materials, including:

- Plastics
- Thin films
- Fibers and threads
- Adhesives
- Foam
- Elastomers
- Biomaterials
- Wood and paper products
- Thin metals
- Wire
- High-strength metals
- Components
- Fasteners
- Composites

E42

Rated force capacity: 5 kN
Applications: Steel wire, plastics, fine wire, fibers and threads, biomaterials, thin films, adhesives, foam, packaging, paper products, consumer products.

SERIES 40 SYSTEM KEY FEATURES

- Wide selection of high stiffness single and dual column load frame configurations
- High speed, low vibration MTS electromechanical drives
- World class, maintenance free AC servomotor and amp
- Precision, pre-loaded ball screws
- Non-clutched drives, rated for full speed at maximum force
- High-resolution, digital closed-loop controls (integrated into load frame)
- Convenient test setup and control handset
- Versatile, easy-to-use MTS TestSuite TW software with standards-compliant test template library (ASTM, ISO, DIN, EN, BS, and more)
- Load cells with TEDS self-identification capabilities
- Complete selection of grips, fixtures, environmental systems and extensometers (optional)
- Dual-zone test space (Models E44 and E45) reduce setup time
- Anti-rotation grip/fixture mounting
- Optional T-slot table
- Automatic limit checking of crosshead position, overload, over-temperature, over-voltage, etc.
- Durable test space protection

E45.105

Rated force capacity: 100 kN
Applications: Plastics and metal materials.

E43

Rated force capacity: 10 kN
Applications: Plastics, rubber, and other non-metal materials.

E44

Rated force capacity: 30 kN
Applications: Metal and non-metal materials.

E45.305

Rated force capacity: 300 kN
Applications: Metal materials.

E45.605

Rated force capacity: 600 kN
Applications: Metal materials.

MTS Exceed Series 40 Specifications - Common

	ISO 7500 Class 0.5 / Class 1 or ASTM E4	
Low Profile Force Accuracy* *(bending beam & shear beam)*	± 0.5% of applied force	± 1.0% of applied force
Low Profile Force Range** *(bending beam & shear beam)*	1 to 100% of rated force capacity	0.5 to 1% of force rated capacity
S-Beam Force Accuracy*	± 1.0% of applied force	
S-Beam Force Range**	1 to 100% of rated force capacity	
Rated maximum force at max. test speed	100%	
Rated maximum test speed at maximum force	100%	
Speed accuracy	Set speed < 0.01 mm/min: speed accuracy is within ± 1.0% of set speed Set speed ≥ 0.01 mm/min: speed accuracy is within ± 0.5% of set speed	
Position accuracy	Within ± 0.5%	
Strain accuracy*** *(depending on extensometer)*	± 0.5% of applied strain	
Security protection	Over-force, travel limits, over-voltage and others	
Over force protection	10%	
Data acquisition rate	Up to 2500 Hz	
Control loop rate	5000 Hz	
Environmental requirements (For indoor use only) *Operating temperature* *Operating humidity* *Storage temperature* *Maximum storage humidity* *Maximum altitude*	 *5° C to 40° C (41° F to 104° F)* *5% - 85% non-condensing* *-18° C to 49° C (0° to 120° F)* *90% non-condensing* *2000 meters*	
Motor & drive system	AC Servo Motor	
Ballscrews	Pre-loaded	
Position measurement	Encoder	
User Digital Inputs/Outputs (DIO)	4 user Digital Inputs and 4 user Digital Outputs	
Encoder capacity	4 Encoders	

** Applicable onsite calibration services are available to meet ISO 7500-1, ASTM E4.*
*** Range dependent upon controller settings and operating environment.*
**** Extensometer calibration services are available to meet ISO 9513, ASTM E83.*

MTS Exceed Series 40 Specifications - Comparative

Model		E42.503*	E43.104	E43.504
Maximum rated force capacity		5 kN (1100 lbf)	10 kN (2200 lbf)	50 kN (11000 lbf)
Force capacity options		5 N, 10 N, 20 N, 50 N, 100 N, 200 N, 500 N, 1 kN, 2 kN, 5 kN 1 lbf, 2 lbf, 5 lbf, 10 lbf, 20 lbf, 45 lbf, 110 lbf, 220 lbf, 450 lbf, 1100 lbf	5 N, 10 N, 20 N, 50 N, 100 N, 200 N, 500 N, 1 kN, 2 kN, 5 kN, 10 kN 1 lbf, 2 lbf, 5 lbf, 10 lbf, 20 lbf, 45 lbf, 110 lbf, 220 lbf, 450 lbf, 1100 lbf, 2200 lbf	20 kN, 30 kN, 50 kN 4500 lbf, 6700 lbf, 11000 lbf
Frame type		Table top	Table top	Table top
Test zones (single/dual)		Single	Single	Single
Maximum test speed		508 mm/min (20 in/min)	508 mm/min (20 in/min)	508 mm/min (20 in/min)
Minimum test speed		0.001 mm/min (0.00004 in/min)	0.001 mm/min (0.00004 in/min)	0.001 mm/min (0.00004 in/min)
Position resolution		0.000051 mm (0.0000022 in)	0.000041 mm (0.0000016 in)	0.00006 mm (0.0000023 in)
Vertical test space **crosshead travel**	*Standard* *Extended*	700 mm (27.6 in) 1000 mm (39.4 in)	1000 mm (39.4 in) 1300 mm (51.2 in)	1000 mm (39.4 in) 1300 mm (51.2 in)
Space between columns		100 mm (3.94 in)*	340 mm (13.4 in)	420 mm (16.5 in)
Frame height	*Standard* *Extended*	1300 mm (51.18 in) 1600 mm (63.0 in)	1617 mm (63.7 in) 1917 mm (75.5 in)	1770 mm (69.7 in) 2070 mm (81.5 in)
Frame width		642 mm (25.28 in)	681 mm (26.81 in)	820 mm (32.3 in)
Frame depth		582 mm (22.91 in)	588 mm (23.15 in)	775 mm (30.5 in)
Weight	*Standard* *Extended*	120 kg (265 lb) 130 kg (287 lb)	120 kg (265 lb) 130 kg (287 lb)	325 kg (716 lb) 345 kg (761 lb)
Power requirement		Single-phase 200-240 V AC, 3 Amp 50/60 Hz, 600 W	Single-phase 200-240 V AC, 3 Amp 50/60 Hz, 600 W	Single-phase 200-240 V AC, 6 Amp 50/60 Hz, 1600 W

** For single-column load frame this measurement denotes the distance from the center of the clevis to the front of the column cover.*

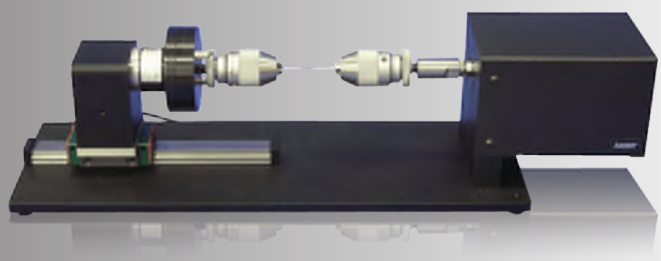
Model	E44.304	E45.105	E45.305	E45.605
Maximum rated force capacity	30 kN (6600 lbf)	100 kN (22000 lbf)	300 kN (66000 lbf)	600 kN (132000 lbf)
Force capacity options	100 N, 250 N, 500 N, 1 kN, 2 kN, 5 kN, 10 kN, 20 kN, 30 kN 20 lbf, 50 lbf, 110 lbf, 220 lbf, 450 lbf, 1100 lbf, 2200 lbf, 4400 lbf, 6600 lbf	50 kN, 100 kN 11000 lbf, 22000 lbf	200 kN, 300 kN 44000 lbf, 66000 lbf	200 kN, 300 kN, 600 kN 44000 lbf, 66000 lbf, 132000 lbf
Frame type	Floor-standing	Floor-standing	Floor-standing	Floor-standing
Test zones (dual)	Dual	Dual	Dual	Dual
Maximum test speed	508 mm/min (20 in/min)	508 mm/min (20 in/min)	250 mm/min (9.84 in/min)	254 mm/min (10 in/min)
Minimum test speed	0.001 mm/min (0.00004 in/min)	0.001 mm/min (0.00004 in/min)	0.001 mm/min (0.00004 in/min)	0.001 mm/min (0.00004 in/min)
Position resolution	0.000040 mm (0.0000015 in)	0.000041 mm (0.0000016 in)	0.000017 mm (0.0000007 in)	0.000016 mm (0.0000006 in)
Vertical test space crosshead travel *Standard* *Extended*	 1150 mm (45.28 in) 1450 mm (57.09 in)	 1050 mm (41.34 in) 1350 mm (53.15 in)	 1100 mm (43.30 in) 1400 mm (55.12 in)	 1300 mm (51.2 in)
Space between columns	400 mm (15.75 in)	600 mm (23.62 in)	580 mm (22.83 in)	750 mm (29.52 in)
Frame height *Standard* *Extended*	 1862 mm (73.3 in) 2162 mm (85.12 in)	 2133 mm (83.98 in) 2433 mm (95.79 in)	 2360 mm (92.91 in) 2660 mm (104.72 in)	 2820 mm (111.02 in)
Frame width	845 mm (33.27 in)	1230 mm (48.43 in)	1215 mm (47.83 in)	1660 mm (65.35 in)
Frame depth	716 mm (27.19 in)	870 mm (34.25 in)	960 mm (37.80 in)	1272 mm (50.08 in)
Weight *Standard* *Extended*	 435 kg (959 lb) 450 kg (992 lb)	 1400 kg (3086 lb) 1450 kg (3197 lb)	 1700 kg (3748 lb) 1750 kg (3758 lb)	 3500 kg (7716 lb)
Power requirement	Single-phase 200-240 V AC, 6 Amp 50/60 Hz, 1200 W	Single-phase 200-240 V AC, 10 Amp 50/60 Hz, 2000 W	Three-phase 380-415 V AC, or 440-480 V AC, 6.8 Amp 50/60 Hz, 5000 W	Three-phase 380-415 V AC, or 440-480 V AC, 10 Amp 50/60 Hz, 5000 W

M013

eXpert 9000 Series

Torsion Testing Systems

System Brochure



eXpert 9000 Series

Torsion Testing Systems

Precision, Versatility, and Performance.

Torsion Testing Machines for static and fatigue testing.

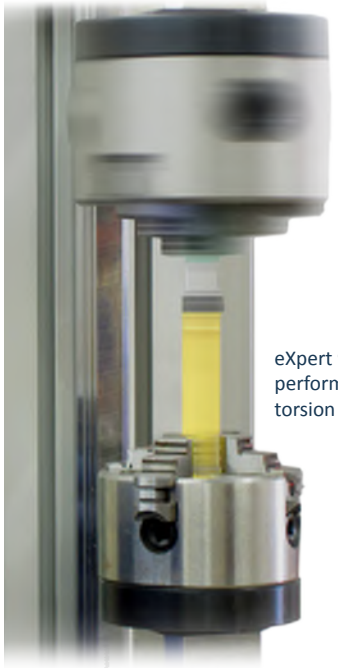
eXpert 9000 Series Table Top Torsion Testing Machines are available in vertical or horizontal orientations for static and fatigue testing applications. Horizontal systems feature a fixed spindle with sliding tail stock while vertical systems employ a sliding drive spindle. Maximum torsional stiffness and minimal axial friction is achieved with a roller slide frame design. A reaction torque transducer can be mounted to the tail stock or a rotary torque transducer can be mounted to the drive spindle to accommodate a wide range of applications. In the case of the horizontal machine, the tail stock can be left free floating or clamped during testing. A dead weight pulley system is provided with all torsion testers for applying uniaxial tensile or compressive forces. All torsion testers feature unlimited rotation in both directions.

eXpert 9618 (300Nm) Static, Horizontal

- Table-top models are offered in capacities up to 300Nm (2,650 inlb).
- Models are available for static (9600 Models) and fatigue (9900 Models) testing.
- Test bone screws, fasteners, orthopedic devices, shafting, tubing, wires and other materials with confidence.

eXpert 9612 (20Nm) Static, Vertical

Customizable - Backed by superior engineering and a willingness to tailor a system to meet your needs.



eXpert 9612 performing torsion test

The length of the test bed or frame structure can be modified to accommodate varying specimen lengths and sizes. Test frames can be provided to allow the machine to operate in both a vertical or horizontal orientation. Load cells and displacement sensors can be incorporated to measure axial forces and spindle displacement. Faster spindle speeds are also available .

Custom eXpert 9600 Series 110Nm Static Torsion Testing System for measuring the torsional properties of a large articulating arm (not shown). A rotary torque transducer is mounted to the drive spindle. The drive spindle can be adjusted vertically and has a head to tail stock open range from 0-1,800mm (0-72in). The machine base is 2,210mm (87in) square.

51 Morgan Drive Norwood, MA 02062
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Test with Certainty.

eXpert 9000 Series

Torsion Testing Systems

Precision, Versatility, and Performance.

System Specifications

Model		9610 Static	9612 Static	9613 Static	9614 Static	9618 Static	9910 Fatigue	9911 Fatigue	9912 Fatigue
Torque Capacity	Nm lbft inlb	5 3.6 44	20 14.7 177	50 36.5 442	100 73.7 885	300 221 2,650	5 3.6 44	10 7.4 88	25 18 220
Maximum Speed at 110 VAC[1]	rpm	200	90	100	70	40	1,500	1,500	750
Minimum Speed	rpm deg/min	0.01 3.6	0.0045 1.6	0.005 1.8	0.0035 1.26	0.002 0.72	0.075 27	0.075 27	0.038 13.5
Maximum Torque at Full Speed	Nm inlb	5 44	20 177	50 442	100 885	300 2,650	5 44	10 88	25 220
Angle Resolution	deg	0.0014	0.0008	0.0008	0.0008	0.0008	0.09	0.09	0.09
Maximum Angle	deg	infinite	infinite	infinite	infinite	infinite	infinite	infinite	infinite
Head to Tailstock Opening Range[2]	in mm	0-30 0-760	0-30 0-760	0-30 0-760	0-30 0-760	0-30 0-760	0-30 0-760	0-30 0-760	0-30 0-760
Base to Center Line Test Space[3]	in mm	4 100	4 100	4 100	4 100	4 100	4 100	4 100	4 100
Horizontal Frame Footprint	in mm	12 x 36 304 x 1,220	12 x 36 304 x 1,220	12 x 36 304 x 1,220	12 x 36 304 x 1,220	12 x 36 304 x 1,220	12 x 36 304 x 1,220	12 x 36 304 x 1,220	12 x 36 304 x 1,220
Vertical Frame Footprint	in mm	18 x 18 457 x 457	18 x 18 457 x 457	18 x 18 457 x 457	18 x 18 457 x 457	18 x 18 457 x 457	18 x 18 457 x 457	18 x 18 457 x 457	18 x 18 457 x 457
Vertical Frame Column Height	in mm	42 1,066	42 1,066	42 1,066	42 1,066	42 1,066	42 1,066	42 1,066	42 1,066
Maximum Power	VA	330	330	880	1,100	2,750	1,110	2,200	3,300
Single Phase Voltage	VAC Hz	110-220 50,60	110-220 50,60	110-220 50,60	110-220 50,60	110-220 50,60	110-220 50,60	110-220 50,60	220 50,60

ADMET will modify a system to meet your needs.

Notes:

1. At 220 VAC the maximum speed will double.
2. Head to tail stock opening range is calculated without torque cells, grips and fixtures. Larger openings can be accommodated by ordering an extended frame.
3. Base to center line test space is the distance from the top surface of the base plate (horizontal orientation) or column (vertical orientation) to the center line of the rotating spindle. Larger test spaces can be accommodated upon request.

eXpert 9912 (25Nm) Fatigue Testing System

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Test with ADMET.

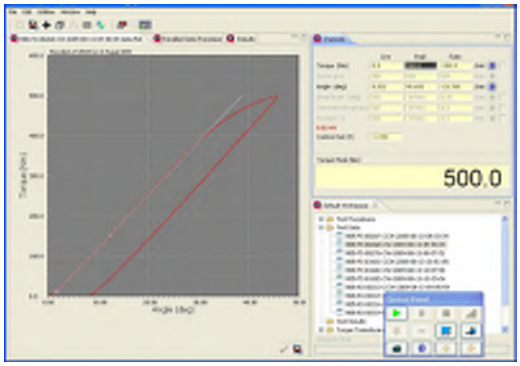
eXpert 9000 Series

Torsion Testing Systems

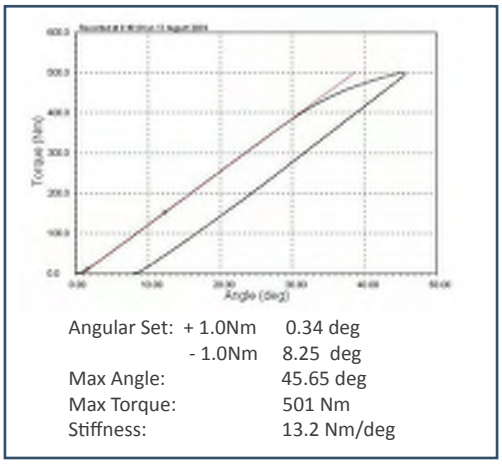
Precision, Versatility, and Performance.

Controls and Software

All ADMET eXpert 9000 Series Torsion Testing Machines are equipped with either one of two digital controllers. MTESTQuattro®, our most advanced testing system, is a PC-based unit that offers a wide range of flexibility in control, data acquisition, analysis, and reporting. The eP2 Digital Controller (available on 9600 series static models only), a standalone touch panel unit, offers a balance between performance and simplicity. Both controllers feature 8 kHz servo update periods and programmable log rates to 1 kHz.

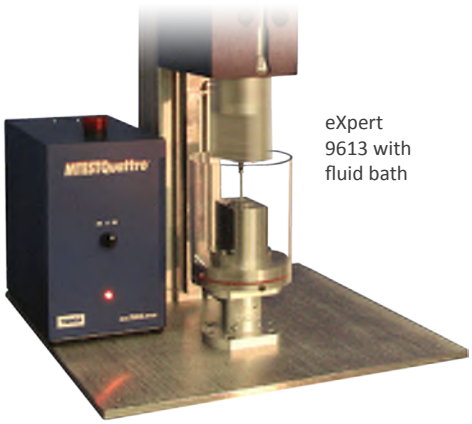


Controller	MTESTQuattro®	eP2 Digital Controller
Interface	PC Software	Touch Panel
Analysis	Extensive data results library with built-in ASTM/ISO calculations.	Standard calculation package for basic testing requirements and QC testing.
Test Procedures	Use built-in or create an unlimited number of simple to complex test procedures.	Save up to six test procedures in eP2.
Reporting	Store and organize all data. View and print user customized test reports with chart and tables.	Post test, view current results on eP2 screen and send data to PC for reporting using optional GaugeSafe software.



Angular Set:	+ 1.0Nm	0.34 deg
	- 1.0Nm	8.25 deg
Max Angle:		45.65 deg
Max Torque:		501 Nm
Stiffness:		13.2 Nm/deg

MTESTQuattro® running on Windows



eXpert 9613 with fluid bath

Accessories

ADMET offers a full line of grips, fixtures, collets, chucks, environmental chambers and temperature controlled baths. For more accurate strain measurements, extensometers or deflectometers can be provided.

Service and Calibration

Training and Service - ADMET testing systems are easy to learn and use. We provide free introductory on-line training and, if needed, additional on-site training. Our manuals, tutorials, and trouble shooting guides are updated regularly. We provide free phone and email product support through the life of the system. ADMET's on-site service and calibration team includes over 100 individuals in over 40 locations in the USA.

Calibration - Customers can setup calibration contracts with ADMET or a private party. All services are A2LA accredited and meet ISO/IEC Guide 17025 and ANSI/NCSL Z540.

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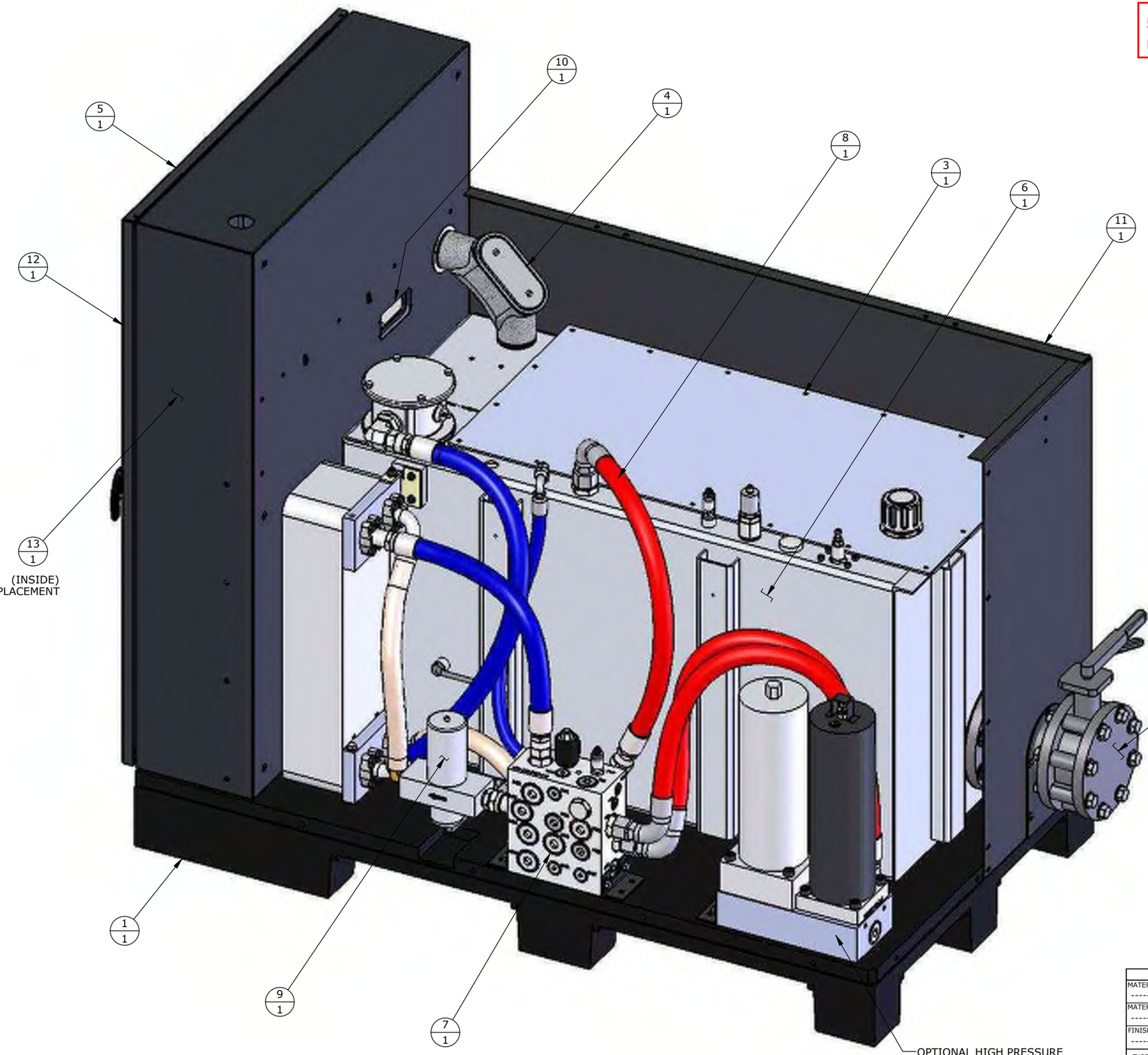
515.30 HPU which is the 60HP model of pump.



14 PRODUCT INFORMATION

15 PLC CODE

16 HMI CODE

17 HMI-PLC CODE

MANY ITEMS NOT SHOWN FOR CLARITY

NOTES:

1. BOM ITEM NUMBERS GREATER THAN 17 ARE OPTIONS, SEE ASSOCIATED DRAWING FOR ASSEMBLY AND INSTALLATION

REVISIONS

DESCRIPTION	DRAWN	ENGR	DATE	LETTER	ECN NO
-UPDATED MANIFOLD DIM. ON SHEET 4 -REMOVED REF. DIM. ON SHEET 3 (B)	RAP	PJR	10/14/16	B	500052195

-

SOURCE/REF DRAWING -

PROPRIETARY DATA

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UNLESS OTHERWISE SPECIFIED

MATERIAL DESCRIPTION -----

MATERIAL SIZE -----

FINISH ----- MASK

- THREAD DEPTHS ARE TO MIN FULL THDS
- DRILL DEPTHS ARE TO FULL DIA
- REMOVE BURRS AND SHARP EDGES
- DO NOT SCALE PRINT

SCALE NONE

MACHINED SURFACES 180√

.XXX HOLE SIZE TOLERANCE: 0.000 TO .750 +.010/-.002; OVER .750 TO 1.500 +.015/-.003

GENERAL TOLERANCES: ANGLE ±2° | X/Y ±1/4 | .X ±.1 | .XX ±.03 | .XXX ±.010

THIRD ANGLE PROJ

DRAWN	CHECK	ENGR	MFG
DCP	-	PJR	-
DATE 04/22/15	DATE -	DATE 07/13/15	DATE -

TITLE: CONFIGURATION DRAWING-515,40/60HP

NEXT LEVEL -----

SIZE D

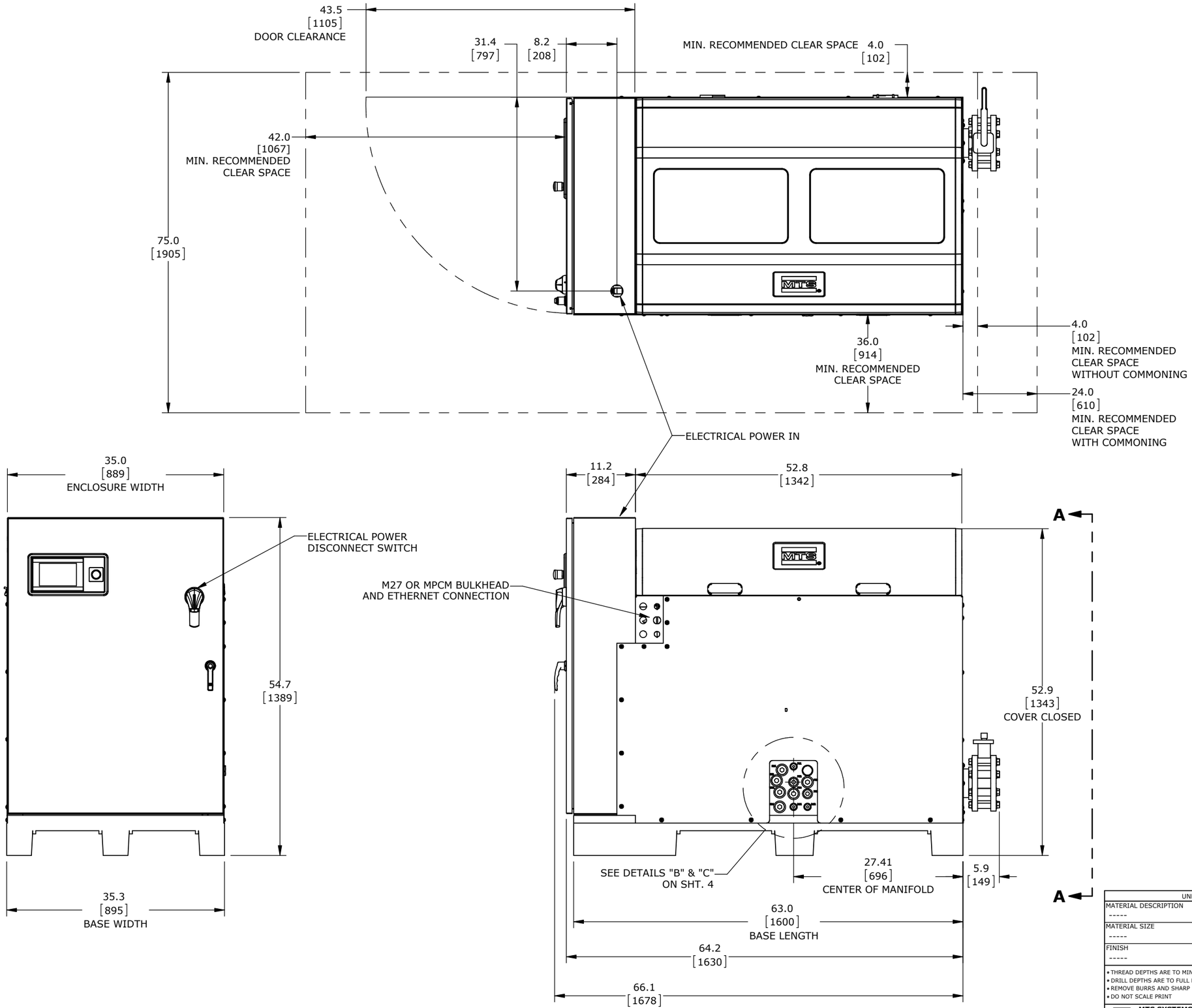
NUMBER 700-007-770

REV B

PRODUCT CODE 515

SHEET 1 OF 4

MTS SYSTEMS CORPORATION
EDEN PRAIRIE, MINNESOTA U.S.A.



REVISIONS					
DESCRIPTION	DRAWN	ENGR	DATE	LETTER	ECN NO

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SOURCE/REF DRAWING -

PROPRIETARY DATA

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UNLESS OTHERWISE SPECIFIED

MATERIAL DESCRIPTION -----

MATERIAL SIZE -----

FINISH ----- MASK

- THREAD DEPTHS ARE TO MIN FULL THDS
- DRILL DEPTHS ARE TO FULL DIA
- REMOVE BURRS AND SHARP EDGES
- DO NOT SCALE PRINT

SCALE NONE

MACHINED SURFACES 180√

.XXX HOLE SIZE TOLERANCE

0.000 TO .750 +.010/-.002	OVER .750 TO 1.500 +.015/-.003

GENERAL TOLERANCES: ANGLE ±2° | X/Y ±1/4 | .X ±.1 | .XX ±.03 | .XXX ±.010

THIRD ANGLE PROJ

DRAWN	CHECK	ENGR	MFG
DCP	-	PJR	-
DATE 04/22/15	DATE -	DATE 07/13/15	DATE -

TITLE
CONFIGURATION
DRAWING-515,40/60HP

NEXT LEVEL -----

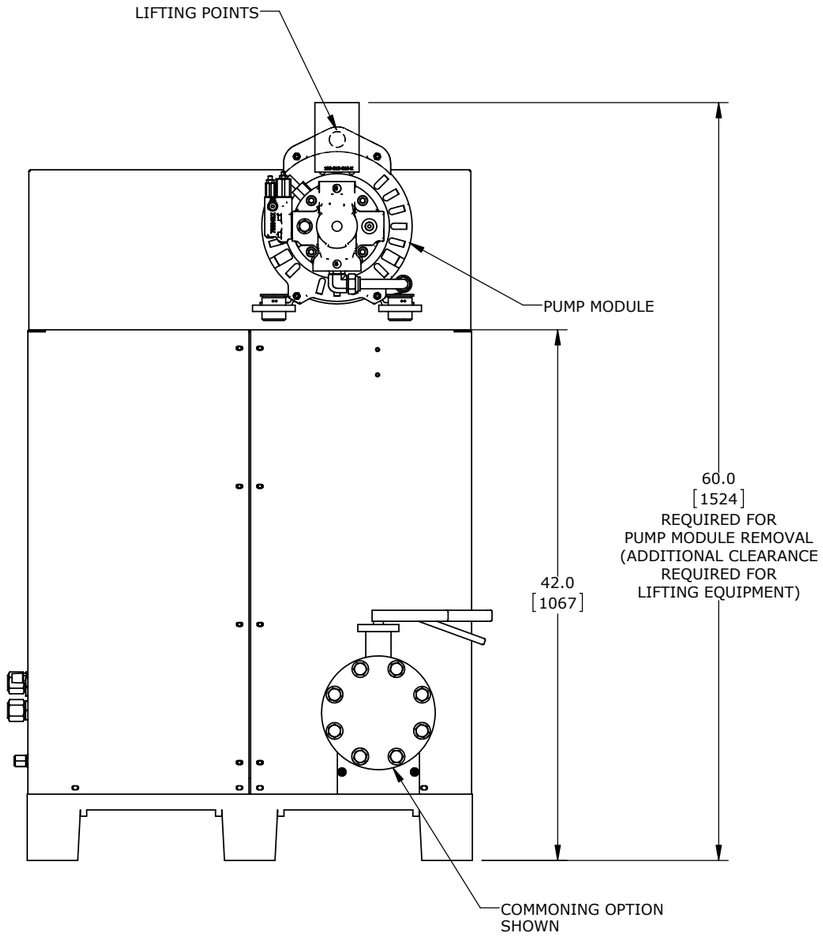
SIZE D

NUMBER 700-007-770 REV B

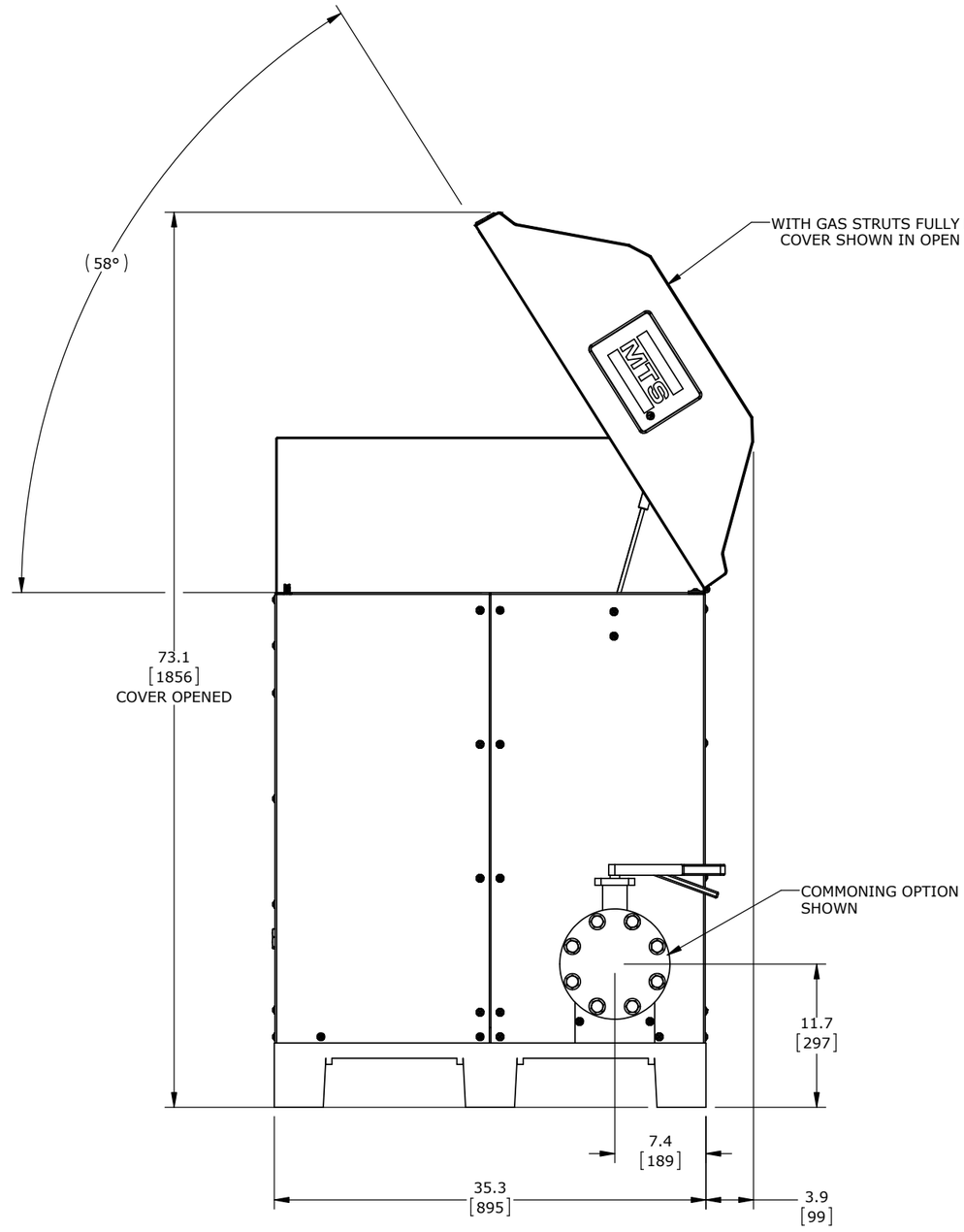
PRODUCT CODE 515

SHEET 2 OF 4

MTS SYSTEMS CORPORATION
EDEN PRAIRIE, MINNESOTA U.S.A.



MODULE REMOVAL:
MULTIPLE ITEMS REMOVED FOR CLARITY



VIEW A-A

REVISIONS

DESCRIPTION	DRAWN	ENGR	DATE	LETTER	ECN NO

-

SOURCE/REF DRAWING -

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GENERAL TOLERANCES

ANGLE	±2°
X/Y	±1/4
.X	±.1
.XX	±.03
.XXX	±.010

DRAWN	CHECK	ENGR	MFG
DCP	-	PJR	-
DATE 04/22/15	DATE -	DATE 07/13/15	DATE -

TITLE: CONFIGURATION DRAWING-515,40/60HP

NEXT LEVEL: -----

SIZE: D

NUMBER: 700-007-770

REV: B

PRODUCT CODE: 515

SHEET 3 OF 4

MTS SYSTEMS CORPORATION
EDEN PRAIRIE, MINNESOTA U.S.A.