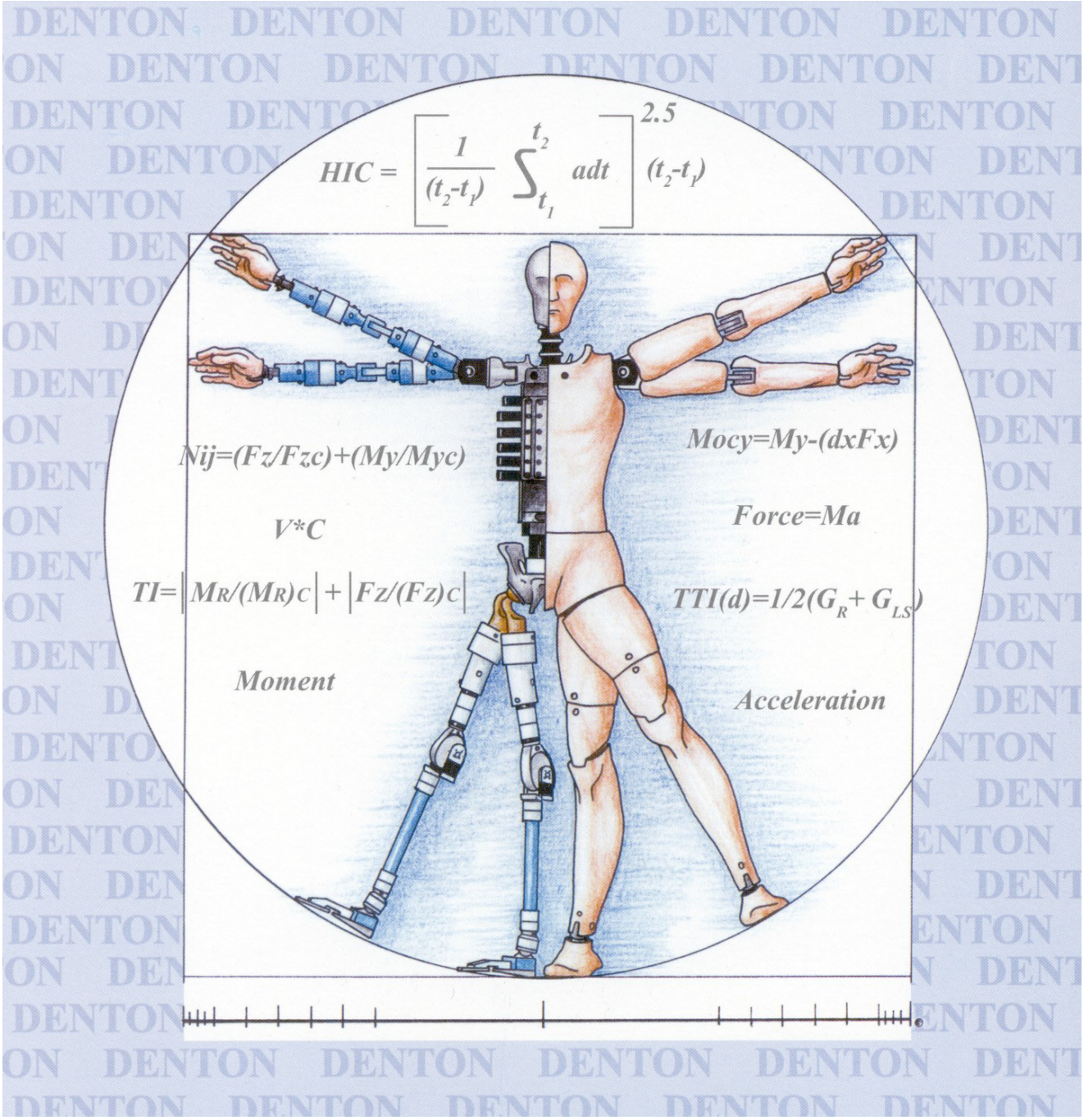
DENTON



2003 Product Catalog

Denton, Inc.

Corporate Office

Worldwide Distributors

Regional Offices

Robert A. Denton, Inc.

Contact Information

Company Profile

A2LA Accreditation

Products & Services

Denton ATD, Inc.

Contact Information

Company Profile

ISO 9001 and Q9001

Products & Services

Denton, Inc.

Corporate Offices
2967 Waterview Drive
Rochester Hills, MI 48309-4600
United States of America

Phone: +1 (248) 852-5100
Fax: +1 (248) 852-6060

Email: Sales@radenton.com

Internet: http://www.dentoninc.com

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United States of America

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Fax: +1 (248) 852-6060

Email: info@radenton.com

Internet: http://www.radenton.com

Company Profile

Robert A. Denton, Inc. was founded in 1974 by Robert Denton as an extension of his work in automotive safety conducted at Wayne State University, Detroit, Michigan, USA. At the heart of developing improved vehicle safety is crash testing using anthropomorphic dummies for the acquisition of force and impact data. In this area, Denton transducers excel, gathering and transmitting data to recording devices. Denton's first products included neck and femur load cells. Over the years new transducers were designed and produced to support the evolution of the various types of anthropomorphic dummies as well as other specialized areas of force measurement. Robert A. Denton, Inc designed virtually all the load cells used in today's anthropomorphic test dummies. While the major market we service continues to be automotive, our company responds to a broad range of industry requirements including devices to serve aerospace, aviation, biomechanics, recreation, and various segments of science and research. As part of our commitment to further the advancement of vehicle safety, a number of our staff are members of the Society of Automotive Engineers (SAE), a worldwide professional organization of automotive and aerospace design engineers. These individuals are members and chairpersons of SAE design and research committees specifying the design, implementation, and data analysis aspects of vehicular crash research.

Our Mission

Robert A. Denton, Inc. is committed to being the world's preferred provider of sophisticated force measurement devices and related services. We are focusing our efforts on the vehicle safety industry with emphasis on the automotive and aerospace markets. Our intention is to always exceed our customer's expectations by providing the best in innovative, reliable solutions in products, systems and services. We will enhance our position as the world's leader in the design, development and manufacture of force transducers and related systems and services through the continuous development of our people and organization. We will continue to play a key role in the further development of safer vehicles - ultimately saving lives.

Denton ATD, Inc.

10317 US Highway 250 N.
Milan, OH 44846-9570
United States of America

Phone: +1 (419) 625-5200
Fax: +1 (419) 625-5335

Email: info@dentonatd.com

Internet: http://www.dentonatd.com

Company Profile

Robert A. Denton Inc. established Denton ATD, Inc. on July 17, 2000 after the purchase of Applied Safety Technologies Corporation (ASTC) in Milan, Ohio, USA. Denton ATD, Inc. produces a full line of regulated and non-regulated crash dummies and dummy laboratory calibration equipment for the automotive safety and aerospace industries. While the major market we service continues to be automotive, our company responds to a broad range of industry requirements including ATD devices to serve aerospace, aviation, biomechanics, recreation and various segments of science and research. As part of our commitment to further the advancement of vehicle safety, a number of our staff are members of the Society of Automotive engineers (SAE), a worldwide professional organization of automotive and aerospace engineers. These engineers are members and chairpersons of SAE design and research committees specifying the design, implementation and data analysis aspects of vehicular crash research.

Our Mission

Denton ATD, Inc. is committed to being the world's preferred provider of anthropomorphic test devices (ATD's) - commonly known as crash test dummies - and dummy laboratory calibration equipment. We are focusing our efforts on the vehicle safety industry with an emphasis on the automotive and aerospace markets. Our intention is to always exceed our customer's expectations by providing the best in innovative, reliable solutions in products, systems and services.

We will enhance our position as the world's leader in the design, development and manufacturer of ATD's and related systems and services through the continuous development of our people and organization. We will continue to play a key role in the further development of safer vehicles - ultimately saving lives.

Worldwide Distribution

Australia - Applied Measurement

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PO Box 159
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Mr. John Ralton
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Fax: 81-3-5820-7027
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Mr.Naum P.Valler, President
infax@provide.net

Latin America - Soluciones Tecnológicas, S.A. de C.V.

Guadalajara, Mexico
Tel. 52-33-3615 1856
Fax 52-33-3615 3214
Mr. Edwin J. Reichel
ereichel@visionandautomation.com
www.visionandautomation.com

Accreditation

On April 22, 2002, Robert A. Denton, Inc.'s Calibration Laboratory was approved for accreditation by the American Association for Laboratory Accreditation (A2LA) in the Calibration field for the calibrations identified in the Scope of Accreditation. Our laboratory is accredited to ISO/IEC Guide 17025 - 1999 through December 31, 2003 by virtue of the onsite assessment of the calibration laboratory and evaluation of all activity related to the assessment by the A2LA Accreditation Council.

View a copy of the Robert A. Denton, Inc. A2LA Accreditation Certificate numbered 1644.01.

On October 8, 1999, Denton ATD, Inc. received their Certificate of Quality System Assessment from the American Quality Assessors (AQA). Denton ATD, Inc. has established a quality management system that is in compliance with the International Quality System Standard ISO 9001 and Q 9001 (1994) with a scope of Engineer, Development and Manufacture of Crash Dummies and Calibration Equipment.

View a copy of the Denton ATD, Inc. Certificate of Quality System Assessment certificate No. 1616.

ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

ROBERT A. DENTON, INC.
Rochester Hills, MI

for technical competence in the field of

Calibration

The accreditation covers the specific calibrations listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories". Testing and calibration laboratories that comply with this International Standard also operate in accordance with ISO 9001 or ISO 9002 (1994). This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

Presented this 22nd day of April 2002.

SEAL

President
For the Accreditation Council
Certificate Number: 1644.01
Valid to: 12/31/2003

For the calibrations to which this accreditation applies,
please refer to the laboratory's Calibration Scope of Accreditation

American Association for Laboratory Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 10725-1999
& ANSI/NCSL Z540-1-1994

ROBERT A. DENTON, INC.
2967 Waterview Drive
Rochester Hills, MI 48309
Kurt M. Bambach Phone: 248 852 5100

CALIBRATION

Valid To: December 31, 2003 Certificate Number: 1644.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1]:

Parameter/Equipment	Range	Best Uncertainty[2,3] (±)	Comments
Force –			
Dead Weights	4 ozf – 400 lbf	0.064%	Class F Weights
Load Cells	50 – 500 lbf	0.062%	Axial Load
	100 – 1 000 lbf	0.086%	
	200 – 2 000 lbf	0.074%	
	500 – 5 000 lbf	0.080%	
	1 000 – 10 000 lbf	0.078%	
	2 500 – 25 000 lbf	0.080%	
	5 000 – 50 000 lbf	0.082%	
	8 000 – 80 000 lbf	0.11%	
Moment –			
Load Cells	50 – 500 in-lbf	0.15%	Moment Load
	100 – 1 000 in-lbf	0.12%	
	200 – 2 000 in-lbf	0.11%	
	500 – 5 000 in-lbf	0.16%	

[1] This laboratory offers commercial calibration services.
[2] Best Uncertainties represent expanded uncertainties using a coverage factor of k = 2 which provides a level of confidence of approximately 95%.
[3] Best Uncertainties are expressed as a percentage of the full scale.

5301 Buckeystown Pike, Suite 350 • Frederick, MD 21704-8373 • Phone: 301-644 3248 • Fax: 301-662 2974

Certificate of Quality System Assessment

American Quality Assessors, AQA, a provider of ISO 9000/Q9000 third party quality system registration and accredited by the American National Accreditation Program for Registrars of Quality Systems, ANSI-RAB, attests that:

DENTON ATD Inc.
10317 US Hwy 250 N.
Milan, OH 44846

with a scope of :

Engineer, Development and Manufacture of Crash Dummies and Calibration Equipment

has established a quality management system that is in compliance with the International Quality System Standard ISO 9001 and Q 9001 (1994).

October 8, 1999	October 8, 2002
Registration Date	Registration Period Ending
1616	
Certificate No.	Executive Director, AQA

American Quality Assessors
1107 Belleview Ave., Columbia, SC 29201
Phone (800) 281-4384

ANSI-RAB QMS ACCREDITED

Denton Regional Offices

Denton COE, GmbH

Denton COE GmbH will service the full product lines of Robert A. Denton, Inc., and Denton ATD, Inc. for all European distributors and customers. This will include service, training and technical support for crash test dummies, load cells, accelerometers and other related instrumentation. These services include complete calibration, repair and systems integration including special cabling and connectors with channel identification modules. The COE staff can provide applications engineering and will continue active participation in ISO, ECE, EEVC and SAE committees.

In addition to the service activities offered, the Denton COE will exclusively represent Denton products for the transportation safety industry in Germany, Switzerland, Austria and England.

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69126 Heidelberg
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Fax: 011 49 6221 33 50 850
Mr. Thomas Warkentin
Twarkentin@dentoncoe.de
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England

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69126 Heidelberg
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Telephone: 011 49 6221 33 508 22
Fax: 011 49 6221 33 50 850
Mr. Alexander Schmitt
ASchmitt@dentoncoe.de
Website: www.dentoncoe.de

For additional information regarding any Denton products and services please contact Mr. Randy Kelly, Corporate Director of Sales and Customer Service for the Denton companies at (248) 852-5100 or via email randyk@radenton.com.

Denton ATD Regional Service Center

For additional information regarding the Denton ATD Regional Service Center please contact Mr. Randy Kelly, Corporate Director of Sales and Customer Service for the Denton companies at (248) 852-5100 or via email randyk@radenton.com.

Products & Services

Load Cell Products

ATD Load Cell and Calibration Fixtures Reference Guide
Load Cell Installation Tools and Adapter Plates
Accelerometer Mounts

Safety Test & Measurement Load Cells
Custom-Designed Load Cells

Associated Products
Load Cell Calibration Systems
Calibration Products

Support Services
Custom Transducer Connector and Cable Assemblies
Load Cell Regaging & Repairs
Load Cell Calibrations
Accelerometer Calibrations

Anthropomorphic Test Device Products

Anthropomorphic Test Devices (Crash Test Dummies)
ATD Calibration Test Fixtures
Associated Products
Services

Robert A. Denton, Inc. Products and Services

Non-ATD Load Cells

ATD Load Cell and Calibration Fixture Reference Guide

Installation Tools and Adapter Plates

The following is a representative sampling of load cell installation tools and adapter plates manufactured by Robert A. Denton, Inc.

Model 2023	Hybrid III 50th and 95th Neck Installation Tool
Model 2023A	Hybrid III 5th Neck Installation Tool
Model 2994	Hybrid III 50th Lumbar Alignment Tool
Drawing 3367	H-Point Alignment Tools and Adapter Plates

Accelerometer Mounts

The following is a representative sampling of accelerometer mounts manufactured by Robert A. Denton, Inc.

Model 1846	Accelerometer Head Mount Hybrid III 50th
Model 3056	Accelerometer Head Mount Free Motion Head Form
Model 3623	Accelerometer Head Mount Hybrid III 50th
Model 4310	Accelerometer Head Mount Hybrid III 5th Female
Model 5640	Accelerometer Head Mount Hybrid III 6-Year-Old Child
Model 3522	Accelerometer Mount Femur Load Cell

Safety Test and Measurement

This is a representative sampling of non-ATD load cells manufactured by Robert A. Denton, Inc. Calibration Fixtures are available for all of the load cells.

Three Channel Load Cells

Model 2419 (2000 LB / 8897 N capacity)

Model 2420 (10000 LB / 44484 N capacity)

Model 2881 (10000 LB / 44484 N capacity)

Model 3540 (20000 LB / 88968 N capacity)

Five Channel Load Cells

Model 1968

Model 3235

Barrier Face Load Cells

Model 3252 (one channel)

Model 3787 (two channel)

Model 3830 (two channel)

Model 1645 (three channel)

Seat Belt Load Cells

Model 4930 (100 LB / 445 N capacity)

Model 3452 (250 LB / 1112 N capacity)

Model 3371 (1500 LB / 6673 N capacity)

Model 3255 (3000 LB / 13345 N capacity)

Model 2346 (5000 LB / 22242 N capacity)

Model 5155 (1000 LB/4500 N capacity)

Seat Pan Load Cells

Model 2177 (three channel)

Model 2513 (six channel)

Steering Column Load Cells

Model 4188 (three channel)

Model 3480 (five channel)

Model 3868 (six channel)

Miscellaneous, Non-ATD Load Cells

Model 2281 Five Channel Shear Capsule Load Cell

Model 2655 Three Channel B-Pillar Load Cell

Model 4639 Three Channel Air Curtain Load Cell

Custom Designed Load Cells

Serving numerous worldwide markets, the products and technologies of Robert A. Denton, Inc. span the testing and measurement requirements of various industries outside of the safety testing community. Denton has custom designed load cells for tire performance evaluation, transportation equipment testing, biomechanics, recreational equipment testing, automotive component testing, aircraft and aerospace parts and manufacturing testing.

Three Channel Load Cells

Model 2236

Model 2880

Model 4004

Five Channel Load Cells

Model 3118

Model 3124

Six Channel Load Cells

Model 3100

Model 3101

Model 4386

Model 4526

Load Plates

Model 3632 (4000 LBF / 1814 KG capacity)

Model 3580 (11023 LBF / 5000 KG capacity)

Model 4433 (17637 LBF / 8000 KG capacity)

Miscellaneous Load Cells

Model 2571 Compression Load Cell

Model 2993 Needle Sensor

Model 3346 Pedal Force Load Cell

Model 3845 Rolling Resistance Load Cell

Model 4438 Shoulder Belt Anchor Load Cell

Model 4548 Skid Trailer Load Cell

Model 2527 Skid Trailer Load Cell

Model 3555 Tension Load Cell

Model 2409 Window Seal Force Load Cell

This is a representative sampling of custom designed load cells manufactured by Robert A. Denton, Inc. Calibration Fixtures are available for all of the load cells.

This is a representative sampling of custom designed load cells manufactured by Robert A. Denton, Inc. Calibration Fixtures are available for all of the load cells.

Load Cell Calibration Systems

Three models are available for purchase: Model CAL-20000, Model CAL-30000 and Model CAL-6000 The basic difference between the models is the capacity of the loading frames. Calibrations can be performed in both tension and compression for up to six simultaneously sampled test channels. Software and hardware is supplied for the complete control of calibration setup, data acquisition, data storage and retrieval, and hardcopy reporting. The system is capable of performing computer controlled loading, manual loading, deadweight loading, and pressure transducer calibrations, each with its own suite of data reports. System Features:

CAL-20000 Computer Automated Multi-Axis Load Cell Calibration System

- United Model STM-20 Table Top Load Frame, 20,000 LBF capacity tension and compression, 42" crosshead travel, 22" column clearance, 0.001" to 20"/minute programmable speed range, +/- 0.1% of set speed accuracy, 32"W x 28"D x 64"H
- 5,000 LB capacity precision reference cell, ≤ 0.01%FS non-linearity & hysteresis
- Tension and Compression compliant loading fixture, 5,000 LB capacity
- Precision 8 channel instrument amplifier, 3 software selectable gain ranges (100, 200, and 500), 3 manually selectable filter ranges (50HZ, 500HZ, and 5KHZ), software controlled zero offset compensation
- DC Excitation power supply, software programmable via GPIB interface
- Table top 19" rack mount electronics enclosure
- 6 Channel Remote Transducer connection IO module with manual shunt resistor capability
- Intel Pentium™ Processor based PC computer with Microsoft Windows™ Operating System, 32MB Ram, 840MB (or larger) hard disk, 17" Multi-Frequency Monitor, 104+ keyboard, mouse
- GPIB Interface card
- 16 bit data acquisition card with 8 channel (differential) inputs, 8 programmable DIO lines, 2 precision on board programmable clock/trigger circuits, simultaneous channel sampling for all test and reference channels, typically 1000HZ sustained sampling per channel, 0.02%FS reading accuracy, overall system accuracy ≤ 0.05% FS, overall system repeatability ≤ 0.1% FS
- Electronic Temperature / Humidity monitoring module
- Ink Jet Printer
- Intelligent, uninterruptible power supply with automatic system shutdown capabilities
- Stylish desk enclosure for all electronic equipment and operator workspace
- Hardwood work table to house load frame and supply additional operator work space

CAL-30000 Computer Automated Multi-Axis Load Cell Calibration System

Same specifications as CAL-20000 system with the following differences:

- United Model SFM-30 Floor Standing Load Frame, 30,000 LBF capacity tension and compression, 60" crosshead travel, 22" column clearance, 2 software selectable speed ranges - 0.002" to 2.0"/minute and 0.02" to 20.0"/minute, +/-0.1% of set speed accuracy, anti-backlash system, solid state electronics, 32"W x 27"D x 96"H

CAL-60000 Computer Automated Multi-Axis Load Cell Calibration System
Same specifications as CAL-30000 system with the following differences

- United Model SFM-60 Floor Standing Load Frame, 60,000 LBF capacity tension and compression, 60" crosshead travel, 22" column clearance, 2 software selectable speed ranges - 0.002" to 2.0"/minute and 0.02" to 20.0"/minute, +/-0.1% of set speed accuracy, anti-backlash system, solid state electronics, 36"W x 42"D x 107"H

CALIB Calibration System Control Software (included with all systems)

- Microsoft Windows™ and Windows 95™ compatible
- Fast user-friendly software for the complete control of calibration setup, automatic data acquisition, data storage and retrieval, and hardcopy reporting. Supports up to 6 channels of simultaneous transducer calibration
- Multi level password control of calibration configuration setup definitions and system operation
- Borland Paradox compatible data file format
- Integrated report template editor for the creation and maintenance of data report forms
- Capable of performing Automatic, Manual, Deadweight, and Pressure Transducer calibrations, each with its own suite of data reports

Support Services

Custom Transducer Connector and Cable Assemblies

Robert A. Denton, Inc. offers a connector installation service for cable assemblies. This service includes the installation of cabling and/or connectors on new or customer furnished load cells, accelerometers, potentiometers, etc. The connectors are to interface the load cells to the customers' data acquisition equipment, thereby permitting test departments to have immediate use of the load cells as soon as they are received. Connectors are installed per the wiring instructions furnished by the customer. Special techniques are used to "breakout" the individual channels, from multi-channel cables, to ensure each channel has continuous "shielding" from the transducer to each individual connector. Dallas ID Module installation into connectors and strain relief is also offered.

Each detachable cable assembly is checked with a computerized cable tester to verify the wiring scheme, continuity and individual wire resistance. Hard-wired cable assemblies are continuity checked with a handheld tester and verified during the calibration of the load cell.

Customers may choose to furnish their own connectors or Denton, Inc. will procure and maintain an inventory of connectors.

Repairs & Regaging

Robert A. Denton, Inc. repairs and regages their entire load cell product line as well as the load cells of other manufactures.

Load Cell Calibrations

- ISO Guide 25 Compliant, A2LA Accredited
- Traceability to the National Institute of Standards (NIST)
- Member of National Conference of Standards Laboratories (NCSL) since 1988
- Calibrates other manufacturers load cells
- Data presented in English or Metric units
- Average turn-around time of 5 working days
- Normally consists of 5 upscale and 5 downscale points

Computer Automated Multi-Axis Load Cell Calibration System:

- Multi-axis calibrations using personal computers for data collection
- Load frame capacity of 30,000 lbs. compression and 20,000 lbs. tension
- Precision 8 channel instrument amplifier
- 3 software selectable gain ranges (100, 200 and 500)
- 3 manually selectable filter ranges (50HZ, 500HZ and 5KHZ)
- Software controlled zero offset compensation
- Manual shunt resistor capabilities

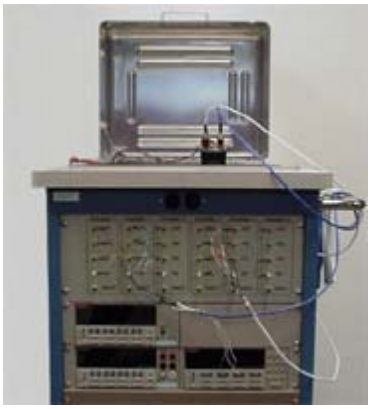
Hydraulic Load Frame:

- Manual, multi-axis calibrations
- 80,000 lb. limit
- Personal computer for data collection

Deadweight:

- Avoirdupois Weight Test System manual calibrations
- Calibrations performed from 1 lb. to 400 lb. limit
- Personal computer for data collection

Bridge Tester:



- Measures input and output impedance
- Check for high shorts between load cell and +excitation
- Personal computer for data collection

Pressure Transducers:

- Ametek Hydraulic Deadweight Pressure Test System manual calibrations
- Calibration range is up to 1000 psi limit
- Personal computer for data collection

Accelerometer Calibration Services

- Endevco "Authorized" Regional Calibration Center for accelerometer calibrations
- Calibrations performed on accelerometers from Accelerometer on other manufacturers
- Traceable to NIST in accordance with ANSI/NCSL Z540-1-1994 standards
- Ability to calibrate piezoelectric, peizoresistive, variable capacitance and integral electronics type accelerometers
- Average turn-around time of 5 working days

NOTE: Robert A. Denton, Inc. does not repair accelerometers. Accelerometers must be returned to the original manufacturer for repair.

Calibration Protocol: Accelerometer calibrations are normally performed at a 10 G level from 20 Hz through the usable frequency range up to 50kHz. A resonance search is also provided up to 50kHz. Robert A. Denton, Inc. performs DS411 Service (sensitivity, 10 g, 100 hz) and the DS415 Service (sensitivity, Freq Resp Fn) for uniaxial and triaxial accelerometers. In addition, the DS270 Shunt Calibration is available in conjunction with the DS415 and DS411 calibrations for piezoresistive type accelerometers.

Anthropomorphic Test Devices

Adult Frontal Impact ATDs

Hybrid II - 50th Percentile Male

Hybrid III - 5th Percentile Female

Hybrid III - 50th Percentile Male

Hybrid III - 95th Percentile Male

Adult Side Impact ATDs

BioSID (Side Impact Dummy)

EuroSID-1

SID (Side Impact Dummy)

SID-H III

SID-H III Conversion Kit

Specialty ATDs

FAA-Hybrid III 50th Percentile Male

BioRID II (Rear Impact Dummy)

Pedestrian

HURD 116

HURD 132

HURD 202

HURD 212

Child ATDs

CAMI and CAMI-N (Newborn Infant Child)

CRABI (Child Restraint Airbag Interaction) 12 Month Old

Hybrid II - 3 Year Old Child

Hybrid II - 6 Year Old Child

Hybrid III - 3 Year Old Child

Hybrid III - 6 Year Old Child

Associated Products

Thor-Lx

Thor-Flx

H-III 5th and 95th Ball Bearing Knee Sliders

H-III 50th Ball Bearing Knee Sliders

Zippered Flesh

Dummy Chair

ATD Calibration Test Fixtures

TF-100: Head Drop

TF-200: Neck Pendulum

TF-300: Thorax Impact

TF-400: Knee Impact/Knee Slider

TF-600: Lumbar Flexion

TF-78051-600 Foot Compression

V00039: Hip Calibration

V00364 EuroSID Thorax Certification

TMA-001: Automated Torso Flexion Test Stand

Services

3-D Computer Design Manufacturing

Signal Waveform Generator

ATD Load Cell Reference Guide 2003

MODEL	# OF CHANNELS	DESCRIPTION	CAL FIXTURES	HII - 50TH	HIII - 5THF	HIII - 50TH	HIII - 95TH	FAA - HIII-50TH	THOR	FEMALE THOR	BIORID-II	BIOSID	SID	SID/HIII	EUROSID-1	SID-IIs	ES-2	3YO AIRBAG	HIII - 3C	HIII - 6C	HIII-10C	CRABI - 6MO	CRABI - 12&18 MO	TNO P 3/4 & P3	TNO P 1 1/2	TNO Q3 & Q6	TNO Q1
1567	1	Load Bolt	3700			X																					
1571	14/pair	Lower Leg	1861/2171			X		X				X					X										
1583	2	Upper Tibia	2171		X	X	X	X				X					X										
1584	3	Lower Tibia	2171		X	X	X	X				X					X										
1587	2	Knee Clevis	1861			X		X				X					X										
1708	6	Lumbar	2555	X									X	X													
1716	6	Upper Neck	1860		R	R	X	X				X		X		X				R	X						
1794	6	Lower Neck	1920			X	X	X				X															
1842	3	Lumbar	1883			X	X																				
1846	12/15 Accels	Head Accelerometer Mounting				X	X	X				X															
1891	3	Lumbar	2452	R				R																			
1911	5	50th)	1934			X	X	X	X																		
1914	6	Femur	1957	X	X	X	X	X	X			X	X	X	X	X											
2062	3	Upper Neck (Low Capacity)	2130		X	X	X	X				X				X											
2090	1	Femur	3863																	R	X						
2110	0	Clevis	N/A			X		X				X															
2121	1	Femur	3203	R	R	R	X	R																			
2150	5	Lower Neck	2155		X																						
2151	5	Thoracic	2156		X																						
2152	5	Lumbar	2157		X																						
2153	14/pair	Lower Leg	1861/2171		X																						
2154	2	Knee Clevis	1861		X											X											
2193	6	Upper Femur	1976			X						X															
2254	5	Lumbar	2295									X															
2255	3	Shoulder	2294									X															
2256	1	Sacrum	2292									X															
2257	1	Pubic	2291									X															
2258	1	Ilium	2293									X															
2331	3	Upper Neck	2900																				X				
2372	2	Knee Clevis	1861			X																					
2421	0	Knee Clevis	NA		X																						
2430	6	Lower Neck	2590																X								
2431	6	Lumbar	2591																X	X							

R = Government Regulated

ATD Load Cell Reference Guide 2003

MODEL	# OF CHANNELS	DESCRIPTION	CAL FIXTURES	HII - 50TH	HIII - 5THF	HIII - 50TH	HIII - 95TH	FAA - HIII-50TH	THOR	FEMALE THOR	BIORID-II	BIOSID	SID	SID/HIII	EUROSID-1	SID-IIs	ES-2	3YO AIRBAG	HIII - 3C	HIII - 6C	HIII-10C	CRABI - 6MO	CRABI - 12&18 MO	TNO P 3/4 & P3	TNO P 1 1/2	TNO Q3 & Q6	TNO Q1
2432	6	Femur	2592																X	X							
2453	14/pair	Lower Leg	1861/2171				X																				
2554	6	Neck/Lumbar	2597																		X	R		X			
2564	3	Upper Neck	1860		X	X	X	X												X							
2586	6	Lumbar	2295									X															
2587	6	Upper Neck	3308																				X				
2631	3 /Dummy	Abdominal	2858												R												
2656	4/pair	Iliac	2922		X																						
2693	4	Upper Femur	3340			X						X															
2770	2	Sacrum	2292									X															
2789	2	Pubic	2857																			X					
2791	4/pair	Shoulder	2856																			X					
2792	3	Lumbar	1883						X																		
2837	2	Anterior Tibia	2837CP			X		X	X																		
2890	3	Lumbar (Steel-High Capacity	3184												X												
2896	6	Upper Neck (Low Capacity)	1860		X	X	X	X				X								X							
2944	6	Lumbar	3437																X								
2945	1	Acetabulum	3222																X								
2981	1	Damper	3000										X	X													
2992	6	Lower Neck (Adjustable)	3286			X	X	X				X															
3043	1	Acetabulum	3047									X															
3060	4/pair	ASIS	3547																	X	X						
3071	20/pair	Enhanced Legs	1861/2171			X		X				X															
3079	4/pair	ASIS	3625																X								
3090	6	Ankle & Toe	3301/3398			X		X				X															
3091	1	Upper Femur	3413									X															
3093	3	Lower Tibia	2171		X	X		X				X															
3096	1	Pubic	3366												R												
3114	4	Lower Tibia	2171		X	X	X	X				X				X												
3115	4	Upper Tibia	2171		X	X	X	X				X															
3133	5	Thoracic Spine	2156										X	X													
3142	3	Lumbar Spine	3282										X	X													
3155	3	Shoulder	3225												X												
3156	8	Humerus	3649/3647			X		X																			

R = Government Regulated

ATD Load Cell Reference Guide 2003

MODEL	# OF CHANNELS	DESCRIPTION	CAL FIXTURES	HII - 50TH	HIII - 5THF	HIII - 50TH	HIII - 95TH	FAA - HIII-50TH	THOR	FEMALE THOR	BIORID-II	BIOSID	SID	SID/HIII	EUROSID-1	SID-IIs	ES-2	3YO AIRBAG	HIII - 3C	HIII - 6C	HIII-10C	CRABI - 6MO	CRABI - 12&18 MO	TNO P 3/4 & P3	TNO P 1 1/2	TNO Q3 & Q6	TNO Q1
3166	6	Lower Neck	3264												X												
3167	3	Shoulder	3265												X												
3168	1	Pubic	3268												X												
3169	2/pair	Upper Femur	3269												X												
3213	3	Thoracic	1934		X	X																					
3228	1	Iliac	3267												X												
3229	6	Lumbar	3266												X												
3249	1	Acetabulum	3270												X												
3250	20/pair	Enhanced Legs	1861/2171	X																							
3251	6	Lower Neck	2155	X																							
3253	20/pair	Lower Legs	1861/2171												X												
3259	4	Upper Tibia	2171								X				X												
3287	4	Lower Tibia	2171	X	X	X	X				X																
3290	3	Lumbar (Aluminum-Standard	3184											X													
3292	3	Upper Tibia	2171	X	X		X				X																
3300	6	Lower Neck	3527											X													
3303	6	Upper Neck	2028														X	R									
3304	6	Lower Neck	2028															X									
3309	3/side	Abdominal	2858									X	X														
3390	20/pair	Enhanced Legs	1861/2171			X																					
3416	20/pair	Lower Legs	1861/2171		X		X				X																
3448	0	Upper Tibia	NA		X		X																				
3454	6	Upper Neck	3637					X																			
3455	6/pair	Acetabulum (right side)	3633					X																			
3457	12	Rib	3485		X		X																				
3471	5	Lower Neck (T1)	1934		X		X				X																
3491	8/pair	Lower Leg	1861/2171		X		X				X																
3525	20/arm	Arm	3697/3698	X											X												
3552	20/pair	Lower Leg	1861/2171			X																					
3553	20/pair	Lower Leg	1861/2171	X																							
3643	5	Upper Tibia	2171	X	X	X	X				X																
3644	5	Lower Tibia	2171	X	X	X	X				X																
3676	4/dummy	Rib	3765												X												
3690	3	Upper Neck (Low Capacity)	1860	X	X	X	X				X		X						X								

R = Government Regulated

ATD Load Cell Reference Guide 2003

MODEL	# OF CHANNELS	DESCRIPTION	CAL FIXTURES	HII - 50TH	HIII - 5THF	HIII - 50TH	HIII - 95TH	FAA - HIII-50TH	THOR	FEMALE THOR	BIORID-II	BIOSID	SID	SID/HIII	EUROSID-1	SID-IIs	ES-2	3YO AIRBAG	HIII - 3C	HIII - 6C	HIII-10C	CRABI - 6MO	CRABI - 12&18 MO	TNO P 3/4 & P3	TNO P 1 1/2	TNO Q3 & Q6	TNO Q1
3695	5	Foot	3301			X		X				X															
3696	1	Toe	3398			X		X				X															
3711	16/pair	Lower Leg	1861/2171			X		X				X															
3715	6	Upper & Lower Neck and Lumbar	3788																						X	X	
3716	5	Lower Neck (T1)	1934				X																				
3717	5	Lower Neck (T1)	2156		X																						
3743	2	Left ASIS	2922		X																						
3744	2	Right ASIS	2922		X																						
3745	2	Left ASIS	3547																X								
3746	2	Right ASIS	3547																X								
3747	2	Left Side	3625															X									
3748	2	Right Side	3625															X									
3780	6	Upper/Lower Arm	3697		X										X												
3781	2	Elbow	3698		X										X												
3795	4	Back Plate	4053											R													
3821	1	Dual Bridge Femur	3203	X	X	X	X	X				X															
3840	10/pair	Lower Leg	2171			X		X				X															
3855	3	Acetabulum (left side)	3633						X																		
3881	6	Thoracic	2156		X																						
3911	2	Shoulder	4034															X									
3933	6	Upper Neck (Low Capacity)	1860		X	X	X	X				X				X				X							
3959	18/pair	Lower Leg	1861/2171			X		X				X															
4016	2	Clavicle	2998			X		X																			
4037	3	Upper Neck (Low Capacity)	1860		X	X	X	X				X								X							
4085	6	Upper Neck	4316												X												
4092	6	Lower Neck (Low Capacity)	3286			X	X	X				X															
4102	3	Lumbar (Low Capacity)	1883			X	X																				
4150	2	Pubic	2857															X									
4205	12/pair	Lower Leg	1861/2171			X																					
4218	5	Ankle	5346			X	X					X															
4231	3	Lumbar	2591																X								
4251	24/pair	Lower leg	1861/2171		X																						
4252	24/pair	Lower Leg	1861/2171			X		X				X															

R = Government Regulated

ATD Load Cell Reference Guide 2003

MODEL	# OF CHANNELS	DESCRIPTION	CAL FIXTURES	HII - 50TH	HIII - 5THF	HIII - 50TH	HIII - 95TH	FAA - HIII-50TH	THOR	FEMALE THOR	BIORID-II	BIOSID	SID	SID/HIII	EUROSID-1	SID-IIs	ES-2	3YO AIRBAG	HIII - 3C	HIII - 6C	HIII-10C	CRABI - 6MO	CRABI - 12&18 MO	TNO P 3/4 & P3	TNO P 1 1/2	TNO Q3 & Q6	TNO Q1
4253	24/pair	Lower Leg	1861/2171				X																				
4254	20/pair	Lower Leg	1861/2171		X																						
4255	20/pair	Lower Leg	1861/2171			X																					
4256	20/pair	Lower Leg	1861/2171				X																				
4257	6	Femur	1957	X	X	X	X	X	X			X	X	X	X	X											
4263	15 Accels	Head Accelerometer Mounting			X																						
4284	4	T-12 (Thoracic) Spine	4620					X								R											
4300	6	In-Line Lower Neck	2857			X																					
4302	16/pair	Lower Leg	1861/2171				X																				
4351	1	Uniaxial Lumbar	2452			X		X																			
4353	4	Upper Tibia	2171						X																		
4354	4	Lower Tibia	2171					X	X																		
4365	4	Lower Neck	3527													X											
4366	6	Lower Neck	N.A.					X	X																		
4380	24	Enhanced Airbag Arm	N.A.		X												X										
4385	2	ASIS	4430				X																				
4502	6	Lumbar	4506			X	X	X																			
4507	16/pair	Lower Leg	1861/2171			R																					
4509	5	Upper Tibia	2171						X																		
4541	6	Lower Neck	2155		X																						
4543	16/pair	Lower Leg	1816/2171		X																						
4565	2	Ankle				X		X				X															
4567	2	Lower Tibia				X																					
4568	4/pair	Lower Leg		X		X																					
4664	1	Femur	1957	X	X	X	X	X	X			X	X	X	X	X	X										
4825	4	Upper Tibia	4976							X																	
4826	5	Lower Tibia	4974							X																	
4841	1	Femur	3203	X	X	X	X	X																			
4894	6	Lower Neck	1920			X	X	X				X															
4900	5	Femur	4979						X																		
4929	5	Lower Tibia	4989						X																		
4949	6	Upper Neck	5029								X																
4985	3	Upper Neck	5029								X																
5000		Rib/Spine Assembly				X																					

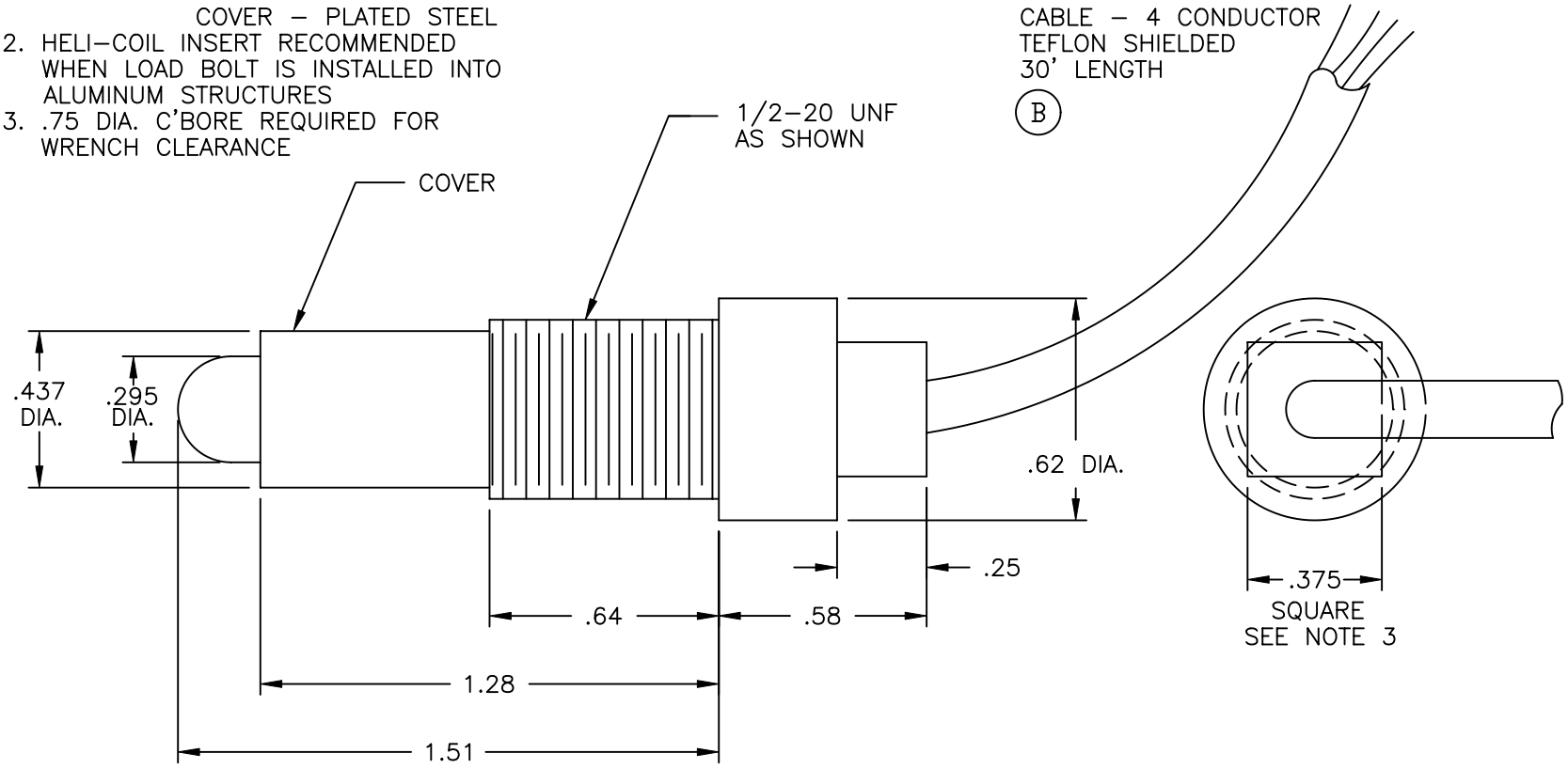
R = Government Regulated

ATD Load Cell Reference Guide 2003

MODEL	# OF CHANNELS	DESCRIPTION	CAL FIXTURES	HII - 50TH	HIII - 5THF	HIII - 50TH	HIII - 95TH	FAA - HIII-50TH	THOR	FEMALE THOR	BIORID-II	BIOSID	SID	SID/HIII	EUROSID-1	SID-IIs	ES-2	3YO AIRBAG	HIII - 3C	HIII - 6C	HIII-10C	CRABI - 6MO	CRABI - 12&18 MO	TNO P 3/4 & P3	TNO P 1 1/2	TNO Q3 & Q6	TNO Q1
5015	4	Eurosid Back Plate	4053											X													
5045	6	Adjustable Lower Neck	5583		X																						
5092	3	Lumbar Spine	2157		X																						
5123	4	Shoulder, Pair	5495																	X							
5124	6	Lower Neck	5340																	X							
5145	1	Achilles	5165			X			X																		
5190	6	Lumbar	5366											X		X											
5226	6	Upper Neck	5430	X																							
5233	6	InstrumentThoracic Spine Assembly									X																
5294	6	Lower Neck	5415										X														
5400	2	Left Shoulder	5495																	X							
5410	2	Right Shoulder	5495																	X							
5462	6	Straight Lumbar																									
5520	6	Upper Neck	5560							X																	
5521	5	Thoracic								X																	
5574	3	Acetabulum (Right)	5670							X																	
5575	6	Lower Neck	5656							X																	
5576	3	Acetabulum (left side)	5670							X																	
5580	3	T1 Thoracic Vertebrae	5680								X																
5686	6	Adjustable Lower Neck	5583												X												
5750	5	Upper Tibia								X																	
5832	6	Adjustable Lower Neck	5910			X	X																				

R = Government Regulated

NOTES:
1. MATERIAL – SENSOR – ALUM. ALLOY
   COVER – PLATED STEEL
2. HELI–COIL INSERT RECOMMENDED WHEN LOAD BOLT IS INSTALLED INTO ALUMINUM STRUCTURES
3. .75 DIA. C'BORE REQUIRED FOR WRENCH CLEARANCE



LOAD BOLTS ARE DESIGNED FOR USE IN THE SUBMARINING INDICATING PELVIS OF HYBRID III A.T.D. THE 50TH PERCENTILE AND LARGE MALE REQUIRE 6 BOLTS. THE SMALL FEMALE REQUIRES 4 BOLTS.

CAPACITY: 1000 LBS.
OUTPUT: 3 mV/V NOMINAL
NONLINEARITY <1% OF FULL SCALE

SYM	REVISION	DATE
C	WAS DRG. A-1567	4/99
B	CHG. CABLE LENGTH	9/30/96
A	REDRAWN IN CAD	7/16/93

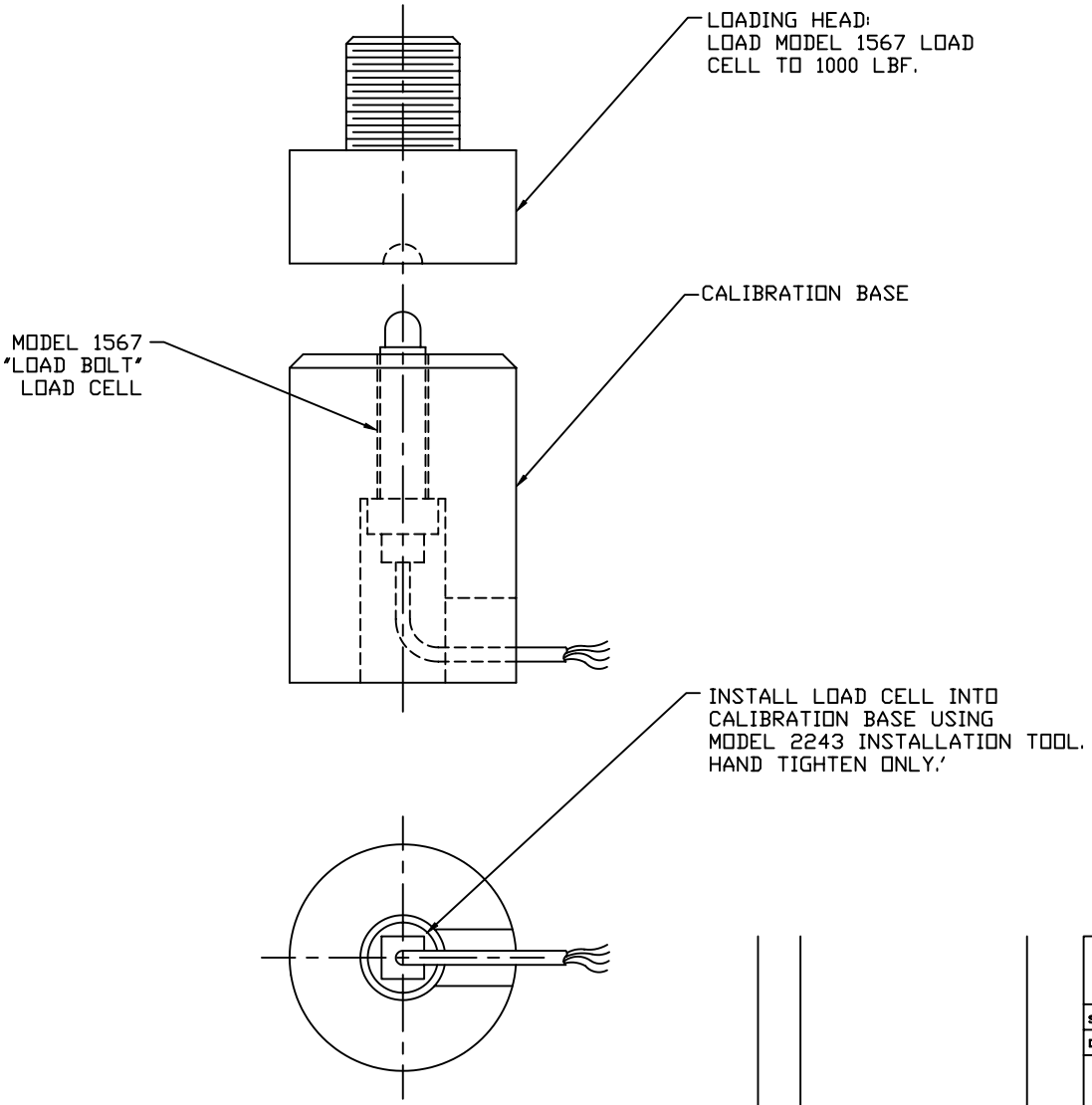
LOAD BOLT LOAD CELL

SCALE: 2X		DRAWN BY: C.R.M./S.E.F.
DATE: 6-11-81		MODEL: 1567

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-1567-D



USE CALIBRATION FIXTURE MODEL 3700

SYM	REVISION	DATE

MODEL 1567, LOAD BOLT CALIBRATION FIXTURE

SCALE: FULL		DRAWN BY: C.R. MORGAN
DATE: 25OCT96		MODEL: 1567

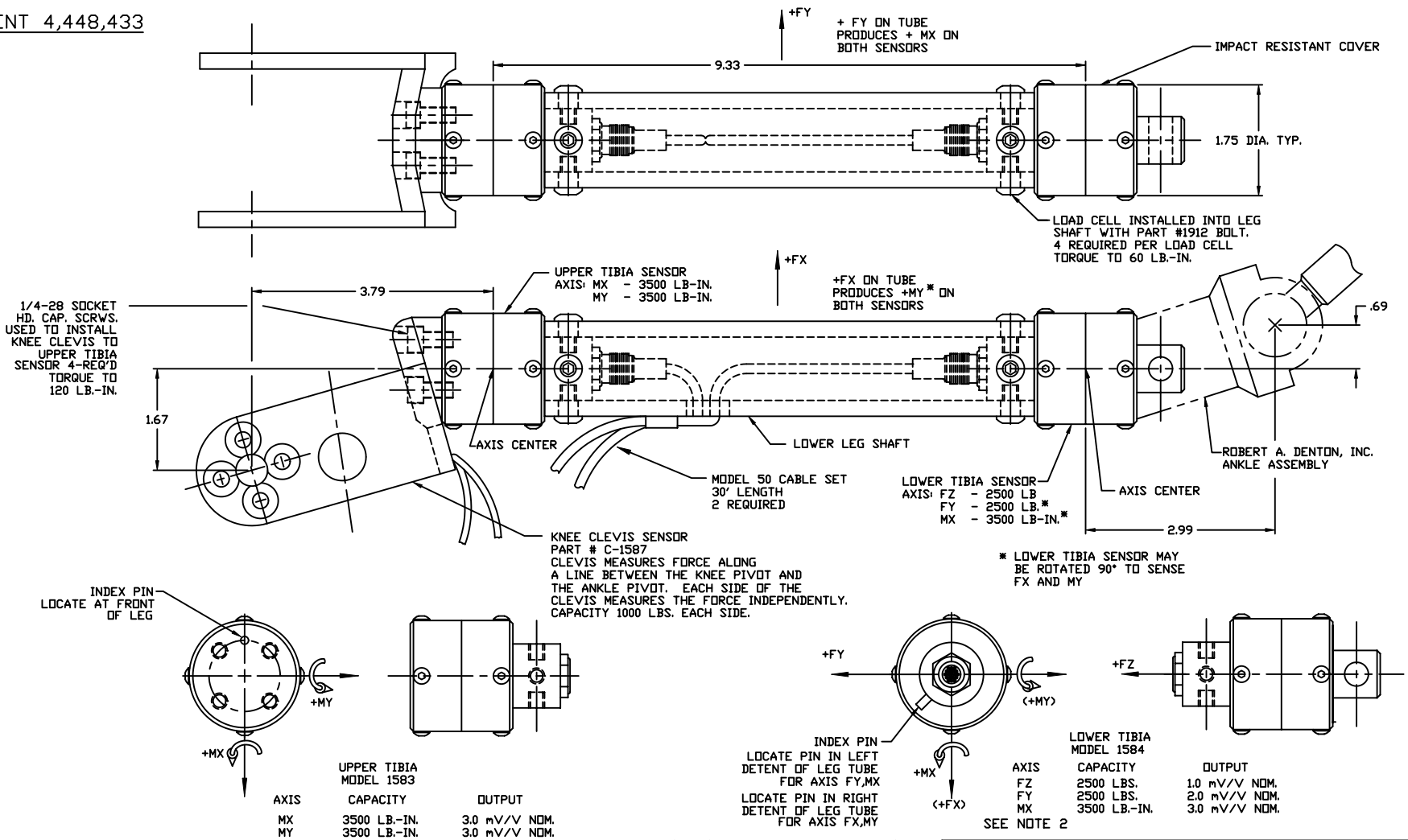
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1567-C

PATENT 4,448,433



UPPER TIBIA
MODEL 1583

AXIS	CAPACITY	OUTPUT
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SEE NOTE 2

LOWER TIBIA
MODEL 1584

AXIS	CAPACITY	OUTPUT
FZ	2500 LBS.	1.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.

SEE NOTE 2

NOTES:
1. POLARITIES SHOWN ARE PER THE STANDARD DENTON MODEL 1571 INSTRUMENTED LOWER LEG. POLARITIES DO NOT AGREE WITH S.A.E. J-211.

2. THE TIBIA LOAD CELLS MAY BE CONFIGURED WITH UP TO 4 CHANNELS. CONFIGURATIONS MAY BE MADE UP OF ANY COMBINATION OF FX, FY, FZ, MX, MY, MZ.

SYM	REVISION	DATE
C	WAS B1571.DWG	10/99
B	ADD NOTE 2	2/94
A	REDRAWN IN CAD	6/93

INSTRUMENTED LEG HYBRID III
50TH PERCENTILE

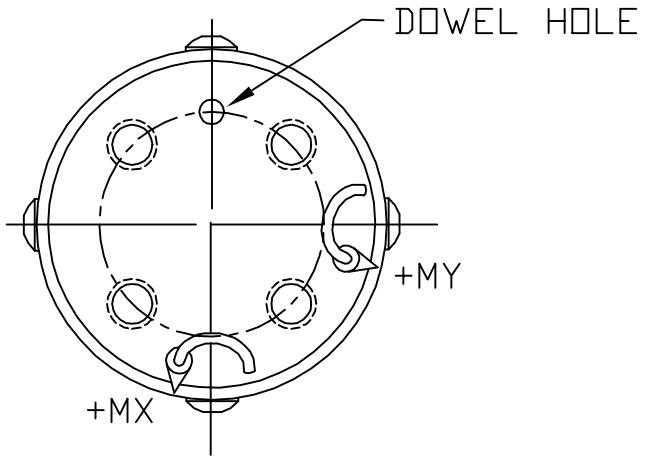
SCALE:	NONE		DRAWN BY: C.R.M/S.E.F.
DATE:	7/3/81		MODEL: 1571

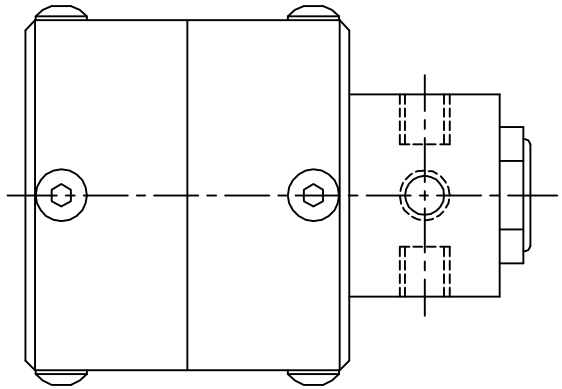
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1571-D

PATENT# 4,448,433





AXIS	CAPACITY	OUTPUT	BRIDGE RESISTANCE
MX	3500 LB.-IN.	3.0 mV/V NOM.	350 OHMS
MY	3500 LB.-IN.	3.0 mV/V NOM.	350 OHMS

SEE NOTE 2

CABLE COLOR CODE

MX		MY	
ORANGE	+EXC.	RED STRIPE	+EXC.
RED	+SIG.	BLACK	+SIG.
BROWN	-EXC.	WHITE	-EXC.
YELLOW	-SIG.	BLACK STRIPE	-SIG.

NOTES:

1. POLARITIES SHOWN ARE PER THE STANDARD DENTON MODEL# 1571 INSTRUMENTED LOWER LEG. POLARITIES DO NOT AGREE WITH S.A.E. J-211.
2. TO CONFORM TO J-211 SIGN CONVENTION, THE POLARITY OF THE DATA FOR MY ON THE UPPER AND LOWER TIBIA MUST BE CHANGED.

SYM	REVISION	DATE
B	WAS DRG. B-1629	5/99
A	REDRAWN IN CAD	11/97

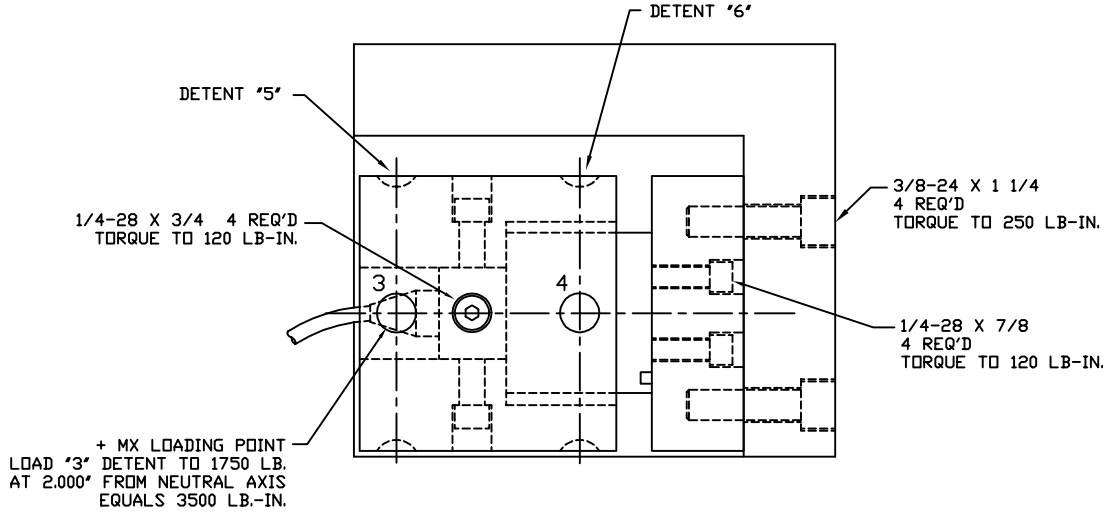
2 CHANNEL UPPER TIBIA

SCALE: FULL
DATE: 4/3/82
DRAWN BY: C.R. MORGAN
MODEL: 1583

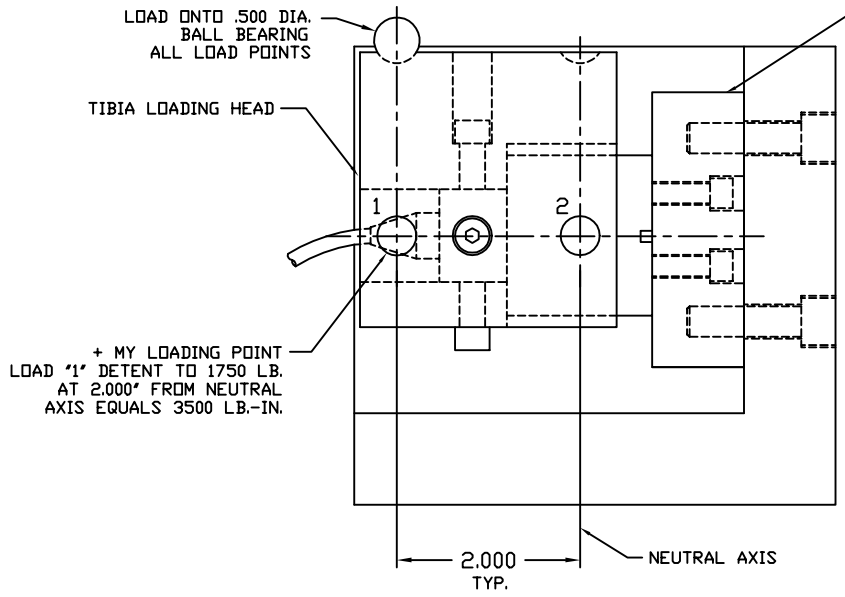
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

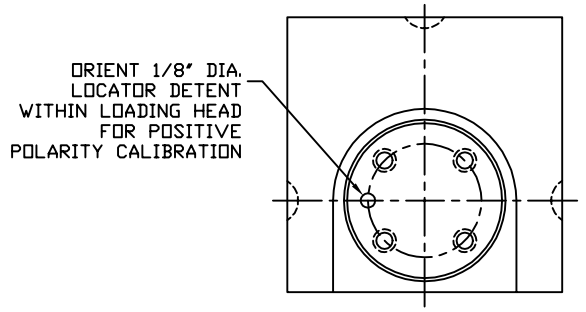
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1583-D



NOTE:
POSITIVE CALIBRATION LOAD POINTS
PER AXIS DEFINITION SPECIFIED ON
DRAWING 1571-D OR 1583-D.





CALIBRATION FIXTURE MODEL #2171

UPPER TIBIA CALIBRATION FIXTURE

UPPER TIBIA MODEL 1583

SCALE:	.75X	DRAWN BY:	H. PROCTOR
DATE:	28MAY96	MODEL:	1583

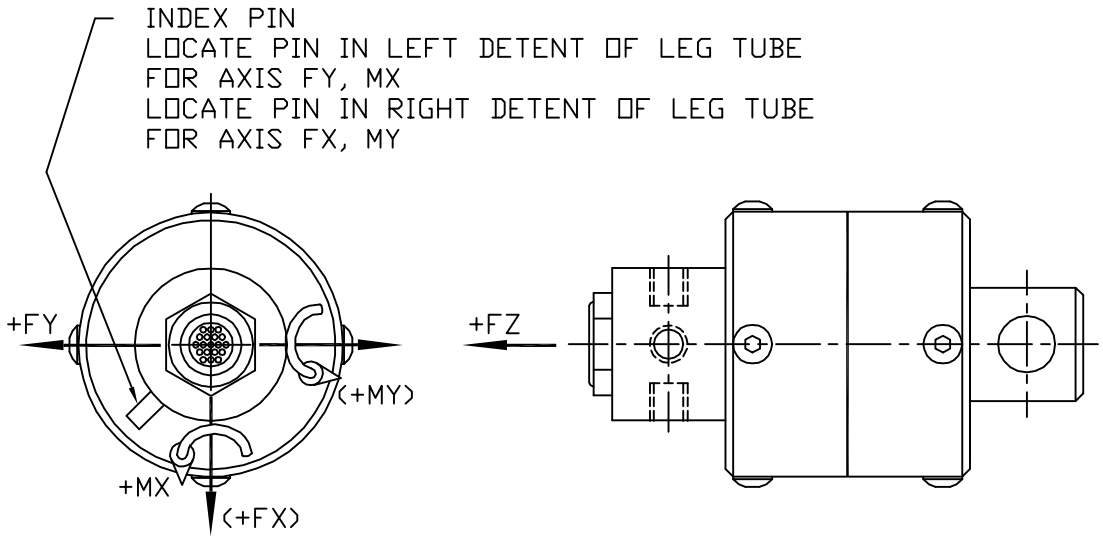
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1583-C

PATENT# 4,448,433



MODEL 1584
LOWER TIBIA

AXIS	CAPACITY	OUTPUT	MODEL 1584 BRIDGE RESISTANCE	MODEL 1584A BRIDGE RESISTANCE
FY	2500 LB.	1.0 mV/V NOM.	350 OHMS	350 OHMS
FZ	2500 LB.	2.0 mV/V NOM.	480 OHMS	700 OHMS
MX	3500 LB.-IN.	3.0 mV/V NOM.	350 OHMS	350 OHMS

SEE NOTE 2

CABLE COLOR CODE

MX		FZ		FY	
ORANGE	+EXC.	WHITE	+EXC.	GREEN	+EXC.
RED	+SIG.	BLACK	+SIG.	BLUE	+SIG.
BROWN	-EXC.	RED STRIPE	-EXC.	VIOLET	-EXC.
YELLOW	-SIG.	BLACK STRIPE	-SIG.	GREY	-SIG.

NOTES:
1. POLARITIES SHOWN ARE PER THE STANDARD DENTON MODEL# 1571 INSTRUMENTED LOWER LEG. POLARITIES DO NOT AGREE WITH S.A.E. J-211.
2. TO CONFORM TO J-211 SIGN CONVENTION, THE POLARITY OF THE DATA FOR MY ON THE UPPER AND LOWER TIBIA MUST BE CHANGED.

SYM	REVISION	DATE
B	WAS DRG. B-1629	5/99
A	REDRAWN IN CAD	11/97

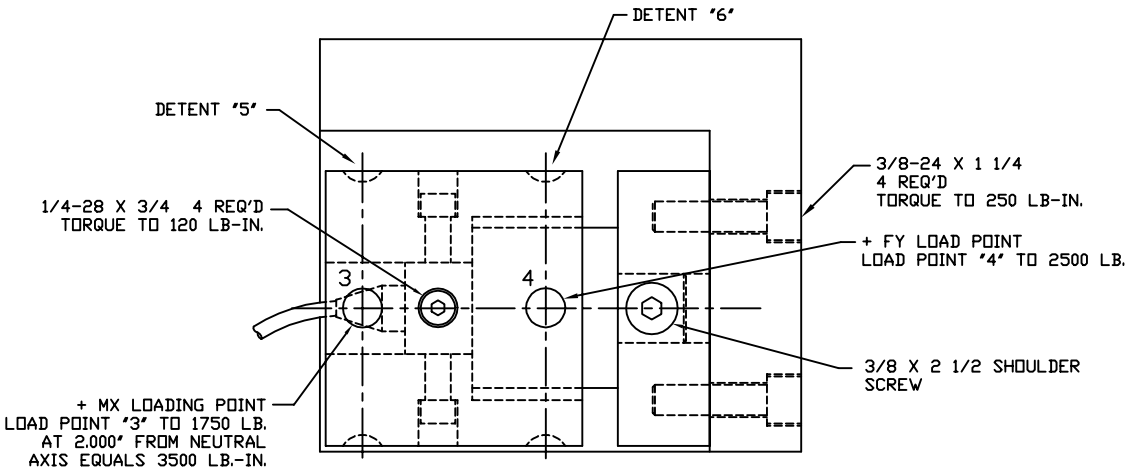
3 CHANNEL LOWER TIBIA

SCALE: FULL
DATE: 4/3/82
DRAWN BY: C.R. MORGAN
MODEL: 1584A

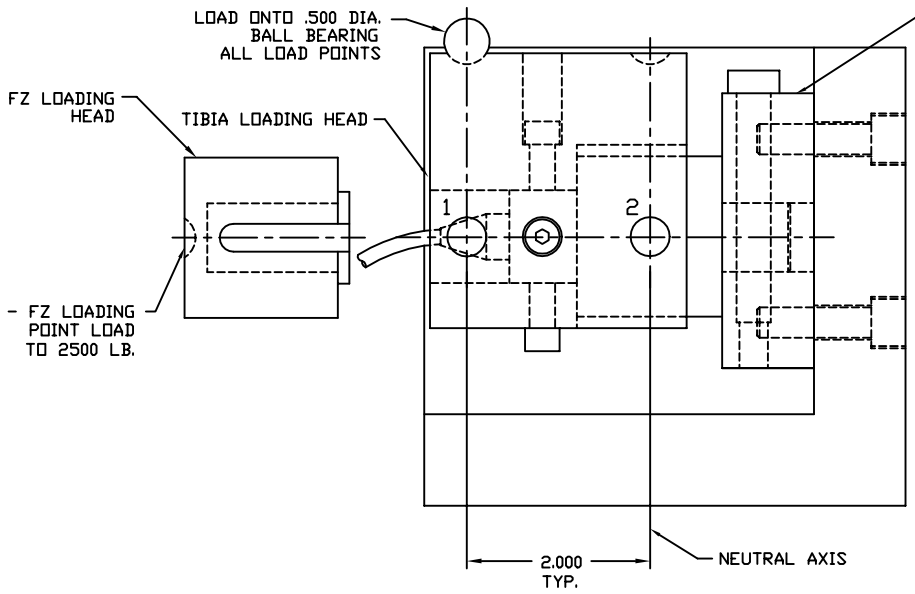
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

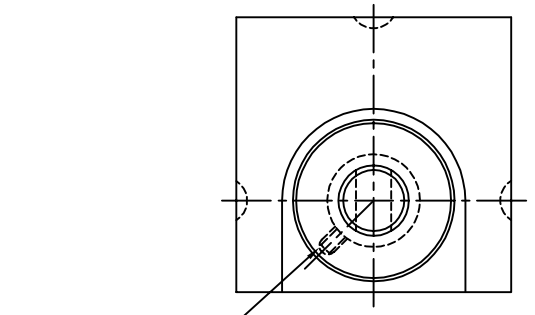
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1584A-D



NOTE:
POSITIVE CALIBRATION LOAD POINTS
PER AXIS DEFINITION SPECIFIED ON
DRAWING 1571.





CALIBRATION FIXTURE MODEL #2171

SYM	REVISION	DATE

LOWER TIBIA CALIBRATION FIXTURE

LOWER TIBIA MODEL 1584

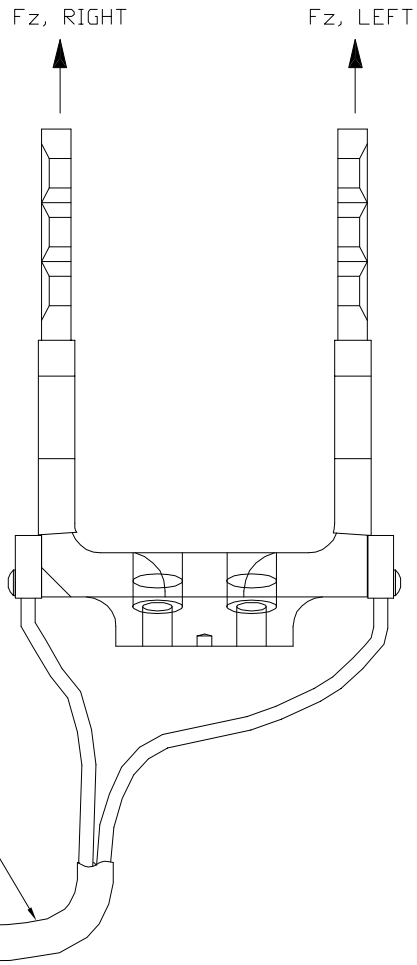
SCALE:	.75X	DRAWN BY:	H. PROCTOR
DATE:	8OCT99	MODEL:	1584

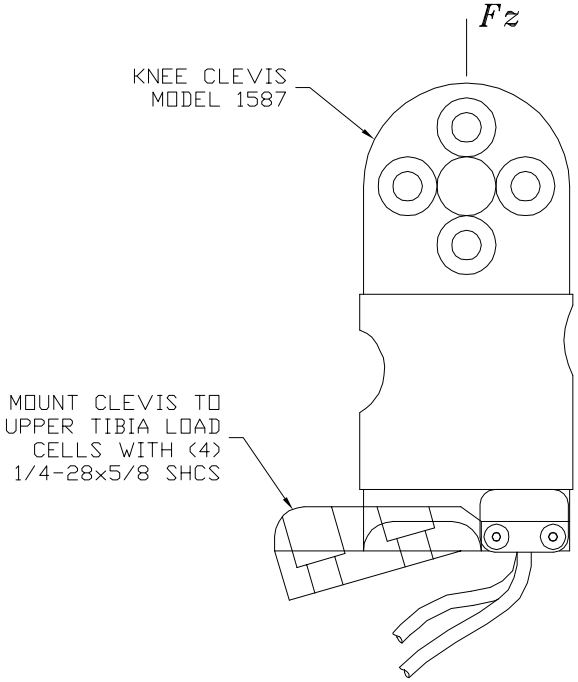
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1584-C





AXIS	Ⓑ CAPACITY	OUTPUT
Fz, LEFT	2000 LBS.	1.2 mV/V NOMINAL
Fz, RIGHT	2000 LBS.	1.2 mV/V NOMINAL

NON-LINEARITY: < 1% OF FULL SCALE
BRIDGE RESISTANCE: 350 OHMS NOMINAL

1571	1
NEXT ASS'Y	QTY
PART USED ON	

SYM	REVISION	DATE
B	WAS 1000 LBS.	10/00
A	WAS DRG. B-4186	4/99

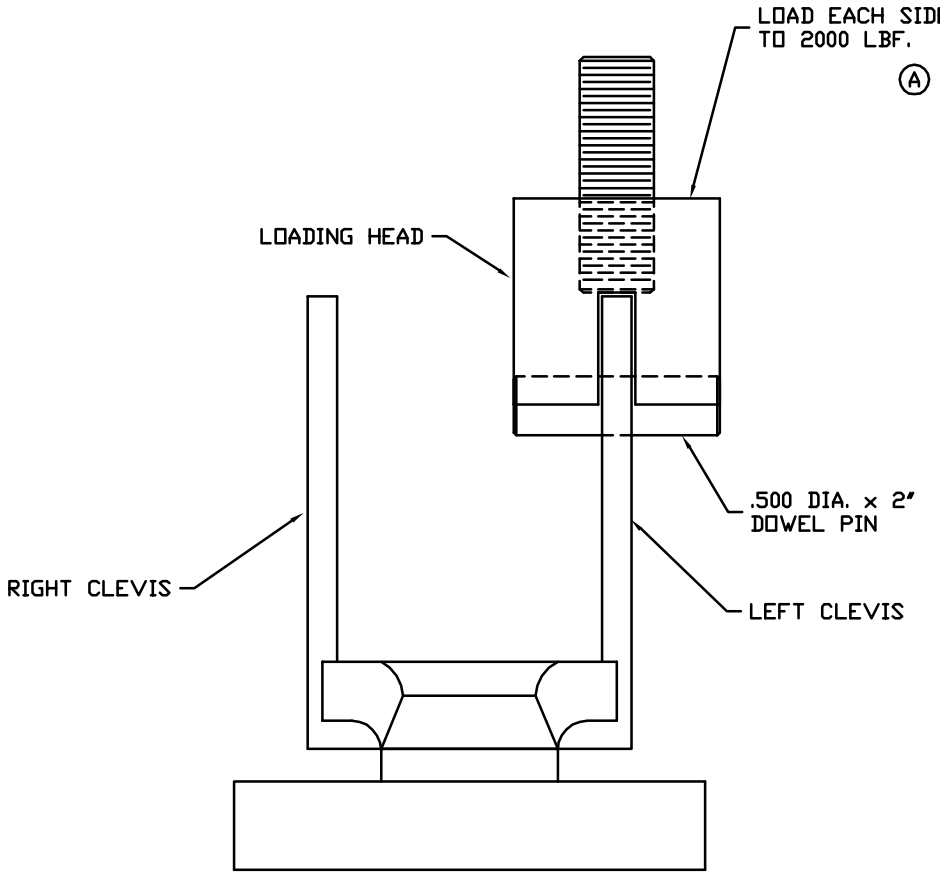
2 - CHANNEL KNEE CLEVIS

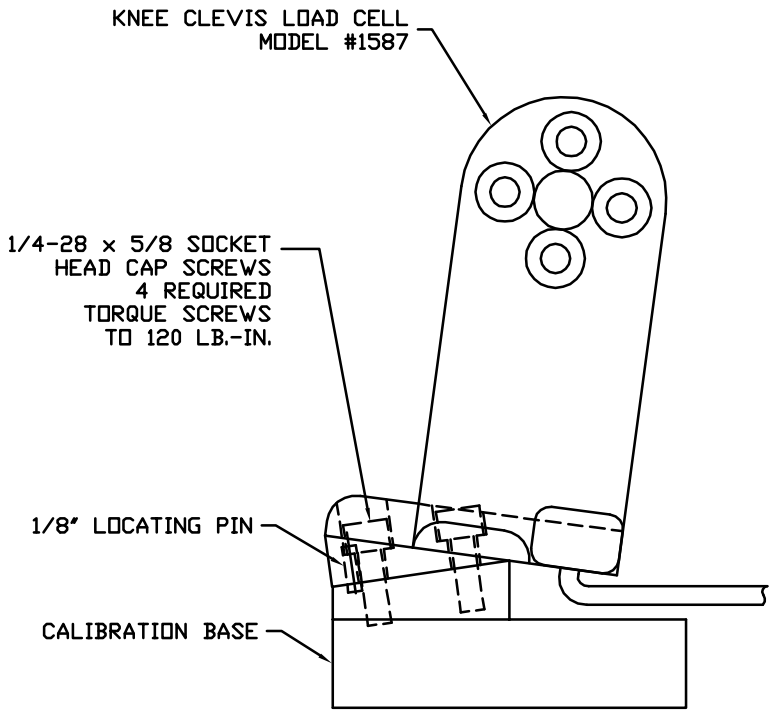
SCALE: FULL
DRAWN BY: R. DuPont
DATE: 24JULY98
MODEL: 1587

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1587-D





CALIBRATION FIXTURE MODEL #1861

SYM	REVISION	DATE
A	WAS 1000 LBF.	10/00

KNEE CALIBRATION FIXTURE

KNEE CLEVIS LOAD CELL MODEL 1587

SCALE: FULL			DRAWN BY: C.R.M./S.E.P.
DATE: 11/15/85			MODEL: 1587

UNLESS OTHERWISE SPECIFIED

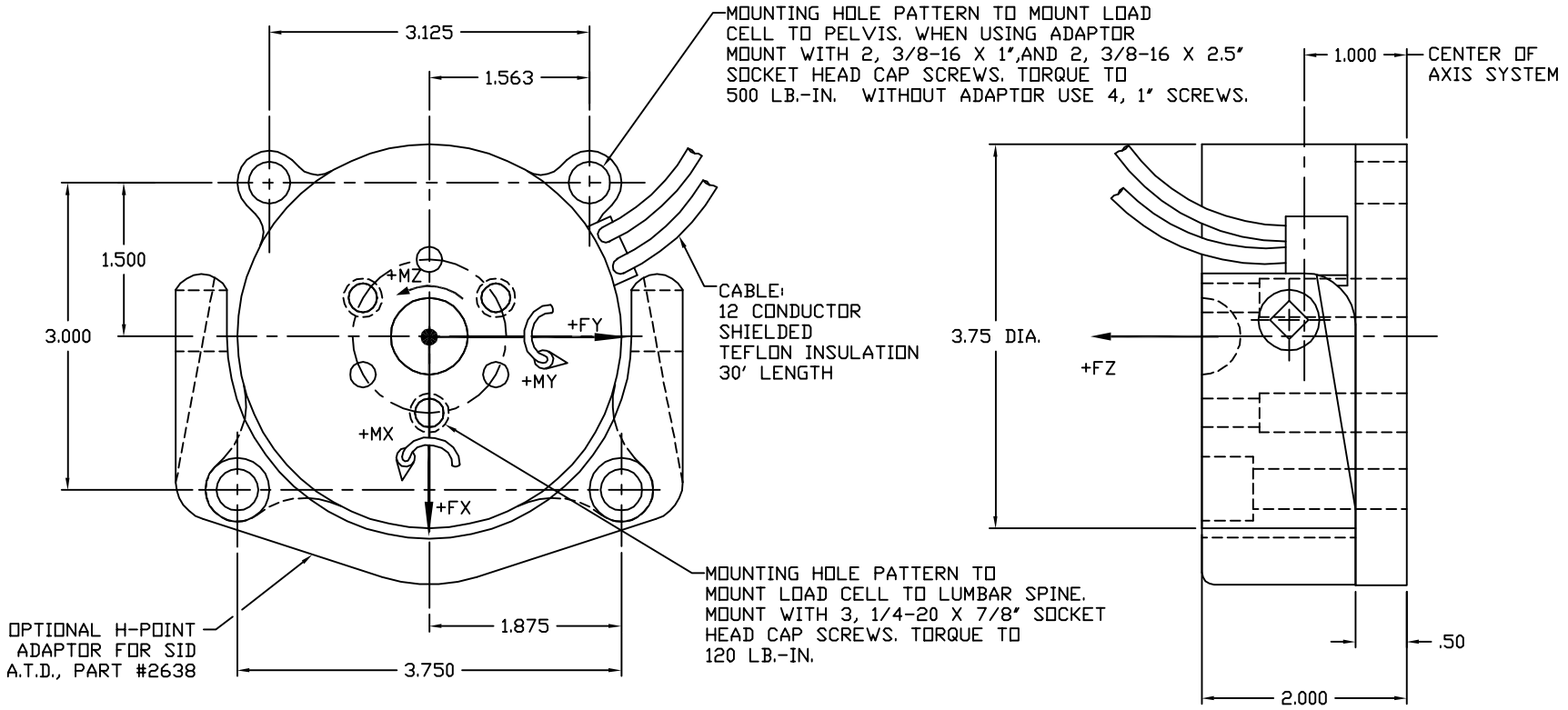
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125

THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES

ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1587-C



MODEL 1708
SIX CHANNEL LUMBAR SPINE LOAD CELL
FOR HYBRID II/ S.I.D. TEST DUMMY

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	3000 LBS.	1.3 mV/V NOMINAL	350 OHMS
FY	3000 LBS.	1.3 mV/V NOMINAL	350 OHMS
FZ	5000 LBS.	0.8 mV/V NOMINAL	700 OHMS
MX	10000 LB.-IN.	1.9 mV/V NOMINAL	350 OHMS
MY	10000 LB.-IN.	1.9 mV/V NOMINAL	350 OHMS
MZ	4000 LB.-IN.	1.1 mV/V NOMINAL	700 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

C	ADD BRIDGE REST.	5/00
B	WAS DRG. B-1708	4/99
A	MODEL WAS 1708L	7/97

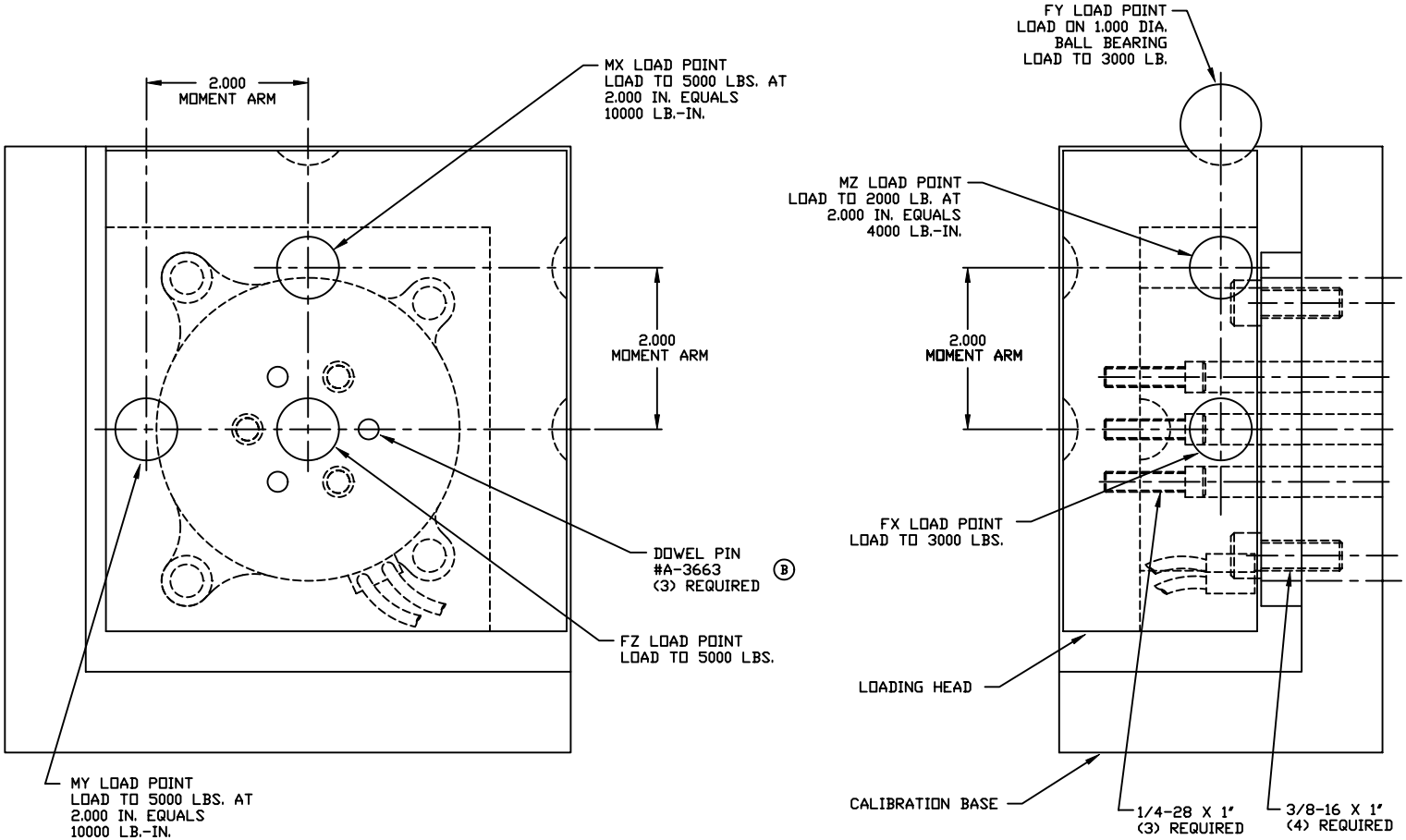
HYBRID II/S.I.D. LUMBAR LOAD CELL

SCALE: FULL
DATE: 8/20/93
DRAWN BY: S.E. FOSTER
MODEL: 1708

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1708-D



ASSEMBLY:

1. FASTEN MODEL# 1708 TO BASE WITH (4) 3/8-16 X 1" SOCKET HEAD CAP SCREWS. TORQUE TO 360 LB.-IN.
2. FASTEN LOADING HEAD TO LOAD CELL WITH (3) 1/4-28 X 1" SOCKET HEAD CAP SCREWS. TORQUE TO 120 LB.-IN.

SYM	REVISION	DATE
D	WAS DRG. C-2555	4/99
C	REV. L.C. #	2/98
B	CORRECT P/N	12/97
A	UPDATED	9/96

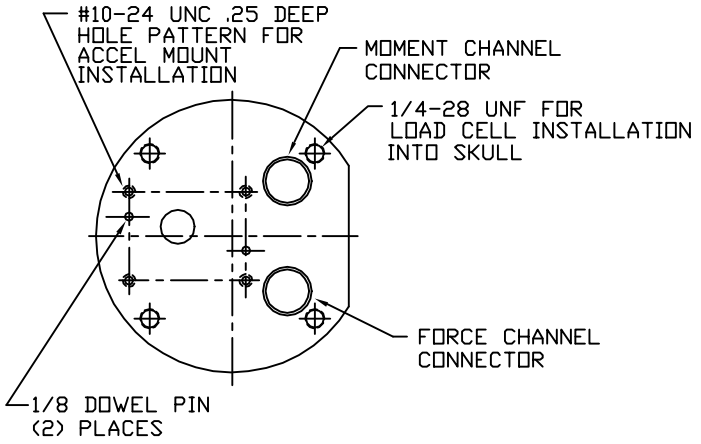
CALIBRATION FIXTURE - 1708

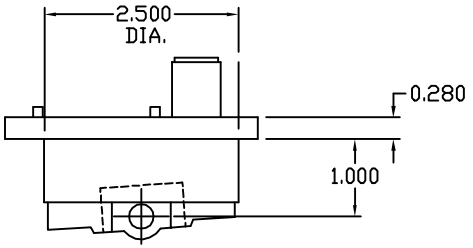
SCALE: FULL
DATE: 10/16/91
DRAWN BY: C.R. MORGAN
MODEL: 2555

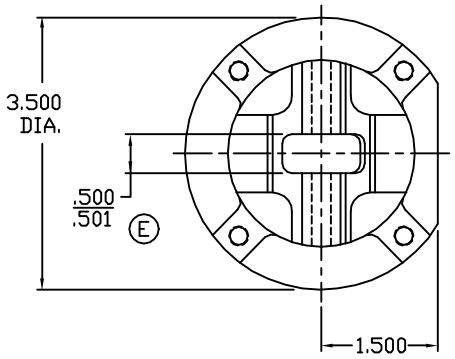
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125 √
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

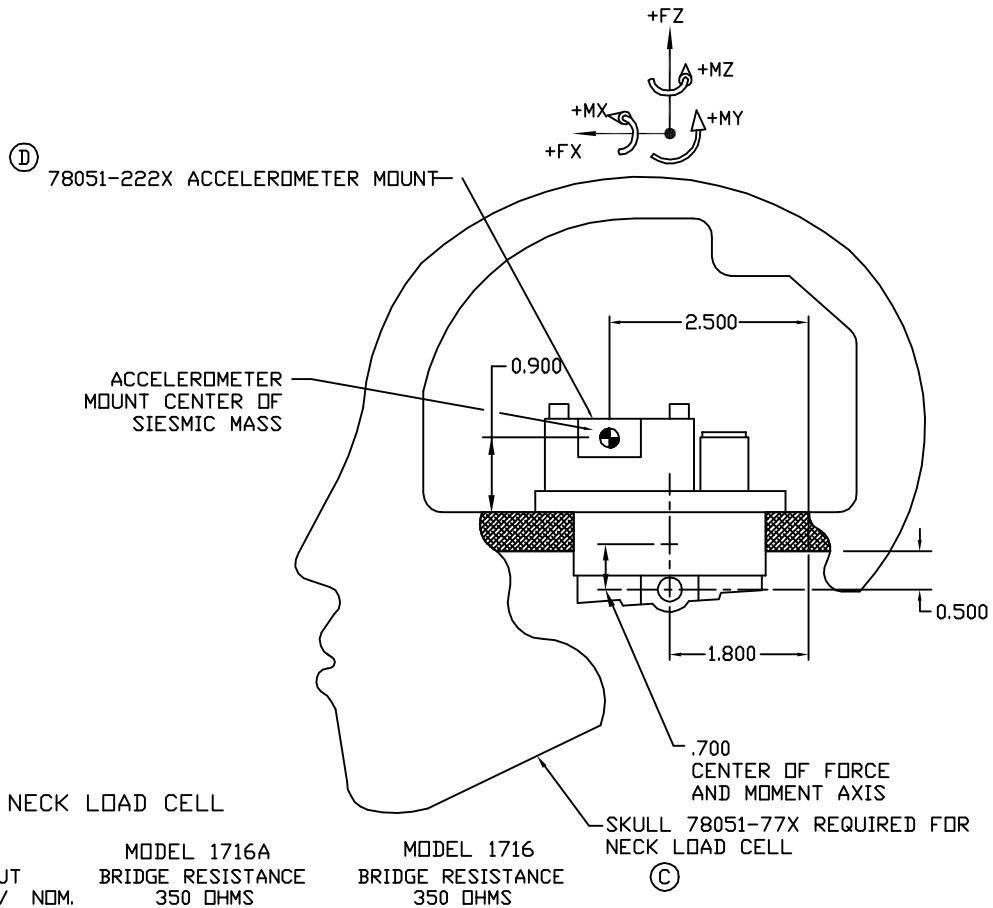
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-1708-C









SIX CHANNEL NECK LOAD CELL

AXIS	CAPACITY	OUTPUT	MODEL 1716A BRIDGE RESISTANCE	MODEL 1716 BRIDGE RESISTANCE
FX	2000 LBS.	1.7 mV/V NOM.	350 OHMS	350 OHMS
FY	2000 LBS.	1.7 mV/V NOM.	350 OHMS	350 OHMS
FZ	3000 LBS.	1.4 mV/V NOM.	700 OHMS	480 OHMS
MX	2500 IN-LB	1.7 mV/V NOM.	350 OHMS	350 OHMS
MY	2500 IN-LB	1.7 mV/V NOM.	350 OHMS	350 OHMS
MZ	2500 IN-LB	2.3 mV/V NOM.	700 OHMS	700 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

F	REMOVE CONNECTOR DIM. AND WAS B1709.DWG	15OCT99
E	CORRECT TOL.	11/02/98
D	UPDATE ACCEL #	3/31/97
C	UPDATE SKULL #	3/31/97
B	UPDATED TEXT	10/22/96
A	REDRAWN IN CAD	2/2/93

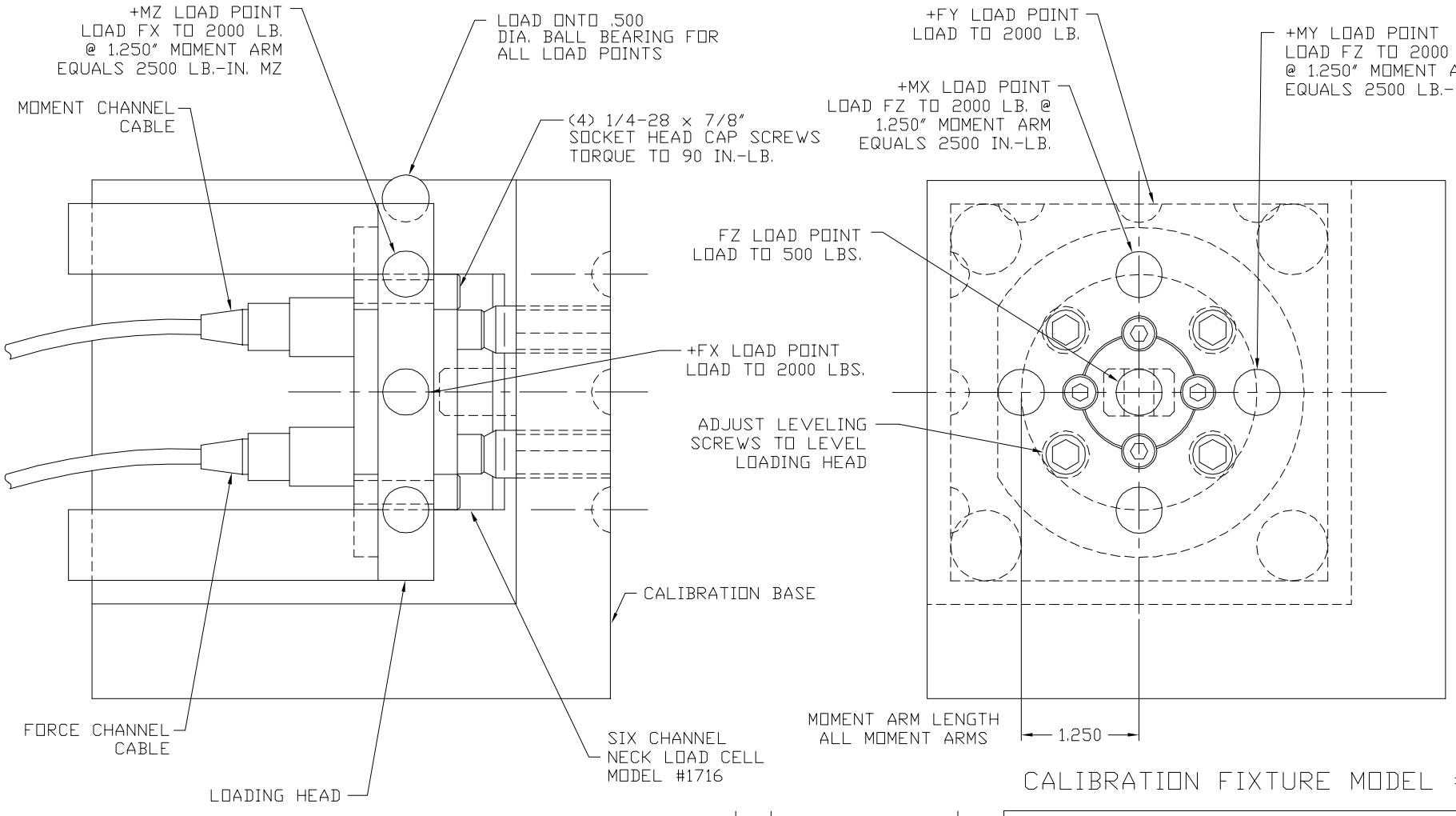
HYBRID III SIX CHANNEL NECK LOAD CELL

SCALE: NONE
DATE: 2/1/93
DRAWN BY: C.R.M./T.R.D.
MODEL: 1716

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1716-D



CALIBRATION FIXTURE MODEL #1860

SYM	REVISION	DATE
A	WAS MODEL# 1716	11/00

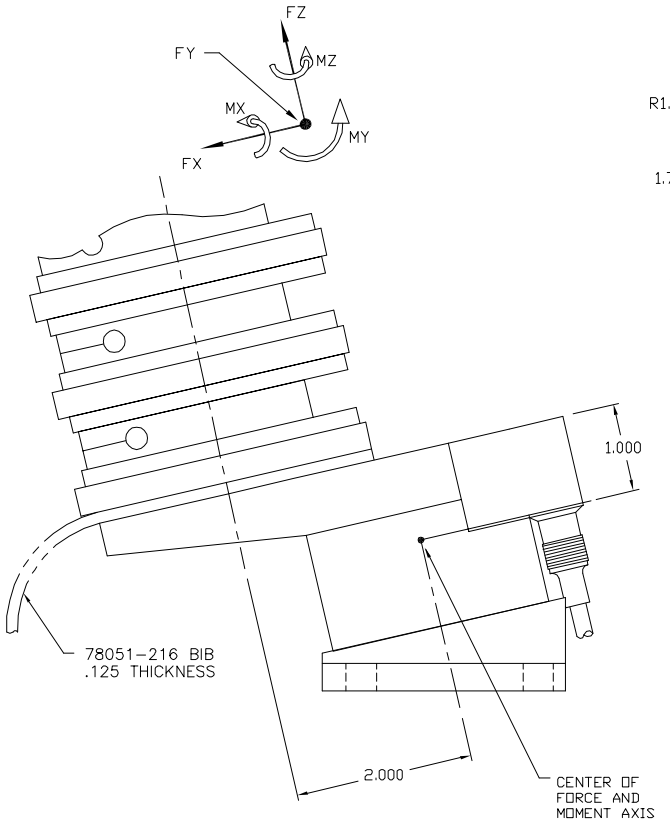
NECK CALIBRATION FIXTURE

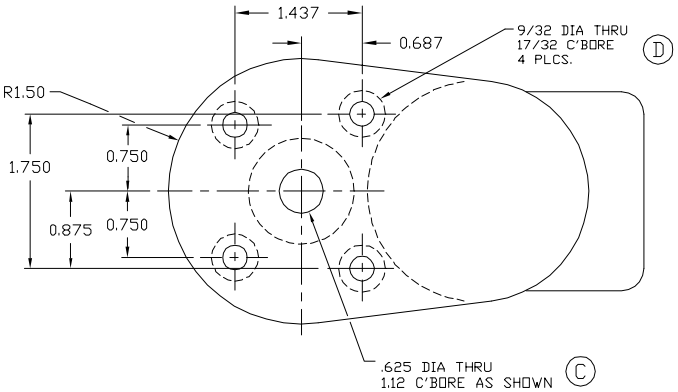
SCALE: FULL		DRAWN BY: C.R.M./S.E.F.
DATE: 11/1/85		MODEL: 1860

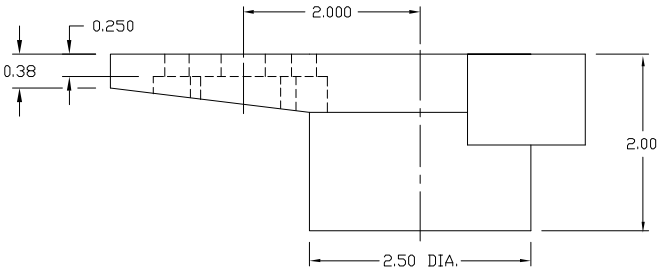
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

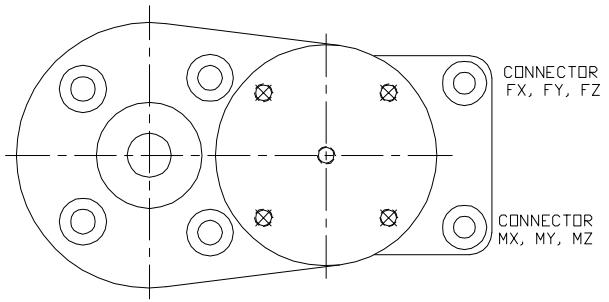
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

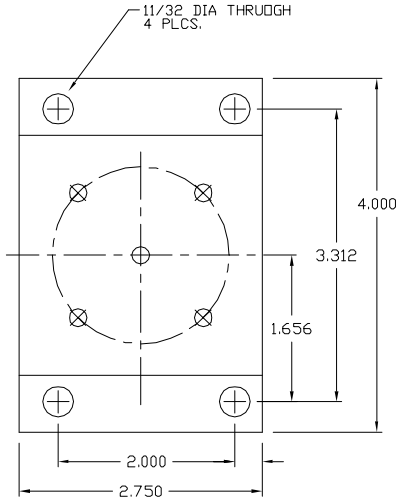
DRAWING NUMBER: B-1716-C

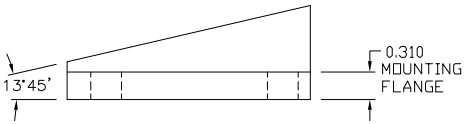












LOWER NECK LOAD CELL ASSEMBLY
DUPLICATES NECK POSITION OF STD.
BRACKETS (78051 - 303 & 307) AT THE
"0" ANGLE POSITION.

MOUNTING FLANGE

NECK BRACKET II - LOWER (2027)

MOUNTING PATTERN IDENTICAL TO
HYBRID III PART #78051 - 303
NOTE: LOWER BRACKET WILL BE
PERMANETLY SECURED TO MAIN
SENSOR AT ASSEMBLY. SHOWN
SEPARATLY FOR ILLUSTRATION ONLY.
BRAKET ANGLE MAY BE MODIFIED
TO CHANGE ANGLE OF NECK.

LOWER NECK LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	3000 LBF	1.6 mV/V NOMINAL	350 Ω
FY	3000 LBF	1.6 mV/V NOMINAL	350 Ω
FZ	3000 LBF	0.9 mV/V NOMINAL	700 Ω
MX	4000 IN-LBF	1.7 mV/V NOMINAL	350 Ω
MY	4000 IN-LBF	1.7 mV/V NOMINAL	350 Ω
MZ	4000 IN-LBF	3.0 mV/V NOMINAL	700 Ω

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

D	WAS 13/32	2/01
C	WAS .500	2/01
B	UPDATE C'BORE DEPTH	2/01
A	REDRAWN IN CAD	2/11/93

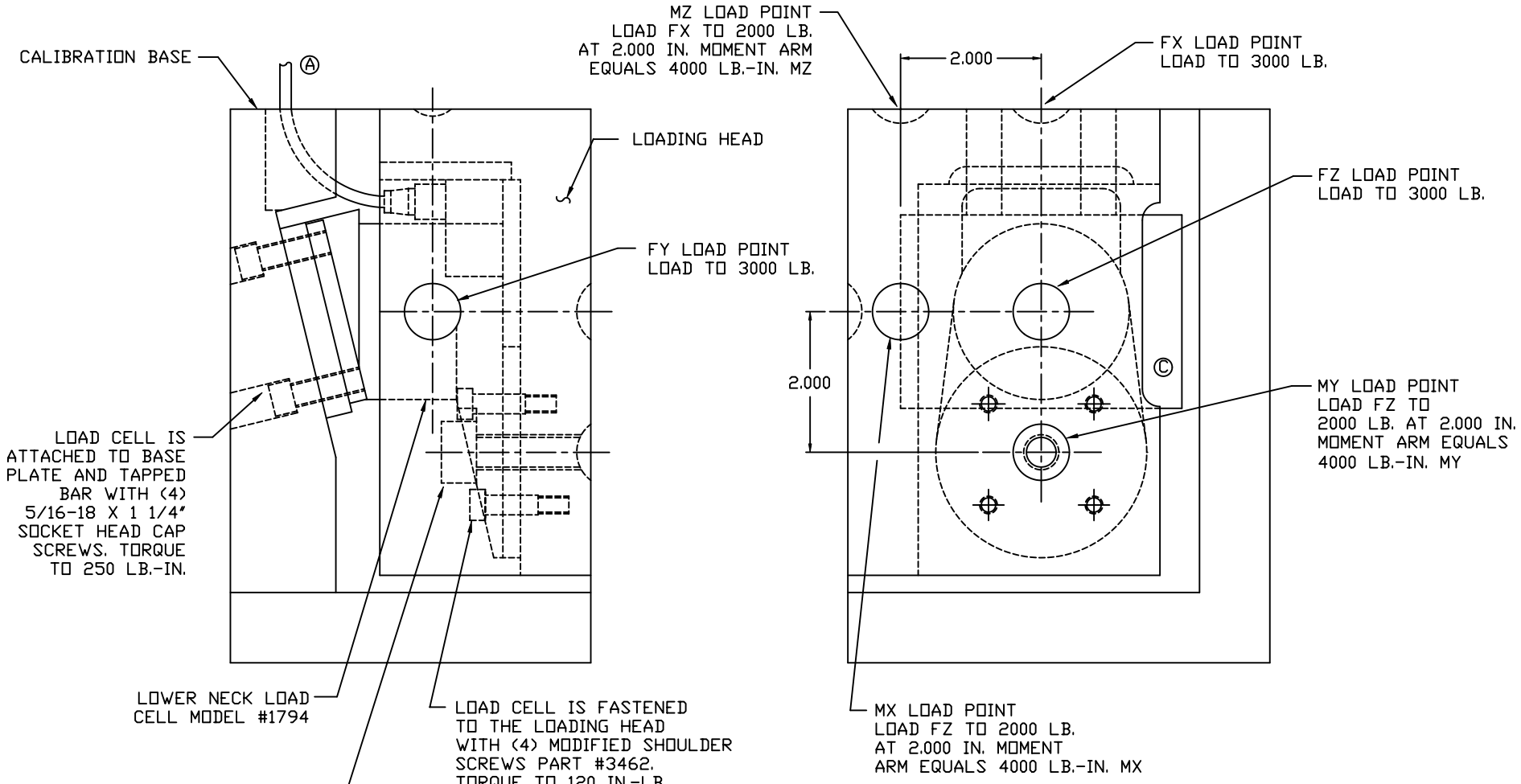
LOWER NECK LOAD CELL - HYBRID III

SCALE: .75X
DATE: 2/15/93
DRAWN BY: C.R.M./T.D.
MODEL: 1794

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1794-D



SYM	REVISION	DATE
D	WAS DRG. B-1920	4/99
C	ADD 2 CUTOUTS	9/87
B	REDRAWN IN CAD	7/93
A	CHG. REV. CONN.	9/87

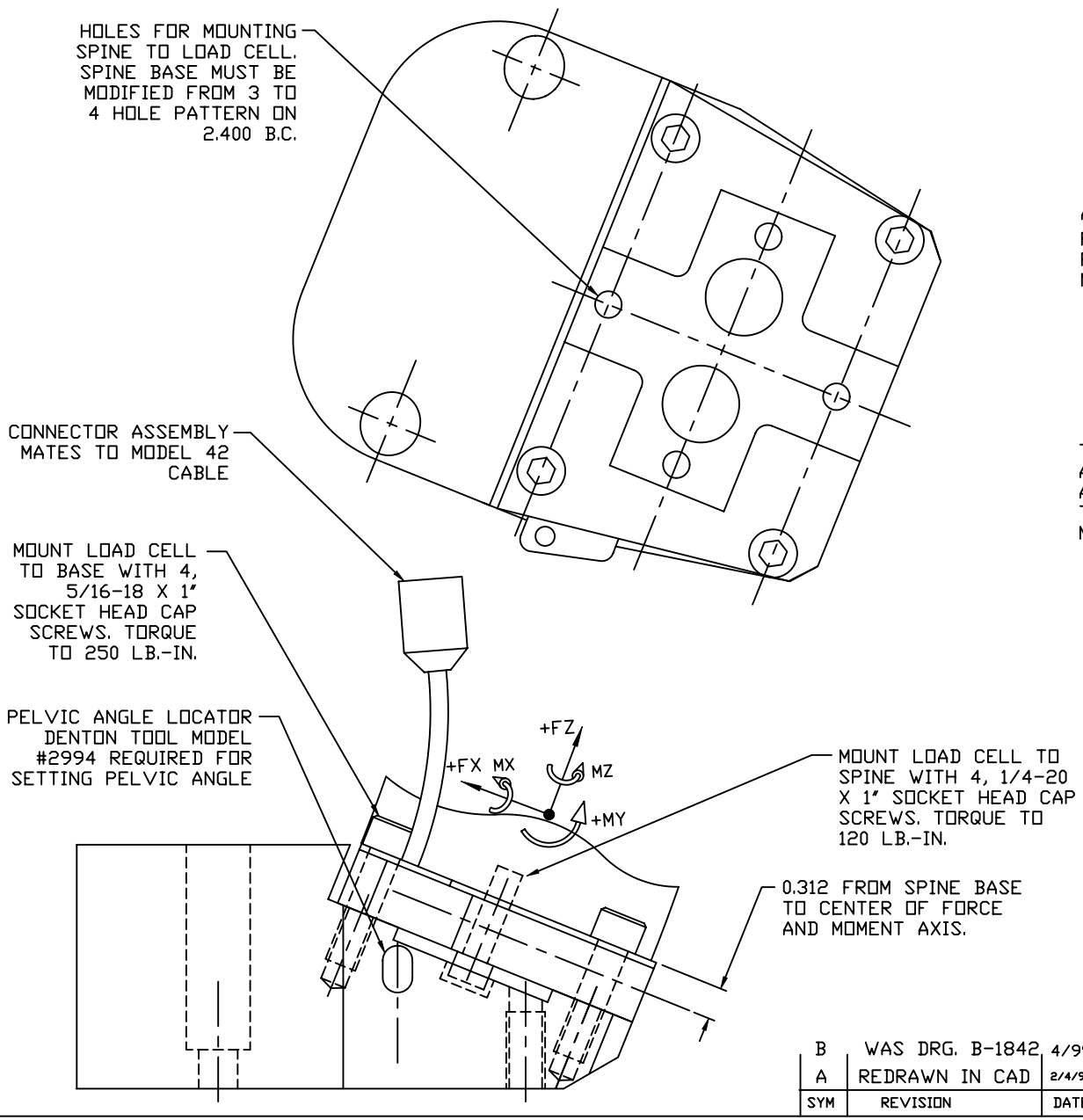
LOWER NECK CALIBRATION FIXTURE

SCALE: 3/4
DATE: 7/1/86
DRAWN BY: C.R.M./S.E.F.
MODEL: 1920

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1794-C



LUMBAR SPINE LOAD CELL

AXIS	CAPACITY	OUTPUT
FX	3000 LBS.	1.0 mV/V NOMINAL
FZ	3000 LBS.	1.0 mV/V NOMINAL
MY	5000 LB.-IN.	1.6 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT OF ASSEMBLY - 15.8 LBS.
SENSOR ONLY WEIGHT = 1.47 LBS

THE MODEL 1842 LUMBAR SPINE LOAD CELL ASSEMBLY REPLACES PART 78051-53 BRACKET ASSEMBLY IN THE HYBRID III 50TH AND 95TH TEST DUMMIES. THE SPINE BASE MUST BE MODIFIED AS NOTED ON THE DRAWING.

SYM	REVISION	DATE
B	WAS DRG. B-1842	4/99
A	REDRAWN IN CAD	2/4/93

3-CHANNEL LUMBAR SPINE LOAD CELL

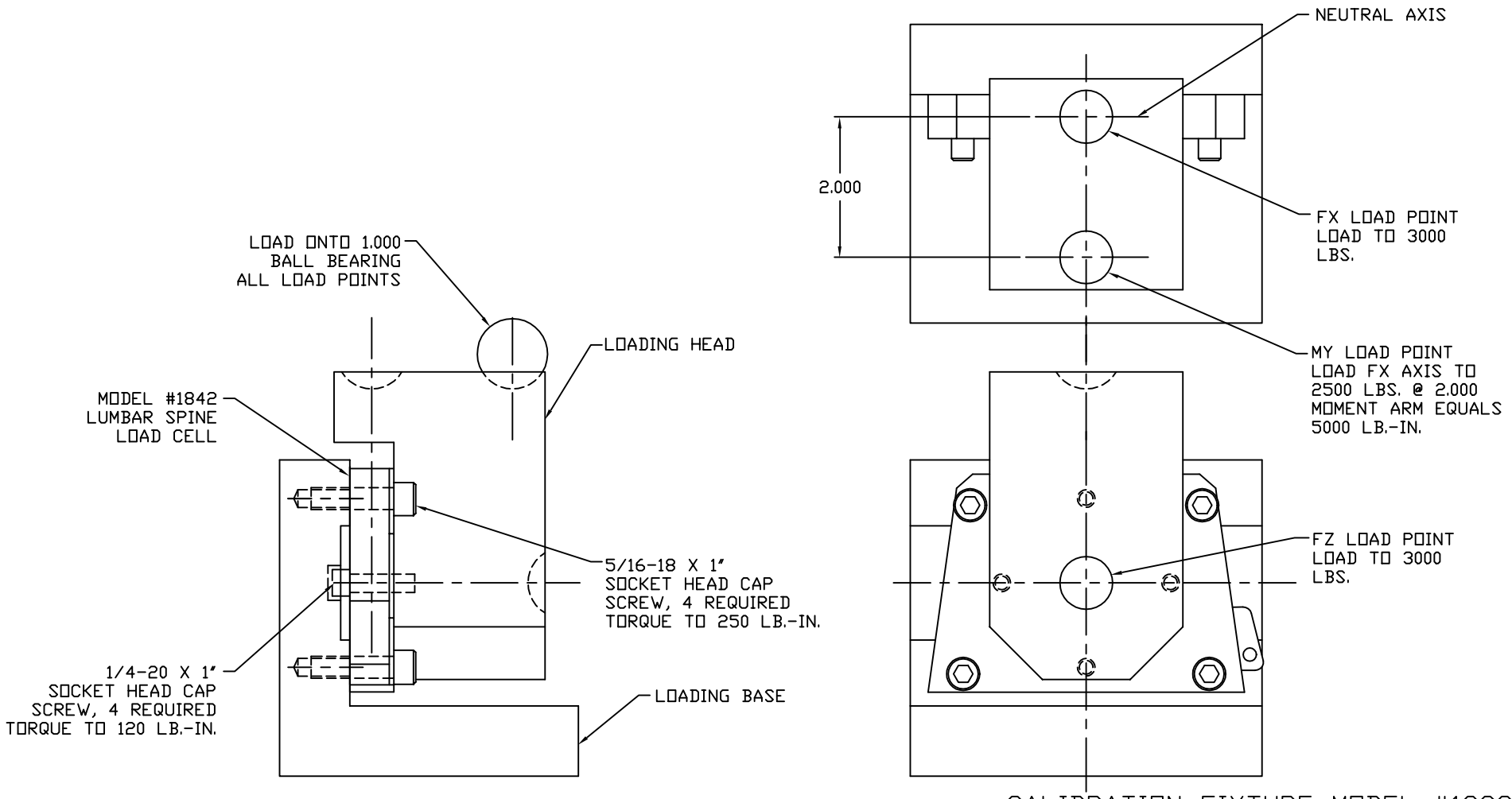
HYBRID III 50TH AND 95TH PERCENTILE

SCALE: FULL
DATE: 5/15/85
DRAWN BY: C.R. MORGAN
MODEL: 1842

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1842-D



CALIBRATION FIXTURE MODEL #1883

SYM	REVISION	DATE
B	WAS DRG. B-1883	4/99
A	UPDATE LOAD HD.	4/96

LUMBAR SPINE CALIBRATION FIXTURE

CALIBRATES MODEL 1842

SCALE: .75X | DRAWN BY: C.R. MORGAN

DATE: 2/11/86 | MODEL: 1842

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS ± .010 | SURFACE FINISH 125

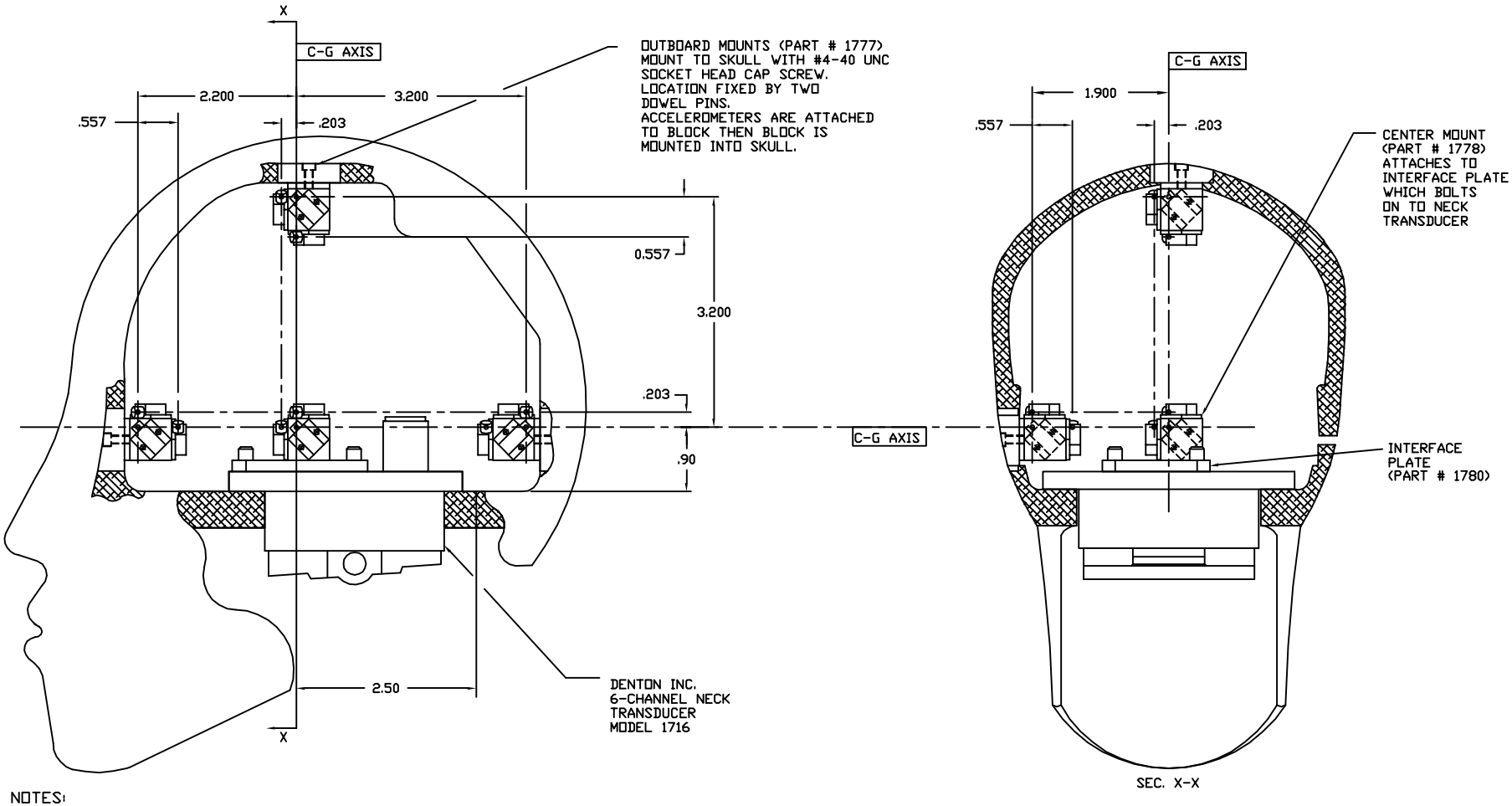
THREE PLACE DECIMALS ± .005 | REMOVE ALL BURRS & SHARP EDGES

ANGLES ± 0° 30' | DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.

ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1842-C



NOTES:

1. DIMENSIONS GIVEN ARE FOR ENDEVCO 7264-2000 AND 7264C-2000 ACCELEROMETERS ONLY.
2. THE TOP, FRONT, LEFT AND REAR MOUNTS ARE INTERCHANGEABLE.
3. POSITION ACCURACY OF BLOCKS IN HEAD ±.005
4. POSITION ACCURACY OF SEISMIC MASS WITHIN ACCELEROMETER ±.03 (PER ENDEVCO SPEC.)
5. CENTER OF GRAVITY (C-G) LOCATIONS PER G.M. DRAWINGS 78051-61 AND 78051-338 FOR HYBRID III TEST DUMMY HEAD

SYM	REVISION	DATE
D	ADD 7264C	23AUG00
C	WAS DWG B1846.DWG	15OCT99
B	REDRAWN IN CAD	6/30/93
A	ADD REAR MOUNT	12/7/89

ACCELEROMETER HEAD MOUNT II

FOR ENDEVCO 7264-2000 AND 7264C-2000 ONLY

SCALE: .75			DRAWN BY: C.R.M./S.E.F.
DATE: 6-28-85			MODEL: 1846

UNLESS OTHERWISE SPECIFIED

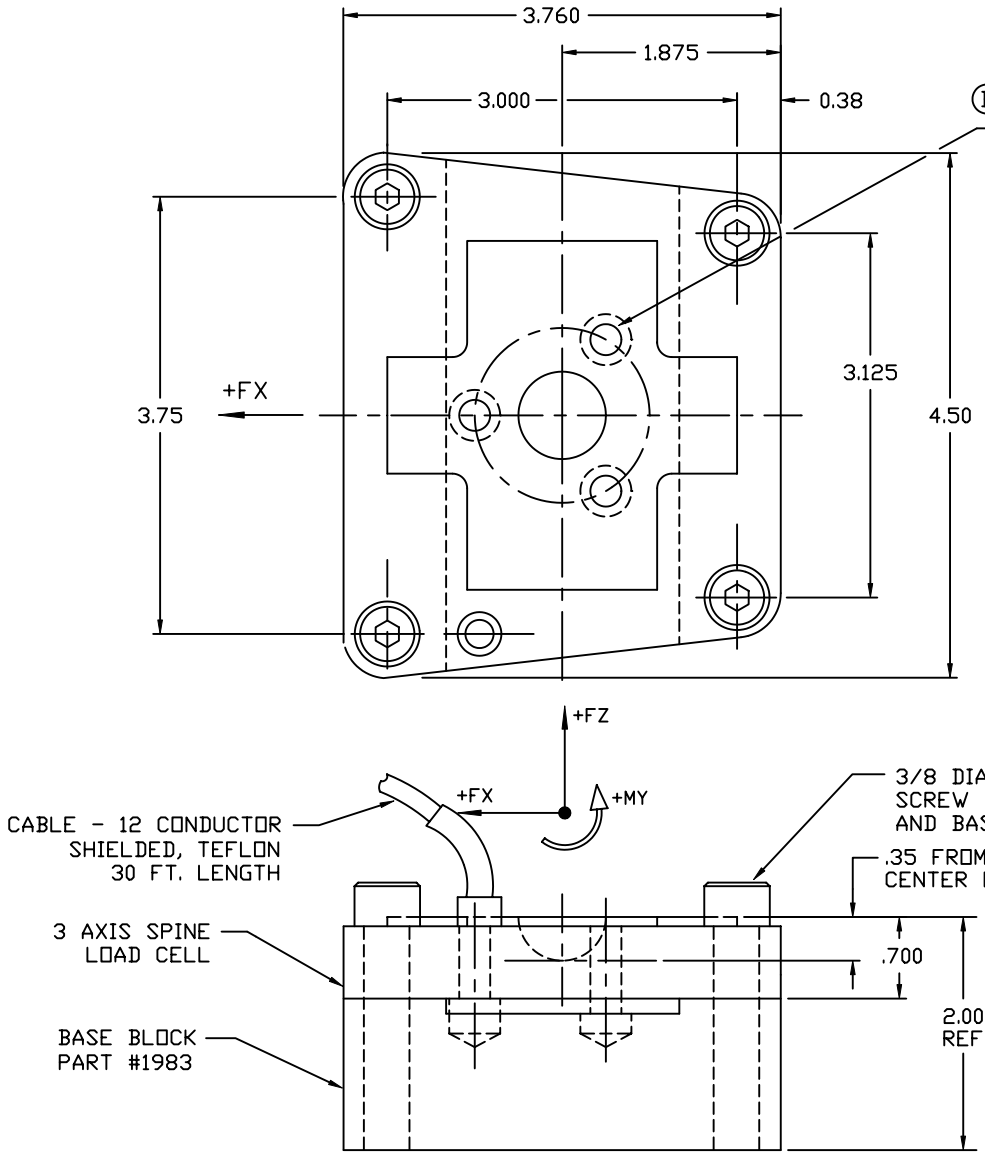
TWO PLACE DECIMALS ± .010 — SURFACE FINISH 125

THREE PLACE DECIMALS ± .005 — REMOVE ALL BURRS & SHARP EDGES

ANGLES ± 0° 30' — DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1846-D



LUMBAR SPINE LOAD CELL

AXIS	CAPACITY	OUTPUT
FX	3500 LBS.	1 mV/V NOM.
FZ	3500 LBS.	1 mV/V NOM.
MY	5000 LB-IN.	1.5 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
C	WAS DRG. B-1891	4/99
B	CHANGED HOLE PATT.	7/95
A	REDRAWN IN CAD	6/93

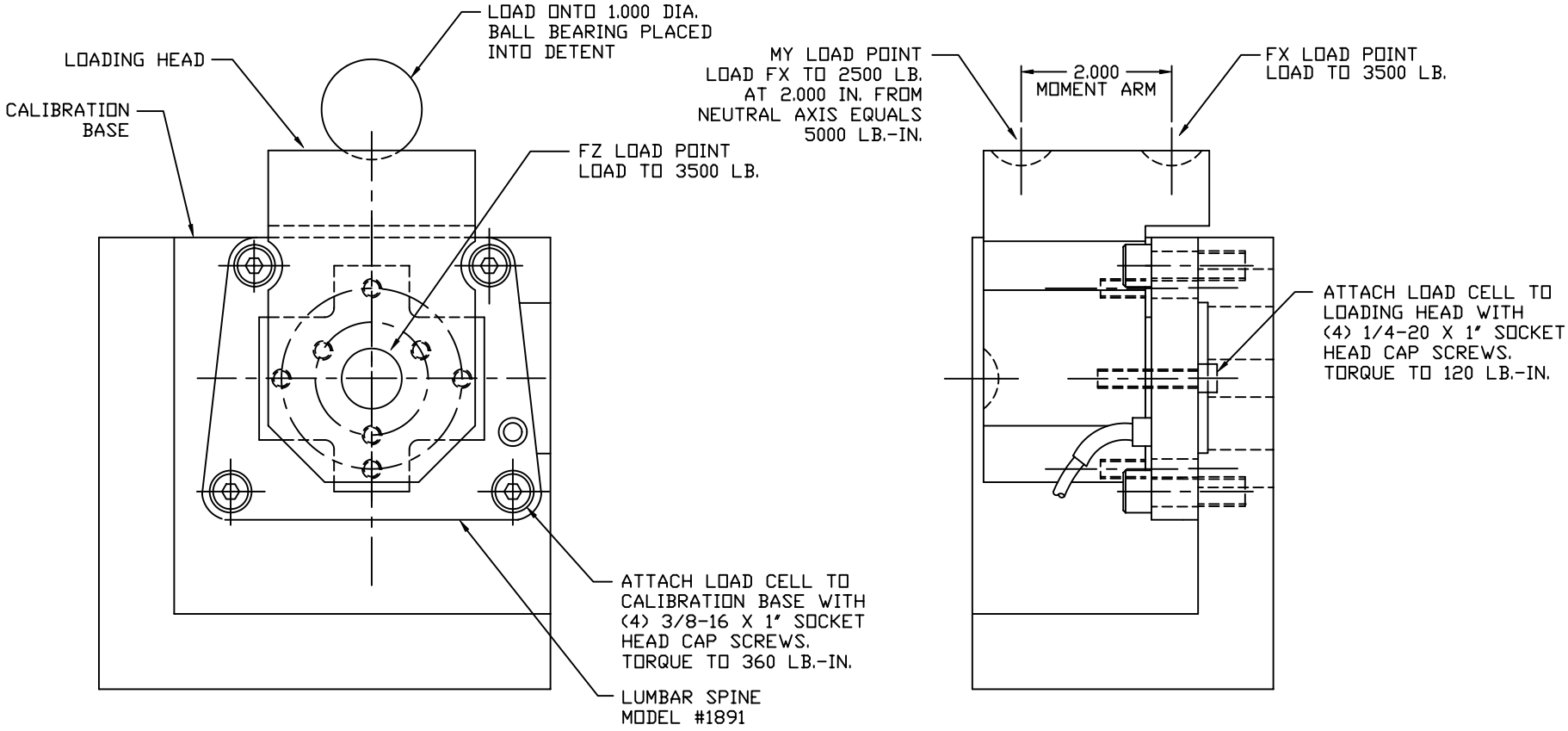
3 CHANNEL LUMBAR SPINE - STRAIGHT SPINE

SCALE: FULL
DATE: 2/12/86
DRAWN BY: C.R.M./S.E.P.
MODEL: 1891

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1891-D



SYM	REVISION	DATE
A	WAS DRG. B-2452	4/99

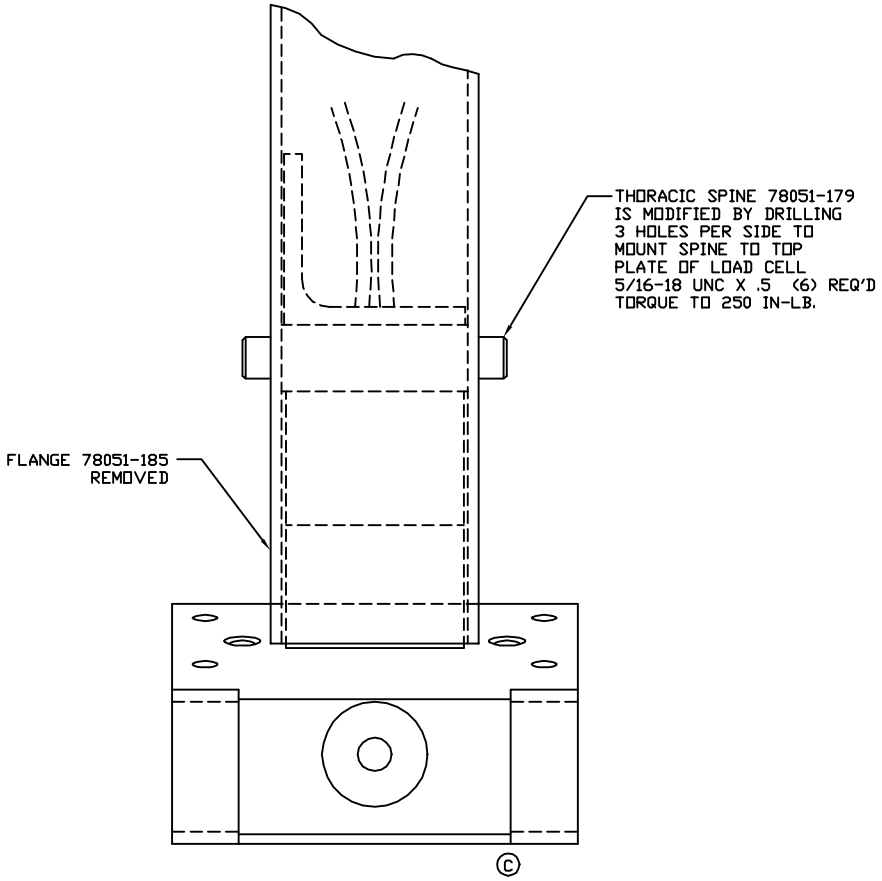
1891 CALIBRATION FIXTURE

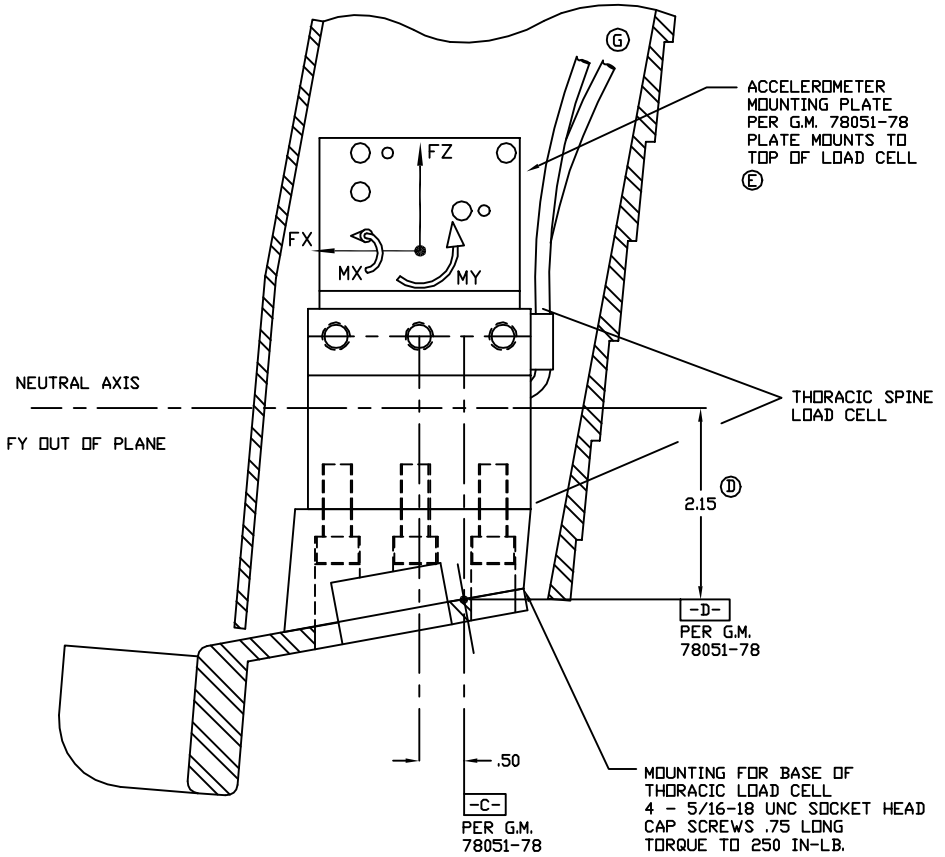
SCALE: 3/4
DATE: 17OCT95
DRAWN BY: H. PROCTOR
MODEL: 2452

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1891-C





THORACIC SPINE LOAD CELL

AXIS	CAPACITY	OUTPUT Ⓕ
FX	3000 LBS.	1.8 mV/V NOM.
FY	3000 LBS.	1.8 mV/V NOM.
FZ	4000 LBS.	1.0 mV/V NOM.
MX	6000 LB-IN.	1.4 mV/V NOM.
MY	8000 LB-IN.	1.6 mV/V NOM.

NONLINEARITY <1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE

MODEL 1911 MOUNTS DIRECTLY INTO HYBRID III LARGE MALE. A MODIFIED THORACIC SPINE AS DETAILED ABOVE IS REQUIRED TO MOUNT THE MODEL 1911 INTO THE HYBRID III 50TH PERCENTILE A.T.D.

H	REDRAWN IN CAD	7/93
G	CHG. CONN. TO CABLE	9/90
F	CAPACITY/OUTPUT REVISIONS	12/86
E	ACC. MOUNT REVISIONS	12/86
D	NEUTRAL AXIS WAS 2.38	12/86
C	ADD BEARING AND BUMPERS	7/86
B	CORNER CHAMFER	7/86
A	BASE MOUNT NOTE	7/86

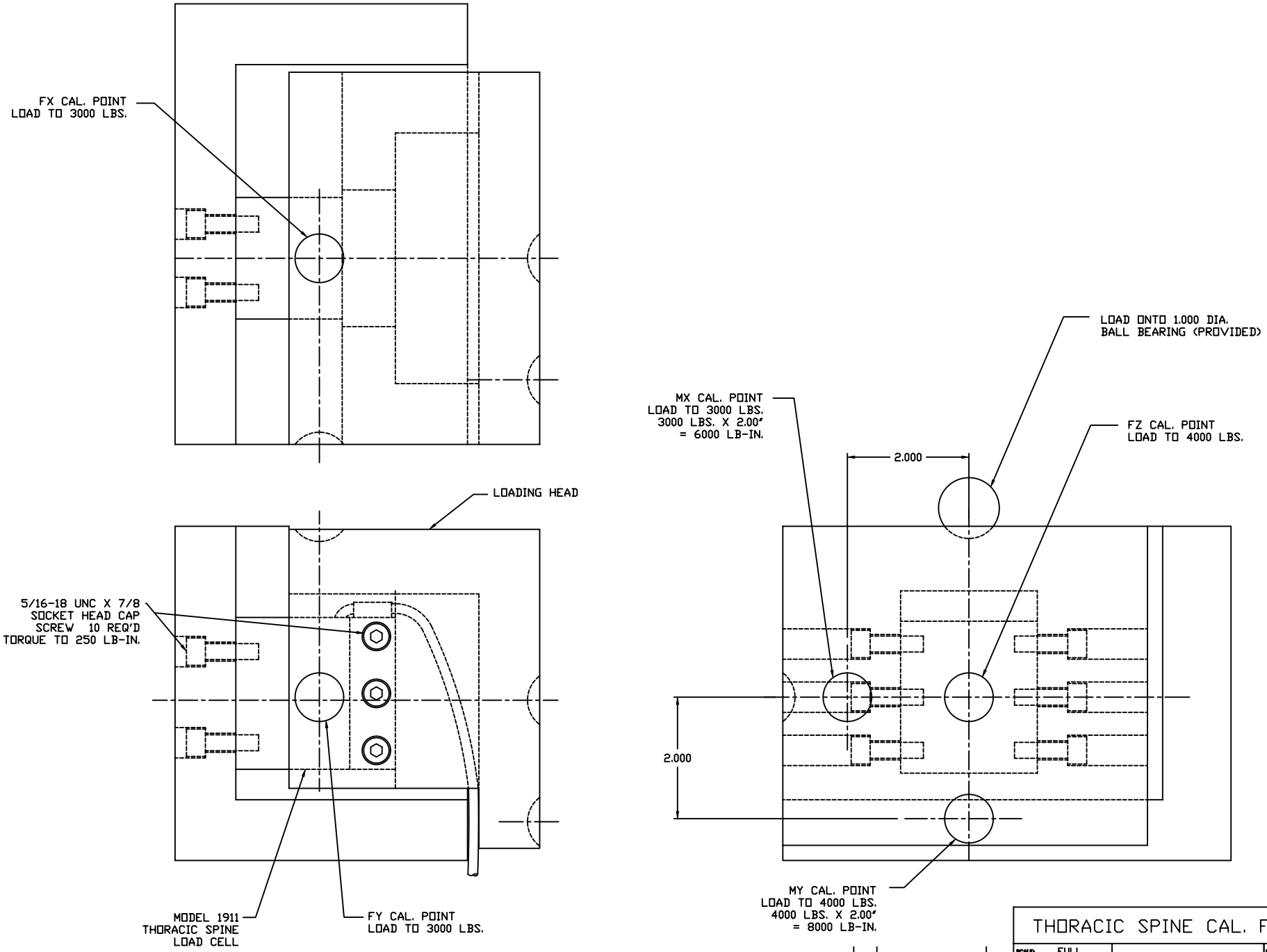
THORACIC SPINE LOAD CELL

SCALE: .75
DATE: 6/9/86
DRAWN BY: C.R.M./S.E.F.
MODEL: 1911

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1911-D



THORACIC SPINE CAL. FIXTURE

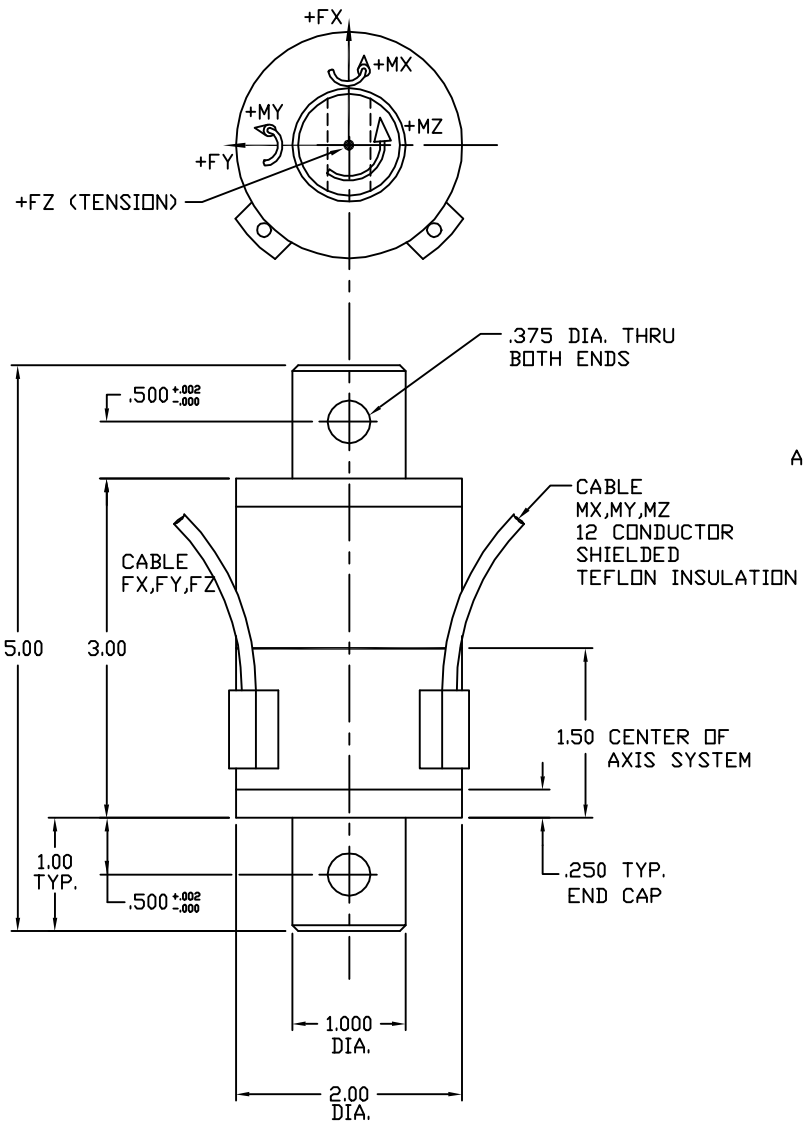
SCALE:	FULL
DATE:	9/20/86
DRAWN BY:	C.R.M./S.E.P.
MODEL:	1934

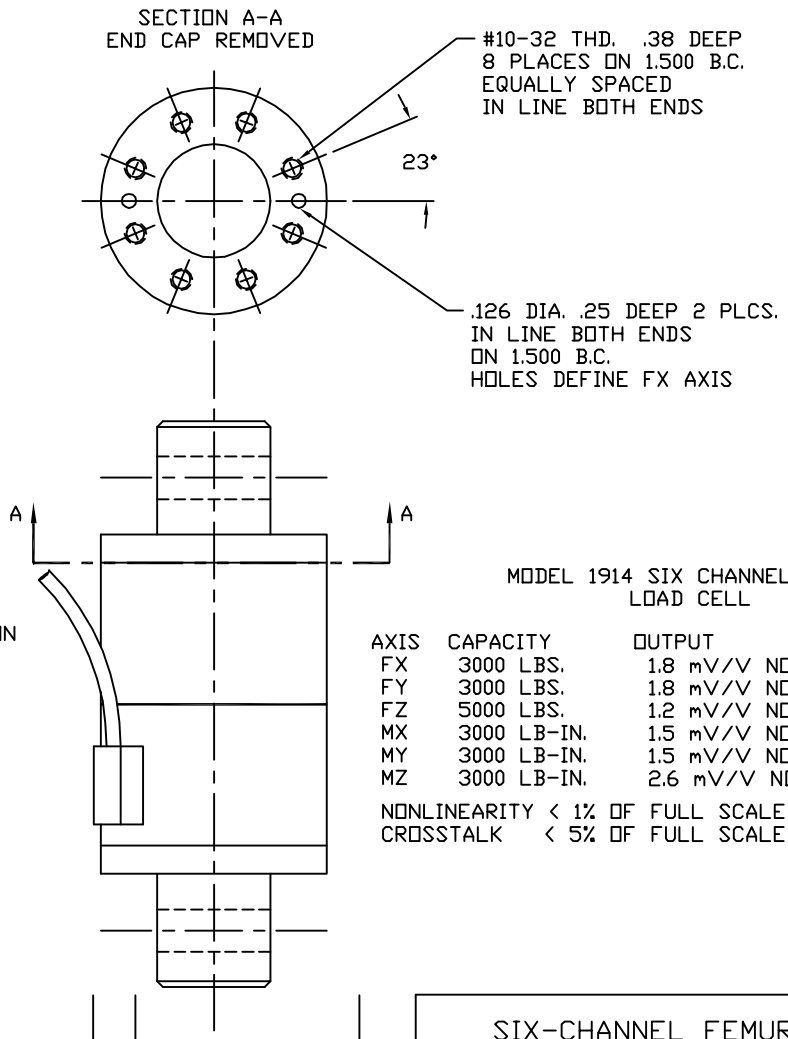
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125√
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

SYM	REVISION	DATE
B	WAS DRG. C-1934	4/99
A	REDRAWN IN CAD	7/93

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-1911-C





MODEL 1914 SIX CHANNEL FEMUR
LOAD CELL

AXIS	CAPACITY	OUTPUT	BRIDGE RESISTANCE
FX	3000 LBS.	1.8 mV/V NOM.	350 OHMS
FY	3000 LBS.	1.8 mV/V NOM.	350 OHMS
FZ	5000 LBS.	1.2 mV/V NOM.	700 OHMS
MX	3000 LB-IN.	1.5 mV/V NOM.	350 OHMS
MY	3000 LB-IN.	1.5 mV/V NOM.	350 OHMS
MZ	3000 LB-IN.	2.6 mV/V NOM.	700 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
C	ADD BRIDGE REST.	5/00
B	WAS DRG. B-1953	4/99
A	REDRAWN IN CAD	6/93

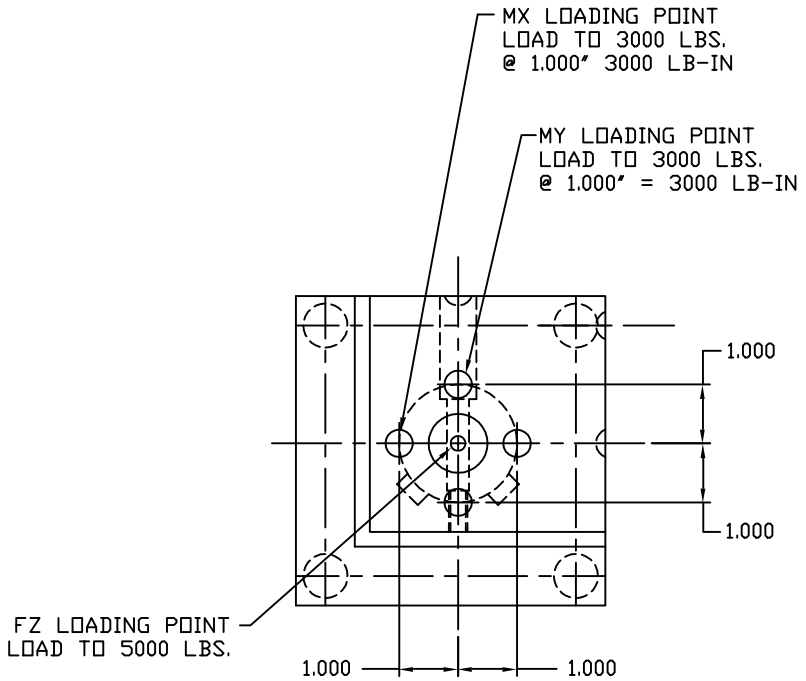
SIX-CHANNEL FEMUR LOAD CELL

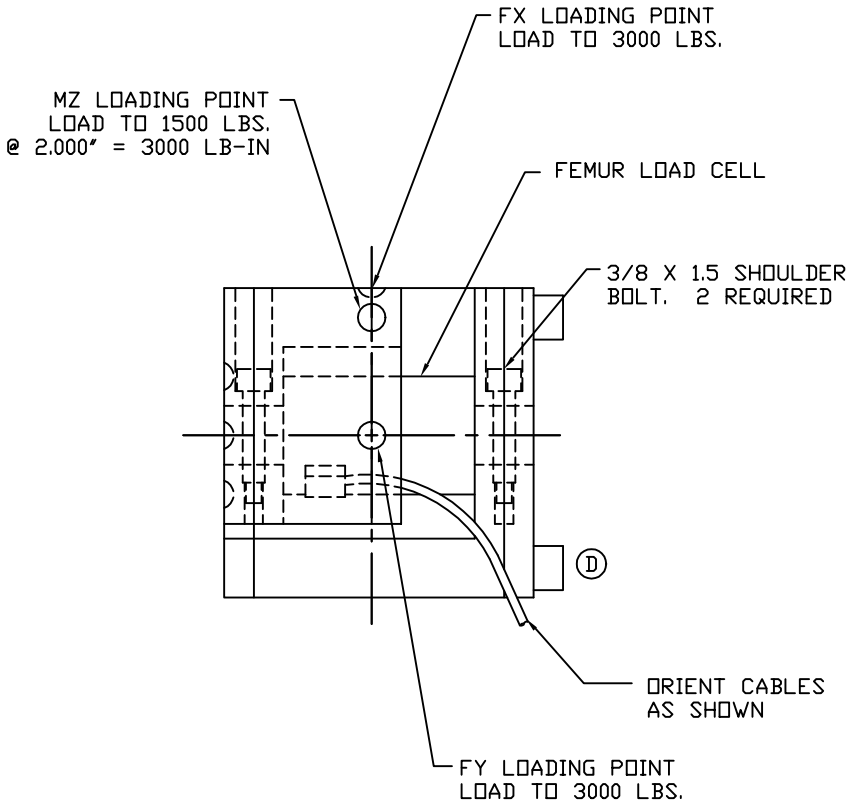
SCALE: FULL
DATE: 11/4/86
DRAWN BY: C.R.M./S.E.F.
MODEL: 1914

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1914-D





CALIBRATION FIXTURE MODEL #1957

SYM	REVISION	DATE
D	ADD FEET	1/00
C	COPY DWG B-1957	10/99
B	REDRAWN IN CAD	12/93
A	REV. FOR MOD.1914	4/90

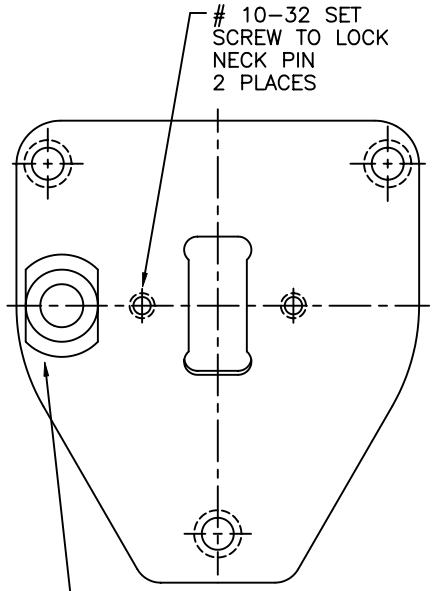
FEMUR CALIBRATION FIXTURE

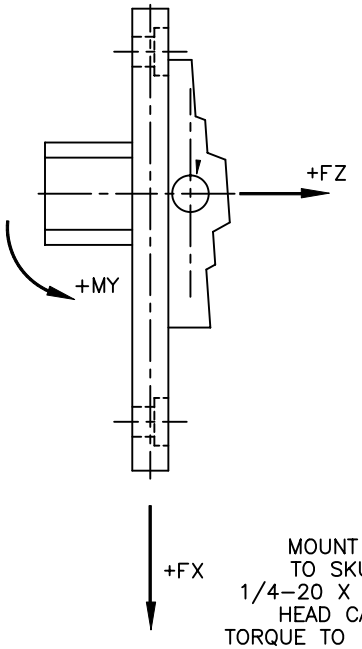
SCALE: 1/2
DATE: 11/10/86
DRAWN BY: C.R.M./S.E.F.
MODEL: 1914A

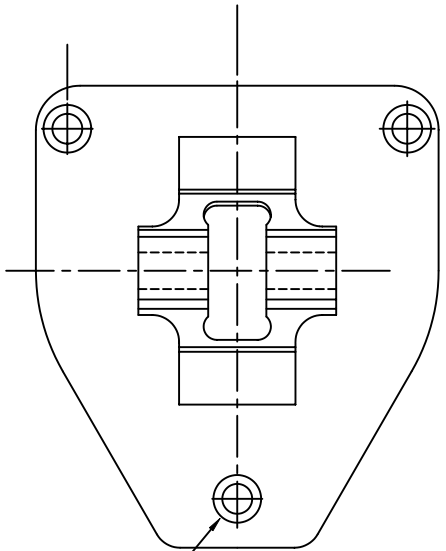
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

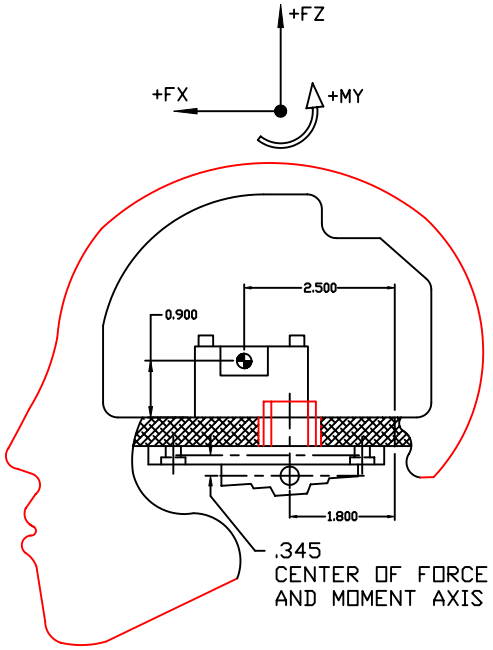
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1914-C









AXIS	CAPACITY	OUTPUT @ CAPACITY	2062 BRIDGE RESISTANCE	2062V BRIDGE RESISTANCE
FX	1000 LBS.	0.9 mV/V NOM.	700 OHMS	120 OHMS
MY	2400 LB.-IN.	2.0 mV/V NOM.	700 OHMS	120 OHMS
FZ	1000 LBS.	0.9 mV/V NOM.	700 OHMS	120 OHMS

CROSSTALK < 5% OF FULL SCALE
NONLINEARITY < 1% OF FULL SCALE

SYM	REVISION	DATE
A	WAS DRG. B-2381	4/99

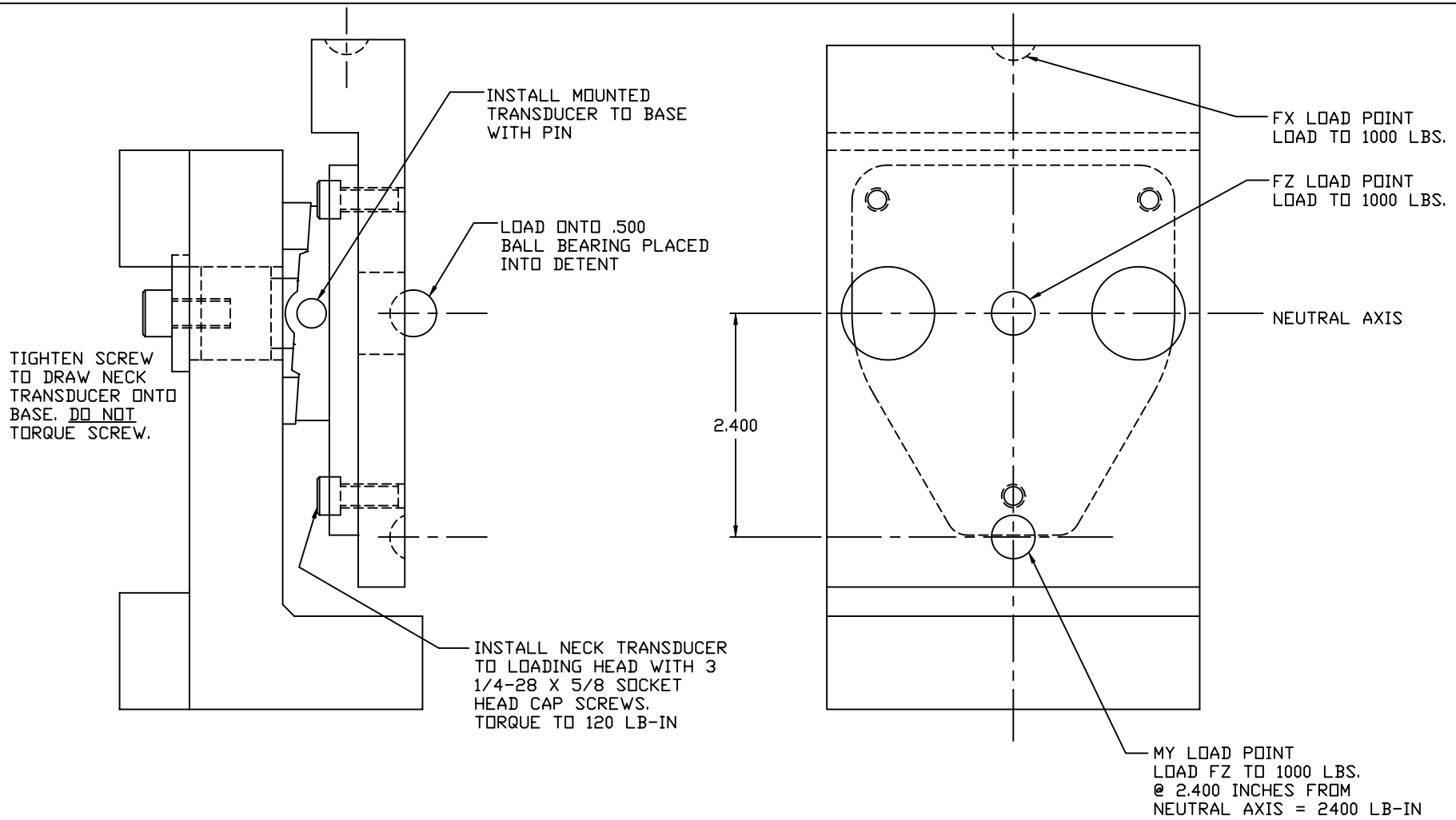
3-CHANNEL NECK LOAD CELL HYBRID III

SCALE: FULL		DRAWN BY: C.R. MORGAN
DATE: 10/15/87		MODEL: 2062

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2062-D



SYM	REVISION	DATE
B	WAS DRG. B-2130	4/99
A	DRWN TO CAD	12/93

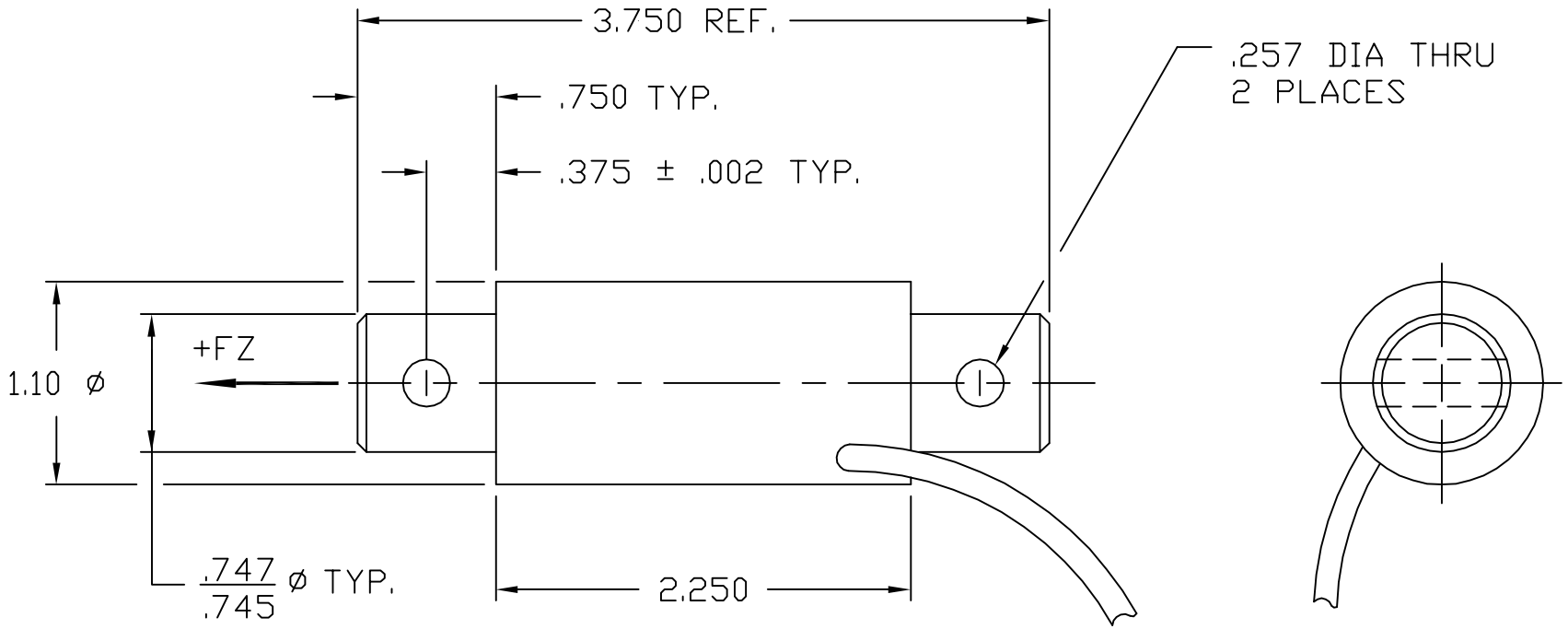
3-CHANNEL NECK CALIBRATION FIXTURE

SCALE: FULL
DATE: 5/10/88
DRAWN BY: C.R.M./S.E.F.
MODEL: 2130

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2062-C



MODEL 2090
CHILD FEMUR LOAD CELL

CAPACITY	1500 LBS.
OUTPUT	1.2 mV/V NOM.
NONLINEARITY < 1% OF FULL SCALE	
BRIDGE RESISTANCE	700 OHMS

CHILD FEMUR LOAD CELL

SCALE: FULL			DRAWN BY: C.R. MORGAN
DATE: 1/7/88			MODEL: 2090

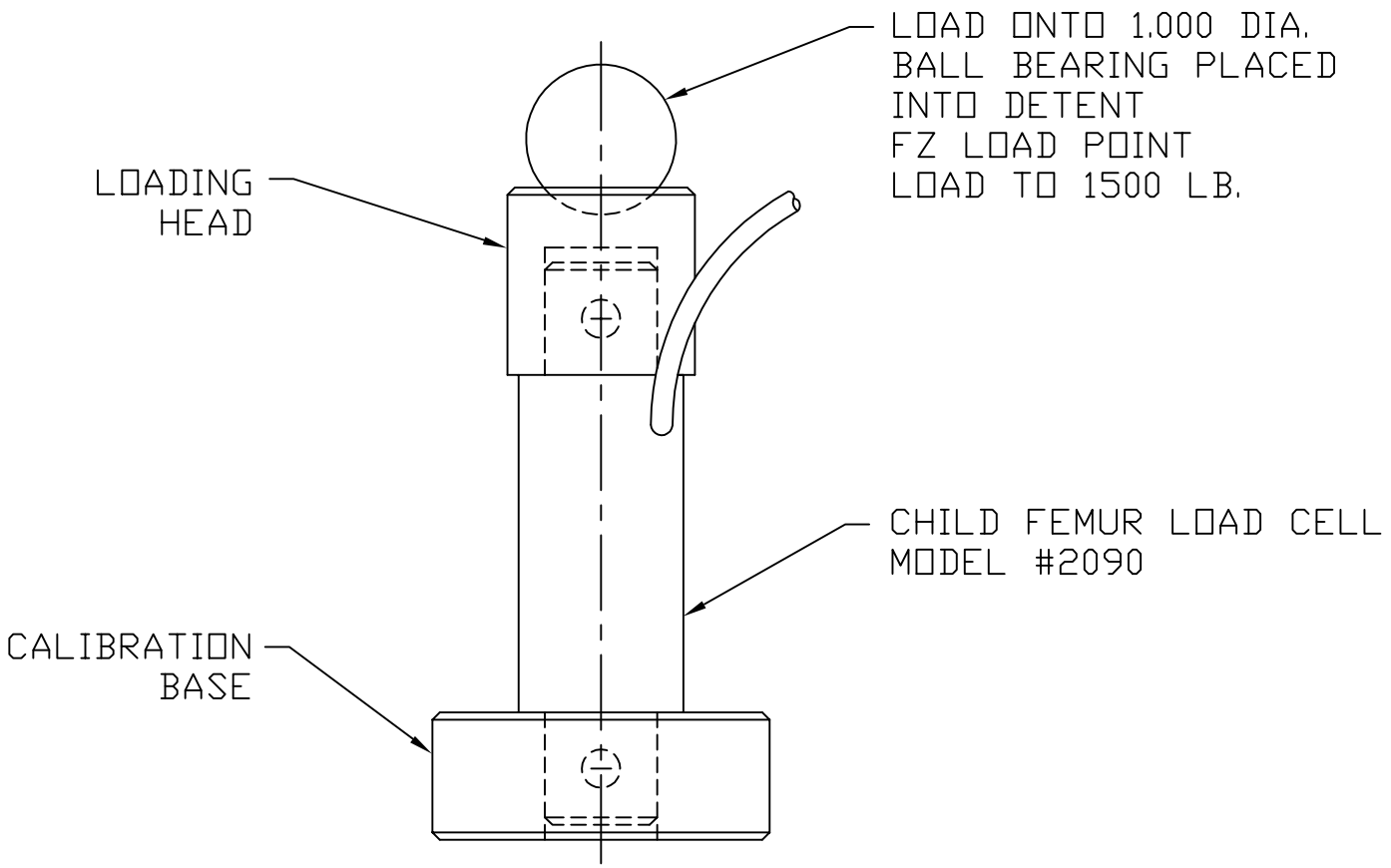
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

SYM	REVISION	DATE
A	WAS DRG. A-2608	4/99

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-2090-D



CALIBRATION FIXTURE MODEL #3863

SYM	REVISION	DATE

CALIBRATION FIXTURE FOR MODEL 2090 1 CHANNEL CHILD FEMUR

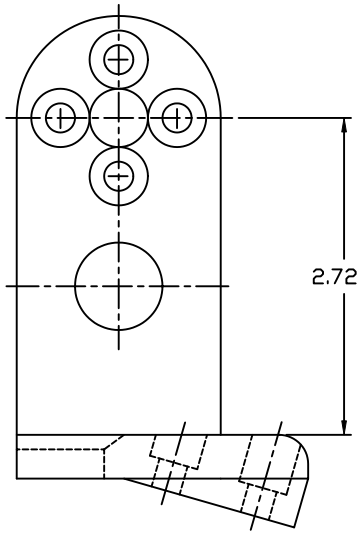
SCALE: .75X		DRAWN BY: *H. CHESTON*
DATE: 8OCT99		MODEL: 2090

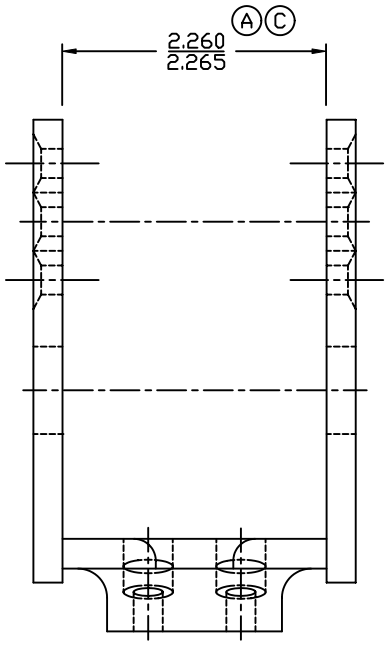
UNLESS OTHERWISE SPECIFIED

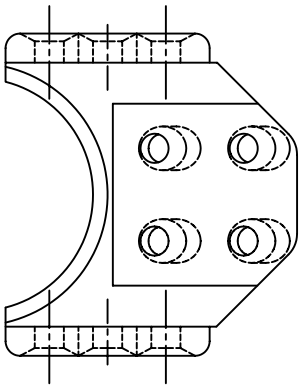
TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-2090-C







THIS REPLACES MODEL# 1587
INSTRUMENTED KNEE FOR 50% DUMMY.

SYM	REVISION	DATE
D	WAS DRG. B-2110	7/99
C	WAS 2.260/2.261	12/97
B	REDRAWN IN CAD	11/97
A	CHG'D. DIM.	1/97

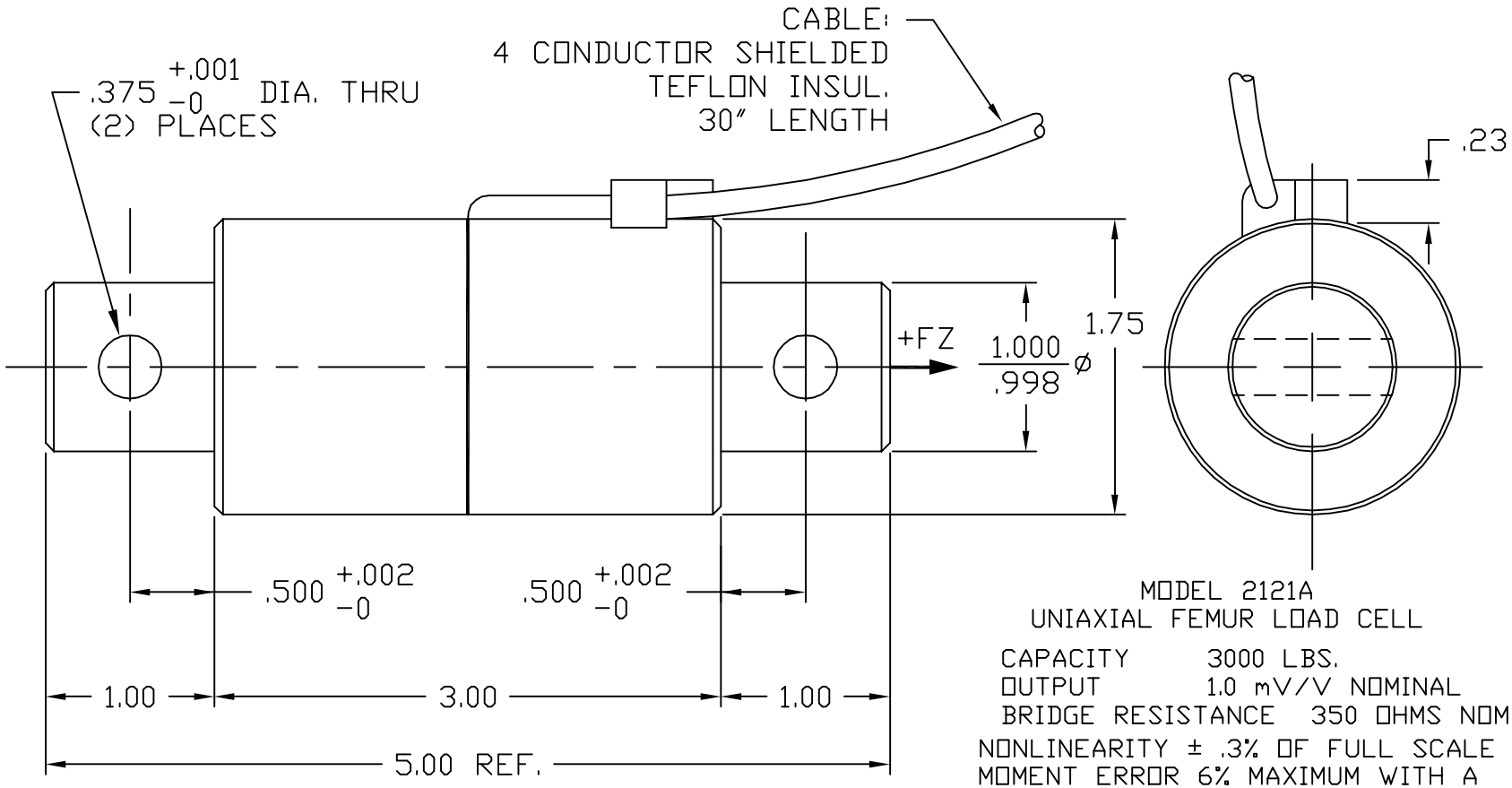
50% KNEE STRUCTURAL REPLACEMENT

SCALE: FULL
DATE: 1/4/86
DRAWN BY: C.R. MORGAN
MODEL: 2110

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2110-D



MODEL 2121A
UNIAXIAL FEMUR LOAD CELL

CAPACITY	3000 LBS.
OUTPUT	1.0 mV/V NOMINAL
BRIDGE RESISTANCE	350 OHMS NOM.

NONLINEARITY ± .3% OF FULL SCALE
MOMENT ERROR 6% MAXIMUM WITH A
5000 IN.-LB MOMENT

SYM	REVISION	DATE
D	ADD "A" IN MOD.#	5/00
C	ADD BRIDGE REST.	5/00
B	WAS DRG. A-2244	4/99
A	REDRAWN IN CAD	6/93

UNIAXIAL FEMUR LOAD CELL

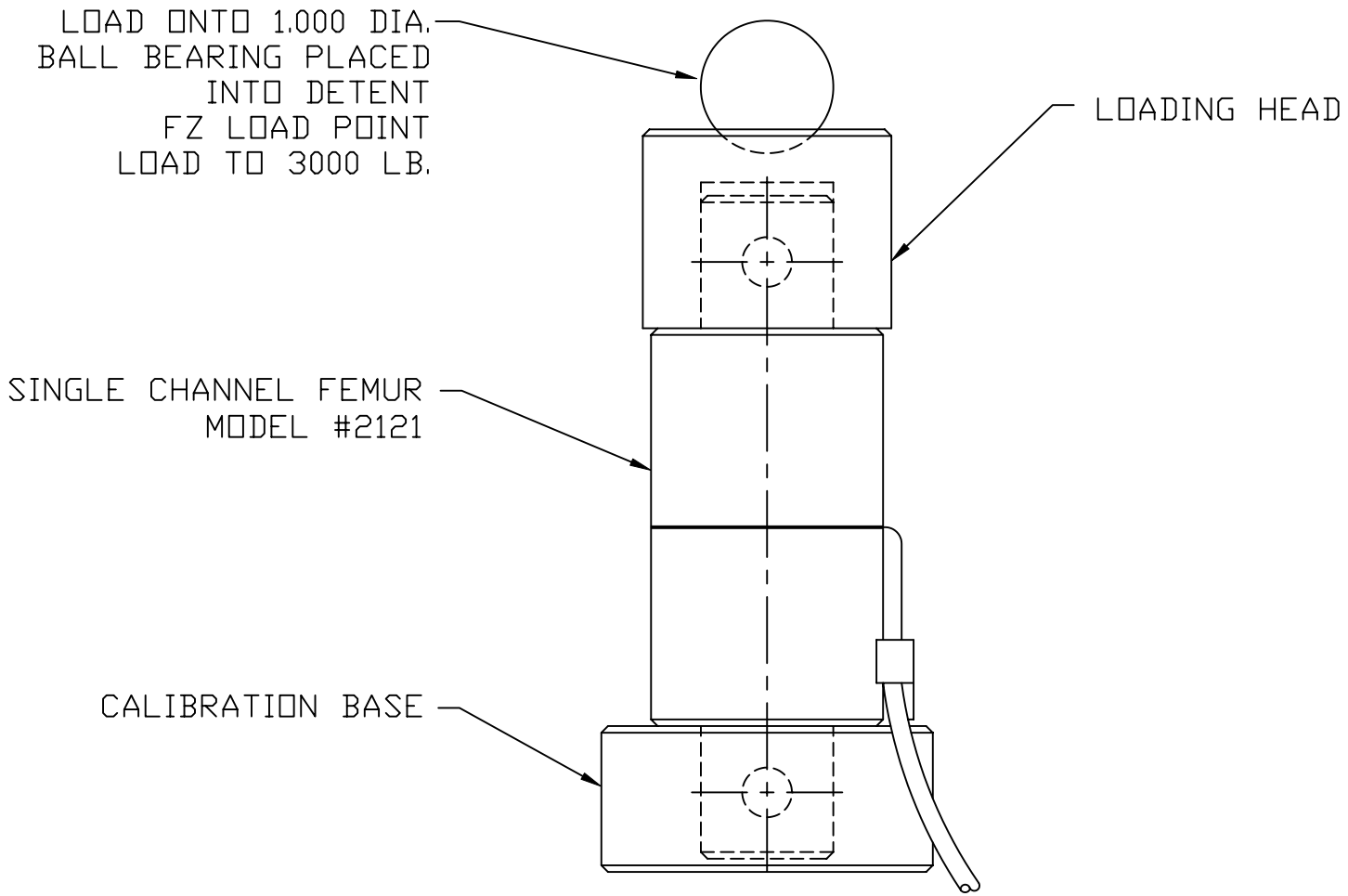
SCALE:	FULL		DRAWN BY: C.R.M/S.E.F.
DATE:	4/7/88		MODEL: 2121A

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-2121-D



CALIBRATION FIXTURE FOR MODEL 2121 SINGLE CHANNEL FEMUR

SCALE: .75X		DRAWN BY: *H. CHESTON*
DATE: 7/29/97		MODEL: 3203

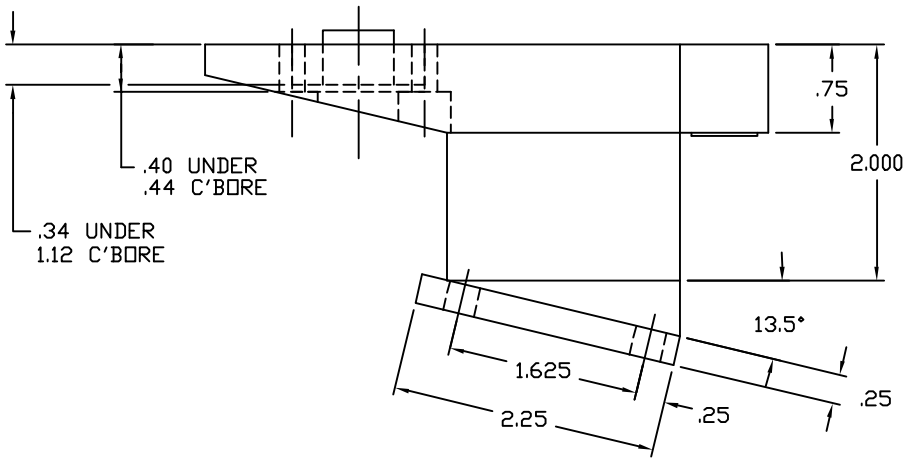
UNLESS OTHERWISE SPECIFIED

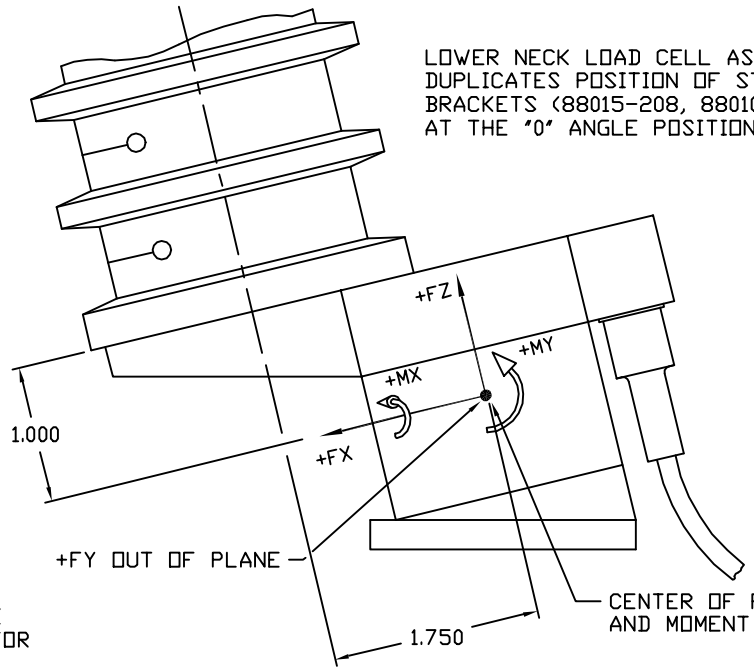
TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

SYM	REVISION	DATE
A	WAS DRG. A-3203	4/99

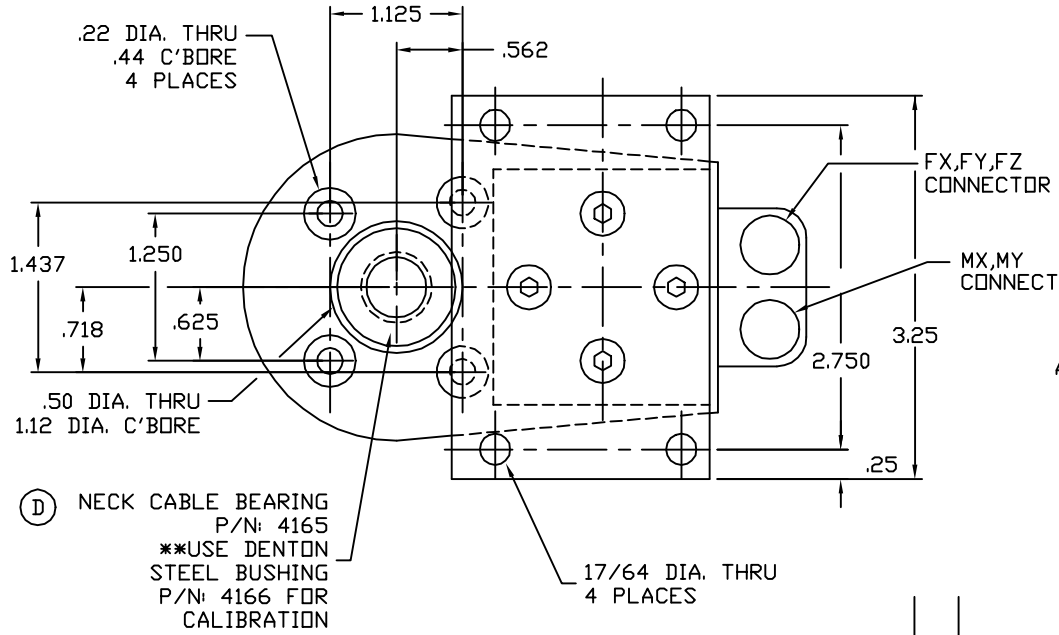
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-2121-C





LOWER NECK LOAD CELL ASSEMBLY
DUPLICATES POSITION OF STANDARD
BRACKETS (88015-208, 880105-207)
AT THE "0" ANGLE POSITION



MODEL 2150 LOWER NECK LOAD CELL
SMALL FEMALE HYBRID III

AXIS	CAPACITY	OUPUT @ CAPACITY	MODEL 2150 BRIDGE RESISTANCE	MODEL 2150A BRIDGE RESISTANCE
FX	3000 LBS.	2.0 mV/V NOM.	350Ω	350Ω
FY	3000 LBS.	2.0 mV/V NOM.	350Ω	350Ω
FZ	3000 LBS.	1.2 mV/V NOM.	700Ω	480Ω Ⓑ
MX	4000 LB-IN	2.0 mV/V NOM.	700Ω	700Ω
MY	4000 LB-IN	2.0 mV/V NOM.	700Ω	700Ω

NONLINEARITY <1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE

SYM	REVISION	DATE
E	WAS DRG. B-2150	4/99
D	CHG NOTE	11/98
C	ADD BEARING	7/98
B	CHANGED FZ RESIS.	3/91
A	REDRAWN IN CAD	7/7/93

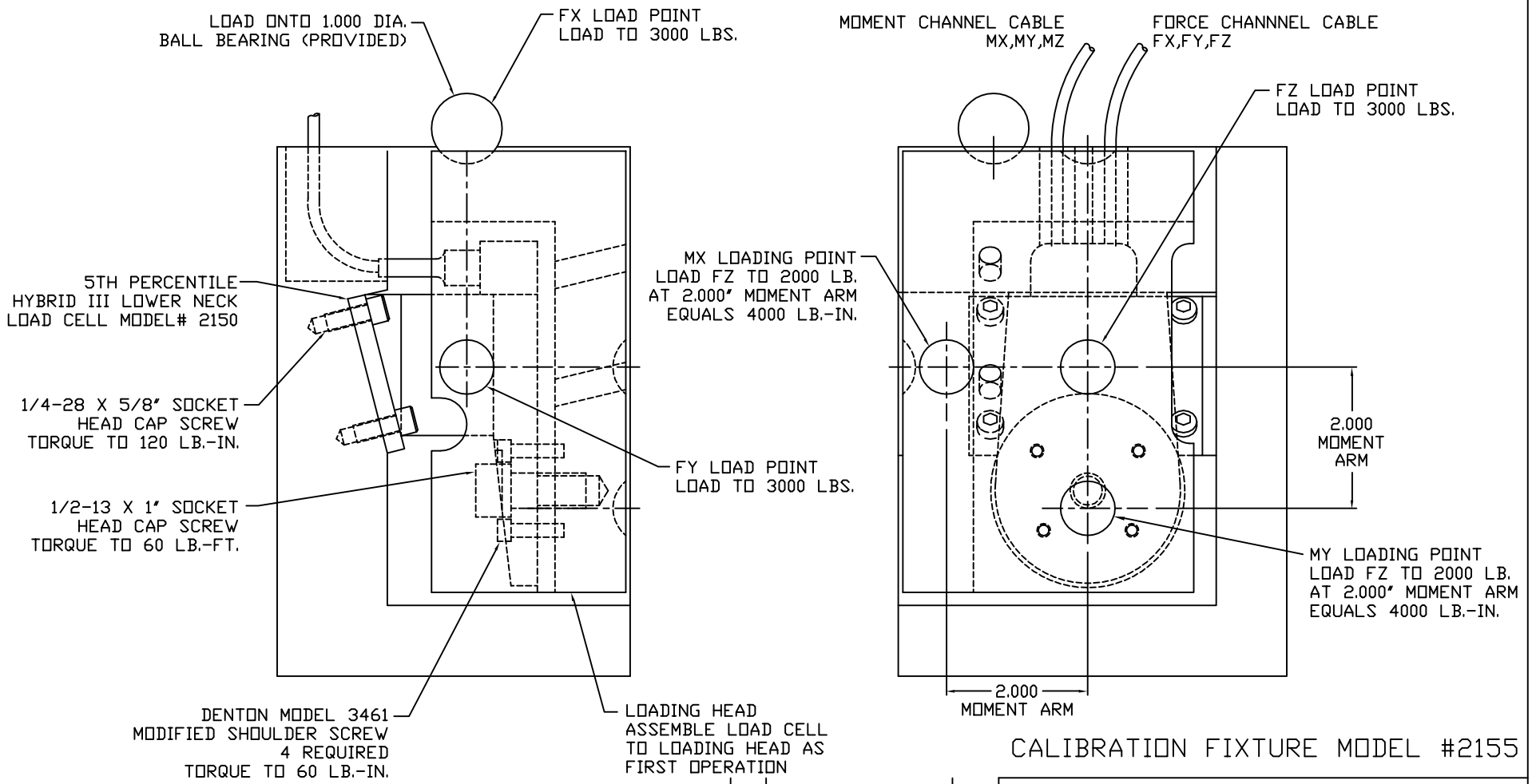
SMALL FEMALE LOWER NECK LOAD CELL

SCALE: FULL
DATE: 3/24/93
DRAWN BY: C.R.M./S.E.F.
MODEL: 2150

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2150-D



CALIBRATION FIXTURE MODEL #2155

5TH % LOWER NECK CALIBRATION FIXTURE

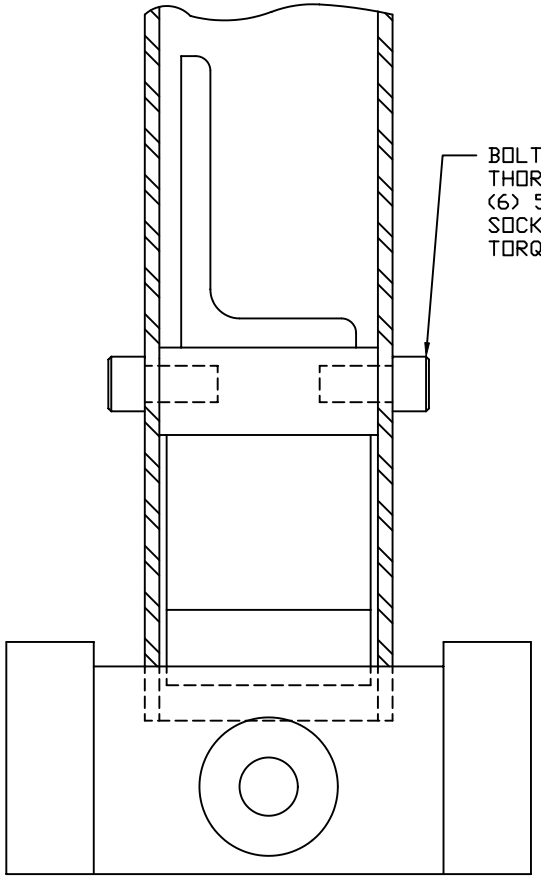
SCALE: FULL		DRAWN BY: C.R.M./S.E.F.
DATE: 3/22/89		MODEL: 2150

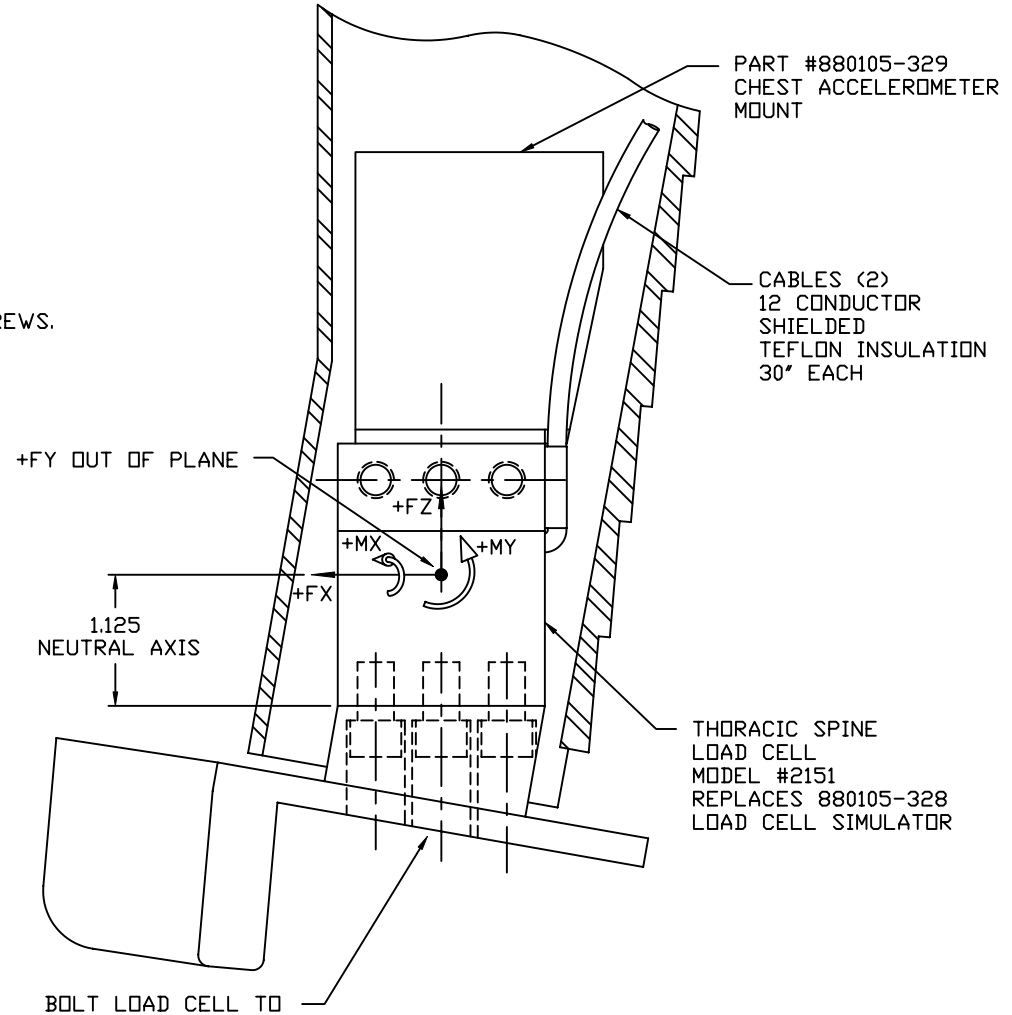
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2150-C





MODEL 2151 THORACIC SPINE LOAD CELL
SMALL FEMALE HYBRID III

AXIS	CAPACITY	OUPUT @ CAPACITY	BRIDGE RESISTANCE
FX	3000 LBS	1.8 mV/V NOM.	350Ω
FY	3000 LBS	1.8 mV/V NOM.	350Ω
FZ	4000 LBS	1.0 mV/V NOM.	700Ω (B)
MX	5000 LB-IN	1.6 mV/V NOM.	700Ω
MY	5000 LB-IN	1.6 mV/V NOM.	700Ω

NONLINEARITY <1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE

SYM	REVISION	DATE
C	WAS DRG. B-2151	4/99
B	CHANGED FZ RESIS.	3/91
A	REDRAWN IN CAD	7/13/93

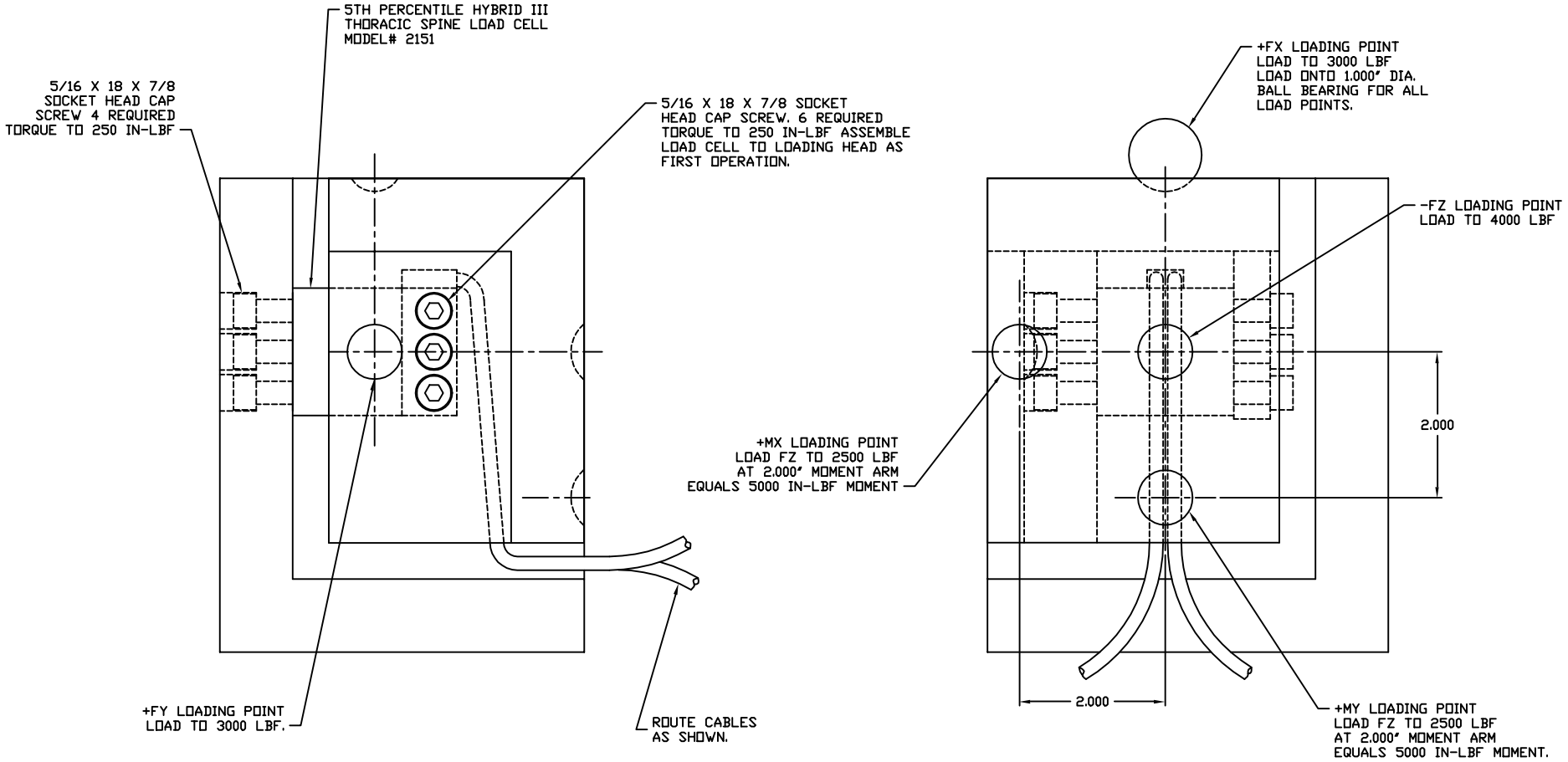
SMALL FEMALE THORACIC SPINE LOAD CELL

SCALE: FULL
DATE: 4/4/89
DRAWN BY: S.E.POSTER
MODEL: 2151

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2151-D



CALIBRATION FIXTURE MODEL #2156

SYM	REVISION	DATE

CALIBRATION FIXTURE FOR
5TH PERCENTILE THORACIC SPINE

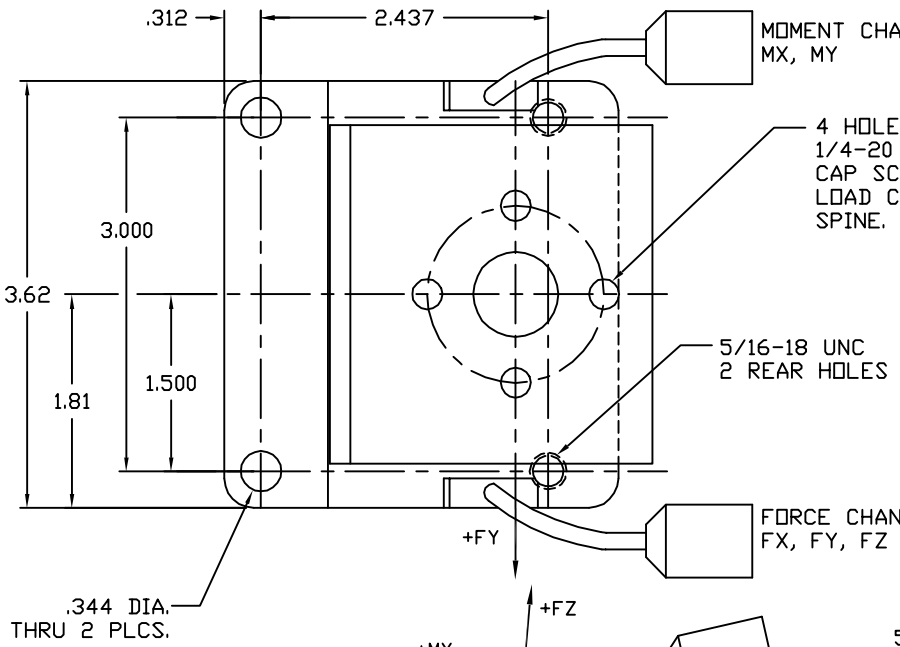
SCALE: FULL | DRAWN BY: C.HEAD

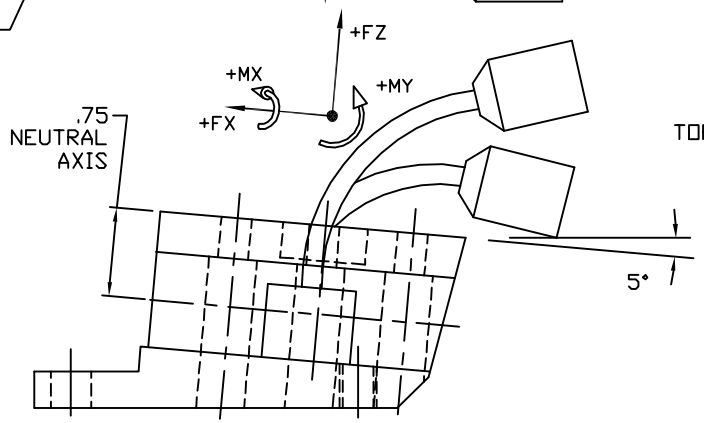
DATE: 2/2/00 | MODEL: 2151

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

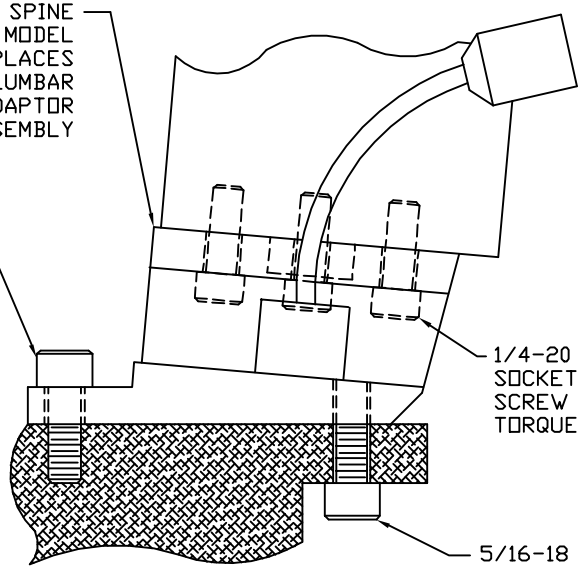
DRAWING NUMBER: C-2151-C





MODEL 2152 LUMBAR SPINE LOAD CELL
SMALL FEMALE HYBRID III

LUMBAR SPINE
LOAD CELL MODEL
#2152 REPLACES
880105-406 LUMBAR
PELVIC ADAPTOR
ASSEMBLY



5/16-18 UNC X 3/4
SOCKET HEAD CAP
SCREW 2 REQ'D
TORQUE TO 250 LB-IN

1/4-20 UNC X 3/4
SOCKET HEAD CAP
SCREW 4 REQ'D
TORQUE TO 120 LB-IN

5/16-18 UNC X 7/8
SOCKET HEAD CAP
SCREW 2 REQ'D
TORQUE TO 250 LB-IN

*NOTE:
2152 HAS A
BRIDGE
RESISTANCE OF
480 OHMS.

AXIS	CAPACITY	OUTPUT@CAPACITY	2152 RESISTANCE	2152A RESISTANCE
FX	3000 LBF	1.9 mV/V NOM.	350 OHMS	350 OHMS
FY	3000 LBF	1.9 mV/V NOM.	350 OHMS	350 OHMS
FZ	4000 LBF	1.0 mV/V NOM.	480 OHMS	700 OHMS
MX	6000 IN-LBF	1.5 mV/V NOM.	700 OHMS	700 OHMS
MY	6000 IN-LBF	1.5 mV/V NOM.	700 OHMS	700 OHMS
	NONLINEARITY	< 1% OF FULL SCALE		
	CROSSTALK	< 5% OF FULL SCALE		

SYM	REVISION	DATE
A	WAS DRG. B-2152	4/99

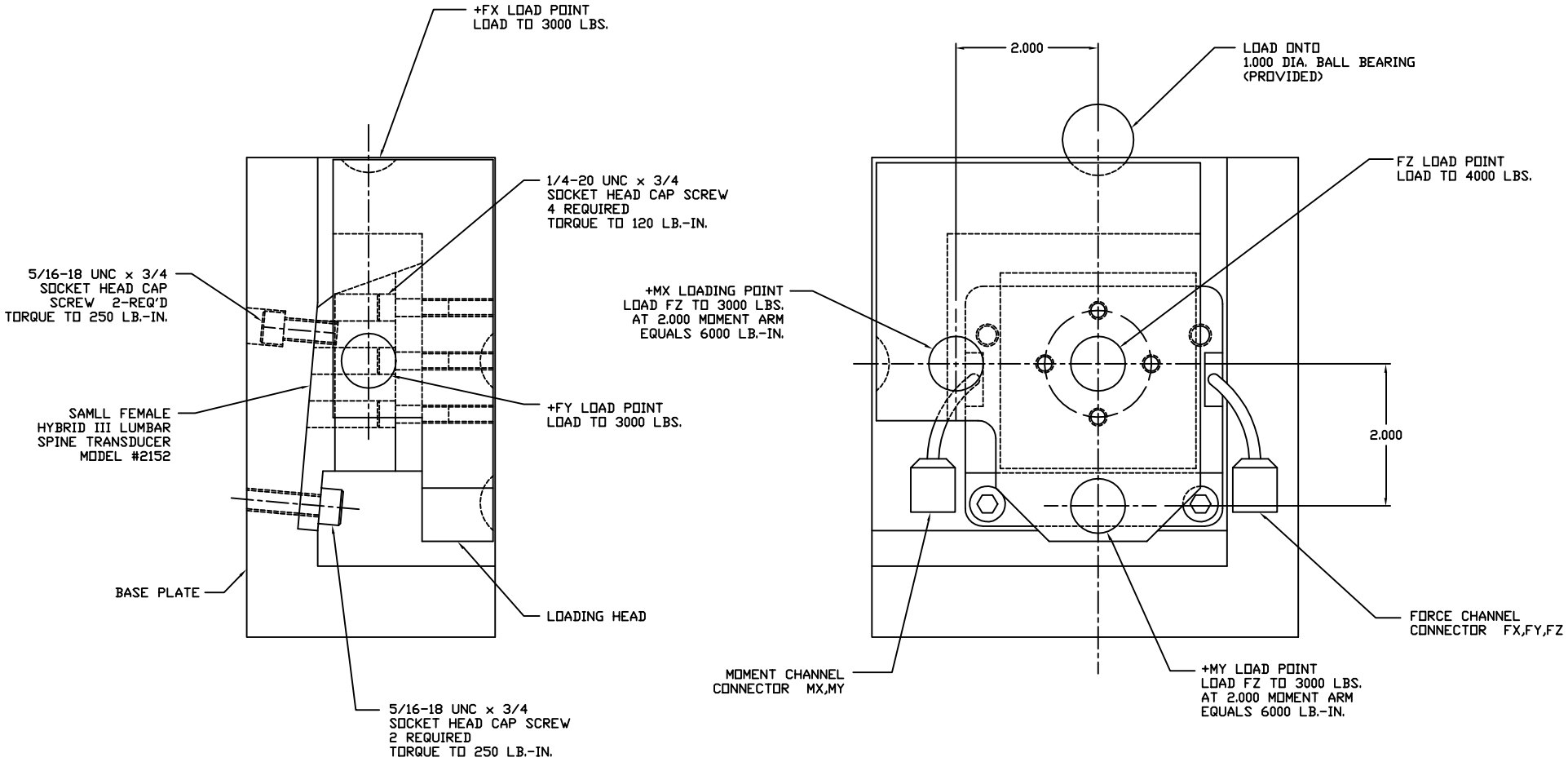
SMALL FEMALE LUMBAR SPINE LOAD CELL

SCALE: FULL
DATE: 4/11/93
DRAWN BY: C.R.M./S.E.P.
MODEL: 2152

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2152-D



CALIBRATION FIXTURE MODEL #2157

SYM	REVISION	DATE
B	WAS DRG. C-2157	4/99
A	REDRAWN IN CAD	7/93

5TH % LUMBAR SPINE CALIBRATION FIXTURE

SCALE: FULL — DRAWN BY: C.R.M./S.E.P.

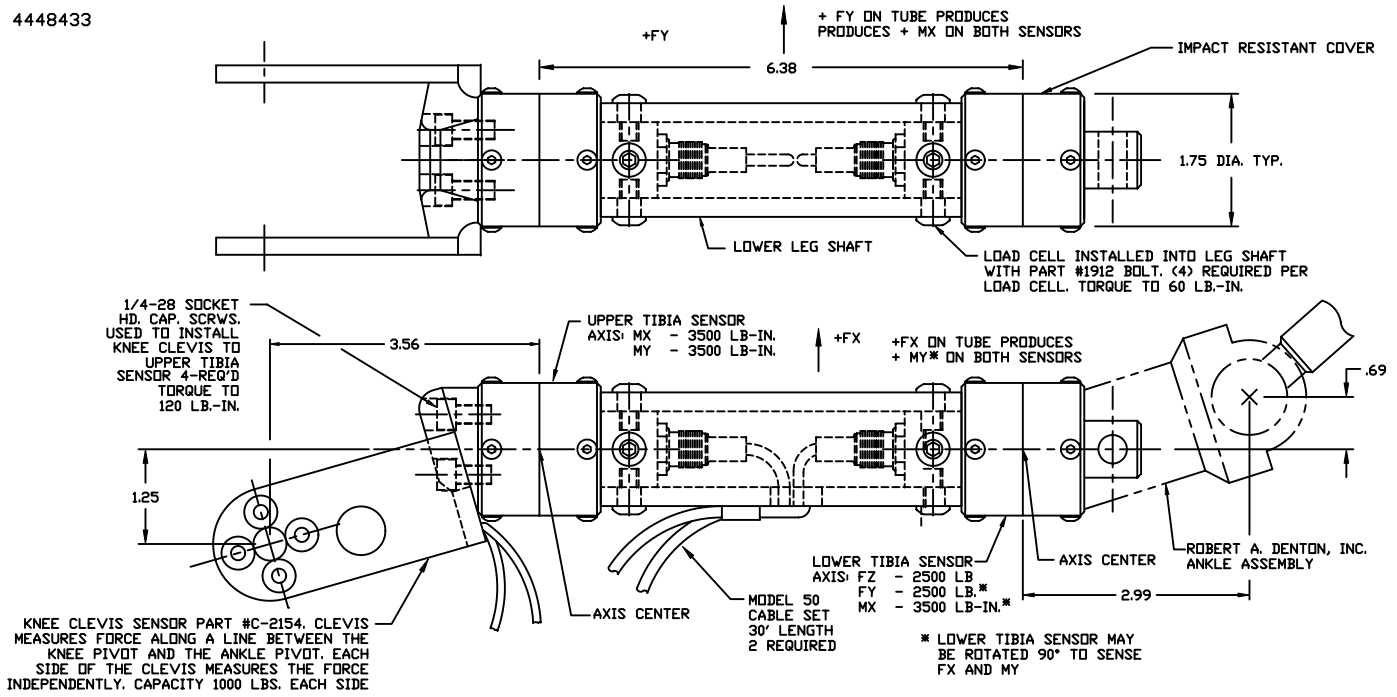
DATE: 4/12/89 — MODEL: 2152

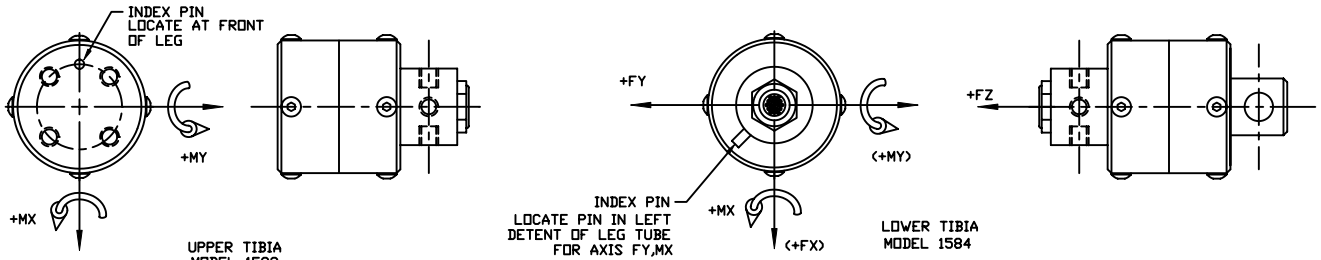
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-2152-C

U.S. PATENT # 4448433





UPPER TIBIA
MODEL 1583

AXIS	CAPACITY	OUTPUT
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SEE NOTE 2

LOWER TIBIA
MODEL 1584

AXIS	CAPACITY	OUTPUT
FZ	2500 LBS.	1.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.

SEE NOTE 2

NOTES:
1. POLARITIES SHOWN ARE PER THE STANDARD DENTON MODEL 1571 INSTRUMENTED LOWER LEG. POLARITIES DO NOT AGREE WITH S.A.E. J-211. CABLE COLOR CODES ARE PROVIDED ON THE LOAD CELL CALIBRATION REPORTS.

2. THE TIBIA LOAD CELLS MAY BE CONFIGURED WITH UP TO 4 CHANNELS. CONFIGURATIONS MAY BE MADE UP OF ANY COMBINATION OF FX, FY, FZ, MX, MY, MZ.

A	REDRAWN IN CAD	7/16/93

INSTRUMENTED LEG HYBRID III
5TH PERCENTILE

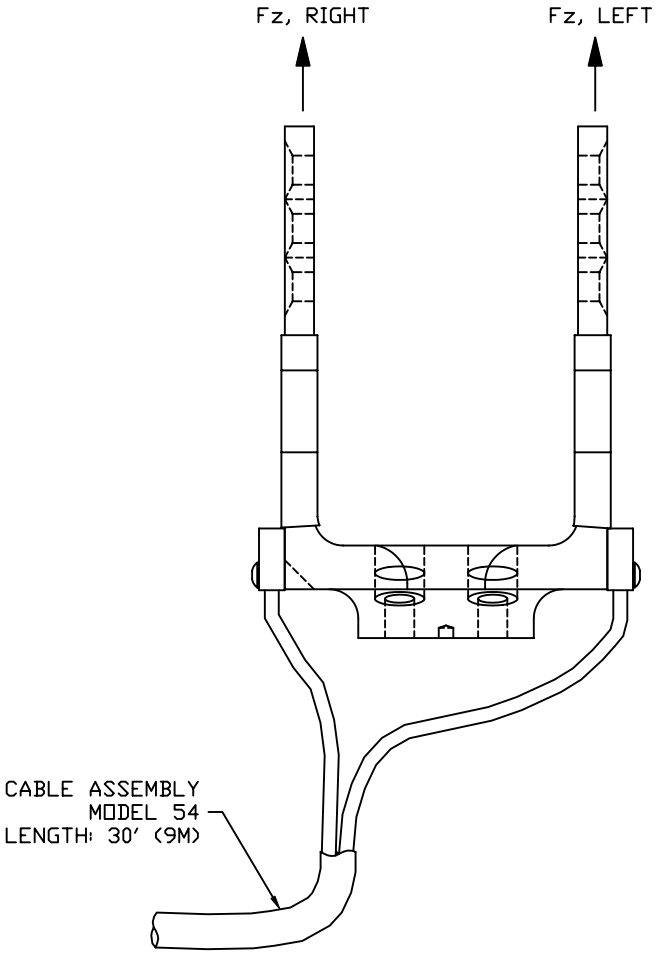
SCALE: .65			DRAWN BY: C.R.M./S.E.P.
DATE: 5/1/89			MODEL: 2153

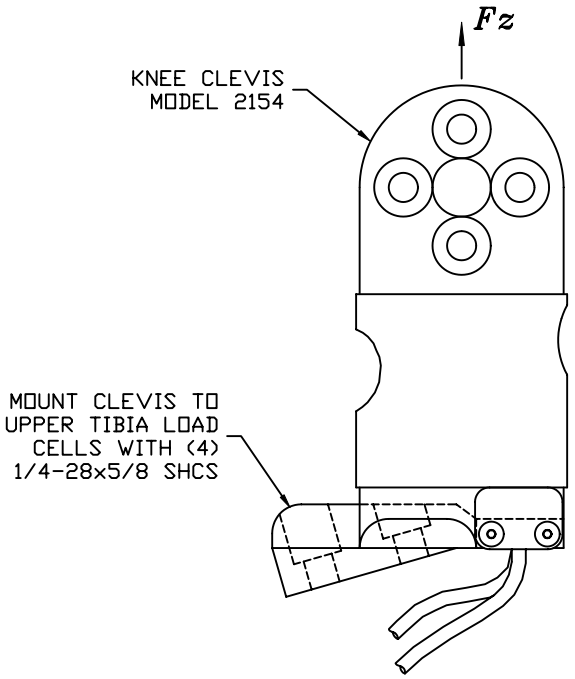
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2153-D





AXIS	CAPACITY	OUTPUT
Fz, LEFT	1500 LBS.	1.3 mV/V NOMINAL
Fz, RIGHT	1500 LBS.	1.3 mV/V NOMINAL

NON-LINEARITY: < 1% OF FULL SCALE
BRIDGE RESISTANCE: 350 OHMS NOMINAL

2154	1
NEXT ASS'Y	QTY
PART USED ON	

SYM	REVISION	DATE
A	WAS DRG. B-4206	5/99

2 - CHANNEL KNEE CLEVIS

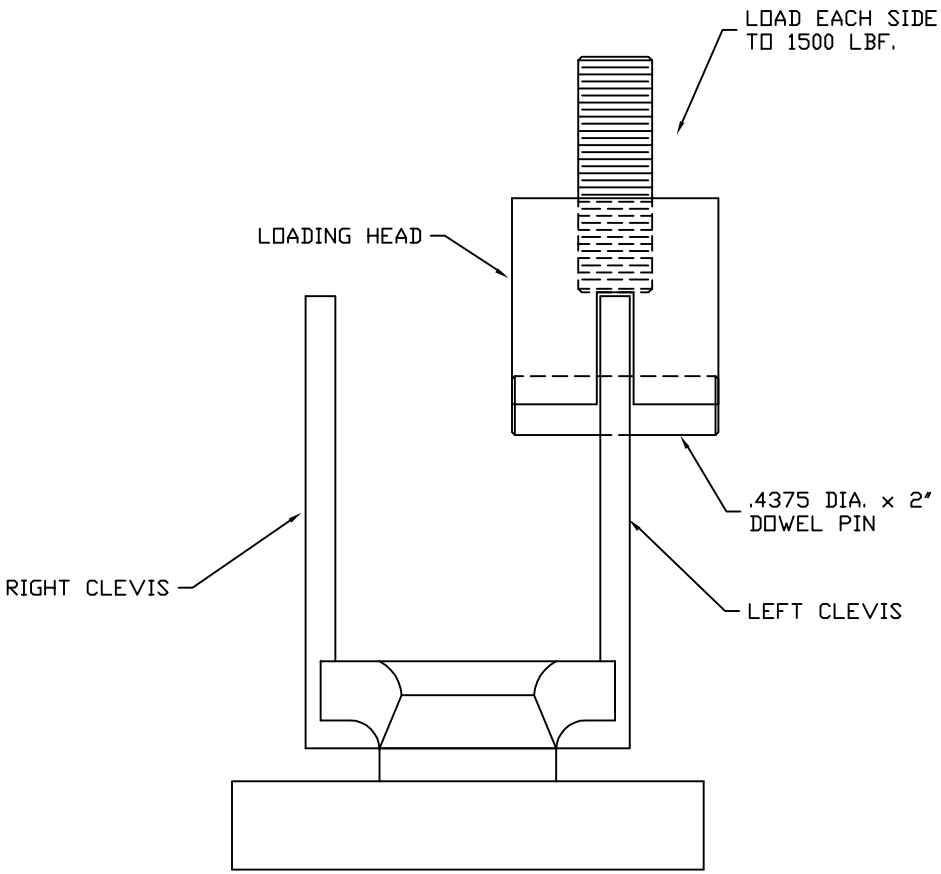
HYBRID III 5TH PERCENTILE

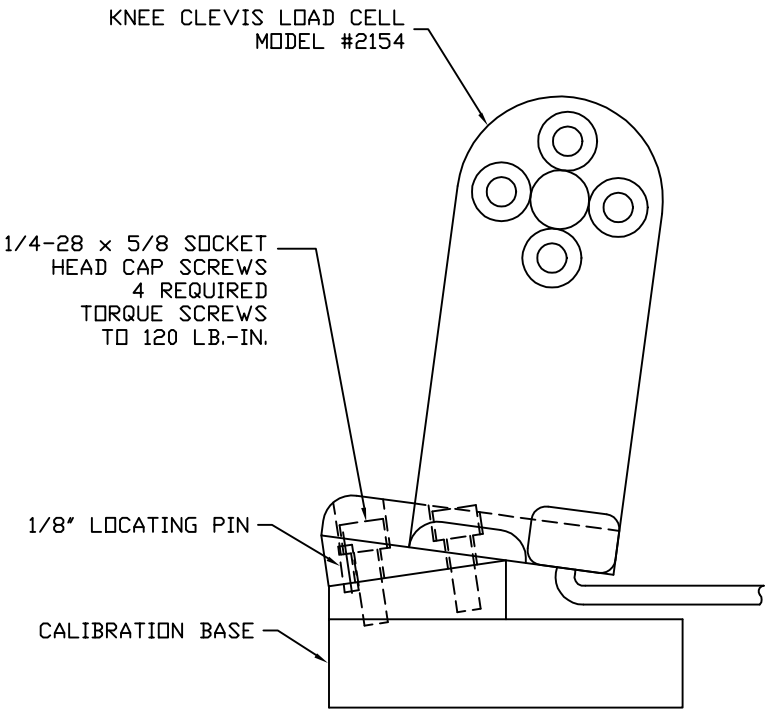
SCALE:	NONE		DRAWN BY: R. DuPont
DATE:	06AUG98		MODEL: 2154A

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2154-D





CALIBRATION FIXTURE MODEL #1861

SYM	REVISION	DATE

KNEE CALIBRATION FIXTURE

KNEE CLEVIS LOAD CELL MODEL 2154

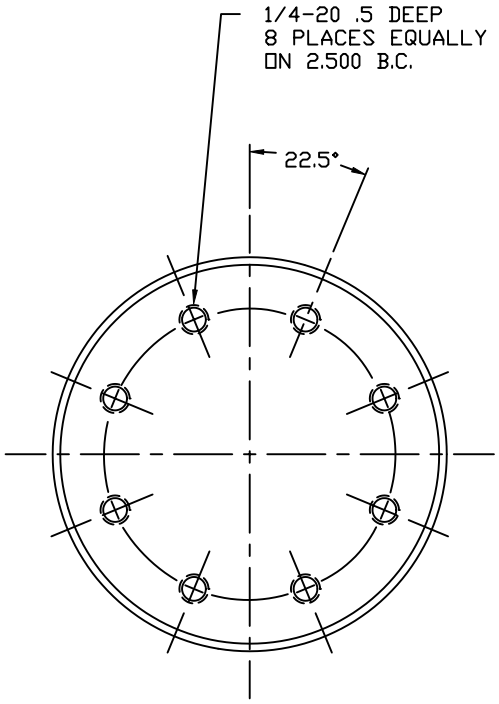
SCALE: FULL			DRAWN BY: C.R.M./S.E.F.
DATE: 80CT99			MODEL: 2154

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

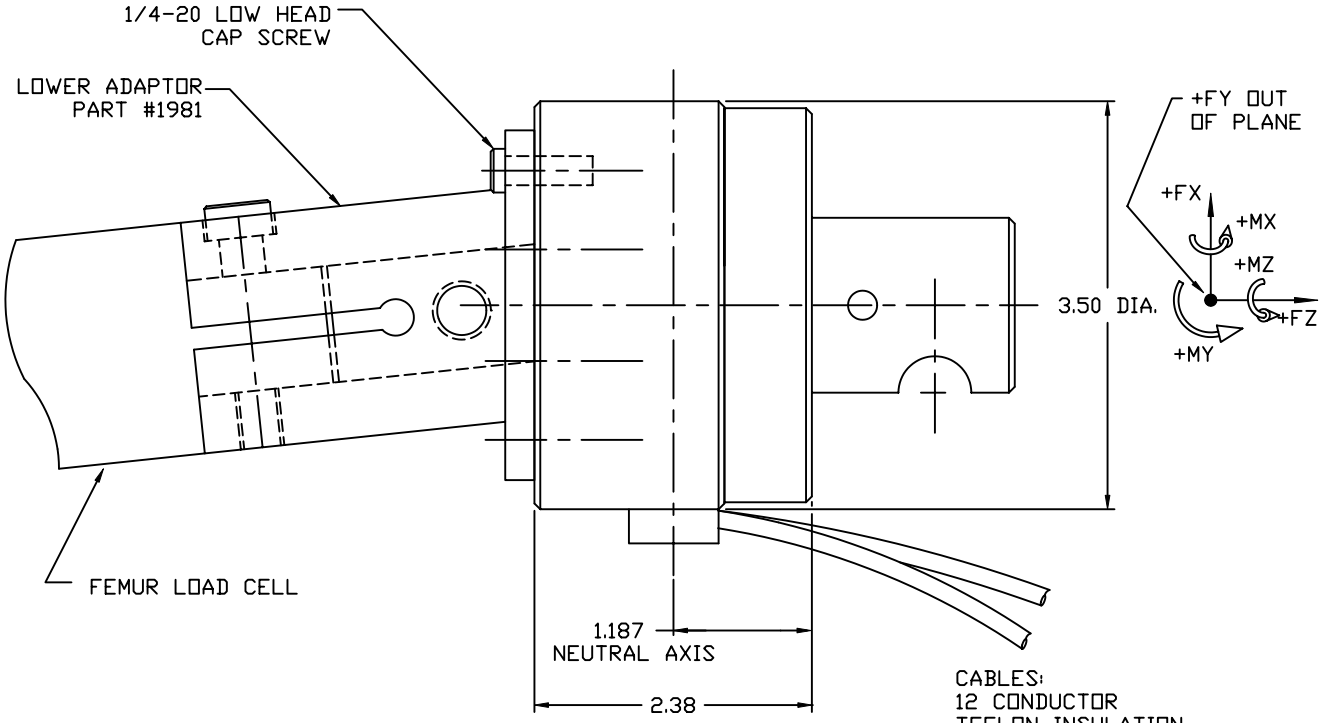
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2154-C



LOAD CELL BASE SHOWN
WITH LOWER ADAPTER REMOVED

NOTE: UPPER FEMUR LOAD CELL
AND LOWER ADAPTOR
REPLACE PART 78051-43/44
OF HYBRID III A.T.D.



6-CHANNEL UPPER FEMUR

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	1.8 mV/V NOM.
FY	2500 LBS.	1.8 mV/V NOM.
FZ	3000 LBS.	.8 mV/V NOM.
MX	7000 LB-IN	2.0 mV/V NOM.
MY	7000 LB-IN	2.0 mV/V NOM.
MZ	5000 LB-IN	2.3 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
B	WAS DRG. B-2211	4/99
A	REDRAWN IN CAD	6/93

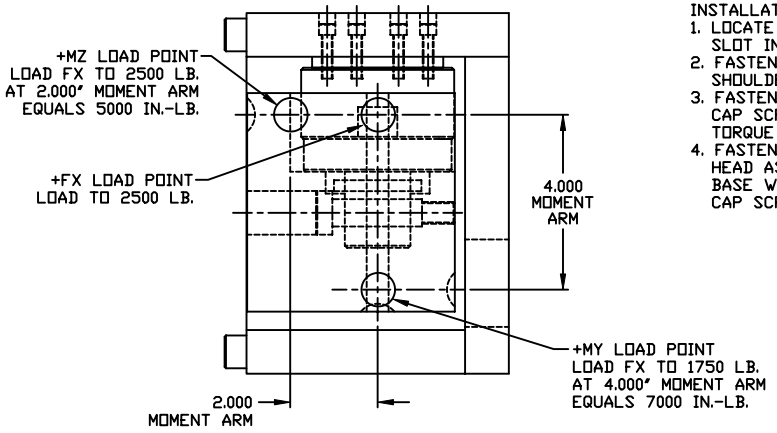
SIX CHANNEL UPPER FEMUR LOAD CELL

SCALE: FULL
DATE: 1/6/89
DRAWN BY: C.R. MORGAN
MODEL: 2193

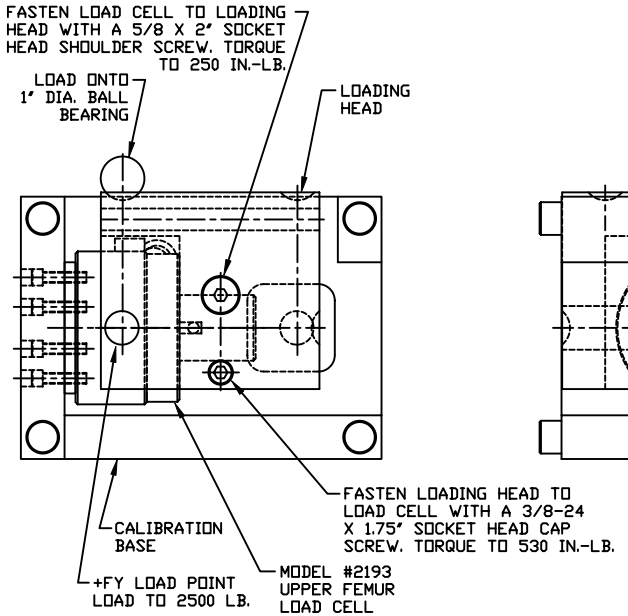
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

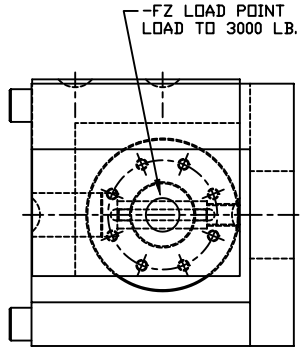
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

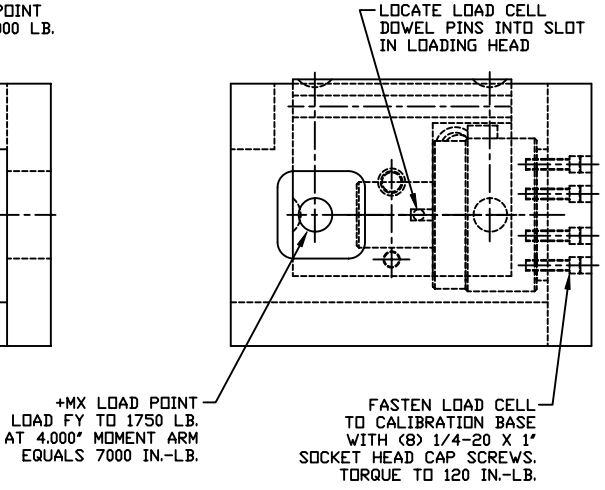
DRAWING NUMBER: B-2193-D



INSTALLATION INSTRUCTIONS:
1. LOCATE LOAD CELL DOWEL PINS INTO SLOT IN LOADING HEAD.
2. FASTEN THE 5/8 X 2" SOCKET HEAD SHOULDER SCREW. TORQUE TO 250 IN.-LB.
3. FASTEN THE 3/8-24 X 1.75" SOCKET HEAD CAP SCREW INTO THE LOADING HEAD. TORQUE TO 530 IN.-LB.
4. FASTEN THE LOAD CELL / LOADING HEAD ASSEMBLY TO THE CALIBRATION BASE WITH (8) 1/4-20 SOCKET HEAD CAP SCREWS. TORQUE TO 120 IN.-LB.







SYM	REVISION	DATE
C	WAS DRG. C-1976	4/99
B	REDRAWN IN CAD	5/97
A	REVISED DESIGN	10/94

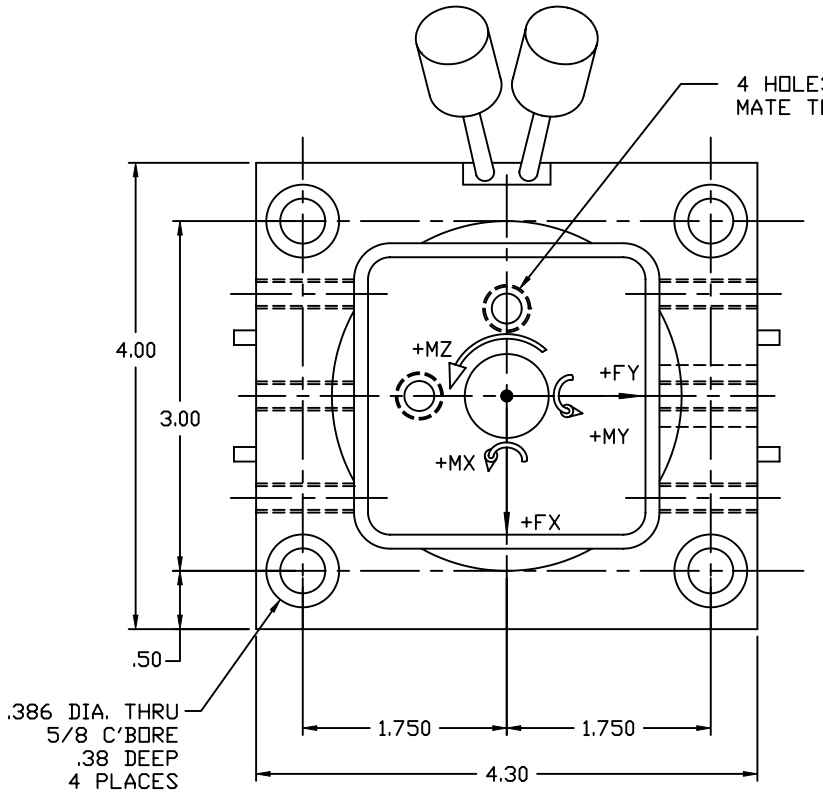
CALIBRATION FIXTURE FOR MODEL 2193 UPPER FEMUR

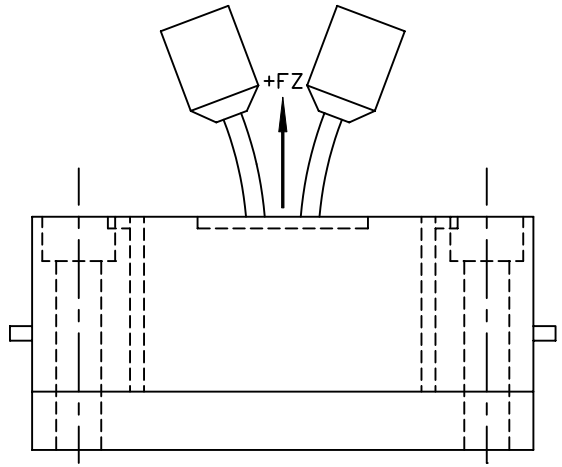
SCALE: 1/2
DATE: 1/14/87
DRAWN BY: C.R. MORGAN
MODEL: 1976

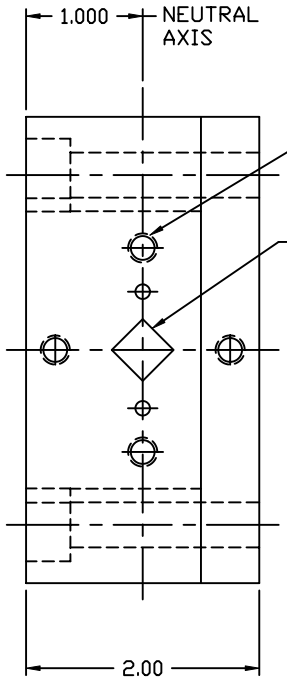
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125√
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-2193-C







5 CHANNEL BIOSID LUMBAR LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	3000 LBS.	1.9 mV/V NOM.
FY	3000 LBS.	1.9 mV/V NOM.
FZ	4000 LBS.	1.5 mV/V NOM.
MX	6000 LB-IN.	1.8 mV/V NOM.
MY	6000 LB-IN.	1.8 mV/V NOM.

NONLINEARITY <1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE

SYM	REVISION	DATE
B	WAS DRG. B-2254	4/99
A	ADD. NEUTRAL AXIS	4/97

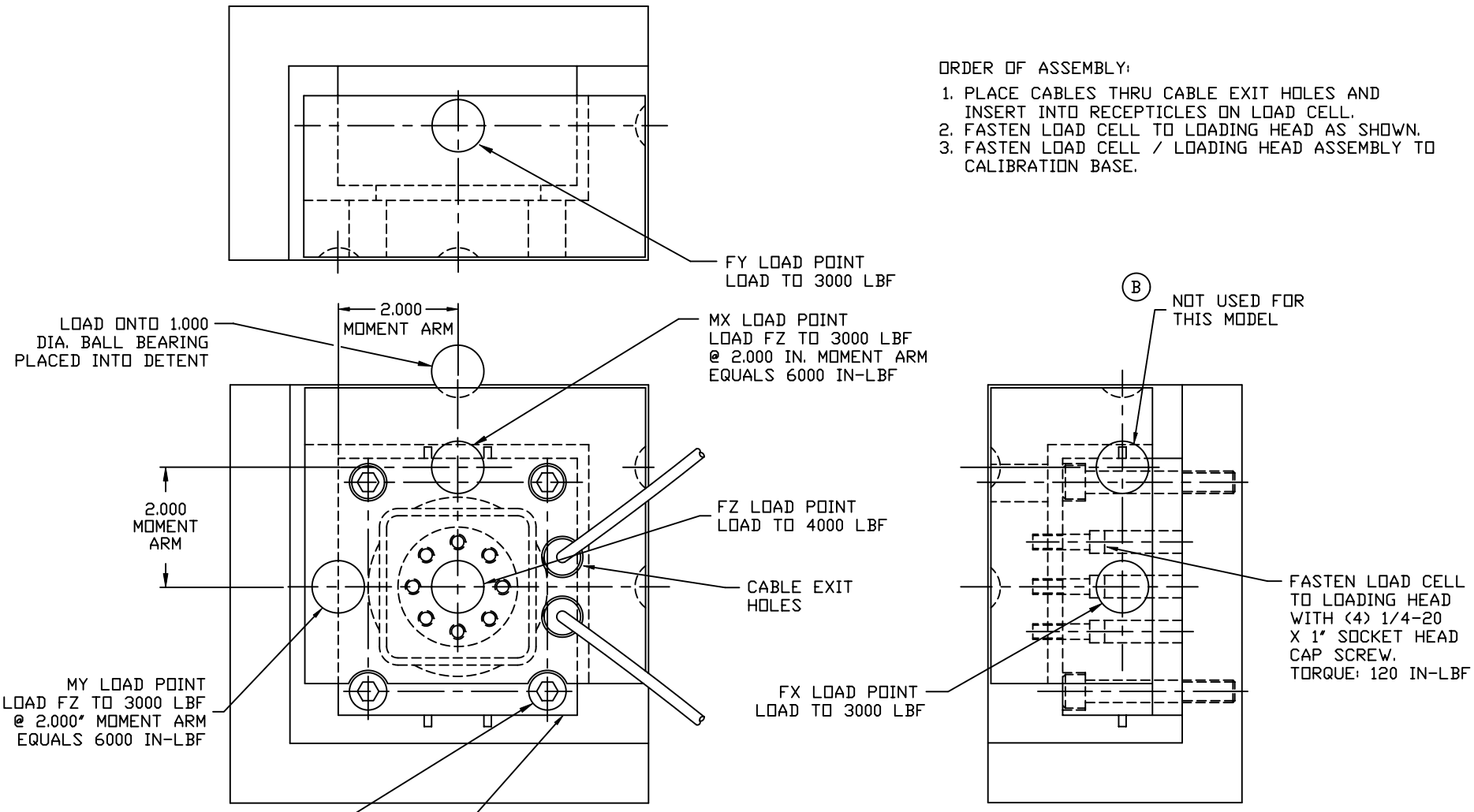
5 CHANNEL BIOSID LUMBAR LOAD CELL

SCALE: FULL
DATE: 7/9/93
DRAWN BY: S.E. FOSTER
MODEL: 2254

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2254-D



ORDER OF ASSEMBLY:

1. PLACE CABLES THRU CABLE EXIT HOLES AND INSERT INTO RECEPTICLES ON LOAD CELL.
2. FASTEN LOAD CELL TO LOADING HEAD AS SHOWN.
3. FASTEN LOAD CELL / LOADING HEAD ASSEMBLY TO CALIBRATION BASE.

SYM	REVISION	DATE
C	WAS DRG. B-2295	4/99
B	ADD NOTE	1/99
A	REDRAWN IN CAD	3/96

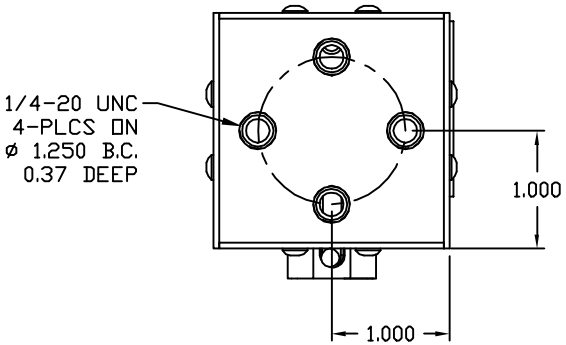
BIOSID LUMBAR LOAD CELL CALIBRATION FIXTURE

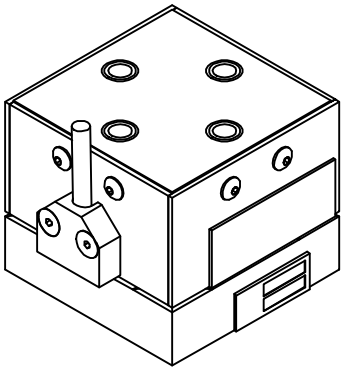
SCALE: .65X
DATE: 10/3/89
DRAWN BY: C.R. MORGAN
MODEL: 2295

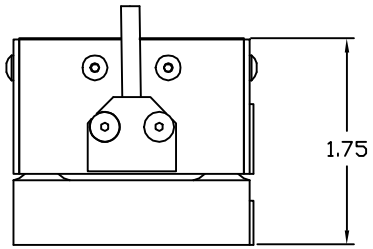
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

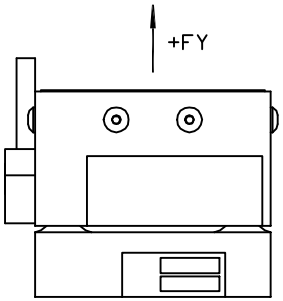
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

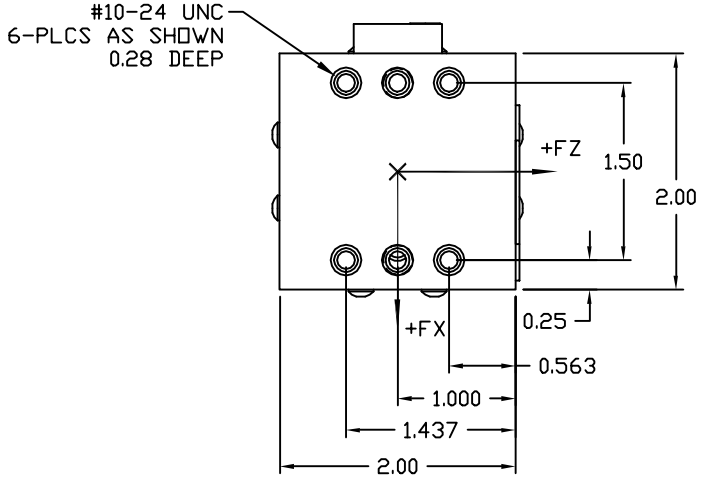
DRAWING NUMBER: B-2254-C











BIOSID 3-CHANNEL SHOULDER LOAD CELL

MODEL 2255

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	500 LBS	1.6 mV/V NOM.
FY	1000 LBS	1.1 mV/V NOM.
FZ	500 LBS	1.6 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
B	ADD STRAIN RELIEF	4/99

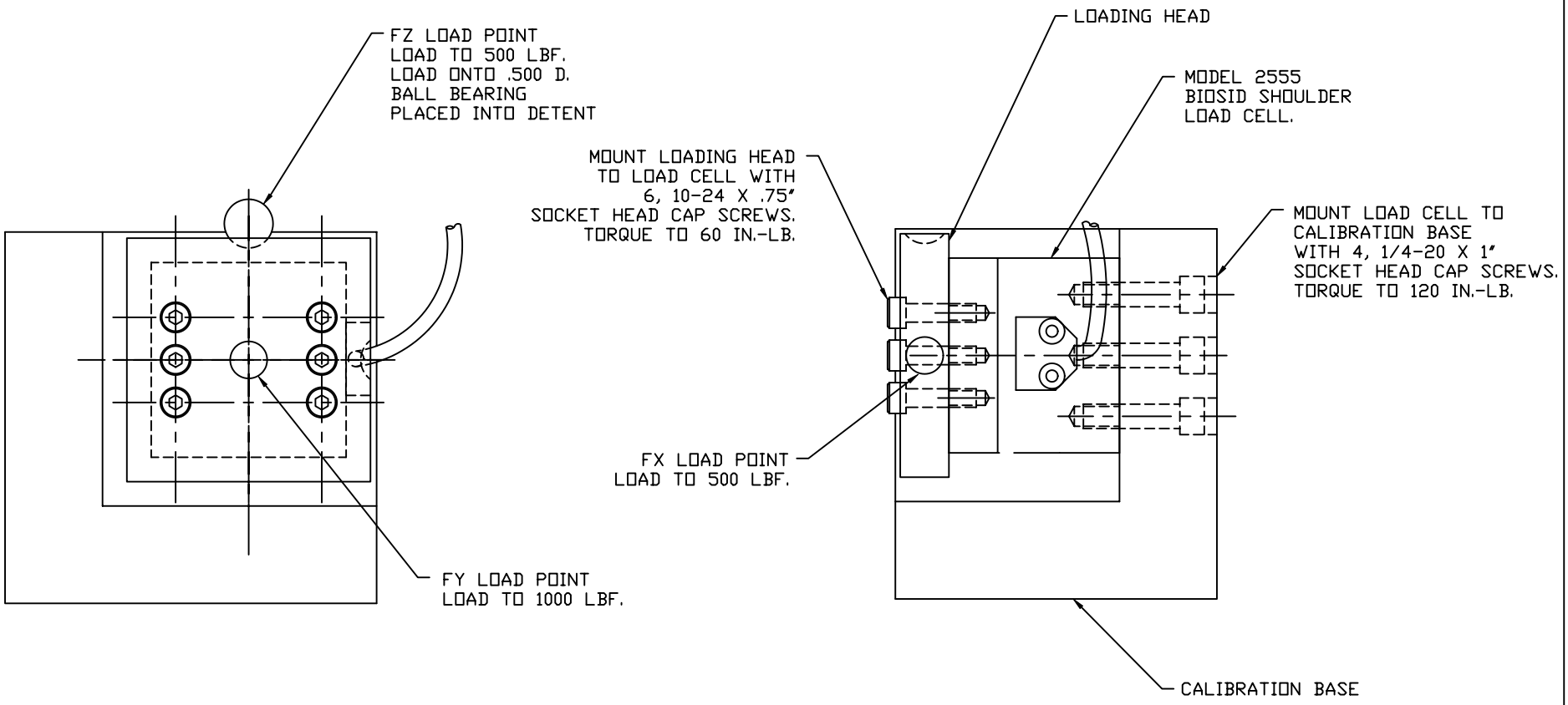
BIOSID SHOULDER LOAD CELL

SCALE: FULL
DATE: 22APR99
DRAWN BY: R. DUPONT
MODEL: 2255

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2255-D



SYM	REVISION	DATE
C	ADD STRAIN RELIEF	4/99
B	WAS DRG. B-2294	4/99
A	REDRAWN IN CAD	10/95

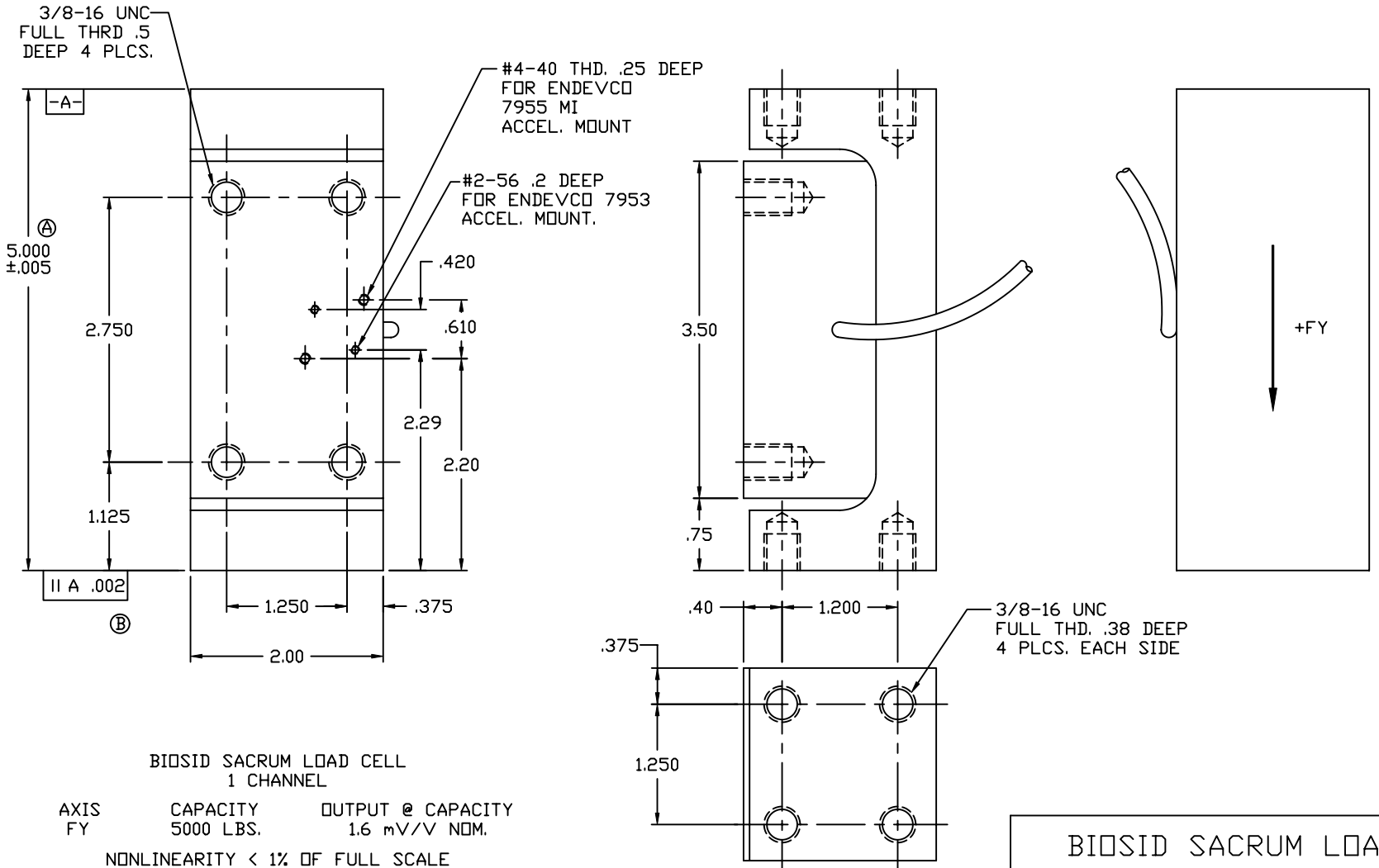
BIOSID SHOULDER CALIBRATION FIXTURE

SCALE: FULL
DATE: 20CT89
DRAWN BY: C.R. MORGAN
MODEL: 2294

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2255-C



BIOSID SACRUM LOAD CELL
1 CHANNEL

AXIS	CAPACITY	OUTPUT @ CAPACITY
FY	5000 LBS.	1.6 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT ~3.5 LBS.

SYM	REVISION	DATE
E	WAS DRG. B-2256	4/2/99
D	REDRAWN IN CAD	7/14/93
C	ADD 7953 MOUNT	2/17/90
B	ADD 11	2/15/90
A	ADD TOL	2/15/90

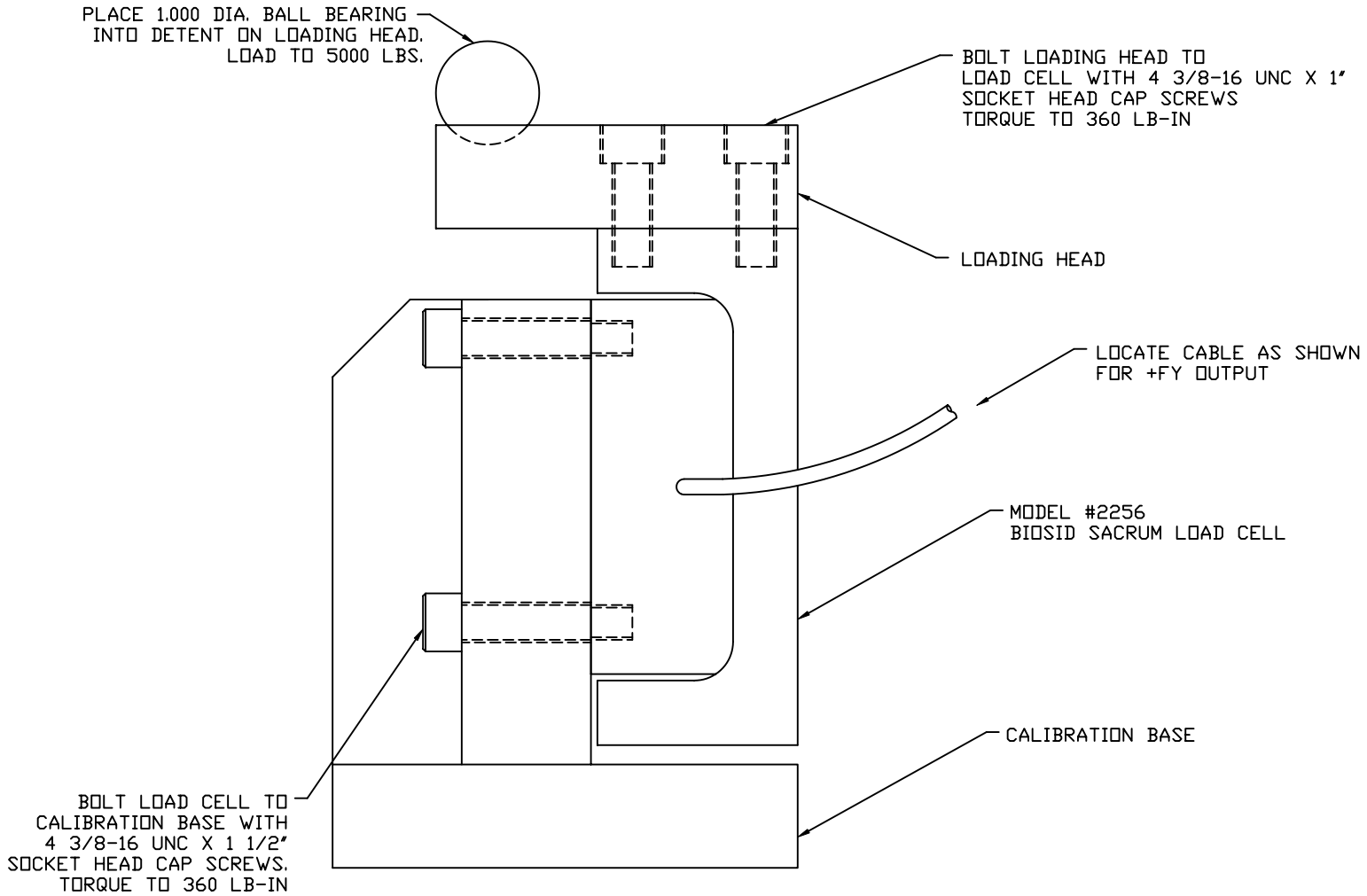
BIOSID SACRUM LOAD CELL

SCALE:	FULL		DRAWN BY: C.R.M./S.E.F.
DATE:	8/3/89		MODEL: 2256

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2256-D



SYM	REVISION	DATE
B	WAS DRG. B-2292	4/99
A	REDRAWN IN CAD	12/93

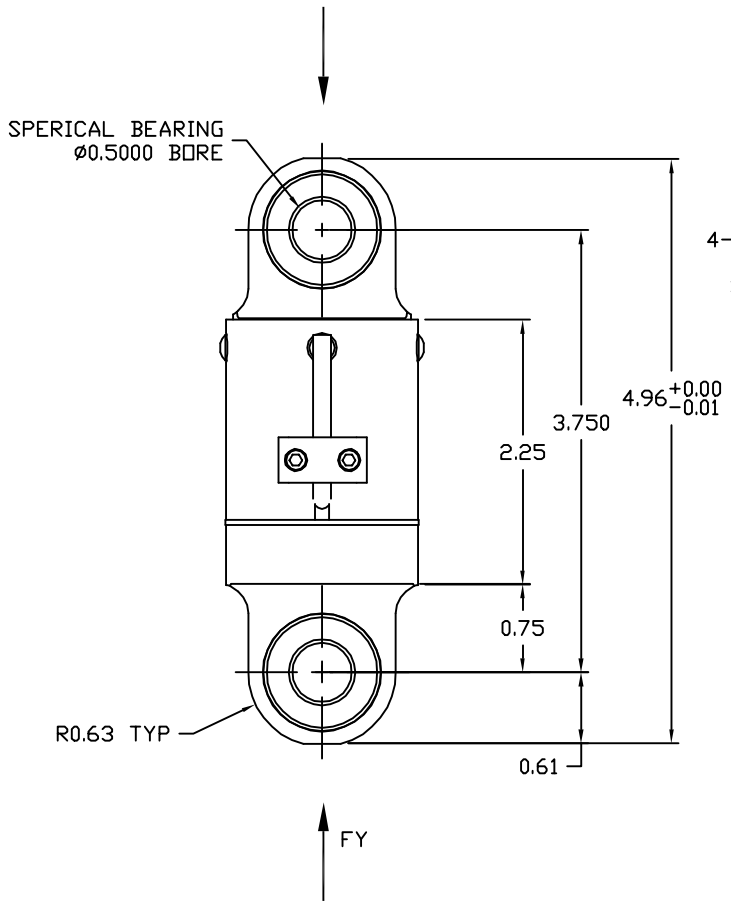
BIOSID SACRUM CALIBRATION FIXTURE

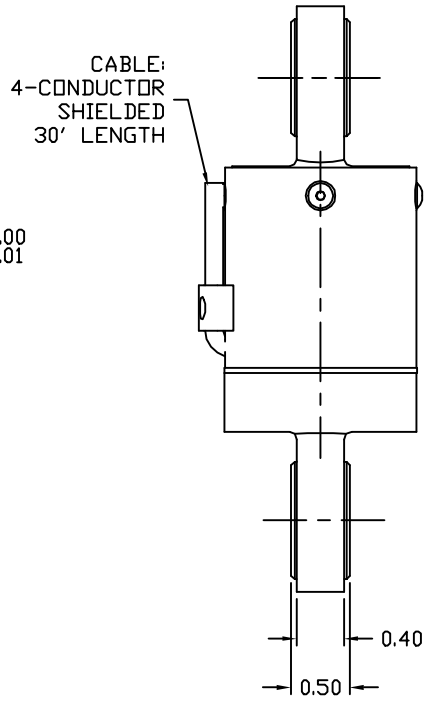
SCALE: FULL
DATE: 10/2/89
DRAWN BY: C.R.M./S.E.F.
MODEL: 2292

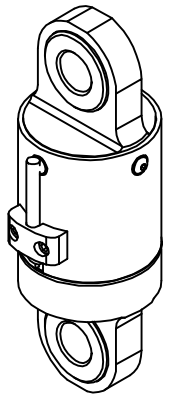
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2256-C







PUBIC FORCE LOAD CELL
BIOSID PUBIC SYMPHYSIS

AXIS	CAPACITY	OUTPUT @ CAPACITY
FY	3000 LBS.	1.3 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
WEIGHT ~.5 LBS.

NEXT ASS'Y	QTY
PART USED ON	

SYM	REVISION	DATE
A	REDRAWN IN CAD	6/30/93

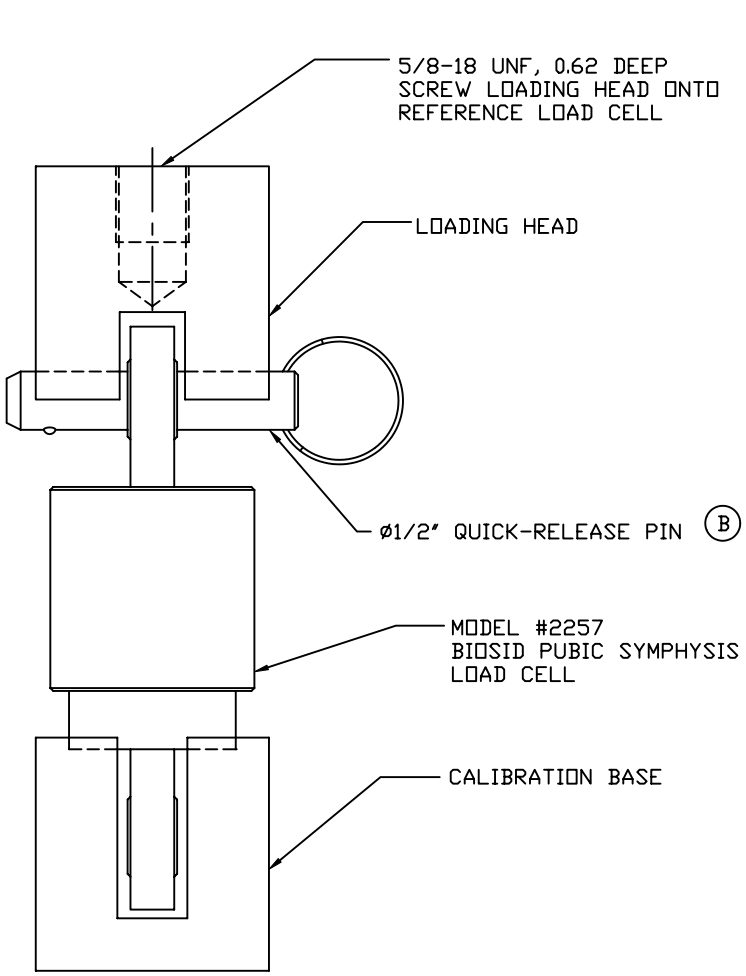
BIOSID PUBIC LOAD CELL

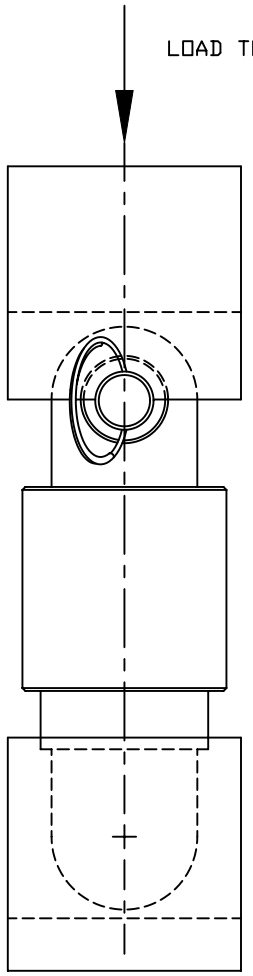
SCALE:	FULL		DRAWN BY: C.R. MORGAN
DATE:	29SEP99		MODEL: 2257

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2257-D





SYM	REVISION	DATE
C	WAS DRG. B-2291	4/99
B	CHG PIN	1/99
A	REDRAWN IN CAD	12/93

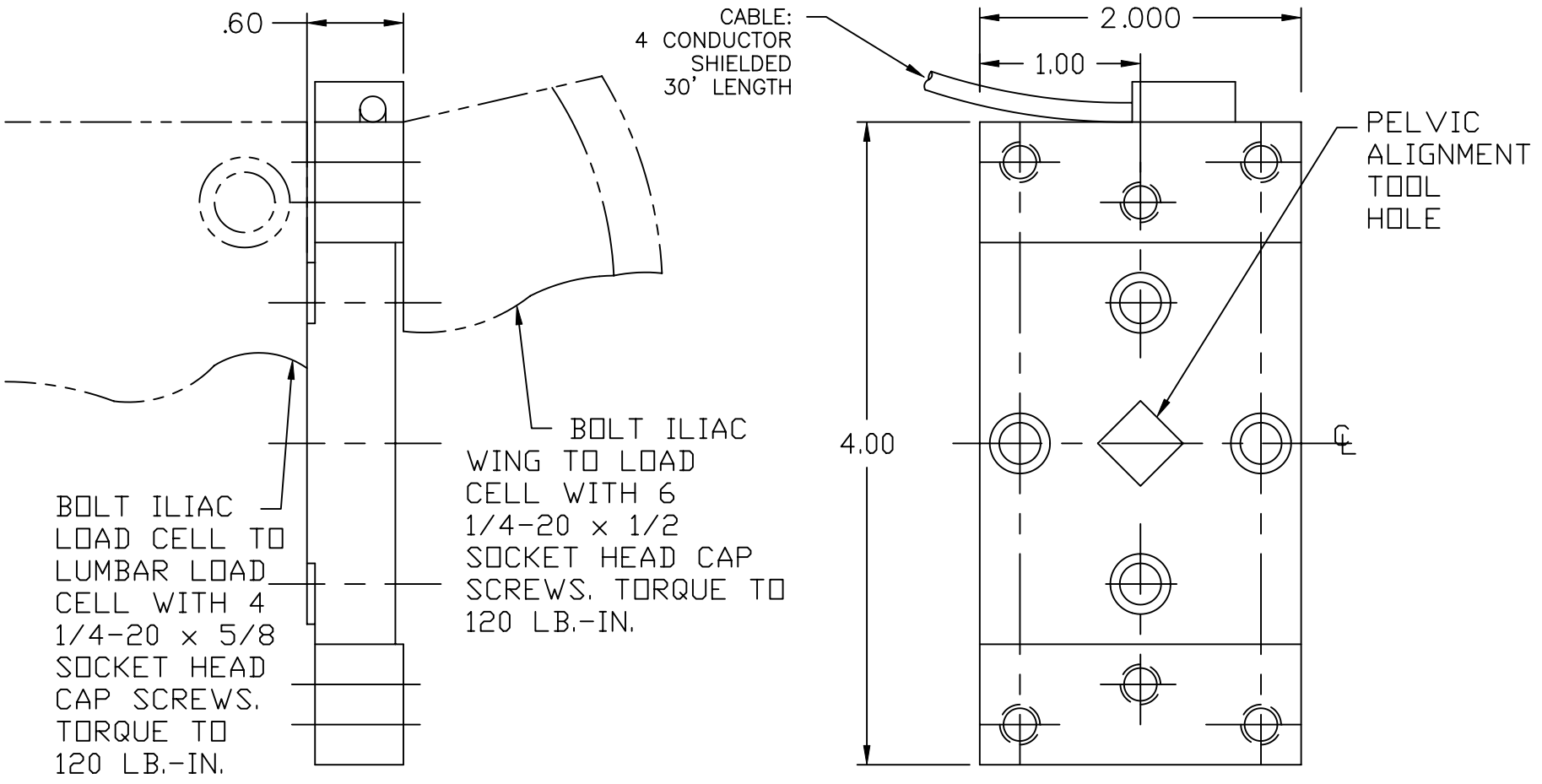
BIOSID PUBIC SYMPHYSIS CAL. FIXTURE

SCALE: FULL
DATE: 10/2/89
DRAWN BY: C.R.M./S.E.F.
MODEL: 2291

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2257-C



ILIAC LOAD CELL
CAPACITY: 4000 LBS.
OUTPUT @ CAPACITY
1.4 mV/V NOMINAL
BRIDGE RESISTANCE: 350 Ω
NONLINEARITY <1% OF FULL SCALE

BIOSID ILIAC LOAD CELL

SCALE: FULL		DRAWN BY: S.E. FOSTER
DATE: 8/17/89		MODEL: 2258

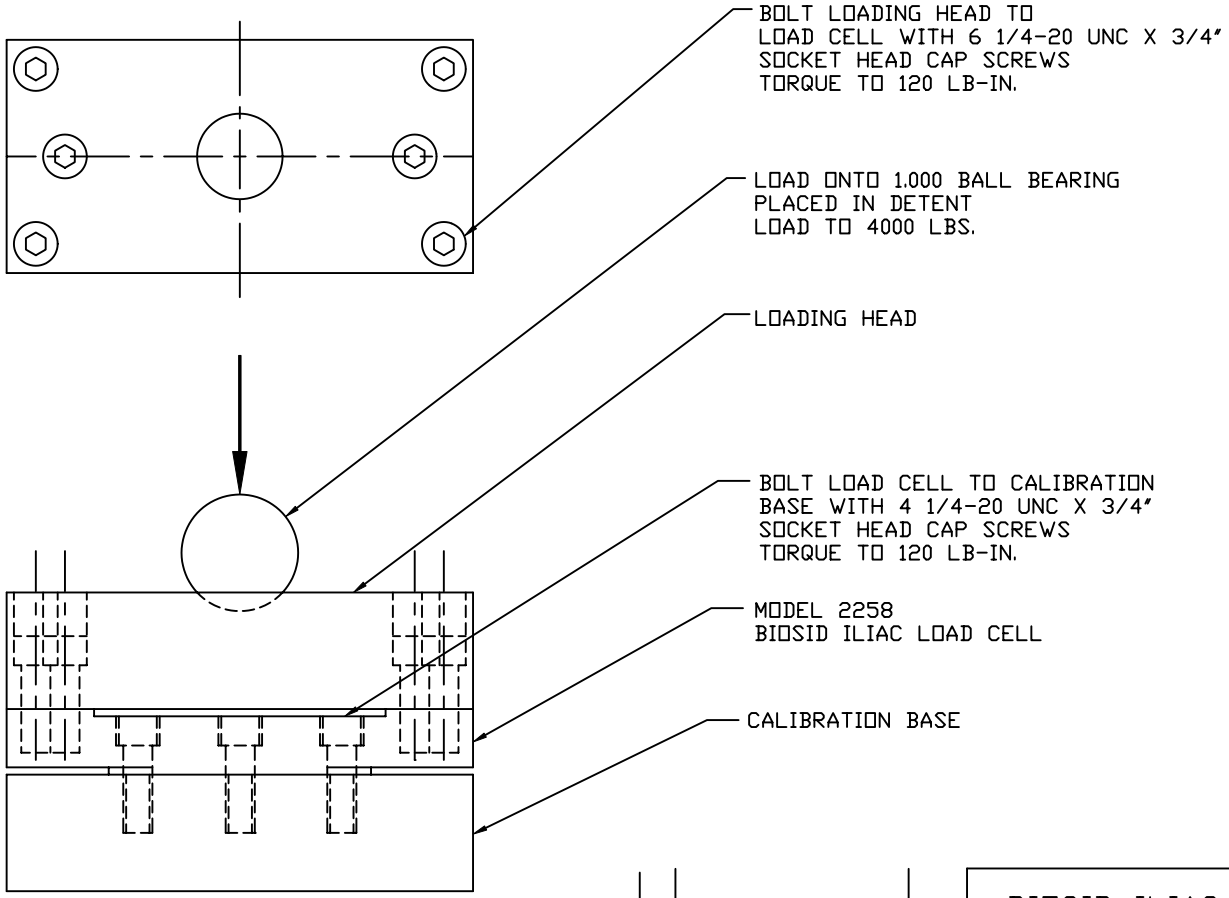
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

SYM	REVISION	DATE
B	WAS DRG. A-2258	4/99
A	REDRAWN IN CAD	7/93

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-2258-D



SYM	REVISION	DATE
B	WAS DRG. B-2293	4/99
A	REDRAWN IN CAD	12/93

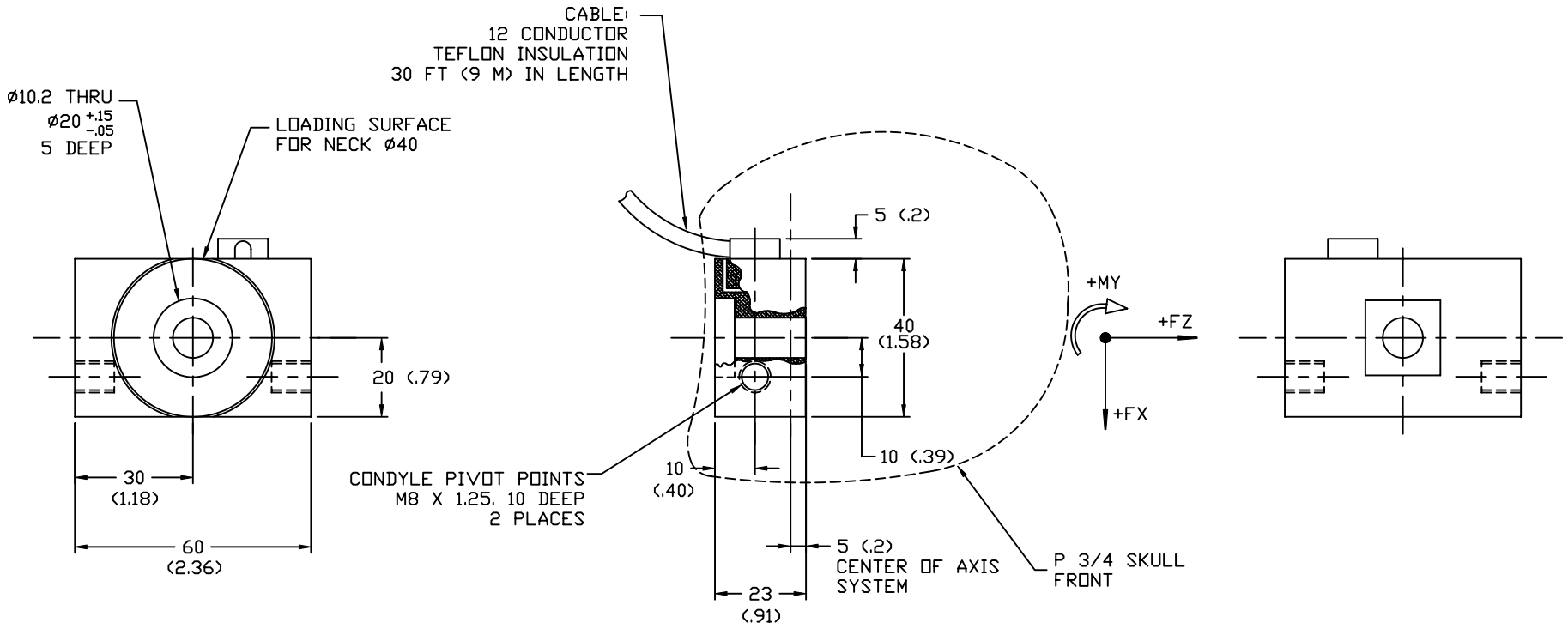
BIOSID ILIAC CALIBRATION FIXTURE

SCALE: FULL
DATE: 10/2/89
DRAWN BY: C.R.M./S.E.F.
MODEL: 2293

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2258-C



AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	3.5 KN (750 LBS)	2.4 mV/V NOMINAL
FZ	3.5 KN (750 LBS)	1.3 mV/V NOMINAL
MY	68 N-M (600 LB-IN)	2.7 mV/V NOMINAL

NONLINEARITY <1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE
DIMENSIONS mm (INCHES)

SYM	REVISION	DATE
G	CORRECT MY POL.	8/99
F	WAS DRG. B-2331	4/99
E	CHG CABLE LGTH	7/98
D	REDRAWN IN CAD	7/93
C	REVISE OUTPUTS	6/90
B	REDUCE MY CAP.	6/90
A	REVISE CAPACITY	3/90

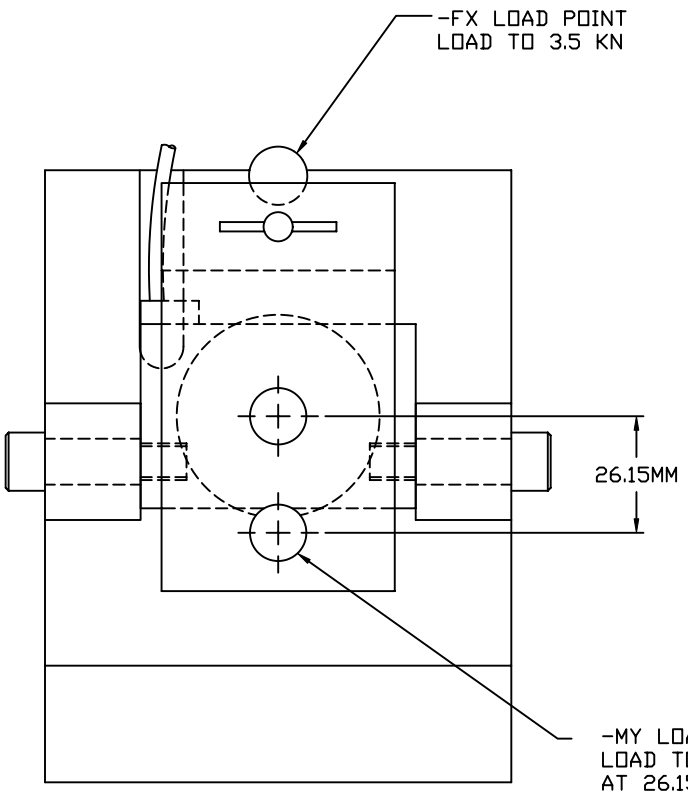
P3/4 NECK LOAD CELL

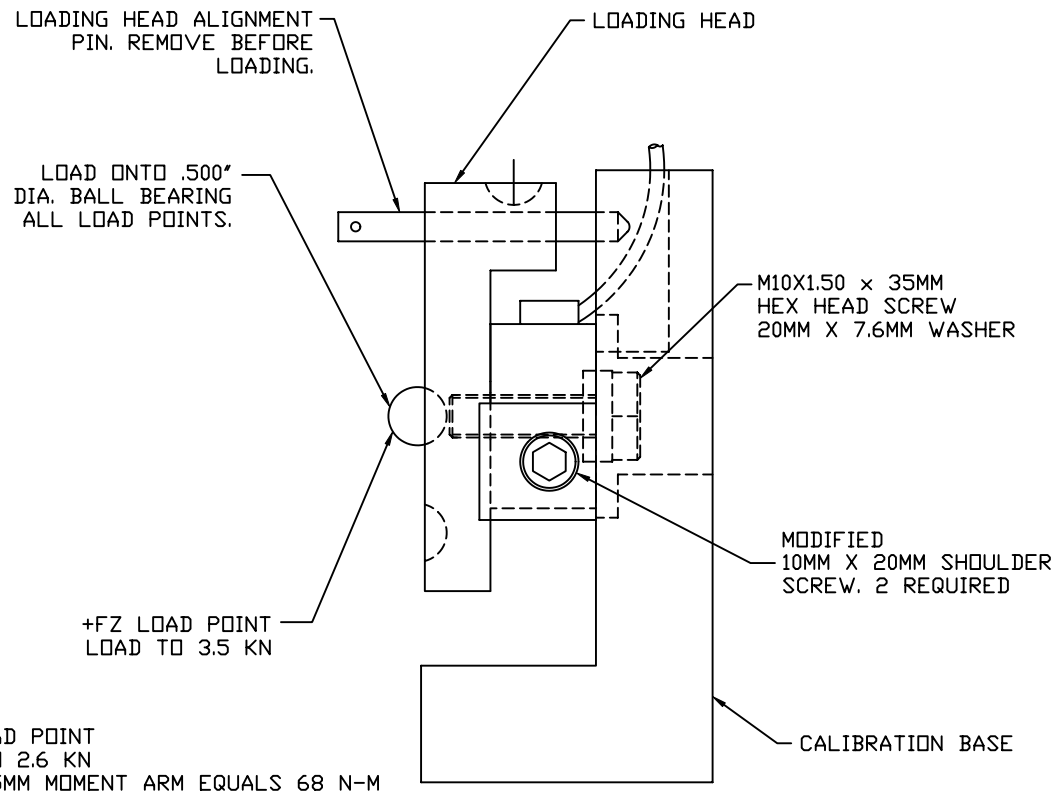
SCALE: FULL
DATE: 1/15/90
DRAWN BY: C.R.M./S.E.P.
MODEL: 2331

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2331-D





INSTALLATION INSTRUCTIONS:

1. MOUNT MODEL 2331 LOAD CELL TO CALIBRATION BASE WITH 2, 10MM X 20MM SHOULDER SCREWS. TORQUE TO 14 N-M
2. MOUNT LOADING HEAD TO LOAD CELL WITH 10MM X 35MM HEX HEAD SCREW AND 20MM WASHER. INSTALL ALIGNMENT PIN THRU LOADING HEAD INTO CALIBRATION BASE. TORQUE 10MM HEX HEAD SCREW TO 28 N-M.
3. REMOVE ALIGNMENT PIN.

SYM	REVISION	DATE
B	CHG POLARITIES	9/99
A	WAS DRG. B-2900	4/99

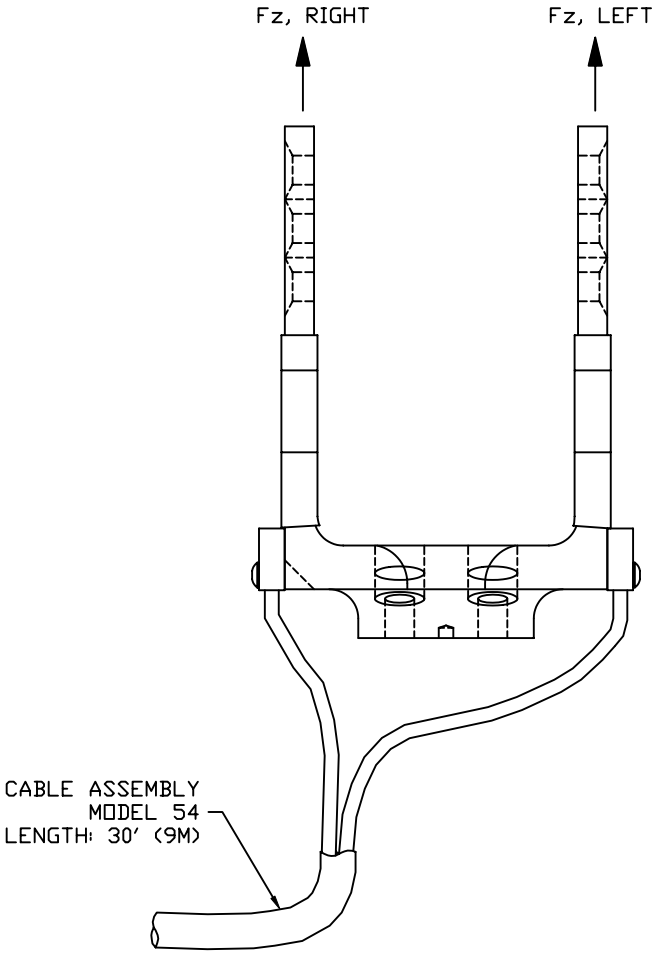
P3/4 NECK LOAD CELL CALIBRATION FIXTURE

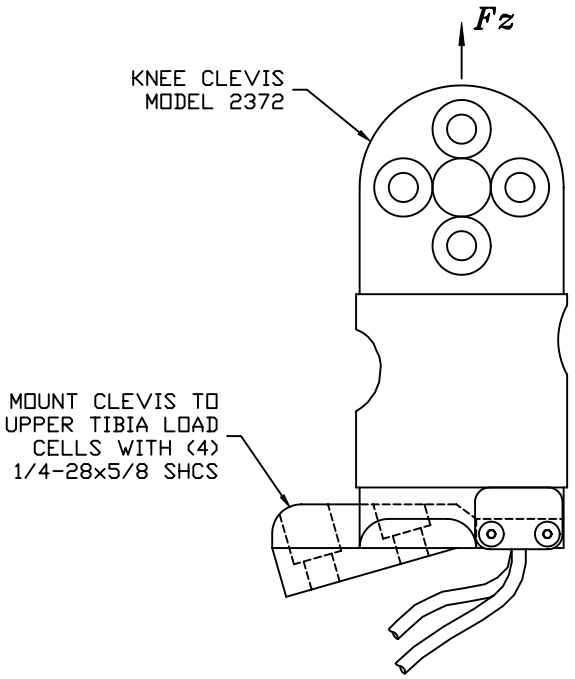
SCALE: FULL
DATE: 8/12/93
DRAWN BY: C.R.M./S.E.F.
MODEL: 2900

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2331-C





AXIS	CAPACITY	OUTPUT
Fz, LEFT	2000 LBS.	2.0 mV/V NOMINAL
Fz, RIGHT	2000 LBS.	2.0 mV/V NOMINAL

NON-LINEARITY: < 1% OF FULL SCALE
BRIDGE RESISTANCE: 350 OHMS NOMINAL

2372	1
NEXT ASS'Y	QTY
PART USED ON	

SYM	REVISION	DATE
A	WAS DRG. B-4207	5/99

2 - CHANNEL KNEE CLEVIS

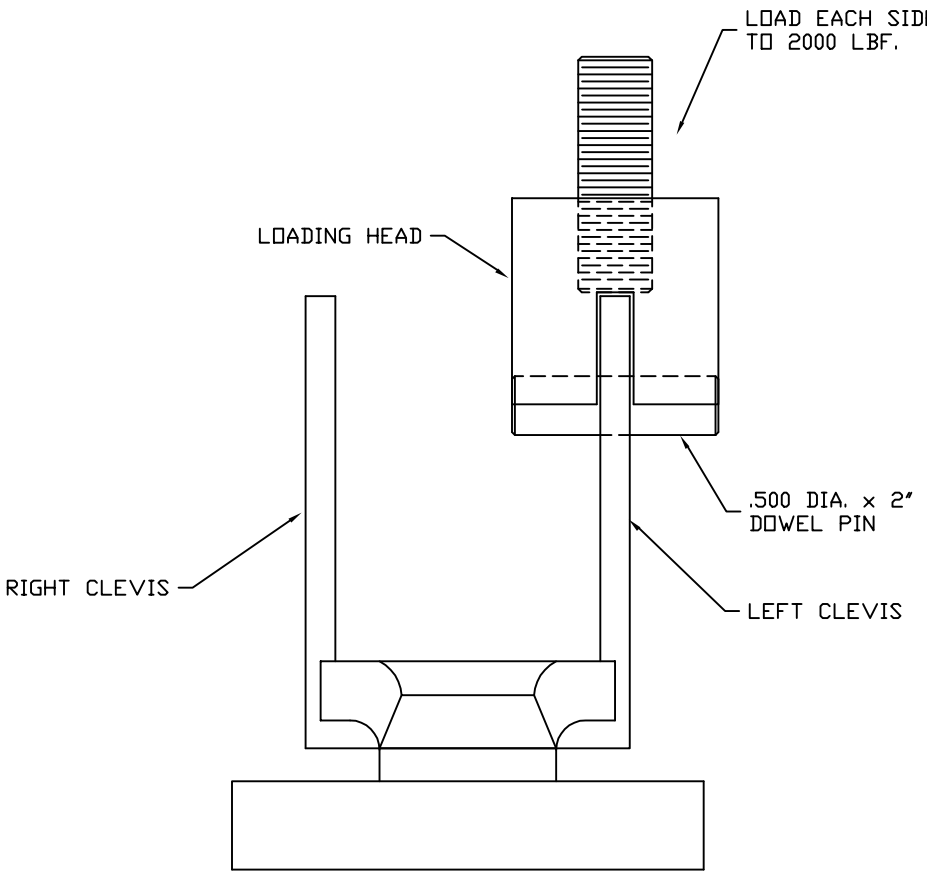
HYBRID III 95TH PERCENTILE

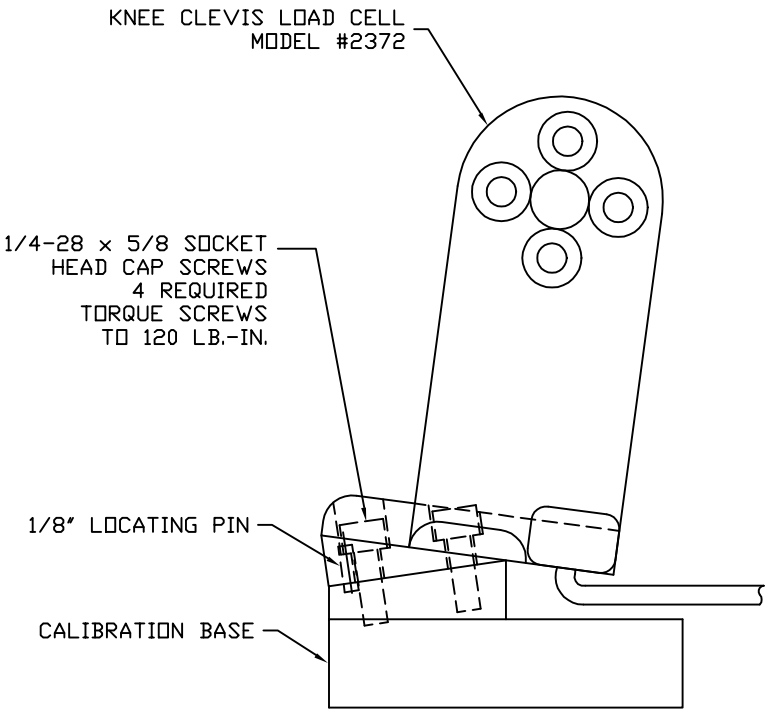
SCALE: NONE
DATE: 06AUG98
DRAWN BY: R. DuPont
MODEL: 2372

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2372-D





CALIBRATION FIXTURE MODEL #1861

SYM	REVISION	DATE

KNEE CALIBRATION FIXTURE

KNEE CLEVIS LOAD CELL MODEL 2372

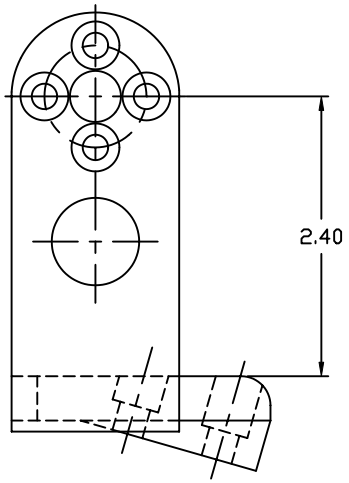
SCALE: FULL			DRAWN BY: C.R.M./S.E.F.
DATE: 80CT99			MODEL: 2372

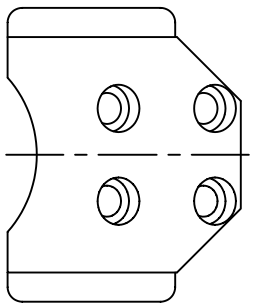
UNLESS OTHERWISE SPECIFIED

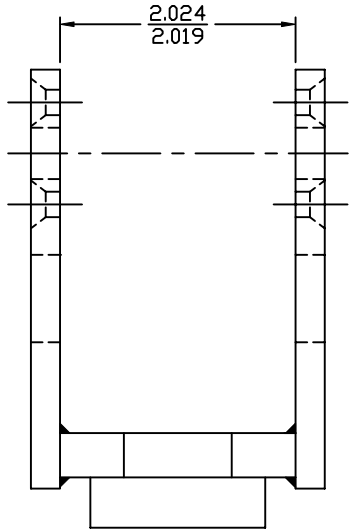
TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2372-C







THE MODEL 2421 NON-INSTRUMENTED KNEE CLEVIS REPLACES THE MODEL 2154 INSTRUMENTED KNEE CLEVIS ON THE 5TH PERCENTILE SMALL FEMALE INSTRUMENTED LOWER LEGS.

SYM	REVISION	DATE
C	WAS DRG. B-2421	7/99
B	ADD NOTE	12/98
A	REDRAWN IN CAD	2/96

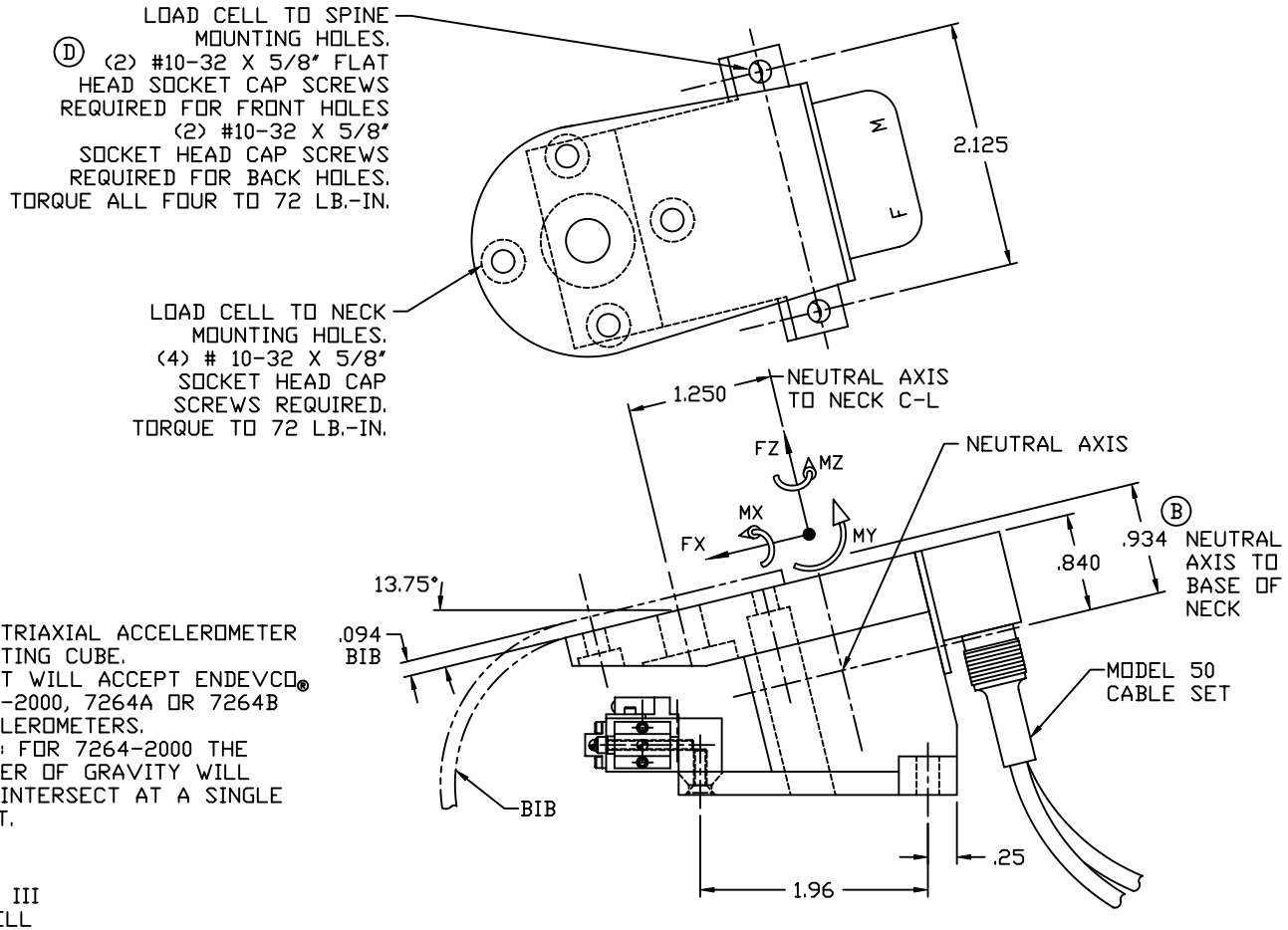
KNEE CLEVIS ASSEMBLY - 5TH

SCALE: FULL
DATE: 8/27/90
DRAWN BY: C.R. MORGAN
MODEL: 2421

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2421-D



SIX YEAR OLD HYBRID III
LOWER NECK LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	1000 LBS.	1.8 mV/V NOM.	350 OHMS
FY	1000 LBS.	1.8 mV/V NOM.	350 OHMS
FZ	1600 LBS.	1.2 mV/V NOM.	700 OHMS
MX	2000 LB.-IN.	2.0 mV/V NOM.	700 OHMS
MY	2000 LB.-IN.	2.0 mV/V NOM.	700 OHMS
MZ	1250 LB.-IN.	2.0 mV/V NOM.	350 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
E	WAS DRG. B-2430	4/99
D	REV. FRONT SCRS.	3/97
C	ADD ACCEL. CUBE	11/96
B	BIB DIM. REV.	10/95
A	ADD BIB	10/93

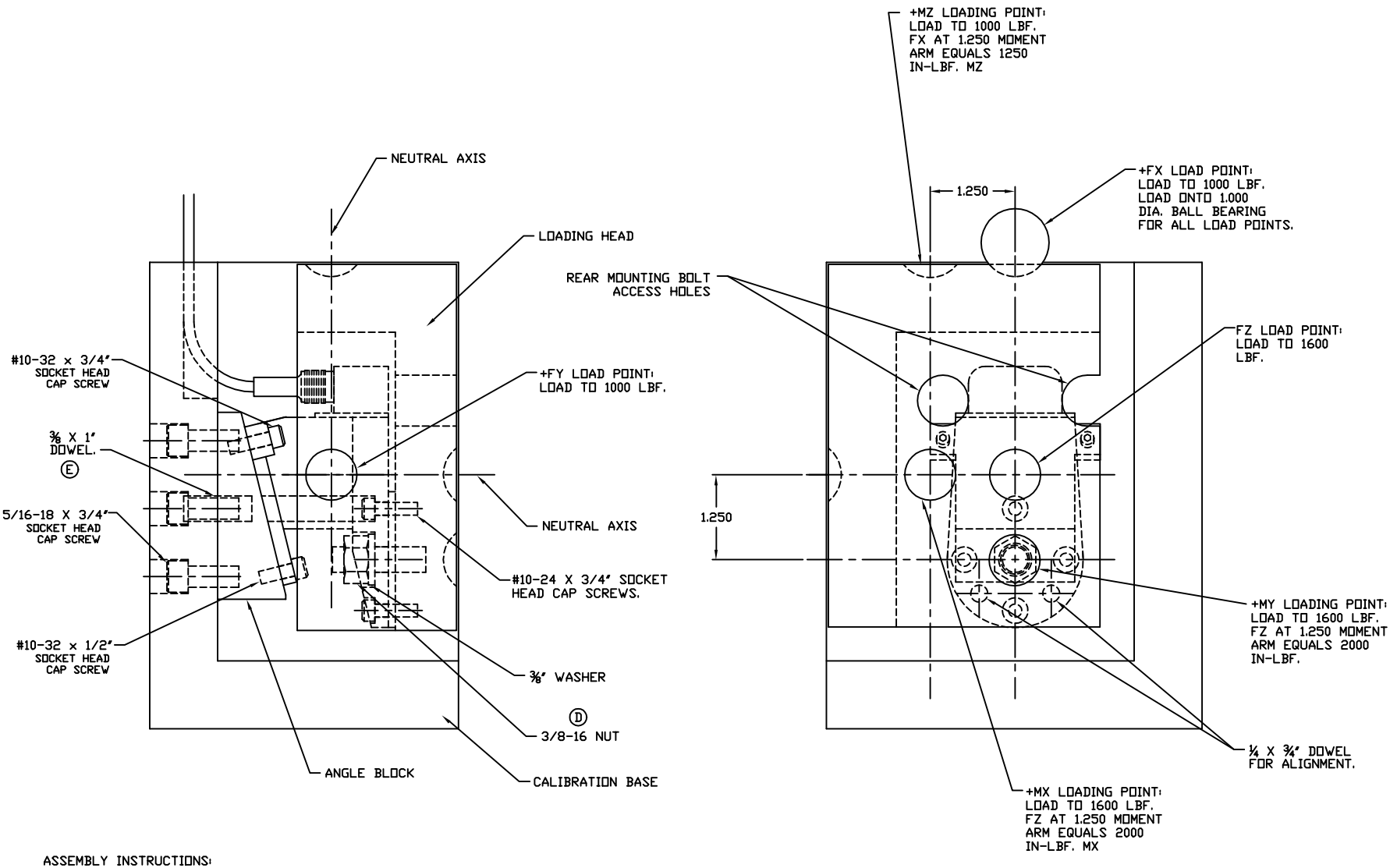
LOWER NECK LOAD CELL
SIX YEAR OLD HYBRID III

SCALE: FULL
DATE: 11/27/92
DRAWN BY: C.R. MORGAN
MODEL: 2430

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2430-D



ASSEMBLY INSTRUCTIONS:

1. MOUNT LOAD CELL TO LOADING HEAD WITH FOUR #10-24 X 3/4" SOCKET HEAD CAP SCREWS AND ONE 3/8-16 NUT TO STUD ON LOADING HEAD. TORQUE #10-24 TO 72 IN.-LBF., AND TORQUE 3/8-16 TO 360 IN.-LBF.
2. MOUNT LOAD CELL/LOADING HEAD ASSEMBLY TO ANGLE BLOCK WITH 4, #10-32 SOCKET HEAD CAP SCREWS. TORQUE TO 72 IN-LBF.
3. INSTALL CONNECTORS INTO LOAD CELL.
4. MOUNT ASSEMBLY TO CALIBRATION BASE WITH 4, 5/16-18 X 3/4 SOCKET HEAD CAP SCREWS. TORQUE TO 360 IN-LBF.

CALIBRATION FIXTURE MODEL #2590

SYM	REVISION	DATE
E	ADD DOWEL	2/00
D	ADD NUT	2/00
C	ADD SCREW NOTES	8/99
B	WAS DRG. C-2590	4/99
A	REV. MOUNTING	9/97

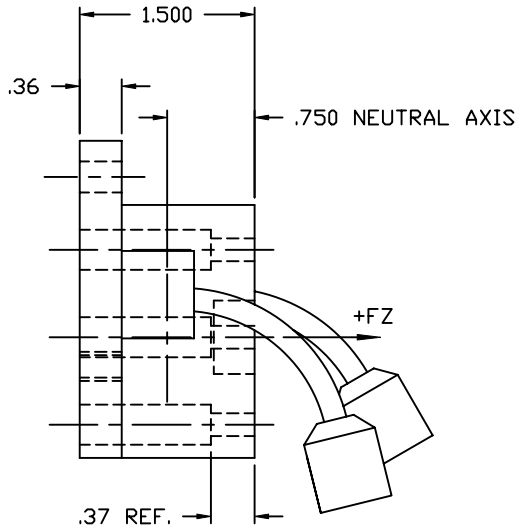
CALIBRATION FIXTURE
6 YEAR OLD HYBRID III LOWER NECK

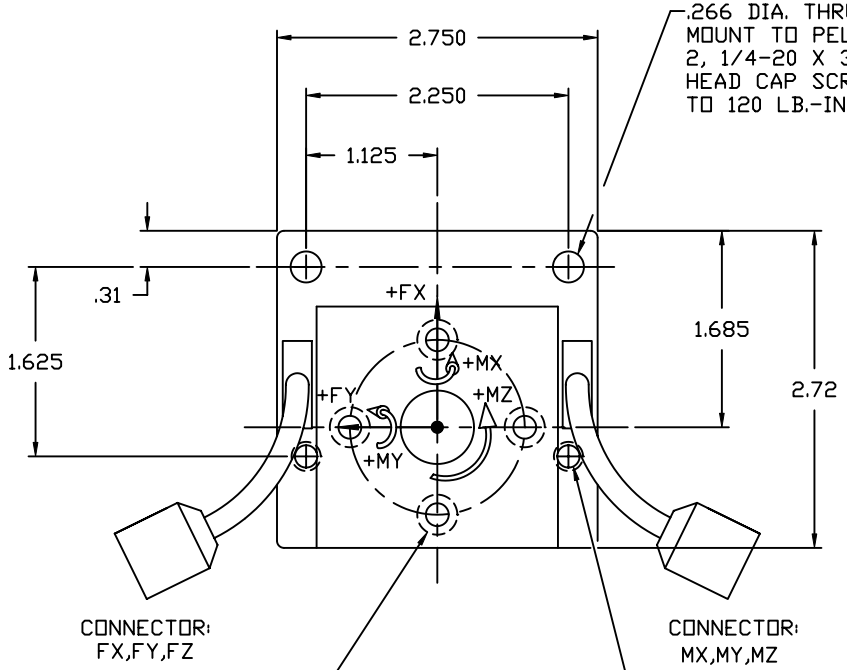
SCALE: FULL
DATE: 11/28/92
DRAWN BY: C.R. MORGAN
MODEL: 2430

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-2430-C





6 YEAR OLD HYBRID III LUMBAR LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	1000 LBS.	2.0 mV/V NOMINAL	350 Ω
FY	1000 LBS.	2.0 mV/V NOMINAL	350 Ω
FZ	1600 LBS.	1.0 mV/V NOMINAL	700 Ω
MX	2000 LB.-IN.	1.5 mV/V NOMINAL	700 Ω
MY	2000 LB.-IN.	1.5 mV/V NOMINAL	700 Ω
MZ	1250 LB.-IN.	2.2 mV/V NOMINAL	350 Ω

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
B	WAS DRG. B-2431	4/99
A	CENTER HOLE DEPTH	8/95

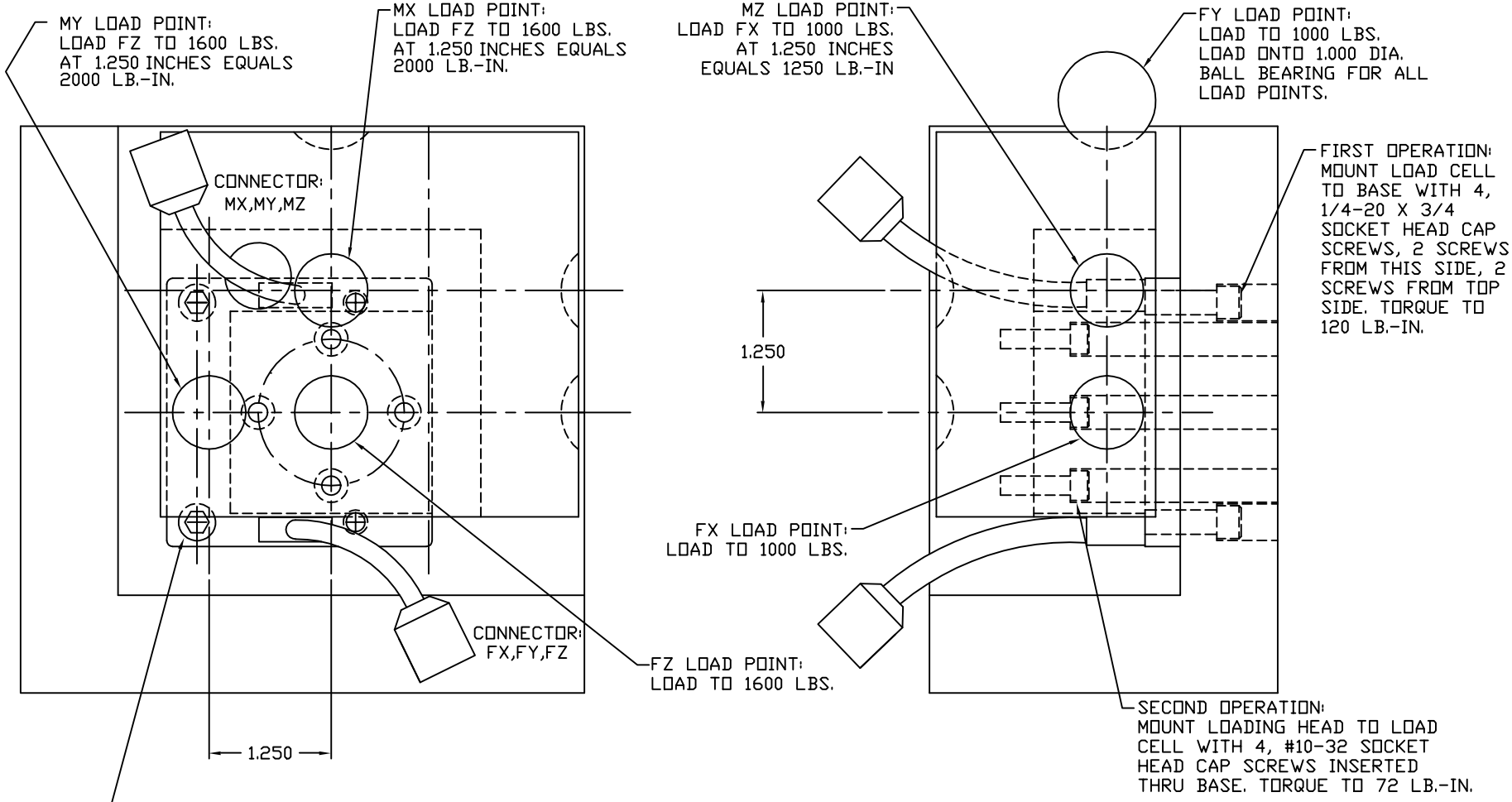
6 YEAR OLD HYBRID III LUMBAR LOAD CELL

SCALE: FULL
DATE: 9/19/92
DRAWN BY: C.R. MORGAN
MODEL: 2431

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2431-D



CALIBRATION FIXTURE MODEL #2591

SYM	REVISION	DATE

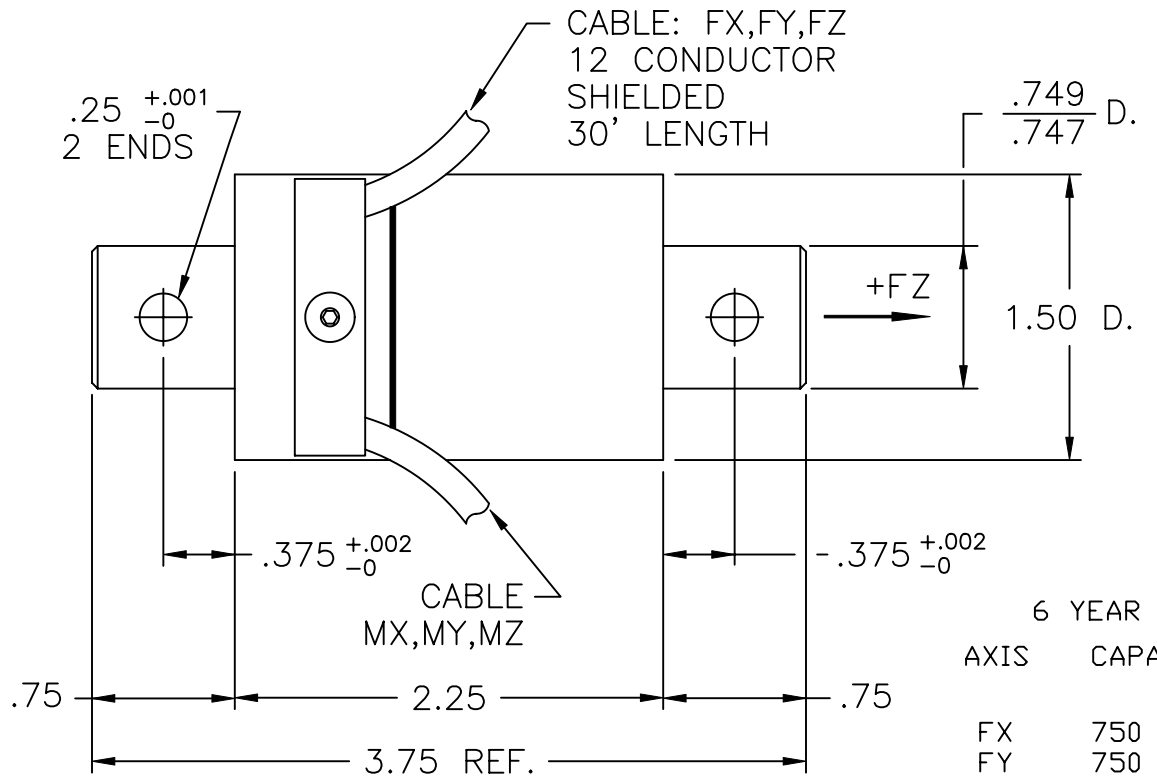
CALIBRATION FIXTURE
6 YEAR OLD HYBRID III LUMBAR LOAD CELL

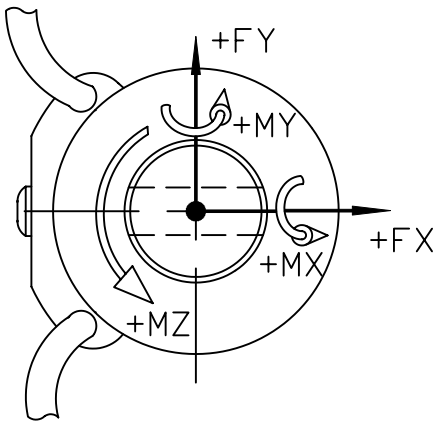
SCALE: FULL		DRAWN BY: C.R. MORGAN
DATE: 11/21/92		MODEL: 2431

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2431-C





6 YEAR OLD HYBRID III FEMUR LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	750 LBS.	2.30 mV/V NOM.	350 Ω
FY	750 LBS.	2.30 mV/V NOM.	350 Ω
FZ	1500 LBS.	1.50 mV/V NOM.	700 Ω
MX	1000 LB.-IN.	2.90 mV/V NOM.	350 Ω
MY	1000 LB.-IN.	2.90 mV/V NOM.	350 Ω
MZ	500 LB.-IN.	2.90 mV/V NOM.	700 Ω

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
B	WAS DRG. A-2432	4/99
A	REDRAWN IN CAD	3/17/93

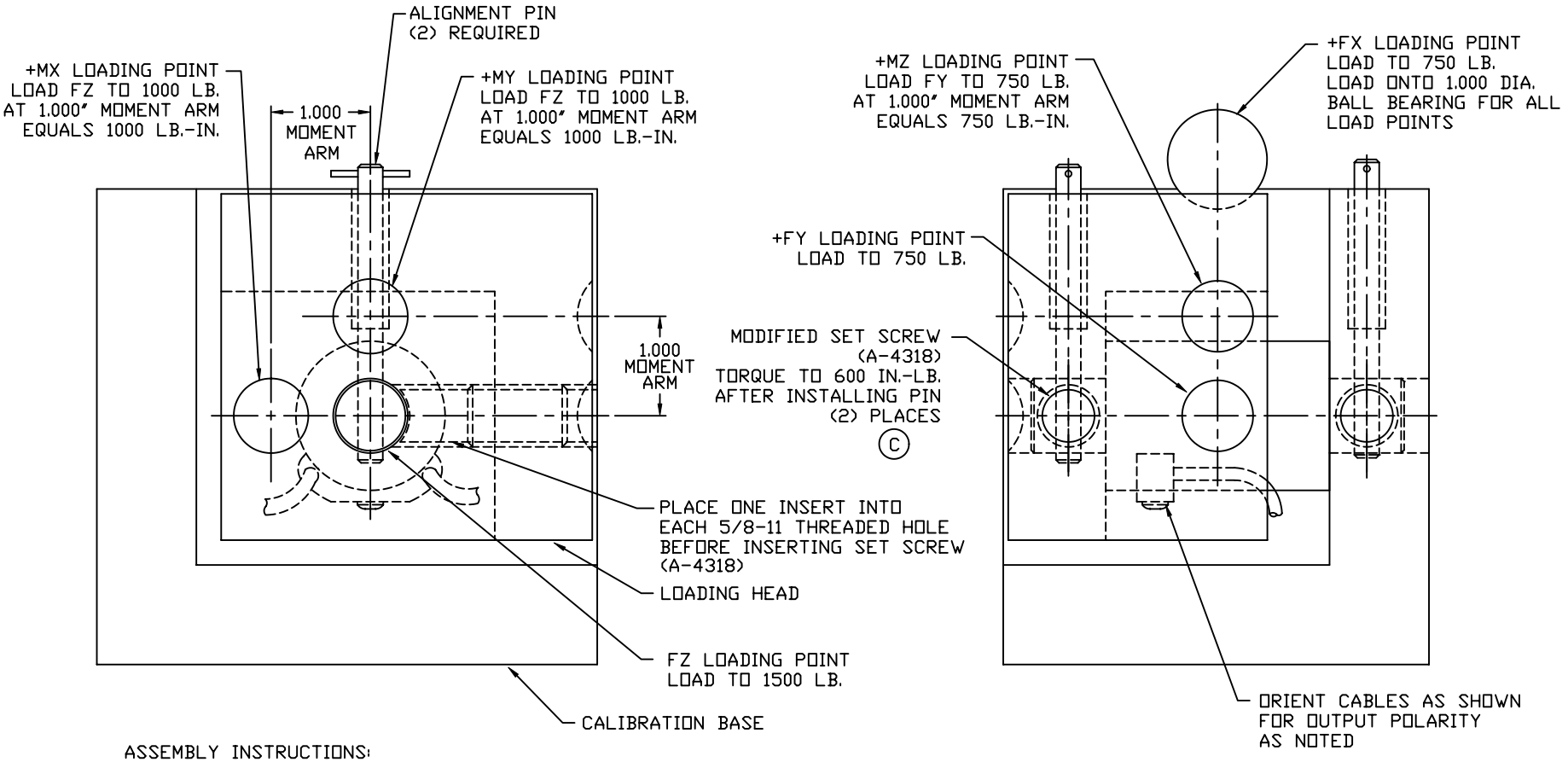
SIX YEAR OLD HYBRID III FEMUR LOAD CELL

SCALE: FULL
DATE: 2/17/93
DRAWN BY: C.R.M./T.R.D.
MODEL: 2432

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-2432-D



ASSEMBLY INSTRUCTIONS:

1. FASTEN LOAD CELL INTO LOADING HEAD WITH CABLES ORIENTED AS SHOWN. INSTALL ALIGNMENT PIN.
2. FASTEN LOAD CELL/LOADING HEAD ASSEMBLY ONTO CALIBRATION BASE. INSTALL ALIGNMENT PIN.
3. TORQUE TWO SET SCREWS TO 600 IN.-LB. AS SHOWN.

SYM	REVISION	DATE
D	WAS DRG. B-2592	4/99
C	ADD PART	1/99
B	REM. 1/4 SHSS	7/97
A	REV. BOLT PAT'N.	7/97

FEMUR LOAD CELL CALIBRATION FIXTURE
6 YEAR OLD HYBRID III

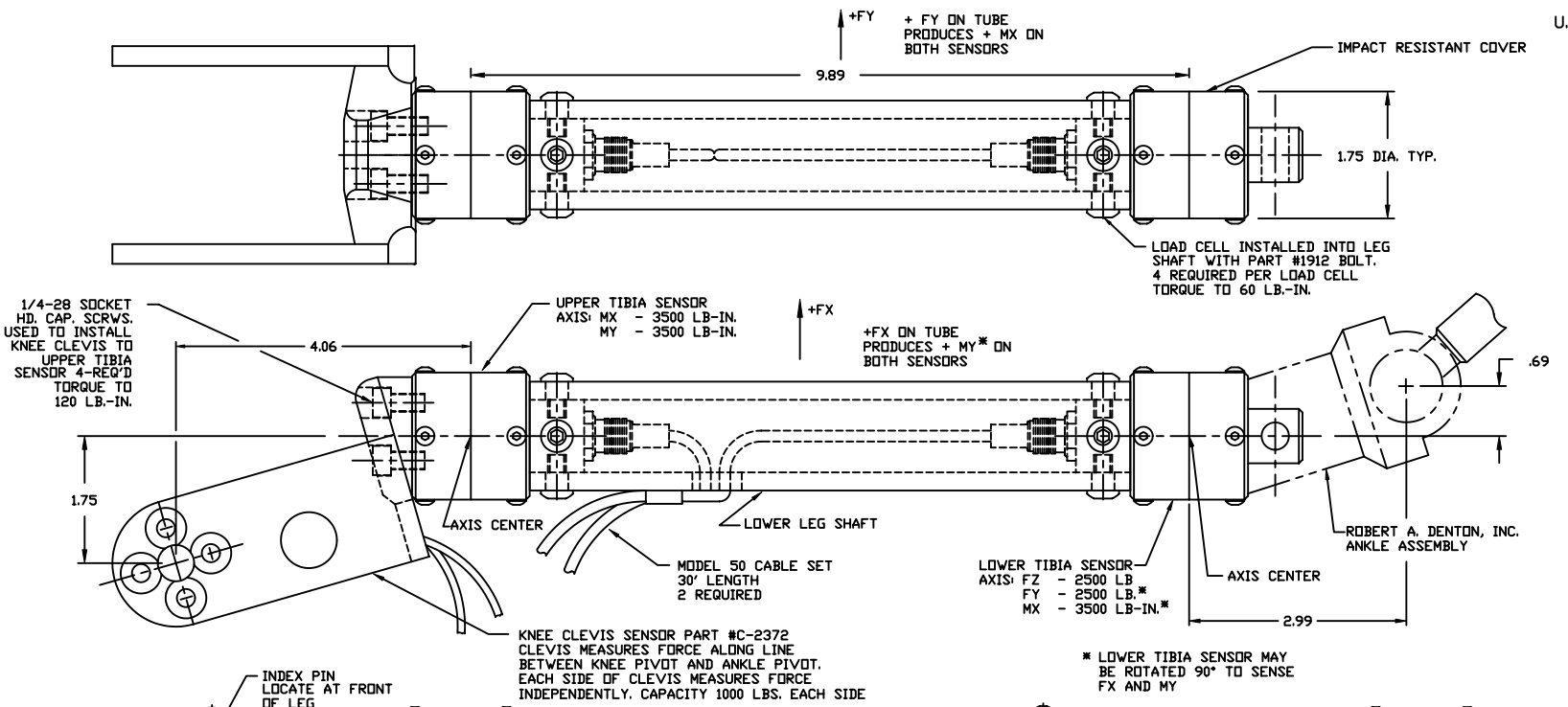
SCALE: FULL
DATE: 11/30/92
DRAWN BY: C.R. MORGAN
MODEL: 2592

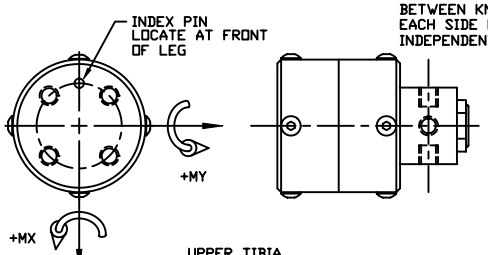
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2432-C

U.S. PATENT # 4,448,433

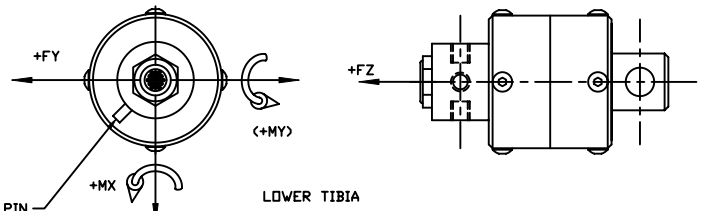




UPPER TIBIA
MODEL 1583

AXIS	CAPACITY	OUTPUT
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SEE NOTE 2



LOWER TIBIA
MODEL 1584

AXIS	CAPACITY	OUTPUT
FZ	2500 LBS.	1.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.

SEE NOTE 2

NOTES:
1. POLARITIES SHOWN ARE PER THE STANDARD DENTON MODEL 1571 INSTRUMENTED LOWER LEG. POLARITIES DO NOT AGREE WITH S.A.E. J-211. CABLE COLOR CODES ARE PROVIDED ON THE TRANSDUCER CALIBRATION REPORTS.

2. THE TIBIA LOAD CELLS MAY BE CONFIGURED WITH UP TO 4 CHANNELS. CONFIGURATIONS MAY BE MADE UP OF ANY COMBINATION OF FX, FY, FZ, MX, MY, MZ.

A	REDRAWN IN CAD	7/16/93

INSTRUMENTED LEG HYBRID III

95TH PERCENTILE

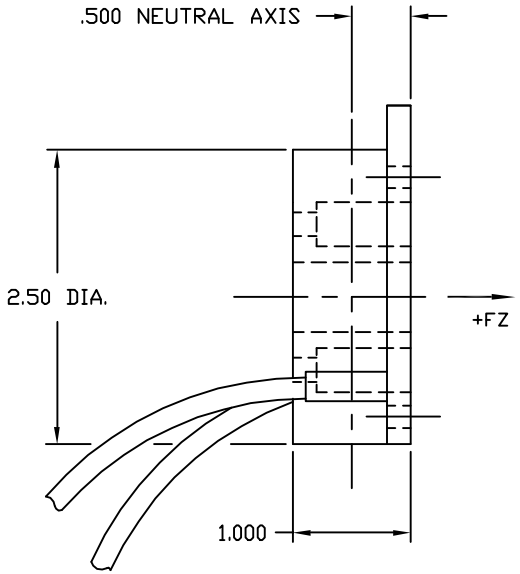
SCALE: .65		DRAWN BY: C.R.M./S.E.F.
DATE: 12/17/90		MODEL: 2453

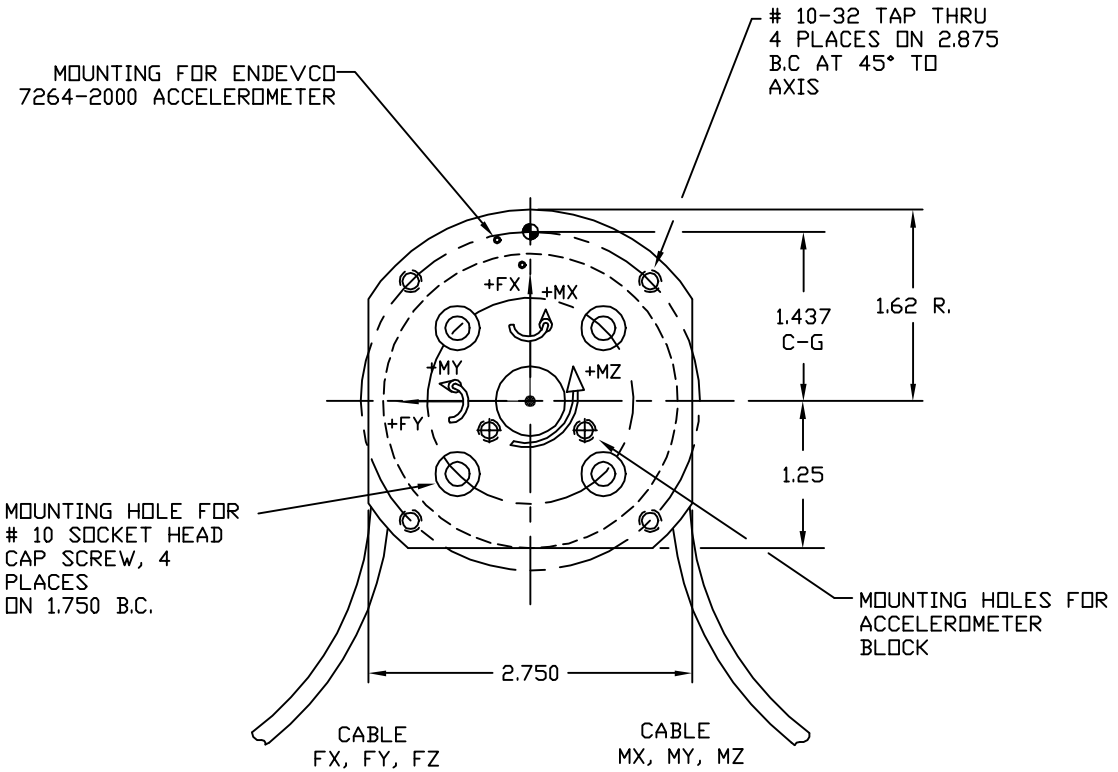
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2453-D





INFANT DUMMY 6-CHANNEL LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY	MODEL 2554 BRIDGE RESISTANCE	MODEL 2554A BRIDGE RESISTANCE
FX	200 LBS.	1.8 mV/V NOMINAL	700 OHMS	700 OHMS
FY	200 LBS.	1.8 mV/V NOMINAL	700 OHMS	700 OHMS
FZ	500 LBS.	.8 mV/V NOMINAL	480 OHMS	700 OHMS
MX	500 LB.-IN.	1.3 mV/V NOMINAL	350 OHMS	350 OHMS
MY	500 LB.-IN.	1.3 mV/V NOMINAL	350 OHMS	350 OHMS
MZ	300 LB.-IN.	1.3 mV/V NOMINAL	700 OHMS	700 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT - 0.30 LBS. NOMINAL (C)

NOTE:
THIS LOAD CELL IS UTILIZED IN THE UPPER NECK, LOWER NECK AND LUMBAR SPINE OF THE INFANT DUMMY. FX AND MX POLARITY WILL CHANGE BASED ON MOUNTING LOCATION.

SYM	REVISION	DATE
C	WAS .40 LBS.	4/99
B	WAS DRG. B-2554	4/99
A	ADD WEIGHT SPEC	12/98

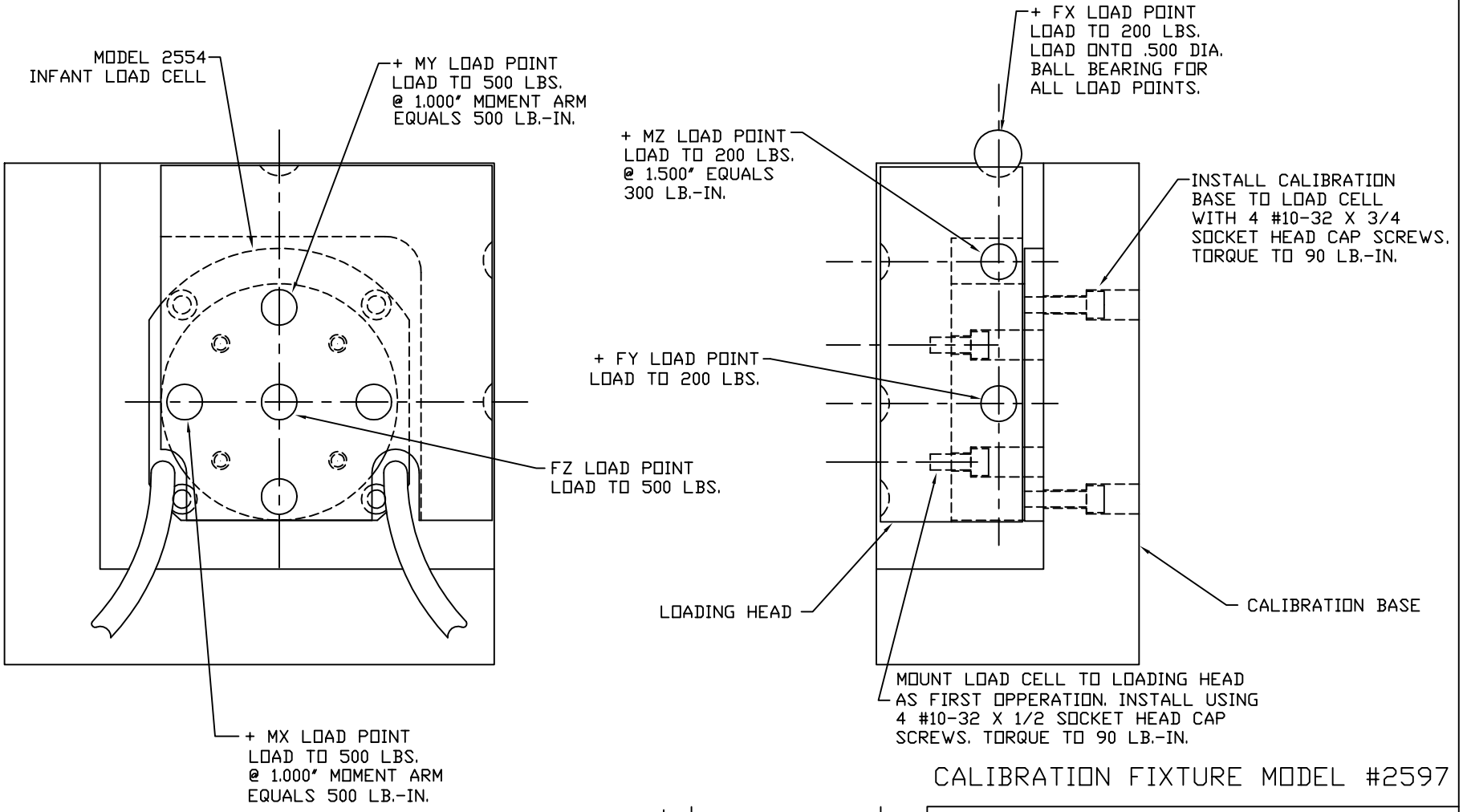
INFANT DUMMY LOAD CELL

SCALE: FULL
DATE: 10/18/91
DRAWN BY: C.R. MORGAN
MODEL: 2554

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2554-D



CALIBRATION FIXTURE MODEL #2597

SYM	REVISION	DATE
A	WAS DRG. B-2597	4/99

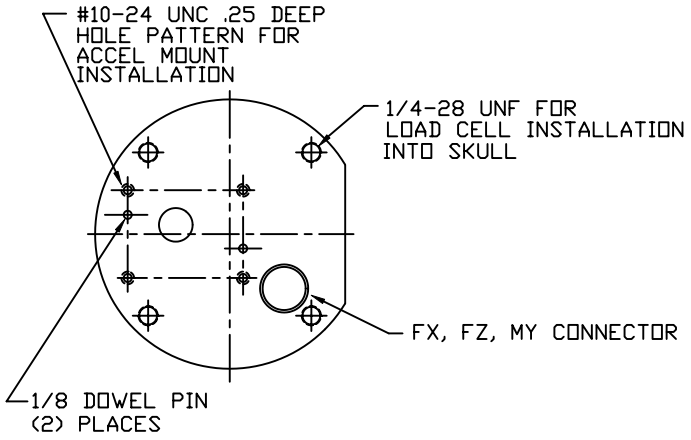
INFANT LOAD CELL CALIBRATION FIXTURE

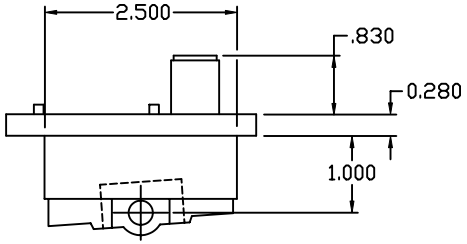
SCALE: FULL
DATE: 2/22/92
DRAWN BY: C.R. MORGAN
MODEL: 2554

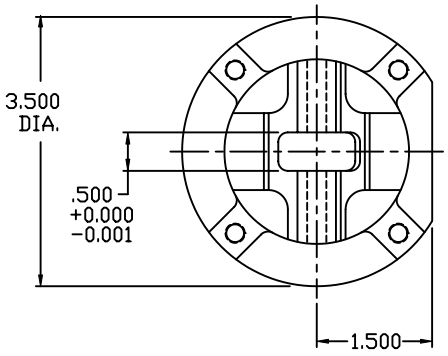
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2554-C





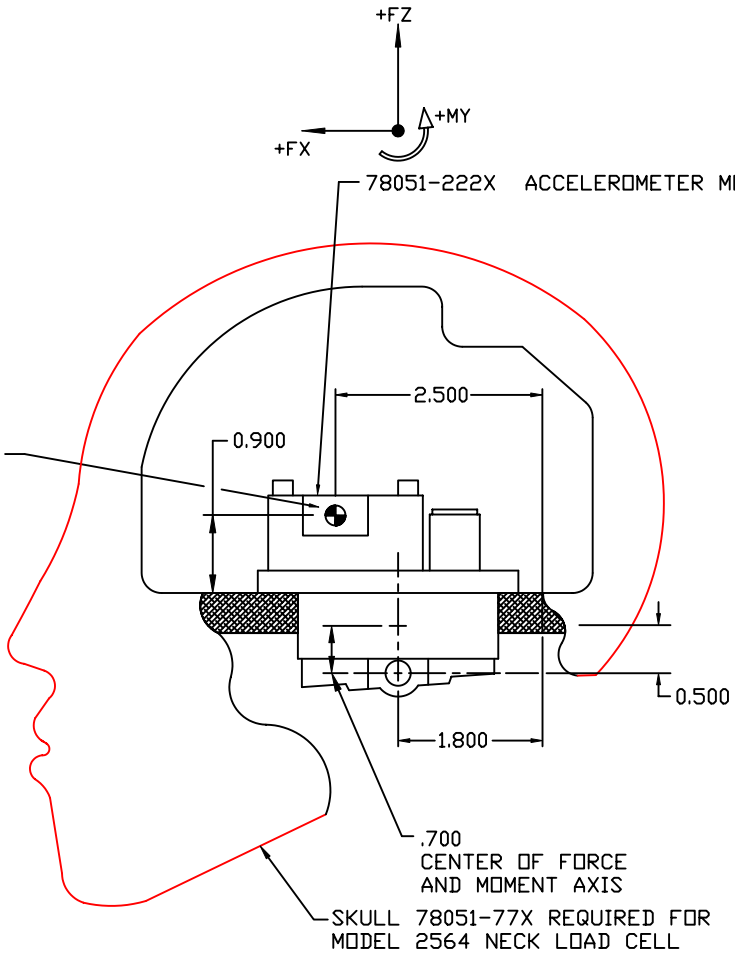


MODEL 2564

THREE CHANNEL NECK LOAD CELL

AXIS	CAPACITY	OUTPUT
FX	2000 LBS.	1.7 mV/V NOM.
FZ	3000 LBS.	1.4 mV/V NOM.
MY	2500 LB.-IN.	1.7 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE



SYM	REVISION	DATE
D	WAS DRG. B-2564	4/99
C	UPDATE PART #	1/98
B	UPDATED TEXT	10/96
A	REDRAWN IN CAD	2/2/93

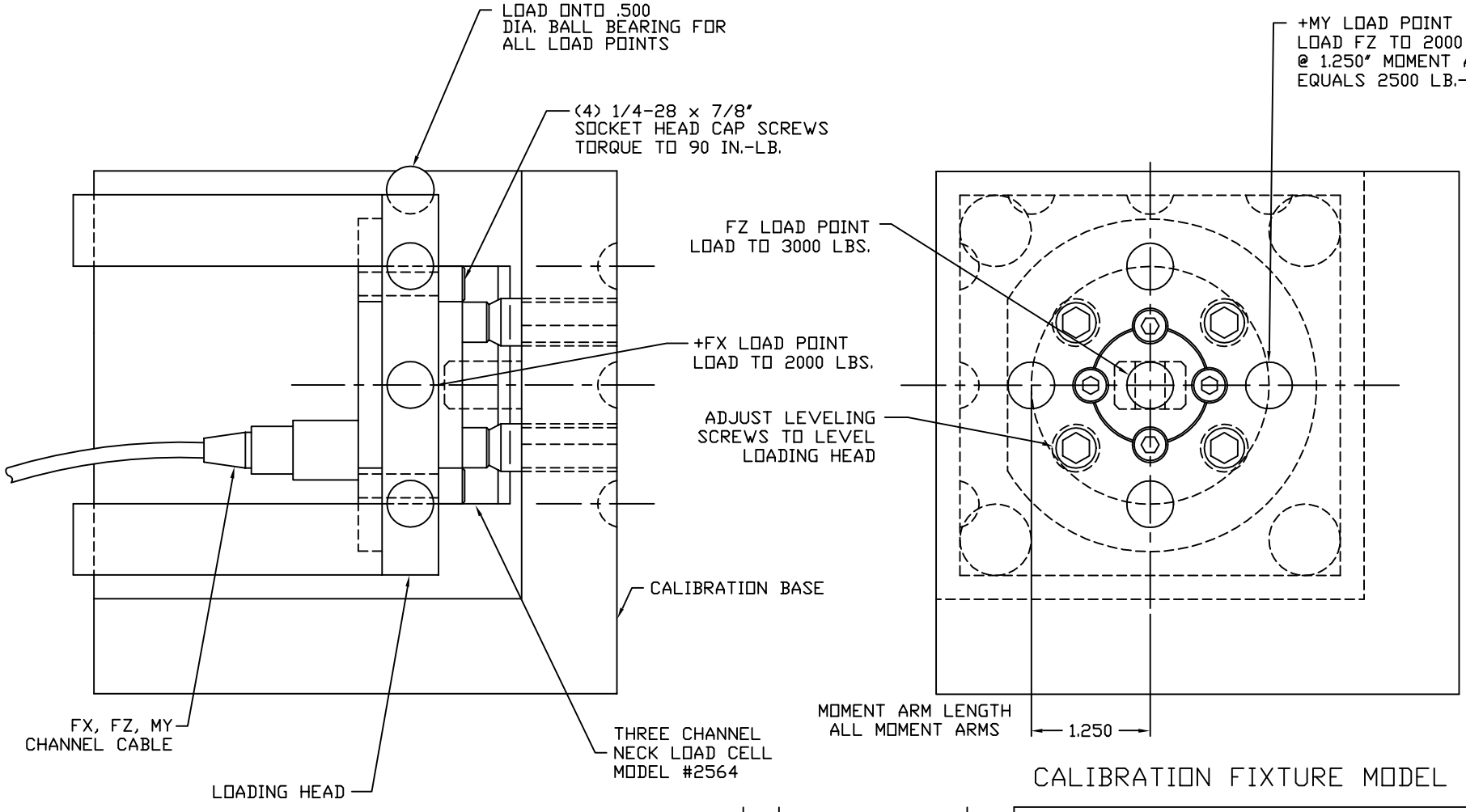
HYBRID III THREE CHANNEL NECK LOAD CELL

SCALE:	NONE		DRAWN BY: T.R. DENTON
DATE:	2/1/93		MODEL: 2564

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2564-D



CALIBRATION FIXTURE MODEL #1860

SYM	REVISION	DATE

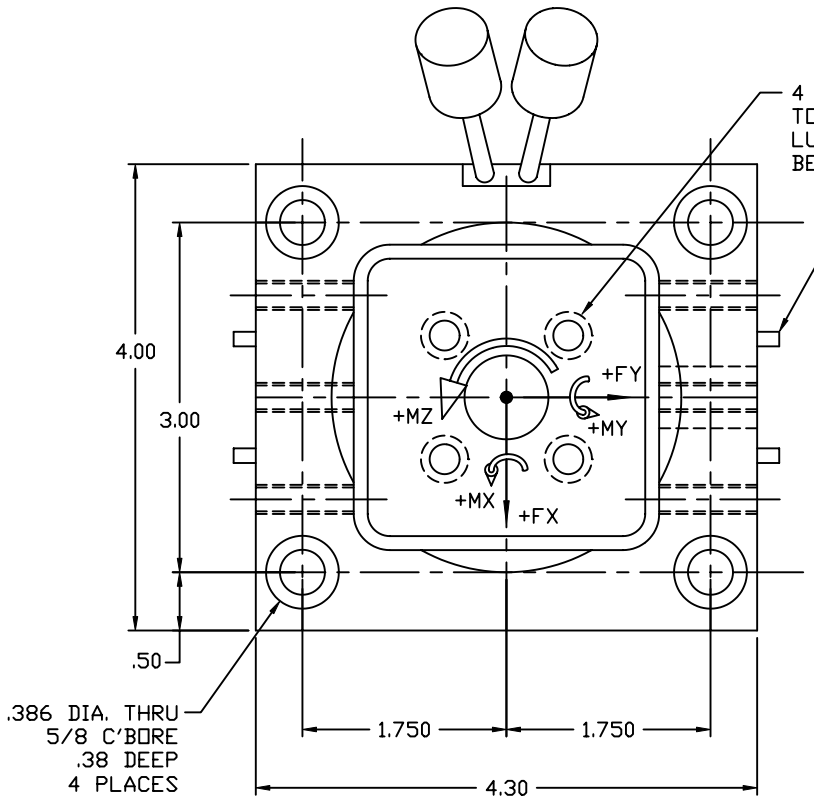
NECK CALIBRATION FIXTURE

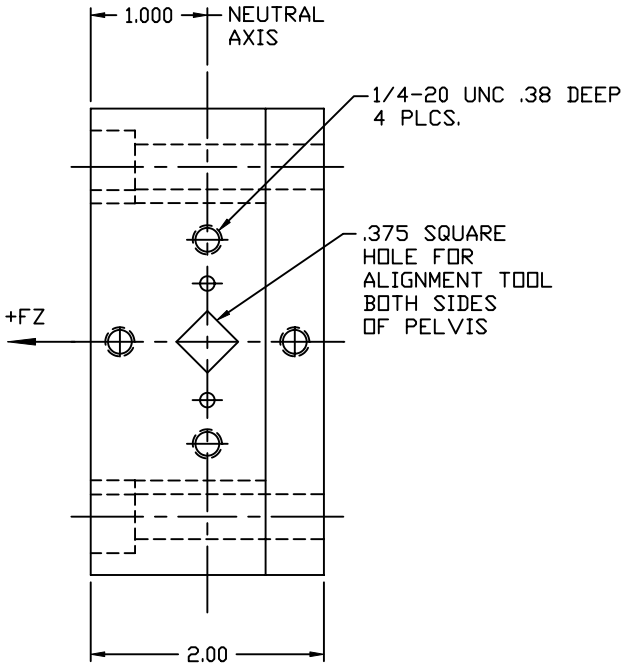
SCALE: FULL		DRAWN BY: C.R.M./S.E.F.
DATE: 11/1/85		MODEL: 2564

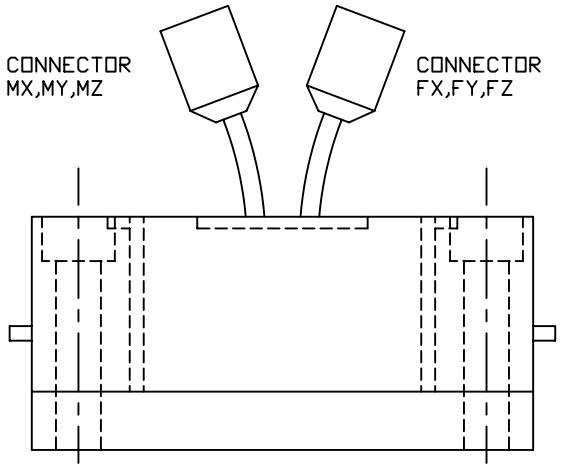
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2564-C







BIOSID 6 CHANNEL LUMBAR LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	3000 LBS.	1.8 mV/V NOM.
FY	3000 LBS.	1.8 mV/V NOM.
FZ	4000 LBS.	1.4 mV/V NOM.
MX	4000 LB-IN.	2.1 mV/V NOM.
MY	4000 LB-IN.	2.1 mV/V NOM.
MZ	3000 LB-IN.	2.9 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
B	WAS DRG. B-2586	4/99
A	ADD NEUTRAL AXIS	4/97

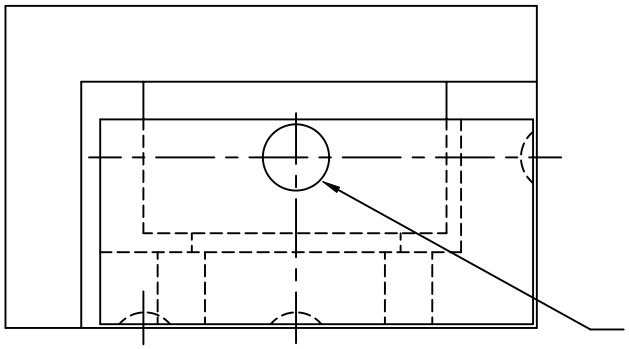
6 CHANNEL BIOSID LUMBAR LOAD CELL

SCALE: FULL
DATE: 7/9/93
DRAWN BY: S.E. FOSTER
MODEL: 2586

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2586-D



FY LOAD POINT
LOAD TO 3000 LBF

2.000
MOMENT ARM

LOAD ONTO 1.000
DIA. BALL BEARING
PLACED INTO DETENT

MX LOAD POINT
LOAD FZ TO 3000 LBF
@ 2.000 IN. MOMENT ARM
EQUALS 6000 IN-LBF

2.000
MOMENT
ARM

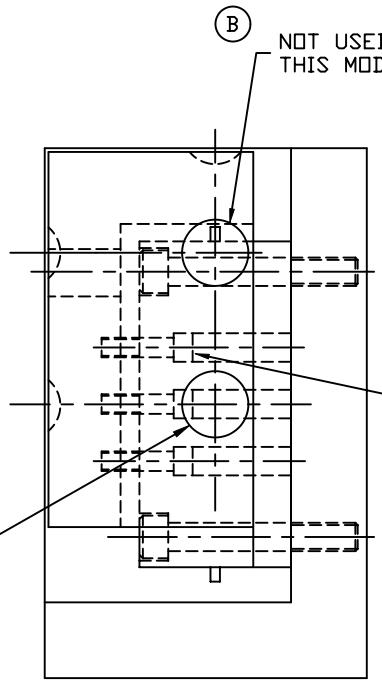
FZ LOAD POINT
LOAD TO 4000 LBF

CABLE EXIT
HOLES

MY LOAD POINT
LOAD FZ TO 3000 LBF
@ 2.000" MOMENT ARM
EQUALS 6000 IN-LBF

FASTEN LOAD CELL TO
CALIBRATION BASE WITH
(4) 3/8-16 X 2.5 SOCKET
HEAD CAP SCREWS.
TORQUE: 360 IN-LBF

BIOSID LUMBAR SPINE
LOAD CELL
MODEL #2254



B

NOT USED FOR
THIS MODEL

FASTEN LOAD CELL
TO LOADING HEAD
WITH (4) 1/4-20
X 1" SOCKET HEAD
CAP SCREW.
TORQUE: 120 IN-LBF

FX LOAD POINT
LOAD TO 3000 LBF

ORDER OF ASSEMBLY:

1. PLACE CABLES THRU CABLE EXIT HOLES AND INSERT INTO RECEPTICLES ON LOAD CELL.
2. FASTEN LOAD CELL TO LOADING HEAD AS SHOWN.
3. FASTEN LOAD CELL / LOADING HEAD ASSEMBLY TO CALIBRATION BASE.

SYM	REVISION	DATE
C	WAS DRG. B-2295	4/99
B	ADD NOTE	1/99
A	REDRAWN IN CAD	3/96

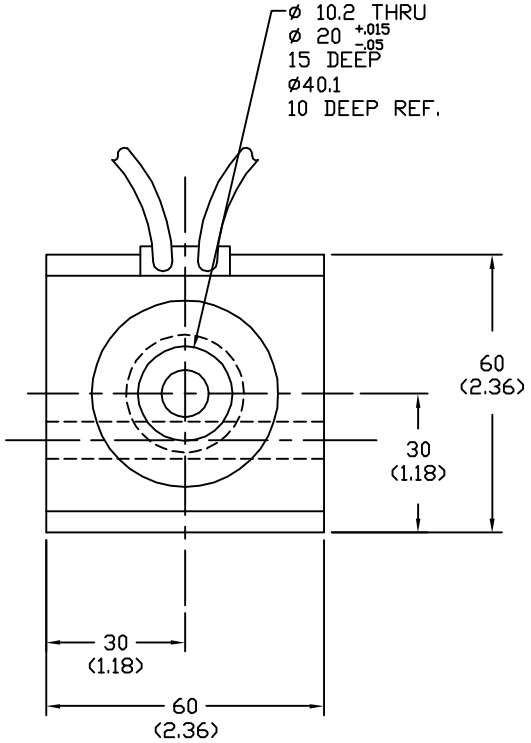
BIOSID LUMBAR LOAD CELL CALIBRATION FIXTURE

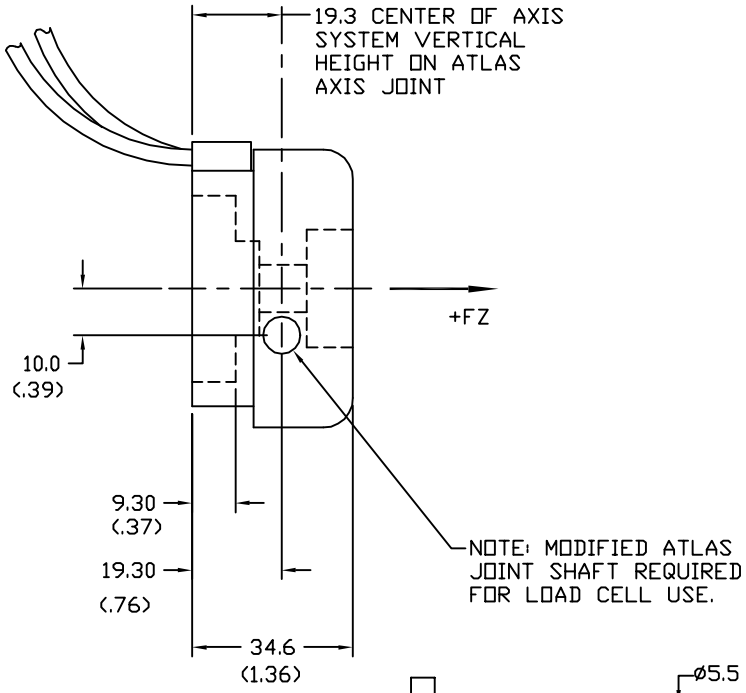
SCALE: .65X
DATE: 10/3/89
DRAWN BY: C.R. MORGAN
MODEL: 2295

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2586-C

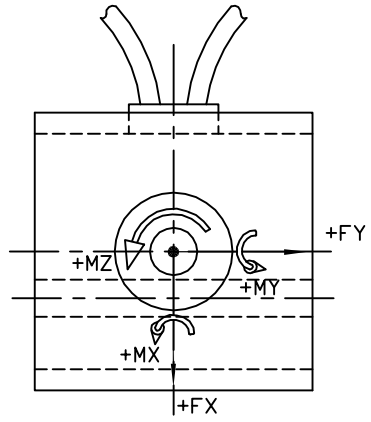


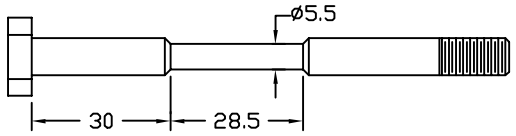


CABLES
12 CONDUCTOR, SHIELDED
TEFLON INSULATION
30 FT (9 M) LENGTH

CABLE
MX, MY, MZ

CABLE
FX, FY, FZ





AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	3.5KN (750 LB.)	2.0 mV/V NOMINAL
FY	3.5KN (750 LB.)	2.0 mV/V NOMINAL
FZ	3.5KN (750 LB.)	0.8 mV/V NOMINAL
MX	70NM (620 LB.-IN.)	1.0 mV/V NOMINAL
MY	70NM (620 LB.-IN.)	1.0 mV/V NOMINAL
MZ	70NM (620 LB.-IN.)	1.0 mV/V NOMINAL

(E)

NONLINEARITY <1 % OF FULL SCALE
CROSSTALK < 5 % OF FULL SCALE

SYM	REVISION	DATE
E	WAS 68Nm	02/00
D	WAS DRG. B-2587	4/99
C	CHG CABLE LNGTH	7/98
B	POLARITY	2/10/95
A	REV. DESIGN	4/11/93

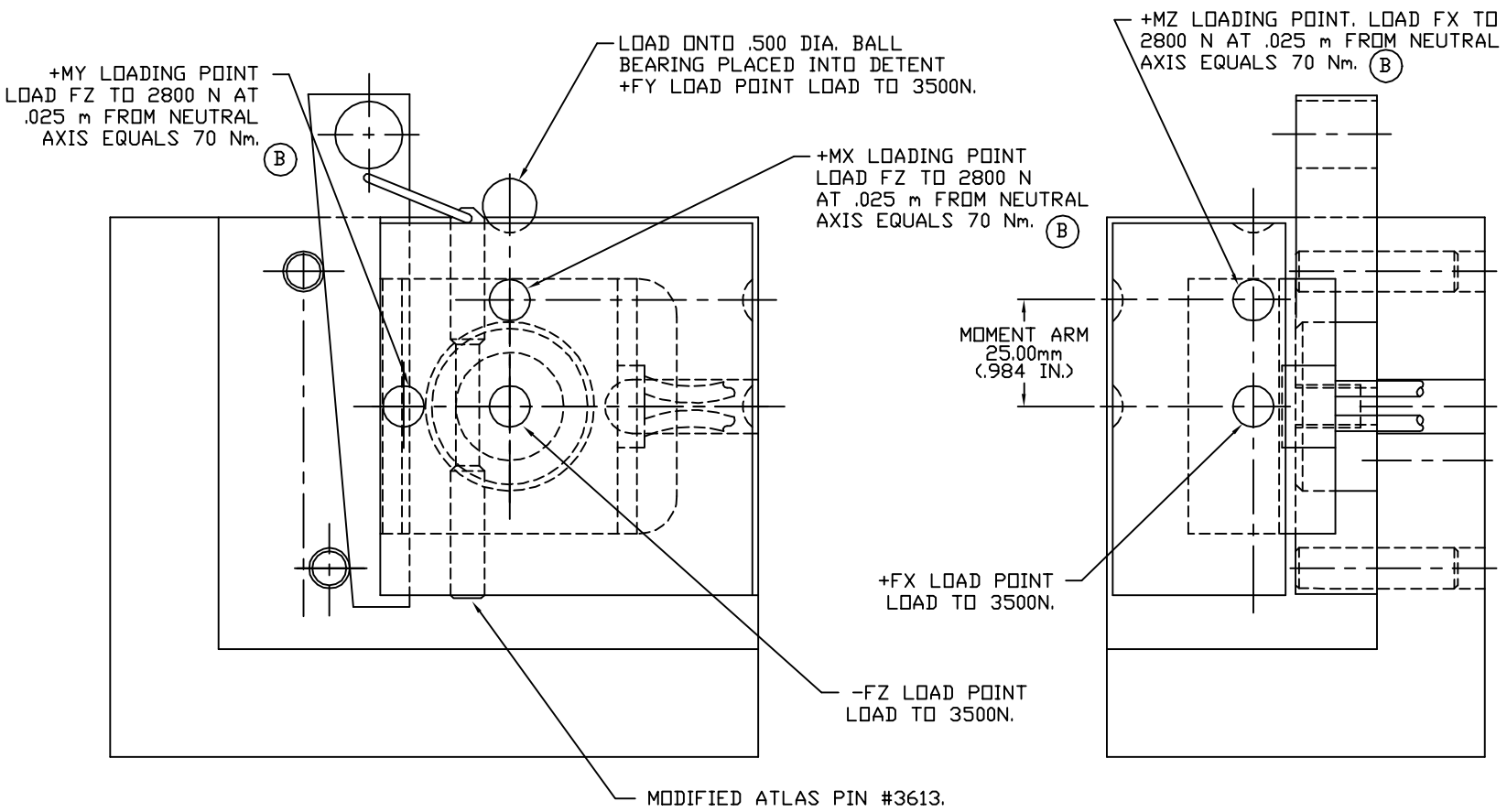
P 3/4 6-CHANNEL NECK LOAD CELL

SCALE: FULL
DATE: 1/6/92
DRAWN BY: C.R. MORGAN
MODEL: 2587

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2587-D



NOTES:
1. PLACE LOAD CELL ONTO BASE.
2. SLIDE IN WEDGE AGAINST PINS AND LOAD CELL TO SQUARE LOAD CELL TO BASE.
3. INSTALL BOLT IN CENTER OF LOAD CELL AND TORQUE M10 X 1.5, 25mm TO 28Nm (250 LB.-IN.).
4. PLACE LOADING HEAD ONTO LOAD CELL AS SHOWN AND LOCATE IN PLACE WITH MODIFIED ATLAS SHAFT PART# A-3613.

SYM	REVISION	DATE
C	WAS 3308	02/00
B	CAP. WAS 68Nm	02/00
A	WAS DRG. B-3308	4/99

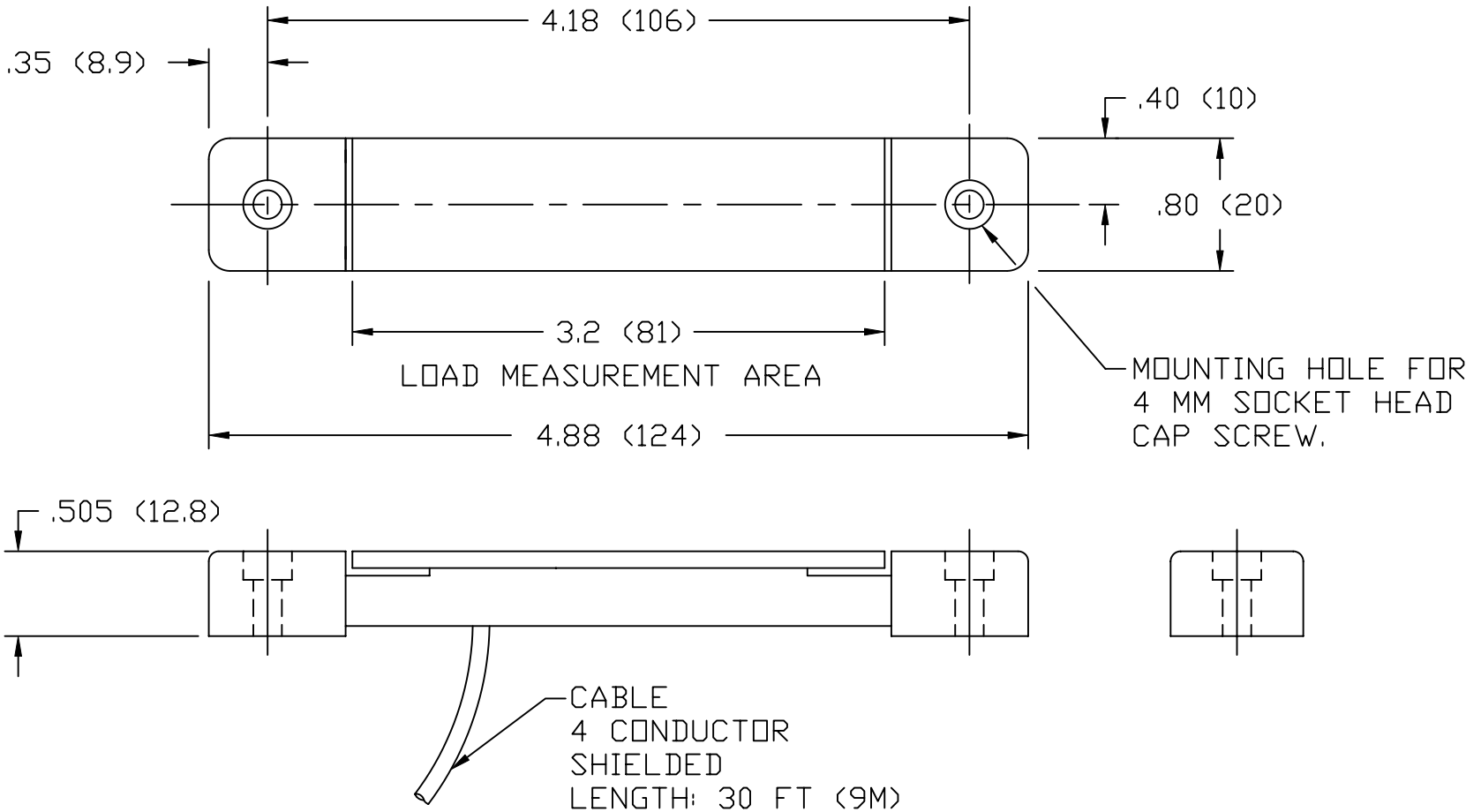
CALIBRATION FIXTURE FOR THE P 3/4 6 CH. NECK LOAD CELL

SCALE: FULL
DATE: 7/2/96
(C)
DRAWN BY: H. PROCTOR
MODEL: 2587

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2587-C



EUROSID I ABDOMINAL LOAD CELL

CAPACITY: 5000 NEWTONS
OUTPUT @ CAPACITY: 3.3 mV/V NOMINAL
NONLINEARITY < 1% OF FULL SCALE
BRIDGE RESISTANCE: 350 Ω NOMINAL

SYM	REVISION	DATE
D	WAS DRG. A-2859	4/99
C	CHG CABLE LNGTH	7/98
B	RADIUS CORNERS	4/98
A	REV. CAPACITY	10/94

EUROSID I ABDOMINAL LOAD CELL

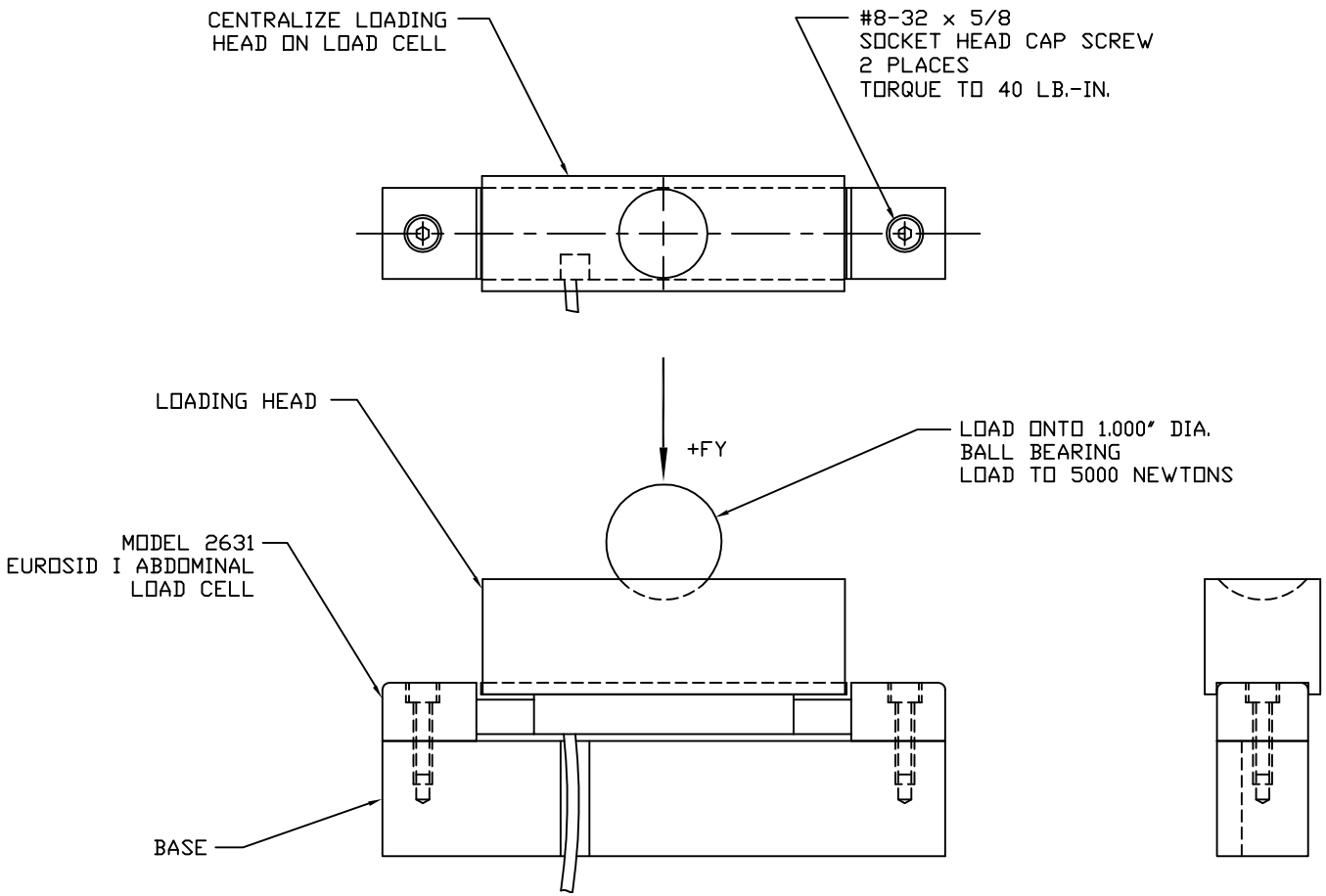
SCALE:	FULL		DRAWN BY: C.R. MORGAN
DATE:	8/30/92		MODEL: 2631

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-2631-D



CALIBRATION FIXTURE MODEL #2858

CAPACITY: 5000 NEWTONS
OUTPUT @ CAPACITY: 3.0 mV/V NOMINAL
NONLINEARITY < 1% OF FULL SCALE
BRIDGE RESISTANCE: 350 Ω NOMINAL

SYM	REVISION	DATE
B	WAS DRG. B-2858	4/99
A	REV. CAPACITY	3/95

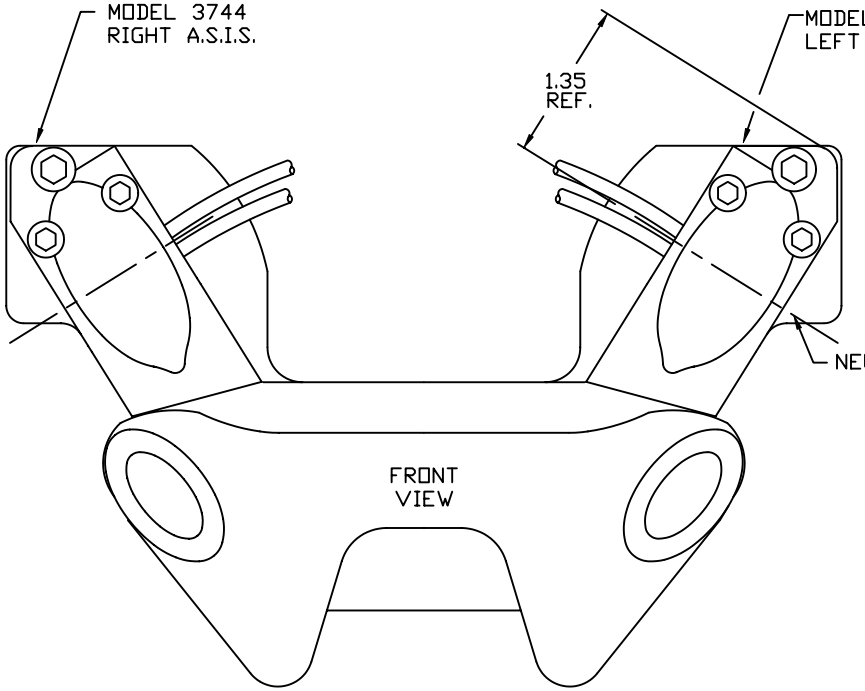
CAL FIXTURE FOR MODEL 2631

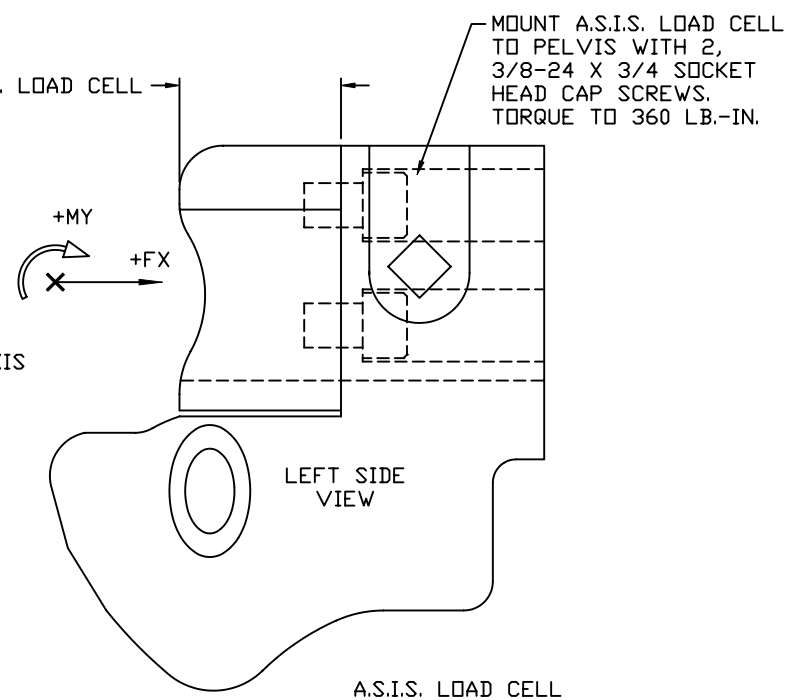
SCALE: FULL			DRAWN BY: S.E. FOSTER
DATE: 8/2/93			MODEL: 2631

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2631-C





A.S.I.S. LOAD CELL

THE MODEL 2656 A.S.I.S. LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THIS FORCE IS MEASURED AS FX AND IS INSENSITIVE TO THE POSITION OF THE BELT ON THE ILIAC. THE CHANNEL MY IS DESIGNED TO PROVIDE AN INDICATION OF THE POSITION OF THE BELT ON THE ILIAC. A READING OF ZERO OUTPUT WOULD OCCUR IF THE CENTER OF PRESSURE OF THE BELT IS ON THE LOAD CELL NEUTRAL AXIS. IF THE BELT IS ABOVE THE NEUTRAL AXIS A POSITIVE MOMENT READING WOULD OCCUR, AND A BELT POSITIONED BELOW THE NEUTRAL AXIS WOULD PRODUCE A NEGATIVE BENDING MOMENT OUTPUT.

NOTE: THE LOAD CELL CALIBRATION DATA IS POSITIVE FOR COMPRESSION ON THE FRONT FACE OF THE LOAD CELL. TO CONFORM TO S.A.E. J-211 POLARITY, THE POLARITY OF THE FX CHANNEL MUST BE CHANGED. THE POLARITY FOR THE MY CHANNEL CONFORMS TO S.A.E J-211.

MODEL 2656 LOAD CELL ASSEMBLY CONSISTS OF ONE OF MODEL 3743 LEFT A.S.I.S. AND ONE OF MODEL 3744 RIGHT A.S.I.S.

AXIS	CAPACITY	OUTPUT
FX	2000 LBS.	1.5 mV/V NOMINAL
MY	2000 LB.-IN.	1.0 mV/V NOMINAL

NONLINEARITY <1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

CABLE COLOR CODE @ LOAD CELL, FX AND MY CHANNELS

RED	+EXCITATION
GREEN	+SIGNAL
BLACK	-EXCITATION
WHITE	-SIGNAL

SYM	REVISION	DATE
E	WAS DRG. B-2656	4/99
D	CORRECT OUTPUT	8/98
C	ADD TEXT, DETAILS	4/98
B	ADD. CABLES	2/98
A	ADD MODEL#	1/97

ANTERIOR SUPERIOR ILIAC SPINE LOAD CELL

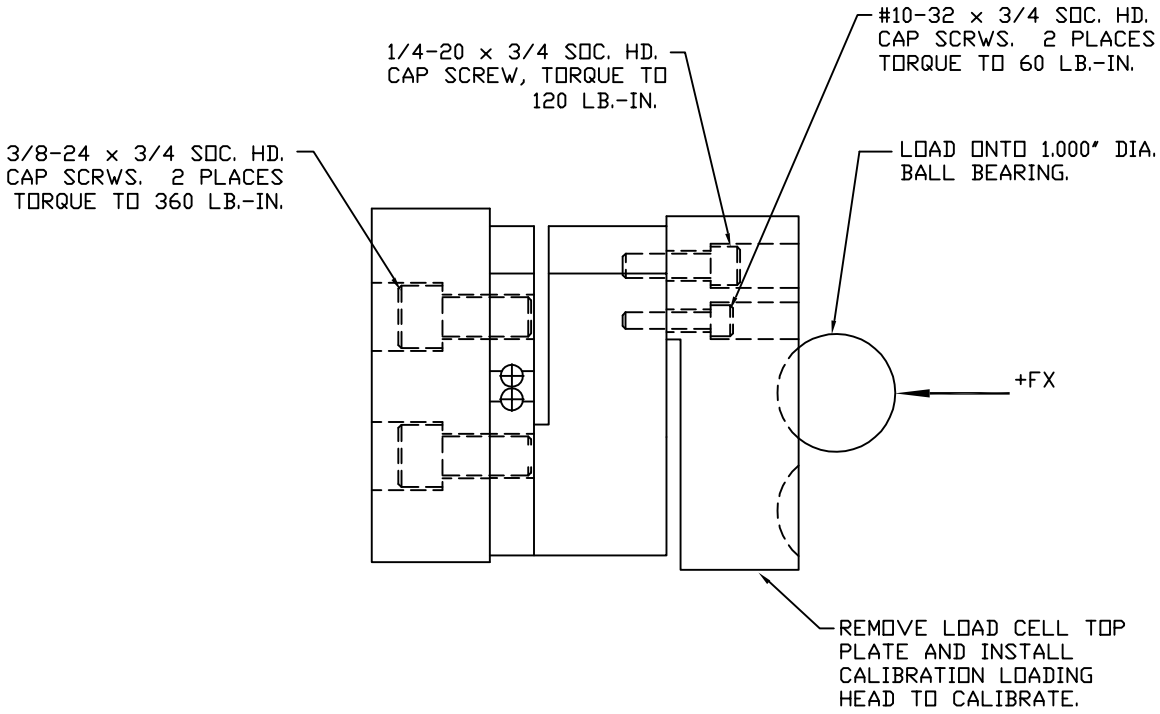
HYBRID III 5TH PERCENTILE

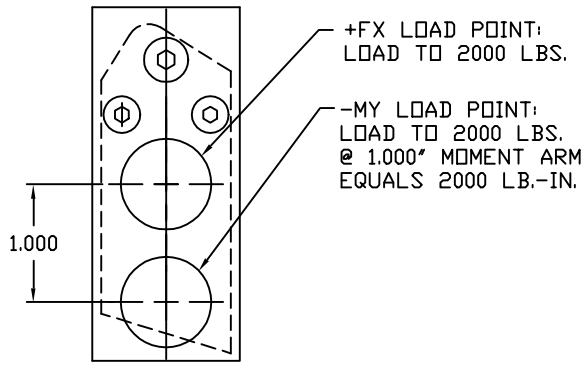
SCALE: NONE
DATE: 11/15/92
DRAWN BY: C.R. MORGAN
MODEL: 2656

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2656-D





CALIBRATION FIXTURE MODEL #2922

SYM	REVISION	DATE
B	ADD -MY POL.	10/99
A	WAS DRG. B-2922	4/99

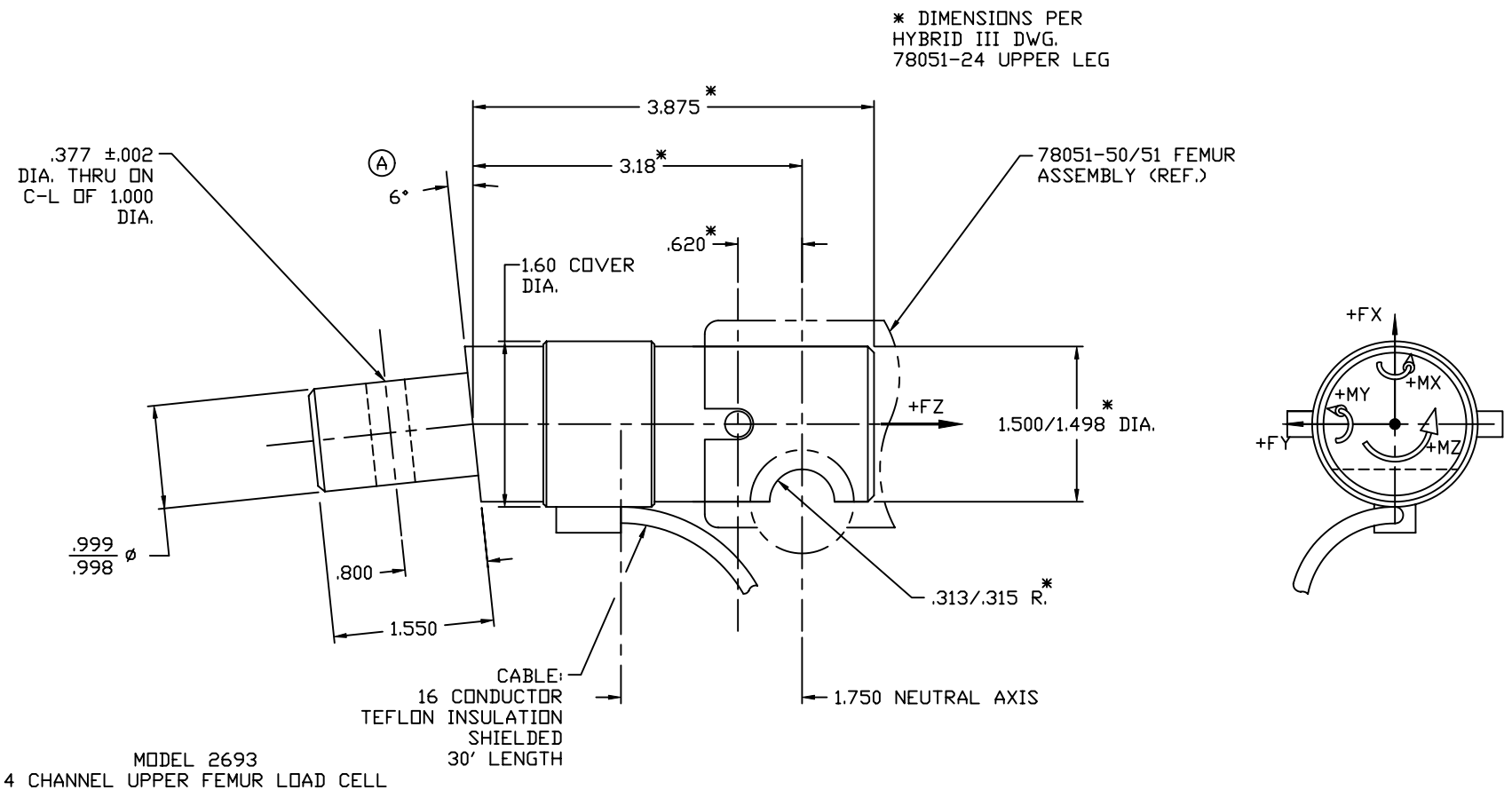
A.S.I.S. CALIBRATION FIXTURE

SCALE: FULL
DATE: 8/24/93
DRAWN BY: C.R.M./S.E.F.
MODEL: 2656

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2656-C



MODEL 2693
4 CHANNEL UPPER FEMUR LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY
FZ	3000 LBS.	0.7 mV/V NOMINAL
MX	5000 LB.-IN.	2.4 mV/V NOMINAL
MY	5000 LB.-IN.	2.4 mV/V NOMINAL
MZ	3000 LB.-IN.	2.1 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
C	ADDED DOWEL PIN NOTE	7/99
B	WAS DRG. B-2693	4/99
A	ADD 6° DIM.	11/15/92

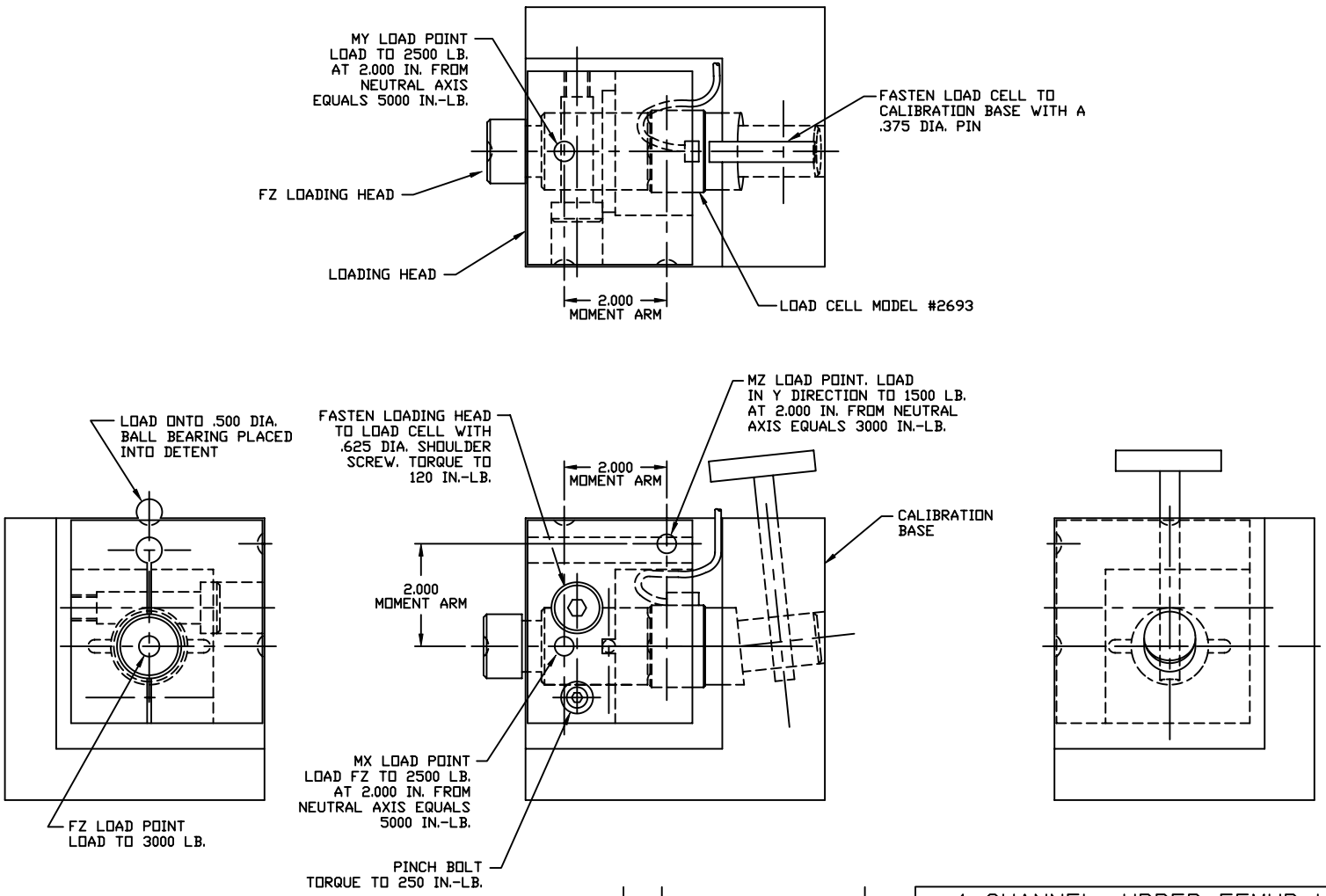
4 CHANNEL UPPER FEMUR LOAD CELL

SCALE: FULL
DATE: 11/7/92
DRAWN BY: C.R. MORGAN
MODEL: 2693

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2693-D



SYM	REVISION	DATE

4 CHANNEL, UPPER FEMUR LOAD CELL CALIBRATION FIXTURE

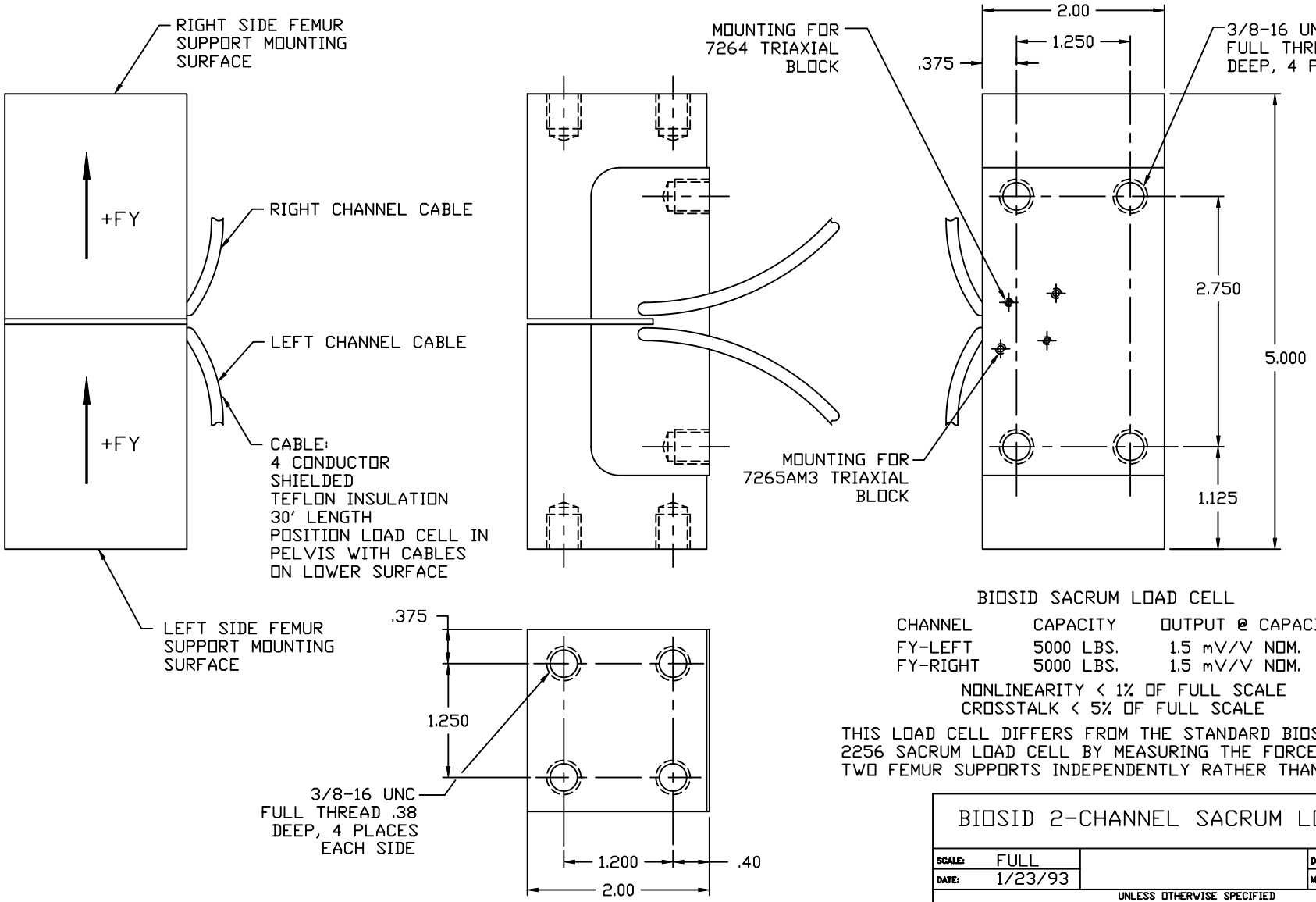
SCALE: 1/2		DRAWN BY: *H. PROCTOR*
DATE: 11/17/95		MODEL: 2693

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125 √
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2693-C



BIOSID SACRUM LOAD CELL

CHANNEL	CAPACITY	OUTPUT @ CAPACITY
FY-LEFT	5000 LBS.	1.5 mV/V NOM.
FY-RIGHT	5000 LBS.	1.5 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

THIS LOAD CELL DIFFERS FROM THE STANDARD BIOSID MODEL 2256 SACRUM LOAD CELL BY MEASURING THE FORCE FROM THE TWO FEMUR SUPPORTS INDEPENDENTLY RATHER THAN IN TOTAL.

BIOSID 2-CHANNEL SACRUM LOAD CELL

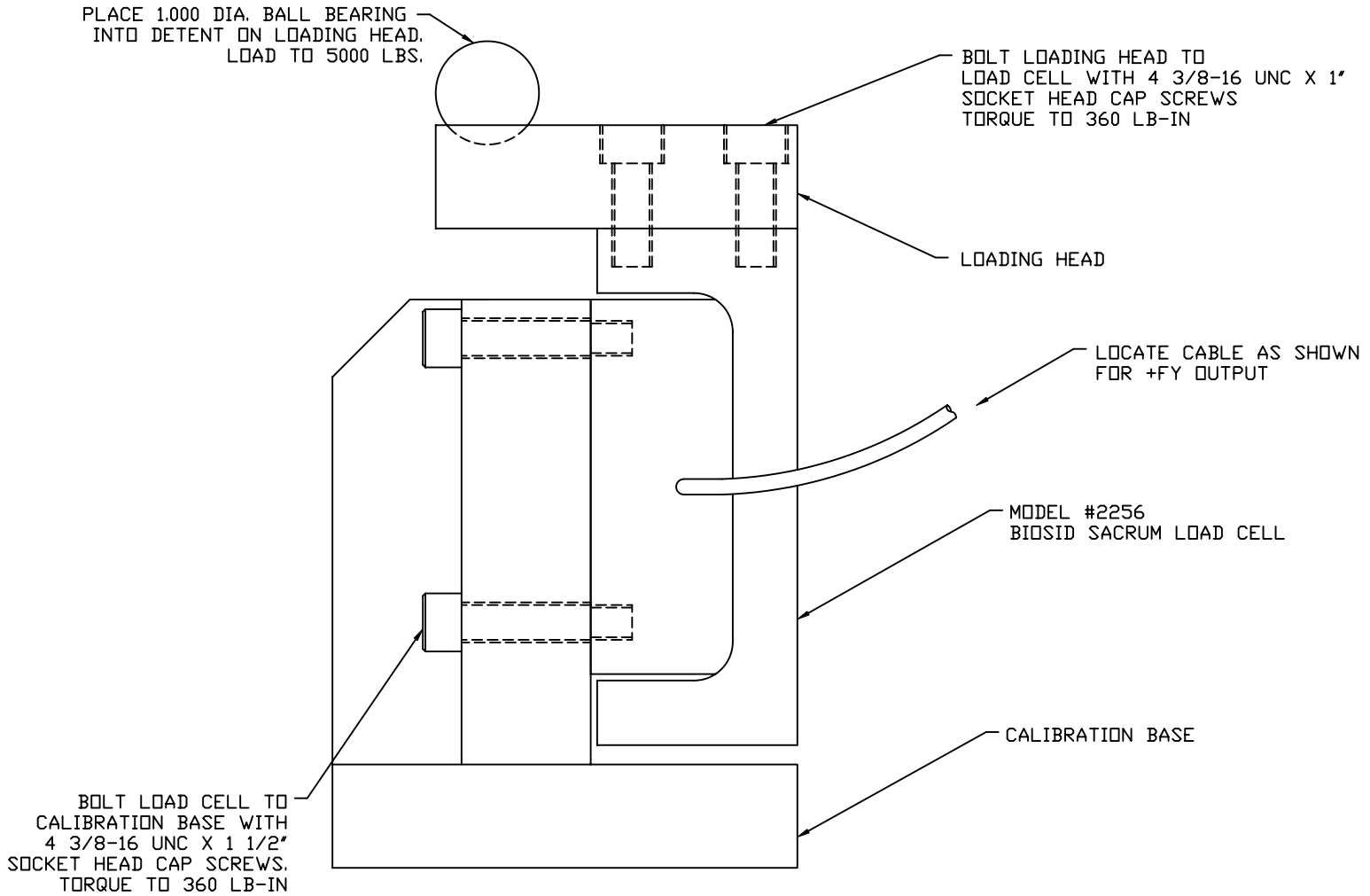
SCALE: FULL			DRAWN BY: C.R. MORGAN
DATE: 1/23/93			MODEL: 2770

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2770-D

SYM	REVSION	DATE
A	WAS DRG. B-2770	4/99



SYM	REVISION	DATE
B	WAS DRG. B-2292	4/99
A	REDRAWN IN CAD	12/93

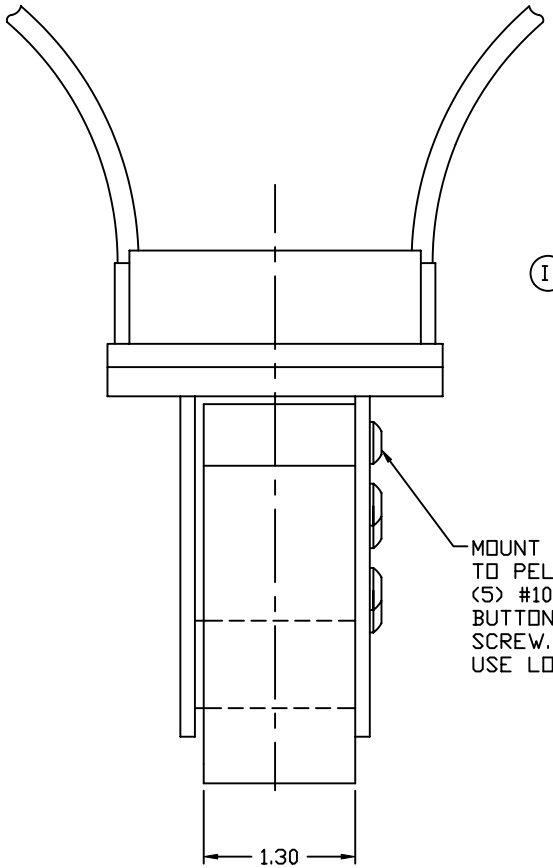
BIOSID SACRUM CALIBRATION FIXTURE

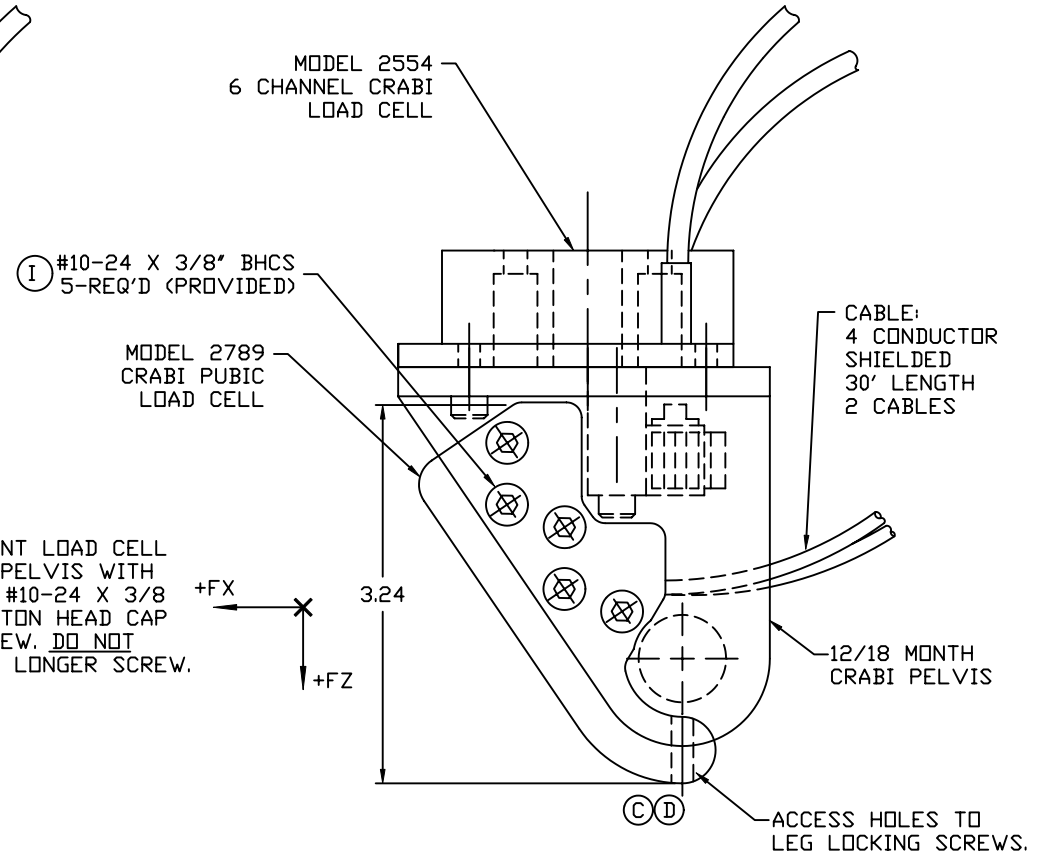
SCALE: FULL
DATE: 10/2/89
DRAWN BY: C.R.M./S.E.F.
MODEL: 2292

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2770-C





MODEL 2789
12/18 CRABI PUBIC LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	1000 LBS.	1.5 mV/V NOMINAL	350 OHMS
FZ	1000 LBS. (A)	1.5 mV/V NOMINAL	350 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT: 0.54 LBS. (H)

I	ADD NOTE	9/99
H	WAS .55 LBS.	4/99
G	WAS DRG. B-2789	4/99
F	ADD DIM.	12/98
E	REV. WEIGHT	12/98
D	REV. SHAPE	6/98
C	REV. SHAPE	12/97
B	REV. SHAPE	9/94
A	CAP. WAS 400	7/93

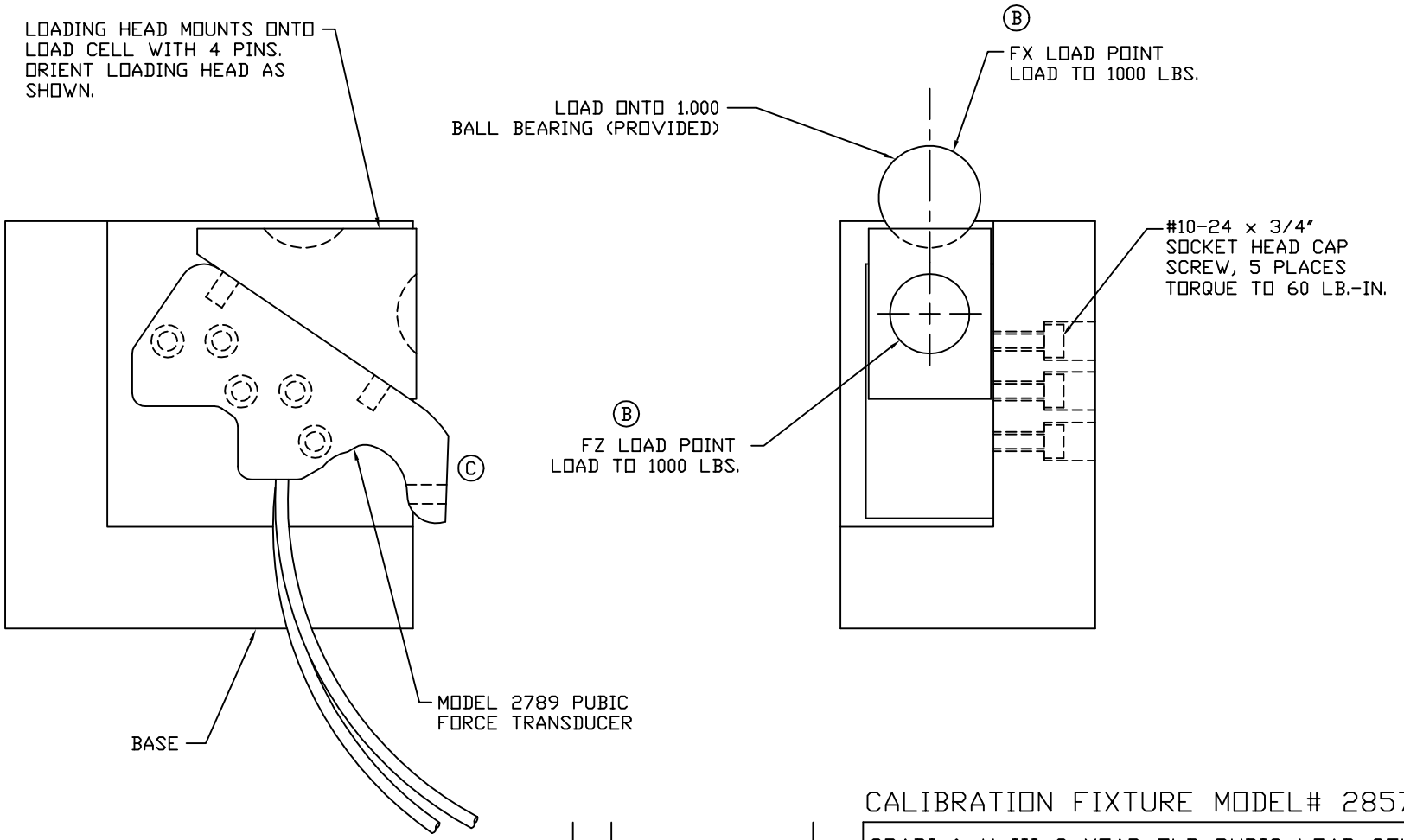
CRABI PUBIC LOAD CELL

SCALE: FULL
DATE: 2/20/93
DRAWN BY: C.R. MORGAN
MODEL: 2789

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2789-D



CALIBRATION FIXTURE MODEL# 2857

SYM	REVISION	DATE
D	WAS DRG. B-2857	4/99
C	REV. SHAPE	12/97
B	AXES CORRECTED	9/94
A	DESIGN UPDATE	1/94

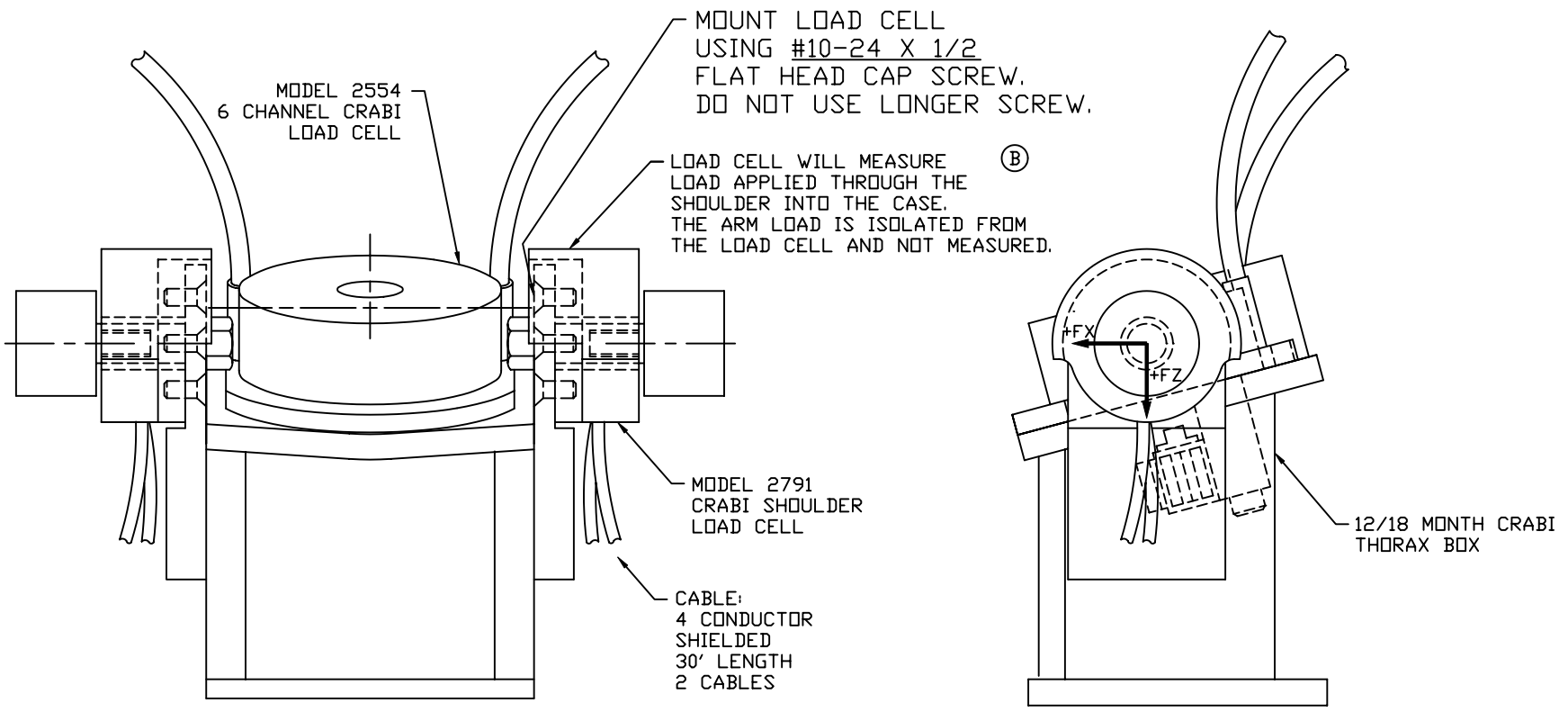
CRABI & H-III 3 YEAR OLD PUBIC LOAD CELL
CALIBRATION FIXTURE

SCALE: FULL
DATE: 8/13/93
DRAWN BY: S.E. FOSTER
MODEL: 2789

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2789-C



MODEL 2791
CRABI SHOULDER LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	400 LBS.	1.5 mV/V NOMINAL	350 OHMS
FZ	400 LBS.	1.5 mV/V NOMINAL	350 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT: 0.13 LBS. EACH
D

SYM	REVISION	DATE
D	WAS .4 LBS.	4/99
C	WAS DRG. B-2791	4/99
B	ISOLATE ARM LOAD	9/94
A	ADD MOUNTING NOTE	11/93

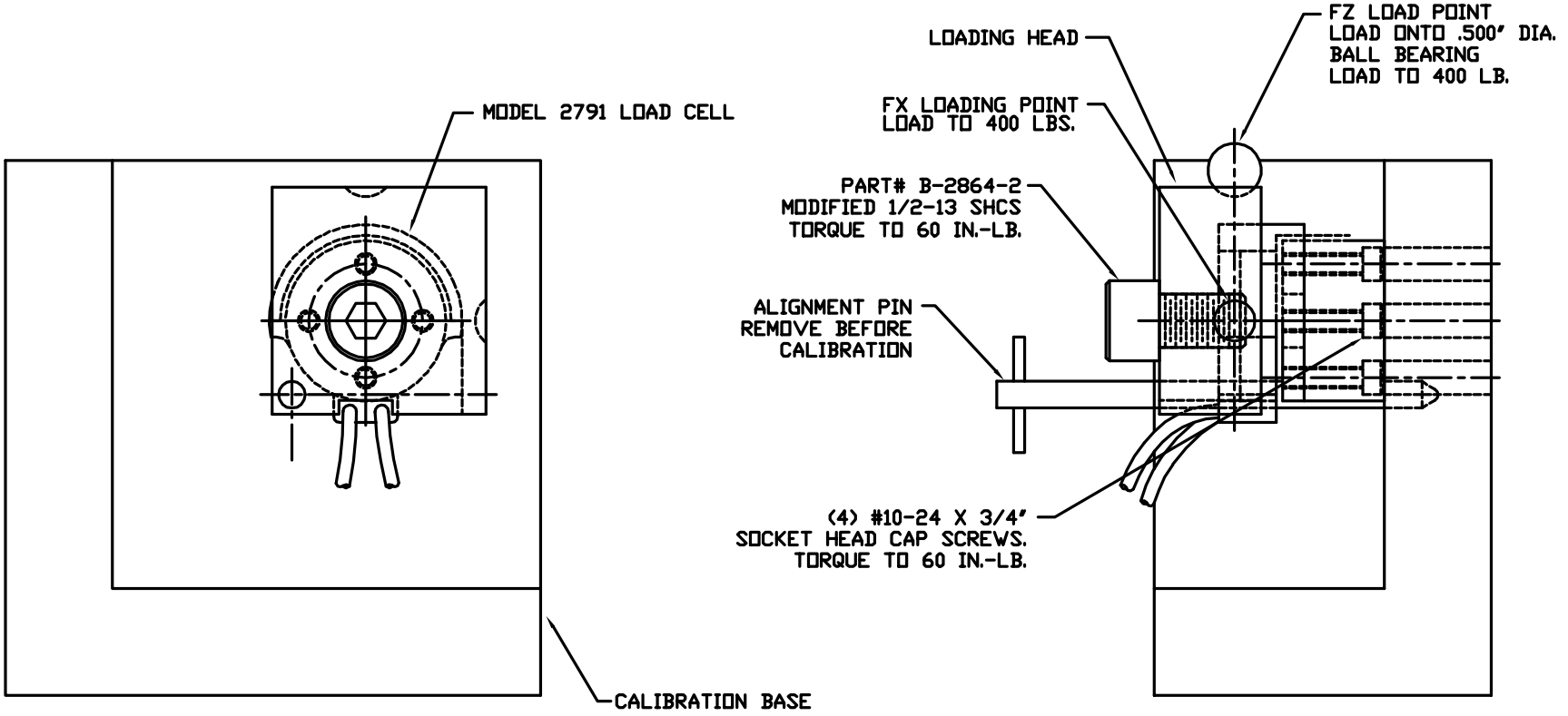
12/18 MONTH CRABI SHOULDER LOAD CELL

SCALE: FULL
DATE: 2/20/93
DRAWN BY: C.R. MORGAN
MODEL: 2791

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2791-D



INSTALLATION INSTRUCTIONS:

1. FASTEN LOAD CELL TO BASE WITH (4) #10-24 X 3/4" SOCKET HEAD CAP SCREWS. TORQUE TO 60 LB.-IN.
2. FASTEN LOADING HEAD TO LOAD CELL WITH (1) 1/2-13 MODIFIED SOCKET HEAD CAP SCREW (.80 LENGTH). INSERT ALIGNMENT PIN THROUGH LOADING HEAD INTO BASE. TORQUE 1/2-13 TO 60 IN.-LB.
3. REMOVE ALIGNMENT PIN BEFORE CALIBRATING.

CALIBRATION FIXTURE MODEL #4034

SYM	REVISION	DATE

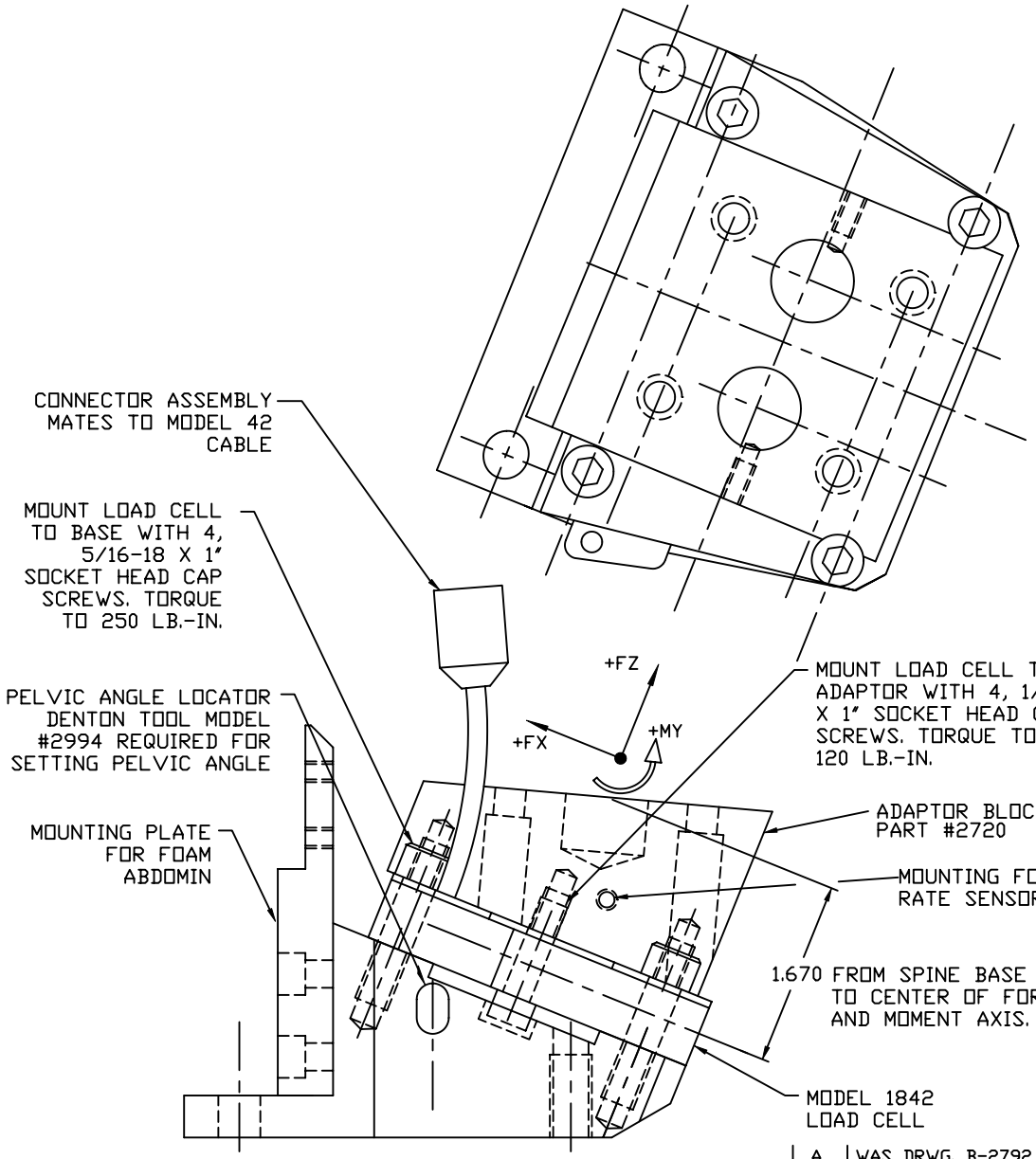
CALIBRATION FIXTURE FOR CRABI SHOULDER LOAD CELL

SCALE: FULL		DRAWN BY: C.R.M.
DATE: 16FEB98		MODEL: 2791

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2791-C



LUMBAR SPINE LOAD CELL

AXIS	CAPACITY	OUTPUT
FX	3000 LBS.	1.0 mV/V NOM.
FZ	3000 LBS.	1.0 mV/V NOM.
MY	5000 LB.-IN.	1.6 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
A	WAS DRWG. B-2792	4/99

3-CHANNEL LUMBAR SPINE LOAD CELL

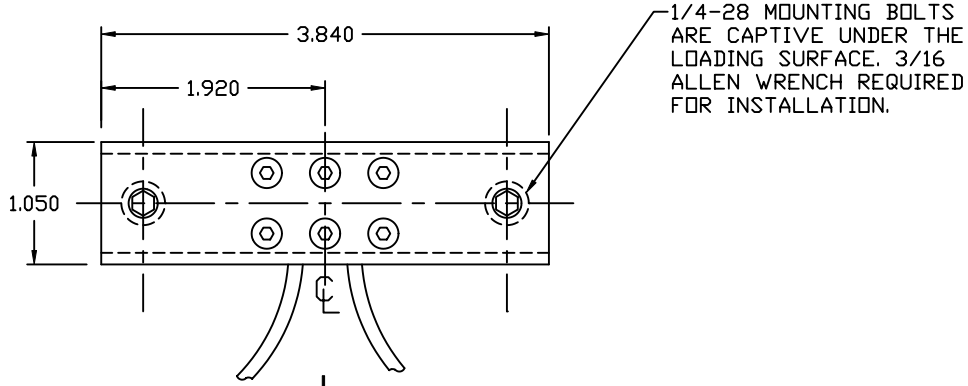
MODEL 1842 ADAPTED TO ADVANCED DUMMY

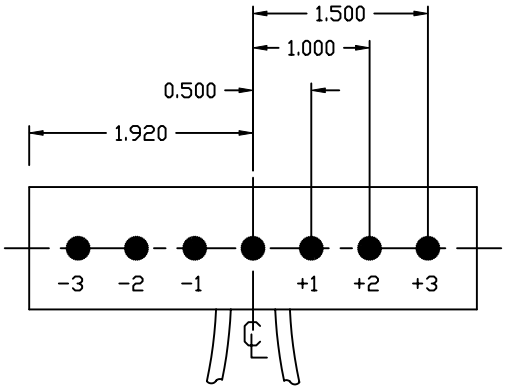
SCALE: FULL		DRAWN BY: C.R. MORGAN
DATE: 3/4/93		MODEL: 2792

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

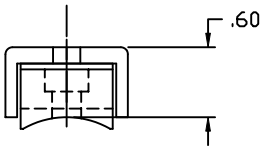
DRAWING NUMBER: B-2792-D





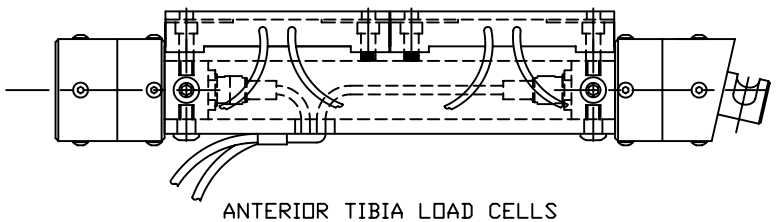
DIMENSIONS SYMMETRIC ABOUT ℄

THE VIEW ABOVE ILLUSTRATES THE CALIBRATION POINT LOCATION AS SPECIFIED ON THE CALIBRATION DATA SHEET.



CABLE:
4 CONDUCTOR
TEFLON INSULATION
SHIELDED
30' LENGTH

THE ANTERIOR TIBIA LOAD CELL MOUNTS ONTO THE FRONT SURFACE OF A MODIFIED INSTRUMENTED LEG (MODEL 1571) OF A HYBRID III 50TH PERCENTILE ATD. THE LOAD CELL CONSISTS OF TWO INDEPENDENT CHANNELS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE TOTAL LOAD AND THE DIFFERENCE IS PROPORTIONAL TO THE POSITION OF THE LOAD ON THE FACE OF THE LOAD CELL. CALIBRATION INFORMATION FOR THE 7 POINTS SHOWN ABOVE IS PROVIDED TO CALCULATE THE OUTPUT/POSITION RELATIONSHIP.



ANTERIOR TIBIA LOAD CELLS
MOUNTED TO V.R.T.C. INSTRUMENTED TIBIA
SCALE: 1:2

	CAPACITY	OUTPUT	BRIDGE RESISTANCE
Ⓑ	1000 LBS. EACH CHANNEL	1.9 mV/V NOM.	350 OHMS

SYM	REVISION	DATE
C	WAS DRG. B-2837	4/99
B	ADD NOTE	3/95
A	ADD ASSEMBLY	3/95

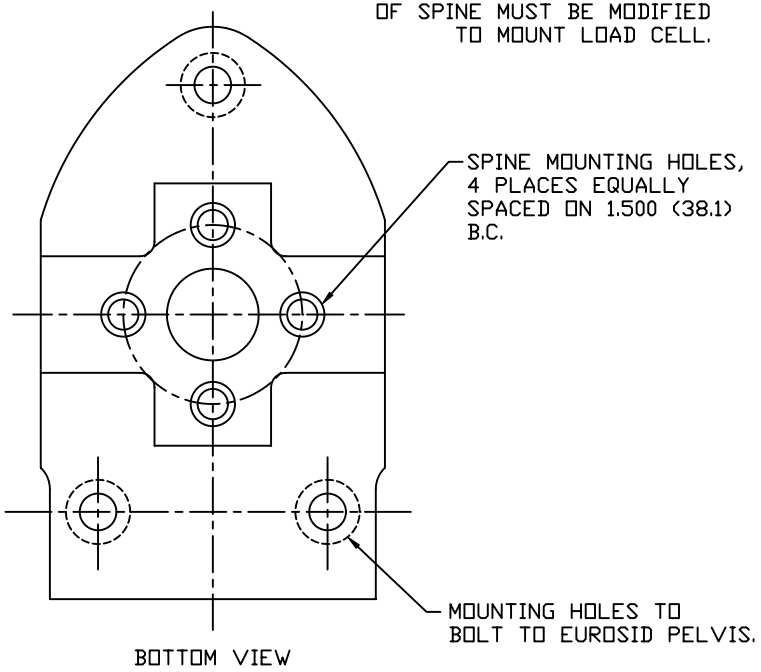
ANTERIOR TIBIA LOAD CELL

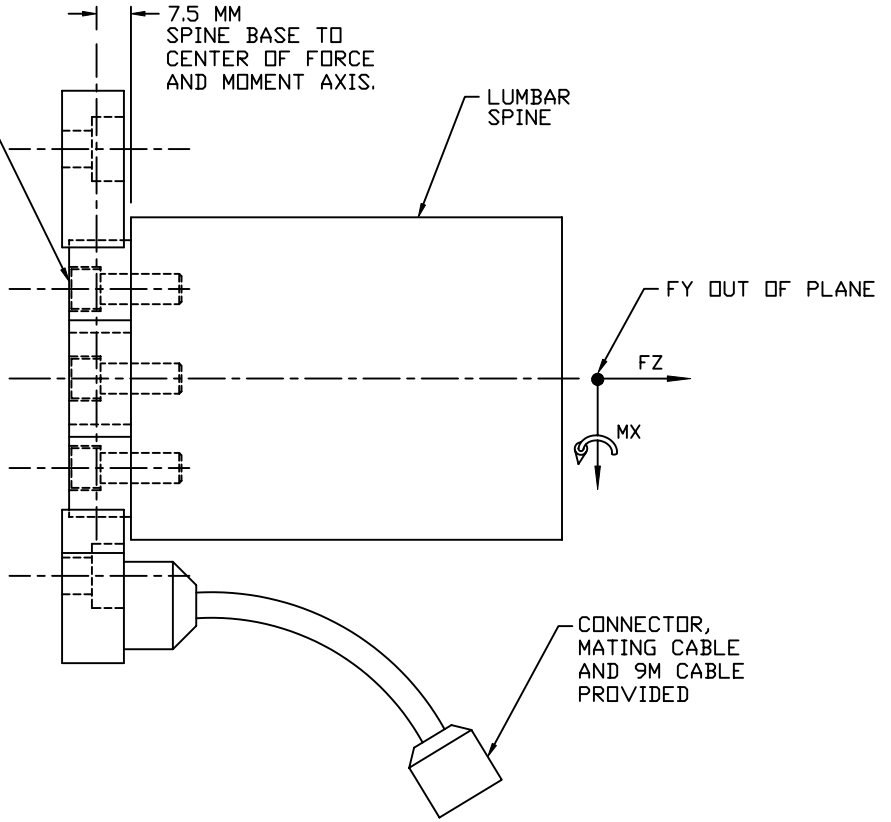
SCALE: FULL
DATE: 6/23/93
DRAWN BY: C.R. MORGAN
MODEL: 2837

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2837-D





LUMBAR SPINE LOAD CELL

AXIS	CAPACITY	OUTPUT
FY	13.5 KN (3000 LBS.)	1.0 mV/V NOM.
FZ	13.5 KN (3000 LBS.)	1.0 mV/V NOM.
MX	550 NM (5000 LB.-IN.)	1.6 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

AXIS POLARITY PER S.A.E. J-211

SYM	REVISION	DATE
A	WAS DRG. B-2890	4/99

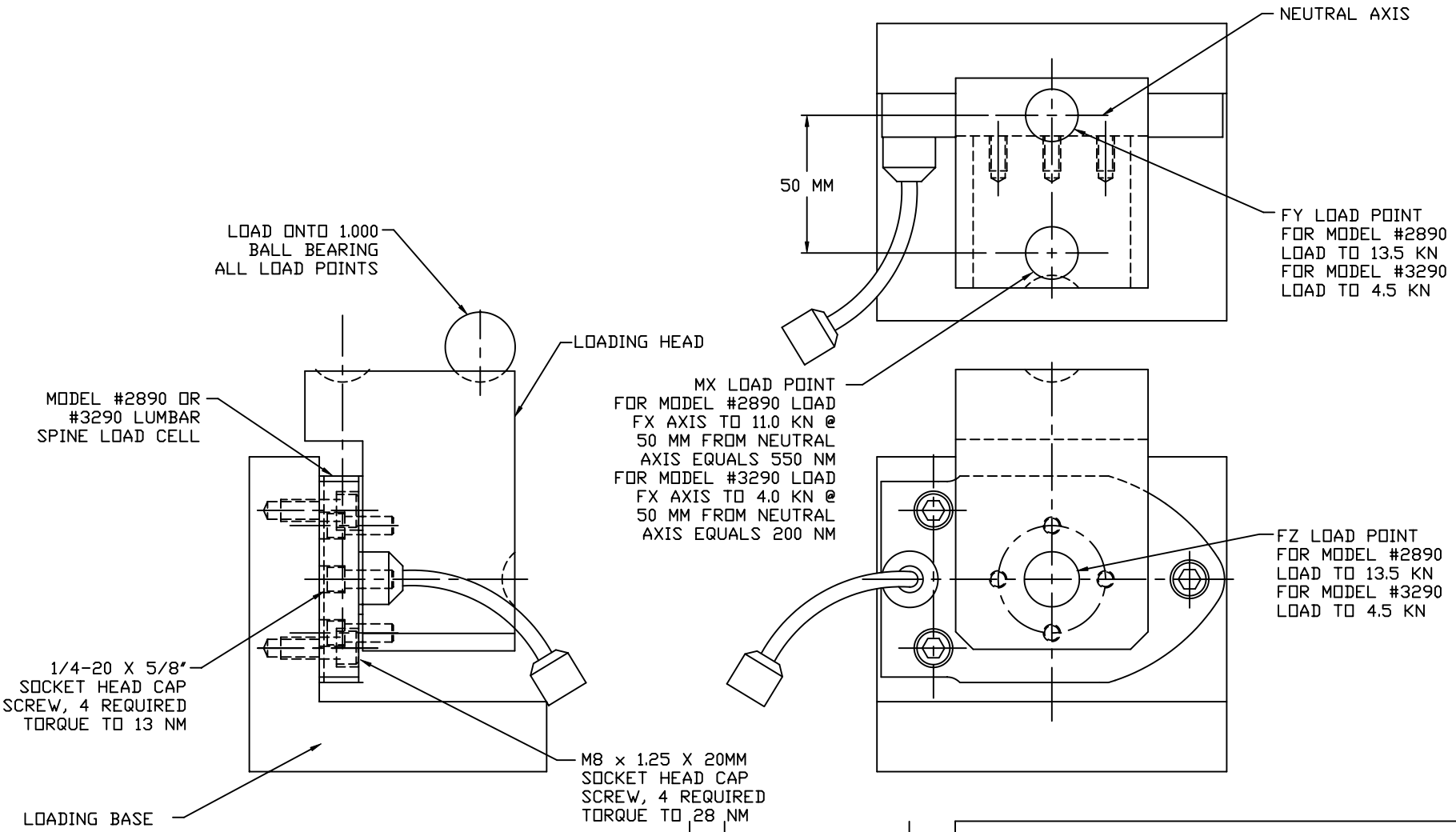
EUROSID-I LUMBAR LOAD CELL

SCALE: FULL		DRAWN BY: C.R. MORGAN
DATE: 8/7/93		MODEL: 2890

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2890-D



SYM	REVISION	DATE
C	WAS DRG. B-3184	4/99
B	ADD MODEL #3290	6/96
A	REV. LOAD HEAD	6/96

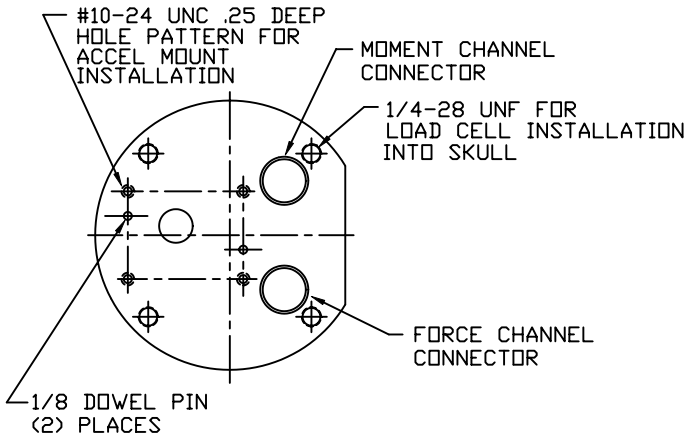
EUROSID I LUMBAR SPINE
CALIBRATION FIXTURE

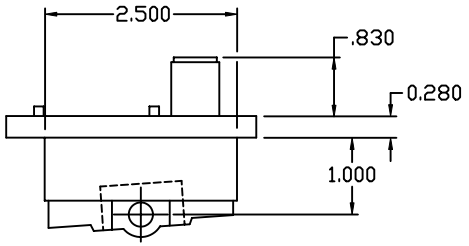
SCALE: .75X
DATE: 23DEC94
DRAWN BY: C.R. MORGAN
MODEL: 3184

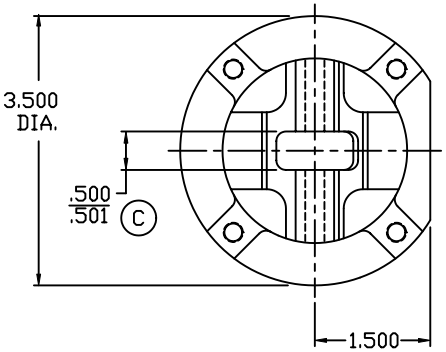
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

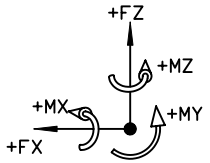
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

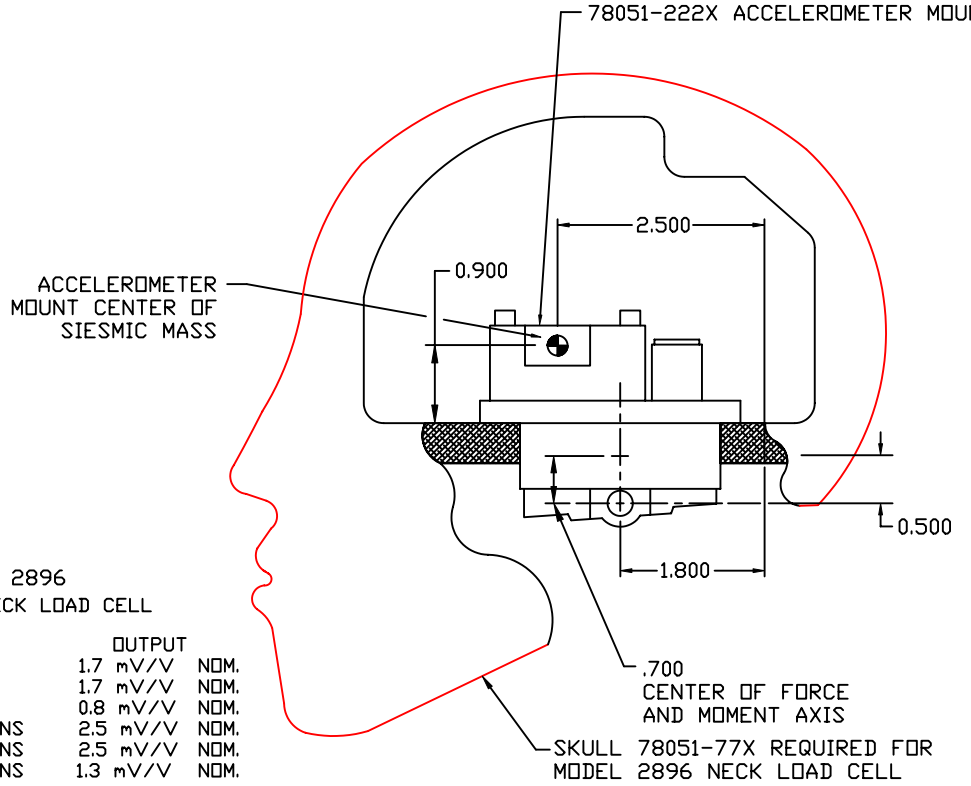
DRAWING NUMBER: B-2890-C











MODEL 2896

SIX CHANNEL NECK LOAD CELL

AXIS	CAPACITY	OUTPUT
FX	200 LBS.	1.7 mV/V NOM.
FY	200 LBS.	1.7 mV/V NOM.
FZ	500 LBS.	0.8 mV/V NOM.
MX	500 LB*INS	2.5 mV/V NOM.
MY	500 LB*INS	2.5 mV/V NOM.
MZ	300 LB*INS	1.3 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
D	WAS DRG. B-2896	4/99
C	CORRECT TOL.	11/98
B	UPDATED PART #	1/98
A	UPDATED TEXT	10/96

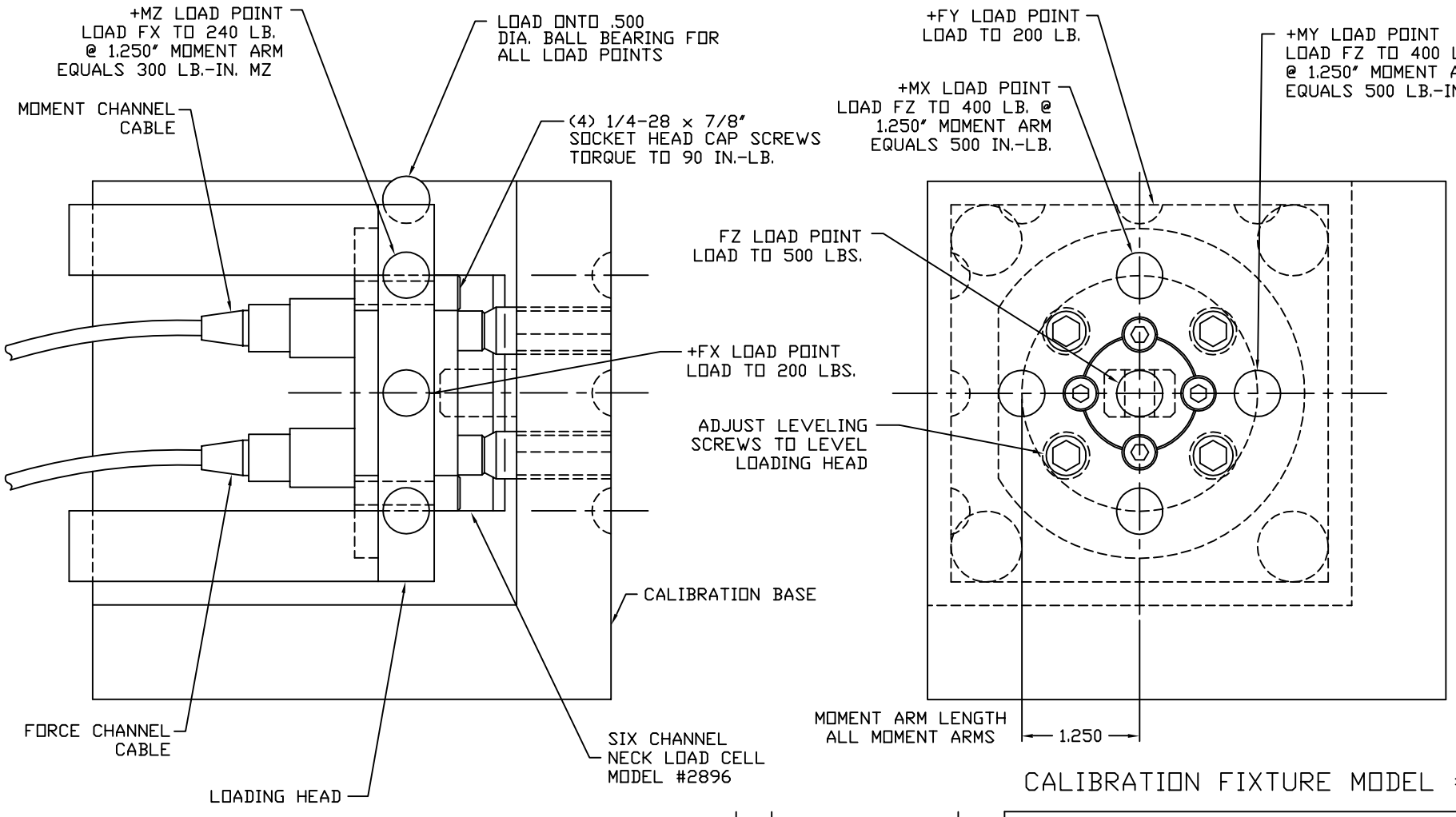
HYBRID III SIX CHANNEL NECK LOAD CELL
LOW CAPACITY

SCALE: NONE
DATE: 2/1/93
DRAWN BY: C.R.M./T.E.D.
MODEL: 2896

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2896-D



CALIBRATION FIXTURE MODEL #1860

SYM	REVISION	DATE

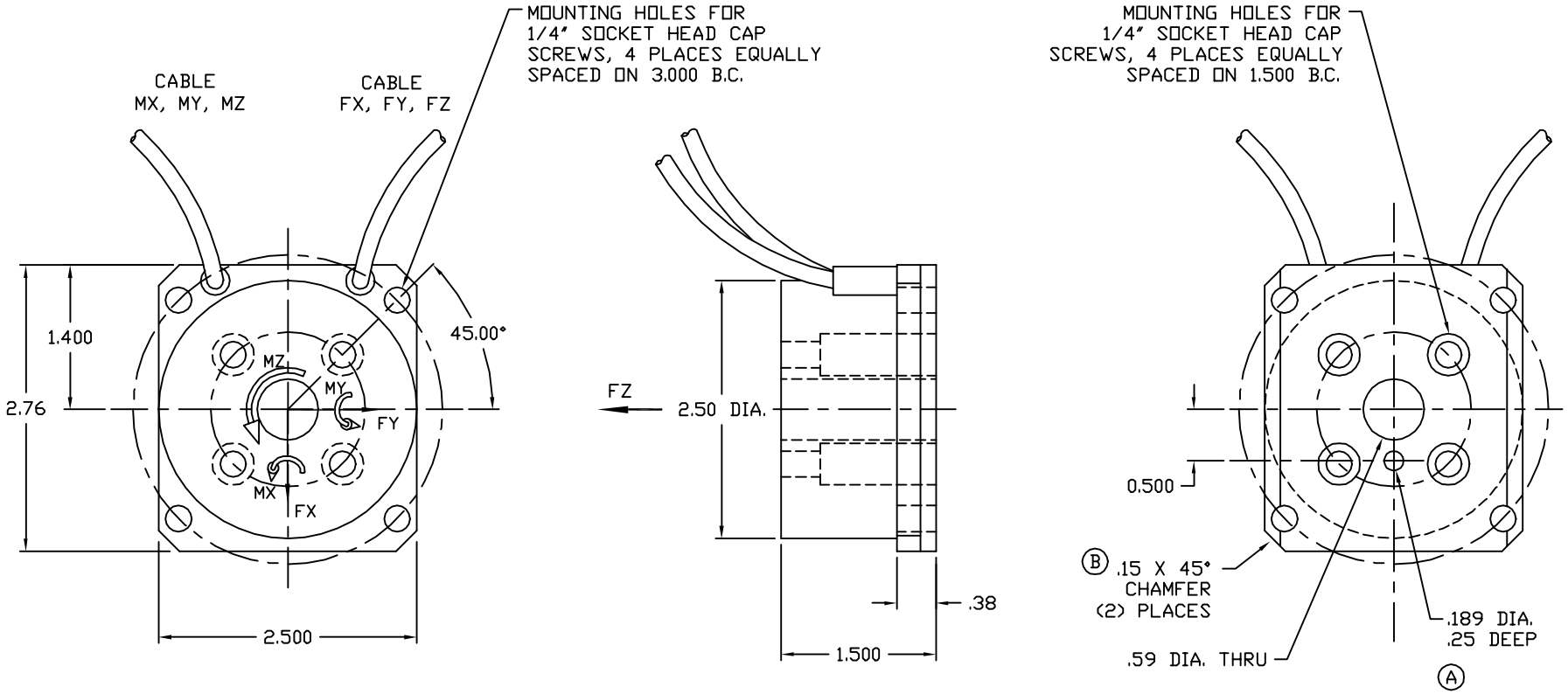
NECK CALIBRATION FIXTURE

SCALE: FULL		DRAWN BY: C.R.M./S.E.P.
DATE: 11/1/85		MODEL: 2896

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2896-C



3 YEAR OLD HYBRID III

6 CHANNEL LUMBAR LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	1000 LBS.	1.6 mV/V NOMINAL	350 OHMS
FY	1000 LBS.	1.6 mV/V NOMINAL	350 OHMS
FZ	1500 LBS.	1.0 mV/V NOMINAL	700 OHMS
MX	1500 LB.-IN.	1.5 mV/V NOMINAL	350 OHMS
MY	1500 LB.-IN.	1.5 mV/V NOMINAL	350 OHMS
MZ	1000 LB.-IN.	1.3 mV/V NOMINAL	700 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT - .49 LBS.

SYM	REVISION	DATE
D	WAS DRG. B-2944	4/99
C	ADD WEIGHT	12/2/98
B	ADD CHAMFER	4/15/96
A	ADD LOCATOR	4/19/94

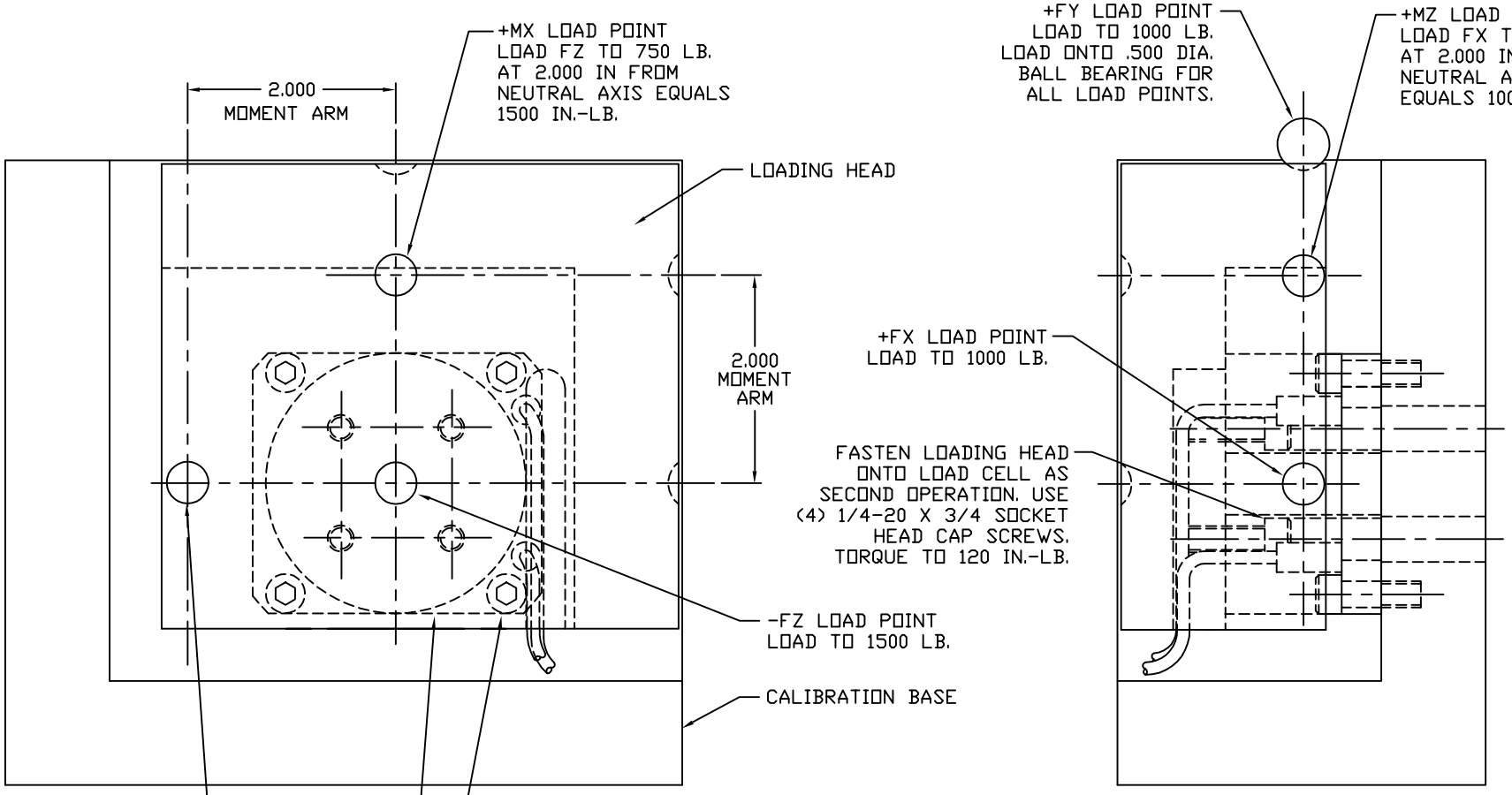
3 YEAR OLD HYBRID III
LUMBAR LOAD CELL

SCALE: FULL
DATE: 10/10/93
DRAWN BY: C.R. MORGAN
MODEL: 2944

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2944-D



CALIBRATION FIXTURE MODEL #3437

SYM	REVISION	DATE
B	WAS DRG. B-3437	4/99
A	ADD. SLOT	11/96

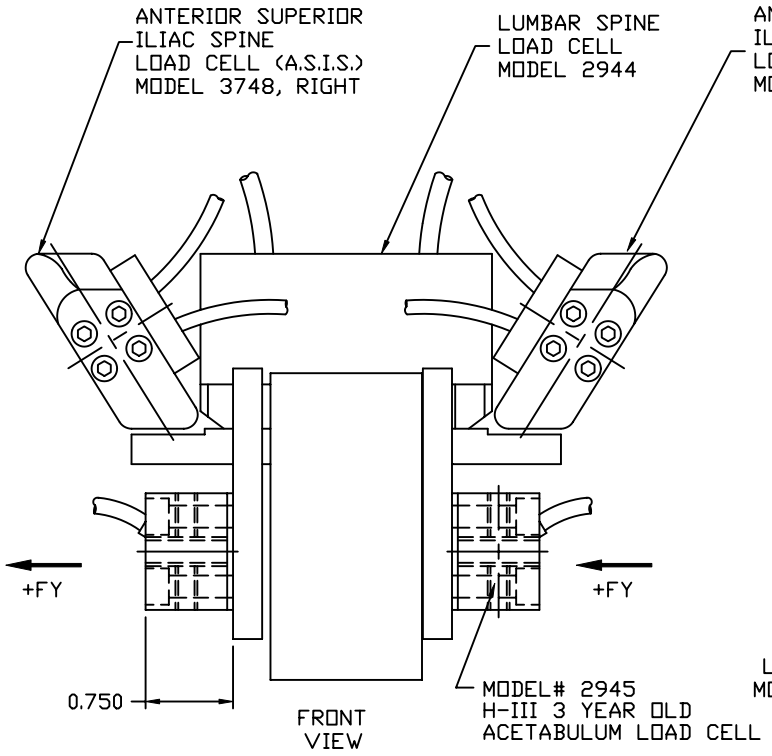
3 YEAR OLD HIII LUMBAR LOAD CELL CALIBRATION FIXTURE

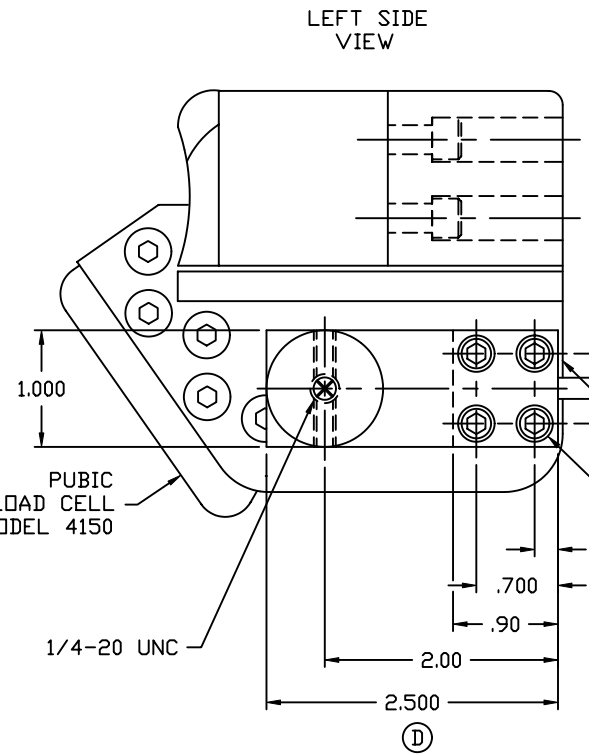
SCALE: FULL
DATE: 12/01/95
DRAWN BY: H. PROCTOR
MODEL: 2944

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2944-C





BODY SEGMENT MANIPULATIONS
FOR POSITIVE LOAD CELL OUTPUT
ACCORDING TO SAE J-211.

LEFT ACETABULUM LOAD CELL

+FY LEFT ACETABULUM RIGHTWARD, CHEST LEFTWARD

RIGHT ACETABULUM LOAD CELL

+FY RIGHT ACETABULUM RIGHTWARD, CHEST LEFTWARD

● REPRESENTS A FORCE VECTOR DIRECTED OUT OF THE PAGE

✕ REPRESENTS A FORCE VECTOR DIRECTED INTO THE PAGE

THE AXIS SHOWN ILLUSTRATE THE DIRECTION OF APPLIED FORCES TO THE H-POINT FOR POSITIVE LOAD CELL OUTPUT ACCORDING TO SAE J-211.

MODEL #2945
H-III 3 YEAR OLD ACETABULUM LOAD CELL

CAPACITY: 1000 LBS.
OUTPUT @ CAPACITY: 2mV/V NOM.
NONLINEARITY < 1% OF FULL SCALE
WEIGHT - .38 LBS. EACH

NOTE:
THE LOAD CELL CALIBRATION DATA IS REFERENCED TO THE "RIGHT HAND RULE" AS APPLIED BY DENTON INC. TO CONFORM TO SAE J-211 SIGN CONVENTION, THE POLARITY OF THE DATA FOR FY ON THE RIGHT ACETABULUM MUST BE CHANGED.

SYM	REVISION	DATE
G	WAS DRG. B-2945	4/99
F	ADD DETAIL	9/98
E	REV. LAYOUT	8/97
D	REV. DIM'S.	5/97
C	REV. POLARITY	10/96
B	2.375 WAS 2.875	3/94
A	REV. THREADS	10/93

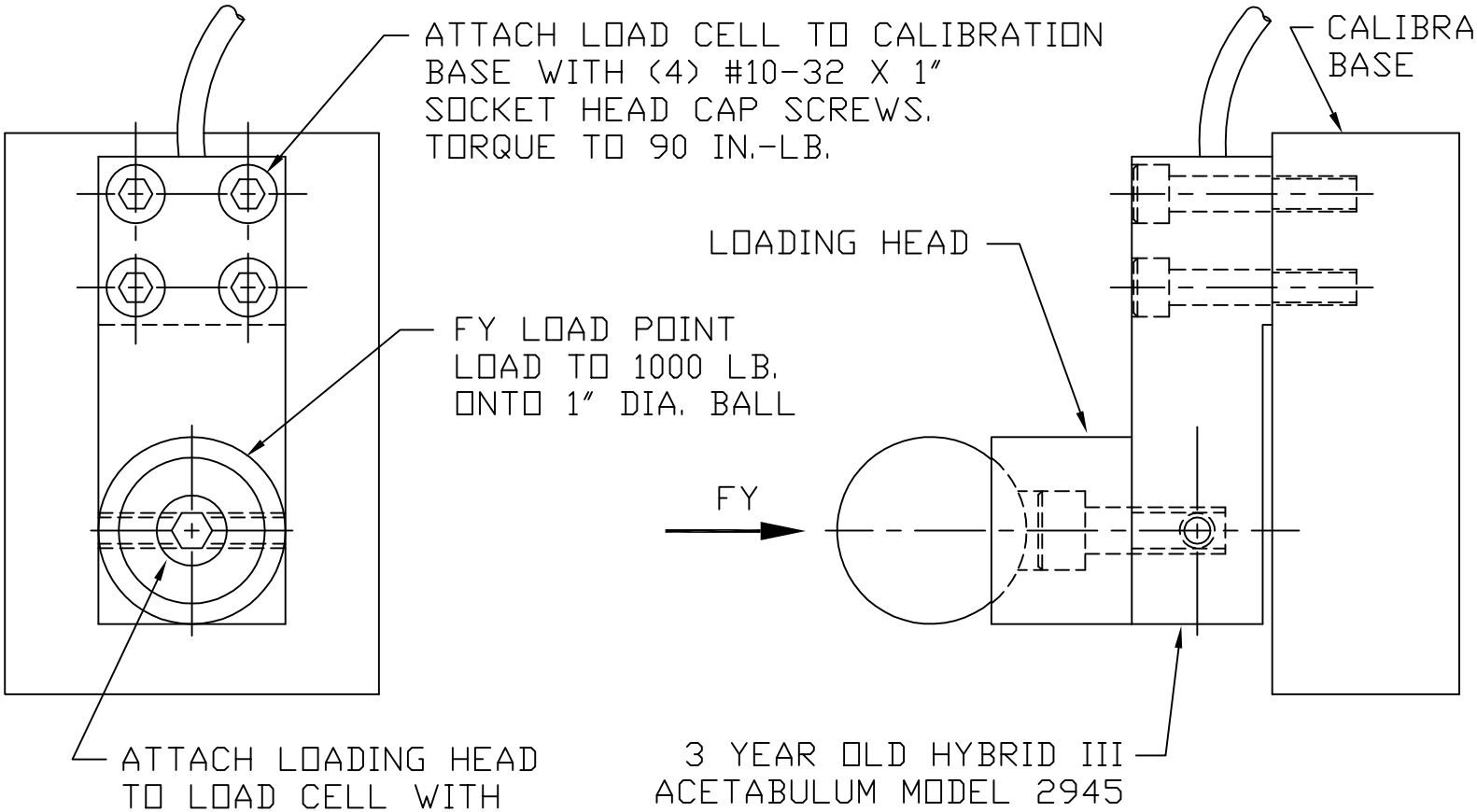
3 YEAR OLD HYBRID III ACETABULUM LOAD CELL

SCALE: FULL
DATE: 10/10/93
DRAWN BY: C.R. MORGAN
MODEL: 2945

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2945-D



CALIBRATION FIXTURE MODEL #3222

3YR. ACETABULUM CALIBRATION FIXTURE

SCALE: FULL			DRAWN BY: *H. PROCTOR*
DATE: 10/25/95			MODEL: 2945

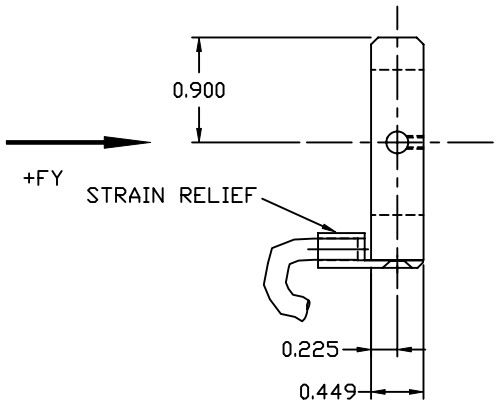
UNLESS OTHERWISE SPECIFIED

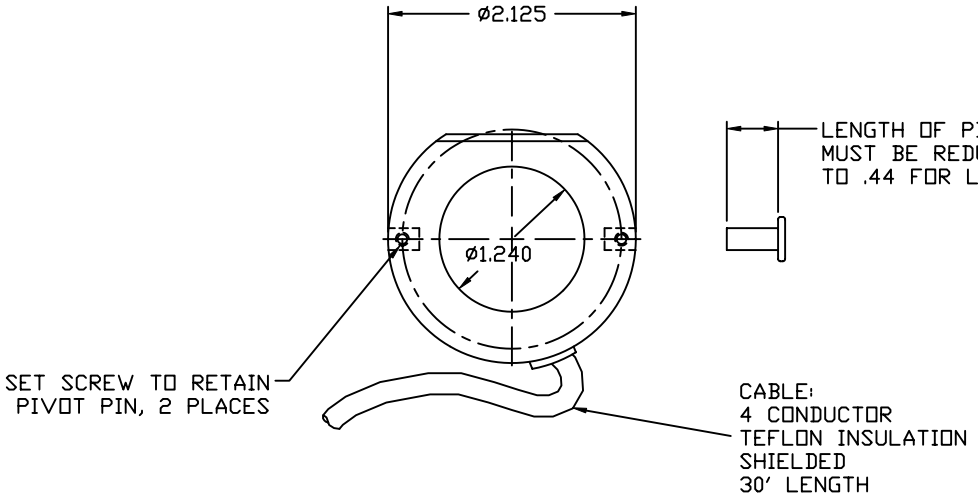
TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-2945-C

SYM	REVISION	DATE
B	WAS DRG. A-3222	4/99
A	REV. HOLE PAT'N.	5/97





CAPACITY: 3000 LBS.
OUTPUT @ CAPACITY: 2 mV/V NOMINAL
NONLINEARITY: < 1% OF FULL SCALE

SYM	REVISION	DATE
B	WAS DRG. B-2981	4/99
A	CHG STRAIN RELIEF	5/98

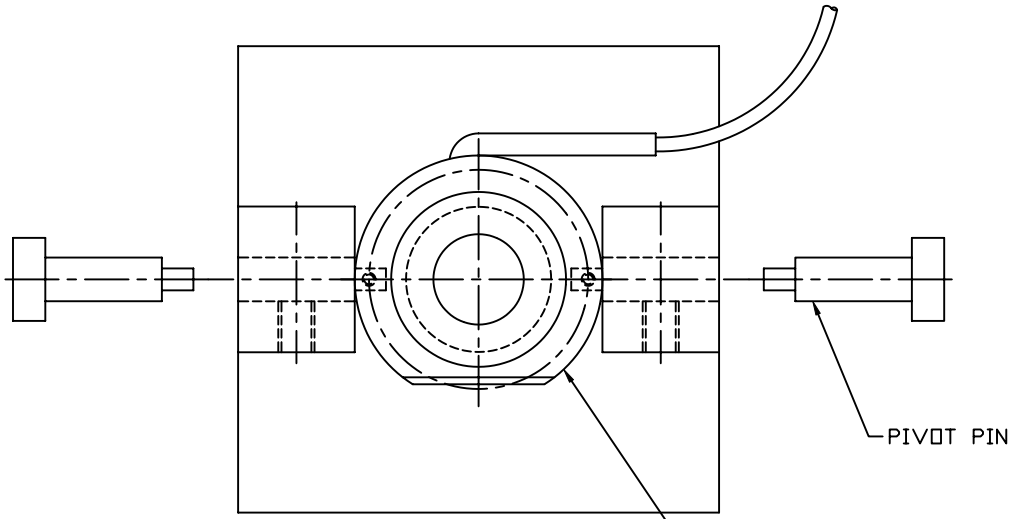
D.O.T. S.I.D. DAMPER LOAD CELL

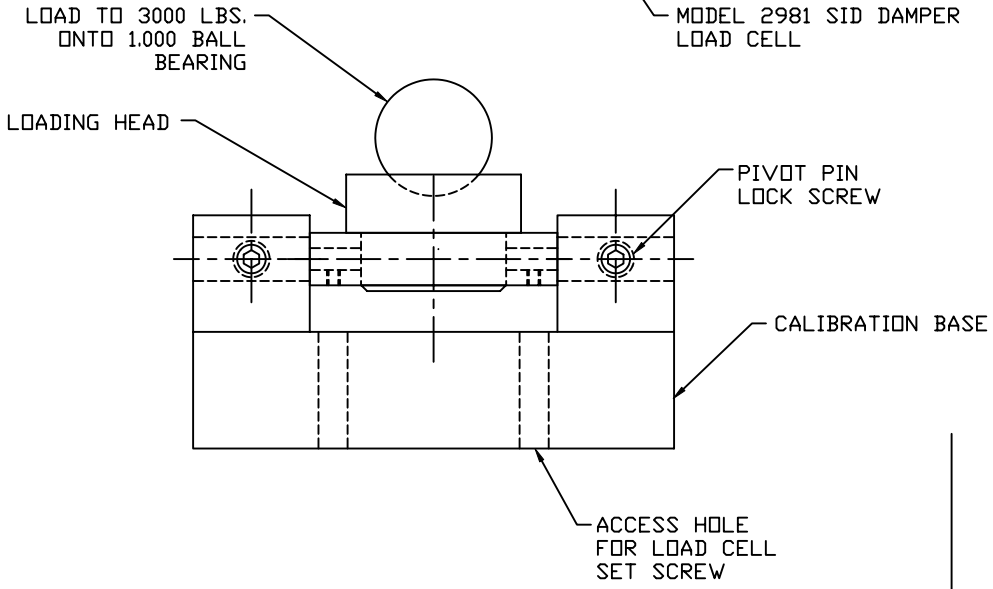
SCALE: FULL
DATE: 1/7/94
DRAWN BY: C.R. MORGAN
MODEL: 2981

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2981-D





ASSEMBLY INSTRUCTIONS

1. PLACE LOAD CELL WITH POTTED AREA UPWARDS INTO CALIBRATION BASE AND INSERT PIVOT PINS INTO LOAD CELL. THE HEAD OF THE PIVOT PINS SHOULD BEAR AGAINST THE CALIBRATION BASE.
2. TIGHTEN 2 SET SCREWS IN LOAD CELL TO SECURE LOAD CELL TO PIVOT PINS. ACCESS LOAD CELL SET SCREWS THROUGH HOLES IN THE CALIBRATION BASE.
3. LEVEL LOAD CELL TO CALIBRATION BASE AND TIGHTEN PIVOT PIN LOCK SCREWS.
4. PLACE LOADING HEAD INTO CENTER HOLE OF LOAD CELL.
5. PLACE 1.000 DIA. BALL BEARING INTO DETENT OF LOADING HEAD.

SYM	REVISION	DATE
A	WAS DRG. B-3000	4/99

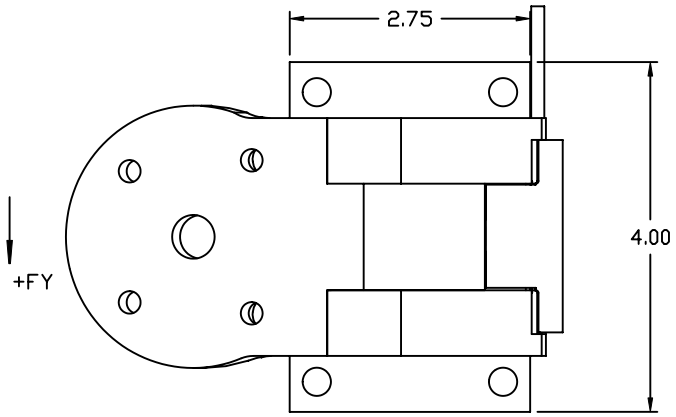
S.I.D. DAMPER CAL FIXTURE

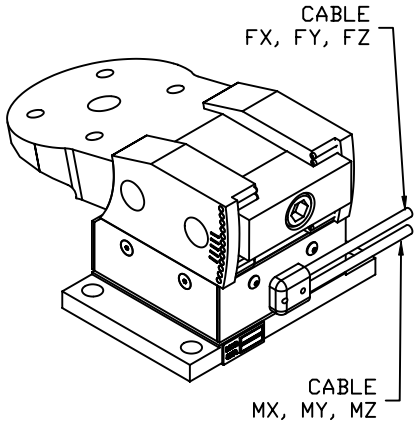
SCALE: FULL		DRAWN BY: C.R. MORGAN
DATE: 2/24/94		MODEL: 2981

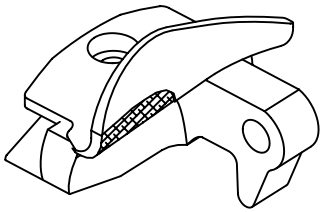
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2981-C

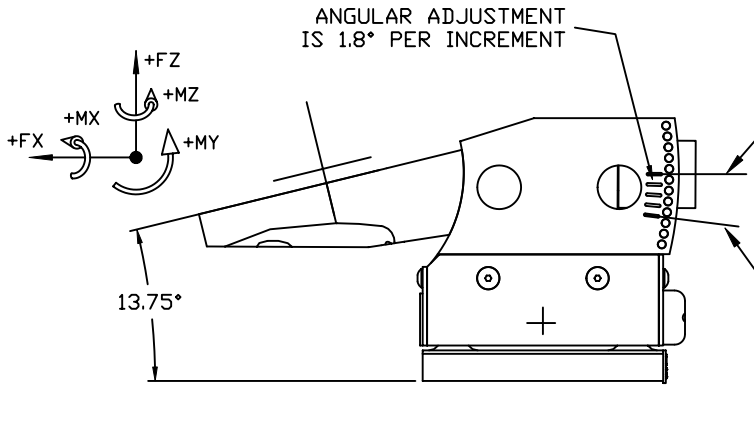






CLAVICLE FITTING

DUE TO VARIANCE IN CLAVICLE LINK ASSEMBLIES, SOME CLAVICLE LINKS MAY CAUSE A FIT PROBLEM WHEN USING THIS LOAD CELL. THE CLAVICLE CAN BE TRIMMED IN THE AREA SHOWN. THE REMOVAL OF APPROXIMATELY 0.08 (2mm) DEPTH OF MATERIAL WILL SUFFICE.



LOWER NECK LOAD CELL
MODEL 2992

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	1500 LBS	2.2 mV/V NOM.	350 OHMS
FY	1500 LBS	2.2 mV/V NOM.	350 OHMS
FZ	2000 LBS	1.5 mV/V NOM.	700 OHMS
MX	3000 IN-LBS	1.4 mV/V NOM.	700 OHMS
MY	3000 IN-LBS	1.4 mV/V NOM.	700 OHMS
MZ	2000 IN-LBS	2.0 mV/V NOM.	350 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

THE LOWER NECK LOAD CELL ASSEMBLLY, MODEL 2992, DUPLICATES THE NECK POSITION OF STANDARD BRACKETS (78051-303 & -307). THE LOAD CELL IS ADJUSTABLE FOR NECK ANGLES FROM -3.6° TO +7.2° FROM THE '0' POSITION IN 1.8° INCREMENTS.

SYM	REVISION	DATE
D	CABLE EXIT MOVED	4/99
C	REDRWN TO MDT	4/99

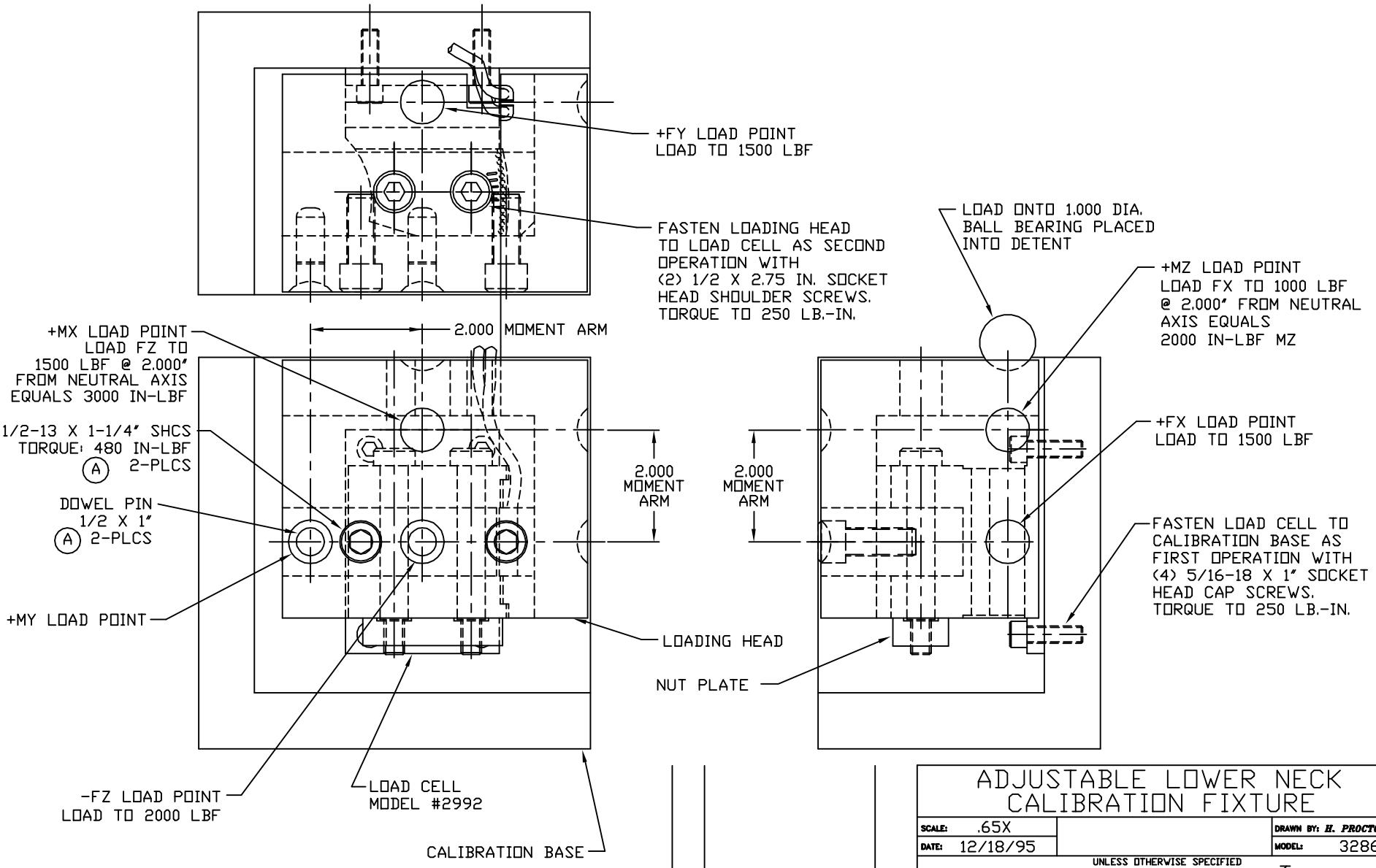
ADJUSTABLE LOWER NECK

SCALE: FULL
DATE: 11APR99
DRAWN BY: R. DUPONT
MODEL: 2992

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2992-D



SYM	REVISION	DATE
B	ADD SLOT	5/00
A	ADD HARDWARE	9/99

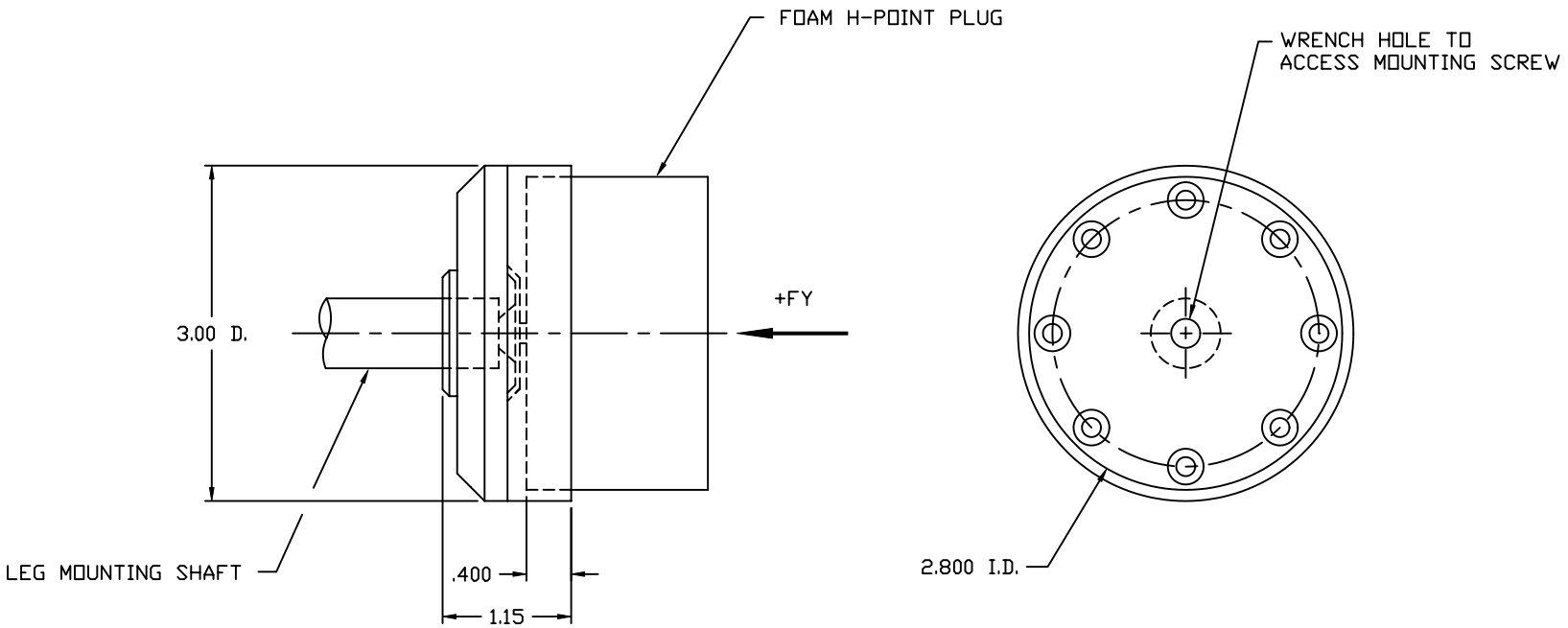
ADJUSTABLE LOWER NECK CALIBRATION FIXTURE

SCALE: .65X
DATE: 12/18/95
DRAWN BY: H. PROCTOR
MODEL: 3286

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2992-C



BIOSID ACETABULUM LOAD CELL

MEASURED AXIS: FY
CAPACITY: 5000 LBS.
OUTPUT @ CAPACITY: 2mV/V NOMINAL

SYM	REVISION	DATE
A	WAS DRG. B-3043	4/99

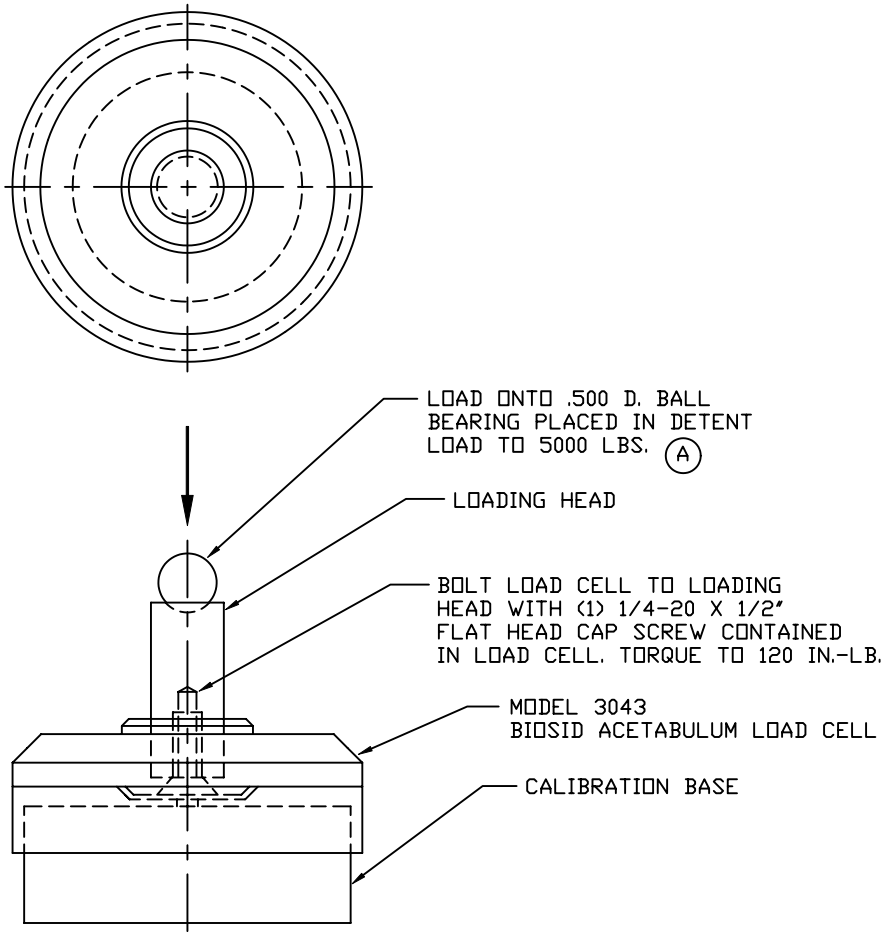
BIOSID ACETABULUM LOAD CELL

SCALE: FULL
DATE: 10/23/95
DRAWN BY: C.R. MORGAN
MODEL: 3043

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3043-D



SYM	REVISION	DATE
B	WAS DRG. B-3047	4/99
A	CHG LOAD TO 5000	9/98

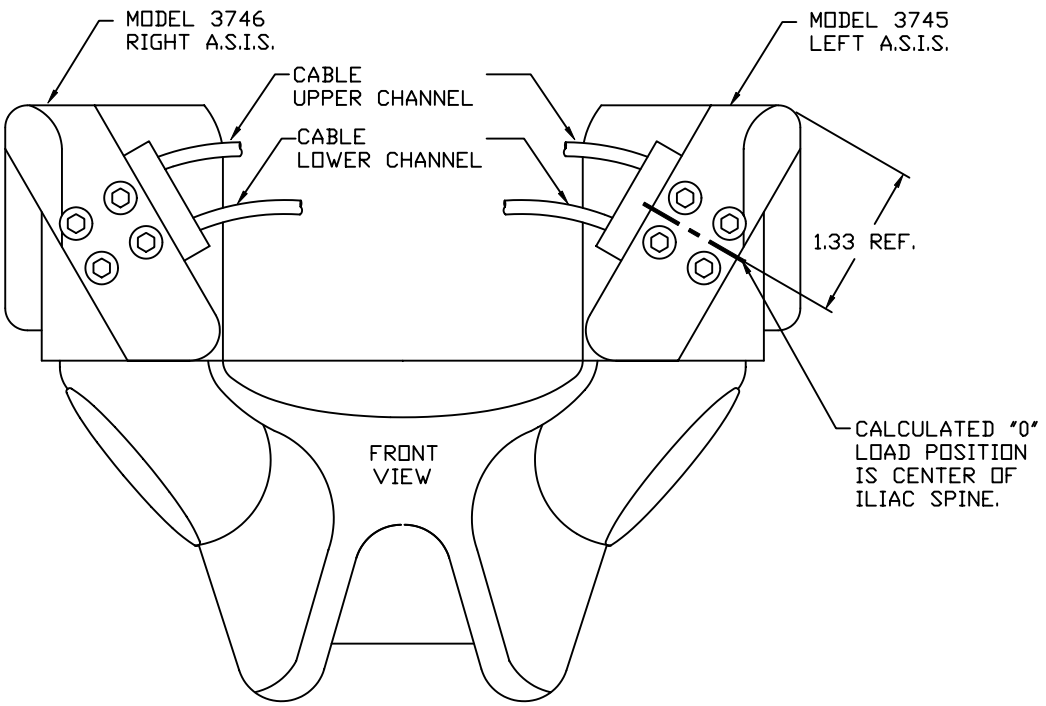
BIOSID ACETABULUM CALIBRATION FIXTURE

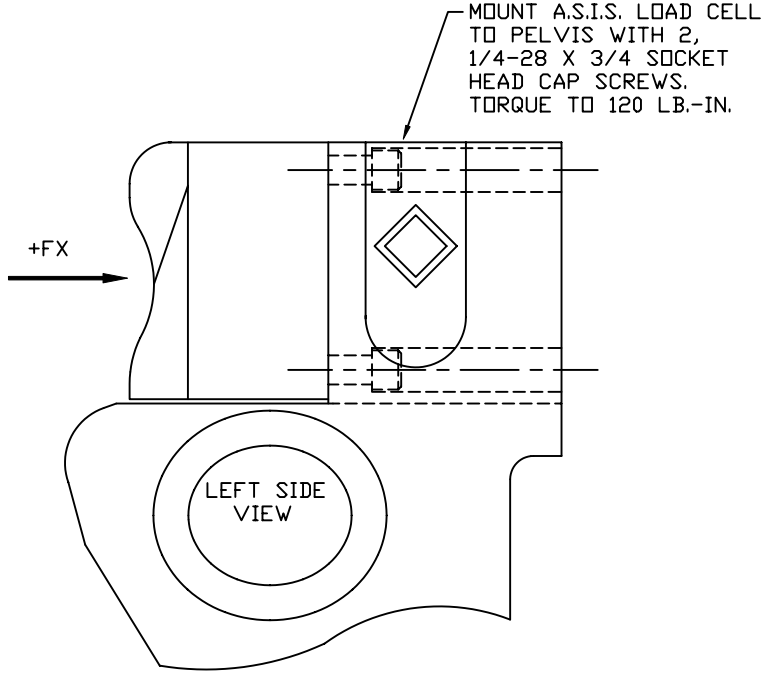
SCALE: FULL
DATE: 13MAY95
DRAWN BY: C.R. MORGAN
MODEL: 3047

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3043-C





THE MODEL 3060, A.S.I.S. LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE AND POSITION OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THE LOAD CELL CONSISTS OF TWO INDEPENDANT FX CHANNELS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE THE TOTAL LOAD. THE DIFFERENCE OF THE TWO CHANNELS DIVIDED BY THE SUM IS PROPORTIONAL TO THE POSITION OF THE LOAD ON THE FACE OF THE LOAD CELL. THE POSITION IS CALCULATED AS FOLLOWS:

((FORCE UPPER-FORCE LOWER)/(FORCE UPPER+FORCE LOWER)) X 1.27
=DISTANCE
NOTE:
THE FORCES ARE IN ENGINEERING UNITS
THE DISTANCE IS IN INCHES ABOVE THE LOAD CELL CENTER LINE

NOTE: THE LOAD CELL CALIBRATION DATA IS POSITIVE FOR COMPRESSION ON THE FRONT FACE OF THE LOAD CELL. TO CONFORM TO S.A.E. J-211 POLARITY, THE POLARITY OF BOTH THE UPPER AND LOWER CHANNELS MUST BE CHANGED.

A.S.I.S. LOAD CELL

MODEL 3060 LOAD CELL ASSEMBLY CONSISTS OF ONE OF MODEL 3745 LEFT A.S.I.S. AND ONE OF MODEL 3746 RIGHT A.S.I.S.

AXIS	CAPACITY	OUTPUT
FX-UPPER	500 LBS.	1.0 mV/V NOMINAL
FX-LOWER	500 LBS.	1.0 mV/V NOMINAL

NONLINEARITY <1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

CABLE COLOR CODE @ LOAD CELL

RED	+EXCITATION
GREEN	+SIGNAL
BLACK	-EXCITATION
WHITE	-SIGNAL

SYM	REVISION	DATE
D	WAS DRG. B-3060	4/99
C	ADD TEXT, DETAILS	4/98
B	ADD MODEL #	1/97
A	ADD CALCULATION	8/95

ANTERIOR SUPERIOR ILIAC SPINE LOAD CELL

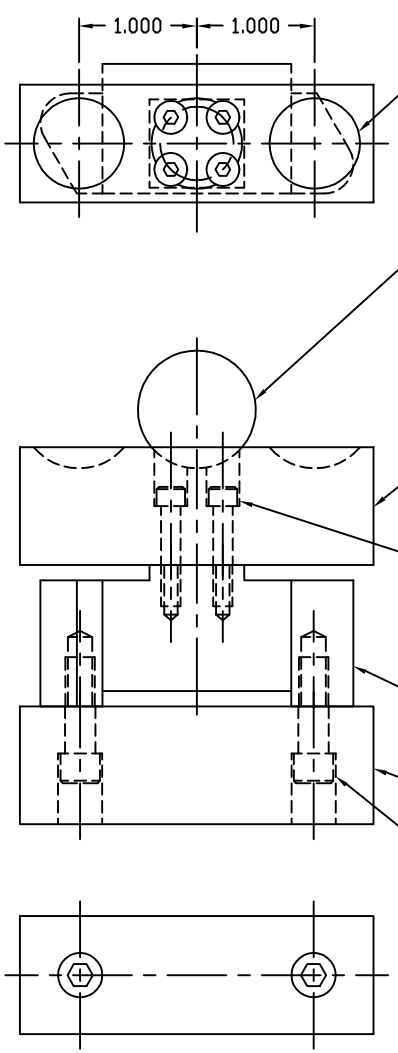
HYBRID III SIX YEAR OLD

SCALE: FULL
DATE: 3JUNE94
DRAWN BY: C.R. MORGAN
MODEL: 3060

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3060-D



STANDARD CALIBRATION:

THE MODEL 3060 LOAD CELL CONSISTS OF TWO INDEPENDENT FX CHANNELS. WHEN THE LOAD CELL IS LOADED DIRECTLY OVER CENTER, EACH CHANNEL RECEIVES 50% OF THE TOTAL LOAD. THE STANDARD CALIBRATION CONSISTS OF LOADING THE CENTER DETENT TO 1000 LBS. TO CALIBRATE EACH CHANNEL TO 500 LBS. (50% OF THE TOTAL LOAD).

COMPREHENSIVE CALIBRATION:

THE MODEL 3060 LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE AND POSITION OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE TOTAL LOAD. THE DIFFERENCE OF THE TWO CHANNELS DIVIDED BY THE SUM IS PROPORTIONAL TO THE POSITION OF THE LOAD ON THE FACE OF THE LOAD CELL. THE POSITION IS CALCULATED AS FOLLOWS:

((FORCE UPPER-FORCE LOWER)/(FORCE UPPER+FORCE LOWER)) X 1.27 =DISTANCE
NOTE:
THE FORCES ARE IN ENGINEERING UNITS
THE DISTANCE IS IN INCHES ABOVE THE LOAD CELL CENTER LINE

TO VERIFY THE ABOVE LISTED CALCULATION, LOAD TO 500 LBS. AT BOTH OF THE OUTSIDE DETENTS. CONVERT THE OUTPUT OBTAINED INTO ENGINEERING UNITS BASED ON THE CALIBRATION PERFORMED ON THE LOAD CELL CENTER. CALCULATE THE POSITION BASED ON THE EQUATION AS LISTED ABOVE.

THE CALCULATED POSITION SHOULD BE WITHIN 5% OF THE ACTUAL 1.000" LOADING POSITION.

CALIBRATION FIXTURE MODEL #3547

SYM	REVISION	DATE
A	WAS DRG. B-3547	4/99

CALIBRATION FIXTURE FOR
HYBRID III 6 YEAR OLD A.S.I.S.

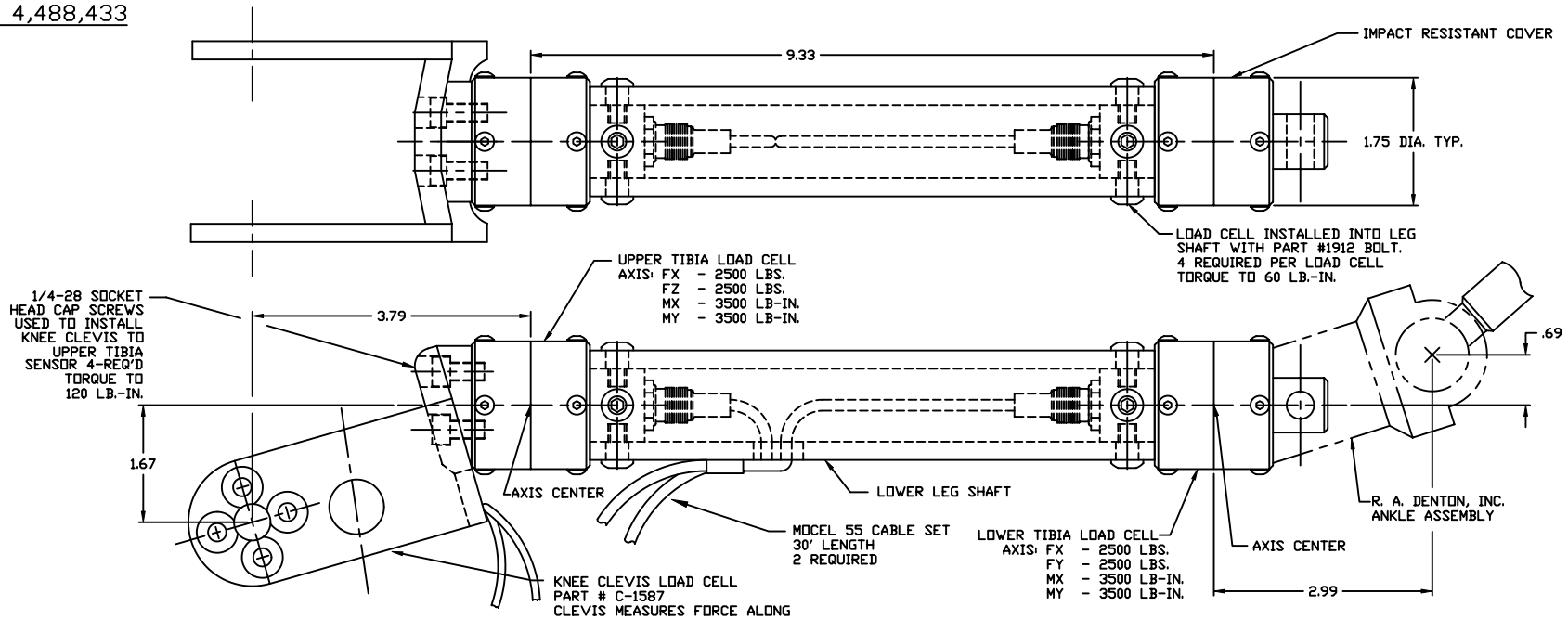
SCALE: FULL | DRAWN BY: C.R.M.
DATE: 26SEPT96 | MODEL: 3060

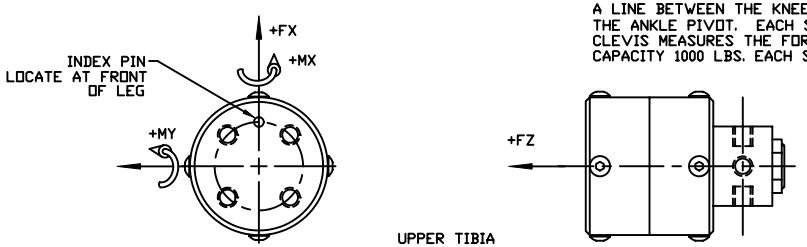
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3060-C

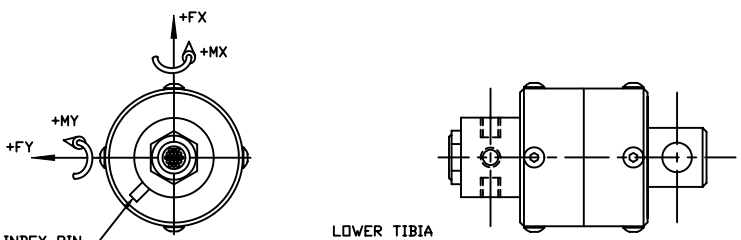
PATENT 4,488,433





UPPER TIBIA
MODEL 3115

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.



LOWER TIBIA
MODEL 3114

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SYM	REVISION	DATE
A	WAS DRG. B-3071	4/99

ENHANCED INSTRUMENTED TIBIA

50TH PERCENTILE HYBRID III

SCALE: NONE
DATE: 19MAY94
DRAWN BY: C.R. MORGAN
MODEL: 3071

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3071-D

SEE DWGS:

1587-C FOR KNEE CLEVIS

3115-C FOR UPPER TIBIA

3114-C FOR LOWER TIBIA

SYM	REVISION	DATE

ENHANCED INSTRUMENTED TIBIA

CALIBRATION FIXTURES

SCALE: FULL		DRAWN BY: RD
DATE: 07OCT99		MODEL: 3071

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS ± .010 — SURFACE FINISH 125

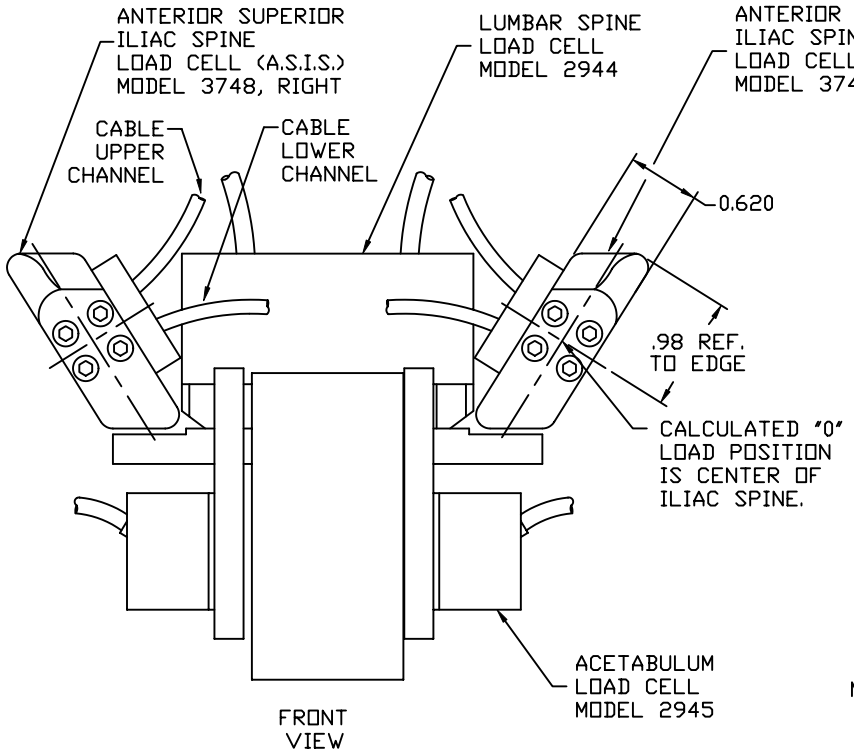
THREE PLACE DECIMALS ± .005 — REMOVE ALL BURRS & SHARP EDGES

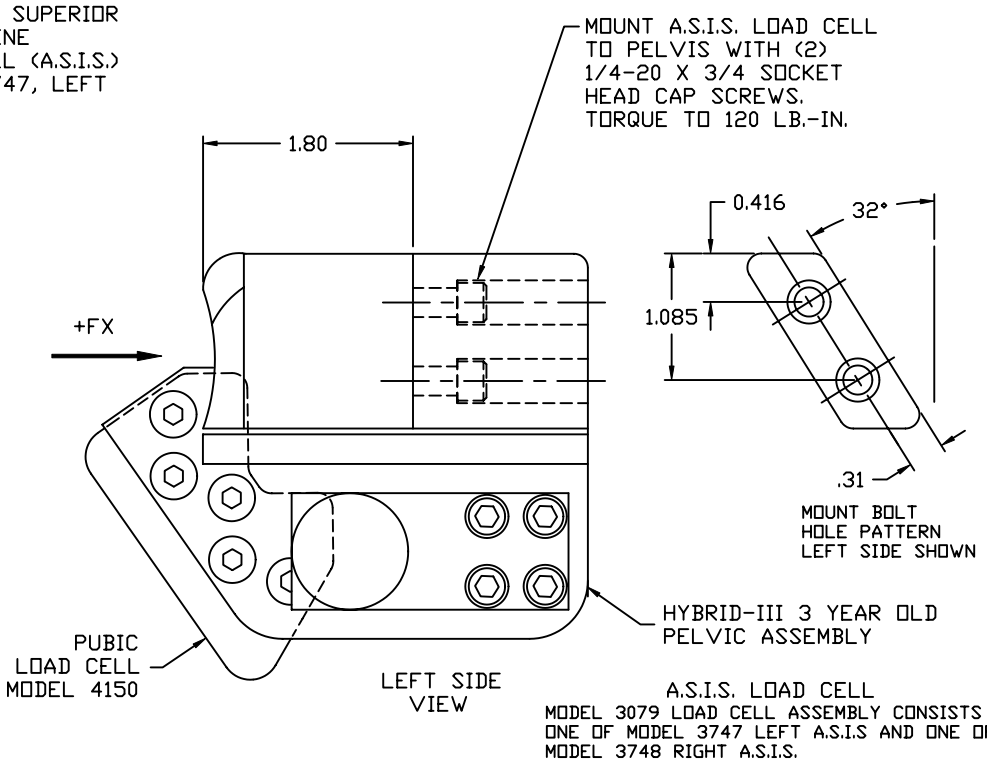
ANGLES ± 0° 30' — DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.

ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3071-C





THE MODEL 3079, A.S.I.S. LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE AND POSITION OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THE LOAD CELL CONSISTS OF TWO INDEPENDANT FX CHANNELS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE THE TOTAL LOAD. THE DIFFERENCE OF THE TWO CHANNELS DIVIDED BY THE SUM IS PROPORTIONAL TO THE POSITION OF THE LOAD ON THE FACE OF THE LOAD CELL. THE POSITION IS CALCULATED AS FOLLOWS:

((FORCE UPPER-FORCE LOWER)/(FORCE UPPER+FORCE LOWER)) X .79 = DISTANCE

THE FORCES ARE IN ENGINEERING UNITS
THE DISTANCE IS IN INCHES ABOVE THE LOAD CELL CENTER LINE

NOTE: THE LOAD CELL CALIBRATION DATA IS POSITIVE FOR COMPRESSION ON THE FRONT FACE OF THE LOAD CELL. TO CONFORM TO S.A.E. J-211 POLARITY, THE POLARITY OF BOTH THE UPPER AND LOWER CHANNELS MUST BE CHANGED.

A.S.I.S. LOAD CELL

MODEL 3079 LOAD CELL ASSEMBLY CONSISTS OF ONE OF MODEL 3747 LEFT A.S.I.S AND ONE OF MODEL 3748 RIGHT A.S.I.S.

AXIS	CAPACITY	OUTPUT
FX-UPPER	400 LBS.	1.4 mV/V NOMINAL
FX-LOWER	400 LBS.	1.4 mV/V NOMINAL

NONLINEARITY <1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT - .40 LBS. EACH

CABLE COLOR CODE @ LOAD CELL

RED	+EXCITATION
GREEN	+SIGNAL
BLACK	-EXCITATION
WHITE	-SIGNAL

SYM	REVISION	DATE
E	WAS DRG. B-3079	4/99
D	ADD WEIGHT	12/98
C	ADD DETAIL	9/98
B	ADD TEXT, DETAILS	4/98
A	ADD MODEL #	1/97

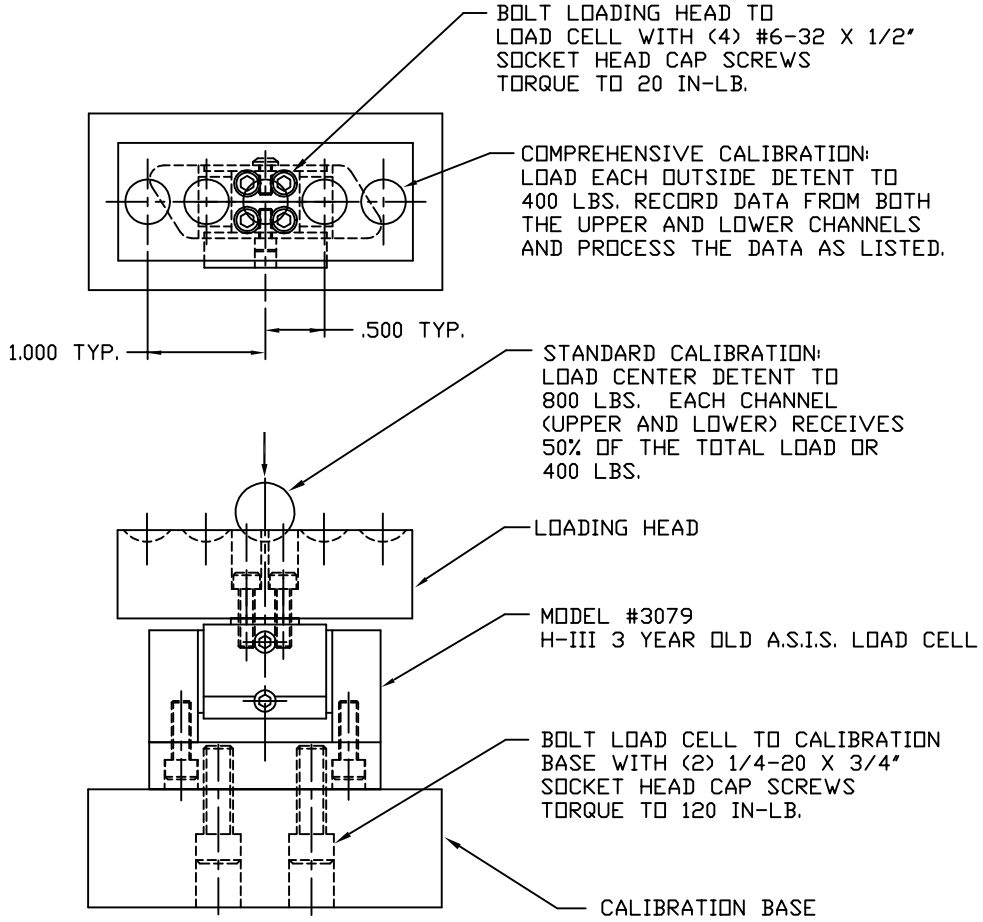
ANTERIOR SUPERIOR ILIAC SPINE LOAD CELL
HYBRID III THREE YEAR OLD

SCALE: FULL
DATE: 13JAN97
DRAWN BY: C.R. MORGAN
MODEL: 3079

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3079-D



STANDARD CALIBRATION:

THE MODEL 3079 LOAD CELL CONSISTS OF TWO INDEPENDENT FX CHANNELS. WHEN THE LOAD CELL IS LOADED DIRECTLY OVER CENTER, EACH CHANNEL RECEIVES 50% OF THE TOTAL LOAD. THE STANDARD CALIBRATION CONSISTS OF LOADING THE CENTER DETENT TO 800 LBS. TO CALIBRATE EACH CHANNEL TO 400 LBS. (50% OF THE TOTAL LOAD).

COMPREHENSIVE CALIBRATION:

THE MODEL 3079 LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE AND POSITION OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE TOTAL LOAD. THE DIFFERENCE OF THE TWO CHANNELS DIVIDED BY THE SUM IS PROPORTIONAL TO THE POSITION OF THE LOAD ON THE FACE OF THE LOAD CELL. THE POSITION IS CALCULATED AS FOLLOWS:

((FORCE UPPER-FORCE LOWER)/(FORCE UPPER+FORCE LOWER)) X .79
=DISTANCE
NOTE:
THE FORCES ARE IN ENGINEERING UNITS
THE DISTANCE IS IN INCHES ABOVE THE LOAD CELL CENTER LINE

TO VERIFY THE ABOVE LISTED CALCULATION, LOAD TO 400 LBS. AT BOTH OF THE OUTSIDE DETENTS (1.000" FROM CENTER). CONVERT THE OUTPUT OBTAINED INTO ENGINEERING UNITS BASED ON THE CALIBRATION PERFORMED ON THE LOAD CELL CENTER. CALCULATE THE POSITION BASED ON THE EQUATION AS LISTED ABOVE.

THE CALCULATED POSITION SHOULD BE WITHIN 5% OF THE ACTUAL 1.000" LOADING POSITION.

CALIBRATION FIXTURE MODEL #3625

SYM	REVISION	DATE
A	WAS DRG. B-3625	4/99

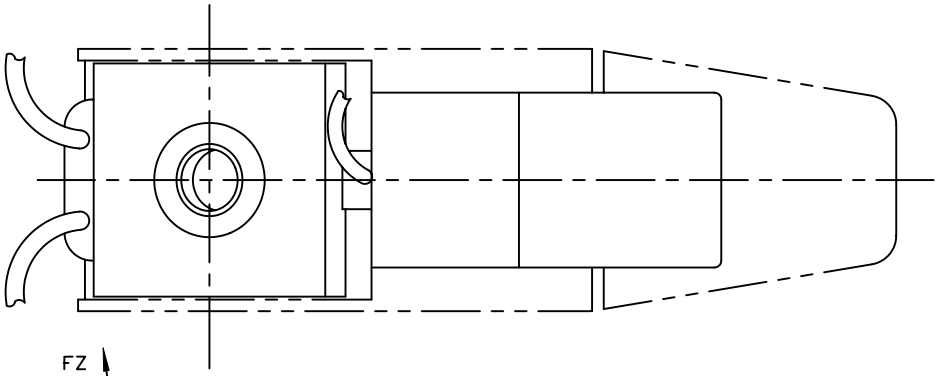
CALIBRATION FIXTURE FOR THE H-III 3 YEAR OLD A.S.I.S.

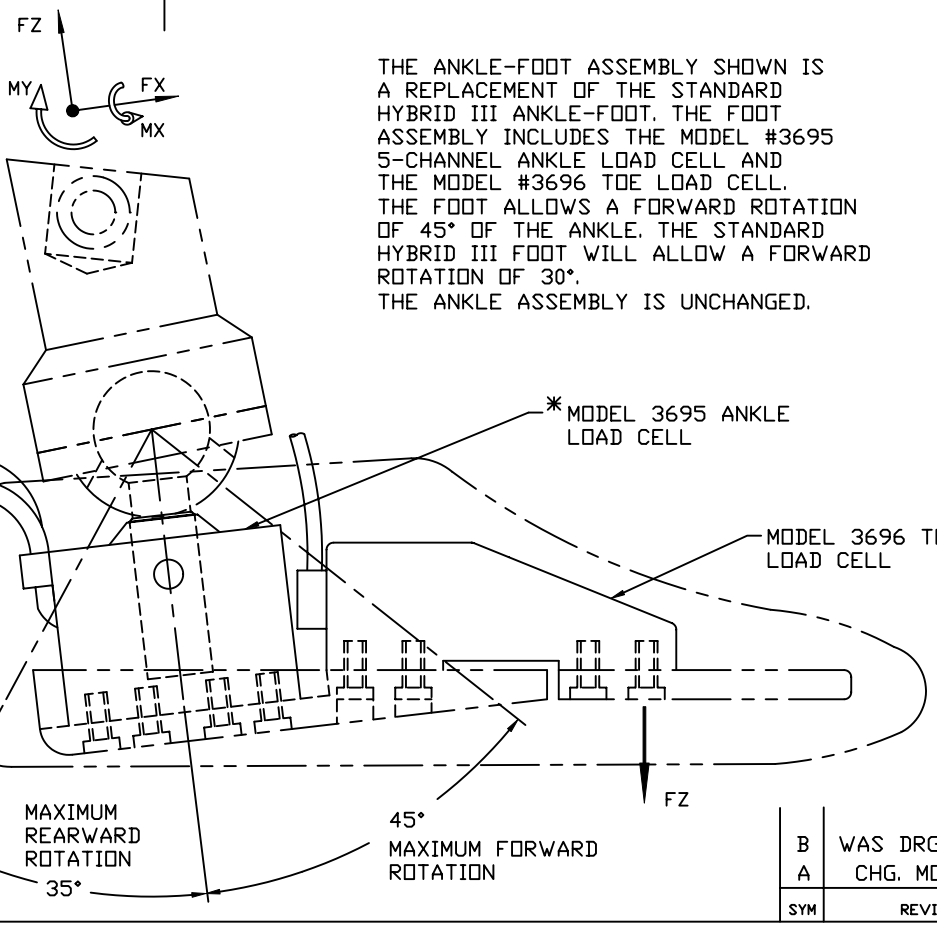
SCALE: FULL
DRAWN BY: H. PROCTOR
DATE: 12/27/96
MODEL: 3079

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3079-C





THE ANKLE-FOOT ASSEMBLY SHOWN IS A REPLACEMENT OF THE STANDARD HYBRID III ANKLE-FOOT. THE FOOT ASSEMBLY INCLUDES THE MODEL #3695 5-CHANNEL ANKLE LOAD CELL AND THE MODEL #3696 TOE LOAD CELL. THE FOOT ALLOWS A FORWARD ROTATION OF 45° OF THE ANKLE. THE STANDARD HYBRID III FOOT WILL ALLOW A FORWARD ROTATION OF 30°. THE ANKLE ASSEMBLY IS UNCHANGED.

HYBRID III TOE LOAD CELL
MODEL 3696

AXIS	CAPACITY	OUTPUT @ CAPACITY
FZ	2000 LBS.	2.0 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

HYBRID III ANKLE LOAD CELL
MODEL 3695

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	2000 LBS.	2.0 mV/V NOMINAL
FY	2000 LBS.	2.0 mV/V NOMINAL
FZ	3500 LBS.	1.5 mV/V NOMINAL
MX	3500 LB.-IN	1.5 mV/V NOMINAL
MY	3500 LB.-IN.	1.5 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

* MODEL 3695 ANKLE LOAD CELL MAY BE USED WITHOUT MODEL 3696 TOE LOAD CELL. A STRUCTURAL REPLACEMENT FOR THE TOE LOAD CELL WOULD THEN BE PROVIDED.

SYM	REVISION	DATE
B	WAS DRG. B-3090	4/99
A	CHG. MODEL#S	11/96

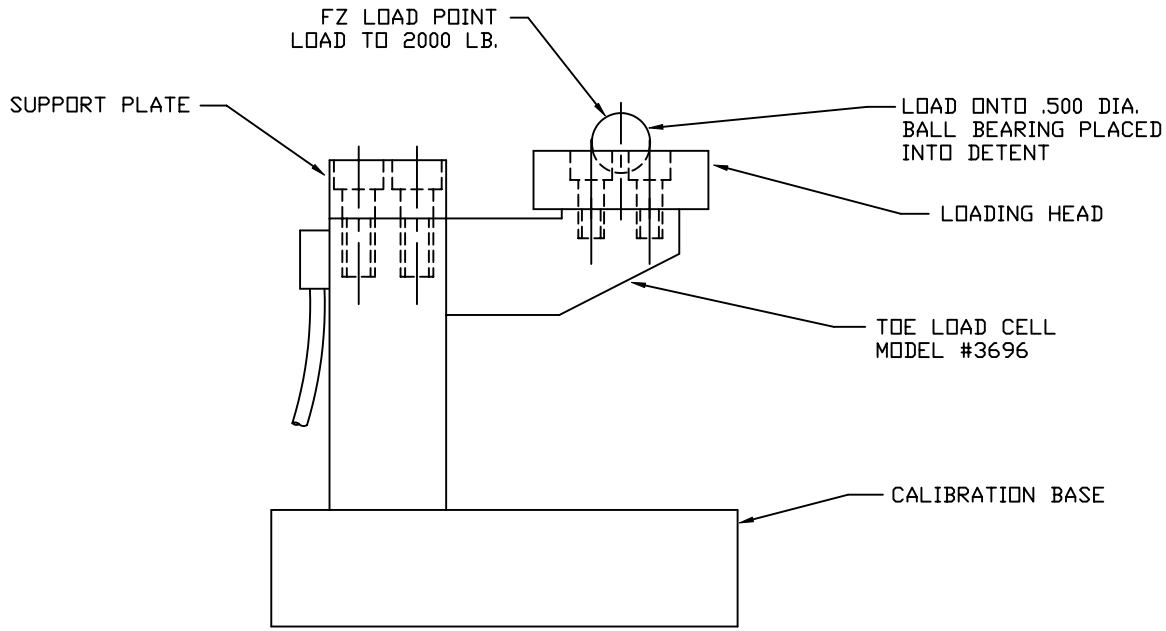
HYBRID III ANKLE/FOOT WITH ANKLE AND TOE LOAD CELLS

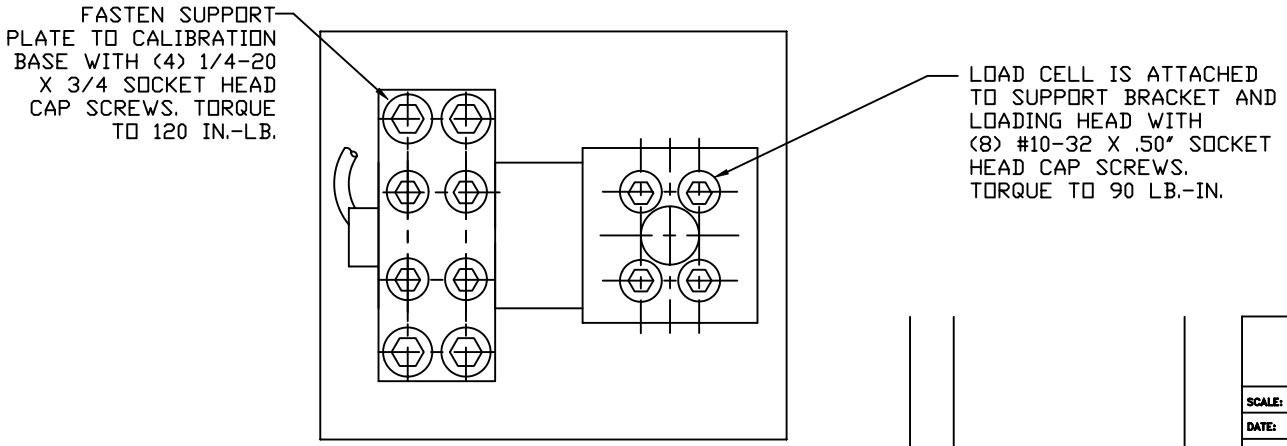
SCALE: FULL		DRAWN BY: C.R. MORGAN
DATE: 30JAN95		MODEL: 3090

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3090-D





SYM	REVISION	DATE
B	WAS DRG. B-3398	4/99
A	CHG. MODEL #	11/96

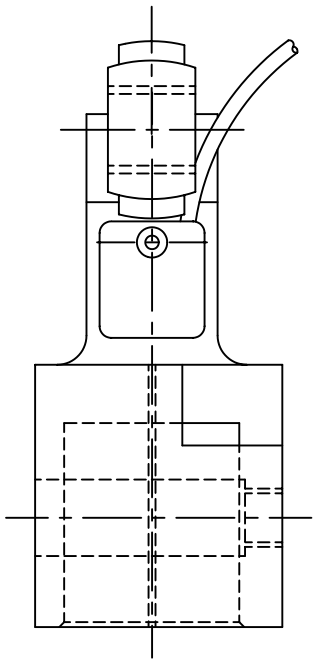
TOE LOAD CELL CALIBRATION FIXTURE

SCALE: FULL
DATE: 19OCT95
DRAWN BY: H. PROCTOR
MODEL: 3398

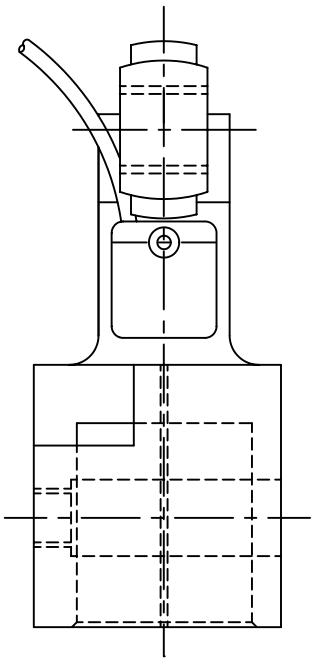
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

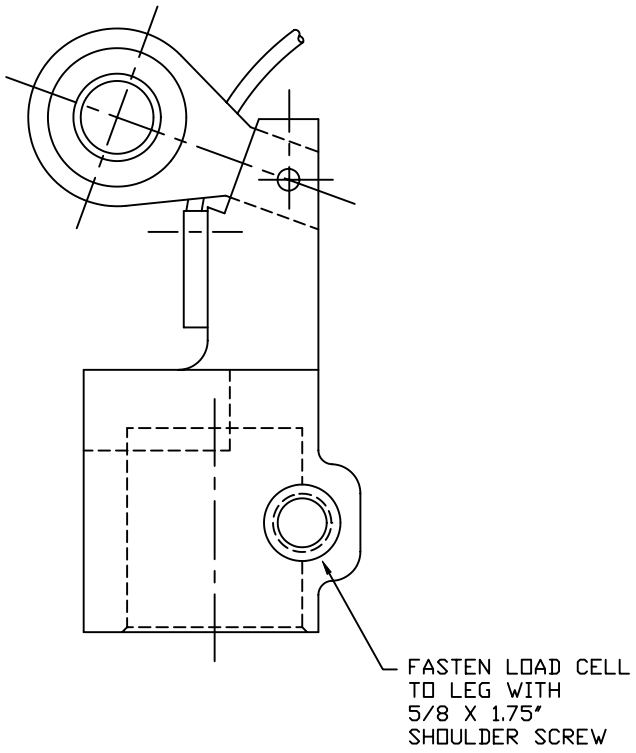
DRAWING NUMBER: B-3090-C



+FY
MODEL 3752
RIGHT FEMUR



+FY
MODEL 3751
LEFT FEMUR



AXIS	CAPACITY	OUTPUT @ CAPACITY
FY	3000 LBS.	1.5mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE

B	WAS DRG. B-3091	4/99
A	REV. MODEL #	1/97

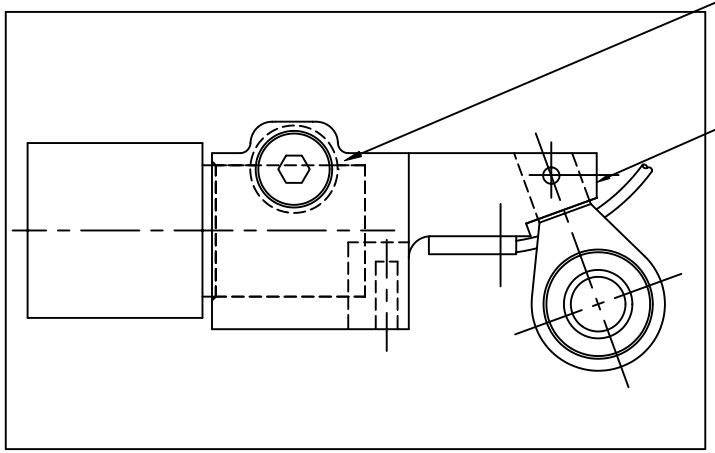
BIOSID FY FEMUR LOAD CELL

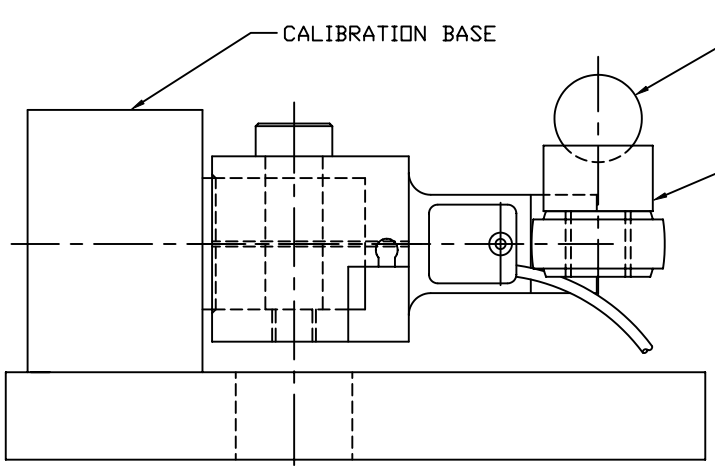
SCALE: FULL
DATE: 11/03/95
DRAWN BY: H. PROCTOR
MODEL: 3091

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3091-D





SYM	REVISION	DATE
A	WAS DRG. B-3413	4/99

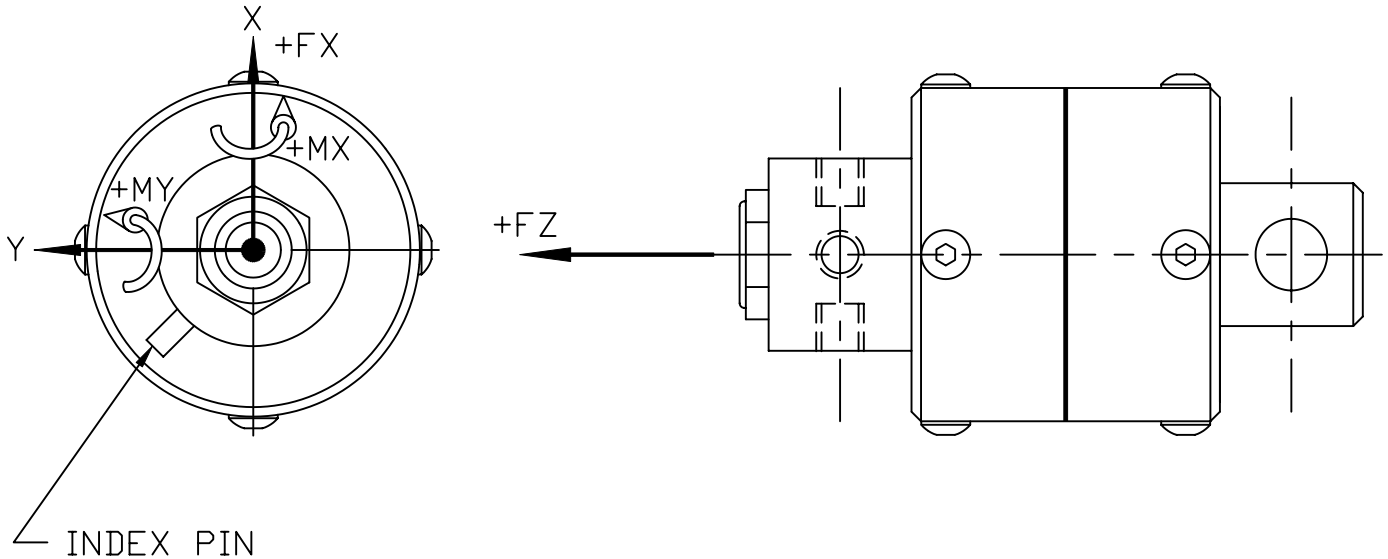
BIOSID FY FEMUR LOAD CELL CALIBRATION FIXTURE

SCALE: 3/4
DATE: 11/01/95
DRAWN BY: H. PROCTOR
MODEL: 3413

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3091-C



INDEX PIN
LOCATE PIN IN LEFT
DETENT OF LEG TUBE
FOR AXES POLARITY
AS SHOWN

AXIS	CAPACITY	OUTPUT
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.

CABLE COLOR CODE

MX		MY		FZ	
GREEN STRIPE	+EXC.	RED STRIPE	+EXC.	GREEN	+EXC.
BLUE STRIPE	+SIG.	BLACK	+SIG.	BLUE	+SIG.
ORANGE STRIPE	-EXC.	WHITE	-EXC.	VIOLET	-EXC.
YELLOW STRIPE	-SIG.	BLACK STRIPE	-SIG.	GREY	-SIG.

3 CHANNEL LOWER TIBIA

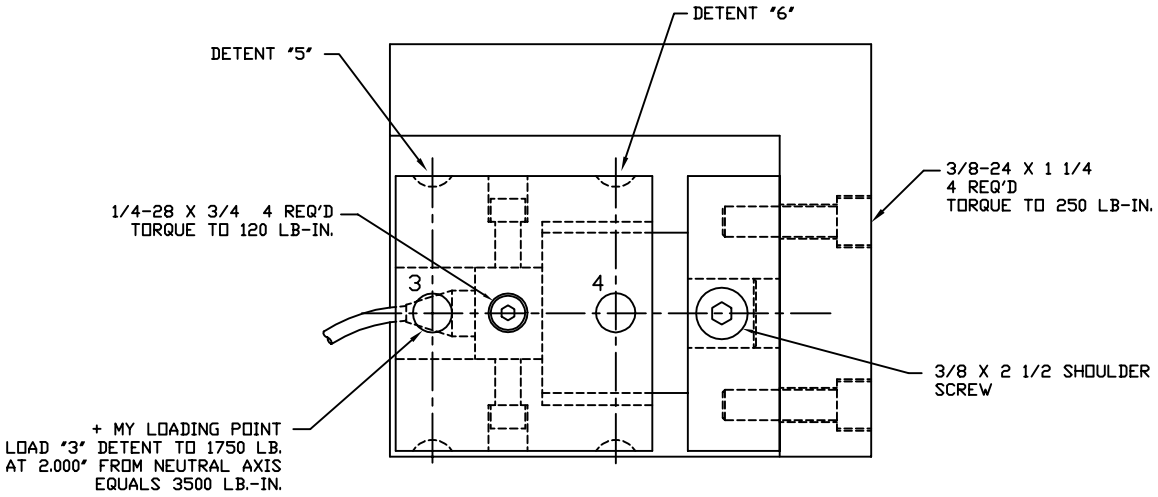
SCALE: FULL
DATE: 25APRIL95
DRAWN BY: C.R. MORGAN
MODEL: 3093

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

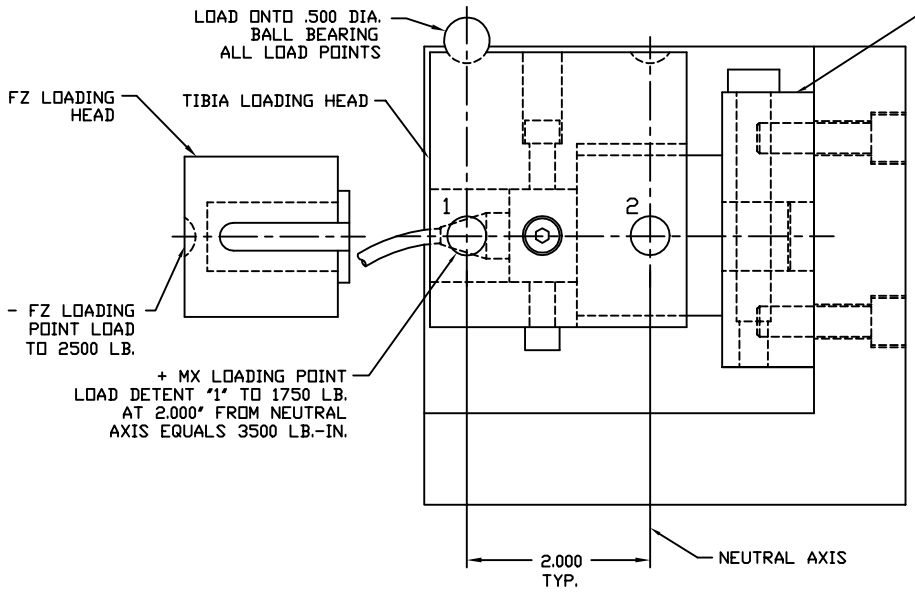
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

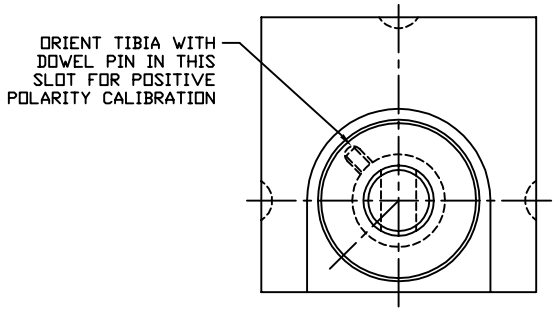
DRAWING NUMBER: A-3093-D

SYM	REVISION	DATE
A	WAS DRG. A-3287	5/99



NOTE:
POSITIVE CALIBRATION LOAD POINT
PER AXIS DEFINITION SPECIFIED ON
DRAWING 3093-D





CALIBRATION FIXTURE MODEL #2171

SYM	REVISION	DATE

LOWER TIBIA CALIBRATION FIXTURE

LOWER TIBIA MODEL 3093

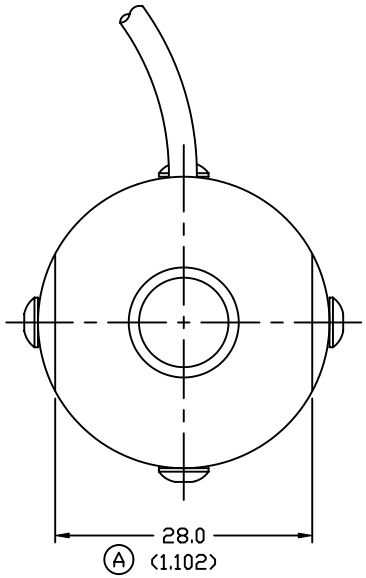
SCALE:	.75X	DRAWN BY:	H. PROCTOR
DATE:	80CT99	MODEL:	3093

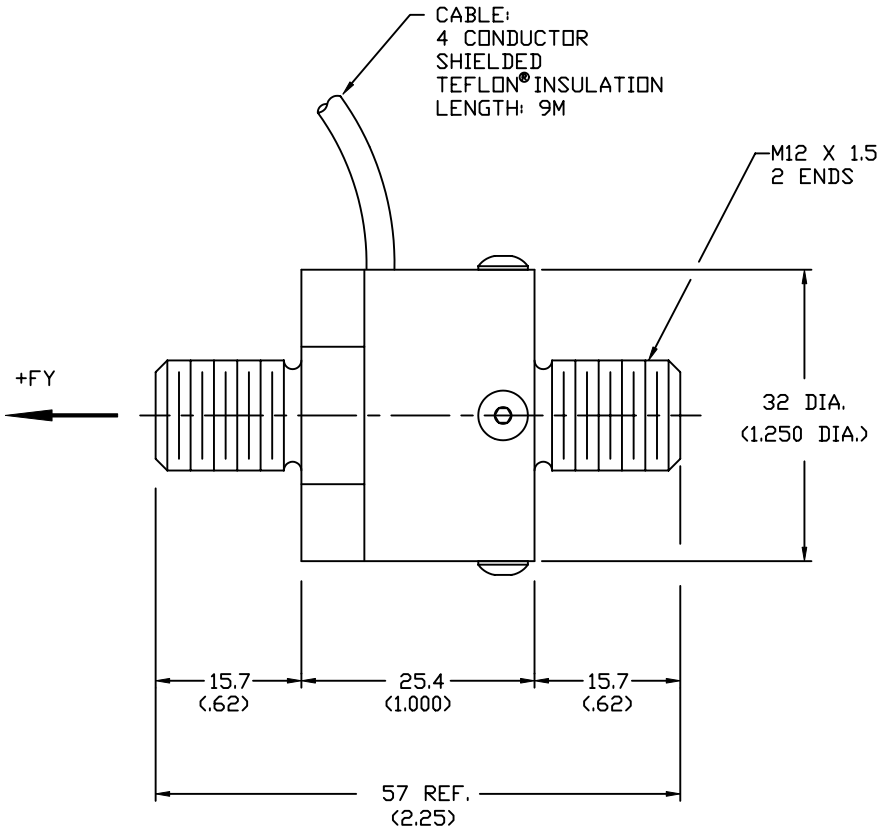
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3093-C





EUROSID I PUBIC LOAD CELL

CAPACITY: 20000N
OUTPUT @ CAPACITY: 2.6 mV/V NOMINAL (B)
NONLINEARITY < .5% OF FULL SCALE
BRIDGE RESISTANCE: 700 OHMS

D	WAS DRG. B-3096	4/99
C	CORRECT FLAT LOC.	12/98
B	CHG OUTPUT NOTE	11/98
A	ADD WRENCH FLATS	8/96

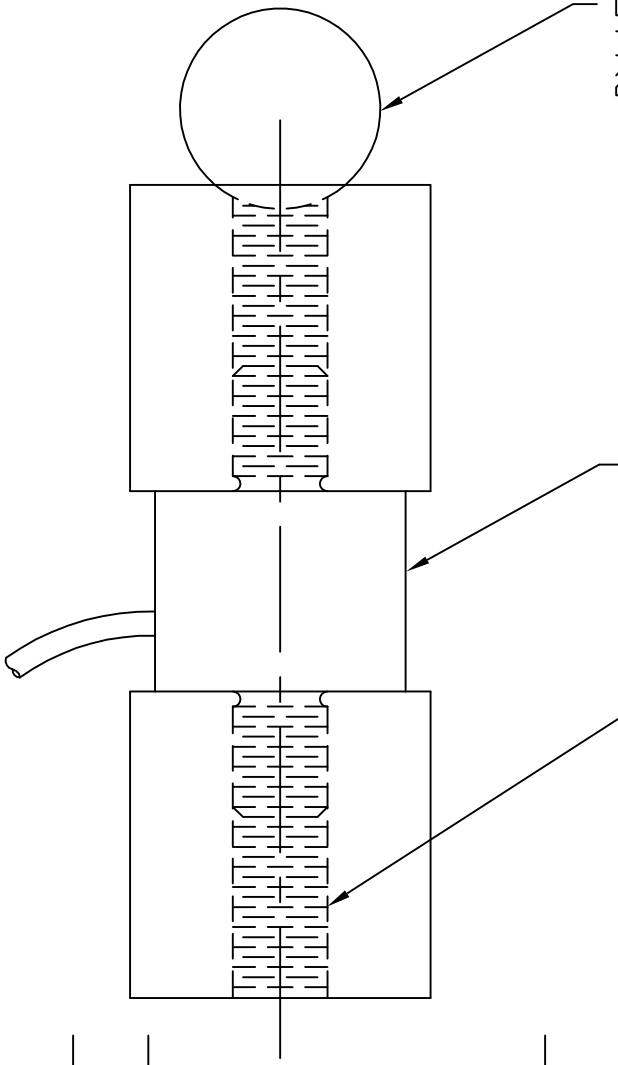
EUROSID-I PUBIC LOAD CELL

SCALE: 2X
DATE: 17AUG94
DRAWN BY: C.R. MORGAN
MODEL: 3096

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3096-D



CALIBRATION FIXTURE MODEL #3366

SYM	REVISION	DATE
B	WAS DRG. A-3366	4/99
A	REV. TEXT	1/97

EUROSID PUBIC LOAD CELL CALIBRATION FIXTURE

SCALE: FULL

DATE: 10AUG95

DRAWN BY: *C.R. MORGAN*

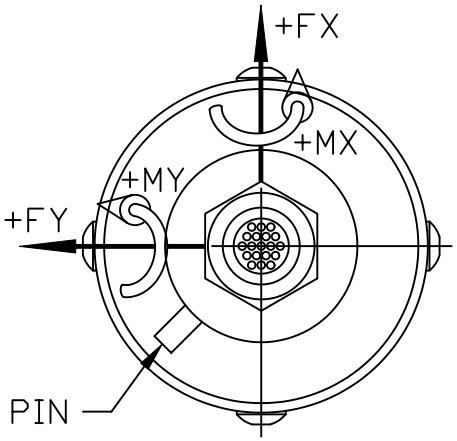
MODEL: 3096

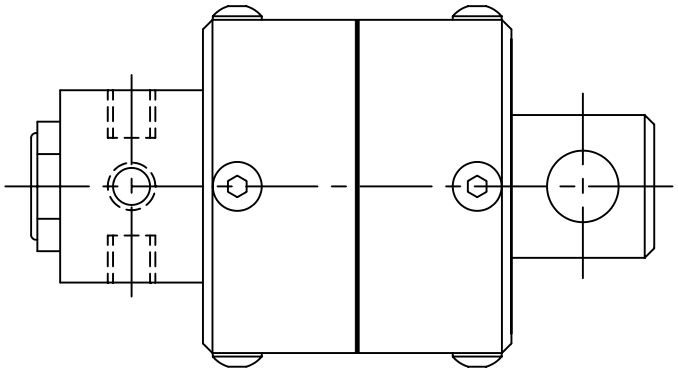
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER:
A-3096-C





INDEX PIN
LOCATE PIN IN LEFT DETENT OF LEG TUBE FOR CORRECT AXES ORIENTATION

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

CABLE COLOR CODE

FX		MY		Ⓐ FY		MX	
BROWN	+EXC.	RED STRIPE	+EXC.	GREEN	+EXC.	GREEN STRIPE	+EXC.
RED	+SIG.	BLACK	+SIG.	BLUE	+SIG.	BLUE STRIPE	+SIG.
ORANGE	-EXC.	WHITE	-EXC.	VIOLET	-EXC.	ORANGE STRIPE	-EXC.
YELLOW	-SIG.	BLACK STRIPE	-SIG.	GREY	-SIG.	YELLOW STRIPE	-SIG.

TO CONFORM TO S.A.E. J-211 THE POLARITY OF THE FX AND MX CHANNELS MUST BE CHANGED.

SYM	REVISION	DATE
B	WAS DRG. A-3114	5/99
A	REV. AXIS	10/97

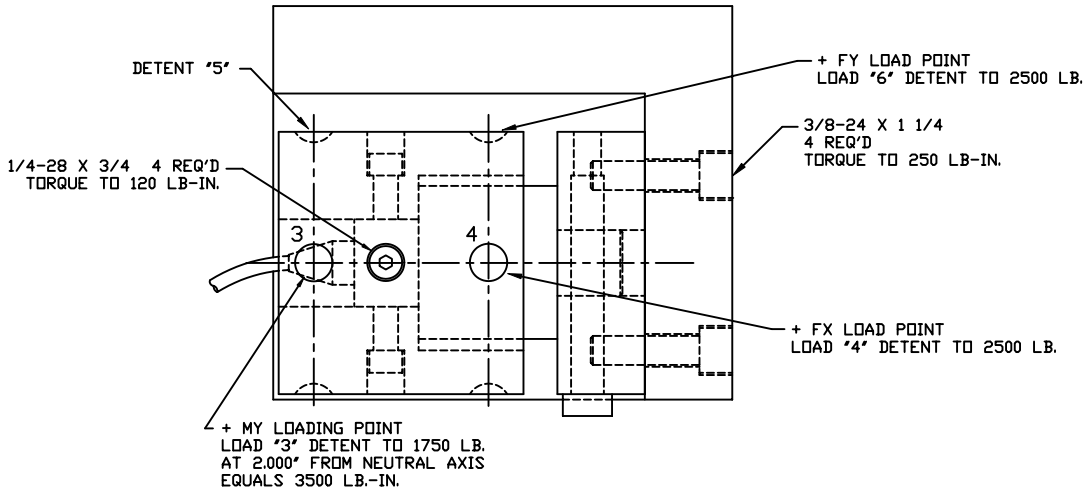
LOWER TIBIA LOAD CELL

SCALE: FULL
DATE: 7/14/97
DRAWN BY: C.R. MORGAN
MODEL: 3114

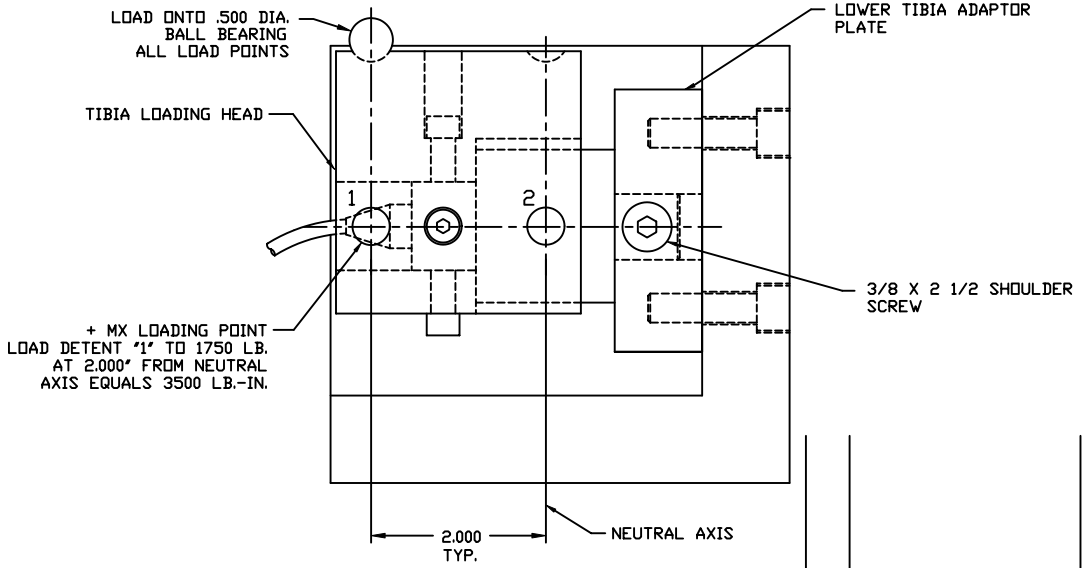
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

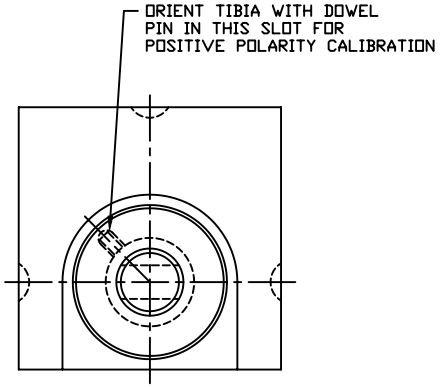
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-3114-D



NOTE:
POSITIVE CALIBRATION LOAD POINTS
PER AXIS DEFINITION SPECIFIED ON
DRAWING 3071-D, 3253-D OR 3114-D





CALIBRATION FIXTURE MODEL #2171

SYM	REVISION	DATE

LOWER TIBIA CALIBRATION FIXTURE

LOWER TIBIA MODEL 3114

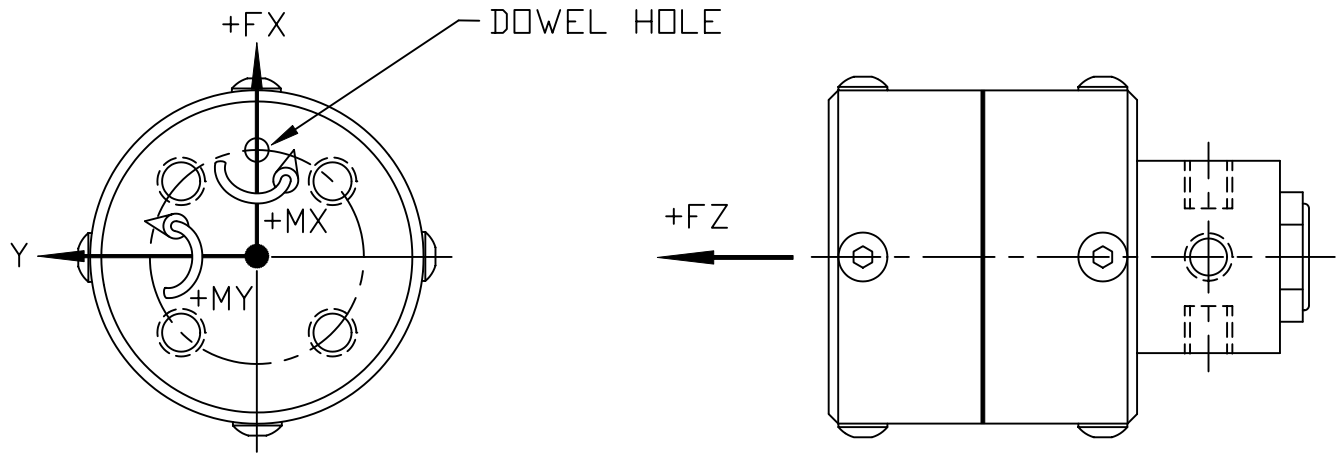
SCALE: .75X			DRAWN BY: C.R. MORGAN
DATE: 28MAY96			MODEL: 3114

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3114-C



AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

CABLE COLOR CODE

FX		MY		Ⓐ FZ		MX	
BROWN	+EXC.	RED STRIPE	+EXC.	GREEN	+EXC.	GREEN STRIPE	+EXC.
RED	+SIG.	BLACK	+SIG.	BLUE	+SIG.	BLUE STRIPE	+SIG.
ORANGE	-EXC.	WHITE	-EXC.	VIOLET	-EXC.	ORANGE STRIPE	-EXC.
YELLOW	-SIG.	BLACK STRIPE	-SIG.	GREY	-SIG.	YELLOW STRIPE	-SIG.

TO CONFORM TO S.A.E. J-211 THE POLARITY OF THE FX AND MX CHANNELS MUST BE CHANGED.

SYM	REVISION	DATE
B	WAS DRG. A-3115	5/99
A	FZ WAS MY	9/97

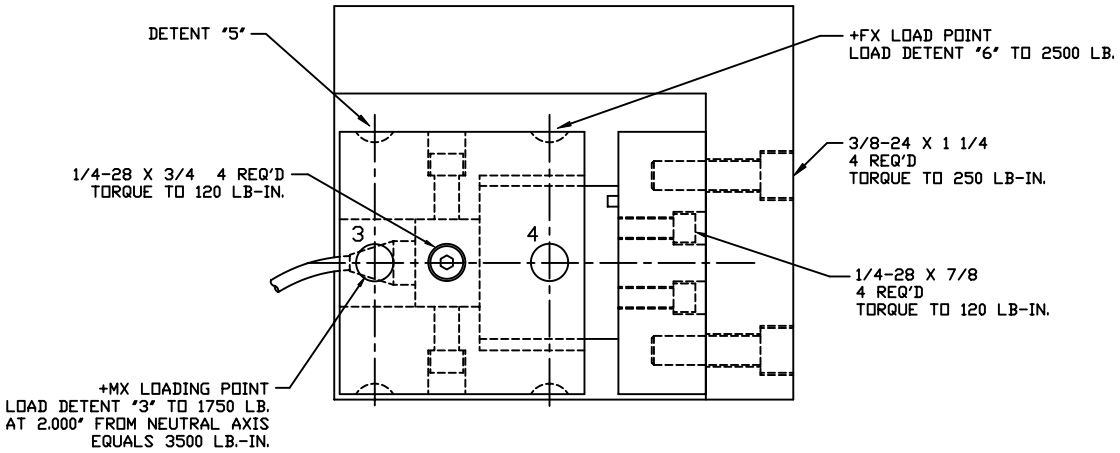
4 CHANNEL UPPER TIBIA

SCALE: FULL
DATE: 7/14/97
DRAWN BY: *C.R. MORGAN*
MODEL: 3115

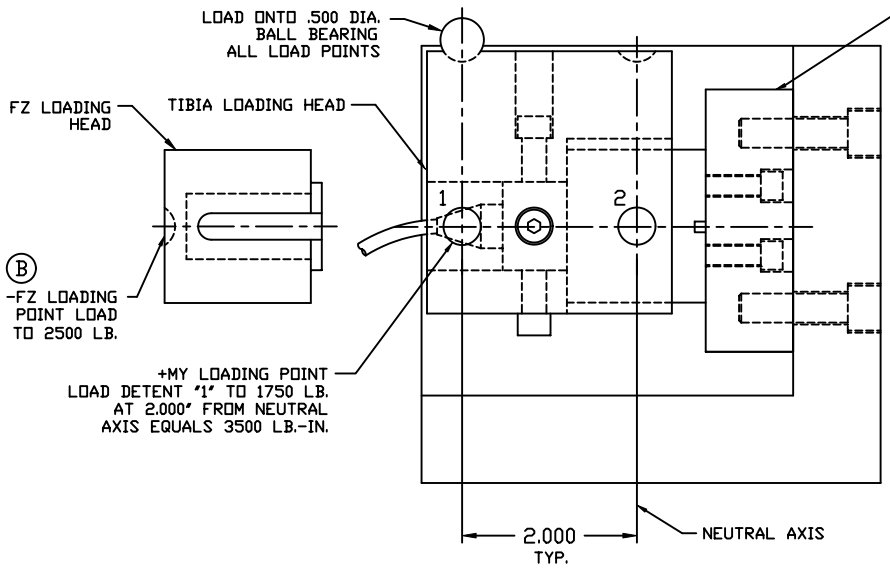
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30′
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

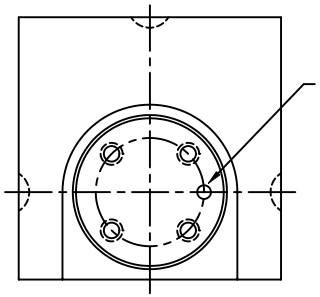
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-3115-D



NOTE:
POSITIVE CALIBRATION LOAD POINTS
PER AXIS DEFINITION SPECIFIED ON
DRAWING 3071-D, 3390-D, 3250 OR 3115-D.





CALIBRATION FIXTURE MODEL #2171

SYM	REVISION	DATE

UPPER TIBIA CALIBRATION FIXTURE

UPPER TIBIA MODEL 3115

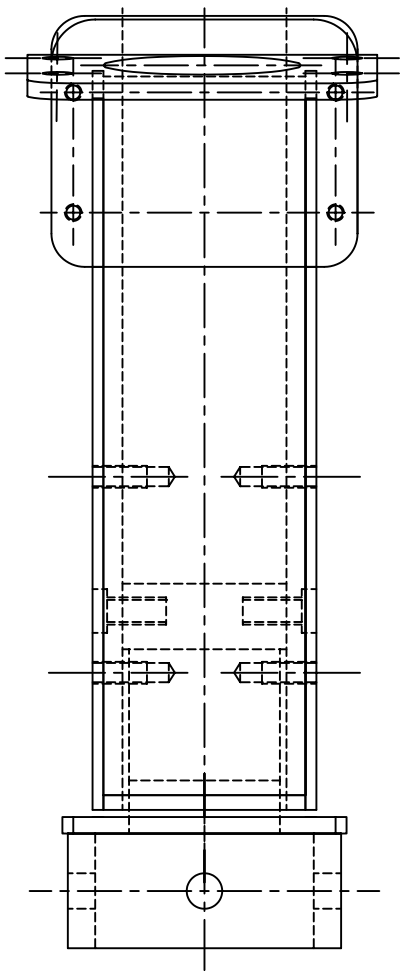
SCALE: .75X			DRAWN BY: H. PROCTOR
DATE: 8/02/96			MODEL: 3115

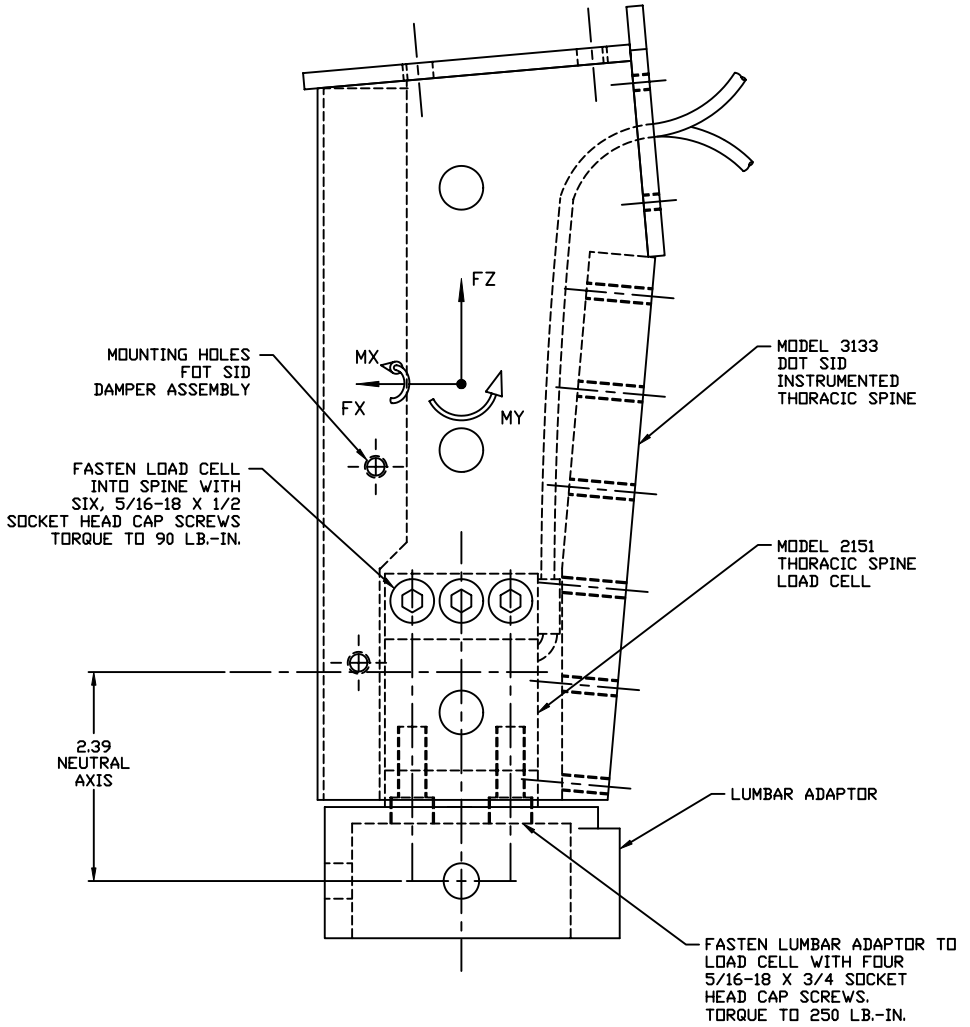
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3115-C





MODEL 2151 THORACIC SPINE LOAD CELL

AXIS	CAPACITY	OUPUT	BRIDGE RESISTANCE
FX	3000 LBS	1.8 mV/V NOM.	350Ω
FY	3000 LBS	1.8 mV/V NOM.	350Ω
FZ	4000 LBS	1.0 mV/V NOM.	700Ω
MX	5000 LB-IN	1.6 mV/V NOM.	700Ω
MY	5000 LB-IN	1.6 mV/V NOM.	700Ω

NONLINEARITY <1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE

SYM	REVISION	DATE
A	WAS DRG. C-3133	4/99

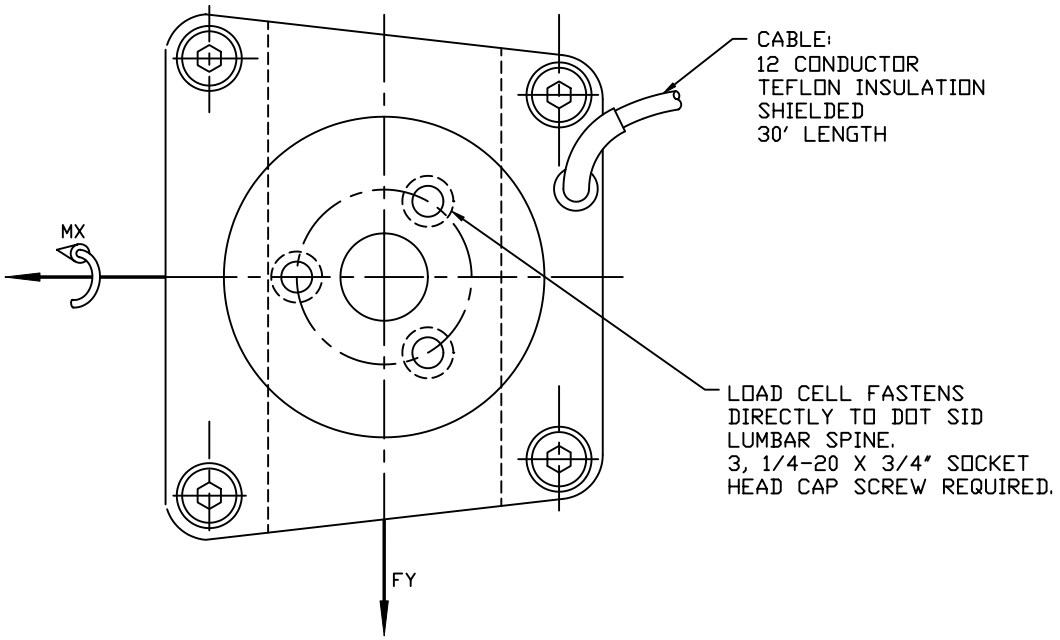
INSTRUMENTED THORACIC SPINE ASSEMBLY
DOT SID

SCALE: FULL
DATE: 12/13/94
DRAWN BY: C.R. MORGAN
MODEL: 3133

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125√
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

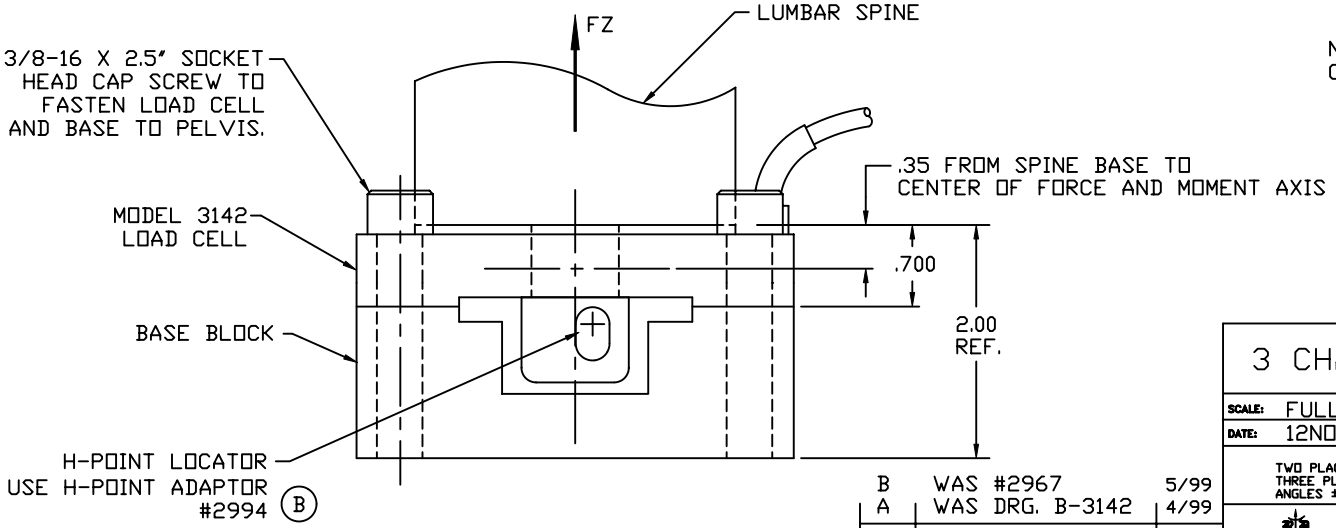
DRAWING NUMBER: C-3133-D



LUMBAR SPINE LOAD CELL

AXIS	CAPACITY	OUTPUT
FY	3500 LBS.	1 mV/V NOM.
FZ	3500 LBS.	1 mV/V NOM.
MX	5000 LB-IN.	1.5 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE



SYM	REVISION	DATE
B	WAS #2967	5/99
A	WAS DRG. B-3142	4/99

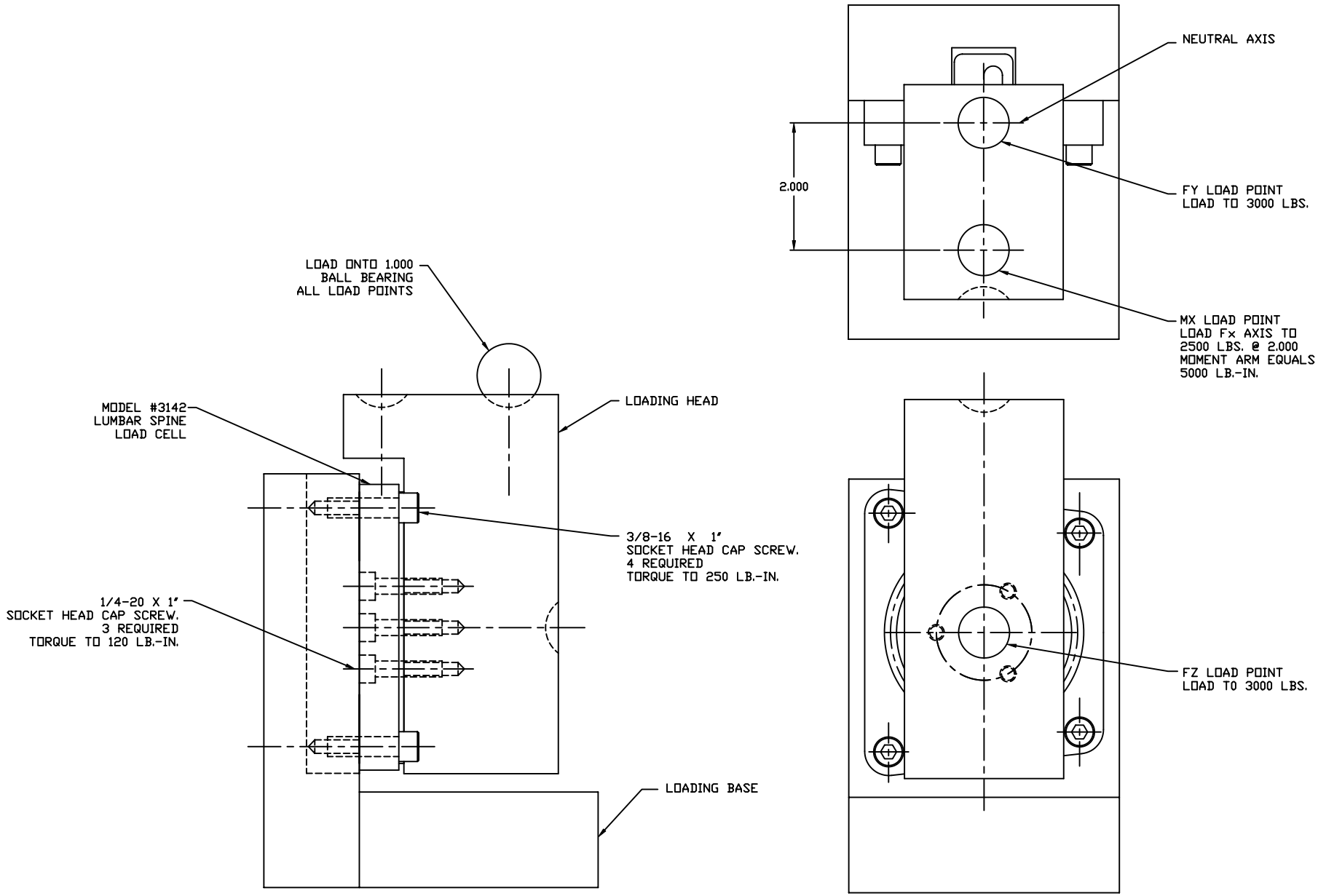
3 CHANNEL DOT SID LUMBAR SPINE

SCALE: FULL
DATE: 12NOV94
DRAWN BY: C.R. MORGAN
MODEL: 3142

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3142-D



SYM	REVISION	DATE
A	WAS DRG. C-3282	4/99

LUMBAR SPINE CAL. FIXTURE FOR MODEL 3142

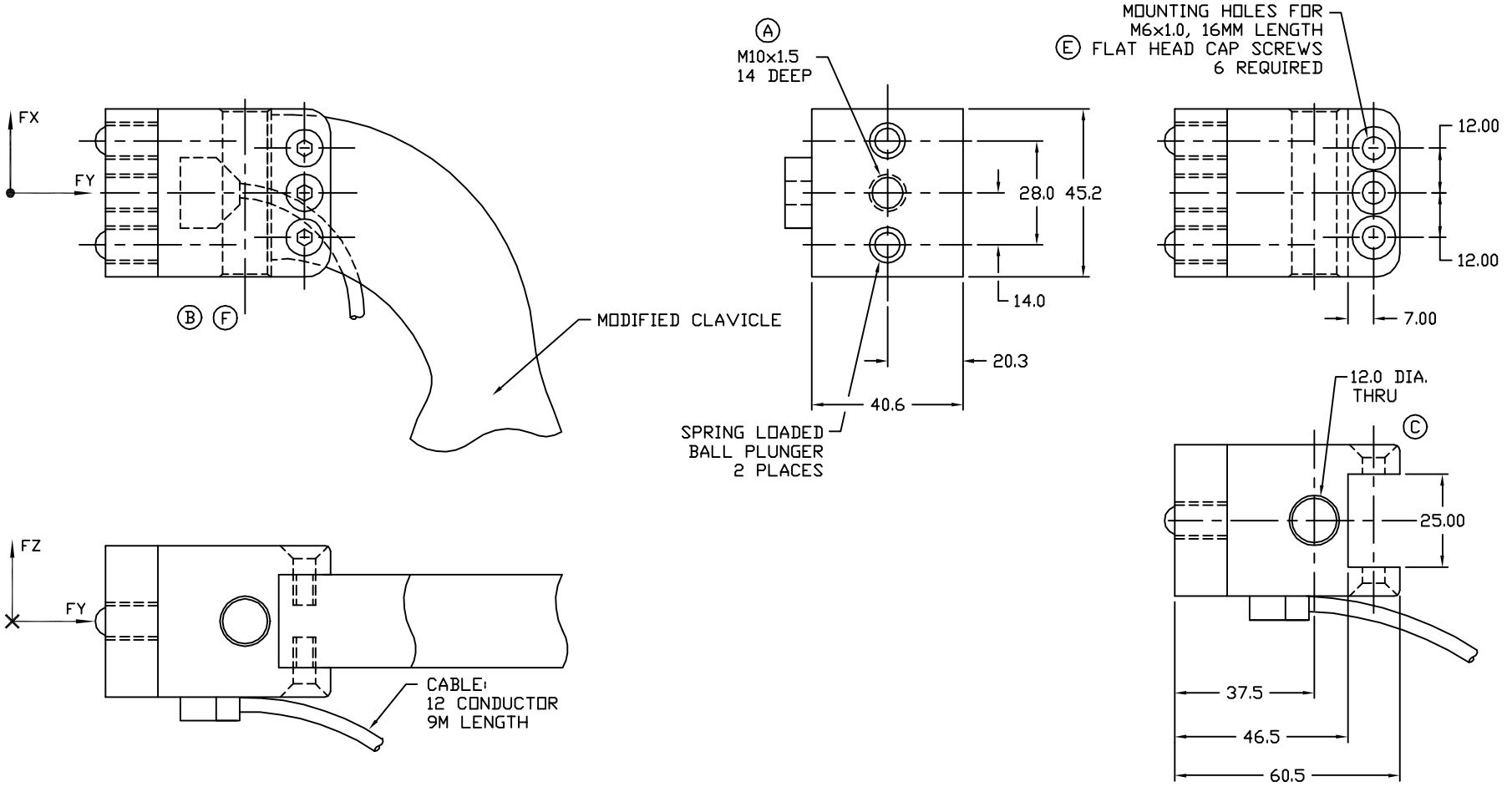
SCALE: FULL | DRAWN BY: P.M. LUKENS

DATE: 26JULY95 | MODEL: 3282

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125√
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-3142-C



EUROSID I SHOULDER LOAD CELL

AXIS	CAPACITY	OUTPUT	BRIDGE RESISTANCE
FX	4000N	2mV/V NOM.	350 OHMS
FY	8000N	2mV/V NOM.	700 OHMS
FZ	4000N	2mV/V NOM.	350 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
G	ADD BRIDGE REST.	5/00
F	CHG. STRAIN RELIEF	7/99
E	CHG TEXT	6/99
D	WAS DRG. B-3155	4/99
C	ADD C'SINK	12/97
B	VIEW CORRECTED	12/97
A	THD. CORRECTED	11/95

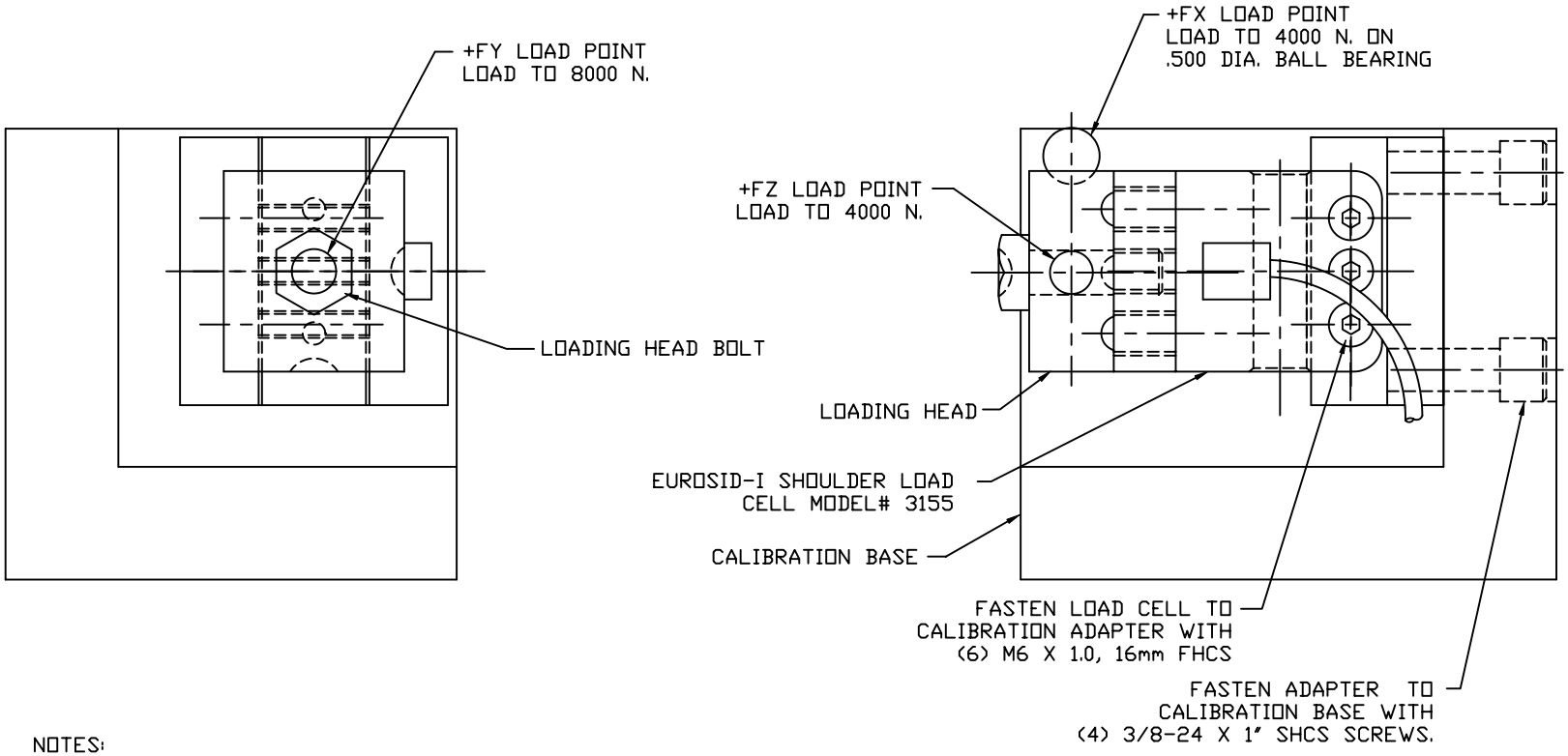
SHOULDER LOAD CELL - EUROSID-I

SCALE: FULL
DATE: 26NOV94
DRAWN BY: C.R. MORGAN
MODEL: 3155

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3155-D



NOTES:
1. FASTEN LOAD CELL TO CALIBRATION ADAPTER WITH (6) M6 X 1.0, 16mm SCREWS. TORQUE TO 10 NM (90 IN-LB)
2. FASTEN CALIBRATION ADAPTER TO CALIBRATION BASE WITH (4) 3/8-24 SHCS. TORQUE TO 28 NM (250 IN-LB)
3. FASTEN LOADING HEAD TO LOAD CELL WITH M10 X 1.5, 30mm HEX HEAD SCREW. TORQUE TO 28 NM (250 IN-LB)

SYM	REVISION	DATE
B	WAS DRG. B-3225	4/99
A	CORRECT MOUNTING	12/97 CRM

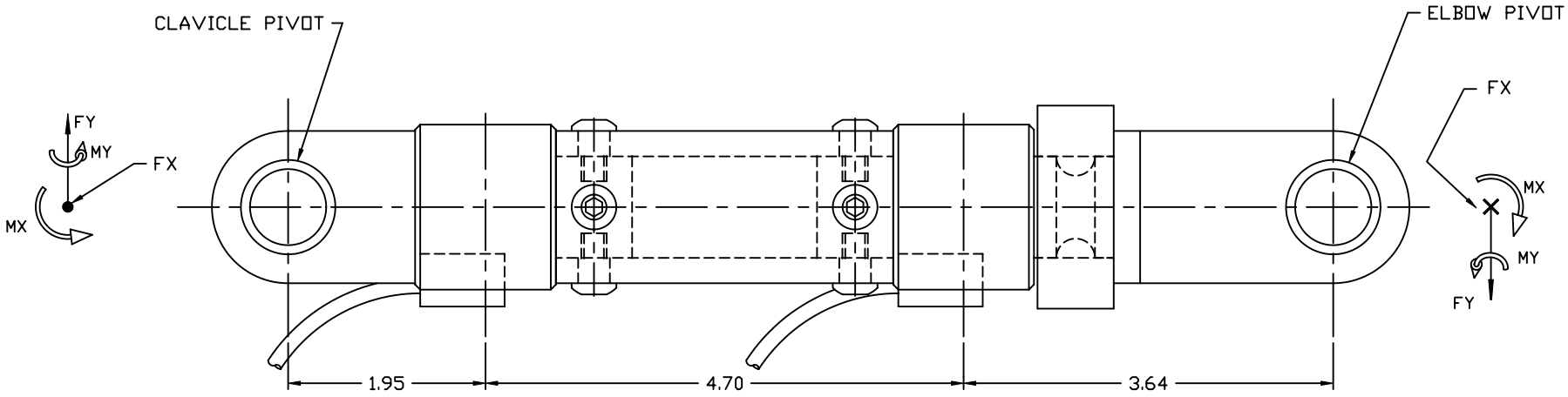
CALIBRATION FIXTURE FOR THE EUROSID I SHOULDER LOAD CELL

SCALE: FULL
DATE: 8 FEB95
DRAWN BY: H. PROCTOR
MODEL: 3225

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

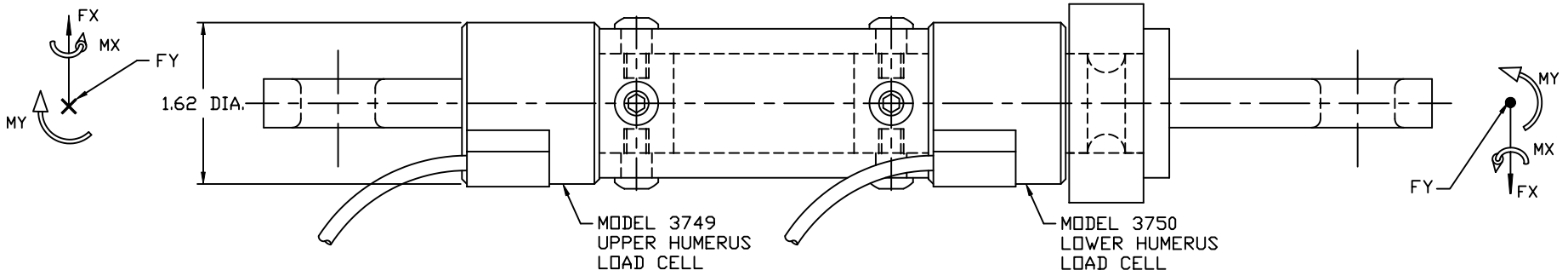
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3155-C



AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2 mV/V NOMINAL
FY	2500 LBS.	2 mV/V NOMINAL
MX	3000 IN.-LB.	3 mV/V NOMINAL
MY	3000 IN.-LB.	3 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE



THE MODEL 3156 INSTRUMENTED HUMERUS DUPLICATES THE GEOMETRY AND ARTICULATION OF HYBRID III ARM ASSEMBLY 78051-123 AND 124. MODIFIED ARM FLESH IS REQUIRED.

SYM	REVISION	DATE
C	WAS DRG. B-3156	4/99
B	ADD AXIS DETAIL	11/98
A	ADD MODEL #	1/97

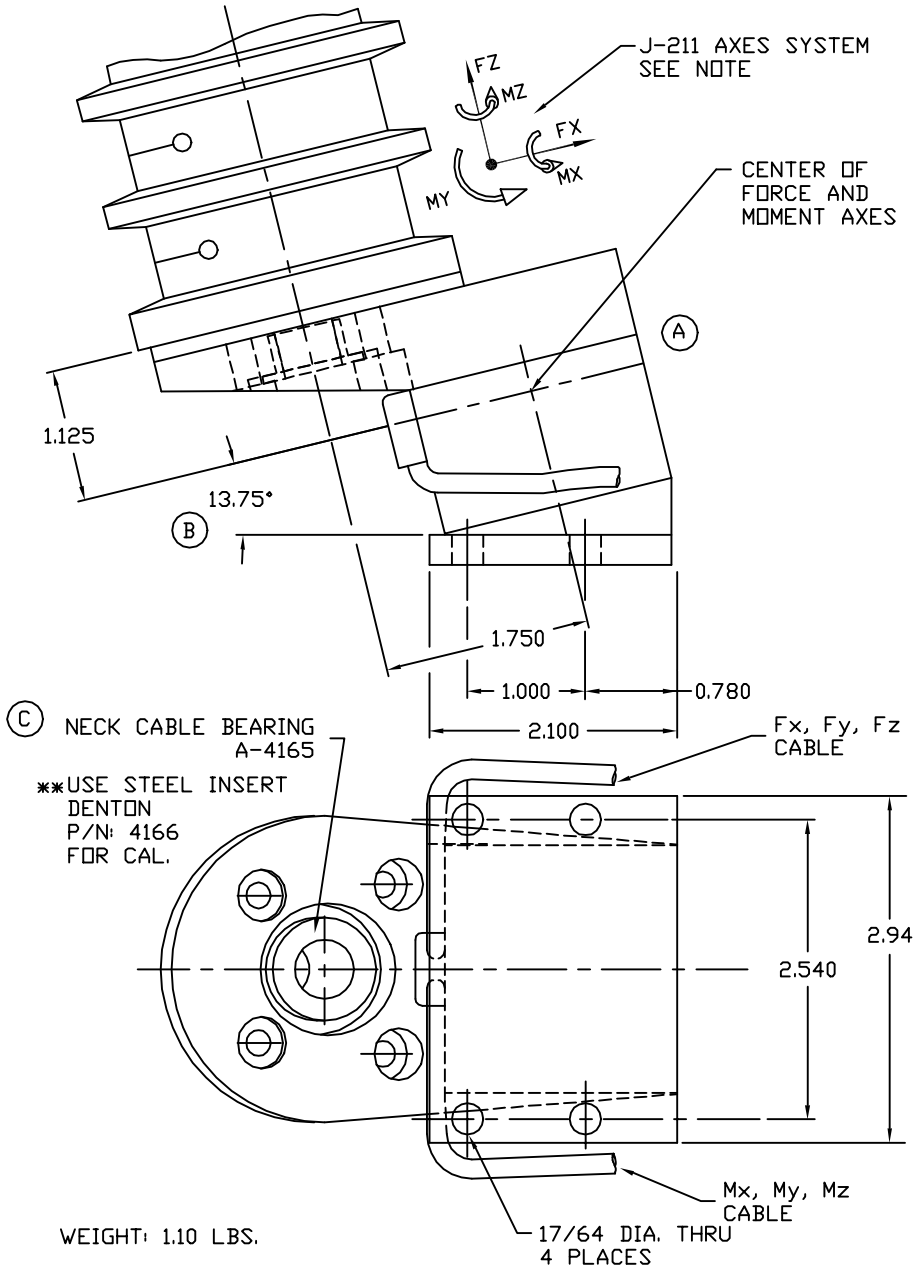
INSTRUMENTED HUMERUS

SCALE: FULL
DATE: 3DEC94
DRAWN BY: C.R. MORGAN
MODEL: 3156

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3156-D



WEIGHT: 1.10 LBS.

MODEL 3166 LOWER NECK LOAD CELL
SID-IIs

AXIS	CAPACITY	OUPUT	BRIDGE RESISTANCE
FX	3000 LBS.	2.2 mV/V NOM.	350Ω
FY	3000 LBS.	2.2 mV/V NOM.	350Ω
FZ	3000 LBS.	1.2 mV/V NOM.	700Ω
MX	4000 LB-IN	2.0 mV/V NOM.	700Ω
MY	4000 LB-IN	2.0 mV/V NOM.	700Ω
MZ	3000 LB-IN	2.0 mV/V NOM.	350Ω

NONLINEARITY <1% OF FULL SCALE
CROSS TALK <5% OF FULL SCALE

NOTE: THE LOAD CELL CALIBRATION DATA IS REFERENCED TO THE "RIGHT HAND RULE" AS APPLIED BY DENTON INC. TO CONFORM TO S.A.E J-211 SIGN CONVENTION, THE POLARITY OF THE DATA FOR FX AND MX MUST BE CHANGED.

TRANSFORMATION EQUATIONS FOR LOWER NECK LOAD CELL BASED ON J-211 SIGN CONVENTION

MOMENT CORRECTION EQUATIONS TO TRANSFER THE MEASURED MOMENT FROM THE LOAD CELL TO THE BASE OF THE NECK.

TRANSFORMATION EQUATIONS

$$F_X = F_{XM}$$
$$F_Y = F_{YM}$$
$$F_Z = F_{ZM}$$
$$M_X = M_{XM} - F_{YM}\,1.125$$
$$M_Y = M_{YM} + F_{XM}\,1.125 + F_{ZM}\,1.75$$
$$M_Z = M_{ZM} - F_{YM}\,1.75$$

WHERE:

$F_{XM}, F_{YM}, F_{ZM}, M_{XM}, M_{YM}, M_{ZM}$

ARE THE FORCES AND MOMENTS MEASURED BY THE LOWER NECK LOAD CELL AND

$F_X, F_Y, F_Z, M_X, M_Y, M_Z$

ARE THE CALCULATED FORCES AND MOMENTS AT THE CENTER OF THE BASE OF THE NECK.

SYM	REVISION	DATE
E	WAS DRG. B-3166	4/99
D	CHG CABLE EXIT	4/99
C	CHG NOTE	11/98
B	CHG ANGLE	9/98
A	CHG CABLE EXIT	6/98

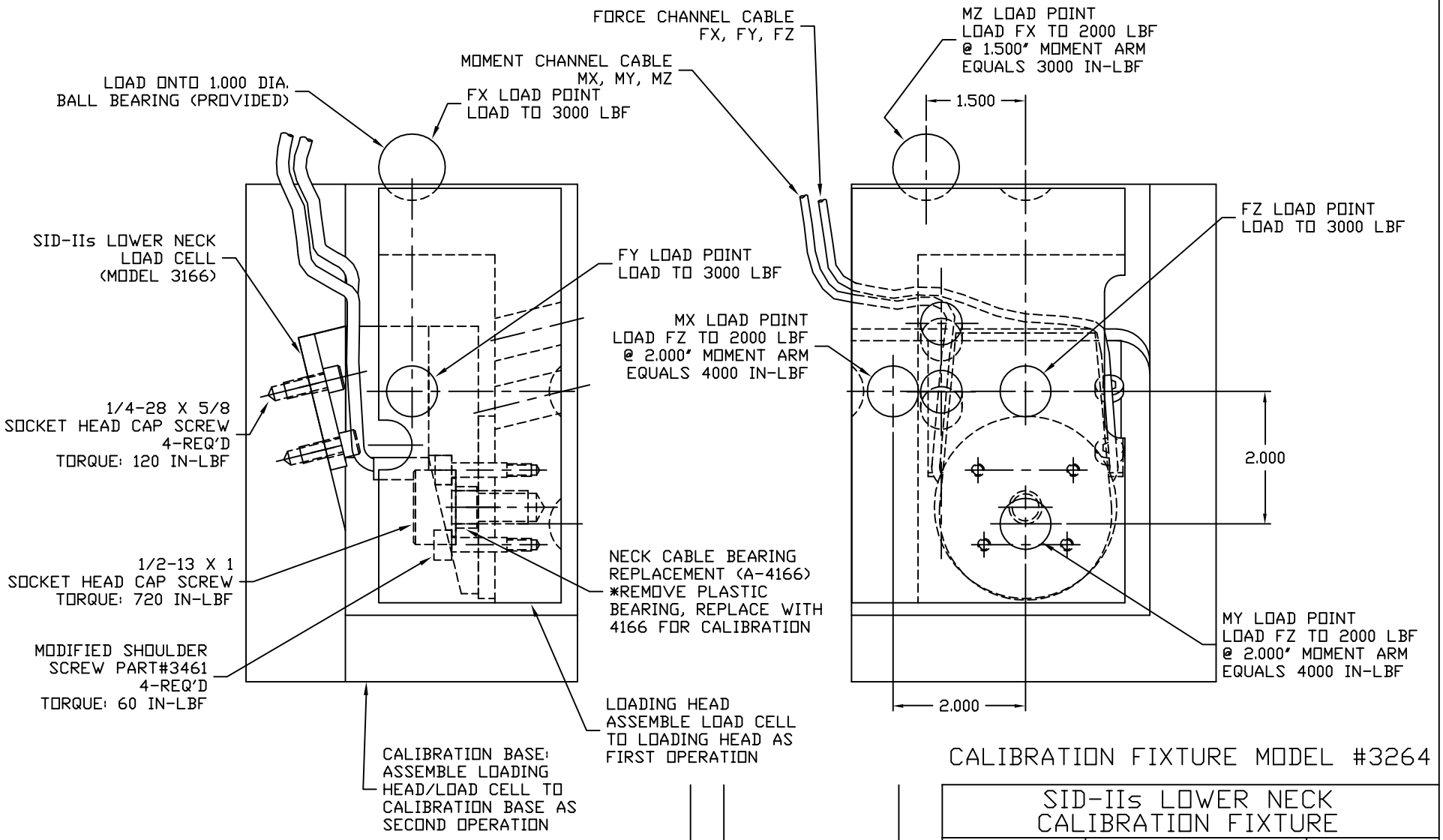
SID-IIs LOWER NECK LOAD CELL

SCALE: FULL
DATE: 12DEC94
DRAWN BY: C.R.MORGAN
MODEL: 3166

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3166-D



CALIBRATION FIXTURE MODEL #3264

SYM	REVISION	DATE
C	CHG CABLE PATH	1/99
B	CHG LC ANGLE	12/98
A	CORRECT TORQUE	8/97

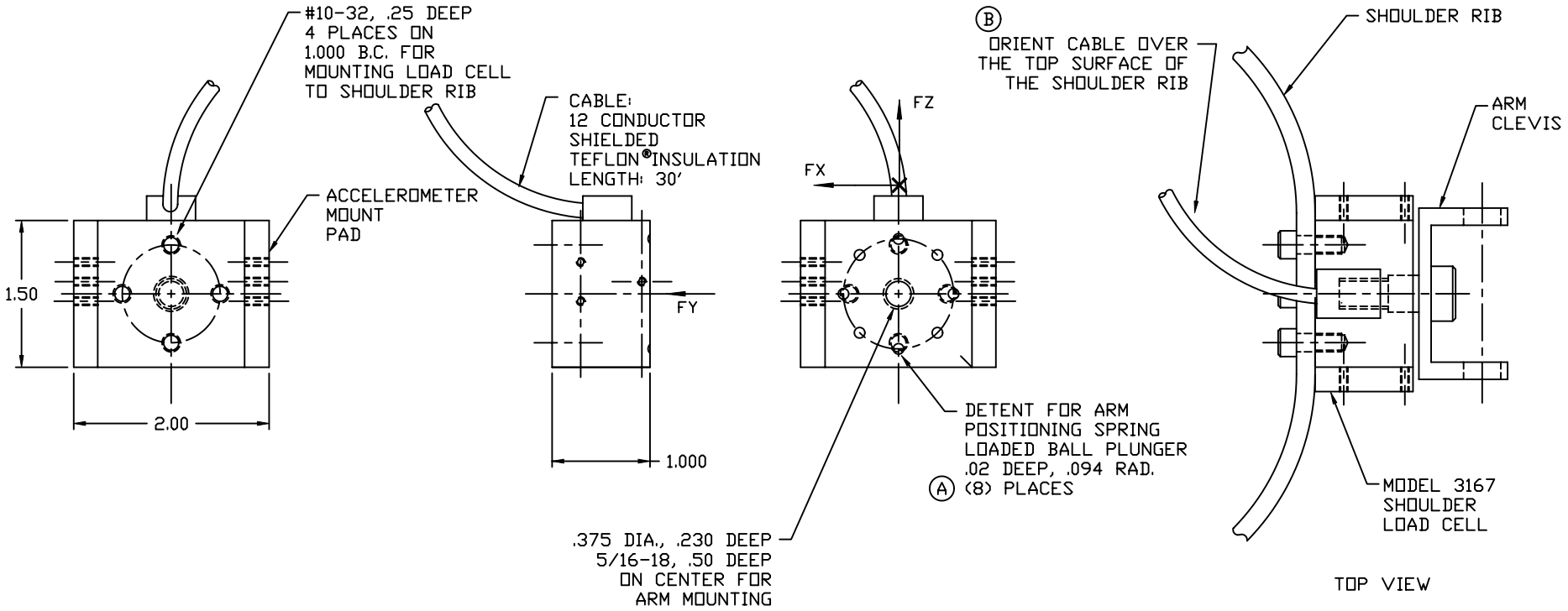
SID-IIs LOWER NECK CALIBRATION FIXTURE

SCALE: .75x
DRAWN BY: C.R. MORGAN
DATE: 11OCT95
MODEL: 3166

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3166-C



SHOULDER LOAD CELL
SID-IIs

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	1000 LBS.	3 mV/V NOMINAL
FY	1000 LBS.	1 mV/V NOMINAL
FZ	1000 LBS.	3 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT: .13 LBS.

SYM	REVISION	DATE
C	WAS DRG. B-3167	4/99
B	ADDED TEXT	2/98
A	CHANGED DIM.	1/96

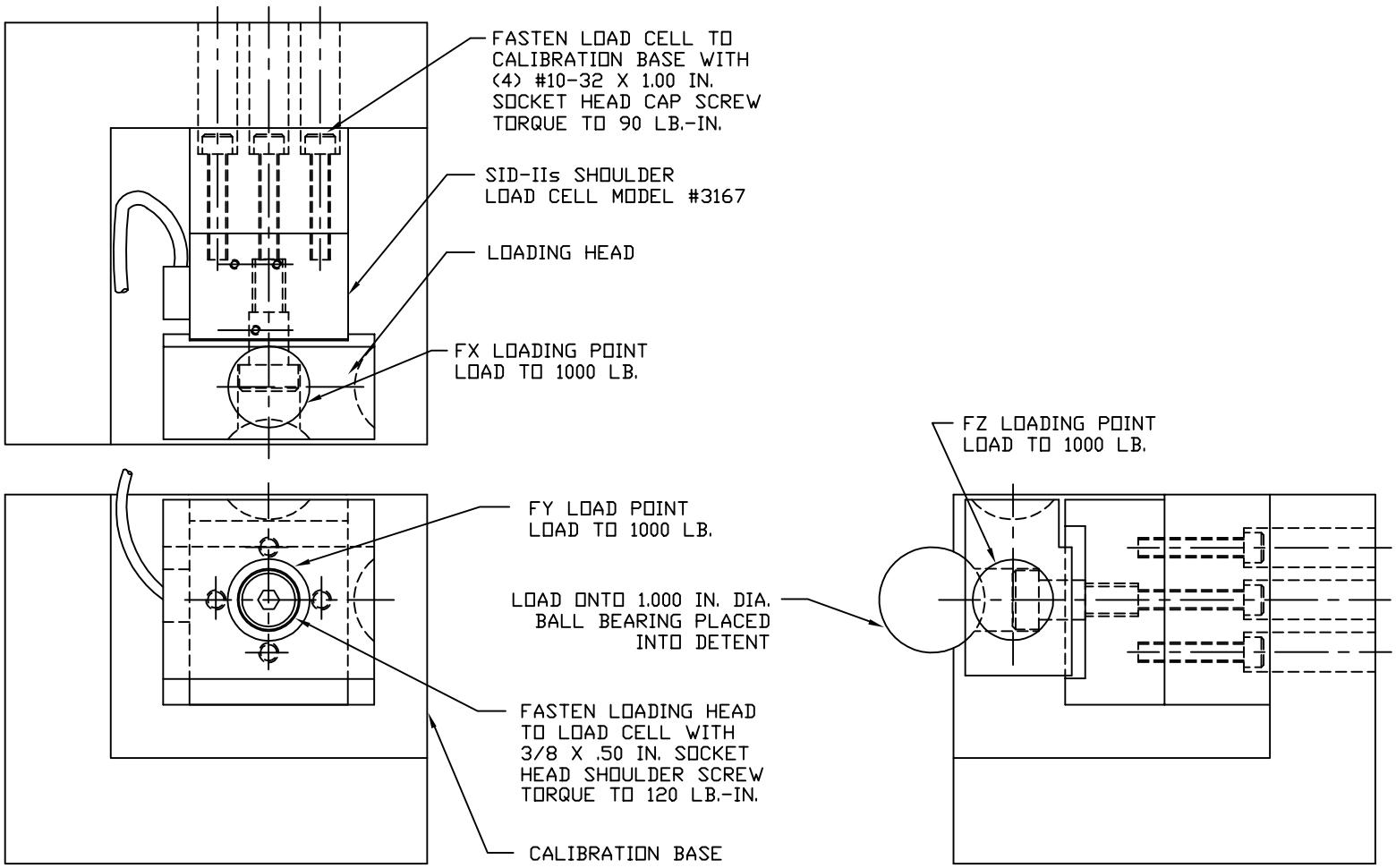
SID-IIs SHOULDER LOAD CELL

SCALE: FULL
DATE: 13DEC94
DRAWN BY: C.R. MORGAN
MODEL: 3167

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3167-D



CALIBRATION FIXTURE MODEL #3265

SYM	REVISION	DATE
A	WAS DRG. B-3265	4/99

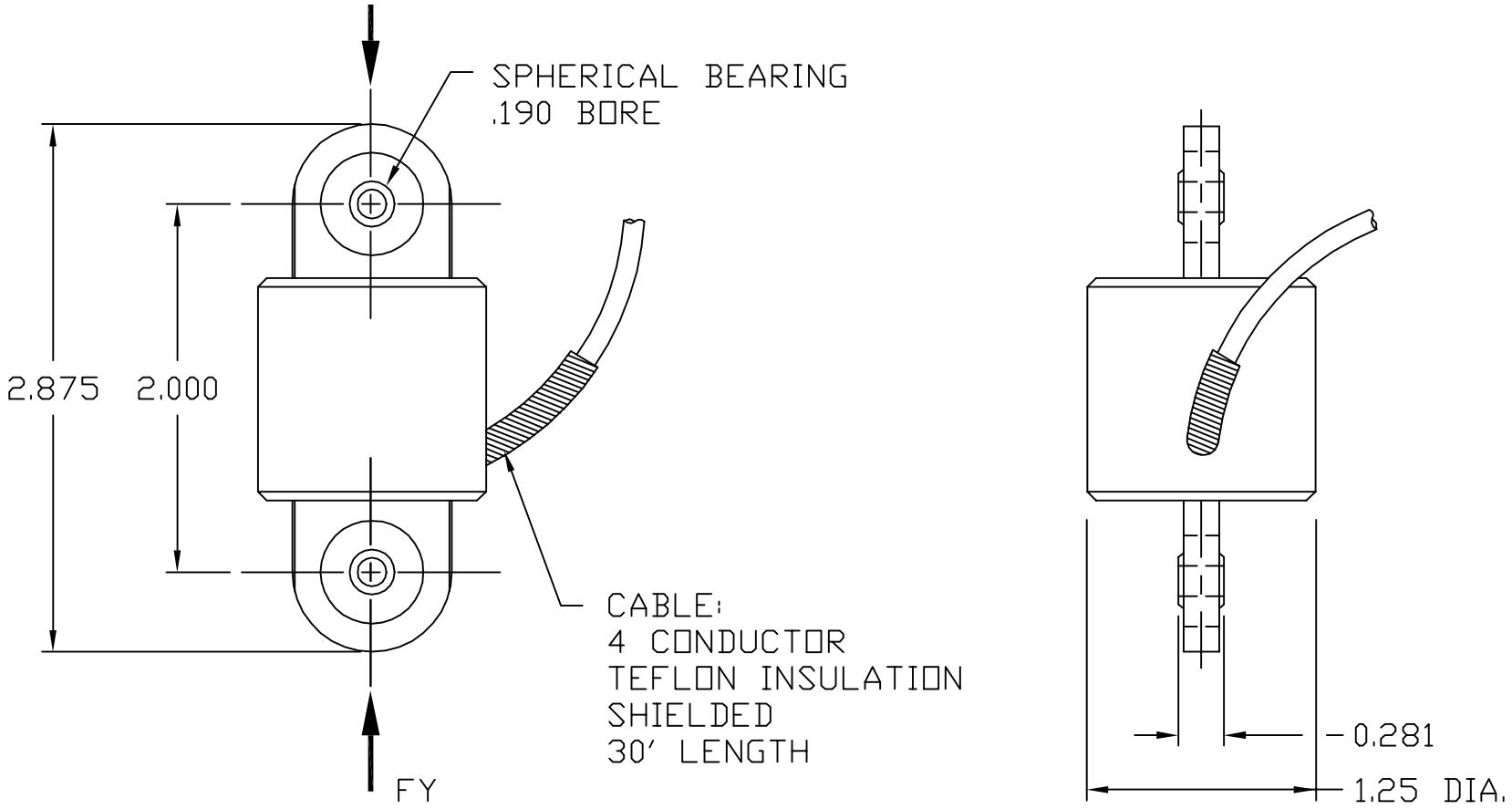
SID-IIs SHOULDER LOAD CELL CALIBRATION FIXTURE

SCALE: FULL
DRAWN BY: H. PROCTOR
DATE: 10/31/95
MODEL: 3167

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3167-C



SID-IIs PUBIC SYMPHYSIS LOAD CELL

AXIS: FY
CAPACITY: 2000 LBS.
OUTPUT @ CAPACITY: 1.3 mV/V
BRIDGE RESISTANCE: 700 OHMS
NONLINEARITY < 1% OF FULL SCALE
WEIGHT: .43 LBS.

SYM	REVISION	DATE
A	WAS DRG. A-3168	5/99

SID-IIs PUBIC SYMPHYSIS LOAD CELL

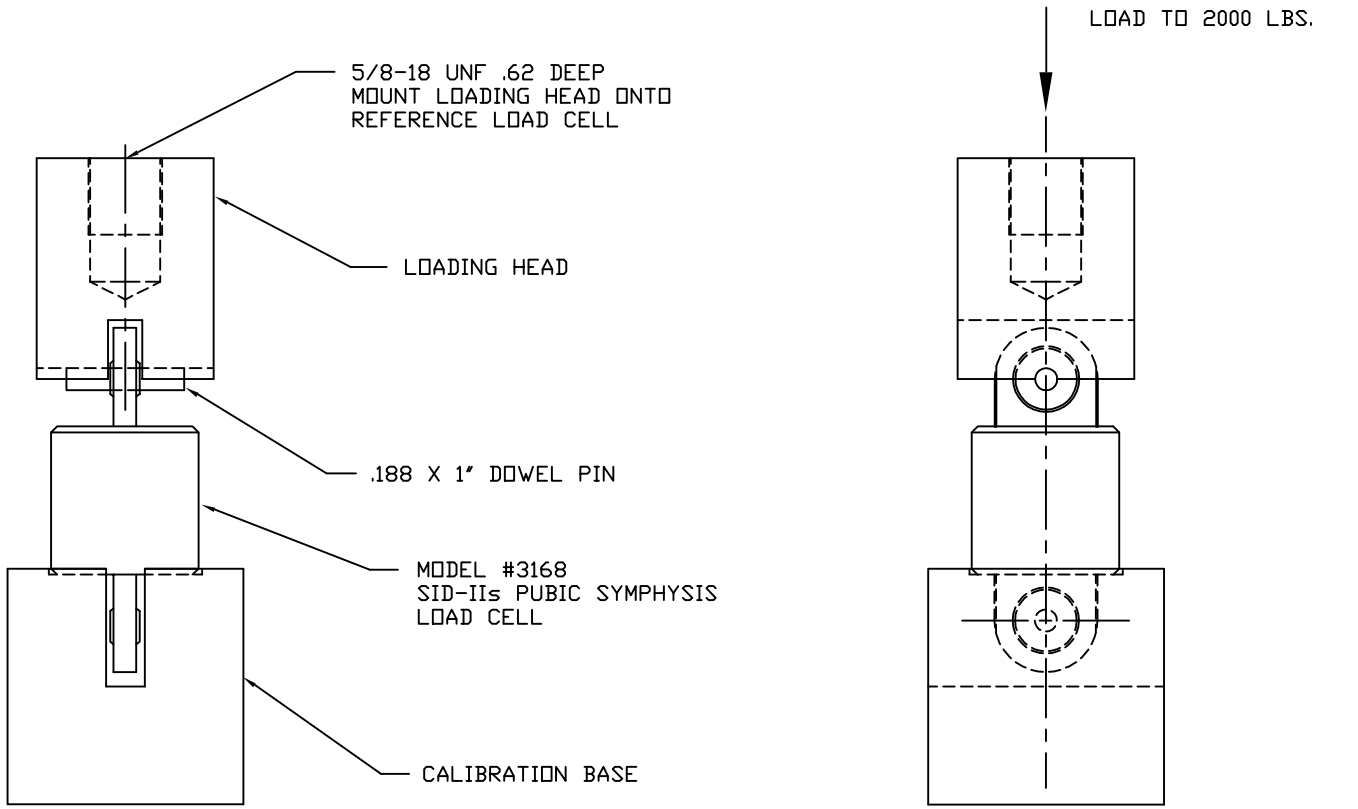
SCALE:	FULL		DRAWN BY: C.R.MORGAN
DATE:	13DEC94		MODEL: 3168

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-3168-D



CALIBRATION FIXTURE MODEL #3268

SYM	REVISION	DATE
B	WAS DRG. B-3268	5/99
A	REV. LD. HEAD	1/96

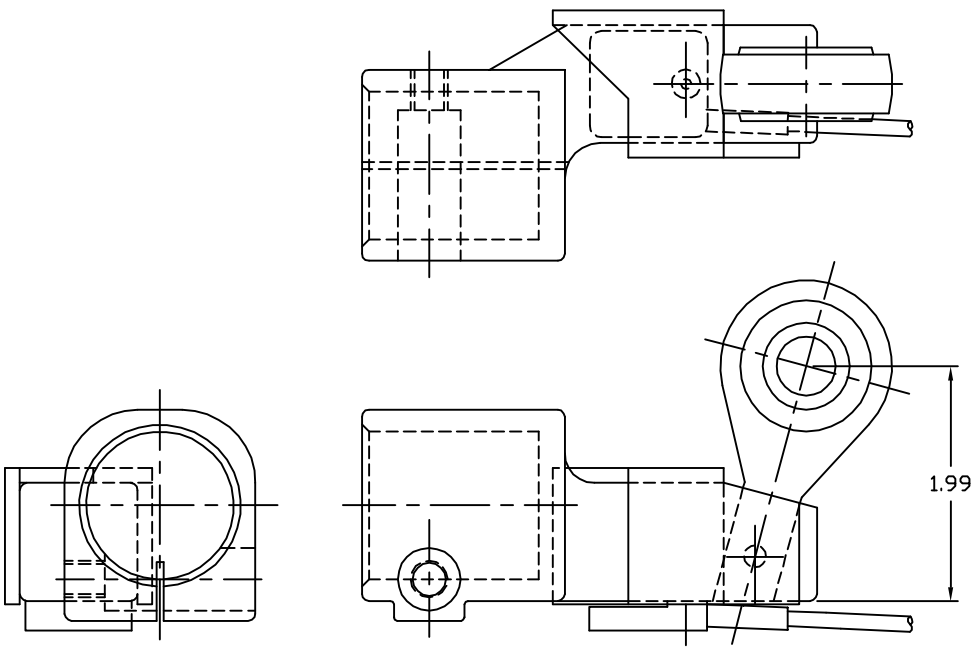
SID-IIs PUBIC LOAD CELL CALIBRATION FIXTURE

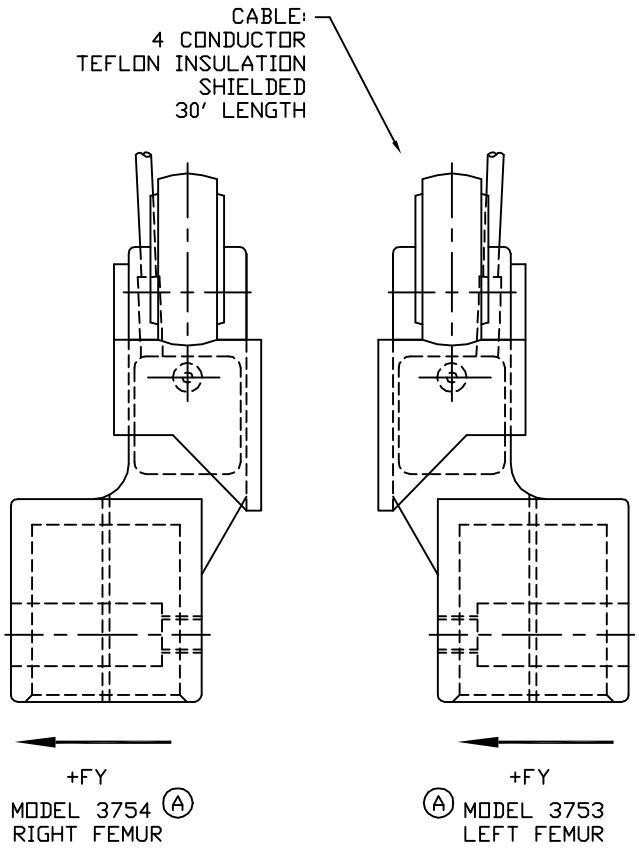
SCALE: FULL
DATE: 10/9/95
DRAWN BY: C.R. MORGAN
MODEL: 3168

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3168-C





AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FY	3000 LBS.	2mV/V NOMINAL	350 OHMS

MODEL 3169 UPPER FEMUR LOAD CELL DUPLICATES THE GEOMETRY OF THE SID-IIs ATD UPPER FEMUR.

NOTES: THE LOAD CELL CALIBRATION DATA IS REFERENCED TO "RIGHT HAND RULE" AS APPLIED BY DENTON, INC. THE DATA CONFORMS TO J-211 SIGN CONVENTION.

BODY SEGMENT MANIPULATIONS FOR POSITIVE LOAD CELL OUTPUT

+FY PELVIS LEFTWARD, FEMUR RIGHTWARD

SYM	REVISION	DATE
E	WAS DRG. B-3169	5/99
D	MOVE CABLE EXIT AND STRAIN RELIEF TO BOTTOM; ADD BUMPER	1/98 PJD
C	REV. CABLE EXIT	7/97
B	ADD ROD ENDS	7/97
A	REV. MODEL #	1/97

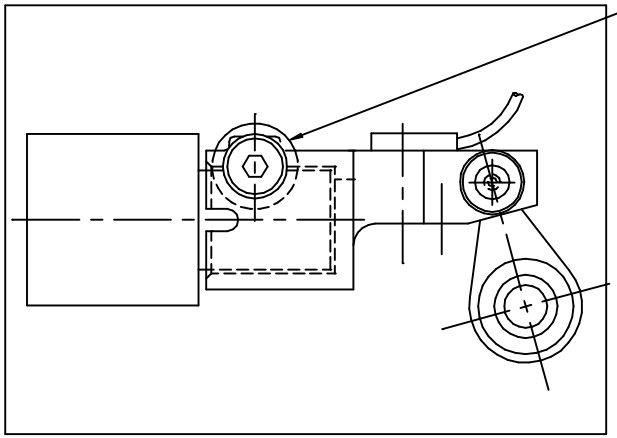
SID-IIs UPPER FEMUR LOAD CELL

SCALE: FULL
DATE: 9FEB95
DRAWN BY: C.R. MORGAN
MODEL: 3169

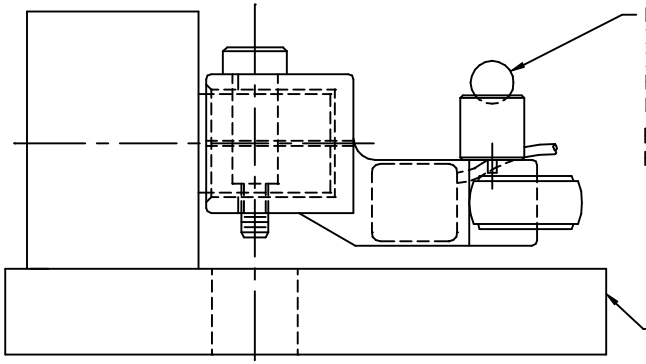
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

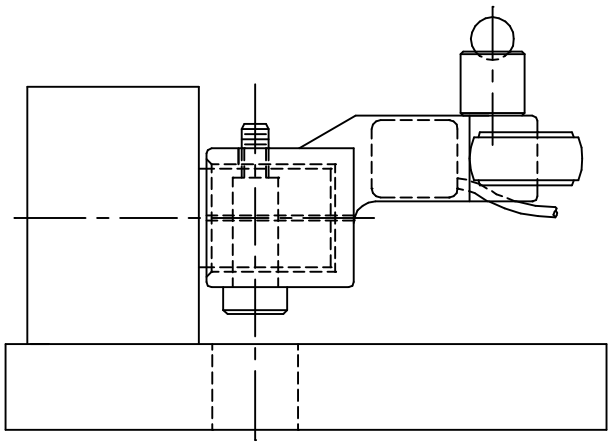
DRAWING NUMBER: B-3169-D



SID-IIs FEMUR LOAD CELLS MODEL 3169 SET CONSISTING OF MODEL 3753 LEFT AND MODEL 3754 RIGHT. ORIENT AS SHOWN FOR POSITIVE OUTPUT.



RIGHT FEMUR LOAD CELL MODEL 3754



LEFT FEMUR LOAD CELL MODEL 3753

CALIBRATION FIXTURE MODEL #3269

SYM	REVISION	DATE
D	CABLE POS'N	1/00
C	WAS DRG. B-3269	5/99
B	ADD LEFT VIEW	5/96
A	NEW LOADING HEAD	5/96

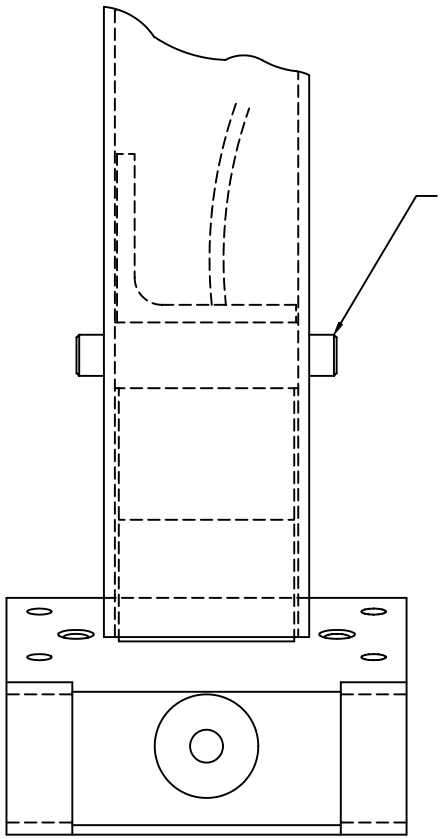
SID-IIs FY FEMUR LOAD CELL CALIBRATION FIXTURE

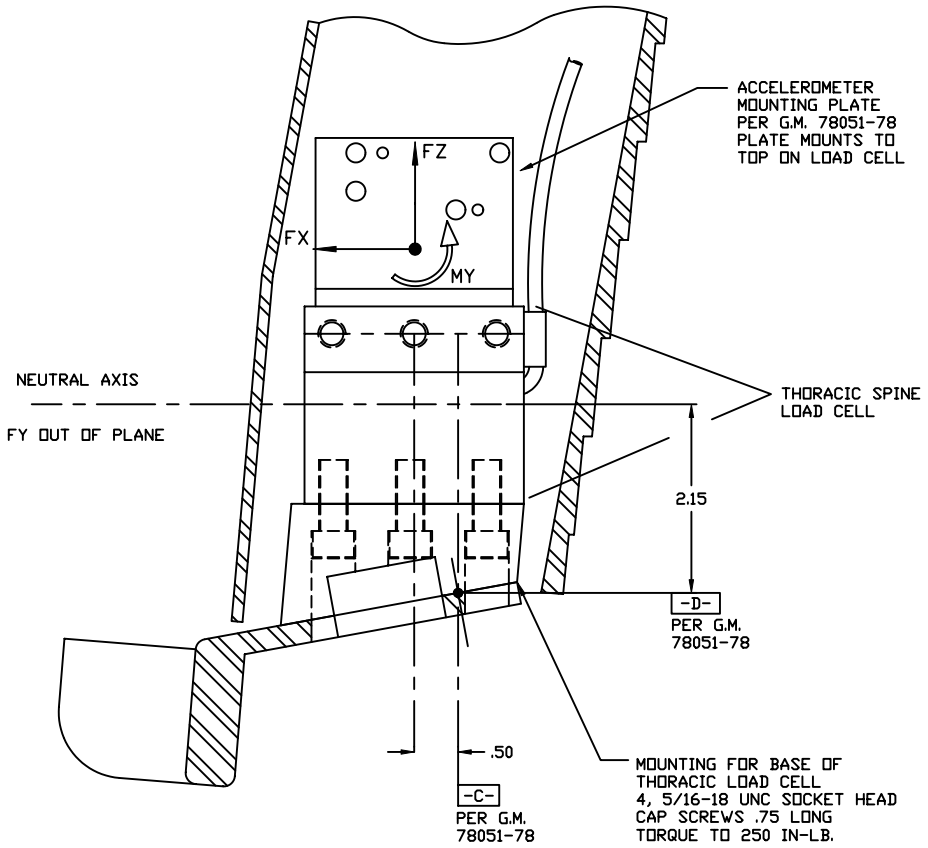
SCALE: .75 | DRAWN BY: H. PROCTOR
DATE: 11/27/95 | MODEL: 3169

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3169-C





THORACIC SPINE LOAD CELL

AXIS	CAPACITY	OUTPUT
FX	3000 LBS.	2.0 mV/V NOM.
FZ	4000 LBS.	1.0 mV/V NOM.
MY	5000 LB-IN.	1.0 mV/V NOM.

NONLINEARITY <1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE

MODEL 3213 MOUNTS DIRECTLY INTO HYBRID III LARGE MALE. A MODIFIED THORACIC SPINE AS DETAILED ABOVE IS REQUIRED TO MOUNT THE MODEL 3213 INTO THE HYBRID III 50TH PERCENTILE A.T.D.

SYM	REVISION	DATE
B	WAS DRG. B-3213	5/99
A	CHG OUTPUT CAP.	11/98

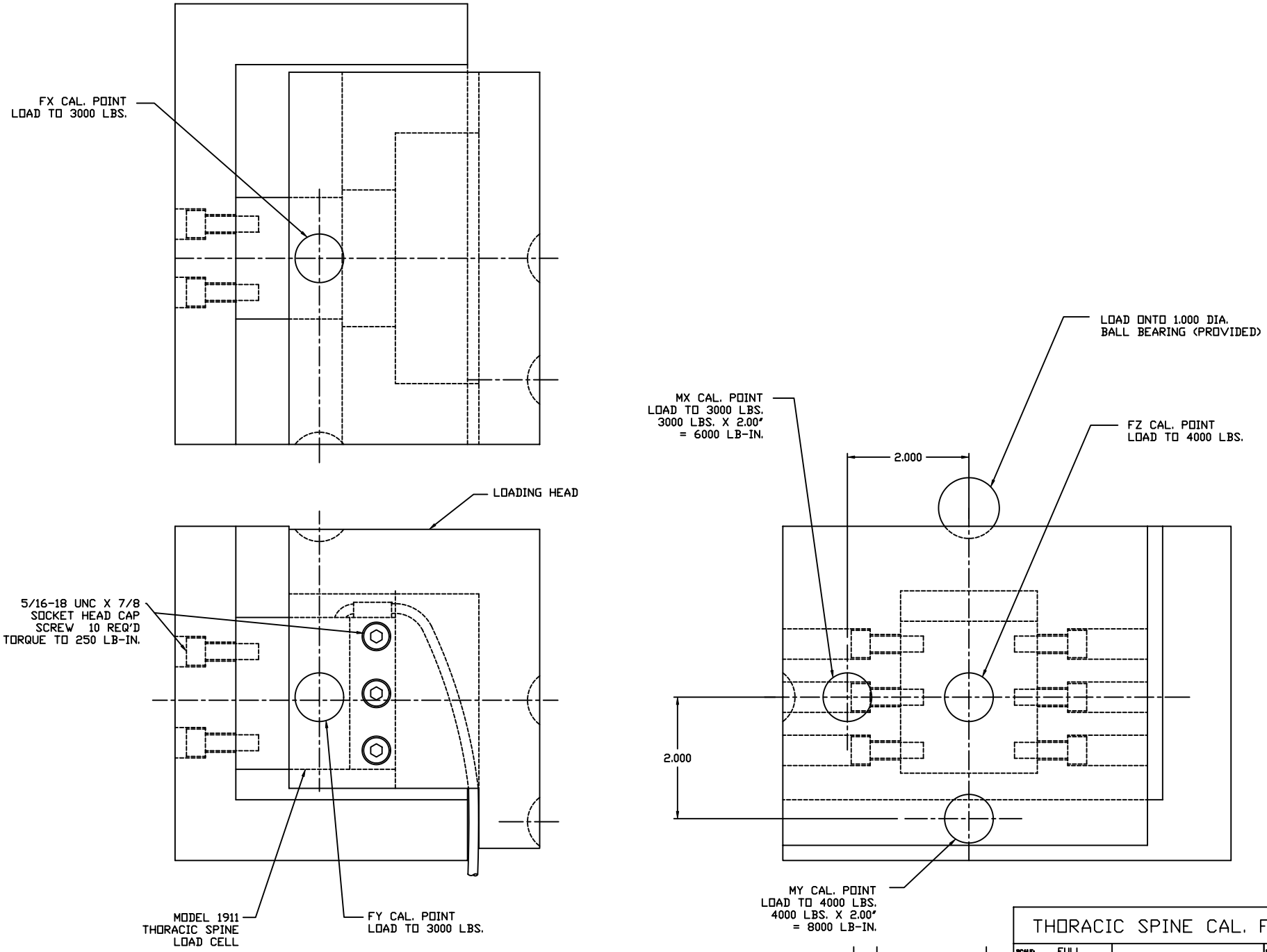
THORACIC SPINE LOAD CELL

SCALE: .75 | DRAWN BY: C.R.MORGAN
DATE: 20JAN93 | MODEL: 3213

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3213-D



THORACIC SPINE CAL. FIXTURE

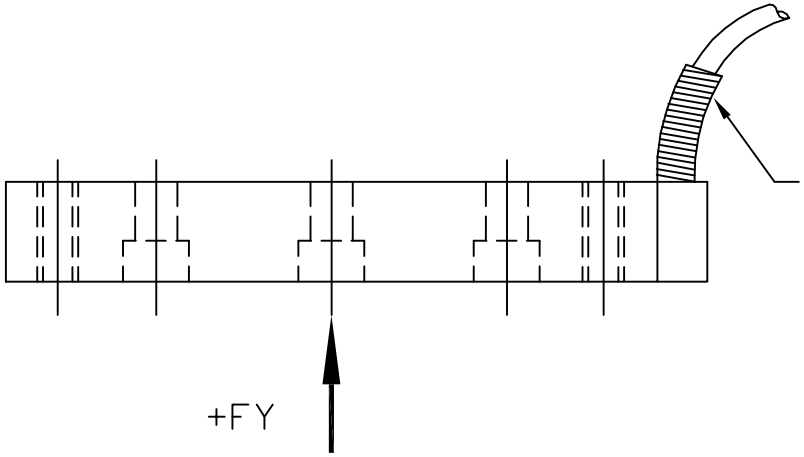
SCALE:	FULL
DATE:	9/20/86
DRAWN BY:	C.R.M./S.E.P.
MODEL:	1934

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125√
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

SYM	REVISION	DATE
B	WAS DRG. C-1934	5/99
A	REDRAWN IN CAD	7/93

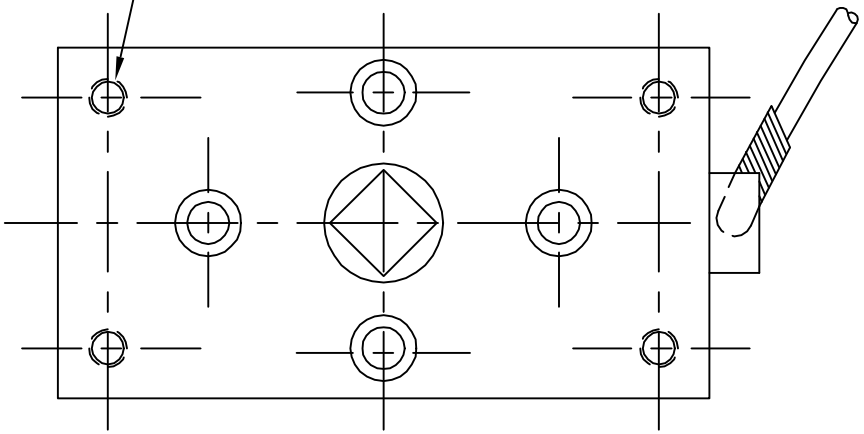
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-3213-C



CABLE:
4 CONDUCTOR
TEFLON INSULATION
SHIELDED
30' LENGTH
ORIENT CABLE TOWARD
REAR OF DUMMY (A)

FASTEN ILIAC WING
TO LOAD CELL WITH
#10-32 SOCKET HEAD
CAP SCREW.



MEASURED AXIS: FY
CAPACITY: 3000 LBS.
OUTPUT @ CAPACITY: 2mV/V NOM.
BRIDGE RESISTANCE: 350 OHMS
NONLINEARITY < 1% OF FULL SCALE
WEIGHT: .65 LBS.

MODEL 3228 ILIAC WING LOAD CELL WILL FASTEN DIRECTLY TO SID-IIs ILIAC WING AND LUMBAR SUPPORT BLOCK OR TO MODEL 3229 LUMBAR LOAD CELL.

SYM	REVISION	DATE
B	WAS DRG. A-3228	5/99
A	UPDATED TEXT	2/98

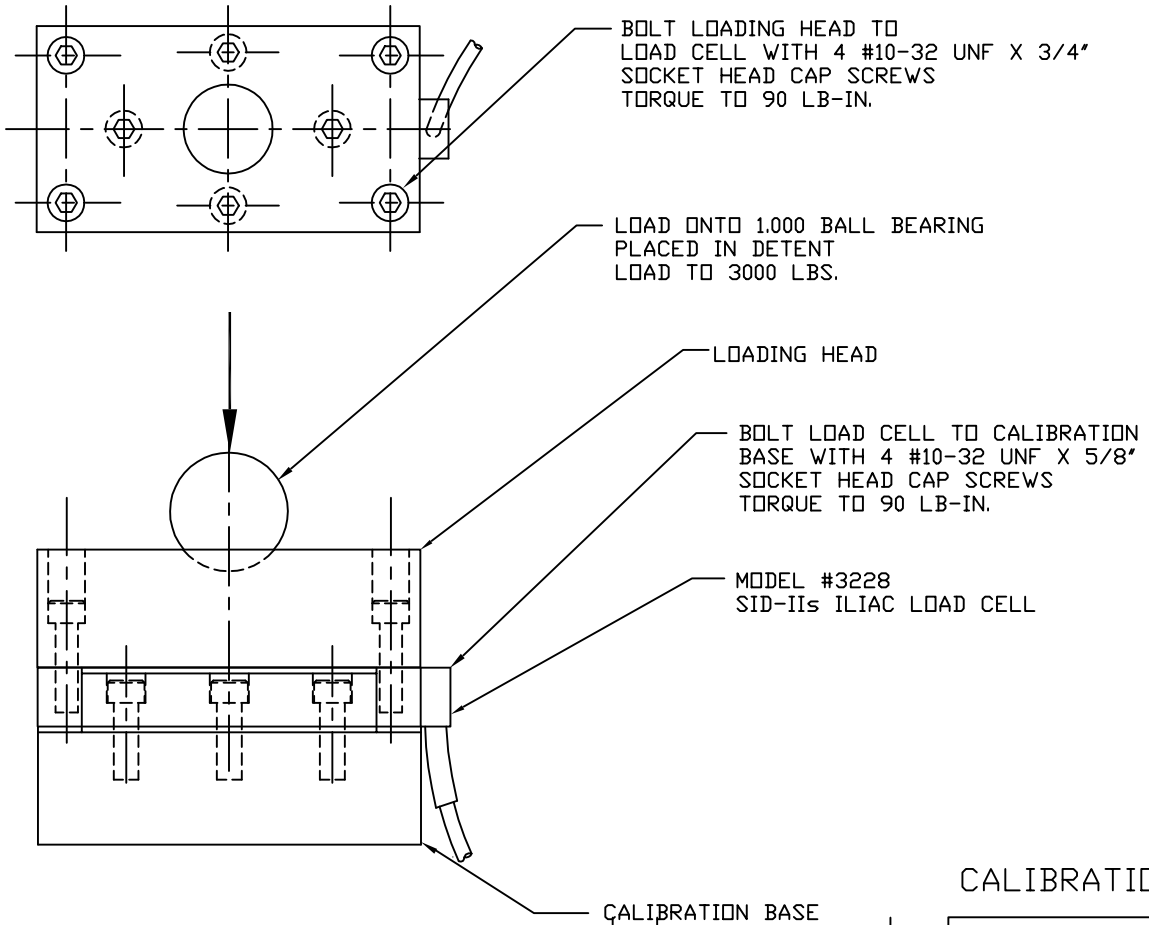
SID-IIs ILIAC WING LOAD CELL

SCALE: FULL
DATE: 9FEB95
DRAWN BY: C.R. MORGAN
MODEL: 3228

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-3228-D



CALIBRATION FIXTURE MODEL #3267

SYM	REVISION	DATE
A	WAS DRG. B-3267	5/99

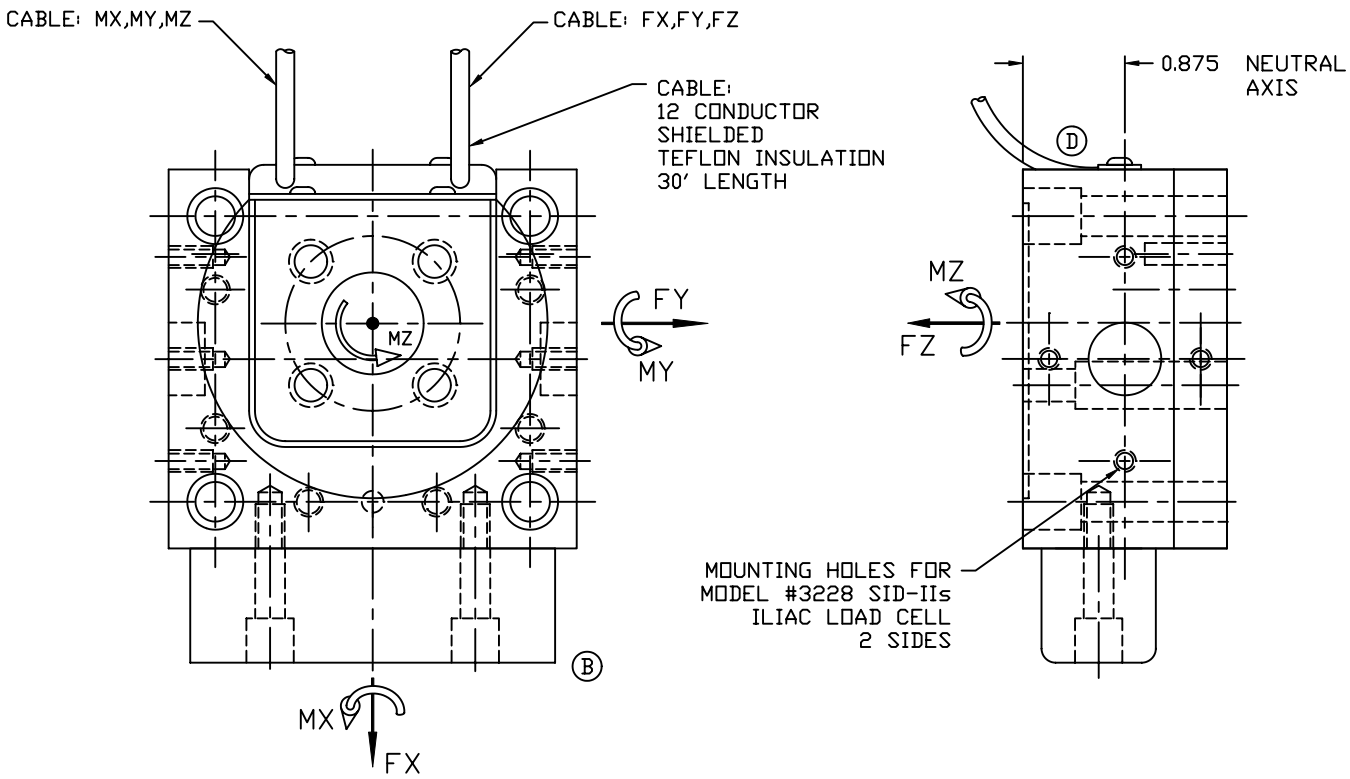
SID-IIs ILIAC CAL FIXTURE

SCALE: FULL		DRAWN BY: H. PROCTOR
DATE: 11OCT95		MODEL: 3228

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3228-C



MODEL 3229 SID-IIs LUMBAR SPINE LOAD CELL WILL FASTEN DIRECTLY TO THE SID-IIs PELVIS AND LUMBAR SPINE.

MODEL 3229 LUMBAR SPINE LOAD CELL
SID-IIs

AXIS	CAPACITY	OUPUT	BRIDGE RESISTANCE
FX	3000 LBS.	2 mV/V NOM.	350 OHMS
FY	3000 LBS.	2 mV/V NOM.	350 OHMS
FZ	3000 LBS.	1.2 mV/V NOM.	700 OHMS
MX	4000 LB-IN	2 mV/V NOM.	350 OHMS
MY	4000 LB-IN	2 mV/V NOM.	350 OHMS
MZ	2000 LB-IN	2 mV/V NOM.	700 OHMS

NONLINEARITY <1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE
WEIGHT: 3.5 LBS.

E	WAS DRG. B-3229	5/99
D	REV. CABLE EXIT	1/98
C	ADD NEUTRAL AXIS	4/97
B	WEIGHT ADDED	2/96
A	UPDATED	12/28/95

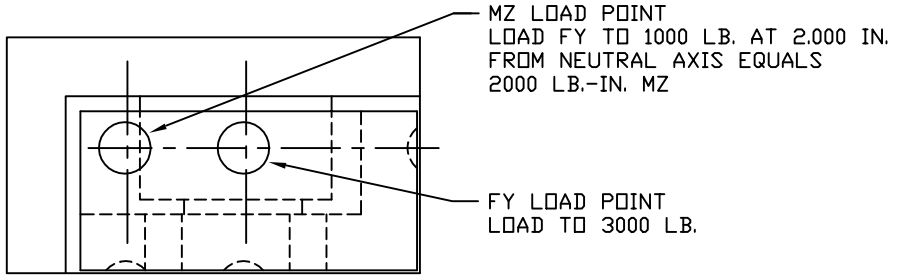
SID-IIs LUMBAR SPINE LOAD CELL

SCALE: FULL
DATE: 9FEB95
DRAWN BY: C.R. MORGAN
MODEL: 3229

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

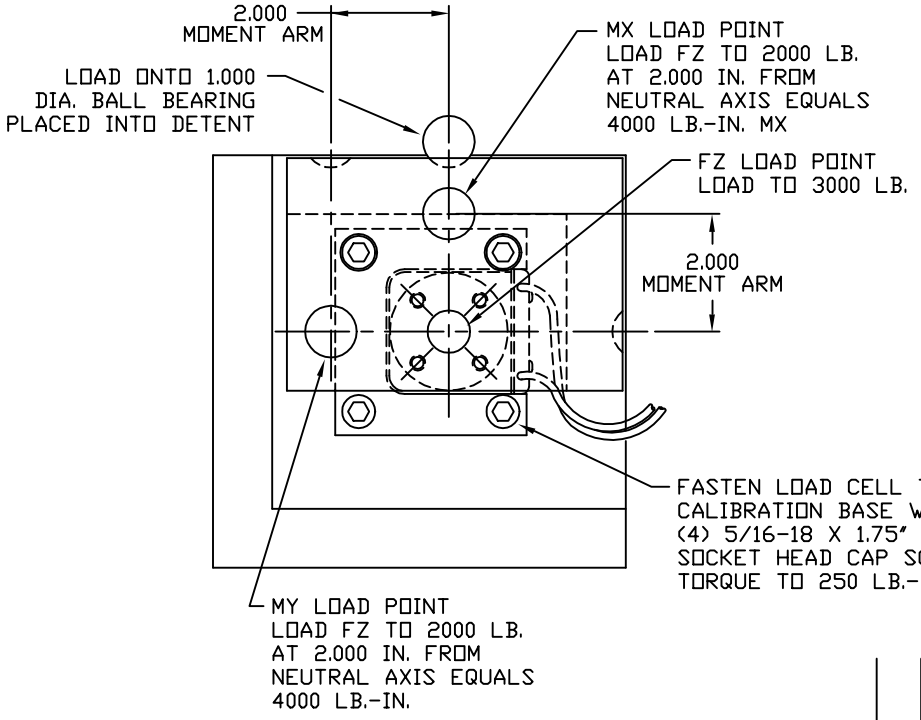
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

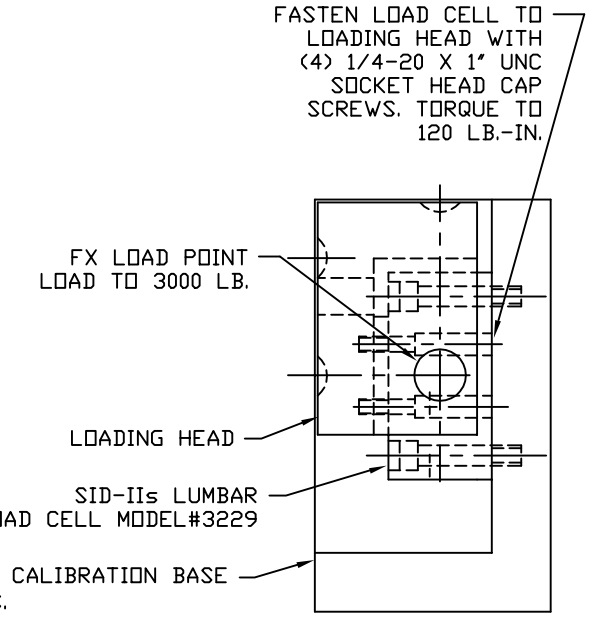
DRAWING NUMBER: B-3229-D



REMOVE BALLAST WEIGHT BEFORE CALIBRATING.

ORDER OF ASSEMBLY:
1. FASTEN LOAD CELL TO LOADING HEAD AS SHOWN.
2. ROUTE CABLES AROUND CORNER AND OUT THROUGH GAP SHOWN IN DRAWING.
3. FASTEN LOAD CELL/LOADING HEAD ASSEMBLY TO CALIBRATION BASE.





CALIBRATION FIXTURE MODEL #3266

SYM	REVISION	DATE

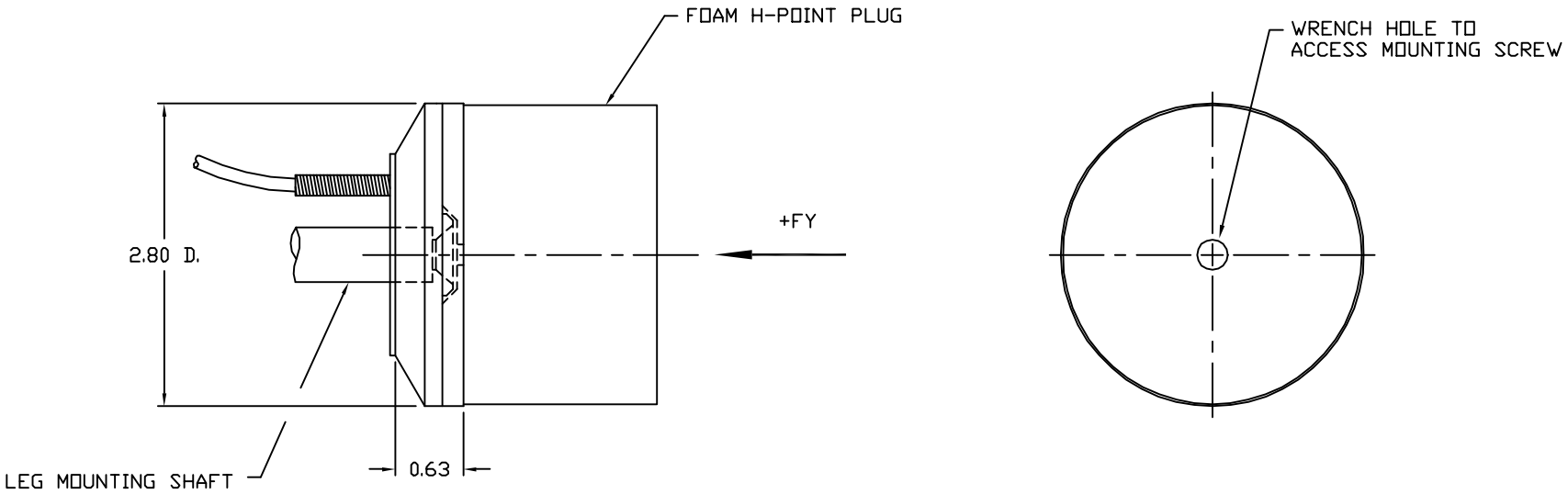
SID-IIs LUMBAR LOAD CELL CALIBRATION FIXTURE

SCALE: 1/2		DRAWN BY: H. PROCTOR
DATE: 10/10/95		MODEL: 3229

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3229-C



SID-IIs ACETABULUM LOAD CELL

MEASURED AXIS: FY
CAPACITY: 2000 LBS.
OUTPUT @ CAPACITY: 2mV/V NOMINAL
BRIDGE RESISTANCE: 350 OHMS
NONLINEARITY < 1% OF FULL SCALE
WEIGHT: .30 LBS.

SYM	REVISION	DATE
B	WAS DRG. B-3249	5/99
A	REMOVE LIP FROM COVER	1/98 PJD

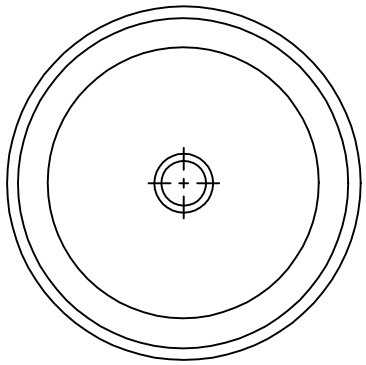
SID-IIs ACETABULUM LOAD CELL

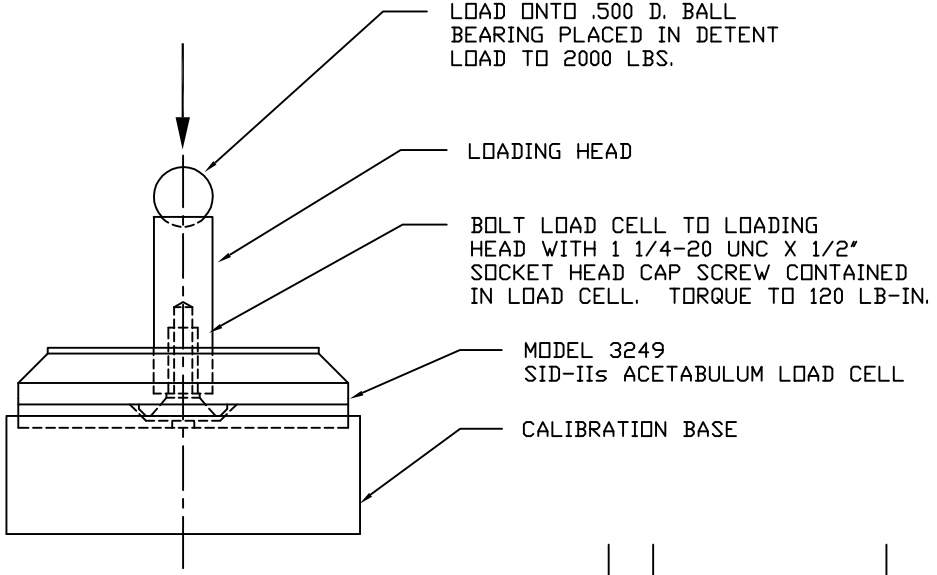
SCALE: FULL | DRAWN BY: C.R. MORGAN
DATE: 30MARCH95 | MODEL: 3249

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3249-D





CALIBRATION FIXTURE MODEL #3270

SYM	REVISION	DATE
B	WAS DRG. B-3270	5/99
A	REMOVE LIP FROM LOAD CELL COVER; ADD LIP TO CALIBRATION BASE	1/98 PJD

SID-IIs ACETABULUM CAL. FIXTURE

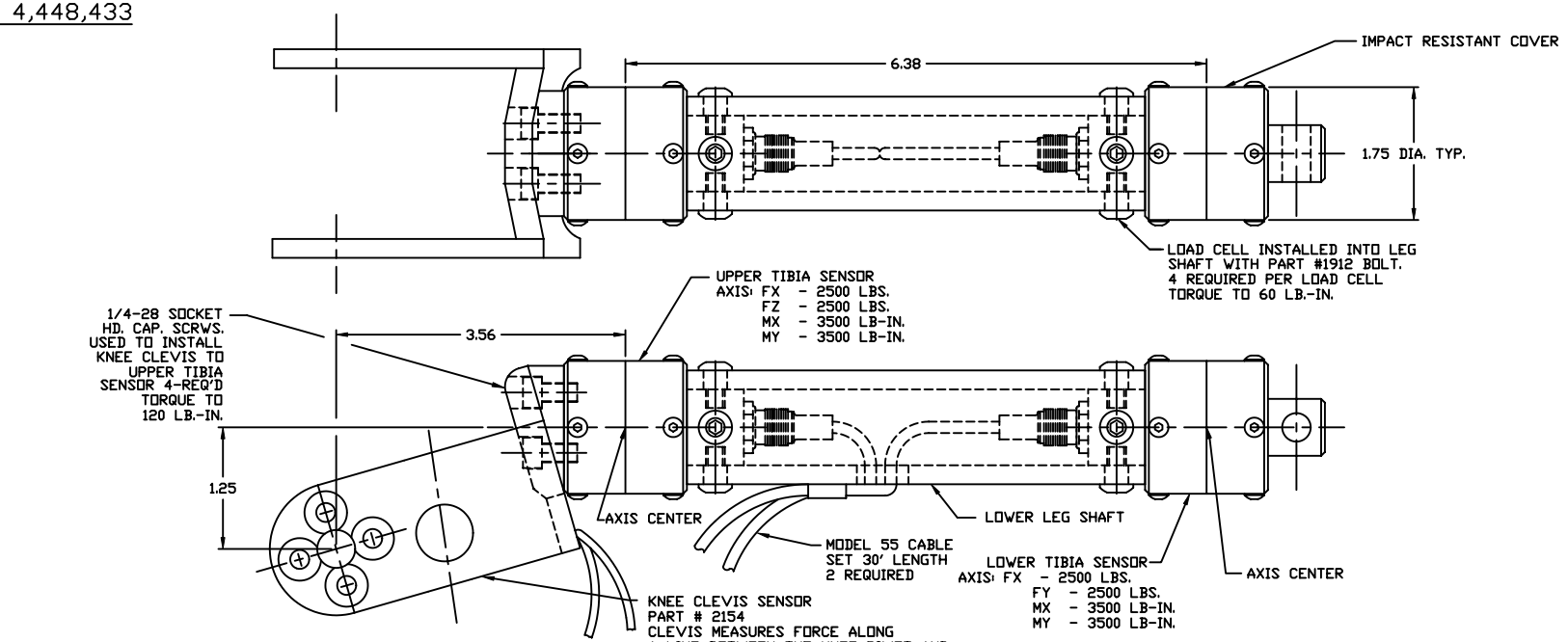
SCALE: FULL
DATE: 12OCT95
DRAWN BY: H. PROCTOR
MODEL: 3249

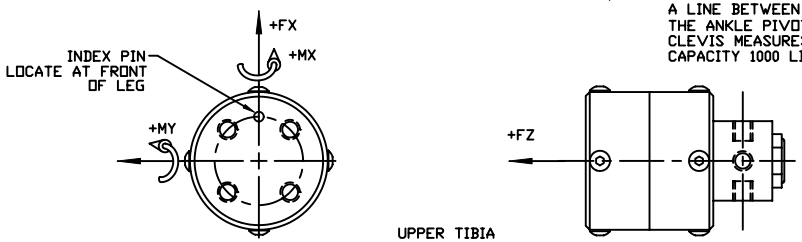
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3249-C

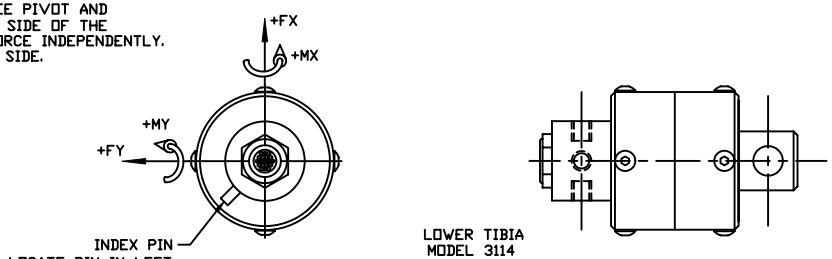
PATENT 4,448,433





UPPER TIBIA
MODEL 3115

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.



LOWER TIBIA
MODEL 3114

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SYM	REVISION	DATE
A	WAS DRG. B-3250	5/99

ENHANCED INSTRUMENTED TIBIA

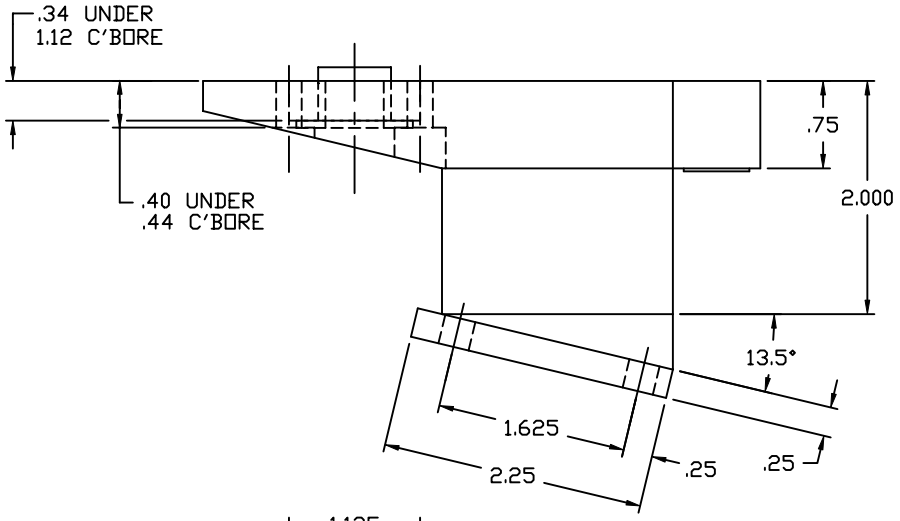
SMALL FEMALE HYBRID III

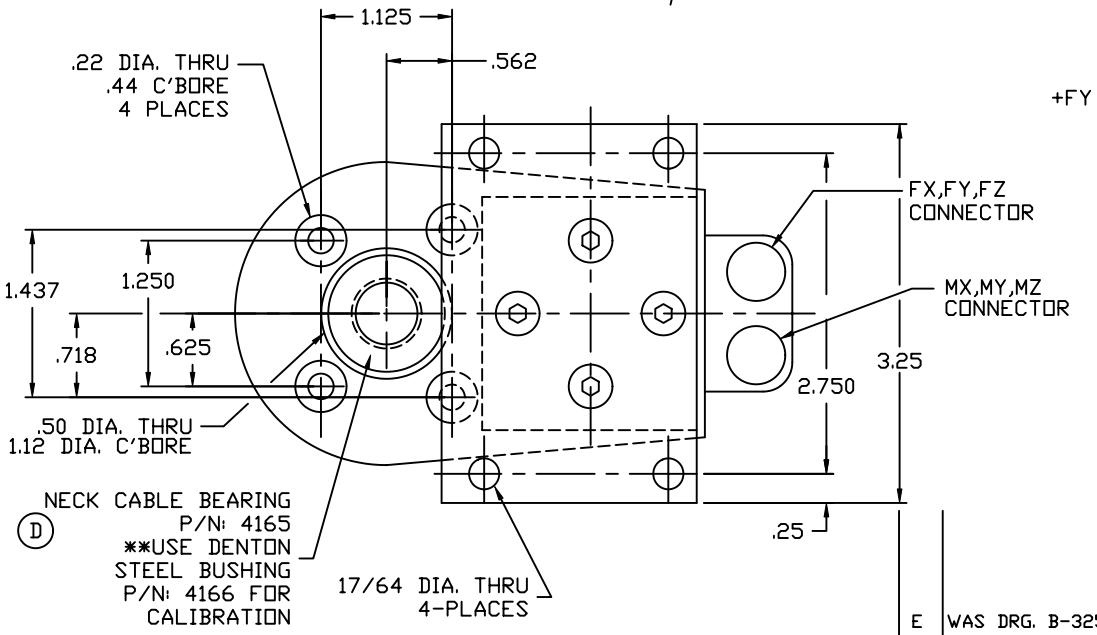
SCALE: NONE		DRAWN BY: C.R. MORGAN
DATE: 19MAY95		MODEL: 3250

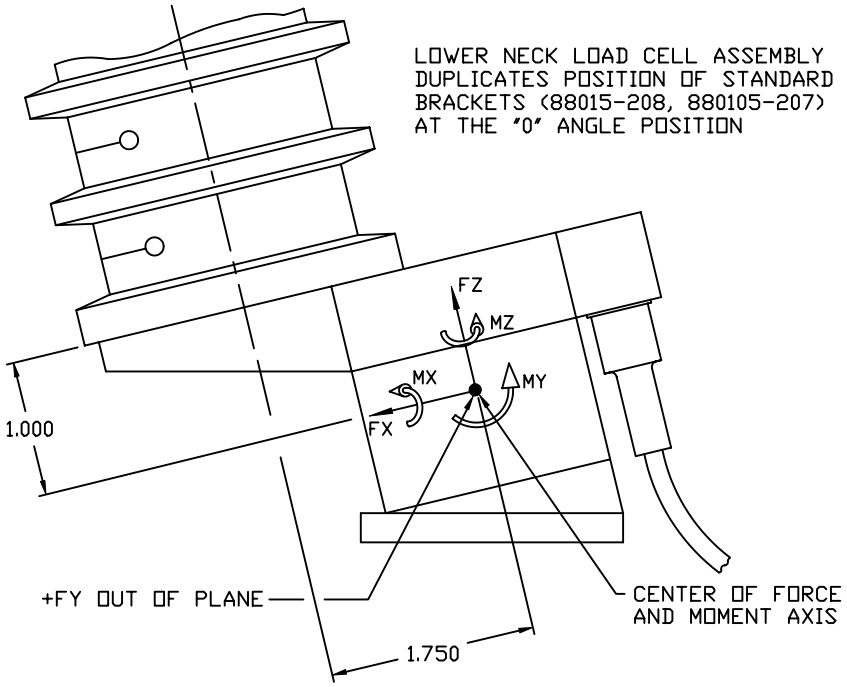
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3250-D







MODEL 3251 SIX CHANNEL LOWER NECK LOAD CELL
SMALL FEMALE HYBRID III

AXIS	CAPACITY	OUPUT	BRIDGE RESISTANCE
FX	3000 LBS.	2.0 mV/V NOM.	350 OHMS
FY	3000 LBS.	2.0 mV/V NOM.	350 OHMS
FZ	3000 LBS.	1.2 mV/V NOM.	700 OHMS
MX	4000 LB-IN	2.0 mV/V NOM.	700 OHMS
MY	4000 LB-IN	2.0 mV/V NOM.	700 OHMS
MZ	3000 LB-IN	2.0 mV/V NOM.	350 OHMS

NONLINEARITY <1% OF FULL SCALE
CROSS TALK <5% OF FULL SCALE

SYM	REVISION	DATE
E	WAS DRG. B-3251	5/99
D	CHG NOTE	11/98
C	ADD BEARING	7/98
A,B	REV. MZ CAPACITY	4/96

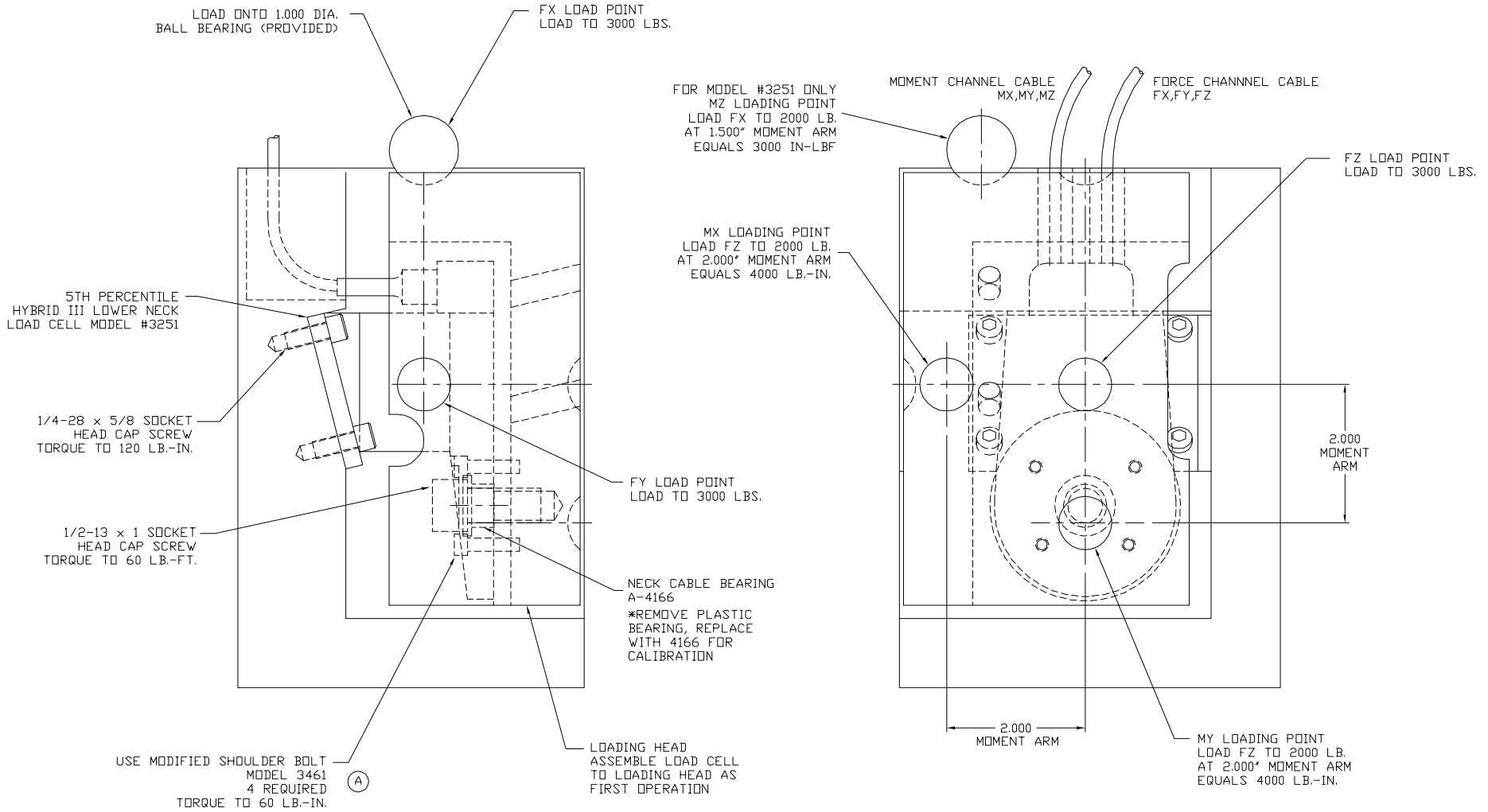
SMALL FEMALE LOWER NECK LOAD CELL

SCALE: FULL
DATE: 17MARCH95
DRAWN BY: C.R.MORGAN
MODEL: 3251

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3251-D



CALIBRATION FIXTURE MODEL #2155

SYM	REVISION	DATE
A	WAS 10-24 SHCS	9/00

5TH % LOWER NECK CALIBRATION FIXTURE

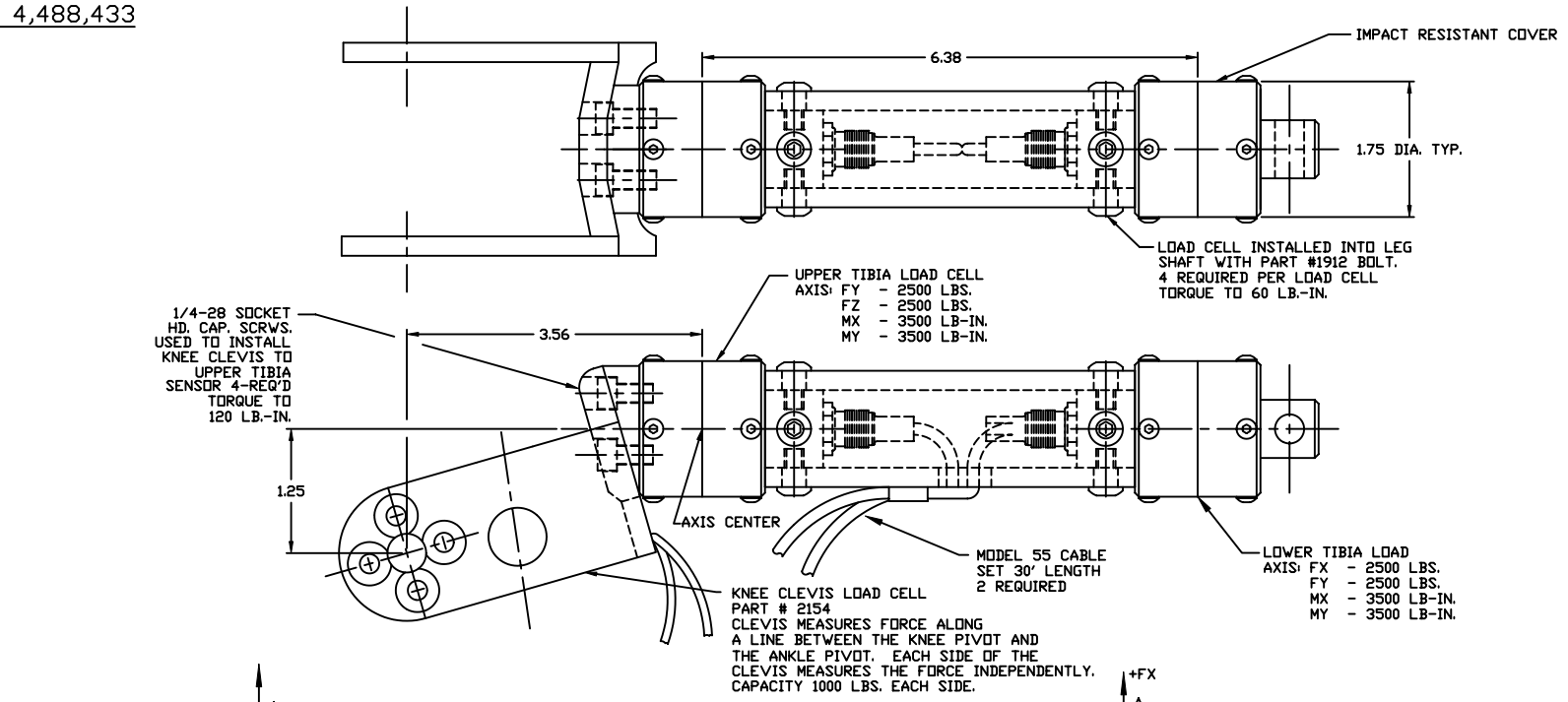
SCALE: FULL
DATE: 3/22/89
DRAWN BY: C.R.M./S.E.F.
MODEL: 2155

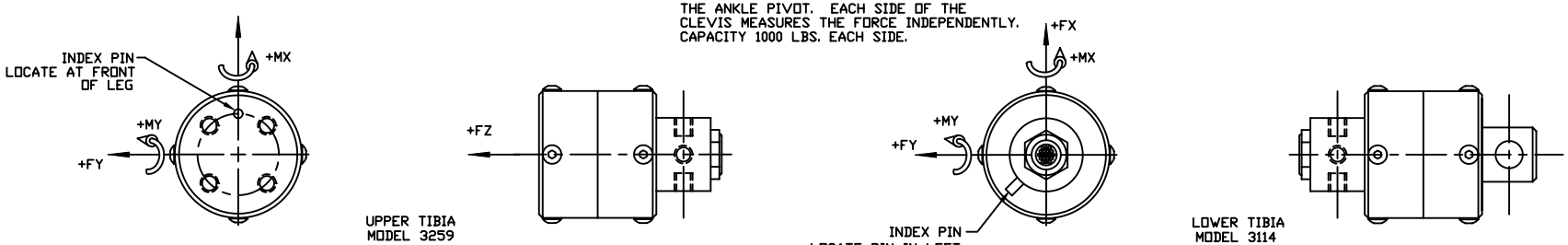
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-3251-C

PATENT 4,488,433





UPPER TIBIA
MODEL 3259

AXIS	CAPACITY	OUTPUT
FY	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

LOWER TIBIA
MODEL 3114

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SYM	REVISION	DATE
A	WAS DRG. B-3253	5/99

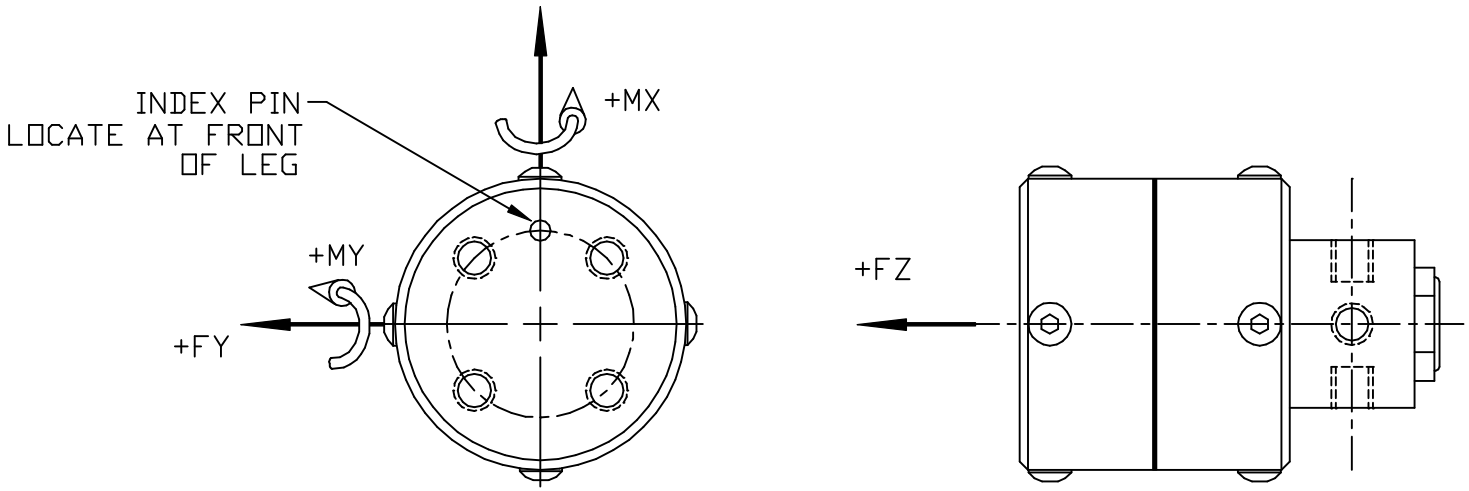
SID-IIs INSTRUMENTED TIBIA

SCALE: NONE
DATE: 30MARCH95
DRAWN BY: C.R. MORGAN
MODEL: 3253

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3253-D



UPPER TIBIA
MODEL 3259

AXIS	CAPACITY	OUTPUT
FY	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SYM	REVISION	DATE
A	WAS DRG. B-3253	6/99

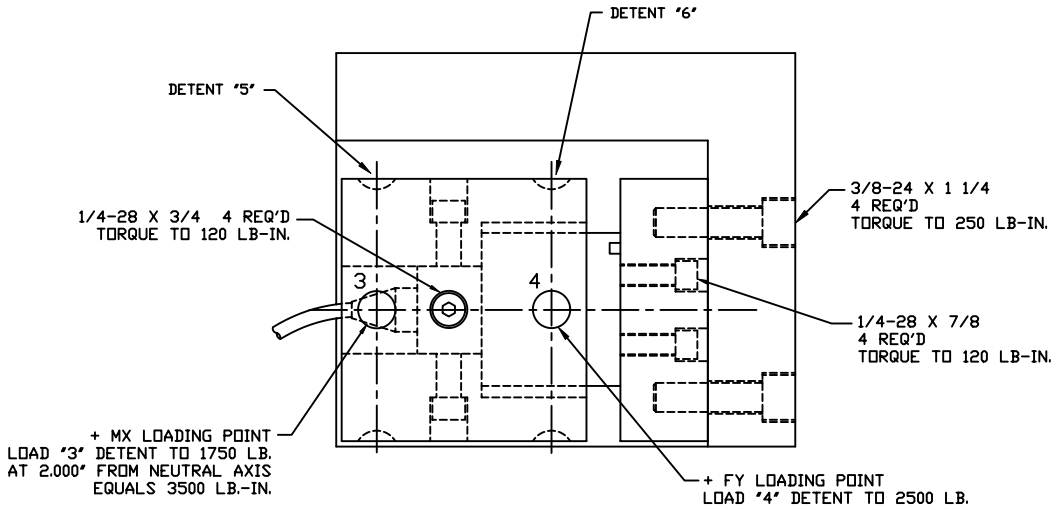
SID-IIs INSTRUMENTED UPPER TIBIA

SCALE: NONE
DRAWN BY: C.R. MORGAN
DATE: 30MARCH95
MODEL: 3259

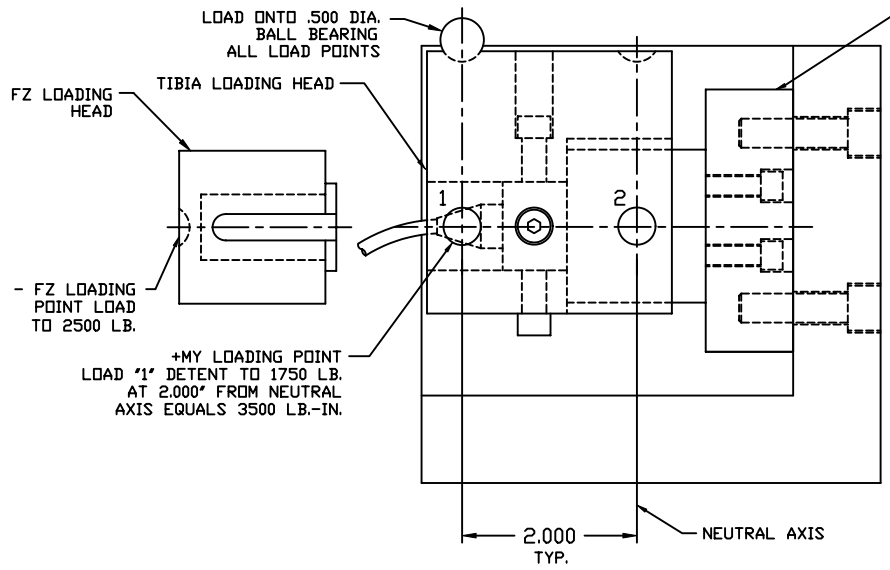
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

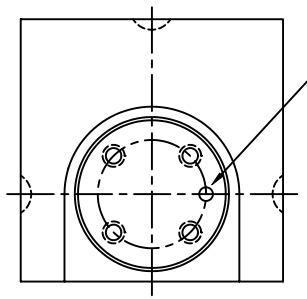
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3259-D



NOTE:
POSITIVE CALIBRATION LOAD POINTS
PER AXIS DEFINITION SPECIFIED ON
DRAWING 3253-D OR 3259-D





CALIBRATION FIXTURE MODEL #2171

UPPER TIBIA CALIBRATION FIXTURE
SID-IIs UPPER TIBIA MODEL 3259

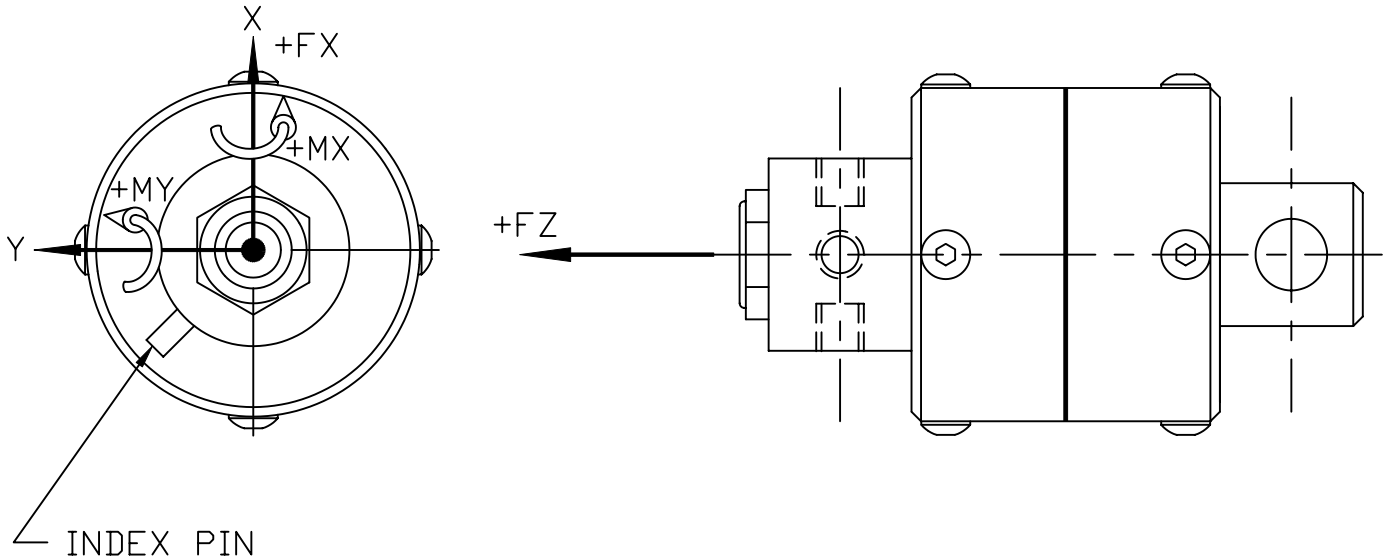
SCALE: .75X			DRAWN BY: C.R. MORGAN
DATE: 15MAY96			MODEL: 3259

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3259-C



INDEX PIN
LOCATE PIN IN LEFT
DETENT OF LEG TUBE
FOR AXES POLARITY
AS SHOWN

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.

CABLE COLOR CODE

FX		MX		MY		FZ	
BROWN	+EXC.	GREEN STRIPE	+EXC.	RED STRIPE	+EXC.	GREEN	+EXC.
RED	+SIG.	BLUE STRIPE	+SIG.	BLACK	+SIG.	BLUE	+SIG.
ORANGE	-EXC.	ORANGE STRIPE	-EXC.	WHITE	-EXC.	VIOLET	-EXC.
YELLOW	-SIG.	YELLOW STRIPE	-SIG.	BLACK STRIPE	-SIG.	GREY	-SIG.

SYM	REVISION	DATE
A	WAS DRG. A-3287	5/99

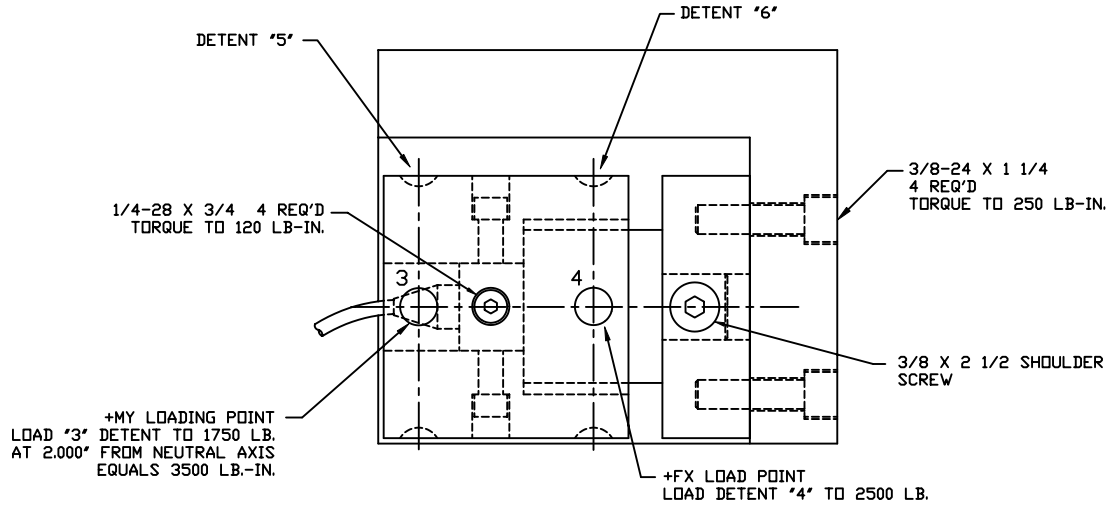
4 CHANNEL LOWER TIBIA

SCALE: FULL
DATE: 25APRIL95
DRAWN BY: C.R. MORGAN
MODEL: 3287

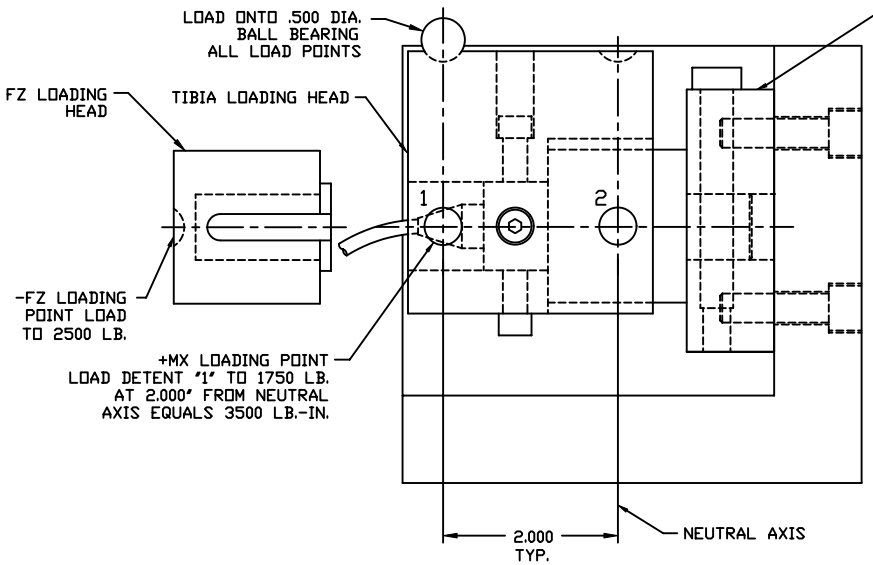
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

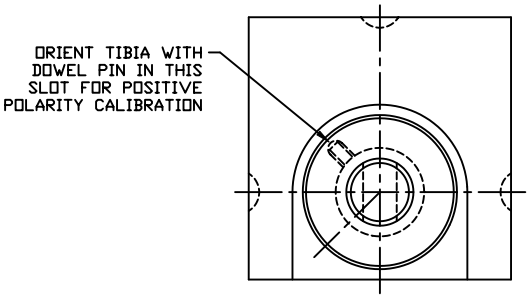
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-3287-D



NOTE:
POSITIVE CALIBRATION LOAD POINT
PER AXIS DEFINITION SPECIFIED ON
DRAWING 3416-D, 3552-D, 3553-D OR 3287-D.





CALIBRATION FIXTURE MODEL #2171

LOWER TIBIA CALIBRATION FIXTURE

LOWER TIBIA MODEL 3287

SCALE: .75X		DRAWN BY: H. PROCTOR	
DATE: 80CT99		MODEL: 3287	

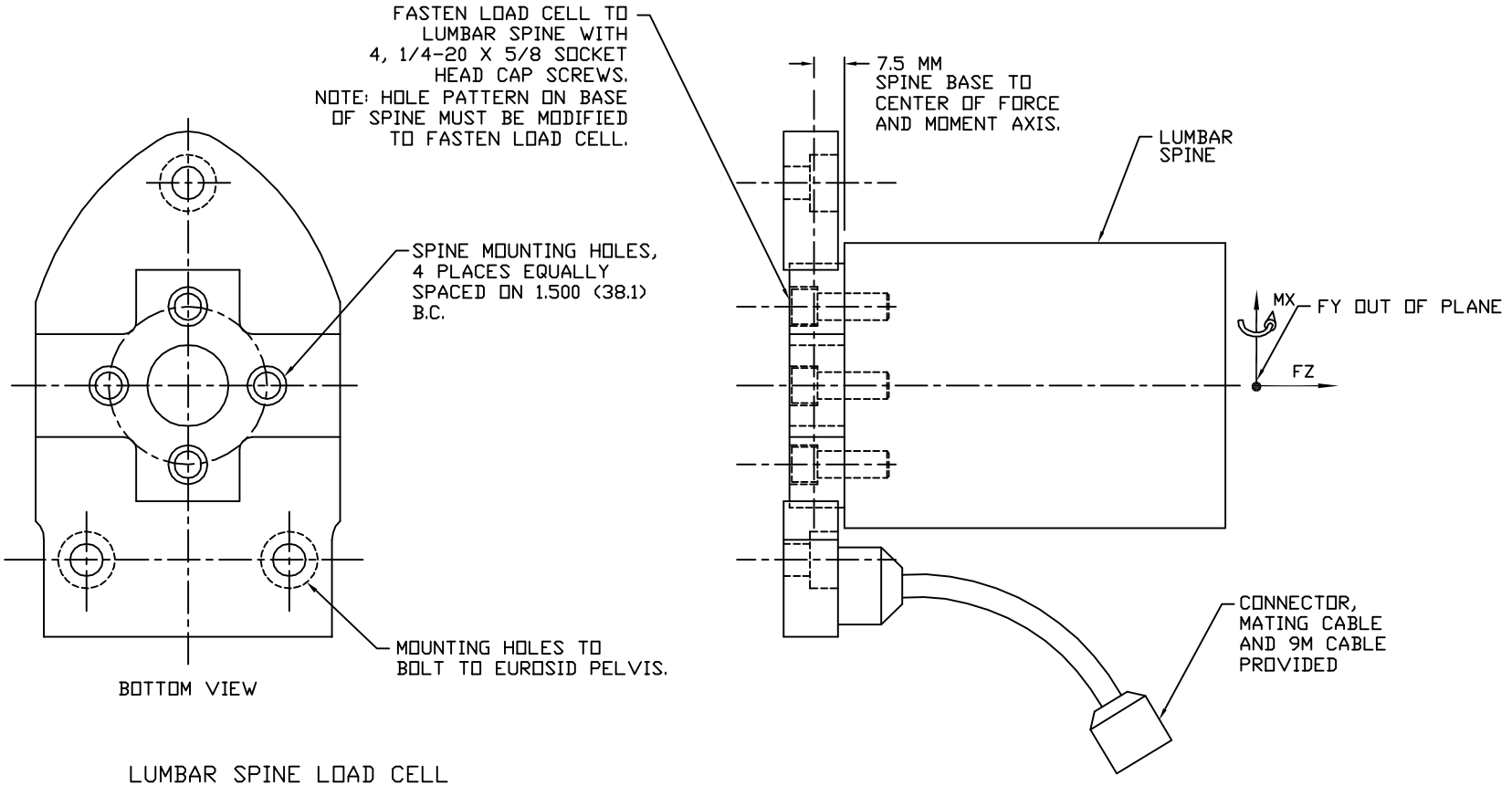
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3287-C

SYM	REVISION	DATE



LUMBAR SPINE LOAD CELL

AXIS	CAPACITY	OUTPUT	BRIDGE RESISTANCE
FY	4.5 KN	1.0 mV/V NOMINAL	350 OHMS
FZ	4.5 KN	1.0 mV/V NOMINAL	350 OHMS
MX	200 NM	1.6 mV/V NOMINAL	350 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

TO CONFORM TO POLARITY PER S.A.E. J-211 THE POLARITY OF THE MX CHANNEL MUST BE CHANGED

WEIGHT: 270 GRAMS

C	ADD BRIDGE REST.	5/00
B	WAS DRG. B-3290	5/99
A	CORRECT J-211 NOTE	10/96

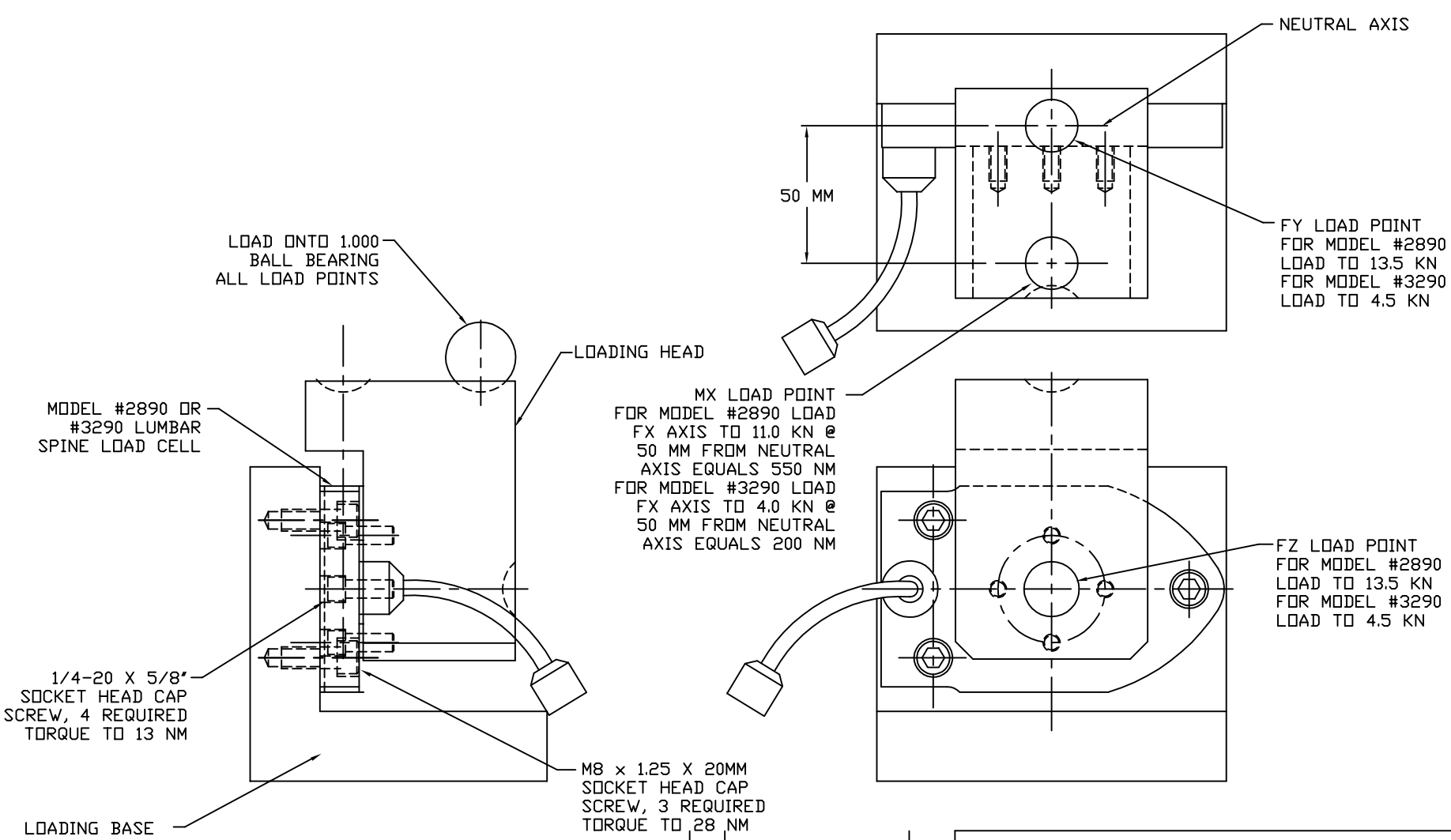
EUROSID-I LUMBAR LOAD CELL

SCALE: FULL
DATE: 22APRIL95
DRAWN BY: C.R. MORGAN
MODEL: 3290

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3290-D



SYM	REVISION	DATE
C	WAS DRG. B-3184	5/99
B	ADD MODEL #3290	6/96
A	REV. LOAD HEAD	6/96

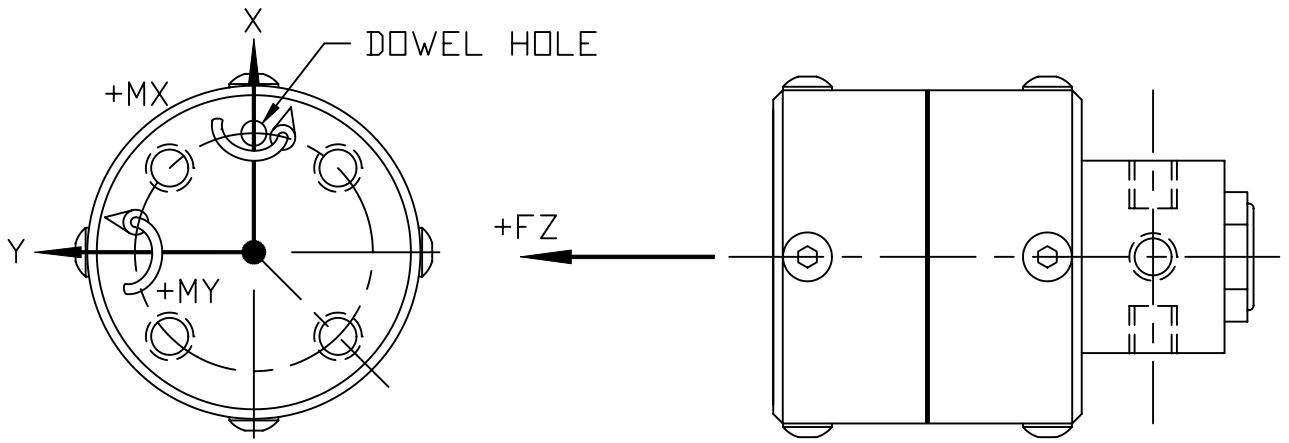
EUROSID I LUMBAR SPINE
CALIBRATION FIXTURE

SCALE: .75X
DRAWN BY: C.R. MORGAN
DATE: 23DEC94
MODEL: 3184

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3290-C



AXIS	CAPACITY	OUTPUT
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.

CABLE COLOR CODE

MX		MY		FZ	
BROWN	+EXC.	RED STRIPE	+EXC.	GREEN	+EXC.
RED	+SIG.	BLACK	+SIG.	BLUE	+SIG.
ORANGE	-EXC.	WHITE	-EXC.	VIOLET	-EXC.
YELLOW	-SIG.	BLACK STRIPE	-SIG.	GREY	-SIG.

SYM	REVISION	DATE
C	WAS DRG. A-3292	5/99
B	CORRECT POLARITY	3/97
A	WAS MODEL# 1583M	8/96

3 CHANNEL UPPER TIBIA
350 OHM

SCALE: FULL

DATE: 25APRIL95

DRAWN BY: *C.R. MORGAN*

MODEL: 3292

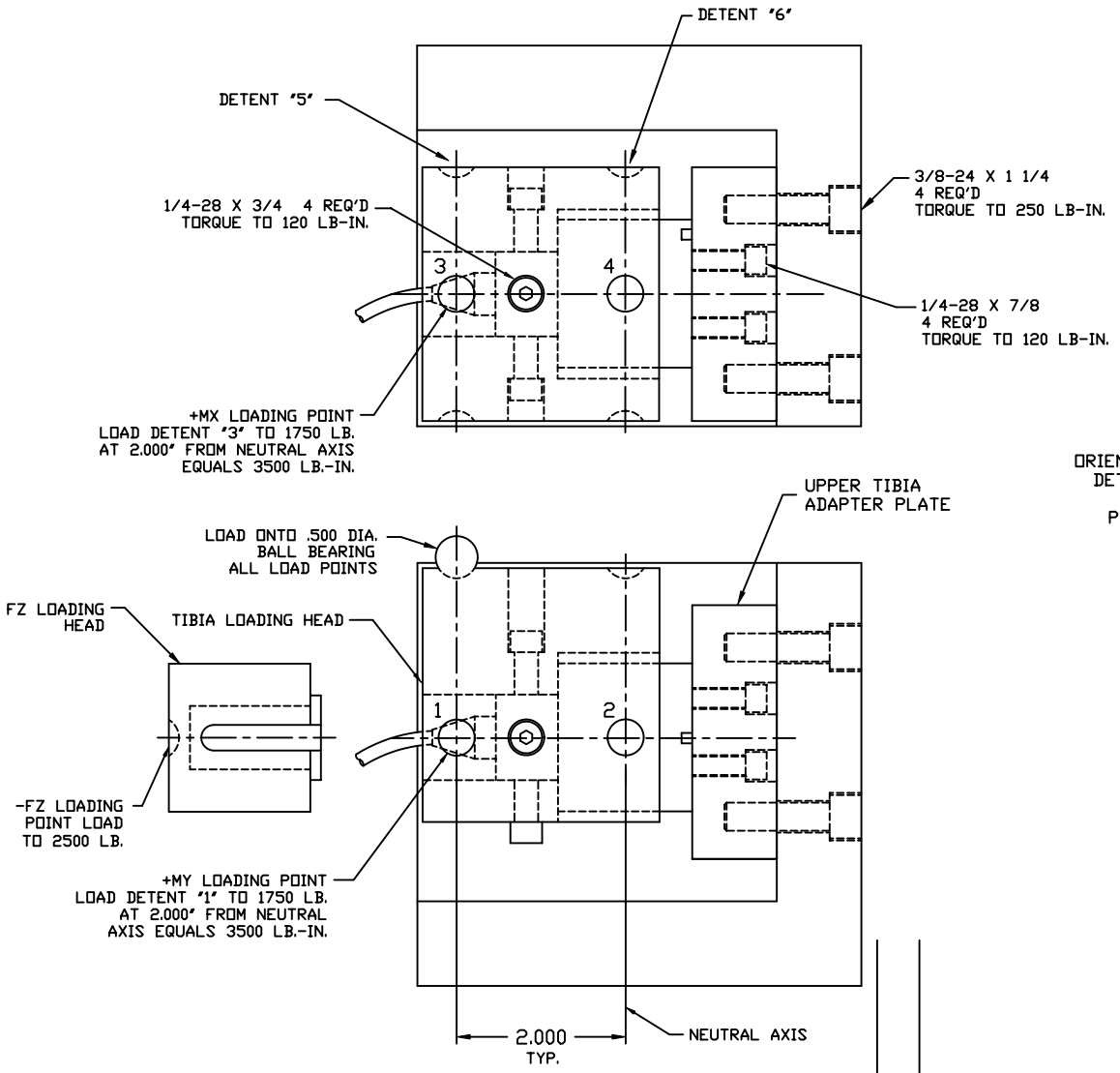
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'

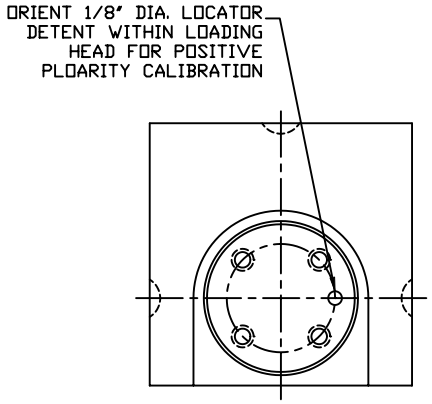
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER:
A-3292-D



NOTE:
POSITIVE CALIBRATION LOAD POINTS
PER AXIS DEFINITION SPECIFIED ON
DRAWING 3292-D.



CALIBRATION FIXTURE MODEL #2171

UPPER TIBIA CALIBRATION FIXTURE

UPPER TIBIA MODEL 3292

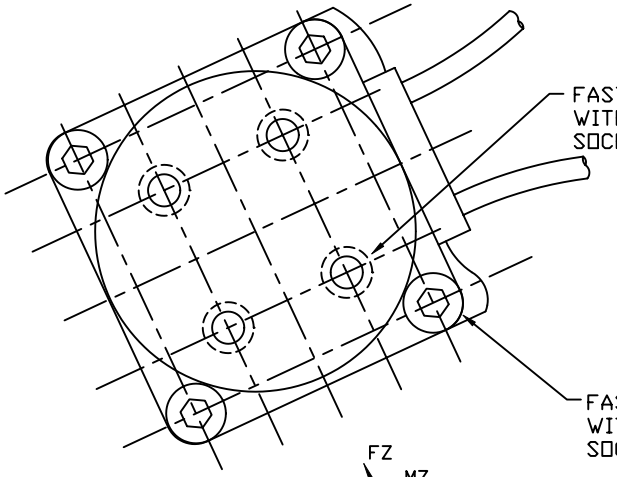
SCALE: .75X			DRAWN BY: H. PROCTOR
DATE: 8/02/96			MODEL: 3292

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

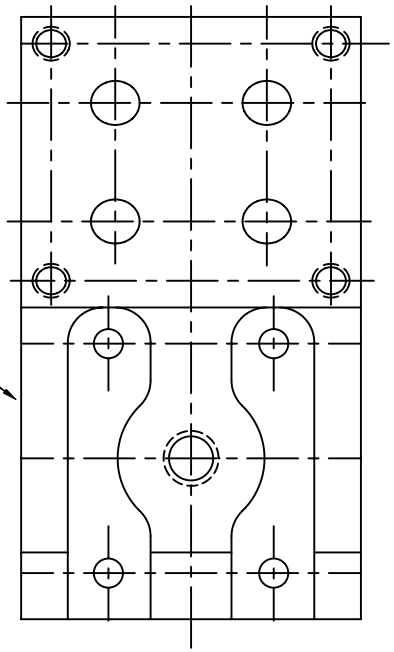
DRAWING NUMBER: B-3292-C

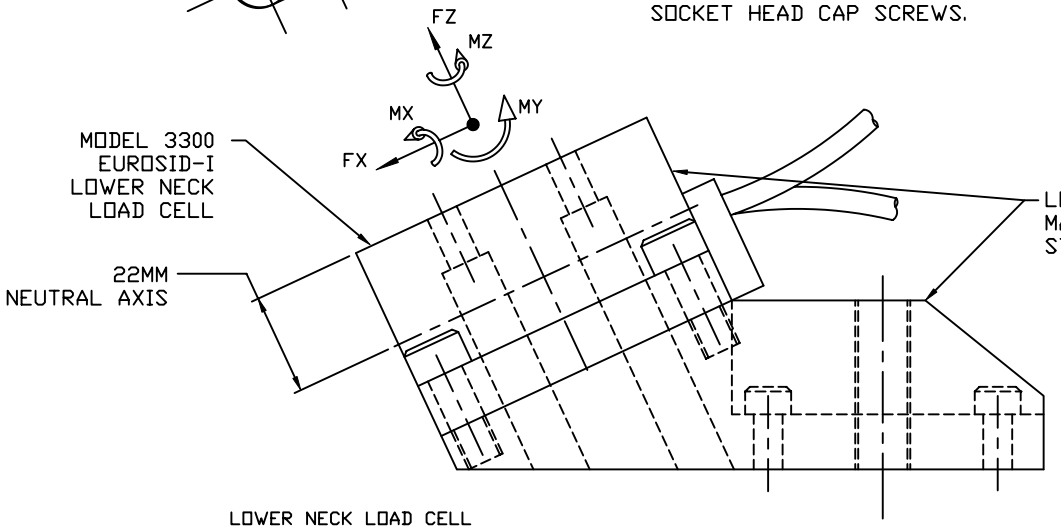


FASTEN NECK TO LOAD CELL
WITH 4, M6 X 1.0, 20MM LENGTH
SOCKET HEAD CAP SCREWS.

FASTEN LOAD CELL TO BASE
WITH 4, M8 X 1.25, 20MM LENGTH
SOCKET HEAD CAP SCREWS.

BASE BRACKET DUPLICATES
THE MOUNTING GEOMETRY
OF EUROSID-I NECK BRACKET

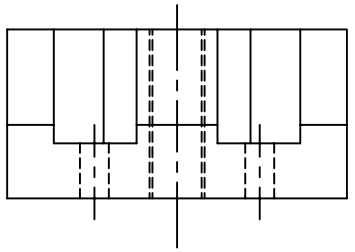




MODEL 3300
EUROSID-I
LOWER NECK
LOAD CELL

22MM
NEUTRAL AXIS

LOAD CELL AND BRACKET
MAINTAIN NECK IN THE
STANDARD LOCATION.



LOWER NECK LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	12000 N	1.6 mV/V NOM.	350 OHMS
FY	12000 N	1.6 mV/V NOM.	350 OHMS
FZ	14000 N	0.9 mV/V NOM.	700 OHMS
MX	450 N-M	1.7 mV/V NOM.	350 OHMS
MY	450 N-M	1.7 mV/V NOM.	350 OHMS
MZ	300 N-M	2.0 mV/V NOM.	700 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

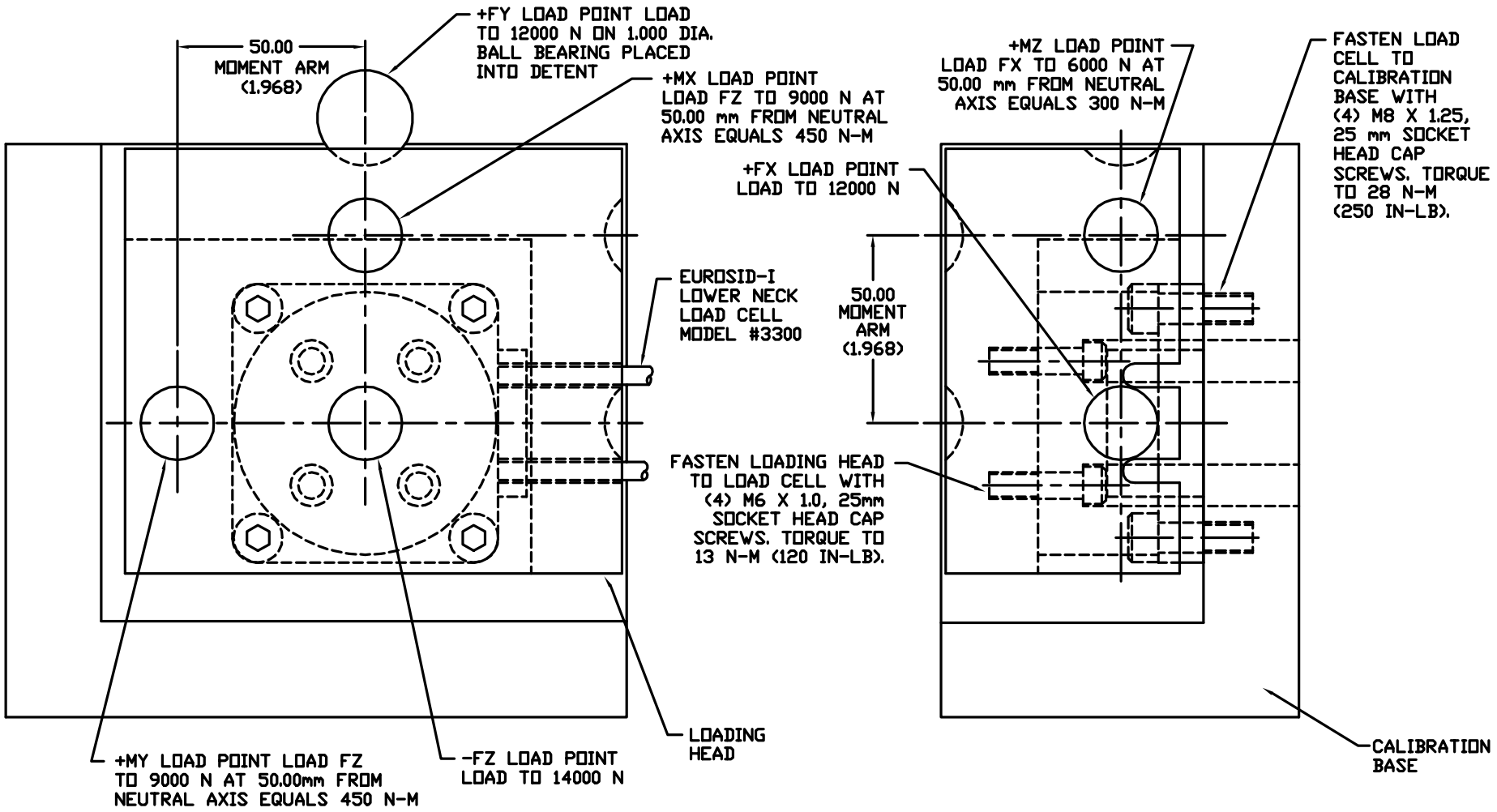
EUROSID-I LOWER NECK LOAD CELL

SCALE: FULL
DATE: 18MAY95
DRAWN BY: C.R. MORGAN
MODEL: 3300

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER:
B-3300-D



ORDER OF ASSEMBLY:

1. FASTEN LOAD CELL TO CALIBRATION BASE WITH (4) M8 X 1.25, 25mm LENGTH SOCKET HEAD CAP SCREWS. TORQUE TO 28 N-M (250 LB-IN).
2. FASTEN LOADING HEAD TO LOAD CELL WITH (4) M6 X 1.0, 25mm LENGTH SOCKET HEAD CAP SCREWS. TORQUE TO 13 N-M (120 LB-IN).

DIMENSIONS = mm (IN.)

SYM	REVISION	DATE

EUROSID-I LOWER NECK CALIBRATION FIXTURE

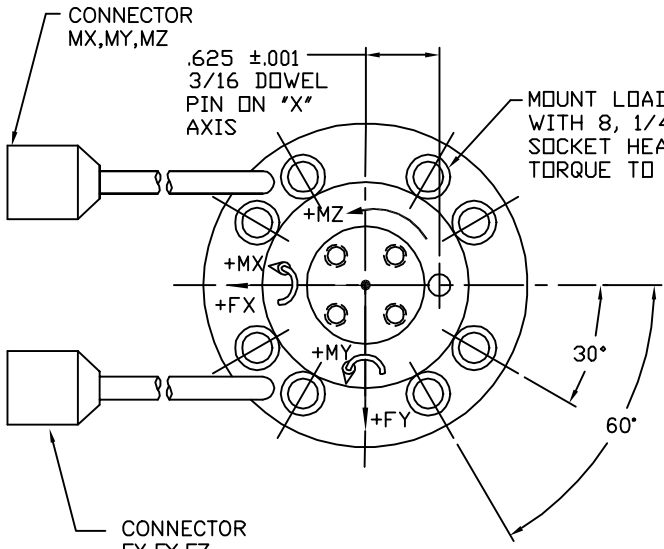
SCALE: FULL		DRAWN BY: E. PROCTOR
DATE: 4/19/96		MODEL: 3527/3300

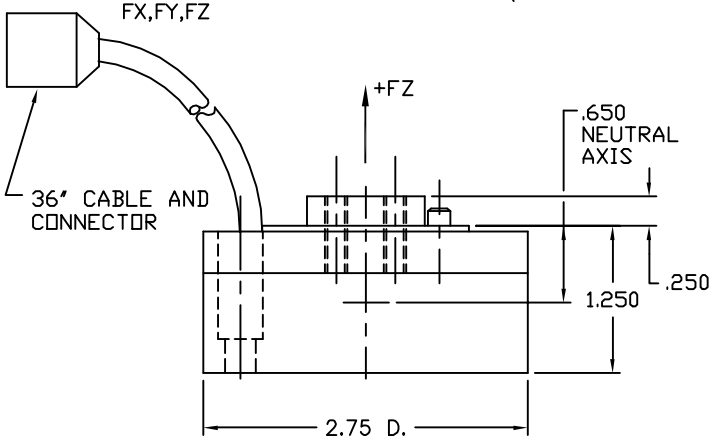
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS ± .010 — SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 — REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' — DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

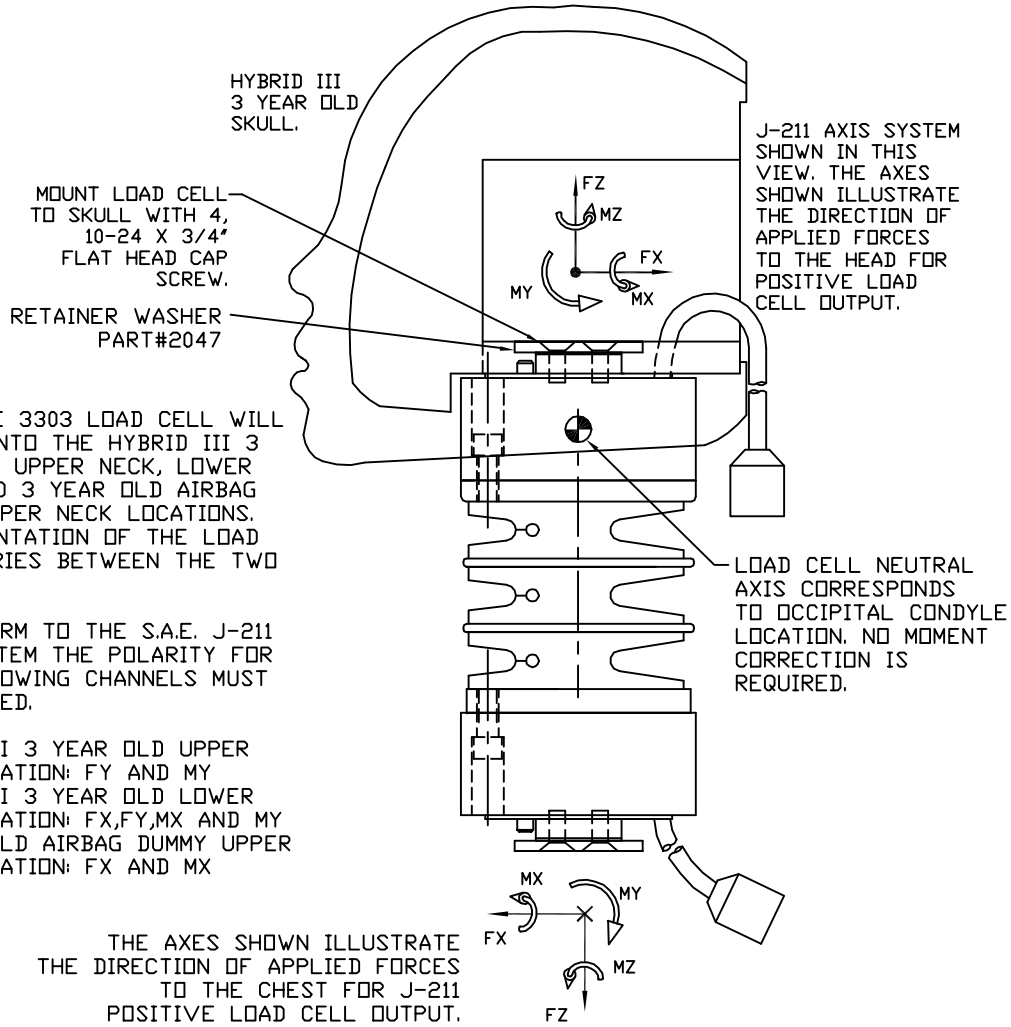
DRAWING NUMBER: B-3300-C





AXIS	CAPACITY	OUTPUT @ CAP	OHMS
FX	1000 LBS.	1.8 mV/V NOM.	350
FY	1000 LBS.	1.8 mV/V NOM.	350
FZ	1500 LBS.	1.5 mV/V NOM.	700
MX	1500 LB.-IN	1.8 mV/V NOM.	350
MY	1500 LB.-IN	1.8 mV/V NOM.	350
MZ	1000 LB.-IN	1.0 mV/V NOM.	700

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT = 0.56 LBS.



NOTE: THE 3303 LOAD CELL WILL FASTEN INTO THE HYBRID III 3 YEAR OLD UPPER NECK, LOWER NECK, AND 3 YEAR OLD AIRBAG DUMMY UPPER NECK LOCATIONS. THE ORIENTATION OF THE LOAD CELL VARIES BETWEEN THE TWO DUMMIES.

TO CONFORM TO THE S.A.E. J-211 AXIS SYSTEM THE POLARITY FOR THE FOLLOWING CHANNELS MUST BE CHANGED.

HYBRID III 3 YEAR OLD UPPER NECK LOCATION: FY AND MY
HYBRID III 3 YEAR OLD LOWER NECK LOCATION: FX,FY,MX AND MY
3 YEAR OLD AIRBAG DUMMY UPPER NECK LOCATION: FX AND MX

THE AXES SHOWN ILLUSTRATE THE DIRECTION OF APPLIED FORCES TO THE CHEST FOR J-211 POSITIVE LOAD CELL OUTPUT.

D	WAS DRG B-3303	08/99
C	ADD WEIGHT	12/98
B	ADD WASHER P/N	10/98
A	REV. TEXT	8/98

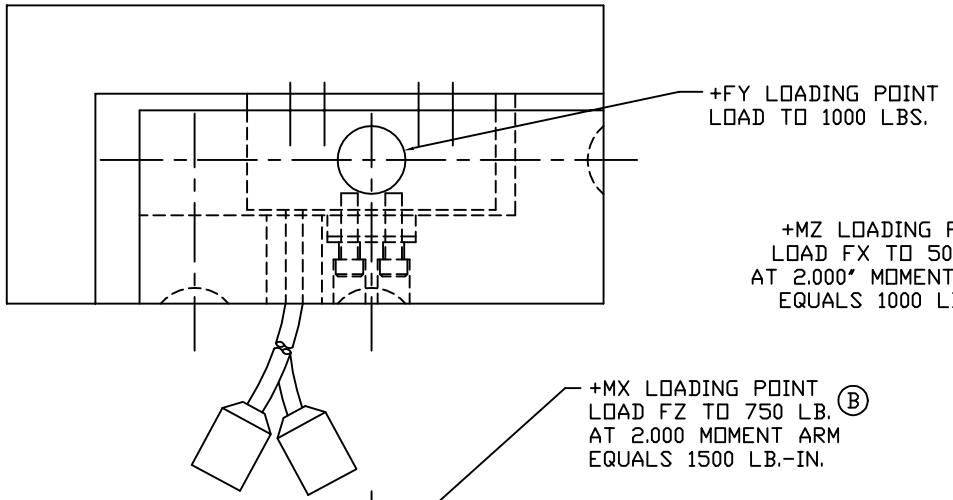
SIX CHANNEL LOAD CELL FOR HYBRID III 3 YEAR OLD

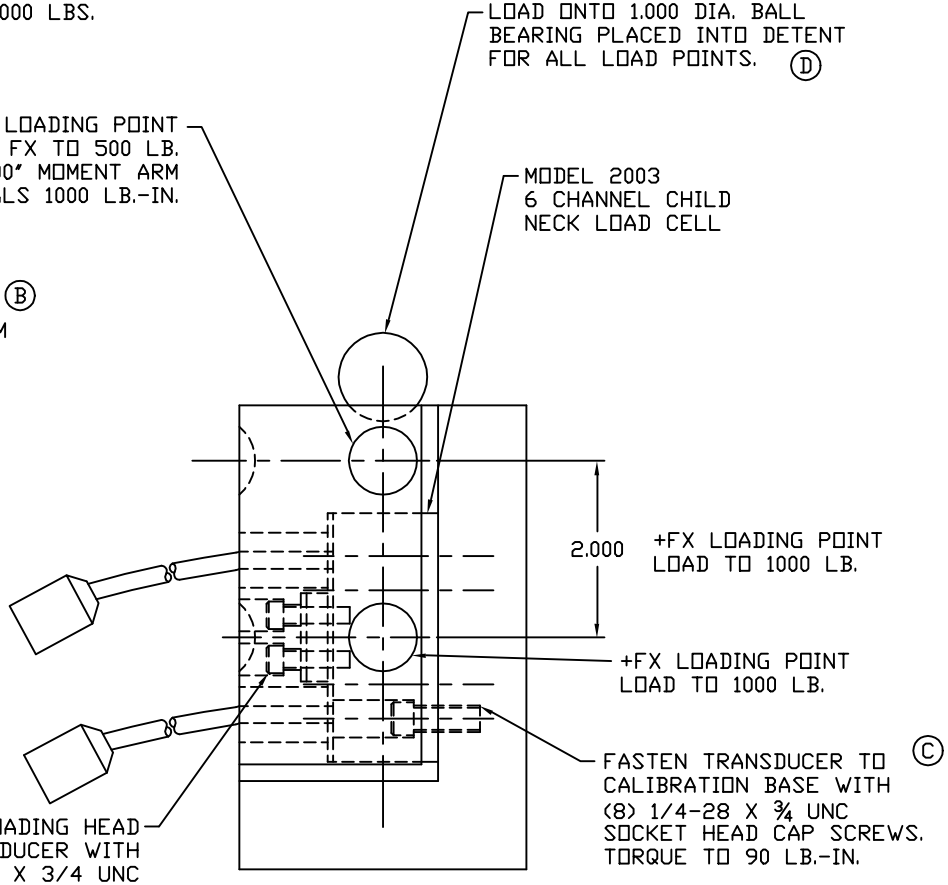
SCALE: FULL
DATE: 3/5/96
DRAWN BY: C.R. MORGAN
MODEL: 3303

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3303-D





CALIBRATION FIXTURE MODEL #2028

SYM	REVISION	DATE
E	WAS DRG. B-2028	4/99
D	ADD BALL NOTE	4/97
C	REV. THREAD	1/97
B	INCR. CAP. MX,MY	12/96
A	REDRAWN IN CAD	9/93

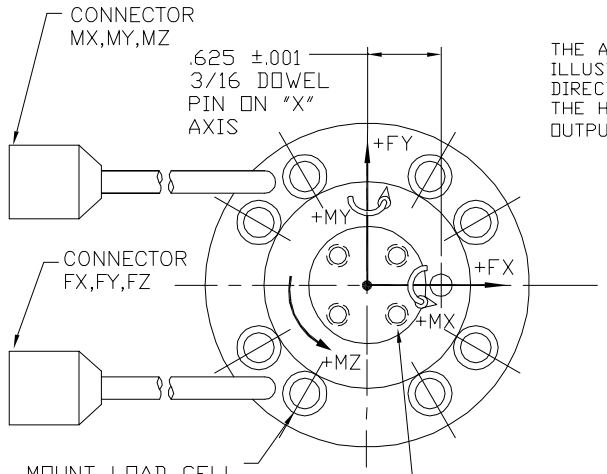
CHILD NECK CAL. FIXTURE

SCALE: .75X
DATE: 6/22/87
DRAWN BY: C.R.M./S.E.F.
MODEL: 3303

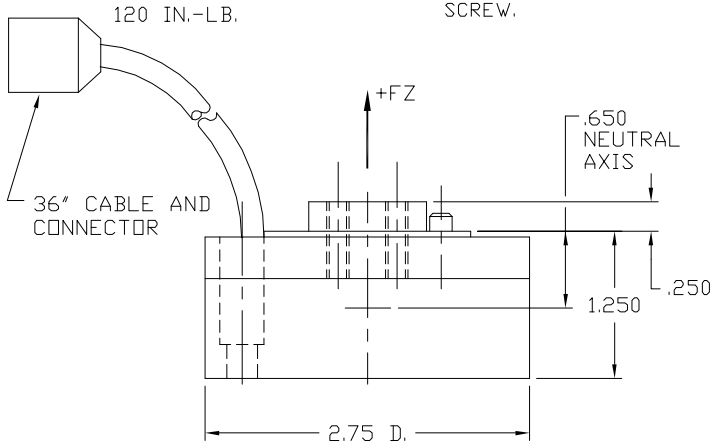
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3303-C

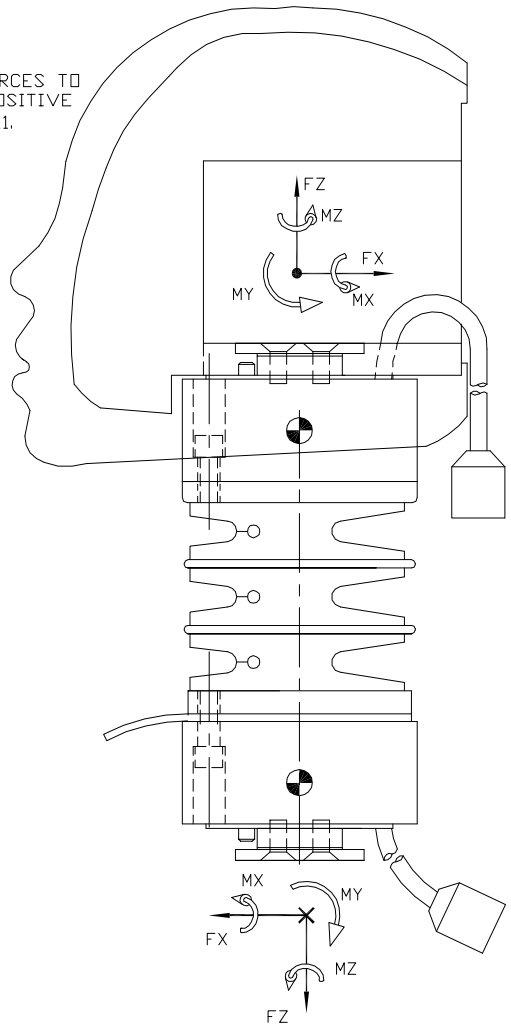


THE AXIS SHOWN ILLUSTRATE THE DIRECTION OF FORCES TO THE HEAD FOR POSITIVE OUTPUT PER J-211.



AXIS	CAPACITY	OUTPUT @ CAP	OHMS
FX	1000 LBS.	1.8 mV/V NOM.	350
FY	1000 LBS.	1.8 mV/V NOM.	350
FZ	1500 LBS.	1.5 mV/V NOM.	700
MX	1500 LB.-IN	1.8 mV/V NOM.	350
MY	1500 LB.-IN	1.8 mV/V NOM.	350
MZ	1000 LB.-IN	1.0 mV/V NOM.	700

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT = 0.56 LBS.



THE AXES SHOWN ILLUSTRATE THE DIRECTION OF APPLIED FORCES TO THE CHEST FOR J-211 POSITIVE LOAD CELL OUTPUT.

MODEL 3304J

LOWER NECK LOAD CELL FOR HYBRID III 3 YEAR OLD WITH POLARITY CONFORMING TO SAE J-211

● REPRESENTS A FORCE VECTOR DIRECTED OUT OF THE PAGE

✕ REPRESENTS A FORCE VECTOR DIRECTED INTO THE PAGE

MOMENT CORRECTION EQUATIONS

LOWER NECK LOAD CELL

MOMENT CORRECTION EQUATION TO TRANSFER THE MEASURED MOMENT FROM THE LOAD CELL TO THE BASE OF THE NECK.

MOMENT X ABOUT THE BASE OF THE NECK

$$MX_{NECK} = MX - FY(DZ)$$

MX_{NECK} = MOMENT X ABOUT THE BASE OF THE NECK
MX= MEASURED MOMENT FROM LOAD CELL
FY= MEASURED FORCE FROM LOAD CELL

MOMENT Y ABOUT THE BASE OF THE NECK

$$MY_{NECK} = MY + FX(DZ)$$

MY_{NECK} = MOMENT Y ABOUT THE BASE OF THE NECK
MY= MEASURED MOMENT FROM LOAD CELL
FX= MEASURED FORCE FROM LOAD CELL

DZ EQUALS .66 INCHES OR .0168M

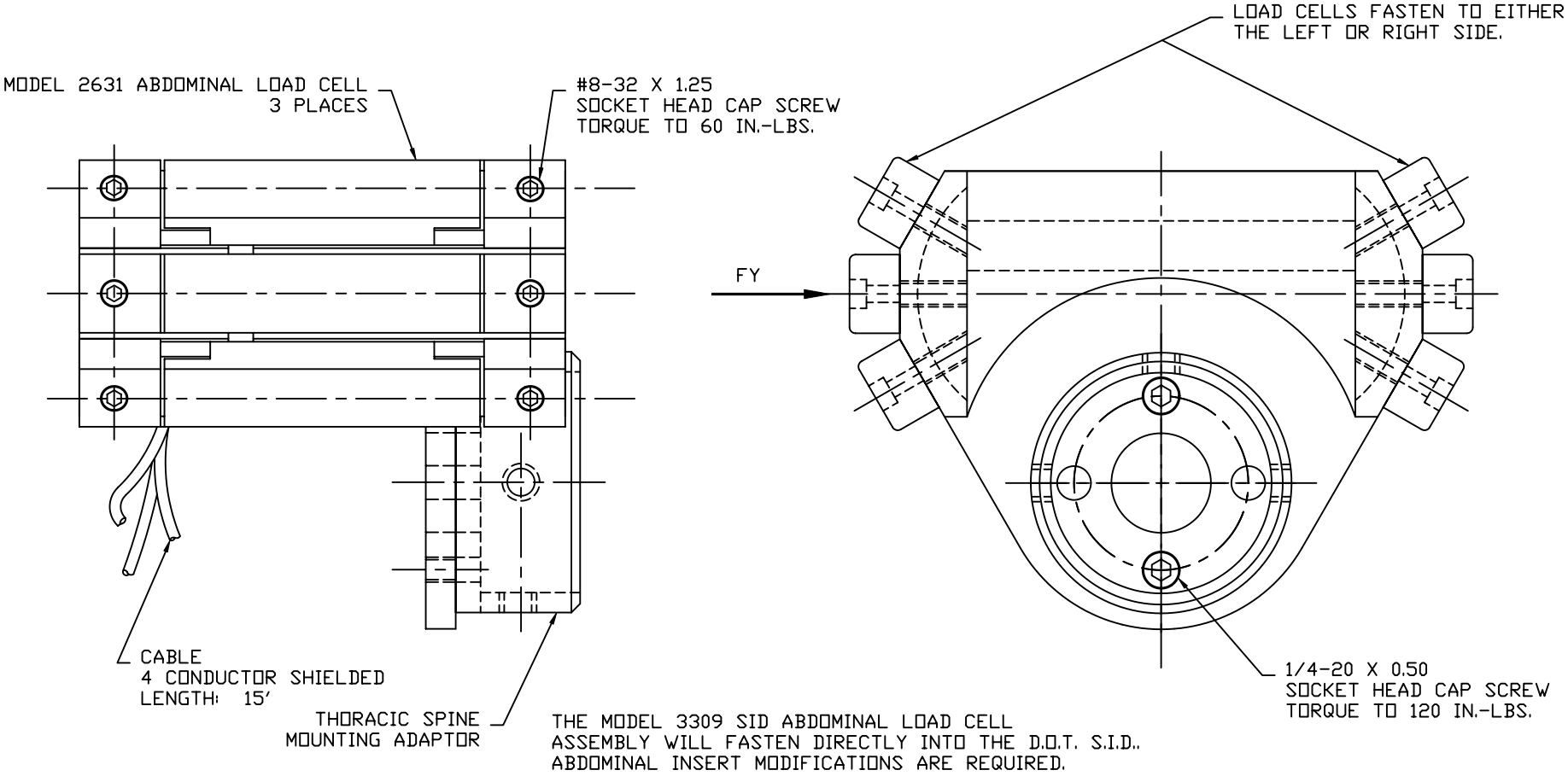
SIX CHANNEL LOAD CELL
FOR HYBRID III 3 YEAR OLD LOWER NECK

SCALE: FULL		DRAWN BY: C.R. MORGAN
DATE: 8/20/01		MODEL: 3304J

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3304-D



THE MODEL 3309 SID ABDOMINAL LOAD CELL ASSEMBLY WILL FASTEN DIRECTLY INTO THE D.O.T. S.I.D.. ABDOMINAL INSERT MODIFICATIONS ARE REQUIRED.

MODEL 2631 ABDOMINAL LOAD CELL

CAPACITY: 5000 NEWTONS
OUTPUT @ CAPACITY: 3.0 mV/V NOMINAL
NONLINEARITY < 1% OF FULL SCALE
BRIDGE RESISTANCE: 350 OHMS NOMINAL

SYM	REVISION	DATE
A	WAS 3309	10/99

S.I.D. ABDOMINAL LOAD CELL ASSEMBLY

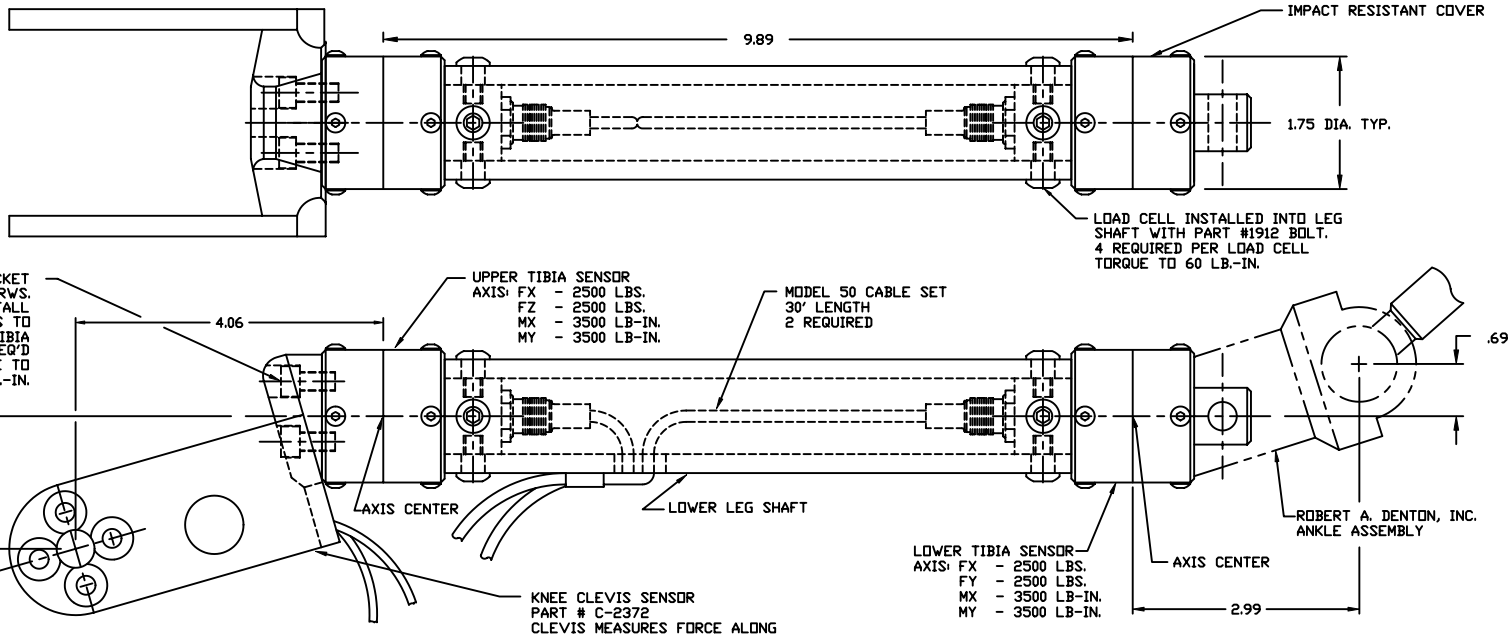
SCALE: FULL		DRAWN BY: P. M. LUKENS
DATE: 1AUG95		MODEL: 3309

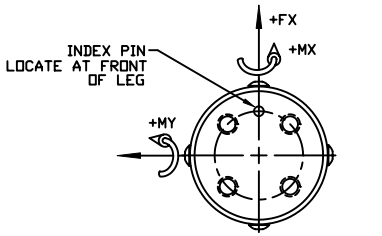
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

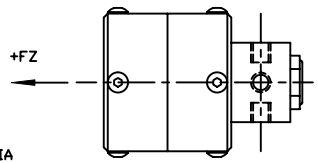
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3309-D

U.S. PATENT # 4488433

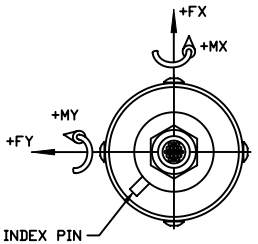


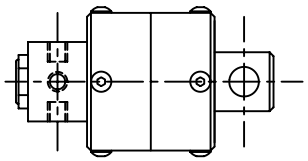




UPPER TIBIA
MODEL 3115

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.





LOWER TIBIA
MODEL 3114

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SYM	REVISION	DATE
A	WAS 3390	10/99

ENHANCED INSTRUMENTED TIBIA

95TH PERCENTILE HYBRID III

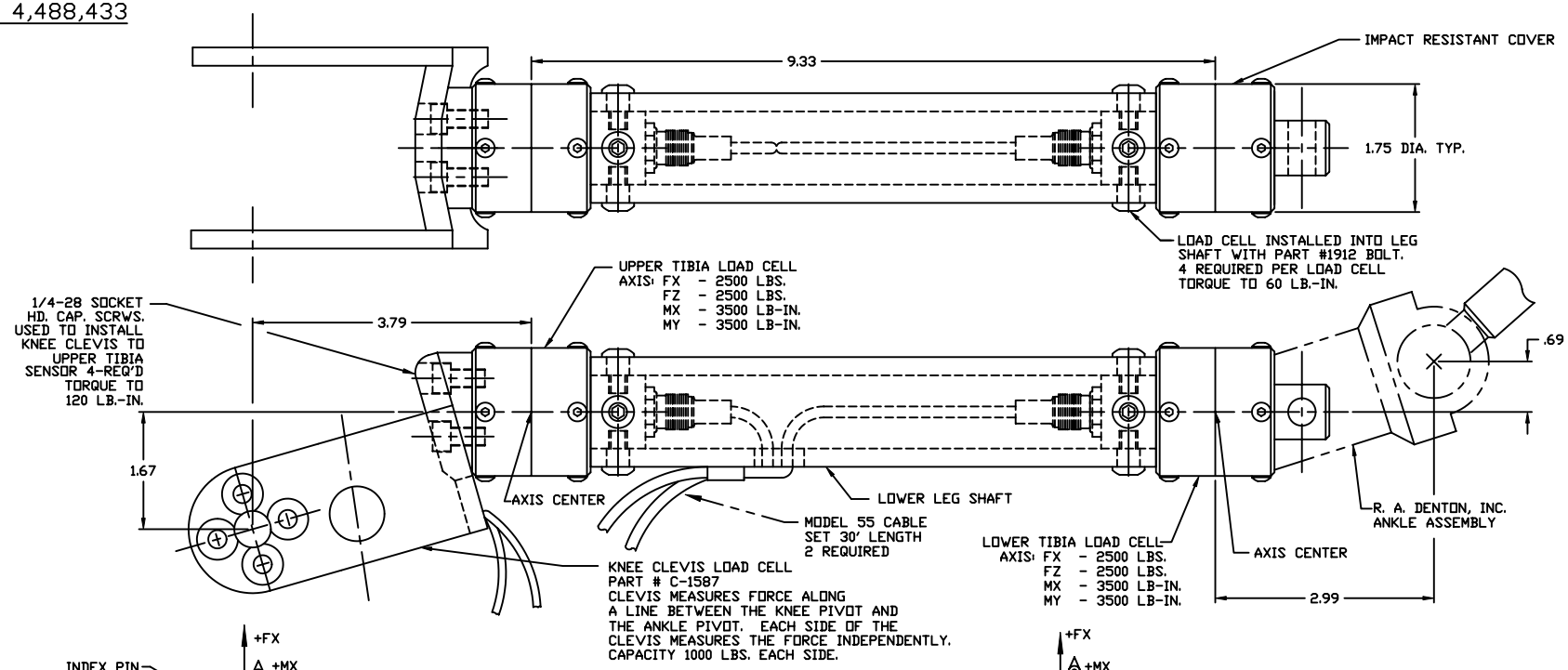
SCALE: NONE
DATE: 3/25/96
DRAWN BY: H. PROCTOR
MODEL: 3390

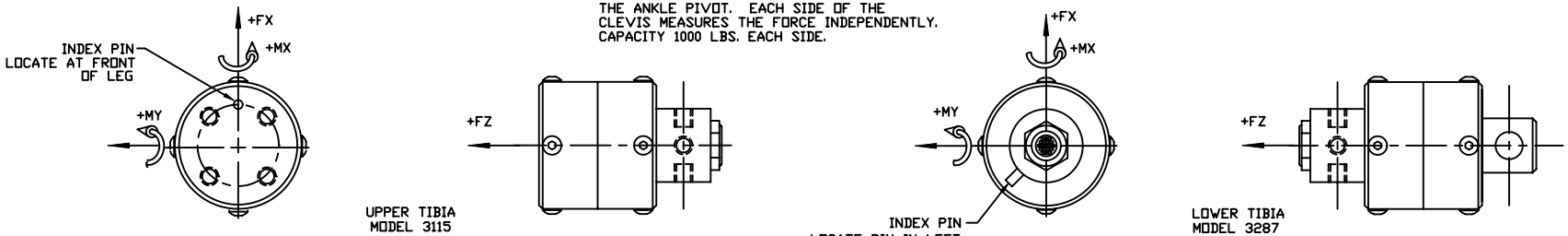
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3390-D

PATENT 4,488,433





UPPER TIBIA
MODEL 3115

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

LOWER TIBIA
MODEL 3287

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SYM	REVISION	DATE
A	WAS 3416	10/99

INSTRUMENTED LOWER LEG

50TH PERCENTILE HYBRID III

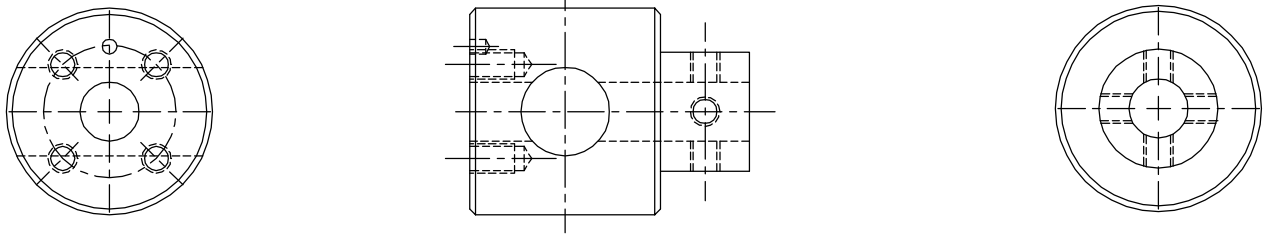
SCALE:	NONE		DRAWN BY: C.R. MORGAN
DATE:	19MAY94		MODEL: 3416

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3416-D



UPPER TIBIA STRUCTURAL REPLACEMENT

SCALE: FULL		DRAWN BY: C.R.M.
DATE: 8DEC95		MODEL:

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS ± .010 SURFACE FINISH 125

THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES

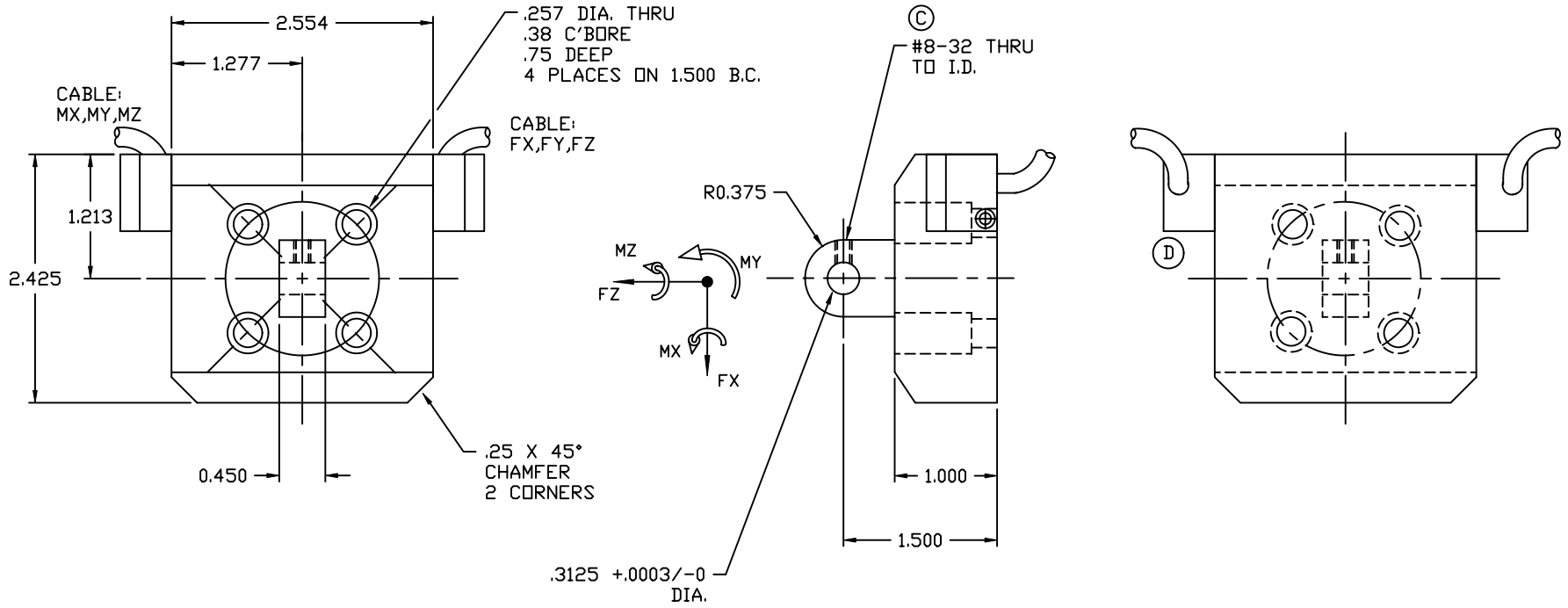
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.

ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3448-D

SYM	REVISION	DATE



MODEL 3454 UPPER NECK LOAD CELL
HYBRID IV

AXIS	CAPACITY	OUTPUT	BRIDGE RESISTANCE
FX	2000 LBS.	1.5mV/V NOM.	350
FY	2000 LBS.	1.5 mV/V NOM.	350
FZ	3000 LBS.	1.2 mV/V NOM.	700
MX	2500 LB-IN	1.7 mV/V NOM.	350
MY	2500 LB-IN	1.7 mV/V NOM.	350
MZ	2500 LB-IN	2.0mV/V NOM.	700

NONLINEARITY <1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE

SYM	REVISION	DATE
E	WAS DRG. B-3454	5/99
D	CHG. STRAIN RELIEF	1/99
C	CHG. THREAD	7/97
B	REV. STRAIN REL.	11/96
A	ADD STRAIN REL.	8/96

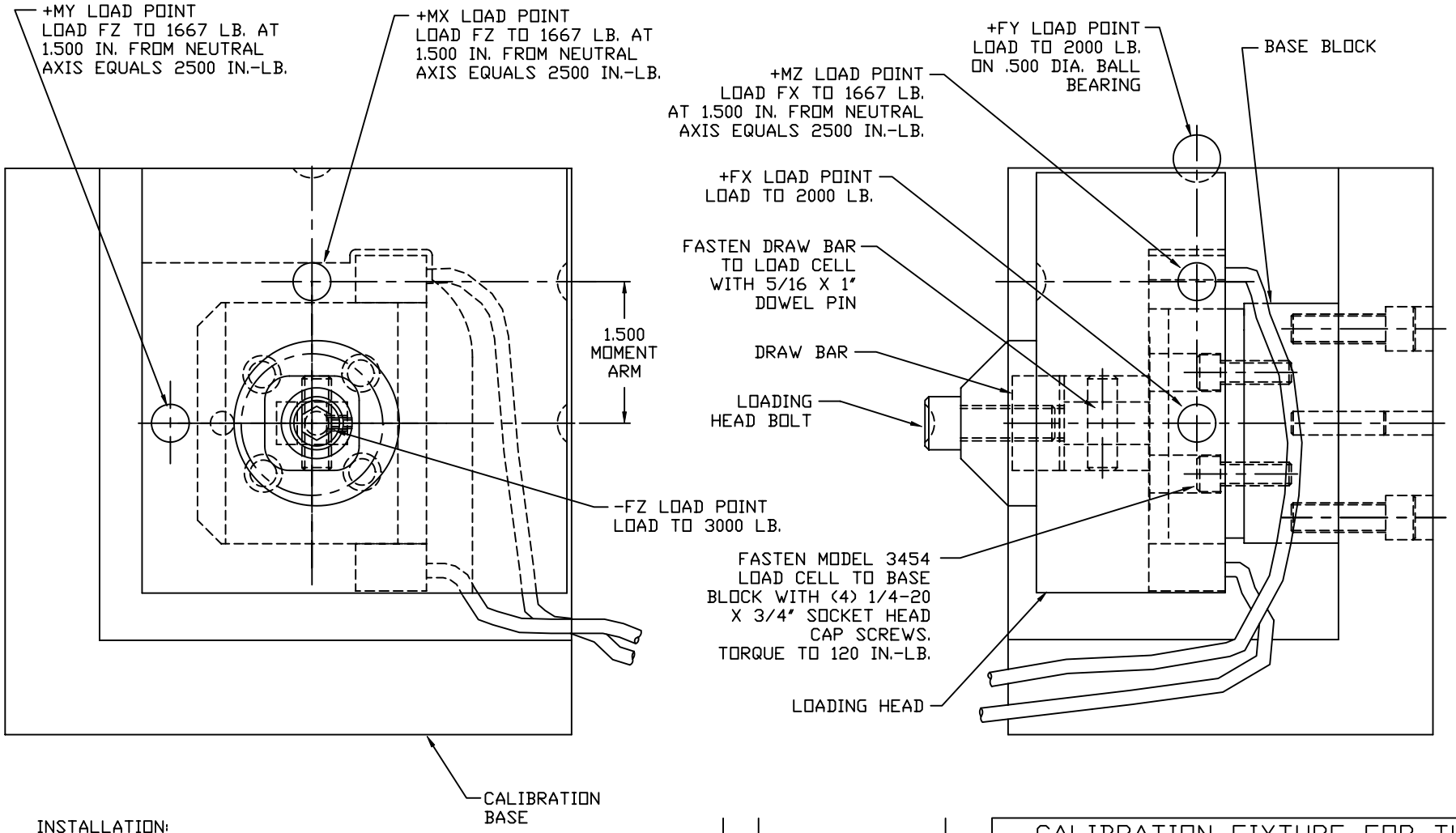
UPPER NECK LOAD CELL
ADVANCED DUMMY

SCALE: FULL
DATE: 12/14/95
DRAWN BY: H. PROCTOR
MODEL: 3454

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3454-D



INSTALLATION:
1. FASTEN LOAD CELL TO CALIBRATION BASE WITH (4) 1/4-20 X 3/4" SOCKET HEAD CAP SCREWS, TORQUE TO 120 IN.-LB.
2. FASTEN DRAW BAR TO LOAD CELL WITH 5/16 X 1" DOWEL PIN.
3. PLACE LOADING HEAD OVER DRAW BAR AS SHOWN.
4. FASTEN LOADING HEAD TO DRAW BAR WITH LOADING HEAD BOLT, TORQUE TO 360 IN.-LB.

SYM	REVISION	DATE
C	WAS 3637-C	10/99
B	NAME WAS B-3637	4/99
A	NOTCH IN HEAD	2/99

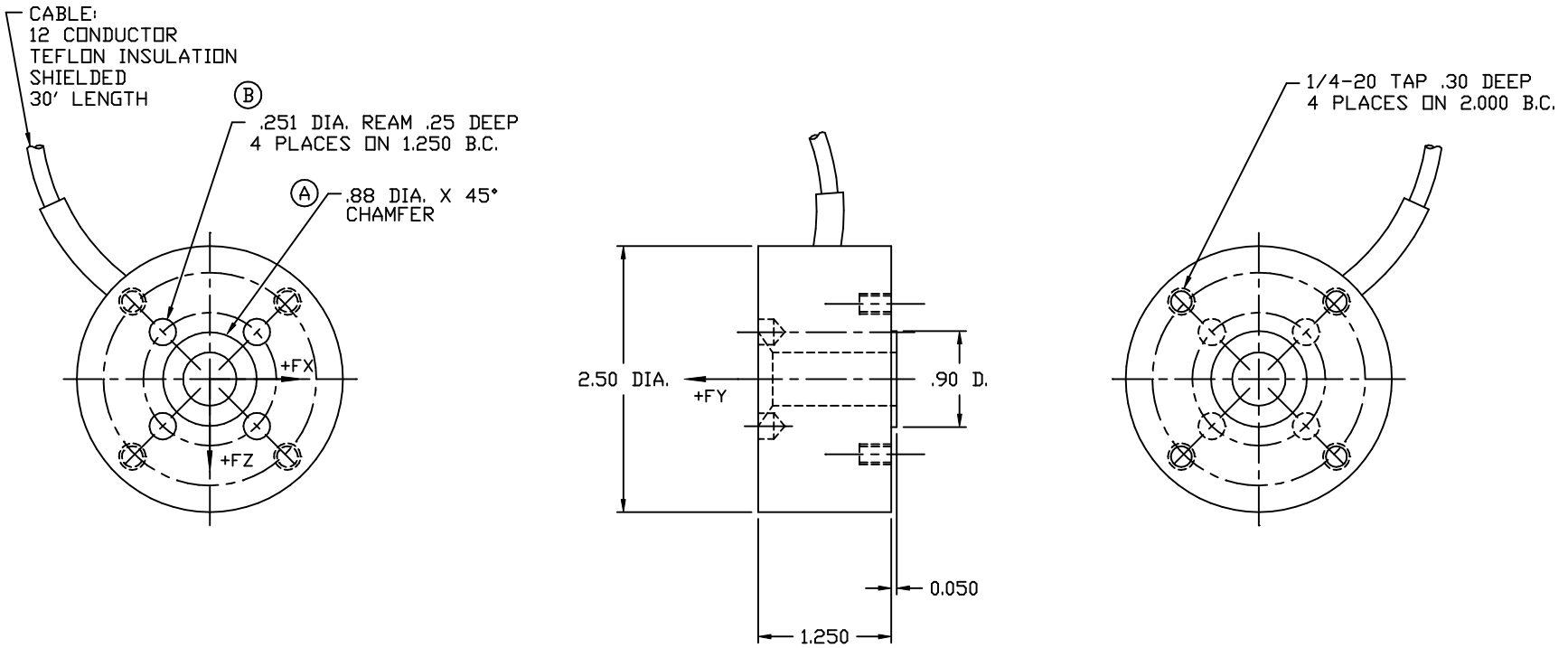
CALIBRATION FIXTURE FOR THE ADVANCED DUMMY UPPER NECK

SCALE: FULL
DATE: 8/14/96
DRAWN BY: H. PROCTOR
MODEL: 3454

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3454-C



AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	5000 LBF.	2.4 mV/V NOMINAL
FY	3000 LBF.	0.8 mV/V NOMINAL
FZ	3000 LBF.	2.0 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

OUTPUT POLARITY CONFORMS TO SAE J-211

SYM	REVISION	DATE
E	CHANGE FZ POL.	12/99
D	ADD J TO MODEL #	12/99
C	WAS DRG. B-3455	5/99
B	REV. DOWEL	2/97
A	ADDED CHAMFER	8/96

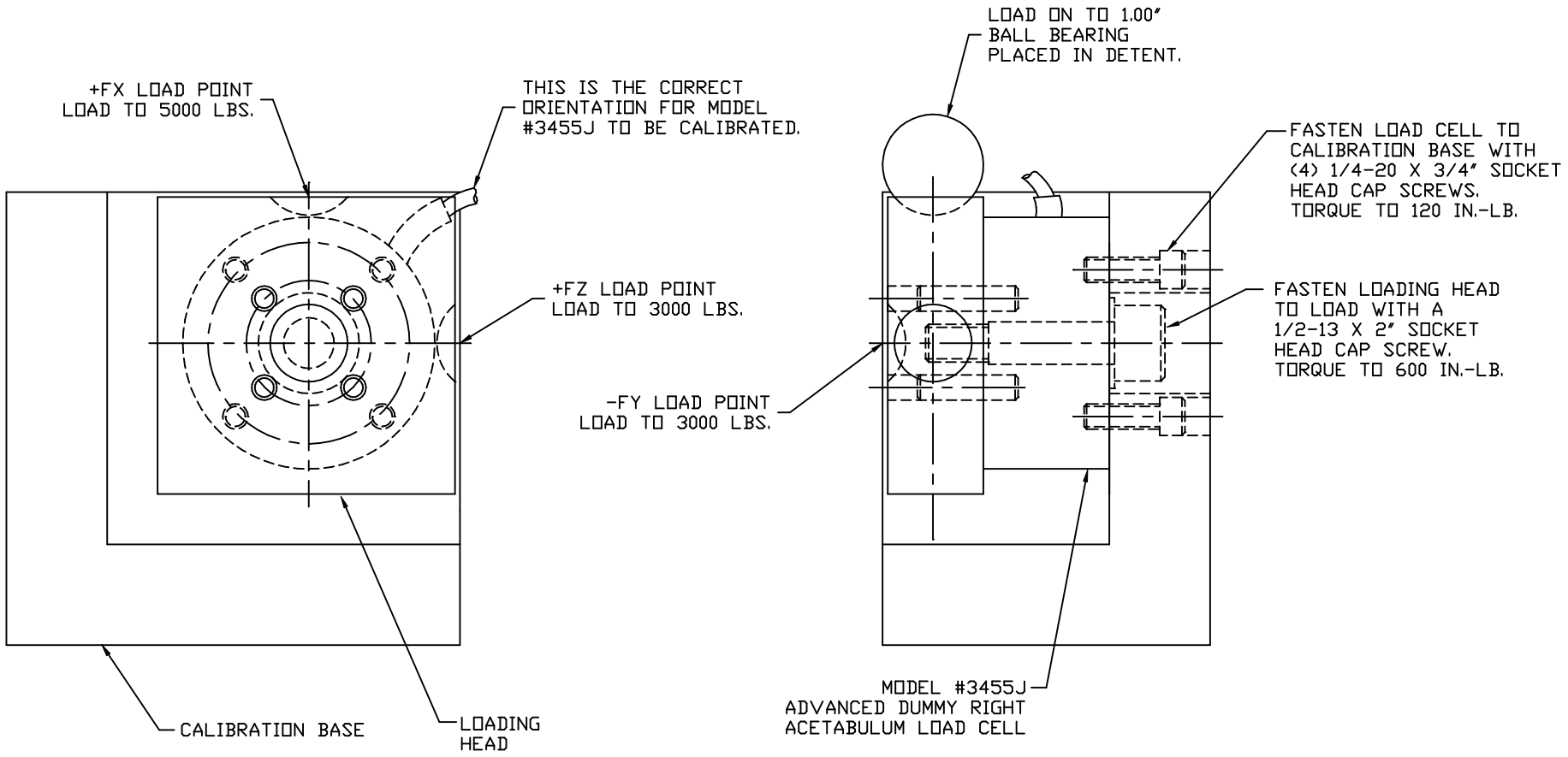
RIGHT SIDE ACETABULUM LOAD CELL
FOR ADVANCED DUMMY

SCALE: FULL
DATE: 9JAN95
DRAWN BY: H. PROCTOR
MODEL: 3455J

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3455-D



CALIBRATION FIX. MODEL# 3633

SYM	REVISION	DATE

CALIBRATION FIXTURE FOR THE ADVANCED DUMMY ACETABULUM

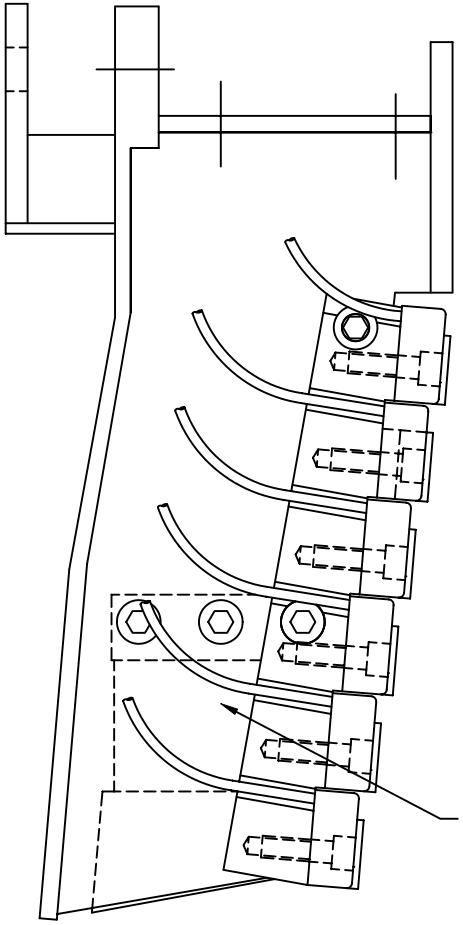
SCALE: FULL		DRAWN BY: C.HEAD
DATE: 1/6/00		MODEL: 3455J

UNLESS OTHERWISE SPECIFIED

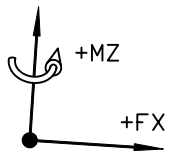
TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

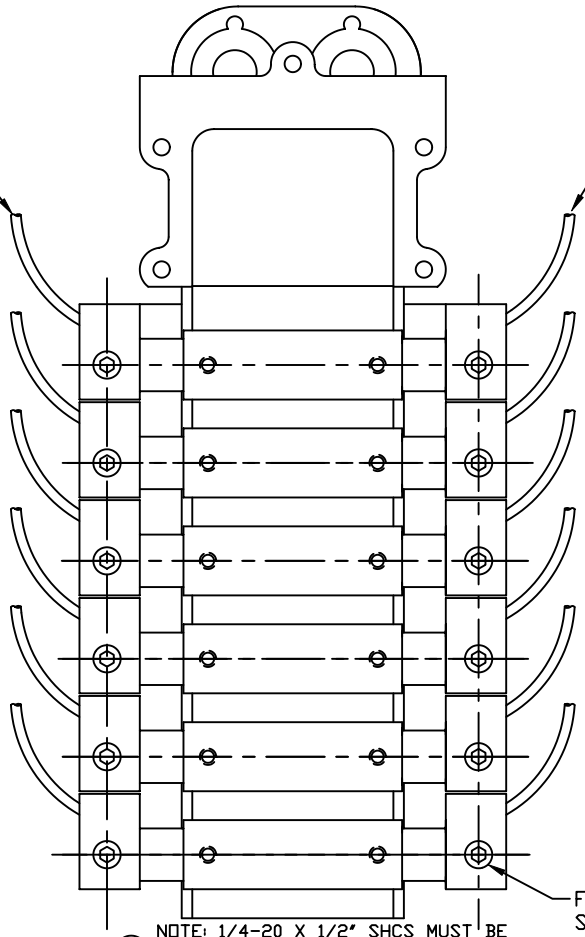
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3455-C



MODEL 1911
THORACIC SPINE
LOAD CELL WILL
FASTEN INTO THE
3457 SPINE ASSEMBLY.





CABLE: LEFT

CABLE: RIGHT

CABLE:
4 CONDUCTOR
TEFLON INSULATION
SHIELDED
30' LENGTH

Ⓑ NOTE: 1/4-20 X 1/2" SHCS MUST BE USED IN THE REAR POSITIONS TO ATTACH THE LUMBAR SPINE TO THE INSTRUMENTATION ADAPTER.

Ⓐ FASTEN LOAD CELL TO SPINE WITH 1/4-20 X 3/4" SOCKET HEAD CAP SCREW. TORQUE TO 120 IN.-LB.

MODEL 3457 RIB LOAD CELL

AXIS	CAPACITY	OUTPUT
FX-LEFT	500 LBS.	1.2 mV/V NOMINAL
FX-RIGHT	500 LBS.	1.2 mV/V NOMINAL

NONLINEARITY <1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

THE MODEL 3457, RIB LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE AND MOMENT ON THE RIBS OF A HYBRID III 50TH PERCENTILE ATD. THE LOAD CELL CONSISTS OF TWO INDEPENDANT FX CHANNELS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE THE TOTAL LOAD. THE DIFFERENCE OF THE TWO CHANNELS DIVIDED BY THE SUM IS PROPORTIONAL TO THE MOMENT ABOUT THE Z AXIS. THE MOMENT ABOUT Z IS CALCULATED AS FOLLOWS:

((FORCE LEFT - FORCE RIGHT/(FORCE LEFT+FORCE RIGHT)) X 882 = MZ

SYM	REVISION	DATE
C	WAS DRG. B-3457	5/99
B	ADD NOTE	04DEC98 PJD
A	CHG SCREW THREAD AND LENGTH	06OCT98 PJD

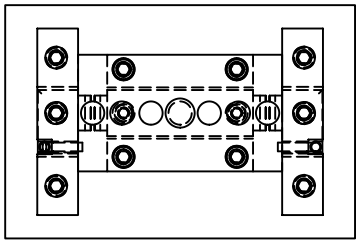
RIB LOAD CELL/SPINE ASSEMBLY

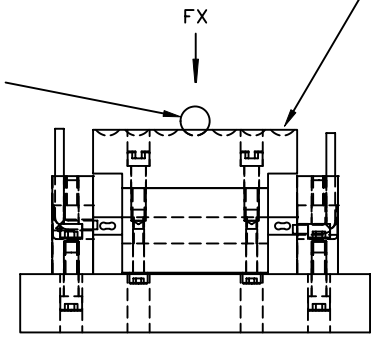
SCALE: .75X
DATE: 19JAN96
DRAWN BY: C.R. MORGAN
MODEL: 3457

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3457-D





STANDARD CALIBRATION:
THE MODEL 3457 LOAD CELL CONSISTS OF TWO INDEPENDENT FX CHANNELS. WHEN THE LOAD CELL IS LOADED DIRECTLY OVER CENTER, EACH CHANNEL RECEIVES 50% OF THE TOTAL LOAD. THE STANDARD CALIBRATION CONSISTS OF LOADING THE CENTER DETENT TO 1000 LBF TO CALIBRATE EACH CHANNEL TO 500 LBF (50% OF THE TOTAL LOAD).

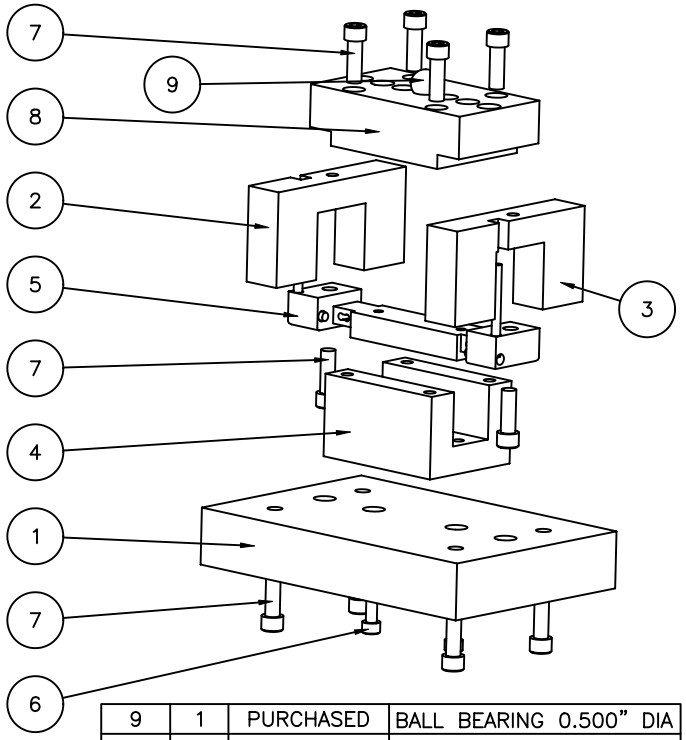
COMPREHENSIVE CALIBRATION:
THE MODEL 3457, RIB LOAD CELL, PROVIDES MEASUREMENT OF THE FORCE AND MOMENT ON THE RIBS OF A HYBRID III 50TH PERCENTILE ATD. THE LOAD CELL CONSISTS OF TWO INDEPENDENT FX CHANNELS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE TOTAL LOAD. THE DIFFERENCE OF THE TWO CHANNELS DIVIDED BY THE SUM IS PROPORTIONAL TO THE MOMENT ABOUT THE Z AXIS.
THE MOMENT ABOUT 'Z' IS CALCULATED AS FOLLOWS:

$$\frac{(\text{FORCE LEFT} - \text{FORCE RIGHT})}{(\text{FORCE LEFT} + \text{FORCE RIGHT})} \times 882 = MZ$$

APPLY 500 LBF LOAD TO EACH OUTSIDE DETENTS.

NOTES:
THE FORCES ARE IN ENGINEERING UNITS. THE DISTANCE IS IN INCHES ABOVE THE LOAD CELL CENTER LINE.

TO VERIFY THE LISTED CALCULATION, LOAD TO 500 LBF AT BOTH OF THE OUTSIDE DETENTS. CONVERT THE OUTPUT OBTAINED INTO ENGINEERING UNITS BASED ON THE CALIBRATION PERFORMED ON THE LOAD CELL CENTER. CALCULATE THE POSITION BASED ON THE EQUATION AS LISTED ABOVE.



9	1	PURCHASED	BALL BEARING 0.500" DIA
8	1	3484-4	LOADING HEAD
7	10	PURCHASED	1/4-20 X 3/4" SHCS
6	2	PURCHASED	#10-32 X 3/4" SHCS
5	1	3465	RIB LOAD CELL
4	1	3484-3	RIB MOUNT
3	1	3484-2	LEG, RIGHT
2	1	3484-1	LEG, LEFT
1	1	3483	LOADING BASE
ITEM	QTY	PART NUMBER	DESCRIPTION
PARTS LIST			

MODEL 3457 RIB LOAD CELL

AXIS	CAPACITY	OUTPUT
FX-LEFT	500 LBF	1.2 mV/V NOMINAL
FX-RIGHT	500 LBF	1.2 mV/V NOMINAL

NON-LINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

CALIBRATION FIXTURE ASSEMBLY PROCEDURE

1) ATTACH THE RIB MOUNT BLOCK (ITEM#4) TO THE SENSOR USING TWO #10-32 X 3/4" SHCS. TORQUE: 90 IN-LBF.
2) ATTACH LEFT AND RIGHT LEGS (ITEMS# 2&3) TO SENSOR/RIB MOUNT USING ONE 1/4-20 X 3/4" SHCS. TORQUE: 120 IN-LBF.
3) ATTACH LEG/SENSOR ASSEMBLY TO BASE (ITEM#1) USING FOUR (2 PER LEG) 1/4-20 X 3/4" SHCS. TORQUE: 120 IN-LBF.
4) ATTACH LOADING HEAD (ITEM#8) TO ASSEMBLY USING FOUR 1/4-20 X 3/4" SHCS. TORQUE: 120 IN-LBF.

CALIBRATION FIXTURE FOR 3457 RIB LOAD CELL

SCALE: .5X			DRAWN BY: rdupont
DATE: 30AUG99			MODEL: 3457

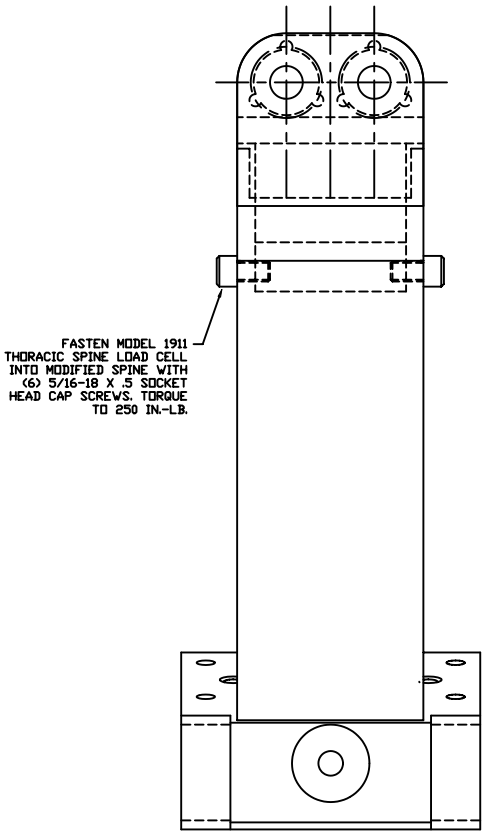
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

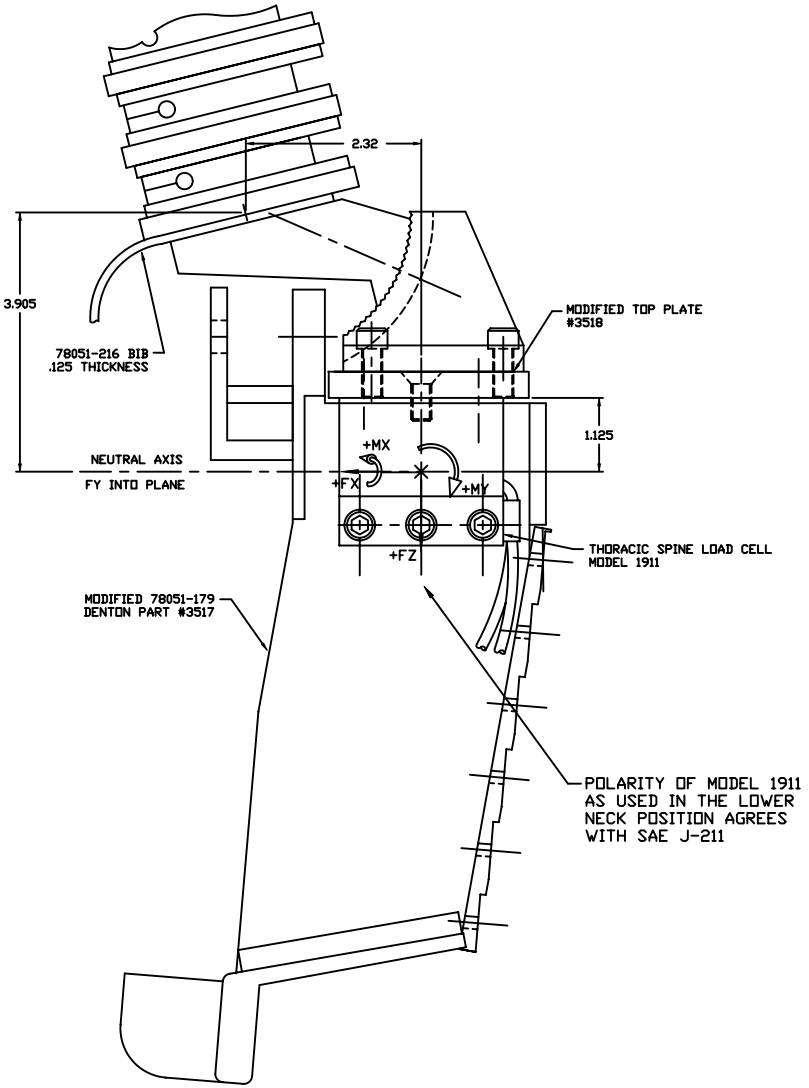
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3457-C

NEXT ASS'Y	QTY
PART USED ON	

SYM	REVISION	DATE





THORACIC SPINE LOAD CELL

AXIS	CAPACITY	OUTPUT
FX	3000 LBS.	1.8 mV/V NOM.
FY	3000 LBS.	1.8 mV/V NOM.
FZ	4000 LBS.	1 mV/V NOM.
MX	6000 LB-IN.	1.4 mV/V NOM.
MY	8000 LB-IN.	1.6 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
A	WAS DRG. C-3471	5/99

MODIFIED THORACIC SPINE AND THORACIC SPINE LOAD CELL

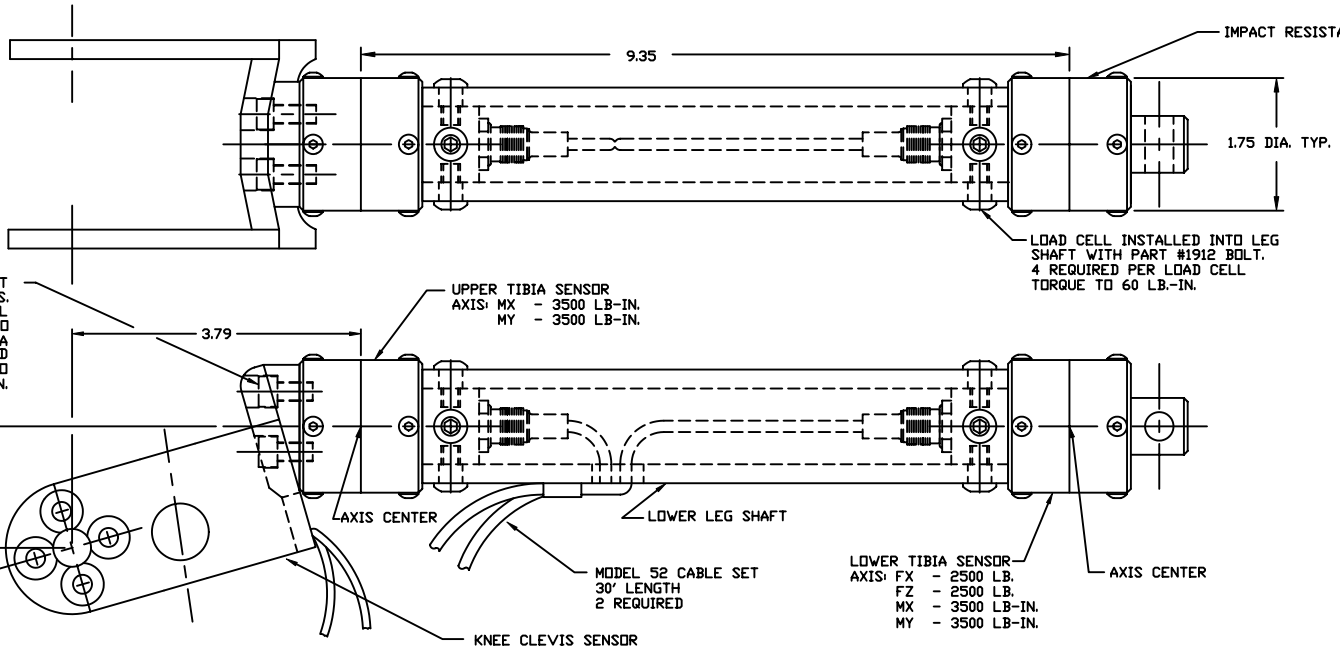
SCALE: .75X
DATE: 3/18/96
DRAWN BY: E. PROCTOR
MODEL: 3471

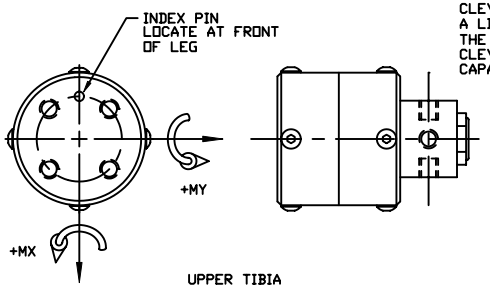
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125√
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-3471-D

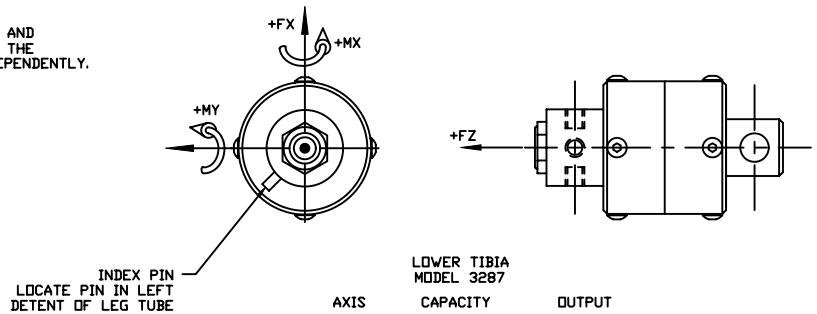
PATENT 4,448,433





UPPER TIBIA
MODEL 1583

AXIS	CAPACITY	OUTPUT
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.



LOWER TIBIA
MODEL 3287

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.

SYM	REVISION	DATE
A	WAS 3491	10/99

INSTRUMENTED LOWER LEG

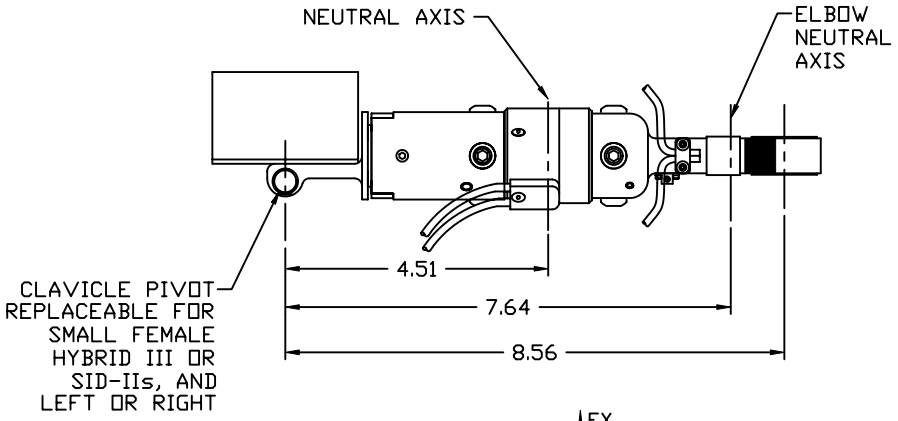
50TH PERCENTILE HYBRID III

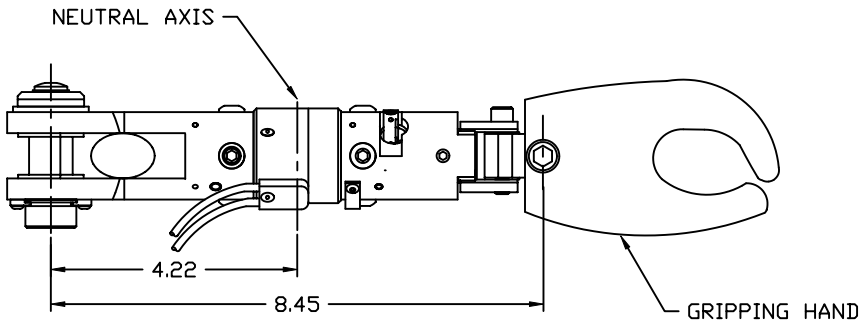
SCALE: .65X
DATE: 3/25/96
DRAWN BY: H. PROCTOR
MODEL: 3491

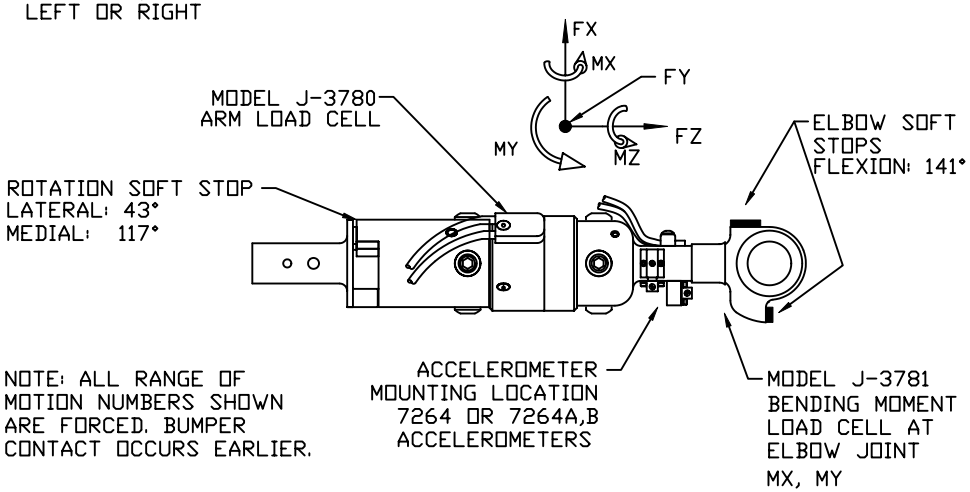
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

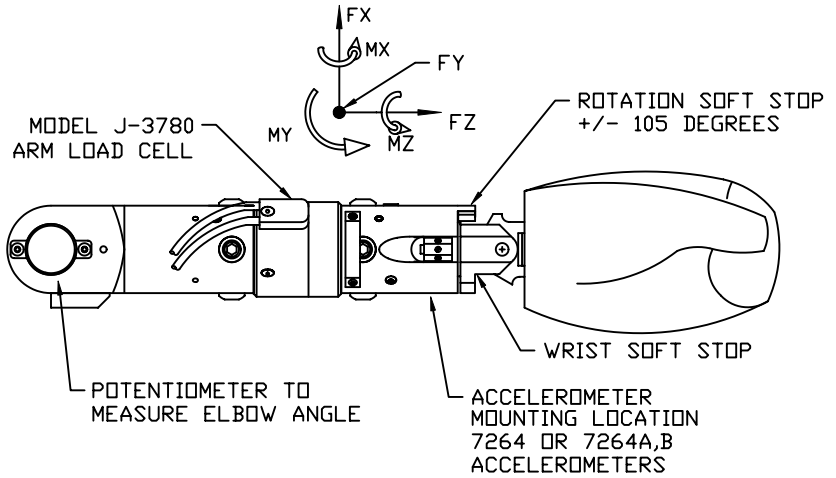
DRAWING NUMBER: B-3491-D







NOTE: ALL RANGE OF MOTION NUMBERS SHOWN ARE FORCED. BUMPER CONTACT OCCURS EARLIER.



MODEL J-3780 ARM LOAD CELL

AXIS	CAPACITY	OUTPUT
FX	2000 LBS.	2 mV/V NOMINAL
FY	2000 LBS.	2 mV/V NOMINAL
FZ	3000 LBS.	1 mV/V NOMINAL
MX	2000 IN.-LB.	3 mV/V NOMINAL
MY	2000 IN.-LB.	3 mV/V NOMINAL
MZ	1500 IN.-LB.	3 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

MODEL J-3781 ELBOW LOAD CELL

AXIS	CAPACITY	OUTPUT
MX	2000 IN.-LB.	3 mV/V NOMINAL
MY	2000 IN.-LB.	3 mV/V NOMINAL

SYM	REVISION	DATE

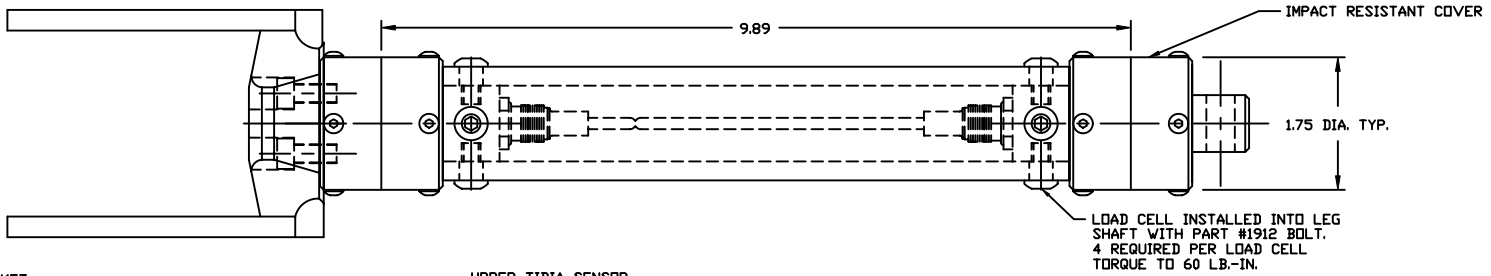
AIRBAG INTERACTION ARM

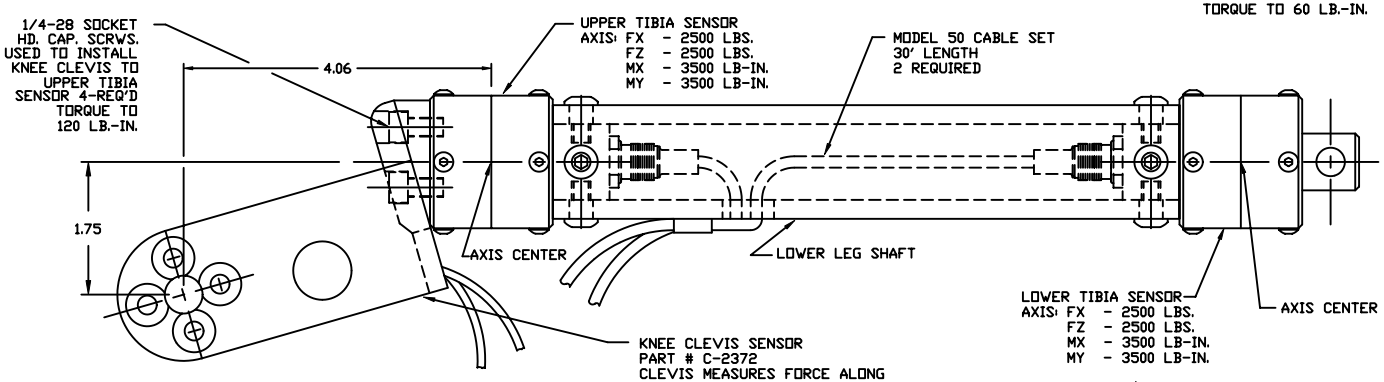
SCALE: FULL
DATE: 12APRIL96
DRAWN BY: C.R. MORGAN
MODEL: 3525J

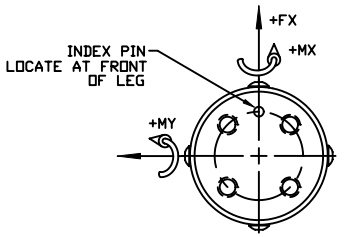
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

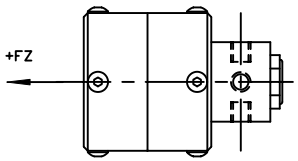
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3525-D



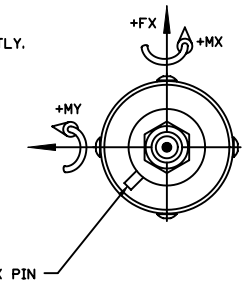


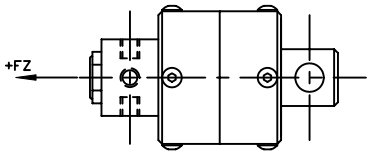




UPPER TIBIA
MODEL 3115

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.





LOWER TIBIA
MODEL 3287

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.

SYM	REVISION	DATE

INSTRUMENTED LOWER LEG

95TH PERCENTILE HYBRID III

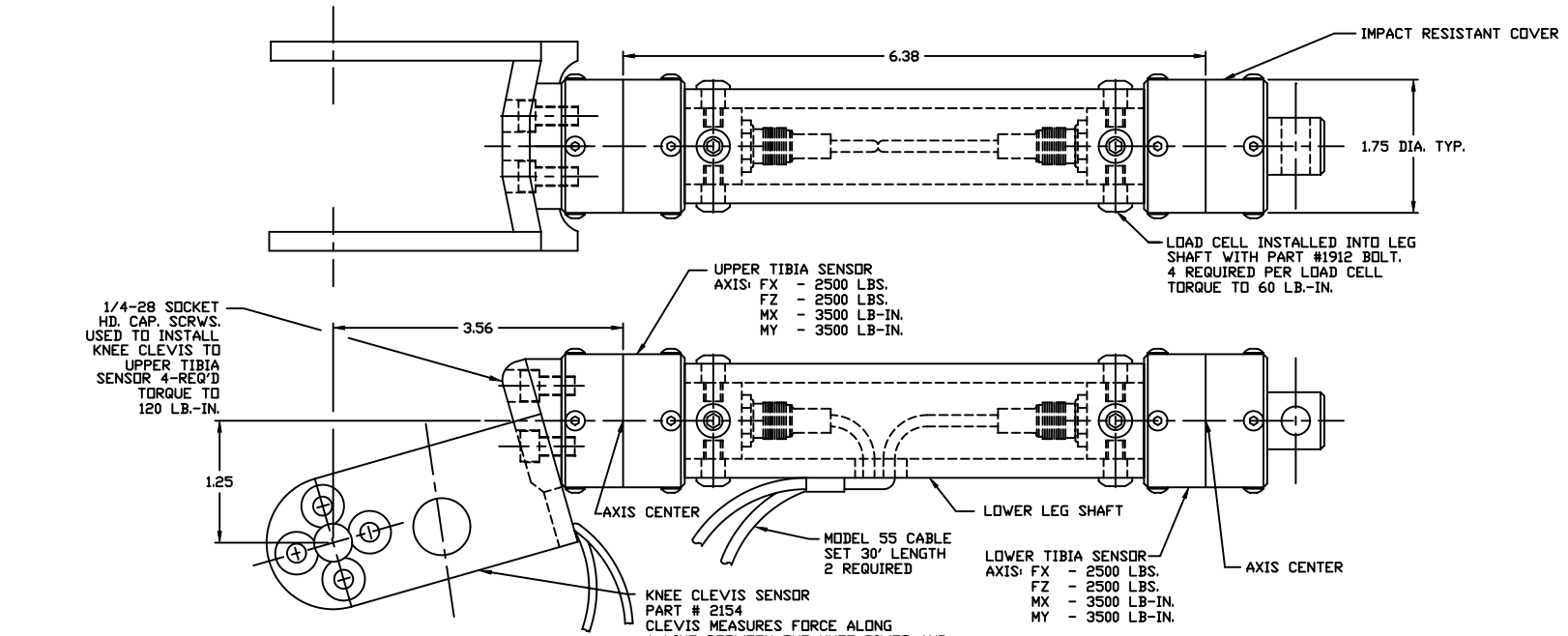
SCALE: NONE		DRAWN BY: H. PROCTOR
DATE: 5/21/96		MODEL: 3552

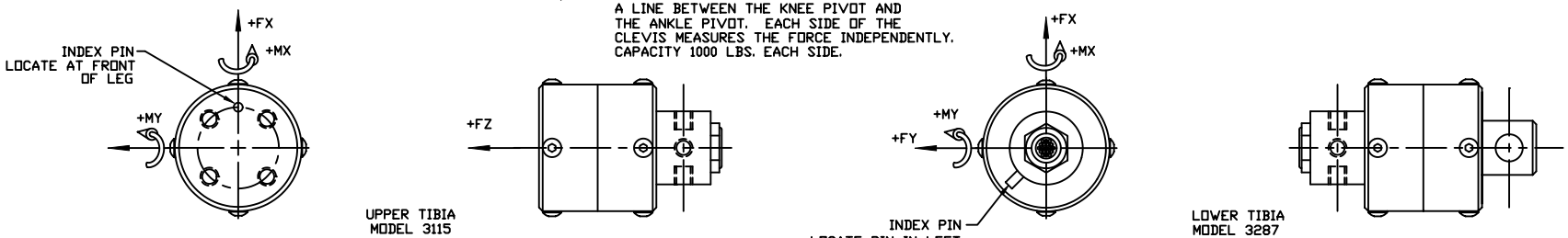
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3552-D





UPPER TIBIA
MODEL 3115

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

LOWER TIBIA
MODEL 3287

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	2.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SYM	REVISION	DATE
A	WAS 3553	10/99

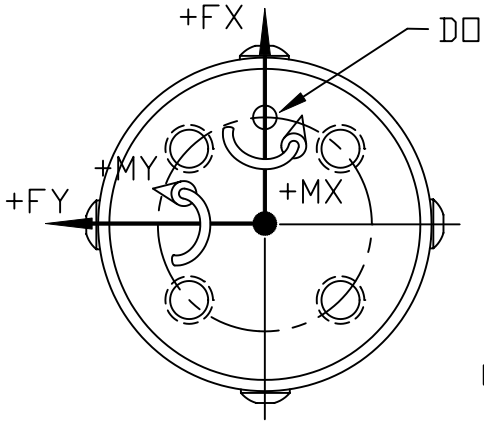
INSTRUMENTED LOWER LEG
5TH PERCENTILE HYBRID III

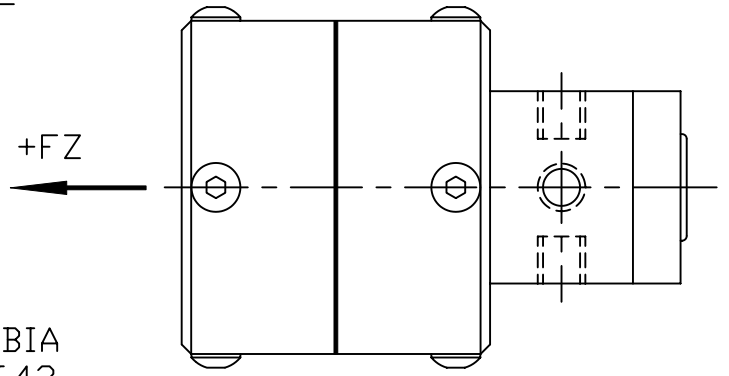
SCALE: NONE
DATE: 5/21/96
DRAWN BY: H. PROCTOR
MODEL: 3553

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3553-D





UPPER TIBIA
MODEL 3643

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

CABLE COLOR CODE

FX		FY		FZ		MX	
BROWN	+EXC.	RED STRIPE	+EXC.	GREEN	+EXC.	GREEN STRIPE	+EXC.
RED	+SIG.	BLACK	+SIG.	BLUE	+SIG.	BLUE STRIPE	+SIG.
ORANGE	-EXC.	WHITE	-EXC.	VIOLET	-EXC.	ORANGE STRIPE	-EXC.
YELLOW	-SIG.	BLACK STRIPE	-SIG.	GREY	-SIG.	YELLOW STRIPE	-SIG.

MY	
PINK	+EXC.
TAN	+SIG.
BROWN STRIPE	-EXC.
VIOLET STRIPE	-SIG.

SYM	REVISION	DATE
A	ADD SPACER	5/99

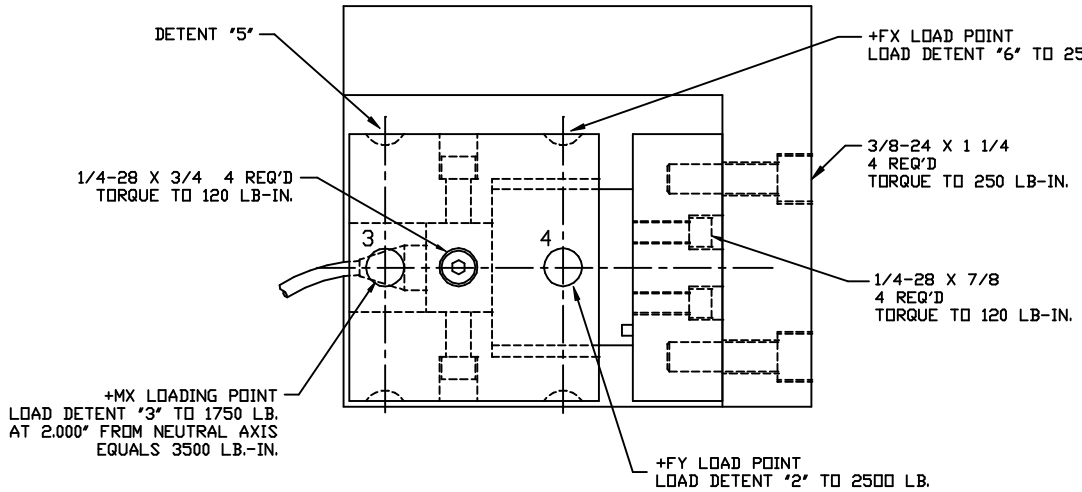
OUTPUT POLARITY - MODEL 3643

SCALE: FULL
DATE: 2/17/98
DRAWN BY: C.R. MORGAN
MODEL: 3643

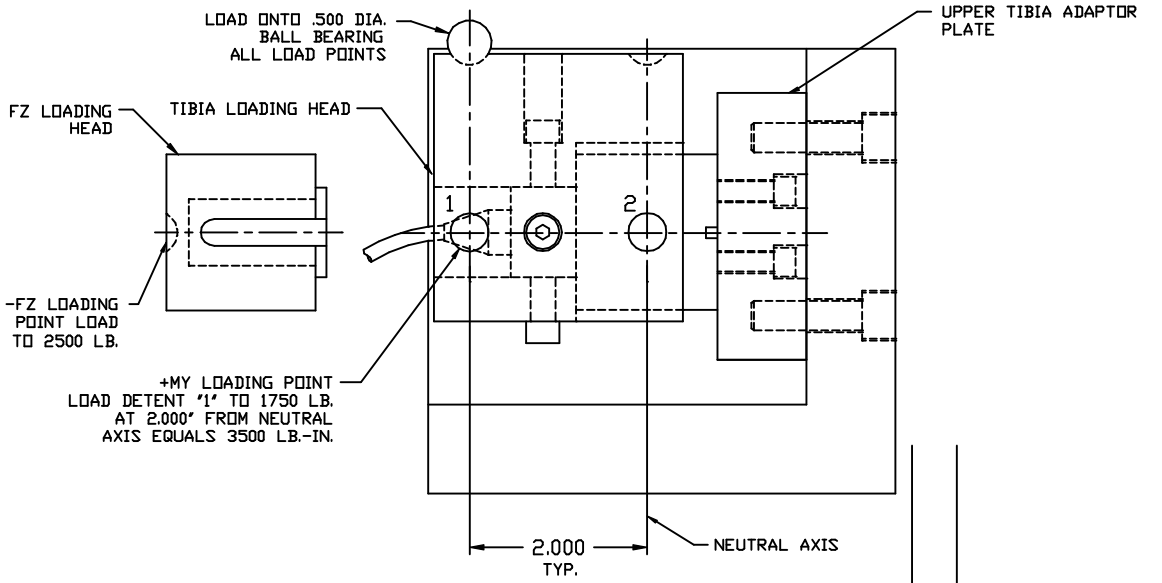
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

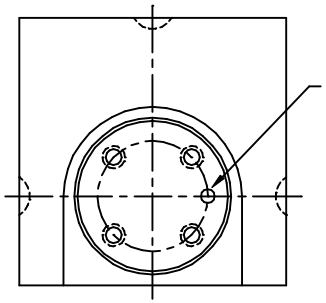
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-3643-D



NOTE:
POSITIVE CALIBRATION LOAD POINTS
PER AXIS DEFINITION SPECIFIED ON
DRAWING 3643





CALIBRATION FIXTURE MODEL #2171

SYM	REVISION	DATE

UPPER TIBIA CALIBRATION FIXTURE

UPPER TIBIA MODEL 3643

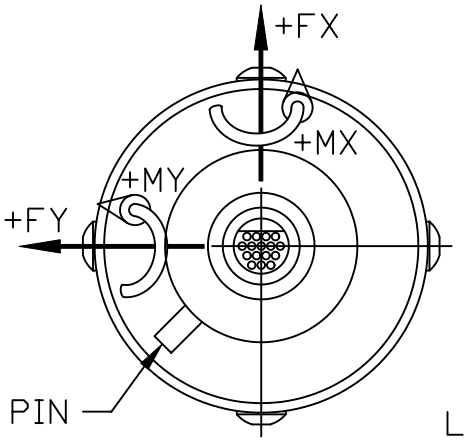
SCALE: .75X			DRAWN BY: H. PROCTOR
DATE: 10AUG			MODEL: 3643

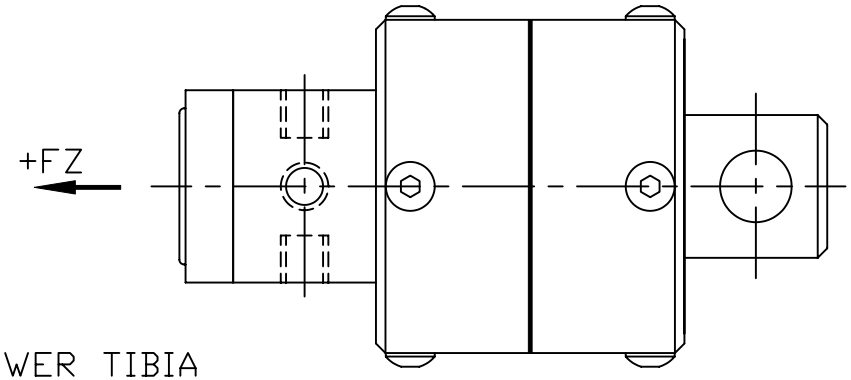
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3643-C





INDEX PIN
LOCATE PIN IN LEFT DETENT OF LEG TUBE FOR CORRECT AXES ORIENTATION

LOWER TIBIA
MODEL 3644

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

CABLE COLOR CODE

FX		FY		FZ		MX	
BROWN	+EXC.	RED STRIPE	+EXC.	GREEN	+EXC.	GREEN STRIPE	+EXC.
RED	+SIG.	BLACK	+SIG.	BLUE	+SIG.	BLUE STRIPE	+SIG.
ORANGE	-EXC.	WHITE	-EXC.	VIOLET	-EXC.	ORANGE STRIPE	-EXC.
YELLOW	-SIG.	BLACK STRIPE	-SIG.	GREY	-SIG.	YELLOW STRIPE	-SIG.

MY

PINK	+EXC.
TAN	+SIG.
BROWN STRIPE	-EXC.
VIOLET STRIPE	-SIG.

OUTPUT POLARITY - MODEL 3644

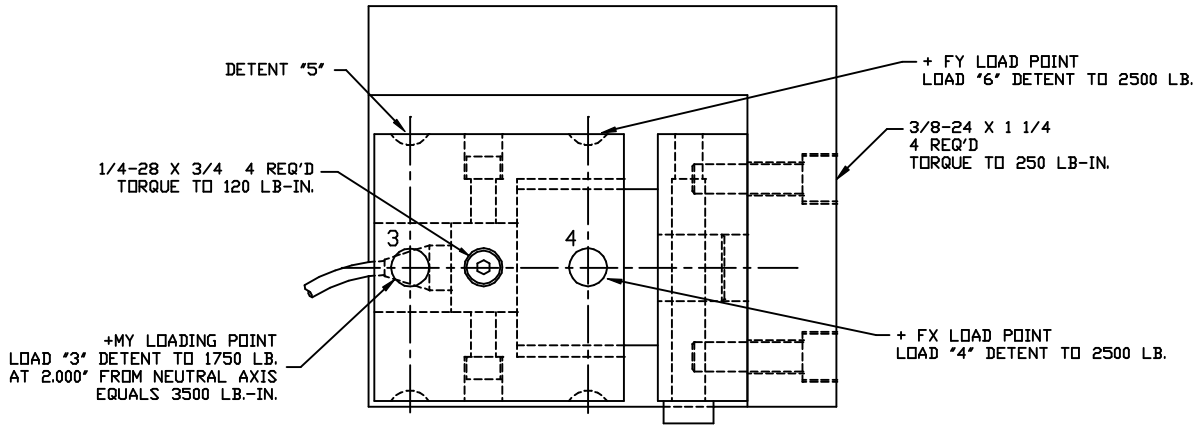
SCALE: FULL
DATE: 2/17/98
DRAWN BY: C.R. MORGAN
MODEL: 3644

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

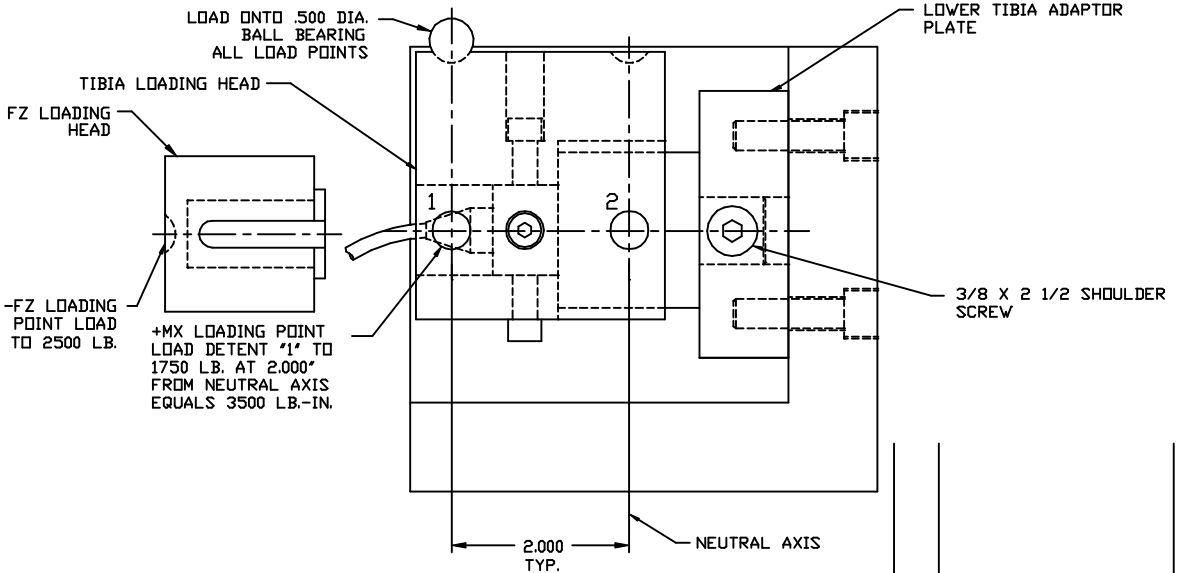
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

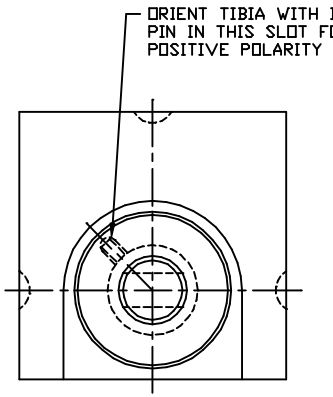
DRAWING NUMBER: A-3644-D

SYM	REVISION	DATE
A	ADD SPACER	5/99



NOTE:
POSITIVE CALIBRATION LOAD POINTS
PER AXIS DEFINITION SPECIFIED ON
DRAWING 3644





CALIBRATION FIXTURE MODEL #2171

SYM	REVISION	DATE

LOWER TIBIA CALIBRATION FIXTURE

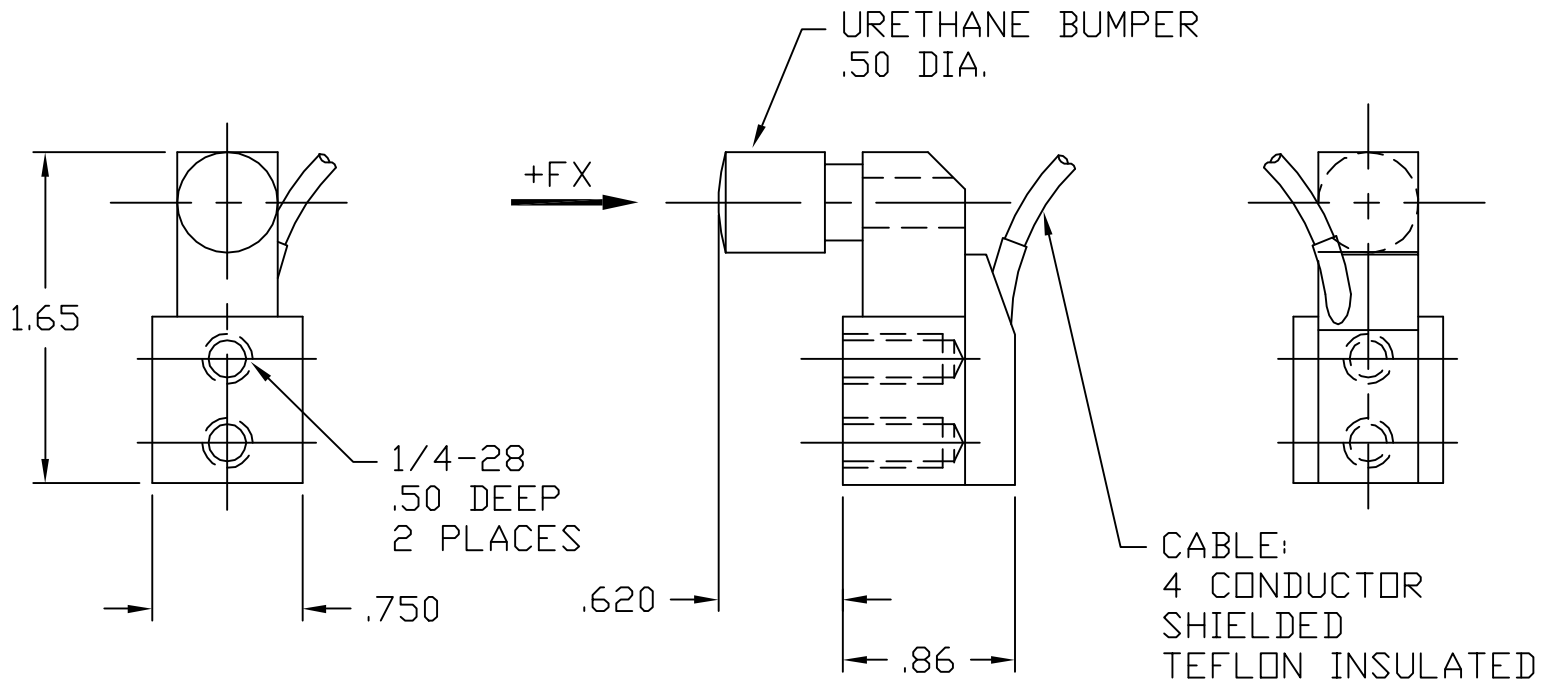
LOWER TIBIA MODEL 3644

SCALE: .75X			DRAWN BY: C.R. MORGAN
DATE: 10AUG98			MODEL: 3644

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3644-C



(A) THE RIB LOAD CELLS ARE FASTENED TO THE INSIDE REAR SURFACE OF THE SID-IIs THORAX BOX TO SENSE THE DEPLOYEMENT FORCE OF A SIDE AIR BAG INTO THE REAR OF THE DUMMY.

RIB LOAD CELL
CAPACITY: 1000 LBF
OUTPUT @ CAPACITY: 1.5 mV/V NOM.
BRIDGE RESISTANCE: 350 OHMS
NONLINEARITY: < 1%

SYM	REVISION	DATE
B	WAS DRG. A-3676	5/99
A	UPDATE TEXT	2/98

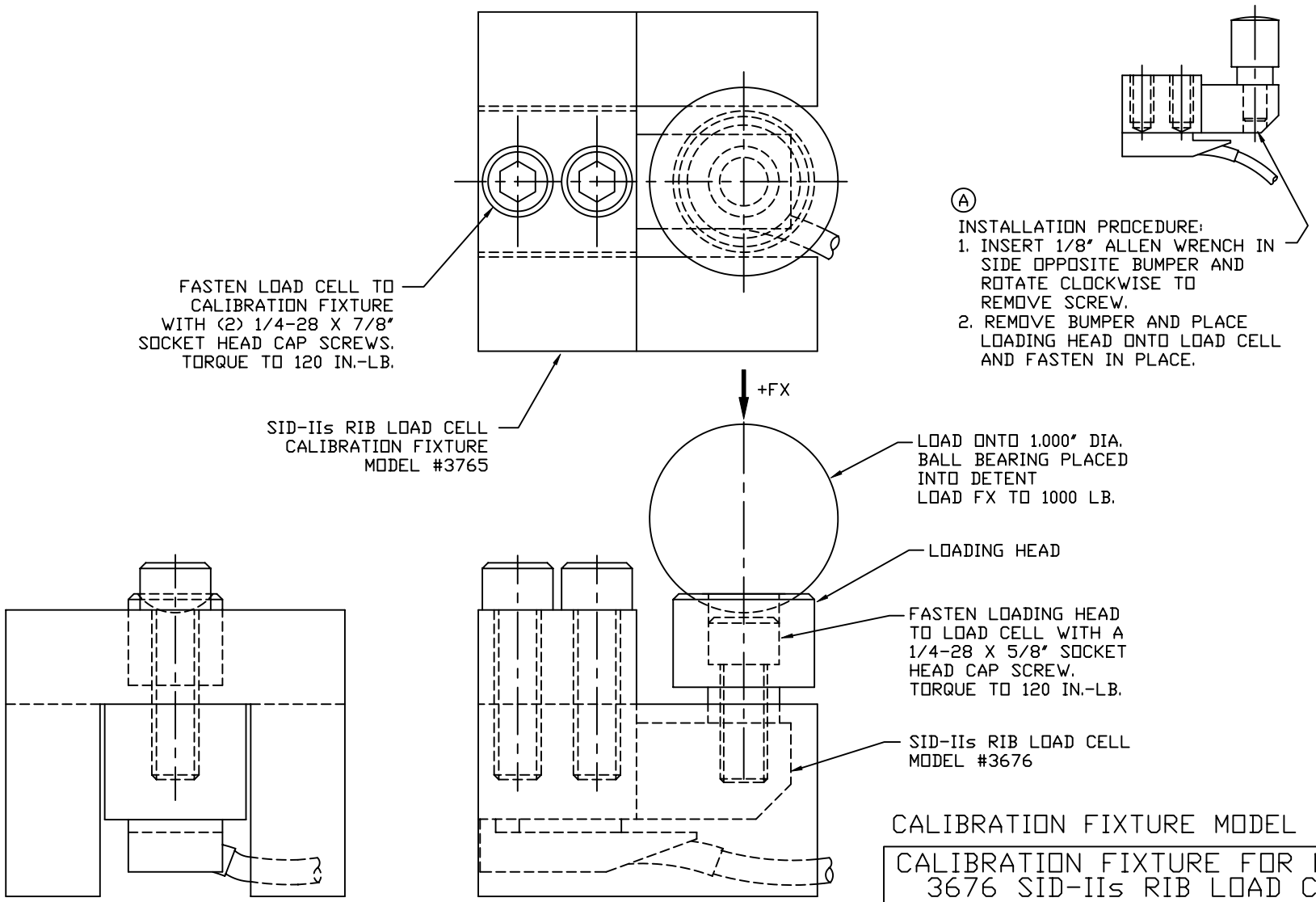
SID-IIs RIB LOAD CELL

SCALE: FULL
DATE: 5OCT96
DRAWN BY: C.R. MORGAN
MODEL: 3676

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-3676-D



CALIBRATION FIXTURE MODEL #3765

CALIBRATION FIXTURE FOR MODEL 3676 SID-IIs RIB LOAD CELL

SCALE: 2X			DRAWN BY: H. PROCTOR
DATE: 2/18/97			MODEL: 3676

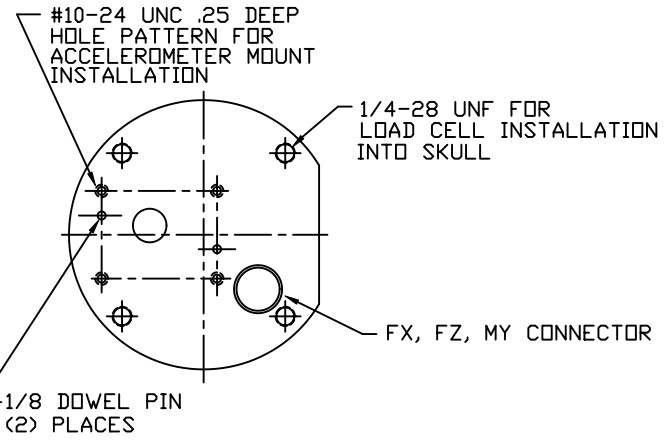
UNLESS OTHERWISE SPECIFIED

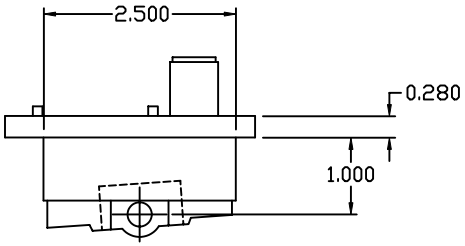
TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

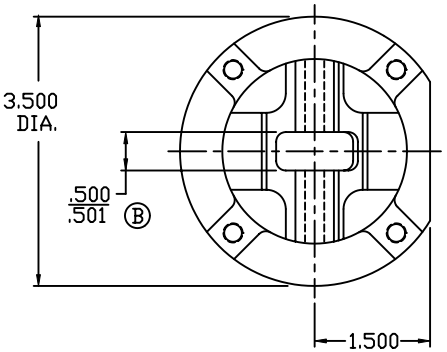
SYM	REVISION	DATE

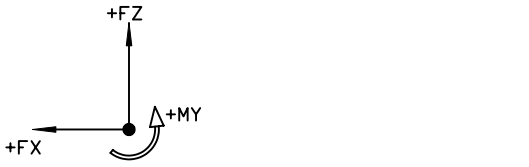
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

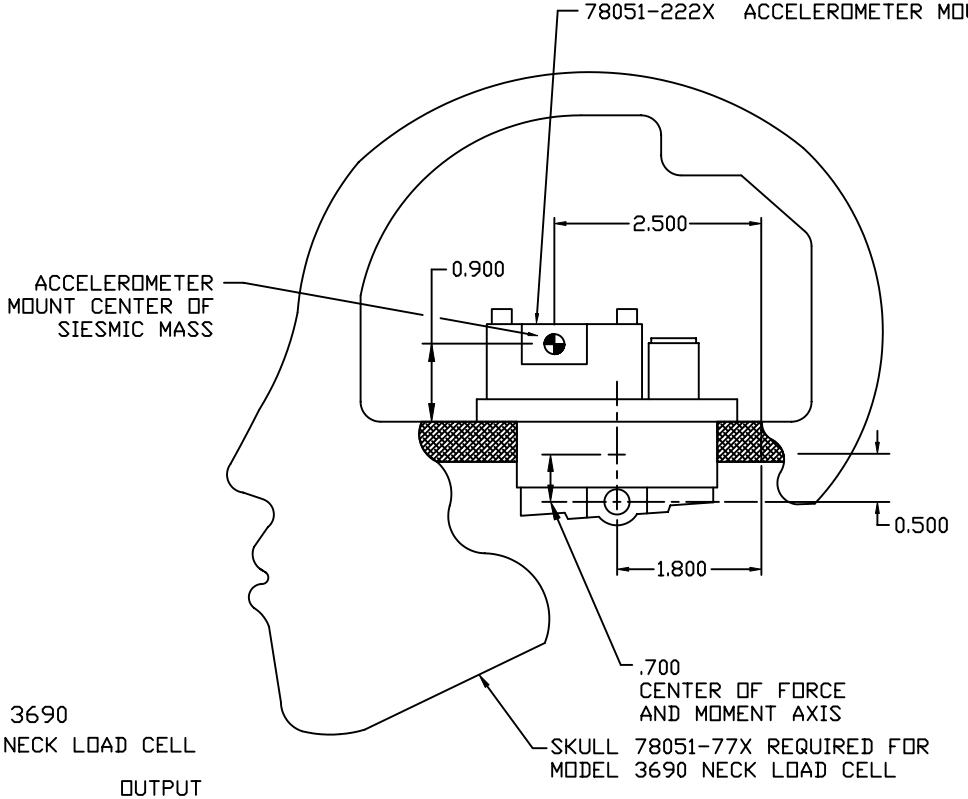
DRAWING NUMBER: B-3676-C











MODEL 3690

THREE CHANNEL NECK LOAD CELL

AXIS	CAPACITY	OUTPUT
FX	200 LBS.	1.7 mV/V NOM.
FZ	500 LBS.	0.8 mV/V NOM.
MY	500 LB*IN	2.5 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
C	WAS DRG. B-3690	5/99
B	CORRECT TOL.	11/98
A	UPDATE TEXT	1/98

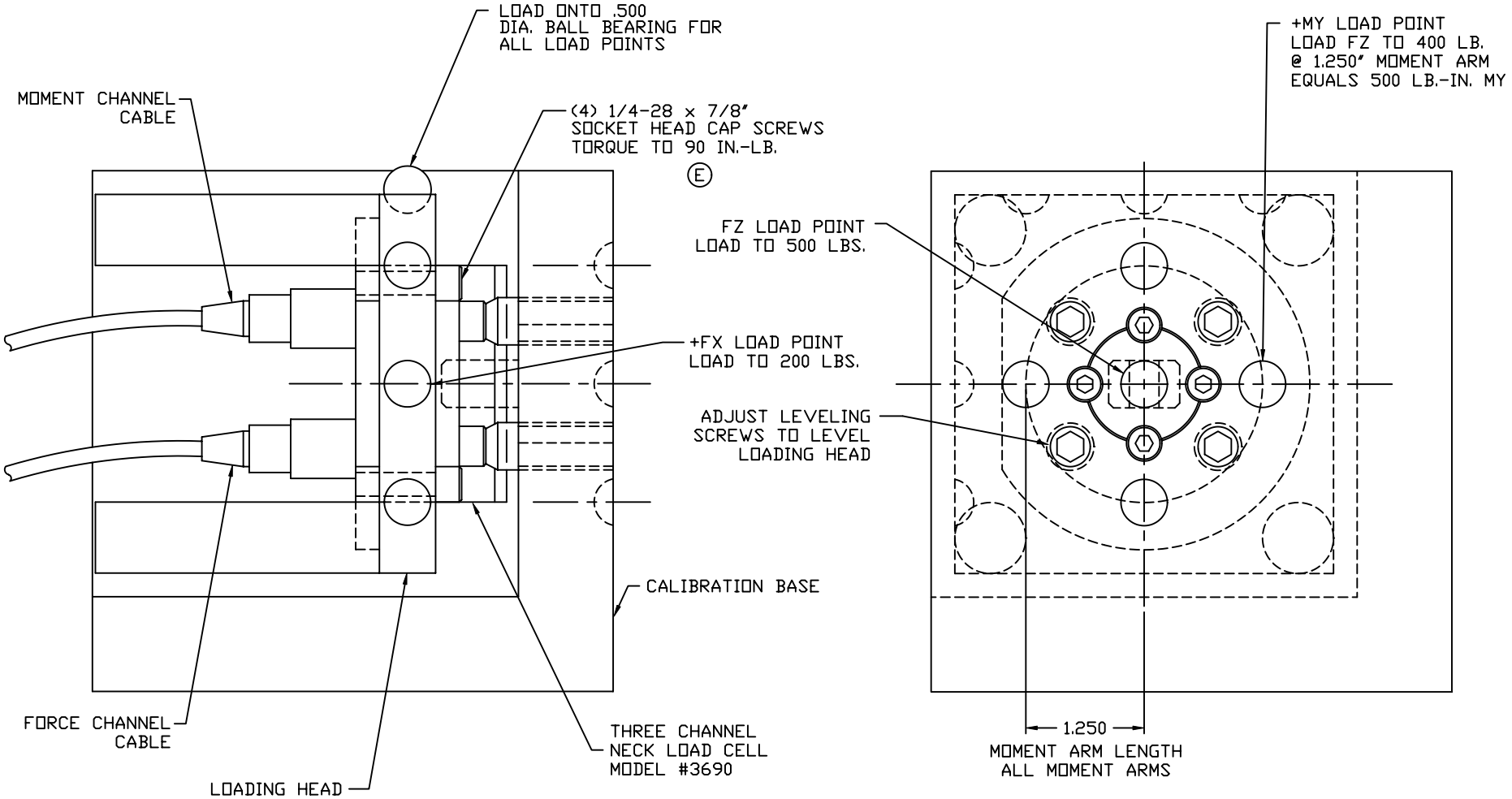
HYBRID III THREE CHANNEL NECK LOAD CELL
LOW CAPACITY

SCALE: NONE
DATE: 10/18/96
DRAWN BY: C.R.M./H.P.
MODEL: 3690

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3690-D



USED-ON

SYM	REVISION	DATE
A	WAS DRG. B-1860	10/99

NECK CALIBRATION FIXTURE

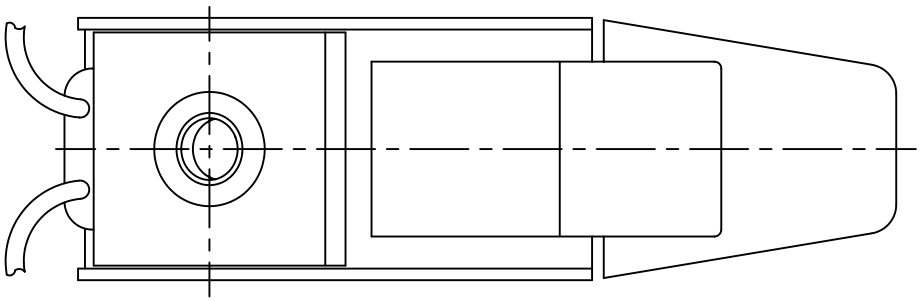
SCALE: FULL		DRAWN BY: C.R.M./S.E.P.
DATE: 11/1/85		MODEL: 3690

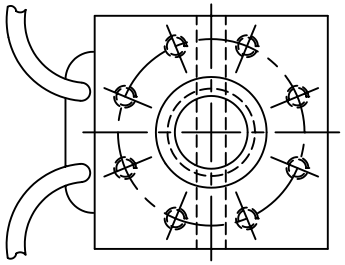
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3690-C

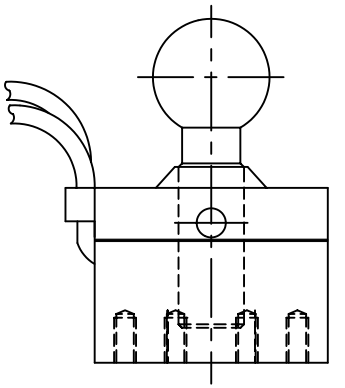
ROTATION



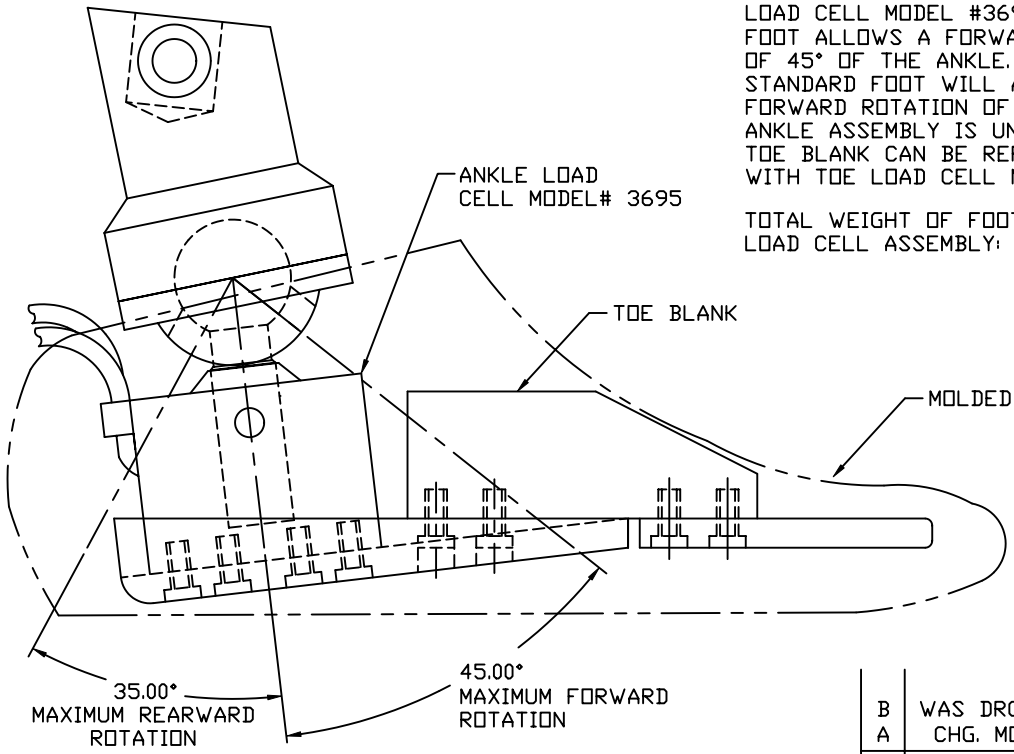


THE ANKLE-FOOT ASSEMBLY SHOWN IS A REPLACEMENT OF THE STANDARD HYBRID III ANKLE-FOOT. THE FOOT ASSEMBLY INCLUDES A 5-CHANNEL ANKLE LOAD CELL MODEL #3695. THE FOOT ALLOWS A FORWARD ROTATION OF 45° OF THE ANKLE. THE STANDARD FOOT WILL ALLOW A FORWARD ROTATION OF 30°. THE ANKLE ASSEMBLY IS UNCHANGED. THE TOE BLANK CAN BE REPLACED WITH TOE LOAD CELL MODEL #3696.

TOTAL WEIGHT OF FOOT AND LOAD CELL ASSEMBLY: 3.1 LBS.



HYBRID III ANKLE LOAD CELL



AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	2000 LBS.	2.0 mV/V NOMINAL
FY	2000 LBS.	2.0 mV/V NOMINAL
FZ	3500 LBS.	1.5 mV/V NOMINAL
MX	3500 LB.-IN	1.5 mV/V NOMINAL
MY	3500 LB.-IN.	1.5 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
B	WAS DRG. B-2932	4/99
A	CHG. MODEL #	11/96

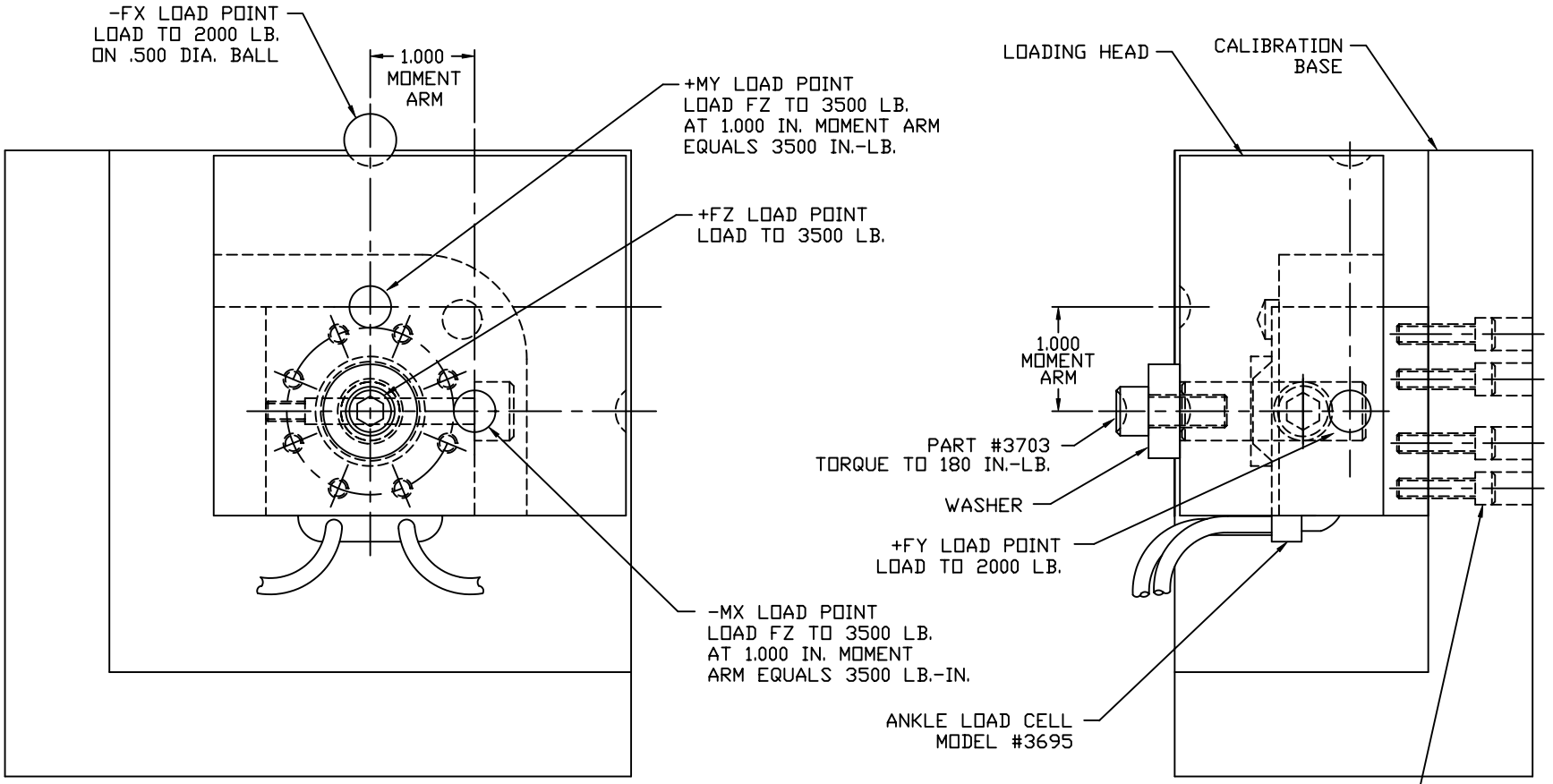
HYBRID III ANKLE LOAD CELL

SCALE: FULL
DATE: 9/18/93
DRAWN BY: C.R. MORGAN
MODEL: 3695

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3695-D



INSTALLATION:

1. FASTEN LOAD CELL TO CALIBRATION BASE AS SHOWN WITH (8) #10-24 X 3/4" SOCKET HEAD CAP SCREWS. TORQUE TO 90 IN.-LB.
2. FASTEN SHAFT TO LOAD CELL WITH A 1/4 X 1 1/2" SOCKET HEAD SHOULDER SCREW. TORQUE TO 60 IN.-LB.
3. ORIENT LOADING HEAD AND PLACE ON LOAD CELL AS SHOWN. PLACE THE 5/16-24 X 3/4" SOCKET HEAD CAP SCREW (PART #3703) THROUGH THE WASHER AND FASTEN IT TO THE SHAFT. TORQUE TO 180 IN.-LB.

SYM	REVISION	DATE
B	WAS DRG. B-3301	4/99
A	CHG. ANKLE MODEL#	11/96

CALIBRATION FIXTURE FOR THE ANKLE LOAD CELL MODEL #3695

SCALE: FULL | DRAWN BY: H. PROCTOR

DATE: 10/28/96 | MODEL: 3301

UNLESS OTHERWISE SPECIFIED

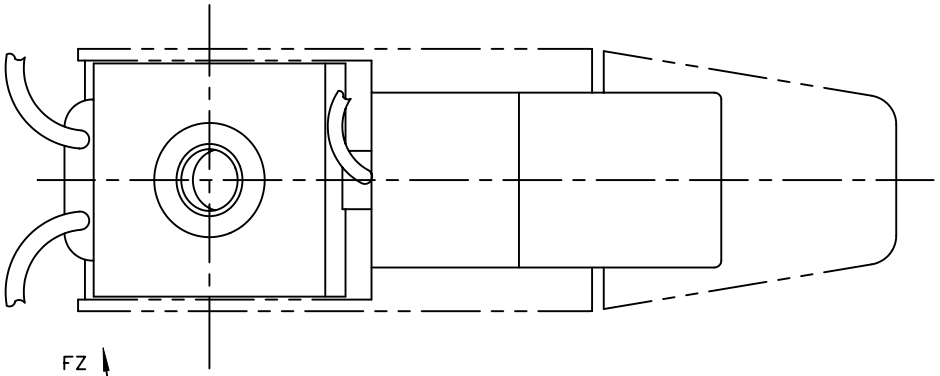
TWO PLACE DECIMALS ± .010 | SURFACE FINISH 125

THREE PLACE DECIMALS ± .005 | REMOVE ALL BURRS & SHARP EDGES

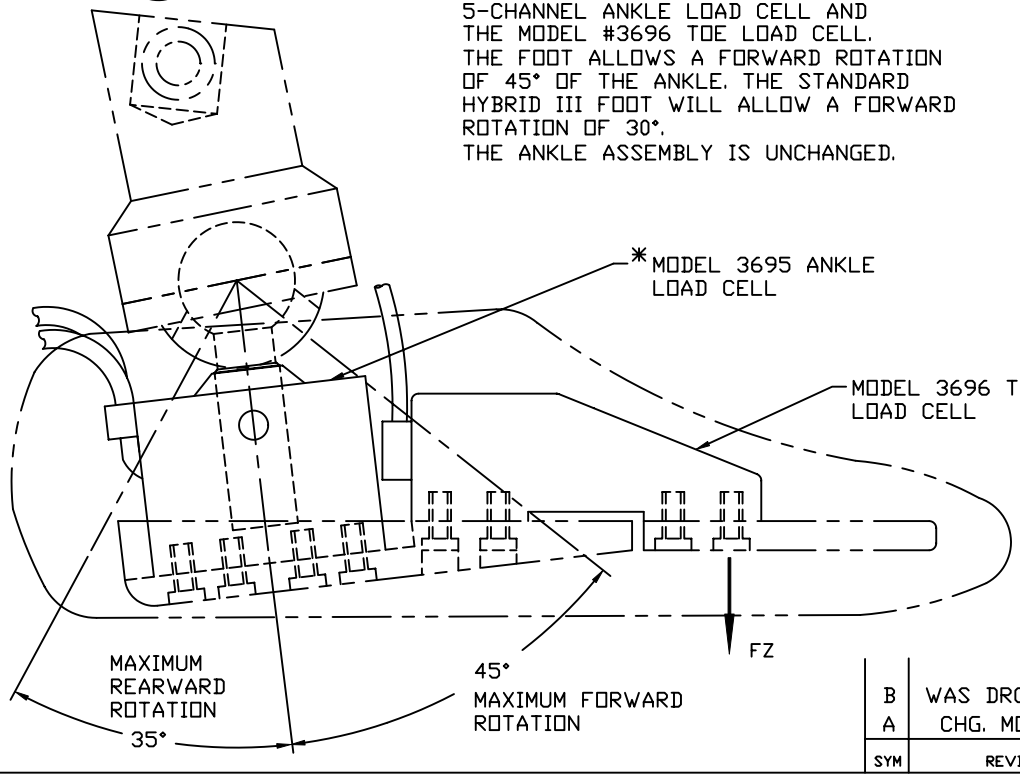
ANGLES ± 0° 30' | DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3695-C



THE ANKLE-FOOT ASSEMBLY SHOWN IS A REPLACEMENT OF THE STANDARD HYBRID III ANKLE-FOOT. THE FOOT ASSEMBLY INCLUDES THE MODEL #3695 5-CHANNEL ANKLE LOAD CELL AND THE MODEL #3696 TOE LOAD CELL. THE FOOT ALLOWS A FORWARD ROTATION OF 45° OF THE ANKLE. THE STANDARD HYBRID III FOOT WILL ALLOW A FORWARD ROTATION OF 30°. THE ANKLE ASSEMBLY IS UNCHANGED.



HYBRID III TOE LOAD CELL
MODEL 3696

AXIS	CAPACITY	OUTPUT @ CAPACITY
FZ	2000 LBS.	2.0 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

HYBRID III ANKLE LOAD CELL
MODEL 3695

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	2000 LBS.	2.0 mV/V NOMINAL
FY	2000 LBS.	2.0 mV/V NOMINAL
FZ	3500 LBS.	1.5 mV/V NOMINAL
MX	3500 LB.-IN	1.5 mV/V NOMINAL
MY	3500 LB.-IN.	1.5 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

* MODEL 3695 ANKLE LOAD CELL MAY BE USED WITHOUT MODEL 3696 TOE LOAD CELL. A STRUCTURAL REPLACEMENT FOR THE TOE LOAD CELL WOULD THEN BE PROVIDED.

SYM	REVISION	DATE
B	WAS DRG. B-3090	7/99
A	CHG. MODEL#S	11/96

TOE LOAD CELL

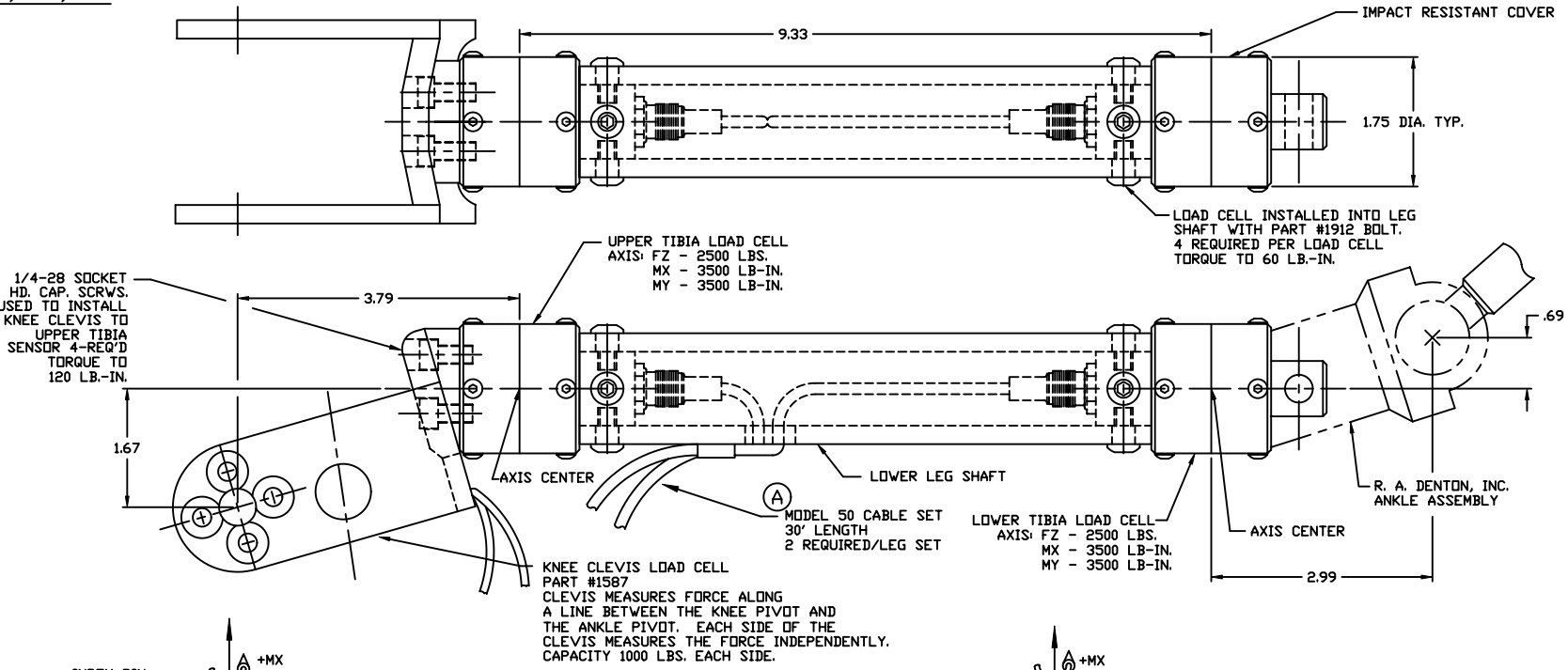
SCALE: FULL
DATE: 30JAN95
DRAWN BY: C.R. MORGAN
MODEL: 3696

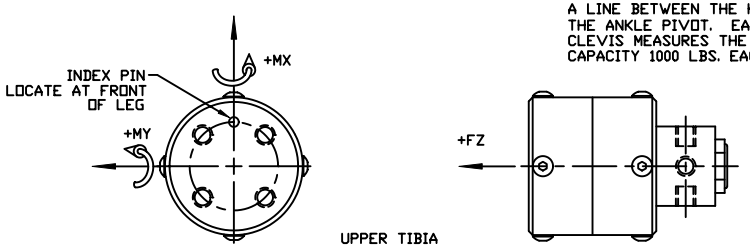
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3696-D

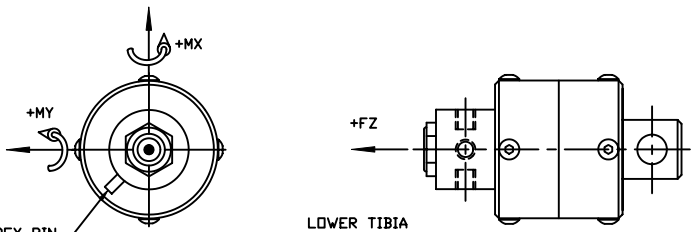
PATENT 4,448,433





UPPER TIBIA
MODEL 3292

AXIS	CAPACITY	OUTPUT
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.



LOWER TIBIA
MODEL 3093

AXIS	CAPACITY	OUTPUT
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SYM	REVISION	DATE
B	WAS 3711	10/99
A	WAS MODEL 55	2/98

INSTRUMENTED LOWER LEGS

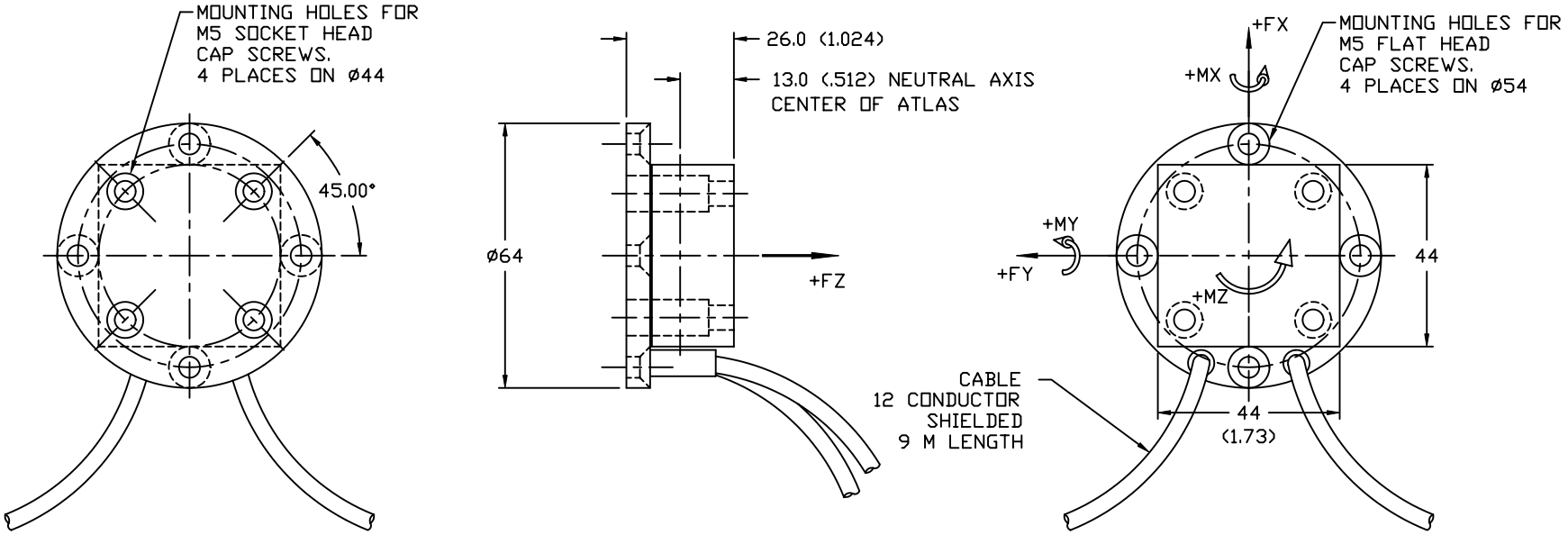
H-III 50TH PERCENTILE

SCALE: NONE
DATE: 11/07/96
DRAWN BY: H. PROCTOR
MODEL: 3711

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3711-D



AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	5.0 KN (1125 LBF)	2.0 mV/V NOMINAL
FY	5.0 KN (1125 LBF)	2.0 mV/V NOMINAL
FZ	6.0 KN (1350 LBF)	1.0 mV/V NOMINAL
MX	150 NM (1325 LB.-IN.)	2.0 mV/V NOMINAL
MY	150 NM (1325 LB.-IN.)	2.0 mV/V NOMINAL
MZ	80 NM (700 LB.-IN.)	2.5 mV/V NOMINAL

NONLINEARITY <1 % OF FULL SCALE
CROSSTALK < 5 % OF FULL SCALE

SYM	REVISION	DATE
E	WAS DRG. B-3715	5/99
D	CABLE TO 9M	1/99
C	CABLE LENGTH	10/98
B	REV. MZ CAP.	4/97
A	REV. CABLE EXIT	1/97

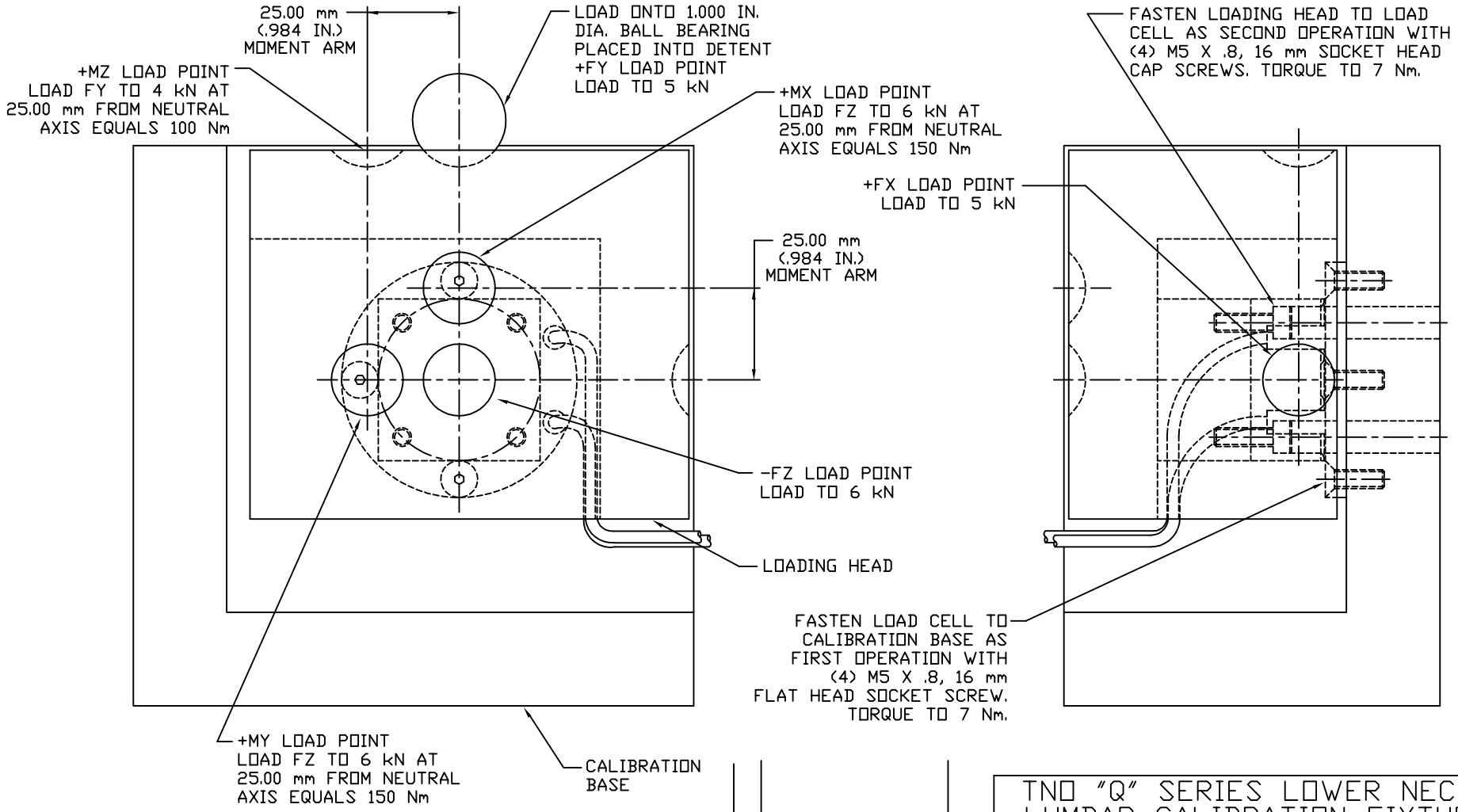
TNO Q-SERIES LOWER NECK/LUMBAR LOAD CELL

SCALE: FULL
DATE: 9NOV96
DRAWN BY: C.R. MORGAN
MODEL: 3715

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3715-D



ORDER OF ASSEMBLY:

1. FASTEN LOAD CELL TO CALIBRATION BASE WITH (4) M5 X .8, 16 mm FLAT HEAD SOCKET SCREWS. TORQUE TO 7 Nm.
2. ROUTE CABLES AROUND SIDE OF LOADING HEAD AS SHOWN.
3. FASTEN LOADING HEAD TO LOAD CELL WITH (4) M5 X .8, 16 mm SOCKET HEAD CAP SCREWS. TORQUE TO 7 Nm.

Ⓐ

SYM	REVISION	DATE
B	WAS DWG. B-3788	11/99
A	WAS 20MM	11/99

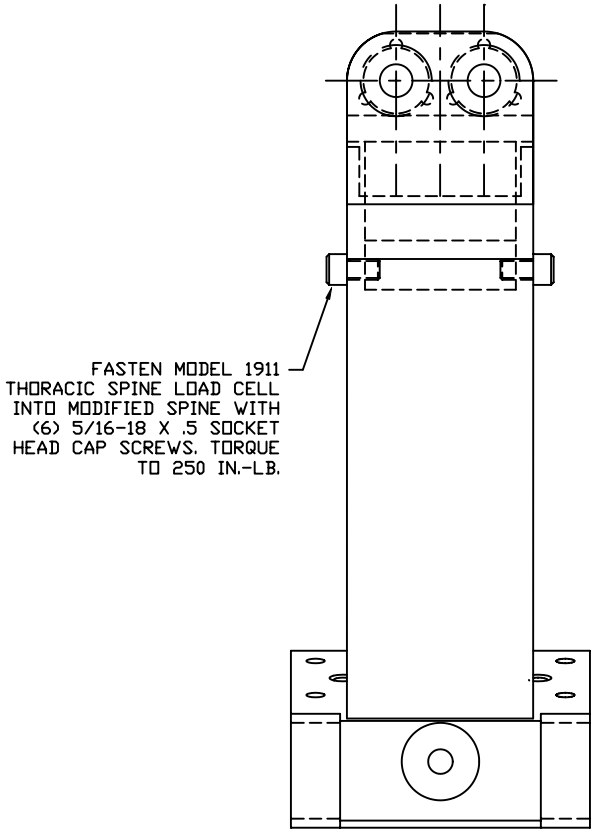
TNO "Q" SERIES LOWER NECK/ LUMBAR CALIBRATION FIXTURE

SCALE: FULL
DATE: 3/31/97
DRAWN BY: H. PROCTOR
MODEL: 3715/3788

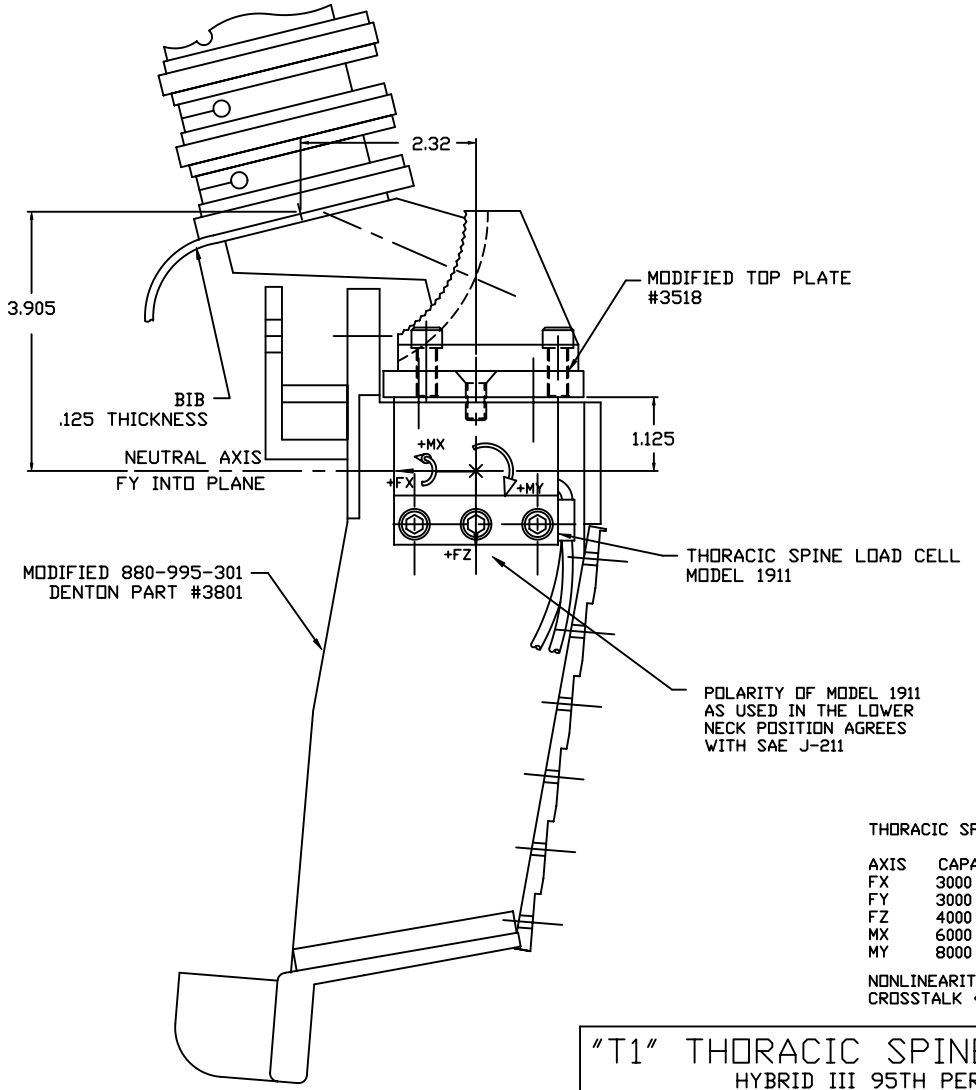
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3715-C



FASTEN MODEL 1911 THORACIC SPINE LOAD CELL INTO MODIFIED SPINE WITH (6) 5/16-18 X .5 SOCKET HEAD CAP SCREWS. TORQUE TO 250 IN.-LB.



THORACIC SPINE LOAD CELL

AXIS	CAPACITY	OUTPUT
FX	3000 LBS.	1.8 mV/V NOM.
FY	3000 LBS.	1.8 mV/V NOM.
FZ	4000 LBS.	1 mV/V NOM.
MX	6000 LB-IN.	1.4 mV/V NOM.
MY	8000 LB-IN.	1.6 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

"T1" THORACIC SPINE LOAD CELL

HYBRID III 95TH PERCENTILE

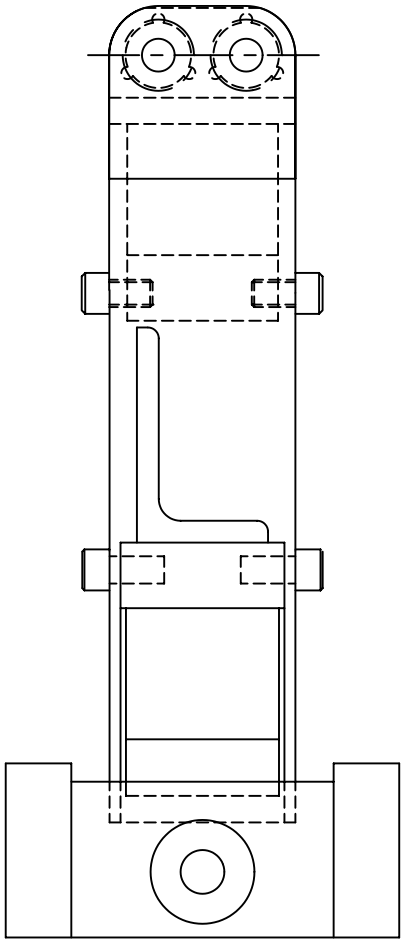
SCALE: NONE
DATE: 5/3/97
DRAWN BY: C.R. MORGAN
MODEL: 3716

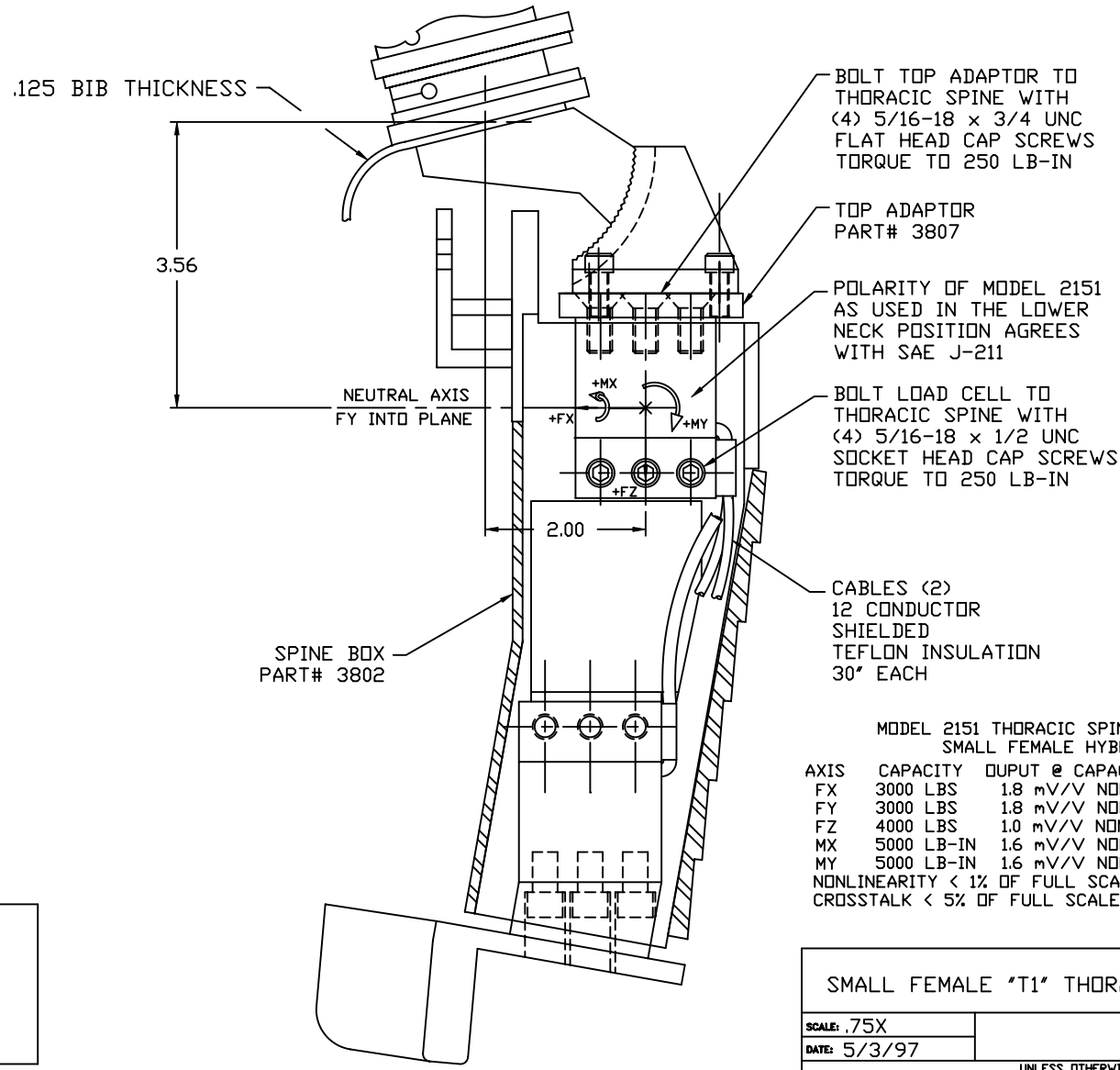
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3716-D

SYM	REVISION	DATE
A	WAS 3716	10/99





MODEL 2151 THORACIC SPINE LOAD CELL
SMALL FEMALE HYBRID III

AXIS	CAPACITY	OUPUT @ CAPACITY	BRIDGE RESISTANCE
FX	3000 LBS	1.8 mV/V NOM.	350 OHMS
FY	3000 LBS	1.8 mV/V NOM.	350 OHMS
FZ	4000 LBS	1.0 mV/V NOM.	700 OHMS
MX	5000 LB-IN	1.6 mV/V NOM.	700 OHMS
MY	5000 LB-IN	1.6 mV/V NOM.	700 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
A	WAS 3717	10/99

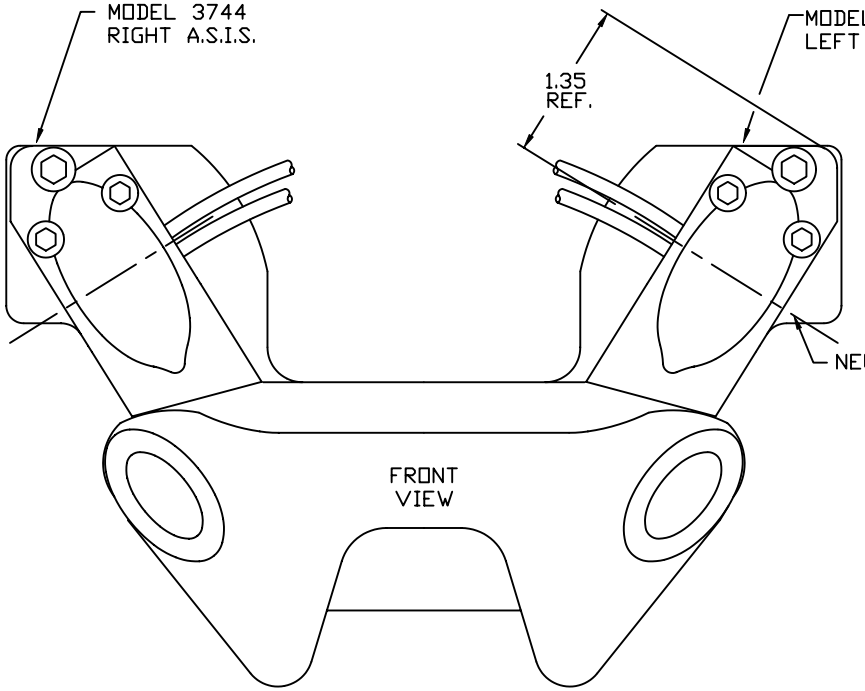
SMALL FEMALE "T1" THORACIC SPINE LOAD CELL

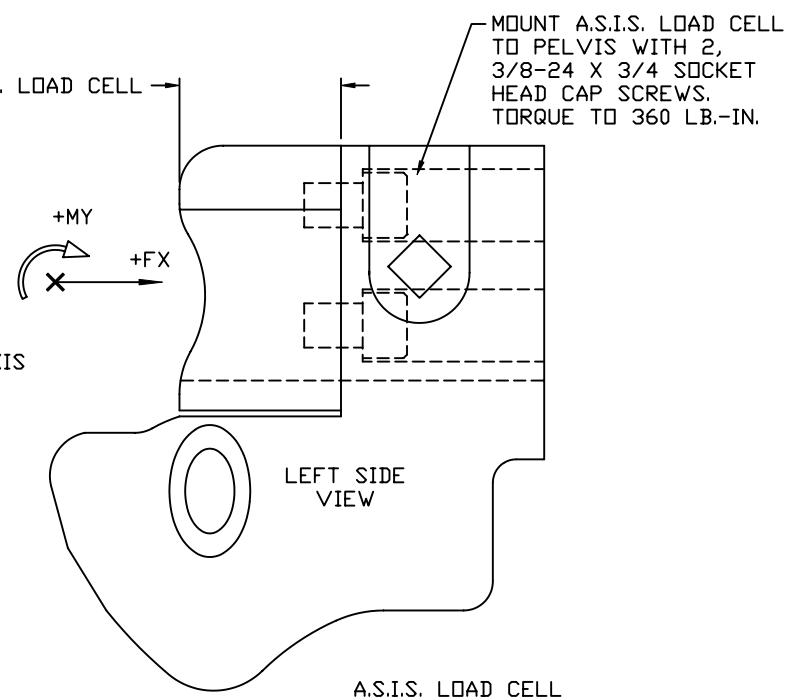
SCALE: .75X
DATE: 5/3/97
DRAWN BY: C.R. MORGAN
MODEL: 3717

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3717-D





A.S.I.S. LOAD CELL

THE MODEL 2656 A.S.I.S. LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THIS FORCE IS MEASURED AS FX AND IS INSENSITIVE TO THE POSITION OF THE BELT ON THE ILIAC. THE CHANNEL MY IS DESIGNED TO PROVIDE AN INDICATION OF THE POSITION OF THE BELT ON THE ILIAC. A READING OF ZERO OUTPUT WOULD OCCUR IF THE CENTER OF PRESSURE OF THE BELT IS ON THE LOAD CELL NEUTRAL AXIS. IF THE BELT IS ABOVE THE NEUTRAL AXIS A POSITIVE MOMENT READING WOULD OCCUR, AND A BELT POSITIONED BELOW THE NEUTRAL AXIS WOULD PRODUCE A NEGATIVE BENDING MOMENT OUTPUT.

NOTE: THE LOAD CELL CALIBRATION DATA IS POSITIVE FOR COMPRESSION ON THE FRONT FACE OF THE LOAD CELL. TO CONFORM TO S.A.E. J-211 POLARITY, THE POLARITY OF THE FX CHANNEL MUST BE CHANGED. THE POLARITY FOR THE MY CHANNEL CONFORMS TO S.A.E J-211.

MODEL 2656 LOAD CELL ASSEMBLY CONSISTS OF ONE OF MODEL 3743 LEFT A.S.I.S. AND ONE OF MODEL 3744 RIGHT A.S.I.S.

AXIS	CAPACITY	OUTPUT
FX	2000 LBS.	1.5 mV/V NOMINAL
MY	2000 LB.-IN.	1.0 mV/V NOMINAL

NONLINEARITY <1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

CABLE COLOR CODE @ LOAD CELL, FX AND MY CHANNELS

RED	+EXCITATION
GREEN	+SIGNAL
BLACK	-EXCITATION
WHITE	-SIGNAL

SYM	REVISION	DATE
E	WAS DRG. B-2656	4/99
D	CORRECT OUTPUT	8/98
C	ADD TEXT, DETAILS	4/98
B	ADD. CABLES	2/98
A	ADD MODEL#	1/97

ANTERIOR SUPERIOR ILIAC SPINE LOAD CELL

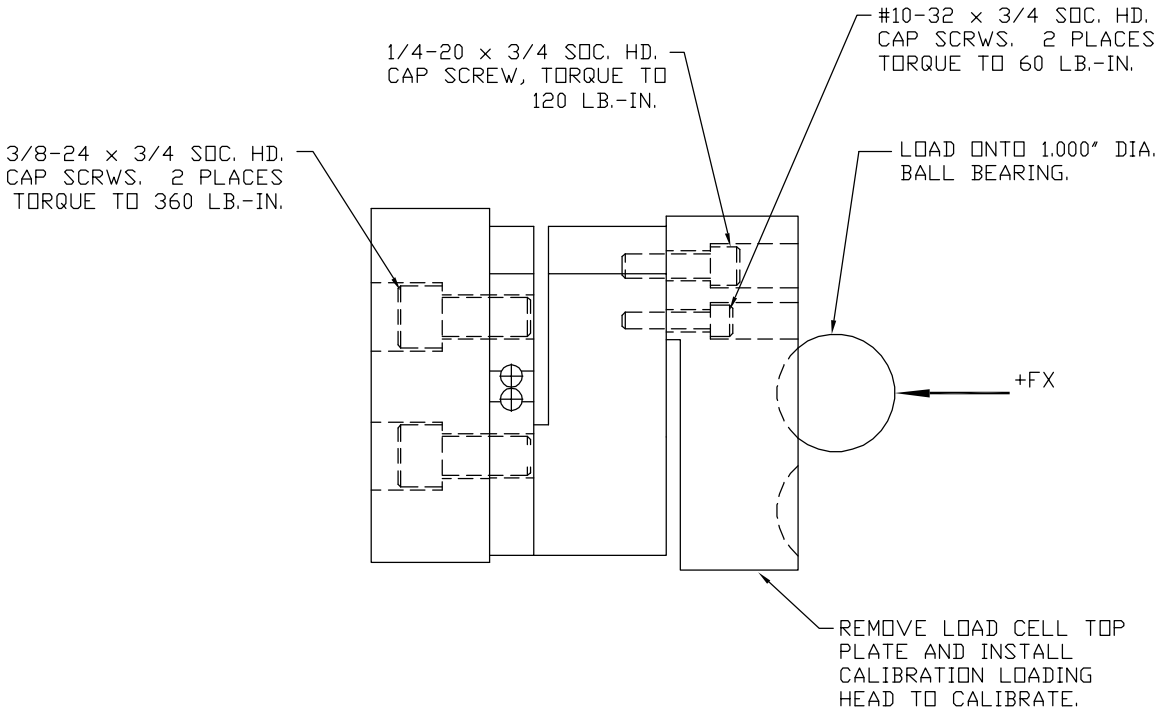
HYBRID III 5TH PERCENTILE - LEFT ASIS

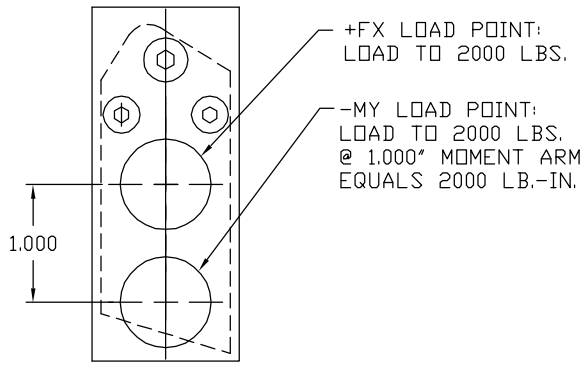
SCALE: NONE
DATE: 11/15/92
DRAWN BY: C.R. MORGAN
MODEL: 2656

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3743-D





CALIBRATION FIXTURE MODEL #2922

SYM	REVISION	DATE
B	ADD -MY POL.	10/99
A	WAS DRG. B-2922	4/99

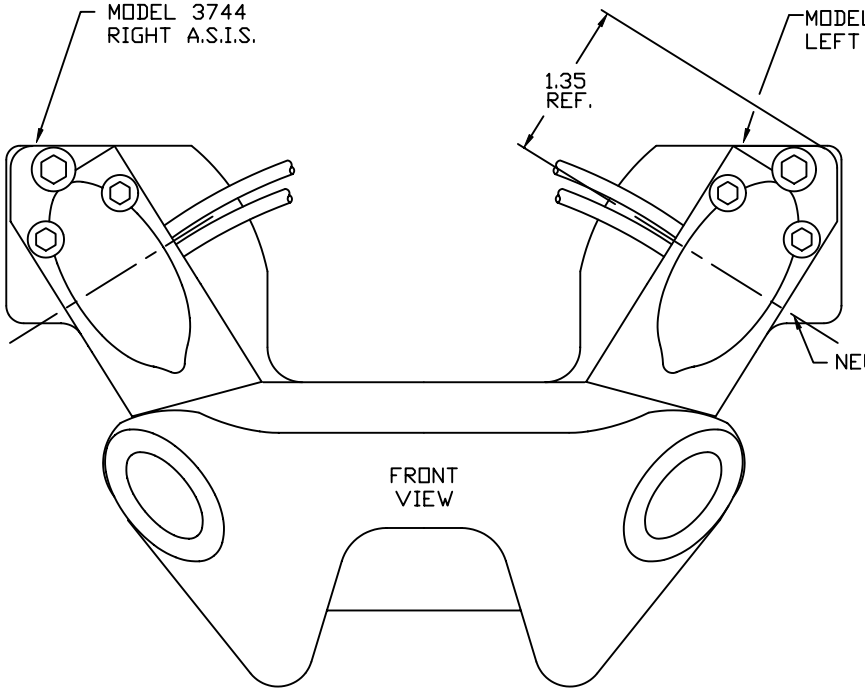
A.S.I.S. CALIBRATION FIXTURE

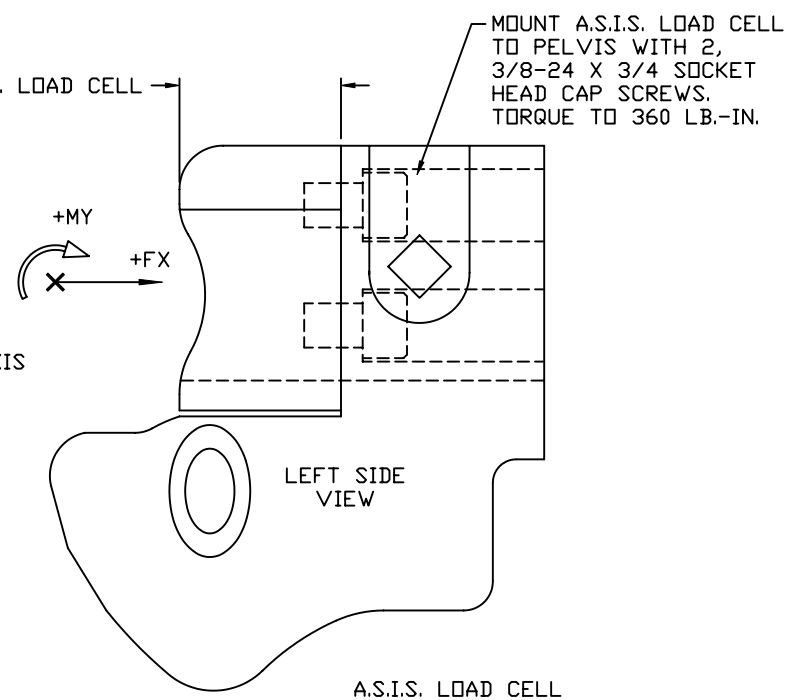
SCALE: FULL
DATE: 8/24/93
DRAWN BY: C.R.M./S.E.F.
MODEL: 3743

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3743-C





A.S.I.S. LOAD CELL

THE MODEL 2656 A.S.I.S. LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THIS FORCE IS MEASURED AS FX AND IS INSENSITIVE TO THE POSITION OF THE BELT ON THE ILIAC. THE CHANNEL MY IS DESIGNED TO PROVIDE AN INDICATION OF THE POSITION OF THE BELT ON THE ILIAC. A READING OF ZERO OUTPUT WOULD OCCUR IF THE CENTER OF PRESSURE OF THE BELT IS ON THE LOAD CELL NEUTRAL AXIS. IF THE BELT IS ABOVE THE NEUTRAL AXIS A POSITIVE MOMENT READING WOULD OCCUR, AND A BELT POSITIONED BELOW THE NEUTRAL AXIS WOULD PRODUCE A NEGATIVE BENDING MOMENT OUTPUT.

NOTE: THE LOAD CELL CALIBRATION DATA IS POSITIVE FOR COMPRESSION ON THE FRONT FACE OF THE LOAD CELL. TO CONFORM TO S.A.E. J-211 POLARITY, THE POLARITY OF THE FX CHANNEL MUST BE CHANGED. THE POLARITY FOR THE MY CHANNEL CONFORMS TO S.A.E J-211.

MODEL 2656 LOAD CELL ASSEMBLY CONSISTS OF ONE OF MODEL 3743 LEFT A.S.I.S. AND ONE OF MODEL 3744 RIGHT A.S.I.S.

AXIS	CAPACITY	OUTPUT
FX	2000 LBS.	1.5 mV/V NOMINAL
MY	2000 LB.-IN.	1.0 mV/V NOMINAL

NONLINEARITY <1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

CABLE COLOR CODE @ LOAD CELL, FX AND MY CHANNELS

RED	+EXCITATION
GREEN	+SIGNAL
BLACK	-EXCITATION
WHITE	-SIGNAL

SYM	REVISION	DATE
E	WAS DRG. B-2656	4/99
D	CORRECT OUTPUT	8/98
C	ADD TEXT, DETAILS	4/98
B	ADD. CABLES	2/98
A	ADD MODEL#	1/97

ANTERIOR SUPERIOR ILIAC SPINE LOAD CELL

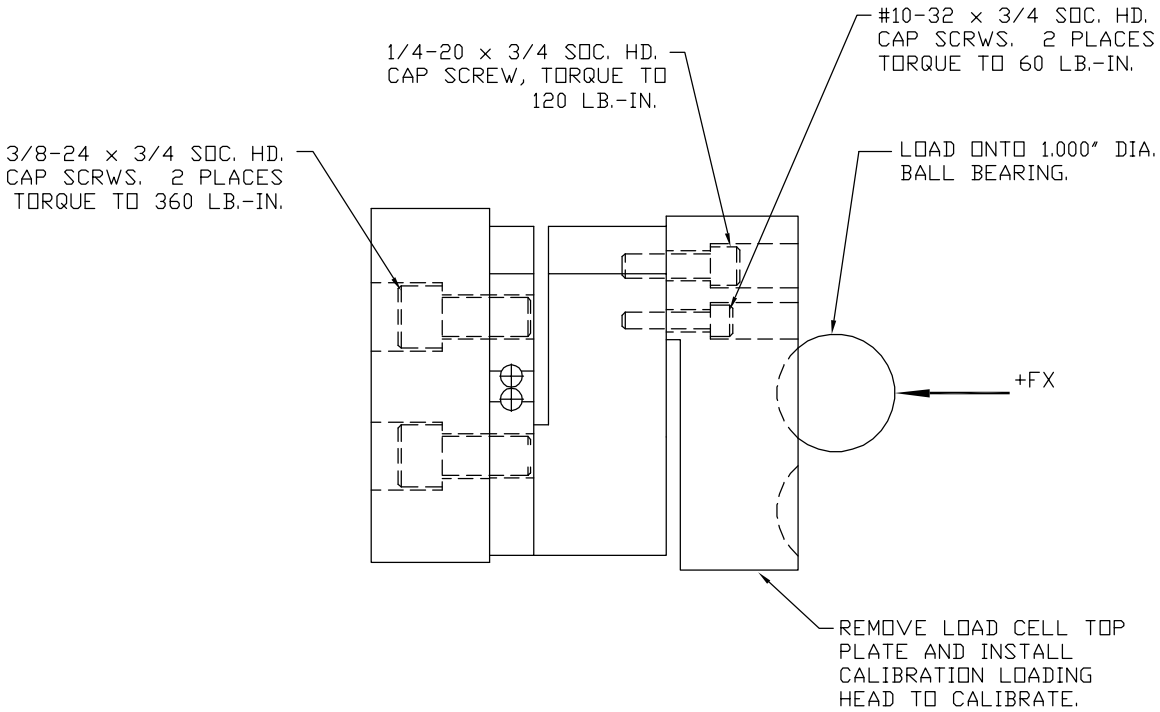
HYBRID III 5TH PERCENTILE - RIGHT ASIS

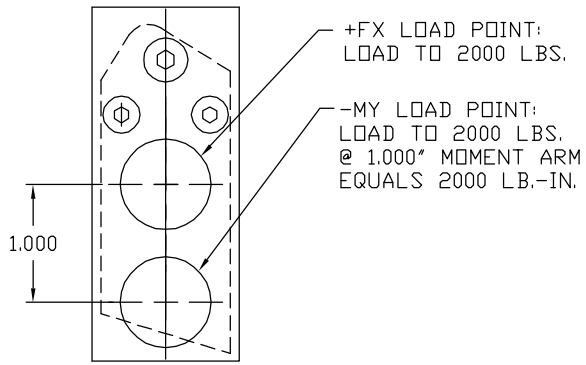
SCALE: NONE
DATE: 11/15/92
DRAWN BY: C.R. MORGAN
MODEL: 3744

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3744-D





CALIBRATION FIXTURE MODEL #2922

SYM	REVISION	DATE

A.S.I.S. CALIBRATION FIXTURE

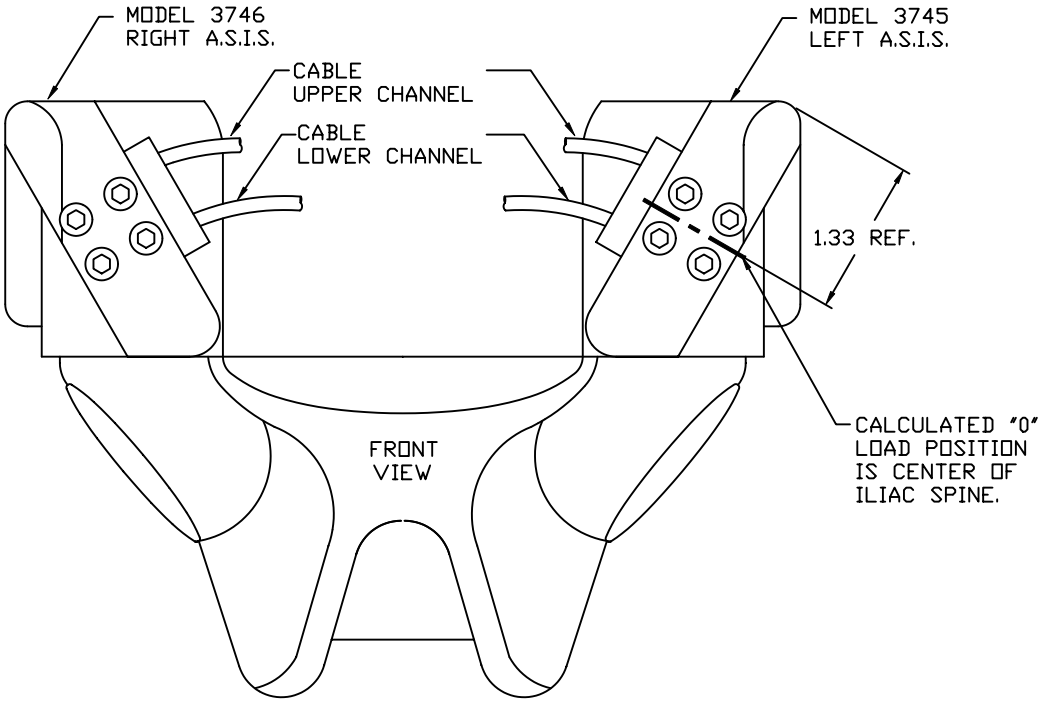
SCALE: FULL		DRAWN BY: C.R.M./S.E.F.
DATE: 8/24/93		MODEL: 3744

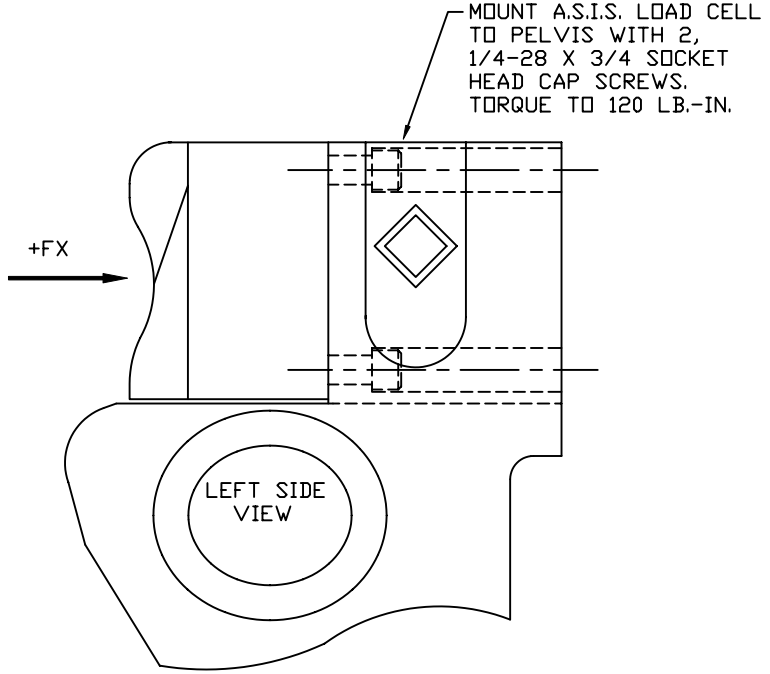
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3744-C





THE MODEL 3060, A.S.I.S. LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE AND POSITION OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THE LOAD CELL CONSISTS OF TWO INDEPENDANT FX CHANNELS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE THE TOTAL LOAD. THE DIFFERENCE OF THE TWO CHANNELS DIVIDED BY THE SUM IS PROPORTIONAL TO THE POSITION OF THE LOAD ON THE FACE OF THE LOAD CELL. THE POSITION IS CALCULATED AS FOLLOWS:

((FORCE UPPER-FORCE LOWER)/(FORCE UPPER+FORCE LOWER)) X 1.27
=DISTANCE
NOTE:
THE FORCES ARE IN ENGINEERING UNITS
THE DISTANCE IS IN INCHES ABOVE THE LOAD CELL CENTER LINE

NOTE: THE LOAD CELL CALIBRATION DATA IS POSITIVE FOR COMPRESSION ON THE FRONT FACE OF THE LOAD CELL. TO CONFORM TO S.A.E. J-211 POLARITY, THE POLARITY OF BOTH THE UPPER AND LOWER CHANNELS MUST BE CHANGED.

A.S.I.S. LOAD CELL

MODEL 3060 LOAD CELL ASSEMBLY CONSISTS OF ONE OF MODEL 3745 LEFT A.S.I.S. AND ONE OF MODEL 3746 RIGHT A.S.I.S.

AXIS	CAPACITY	OUTPUT
FX-UPPER	500 LBS.	1.0 mV/V NOMINAL
FX-LOWER	500 LBS.	1.0 mV/V NOMINAL

NONLINEARITY <1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

CABLE COLOR CODE @ LOAD CELL

RED	+EXCITATION
GREEN	+SIGNAL
BLACK	-EXCITATION
WHITE	-SIGNAL

SYM	REVISION	DATE
D	WAS DRG. B-3060	5/99
C	ADD TEXT, DETAILS	4/98
B	ADD MODEL #	1/97
A	ADD CALCULATION	8/95

ANTERIOR SUPERIOR ILIAC SPINE LOAD CELL

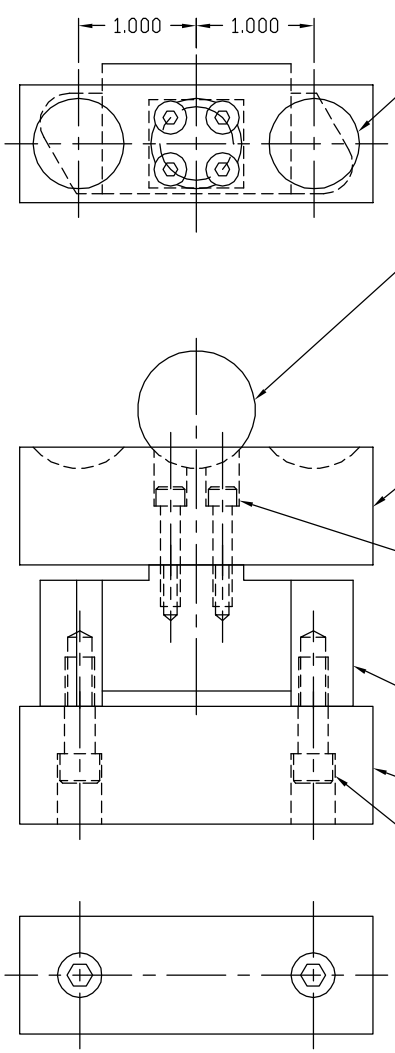
HYBRID III SIX YEAR OLD - LEFT ASIS

SCALE: FULL
DATE: 3JUNE94
DRAWN BY: C.R. MORGAN
MODEL: 3745

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3745-D



STANDARD CALIBRATION:

THE MODEL 3745 LOAD CELL CONSISTS OF TWO INDEPENDENT FX CHANNELS. WHEN THE LOAD CELL IS LOADED DIRECTLY OVER CENTER, EACH CHANNEL RECEIVES 50% OF THE TOTAL LOAD. THE STANDARD CALIBRATION CONSISTS OF LOADING THE CENTER DETENT TO 1000 LBS. TO CALIBRATE EACH CHANNEL TO 500 LBS. (50% OF THE TOTAL LOAD).

COMPREHENSIVE CALIBRATION:

THE MODEL 3745 LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE AND POSITION OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE TOTAL LOAD. THE DIFFERENCE OF THE TWO CHANNELS DIVIDED BY THE SUM IS PROPORTIONAL TO THE POSITION OF THE LOAD ON THE FACE OF THE LOAD CELL. THE POSITION IS CALCULATED AS FOLLOWS:

((FORCE UPPER-FORCE LOWER)/(FORCE UPPER+FORCE LOWER)) X 1.27
=DISTANCE
NOTE:
THE FORCES ARE IN ENGINEERING UNITS
THE DISTANCE IS IN INCHES ABOVE THE LOAD CELL CENTER LINE

TO VERIFY THE ABOVE LISTED CALCULATION, LOAD TO 500 LBS. AT BOTH OF THE OUTSIDE DETENTS. CONVERT THE OUTPUT OBTAINED INTO ENGINEERING UNITS BASED ON THE CALIBRATION PERFORMED ON THE LOAD CELL CENTER. CALCULATE THE POSITION BASED ON THE EQUATION AS LISTED ABOVE.

THE CALCULATED POSITION SHOULD BE WITHIN 5% OF THE ACTUAL 1.000" LOADING POSITION.

CALIBRATION FIXTURE MODEL #3547

SYM	REVISION	DATE

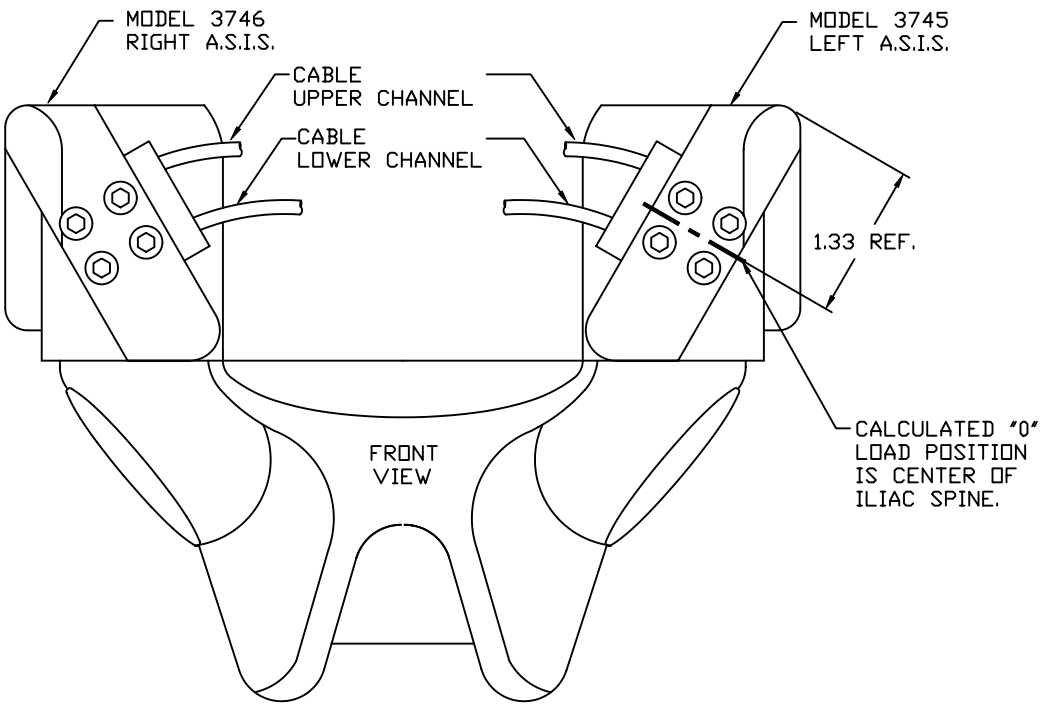
CALIBRATION FIXTURE FOR
HYBRID III 6 YEAR OLD A.S.I.S.

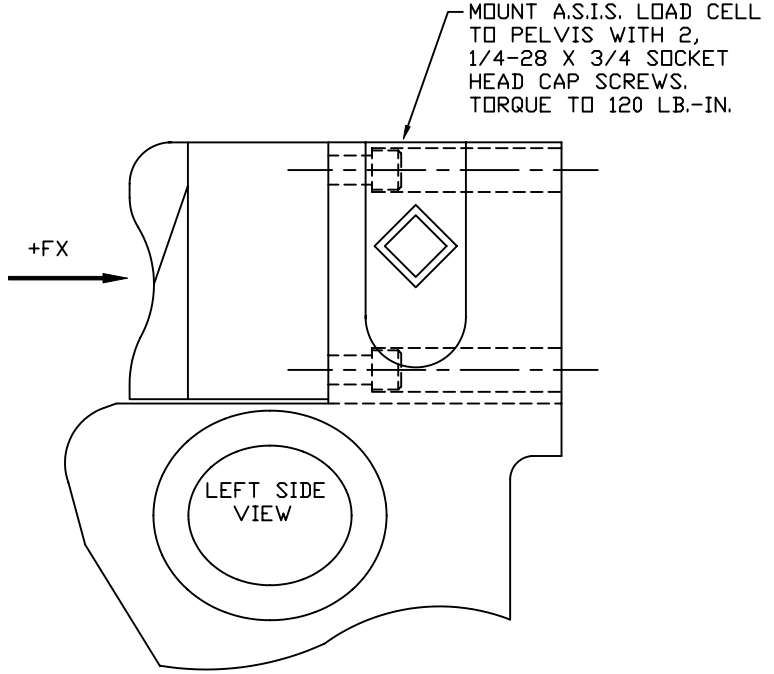
SCALE: FULL		DRAWN BY: C.R.M.
DATE: 26SEPT96		MODEL: 3745

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3745-C





THE MODEL 3060, A.S.I.S. LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE AND POSITION OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THE LOAD CELL CONSISTS OF TWO INDEPENDANT FX CHANNELS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE THE TOTAL LOAD. THE DIFFERENCE OF THE TWO CHANNELS DIVIDED BY THE SUM IS PROPORTIONAL TO THE POSITION OF THE LOAD ON THE FACE OF THE LOAD CELL. THE POSITION IS CALCULATED AS FOLLOWS:

((FORCE UPPER-FORCE LOWER)/(FORCE UPPER+FORCE LOWER)) X 1.27
=DISTANCE
NOTE:
THE FORCES ARE IN ENGINEERING UNITS
THE DISTANCE IS IN INCHES ABOVE THE LOAD CELL CENTER LINE

NOTE: THE LOAD CELL CALIBRATION DATA IS POSITIVE FOR COMPRESSION ON THE FRONT FACE OF THE LOAD CELL. TO CONFORM TO S.A.E. J-211 POLARITY, THE POLARITY OF BOTH THE UPPER AND LOWER CHANNELS MUST BE CHANGED.

A.S.I.S. LOAD CELL

MODEL 3060 LOAD CELL ASSEMBLY CONSISTS OF ONE OF MODEL 3745 LEFT A.S.I.S. AND ONE OF MODEL 3746 RIGHT A.S.I.S.

AXIS	CAPACITY	OUTPUT
FX-UPPER	500 LBS.	1.0 mV/V NOMINAL
FX-LOWER	500 LBS.	1.0 mV/V NOMINAL

NONLINEARITY <1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

CABLE COLOR CODE @ LOAD CELL

RED	+EXCITATION
GREEN	+SIGNAL
BLACK	-EXCITATION
WHITE	-SIGNAL

SYM	REVISION	DATE
D	WAS DRG. B-3060	4/99
C	ADD TEXT, DETAILS	4/98
B	ADD MODEL #	1/97
A	ADD CALCULATION	8/95

ANTERIOR SUPERIOR ILIAC SPINE LOAD CELL

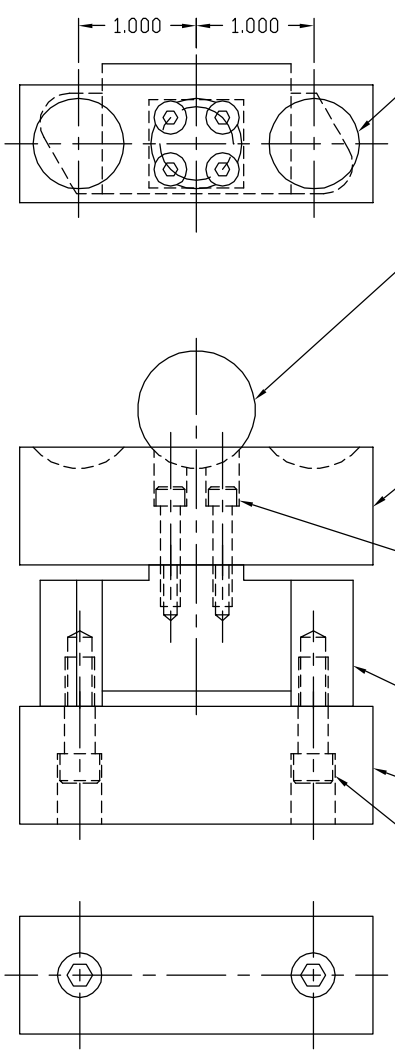
HYBRID III SIX YEAR OLD - RIGHT ASIS

SCALE: FULL
DATE: 3JUNE94
DRAWN BY: C.R. MORGAN
MODEL: 3746

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3746-D



STANDARD CALIBRATION:

THE MODEL 3746 LOAD CELL CONSISTS OF TWO INDEPENDENT FX CHANNELS. WHEN THE LOAD CELL IS LOADED DIRECTLY OVER CENTER, EACH CHANNEL RECEIVES 50% OF THE TOTAL LOAD. THE STANDARD CALIBRATION CONSISTS OF LOADING THE CENTER DETENT TO 1000 LBS. TO CALIBRATE EACH CHANNEL TO 500 LBS. (50% OF THE TOTAL LOAD).

COMPREHENSIVE CALIBRATION:

THE MODEL 3746 LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE AND POSITION OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE TOTAL LOAD. THE DIFFERENCE OF THE TWO CHANNELS DIVIDED BY THE SUM IS PROPORTIONAL TO THE POSITION OF THE LOAD ON THE FACE OF THE LOAD CELL. THE POSITION IS CALCULATED AS FOLLOWS:

((FORCE UPPER-FORCE LOWER)/(FORCE UPPER+FORCE LOWER)) X 1.27 =DISTANCE
NOTE:
THE FORCES ARE IN ENGINEERING UNITS
THE DISTANCE IS IN INCHES ABOVE THE LOAD CELL CENTER LINE

TO VERIFY THE ABOVE LISTED CALCULATION, LOAD TO 500 LBS. AT BOTH OF THE OUTSIDE DETENTS. CONVERT THE OUTPUT OBTAINED INTO ENGINEERING UNITS BASED ON THE CALIBRATION PERFORMED ON THE LOAD CELL CENTER. CALCULATE THE POSITION BASED ON THE EQUATION AS LISTED ABOVE.

THE CALCULATED POSITION SHOULD BE WITHIN 5% OF THE ACTUAL 1.000" LOADING POSITION.

CALIBRATION FIXTURE MODEL #3547

SYM	REVISION	DATE

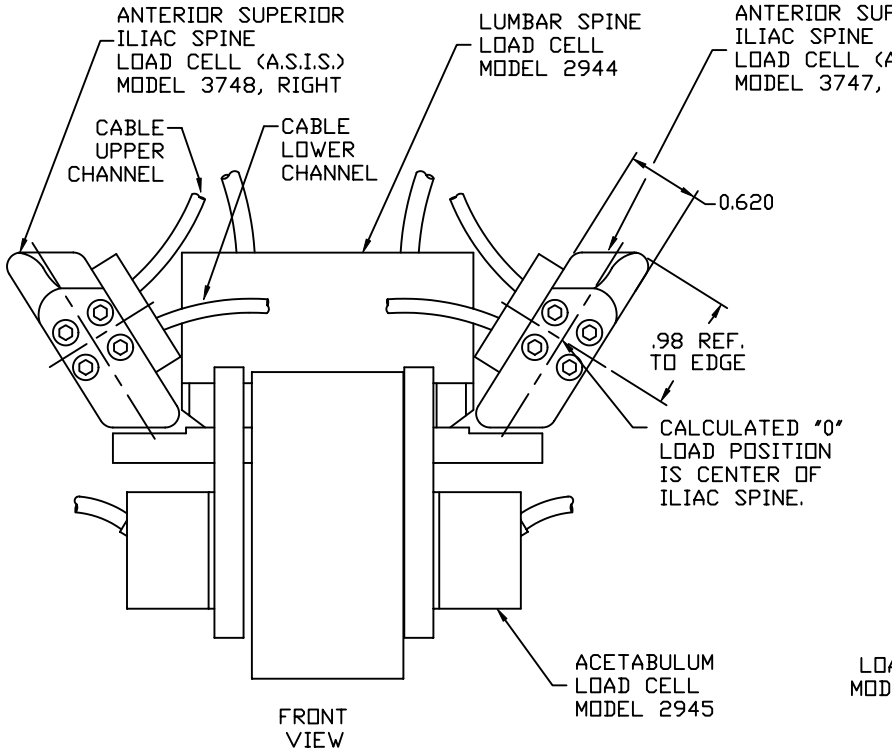
CALIBRATION FIXTURE FOR HYBRID III 6 YEAR OLD A.S.I.S.

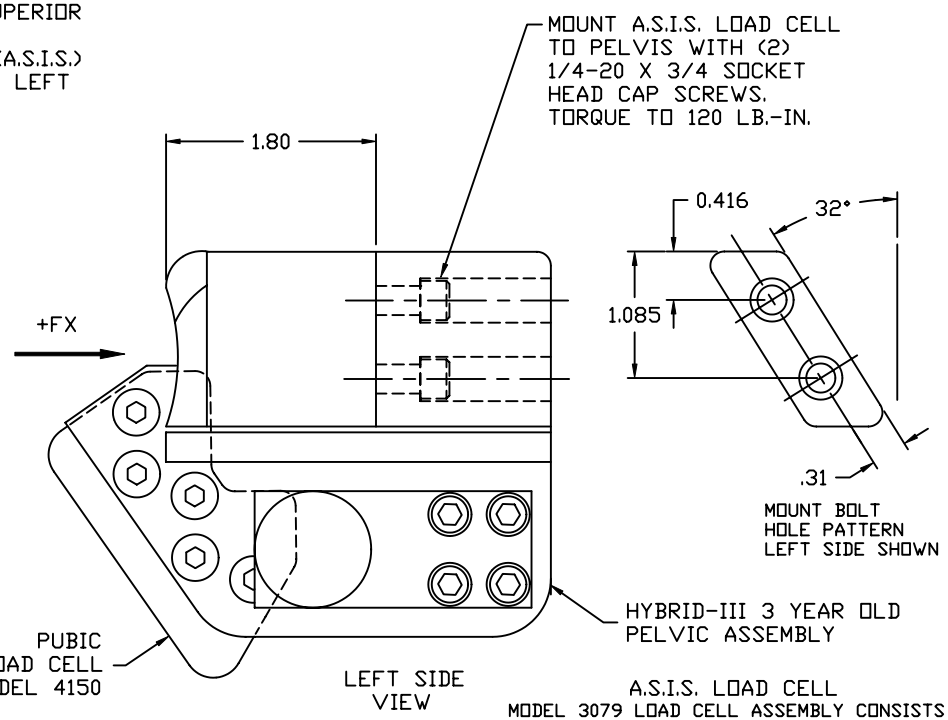
SCALE: FULL		DRAWN BY: C.R.M.
DATE: 26SEPT96		MODEL: 3746

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3746-C





THE MODEL 3079, A.S.I.S. LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE AND POSITION OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THE LOAD CELL CONSISTS OF TWO INDEPENDANT FX CHANNELS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE THE TOTAL LOAD. THE DIFFERENCE OF THE TWO CHANNELS DIVIDED BY THE SUM IS PROPORTIONAL TO THE POSITION OF THE LOAD ON THE FACE OF THE LOAD CELL. THE POSITION IS CALCULATED AS FOLLOWS:

((FORCE UPPER-FORCE LOWER)/(FORCE UPPER+FORCE LOWER)) X .79 = DISTANCE

THE FORCES ARE IN ENGINEERING UNITS
THE DISTANCE IS IN INCHES ABOVE THE LOAD CELL CENTER LINE

NOTE: THE LOAD CELL CALIBRATION DATA IS POSITIVE FOR COMPRESSION ON THE FRONT FACE OF THE LOAD CELL. TO CONFORM TO S.A.E. J-211 POLARITY, THE POLARITY OF BOTH THE UPPER AND LOWER CHANNELS MUST BE CHANGED.

A.S.I.S. LOAD CELL

MODEL 3079 LOAD CELL ASSEMBLY CONSISTS OF ONE OF MODEL 3747 LEFT A.S.I.S AND ONE OF MODEL 3748 RIGHT A.S.I.S.

AXIS	CAPACITY	OUTPUT
FX-UPPER	400 LBS.	1.4 mV/V NOMINAL
FX-LOWER	400 LBS.	1.4 mV/V NOMINAL

NONLINEARITY <1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT - .40 LBS. EACH

CABLE COLOR CODE @ LOAD CELL

RED	+EXCITATION
GREEN	+SIGNAL
BLACK	-EXCITATION
WHITE	-SIGNAL

SYM	REVISION	DATE
E	WAS DRG. B-3079	4/99
D	ADD WEIGHT	12/98
C	ADD DETAIL	9/98
B	ADD TEXT, DETAILS	4/98
A	ADD MODEL #	1/97

ANTERIOR SUPERIOR ILIAC SPINE LOAD CELL

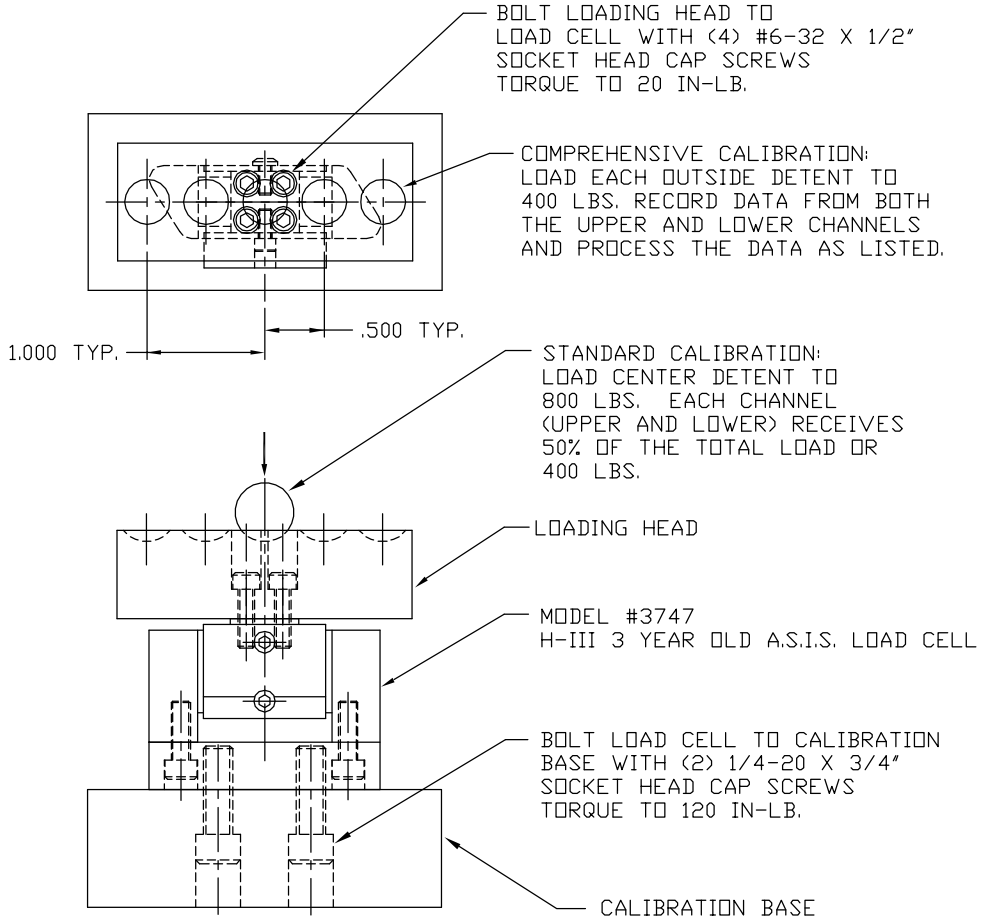
HYBRID III THREE YEAR OLD - LEFT SIDE

SCALE: FULL
DATE: 13JAN97
DRAWN BY: C.R. MORGAN
MODEL: 3747

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3747-D



STANDARD CALIBRATION:

THE MODEL 3747 LOAD CELL CONSISTS OF TWO INDEPENDENT FX CHANNELS. WHEN THE LOAD CELL IS LOADED DIRECTLY OVER CENTER, EACH CHANNEL RECEIVES 50% OF THE TOTAL LOAD. THE STANDARD CALIBRATION CONSISTS OF LOADING THE CENTER DETENT TO 800 LBS. TO CALIBRATE EACH CHANNEL TO 400 LBS. (50% OF THE TOTAL LOAD).

COMPREHENSIVE CALIBRATION:

THE MODEL 3747 LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE AND POSITION OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE TOTAL LOAD. THE DIFFERENCE OF THE TWO CHANNELS DIVIDED BY THE SUM IS PROPORTIONAL TO THE POSITION OF THE LOAD ON THE FACE OF THE LOAD CELL. THE POSITION IS CALCULATED AS FOLLOWS:

((FORCE UPPER-FORCE LOWER)/(FORCE UPPER+FORCE LOWER)) X .79
=DISTANCE
NOTE:
THE FORCES ARE IN ENGINEERING UNITS
THE DISTANCE IS IN INCHES ABOVE THE LOAD CELL CENTER LINE

TO VERIFY THE ABOVE LISTED CALCULATION, LOAD TO 400 LBS. AT BOTH OF THE OUTSIDE DETENTS (1.000" FROM CENTER). CONVERT THE OUTPUT OBTAINED INTO ENGINEERING UNITS BASED ON THE CALIBRATION PERFORMED ON THE LOAD CELL CENTER. CALCULATE THE POSITION BASED ON THE EQUATION AS LISTED ABOVE.

THE CALCULATED POSITION SHOULD BE WITHIN 5% OF THE ACTUAL 1.000" LOADING POSITION.

CALIBRATION FIXTURE MODEL #3625

SYM	REVISION	DATE

CALIBRATION FIXTURE FOR THE H-III 3 YEAR OLD A.S.I.S.

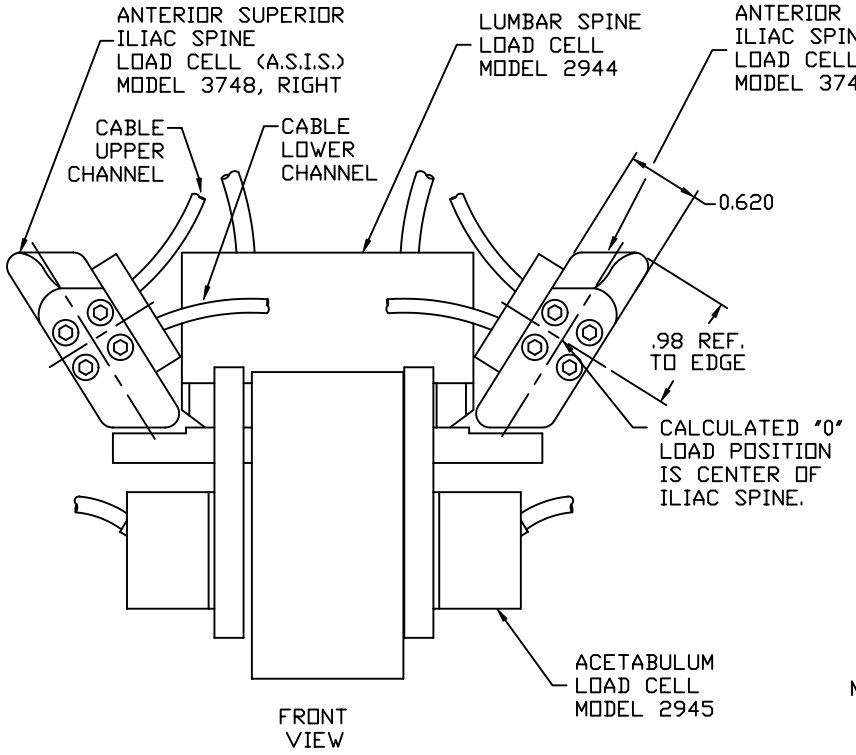
SCALE: FULL		DRAWN BY: H. PROCTOR
DATE: 12/27/96		MODEL: 3747

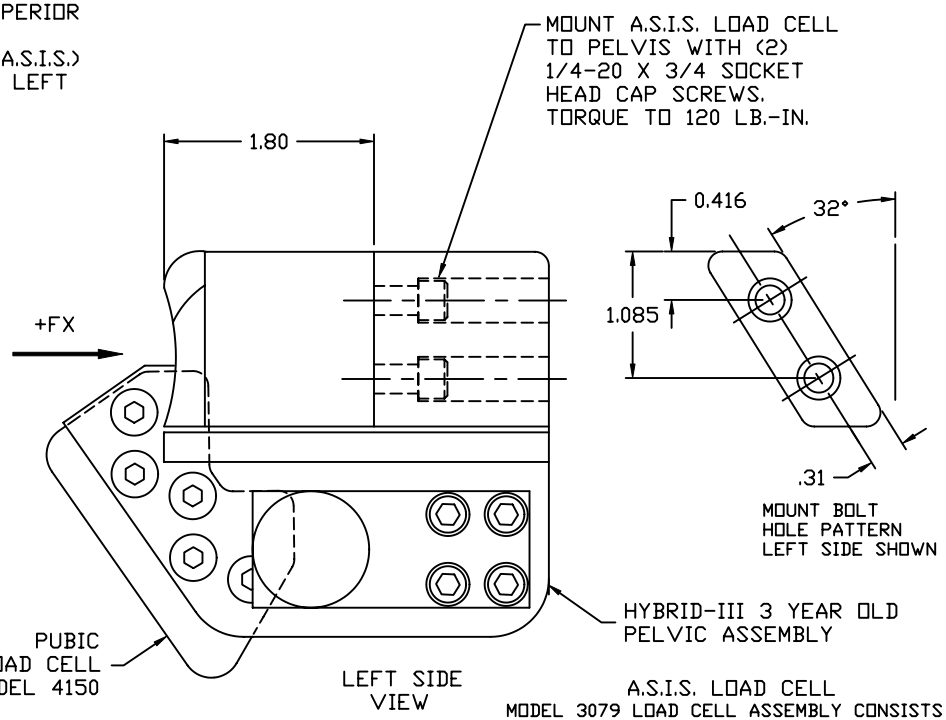
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3747-C





THE MODEL 3079, A.S.I.S. LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE AND POSITION OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THE LOAD CELL CONSISTS OF TWO INDEPENDANT FX CHANNELS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE THE TOTAL LOAD. THE DIFFERENCE OF THE TWO CHANNELS DIVIDED BY THE SUM IS PROPORTIONAL TO THE POSITION OF THE LOAD ON THE FACE OF THE LOAD CELL. THE POSITION IS CALCULATED AS FOLLOWS:

((FORCE UPPER-FORCE LOWER)/(FORCE UPPER+FORCE LOWER)) X .79 = DISTANCE

THE FORCES ARE IN ENGINEERING UNITS
THE DISTANCE IS IN INCHES ABOVE THE LOAD CELL CENTER LINE

NOTE: THE LOAD CELL CALIBRATION DATA IS POSITIVE FOR COMPRESSION ON THE FRONT FACE OF THE LOAD CELL. TO CONFORM TO S.A.E. J-211 POLARITY, THE POLARITY OF BOTH THE UPPER AND LOWER CHANNELS MUST BE CHANGED.

A.S.I.S. LOAD CELL

MODEL 3079 LOAD CELL ASSEMBLY CONSISTS OF ONE OF MODEL 3747 LEFT A.S.I.S AND ONE OF MODEL 3748 RIGHT A.S.I.S.

AXIS	CAPACITY	OUTPUT
FX-UPPER	400 LBS.	1.4 mV/V NOMINAL
FX-LOWER	400 LBS.	1.4 mV/V NOMINAL

NONLINEARITY <1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT - .40 LBS. EACH

CABLE COLOR CODE @ LOAD CELL

RED	+EXCITATION
GREEN	+SIGNAL
BLACK	-EXCITATION
WHITE	-SIGNAL

SYM	REVISION	DATE
E	WAS DRG. B-3079	5/99
D	ADD WEIGHT	12/98
C	ADD DETAIL	9/98
B	ADD TEXT, DETAILS	4/98
A	ADD MODEL #	1/97

ANTERIOR SUPERIOR ILIAC SPINE LOAD CELL

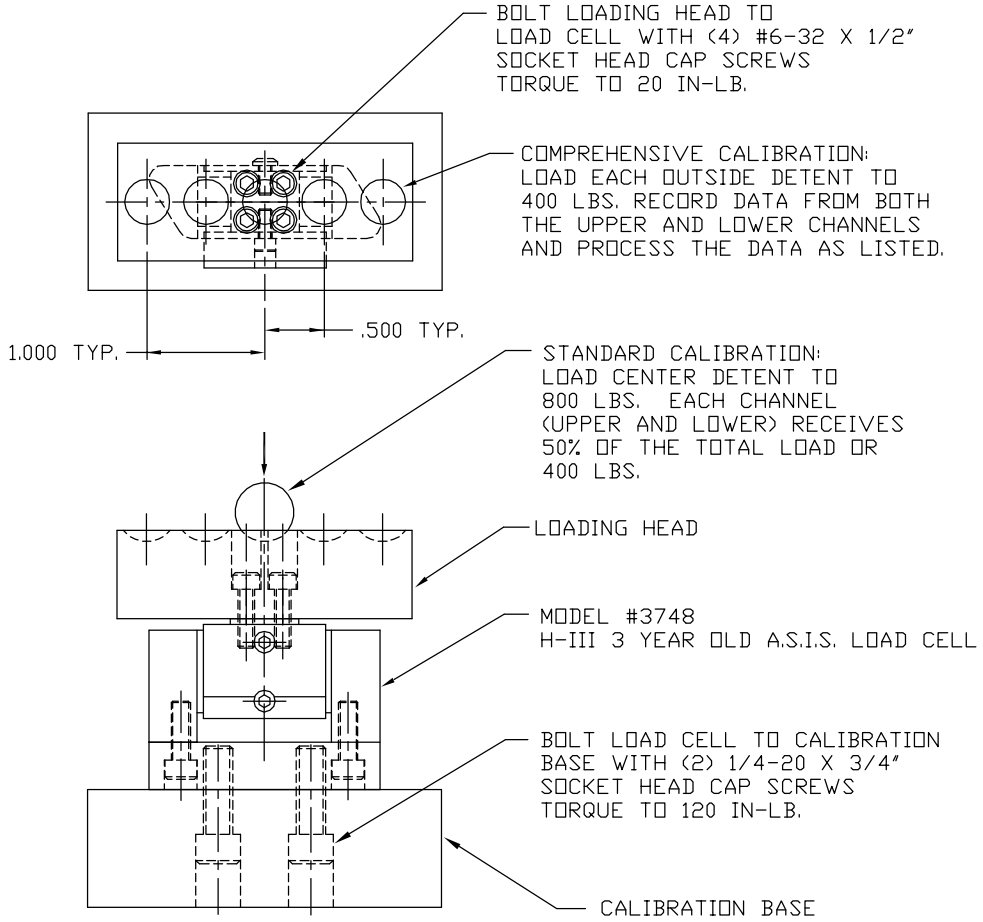
HYBRID III THREE YEAR OLD - RIGHT ASIS

SCALE: FULL
DATE: 13JAN97
DRAWN BY: C.R. MORGAN
MODEL: 3748

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3748-D



STANDARD CALIBRATION:

THE MODEL 3748 LOAD CELL CONSISTS OF TWO INDEPENDENT FX CHANNELS. WHEN THE LOAD CELL IS LOADED DIRECTLY OVER CENTER, EACH CHANNEL RECEIVES 50% OF THE TOTAL LOAD. THE STANDARD CALIBRATION CONSISTS OF LOADING THE CENTER DETENT TO 800 LBS. TO CALIBRATE EACH CHANNEL TO 400 LBS. (50% OF THE TOTAL LOAD).

COMPREHENSIVE CALIBRATION:

THE MODEL 3748 LOAD CELL IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE AND POSITION OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE TOTAL LOAD. THE DIFFERENCE OF THE TWO CHANNELS DIVIDED BY THE SUM IS PROPORTIONAL TO THE POSITION OF THE LOAD ON THE FACE OF THE LOAD CELL. THE POSITION IS CALCULATED AS FOLLOWS:

((FORCE UPPER-FORCE LOWER)/(FORCE UPPER+FORCE LOWER)) X .79
=DISTANCE
NOTE:
THE FORCES ARE IN ENGINEERING UNITS
THE DISTANCE IS IN INCHES ABOVE THE LOAD CELL CENTER LINE

TO VERIFY THE ABOVE LISTED CALCULATION, LOAD TO 400 LBS. AT BOTH OF THE OUTSIDE DETENTS (1.000" FROM CENTER). CONVERT THE OUTPUT OBTAINED INTO ENGINEERING UNITS BASED ON THE CALIBRATION PERFORMED ON THE LOAD CELL CENTER. CALCULATE THE POSITION BASED ON THE EQUATION AS LISTED ABOVE.

THE CALCULATED POSITION SHOULD BE WITHIN 5% OF THE ACTUAL 1.000" LOADING POSITION.

CALIBRATION FIXTURE MODEL #3625

SYM	REVISION	DATE

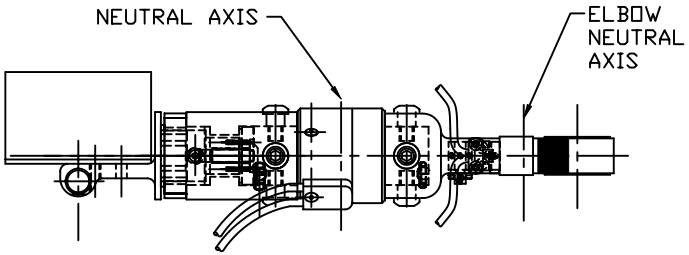
CALIBRATION FIXTURE FOR
THE H-III 3 YEAR OLD A.S.I.S.

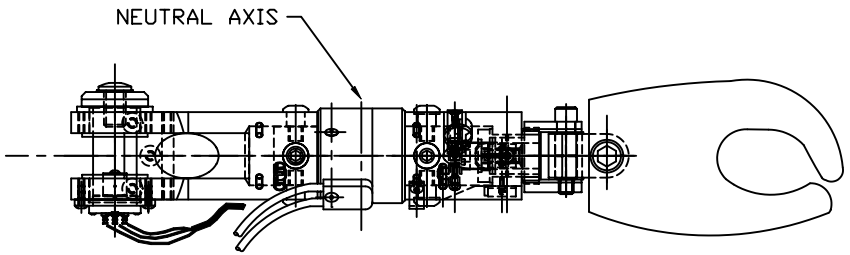
SCALE: FULL		DRAWN BY: H. PROCTOR
DATE: 12/27/96		MODEL: 3748

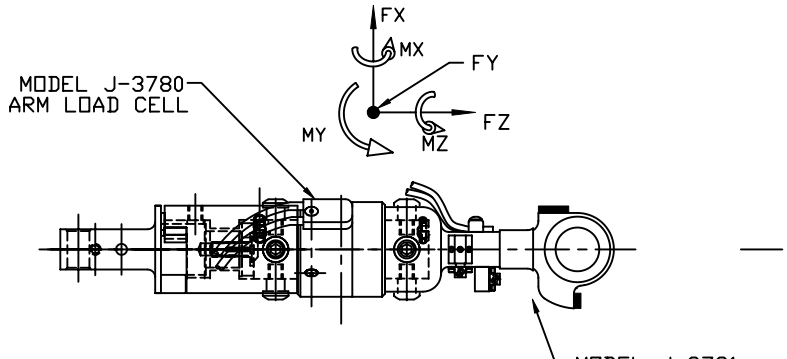
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

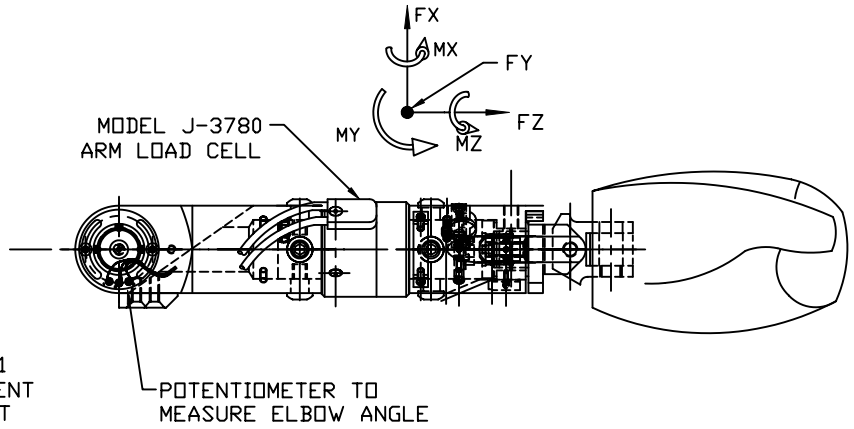
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3748-C









MODEL J-3780
ARM LOAD CELL

AXIS	CAPACITY	OUTPUT
FX	2000 LBS.	2 mV/V NOMINAL
FY	2000 LBS.	2 mV/V NOMINAL
FZ	3000 LBS.	1 mV/V NOMINAL
MX	2000 IN.-LB.	3 mV/V NOMINAL
MY	2000 IN.-LB.	3 mV/V NOMINAL
MZ	1500 IN.-LB.	3 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
A	WAS SRG. B-3525	7/99

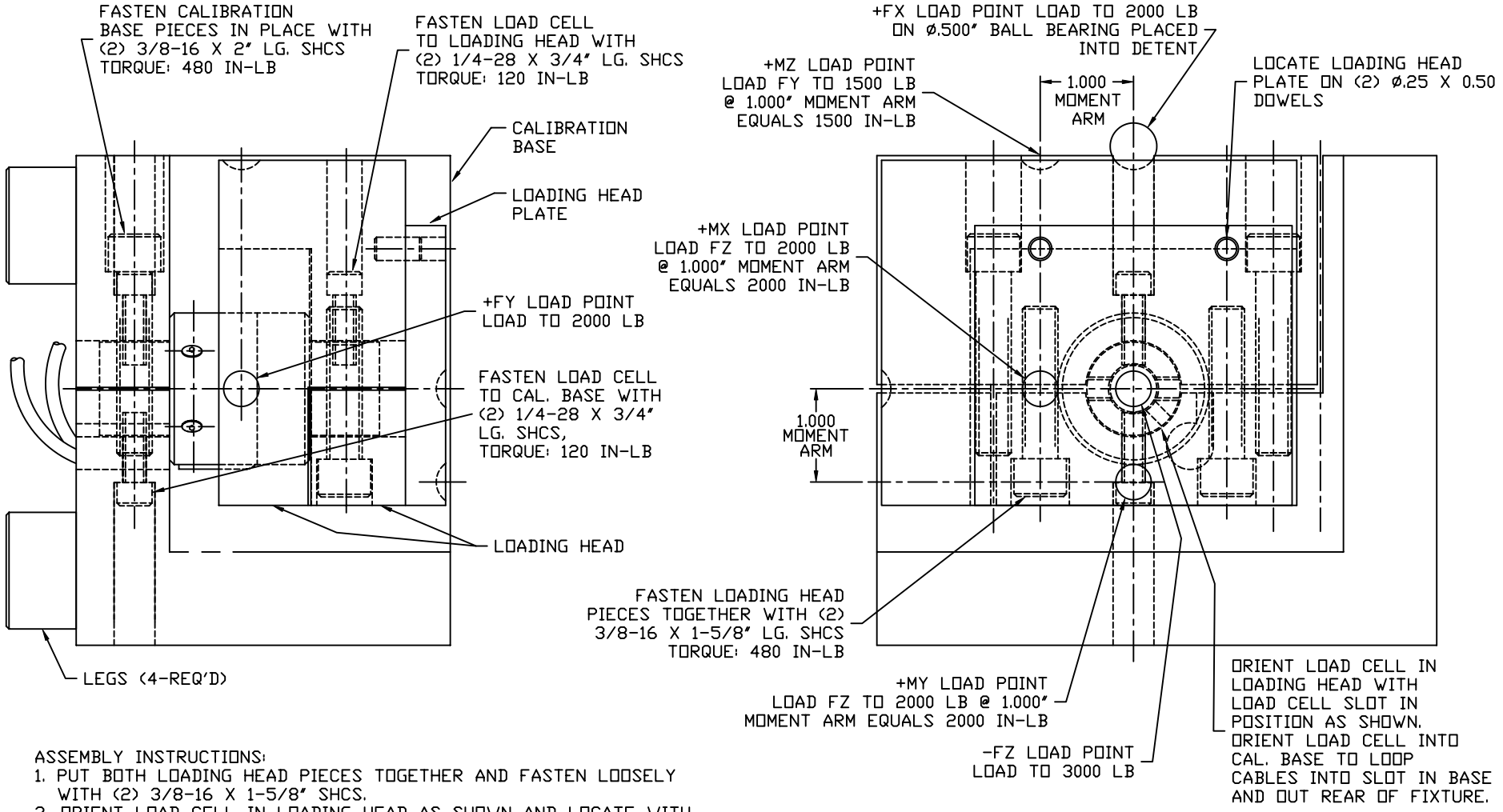
ARM LOAD CELL FOR 3525 AIRBAG
INTERACTION ARM

SCALE: FULL		DRAWN BY: C.R. MORGAN
DATE: 12APRIL96		MODEL: 3780

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3780-D



ASSEMBLY INSTRUCTIONS:

1. PUT BOTH LOADING HEAD PIECES TOGETHER AND FASTEN LOOSELY WITH (2) 3/8-16 X 1-5/8" SHCS.
2. ORIENT LOAD CELL IN LOADING HEAD AS SHOWN AND LOCATE WITH (2) 1/4-28 X 3/4" LG. SHCS. TORQUE TO 120 IN.-LB. TIGHTEN THE 3/8 SCREWS AND THEN TORQUE TO 480 IN.-LB.
3. PLACE BOTH CALIBRATION BASE PIECES TOGETHER AND FASTEN LOOSELY WITH (2) 3/8-16 X 2" LG. SHCS.
4. INSERT LOAD CELL IN CALIBRATION BASE AS SHOWN AND LOCATE WITH (2) 1/4-28 X 3/4" LG. SHCS. TORQUE TO 120 IN.-LB. TIGHTEN THE 3/8 SCREWS AND THEN TORQUE TO 480 IN.-LB.
5. PLACE LOADING HEAD PLATE ONTO DOWEL PINS AS SHOWN.

D	ADD LEGS	11/98
C	ADD ORIENTATION NOTE	9/98
B	CHG AXIS DESIGNATION	5/98
A	ADDED KEYING SLOT	14NOV97

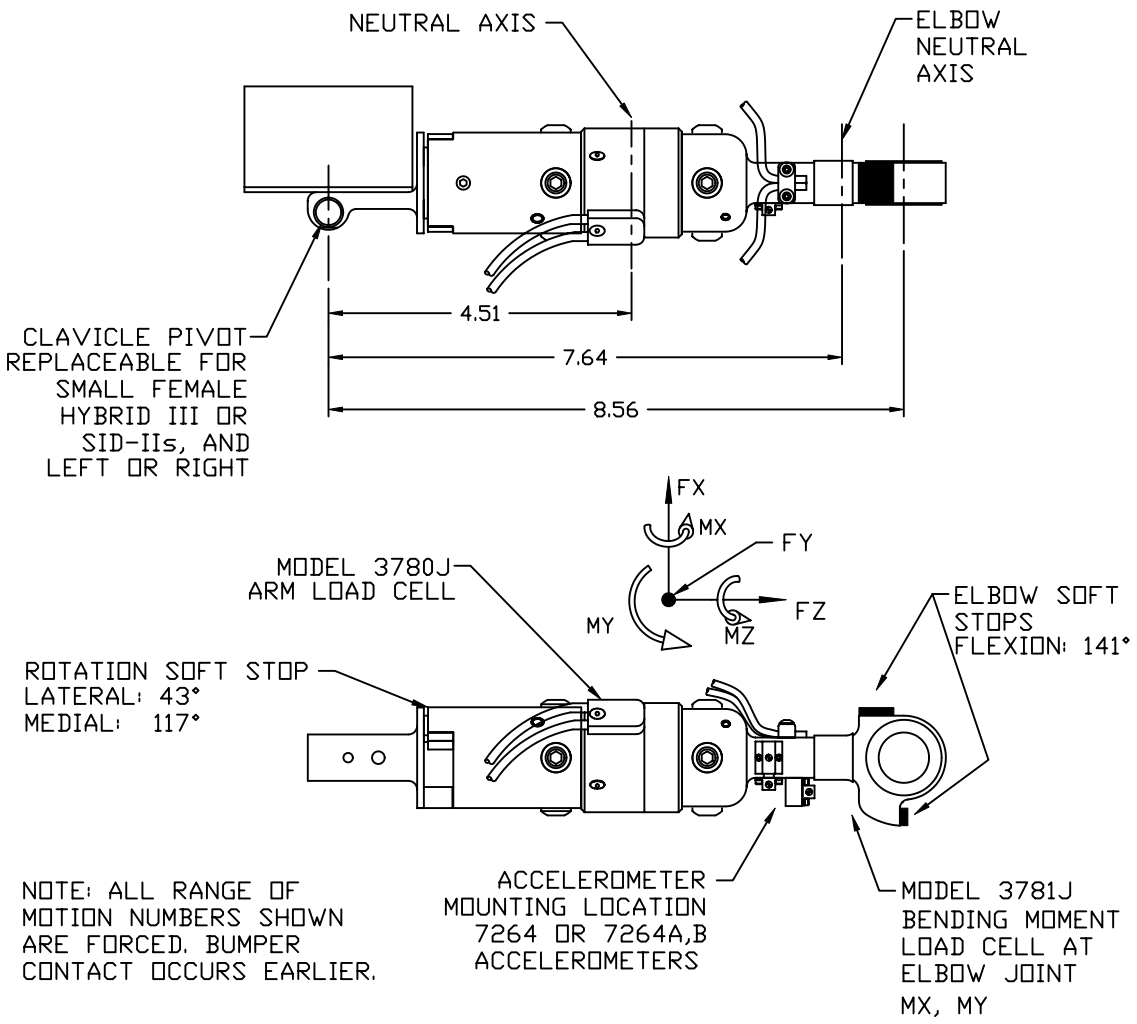
CALIBRATION FIXTURE FOR MODEL 3780 ARM LOAD CELL

SCALE: FULL
DATE: 4/21/97
DRAWN BY: H. PROCTOR
MODEL: 3780

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3780-C



NOTE: ALL RANGE OF MOTION NUMBERS SHOWN ARE FORCED. BUMPER CONTACT OCCURS EARLIER.

MODEL 3781J
ELBOW LOAD CELL

AXIS	CAPACITY	OUTPUT
MX	2000 IN.-LB.	3 mV/V NOMINAL
MY	2000 IN.-LB.	3 mV/V NOMINAL

SYM	REVISION	DATE
A	WAS DRG. B-3525	6/99

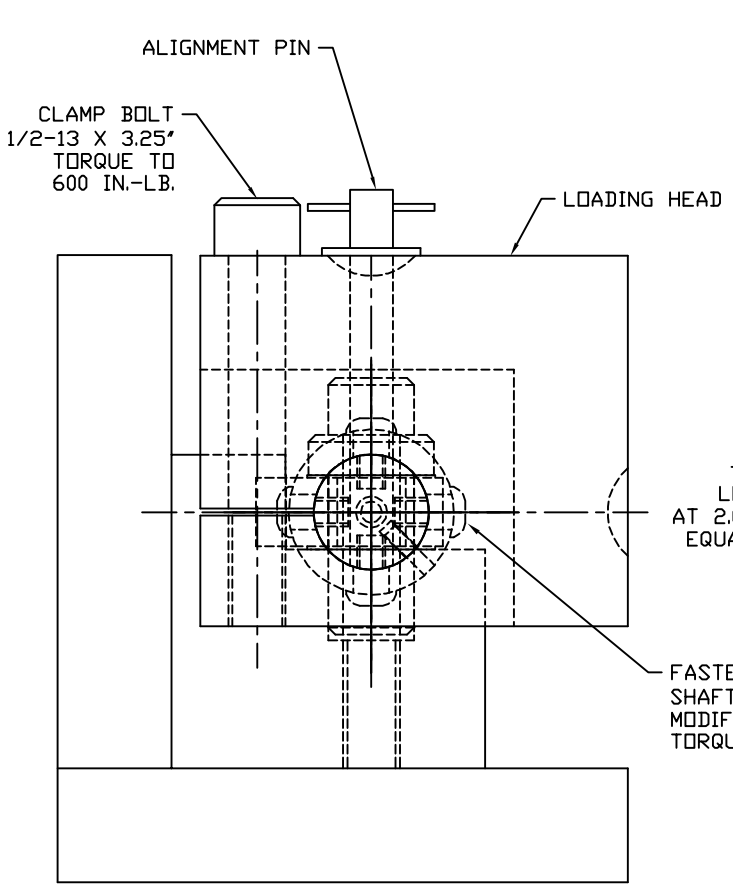
ELBOW LOAD CELL FOR 3525
AIRBAG INTERACTION ARM

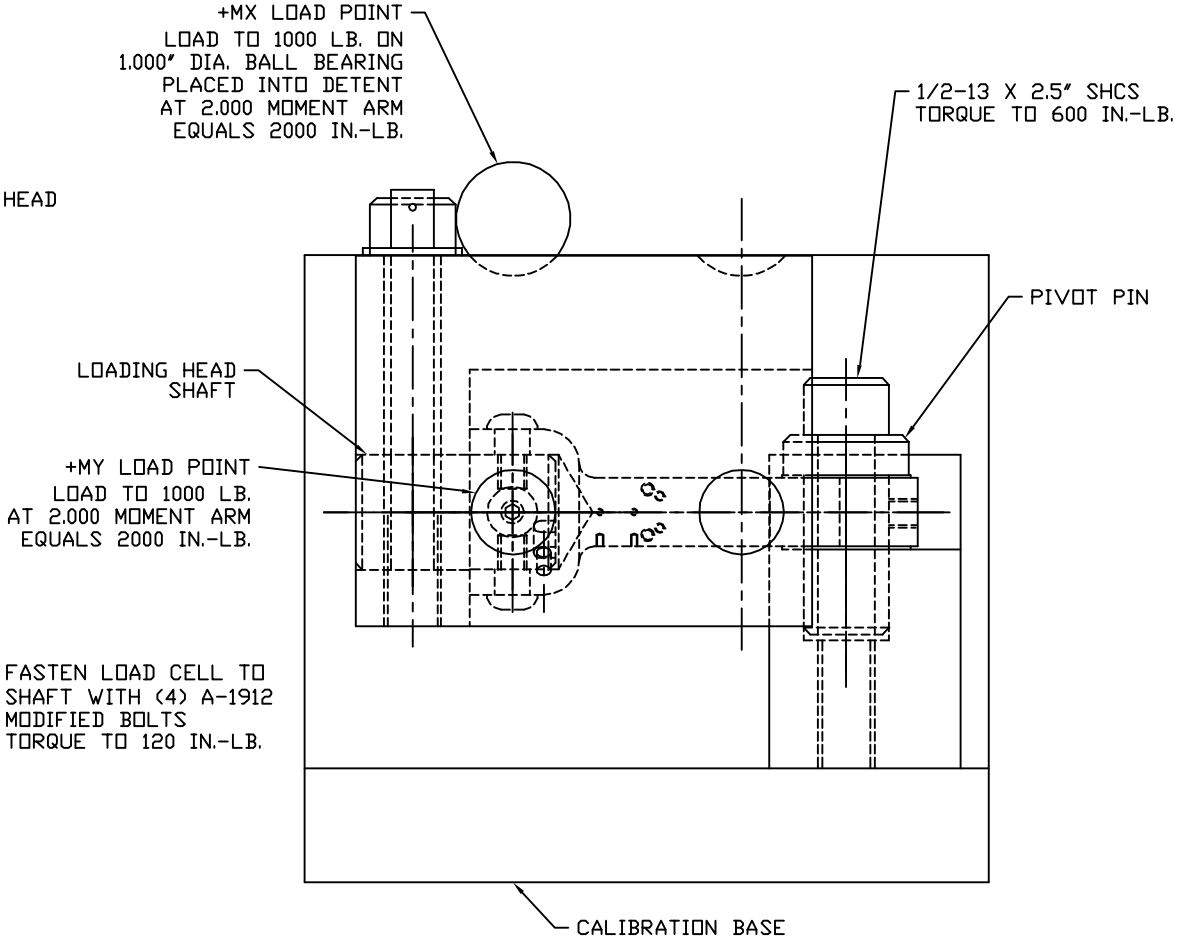
SCALE: FULL | DRAWN BY: C.R. MORGAN
DATE: 12APRIL96 | MODEL: 3781

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3781-D





ASSEMBLY INSTRUCTIONS

1. REMOVE ELBOW FLEXION PAD.
2. INSERT SHAFT INTO LOAD CELL WITH PIN HOLE PARALLEL TO ELBOW PIVOT SHAFT BORE. FASTEN WITH (4) A-1912 MODIFIED BOLTS. TORQUE TO 120 IN.-LB.
3. ATTACH LOAD CELL TO BASE WITH PIVOT PIN AND (1) 1/2-13 X 2.5" SHCS. TORQUE TO 600 IN.-LB.
4. SLIDE LOADING HEAD ONTO LOADING HEAD SHAFT. INSERT ALIGNMENT PIN AND 1/2-13 X 3.25" SHCS CLAMP BOLT. TORQUE CLAMP BOLT TO 600 IN.-LB.
5. AFTER CALIBRATION, REINSTALL FLEXION PAD WITH: LOCTITE "420"

CALIBRATION FIXTURE MODEL #3698

SYM	REVISION	DATE

CALIBRATION FIXTURE FOR MODEL 3781 ELBOW LOAD CELL

SCALE: FULL		DRAWN BY: P.J. DEPINET
DATE: 19NOV97		MODEL: 3781

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3781-C

ROBERT A. DENTON, INC.
2967 Waterview Dr., Rochester Hills, MI 48309
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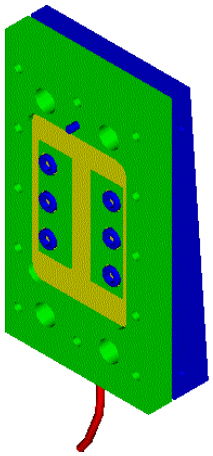


MODEL 3795
EUROSID BACK PLATE LOAD CELL

Applications:
The EuroSID Back Plate Load Cell (Model# 3795) is a four-channel force (Fx, Fy) and moment (My, Mz) measure device. It is designed to measure the forces and moments between back plate and the Thoracic Spine section of the EuroSID Crash Test Dummy.

Standard Ordering Configuration: 3795J
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Fx	3 kN	674.4 lbf	700 ohms	2.0 mV/V
Fy	3 kN	674.4 lbf	700 ohms	1.9 mV/V
My	160 NM	1416.1 in-lbf	700 ohms	1.5 mV/V
Mz	160 Nm	1416.1 in-lbf	350 ohms	1.1 mV/V

Non-linearity ..... less than 1% of full scale
Hysteresis..... less than 1% of full scale
Crosstalk ..... less than 5% of full scale
Excitation ..... 10 VDC nom. 15 VDC max.
Assembly Mass (without cable, with mounting screws)..... (6.88 lb) 3.12 kg

Wiring:

Fx Channel		Fy Channel	
Brown	+Exc	Red Stripe	+Exc
Red	+Sig	Black	+Sig
Orange	-Exc	White	-Exc
Yellow	-Sig	Black Stripe	-Sig

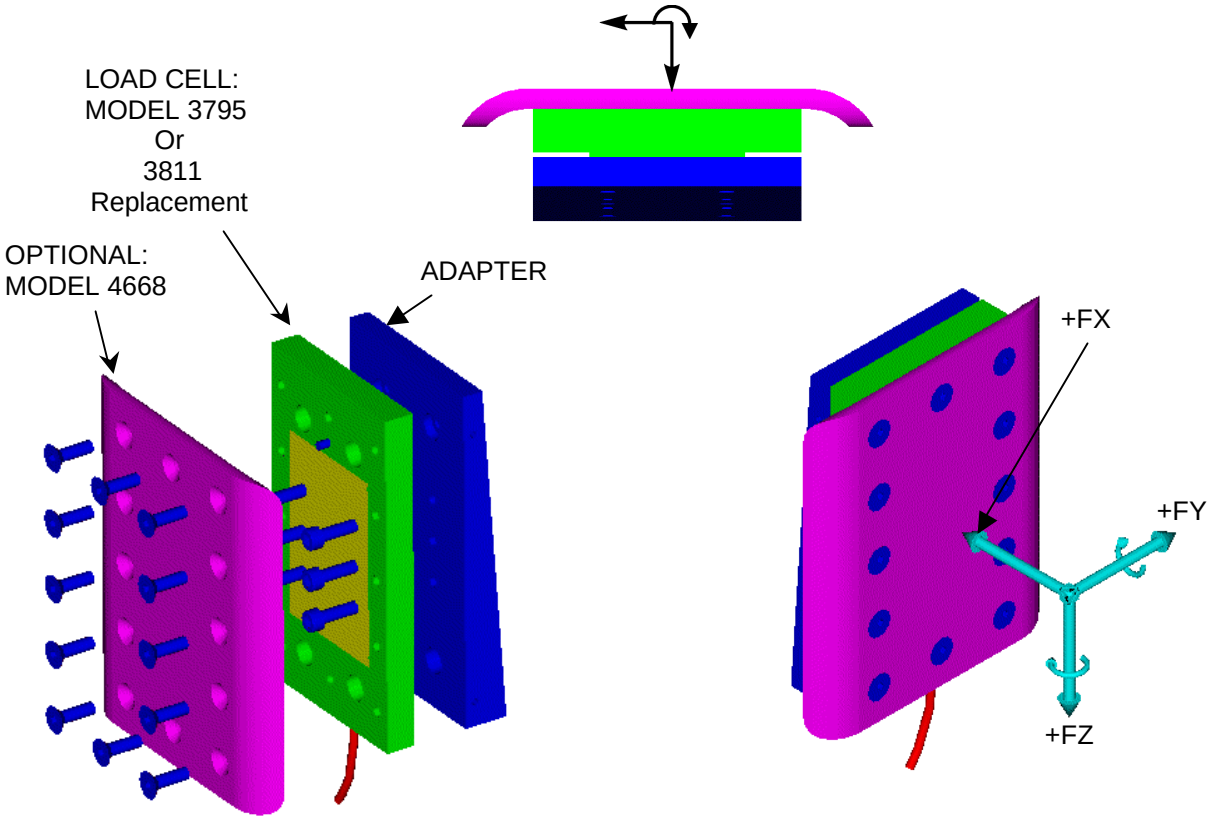
My Channel		Mz Channel	
Green Stripe	+Exc	Green	+Exc
Blue Stripe	+Sig	Blue	+Sig
Orange Stripe	-Exc	Violet	-Exc
Yellow Stripe	-Sig	Grey	-Sig

Issue Date: 21JAN00

MODEL 3795 EUROSID BACK PLATE LOAD CELL

NOTES

1. Use Denton Model 4053 calibration fixture. (Ref. Calibration Fixture drawing 3795-C)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.



Creating the Standard in Safety Measurement Since 1974

Robert A. Denton, Inc. maintains a high level of control over the manufacture of its products to ensure quality, accuracy and reliability. Continued improvement necessitates that we reserve the right to modify these specifications without notice.

Robert A. Denton, Inc., 2967 Waterview Drive, Rochester Hills, Michigan 48309
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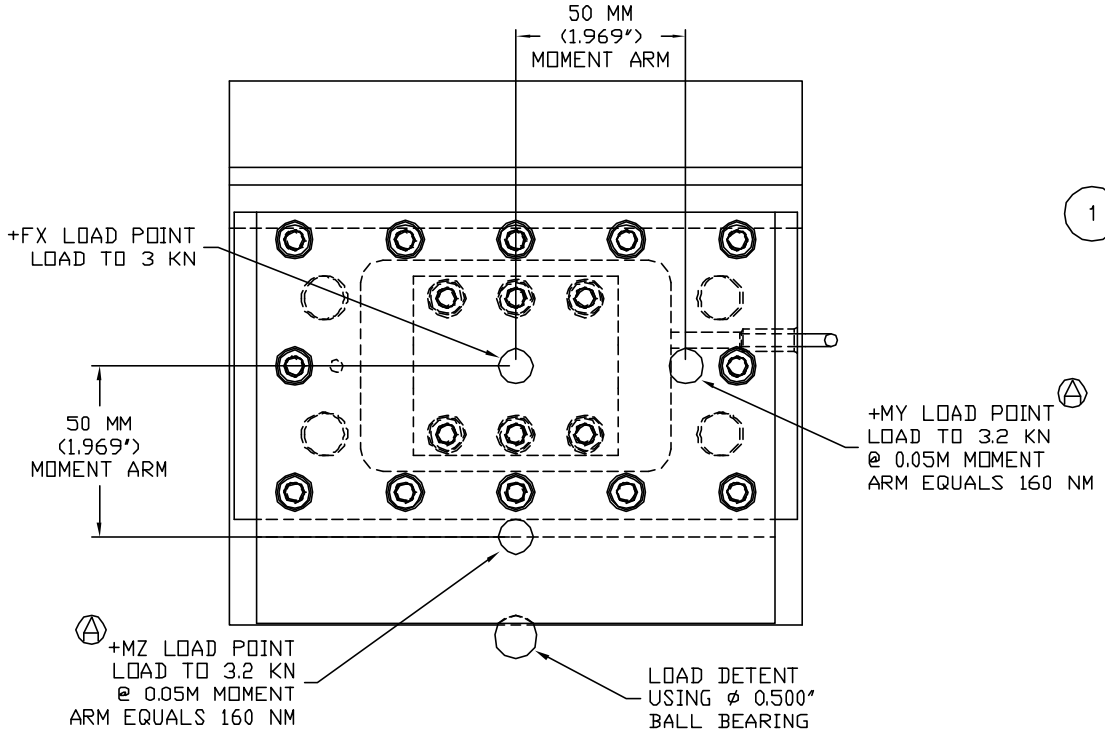
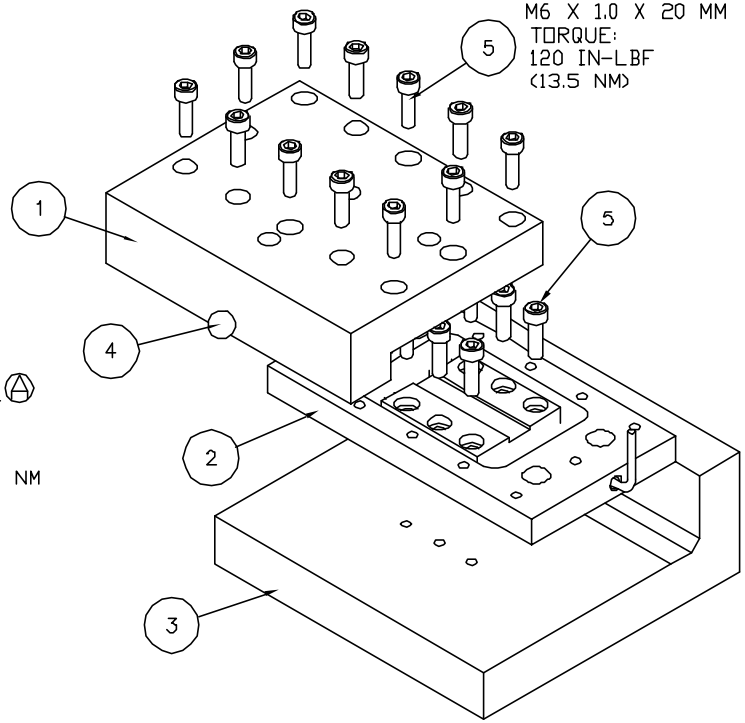
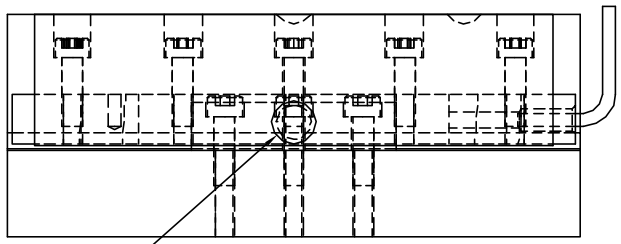
Issue Date: 21JAN00







ITEM	QTY	PART NUMBER	DESCRIPTION
5	18	PURCHASED	M6 X 1 X 20mm SHCS
4	1	PURCHASED	1/2" DIA BALL BEARING
3	1	4427	LOADING BASE
2	1	3795	LOAD CELL
1	1	4428	LOADING HEAD

PARTS LIST

CALIBRATION FIXTURE REF. DWG: 4053

SYM	REVISION	DATE
A	CHG 50MM TO 0.05M	13DEC00 PJD

EUROSID BACK PLATE

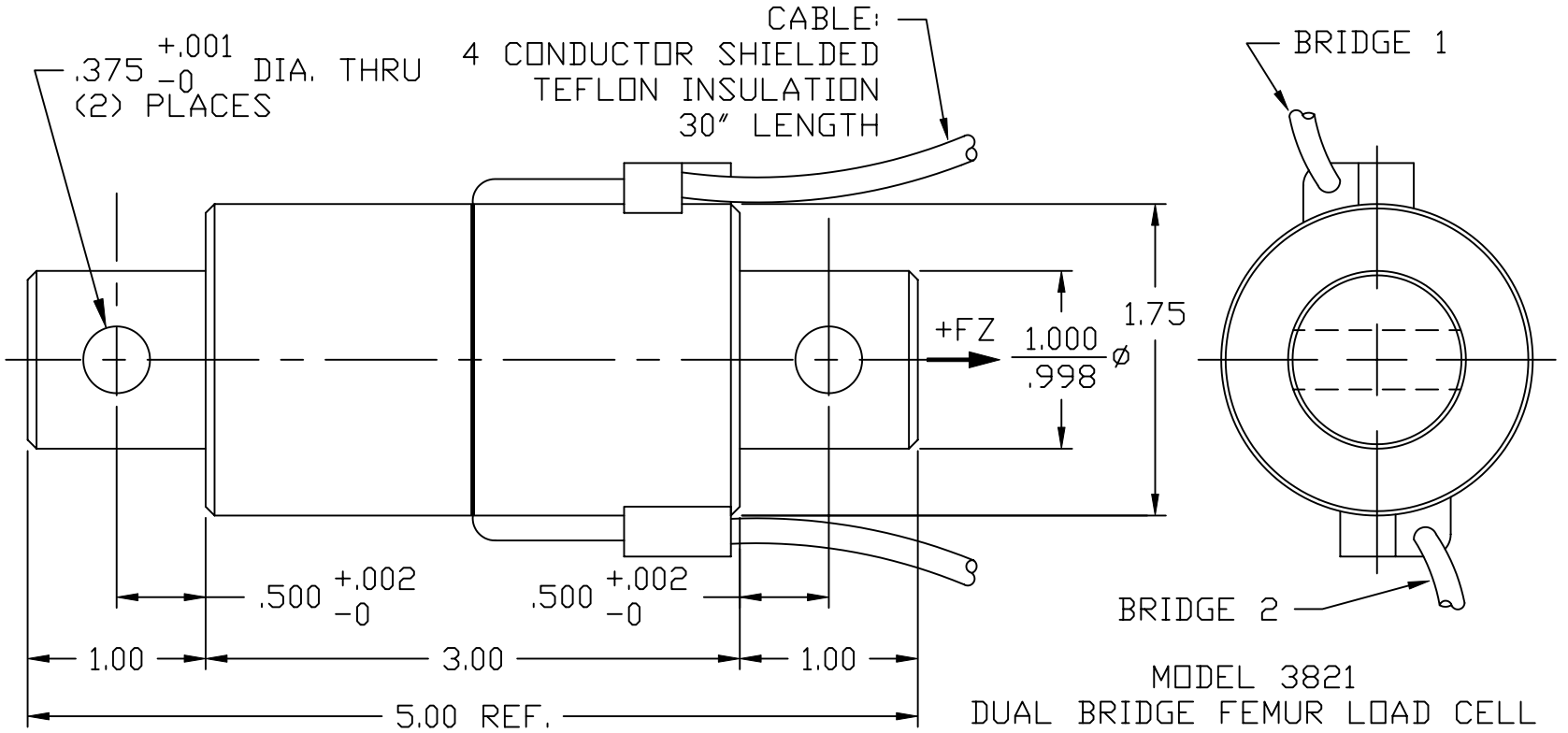
CALIBRATION FIXTURE

SCALE: .75X
DATE: 19APR99
DRAWN BY: R. DUPONT
MODEL: 3795

UNLESS OTHERVISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3795-C



MODEL 3821
DUAL BRIDGE FEMUR LOAD CELL

CAPACITY	3000 LBS.
OUTPUT	1.0 mV/V NOMINAL

NONLINEARITY ± .3% OF FULL SCALE
MOMENT ERROR 6% MAXIMUM WITH A
5000 IN.-LB MOMENT

THE MODEL 3821 DUAL BRIDGE FEMUR LOAD CELL PROVIDES A REDUNDANT SECOND CHANNEL TO THE PRIMARY MEASUREMENT CHANNEL.

UNIAXIAL FEMUR LOAD CELL
DUAL BRIDGE

SCALE: FULL			DRAWN BY: C.R. MORGAN
DATE: 5JULY97			MODEL: 3821

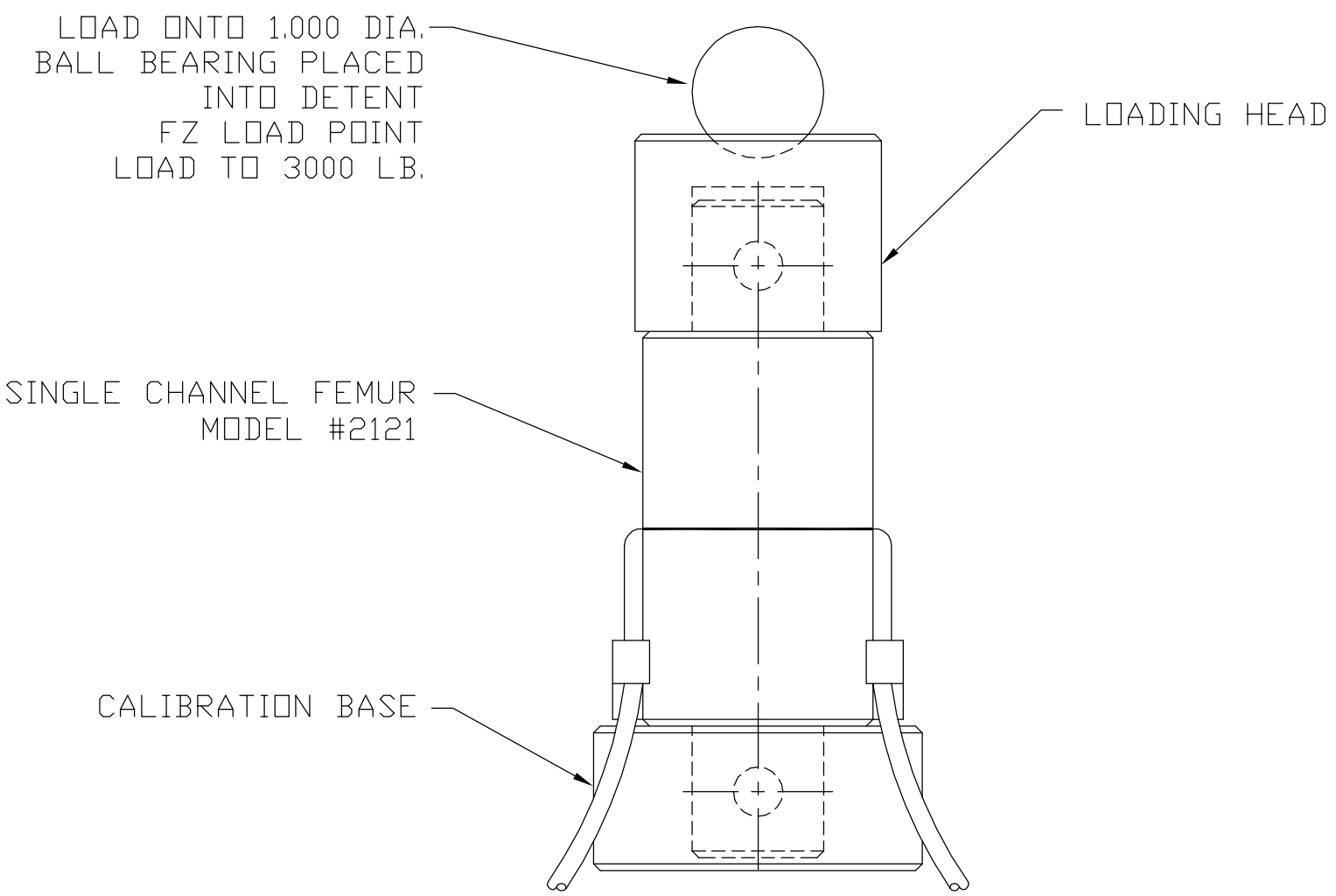
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A−3821−D

SYM	REVISION	DATE
A	WAS DRG. A-3821	6/99



CALIBRATION FIXTURE FOR MODEL 2121 SINGLE CHANNEL FEMUR

SCALE: .75X		DRAWN BY: *H. CHESTON*
DATE: 7/29/97		MODEL: 3203

UNLESS OTHERWISE SPECIFIED

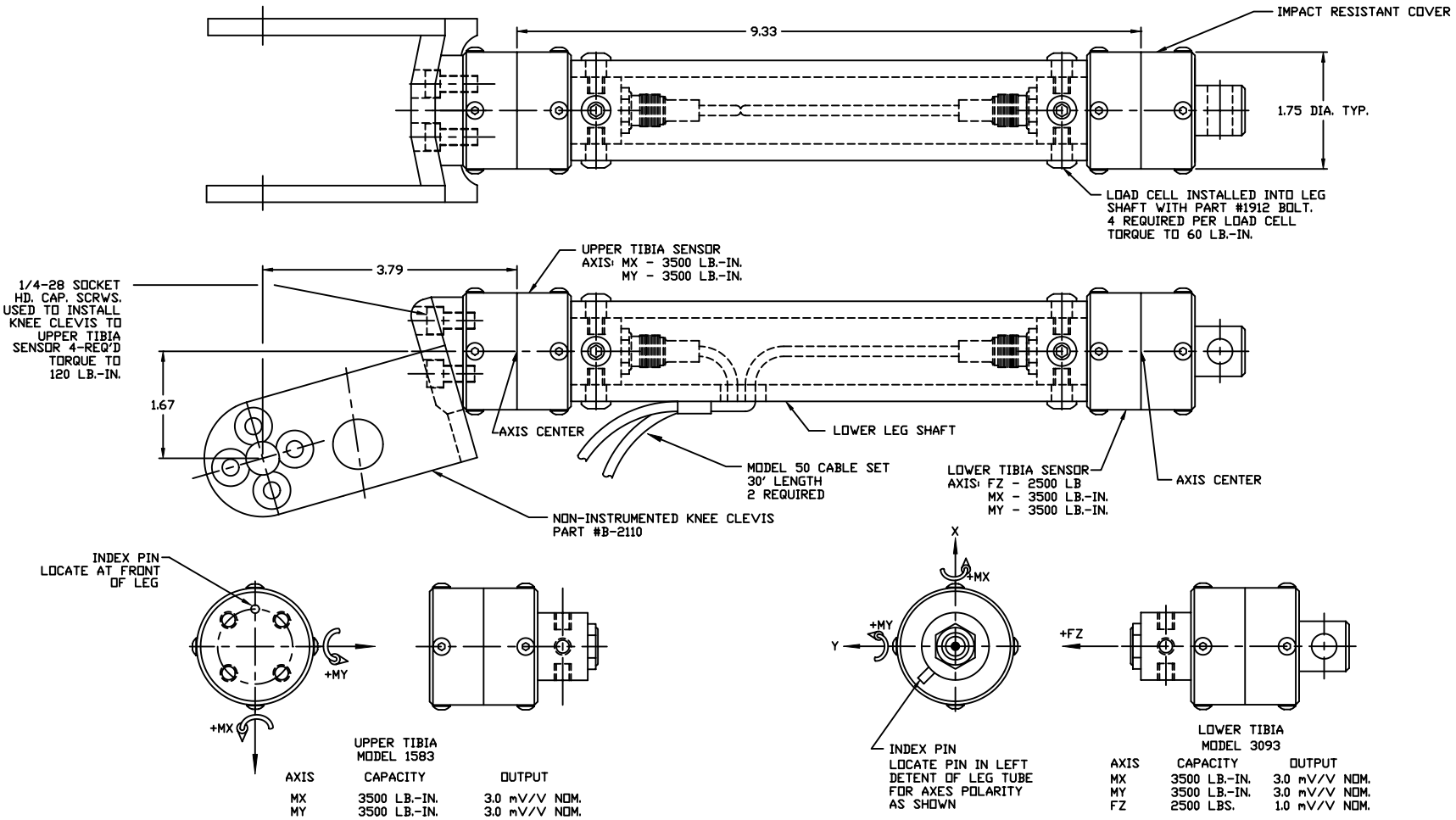
TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

SYM	REVISION	DATE

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-3821-C

PATENT 4,448,433



UPPER TIBIA
MODEL 1583

AXIS	CAPACITY	OUTPUT
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

LOWER TIBIA
MODEL 3093

AXIS	CAPACITY	OUTPUT
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.

NOTE:
TO CONFORM TO SAE J-211, THE POLARITY OF THE MY CHANNEL ON THE MODEL #1583 UPPER TIBIA AND THE MX CHANNEL ON THE MODEL #3093 LOWER TIBIA MUST BE CHANGED.

SYM	REVISION	DATE
A	WAS 3840	10/99

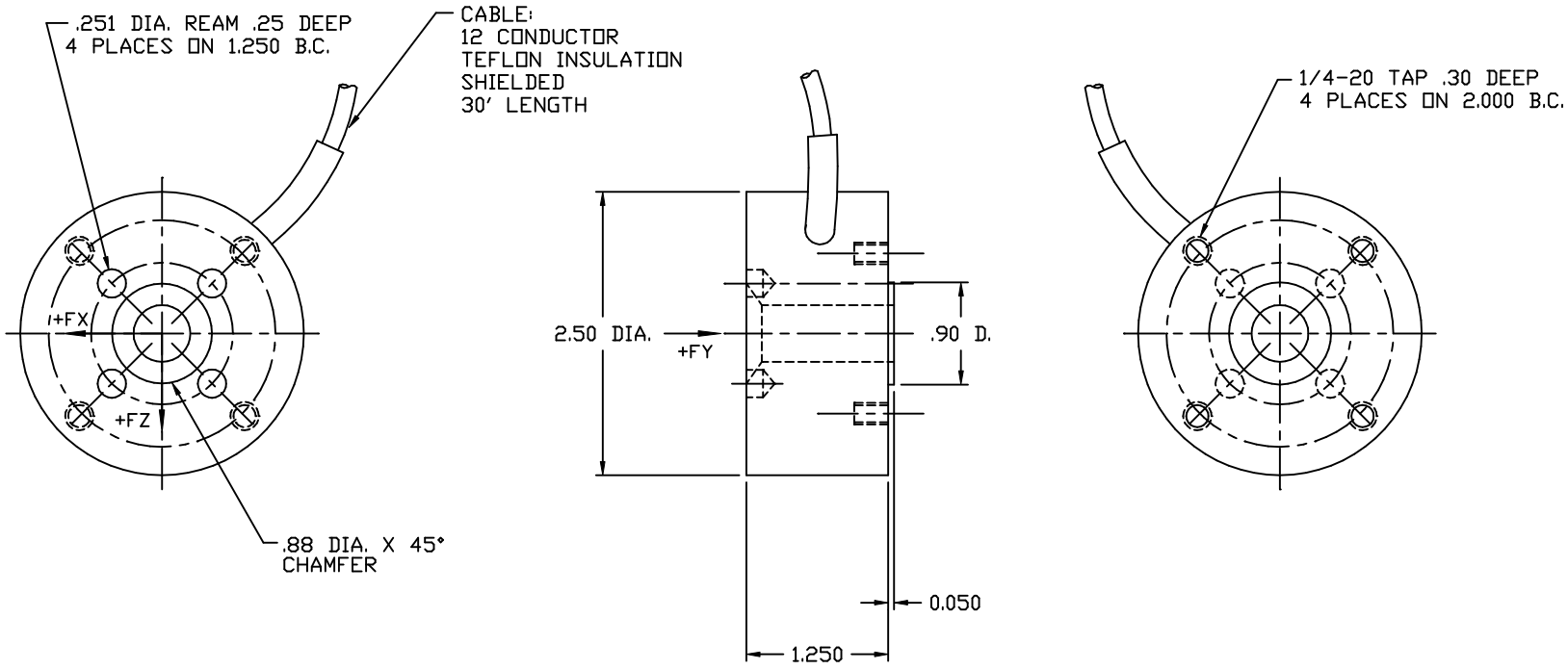
INSTRUMENTED LEG HYBRID III
50TH PERCENTILE

SCALE: .65X
DATE: 7/2/97
DRAWN BY: H. CHESTON
MODEL: 3840

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3840-D



AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	5000 LBF.	2.4 mV/V NOMINAL
FY	3000 LBF.	0.8 mV/V NOMINAL
FZ	3000 LBF.	2.0 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

OUTPUT POLARITY CONFORMS TO SAE J-211

SYM	REVISION	DATE
C	CHNG. FY, FZ POL.	12/99
B	ADD J TO MOD. #	12/99
A	WAS DRG. B-3855	6/99

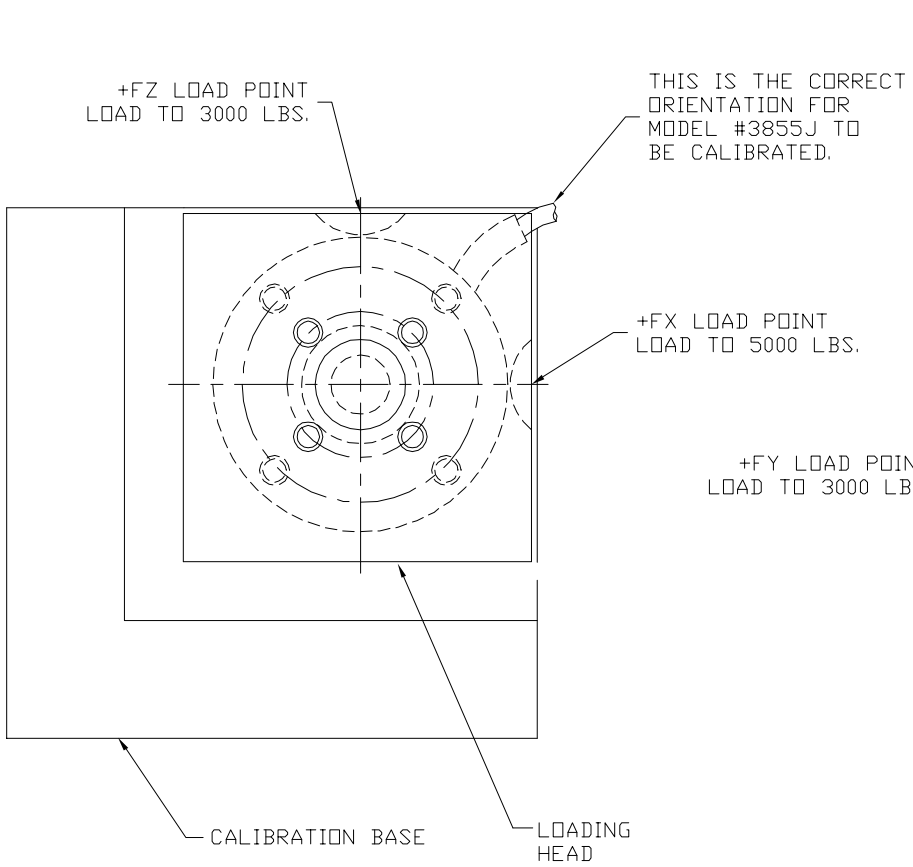
LEFT SIDE ACETABULUM LOAD CELL
FOR ADVANCED DUMMY

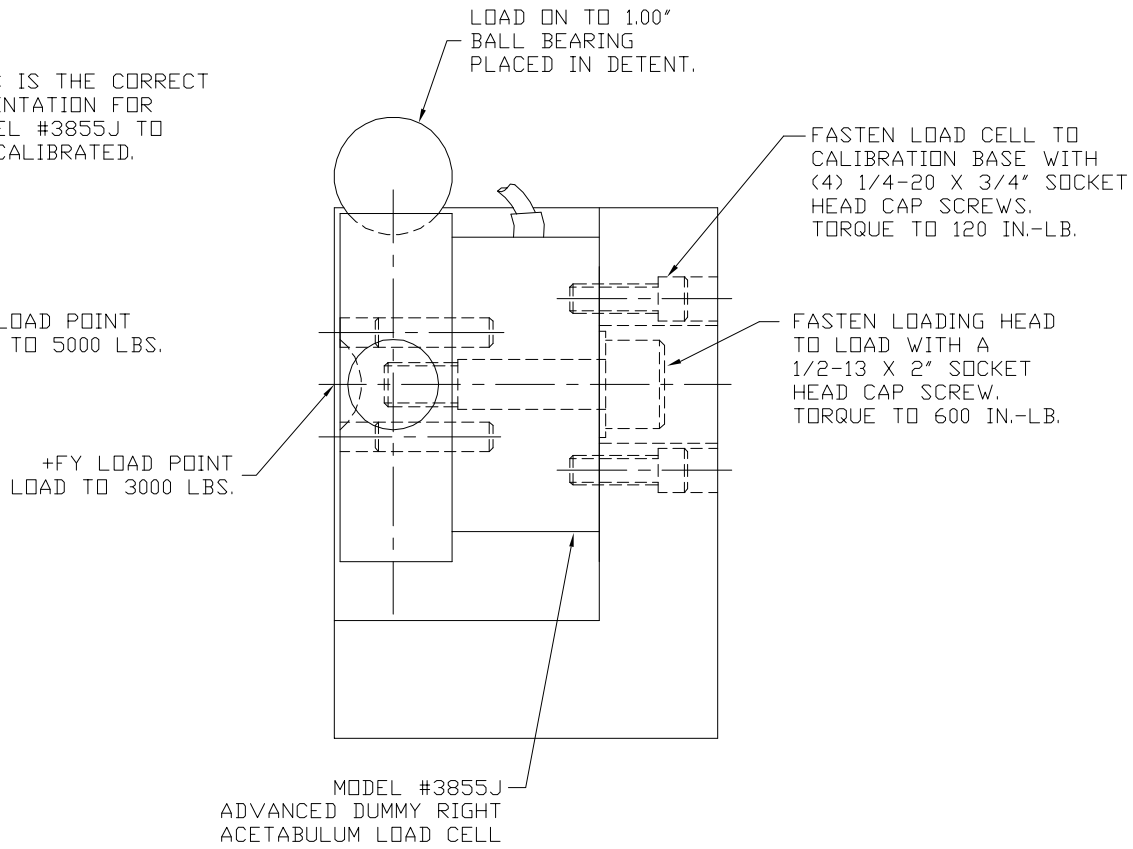
SCALE: FULL
DATE: 17FEB97
DRAWN BY: H. PROCTOR
MODEL: 3855J

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3855-D





NOTE:
FY WILL HAVE A NEGATIVE POLARITY ON LOAD CELLS MANUFACTURED PRIOR TO 12/99.

CALIBRATION FIX. MODEL# 3633

SYM	REVISION	DATE
A	ADD POL. NOTE	9/00

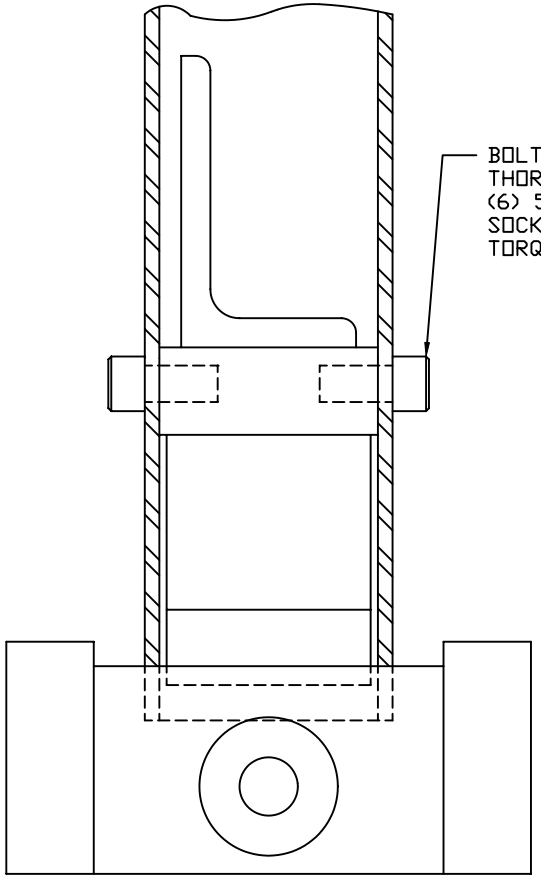
CALIBRATION FIXTURE FOR THE ADVANCED DUMMY ACETABULUM

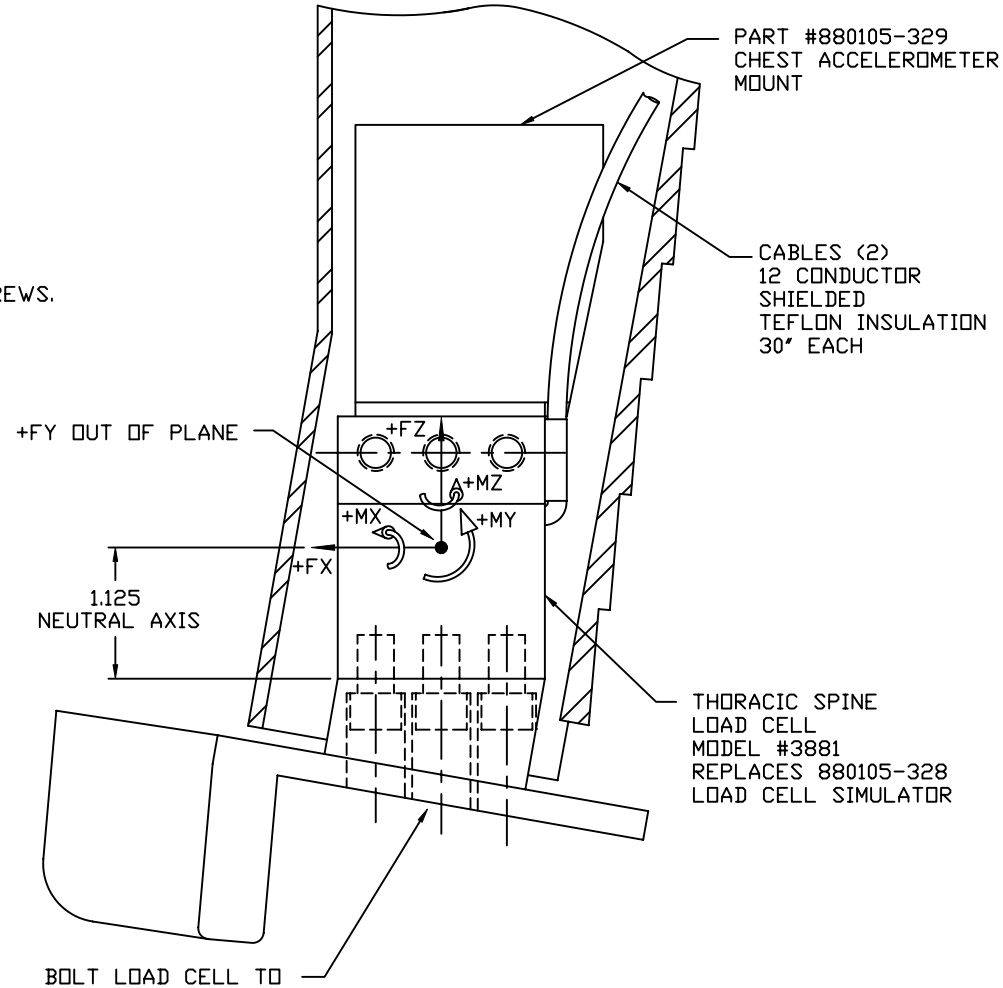
SCALE: FULL		DRAWN BY: C.HEAD
DATE: 1/6/00		MODEL: 3855J

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3855-C





MODEL 3881 THORACIC SPINE LOAD CELL
SMALL FEMALE HYBRID III

AXIS	CAPACITY	OUPUT @ CAPACITY	BRIDGE RESISTANCE
FX	3000 LBS	1.8 mV/V NOM.	350 OHMS
FY	3000 LBS	1.8 mV/V NOM.	350 OHMS
FZ	4000 LBS	1.0 mV/V NOM.	700 OHMS
MX	5000 IN-LB	1.6 mV/V NOM.	700 OHMS
MY	5000 IN-LB	1.6 mV/V NOM.	700 OHMS
MZ	3000 IN-LB	1.5 mV/V NOM.	350 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
A	WAS DRG. B-3881	6/99

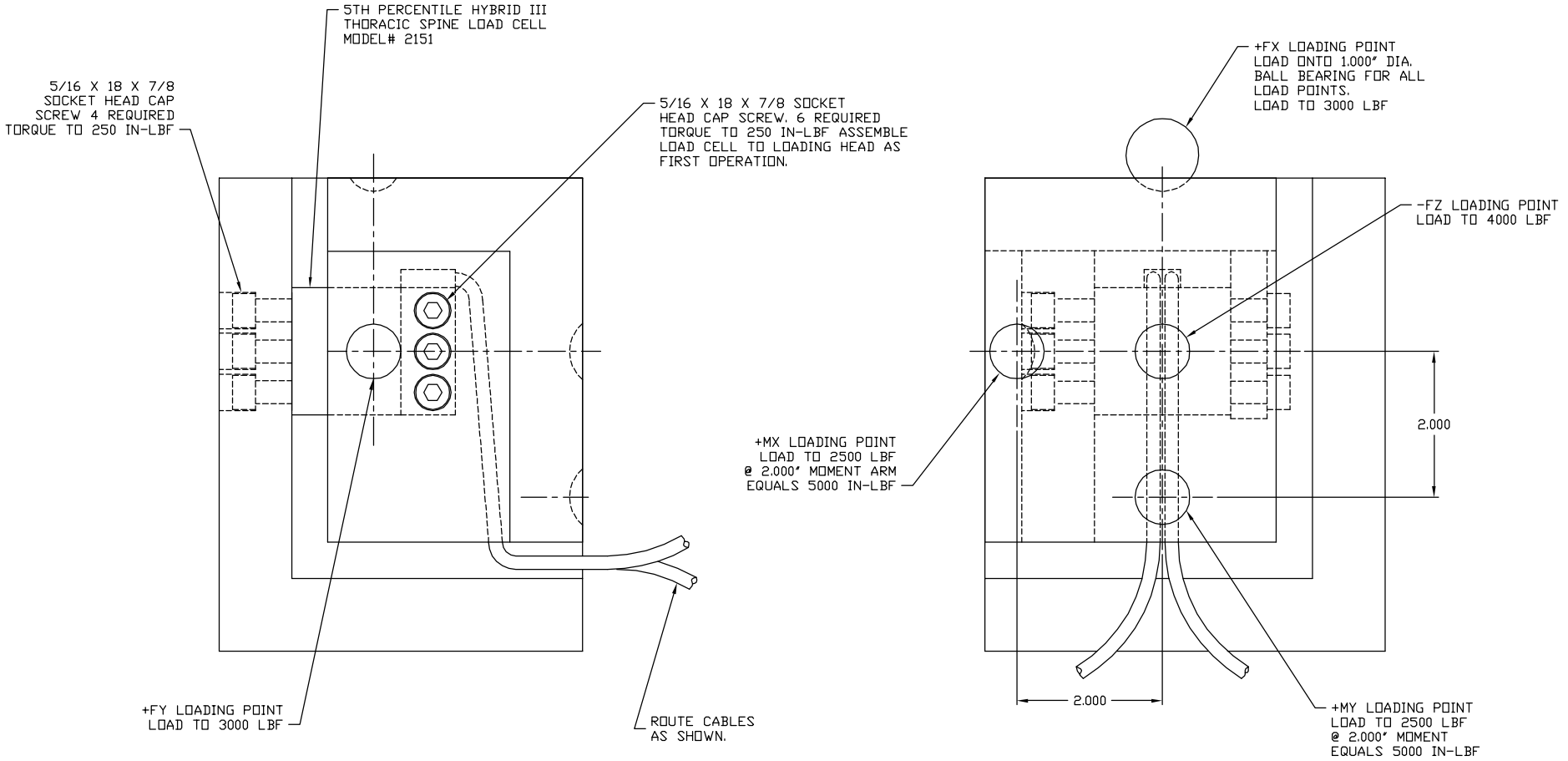
SMALL FEMALE THORACIC SPINE LOAD CELL
SIX CHANNEL

SCALE: FULL
DATE: 9/29/97
DRAWN BY: C.R. MORGAN
MODEL: 3881

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3881-D



USED-ON	SYM	REVISION	DATE

CALIBRATION FIXTURE FOR 5TH PERCENTILE THORACIC SPINE

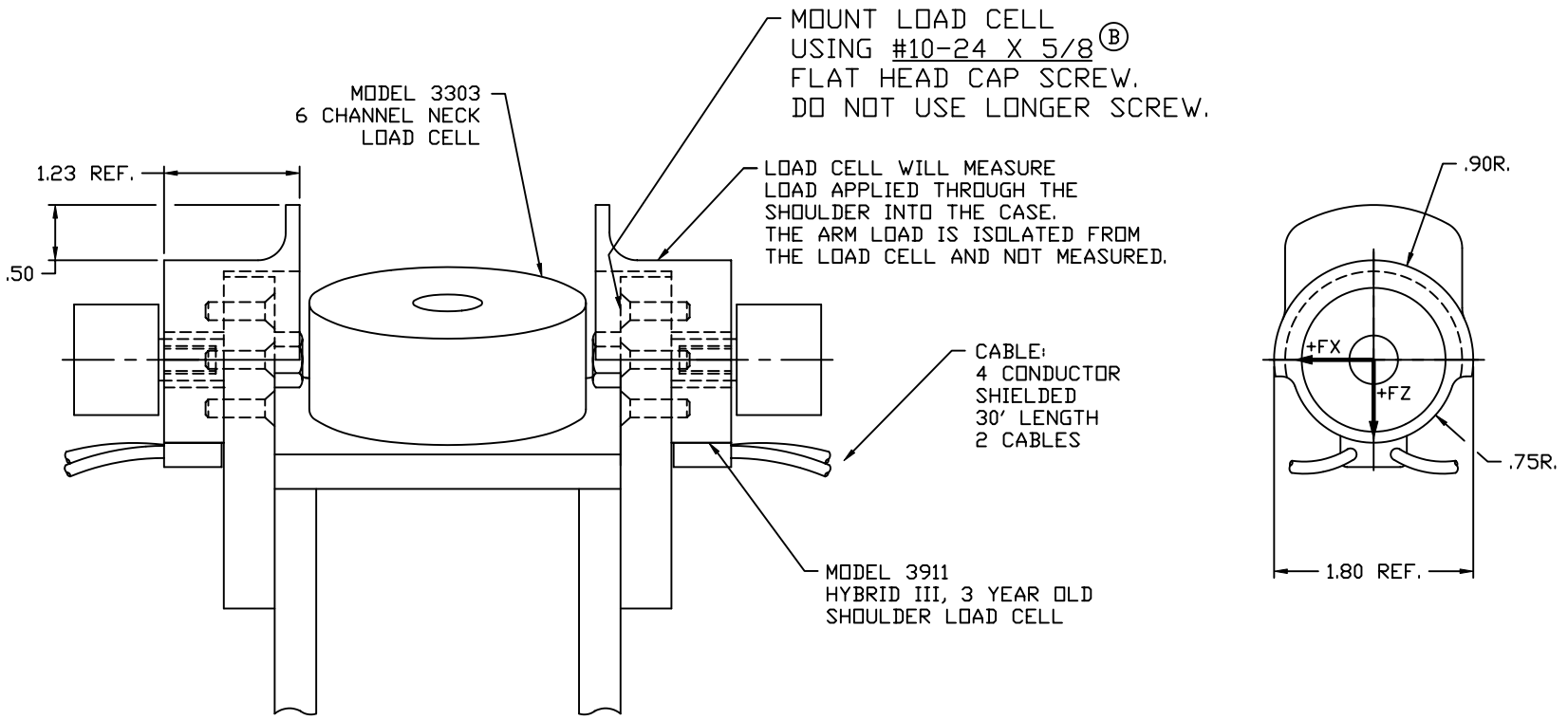
SCALE: FULL			DRAWN BY: C.HEAD
DATE: 2/2/00			MODEL: 3881

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-3881-C



MODEL 3911
H-III 3 YEAR OLD SHOULDER LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	400 LBS.	1.5 mV/V NOMINAL	350 OHMS
FZ	400 LBS.	1.5 mV/V NOMINAL	350 OHMS

(C) NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT: .19 LBS.

SYM	REVISION	DATE
E	WAS DRG. B-3911	6/99
D	ADD DIMS.	12/98
C	CORRECT WEIGHT	12/98
B	LENGTH WAS .5"	12/97
A	EXTEND .175	12/97

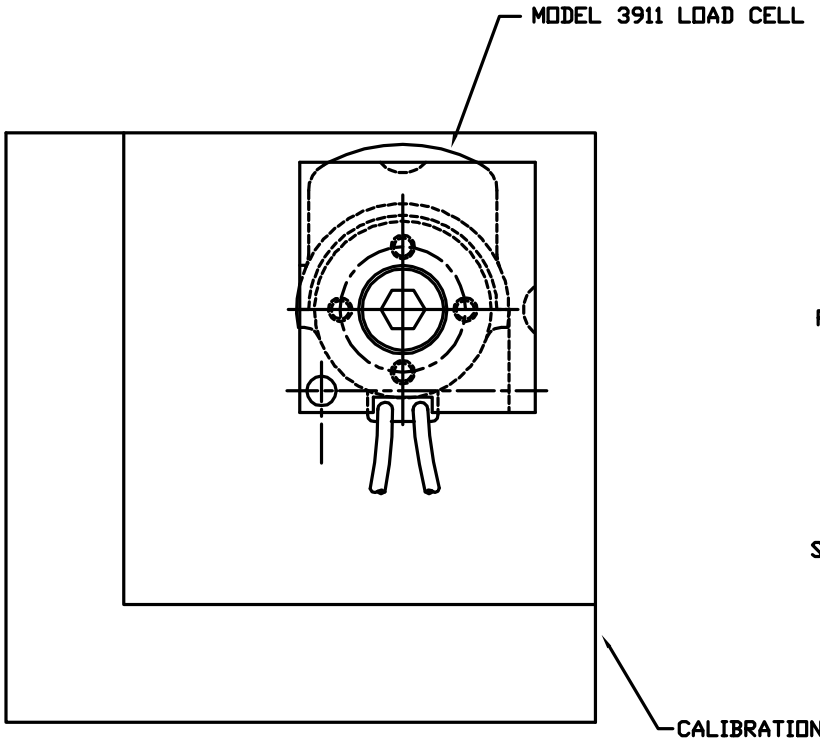
HYBRID III 3 YEAR OLD SHOULDER LOAD CELL

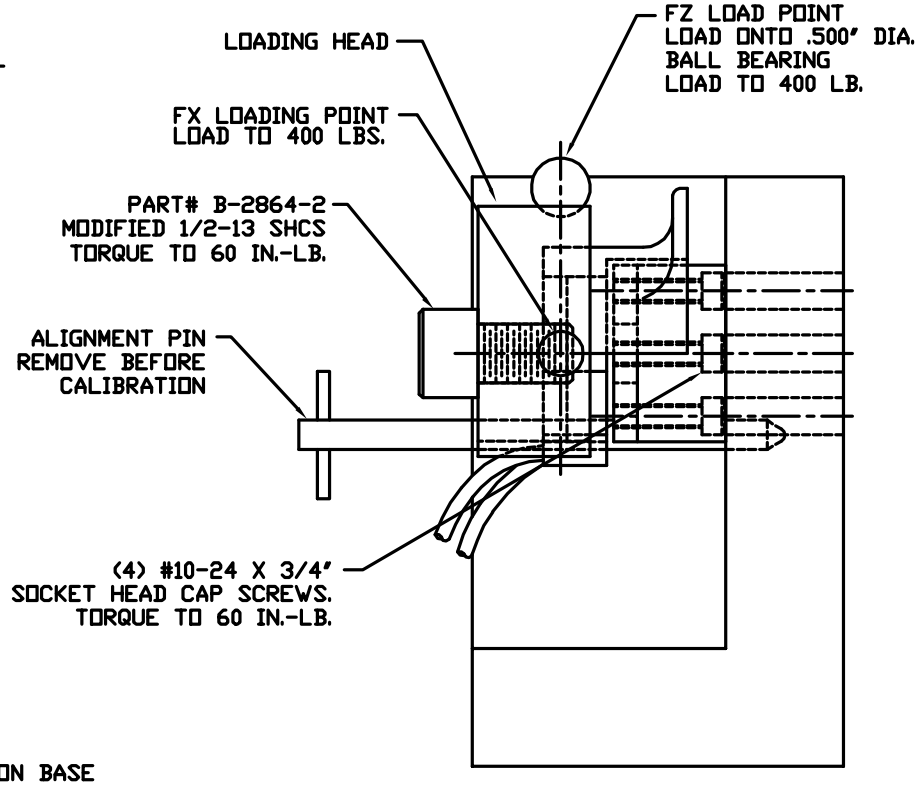
SCALE: FULL
DATE: 27OCT97
DRAWN BY: C.R. MORGAN
MODEL: 3911

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3911-D





INSTALLATION INSTRUCTIONS:

1. FASTEN LOAD CELL TO BASE WITH (4) #10-24 X 3/4" SOCKET HEAD CAP SCREWS. TORQUE TO 60 LB.-IN.
2. FASTEN LOADING HEAD TO LOAD CELL WITH (1) 1/2-13 MODIFIED SOCKET HEAD CAP SCREW (.80 LENGTH). INSERT ALIGNMENT PIN THROUGH LOADING HEAD INTO BASE. TORQUE 1/2-13 TO 60 IN.-LB.
3. REMOVE ALIGNMENT PIN BEFORE CALIBRATING.

CALIBRATION FIXTURE MODEL #4034

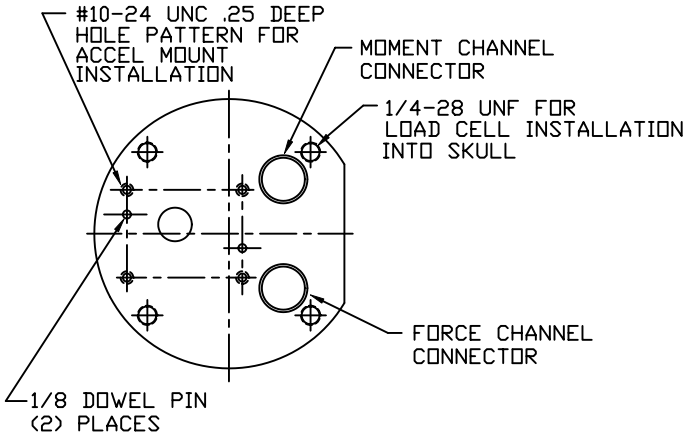
CALIBRATION FIXTURE FOR
H-III 3 YEAR OLD SHOULDER LOAD CELL

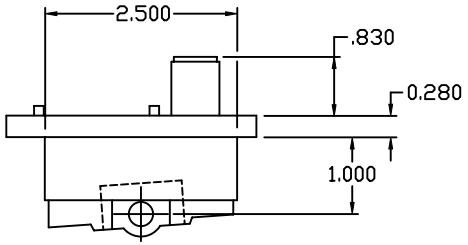
SCALE: FULL		DRAWN BY: C.R.M.
DATE: 16FEB98		MODEL: 3911

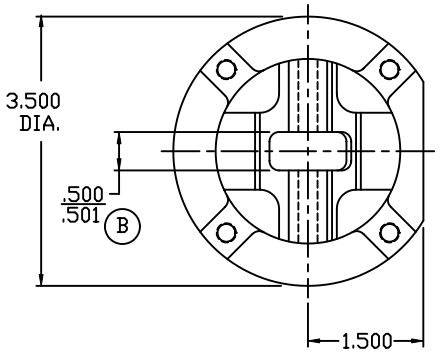
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

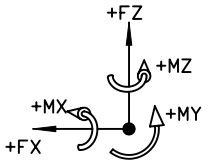
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

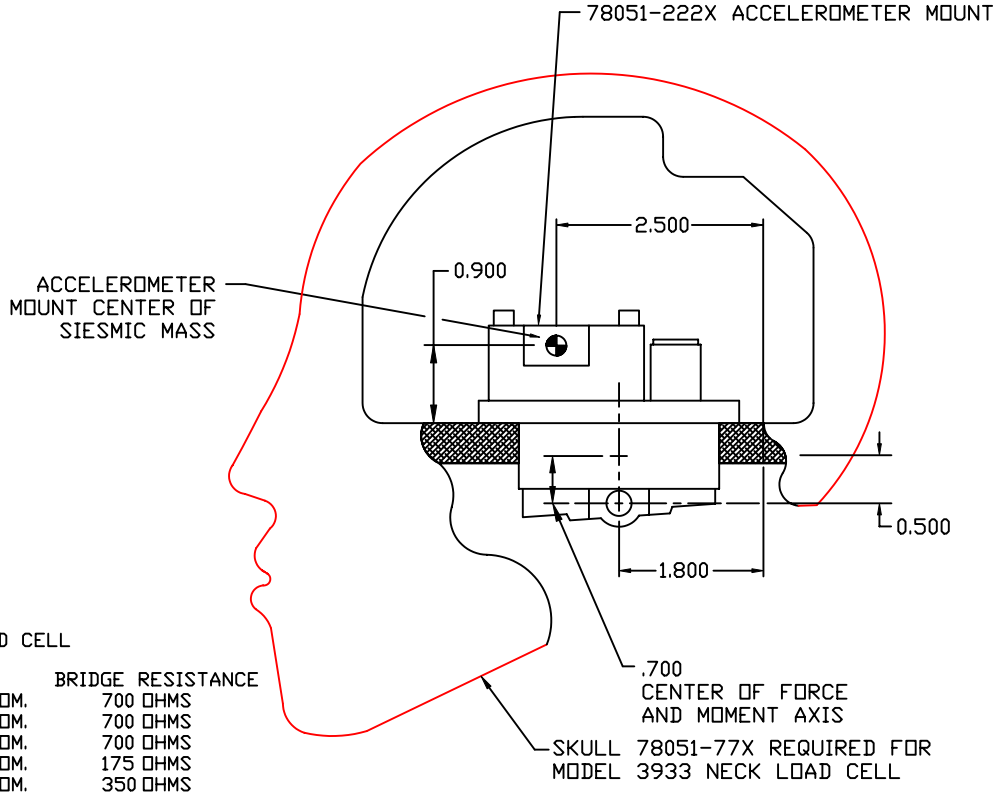
DRAWING NUMBER: B-3911-C











MODEL 3933
SIX CHANNEL NECK LOAD CELL

AXIS	CAPACITY	OUTPUT	BRIDGE RESISTANCE
FX	300 LBS.	2.0 mV/V NOM.	700 OHMS
FY	200 LBS.	1.3 mV/V NOM.	700 OHMS
FZ	1000 LBS.	1.0 mV/V NOM.	700 OHMS
MX	500 IN-LB	1.5 mV/V NOM.	175 OHMS
MY	1000 IN-LB	1.5 mV/V NOM.	350 OHMS
MZ	300 IN-LB	0.8 mV/V NOM.	700 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
C	WAS DRG. B-3933	6/99
B	CORRECT TOL.	11/98
A	UPDATE TEXT	1/98

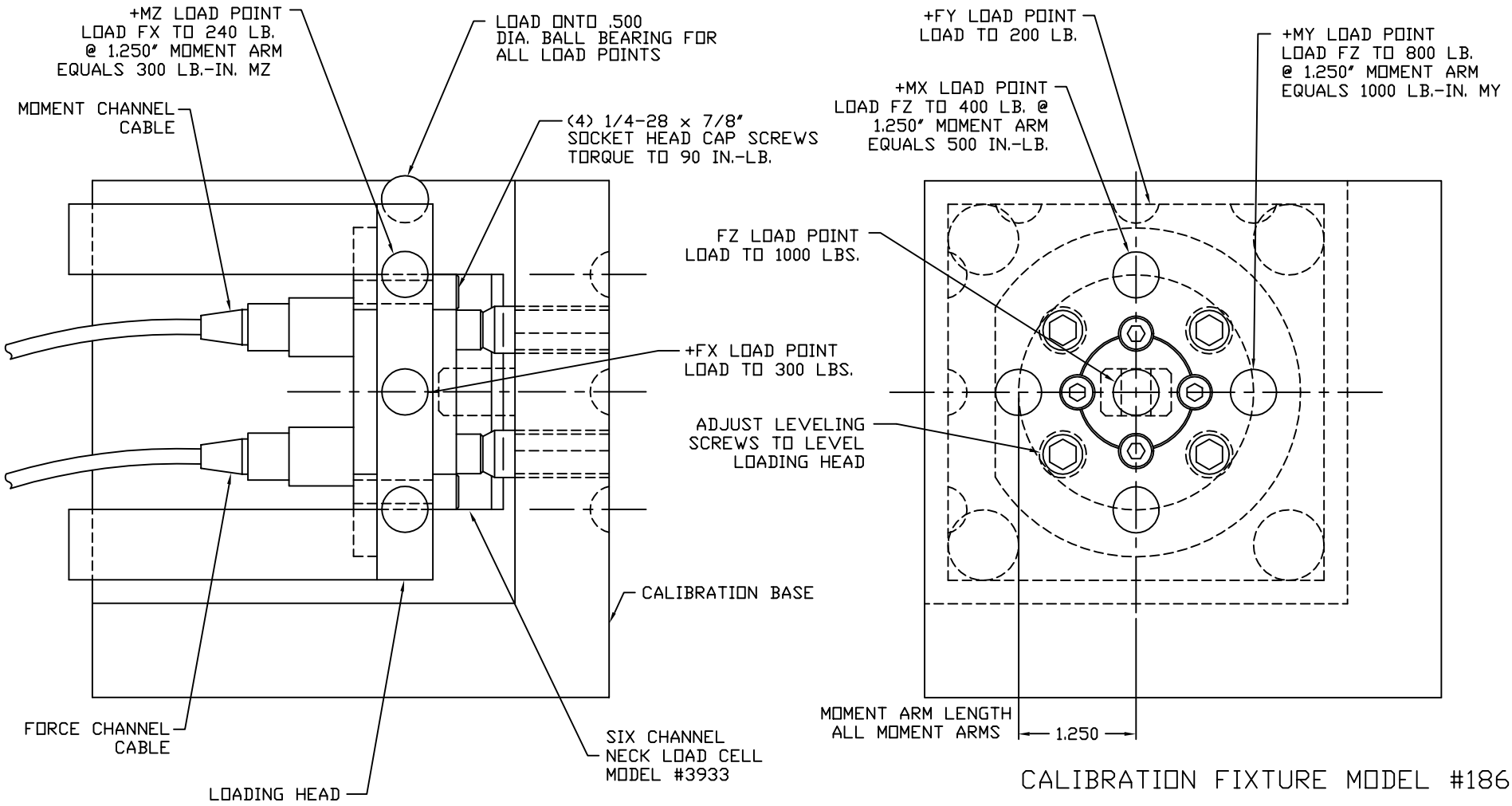
HYBRID III SIX CHANNEL NECK LOAD CELL
LOW CAPACITY

SCALE: NONE			DRAWN BY: C.R. MORGAN
DATE: 25OCT97			MODEL: 3933

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3933-D



CALIBRATION FIXTURE MODEL #1860

SYM	REVISION	DATE

NECK CALIBRATION FIXTURE

SCALE: FULL		DRAWN BY: C.R.M./S.E.P.
DATE: 11/1/85		MODEL: 3933

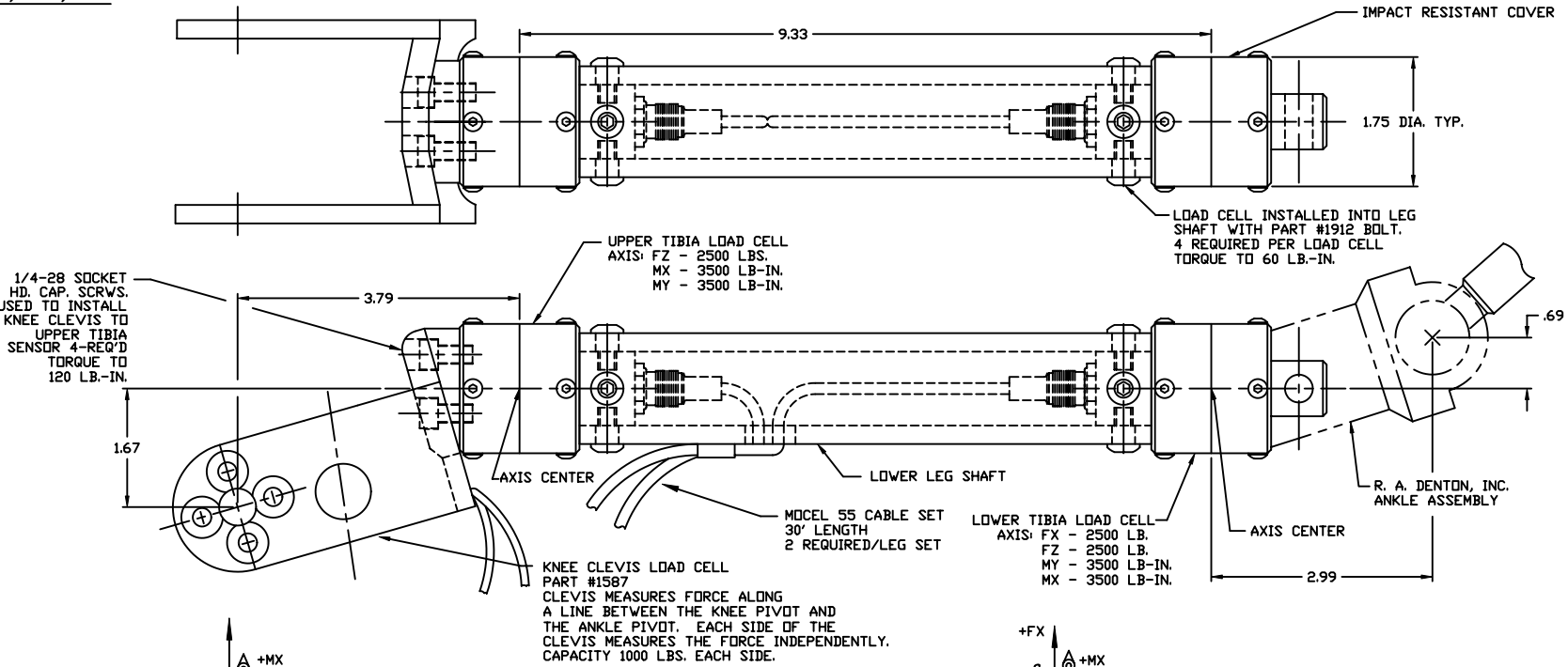
UNLESS OTHERWISE SPECIFIED

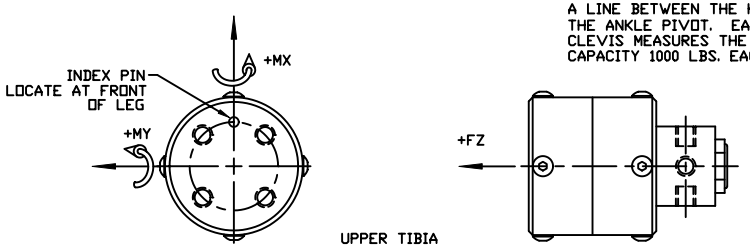
TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3933-C

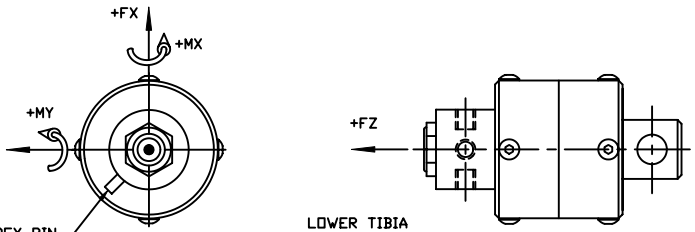
PATENT 4,448,433





UPPER TIBIA
MODEL 3292

AXIS	CAPACITY	OUTPUT
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.



LOWER TIBIA
MODEL 3287

AXIS	CAPACITY	OUTPUT
FX	2500 LB.	2.0 mV/V NOM.
FZ	2500 LB.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SYM	REVISION	DATE
A	WAS 3959	10/99

INSTRUMENTED LOWER LEGS

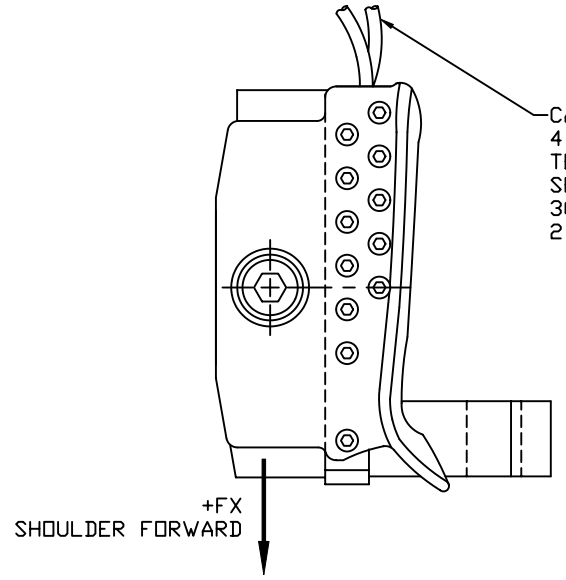
H-III 50TH PERCENTILE

SCALE: NONE
DATE: 2/17/98
DRAWN BY: H. CHESTON
MODEL: 3959

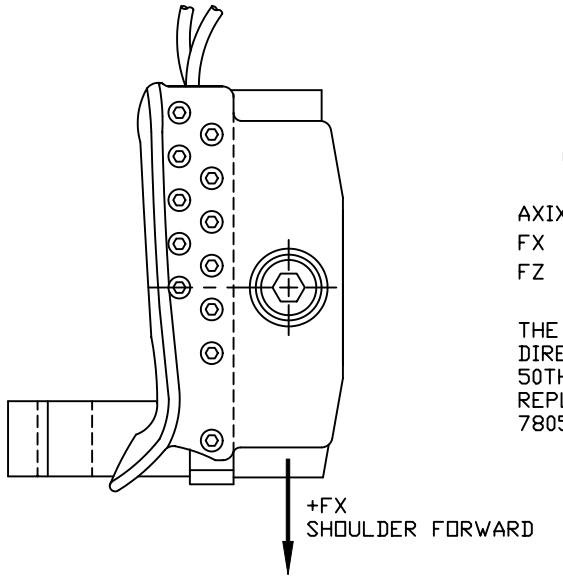
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3959-D



RIGHT CLAVICLE
MODEL 4018



LEFT CLAVICLE
MODEL 4017

HYBRID III
50TH PERCENTILE
CLAVICLE LOAD CELL

AXIX	CAPACITY	OUTPUT @ CAPACITY
FX	4000 N	1.0 mV/V NOM.
FZ	4000 N	1.0 mV/V NOM.

THE MODEL 4016 WILL MOUNT DIRECTLY INTO THE HYBRID III 50TH PERCENTILE. THE LOAD CELLS REPLACE PARTS 78051-188 AND 78051-189.

SYM	REVISION	DATE
A	WAS DRG. B-4016	6/99

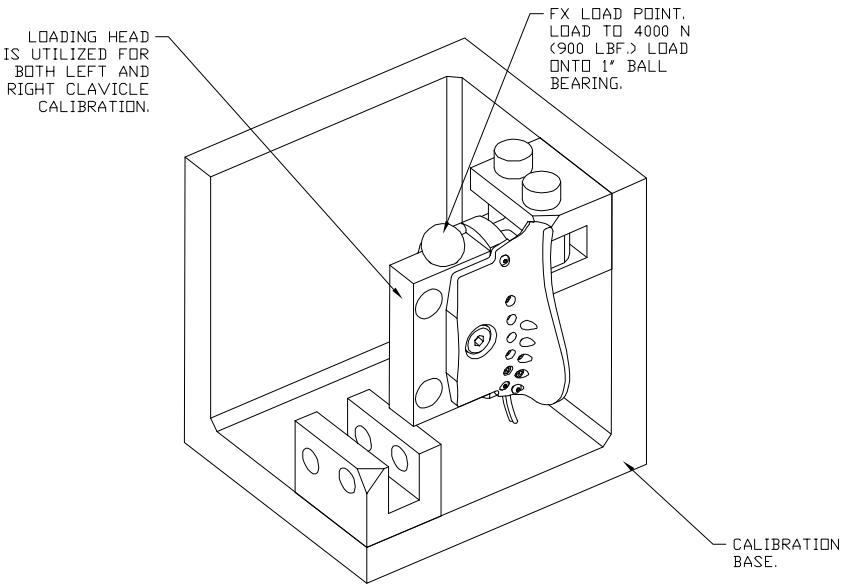
HYBRID III CLAVICLE LOAD CELL

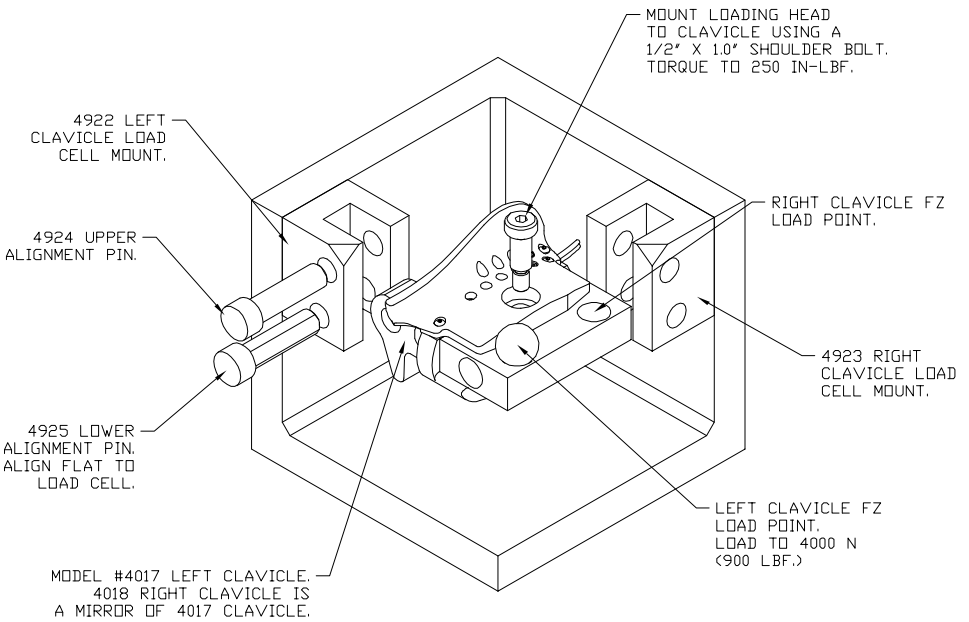
SCALE: .75X
DATE: 26JAN98
DRAWN BY: C.R. MORGAN
MODEL: 4016

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4016-D





INSTALLATION INSTRUCTIONS:

1. INSERT LOADING HEAD INTO CLAVICLE AND SECURE WITH 1/2" X 1.0 SHOULDER BOLT.
2. PLACE CLAVICLE AND LOADING HEAD INTO APPROPRIATE MOUNTING FIXTURE AND SECURE WITH ALIGNMENT PINS.

NOTE: LOWER ALIGNMENT PIN HAS FLAT SURFACE TO ALIGN TO FLAT ON LOAD CELL.

CALIBRATION FIXTURE MODEL #4986

NEXT ASS'Y	QTY
PART USED ON	

SYM	REVISION	DATE
A	WAS MODEL# 2998	11/00

CLAVICLE CALIBRATION FIXTURE

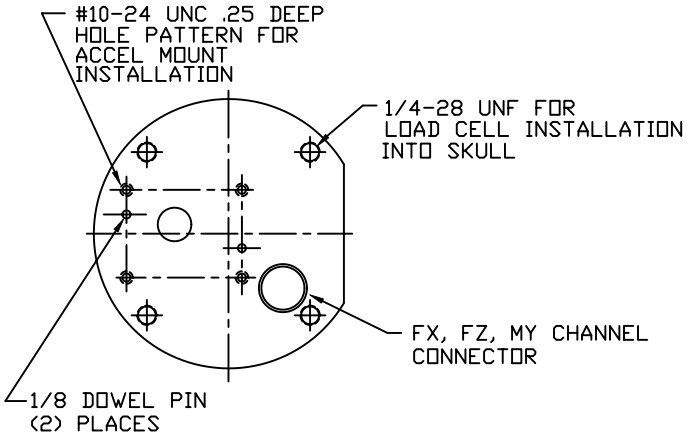
SCALE: 1/2 | DRAWN BY: CHEAD

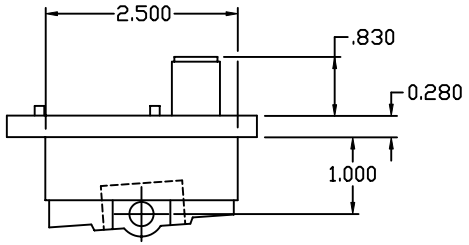
DATE: 8/14/00 | MODEL: 4986

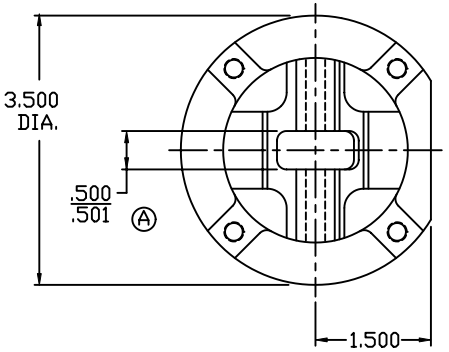
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

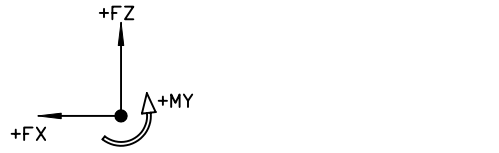
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

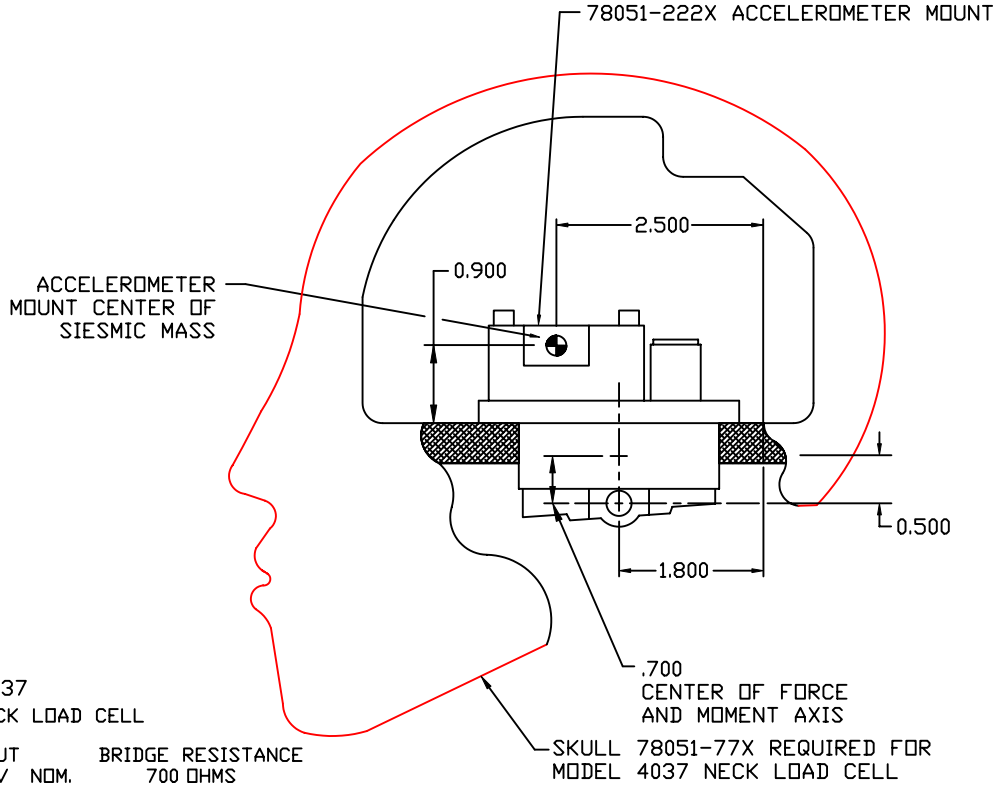
DRAWING NUMBER: 4016-C











MODEL 4037
THREE CHANNEL NECK LOAD CELL

AXIS	CAPACITY	OUTPUT	BRIDGE RESISTANCE
FX	300 LBS.	2.0 mV/V NOM.	700 OHMS
FZ	1000 LBS.	1.0 mV/V NOM.	700 OHMS
MY	1000 LB*INS	1.5 mV/V NOM.	350 OHMS
NONLINEARITY	< 1% OF FULL SCALE		
CROSSTALK	< 5% OF FULL SCALE		

SYM	REVISION	DATE
B	WAS DRG. B-4037	6/99
A	CORRECT TOL.	11/98

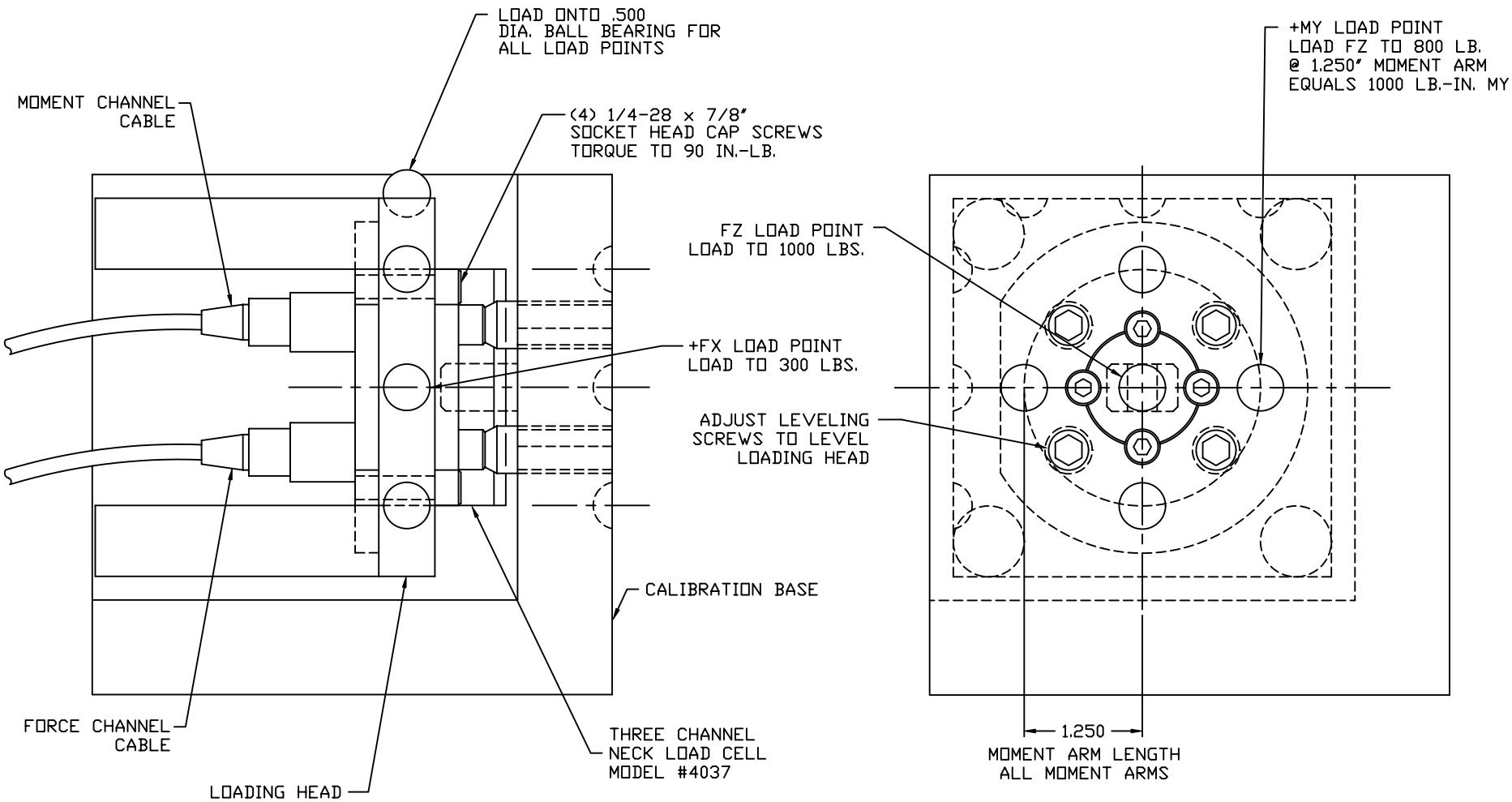
HYBRID III THREE CHANNEL NECK LOAD CELL
LOW CAPACITY

SCALE: NONE		DRAWN BY: C.R. MORGAN
DATE: 3/9/98		MODEL: 4037

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4037-D



NECK CALIBRATION FIXTURE

SCALE: FULL			DRAWN BY: C.R.M./S.E.F.
DATE: 11/1/85			MODEL: 4037

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

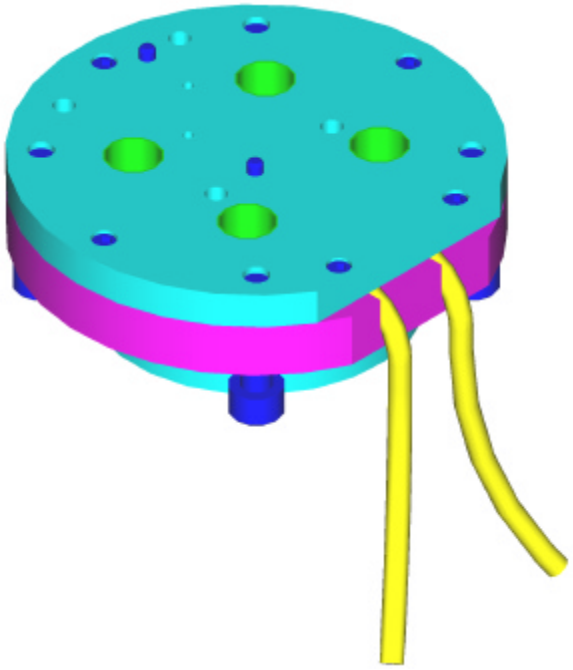
DRAWING NUMBER: B-4037-C

SYM	REVISION	DATE
A	WAS DRG. B-1860	10/99

4037
USED-ON

ROBERT A. DENTON, INC.
2967 Waterview Dr., Rochester Hills, MI 48309
Tel (248) 852-5100 • Fax (248) 852-6060 • email: info@radenton.com • www.radenton.com

MODEL 4085 EUROSID UPPER NECK LOAD CELL



Applications:

The Model 4085 Neck Load Cell was designed to provide upper neck force and bending moment measurement data for designing and evaluating occupant protection systems. Model 4085 is for use with the Eurosid-2 dummy, or the Eurosid-1 dummy with a modified skull and top neck plate. The Model 4085 Load Cell contains six measurement channels: three forces and three moments. Each channel is a full bridge strain gage circuit. Two 9.1 meter cables exit the rear of the load cell. The left cable contains the force channels, and the right cable contains the moment channels. This load cell is wired per the SAE J211 Right Hand Rule sign convention.

Standard Ordering Configuration: 4085J
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Fx	10.0 kN	2248 lb	350 ohms	2.5 mv/v
Fy	10.0 kN	2248 lb	350 ohms	2.5 mv/v
Fz	15.0 kN	3372 lb	700 ohms	1.6 mv/v
Mx	300 Nm	2655 in-lb	350 ohms	1.9 mv/v
My	300 Nm	2655 in-lb	350 ohms	1.9 mv/v
Mz	300 Nm	2655 in-lb	700 ohms	3.2 mv/v

Nonlinearity……...less than 1% of full scale
Hysteresis……less than 1% of full scale
Crosstalk……less than 5% of full scale
Excitation……10 VDC nom. 15 VDC max.
Mass (without mounting screws or cable)……(1.3 lb) 0.60 kg

Wiring:

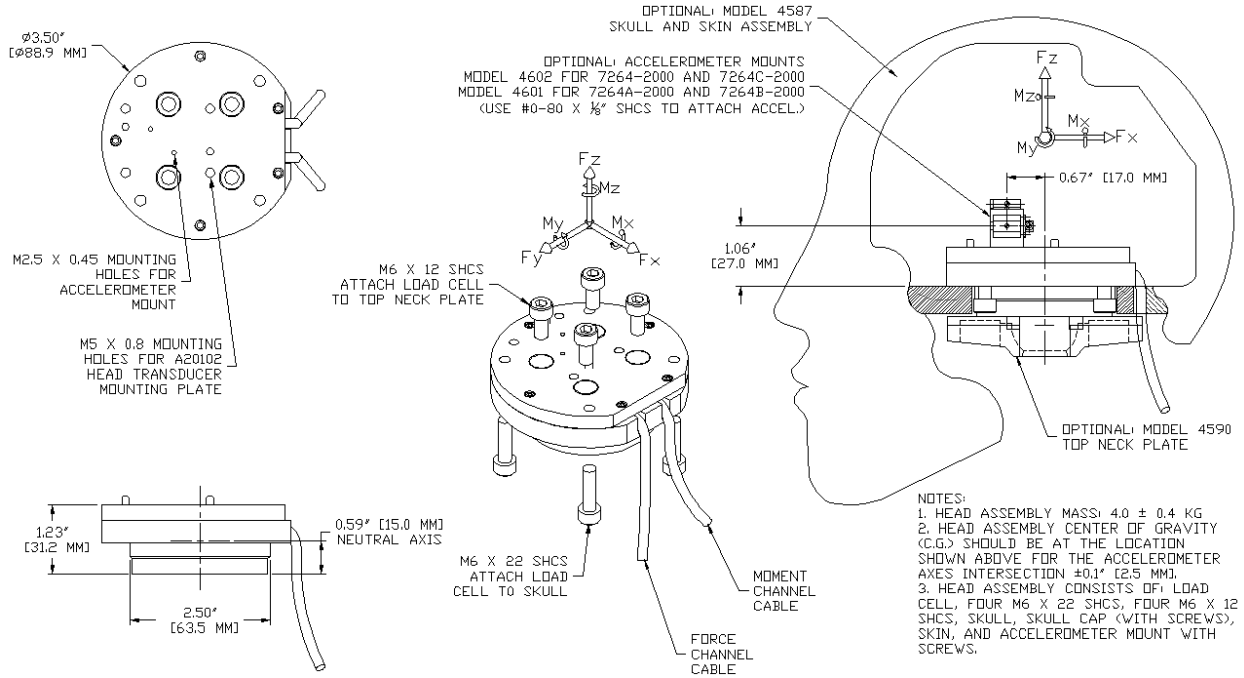
Fx & Mx Channels		Fy & My Channels		Fz & Mz Channels	
Brown	+Exc.	Red Stripe	+Exc.	Green	+Exc.
Red	+Sig.	Black	+Sig.	Blue	+Sig.
Orange	-Exc.	White	-Exc.	Violet	-Exc.
Yellow	-Sig.	Black Stripe	-Sig.	Gray	-Sig.

Issue Date: 25JAN2000

MODEL 4085 EUROSID UPPER NECK LOAD CELL

NOTES

1. Use Denton Model 4316 calibration fixture. (Ref. Denton Drawing B-4085-C)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention which is indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.
6. Optional: model 4587 is a head assembly to use the model 4085 load cell on a Eurosid-1 dummy. This includes a skull, cap, skin, cap skin, and cap screws.
7. Optional: model 4602 mount for Endevco 7264-2000 or 7264C-2000 accelerometers
8. Optional: model 4601 mount for Endevco 7264A-2000 or 7264B-2000 accelerometer.
9. Optional: model 4590 top neck plate.
10. Optional: model 4603 structural replacement for the model 4085 load cell.



Creating the Standard in Safety Measurement Since 1974

Robert A. Denton, Inc. maintains a high level of control over the manufacture of its products to ensure quality, accuracy and reliability. Continued improvement necessitates that we reserve the right to modify these specifications without notice.

Robert A. Denton, Inc., 2967 Waterview Drive, Rochester Hills, Michigan 48309
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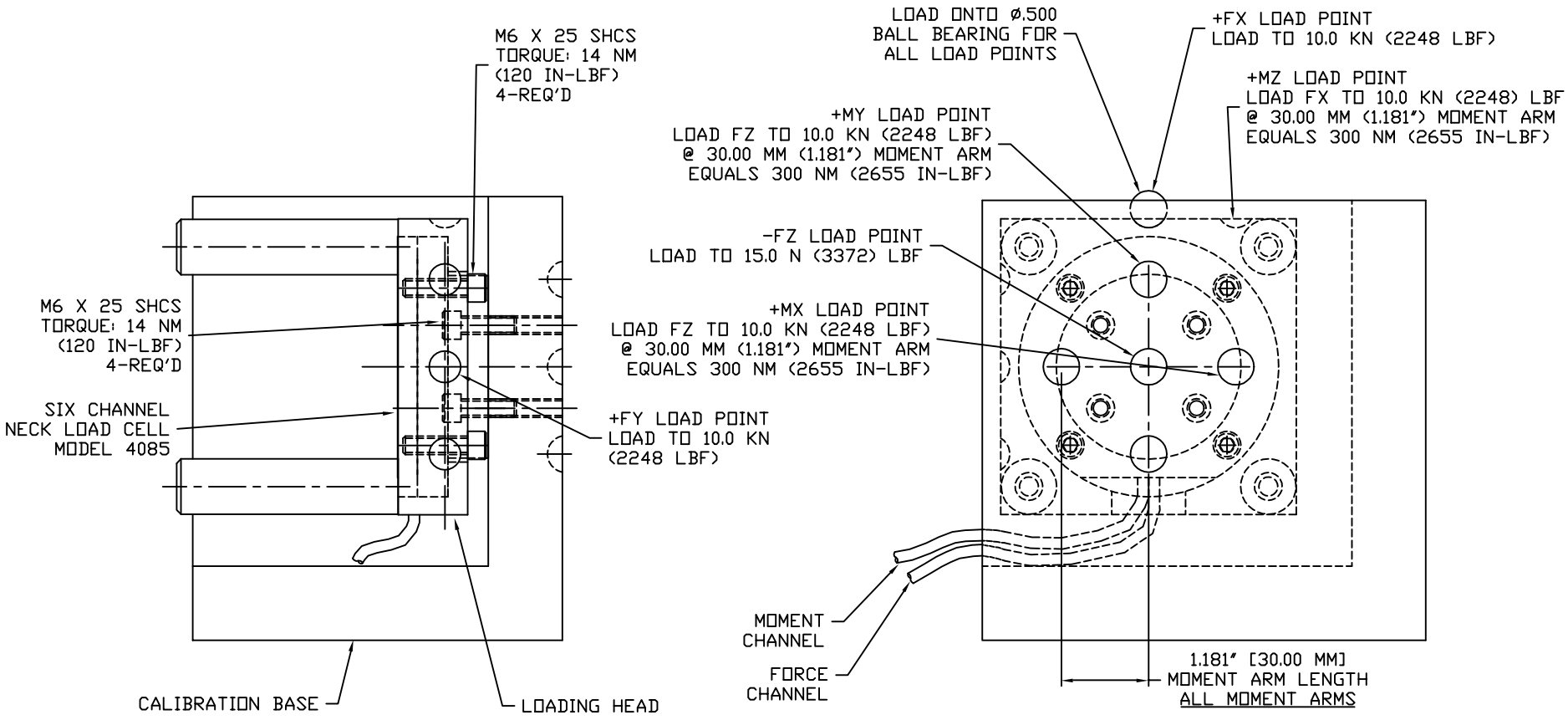
Issue Date: 25JAN2000



USE MODEL 4316 CAL FIXTURE

NECK CALIBRATION FIXTURE

SCALE: .75X			DRAWN BY: R. DUPONT
DATE: 07JAN99			MODEL: 4085

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

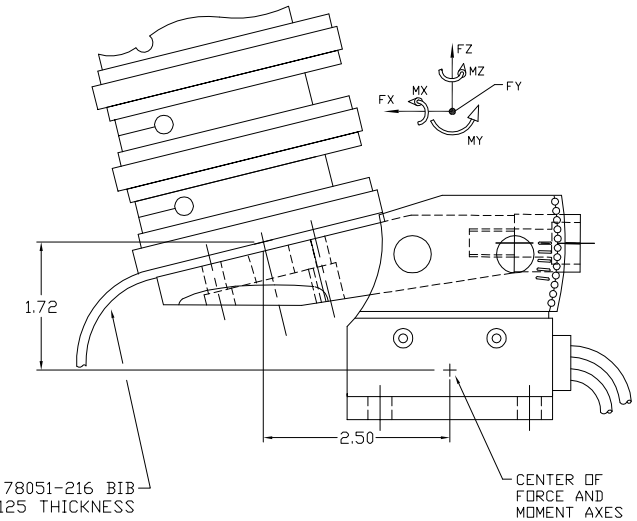
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

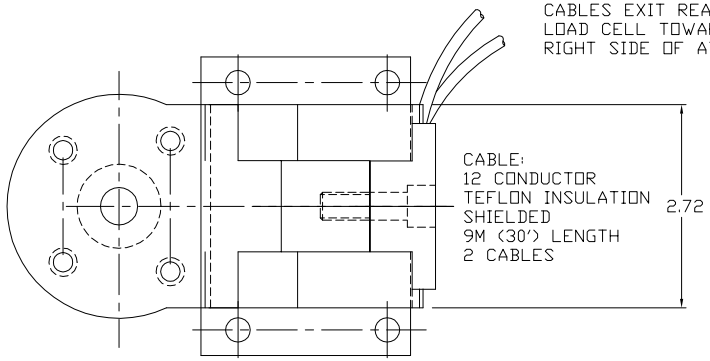
DRAWING NUMBER: B-4085-C

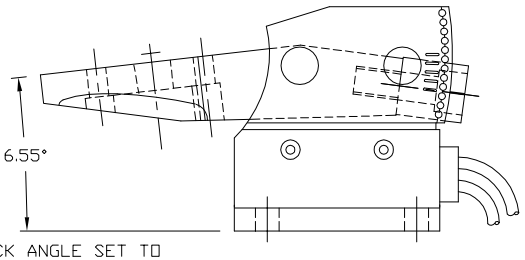
SYM	REVISION	DATE
B	ROTATE L.C. AND CORRECT LOAD POINTS	01NOV99 PJD
A	COPY FROM B-4316	25AUG99 PJD

NEXT ASS'Y	QTY
4085	1

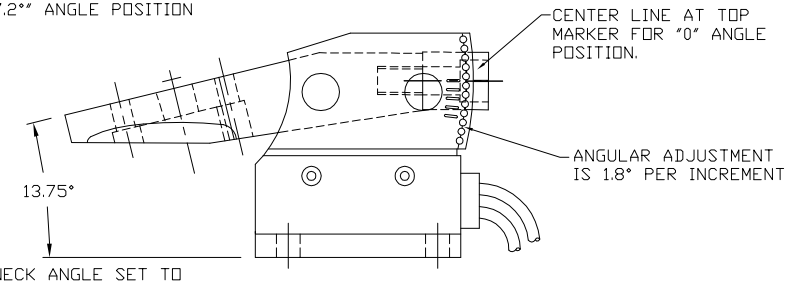
PART USED ON







NECK ANGLE SET TO
"+7.2°" ANGLE POSITION



NECK ANGLE SET TO
"0" ANGLE POSITION

THE LOWER NECK LOAD CELL ASSEMBLY, MODEL 4092, DUPLICATES THE NECK POSITION OF STANDARD BRACKETS (78051 - 303 & 307). THE LOAD CELL IS ADJUSTABLE FOR NECK ANGLE FROM -3.6° TO +7.2° FROM THE "0" POSITION IN 1.8° INCREMENTS.

LOWER NECK LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	2000 N (450 LBS.)	2.0 mV/V NOMINAL	700 OHMS
FY	2000 N (450 LBS.)	2.0 mV/V NOMINAL	700 OHMS
FZ	5000 N (1100 LBS.)	1.0mV/V NOMINAL	700 OHMS
MX	400 NM (3500 LB.-IN.)	1.7 mV/V NOMINAL	700 OHMS
MY	400 NM (3500 LB.-IN)	1.7 mV/V NOMINAL	700 OHMS
MZ	200 NM (1800 LB.-IN.)	1.5 mV/V NOMINAL	350 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
A	WAS 4092	10/99

ADJUSTABLE LOWER NECK LOAD CELL

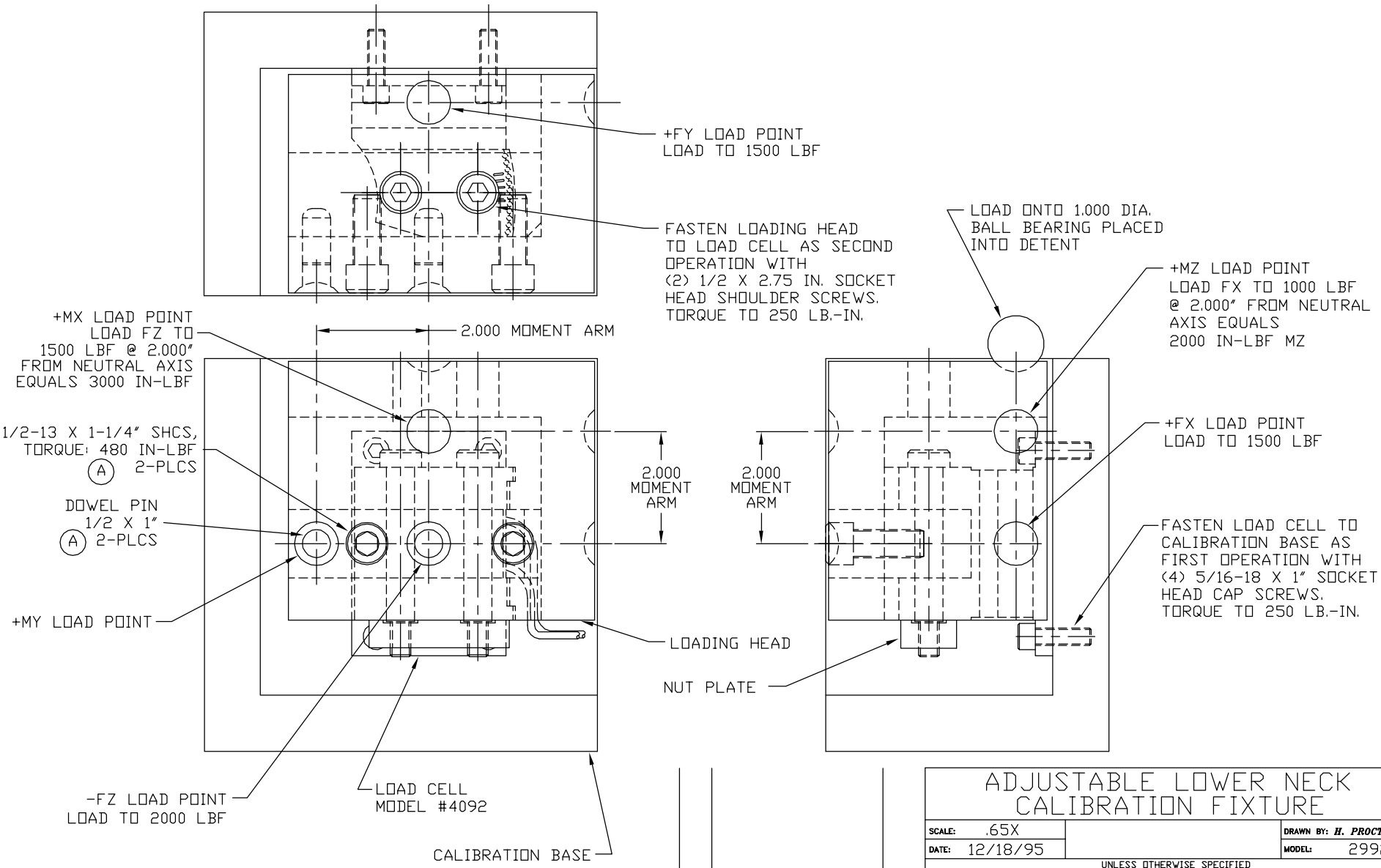
LOW CAPACITY, HYBRID III 50TH, 95TH, BIOSID

SCALE: .65X		DRAWN BY: C.R. MORGAN
DATE: 18MAY98		MODEL: 4092

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4092-D



SYM	REVISION	DATE

ADJUSTABLE LOWER NECK CALIBRATION FIXTURE

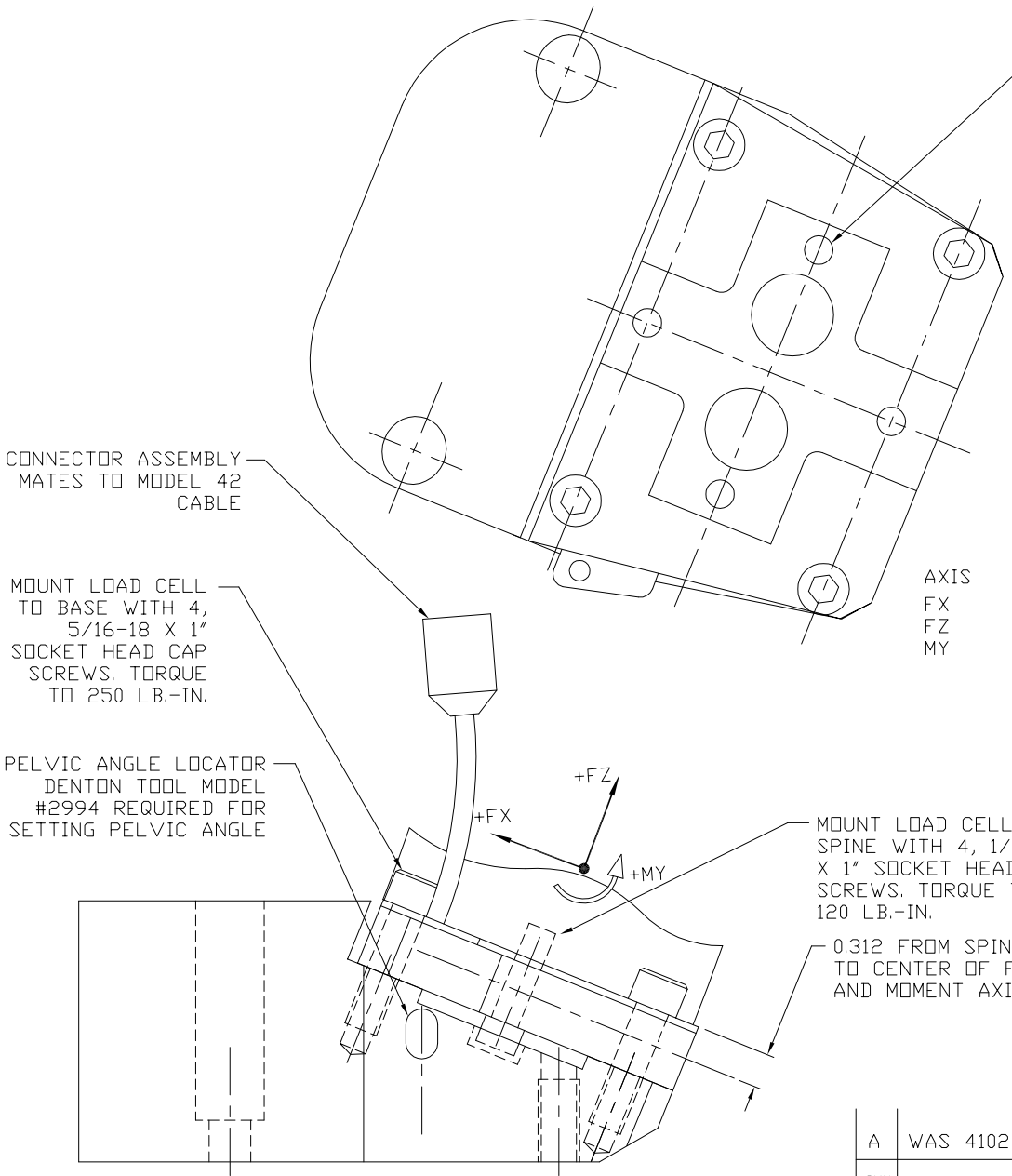
SCALE: .65X		DRAWN BY: H. PROCTOR
DATE: 12/18/95		MODEL: 2992

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4092-C



LUMBAR SPINE LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	5000 N (1100 LBS.)	1.0 mV/V NOMINAL	700 OHMS NOMINAL
FZ	5000 N (1100 LBS.)	1.0 mV/V NOMINAL	700 OHMS NOMINAL
MY	500 NM (4400 LB.-IN.)	2.0 mV/V NOMINAL	350 OHMS NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT OF ASSEMBLY - 15.8 LBS.

THE MODEL 4102 LUMBAR SPINE LOAD CELL ASSEMBLY REPLACES PART 78051-53 BRACKET ASSEMBLY IN THE HYBRID III 50TH AND 95TH TEST DUMMIES. THE SPINE BASE MUST BE MODIFIED AS NOTED ON THE DRAWING.

SYM	REVISION	DATE
A	WAS 4102	10/99

3-CHANNEL LUMBAR SPINE LOAD CELL

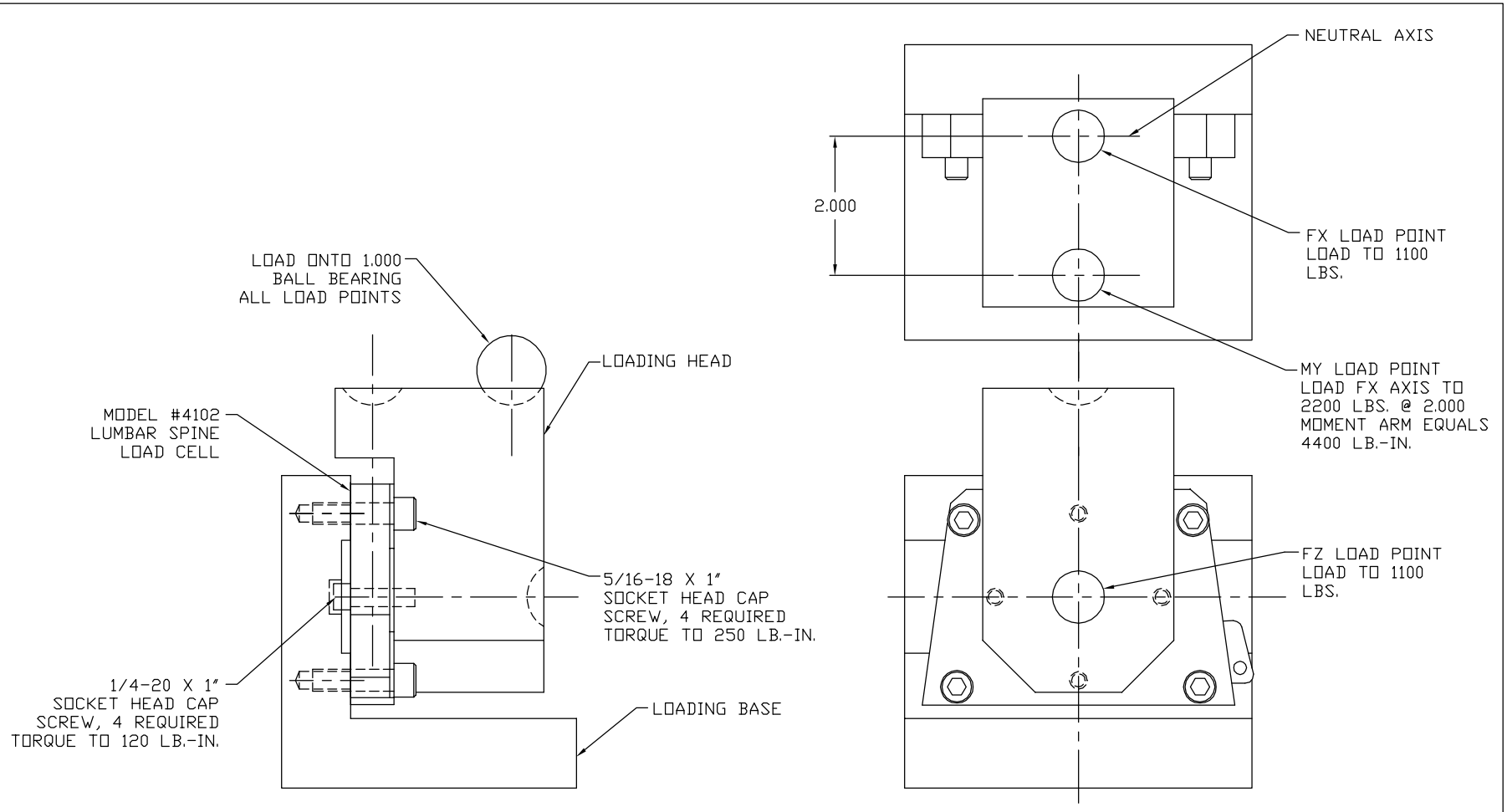
LOW CAPACITY, HYBRID III 50TH AND 95TH PERCENTILE

SCALE: FULL
DATE: 19MAY98
DRAWN BY: C.R. MORGAN
MODEL: 4102

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4102-D



SYM	REVISION	DATE

LUMBAR SPINE CALIBRATION FIXTURE

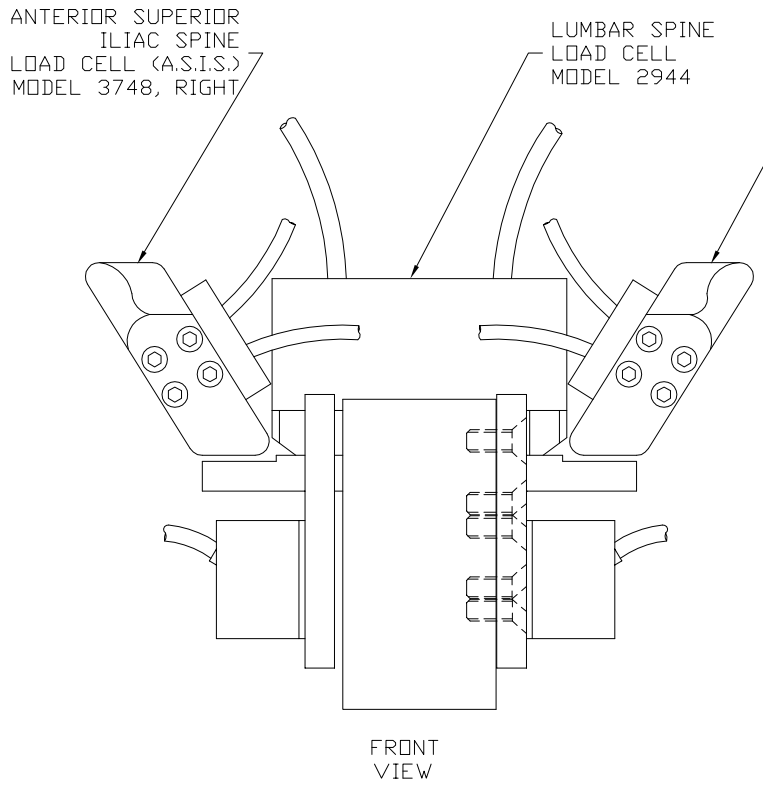
SCALE: .75X		DRAWN BY: C.R. MORGAN
DATE: 2/11/86		MODEL: 1883

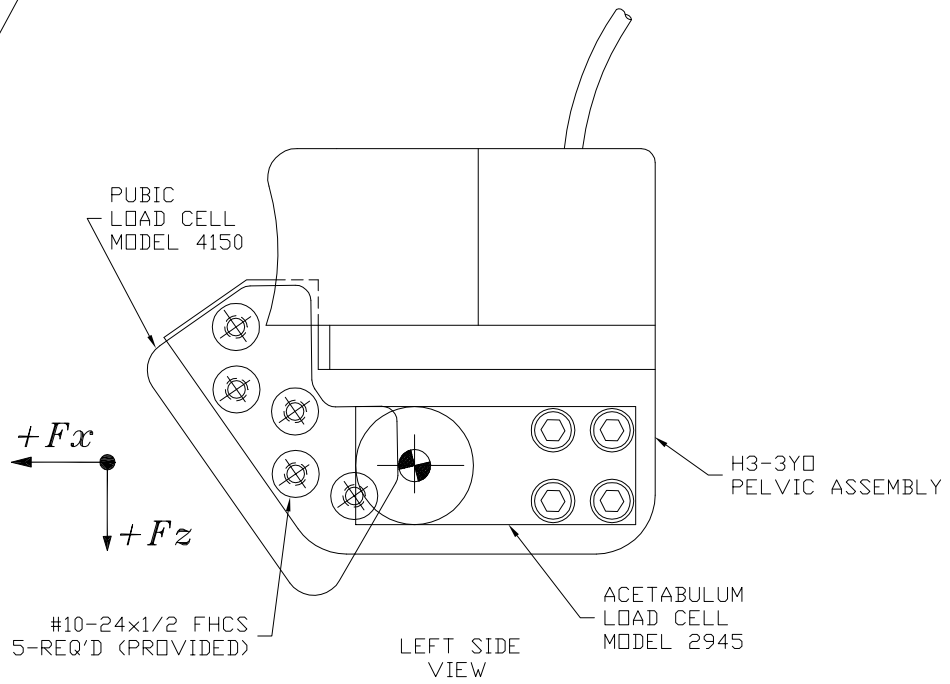
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4102-C





MODEL 4150
HYBRID III THREE YEAR OLD
PUBIC LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
Fx	1000 LBS	1.5 mV/V NOMINAL	350 OHMS
Fz	1000 LBS	1.5 mV/V NOMINAL	350 OHMS

NON-LINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT 0.50 LBS

B	WAS B-4150	9/99
A	CORRECT WEIGHT	12/98

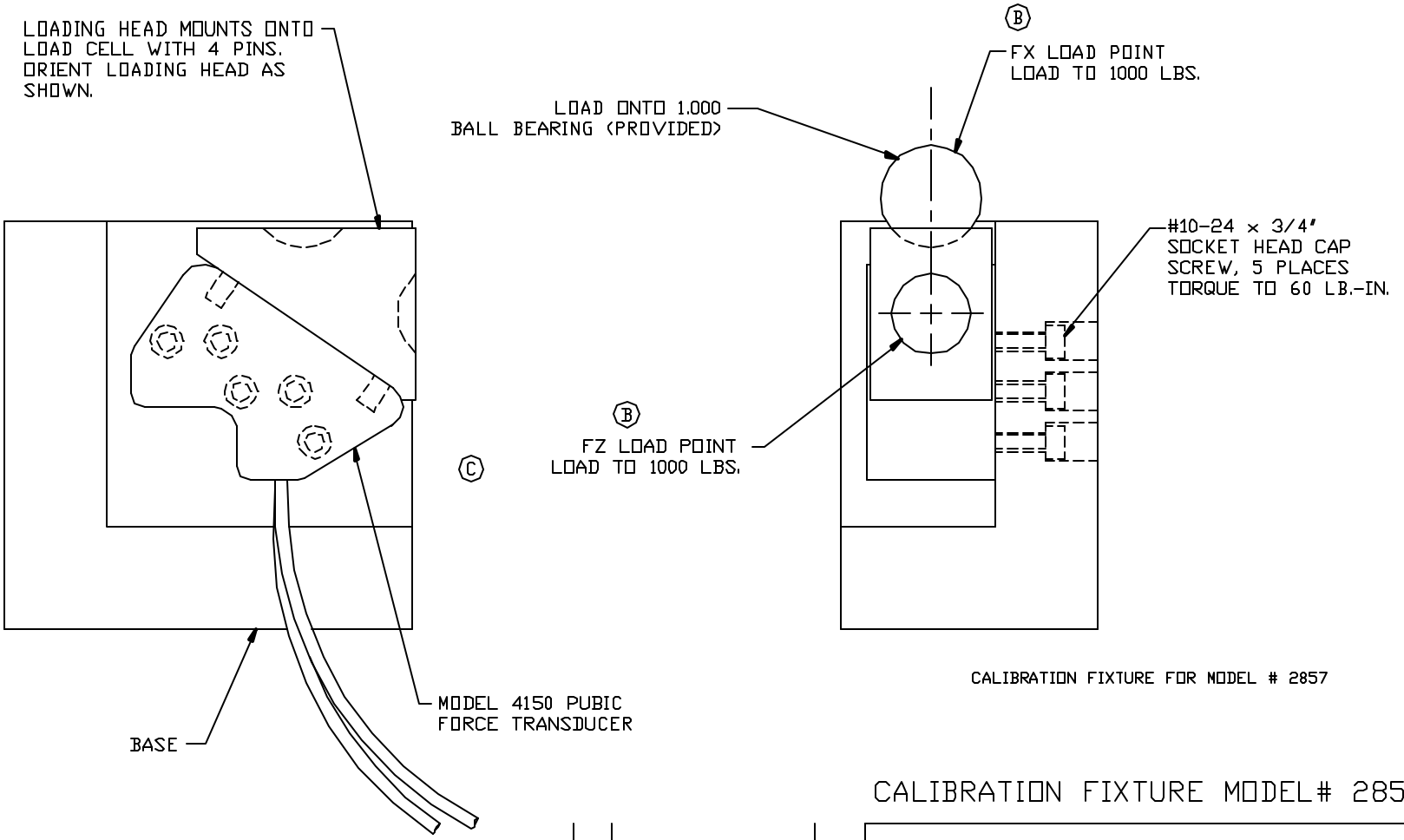
PUBIC LOAD CELL
HYBRID III THREE YEAR OLD (H3-3YO)

SCALE: NONE
DATE: 19JUNE98
DRAWN BY: R. DuPont
MODEL: 4150

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4150-D



CALIBRATION FIXTURE FOR MODEL # 2857

CALIBRATION FIXTURE MODEL# 2857

SYM	REVISION	DATE

H-III 3 YEAR OLD PUBIC LOAD CELL

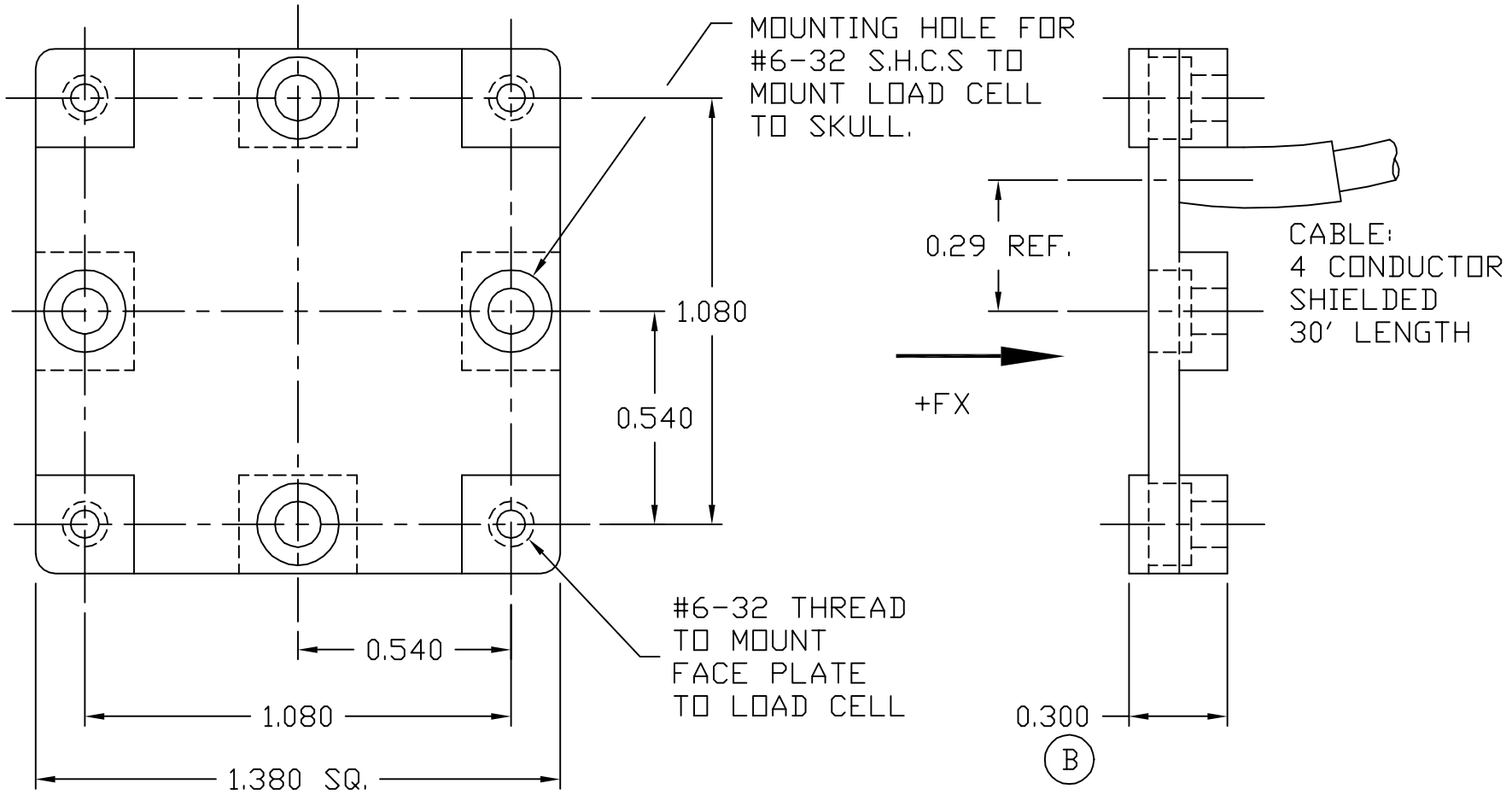
SCALE: FULL		DRAWN BY: SLF POSITIVE
DATE: 8/13/93		MODEL: 4150

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4150-C



CAPACITY: 1000 LBF.
OUTPUT @ CAPACITY 1.5 mV/V
NONLINEARITY <1%

B	WAS 0.350	3/00
A	CHANGE SIZE	3/00

FACE LOAD CELL

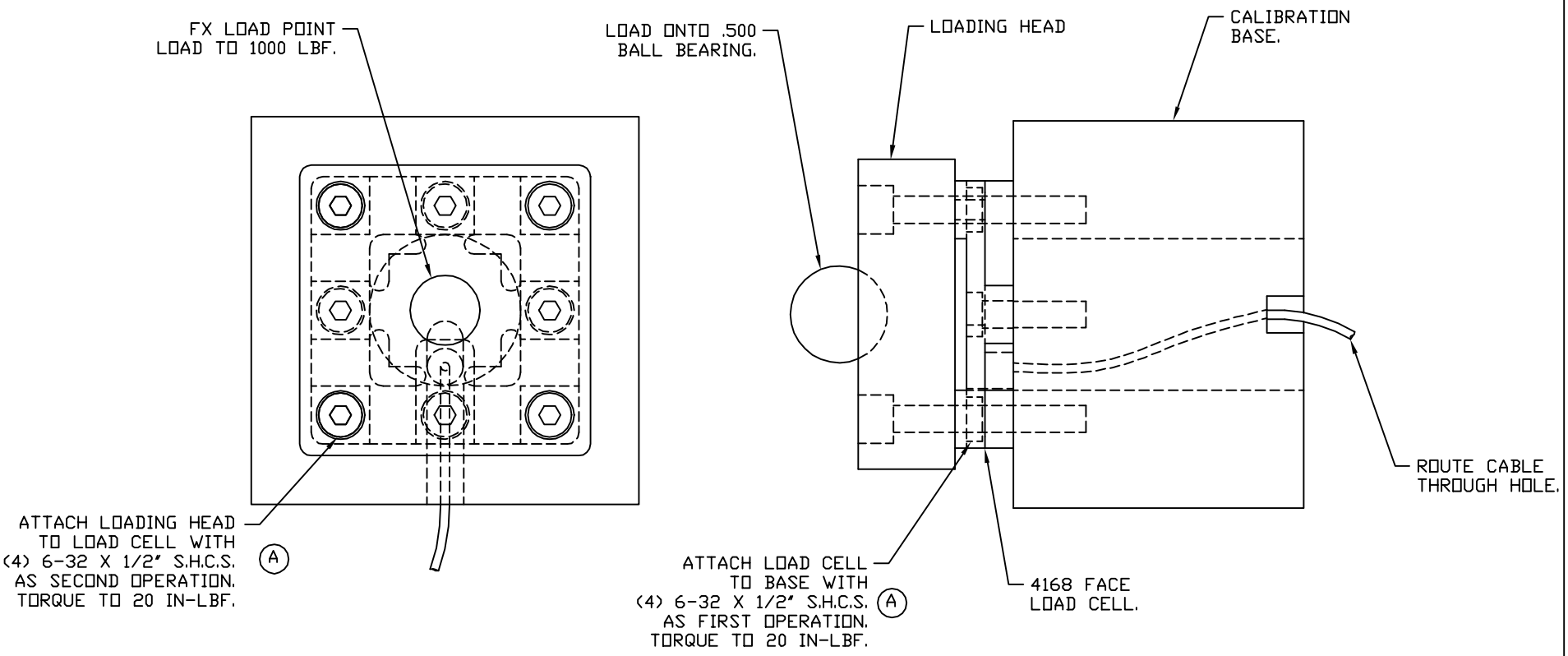
SCALE: NA		DRAWN BY: C.R. MORGAN
DATE: 11JULY98		MODEL: 4168

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-4168-D



CALIBRATION FIXTURE MODEL #4296

A	WAS 3/8" LG	5/00

CAL FIXTURE FOR 4168 FACE

SCALE: 2X		DRAWN BY: C.HEAD
DATE: 4/20/00		MODEL: 4168

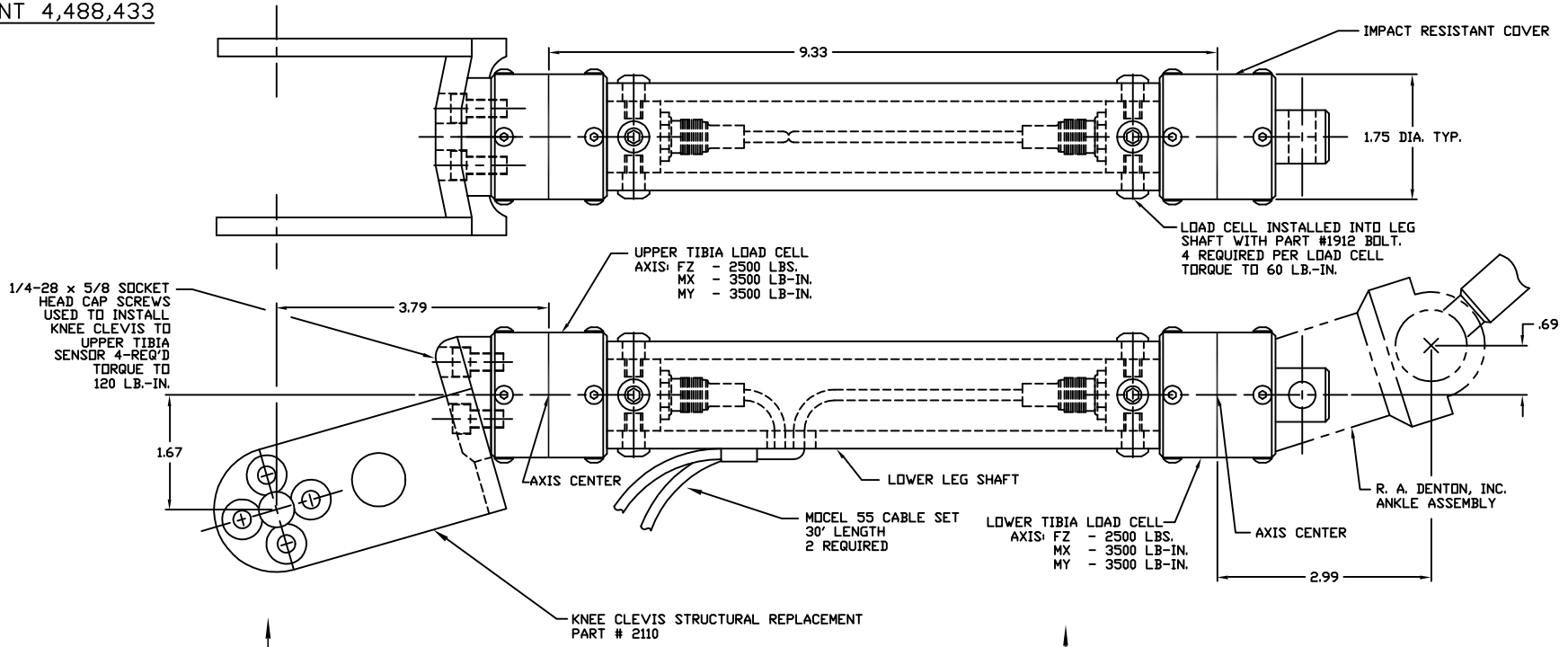
UNLESS OTHERWISE SPECIFIED

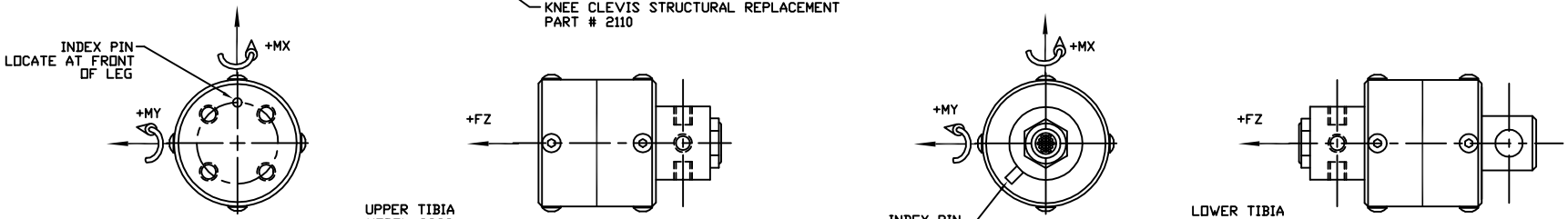
TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4168-C

PATENT 4,488,433





UPPER TIBIA
MODEL 3292

AXIS	CAPACITY	OUTPUT
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

LOWER TIBIA
MODEL 3093

AXIS	CAPACITY	OUTPUT
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SYM	REVISION	DATE
B	DELETE CLEVIS CABLES AND CORRECT CHANNEL LISTS	04NOV99 PJD
A	WAS B-4205	12OCT99

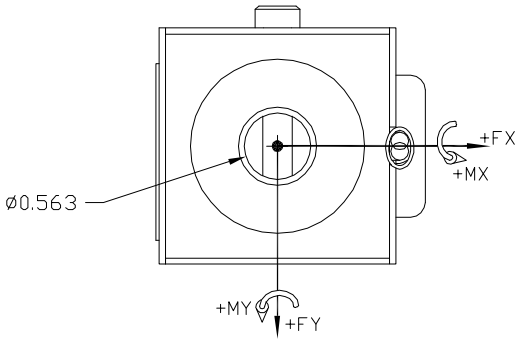
INSTRUMENTED TIBIA
50TH PERCENTILE HYBRID III

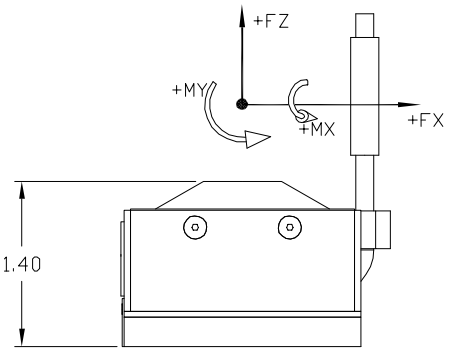
SCALE: NONE
DRAWN BY: C.R. MORGAN
DATE: 10DEC98
MODEL: 4205

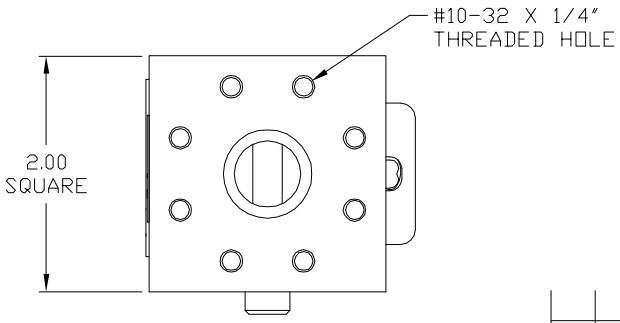
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

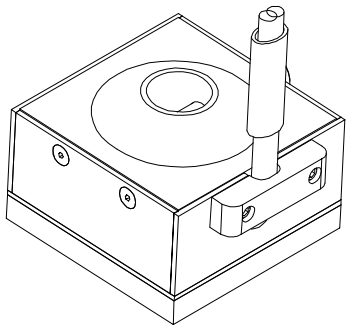
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4205-D









MODEL 4218 ANKLE LOAD CELL

AXIS	CAPACITY	OUTPUT SENSITIVITY
FX	2000 LBF	2.0 mV/V NOMINAL
FY	2000 LBF	2.0 mV/V NOMINAL
FZ	3500 LBF	1.5 mV/V NOMINAL
MX	3500 IN-LBF	1.5 mV/V NOMINAL
MY	3500 IN-LBF	1.5 mV/V NOMINAL

WIRED FOR J-211 POLARITY

SYM	REVISION	DATE	CAR#	INIT.

ANKLE LOAD CELL
FOR H-III

SCALE: 1 : 1 | SHEET 1 OF 1 | DRWN BY: rd

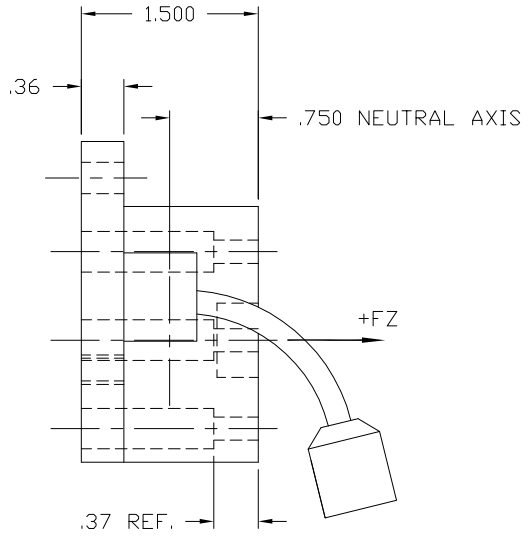
DATE: 20AUG01 | MODEL: 4218-J

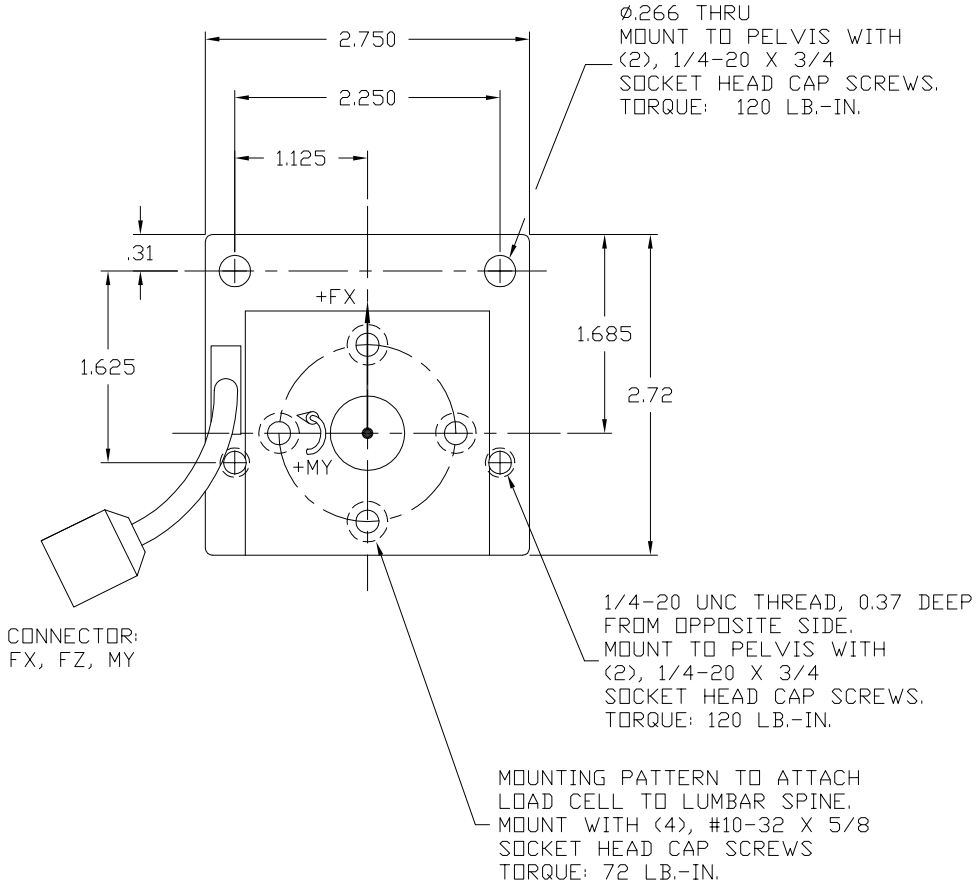
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± 0.010	SURFACE FINISH 125
THREE PLACE DECIMALS	± 0.005	REMOVE ALL BURRS & SHARP EDGES
ANGLES	± 0° 30′	DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4218-D





6 YEAR OLD HYBRID III LUMBAR LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	1000 LBS.	2.0 mV/V NOMINAL	350 Ω
FZ	1600 LBS.	1.0 mV/V NOMINAL	700 Ω
MY	2000 LB.-IN.	1.5 mV/V NOMINAL	700 Ω

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
A	WAS DRG. B-4231	7/99

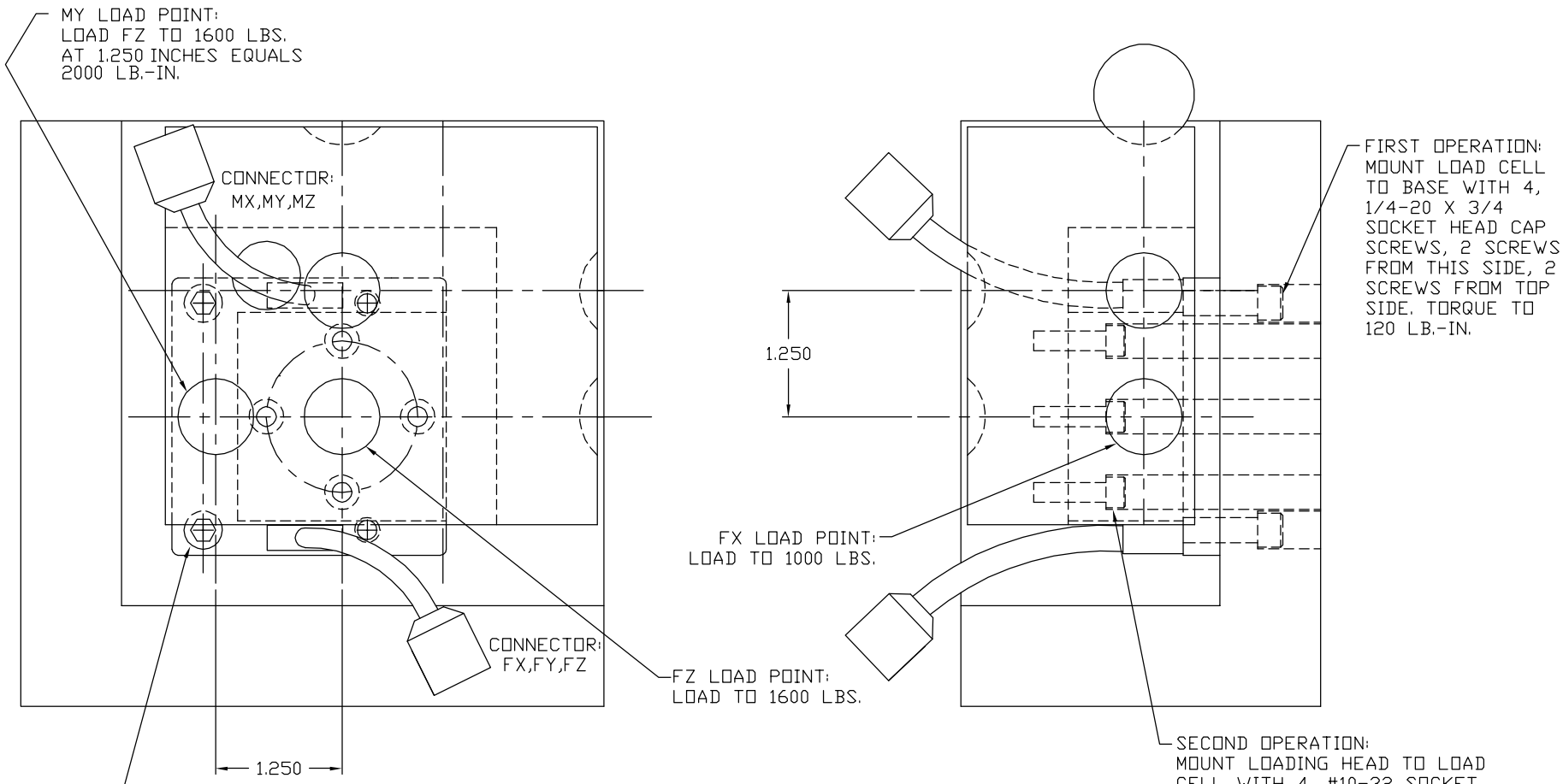
HYBRID III 6 YR. OLD 3 CHANNEL
LUMBAR LOAD CELL

SCALE:	FULL		DRAWN BY: R. DuPont
DATE:	12AUG98		MODEL: 4231

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4231-D



SYM	REVISION	DATE

CALIBRATION FIXTURE

6 YEAR OLD HYBRID III LUMBAR LOAD CELL

SCALE: FULL		DRAWN BY: C.R. MORGAN
DATE: 11/21/92		MODEL: 4231

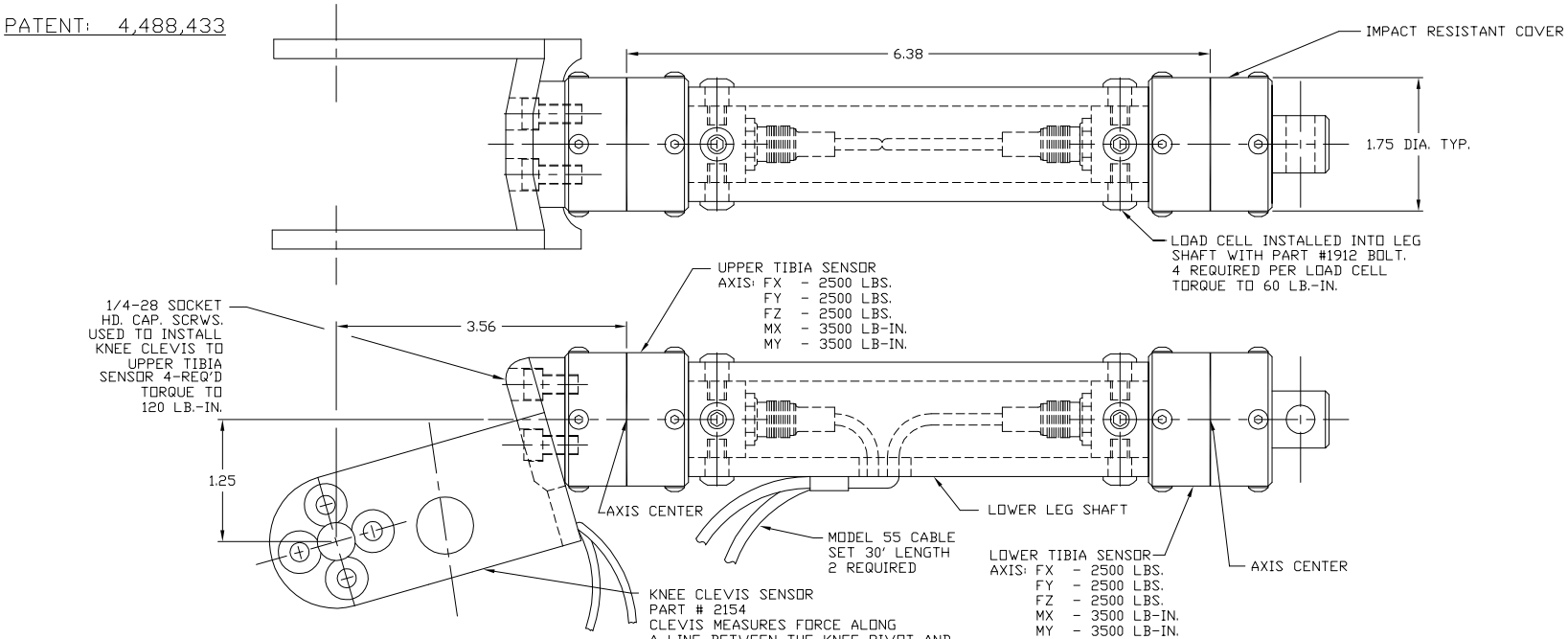
UNLESS OTHERWISE SPECIFIED

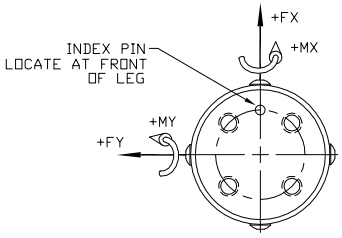
TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

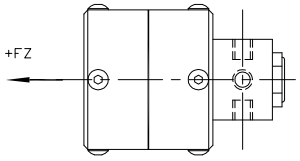
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4231-C

PATENT: 4,488,433

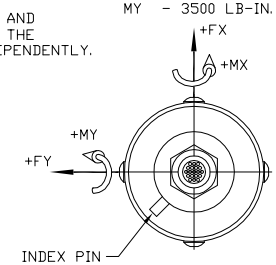


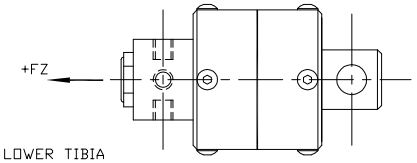




UPPER TIBIA
MODEL 3643

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.





LOWER TIBIA
MODEL 3644

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SYM	REVISION	DATE
A	WAS 4251	10/99

INSTRUMENTED LOWER LEG
5TH PERCENTILE HYBRID III

SCALE:	NONE		DRAWN BY: *H. PROCTOR*
DATE:	2/3/99		MODEL: 4251

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4251-D

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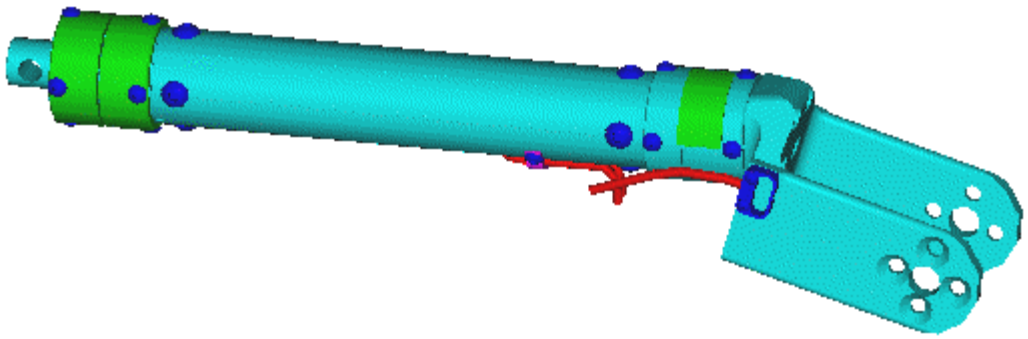


MODEL 4252
LOWER LEG
LOAD CELL ASSEMBLY

Applications:
The Lower Leg Load Cell Assembly (Model# 4252) is three load cells: Knee Clevis (Model 1587), Upper Tibia (Model 3643) and the Lower Tibia (Model 3644). The Model 4252 Lower Leg Load Cell Assembly is used on the Hybrid III 50th percentile Crash Dummy. The instrumented lower leg measures the forces and moments acting upon the lower section of the leg.

Standard Ordering Configuration: 4252
For optional configurations, see load cell ordering guide or consult factory.

Specifications: (for more complete channel information see the Specification sheet for each Load Cell)

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Clevis:				
Left, Fz	4.45 kN	1000 lbf	350 ohms	1.3 mV/V
Right, Fz	4.45 kN	1000 lbf	350 ohms	1.3 mV/V
Upper Tibia:				
Fx	11.1 kN	2500 lbf	350 ohms	2.0 mV/V
Fy	11.1 kN	2500 lbf	350 ohms	2.0 mV/V
Fz	11.1 kN	2500 lbf	700 ohms	1.0 mV/V
Mx	395 NM	3500 in-lbf	700 ohms	3.0 mV/V
My	395 NM	3500 in-lbf	700 ohms	3.0 mV/V
Lower Tibia:				
Fx	11.1 kN	2500 lbf	350 ohms	2.0 mV/V
Fy	11.1 kN	2500 lbf	350 ohms	2.0 mV/V
Fz	11.1 kN	2500 lbf	700 ohms	1.0 mV/V
Mx	395 NM	3500 in-lbf	700 ohms	3.0 mV/V
My	395 NM	3500 in-lbf	700 ohms	3.0 mV/V

Non-linearity ..... less than 1% of full scale
Hysteresis..... less than 1% of full scale
Crosstalk ..... less than 5% of full scale
Excitation ..... 10 VDC nom. 15 VDC max.

Issue Date: 23-Feb-00

MODEL 4252 LOWER LEG LOAD CELL ASSEMBLY

Wiring

Upper & Lower Tibias:

Fx Channel		Fy Channel		Fz Channel	
Brown	+Exc	Red-Stripe	+Exc	Green	+Exc
Red	+Sig	Black	+Sig	Blue	+Sig
Orange	-Exc	White	-Exc	Violet	-Exc
Yellow	-Sig	Black-Stripe	-Sig	Grey	-Sig

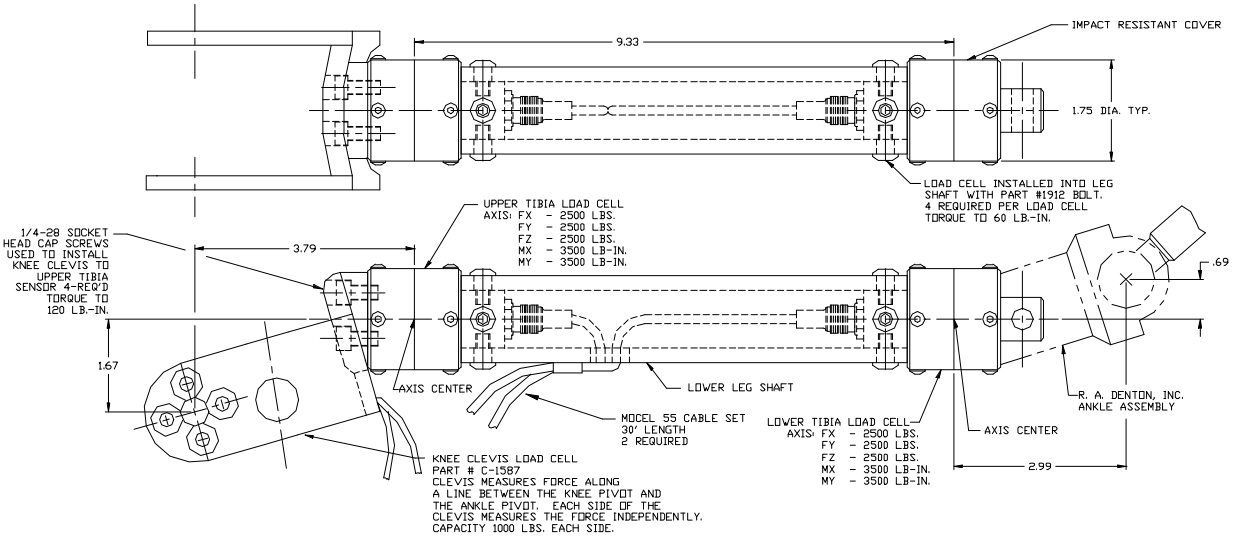
Mx Channel		My Channel	
Brown	+Exc	Red-Stripe	+Exc
Red	+Sig	Black	+Sig
Orange	-Exc	White	-Exc
Yellow	-Sig	Black-Stripe	-Sig

Knee Clevis:

Fz Channel	
Brown	+Exc
Red	+Sig
Orange	-Exc
Yellow	-Sig

NOTES

1. Use Denton Model 2171 and 1861 calibration fixture. (Ref. Calibration Fixture drawing 4252-C)
2. This load cell is not wired for SAE J211 Right Hand Rule sign convention indicated by the suffix "J" on the model tag on the load cell.
3. If the model tag on the load cell includes a "G" suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an "I" suffix, there is an ID module in the body of the load cell. The number following the "I" indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30'). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.



Creating the Standard in Safety Measurement Since 1974

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Issue Date: 23-Feb-00

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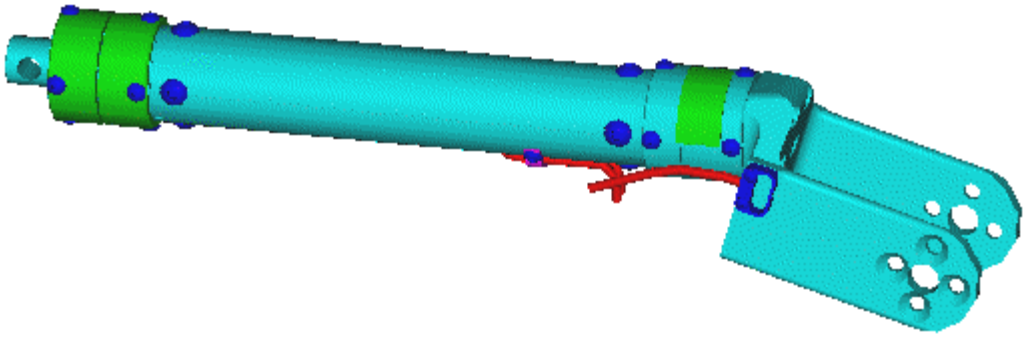


MODEL 4253
LOWER LEG
LOAD CELL ASSEMBLY

Applications:
The Lower Leg Load Cell Assembly (Model# 4253) is three load cells: Knee Clevis (Model 2372), Upper Tibia (Model 3643) and the Lower Tibia (Model 3644). The Model 4253 Lower Leg Load Cell Assembly is used on the Hybrid III 95th percentile Crash Dummy. The instrumented lower leg measures the forces and moments acting upon the lower section of the leg.

Standard Ordering Configuration: 4253J
For optional configurations, see load cell ordering guide or consult factory.

Specifications: (for more complete channel information see the Specification sheet for each Load Cell)

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Clevis:				
Left, Fz	8.9 kN	2000 lbf	350 ohms	2.0 mV/V
Right, Fz	8.9 kN	2000 lbf	350 ohms	2.0 mV/V
Upper Tibia:				
Fx	11.1 kN	2500 lbf	350 ohms	2.0 mV/V
Fy	11.1 kN	2500 lbf	350 ohms	2.0 mV/V
Fz	11.1 kN	2500 lbf	700 ohms	1.0 mV/V
Mx	395 NM	3500 in-lbf	700 ohms	3.0 mV/V
My	395 NM	3500 in-lbf	700 ohms	3.0 mV/V
Lower Tibia:				
Fx	11.1 kN	2500 lbf	350 ohms	2.0 mV/V
Fy	11.1 kN	2500 lbf	350 ohms	2.0 mV/V
Fz	11.1 kN	2500 lbf	700 ohms	1.0 mV/V
Mx	395 NM	3500 in-lbf	700 ohms	3.0 mV/V
My	395 NM	3500 in-lbf	700 ohms	3.0 mV/V

Non-linearity ..... less than 1% of full scale
Hysteresis..... less than 1% of full scale
Crosstalk ..... less than 5% of full scale
Excitation ..... 10 VDC nom. 15 VDC max.

Issue Date: 23-Feb-00

MODEL 4253 LOWER LEG LOAD CELL ASSEMBLY

Wiring

Upper & Lower Tibias:

Fx Channel		Fy Channel		Fz Channel	
Brown	+Exc	Red-Stripe	+Exc	Green	+Exc
Red	+Sig	Black	+Sig	Blue	+Sig
Orange	-Exc	White	-Exc	Violet	-Exc
Yellow	-Sig	Black-Stripe	-Sig	Grey	-Sig

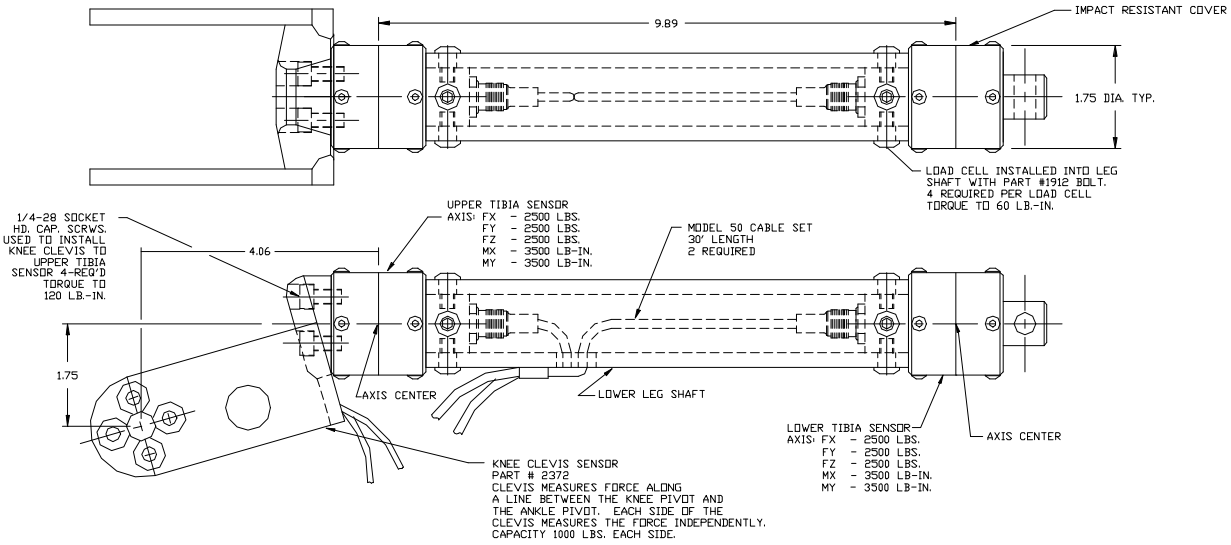
Mx Channel		My Channel	
Brown	+Exc	Red-Stripe	+Exc
Red	+Sig	Black	+Sig
Orange	-Exc	White	-Exc
Yellow	-Sig	Black-Stripe	-Sig

Knee Clevis:

Fz Channel	
Brown	+Exc
Red	+Sig
Orange	-Exc
Yellow	-Sig

NOTES

1. Use Denton Model 2171 and 1861 calibration fixture. (Ref. Calibration Fixture drawing 4253-C)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.



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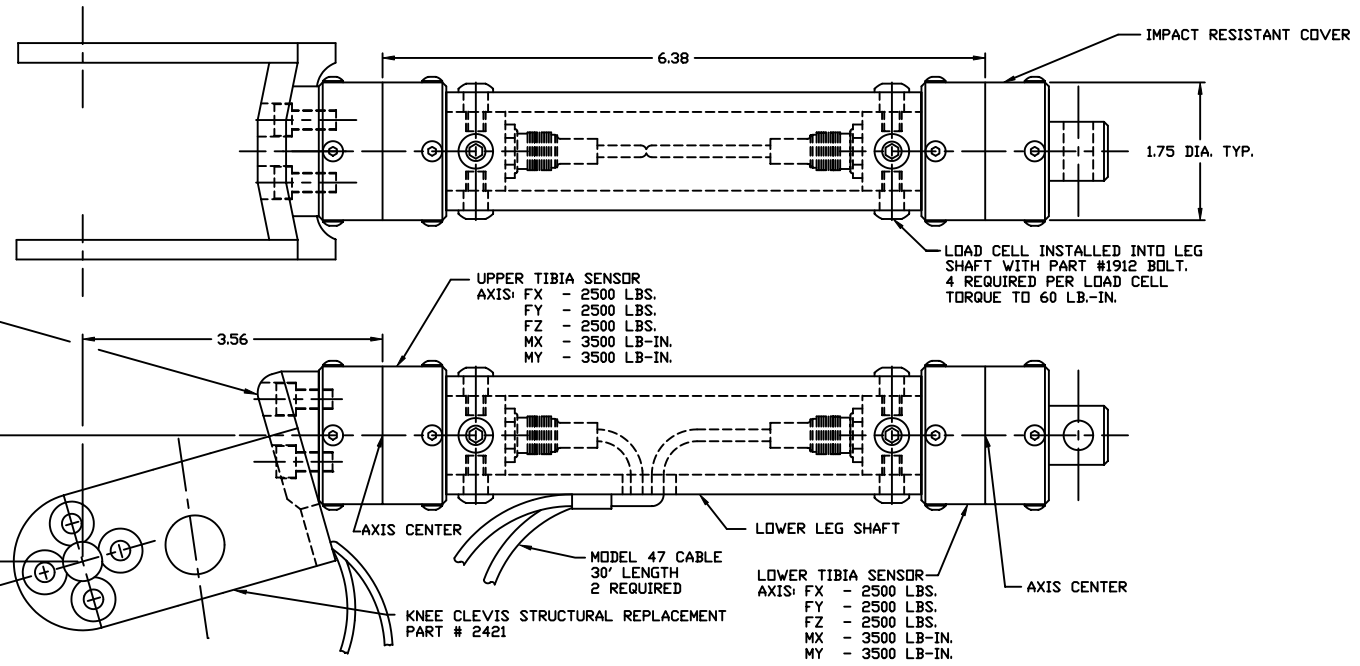
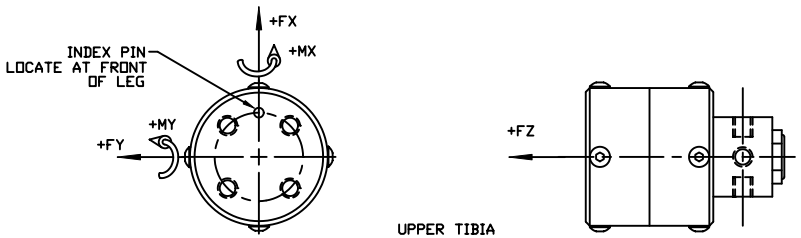
Issue Date: 23-Feb-00

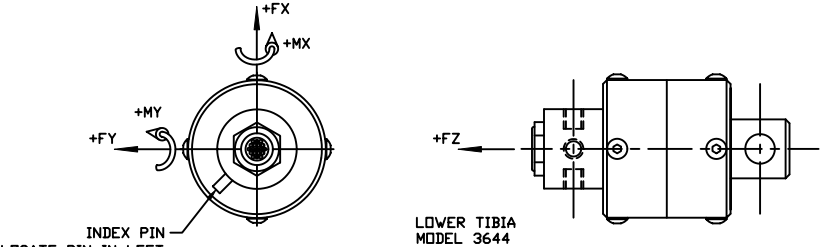
PATENT: 4,488,433





UPPER TIBIA
MODEL 3643

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.



LOWER TIBIA
MODEL 3644

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SYM	REVISION	DATE

INSTRUMENTED LOWER LEG

5TH PERCENTILE HYBRID III

SCALE: NONE		DRAWN BY: CRM
DATE: 2/3/99		MODEL: 4254

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS ± .010 SURFACE FINISH 125

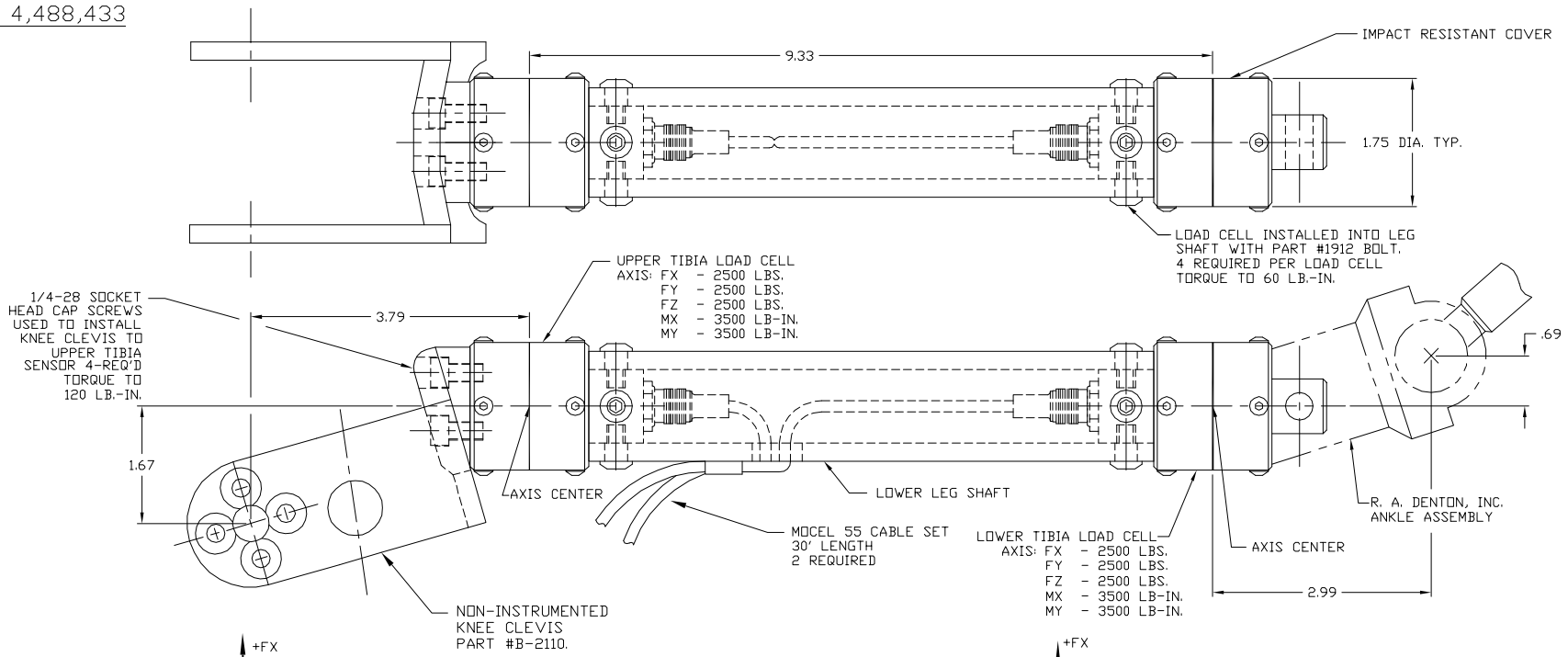
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES

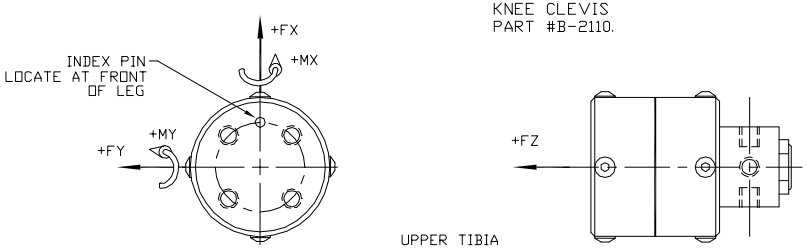
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4254-D

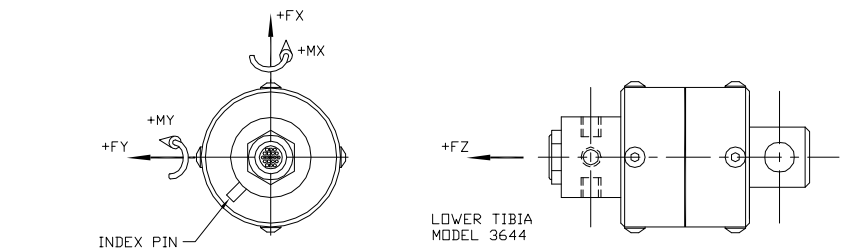
PATENT 4,488,433





UPPER TIBIA
MODEL 3643

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.



LOWER TIBIA
MODEL 3644

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SYM	REVISION	DATE

ENHANCED INSTRUMENTED TIBIA

50TH PERCENTILE HYBRID III

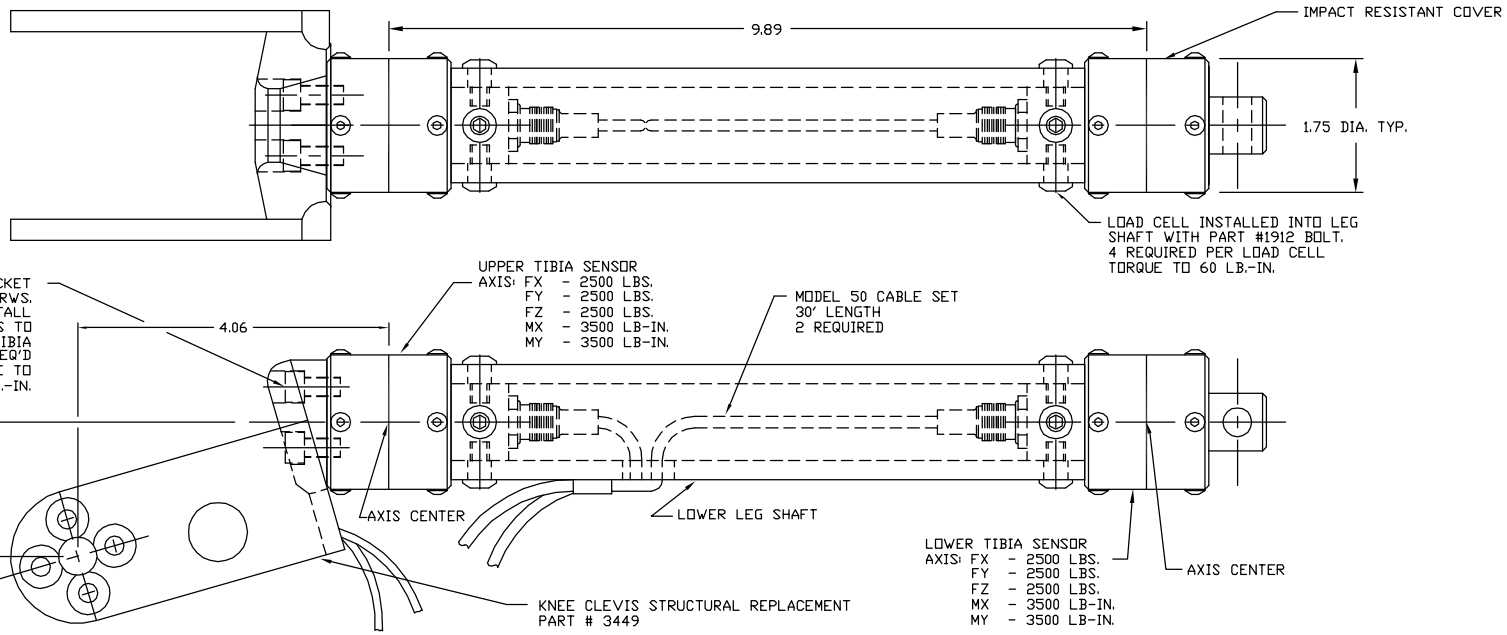
SCALE: NONE		DRAWN BY: C.R. MORGAN
DATE: 01/23/01		MODEL: 4255

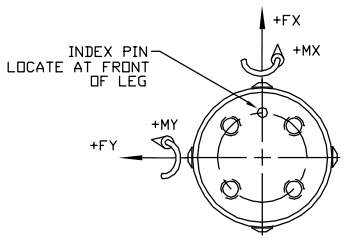
UNLESS OTHERWISE SPECIFIED

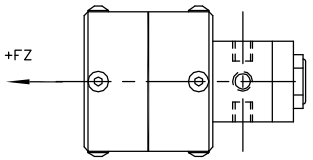
TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4255-D

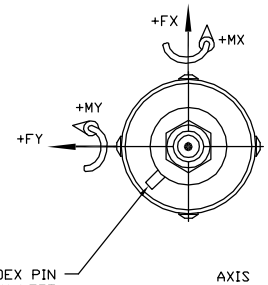


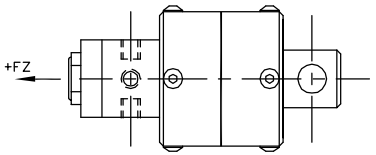




UPPER TIBIA
MODEL 3643

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.





LOWER TIBIA
MODEL 3644

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SYM	REVISION	DATE

INSTRUMENTED LOWER LEG

95TH PERCENTILE HYBRID III

SCALE: NONE		DRAWN BY: H. PROCTOR
DATE: 5/21/96		MODEL: 4256

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4256-D

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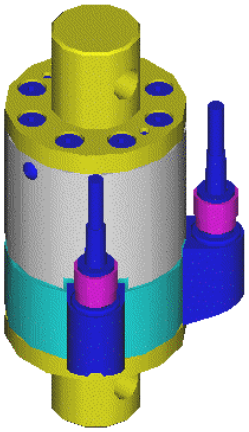


MODEL 4257
FEMUR LOAD CELL

Applications:
The Femur Load Cell (Model# 4257) is a six-channel force (Fx, Fy, Fz) and moment (Mx, My, Mz) measurement device. Model 4257 is designed to measure the forces and moment between the Upper Femur and the Knee Assembly of all the adult size Crash Test Dummies (H3-5th, 50th, 95th, H2-50th, BioSID, SID-IIs, SID).

Standard Ordering Configuration: 4257J
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Fx	13.3 kN	3000 lbf	350 ohms	1.8 mV/V
Fy	13.3 kN	3000 lbf	350 ohms	1.8 mV/V
Fz	22.2 kN	5000 lbf	700 ohms	1.2 mV/V
Mx	339 NM	3000 in-lbf	350 ohms	1.5 mV/V
My	339 NM	3000 in-lbf	350 ohms	1.5 mV/V
Mz	339 NM	3000 in-lbf	700 ohms	2.6 mV/V

Non-linearity ..... less than 1% of full scale
Hysteresis..... less than 1% of full scale
Crosstalk ..... less than 5% of full scale
Excitation ..... 10 VDC nom. 15 VDC max.

Wiring:

Fx Channel		Fy Channel		Fz Channel	
Brown	+Exc	Red-Stripe	+Exc	Green	+Exc
Red	+Sig	Black	+Sig	Blue	+Sig
Orange	-Exc	White	-Exc	Violet	-Exc
Yellow	-Sig	Black-Stripe	-Sig	Grey	-Sig

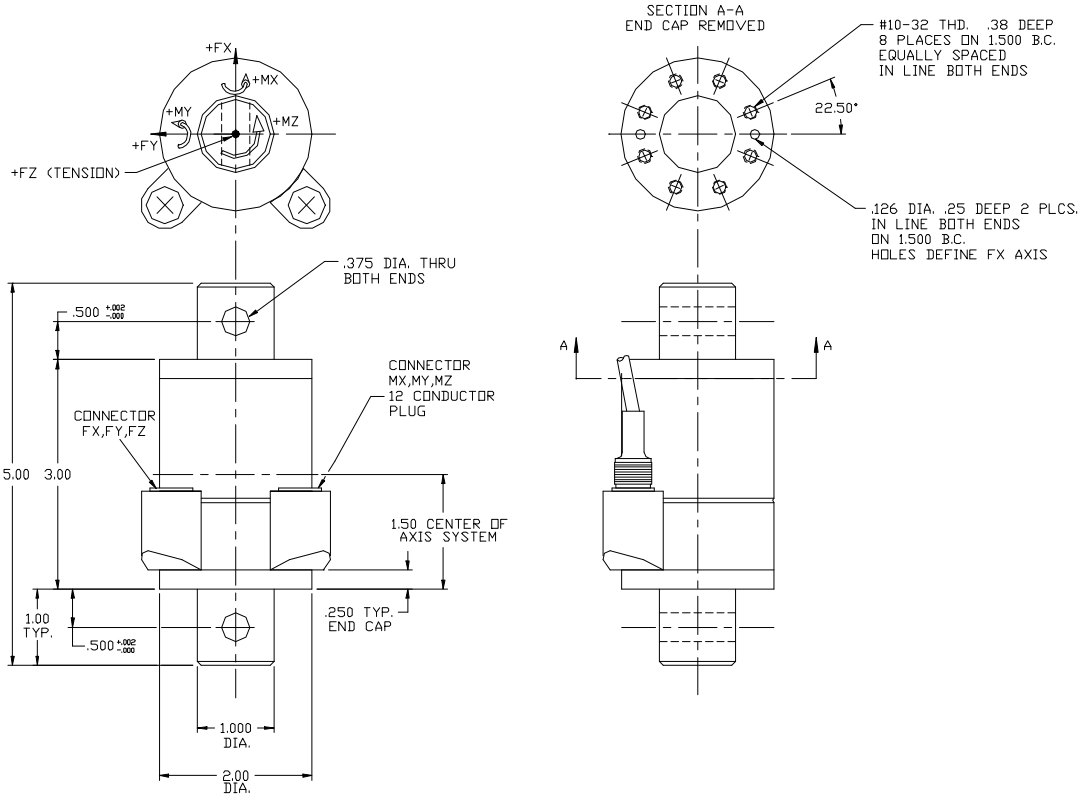
Mx Channel		My Channel		Mz Channel	
Brown	+Exc	Red-Stripe	+Exc	Green	+Exc
Red	+Sig	Black	+Sig	Blue	+Sig
Orange	-Exc	White	-Exc	Violet	-Exc
Yellow	-Sig	Black-Stripe	-Sig	Grey	-Sig

Issue Date: 7-Feb-00

MODEL 4257 FEMUR
LOAD CELL

NOTES

1. Use Denton Model 1957 calibration fixture. (Ref. Calibration Fixture drawing 4257-C)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.



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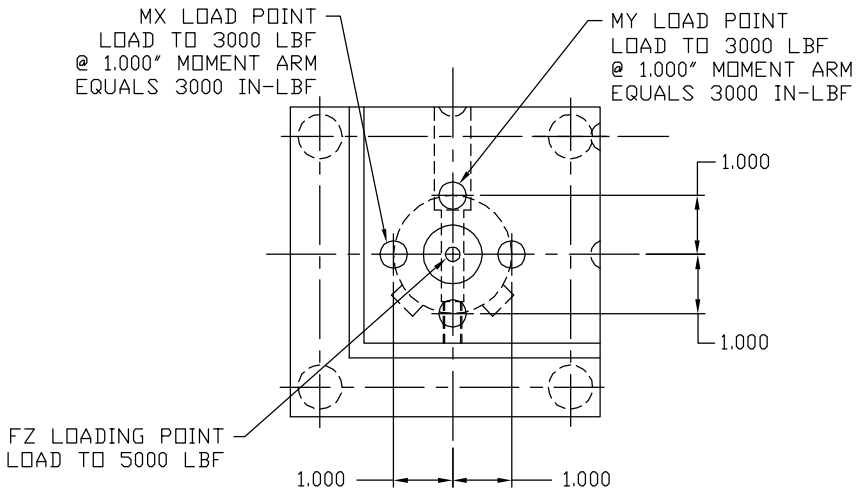
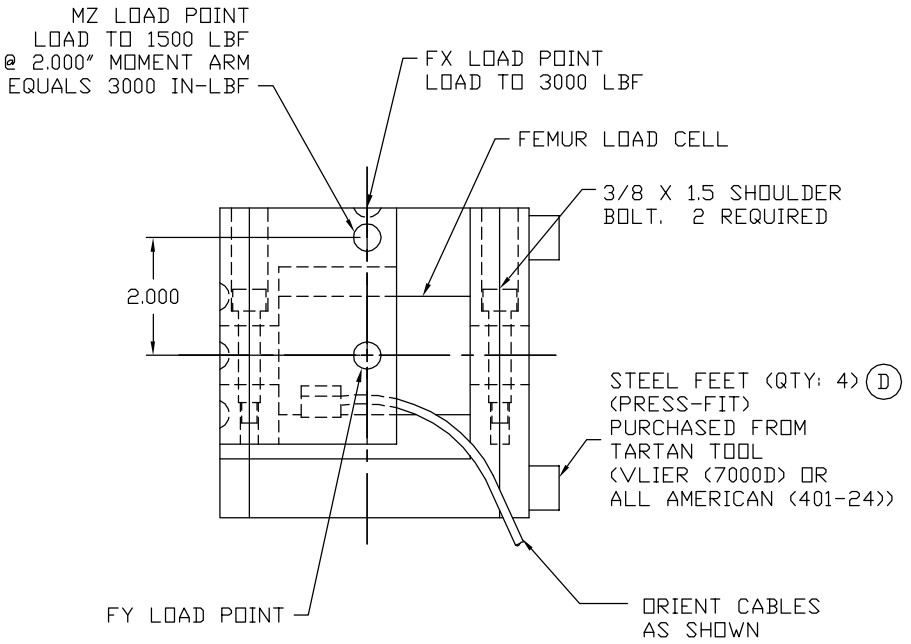
Issue Date: 7-Feb-00





CAL. FIXTURE #: 1957

USED-ON	SYM	REVISION	DATE

FEMUR CALIBRATION FIXTURE

SCALE: 1/2			DRAWN BY: C.R.M./S.E.F.
DATE: 11/10/86			MODEL: 4257

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4257-C

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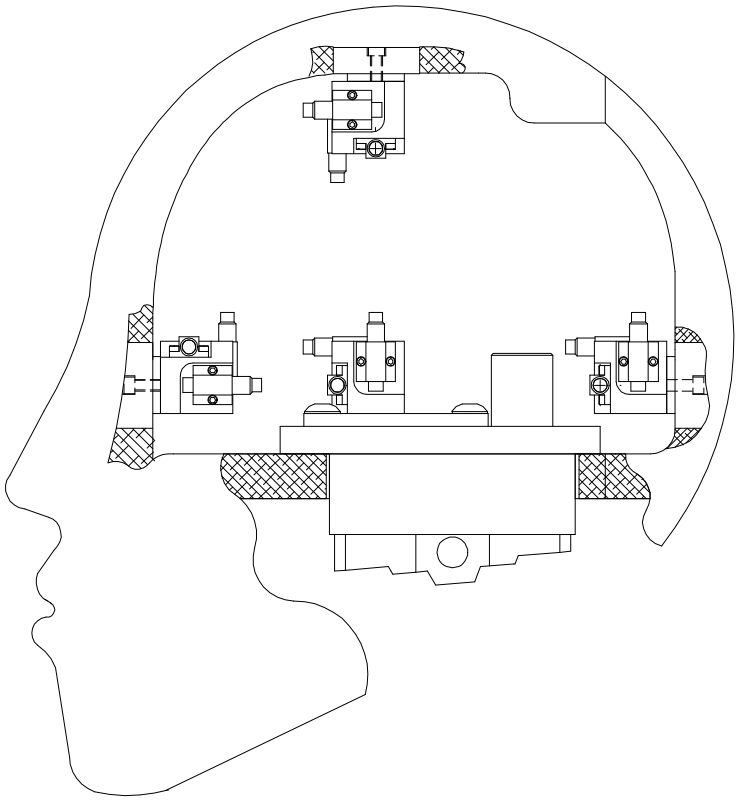


MODEL 4263
SMALL FEMALE HEAD
ACCELEROMETER ARRAY

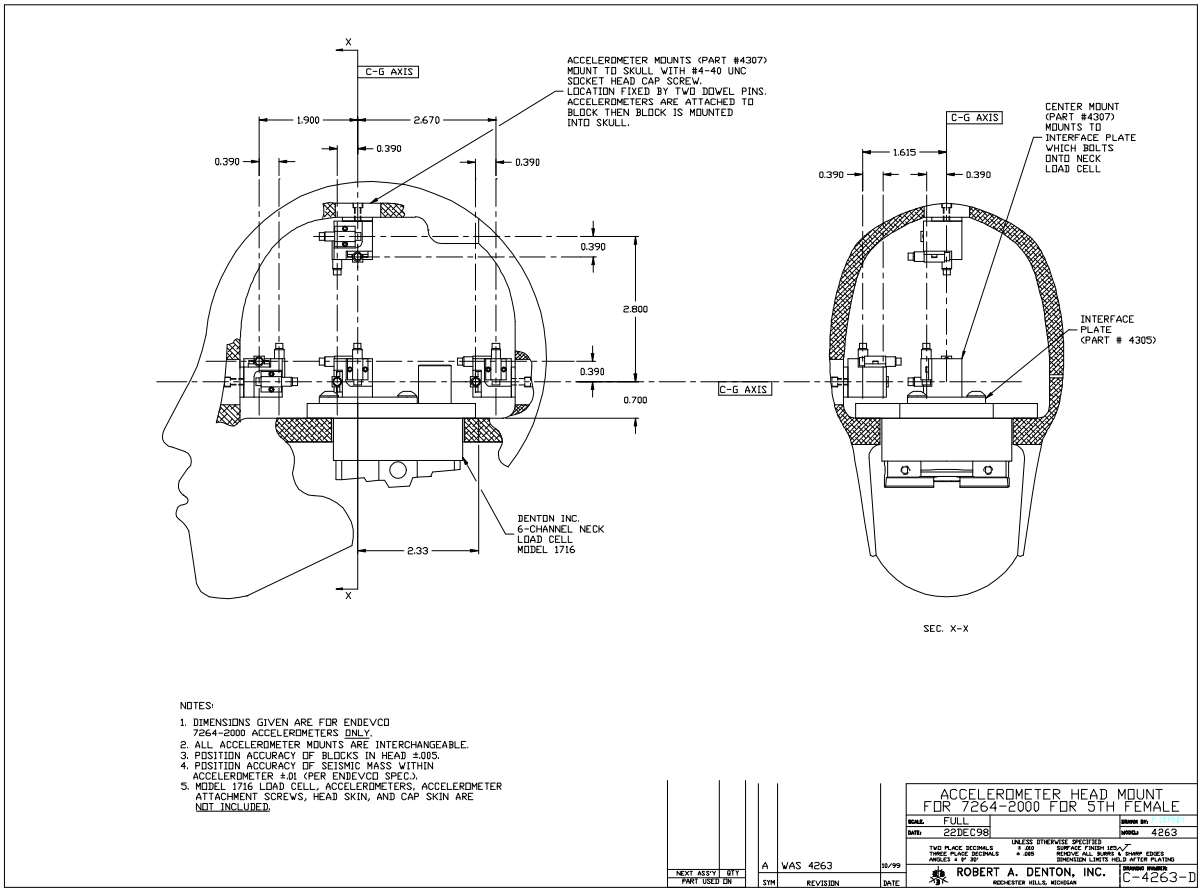
Applications:
The Accelerometer Mounting Head for the Hybrid III 5th percentile (Small Female) ATD and is capable of mounting up to fifteen Endevco 7264-2000 or 7264C-2000 (or equivalent) accelerometers. The 4263 is a modification of a H3-5F skull to install triaxial accelerometer mounts at the top, front, left side and rear of the skull. A C-G mount is also included. These additional accelerometers are utilized to calculate rotational accelerations based on the 9-accelerometer method. Model 4263 does not include: the Model 1716 six-channel Upper Neck load cell, accelerometers, accelerometer attachment screws, the head skin nor the skull cap or skull cap skin. However, upon request, Denton can provide a complete skull assembly with flesh tested and certified or modify an existing skull.

Issue Date: 18-Dec-00

MODEL 4263
ACCELEROMETER HEAD MOUNTING

NOTES

1. All accelerometer mounts are interchangeable.
2. The accelerometers are attached to the mounting cube, then the cubes are attached to the skull with a #4-40 X 3/8" screw from the outside of the skull.
3. The C-G mount interface plate is mounted to the standard 6-channel upper neck load cell (Model 1716).



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Issue Date: 18-Dec-00

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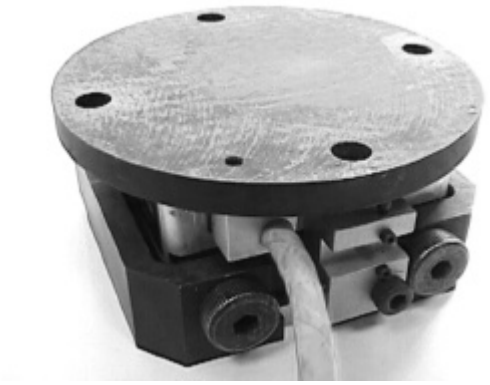


MODEL 4284 EUROSID T-12 LOAD CELL

Applications:

The Model 4284 Eurosid T-12 load cell was designed to provide a way to measure two forces and two moments at the T-12 location in the Eurosid-1 or Eurosid-2 dummy. The top of the load cell assembly attaches to the spine box. The bottom of the load cell assembly attaches to the abdominal drum and lumbar spine. In the Eurosid-1 dummy, the spine box, abdominal drum, and lumbar spine must be modified. The load cell contains four channels, all of which are a full bridge strain gage circuit. This load cell is wired per the SAE J211 Right Hand Rule sign convention.

Standard Ordering Configuration: 4284J
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Fx	14,000 N	3,147 lbf	350 ohms	1.7 mv/v
Fy	14,000 N	3,147 lbf	350 ohms	1.7 mv/v
Mx	1,000 Nm	8,851 in-lbf	700 ohms	1.9 mv/v
My	1,000 Nm	8,851 in-lbf	700 ohms	1.9 mv/v

Nonlinearity .....less than 1% of full scale
Hysteresis .....less than 1% of full scale
Crosstalk .....less than 5% of full scale
Excitation .....10 VDC nom. 15 VDC max.
Mass (without cable, with mounting screws)..... (2.0 lb) 0.90 kg

Wiring:

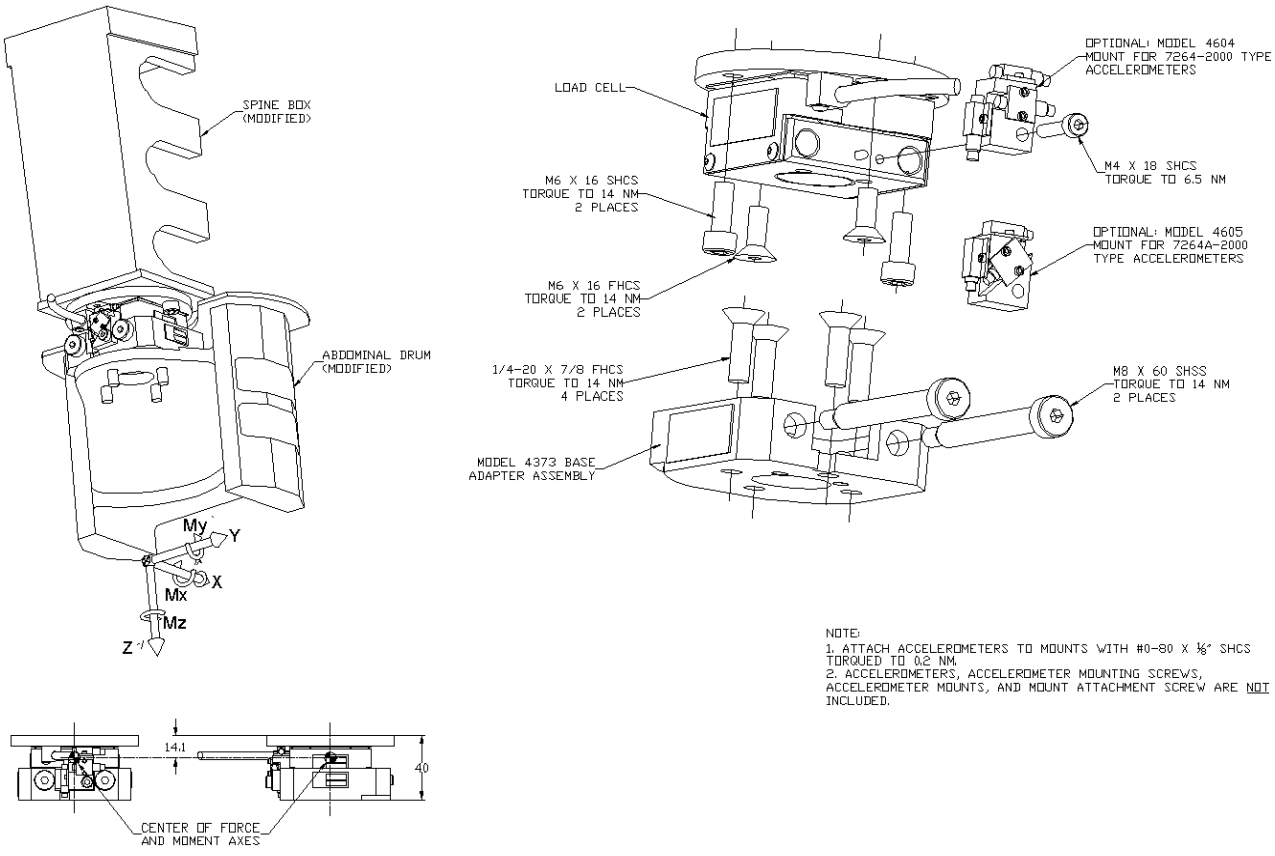
Fx Channel		Fy Channel		Mx Channel		My Channel	
Brown	+Exc.	Red Stripe	+Exc.	Green Stripe	+Exc.	Green	+Exc.
Red	+Sig.	Black	+Sig.	Blue Stripe	+Sig.	Blue	+Sig.
Orange	-Exc.	White	-Exc.	Orange Stripe	-Exc.	Violet	-Exc.
Yellow	-Sig.	Black Stripe	-Sig.	Yellow Stripe	-Sig.	Gray	-Sig.

Issue Date: 20DEC99

MODEL 4284 EUROSID T-12 LOAD CELL

NOTES

1. Use Denton Model 4284-C calibration fixture. (Ref. Calibration Fixture Section)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.
6. Optional model 4593: modify Eurosid-1 spine box.
7. Optional model 4594: modify Eurosid-1 abdominal drum.
8. Optional model 4597: modify Eurosid-1 lumbar spine.
9. Optional model 4604: mount for Endevco 7264-2000 or 7264C-2000 accelerometers.
10. Optional model 4605: mount for Endevco 7264A-2000 or 7264B-2000 accelerometers.
11. Optional Model 4629: load cell structural replacement.



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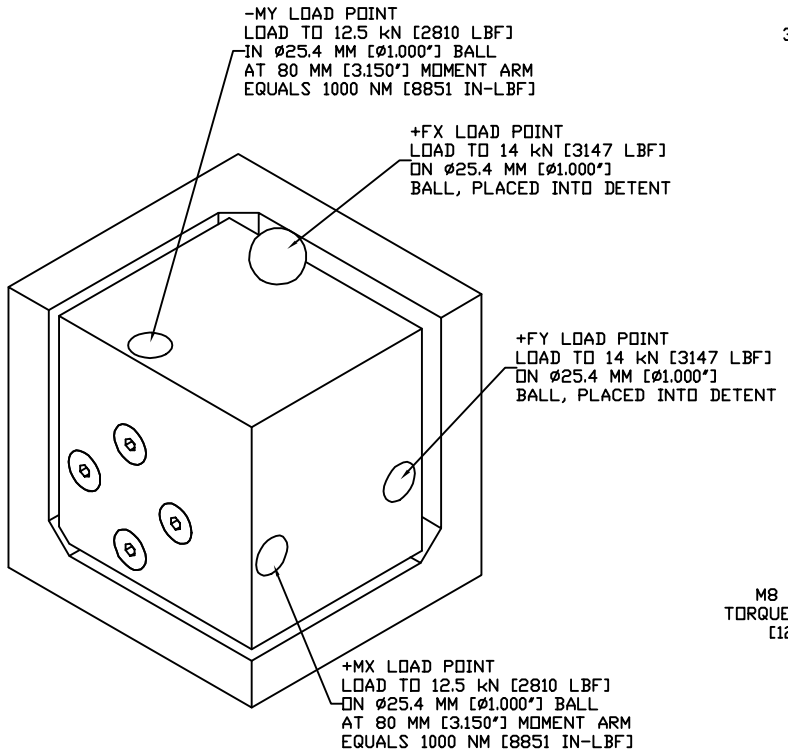
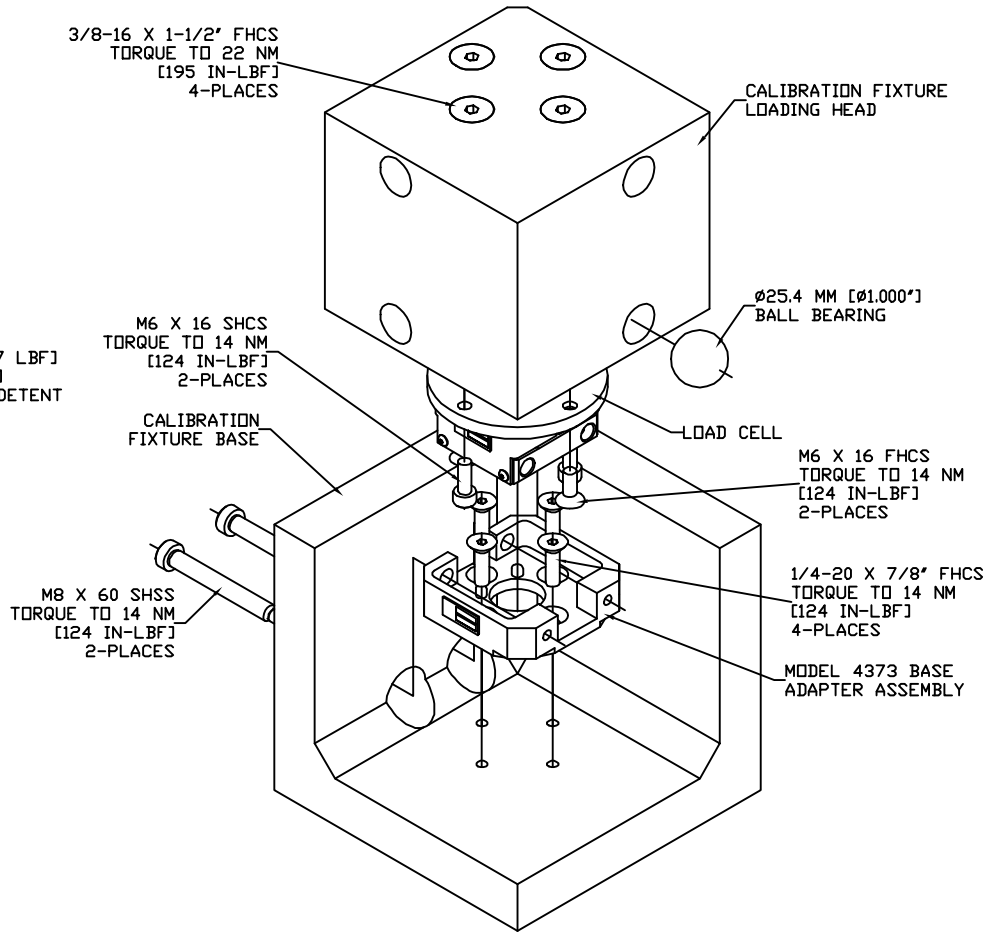
Issue Date: 20DEC99





ASSEMBLY INSTRUCTIONS:

1. SEPARATE 4373 BASE FROM LOAD CELL BY REMOVING M8 X 60 SHSS (2 PLACES).
2. ORIENT 4373 BASE WITH THREADS FOR M8 X 60 SHSS AWAY FROM OPPOSITE THRU HOLES AND ATTACH 4373 BASE TO CAL. FIXTURE BASE USING FOUR (4) 1/4-20 X 7/8" FHCS. TORQUE TO 14 NM.
3. ORIENT LOAD CELL WITH CABLE AWAY FROM CORNER OF LOADING HEAD AND ATTACH LOAD CELL TO CAL. FIXTURE LOADING HEAD USING TWO (2) M6 X 16 SHCS AND TWO (2) M6 X 16 FHCS. TORQUE TO 14 NM.
4. LOWER LOAD CELL/LOADING HEAD ASSEMBLY ONTO 4373/FIXTURE BASE ASSEMBLY SO THAT LOAD CELL SLIDES INTO 4373 BASE AND DOWEL PINS ALIGN WITH HOLES IN LOAD CELL.
5. INSERT TWO (2) M8 X 60 SHSS THRU CLEARANCE HOLES IN FIXTURE BASE INTO 4373 BASE TO JOIN LOAD CELL TO 4373 BASE. TORQUE TO 14 NM.

NEXT ASS'Y	QTY
PART USED ON	

SYM	REVISION	DATE
A	ADD CAL. FIXT. #	27JAN00 PJD

Ⓐ USE CALIBRATION FIXTURE 4620

CALIBRATION FIXTURE FOR EUROSID-1 LOAD CELL MODEL 4284

SCALE:	VARIES		DRAWN BY: P. DEPINET
DATE:	09APR99		MODEL: 4284

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4284-C

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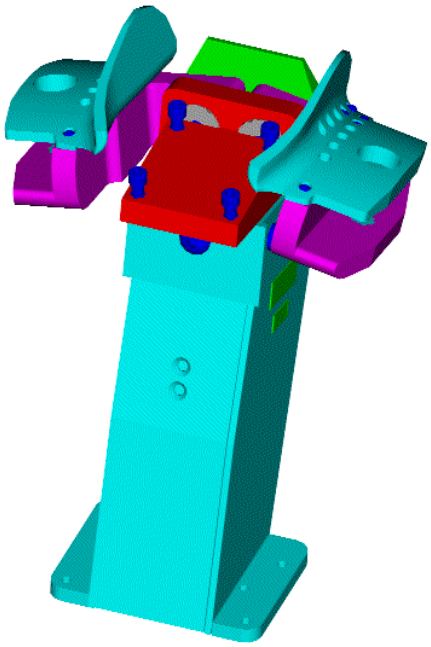


MODEL 4300 IN-LINE LOWER NECK ASSEMBLY

Applications:

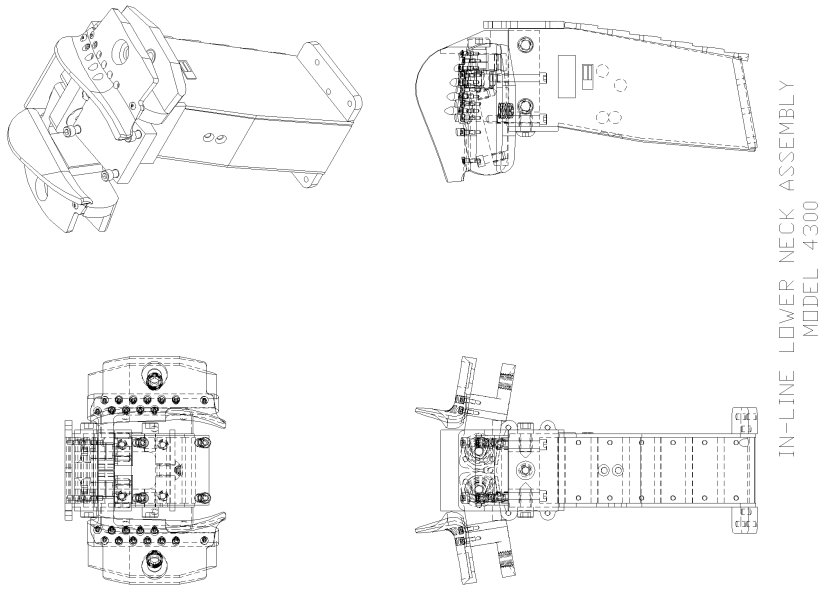
The Model 4300 In-Line Lower Neck Assembly is a new design of the spine box and clavicle link system for the Hybrid III 50th male dummy. This assembly allows the installation of a six-channel lower neck load cell at the base of the neck to make measurements of lower neck loads directly in-line with the base of the neck. The clavicle link pivots have been moved back, are concentric with the standard clavicle link pivot locations, and have a similar range of motion. The location of the base of the neck is identical to the location provided by the zero degree location of the standard neck bracket. The profile of the rear of the spine box and lower neck bracket is maintained up to the point where the new neck bracket is cut off (approximately ½" lower). This design works with either the model 2357 or the model 4366 lower neck load cell.

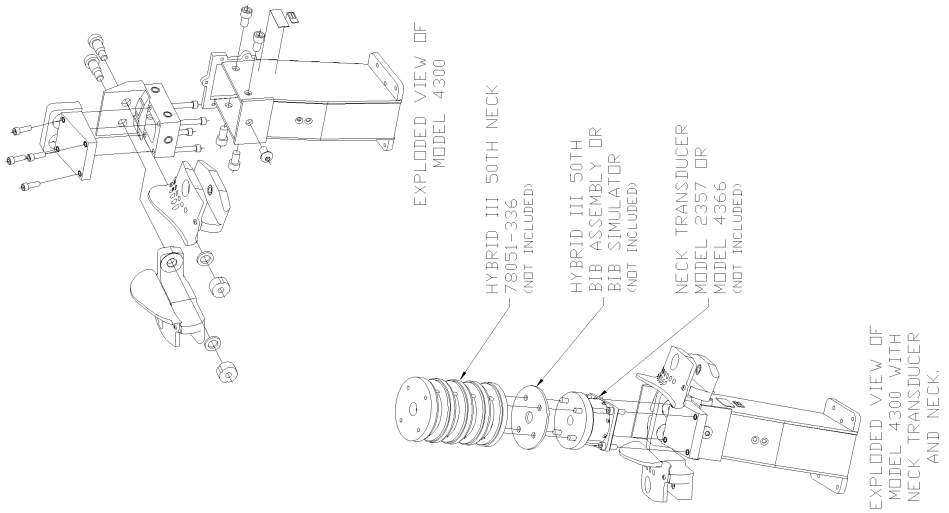
Mass of 4300 with 2357 load cell ..... (10.8 lb) 4.76 kg
Mass of equivalent standard Hybrid III 50th parts ..... (10.6 lb) 4.81 kg

Standard Ordering Configuration: 4300
For optional configurations, see load cell ordering guide or consult factory.

Issue Date: 24-Feb-00

MODEL 4300 IN-LINE LOWER NECK ASSEMBLY





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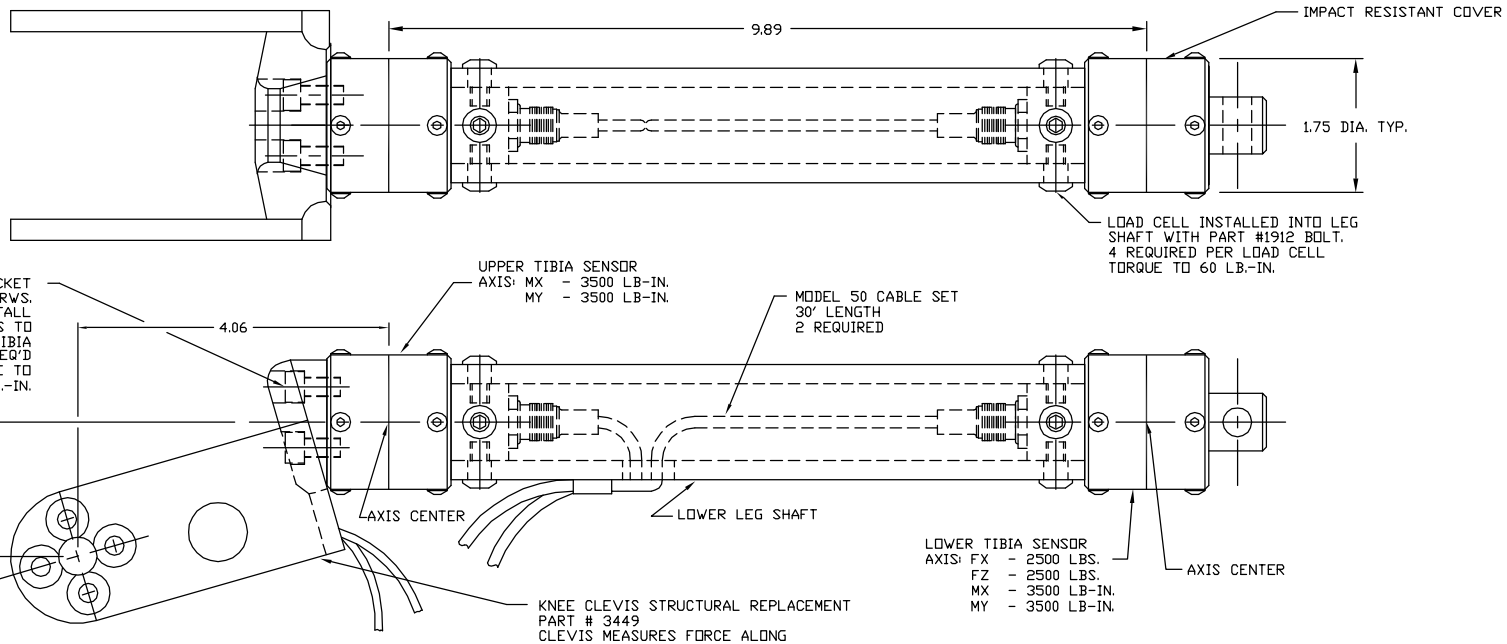
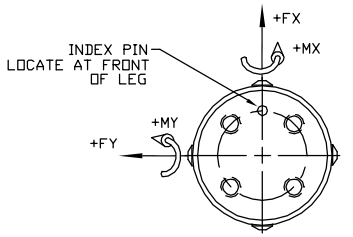
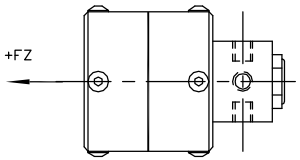
Issue Date: 24-Feb-00

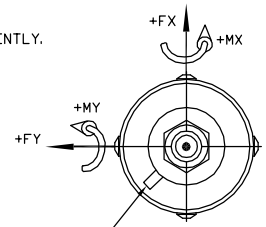




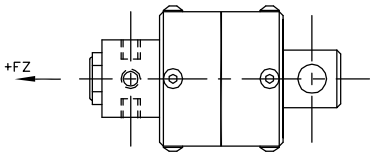


UPPER TIBIA
MODEL 1583

AXIS	CAPACITY	OUTPUT
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.



INDEX PIN
LOCATE PIN IN LEFT DETENT OF LEG TUBE FOR AXES POLARITY AS SHOWN



LOWER TIBIA
MODEL 3287

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

SYM	REVISION	DATE

INSTRUMENTED LOWER LEG

95TH PERCENTILE HYBRID III

SCALE: NONE		DRAWN BY: H. PROCTOR
DATE: 5/21/96		MODEL: 4302

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4302-D

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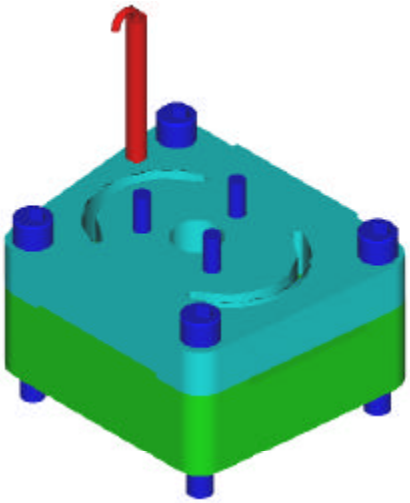


MODEL 4351
LUMBAR SPINE

Applications:
The Lumbar Spine Load Cell (Model 4351) is a uniaxial (one-channel) device used to measure the Fz axis force in the Hybrid II & SID Crash Test Dummies.

Standard Ordering Configuration: 4351J
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Fz	15.6 kN	3500 lbf	700 ohms	1.2 mV/V

Non-linearity ..... less than 1% of full scale
Hysteresis..... less than 1% of full scale
Crosstalk ..... less than 5% of full scale
Excitation ..... 10 VDC nom. 15 VDC max.

Wiring:

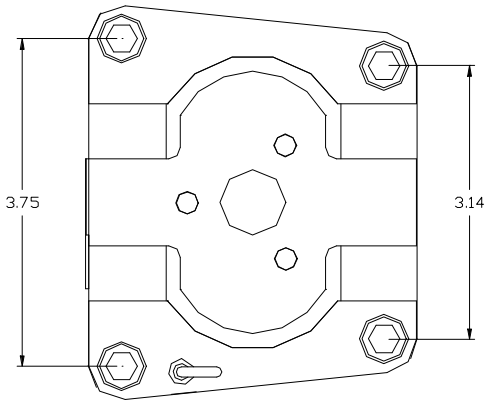
Fz Channel	
Red	+Exc
Green	+Sig
Black	-Exc
White	-Sig

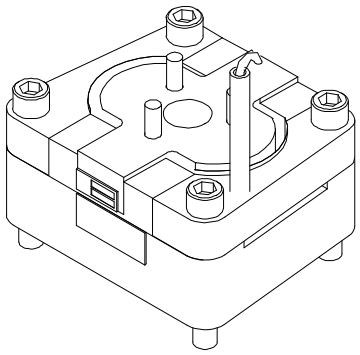
Issue Date: 21-Sep-00

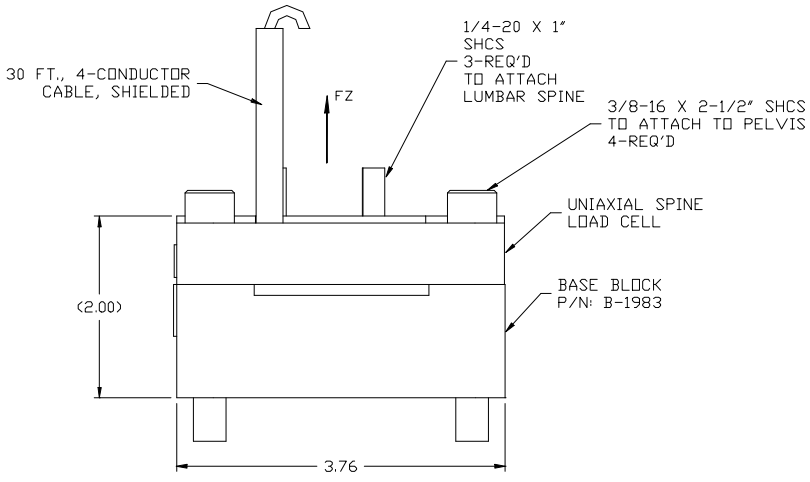
MODEL 4351
LUMBAR SPINE LOAD CELL

NOTES

1. Use Denton Model 2452 calibration fixture. (Ref. Calibration Fixture drawing 4351-C)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.







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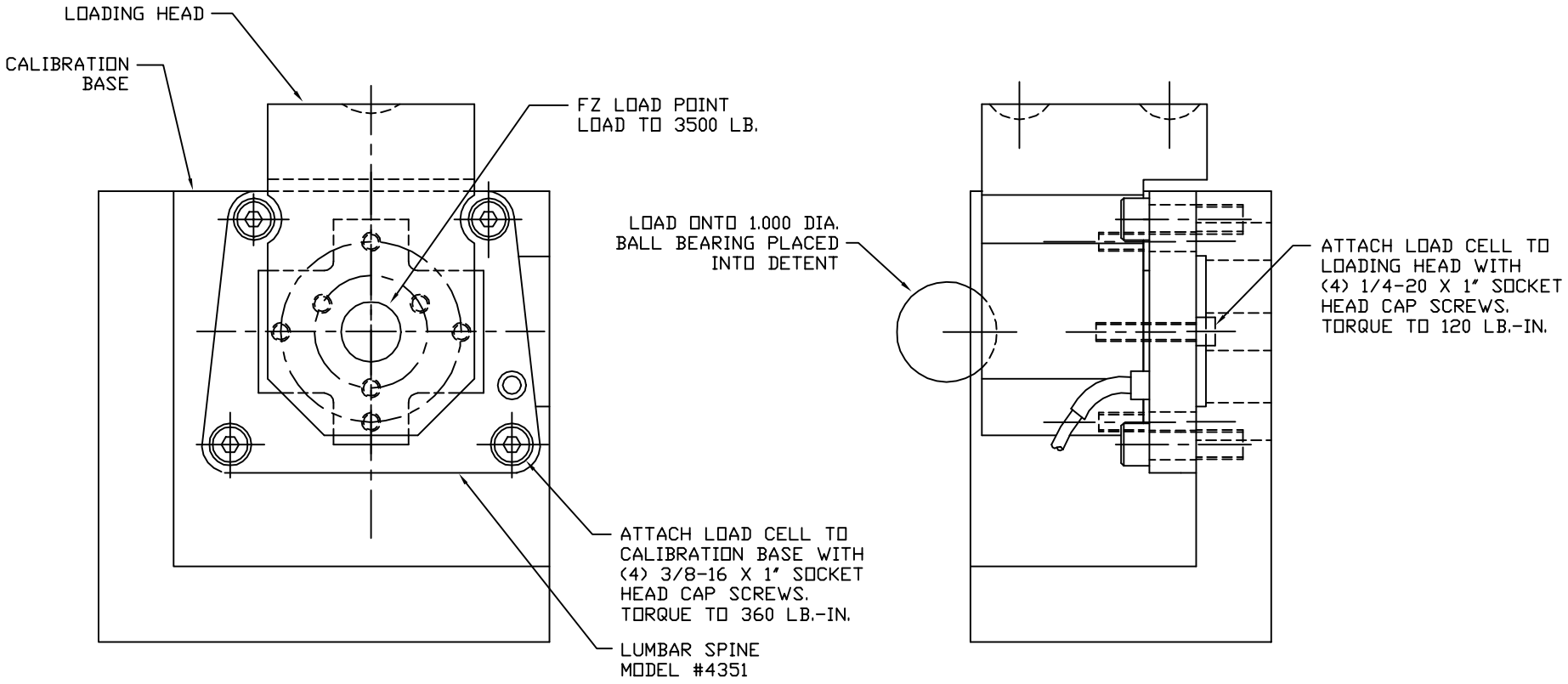
Issue Date: 21-Sep-00



CALIBRATION FIXTURE MODEL #2452

SYM	REVISION	DATE

4351 CALIBRATION FIXTURE

SCALE: .75X		DRAWN BY: R. DUPONT
DATE: 14APR99		MODEL: 4351

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4351-C

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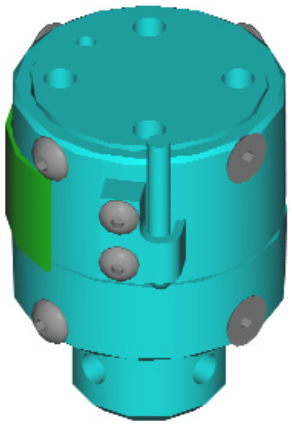


MODEL 4353
UPPER TIBIA LOAD CELL

Applications:
The Upper Tibia Load Cell (Model# 4353) is a four-channel force (Fx, Fz) and moment (Mx, My) measurement device. It is designed to measure the forces and moment between the Knee Assembly and the lower leg tibia of the THOR Crash Test Dummy.

Standard Ordering Configuration: 4353J
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Fx	11.12 kN	2500 lbf	350 ohms	2.0 mV/V
Fz	11.12 kN	2500 lbf	700 ohms	1.0 mV/V
Mx	395 NM	3500 in-lbf	350 ohms	3.0 mV/V
My	395 NM	3500 in-lbf	350 ohms	3.0 mV/V

Non-linearity ..... less than 1% of full scale
Hysteresis..... less than 1% of full scale
Crosstalk ..... less than 5% of full scale
Excitation ..... 10 VDC nom. 15 VDC max.

Wiring:

Fx Channel		Fz Channel	
Brown	+Exc	Green	+Exc
Red	+Sig	Blue	+Sig
Orange	-Exc	Violet	-Exc
Yellow	-Sig	Grey	-Sig

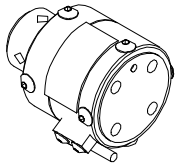
Mx Channel		My Channel	
Green Stripe	+Exc	Red-Stripe	+Exc
Blue Stripe	+Sig	Black	+Sig
Orange Stripe	-Exc	White	-Exc
Yellow Stripe	-Sig	Black-Stripe	-Sig

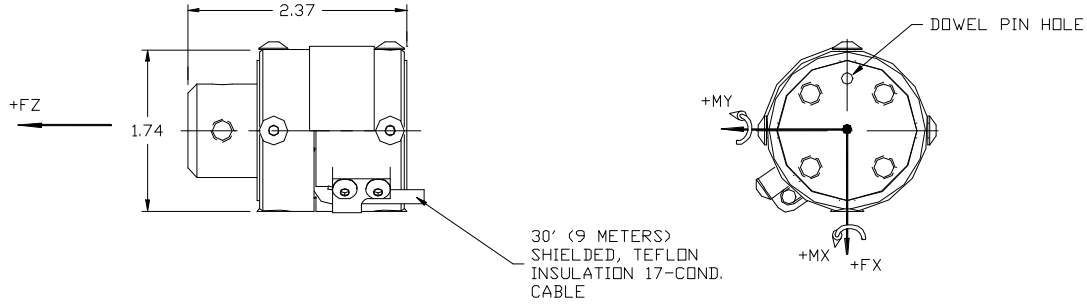
Issue Date: 7-Feb-00

MODEL 4353
UPPER TIBIA LOAD CELL

NOTES

1. Use Denton Model 2171 calibration fixture. (Ref. Calibration Fixture drawing 4353-C)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.





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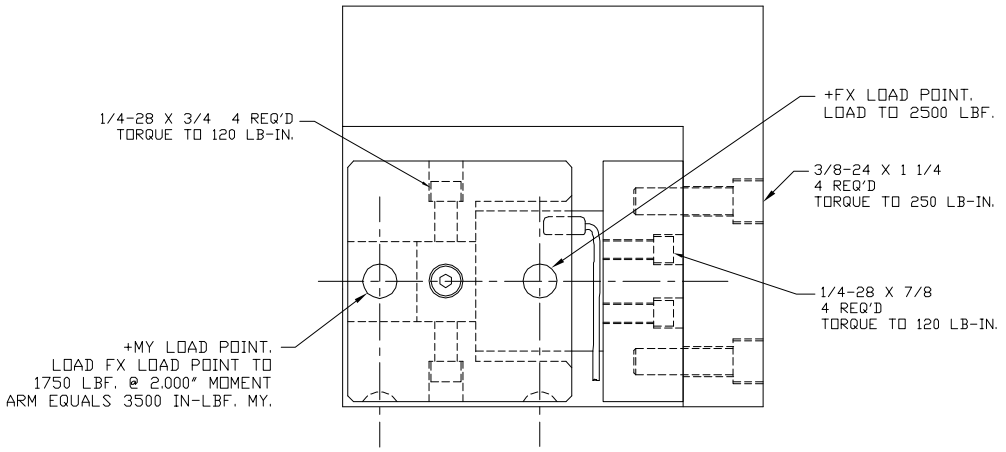
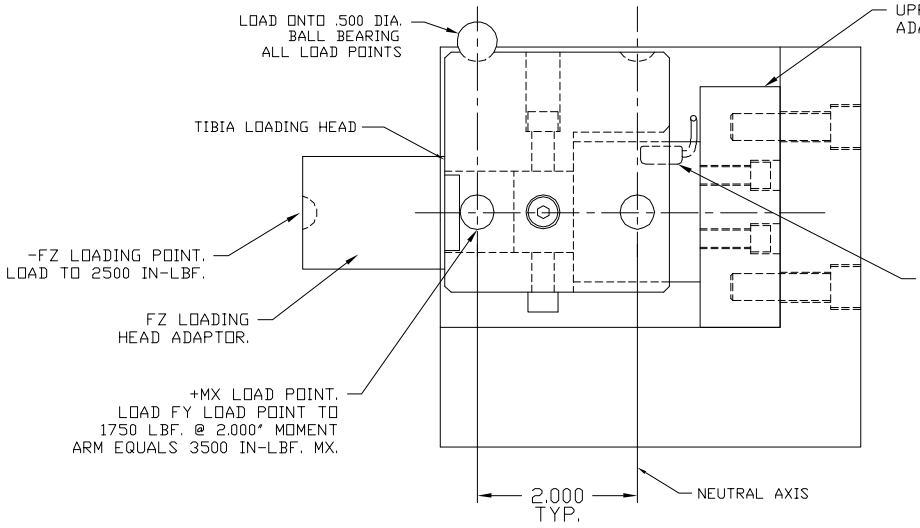
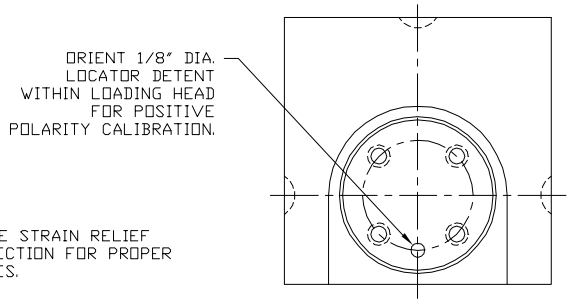
Issue Date: 7-Feb-00







CALIBRATION FIXTURE MODEL #2171

SYM	REVISION	DATE

CALIBRATION FIXTURE FOR THOR-LX UPPER TIBIA

SCALE: NONE		DRAWN BY: C.HEAD
DATE: 2/28/01		MODEL: 4353

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4353-C

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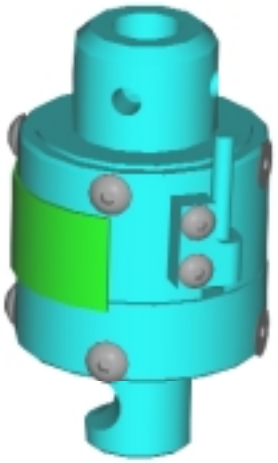


MODEL 4354
LOWER TIBIA LOAD CELL

Applications:
The Lower Tibia Load Cell (Model# 4354) is a four-channel force (Fx, Fz) and moment (Mx, My) measurement device. It is designed to measure the forces and moment between the tibia and the foot of the THOR Crash Test Dummy.

Standard Ordering Configuration: 4354J
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Fx	11.12 kN	2500 lbf	350 ohms	2.0 mV/V
Fz	11.12 kN	2500 lbf	700 ohms	1.0 mV/V
Mx	395 NM	3500 in-lbf	350 ohms	3.0 mV/V
My	395 NM	3500 in-lbf	350 ohms	3.0 mV/V

Non-linearity..... less than 1% of full scale
Hysteresis .....less than 1% of full scale
Crosstalk.....less than 5% of full scale
Excitation ..... 10 VDC nom. 15 VDC max.

Wiring:

Fx Channel		Fz Channel	
Brown	+Exc	Green	+Exc
Red	+Sig	Blue	+Sig
Orange	-Exc	Violet	-Exc
Yellow	-Sig	Grey	-Sig

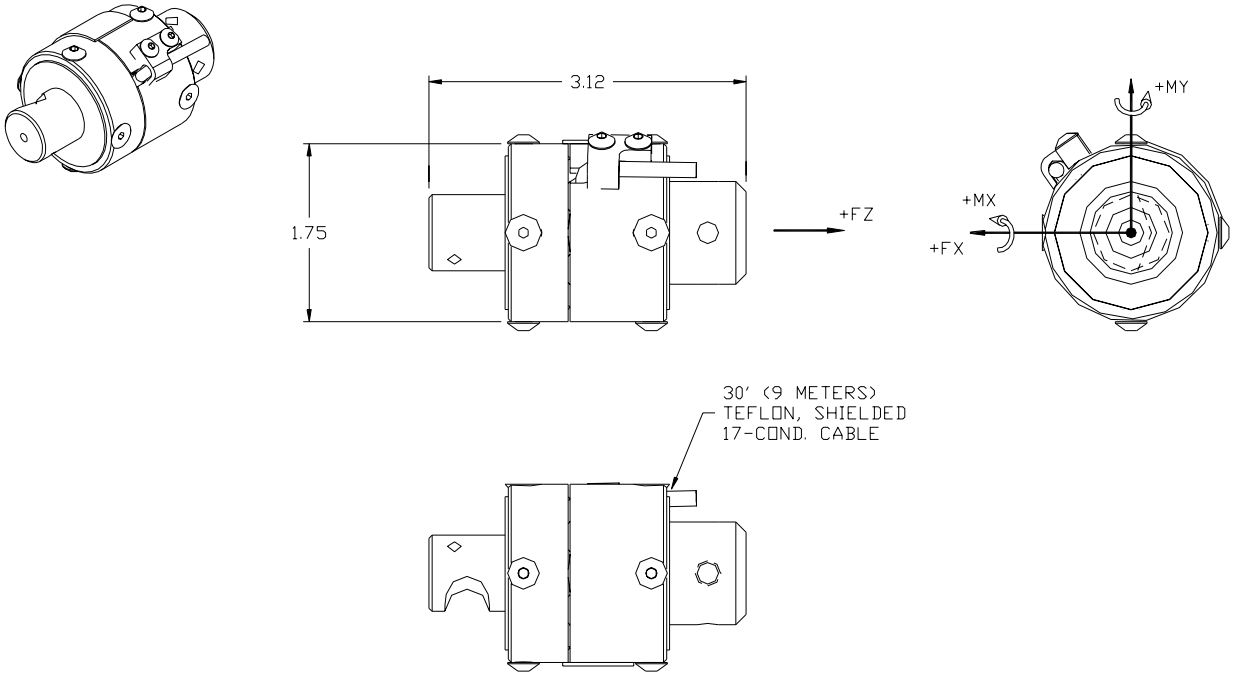
Mx Channel		My Channel	
Green Stripe	+Exc	Red-Stripe	+Exc
Blue Stripe	+Sig	Black	+Sig
Orange Stripe	-Exc	White	-Exc
Yellow Stripe	-Sig	Black-Stripe	-Sig

Issue Date: 20-Apr-00

MODEL 4354
LOWER TIBIA LOAD CELL

NOTES

1. Use Denton Model 2171 calibration fixture. (Ref. Calibration Fixture drawing 4354-C)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.



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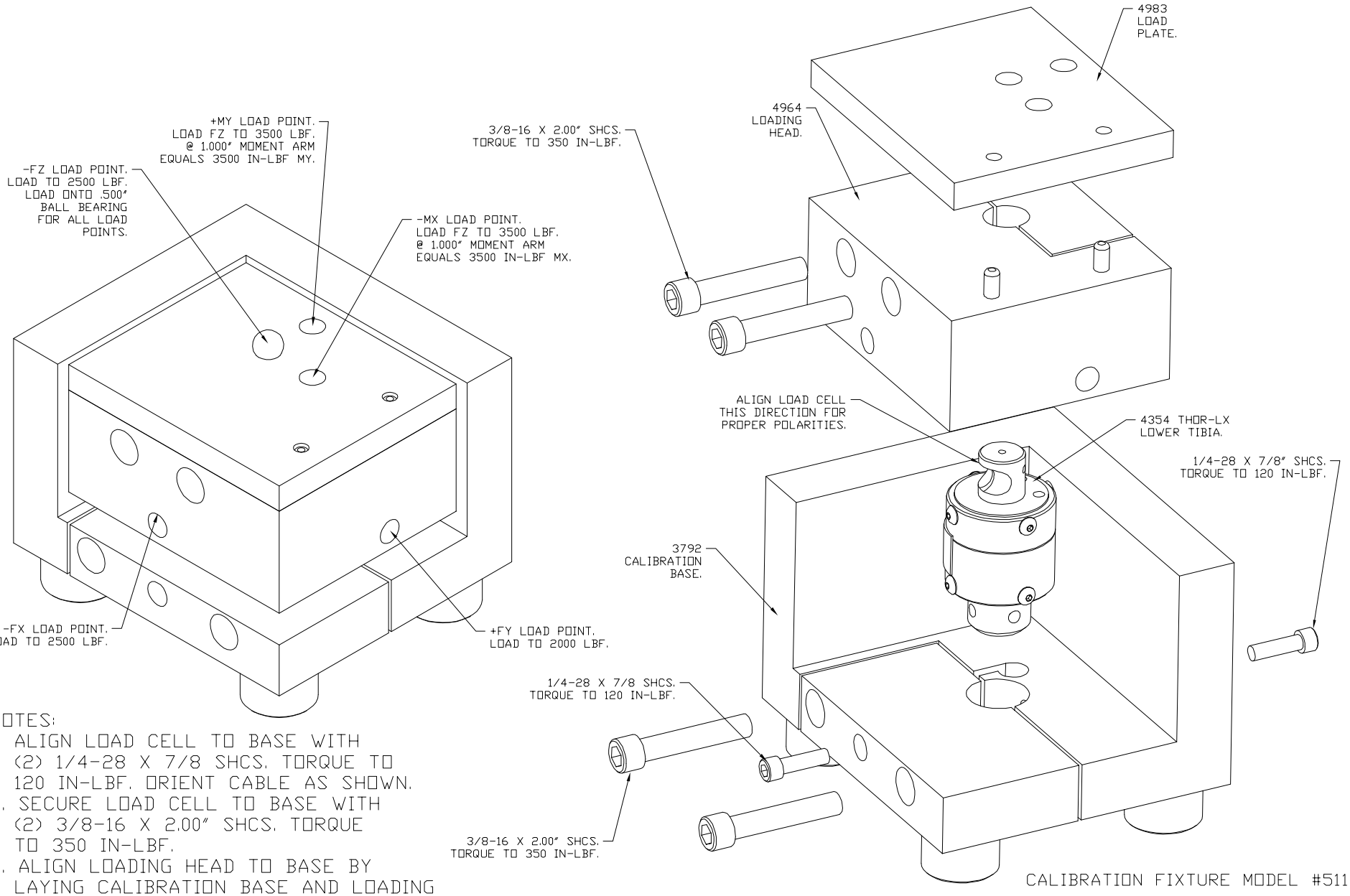
Issue Date: 20-Apr-00



NOTES:

1. ALIGN LOAD CELL TO BASE WITH (2) 1/4-28 X 7/8 SHCS. TORQUE TO 120 IN-LBF. ORIENT CABLE AS SHOWN.
2. SECURE LOAD CELL TO BASE WITH (2) 3/8-16 X 2.00" SHCS. TORQUE TO 350 IN-LBF.
3. ALIGN LOADING HEAD TO BASE BY LAYING CALIBRATION BASE AND LOADING HEAD ON (-FX SIDE) A FLAT SURFACE AND SECURING WITH (2) 3/8-16 X 2.00" SHCS. TORQUE TO 350 IN-LBF.

CALIBRATION FIXTURE MODEL #5116

CALIBRATION FIXTURE FOR 4354 THOR-LX LOWER TIBIA

SCALE: NONE		DRAWN BY: CHEAD	
DATE: 2/27/01		MODEL: 5116	

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-4354-C

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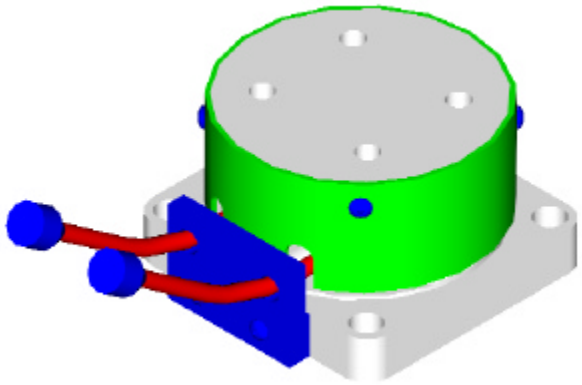


MODEL 4365
LOWER NECK LOAD CELL

Applications:
The Lower Neck Load Cell (Model# 4365) is a six-channel force (Fx, Fy, Fz) and moment (Mx, My, Mz) measurement device. It is designed to measure the forces and moment between the molded Neck and the Neck bracket assembly of the EuroSID Crash Test Dummy.

Standard Ordering Configuration: 4365J
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Fx	12 kN	2698 lbf	350 ohms	1.6 mV/V
Fy	12 kN	2698 lbf	350 ohms	1.6 mV/V
Fz	14 kN	3147 lbf	700 ohms	0.9 mV/V
Mx	450 NM	3983 in-lbf	350 ohms	1.7 mV/V
My	450 NM	3983 in-lbf	350 ohms	1.7 mV/V
Mz	300 NM	2655 in-lbf	700 ohms	2.0 mV/V

Non-linearity ..... less than 1% of full scale
Hysteresis..... less than 1% of full scale
Crosstalk ..... less than 5% of full scale
Excitation ..... 10 VDC nom. 15 VDC max.

Wiring:

Fx Channel		Fy Channel		Fz Channel	
Brown	+Exc	Red-Stripe	+Exc	Green	+Exc
Red	+Sig	Black	+Sig	Blue	+Sig
Orange	-Exc	White	-Exc	Violet	-Exc
Yellow	-Sig	Black-Stripe	-Sig	Grey	-Sig

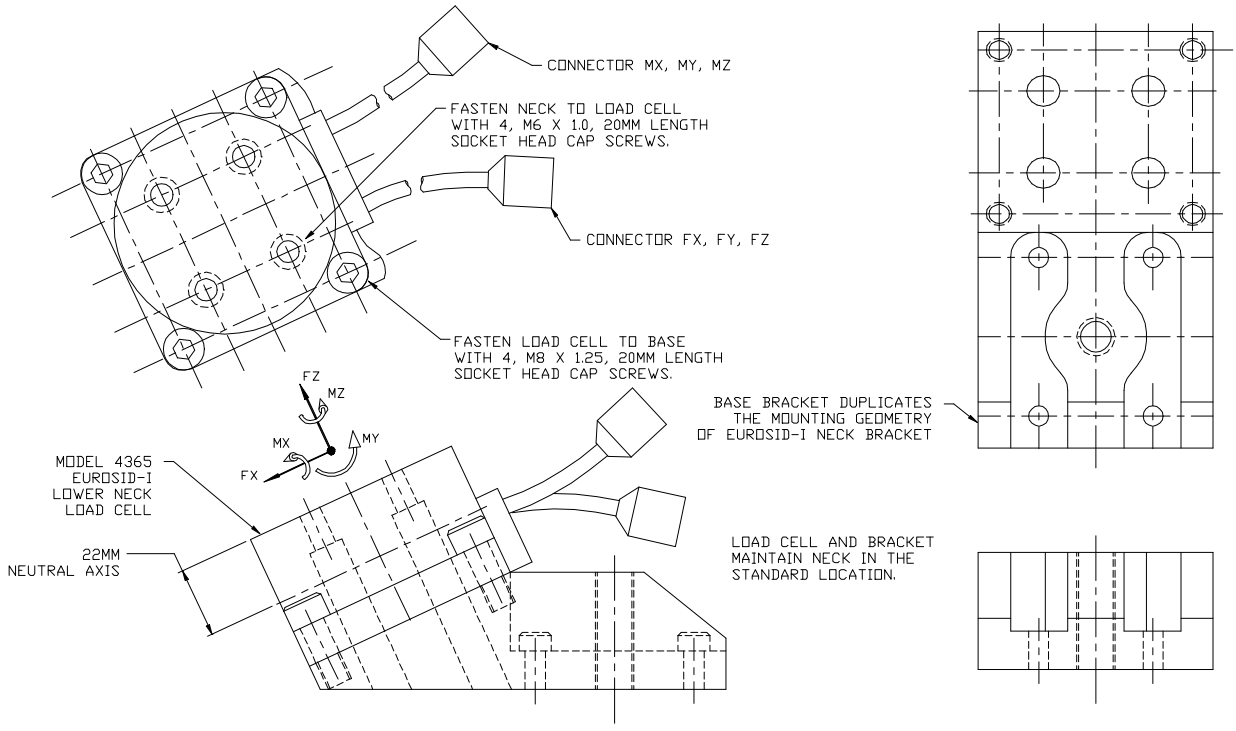
Mx Channel		My Channel		Mz Channel	
Brown	+Exc	Red-Stripe	+Exc	Green	+Exc
Red	+Sig	Black	+Sig	Blue	+Sig
Orange	-Exc	White	-Exc	Violet	-Exc
Yellow	-Sig	Black-Stripe	-Sig	Grey	-Sig

Issue Date: 8-Feb-00

MODEL 4365 LOWER NECK LOAD CELL

NOTES

1. Use Denton Model 3527 calibration fixture. (Ref. Calibration Fixture drawing 4365-C)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.



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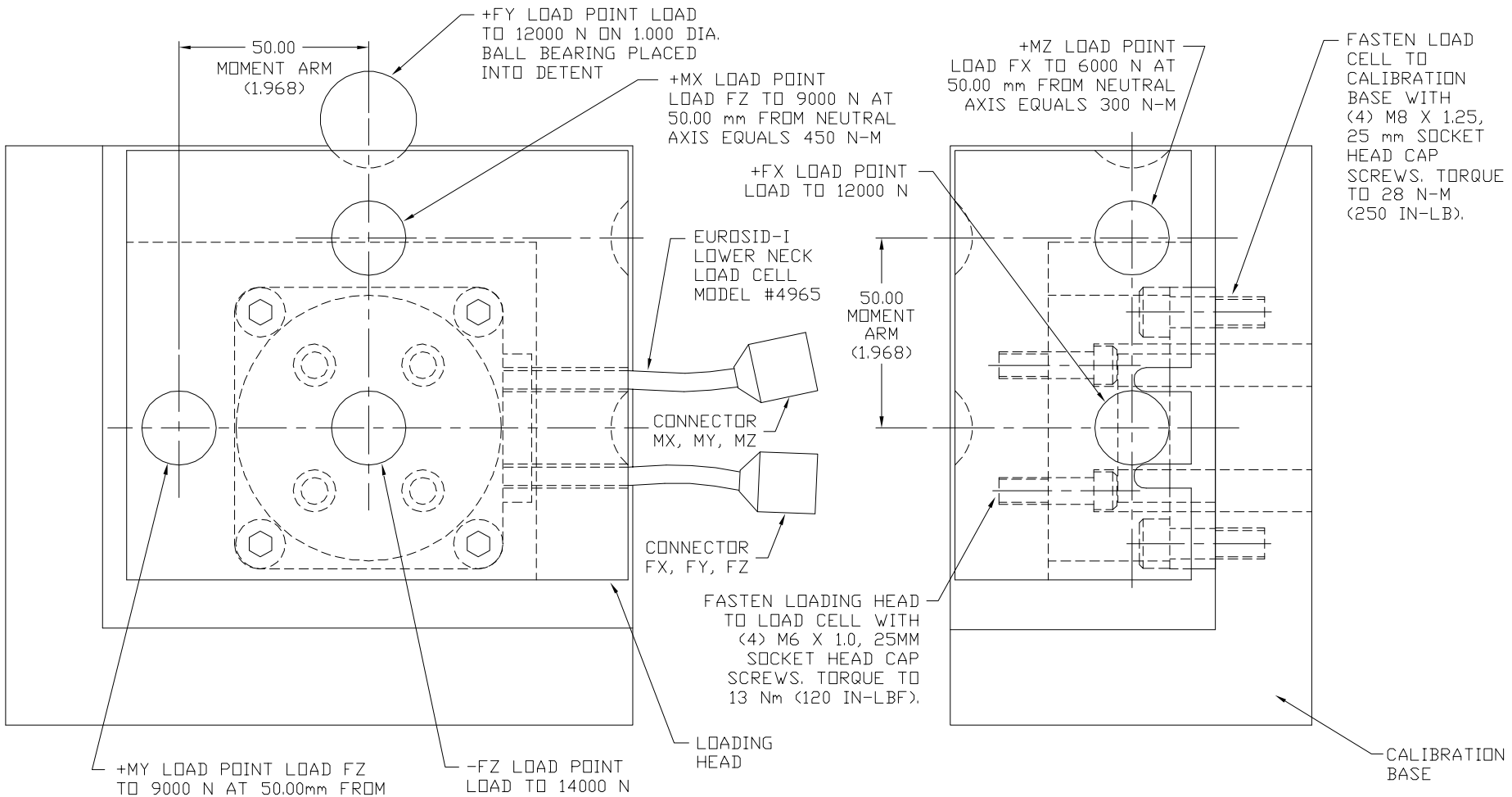
Issue Date: 8-Feb-00



CALIBRATION FIXTURE MODEL #3527

ORDER OF ASSEMBLY:

1. FASTEN LOAD CELL TO CALIBRATION BASE WITH (4) M8 X 1.25, 25mm LENGTH SOCKET HEAD CAP SCREWS, TORQUE TO 28 N-M (250 LB-IN).
2. FASTEN LOADING HEAD TO LOAD CELL WITH (4) M6 X 1.0, 25mm LENGTH SOCKET HEAD CAP SCREWS, TORQUE TO 13 N-M (120 LB-IN).

DIMENSIONS = mm (IN.)

SYM	REVISION	DATE

EUROSID-I LOWER NECK CALIBRATION FIXTURE

SCALE: FULL		DRAWN BY: C.HEAD
DATE: 2/27/01		MODEL: 4365

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4365-C

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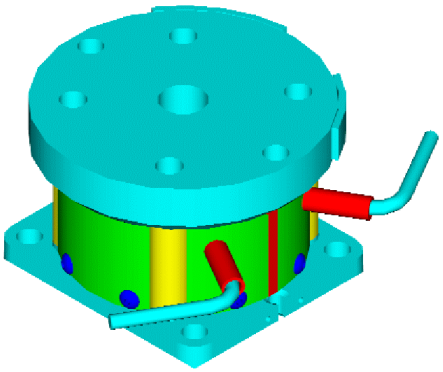


MODEL 4366
THOR LOWER NECK
LOAD CELL

Applications:
The Lower Neck Load Cell (Model# 4366) is a six-channel force (Fx, Fy, Fz) and moment (Mx, My, Mz) measurement device. It is designed to measure the forces and moment between the molded Neck and the Spine Box assembly of the Thor Crash Test Dummy.

Standard Ordering Configuration: 4366J
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Fx	13.3 kN	3000 lbf	350 ohms	2.0 mV/V
Fy	13.3 kN	3000 lbf	350 ohms	2.0 mV/V
Fz	13.3 kN	3000 lbf	700 ohms	1.0 mV/V
Mx	452 NM	4000 in-lbf	350 ohms	2.0 mV/V
My	452 NM	4000 in-lbf	350 ohms	2.0 mV/V
Mz	226 NM	2000 in-lbf	700 ohms	2.0 mV/V

Non-linearity ..... less than 1% of full scale
Hysteresis..... less than 1% of full scale
Crosstalk ..... less than 5% of full scale
Excitation ..... 10 VDC nom. 15 VDC max.
Mass (w/o cable)..... 1.02 Kg (2.25 lbs.)

Wiring:

Fx Channel		Fy Channel		Fz Channel	
Brown	+Exc	Red-Stripe	+Exc	Green	+Exc
Red	+Sig	Black	+Sig	Blue	+Sig
Orange	-Exc	White	-Exc	Violet	-Exc
Yellow	-Sig	Black-Stripe	-Sig	Grey	-Sig

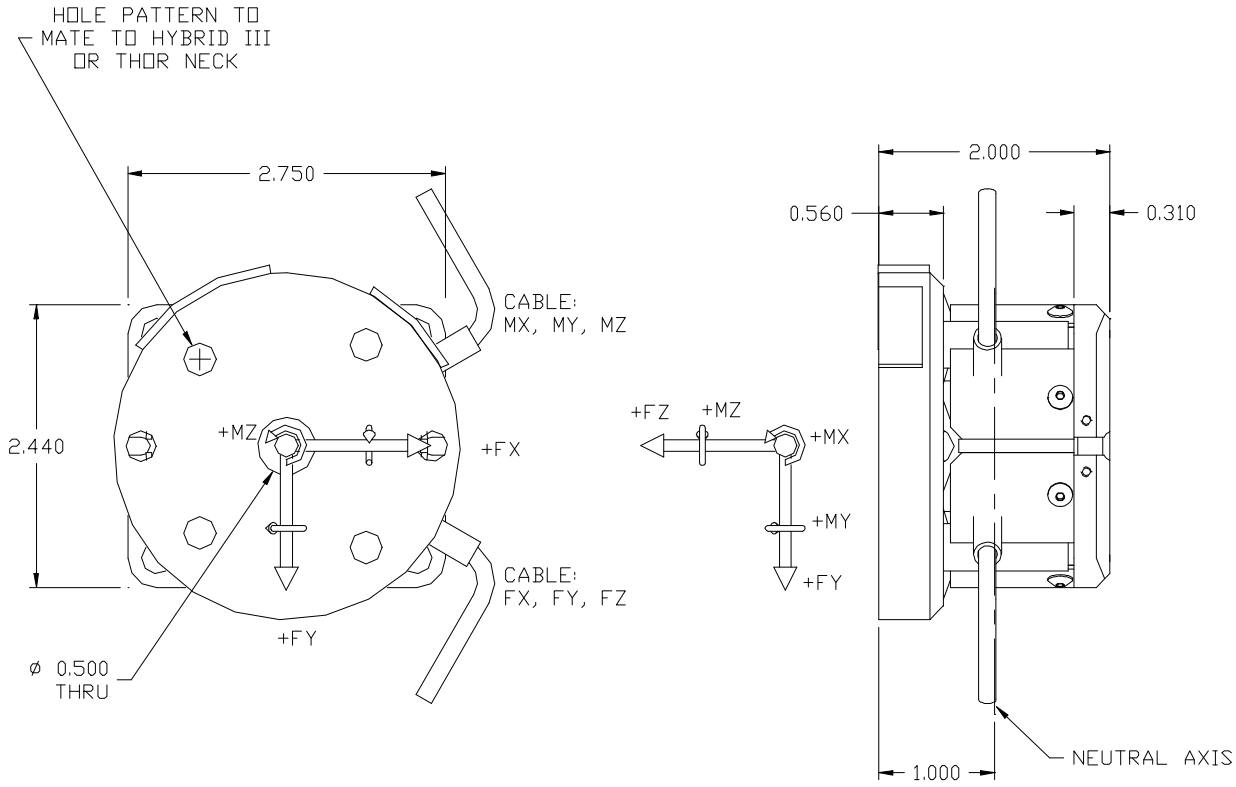
Mx Channel		My Channel		Mz Channel	
Brown	+Exc	Red-Stripe	+Exc	Green	+Exc
Red	+Sig	Black	+Sig	Blue	+Sig
Orange	-Exc	White	-Exc	Violet	-Exc
Yellow	-Sig	Black-Stripe	-Sig	Grey	-Sig

Issue Date: 14-Feb-00

MODEL 4366 THOR LOWER NECK LOAD CELL

NOTES

1. Use Denton Model 4667 calibration fixture. (Ref. Calibration Fixture drawing 4366-C)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.



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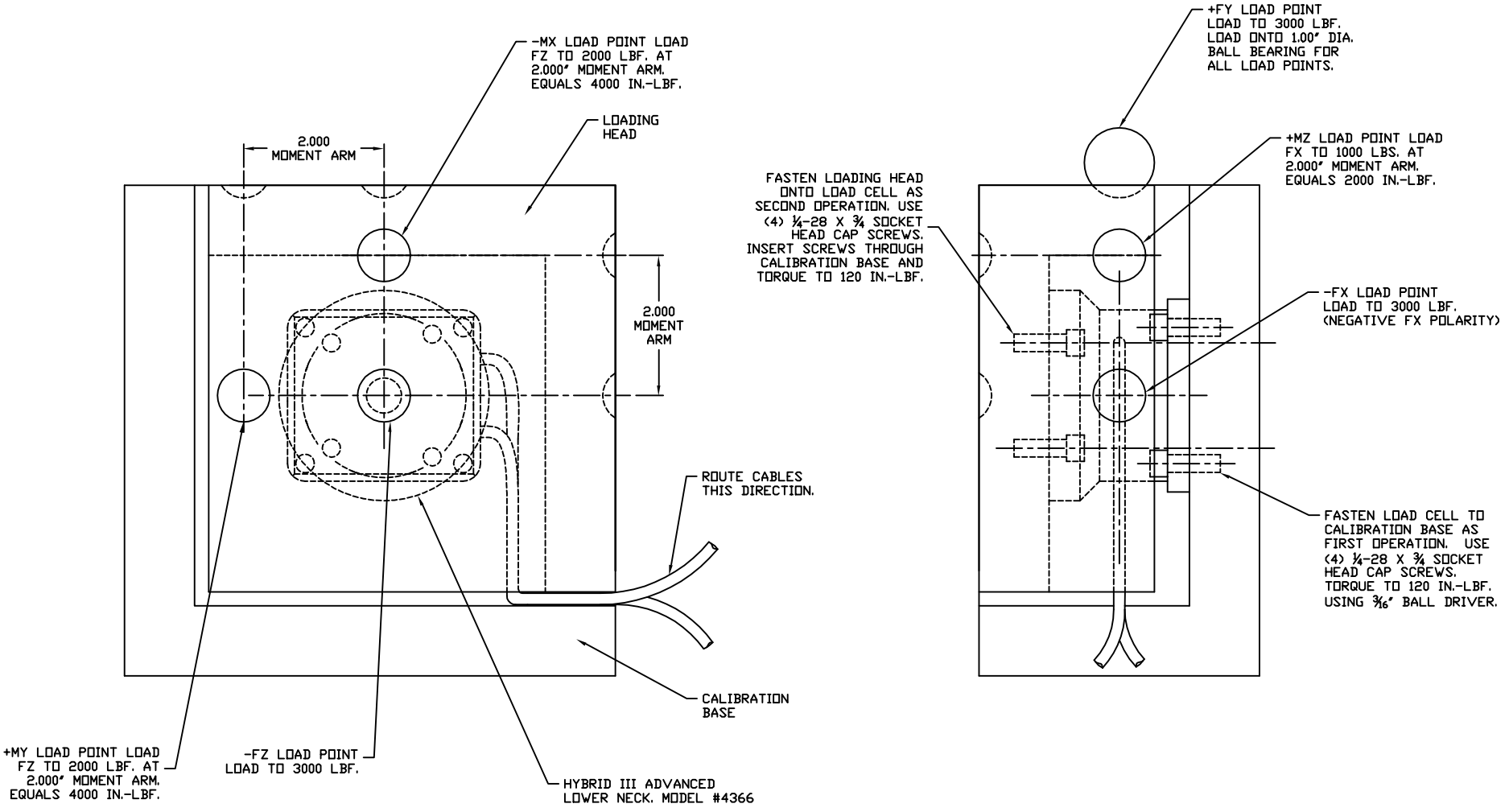
Issue Date: 14-Feb-00



CALIBRATION FIXTURE MODEL #4667

SYM	REVISION	DATE

CALIBRATION FIXTURE FOR
ADVANCED LOWER NECK

SCALE: FULL		DRAWN BY: C.HEAD
DATE: 2/5/00		MODEL: 4366

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-4366-C

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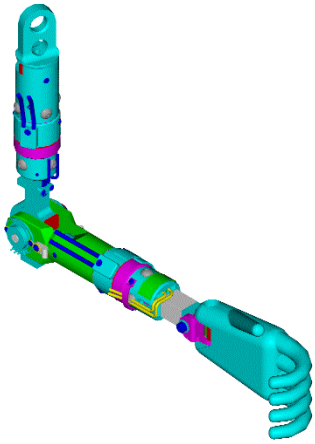


MODEL 4380
Enhanced Airbag Interaction Arm
for
Hybrid III 5th Percentile and SID-IIs ATD's

Applications:

The Model 4380 Enhanced Airbag Interaction Arm load cell assembly is designed for use on the Hybrid III 5th Percentile and the SID-IIs ATD's to measure arm interaction during airbag testing. The Enhanced Airbag Arm provides the capability to measure up to six accelerations, six forces, ten moments and two rotations for a total of twenty-four channels. Each of the four load cells and two potentiometers are wired per the SAE J211 Right Hand Rule sign convention. Accelerometers are not included with the Arm assembly.

Model 4380 includes all necessary flesh and attaching components for the Arm assembly to be used on both the Hybrid III 5th Percentile and the SID-IIs ATD's on either the right or left side.

Standard Ordering Configuration: 4380J
For optional configurations, see load cell ordering guide or consult factory.

Instrumentation:

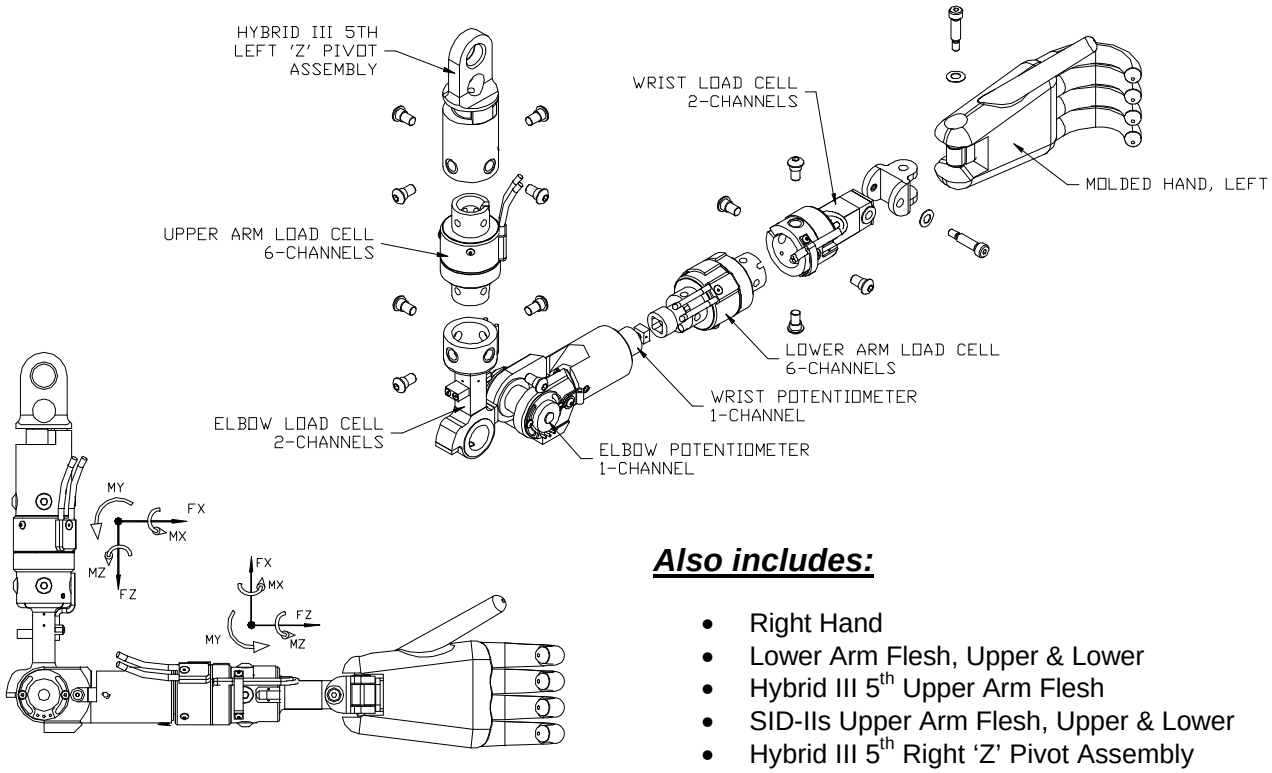
Instrument Position	Number of Channels	Measurements	Model Number
Wrist Load Cell	2	Mx, My	4455
Lower Arm Load Cell	6	Fx, Fy, Fz Mx, My, Mz	4461
Elbow Load Cell	2	Mx, My	3781
Upper Arm Load Cell	6	Fx, Fy, Fz Mx, My, Mz	3780
Uniaxial Accelerometers	6	(2) 'X', (2) 'Y', (2) 'Z'	na
Wrist 'Z' Pot.	1	'Y' rotation	4453
Elbow Rotation Pot.	1	'Z' rotation	4005

Issue Date: 23-Feb-00

Model 4380
Enhanced Airbag Interaction Arm

NOTES

1. The Upper Arm and Lower Arm load cells are both calibrated on fixture number 3697. The Elbow load cell is calibrated on fixture number 3698 and the Wrist load cell is calibrated on fixture number 4464.
2. These load cells are wired for SAE J211 Right Hand Rule sign convention indicated by the suffix "J" on the model tag on the load cell.
3. If the model tag on the load cell includes a "G" suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an "I" suffix, there is an ID module in the body of the load cell. The number following the "I" indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30'). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.



Also includes:

- Right Hand
- Lower Arm Flesh, Upper & Lower
- Hybrid III 5th Upper Arm Flesh
- SID-IIs Upper Arm Flesh, Upper & Lower
- Hybrid III 5th Right 'Z' Pivot Assembly
- SID-IIs Left & Right 'Z' Pivot Assemblies

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Issue Date: 23-Feb-00

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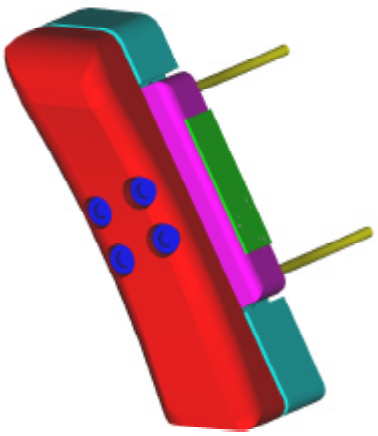
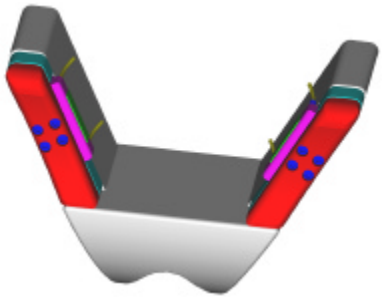
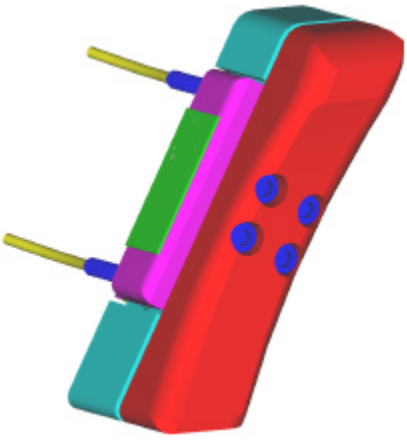




Model 4385



Model 4392

Model 4391

MODEL 4385 A.S.I.S. FOR HYBRID III LARGE MALE

Applications:

The Model 4385 Anterior Superior Iliac Spine (A.S.I.S.) Load Cell for the Hybrid III Large Male dummy is composed of two load cells, Models 4391 and 4392. Each of these load cells is designed to provide a measurement of the force and position of a lap belt against the iliac spine of the pelvis. The load cells consist of two independent Fx channels. Each channel is a full bridge strain gage circuit. The sum of the two channels is equal to the total load. The difference of the two channels divided by the sum is proportional to the position of the load on the face of the load cell. The load cells are wired per the SAE J211 sign convention.

Standard Ordering Configuration: 4385J
For optional configurations, see load cell ordering guide or consult factory.

Specifications for each Load Cell:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Fx upper	18.0 kN	4047 lb	350 ohms	2.0 mv/v
Fx lower	18.0 kN	4047 lb	350 ohms	2.0 mv/v

Nonlinearity .....less than 1% of full scale
Hysteresis .....less than 1% of full scale
Crosstalk .....less than 5% of full scale
Excitation .....10 VDC nom. 15 VDC max.
Mass (each load cell, does not include cable or attachment hardware) ..... (1.6 lb) 0.72 kg

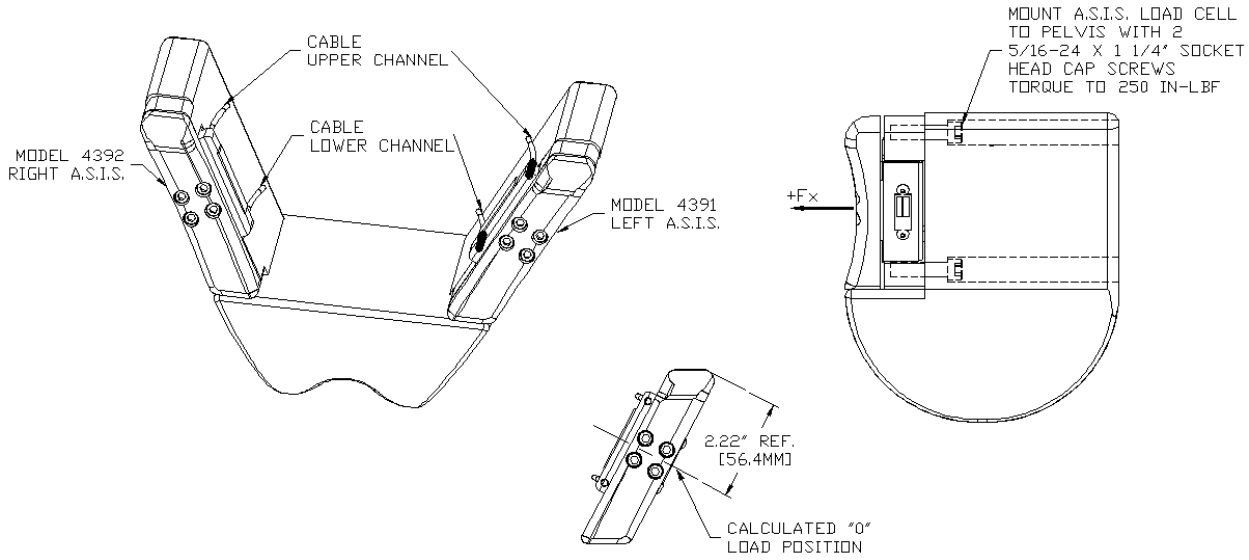
Wiring:

Fx Upper Channel		Fx Lower Channel	
Red	+Exc.	Red	+Exc.
Green	+Sig.	Green	+Sig.
Black	-Exc.	Black	-Exc.
White	-Sig.	White	-Sig.

MODEL 4385 A.S.I.S. FOR HYBRID III LARGE MALE

NOTES

1. Use Denton Model 4385-C calibration fixture. (Ref. Calibration Fixture Section)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.



To Calculate Belt Position:

DISTANCE = ((Fx Upper - Fx Lower)/(Fx Upper + Fx Lower)) X K

where: - the forces are in engineering units
- the distance is in engineering units above the load cell center line
- K = 39.4 for mm, K = 1.55 for inches

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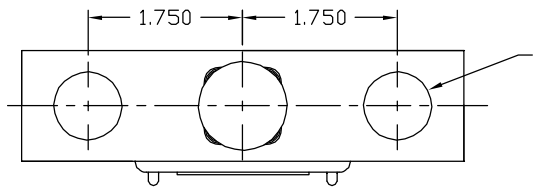
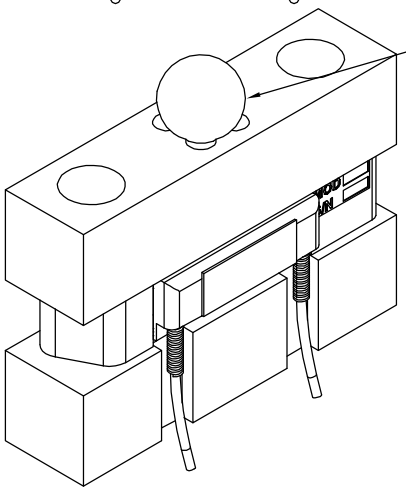
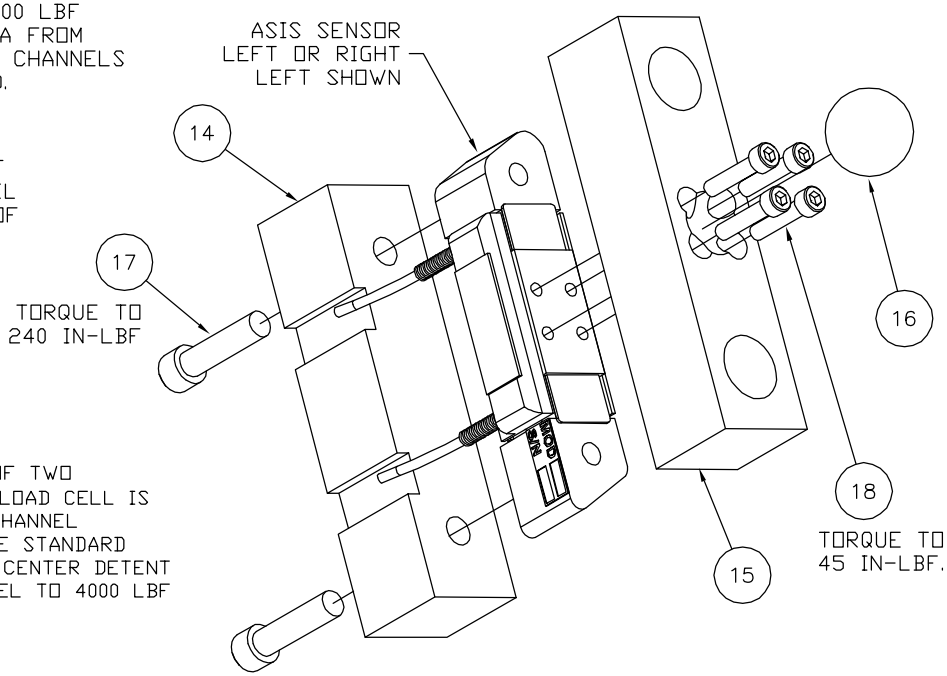


COMPREHENSIVE CALIBRATION:
LOAD EACH OUTSIDE DETENT TO 4000 LBF THRU A 1" DIA BALL. RECORD DATA FROM BOTH THE UPPER AND LOWER DATA CHANNELS AND PROCESS THE DATA AS LISTED.

STANDARD CALIBRATION:
LOAD CENTER DETENT TO 8000 LBF THRU A 1" DIA BALL. EACH CHANNEL (UPPER & LOWER) RECEIVES 50% OF THE TOTAL LOAD OR 4000 LBF.





STANDARD CALIBRATION:

THE MODEL 4385 LOAD CELL CONSISTS OF TWO INDEPENDENT FX CHANNELS. WHEN THE LOAD CELL IS LOADED DIRECTLY OVER CENTER, EACH CHANNEL RECEIVES 50% OF THE TOTAL LOAD. THE STANDARD CALIBRATION CONSISTS OF LOADING THE CENTER DETENT TO 8000 LBF TO CALIBRATE EACH CHANNEL TO 4000 LBF (50% OF THE TOTAL LOAD).

COMPREHENSIVE CALIBRATION:

THE MODEL 4385 IS DESIGNED TO PROVIDE A MEASUREMENT OF THE FORCE AND POSITION OF A LAP BELT AGAINST THE ILIAC SPINE OF THE PELVIS. THE SUM OF THE TWO CHANNELS IS EQUAL TO THE TOTAL LOAD. THE DIFFERENCE OF THE TWO CHANNELS DIVIDED BY THE SUM IS PROPORTIONAL TO THE POSITION OF THE LOAD ON THE FACE OF THE LOAD CELL. THE POSITION IS CALCULATED AS FOLLOWS:

((FORCE UPPER-FORCE LOWER)/(FORCE UPPER+FORCE LOWER)) X K = DISTANCE
NOTE:
THE FORCES ARE IN ENGINEERING UNITS.
THE DISTANCE IS IN ENGINEERING UNITS ABOVE THE LOAD CELL CENTER LINE.
FOR INCHES K= . FOR MM K= .

TO VERIFY THE ABOVE LISTED CALCULATION, LOAD TO 4000 LBF AT BOTH OF THE OUTSIDE DETENTS. CONVERT THE OUTPUT OBTAINED INTO ENGINEERING UNITS BASED ON THE CALIBRATION PERFORMED ON THE LOAD CELL CENTER. CALCULATE THE POSITION BASED ON THE EQUATION AS LISTED ABOVE.

THE CALCULATED POSITION SHOULD BE WITHIN 5% OF THE ACTUAL 1.750" (44.45 MM) LOADING POSITION.

USE CAL. FIXT: MODEL 4430

Parts list			
ITEM	QTY	PART #	DESCRIPTION
14	1	A-4422	BASE, CAL FIXTURE FOR 95TH ASIS
15	1	A-4423	LOADING HEAD, CAL FIXTURE FOR 95TH ASIS
16	1	PURCHASED	1" DIA BALL
17	2	PURCHASED	5/16-24 X 1 1/4" SHCS
18	4	PURCHASED	#10-24 X 7/8" SHCS

NEXT ASS'Y	QTY
PART USED ON	

CAL FIXTURE - 95TH ASIS

SCALE: FULL
DATE: 19MAY99
DRAWN BY: P.DEPINET
MODEL: 4385-C

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4385-C

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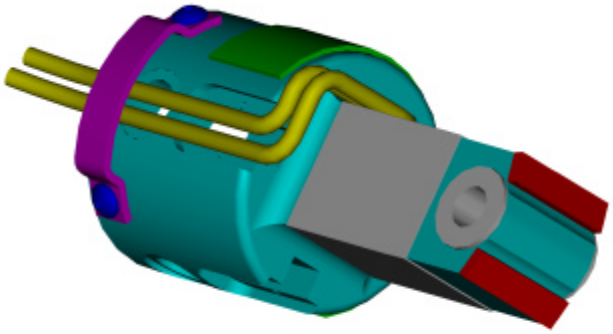


MODEL 4455 WRIST LOAD CELL

Applications:

The Model 4455 wrist load cell was designed to provide a way to measure two bending moments at the wrist of a Small Female instrumented arm. The load cell contains two channels, both of which are a full bridge strain gage circuit. This load cell is wired per the SAE J211 Right Hand Rule sign convention. The wrist load cell is a component of the Denton model 4380 Instrumented Arm for Hybrid III Small Female and SID-IIs test dummies.

Standard Ordering Configuration: 4455J
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Mx	113.0 Nm	1,000 in-lbf	350 ohms	2.9 mv/v
My	113.0 Nm	1,000 in-lbf	350 ohms	2.9 mv/v

Non-linearity ..... less than 1% of full scale
Hysteresis ..... less than 1% of full scale
Crosstalk ..... less than 5% of full scale
Excitation ..... 10 VDC nom. 15 VDC max.
Mass (without cable, with mounting screws) ..... (0.63 lb) 0.29 kg

Wiring:

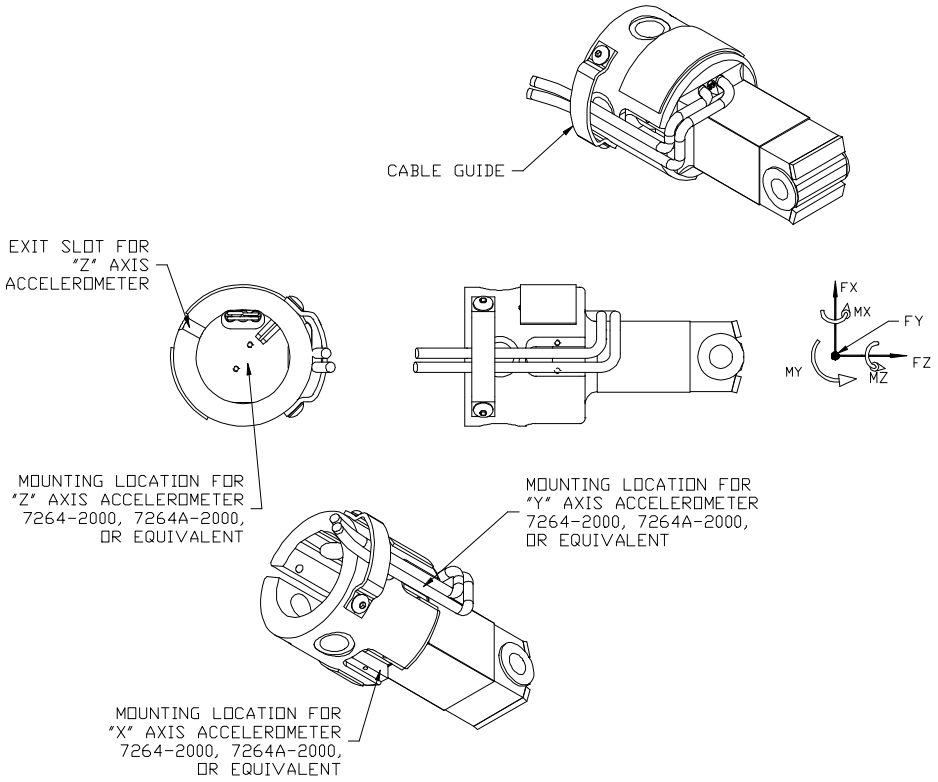
Mx Channel		My Channel	
Red	+Exc.	Red	+Exc.
Green	+Sig.	Green	+Sig.
Black	-Exc.	Black	-Exc.
White	-Sig.	White	-Sig.

Issue Date: 25-Jan-00

MODEL 4455 WRIST LOAD CELL

NOTES

1. Use Denton Model 4464 calibration fixture and calibration instructions B-4455-C (Ref. Calibration Fixture Section)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.



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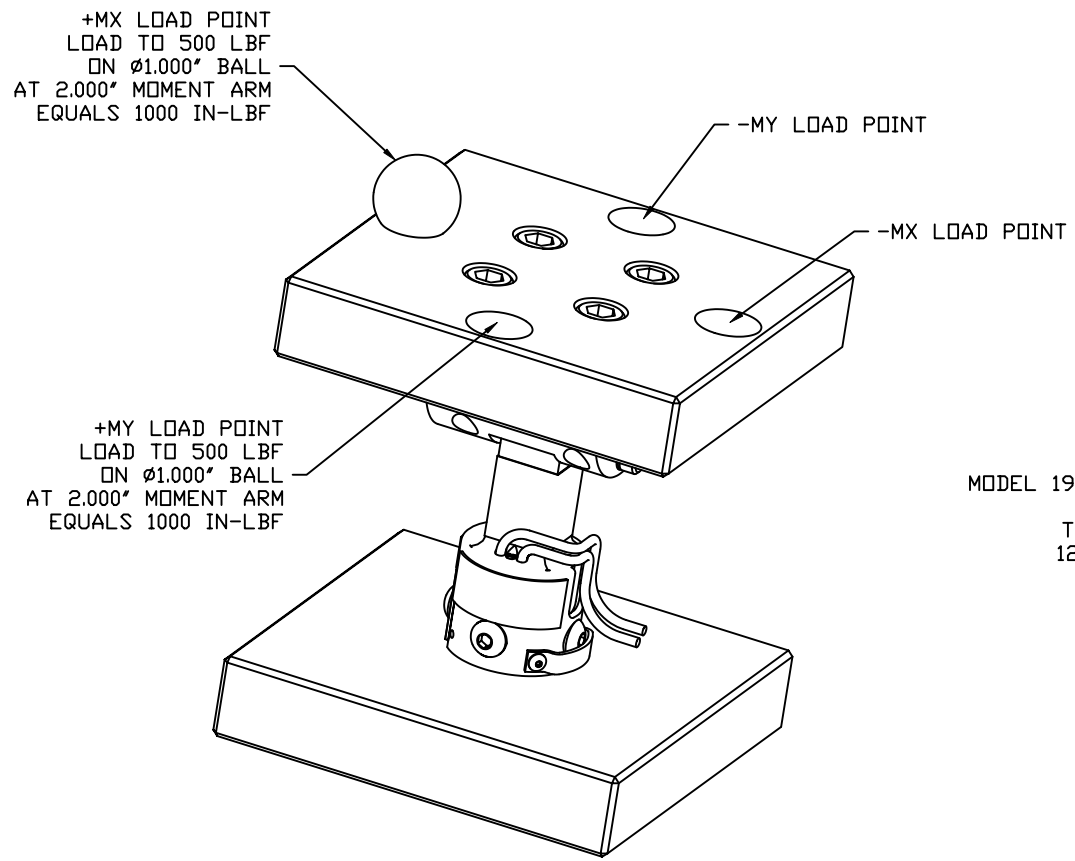
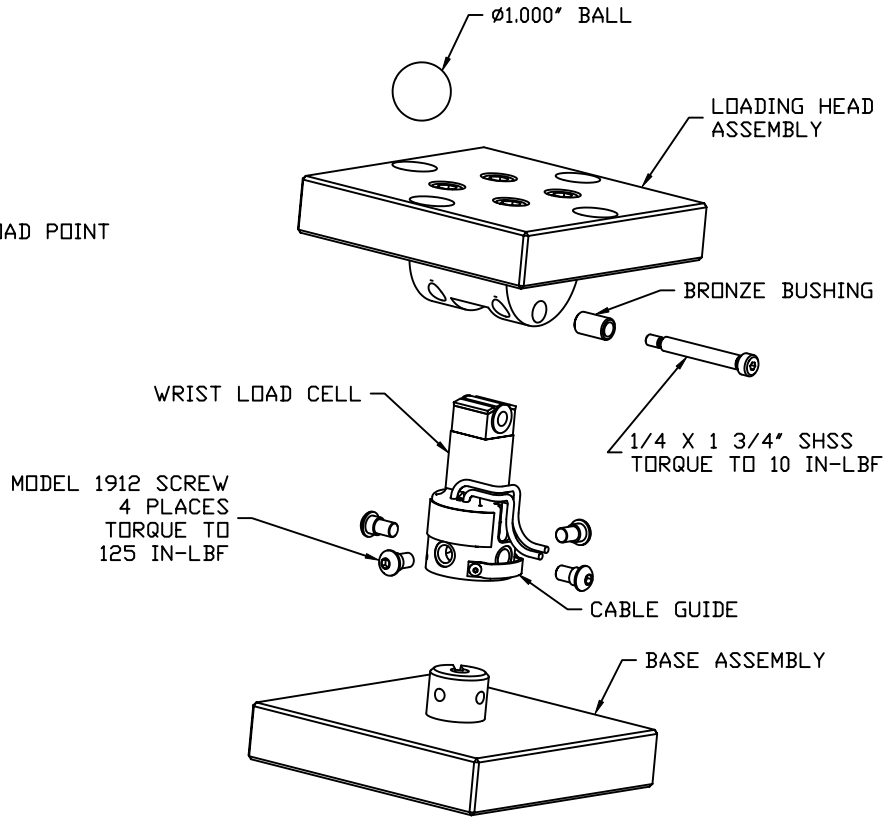
Issue Date: 25-Jan-00





ASSEMBLY INSTRUCTIONS:

1. REMOVE THE BUMPERS FROM THE END OF THE WRIST LOAD CELL.
2. REMOVE THE CABLES FROM UNDER THE CABLE CLAMP.
3. SLIDE THE END OF LOAD CELL INTO THE CLEVIS OF THE LOADING HEAD.
4. SLIDE BRONZE BUSHING INTO HOLE IN CLEVIS. SLIDE SHOULDER SCREW THROUGH BUSHING AND LOAD CELL. TORQUE SHOULDER SCREW TO 10 IN-LBF (1.1 Nm).
5. SLIDE WRIST LOAD CELL ONTO POST OF BASE ASSEMBLY. ATTACH WITH FOUR (4) MODEL 1912 SCREWS. TORQUE SCREWS TO 125 IN-LBF (14.1 Nm).
6. AFTER CALIBRATION BOND NEW BUMPERS IN PLACE USING LOCTITE "BLACK MAX" ADHESIVE.

USE CAL. FIXTURE: MODEL 4464

NEXT ASS'Y	QTY
PART USED ON	

CAL FIXTURE - WRIST LOAD CELL

SCALE:	VARIES		DRAWN BY: P. DEPINET
DATE:	22JUN99		MODEL: 4455/4380

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4455-C

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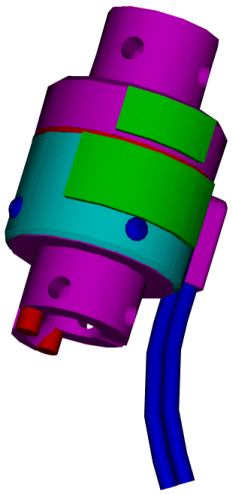


MODEL 4461 LOWER ARM LOAD CELL

Applications:

The Model 4461 Lower Arm load cell was designed to provide a way to measure three forces and three moments in the lower arm of the Hybrid III 5th Percentile ATD. The load cell assembly is mounted in lower arm between the elbow and hand. The load cell contains six channels, all of which are a full bridge strain gage circuit. This load cell is wired per the SAE J211 Right Hand Rule sign convention.

Standard Ordering Configuration: 4461J
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Fx	8,896 N	2,000 lbf	350 ohms	2.0 mV/V
Fy	8,896 N	2,000 lbf	350 ohms	2.0 mV/V
Fz	13,345 N	3,000 lbf	700 ohms	1.0 mV/V
Mx	226 Nm	2,000 in-lbf	350 ohms	3.0 mV/V
My	226 Nm	2,000 in-lbf	350 ohms	3.0 mV/V
Mz	169 Nm	1,500 in-lbf	700 ohms	3.0 mV/V

Non-linearity.....less than 1% of full scale
Hysteresis.....less than 1% of full scale
Crosstalk.....less than 5% of full scale
Excitation.....10 VDC nom. 15 VDC max.
Mass (without cable, with mounting screws).....(0.85 lb) 0.4 kg

Issue Date: 25-Jan-00

MODEL 4461 LOWER ARM LOAD CELL

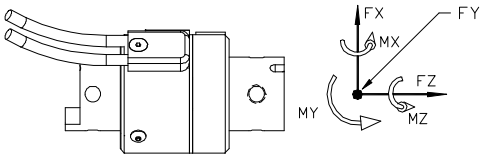
Wiring:

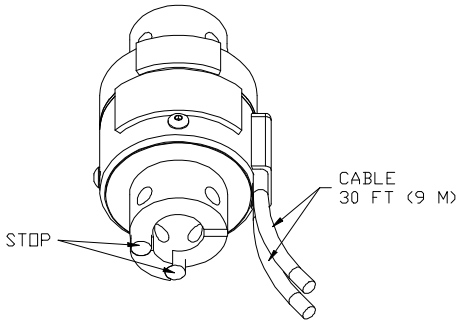
Fx Channel		Fy Channel		Fz Channel	
Brown	+Exc.	Red Stripe	+Exc.	Green	+Exc.
Red	+Sig.	Black	+Sig.	Blue	+Sig.
Orange	-Exc.	White	-Exc.	Violet	-Exc.
Yellow	-Sig.	Black Stripe	-Sig.	Grey	-Sig.

Mx Channel		My Channel		Mz Channel	
Brown	+Exc.	Red Stripe	+Exc.	Green	+Exc.
Red	+Sig.	Black	+Sig.	Blue	+Sig.
Orange	-Exc.	White	-Exc.	Violet	-Exc.
Yellow	-Sig.	Black Stripe	-Sig.	Grey	-Sig.

NOTES

1. Use Denton Model 4461-C calibration fixture. (Ref. Calibration Fixture Section)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.





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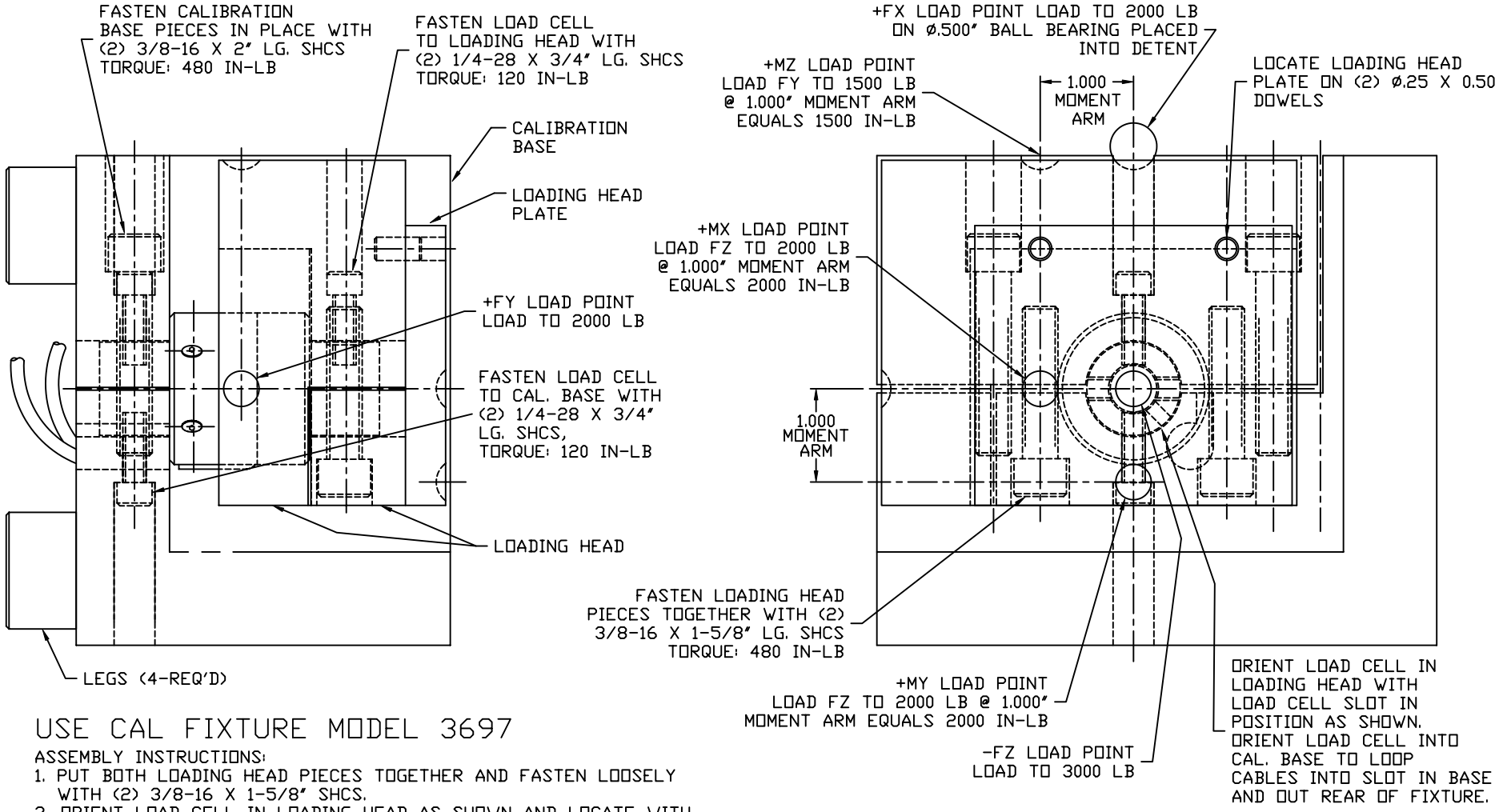

USE CAL FIXTURE MODEL 3697

ASSEMBLY INSTRUCTIONS:

1. PUT BOTH LOADING HEAD PIECES TOGETHER AND FASTEN LOOSELY WITH (2) 3/8-16 X 1-5/8" SHCS.
2. ORIENT LOAD CELL IN LOADING HEAD AS SHOWN AND LOCATE WITH (2) 1/4-28 X 3/4" LG. SHCS. TORQUE TO 120 IN.-LB. TIGHTEN THE 3/8 SCREWS AND THEN TORQUE TO 480 IN.-LB.
3. PLACE BOTH CALIBRATION BASE PIECES TOGETHER AND FASTEN LOOSELY WITH (2) 3/8-16 X 2" LG. SHCS.
4. INSERT LOAD CELL IN CALIBRATION BASE AS SHOWN AND LOCATE WITH (2) 1/4-28 X 3/4" LG. SHCS. TORQUE TO 120 IN.-LB. TIGHTEN THE 3/8 SCREWS AND THEN TORQUE TO 480 IN.-LB.
5. PLACE LOADING HEAD PLATE ONTO DOWEL PINS AS SHOWN.

CALIBRATION FIXTURE FOR MODEL 4461 ARM LOAD CELL

SCALE: FULL			DRAWN BY: H.P. / PJD
DATE: 13JUL99			MODEL: 4461

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4461-C

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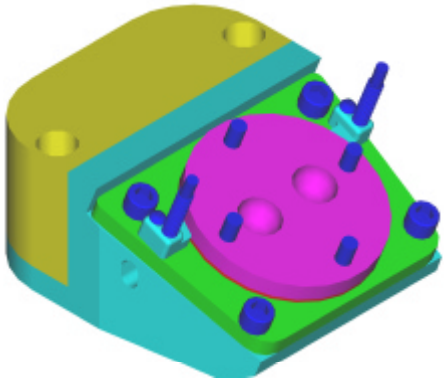


MODEL 4502 SIX CHANNEL LUMBAR SPINE LOAD CELL ASSEMBLY

Applications:

The Model 4502 Lumbar Spine load cell was designed to provide measurement of three forces and three moments at the base of the lumbar spine of the Hybrid III 50th or 95th Percentile ATD. The load cell assembly mounts between the pelvis and the lumbar spine in place of the 78051-53 bracket assembly. The load cell contains six channels, all of which are a full bridge strain gage circuit. This load cell output polarity is per the SAE J211 Right Hand Rule sign convention.

Standard Ordering Configuration: 4502J
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Fx	15.0 kN	3,372 lbf	350 ohms	1.9 mV/V
Fy	15.0 kN	3,372 lbf	350 ohms	1.9 mV/V
Fz	20.0 kN	4,496 lbf	700 ohms	1.1 mV/V
Mx	600 Nm	5,311 in-lbf	700 ohms	1.8 mV/V
My	600 Nm	5,311 in-lbf	700 ohms	1.8 mV/V
Mz	350 Nm	3,098 in-lbf	350 ohms	1.6 mV/V

Non-linearity.....less than 1% of full scale
Hysteresis.....less than 1% of full scale
Crosstalk.....less than 5% of full scale
Excitation.....10 VDC nom. 15 VDC max.
Assembly Mass (without cable or mounting screws).....15.8 lb (7.2 kg)

Wiring:

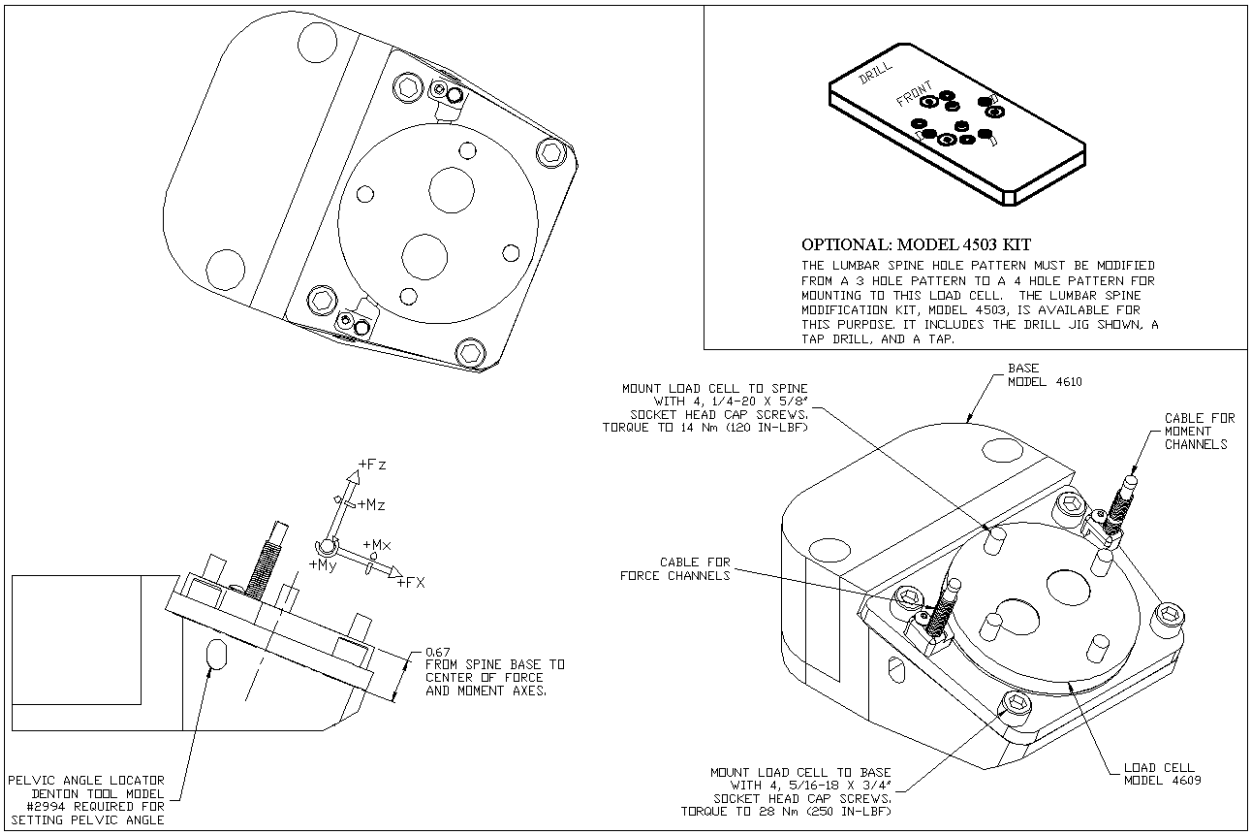
Fx Channel		Fy Channel		Fz Channel	
Brown	+Exc.	Red Stripe	+Exc.	Green	+Exc.
Red	+Sig.	Black	+Sig.	Blue	+Sig.
Orange	-Exc.	White	-Exc.	Violet	-Exc.
Yellow	-Sig.	Black Stripe	-Sig.	Grey	-Sig.
Mx Channel		My Channel		Mz Channel	
Brown	+Exc	Red Stripe	+Exc	Green	+Exc
Red	+Sig	Black	+Sig	Blue	+Sig
Orange	-Exc	White	-Exc	Violet	-Exc
Yellow	-Sig	Black Stripe	-Sig	Grey	-Sig

Issue Date: 7-Feb-00

MODEL 4502 LUMBAR SPINE
LOAD CELL ASSEMBLY

NOTES

1. Use Denton Model 4506 calibration fixture. (Ref. Calibration Fixture drawing 4502-C)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.
6. The load cell and base can be ordered separately as 4609 and 4610 respectively.



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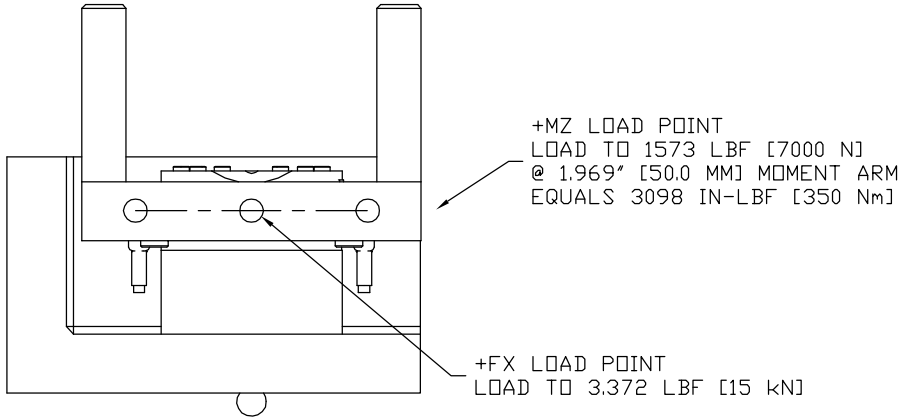
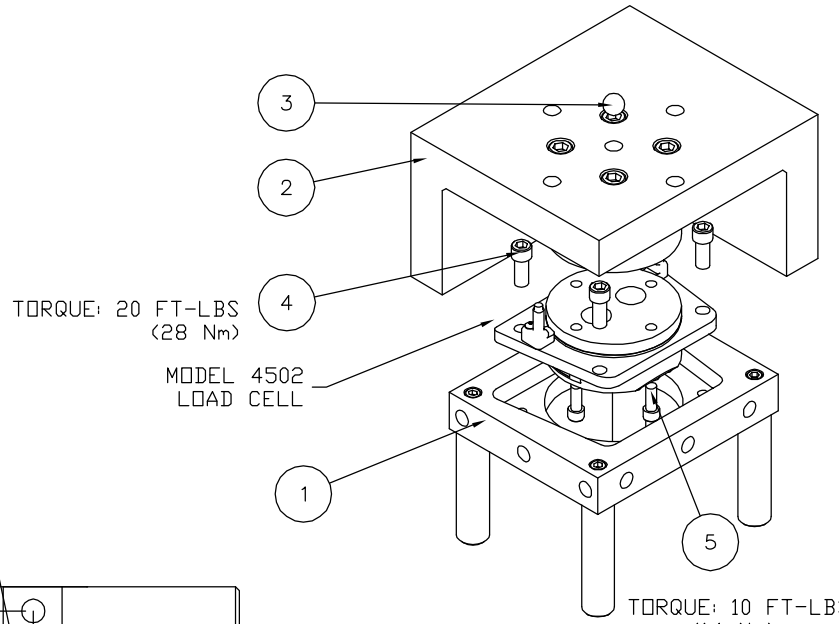
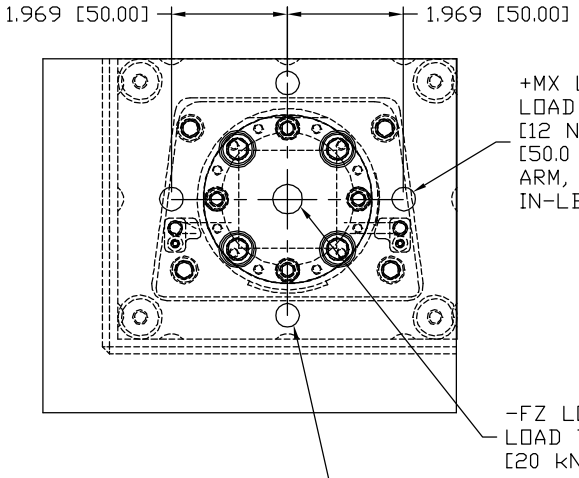
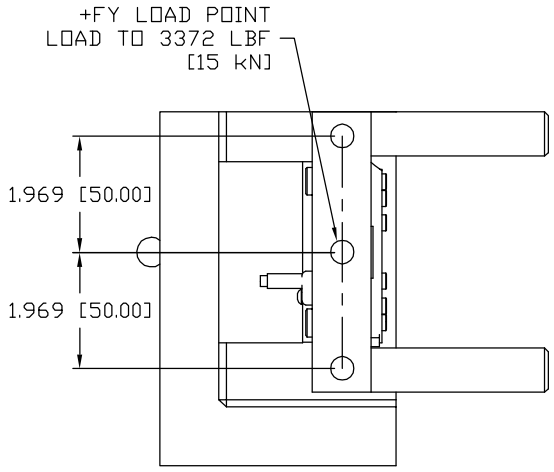
Issue Date: 7-Feb-00









ITEM	QTY	PART NUMBER	DESCRIPTION
5	4	PURCHASED	1/4-20 X 5/8" SHCS
4	4	PURCHASED	5/16-18 X 3/4" SHCS
3	1	PURCHASED	LOADING BALL, ø0.500
2	1	4545	LOADING BASE
1	1	4542	LOADING HEAD

PARTS LIST

CALIBRATION FIXTURE

SCALE: .5X
DATE: 01OCT99
DRAWN BY: rdupont
MODEL: 4502

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4502-C

NEXT ASS'Y	QTY
PART USED ON	

SYM	REVISION	DATE

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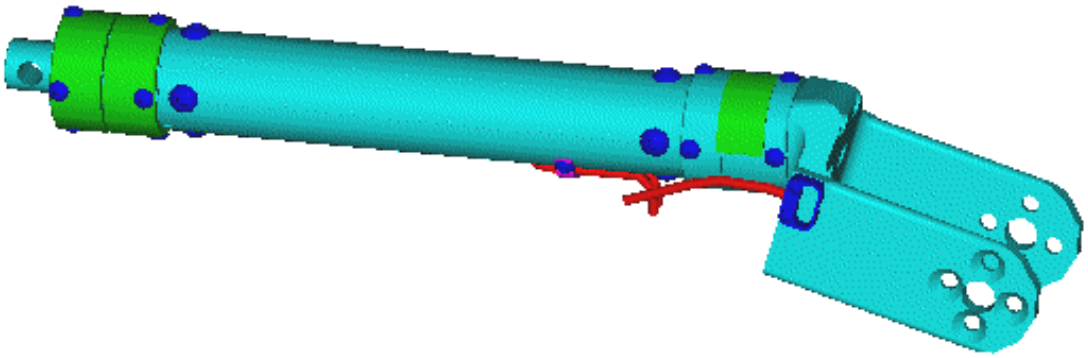
2967 Waterview Dr., Rochester Hills, MI 48309
Tel (248) 852-5100 • Fax (248) 852-6060 • email: info@radenton.com • www.radenton.com



MODEL 4507
LOWER LEG
LOAD CELL ASSEMBLY

Applications:
The Lower Leg Load Cell Assembly (Model# 4507) is two load cells: Upper Tibia (Model 3115), the Lower Tibia (Model 3287) and Non-Instrumented Knee Clevis (Model 2110). The Model 4507 Lower Leg Load Cell Assembly is used on the Hybrid III 50th percentile Crash Dummy. The instrumented lower leg measures the forces and moments acting upon the lower section of the leg.

Standard Ordering Configuration: 4507J
For optional configurations, see load cell ordering guide or consult factory.

Specifications: (for more complete channel information see the Specification sheet for each Load Cell)

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Upper Tibia:				
Fx	11.1 kN	2500 lbf	350 ohms	2.0 mV/V
Fz	11.1 kN	2500 lbf	700 ohms	1.0 mV/V
Mx	395 NM	3500 in-lbf	700 ohms	3.0 mV/V
My	395 NM	3500 in-lbf	700 ohms	3.0 mV/V
Lower Tibia:				
Fx	11.1 kN	2500 lbf	350 ohms	2.0 mV/V
Fz	11.1 kN	2500 lbf	700 ohms	1.0 mV/V
Mx	395 NM	3500 in-lbf	700 ohms	3.0 mV/V
My	395 NM	3500 in-lbf	700 ohms	3.0 mV/V

Non-linearity ..... less than 1% of full scale
Hysteresis..... less than 1% of full scale
Crosstalk ..... less than 5% of full scale
Excitation ..... 10 VDC nom. 15 VDC max.

Issue Date: 22-Feb-00

MODEL 4507 LOWER LEG LOAD CELL ASSEMBLY

Wiring

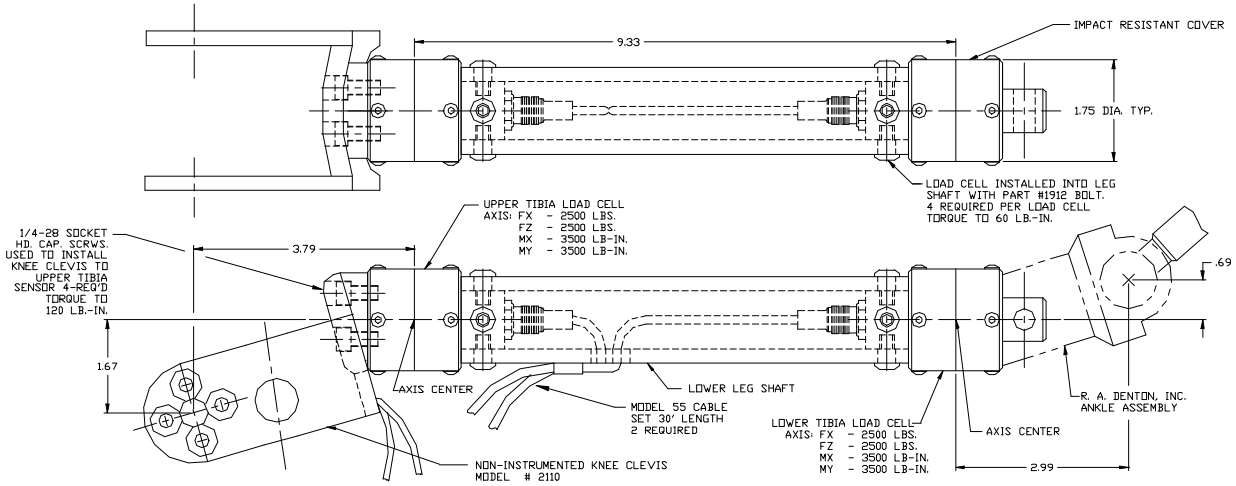
Upper & Lower Tibias:

Fx Channel		Fy Channel		Fz Channel	
Brown	+Exc	Red-Stripe	+Exc	Green	+Exc
Red	+Sig	Black	+Sig	Blue	+Sig
Orange	-Exc	White	-Exc	Violet	-Exc
Yellow	-Sig	Black-Stripe	-Sig	Grey	-Sig

Mx Channel		My Channel	
Brown	+Exc	Red-Stripe	+Exc
Red	+Sig	Black	+Sig
Orange	-Exc	White	-Exc
Yellow	-Sig	Black-Stripe	-Sig

NOTES

1. Use Denton Model 2171 calibration fixture. (Ref. Calibration Fixture drawing 4507-C)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix "J" on the model tag on the load cell.
3. If the model tag on the load cell includes a "G" suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an "I" suffix, there is an ID module in the body of the load cell. The number following the "I" indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30'). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.



Creating the Standard in Safety Measurement Since 1974

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Issue Date: 22-Feb-00

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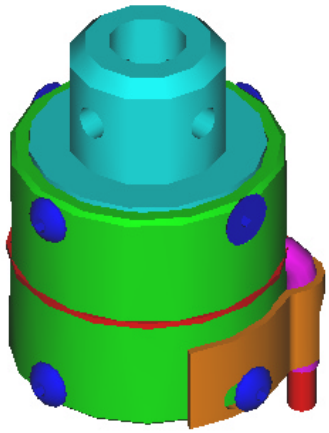


MODEL 4509 FIVE CHANNEL UPPER TIBIA LOAD CELL

Applications:

The Model 4509 Upper Tibia load cell was designed to provide measurement of three forces and two moments (Mx, My) at the top of the lower leg of the THOR-LX leg assembly for the THOR ATD. The load cell mounts to the top of the lower leg bone, under the knee clevis. The load cell contains five channels, all of which are a full bridge strain gage circuit. This load cell is wired per the SAE J211 Right Hand Rule sign convention.

Standard Ordering Configuration: 4509J
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity Metric	Capacity English	Bridge Resistance (nom)	Output Sensitivity (nom)
Fx	11.12 KN	2500 lbf	350 ohms	2.0 mV/V
Fy	11.12 KN	2500 lbf	350 ohms	2.0 mV/V
Fz	11.12 KN	2500 lbf	700 ohms	1.0 mV/V
Mx	395 Nm	3500 in-lbf	700 ohms	3.0 mV/V
My	395 Nm	3500 in-lbf	700 ohms	3.0 mV/V

Non-linearity.....less than 1% of full scale
Hysteresis.....less than 1% of full scale
Cross-talk.....less than 5% of full scale
Excitation.....10 VDC nom. 15 VDC max.
Assembly Mass (without cable and mounting screws).....(1.02 lb) 0.5 kg

Wiring:

Fx Channel		Fy Channel		Fz Channel	
Brown	+Exc.	Red Stripe	+Exc.	Green	+Exc.
Red	+Sig.	Black	+Sig.	Blue	+Sig.
Orange	-Exc.	White	-Exc.	Violet	-Exc.
Yellow	-Sig.	Black Stripe	-Sig.	Grey	-Sig.

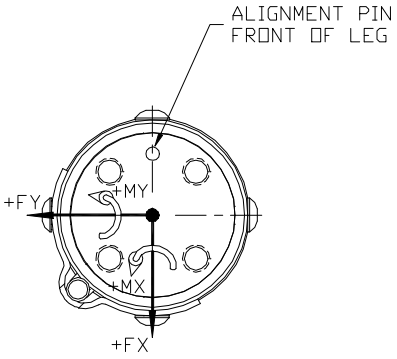
Mx Channel		My Channel	
Green Stripe	+Exc	Pink	+Exc.
Blue Stripe	+Sig	Tan	+Sig.
Orange Stripe	-Exc.	Brown Stripe	-Exc.
Yellow Stripe	-Sig.	Violet Stripe	-Sig.

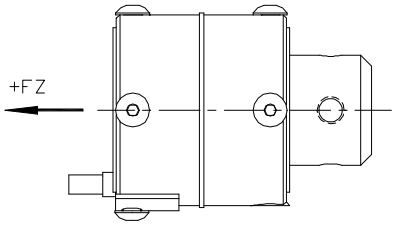
Issue Date: 7-Feb-00

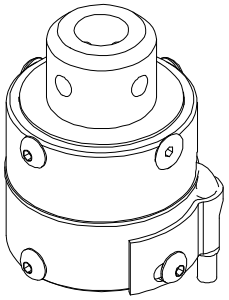
MODEL 4509 UPPER TIBIA LOAD CELL

NOTES

1. Use Denton Model 3337 calibration fixture. (Ref. Calibration Fixture drawing 4509-C)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.







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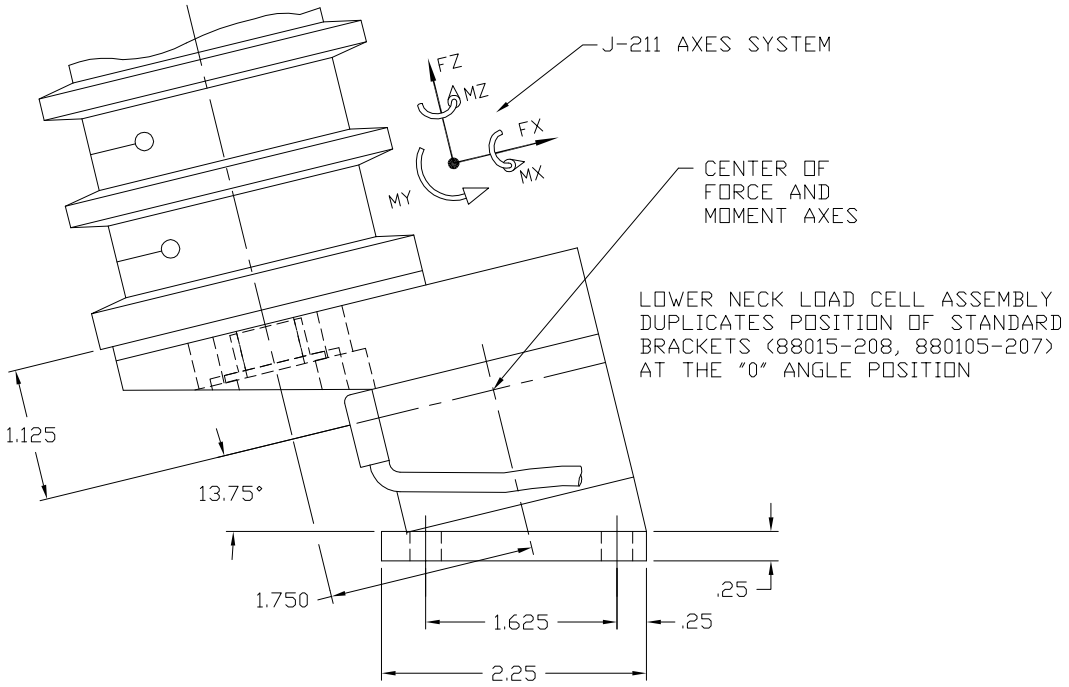
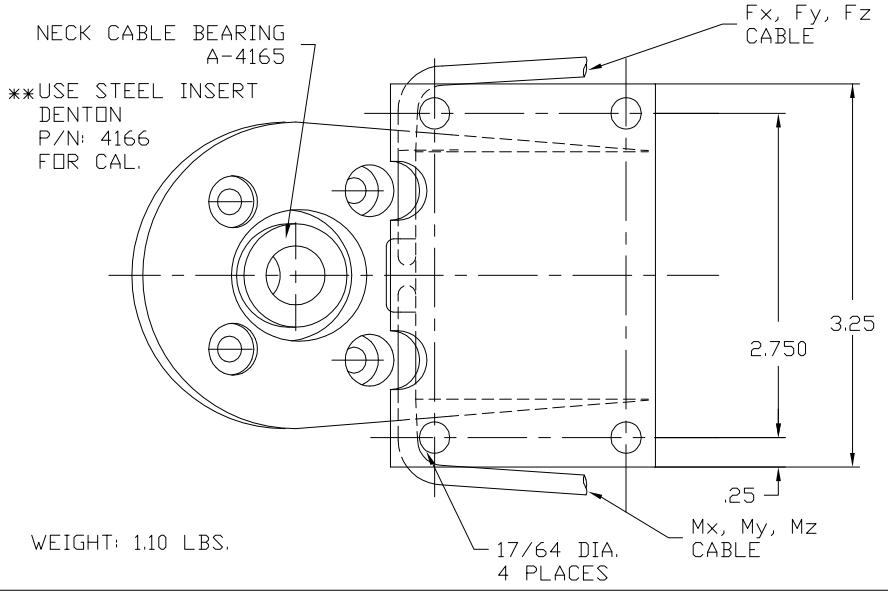
Issue Date: 7-Feb-00





WEIGHT: 1.10 LBS.

MODEL 4541J LOWER NECK LOAD CELL
HYBRID III SMALL FEMALE

AXIS	CAPACITY	OUPUT	BRIDGE RESISTANCE
FX	3000 LBS.	2.2 mV/V NOM.	350Ω
FY	3000 LBS.	2.2 mV/V NOM.	350Ω
FZ	3000 LBS.	1.2 mV/V NOM.	700Ω
MX	4000 LB-IN	2.0 mV/V NOM.	700Ω
MY	4000 LB-IN	2.0 mV/V NOM.	700Ω
MZ	3000 LB-IN	2.0 mV/V NOM.	350Ω

NONLINEARITY <1% OF FULL SCALE
CROSS TALK <5% OF FULL SCALE

THE OUTPUT POLARITY OF THE 4541J LOWER NECK LOAD CELL CONFORMS TO SAE J-211 POLARITY.

TRANSFORMATION EQUATIONS FOR LOWER NECK LOAD CELL BASED ON J-211 SIGN CONVENTION

MOMENT CORRECTION EQUATIONS TO TRANSFER THE MEASURED MOMENT FROM THE LOAD CELL TO THE BASE OF THE NECK.

TRANSFORMATION EQUATIONS

$$F_X = F_{XM}$$
$$F_Y = F_{YM}$$
$$F_Z = F_{ZM}$$
$$M_X = M_{XM} - F_{YM}\,1.125$$
$$M_Y = M_{YM} + F_{XM}\,1.125 + F_{ZM}\,1.75$$
$$M_Z = M_{ZM} - F_{YM}\,1.75$$

WHERE:

$F_{XM}, F_{YM}, F_{ZM}, M_{XM}, M_{YM}, M_{ZM}$

ARE THE FORCES AND MOMENTS MEASURED BY THE LOWER NECK LOAD CELL AND

$F_X, F_Y, F_Z, M_X, M_Y, M_Z$

ARE THE CALCULATED FORCES AND MOMENTS AT THE CENTER OF THE BASE OF THE NECK.

SYM	REVISION	DATE

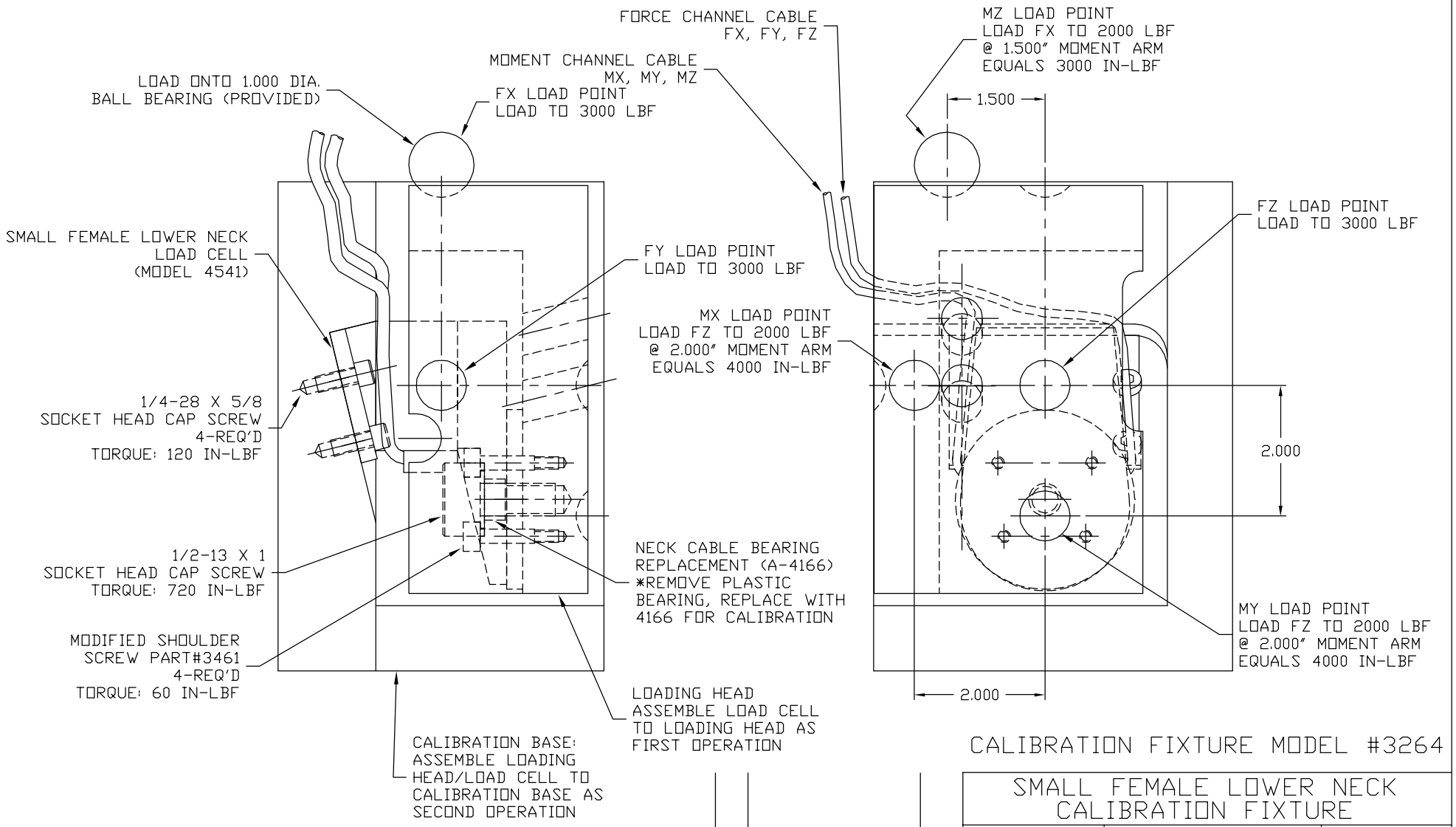
SMALL FEMALE LOWER NECK LOAD CELL

SCALE: FULL			DRAWN BY: C.R.MORGAN
DATE: 30SEPT99			MODEL: 4541J

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4541-D



CALIBRATION FIXTURE MODEL #3264

SYM	REVISION	DATE

SMALL FEMALE LOWER NECK CALIBRATION FIXTURE

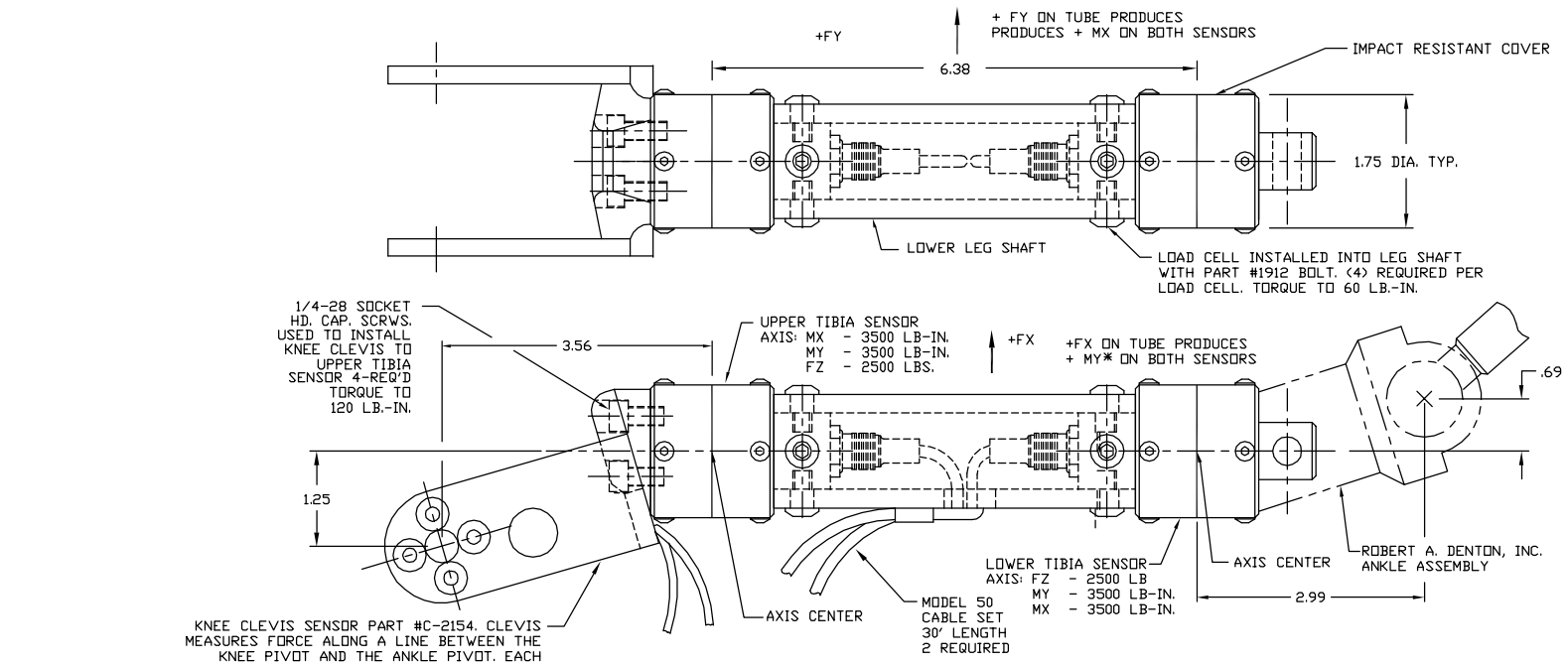
SCALE: .75x		DRAWN BY: C.R. MORGAN
DATE: 11OCT95		MODEL: 4541

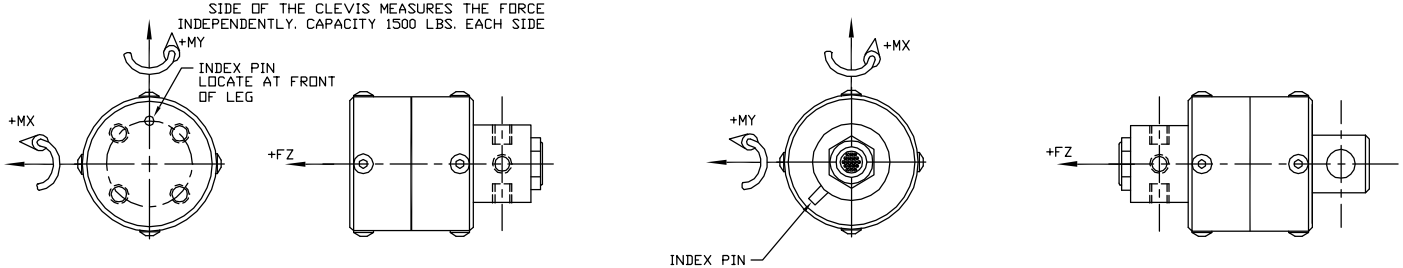
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4541-C





UPPER TIBIA
MODEL 3292

AXIS	CAPACITY	OUTPUT
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.

LOWER TIBIA
MODEL 3093

AXIS	CAPACITY	OUTPUT
FZ	2500 LBS.	1.0 mV/V NOM.
MY	3500 LB-IN.	3.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.

NOTES:
1. POLARITIES SHOWN ARE PER THE STANDARD DENTON MODEL 1571 INSTRUMENTED LOWER LEG. POLARITIES DO NOT AGREE WITH S.A.E. J-211. CABLE COLOR CODES ARE PROVIDED ON THE LOAD CELL CALIBRATION REPORTS.

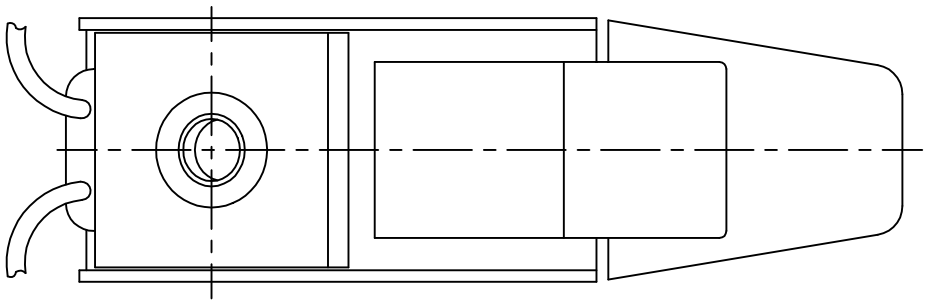
INSTRUMENTED LEG HYBRID III
5TH PERCENTILE

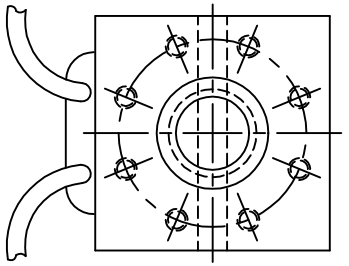
SCALE:	.65		DRAWN BY: C.R.M./S.E.F.
DATE:	5/1/89		MODEL: 4543

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4543-D

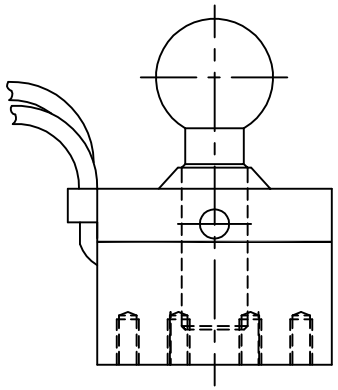




FZ
FX

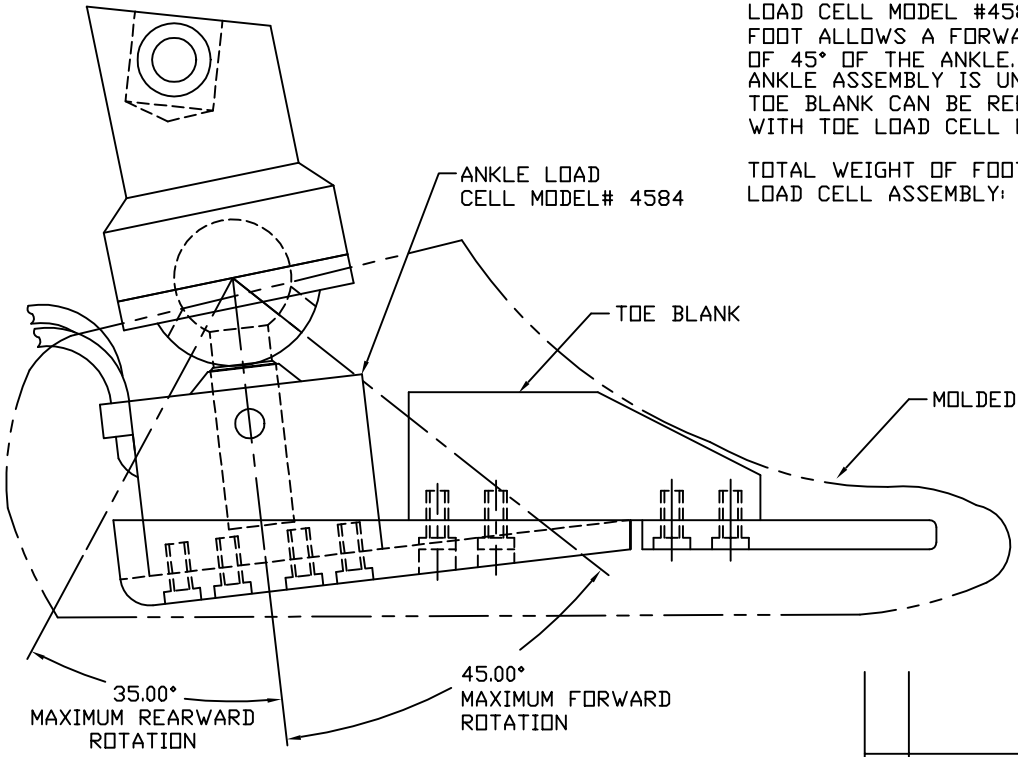
THE ANKLE-FOOT ASSEMBLY SHOWN IS A REPLACEMENT OF THE STANDARD HYBRID III ANKLE-FOOT. THE FOOT ASSEMBLY INCLUDES A 2-CHANNEL ANKLE LOAD CELL MODEL #4584. THE FOOT ALLOWS A FORWARD ROTATION OF 45° OF THE ANKLE. THE ANKLE ASSEMBLY IS UNCHANGED. THE TOE BLANK CAN BE REPLACED WITH TOE LOAD CELL MODEL #3696.

TOTAL WEIGHT OF FOOT AND LOAD CELL ASSEMBLY: 3.1 LBS.



HYBRID III ANKLE LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	2000 LBS.	2.0 mV/V NOMINAL
FZ	3500 LBS.	1.5 mV/V NOMINAL



NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE

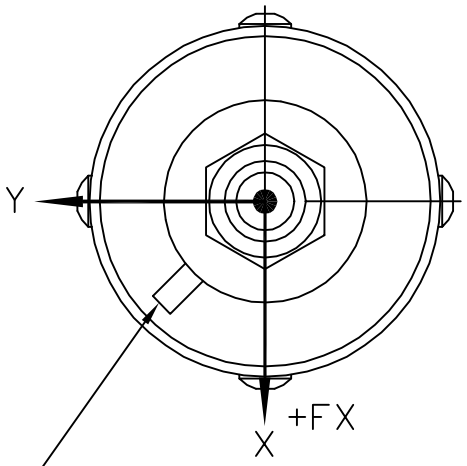
HYBRID III ANKLE LOAD CELL

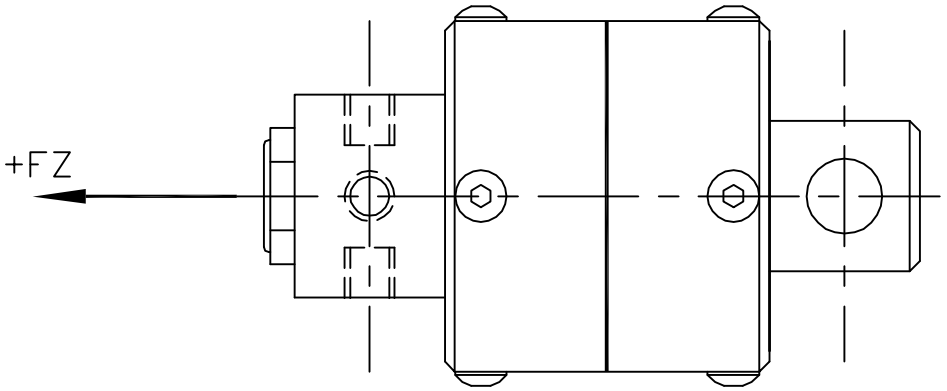
SCALE: FULL		DRAWN BY: P. DEPINET
DATE: 03NOV99		MODEL: 4565

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4565-D





INDEX PIN
LOCATE PIN IN LEFT
DETENT OF LEG TUBE
FOR AXES POLARITY
AS SHOWN

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.

CABLE COLOR CODE

FX		FZ	
BROWN	+EXC.	GREEN	+EXC.
RED	+SIG.	BLUE	+SIG.
ORANGE	-EXC.	VIOLET	-EXC.
YELLOW	-SIG.	GREY	-SIG.

NOTE: POLARITY SHOWN
CONFORMS TO SAE J-211

2 CHANNEL LOWER TIBIA

SCALE: FULL
DATE: 03NOV99
DRAWN BY: *P. DEPINET*
MODEL: 4567

UNLESS OTHERWISE SPECIFIED

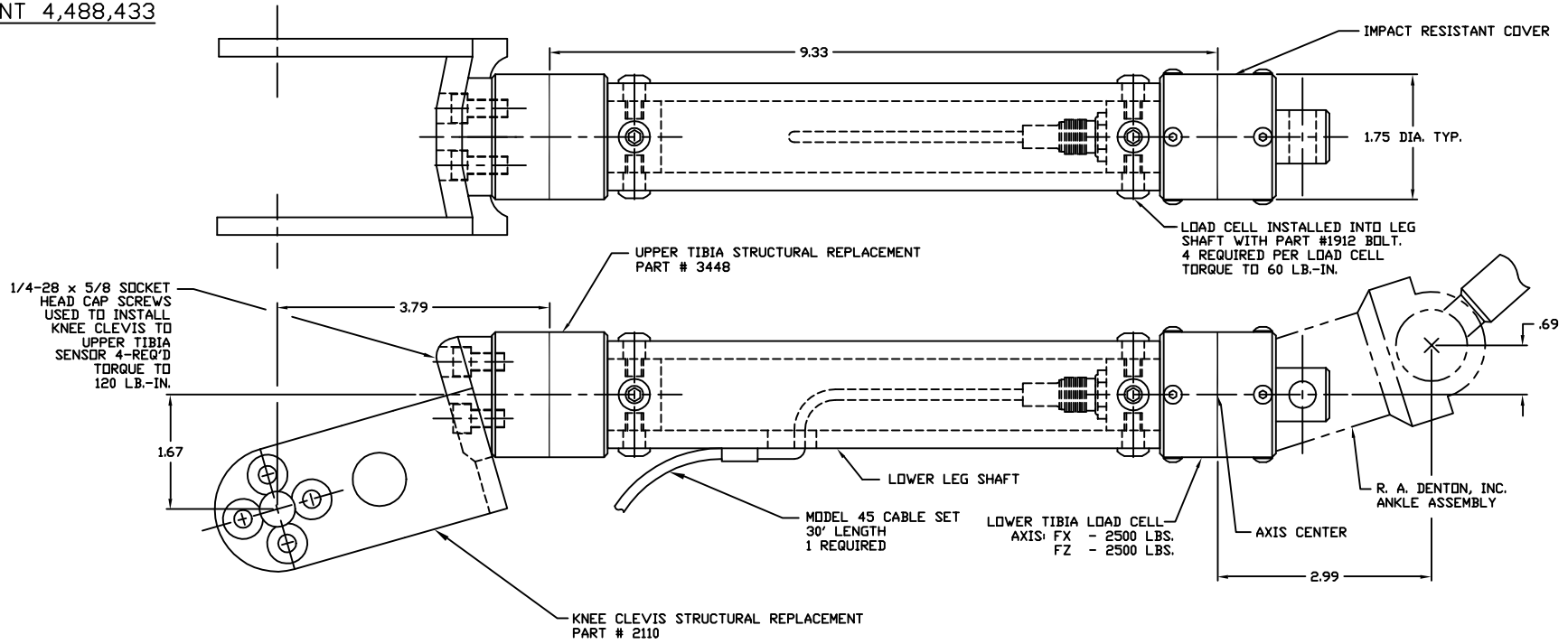
TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

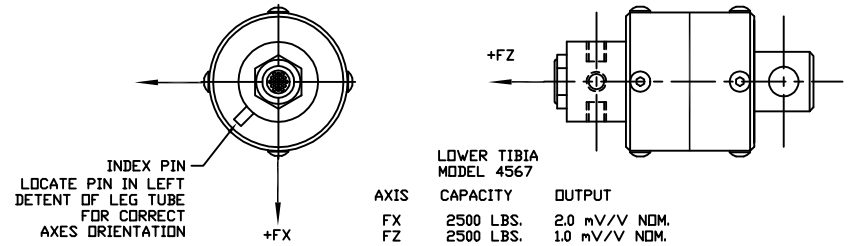
SYM	REVISION	DATE

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-4567-D

PATENT 4,488,433





LOWER TIBIA
MODEL 4567

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.

SYM	REVISION	DATE

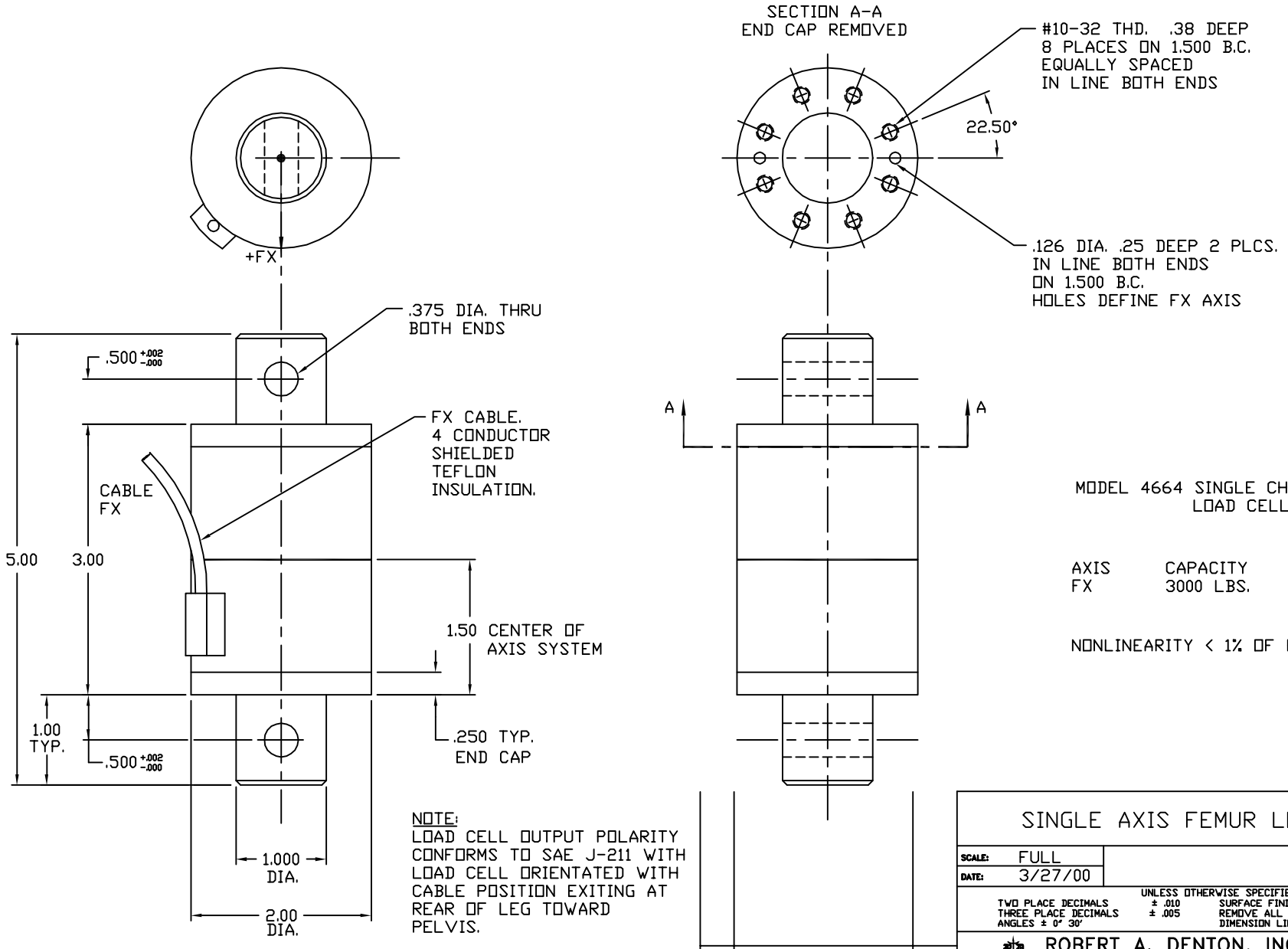
INSTRUMENTED TIBIA
50TH PERCENTILE HYBRID III

SCALE: NONE		DRAWN BY: P. DEPINET
DATE: 03NOV99		MODEL: 4568

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4568-D



MODEL 4664 SINGLE CHANNEL FEMUR
LOAD CELL

AXIS	CAPACITY	OUTPUT
FX	3000 LBS.	1.8 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE

NOTE:
LOAD CELL OUTPUT POLARITY CONFORMS TO SAE J-211 WITH LOAD CELL ORIENTATED WITH CABLE POSITION EXITING AT REAR OF LEG TOWARD PELVIS.

SYM	REVISION	DATE

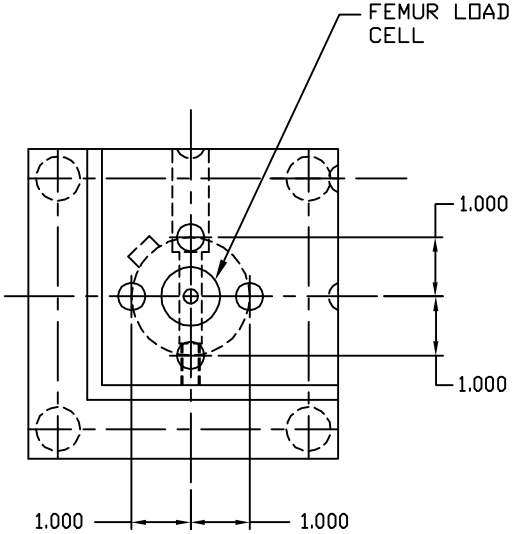
SINGLE AXIS FEMUR LOAD CELL

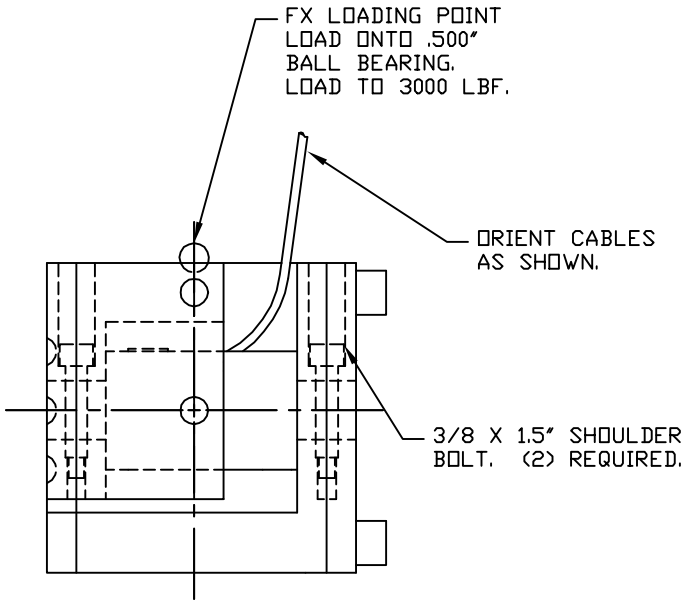
SCALE: FULL		DRAWN BY: C.HEAD
DATE: 3/27/00		MODEL: 4664

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4664-D





CALIBRATION FIXTURE MODEL #1957

SYM	REVISION	DATE

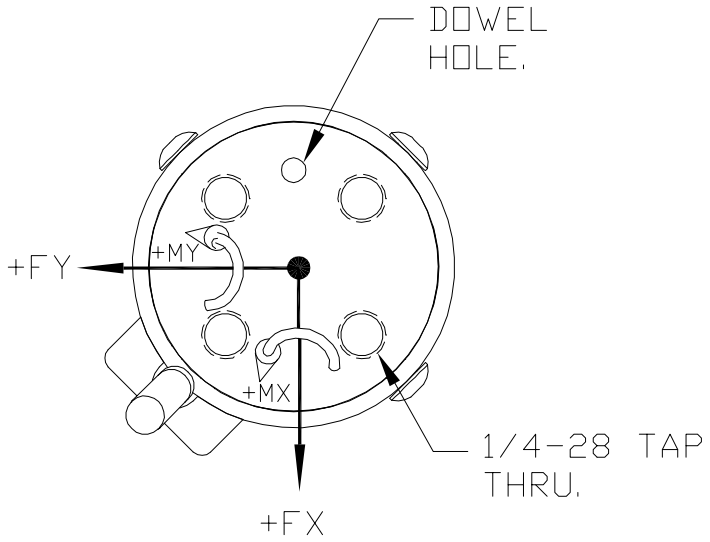
FEMUR CALIBRATION FIXTURE

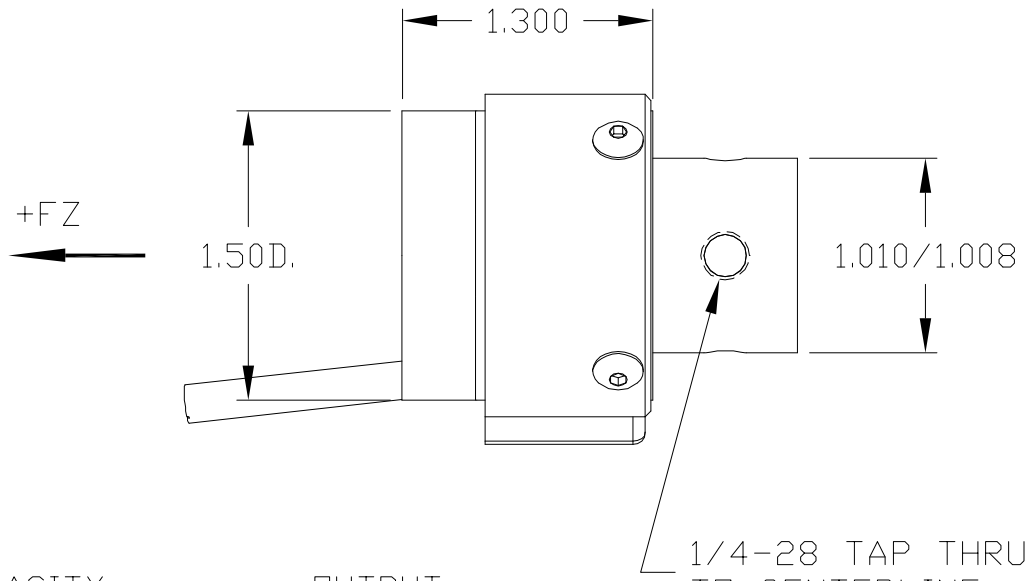
SCALE: 1/2		DRAWN BY: C.HEAD
DATE: 3/29/00		MODEL: 4664

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4664-C





AXIS	CAPACITY	OUTPUT
FX	2000 LBS.	2.0 mV/V NOM.
FZ	2000 LBS.	1.0 mV/V NOM.
MX	2500 LB.-IN.	3.0 mV/V NOM.
MY	2500 LB.-IN.	3.0 mV/V NOM.

CABLE COLOR CODE

FX		FZ		MX		MY	
BROWN	+EXC.	GREEN	+EXC.	GREEN STRIPE	+EXC.	RED STRIPE	+EXC.
RED	+SIG.	BLUE	+SIG.	BLUE STRIPE	+SIG.	BLACK	+SIG.
ORANGE	-EXC.	VIOLET	-EXC.	ORANGE STRIPE	-EXC.	WHITE	-EXC.
YELLOW	-SIG.	GREY	-SIG.	YELLOW STRIPE	-SIG.	BLACK STRIPE	-SIG.

WEIGHT: .65 POUNDS

MODEL 4825 FLX UPPER TIBIA

SCALE: FULL		DRAWN BY: C.R. MORGAN
DATE: 27MAY00		MODEL: 4825

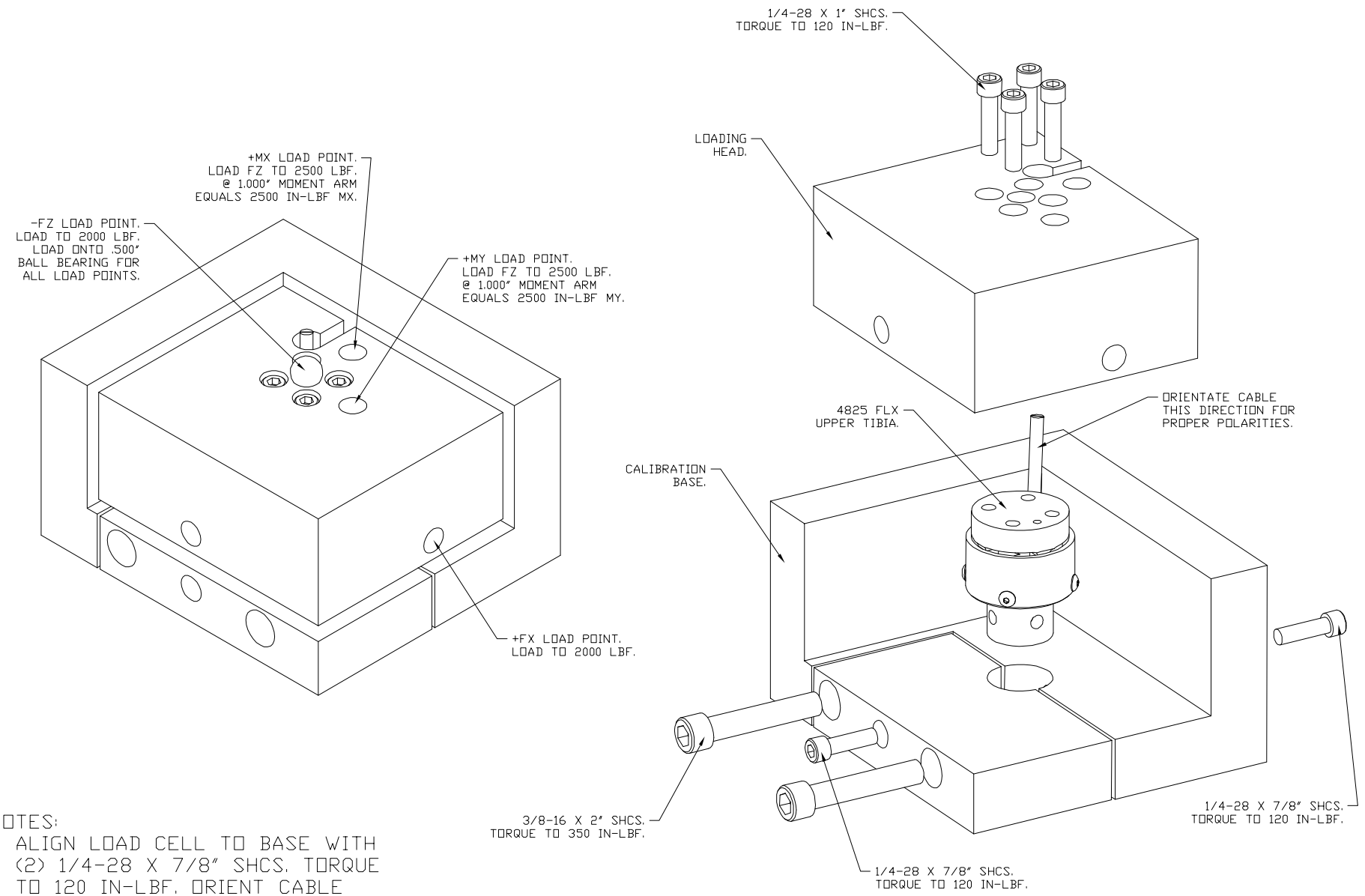
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

SYM	REVISION	DATE

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-4825-D



NOTES:

1. ALIGN LOAD CELL TO BASE WITH (2) 1/4-28 X 7/8" SHCS. TORQUE TO 120 IN-LBF. ORIENT CABLE TOWARD CORNER OF BASE AS SHOWN.
2. SECURE LOAD CELL TO BASE WITH (2) 3/8-16 X 2" SHCS. TORQUE TO 350 IN-LBF.
3. SECURE LOADING HEAD TO LOAD CELL WITH (4) 1/4-28 X 1" SHCS. TORQUE TO 120 IN-LBF.

CALIBRATION FIXTURE MODEL #4976

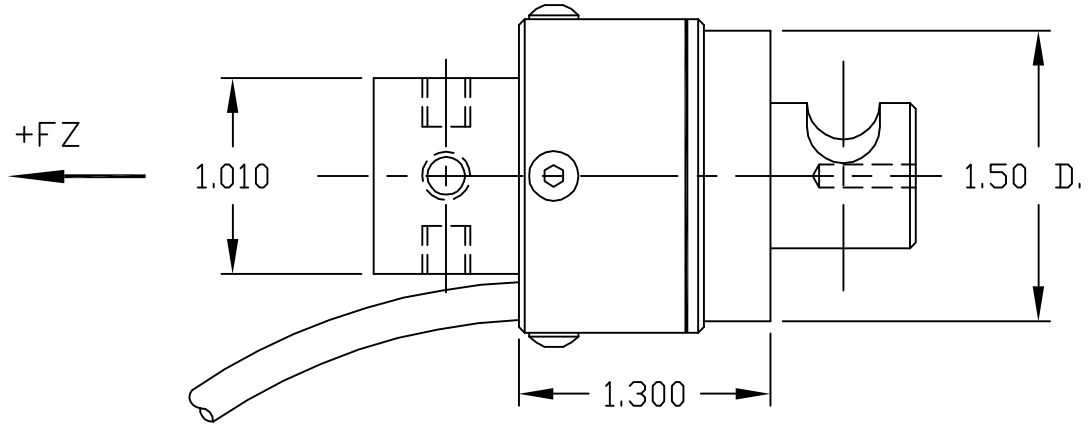
CALIBRATION FIXTURE FOR
4825 FLX UPPER TIBIA

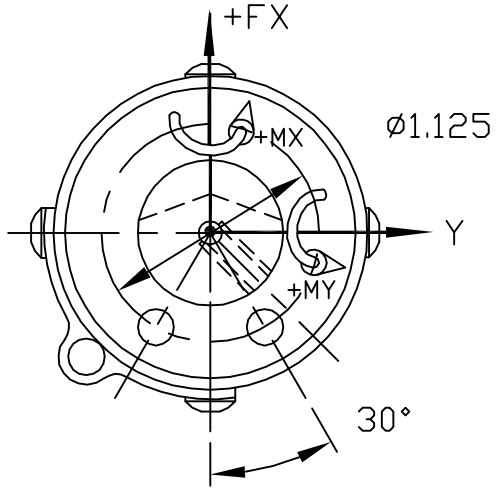
SCALE: NONE			DRAWN BY: CHEAD
DATE: 10/27/00			MODEL: 4976

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-4825-C





AXIS	CAPACITY	OUTPUT
FX	2000 LBS.	2.0 mV/V NOM.
FY	2000 LBS.	2.0 mV/V NOM.
FZ	2000 LBS.	1.0 mV/V NOM.
MX	2500 LB.-IN.	3.0 mV/V NOM.
MY	2500 LB.-IN.	3.0 mV/V NOM.

CABLE COLOR CODE

FX		FY		FZ		MX		MY	
BROWN	+EXC.	RED STRIPE	+EXC.	GREEN	+EXC.	GREEN STRIPE	+EXC.	PINK	+EXC.
RED	+SIG.	BLACK	+SIG.	BLUE	+SIG.	BLUE STRIPE	+SIG.	TAN	+SIG.
ORANGE	-EXC.	WHITE	-EXC.	VIOLET	-EXC.	ORANGE STRIPE	-EXC.	BROWN STRIPE	-EXC.
YELLOW	-SIG.	BLACK STRIPE	-SIG.	GREY	-SIG.	YELLOW STRIPE	-SIG.	VIOLET STRIPE	-SIG.

WEIGHT: .74 POUNDS

SYM	REVISION	DATE

MODEL 4826 FLX LOWER TIBIA

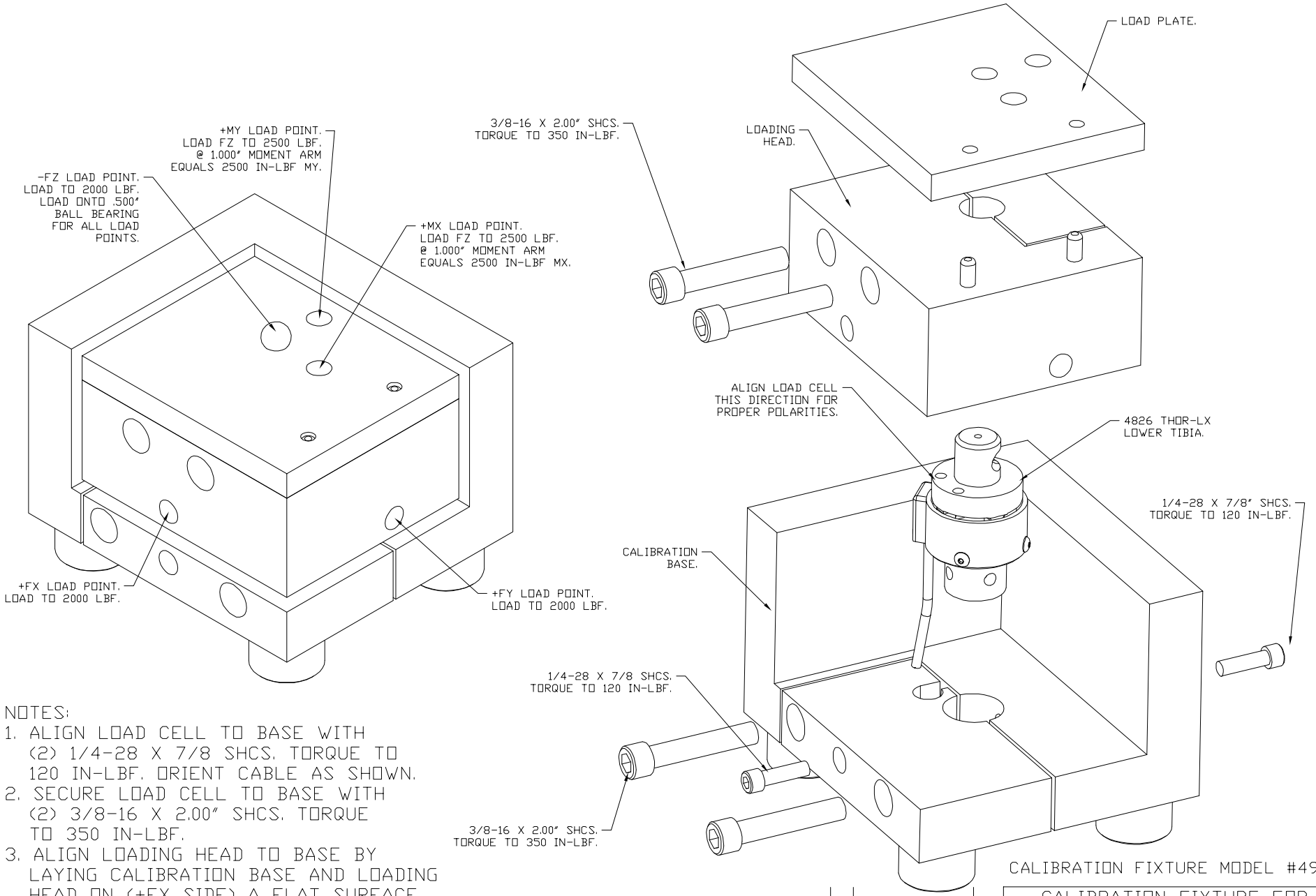
SCALE: FULL		DRAWN BY: *C.R. MORGAN*
DATE: 27MAY00		MODEL: 4826

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-4826



NOTES:

1. ALIGN LOAD CELL TO BASE WITH (2) 1/4-28 X 7/8 SHCS. TORQUE TO 120 IN-LBF. ORIENT CABLE AS SHOWN.
2. SECURE LOAD CELL TO BASE WITH (2) 3/8-16 X 2.00" SHCS. TORQUE TO 350 IN-LBF.
3. ALIGN LOADING HEAD TO BASE BY LAYING CALIBRATION BASE AND LOADING HEAD ON (+FX SIDE) A FLAT SURFACE AND SECURING WITH (2) 3/8-16 X 2.00" SHCS. TORQUE TO 350 IN-LBF.

CALIBRATION FIXTURE MODEL #4974

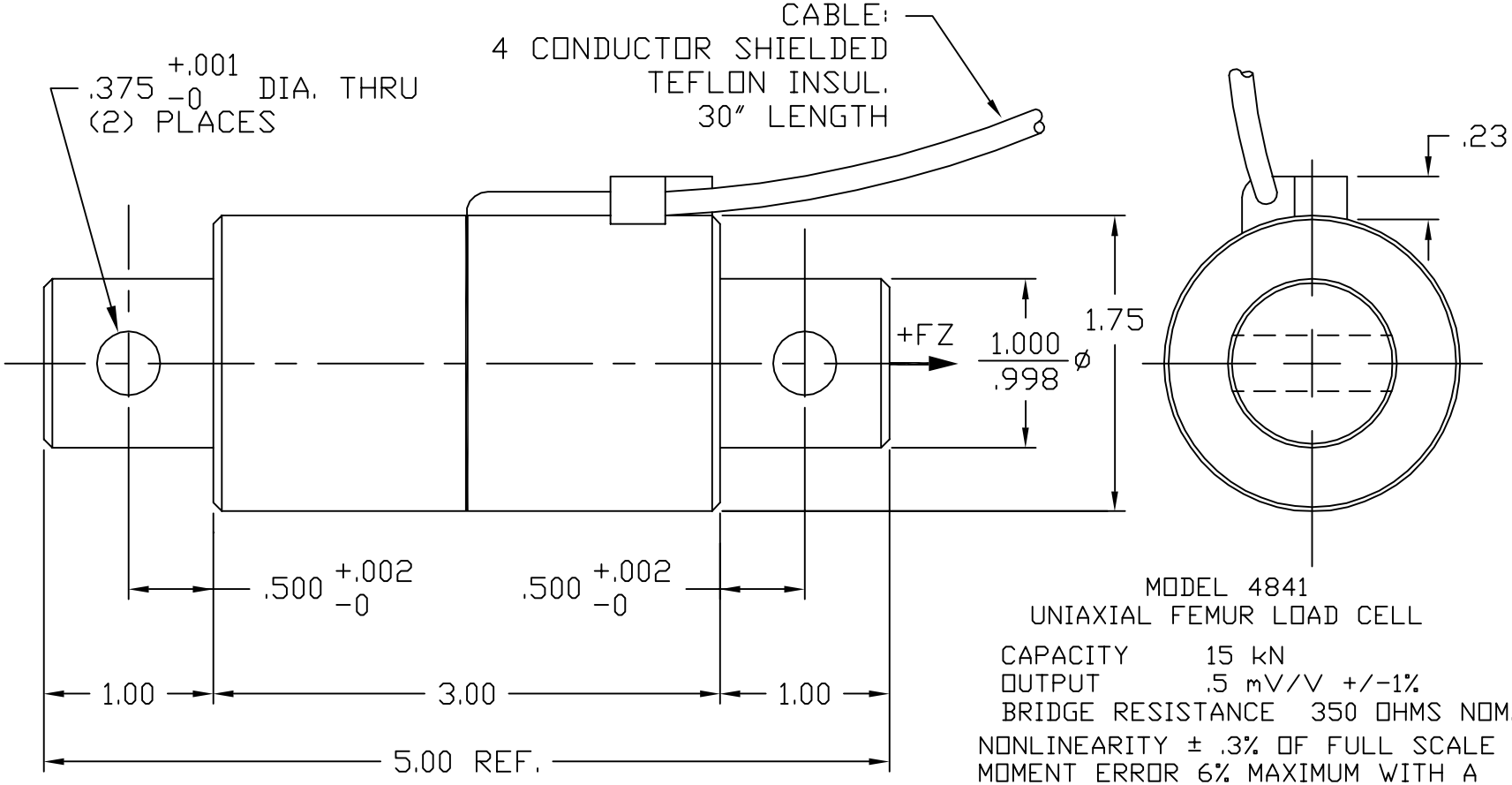
CALIBRATION FIXTURE FOR 4826 FLX LOWER TIBIA

SCALE: NONE			DRAWN BY: CHEAD
DATE: 10/26/00			MODEL: 4974

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-4826-C



MODEL 4841
UNIAXIAL FEMUR LOAD CELL

CAPACITY	15 kN
OUTPUT	.5 mV/V +/-1%
BRIDGE RESISTANCE	350 OHMS NOM.

NONLINEARITY ± .3% OF FULL SCALE
MOMENT ERROR 6% MAXIMUM WITH A
5000 IN.-LB MOMENT

SYM	REVISION	DATE

UNIAXIAL FEMUR LOAD CELL

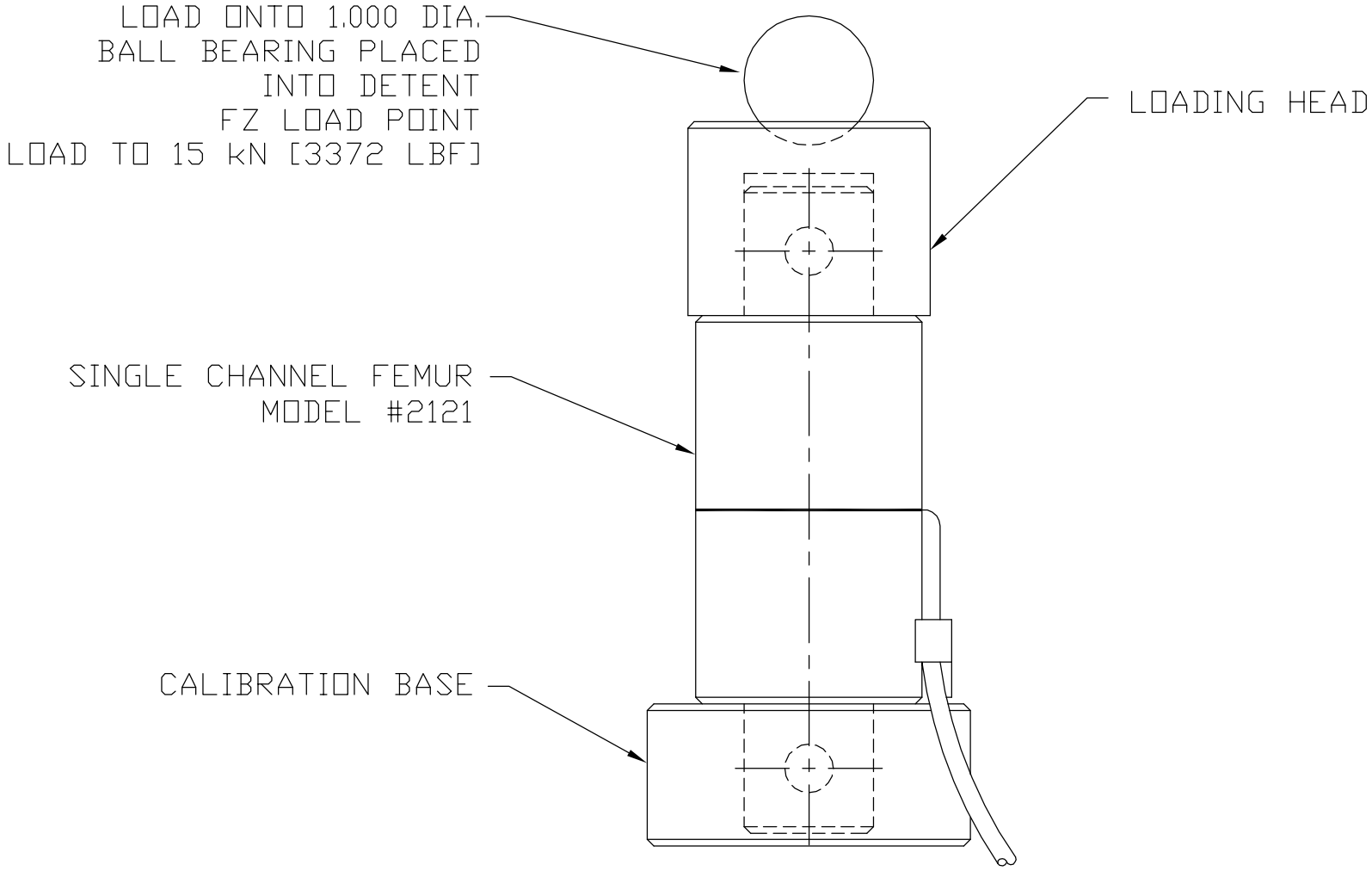
SCALE: FULL		DRAWN BY: C.R.M
DATE: 12JUNE00		MODEL: 4841

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER:
A-4841-D



CALIBRATION FIXTURE - FEMUR LOAD CELL

SCALE: .75X		DRAWN BY: *H. CHESTON*
DATE: 7/29/97		MODEL: 4841

UNLESS OTHERWISE SPECIFIED

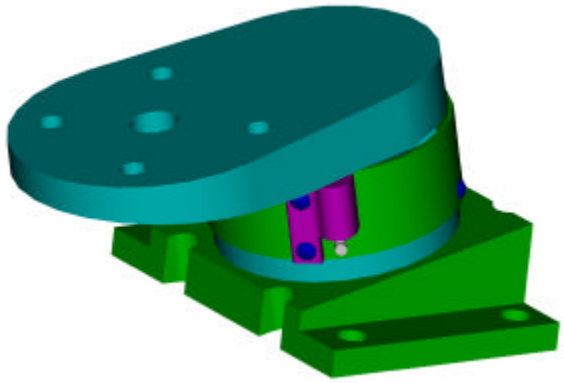
TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-4841-C

USED-ON	SYM	REVISION	DATE

ROBERT A. DENTON, INC.
2967 Waterview Dr.
Rochester Hills, Michigan 48309
(248) 852-5100 • Fax: (248) 852-6060



MODEL 4894 LOWER NECK LOAD CELL

Applications:

The Model 4894 Lower Neck Load Cell was designed for the Hybrid III 50th Percentile Anthropomorphic Test Dummy (ATD) to provide lower neck force and bending moment measurement data at the junction of the neck and thoracic spine. Model 4894 can also be used in Hybrid III 95th Percentile and BIOSID Side Impact dummies. The load cell replaces the standard Hybrid III type lower neck brackets, however, the neck angle can not be adjusted with respect to the upper torso. The neck angle, with the load cell installed, is fixed at the "zero" position as referenced to standard neck brackets. The load cell contains six measurement channels: three forces and three moments. Each channel is a full bridge strain gage circuit. There are two twelve conductor cables located at the front of the load cell. The cable to the right represents the force channels and the cable to the left represents the moment channels.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Fx	13344.7 N	3000 lb	350 ohms	1.6 mv/v
Fy	13344.7 N	3000 lb	350 ohms	1.6 mv/v
Fz	13344.7 N	3000 lb	700 ohms	0.9 mv/v
Mx	451.9 Nm	4000 in-lb	350 ohms	1.7 mv/v
My	451.9 Nm	4000 in-lb	350 ohms	1.7 mv/v
Mz	451.9 Nm	4000 in-lb	700 ohms	3.0 mv/v

Nonlinearity……..less than 1% of full scale
Hysteresis……..less than 1% of full scale
Crosstalk……..less than 5% of full scale
Excitation……..10 VDC nom. 15 VDC max.
Mass (load cell only)……..(1.79 lb) 0.813 kg

Wiring:

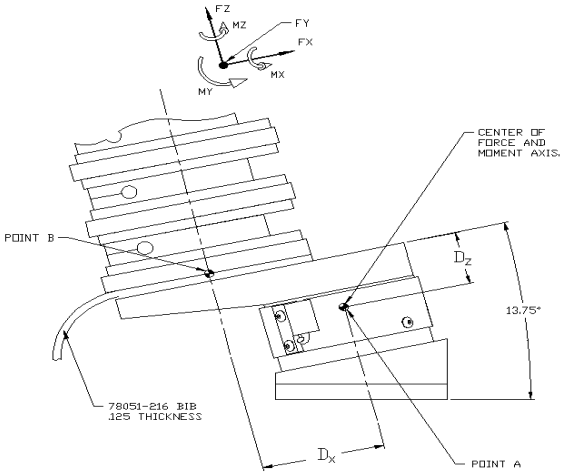
Fx & Mx Channels		Fy & My Channels		Fz & Mz Channels	
Brown	+Exc.	Red Stripe	+Exc.	Green	+Exc.
Red	+Sig.	Black	+Sig.	Blue	+Sig.
Orange	-Exc.	White	-Exc.	Violet	-Exc.
Yellow	-Sig.	Black Stripe	-Sig.	Gray	-Sig.

ROBERT A. DENTON, INC.
2967 Waterview Dr.
Rochester Hills, Michigan 48309
(248) 852-5100 • Fax: (248) 852-6060

MODEL 4894 LOWER NECK LOAD CELL

NOTES

1. Reference R. A. Denton, Inc. Calibration Procedure for Model 4894 Lower Neck Transducer.
2. Use Denton Model 1920 calibration fixture. (Ref. Denton Drawing B-1920)
3. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
4. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.
5. The Model 4894 can be modified to accommodate a Endevco 7264 accelerometer in the “X” direction. Two sets of mounting holes are provided. The holes on center are for 7264-2000A and B. The holes to the left of center are for 7264-2000 and 7264-2000C. This option must be specified at time of order. (see photo below)



LOWER NECK LOAD CELL ASSEMBLY
DUPLICATES NECK POSITION OF STD. BRACKETS < 78051 - 303 & 307 > AT THE "0" ANGLE POSITION.

TRANSFORMATION EQUATIONS
FOR LOWER NECK LOAD CELL

MOMENT CORRECTION EQUATIONS TO TRANSFER THE MEASURED MOMENT FROM THE LOAD CELL AT POINT A TO THE BASE OF THE NECK AT POINT B.

TRANSFORMATION EQUATIONS

$$F_X = F_{XM}$$
$$F_Y = F_{YM}$$
$$F_Z = F_{ZM}$$
$$M_X = M_{XM} - F_{YM} D_Z$$
$$M_Y = M_{YM} + F_{XM} D_Z + F_{ZM} D_X$$
$$M_Z = M_{ZM} - F_{YM} D_X$$

WHERE:

$F_{XM}, F_{YM}, F_{ZM}, M_{XM}, M_{YM}, M_{ZM}$

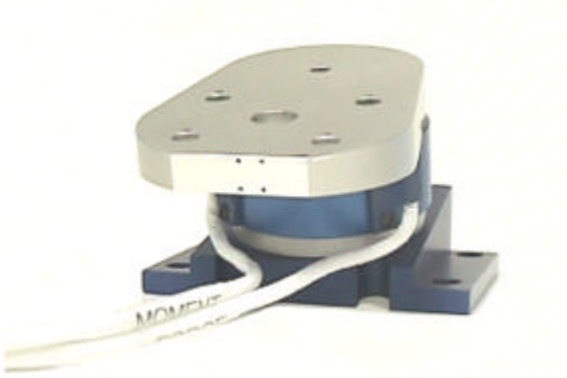
ARE THE FORCES AND MOMENTS MEASURED BY THE LOWER NECK LOAD CELL AND

$F_X, F_Y, F_Z, M_X, M_Y, M_Z$

ARE THE CALCULATED FORCES AND MOMENTS AT THE CENTER OF THE BASE OF THE NECK.

DUMMY SIZE	D_X	D_Z
50TH,95TH	2.000	1.125
BIOSID	2.000	1.000

HYBRID III LOWER NECK LOAD CELL
OUTPUT POLARITY PER S.A.E. J-211



Robert A. Denton, Inc. maintains a high level of control over the manufacture of its products to ensure quality, accuracy and reliability. Continued improvement necessitates that we reserve the right to modify these specifications without notice.

Robert A. Denton, Inc., 2967 Waterview Drive, Rochester Hills, Michigan 48309
Tel: (248) 852-5100 • Fax: (248) 852-6060 • Email: sales@radenton.com
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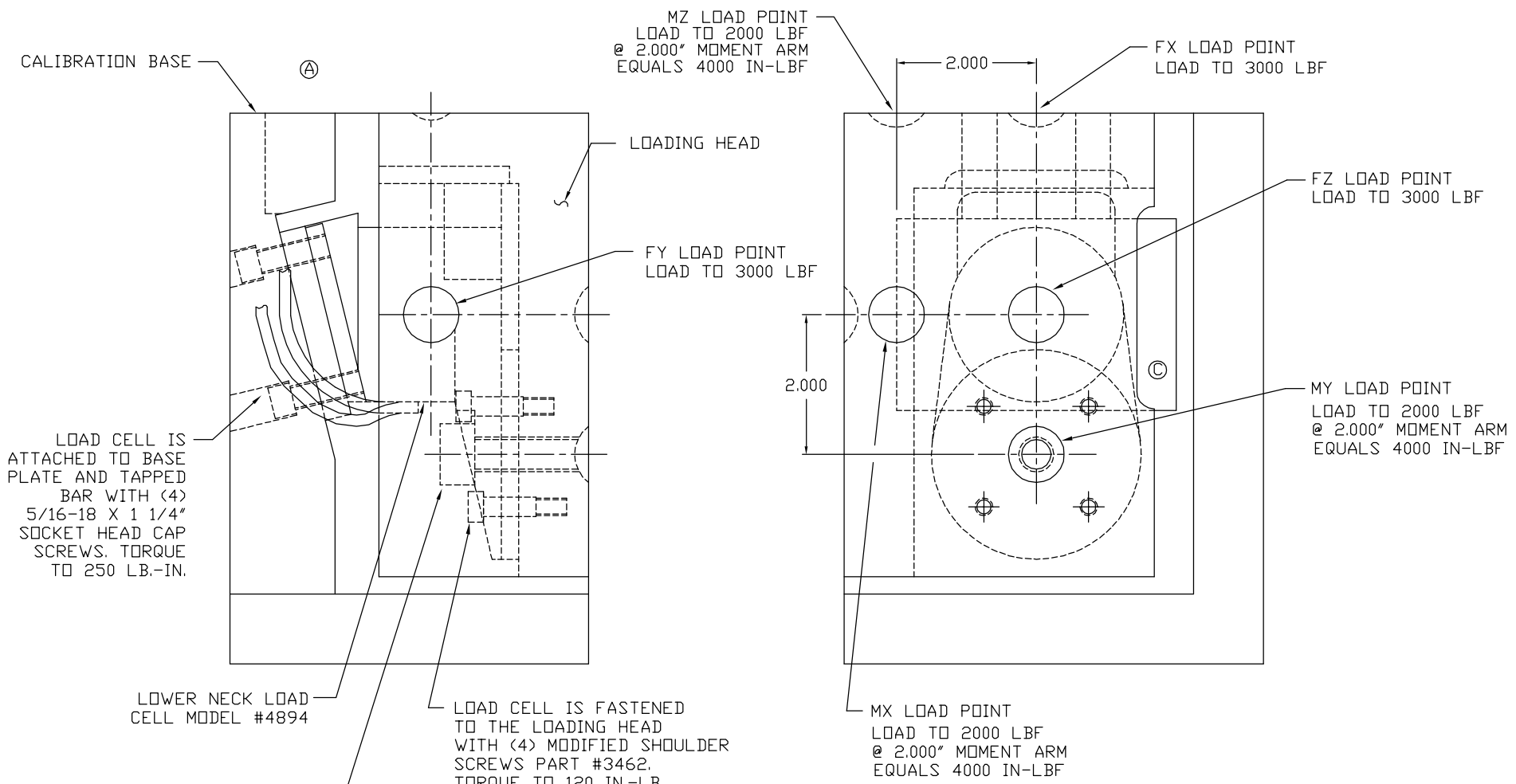
RAD4894PS
Issue Date: 10JUL00



USED-ON	SYM	REVISION	DATE

LOWER NECK CALIBRATION FIXTURE

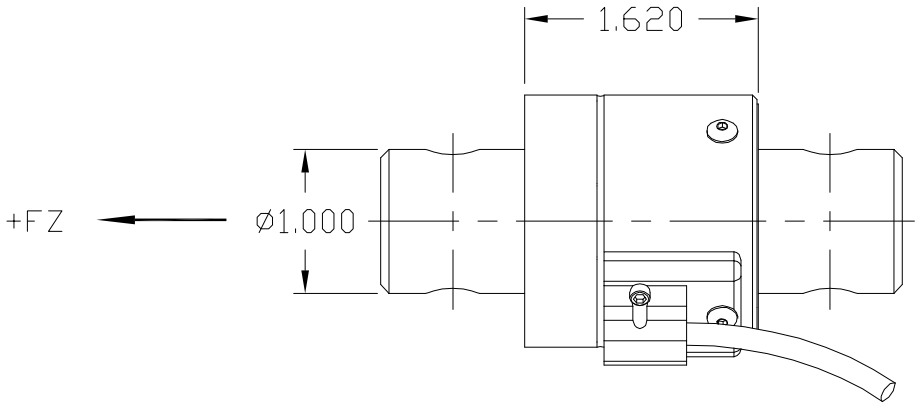
SCALE: 3/4		DRAWN BY: C.R.M./S.E.F.
DATE: 7/1/86		MODEL: 4894

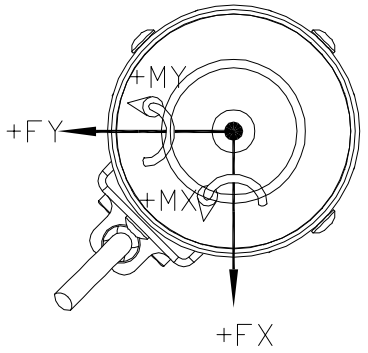
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4894-C





AXIS	CAPACITY	OUTPUT
FX	2500 LBF.	2.0 mV/V NOM.
FY	2500 LBF.	2.0 mV/V NOM.
FZ	2500 LBF.	1.0 mV/V NOM.
MX	2000 IN-LBF.	1.5 mV/V NOM.
MY	2000 IN-LBF.	1.5 mV/V NOM.

CABLE COLOR CODE

FX		FY		FZ		MX		MY	
BROWN	+EXC.	RED STRIPE	+EXC.	GREEN	+EXC.	GREEN STRIPE	+EXC.	PINK	+EXC.
RED	+SIG.	BLACK	+SIG.	BLUE	+SIG.	BLUE STRIPE	+SIG.	TAN	+SIG.
ORANGE	-EXC.	WHITE	-EXC.	VIOLET	-EXC.	ORANGE STRIPE	-EXC.	BROWN STRIPE	-EXC.
YELLOW	-SIG.	BLACK STRIPE	-SIG.	GREY	-SIG.	YELLOW STRIPE	-SIG.	VIOLET STRIPE	-SIG.

SYM	REVISION	DATE

MODEL 4900 5 CHANNEL THOR-LX FEMUR

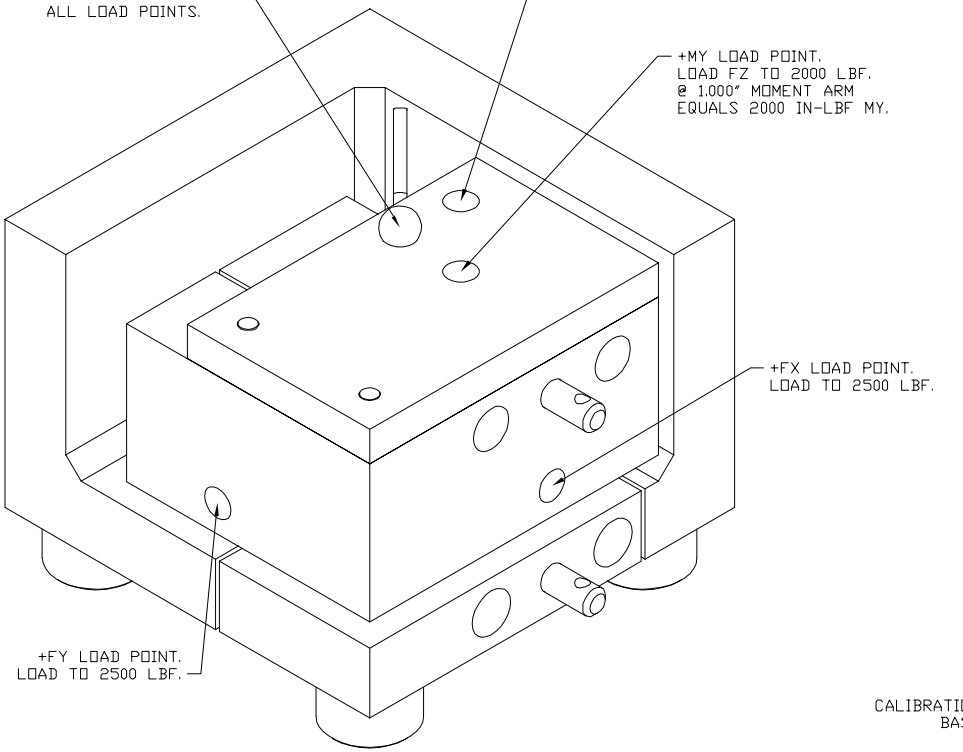
SCALE: 3/4		DRAWN BY: C.HEAD
DATE: 11/07/00		MODEL: 4900

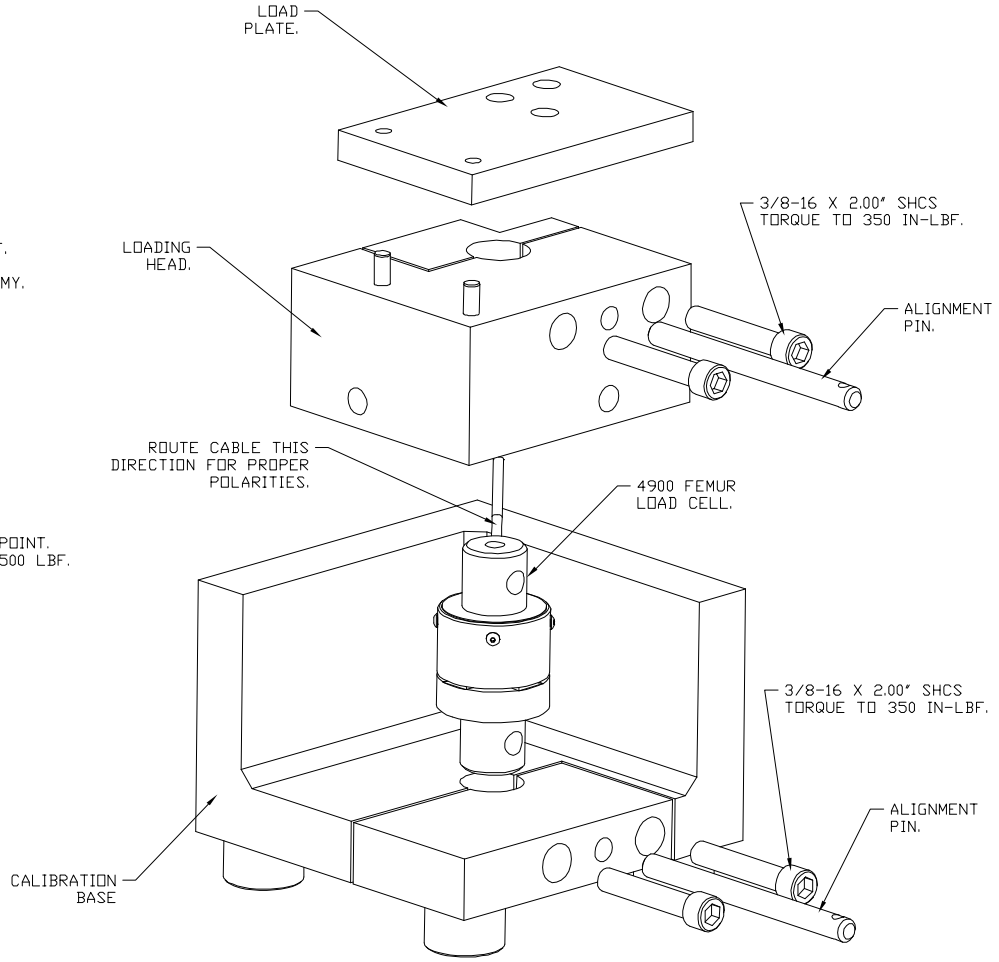
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-4900-D





NOTES:

1. ALIGN LOAD CELL TO BASE WITH ALIGNMENT PIN. ORIENT CABLE AS SHOWN.
2. SECURE LOAD CELL TO BASE WITH (2) 3/8-16 X 2" SHCS. TORQUE TO 350 IN-LBF.
3. ALIGN LOADING HEAD TO LOAD CELL WITH ALIGNMENT PIN.
4. SECURE LOADING HEAD TO LOAD CELL WITH (2) 3/8-16 X 2" SHCS. TORQUE TO 350 IN-LBF.
5. ALIGN LOAD PLATE TO LOADING HEAD WITH (2) 1/4" X 3/4" DOWEL PINS.

CALIBRATION FIXTURE MODEL #4979

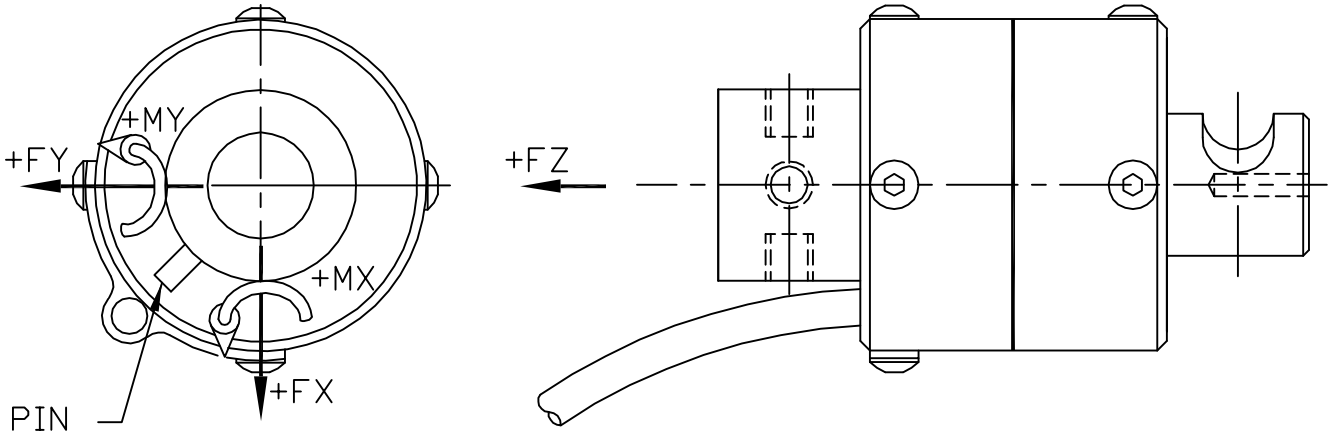
CALIBRATION FIXTURE FOR 4900 THOR-LX FEMUR

SCALE: NONE			DRAWN BY: CHEAD
DATE: 11/02/00			MODEL: 4979

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-4900-C



INDEX PIN

LOCATE PIN IN LEFT DETENT OF LEG TUBE FOR CORRECT AXES ORIENTATION

AXIS	CAPACITY	OUTPUT
FX	2500 LBS.	2.0 mV/V NOM.
FY	2500 LBS.	2.0 mV/V NOM.
FZ	2500 LBS.	1.0 mV/V NOM.
MX	3500 LB.-IN.	3.0 mV/V NOM.
MY	3500 LB.-IN.	3.0 mV/V NOM.

POLARITY CONFORMS TO SAE J-211

CABLE COLOR CODE

FX		FY		FZ		MX	
BROWN	+EXC.	RED STRIPE	+EXC.	GREEN	+EXC.	GREEN STRIPE	+EXC.
RED	+SIG.	BLACK	+SIG.	BLUE	+SIG.	BLUE STRIPE	+SIG.
ORANGE	-EXC.	WHITE	-EXC.	VIOLET	-EXC.	ORANGE STRIPE	-EXC.
YELLOW	-SIG.	BLACK STRIPE	-SIG.	GREY	-SIG.	YELLOW STRIPE	-SIG.

MY	
PINK	+EXC.
TAN	+SIG.
BROWN STRIPE	-EXC.
VIOLET STRIPE	-SIG.

THOR-LX LOWER TIBIA

5-CHANNEL

SCALE: FULL

DATE: 28AUG00

DRAWN BY: *C.R. MORGAN*

MODEL: 4929

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS ± .010

THREE PLACE DECIMALS ± .005

ANGLES ± 0° 30′

SURFACE FINISH 125

REMOVE ALL BURRS & SHARP EDGES

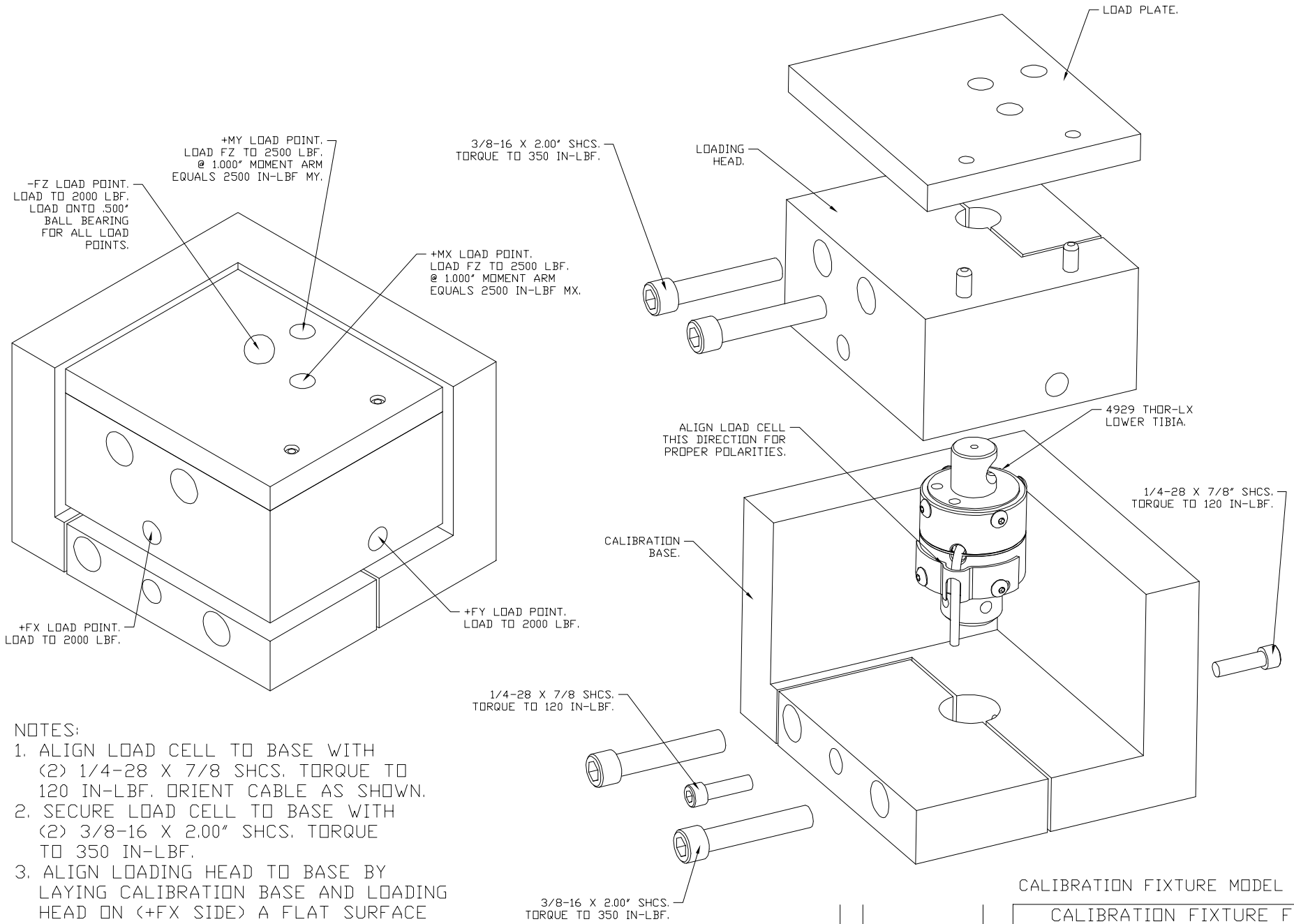
DIMENSION LIMITS HELD AFTER PLATING

SYM	REVISION	DATE

ROBERT A. DENTON, INC.

ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-4929-D

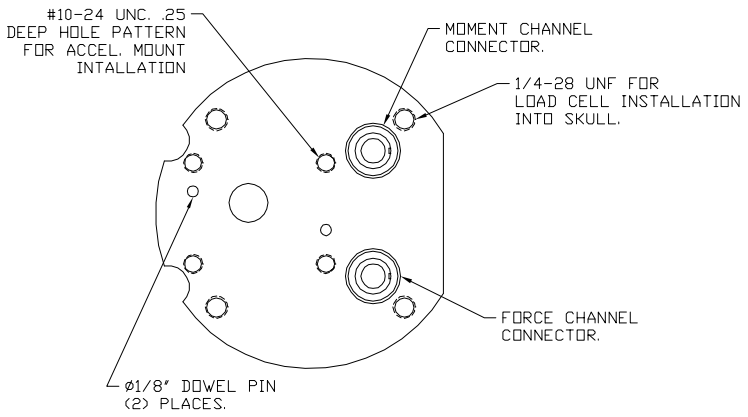


NOTES:

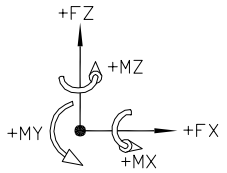
1. ALIGN LOAD CELL TO BASE WITH (2) 1/4-28 X 7/8 SHCS. TORQUE TO 120 IN-LBF. ORIENT CABLE AS SHOWN.
2. SECURE LOAD CELL TO BASE WITH (2) 3/8-16 X 2.00" SHCS. TORQUE TO 350 IN-LBF.
3. ALIGN LOADING HEAD TO BASE BY LAYING CALIBRATION BASE AND LOADING HEAD ON (+FX SIDE) A FLAT SURFACE AND SECURING WITH (2) 3/8-16 X 2.00" SHCS. TORQUE TO 350 IN-LBF.

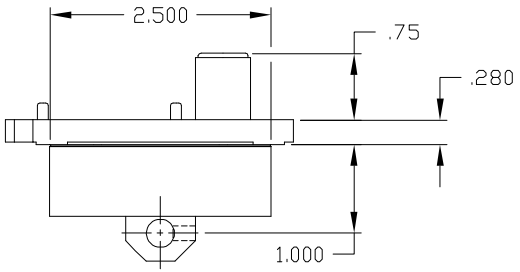
CALIBRATION FIXTURE MODEL #4989

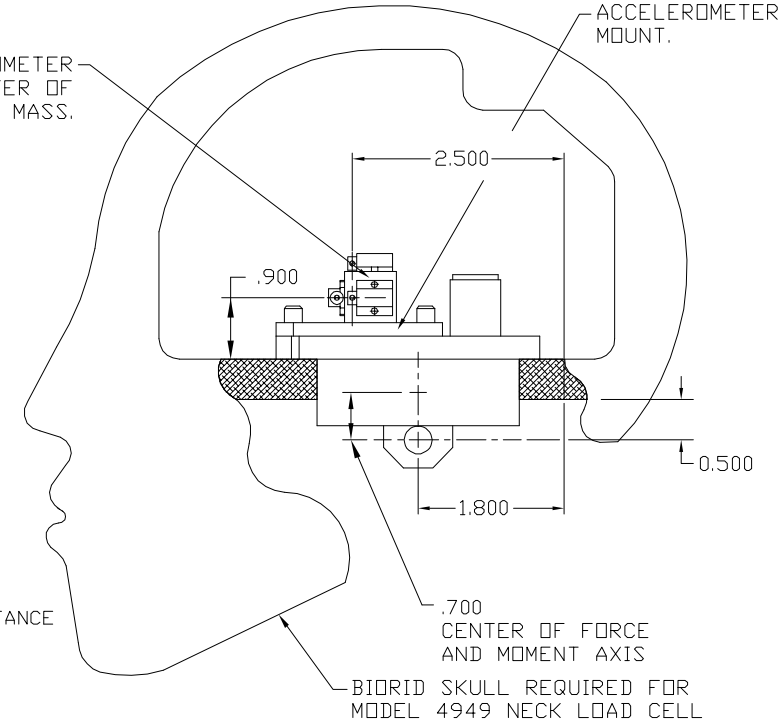
CALIBRATION FIXTURE FOR 4929 THOR-LX LOWER TIBIA			
SCALE: NONE			DRAWN BY: CHEAD
DATE: 11/09/00			MODEL: 4989
TWO PLACE DECIMALS ± .010	UNLESS OTHERWISE SPECIFIED	SURFACE FINISH 125	
THREE PLACE DECIMALS ± .005		REMOVE ALL BURRS & SHARP EDGES	
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING	
ROBERT A. DENTON, INC. ROCHESTER HILLS, MICHIGAN			DRAWING NUMBER: C-4929-C



NOTE:
POLARITY
CONFORMS TO
J-211



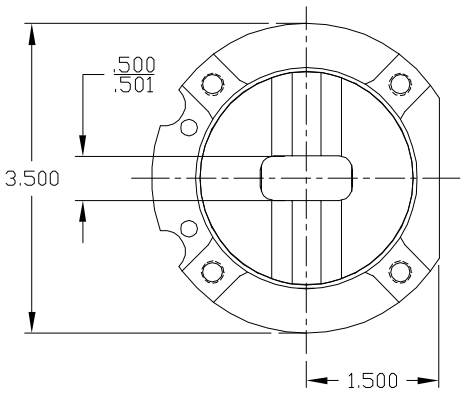




MODEL 4949
SIX CHANNEL NECK LOAD CELL

AXIS	CAPACITY	OUTPUT	BRIDGE RESISTANCE
FX	300 LBS.	2.0 mV/V NOM.	700 OHMS
FY	200 LBS.	1.3 mV/V NOM.	700 OHMS
FZ	1000 LBS.	1.0 mV/V NOM.	700 OHMS
MX	500 IN-LB	0.8 mV/V NOM.	350 OHMS
MY	1000 IN-LB	1.5 mV/V NOM.	350 OHMS
MZ	300 IN-LB	0.8 mV/V NOM.	700 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE



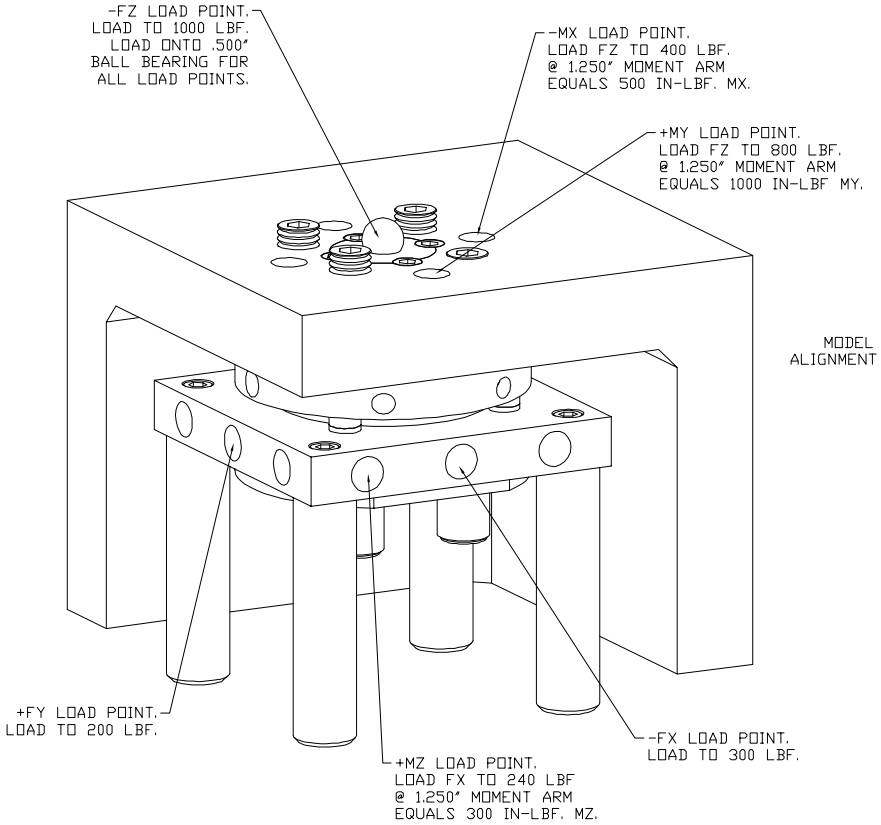
BIO-RID SIX CHANNEL NECK LOAD CELL
LOW CAPACITY

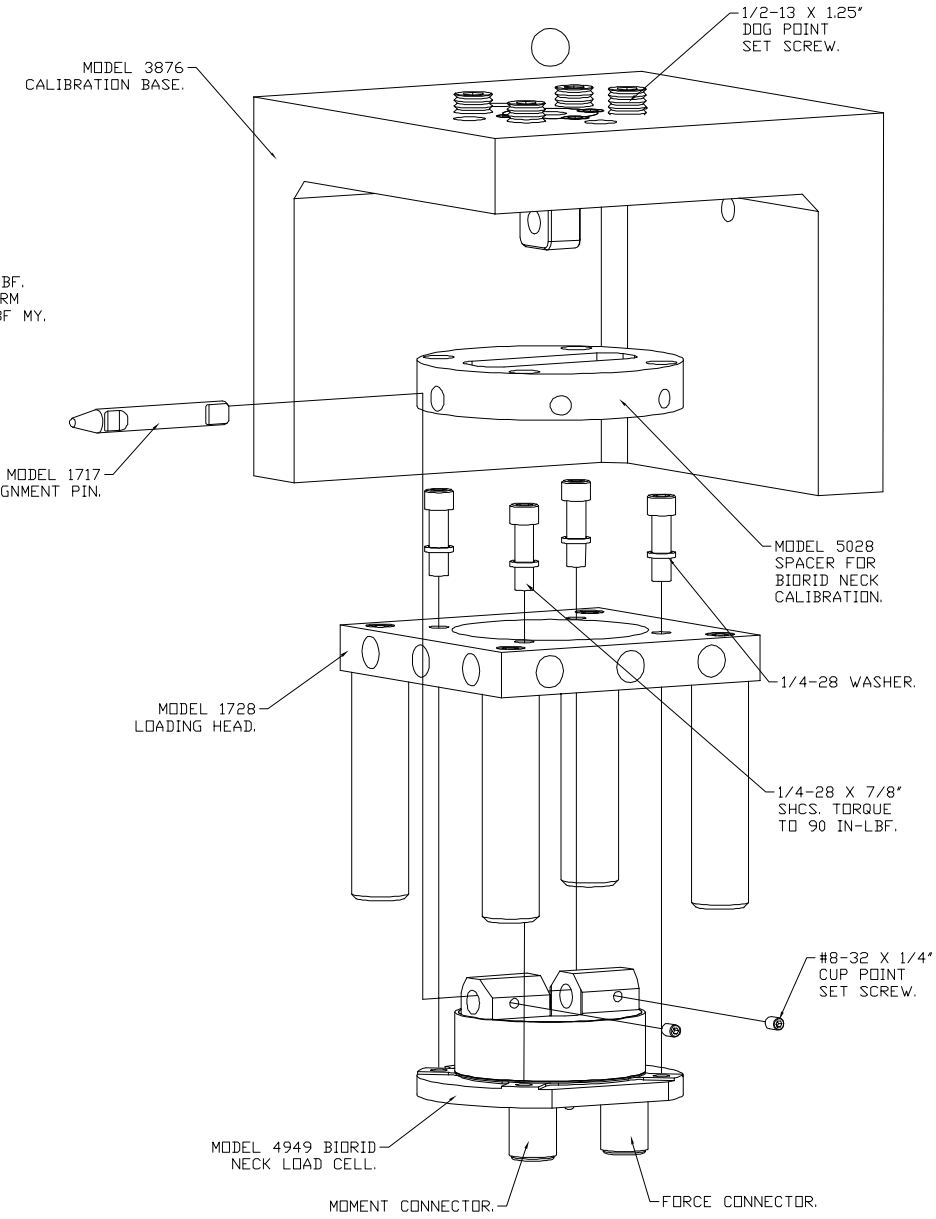
SCALE: NONE			DRAWN BY: C.HEAD
DATE: 01/05/01			MODEL: 4949

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4949-D





NOTES:
1. START #8-32 X 1/4" SET SCREWS INTO LOAD CELL. (DO NOT SCREW ALL THE WAY INTO LOAD CELL.)
2. INSERT LOAD CELL INTO LOADING HEAD AS SHOWN.
3. SECURE LOAD CELL TO LOADING HEAD WITH (4) 1/4-28 X 7/8" SHCS AND 1/4-28 WASHERS. TORQUE TO 90 IN-LBF.
4. LAY MODEL 5028 SPACER OVER LOAD CELL BOTTOM.
5. ALIGN AND SECURE LOADING HEAD ASSEMBLY TO BASE WITH MODEL 1717 ALIGNMENT PIN. ALIGNMENT PIN IS TO BE SLIPPED THRU SPACER INTO LOAD CELL, THRU BASE, AND THRU OTHER SIDE OF LOAD CELL. FLAT OF ALIGMENT PIN IS TO BE ALIGNED WITH #8-32 SET SCREWS.
6. SECURE ALIGMENT PIN WITH #8-32 SET SCREWS. TIGHTEN SET SCREWS, THRU SPACER, WITH T-HANDLE ALLEN.
7. ADJUST LEVEL OF ASSEMBLY WITH (4) 1/2-13 X 1.25" SSDP.

CALIBRATION FIXTURE MODEL #5029

NEXT ASS'Y	QTY
PART USED ON	

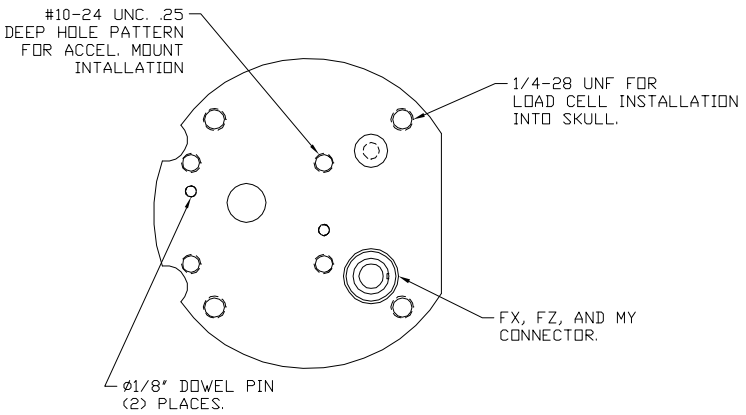
CALIBRATION FIXTURE FOR BIORID NECKS

SCALE:	NONE		DRAWN BY: CHEAD
DATE:	1/25/01		MODEL: 5029

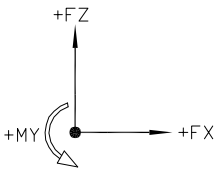
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

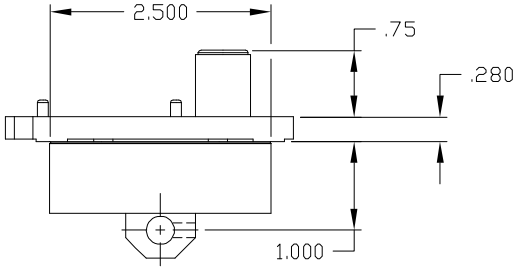
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

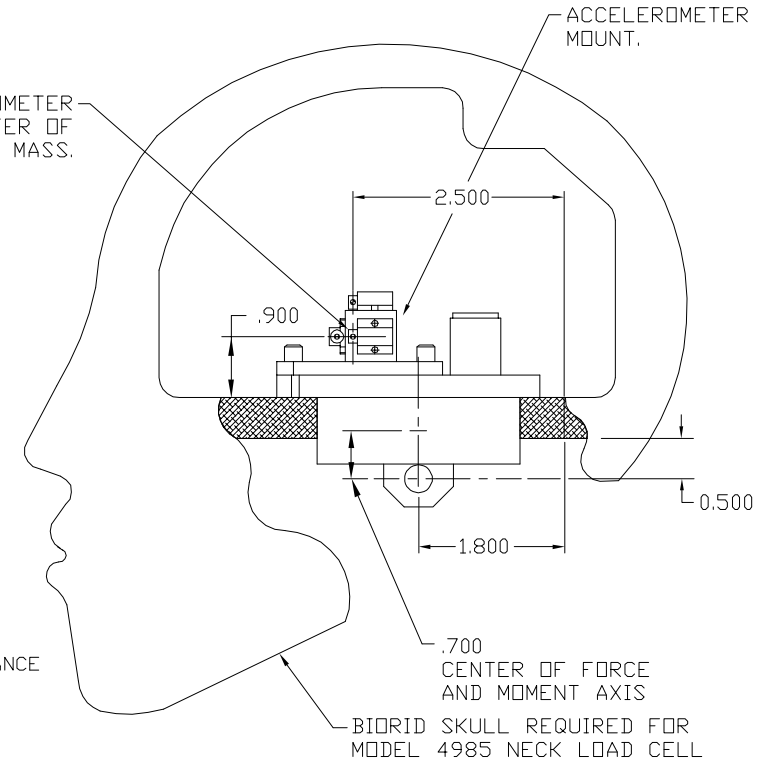
DRAWING NUMBER: C-4949-C



NOTE:
POLARITY
CONFORMS TO
J-211

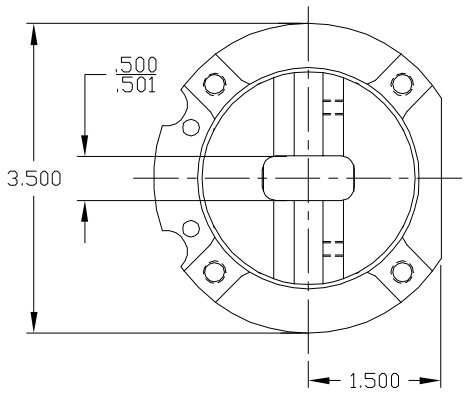






MODEL 4985
THREE CHANNEL NECK LOAD CELL

AXIS	CAPACITY	OUTPUT	BRIDGE RESISTANCE
FX	300 LBS.	2.0 mV/V NOM.	700 OHMS
FZ	1000 LBS.	1.0 mV/V NOM.	700 OHMS
MY	1000 IN-LB	1.5 mV/V NOM.	350 OHMS



NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

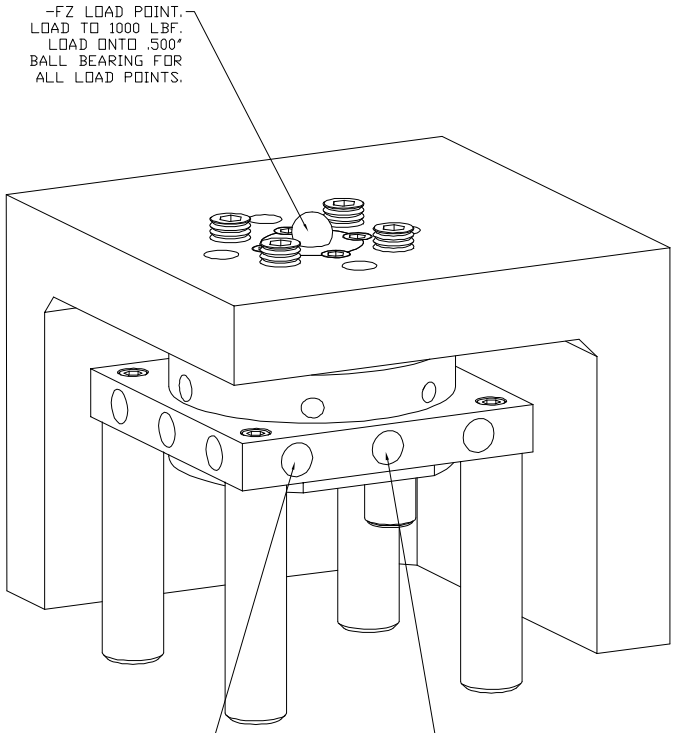
BIO-RID THREE CHANNEL NECK LOAD CELL
LOW CAPACITY

SCALE: NONE			DRAWN BY: C.HEAD
DATE: 01/12/01			MODEL: 4985

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

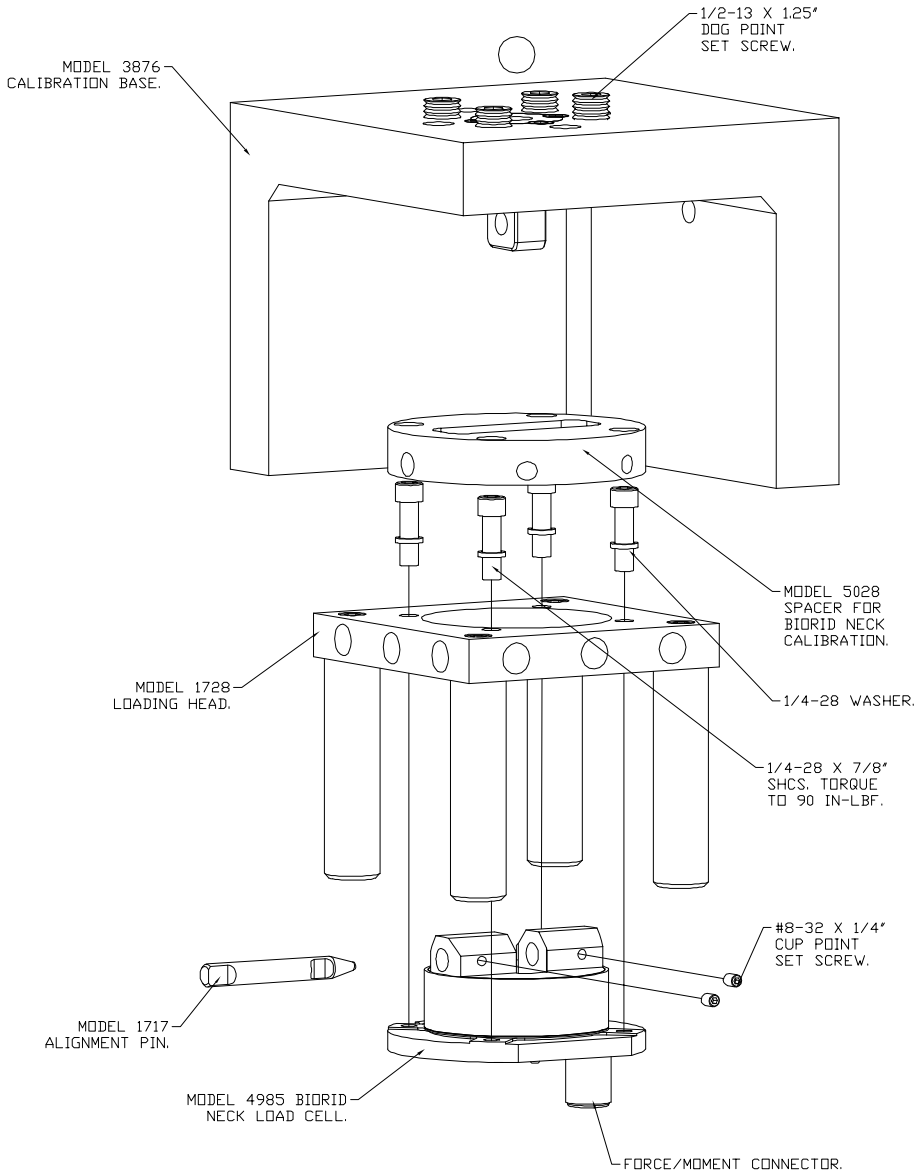
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4985-D



NOTES:

1. START #8-32 X 1/4" SET SCREWS INTO LOAD CELL. (DO NOT SCREW ALL THE WAY INTO LOAD CELL.)
2. INSERT LOAD CELL INTO LOADING HEAD AS SHOWN.
3. SECURE LOAD CELL TO LOADING HEAD WITH (4) 1/4-28 X 7/8" SHCS AND 1/4-28 WASHERS. TORQUE TO 90 IN-LBF.
4. LAY MODEL 5028 SPACER OVER LOAD CELL BOTTOM.
5. ALIGN AND SECURE LOADING HEAD ASSEMBLY TO BASE WITH MODEL 1717 ALIGNMENT PIN. ALIGNMENT PIN IS TO BE SLIPPED THRU SPACER INTO LOAD CELL, THRU BASE, AND THRU OTHER SIDE OF LOAD CELL. FLAT OF ALIGMENT PIN IS TO BE ALIGNED WITH #8-32 SET SCREWS.
6. SECURE ALIGMENT PIN WITH #8-32 SET SCREWS. TIGHTEN SET SCREWS, THRU SPACER, WITH T-HANDLE ALLEN.
7. ADJUST LEVEL OF ASSEMBLY WITH (4) 1/2-13 X 1.25" SSDP.



CALIBRATION FIXTURE MODEL #5029

NEXT ASS'Y	QTY
PART USED ON	

CALIBRATION FIXTURE FOR 3 CHANNEL BIORID NECK

SCALE:	NONE		DRAWN BY: CHEAD
DATE:	1/25/01		MODEL: 4985

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-4985-C

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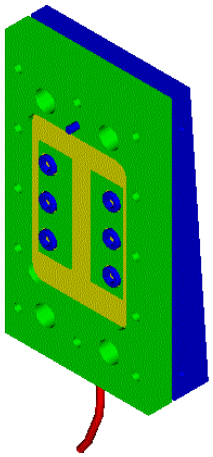


MODEL 5015
EUROSID BACK PLATE LOAD CELL

Applications:
The EuroSID Back Plate Load Cell (Model# 5015) is a four-channel force (Fx, Fy) and moment (My, Mz) measure device. It is designed to measure the forces and moments between back plate and the Thoracic Spine section of the EuroSID-1 or ES-2 Crash Test Dummy.

Standard Ordering Configuration: 5015J
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Fx	5 kN	1124 lbf	350 ohms	1.5 mV/V
Fy	5 kN	1124 lbf	350 ohms	1.5 mV/V
My	200 NM	1770 in-lbf	700 ohms	1.9 mV/V
Mz	200 Nm	1770 in-lbf	350 ohms	1.4 mV/V

Non-linearity ..... less than 1% of full scale
Hysteresis ..... less than 1% of full scale
Crosstalk ..... less than 5% of full scale
Excitation ..... 10 VDC nom. 15 VDC max.
Assembly Mass (without cable, with mounting screws) ..... (6.88 lb) 3.12 kg

Wiring:

Fx Channel		Fy Channel	
Brown	+Exc	Red Stripe	+Exc
Red	+Sig	Black	+Sig
Orange	-Exc	White	-Exc
Yellow	-Sig	Black Stripe	-Sig

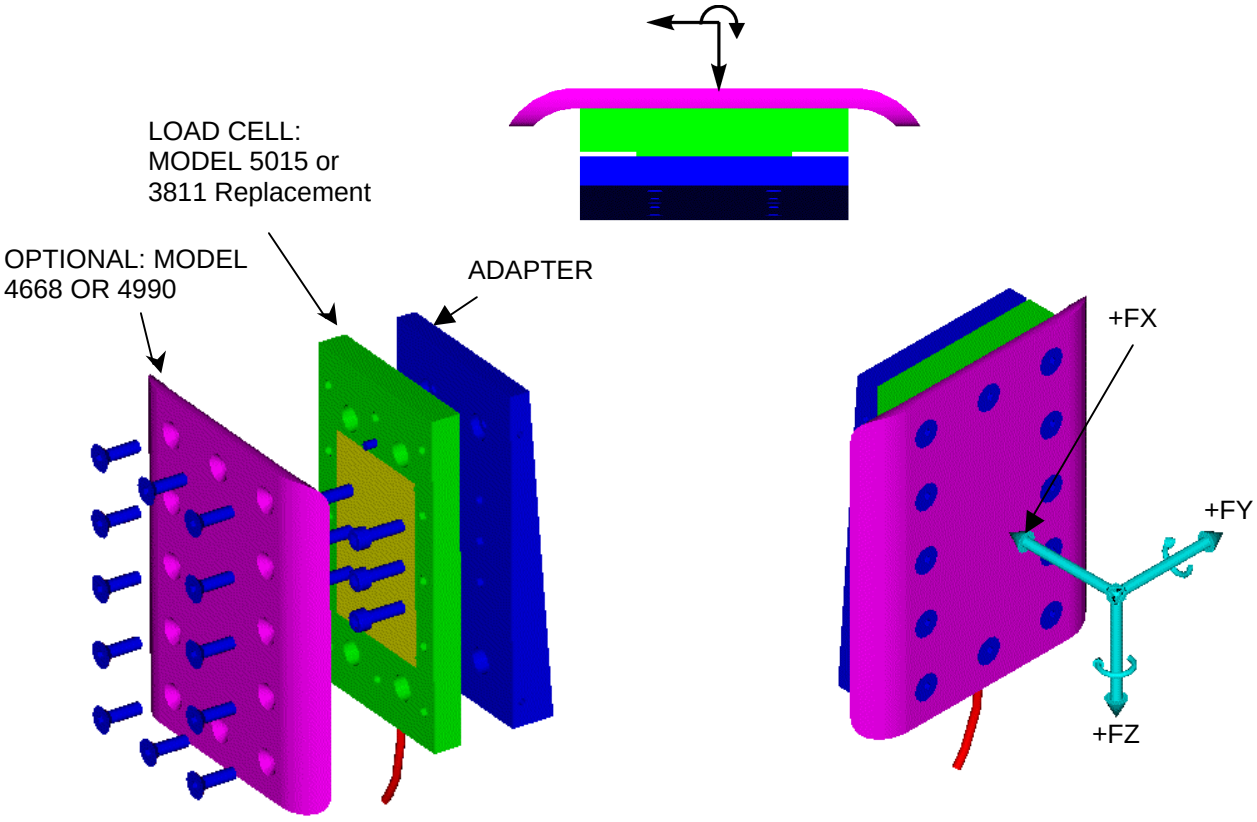
My Channel		Mz Channel	
Green Stripe	+Exc	Green	+Exc
Blue Stripe	+Sig	Blue	+Sig
Orange Stripe	-Exc	Violet	-Exc
Yellow Stripe	-Sig	Grey	-Sig

Issue Date: 13DEC00

MODEL 5015 EUROSID BACK PLATE LOAD CELL

NOTES

1. Use Denton Model 4053 calibration fixture. (Ref. Calibration Fixture drawing 5015-C)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.



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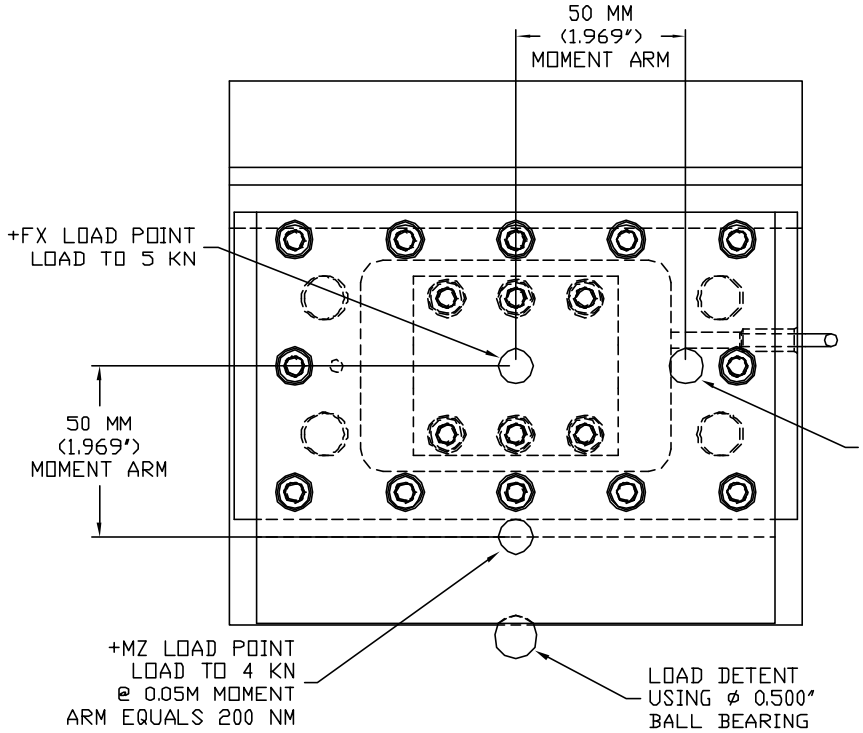
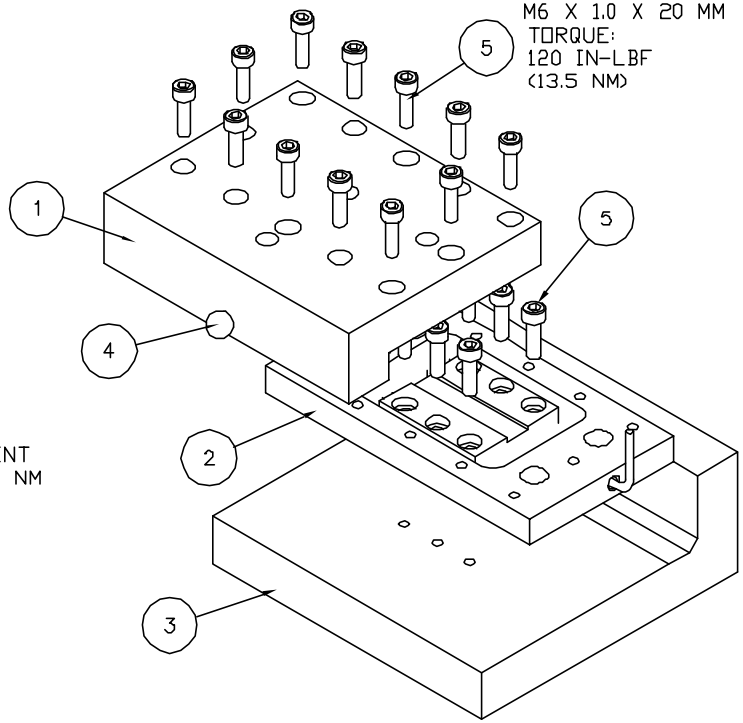
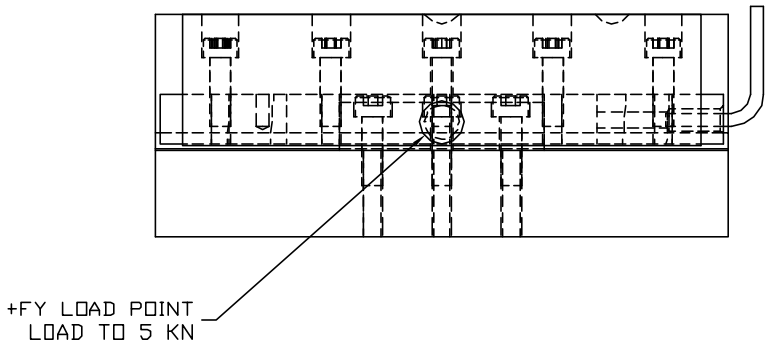
Issue Date: 13DEC00







CALIBRATION FIXTURE REF. DWG: 4053

ITEM	QTY	PART NUMBER	DESCRIPTION
5	18	PURCHASED	M6 X 1 X 20mm SHCS
4	1	PURCHASED	1/2" DIA BALL BEARING
3	1	4427	LOADING BASE
2	1	3795	LOAD CELL
1	1	4428	LOADING HEAD

PARTS LIST

SYM	REVISION	DATE

EUROSID BACK PLATE

CALIBRATION FIXTURE

SCALE:	.75X		DRAWN BY: RD/PJD
DATE:	04DEC00		MODEL: 5015

UNLESS OTHERVISE SPECIFIED

TWO PLACE DECIMALS ± .010 SURFACE FINISH 125√

THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES

ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.

ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-5015-C

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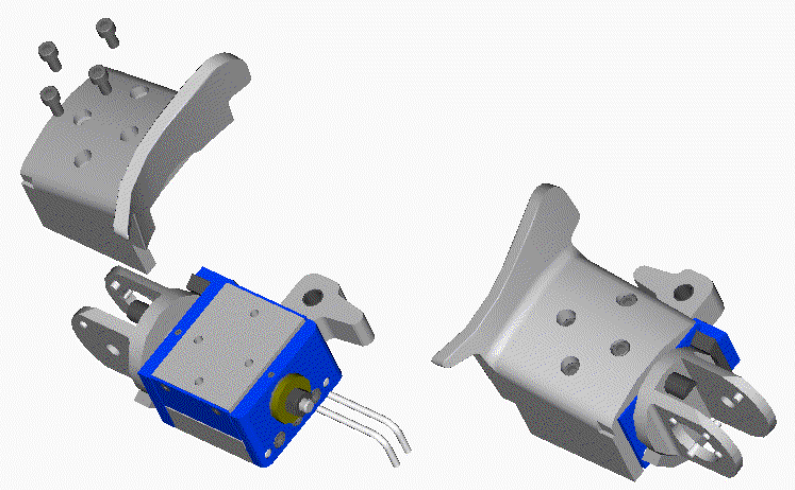


MODEL 5123J 10 YEAR OLD CLAVICLE LOAD CELLS

Applications:

Model 5123J is a pair of clavicle load cells: Model 5410 Right and Model 5400 Left Clavicle Load Cell. Model 5123J mounts directly into the Hybrid III 10 Year Old Anthropomorphic Test Dummy (ATD). The clavicle load cells replace the dummy's clavicles (Part Numbers 420-3800-1 and 420-38000-2). Each clavicle load cell contains two force measurement channels, FX and FZ. The entire top and front surface of the load cell will measure the contact force of the shoulder belt. This ensures that regardless of the position of the ATD or the seat belt across the clavicle, the forces will accurately be measured. Load cell output polarity is per the SAE J211 Right Hand Rule sign convention. Two 30-foot-long (9.15 m) four conductor, Teflon insulated, shielded cables exit each load cell into the thorax for simple cable routing.

Standard Ordering Configuration: 5123J
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
Fx	4.45 kN	1,000 lbf	350 ohms	1.5 mV/V
Fz	4.45 kN	1,000 lbf	700 ohms	1.1 mV/V

Non-linearity ..... less than 1% of full scale
Hysteresis ..... less than 1% of full scale
Crosstalk ..... less than 5% of full scale
Excitation ..... 10 VDC nom. 15 VDC max
Assembly Mass (without cable, with mounting screws) ..... (1.93 lb) .88 kg

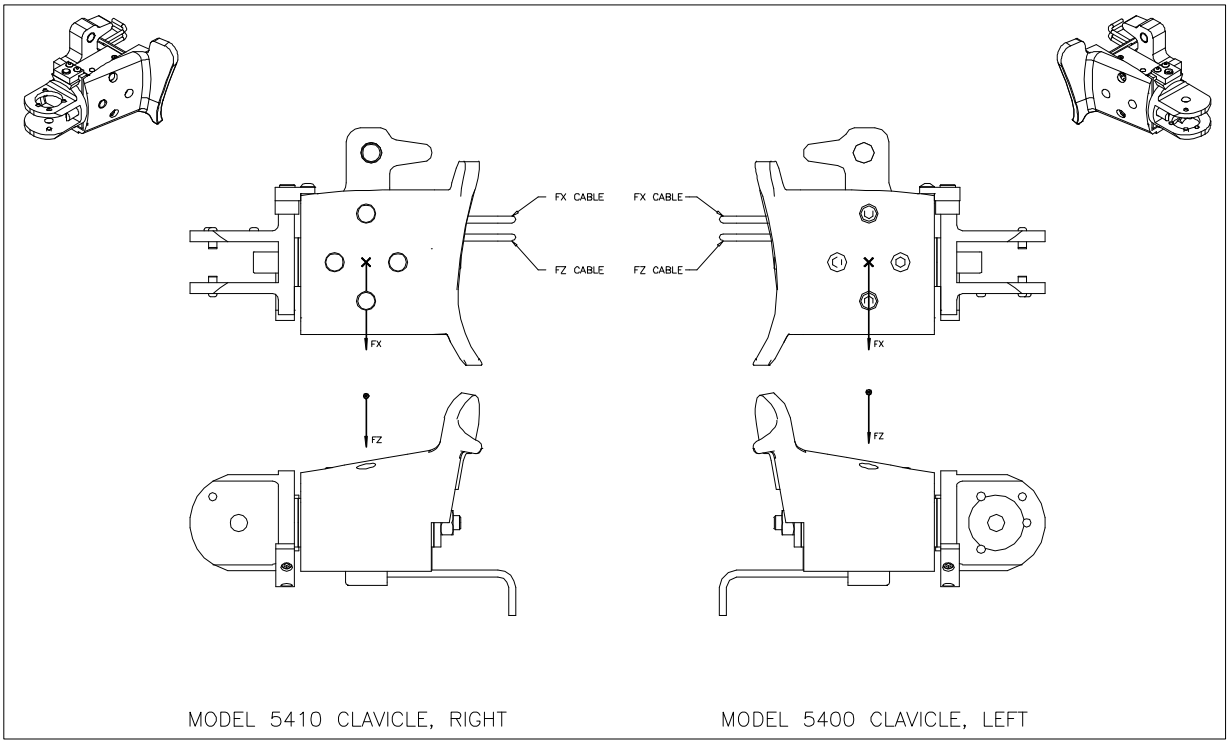
Wiring:

Fx Channel		Fz Channel	
Red	+Exc.	Red	+Exc.
Green	+Sig.	Green	+Sig.
Black	-Exc.	Black	-Exc.
White	-Sig.	White	-Sig.

MODEL 5123 10 YEAR OLD
CLAVICLE LOAD CELLS

NOTES

1. Use Denton Model 5495 calibration fixture. (Ref. Calibration Fixture drawing 5123-C)
2. This load cell is wired for SAE J211 Right Hand Rule sign convention indicated by the suffix “J” on the model tag on the load cell.
3. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
4. If the model tag on the load cell includes an “I” suffix, there is an ID module in the body of the load cell. The number following the “I” indicates the type of ID module.
5. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.



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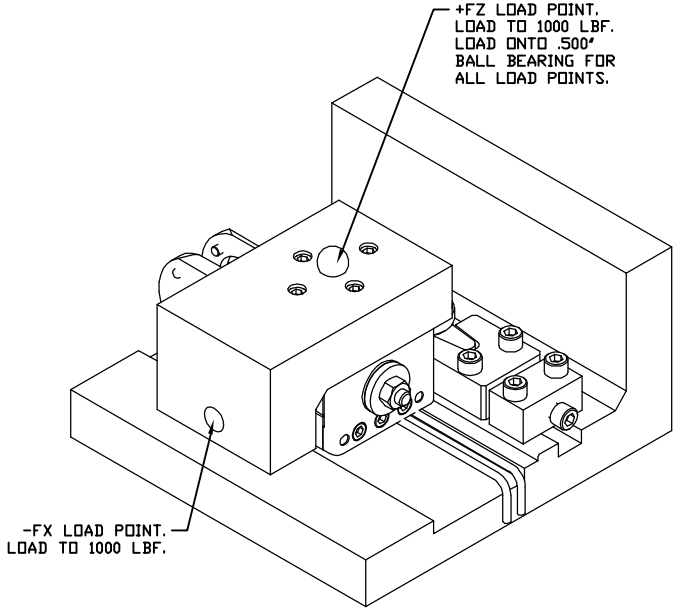
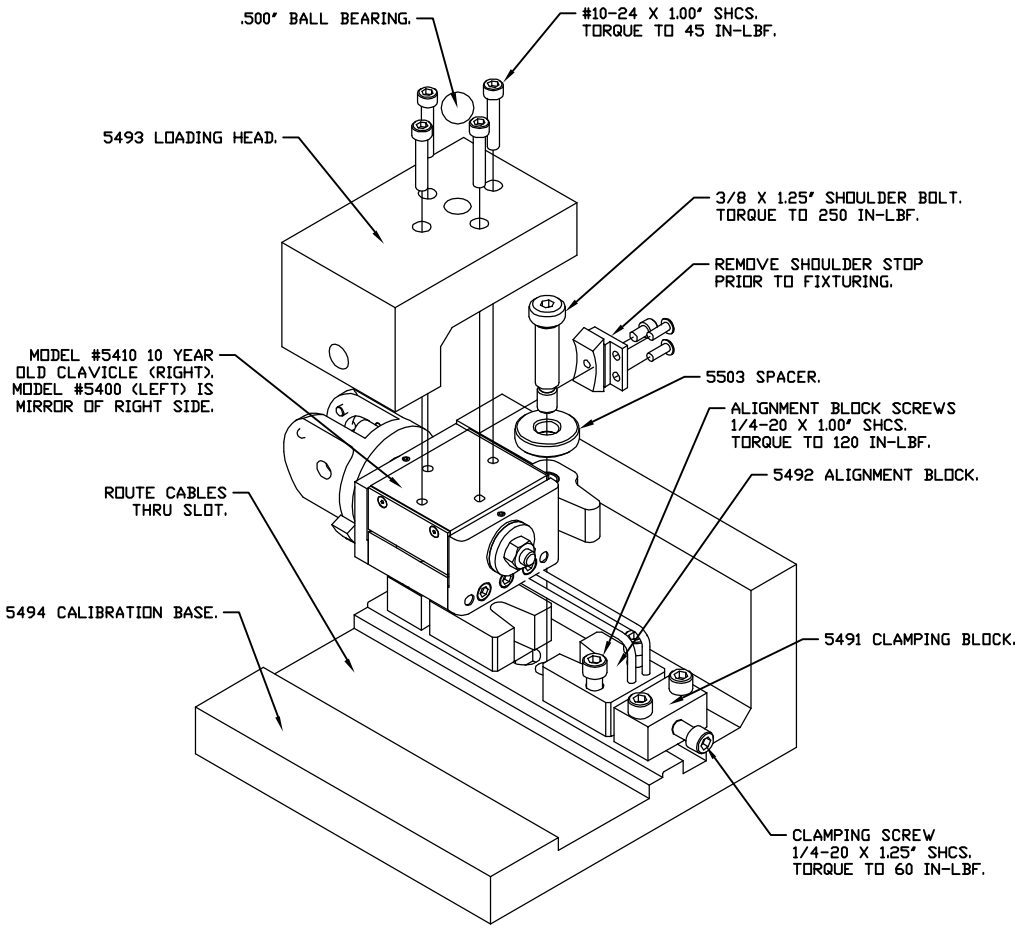




FIXTURING NOTES:
1. REMOVE SHOULDER STOP FROM LOAD CELL.
2. SECURE LOAD CELL TO CALIBRATION BASE WITH 5503 SPACER AND 3/8 X 1.25" SHOULDER BOLT. DO NOT TORQUE.
3. TIGHTEN ALIGNMENT BLOCK SCREWS TO REMOVE CLEARANCE, DO NOT TORQUE.
4. SCREW 1/4-20 X 1.25" SHCS INTO CLAMPING BLOCK AND TIGHTEN ALIGNMENT BLOCK TO LOAD CELL. TORQUE CLAMPING SCREW TO 60 IN-LBF.
5. TORQUE 1/4-20 ALIGNMENT BLOCK SCREWS TO 120 IN-LBF.
6. TORQUE 3/8 X 1.25" SHOULDER BOLT TO 250 IN-LBF.
7. SECURE LOADING HEAD TO LOAD CELL WITH (4) #10-24 X 1.00" SHCS. TORQUE TO 45 IN-LBF.

NOTE: LOOSEN CLAMPING SCREW AND ALIGNMENT BLOCK SCREWS BEFORE REMOVING LOAD CELL FROM CALIBRATION FIXTURE.
* 5400 CLAVICLE IS MIRROR OF 5410.

CALIBRATION FIXTURE MODEL #5495

SYM	REVISION	DATE	CAR#	INIT.

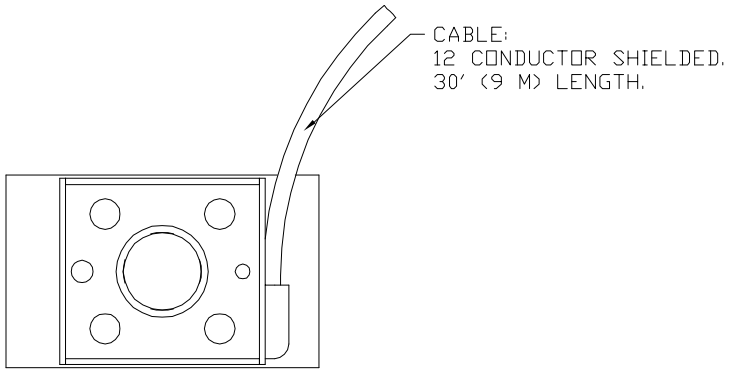
CALIBRATION FIXTURE FOR
10 YEAR OLD CLAVICLE LOAD CELLS

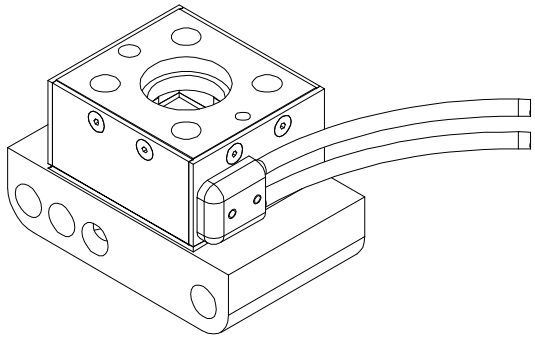
SCALE: NONE	SHEET 1 OF 1	DRWN BY: C.HEAD
DATE: 19FEB02		MODEL: 5495

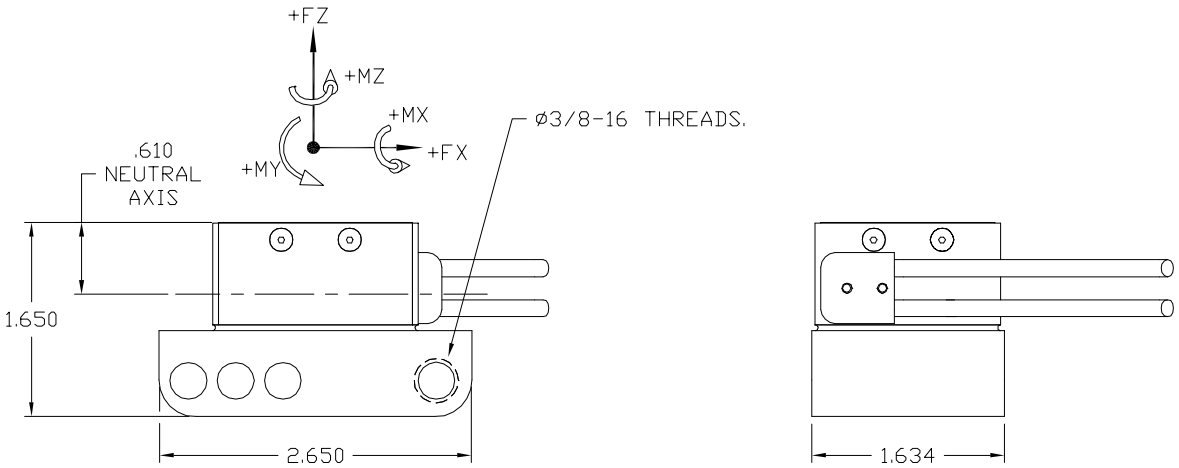
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-5123-C







MODEL 5124 10 YEAR OLD LOWER NECK

SIX CHANNEL LOAD CEL

AXIS	CAPACITY	OUTPUT
FX	1500 LBF.	1.8 mV/V NOM.
FY	1500 LBF.	1.8 mV/V NOM.
FZ	2000 LBF.	2.9 mV/V NOM.
MX	2000 IN-LBF.	2.5 mV/V NOM.
MY	2000 IN-LBF.	2.5 mV/V NOM.
MZ	1500 IN-LBF.	2.0 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE	CAR#	INIT.

5124 10 YEAR OLD LOWER NECK
SIX CHANNEL LOAD CELL

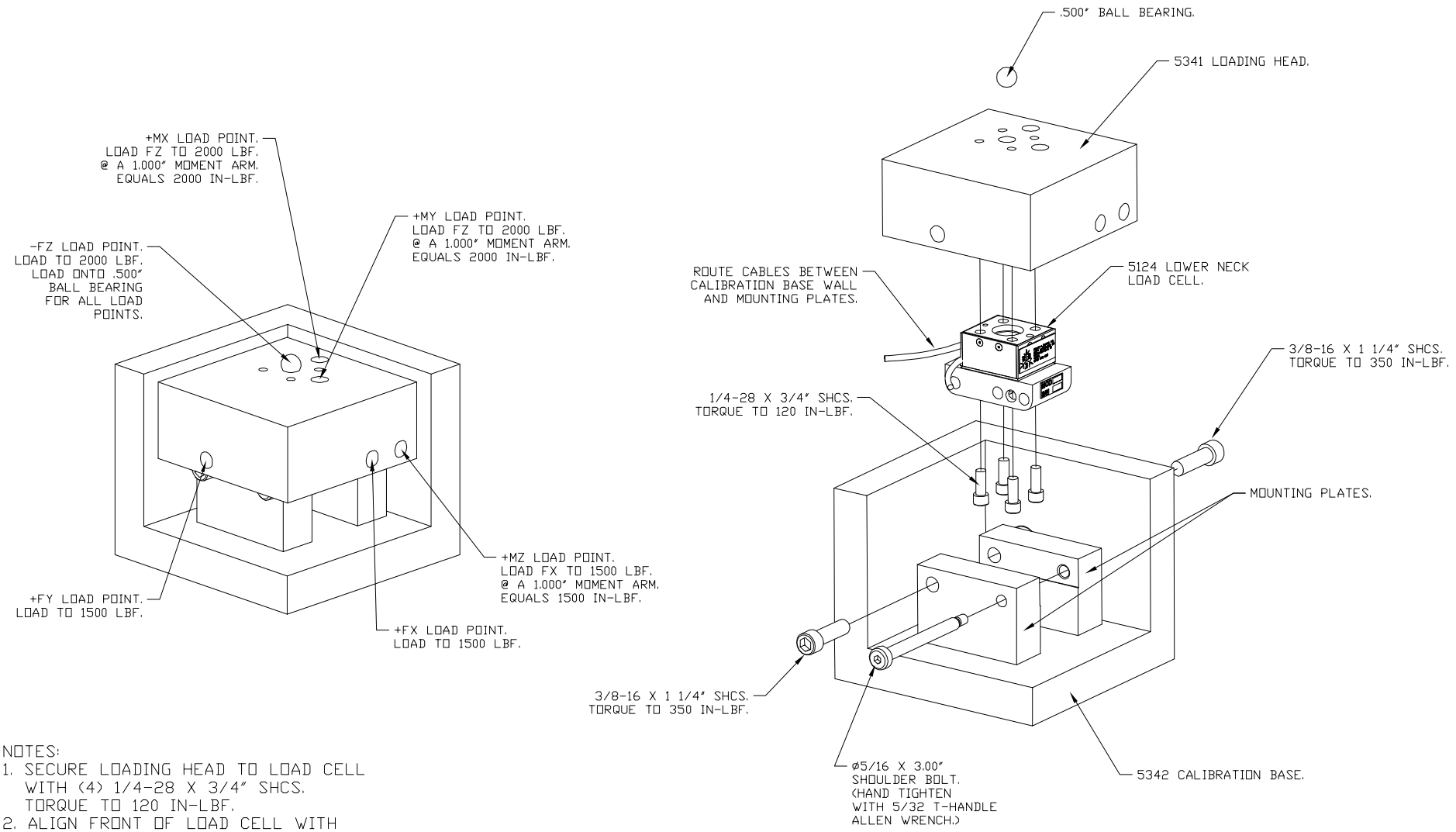
SCALE: 1 : 1	SHEET 1 OF 1	DRWN BY: C.HEAD
DATE: 21AUGUST01		MODEL: 5124

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± 0.010	SURFACE FINISH 125
THREE PLACE DECIMALS	± 0.005	REMOVE ALL BURRS & SHARP EDGES
ANGLES	± 0° 30'	DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-5124-D



NOTES:

1. SECURE LOADING HEAD TO LOAD CELL WITH (4) 1/4-28 X 3/4" SHCS. TORQUE TO 120 IN-LBF.
2. ALIGN FRONT OF LOAD CELL WITH ø5/16 X 3.00" SHOULDER BOLT BY INSERTING THRU HOLE OF MOUNTING PLATE, LOAD CELL, AND OPPOSITE SIDE MOUNTING PLATE. HAND TIGHTEN WITH 5/32" T-HANDLE ALLEN.
3. SECURE REAR OF LOAD CELL TO CALIBRATION BASE WITH (2) 3/8-16 X 1 1/4" SHCS. ON CALIBRATION BASE WALL SIDE INSERT THRU 3/4" HOLE ON BASE. TORQUE 3/8-16 X 1 1/4" SHCS TO 350 IN-LBF.
4. ROUTE CABLES IN BETWEEN BASE WALL AND MOUNTING PLATES.

CALIBRATION FIXTURE MODEL #5340

SYM	REVISION	DATE	CAR#	INIT.
A	RE-DESIGN	10/01		C.D.H.

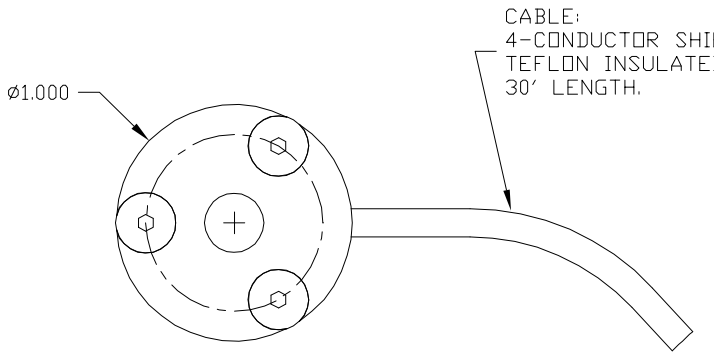
CALIBRATION FIXTURE FOR 5124
10 YEAR OLD LOWER NECK LOAD CELL

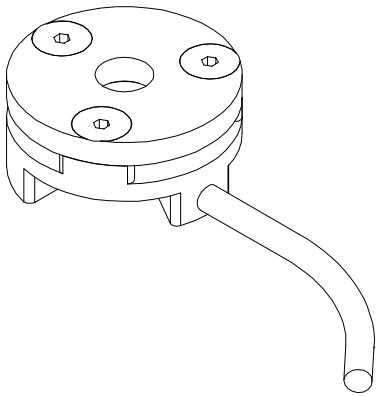
SCALE: NONE	SHEET 1 OF 1	DRWN BY: C.HEAD
DATE: 30AUGUST01		MODEL: 5340

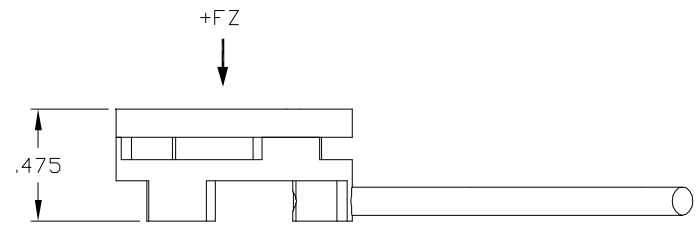
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER:
C-5124-C







MODEL 5145
ACHILLES LOAD CELL

CAPACITY 1000 LBF.
OUTPUT 1.0 mV/V NOMINAL
BRIDGE RESISTANCE 360 OHMS NOM.

NONLINEARITY ± 1% OF FULL SCALE

SYM	REVISION	DATE

ACHILLES LOAD CELL

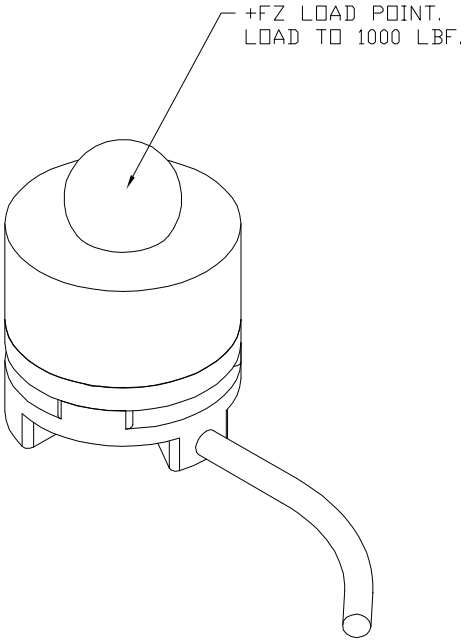
SCALE: FULL		DRAWN BY: C.HEAD
DATE: 19APRIL01		MODEL: 5145

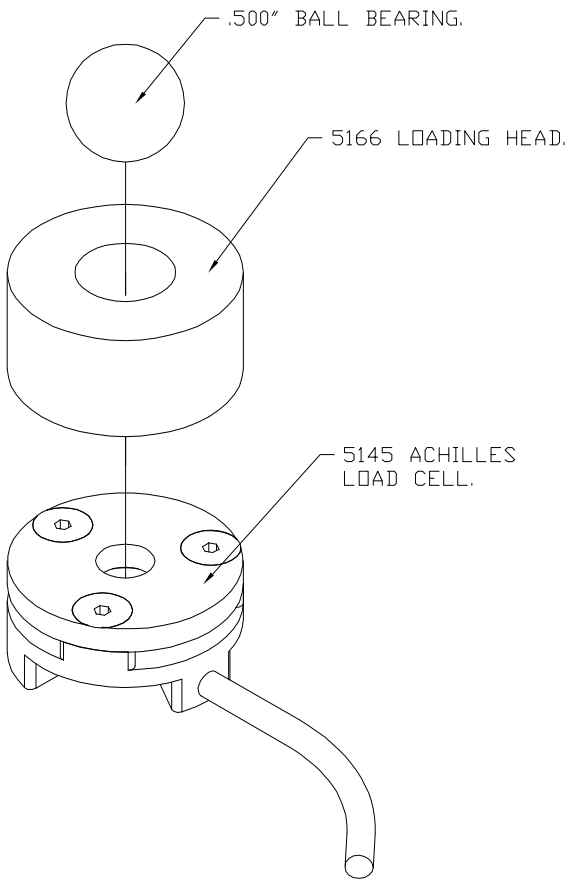
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-5145-D





NOTES:
1. PLACE LOAD CELL ON FLAT METAL SURFACE FOR CALIBRATION.
2. INSTALL LOADING HEAD ONTO LOAD CELL.

CALIBRATION FIXTURE MODEL #5165

SYM	REVISION	DATE

CALIBRATION FIXTURE FOR ACHILLES LOAD CELL

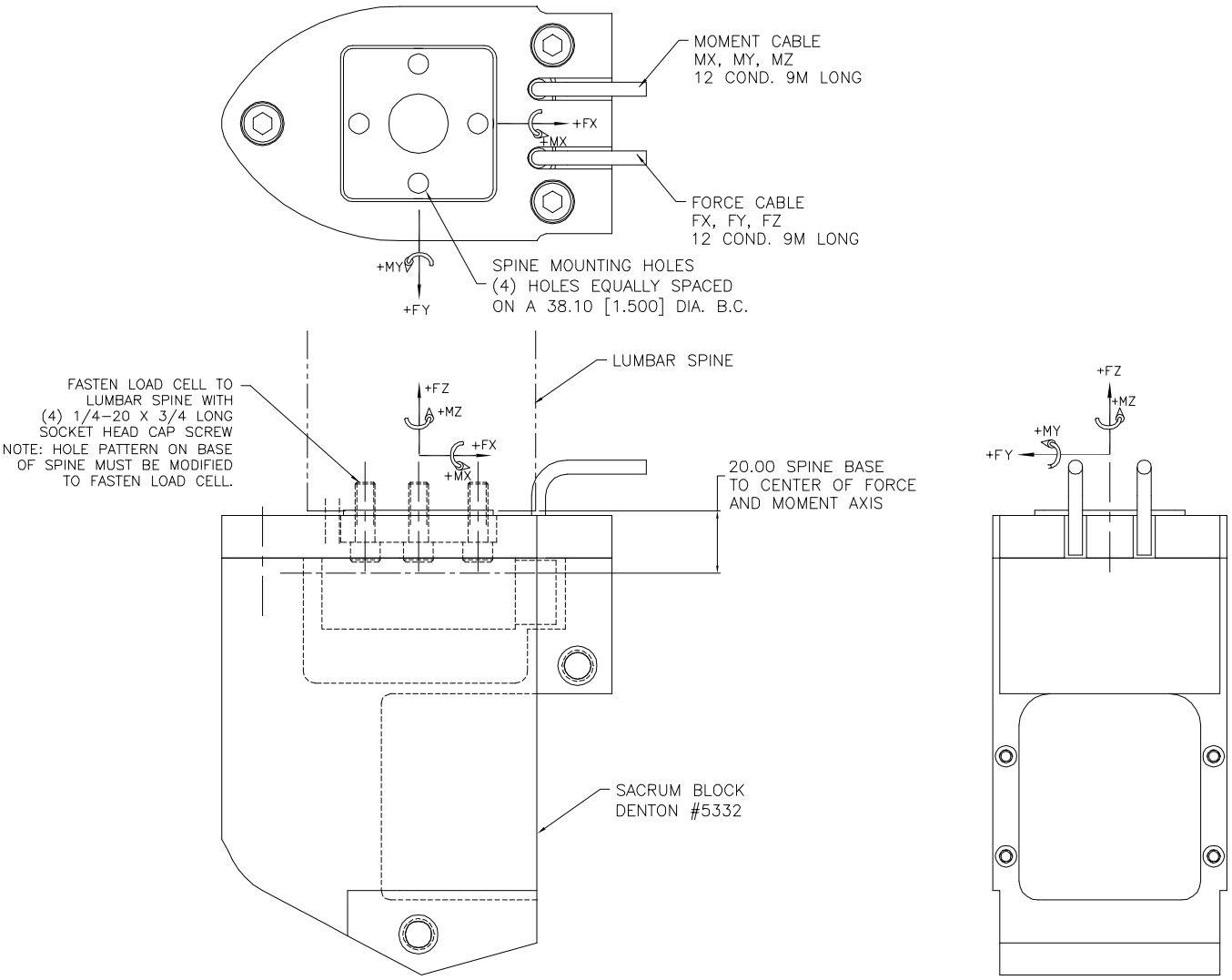
SCALE: NONE		DRAWN BY: *C.HEAD*
DATE: 15MAY01		MODEL: 5145

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-5145-C



LUMBAR SPINE LOAD CELL
(6 CHANNEL)

AXIS	CAPACITY	OUTPUT	BRIDGE RESISTANCE
FX	5 KN	1.8 mV/V NOMINAL	350 OHMS
FY	5 KN	1.8 mV/V NOMINAL	350 OHMS
FZ	7 KN	1.2 mV/V NOMINAL	700 OHMS
MX	225 NM	1.5 mV/V NOMINAL	700 OHMS
MY	225 NM	1.5 mV/V NOMINAL	700 OHMS
MZ	125 NM	2.0 mV/V NOMINAL	350 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

LOAD CELL POLARITY
CONFORMS TO SAE J-211

TOTAL WEIGHT LESS CABLES
& MOUNTING SCREWS 5.49 LBS.

SYM	REVISION	DATE	CAR#	INIT.
A	XXXXXXXXX	M/YY	XXXX	XXX

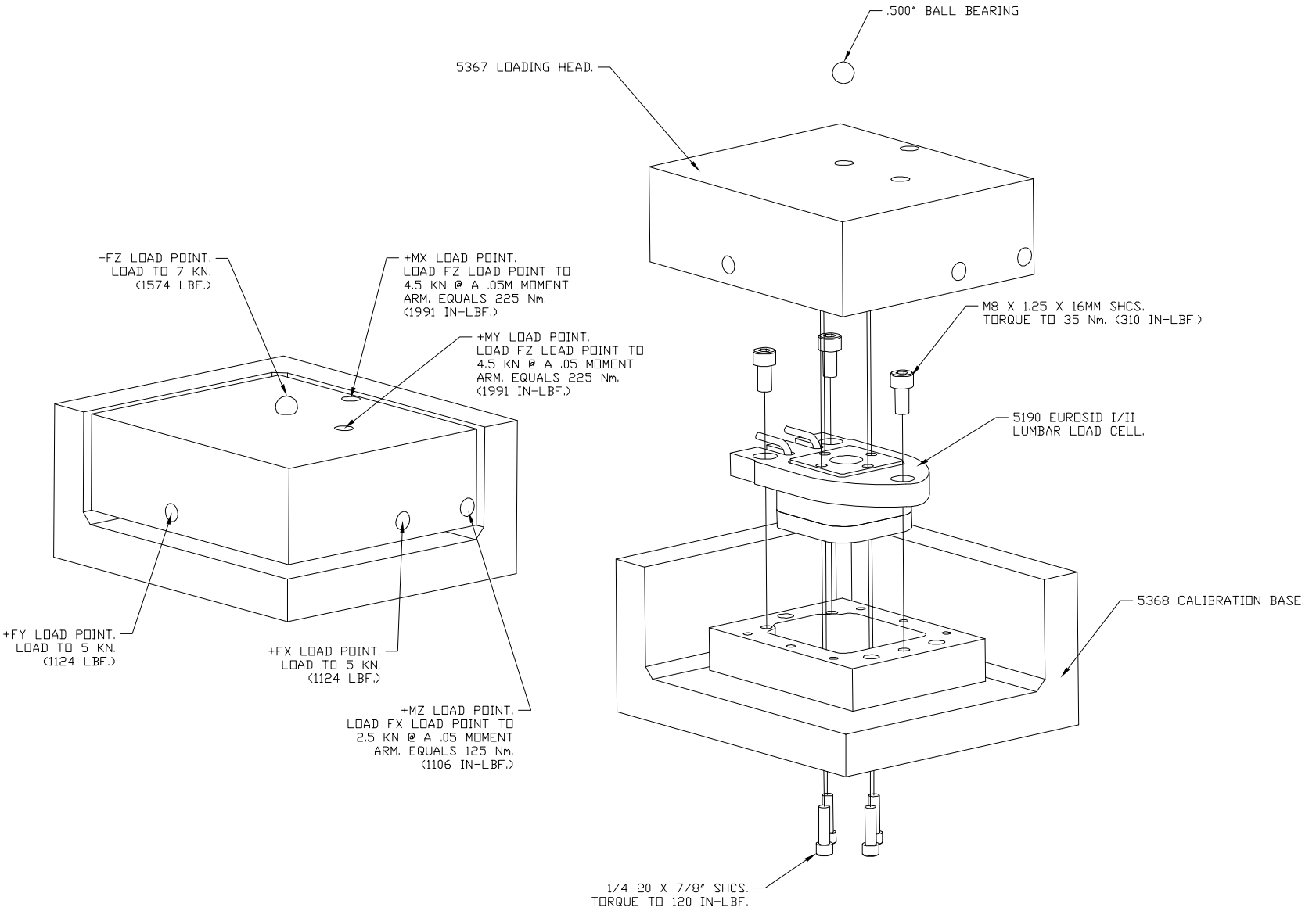
LUMBAR LOAD CELL
EUROSID-1

SCALE: 1 : 1
DATE: 8/15/01
SHEET 1 OF 1
DRWN BY: TORCHALA
MODEL: 5190J

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER:
C-5190-D



CALIBRATION FIXTURING NOTES:

1. SECURE LOAD CELL TO CALIBRATION BASE WITH (3) M8 X 1.25 X 16MM SHCS. TORQUE TO 35 Nm. (310 IN-LBF.)
2. SECURE LOAD CELL AND BASE TO LOADING HEAD WITH (4) 1/4-20 X 7/8" SHCS BY INSERTING THROUGH BOTTOM SURFACE OF 5368 BASE. TORQUE TO 120 IN-LBF.

SYM	REVISION	DATE	CAR#	INIT.

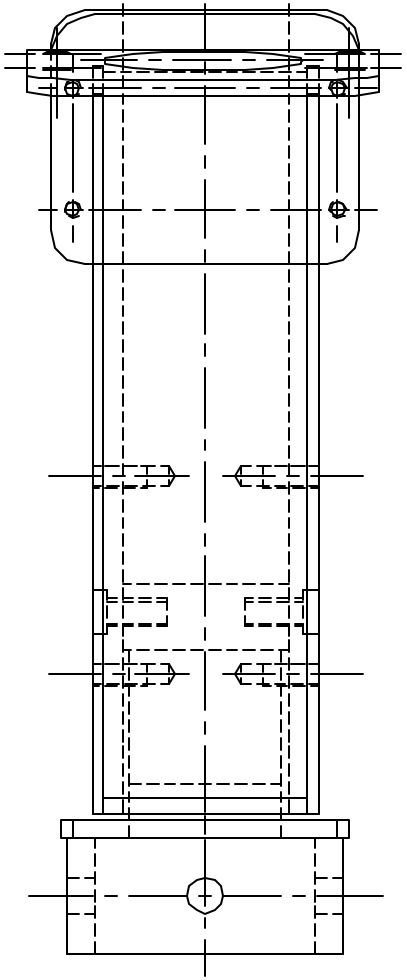
CALIBRATION FIXTURE FOR 5190
EUROSID I/II LUMBAR LOAD CELL

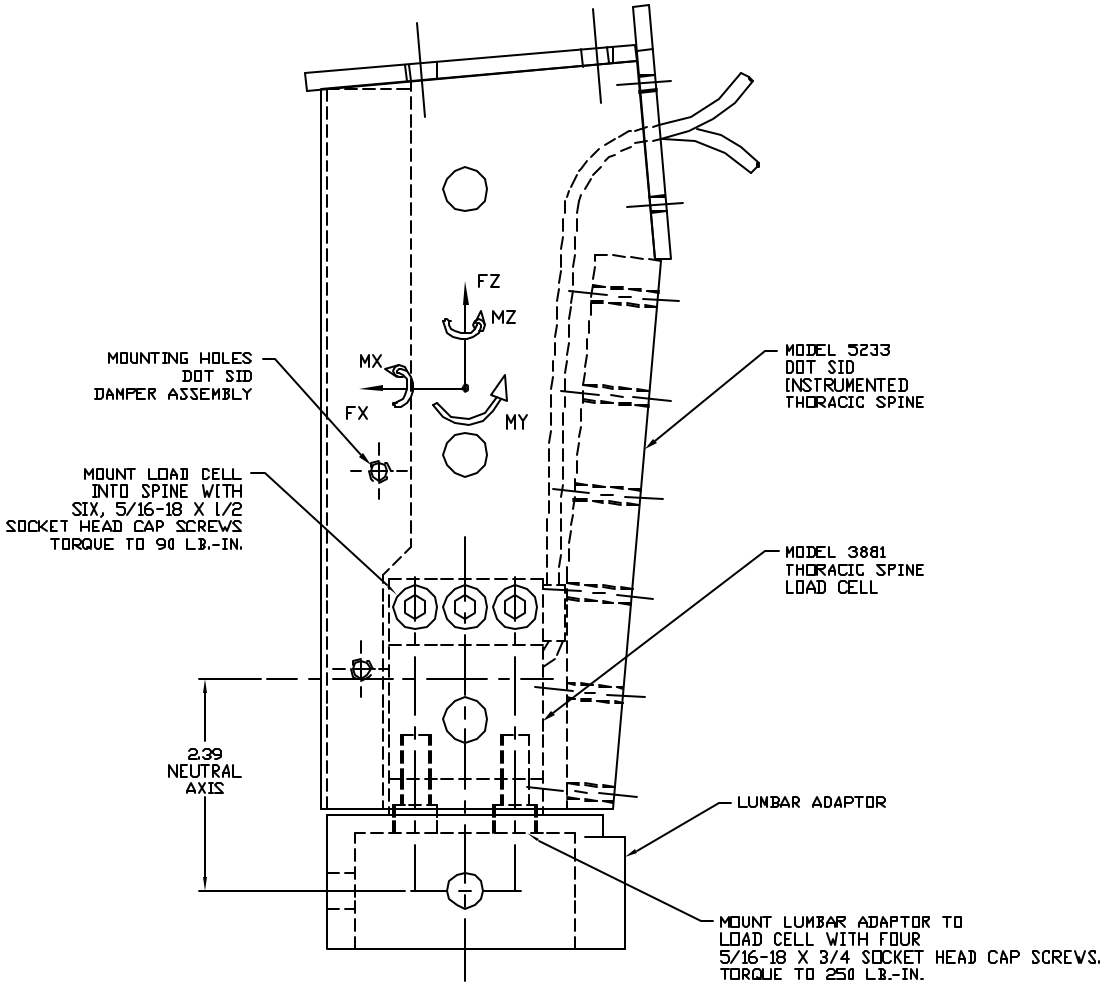
SCALE: NONE	SHEET 1 OF 1	DRWN BY: C. HEAD
DATE: 11OCT01		MODEL: 5366

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-5190-C





MODEL 3881 THORACIC SPINE LOAD CELL

AXIS	CAPACITY	OUPUT	BRIDGE RESISTANCE
FX	3000 LBS	1.8 mV/V NOM.	350Ω
FY	3000 LBS	1.8 mV/V NOM.	350Ω
FZ	4000 LBS	1.0 mV/V NOM.	700Ω
MX	5000 LB-IN	1.6 mV/V NOM.	700Ω
MY	5000 LB-IN	1.6 mV/V NOM.	700Ω
MZ	3000 LB-IN	1.5 mV/V NOM.	350Ω

NONLINEARITY <1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE

SYM	REVISION	DATE

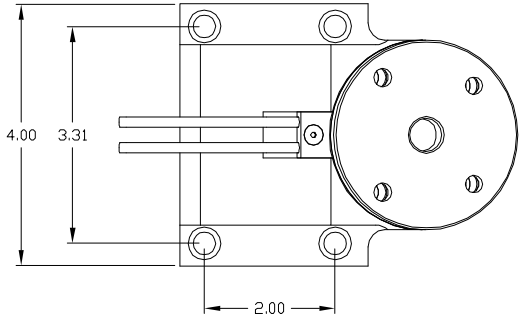
INSTRUMENTED THORACIC SPINE ASSEMBLY DOT SID, 6-CHN

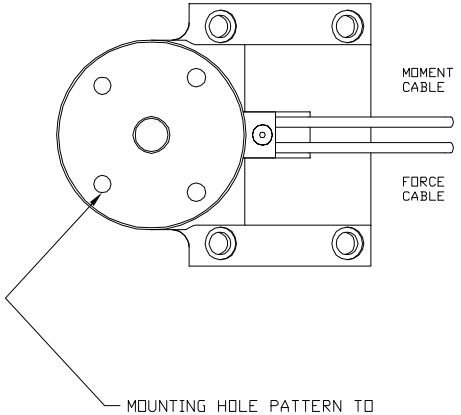
SCALE: .75X		DRAWN BY: C.M. MORGAN
DATE: 06AUG01		MODEL: 5233

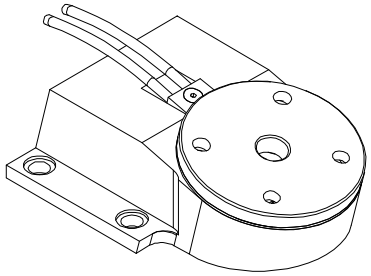
UNLESS OTHERVISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

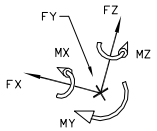
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

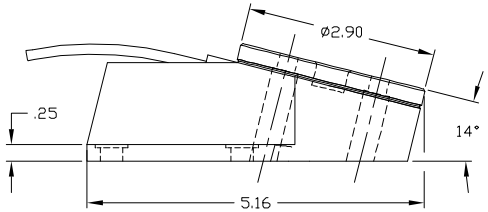
DRAWING NUMBER: B-5233-D











LOWER NECK LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	2000 LBF	2.0 mV/V NOMINAL	350 Ω
FY	2000 LBF	2.0 mV/V NOMINAL	350 Ω
FZ	3000 LBF	1.2 mV/V NOMINAL	700 Ω
MX	4000 IN-LBF	2.0 mV/V NOMINAL	350 Ω
MY	4000 IN-LBF	2.0 mV/V NOMINAL	350 Ω
MZ	3000 IN-LBF	2.3 mV/V NOMINAL	700 Ω

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

POLARITY CONFORMS TO SAE J-211

SYM	REVISION	DATE	CAR#	INIT.

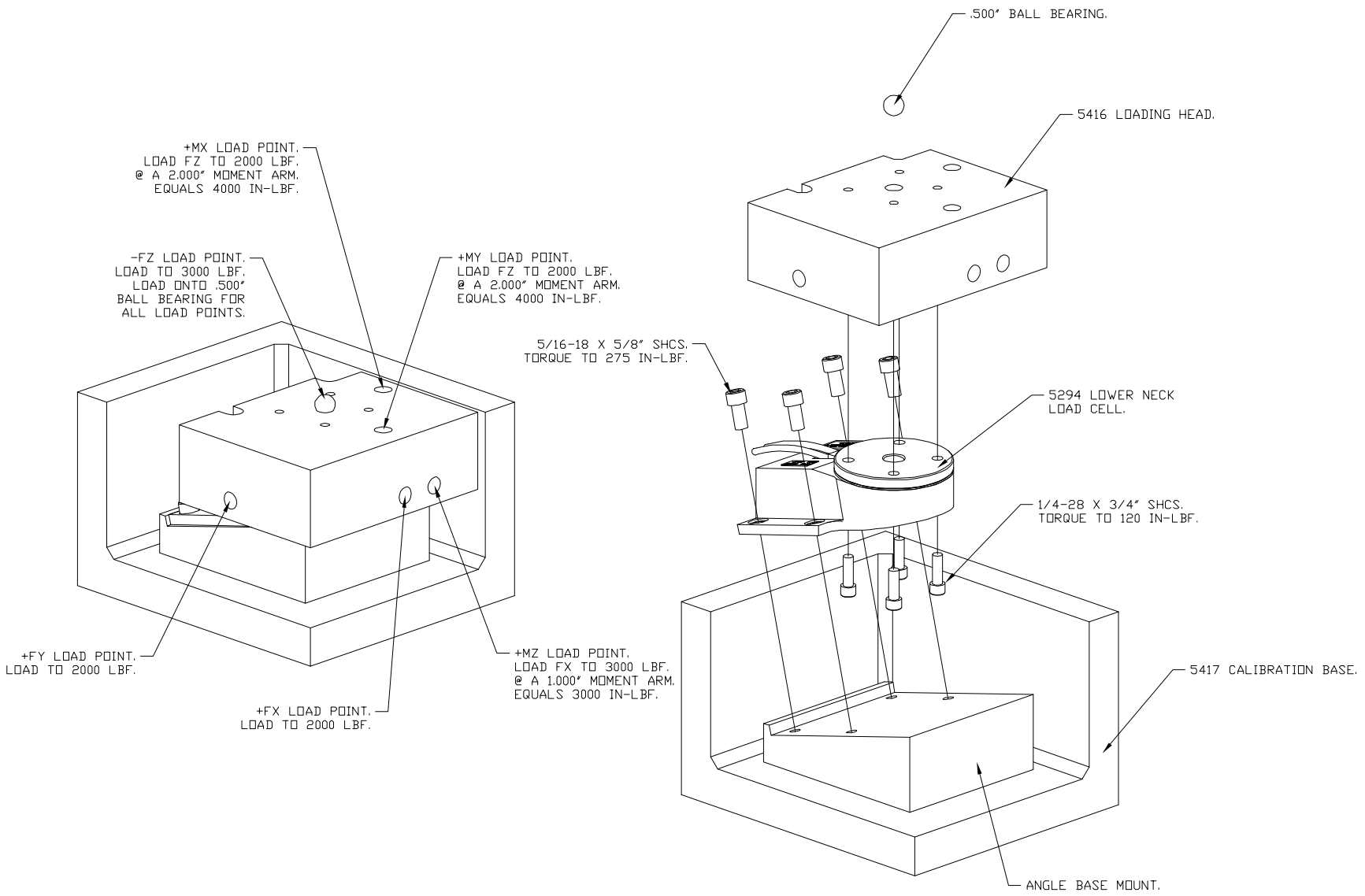
SID-H3 LOWER NECK
LOAD CELL

SCALE: .75X | SHEET 1 OF 1 | DRWN BY: C.HEAD
DATE: 08OCT01 | MODEL: 5294J

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-5294-D



FIXTURING NOTES:

1. SECURE LOAD CELL TO LOADING HEAD WITH (4) 1/4-28 X 3/4" SHCS. TORQUE TO 120 IN-LBF.
2. SECURE LOAD CELL AND LOADING HEAD TO ANGLE BASE MOUNT WITH (4) 5/16-18 X 5/8" SHCS. TORQUE TO 275 IN-LBF.

SYM	REVISION	DATE	CAR#	INIT.

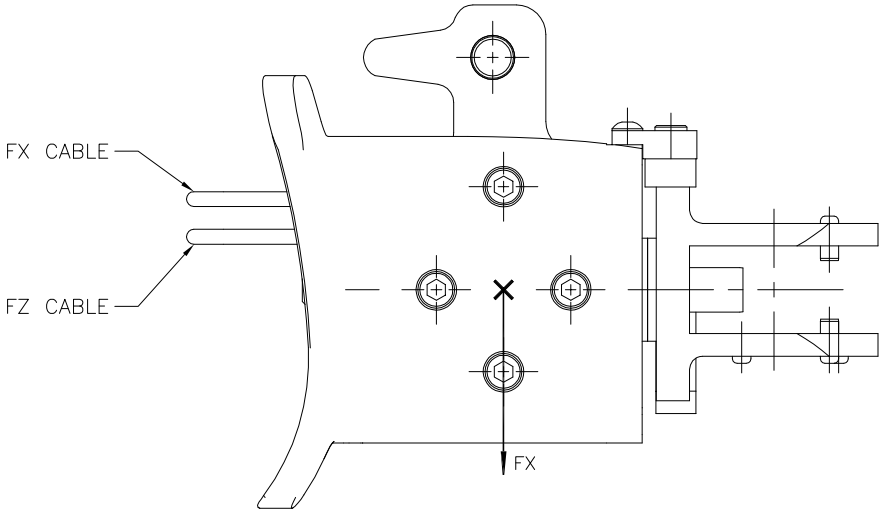
CALIBRATION FIXTURE FOR
5294 LOWER NECK LOAD CELL

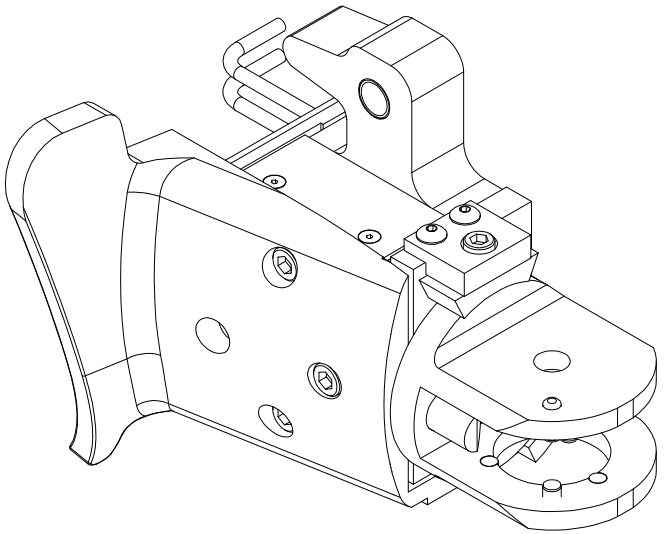
SCALE: NONE	SHEET 1 OF 1	DRWN BY: C. HEAD
DATE: 22OCT01		MODEL: 5415

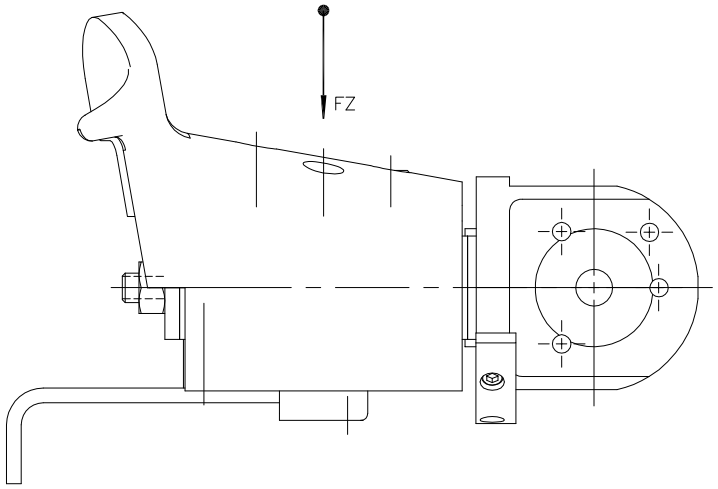
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER:
C-5294-C







POLARITY CONFORMS TO SAE J-211

MODEL 5400

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	1000 LBS	1.5 mV/V NOM.	350Ω
FZ	1000 LBS	1.1 mV/V NOM.	700Ω

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE	CAR#	INIT.
A	XXXXXXXXX	M/YY	XXXX	XXX

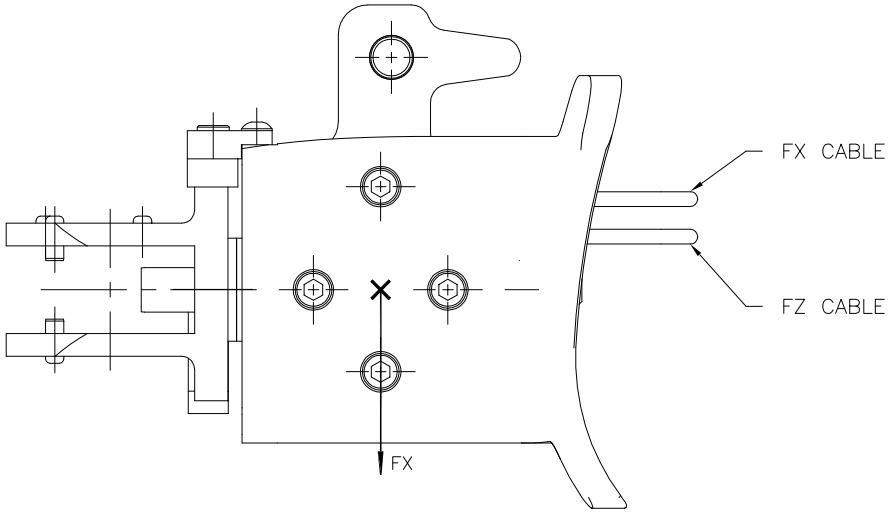
LEFT SHOULDER LOAD CELL
HIII 10 YO

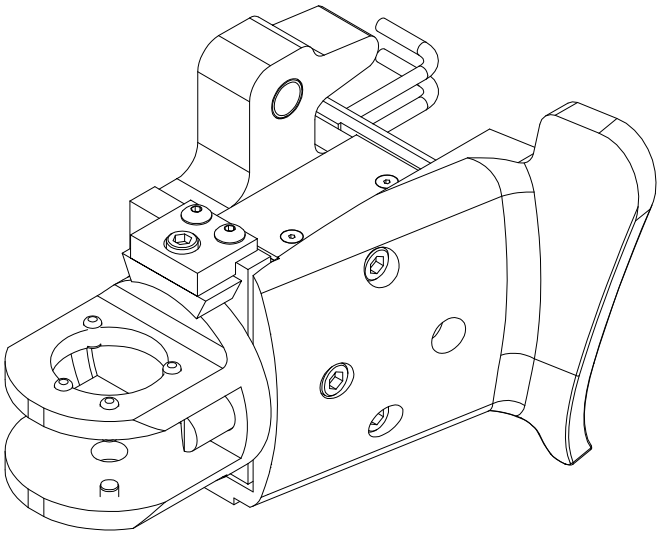
SCALE: 1 : 1
DATE: 11/01/01
SHEET 1 OF 1
DRWN BY: TORCHALA
MODEL: 5400J

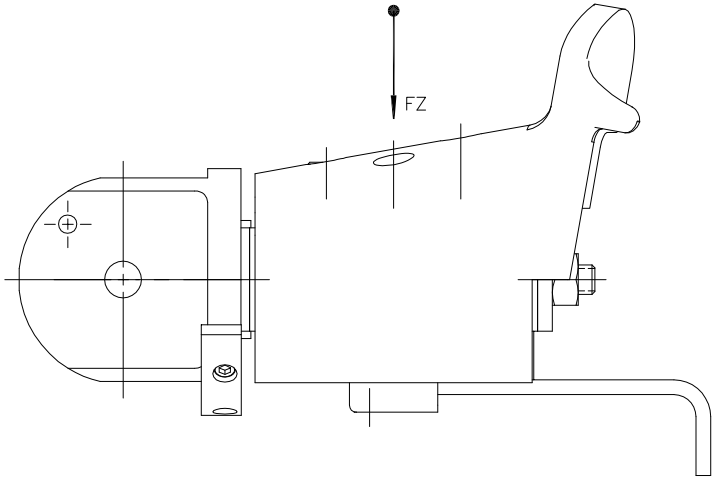
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER:
B-5400-D







MODEL 5410

AXIS	CAPACITY	OUTPUT @ CAPACITY	BRIDGE RESISTANCE
FX	1000 LBS	1.5 mV/V NOM.	350Ω
FZ	1000 LBS	1.1 mV/V NOM.	700Ω

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

POLARITY CONFORMS TO SAE J-211

SYM	REVISION	DATE	CAR#	INIT.
A	XXXXXXXXX	M/YY	XXXX	XXX

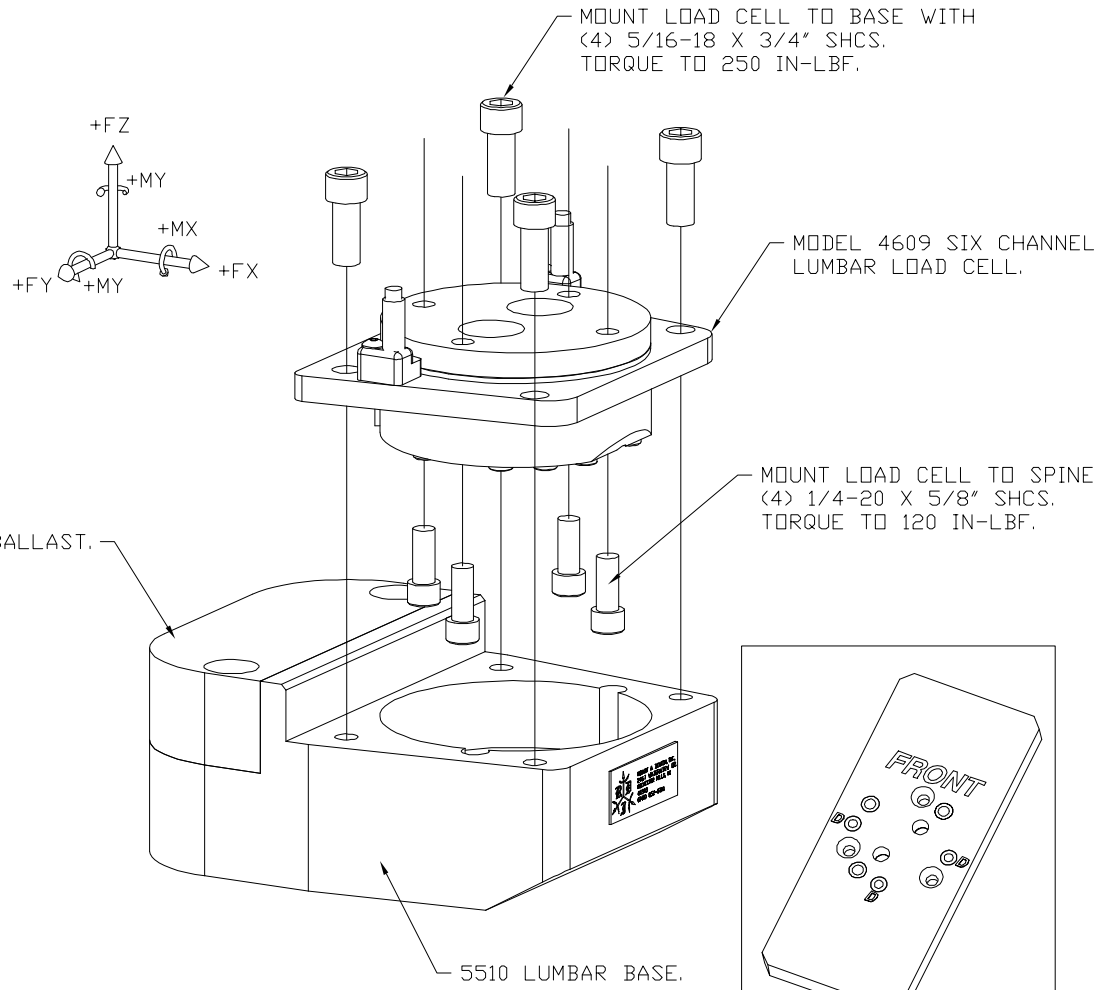
RIGHT SHOULDER LOAD CELL
HIII 10 YO

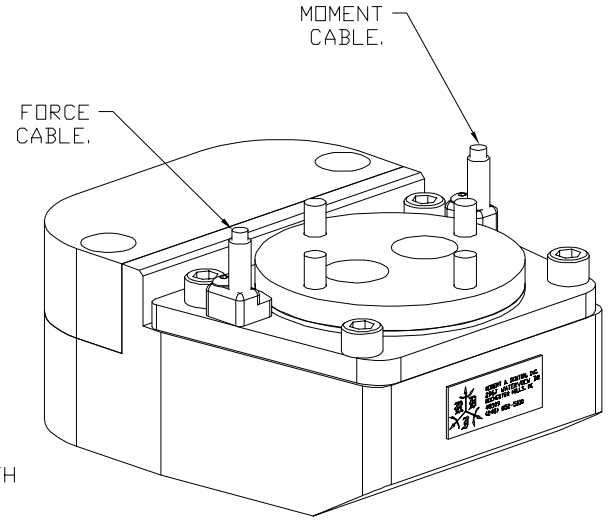
SCALE: 1 : 1
DATE: 11/01/01
SHEET 1 OF 1
DRWN BY: TORCHALA
MODEL: 5410J

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER:
B-5410-D





MODEL 4503

AXIS	CAPACITIES	OUTPUT	BRIDGE RESIST.
FX	3372 LBF	1.9 mV/V NOM.	350 OHMS
FY	3372 LBF	1.9 mV/V NOM.	350 OHMS
FZ	4496 LBF	1.1 mV/V NOM.	700 OHMS
MX	5311 IN-LBF	1.8 mV/V NOM.	700 OHMS
MY	5311 IN-LBF	1.8 mV/V NOM.	700 OHMS
MZ	3098 IN-LBF	1.6 mV/V NOM.	350 OHMS

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT OF ASSEMBLY = 15.8 LBS. (7.2 KG)

POLARITY CONFORMS TO SAE J-211

OPTIONAL: MODEL 4503 KIT

THE LUMBAR SPINE HOLE PATTERN MUST BE MODIFIED FROM A 3 HOLE PATTERN TO A 4 HOLE PATTERN FOR MOUNTING TO THIS LOAD CELL. THE LUMBAR SPINE MODIFICATION KIT, MODEL 4503, IS AVAILABLE FOR THIS PURPOSE. IT INCLUDES THE DRILL JIG SHOWN, A TAP DRILL, AND A TAP.

SYM	REVISION	DATE	CAR#	INIT.

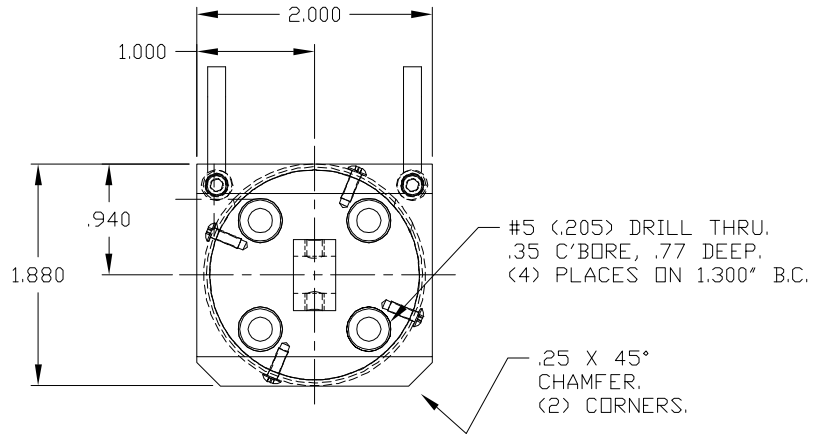
6 CHANNEL STRAIGHT SPINE
LUMBAR LOAD CELL

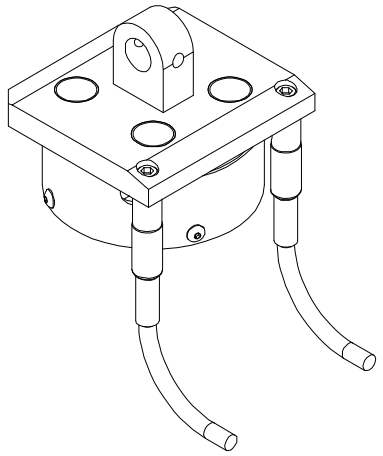
SCALE: .75X	SHEET 1 OF 1	DRWN BY: C.HEAD
DATE: 20FEB02		MODEL: 5462J

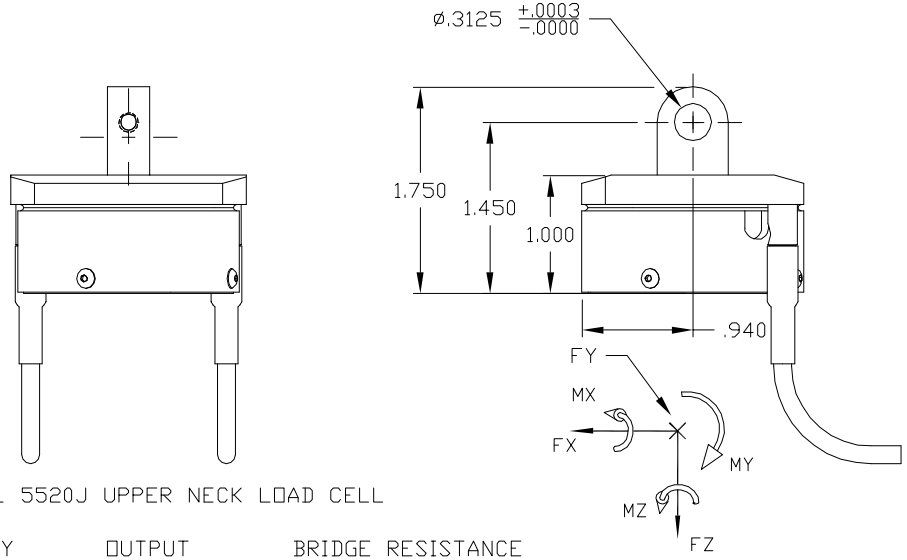
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010 SURFACE FINISH 125
THREE PLACE DECIMALS ± 0.005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-5462-D







MODEL 5520J UPPER NECK LOAD CELL

AXIS	CAPACITY	OUTPUT	BRIDGE RESISTANCE
FX	6.7 kN	2.0mV/V NOM.	350
FY	6.7 kN	2.0 mV/V NOM.	350
FZ	10.0 kN	1.2 mV/V NOM.	700
MX	210 NM	1.7 mV/V NOM.	350
MY	210 NM	1.7 mV/V NOM.	350
MZ	140 NM	2.0 mV/V NOM.	700

NONLINEARITY <1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE

LOAD CELL OUTPUT POLARITY CONFIRMS TO SAE J-211

SYM	REVISION	DATE	CAR#	INIT.

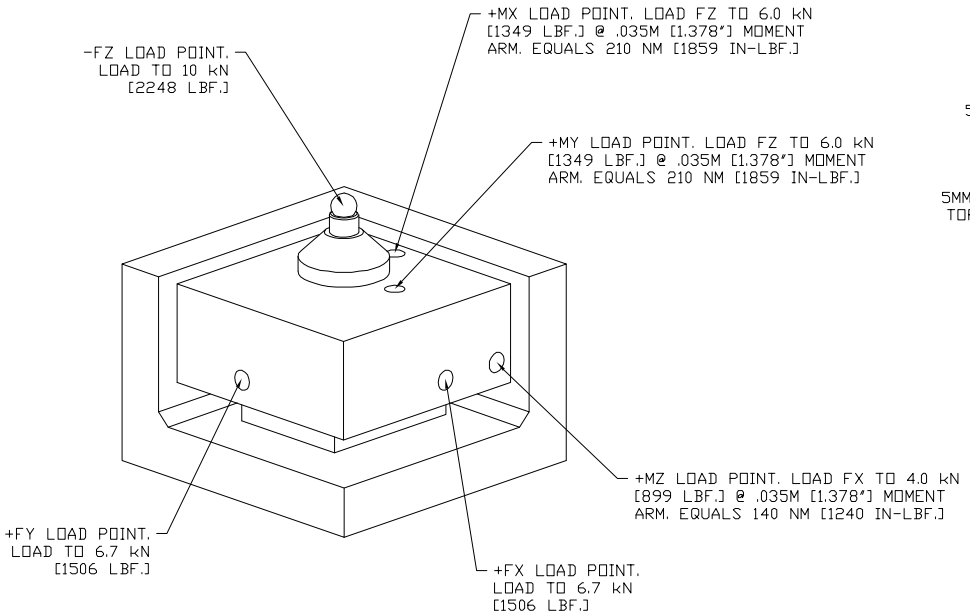
5TH FEMALE, THOR
UPPER NECK

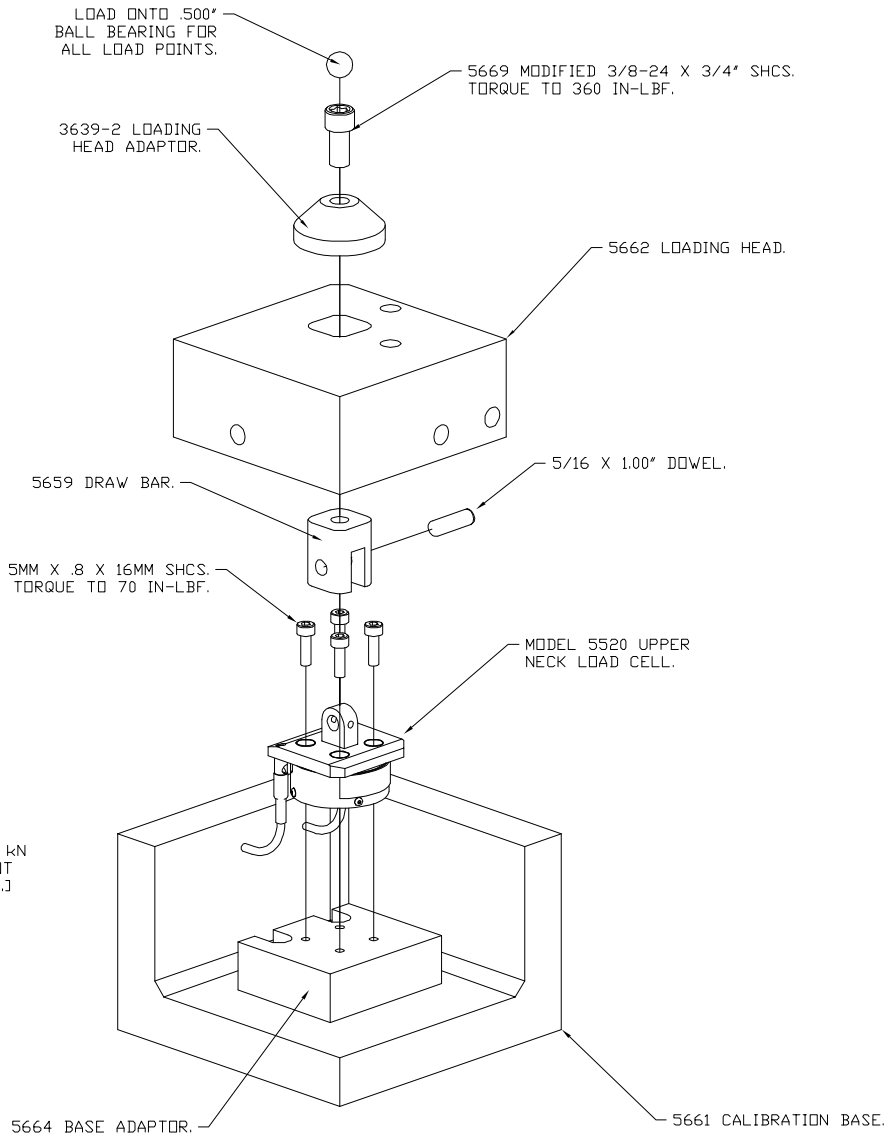
SCALE: FULL	SHEET 1 OF 1	DRWN BY: C.HEAD
DATE: 09APRIL02		MODEL: 5520J

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010 SURFACE FINISH 125
THREE PLACE DECIMALS ± 0.005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-5520-D





FIXTURING NOTES:

1. SECURE LOAD CELL TO CALIBRATION BASE BLOCK WITH (4) M5 X .8 X 16MM SHCS. TORQUE TO 70 IN-LBF.
2. ATTACH DRAW BAR TO LOAD CELL WITH (1) 5/16" X 1" DOWEL PIN.
3. PLACE LOADING HEAD OVER DRAW BAR.
4. ALIGN LOADING HEAD ADAPTOR OVER DRAW BAR AND SECURE WITH 3/8-24 X 3/4" SHCS. TORQUE TO 360 IN-LBF.

CALIBRATION FIXTURE MODEL #5660

SYM	REVISION	DATE	CAR#	INIT.

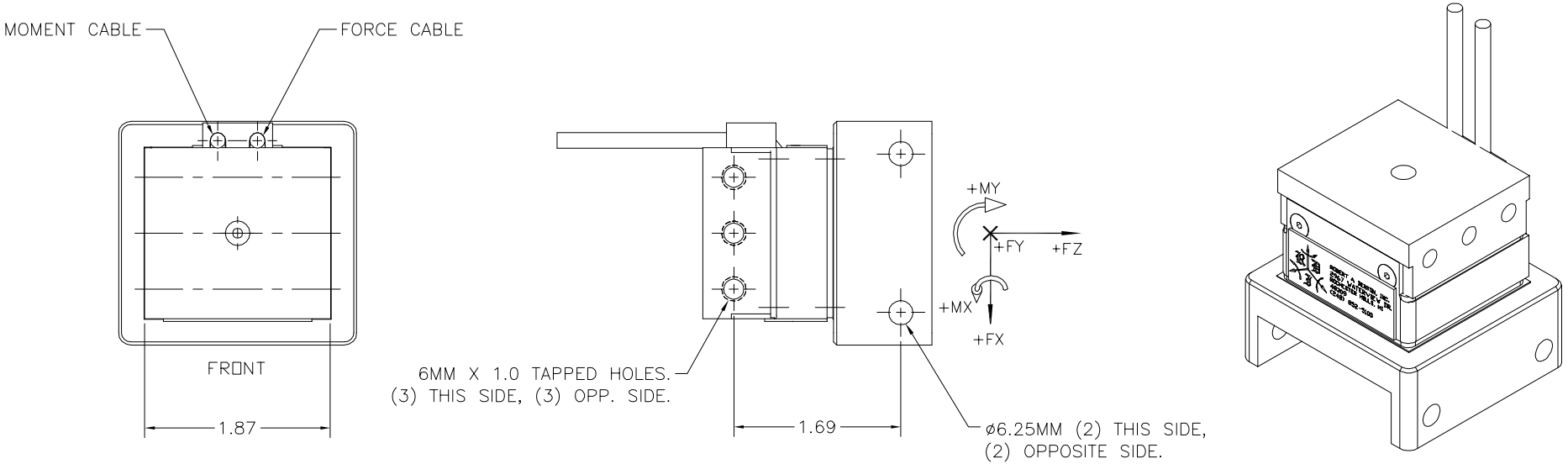
CALIBRATION FIXTURE FOR THOR 5TH
FEMALE UPPER NECK LOAD CELL

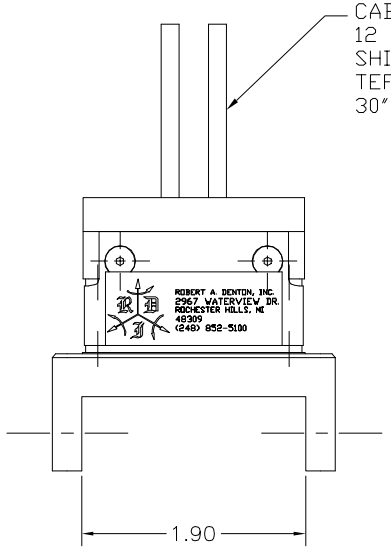
SCALE: NONE	SHEET 1 OF 1	DRWN BY: C.HEAD
DATE: 26JUNE02		MODEL: 5660

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-5520-C





POLARITY CONFORMS TO
SAE J-211

MODEL 5521 THORACIC SPINE LOAD CELL
THOR 5F

AXIS	CAPACITY	OUPUT @ CAPACITY	BRIDGE RESISTANCE
FX	13.0 kN	1.8 mV/V NOM.	350 Ω
FY	13.0 kN	1.8 mV/V NOM.	350 Ω
FZ	18.0 kN	1.0 mV/V NOM.	700 Ω
MX	560 NM	1.6 mV/V NOM.	700 Ω
MY	560 NM	1.6 mV/V NOM.	700 Ω

NONLINEARITY <1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE

SYM	REVISION	DATE	CAR#	INIT.
C	CAPACITIES WERE ENGLISH	8/02		C.D.H.
B	WAS .266	4/02		C.D.H.
A	WAS 5/16-18	4/02		C.D.H.

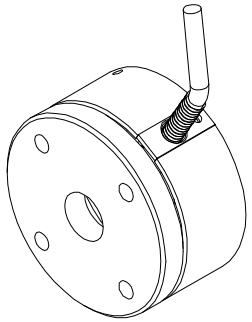
THOR 5F THORACIC SPINE
LOAD CELL

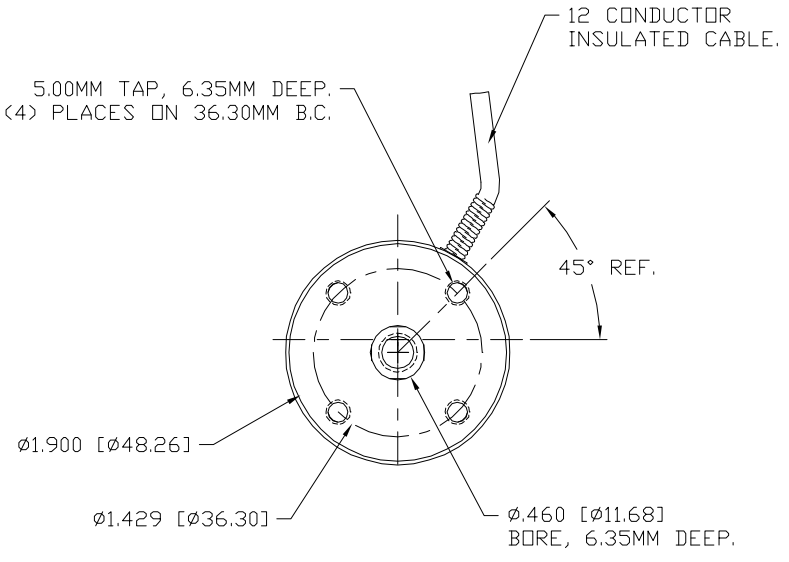
SCALE: 1 : 1
DATE: 2/15/02
SHEET 1 OF 1
DRWN BY: TORCHALA
MODEL: 5521

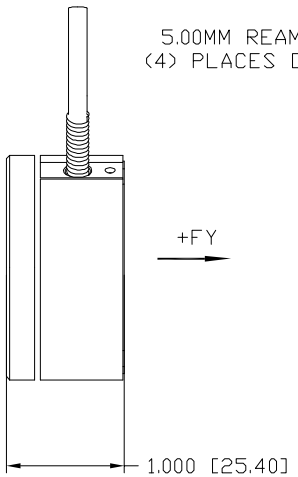
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010 SURFACE FINISH 125
THREE PLACE DECIMALS ± 0.005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

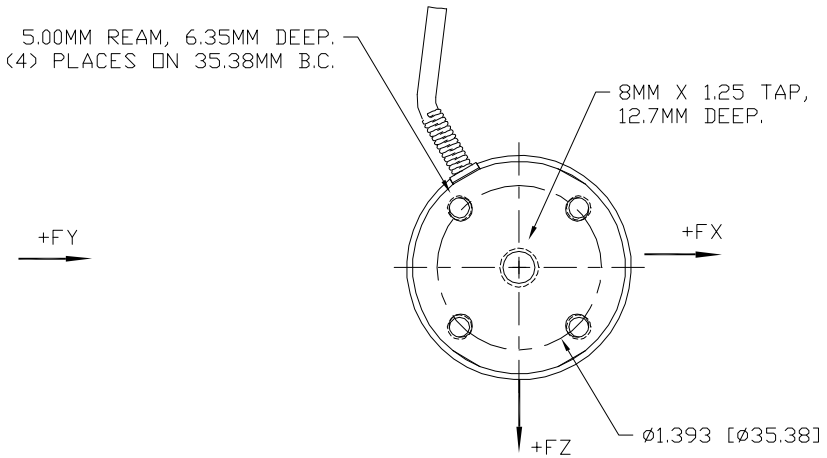
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER:
B-5521-D









AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	3000 LBF	(A) 3.3 mV/V NOMINAL
FY	2000 LBF	1.0 mV/V NOMINAL
FZ	2000 LBF	(A) 3.3 mV/V NOMINAL

NON-LINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

LOAD CELL OUTPUT POLARITY CONFIRMS TO SAE J-211

SYM	REVISION	DATE	CAR#	INIT.
A	WAS 2.5 mv/V	08/02		C.D.H.

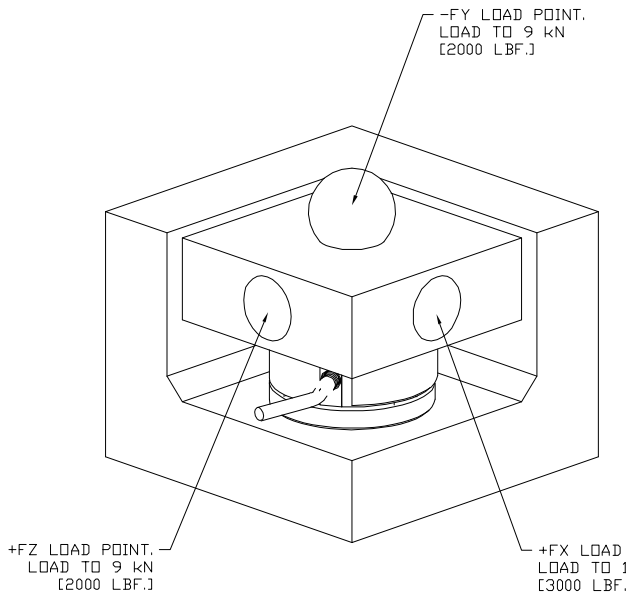
THOR FEMALE ACETABULUM
(RIGHT)

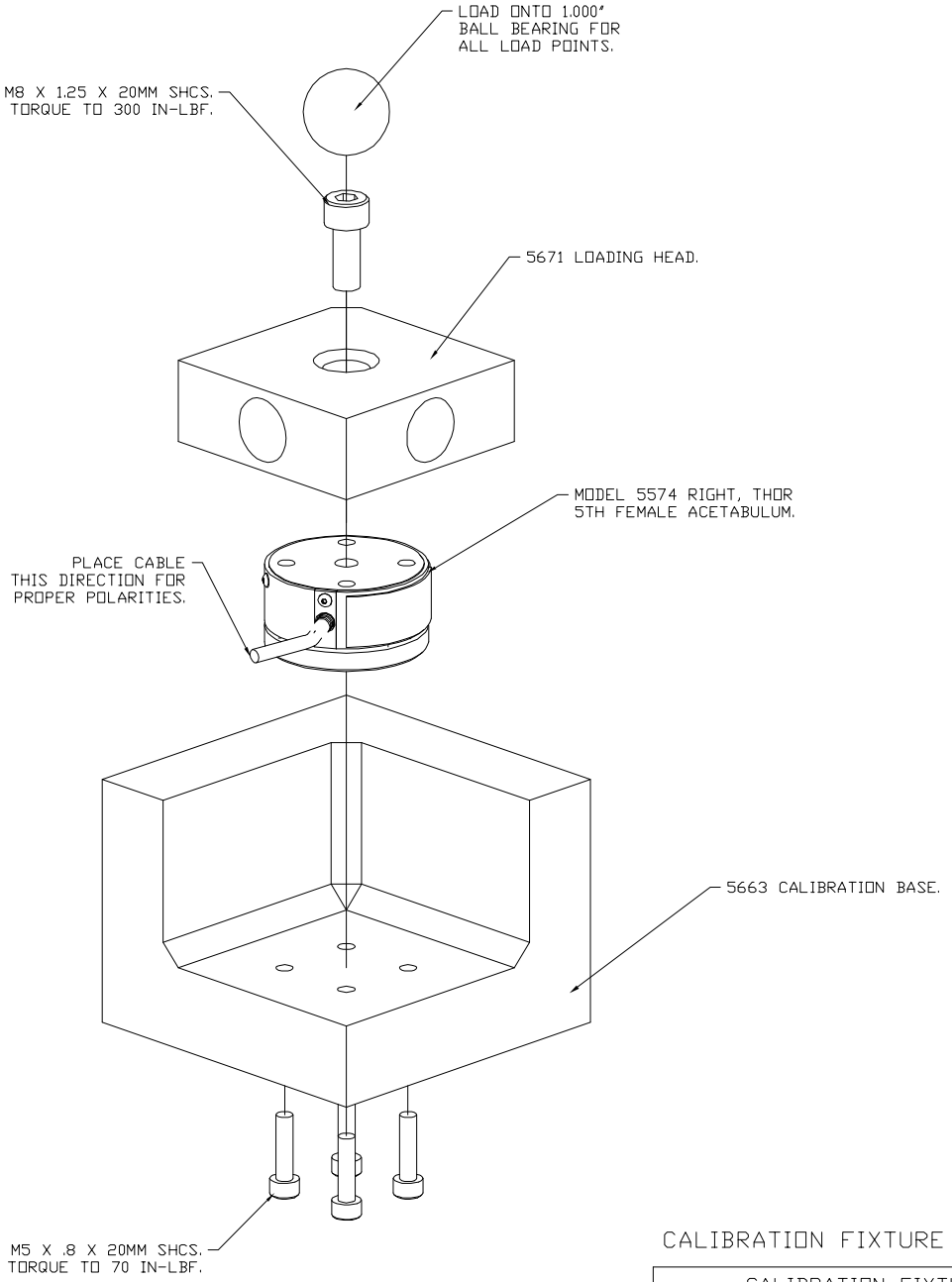
SCALE: 1 : 1
DATE: 06MAY02
SHEET 1 OF 1
DRWN BY: C.HEAD
MODEL: 5574J

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30′
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER:
B-5574-D





FIXTURING NOTES:

1. SECURE LOAD CELL TO CALIBRATION BASE WITH (4) M5 X .8 X 20MM SHCS. TORQUE TO 70 IN-LBF.
2. ALIGN LOADING HEAD TO LOAD CELL WITH (4) ATTACHED 5MM DOWELS, AND SECURE TO LOAD CELL WITH (1) M8 X 1.25 X 20MM SHCS. TORQUE TO 300 IN-LBF.

CALIBRATION FIXTURE MODEL #5670

SYM	REVISION	DATE	CAR#	INIT.

CALIBRATION FIXTURE FOR
RIGHT, THOR 5TH FEMALE ACETABULUM

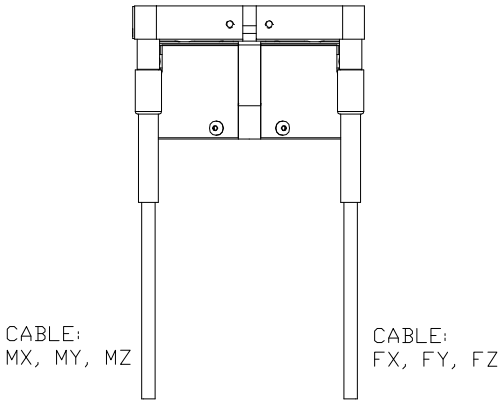
SCALE: 1 : 1	SHEET 1 OF 1	DRWN BY: C.HEAD
DATE: 27JUNE02		MODEL: 5670

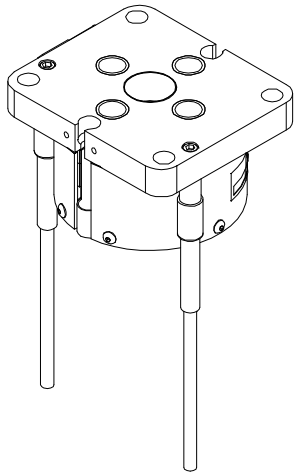
UNLESS OTHERWISE SPECIFIED

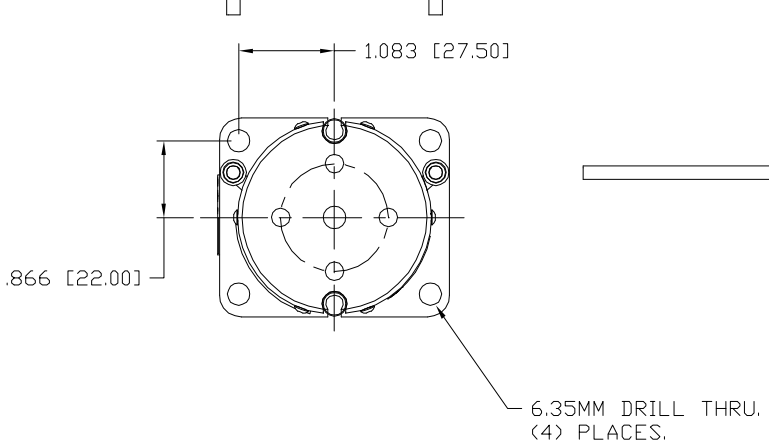
TWO PLACE DECIMALS	± 0.010	SURFACE FINISH 125
THREE PLACE DECIMALS	± 0.005	REMOVE ALL BURRS & SHARP EDGES
ANGLES	± 0° 30'	DIMENSION LIMITS HELD AFTER PLATING

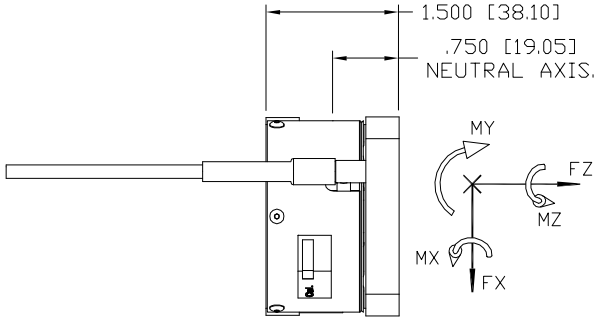
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

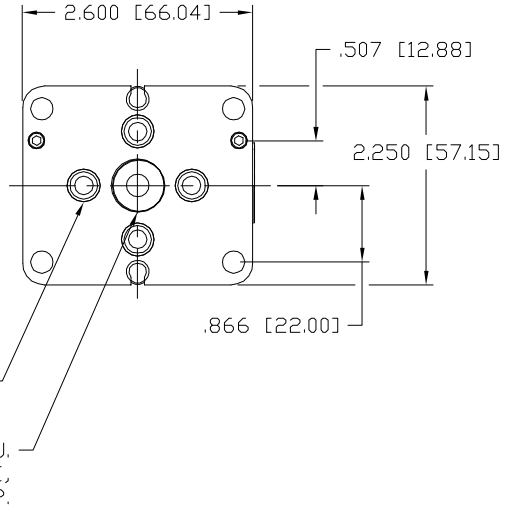
DRAWING NUMBER: C-5574-C











AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	10 kN	2 mV/V NOMINAL
FY	10 kN	2 mV/V NOMINAL
FZ	10 kN	1 mV/V NOMINAL
MX	340 NM	2 mV/V NOMINAL
MY	340 NM	2 mV/V NOMINAL
MZ	170 NM	2 mV/V NOMINAL

NON-LINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

LOAD CELL OUTPUT POLARITY CONFIRMS TO SAE J-211

SYM	REVISION	DATE	CAR#	INIT.

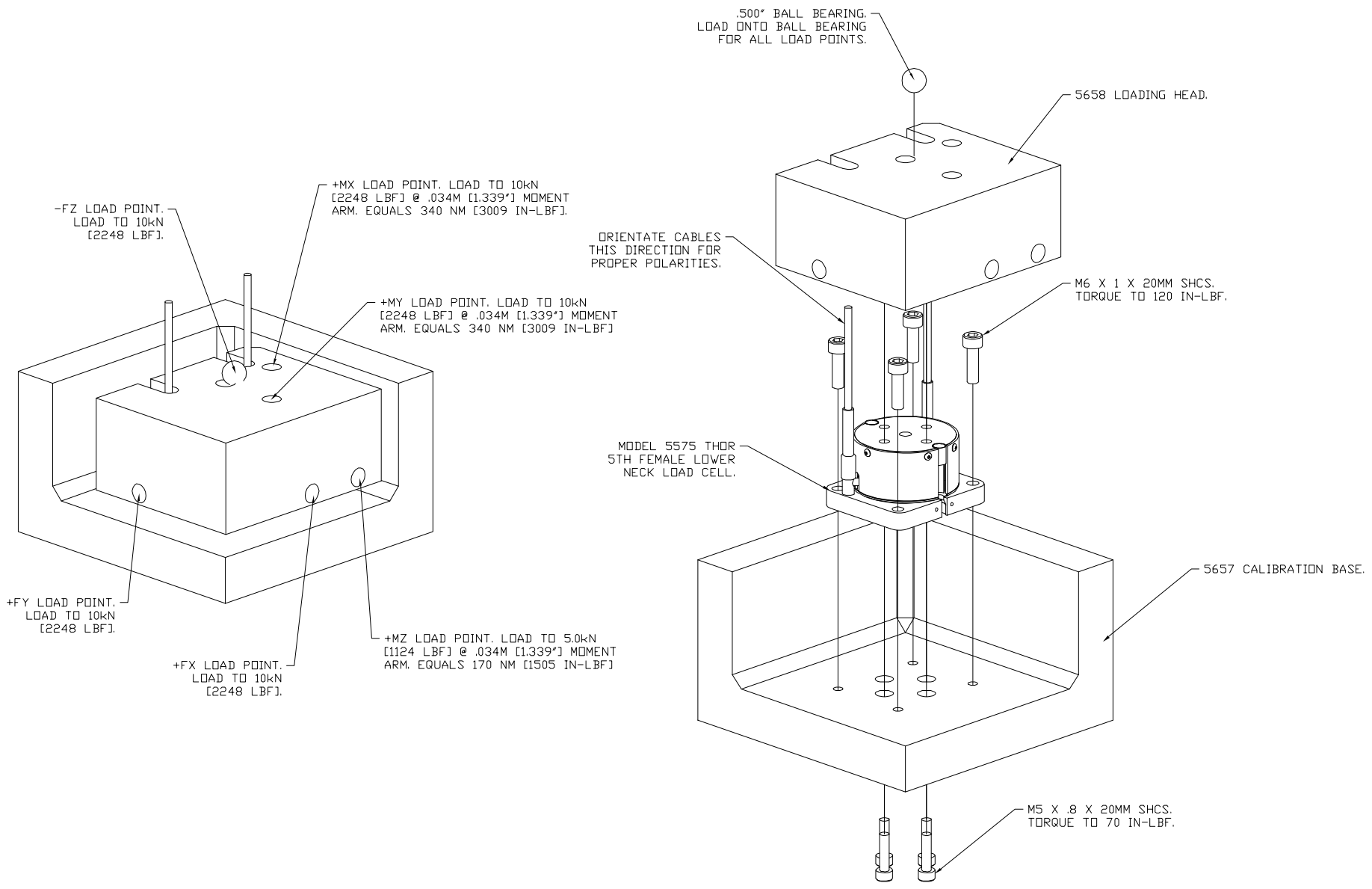
THOR FEMALE LOWER NECK
LOAD CELL

SCALE: .75X
DATE: 30MARCH02
SHEET 1 OF 1
DRWN BY: C.HEAD
MODEL: 5575

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER:
B-5575-D



FIXTURING NOTES:

1. SECURE LOAD CELL TO 5657 CALIBRATION BASE WITH (4) M6 X 1 X 20MM SHCS. TORQUE TO 120 IN-LBF.
2. REPOSITION CALIBRATION BASE AND LOAD CELL TO INSERT (4) M5 X .8 X 20MM SHCS THRU BOTTOM OF CALIBRATION BASE AND LOAD CELL.
3. POSITION LOADING HEAD AS SHOWN AND SECURE WITH THE (4) M5 X .8 X 20MM SHCS. TORQUE TO 70 IN-LBF.

CALIBRATION FIXTURE MODEL #5656

SYM	REVISION	DATE	CAR#	INIT.

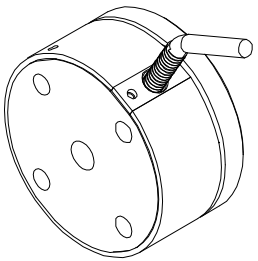
CALIBRATION FIXTURE FOR THOR
5TH FEMALE LOWER NECK LOAD CELL

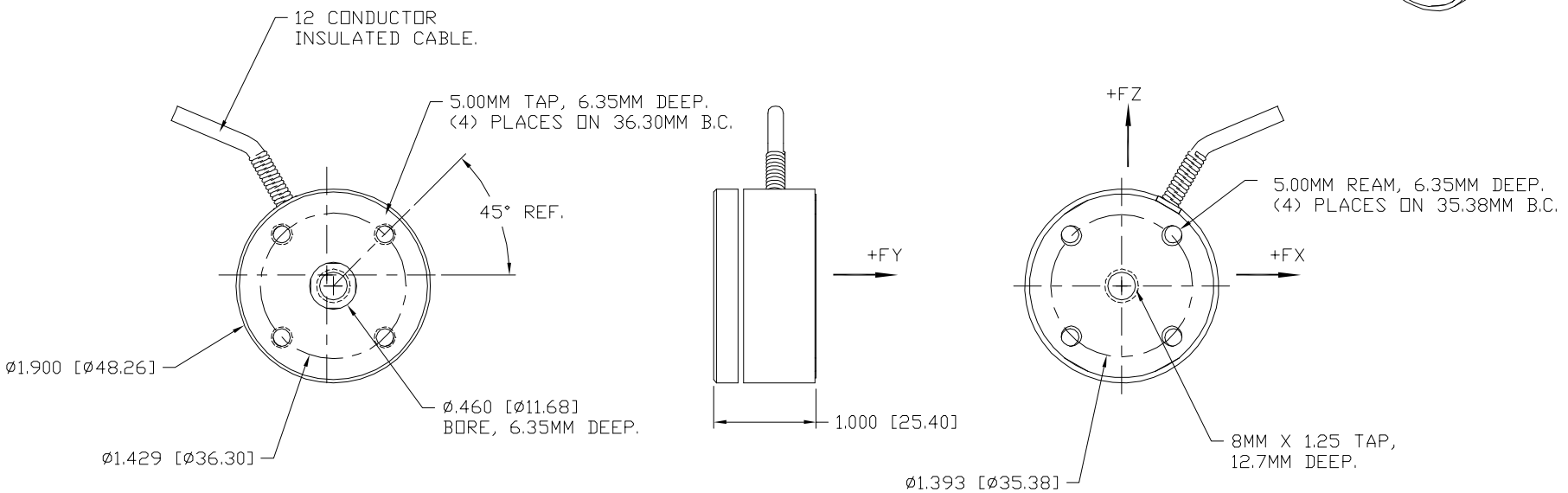
SCALE: NONE	SHEET 1 OF 1	DRWN BY: C.HEAD
DATE: 21JUNE02		MODEL: 5656

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-5575-C





AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	3000 LBF	(A) 3.3 mV/V NOMINAL
FY	2000 LBF	1.0 mV/V NOMINAL
FZ	2000 LBF	(A) 3.3 mV/V NOMINAL

NON-LINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

LOAD CELL OUTPUT POLARITY CONFIRMS TO SAE J-211

SYM	REVISION	DATE	CAR#	INIT.
A	WAS 2.5 mv/V	08/02		C.D.H.

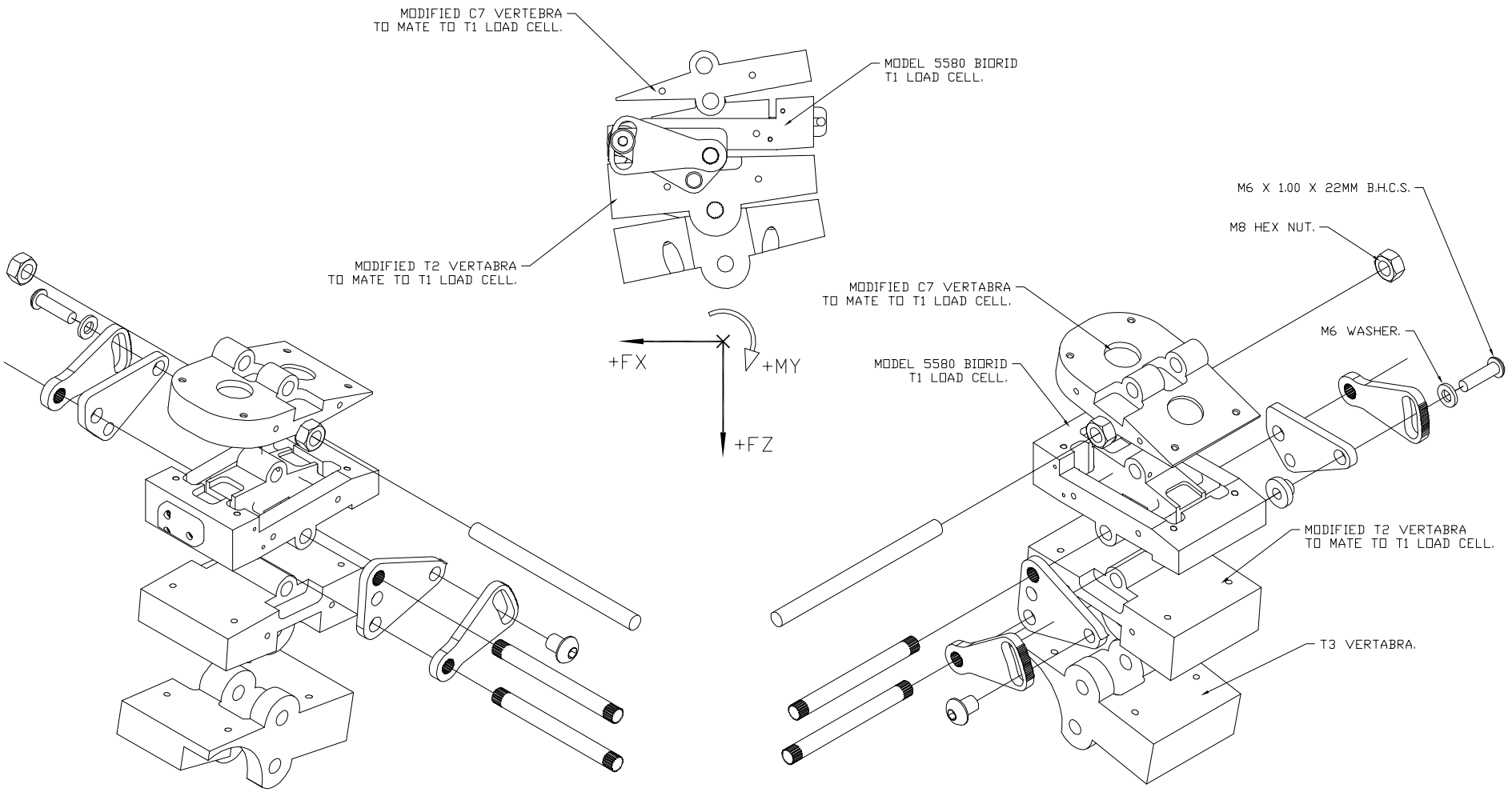
THOR FEMALE ACETABULUM
(LEFT)

SCALE: 1 : 1
DATE: 06MAY02
SHEET 1 OF 1
DRWN BY: C.HEAD
MODEL: 5576

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30′
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER:
B-5576-D



AXIS	CAPACITY	OUTPUT	BRIDGE RESISTANCE
FX	5.0kN	1.0 mV/V NOM.	700 OHMS
FZ	5.0kN	1.0 mV/V NOM.	700 OHMS
MY	200NM	2.0 mV/V NOM.	700 OHMS

NONLINEARITY < 1% OF FULL SCALE
HYSTERESIS < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE	CAR#	INIT.

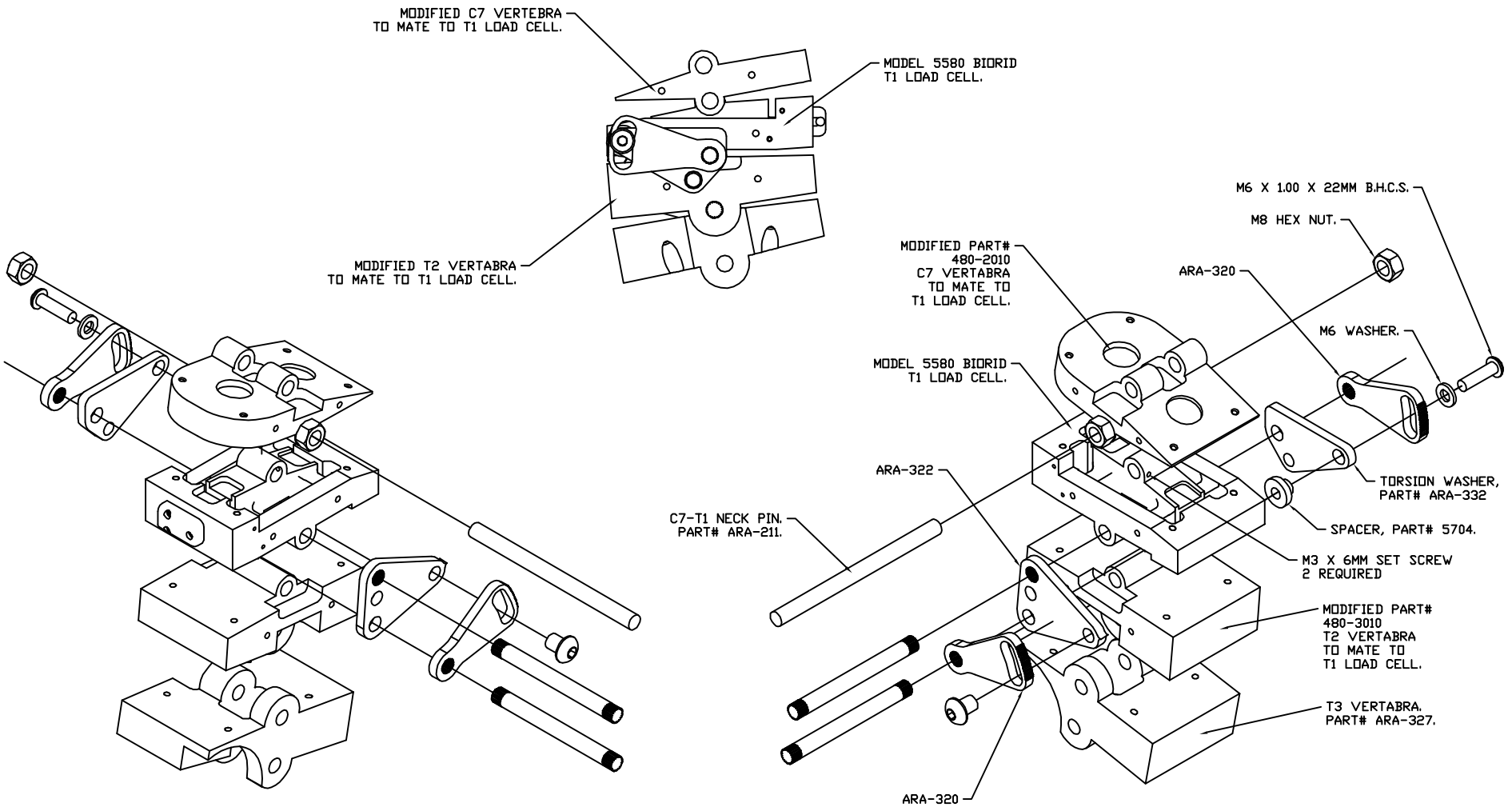
T1 THORACIC VERTEBRAE
LOAD CELL

SCALE: .75X
DATE: 20MAY02
SHEET 1 OF 2
DRWN BY: C.HEAD
MODEL: 5580

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER:
C-5580-1-D



INSTALLATION PROCEDURE
1. REMOVE SKULL FROM BIORID.
2. CUT ENDS OFF OF MUSCLE AND DAMPER CABLES. REMOVE CABLES.
3. REMOVE PIN CONNECTING C6 TO C7. REMOVE UPPER VERTEBRA AS AN ASSEMBLY.
4. REMOVE PINS AND PLATES CONNECTING C7/T1 AND T1/T2. REMOVE C7, T1 AND T2 VERTEBRA.
5. INSTALL REPLACEMENT T2 VERTEBRA (480-3010) TO T3 USING ORIGINAL HARDWARE.
6. INSTALL T1 LOAD CELL TO T2 VERTEBRA USING ORIGINAL HARDWARE.
7. INSTALL REPLACEMENT C7 VERTEBRA (480-2010) TO T1 LOAD CELL USING SUPPLIED PIN WITH FLATS. ALIGN FLATS TO SET SCREWS ON REAR TOP OF LOAD CELL. OUTSIDE FLATS ON PIN WILL ALIGN WITH EDGES OF C7 WHEN CORRECTLY POSITIONED. TIGHTEN SET SCREWS AGAINST PIN.
8. TORSION WASHER (PART # ARA-332) REPLACES THE ORIGINAL RIGHT SIDE PLATE AT THE T1/C7 JUNCTION. PLACE SPACER #5704 INTO REAR HOLE OF ARA-322 AND INSTALL ASSEMBLY ONTO T1/T2 PIN. INSTALL ARA-320 ONTO T1/T2 PIN AND LOCK IN PLACE WITH M6 SCREW AND WASHER INTO REAR OF LOAD CELL AS SHOWN.
9. INSTALL C1 TO C6 ASSEMBLY TO C7 WITH STANDARD HARDWARE.
10 REINSTALL DAMPER AND MUSCLE SUBSTITUTE CABLES.
11. INSTALL SKULL ASSEMBLY.

SYM	REVISION	DATE	CAR#	INIT.

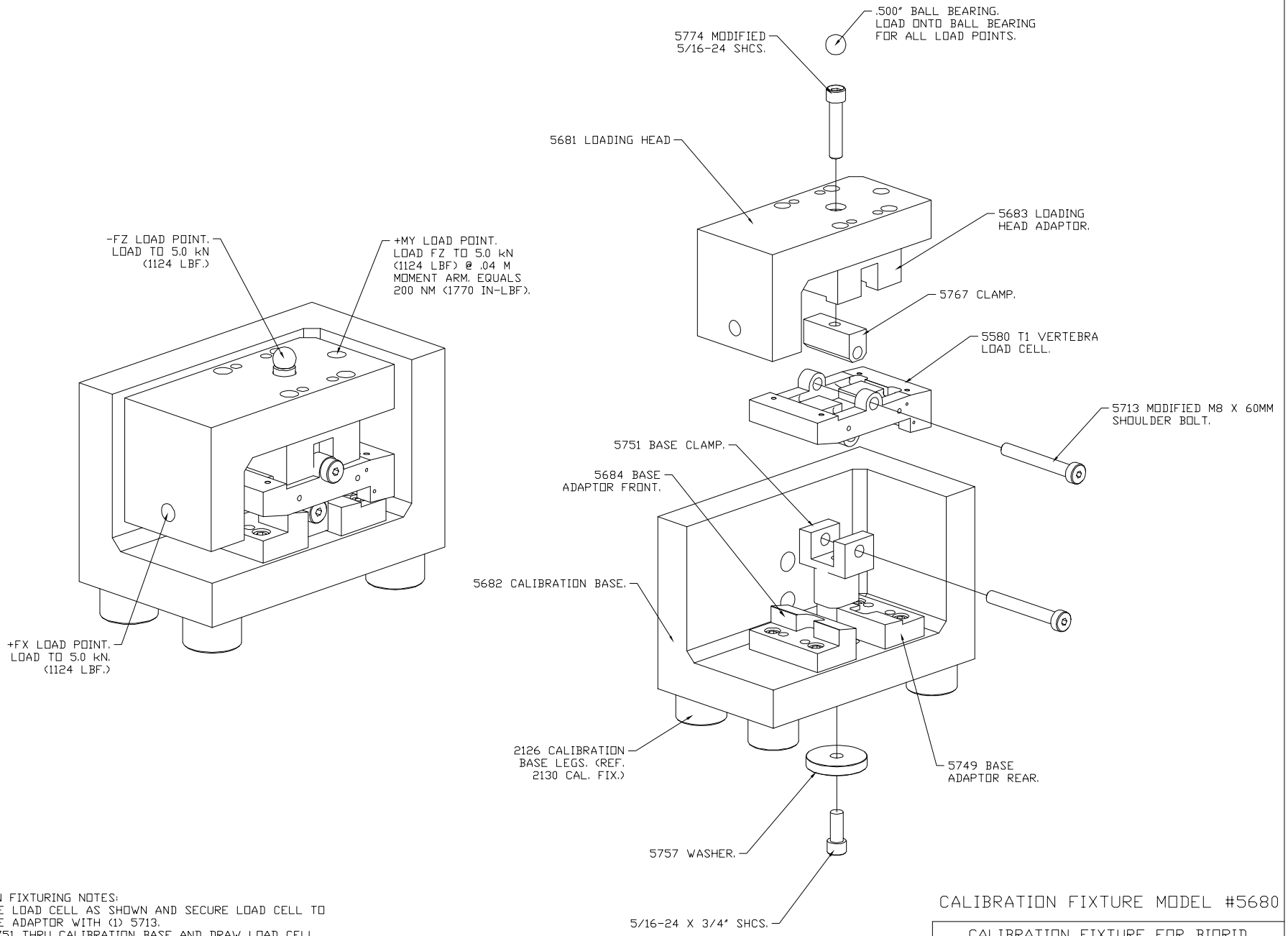
T1 THORACIC LOAD CELL
INSTALLATION PROCEDURE

SCALE: .75X	SHEET 1 OF 1	DRWN BY: C.HEAD
DATE: 20MAY02		MODEL: 5580

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-5580-2-D



CALIBRATION FIXTURING NOTES:

1. ORIENTATE LOAD CELL AS SHOWN AND SECURE LOAD CELL TO 5751 BASE ADAPTOR WITH (1) 5713.
2. PLACE 5751 THRU CALIBRATION BASE AND DRAW LOAD CELL DOWN TO BASE ADAPTORS BY HAND TIGHTENING THE 5/16-24 X 3/4" SHCS.
3. ATTACH LOADING HEAD BY INSERTING 5767 CLAMP INTO THE LOAD CELL, AND INSERTING LAST 5713.
4. HAND TIGHTEN 5774 MODIFIED SHCS UNTIL LOADING HEAD IS SECURELY DRAWN TO LOAD CELL.

CALIBRATION FIXTURE MODEL #5680

SYM	REVISION	DATE	CAR#	INIT.

CALIBRATION FIXTURE FOR BIORID
T1 LOAD CELL

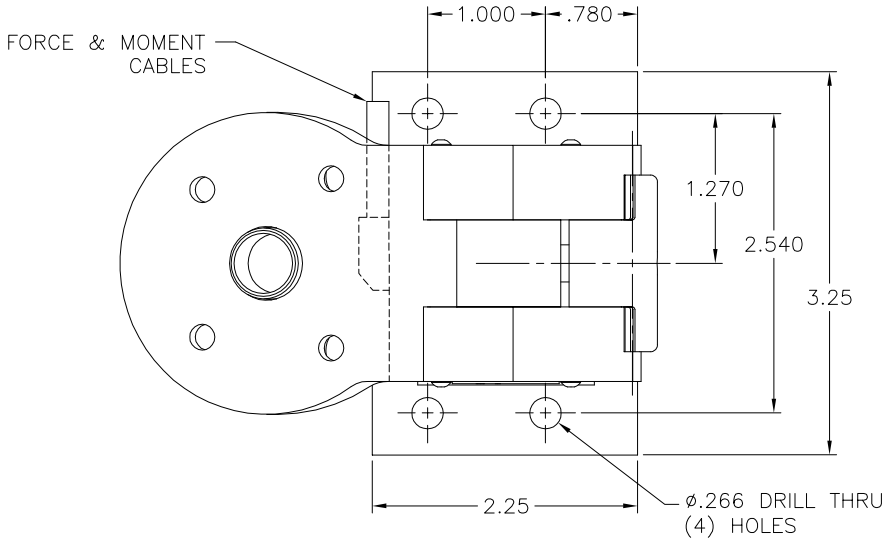
SCALE: NONE	SHEET 1 OF 1	DRWN BY: C.HEAD
DATE: 01OCTOBER02		MODEL: 5680

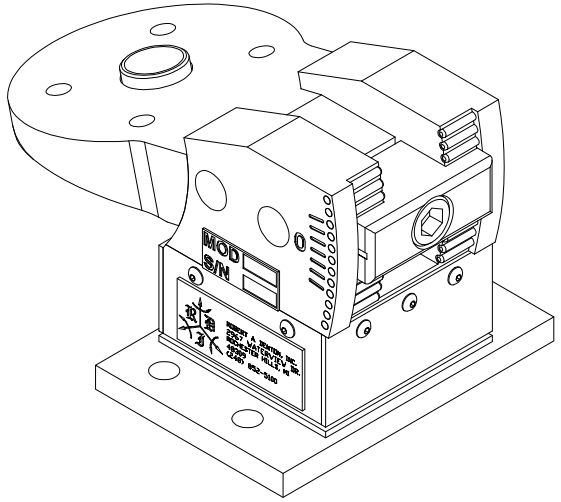
UNLESS OTHERWISE SPECIFIED

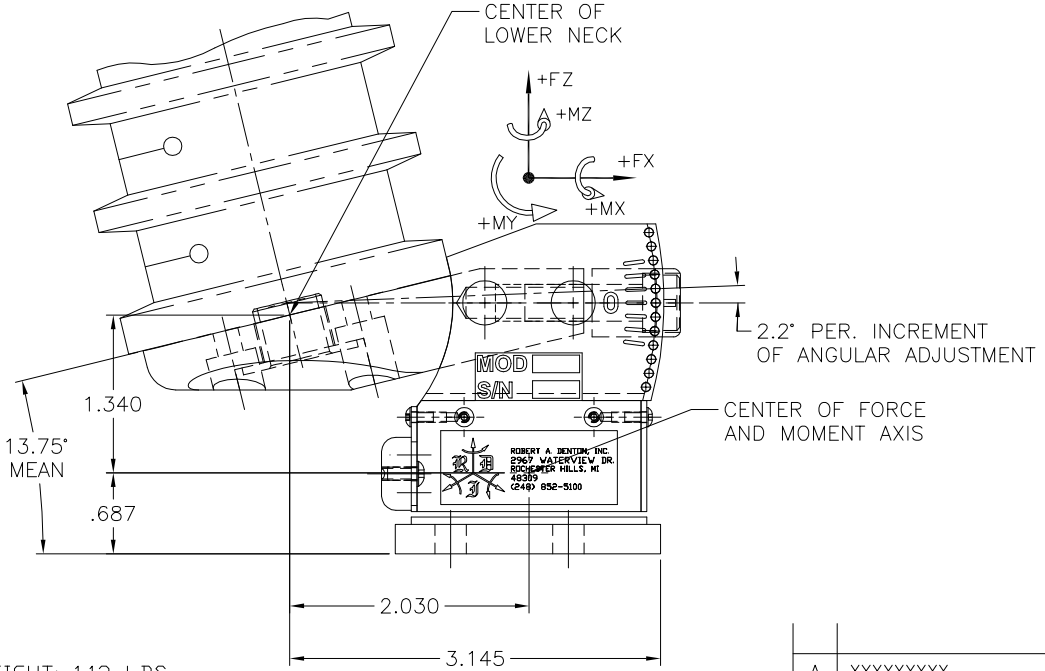
TWO PLACE DECIMALS	± 0.010	SURFACE FINISH 125
THREE PLACE DECIMALS	± 0.005	REMOVE ALL BURRS & SHARP EDGES
ANGLES	± 0° 30'	DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-5580-C







WEIGHT: 1.12 LBS.

MODEL 5686 ADJUSTABLE LOWER NECK LOAD CELL
SID-IIs

AXIS	CAPACITY	OUPUT	BRIDGE RESISTANCE
FX	3000 LBS.	2.2 mV/V NOM.	350Ω
FY	3000 LBS.	2.2 mV/V NOM.	350Ω
FZ	3000 LBS.	1.2 mV/V NOM.	700Ω
MX	4000 LB-IN	2.0 mV/V NOM.	700Ω
MY	4000 LB-IN	2.0 mV/V NOM.	700Ω
MZ	3000 LB-IN	2.0 mV/V NOM.	350Ω

NONLINEARITY <1% OF FULL SCALE
CROSS TALK <5% OF FULL SCALE

THE OUTPUT POLARITY OF THE 5686 LOWER NECK LOAD CELL CONFORMS TO SAE J-211 POLARITY.

SYM	REVISION	DATE	CAR#	INIT.
A	XXXXXXXXX	M/YY	XXXX	XXX

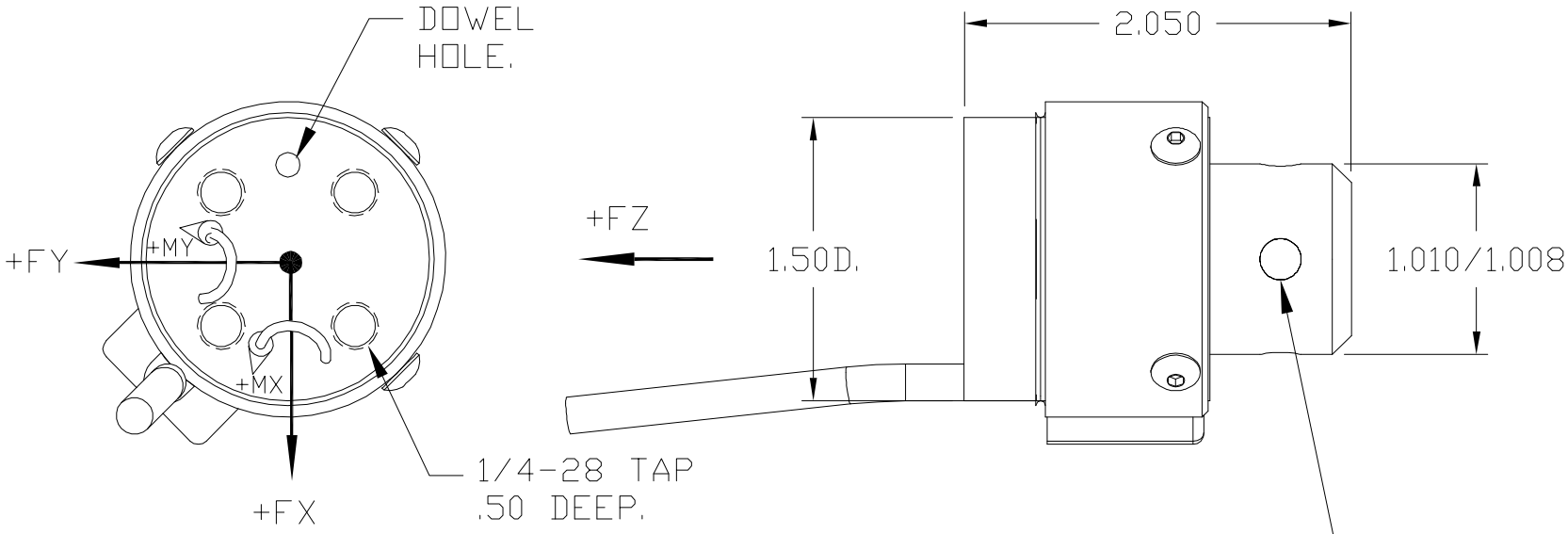
LOAD CELL
SID-IIs ADJUSTABLE LOWER NECK

SCALE: 1 : 1
DATE: 7/22/02
SHEET 1 OF 1
DRWN BY: TORCHALA
MODEL: 5686

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± 0.010
THREE PLACE DECIMALS ± 0.005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER:
B-5686-D



AXIS	CAPACITY	OUTPUT
FX	2000 LBS.	2.0 mV/V NOM.
FY	2000 LBS.	2.0 mV/V NOM.
FZ	2000 LBS.	1.0 mV/V NOM.
MX	2500 LB.-IN.	3.0 mV/V NOM.
MY	2500 LB.-IN.	3.0 mV/V NOM.

CABLE COLOR CODE

FX		FY		FZ		MX		MY	
BROWN	+EXC.	RED STRIPE	+EXC.	GREEN	+EXC.	GREEN STRIPE	+EXC.	PINK	+EXC.
RED	+SIG.	BLACK	+SIG.	BLUE	+SIG.	BLUE STRIPE	+SIG.	TAN	+SIG.
ORANGE	-EXC.	WHITE	-EXC.	VIOLET	-EXC.	ORANGE STRIPE	-EXC.	BROWN STRIPE	-EXC.
YELLOW	-SIG.	BLACK STRIPE	-SIG.	GREY	-SIG.	YELLOW STRIPE	-SIG.	VIOLET STRIPE	-SIG.

WEIGHT: .65 POUNDS

SYM	REVISION	DATE
A	CHNG. CABLE DIR.	19DEC02 C.D.H.

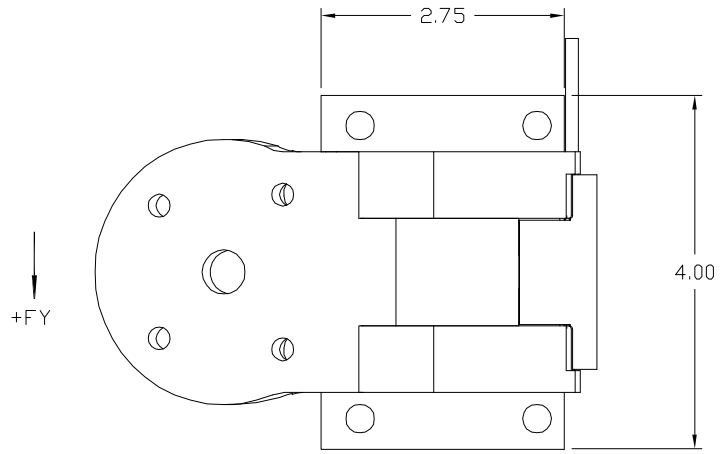
MODEL 5750 5 CHANNEL FLX UPPER TIBIA

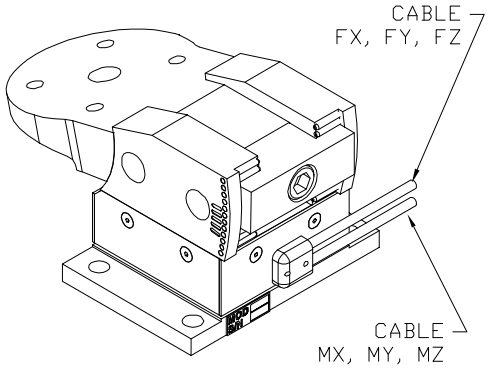
SCALE: FULL
DATE: 27SEPT02
DRAWN BY: *C.HEAD*
MODEL: 5750

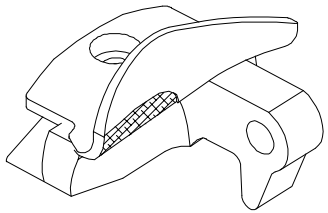
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-5750-D

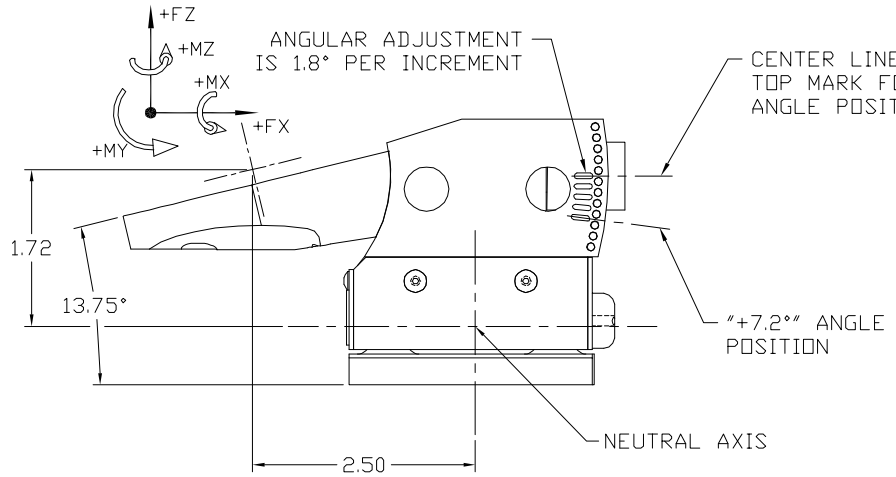






CLAVICLE FITTING

DUE TO VARIANCE IN CLAVICLE LINK ASSEMBLIES, SOME CLAVICLE LINKS MAY CAUSE A FIT PROBLEM WHEN USING THIS LOAD CELL. THE CLAVICLE CAN BE TRIMMED IN THE AREA SHOWN. THE REMOVAL OF APPROXIMATELY 0.08 (2mm) DEPTH OF MATERIAL WILL SUFFICE.



AXIS	CAPACITY	OUTPUT @ CAPACITY	MODEL 5832 BRIDGE RESISTANCE	MODEL 5832V BRIDGE RESISTANCE
FX	3000 LBF	1.8 mV/V NOM.	350Ω	120Ω
FY	3000 LBF	1.8 mV/V NOM.	350Ω	120Ω
FZ	3000 LBF	1.0 mV/V NOM.	700Ω	120Ω
MX	6000 IN-LBF	1.5 mV/V NOM.	700Ω	240Ω
MY	6000 IN-LBF	1.5 mV/V NOM.	700Ω	240Ω
MZ	4000 IN-LBF	1.5 mV/V NOM.	350Ω	120Ω

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

THE LOWER NECK LOAD CELL ASSEMBLLY, MODEL 5832, DUPLICATES THE NECK POSITION OF STANDARD BRACKETS (78051-303 & -307). THE LOAD CELL IS ADJUSTABLE FOR NECK ANGLES FROM -3.6° TO +7.2° FROM THE "0" POSITION IN 1.8° INCREMENTS.

POLARITY CONFORMS TO SAE J-211

SYM	REVISION	DATE

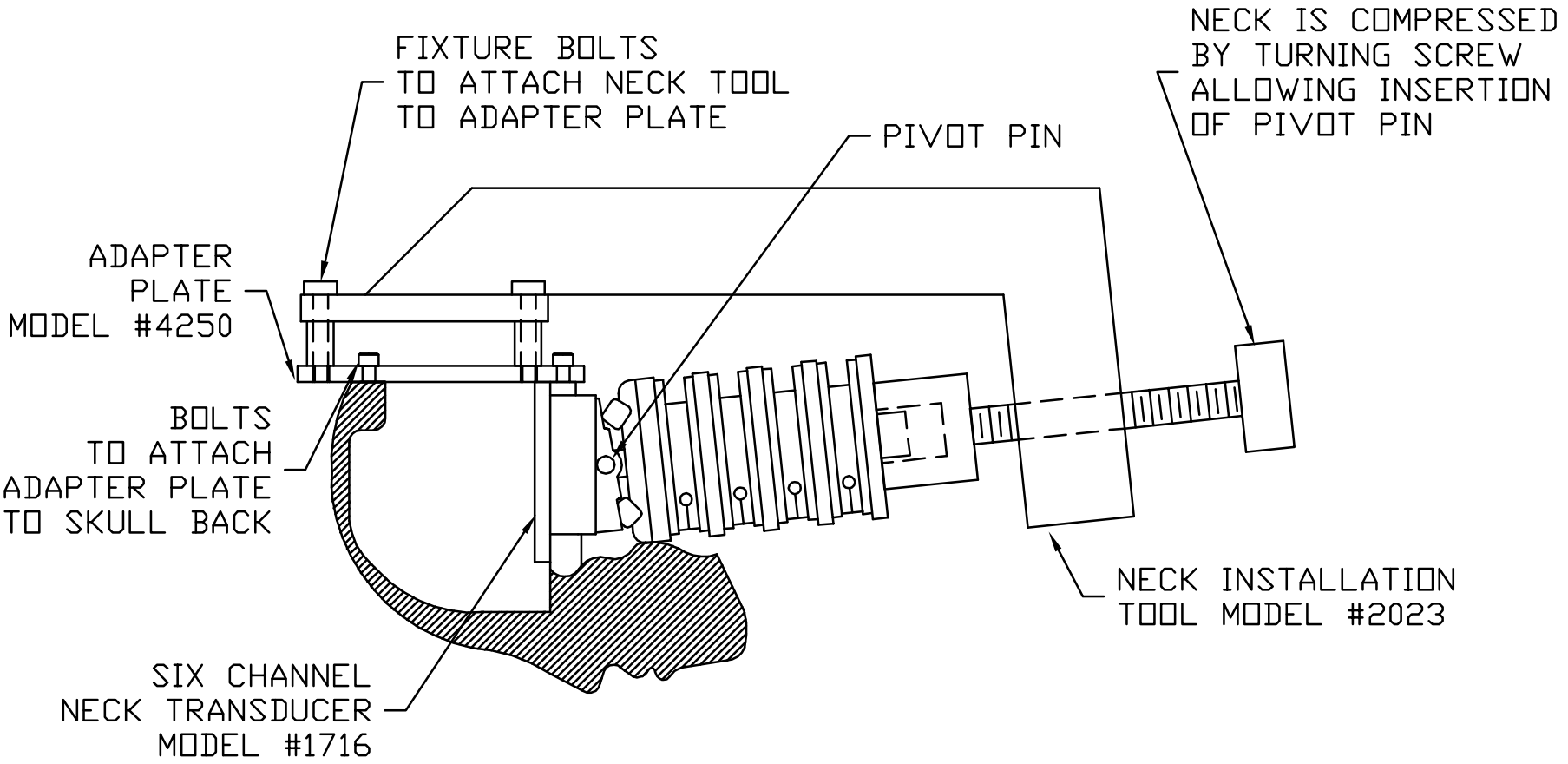
HIGH CAPACITY ADJUSTABLE LOWER NECK

SCALE: FULL | DRAWN BY: C.HEAD
DATE: 15NOV02 | MODEL: 5832J

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-5832-D



SYM	REVISION	DATE
A	WAS A-2023A	10/99

H3-5th NECK INSTALLATION TOOL

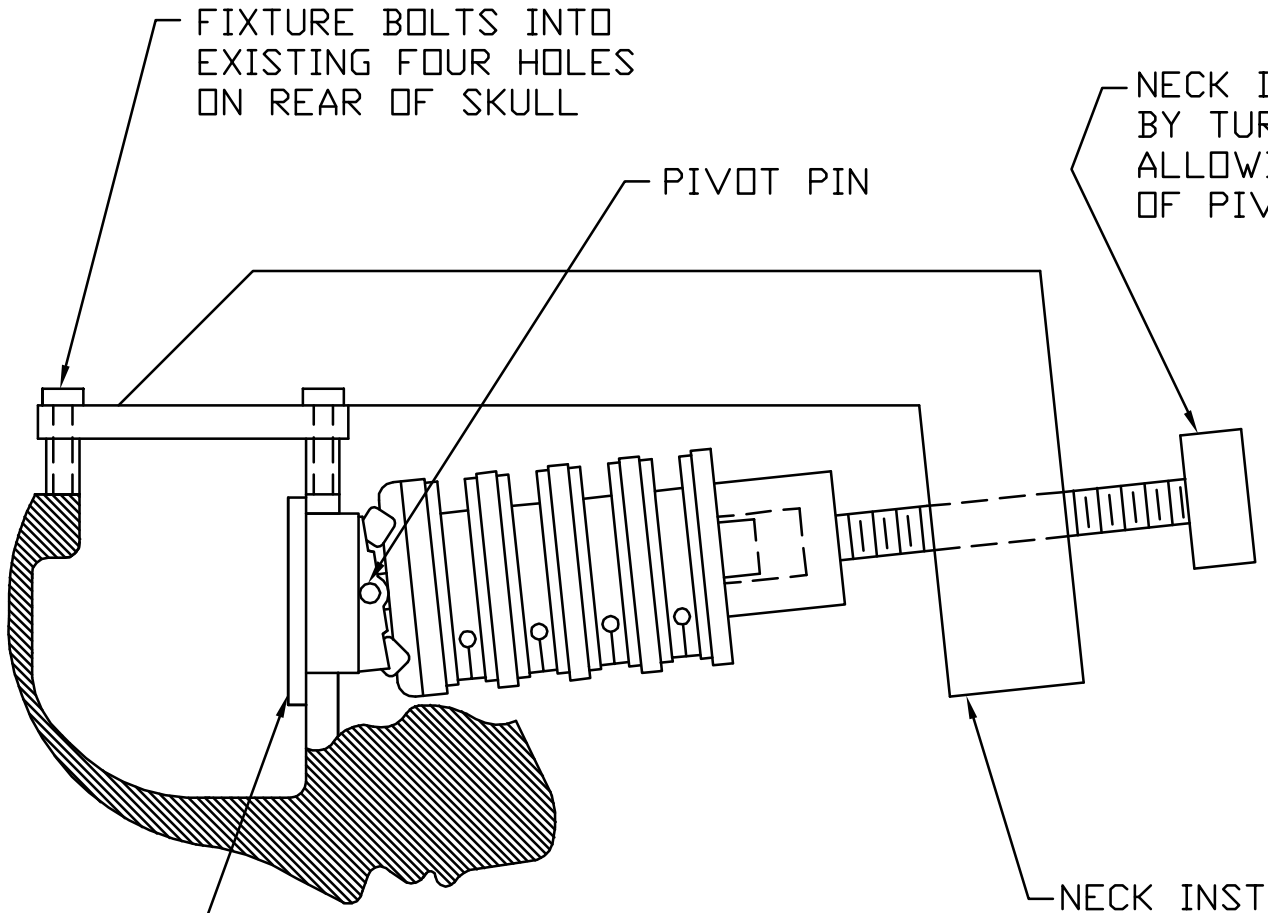
NONE		rd/crm/sef
6/10/87		2023

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

A-2023A-D



HYBRID III NECK INSTALLATION TOOL

SCALE: NONE			DRAWN BY: C.R.M./S.E.F.
DATE: 6/10/87			MODEL: 2023

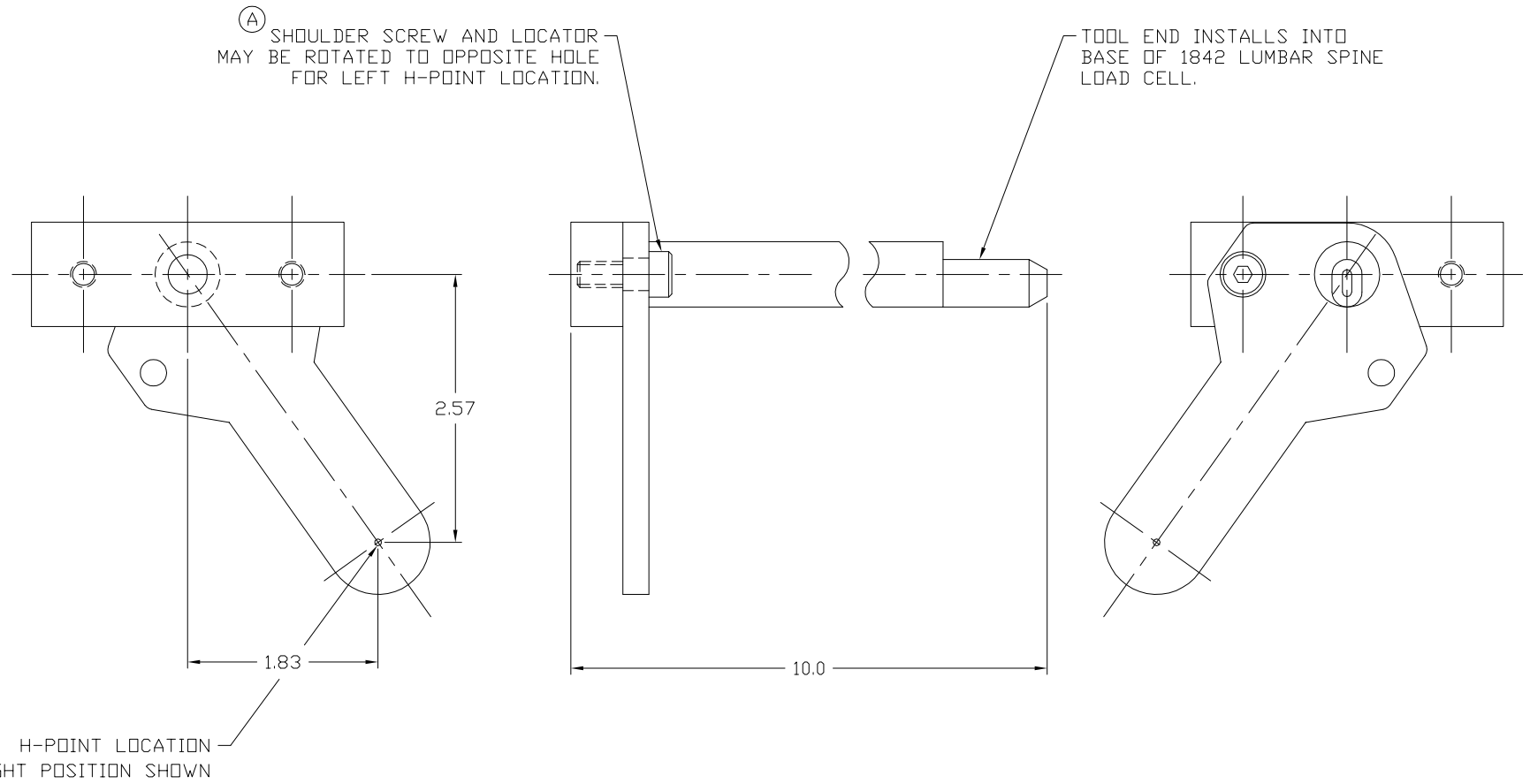
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-2023-D

SYM	REVISION	DATE
B	WAS DRG. A-2023	7/99
A	REDRAWN IN CAD	12/93



NOTE:
FOR USE ON MODEL 1842 AND 2792 LOAD CELLS.

SYM	REVISION	DATE
A	WAS THUMB SCREW	11/13/00 TORCHALA

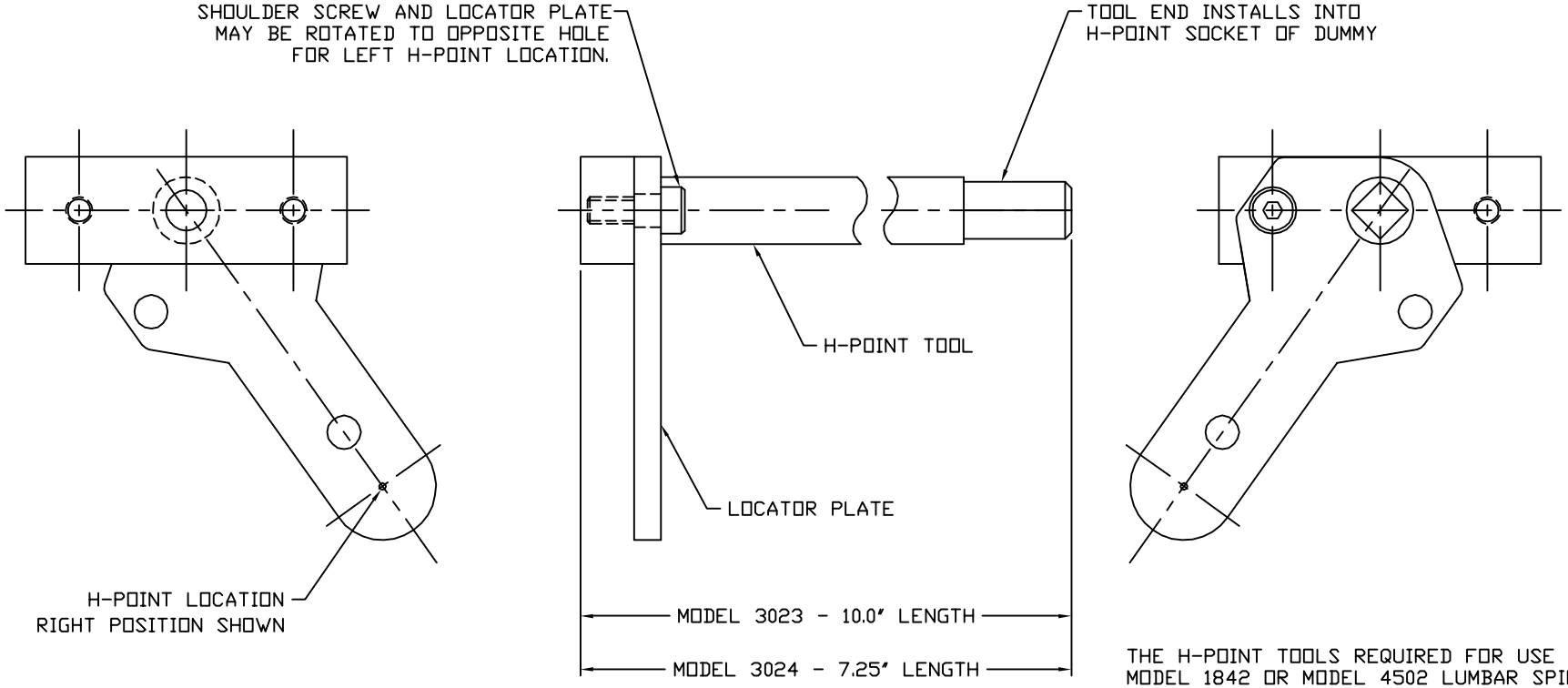
1842 ALIGNMENT TOOL-50TH PERCENTILE

SCALE: FULL
DATE: 9/23/92
DRAWN BY: C.R. MORGAN
MODEL: 2994

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2994-D



LOCATOR PART NUMBER	DUMMY
3025	5TH (H3-5F)
3026	50TH (H3-50M)
3027	95TH (H3-95M)
3028	SID
4032	6YO (H3-6YO)
5347	10YO (H3-10YO)
5566	SID-IIs
5643	BIORID

THE H-POINT TOOLS REQUIRED FOR USE WITH MODEL 1842 OR MODEL 4502 LUMBAR SPINE LOAD CELLS HAVE A A OVAL SHAPED END IN PLACE OF THE SQUARE END TOOL.

TOOLS FOR USE WITH 1842 OR 4502 LOAD CELLS

TOOL LENGTH	MODEL NUMBER
10.0"	1979
7.25"	3508

THE 1979 AND 3508 TOOLS USE THE 3026 (50TH) OR THE 3027 (95TH) PLATE.

ALL TOOLS AND PLATES ARE INTERCHANGABLE. ORDER TOOLS AND PLATES BY PART NUMBER.

SYM	REVISION	DATE
F	ADD BIORID	6/9/02 CRM
E	ADD 1842/4502 TEXT	4/1/02 CRM
D	5566 PART ADDED	3/27/02 PJD
C	5347 PART ADDED	8/31/01 CRM
B	4032 PART ADDED	11/13/00 TORCHALA
A	ADD 3024 TOOL	12/98

H-POINT ALIGNMENT TOOL

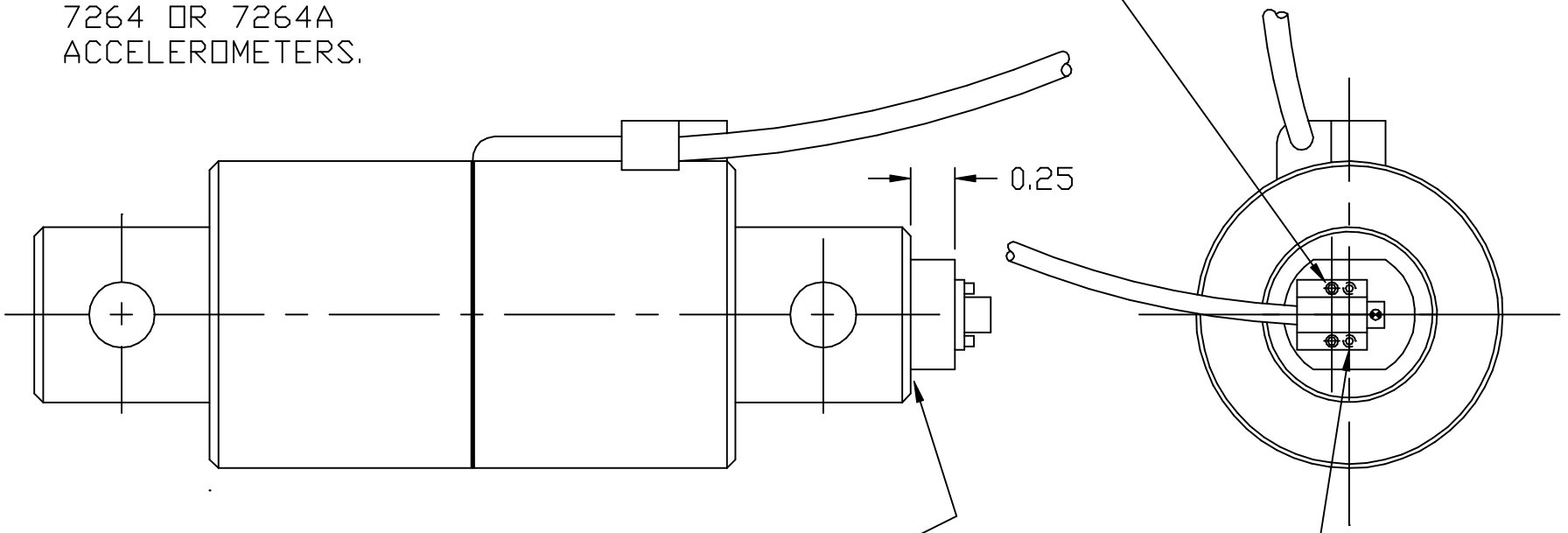
SCALE: FULL
DATE: 9/23/92
DRAWN BY: C.R. MORGAN
MODEL: 3023/3024

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

B-3367-D

ACCELEROMETER MOUNT
ACCEPTS ENDEVCO
7264 OR 7264A
ACCELEROMETERS.



FEMUR LOAD CELL ACCELEROMETER MOUNT

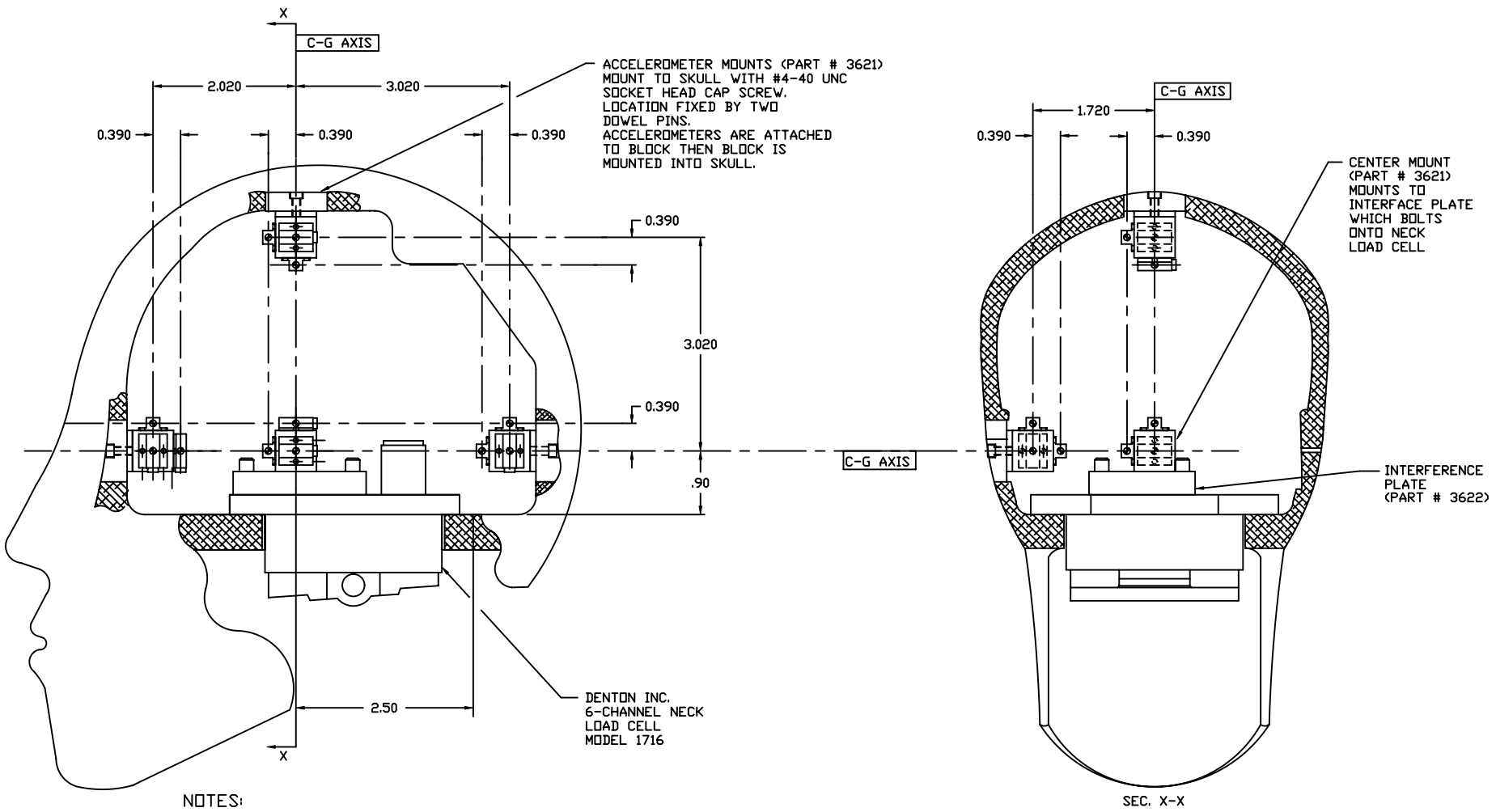
SCALE: FULL		DRAWN BY: *C.R.MORGAN*
DATE: 26MARCH96		MODEL: 3522

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-3522-D



NOTES:

1. DIMENSIONS GIVEN ARE FOR ENDEVCO 7264A-2000 AND 7264B-2000 ACCELEROMETERS ONLY.
2. ALL ACCELEROMETER MOUNTS ARE INTERCHANGEABLE.
3. POSITION ACCURACY OF BLOCKS IN HEAD ±.005.
4. POSITION ACCURACY OF SEISMIC MASS WITHIN ACCELEROMETER ±.01 (PER ENDEVCO SPEC.)
5. CENTER OF GRAVITY (C-G) LOCATIONS PER G.M. DRAWINGS 78051-61 AND 78051-338 FOR HYBRID III TEST DUMMY HEAD.

B	WAS B-3623	10/99
A	CHG. ACCEL	10/96

ACCELEROMETER HEAD MOUNT III

FOR ENDEVCO 7264A & B ACCELEROMETERS

SCALE: .75X | DRAWN BY: C.R. MORGAN

DATE: 1AUG96 | MODEL: 3623

UNLESS OTHERWISE SPECIFIED

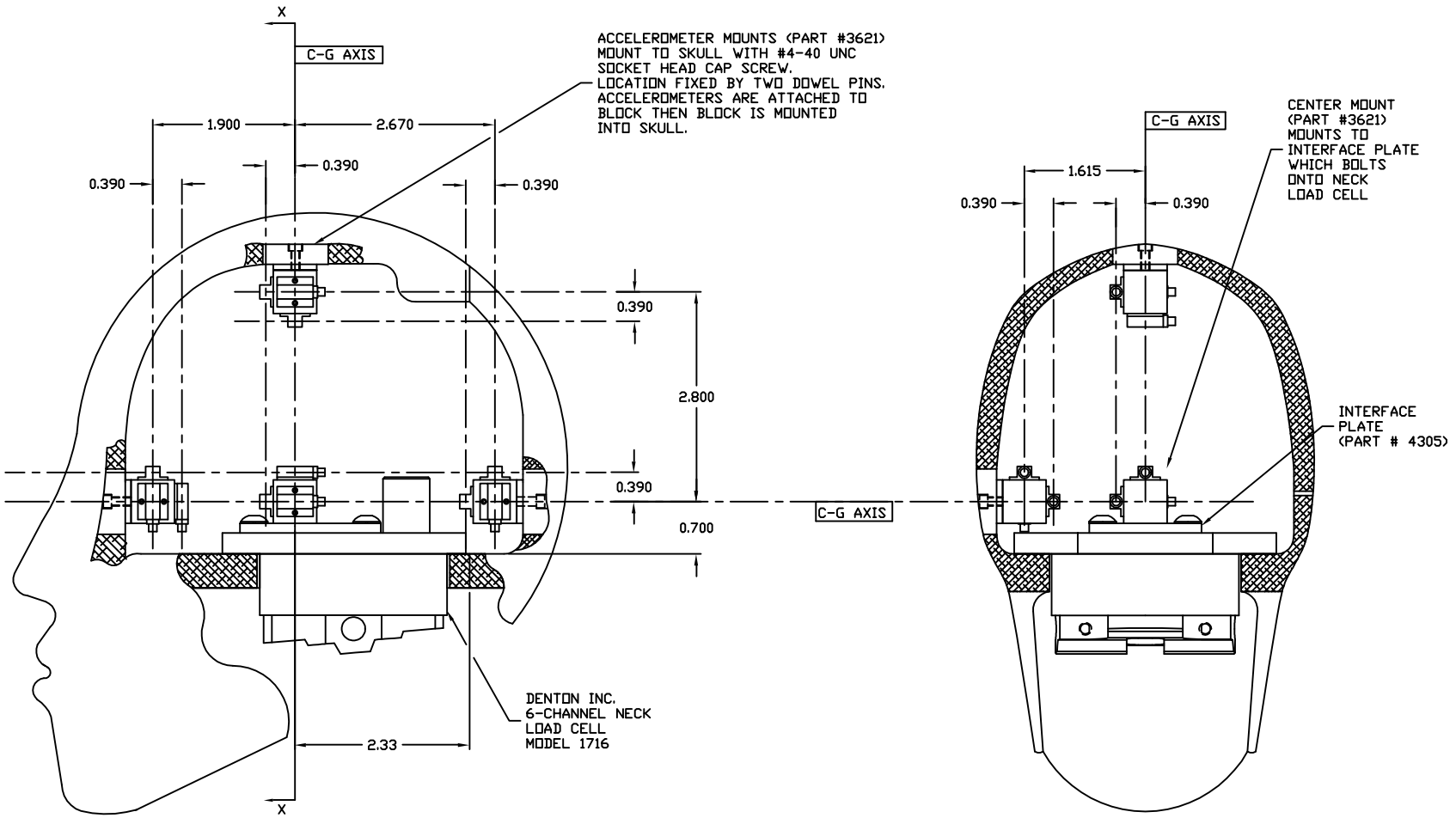
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125

THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES

ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3623-D



SEC. X-X

NOTES:

1. DIMENSIONS GIVEN ARE FOR ENDEVCO 7264A-2000 AND 7264B-2000 ACCELEROMETERS ONLY.
2. ALL ACCELEROMETER MOUNTS ARE INTERCHANGEABLE.
3. POSITION ACCURACY OF BLOCKS IN HEAD ±.005.
4. POSITION ACCURACY OF SEISMIC MASS WITHIN ACCELEROMETER ±.01 (PER ENDEVCO SPEC.).
5. MODEL 1716 LOAD CELL, ACCELEROMETERS, ACCELEROMETER ATTACHMENT SCREWS, HEAD SKIN, AND CAP SKIN ARE NOT INCLUDED.

NEXT ASS'Y	QTY
PART USED ON	

SYM	REVISION	DATE
A	WAS C-4310	12OCT99

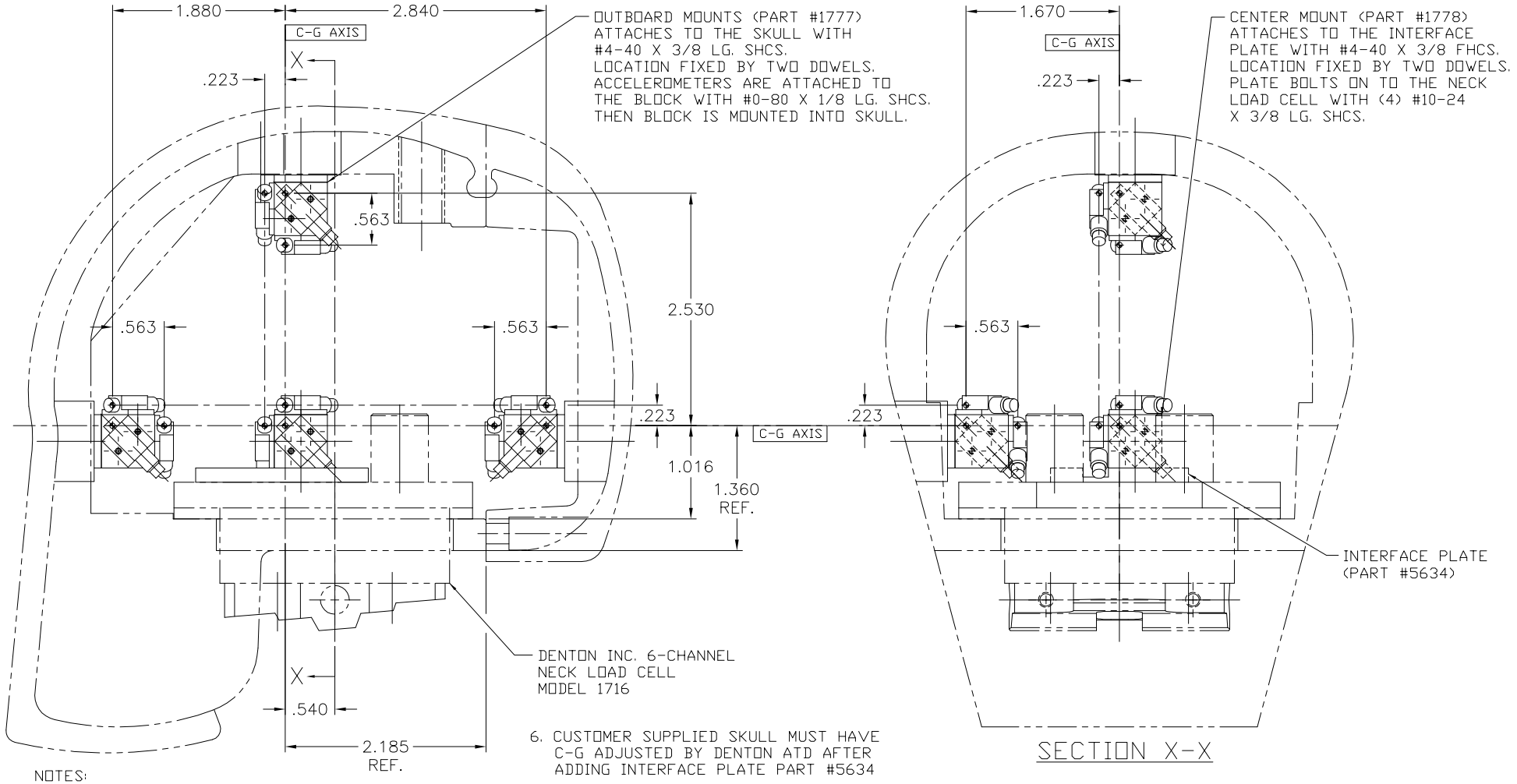
ACCELEROMETER HEAD MOUNTN FOR ENDEVCO 7264A & B FOR 5TH FEMALE

SCALE:	FULL	DRAWN BY:	P. DEPINET
DATE:	04JAN99	MODEL:	4310

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-4310-D



SECTION X-X

NOTES:

1. DIMENSIONS GIVEN ARE FOR ENDEVCO 7264-2000 AND 7264C-2000 ACCELEROMETERS ONLY.
2. THE TOP, FRONT, LEFT AND REAR MOUNTS ARE INTERCHANGEABLE.
3. POSITION ACCURACY OF BLOCKS IN HEAD ±.005
4. POSITION ACCURACY OF SEISMIC MASS WITHIN ACCELEROMETER ±.03 (PER ENDEVCO SPEC.)
5. CENTER OF GRAVITY (C-G) LOCATIONS PER DRAWINGS 127-1000 AND 127-0000 FOR HYBRID III TEST DUMMY HEAD
6. CUSTOMER SUPPLIED SKULL MUST HAVE C-G ADJUSTED BY DENTON ATD AFTER ADDING INTERFACE PLATE PART #5634
7. MODEL 5640 CONSISTS OF THE FOLOWING:
   MOUNT & PLATE ATTACHMENT SCREWS
   (1) INTERFACE PLATE 5634
   (1) 3-CHANNEL MOUNT 1778
   (4) 3-CHANNEL MOUNT 1777
8. ACCELEROMETERS ARE NOT INCLUDED.

SYM	REVISION	DATE	CAR#	INIT.
A	XXXXXXXXX	M/YY	XXXX	XXX

ACCELEROMETER HEAD MOUNT (HIII 6C)

FOR ENDEVCO 7264-2000 & 7264C-2000

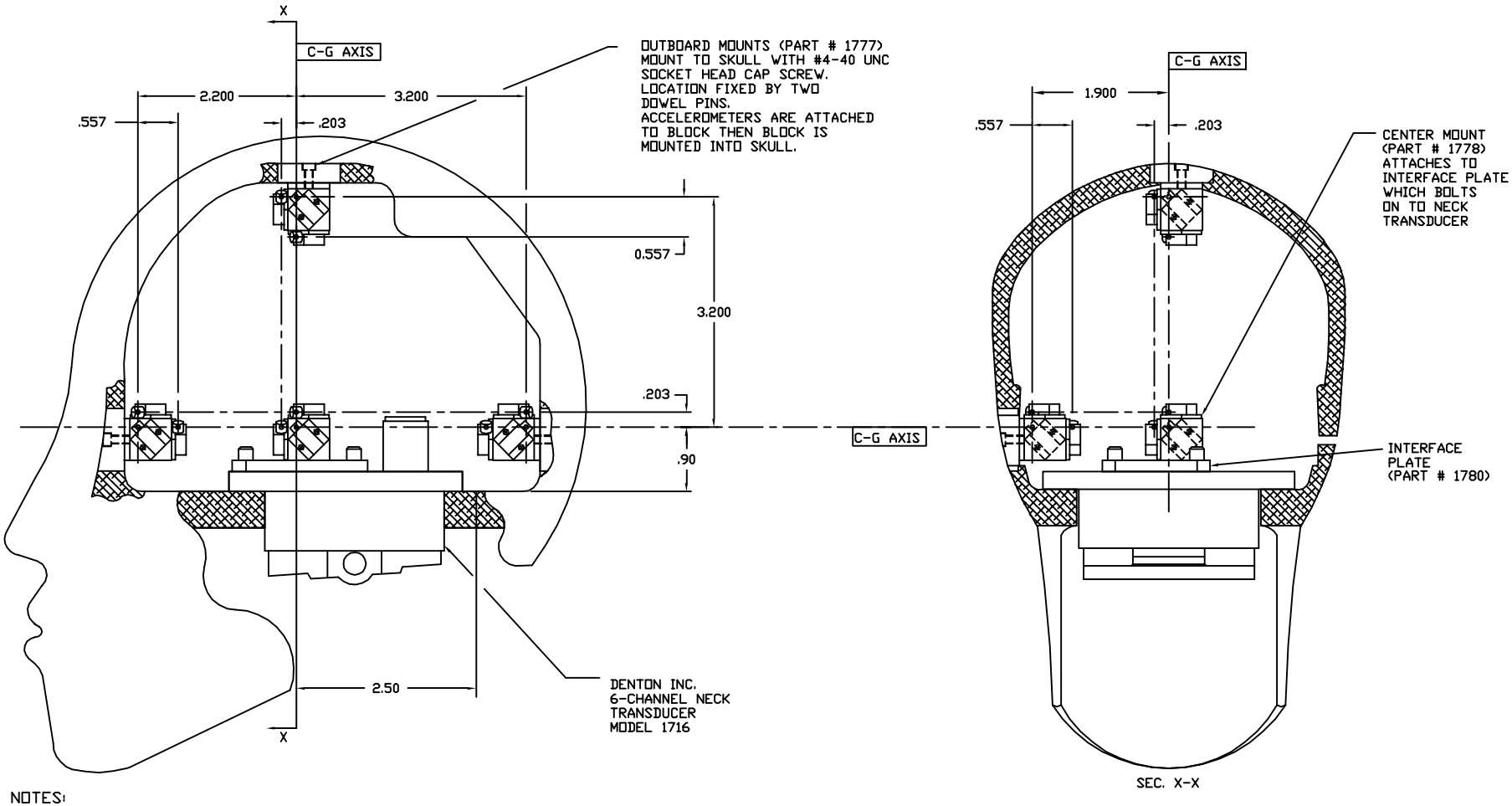
SCALE: 1 : 1	SHEET 1 OF 1	DRWN BY: TORCHALA
DATE: 6/10/02		MODEL: 5640

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± 0.010	SURFACE FINISH 125
THREE PLACE DECIMALS	± 0.005	REMOVE ALL BURRS & SHARP EDGES
ANGLES	± 0° 30'	DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-5640-D



NOTES:

1. DIMENSIONS GIVEN ARE FOR ENDEVCO 7264-2000 AND 7264C-2000 ACCELEROMETERS ONLY.
2. THE TOP, FRONT, LEFT AND REAR MOUNTS ARE INTERCHANGEABLE.
3. POSITION ACCURACY OF BLOCKS IN HEAD ±.005
4. POSITION ACCURACY OF SEISMIC MASS WITHIN ACCELEROMETER ±.03 (PER ENDEVCO SPEC.)
5. CENTER OF GRAVITY (C-G) LOCATIONS PER G.M. DRAWINGS 78051-61 AND 78051-338 FOR HYBRID III TEST DUMMY HEAD

SYM	REVISION	DATE
D	ADD 7264C	23AUG00
C	WAS DWG B1846.DWG	15OCT99
B	REDRAWN IN CAD	6/30/93
A	ADD REAR MOUNT	12/7/89

ACCELEROMETER HEAD MOUNT II

FOR ENDEVCO 7264-2000 AND 7264C-2000 ONLY

SCALE: .75			DRAWN BY: C.R.M./S.E.F.
DATE: 6-28-85			MODEL: 1846

UNLESS OTHERWISE SPECIFIED

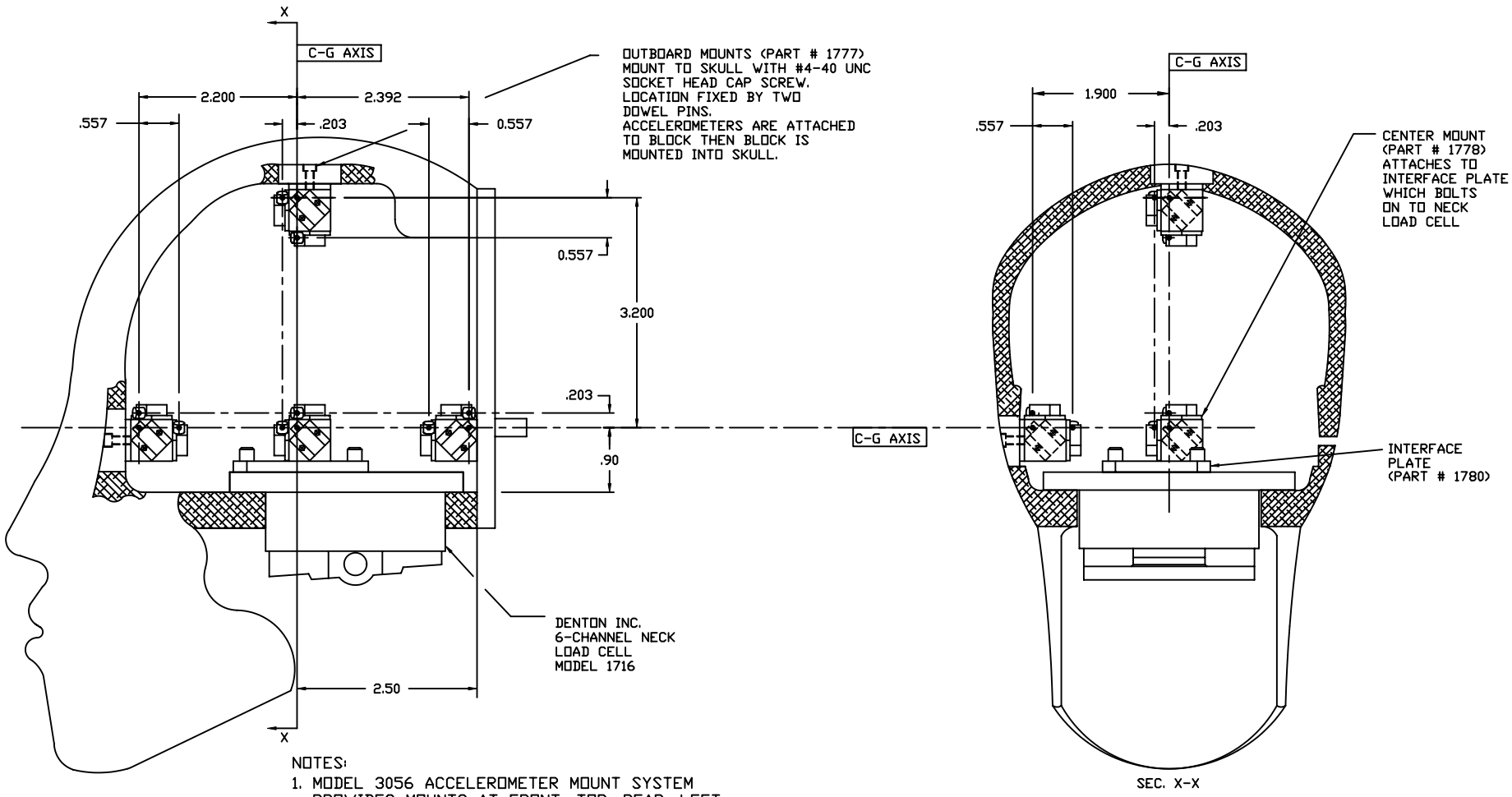
TWO PLACE DECIMALS ± .010 — SURFACE FINISH 125

THREE PLACE DECIMALS ± .005 — REMOVE ALL BURRS & SHARP EDGES

ANGLES ± 0° 30' — DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1846-D



NOTES:

1. MODEL 3056 ACCELEROMETER MOUNT SYSTEM PROVIDES MOUNTS AT FRONT, TOP, REAR, LEFT SIDE AND CENTER (HEAD C-G) LOCATIONS.
2. DIMENSIONS GIVEN ARE FOR ENDEVCO 7264-2000 ACCELEROMETERS ONLY.
3. THE TOP, FRONT, LEFT AND REAR MOUNTS ARE INTERCHANGEABLE.
4. POSITION ACCURACY OF BLOCKS IN HEAD ±.005
5. POSITION ACCURACY OF SEISMIC MASS WITHIN ACCELEROMETER ±.03 (PER ENDEVCO SPEC.)
6. CENTER OF GRAVITY (C-G) LOCATIONS PER G.M. DRAWINGS 78051-61 AND 78051-338 FOR HYBRID III TEST DUMMY HEAD

SYM	REVISION	DATE
B	WAS B-3056	10/99
A	ADD SIDE MOUNT	12/98

FREE MOTION HEAD FORM

ACCELEROMETER HEAD MOUNT FOR 7264 ACCELEROMETERS

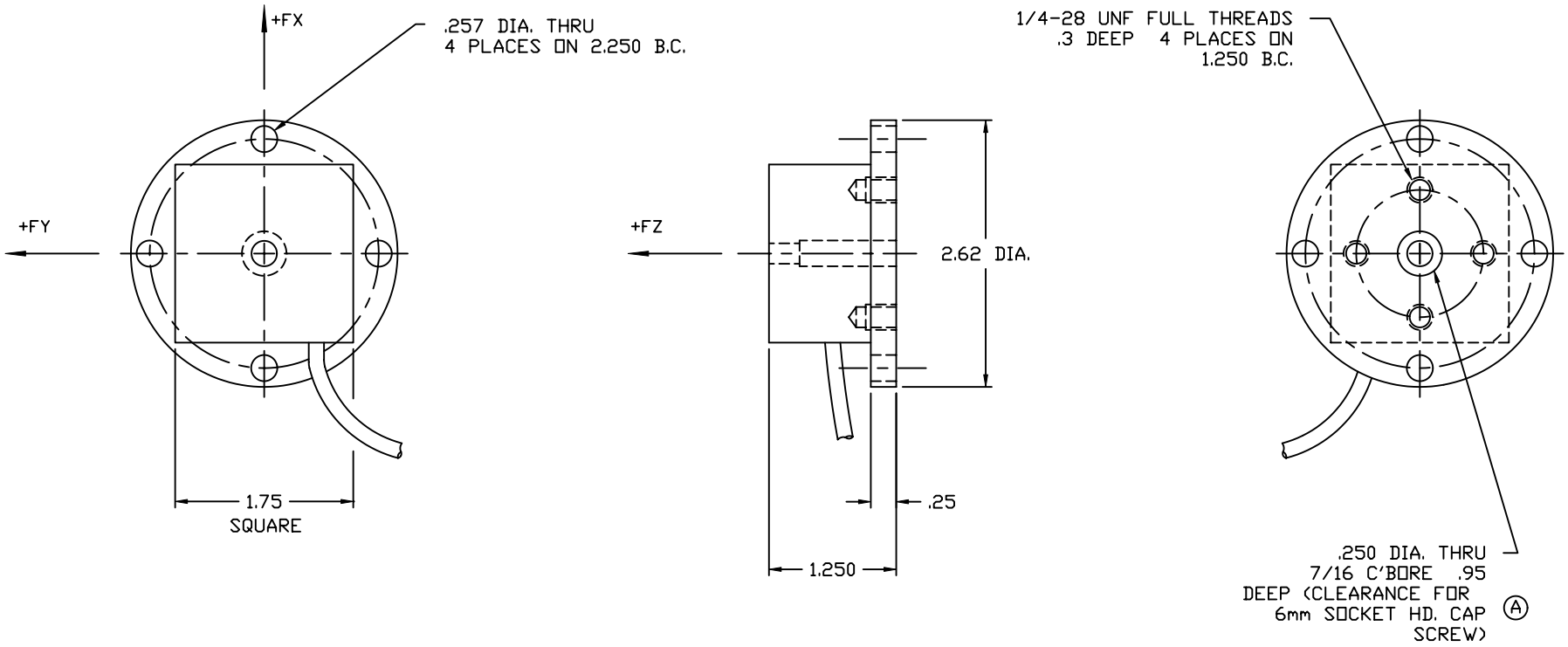
SCALE: .75X		DRAWN BY: C.R. MORGAN
DATE: 3JUN94		MODEL: 3056

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3056-D



TRI-CHANNEL LOAD CELL

CHANNEL	CAPACITY	OUTPUT @ CAPACITY
FX	2000 LBS.	2.5 mV/V NOM.
FY	2000 LBS.	2.5 mV/V NOM.
FZ	2000 LBS.	0.9 mV/V NOM.

NON-LINEARITY < 1% OF FULL SCALE
CROSS-TALK < 5% OF FULL SCALE

SYM	REVISION	DATE
B	REDRAWN IN CAD	12/93
A	REV. FOR 6mm	8/90

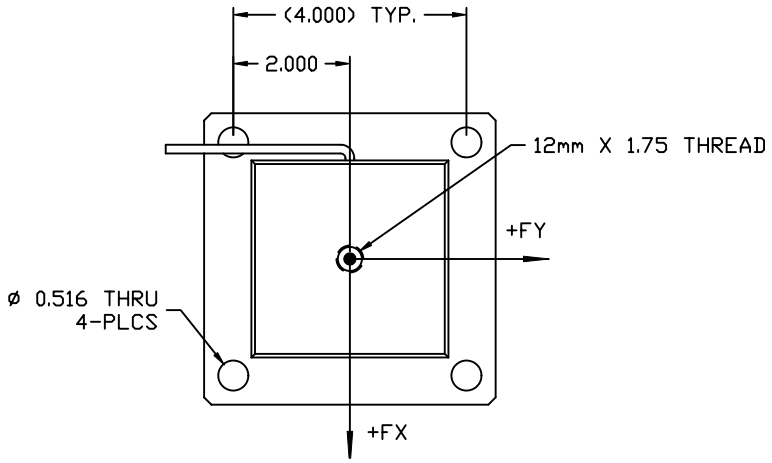
TRI-CHANNEL LOAD CELL

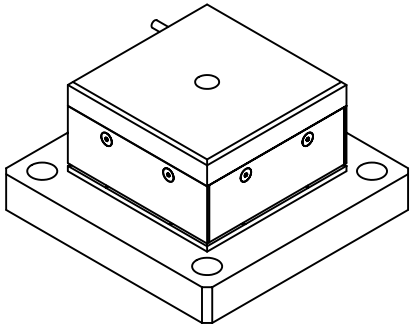
SCALE: FULL
DATE: 8/27/90
DRAWN BY: C.R.M./S.E.P.
MODEL: 2419

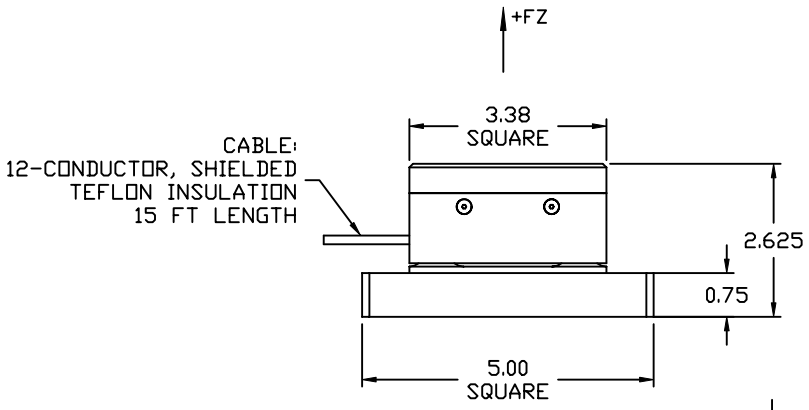
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2419-D







TRIAXIAL LOAD CELL

MODEL 2420

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	10000 LBF	2.0 mV/V NOMINAL
FY	10000 LBF	2.0 mV/V NOMINAL
FZ	10000 LBF	1.2 mV/V NOMINAL

NON-LINEARITY < 1% OF FULL SCALE
CROSS TALK < 5% OF FULL SCALE

SYM	REVISION	DATE

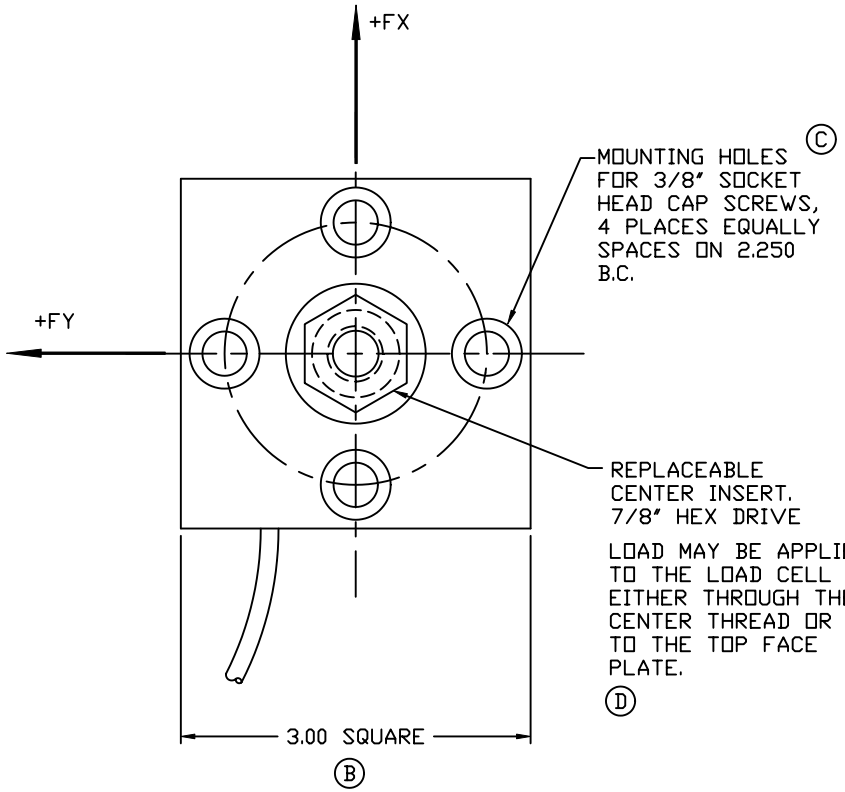
TRIAXIAL LOAD CELL

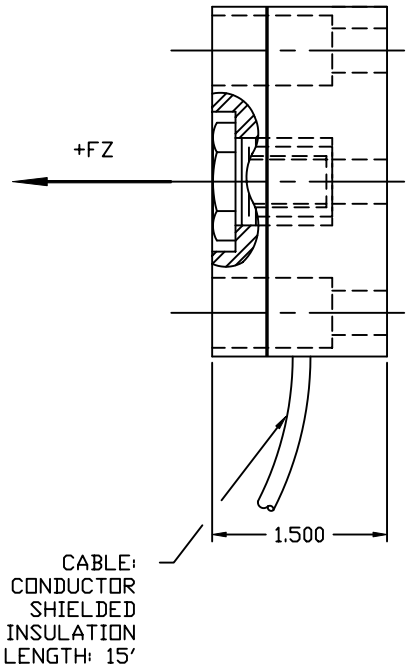
SCALE: .5X		DRAWN BY: RDUPONT	
DATE: 28APR99		MODEL: 2420	

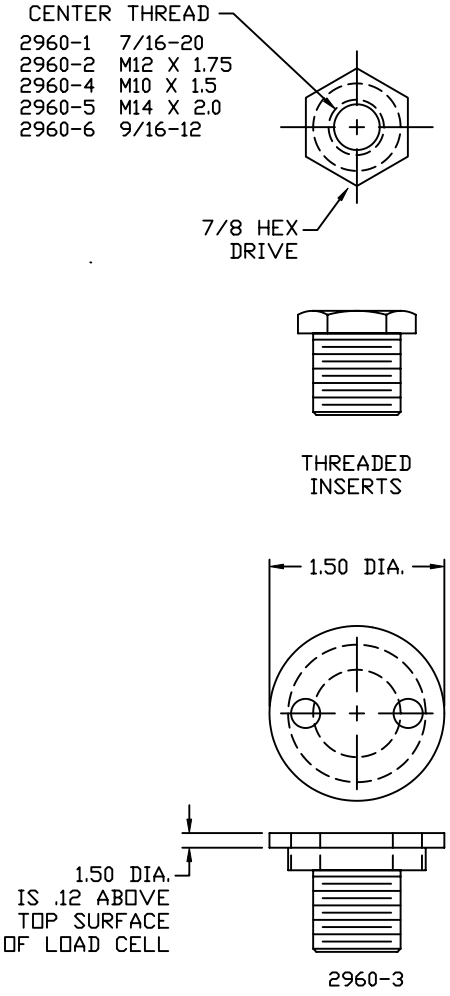
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2420-D







AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	10K LBS.	2.0 mV/V NOMINAL
FY	10K LBS.	2.0 mV/V NOMINAL
FZ	10K LBS.	1.5 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSS TALK < 5% OF FULL SCALE

LOAD CELL IS PROVIDED WITH TWO INSERTS

SYM	REVISION	DATE
F	WAS DRG. B-2881	5/99
E	ADD INSERT -#'s	9/98
D	ADD LOADING NOTE	6/96
C	3/8 WAS 1/2	7/93
B	3.0 WAS 3.5	7/93
A	ADD INSERTS	7/93

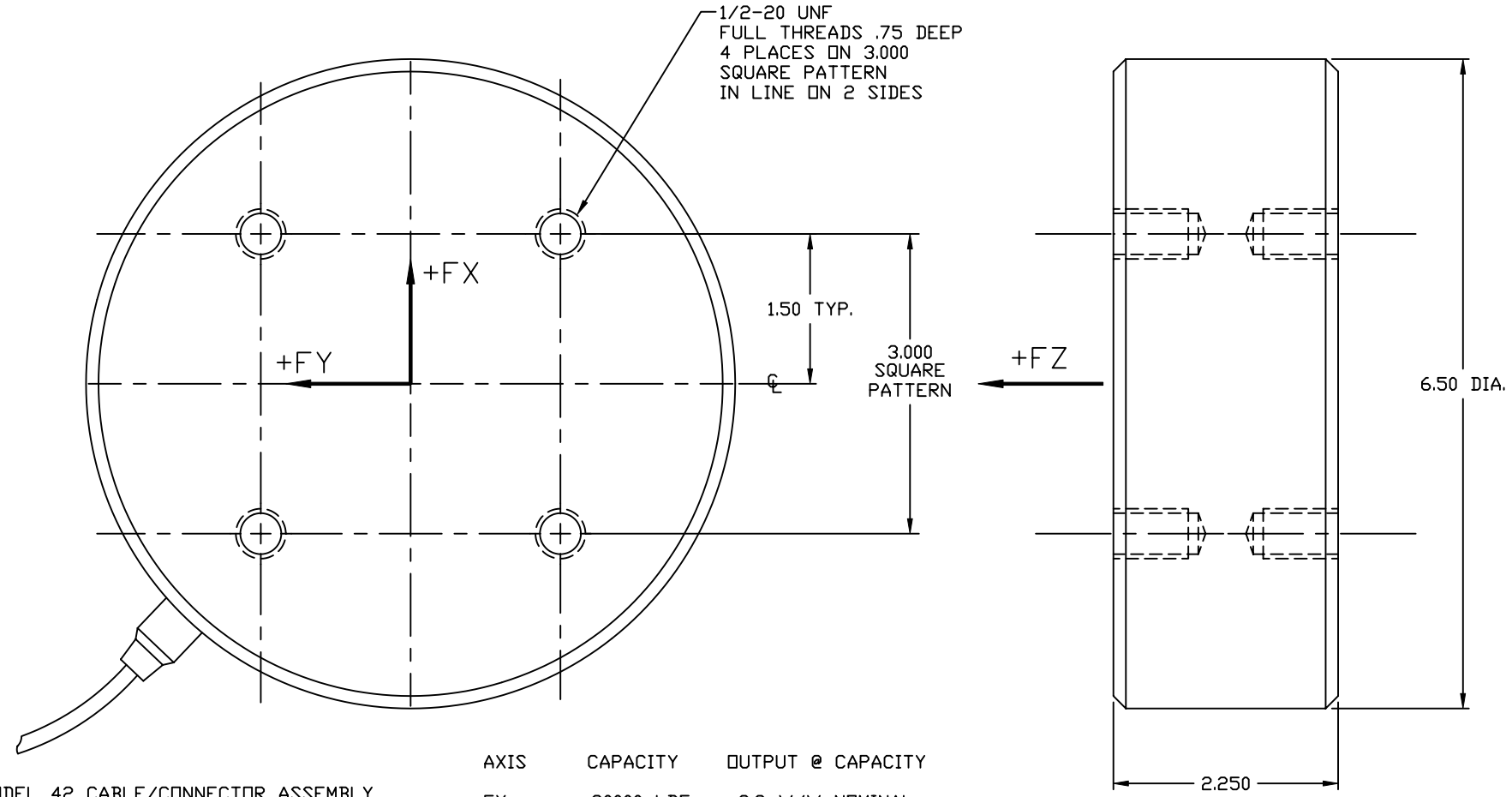
TRIAXIAL LOAD CELL

SCALE: FULL
DATE: 7/19/93
DRAWN BY: C.R. MORGAN
MODEL: 2881

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2881-D



MODEL 42 CABLE/CONNECTOR ASSEMBLY
12 CONDUCTOR
TEFLON INSULATION
SHIELDED
LENGTH - 30'

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	20000 LBF	2.2mV/V NOMINAL
FY	20000 LBF	2.2mV/V NOMINAL
FZ	20000 LBF	1.0mV/V NOMINAL

NONLINEARITY <1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE

3-CHANNEL 20K LOAD CELL

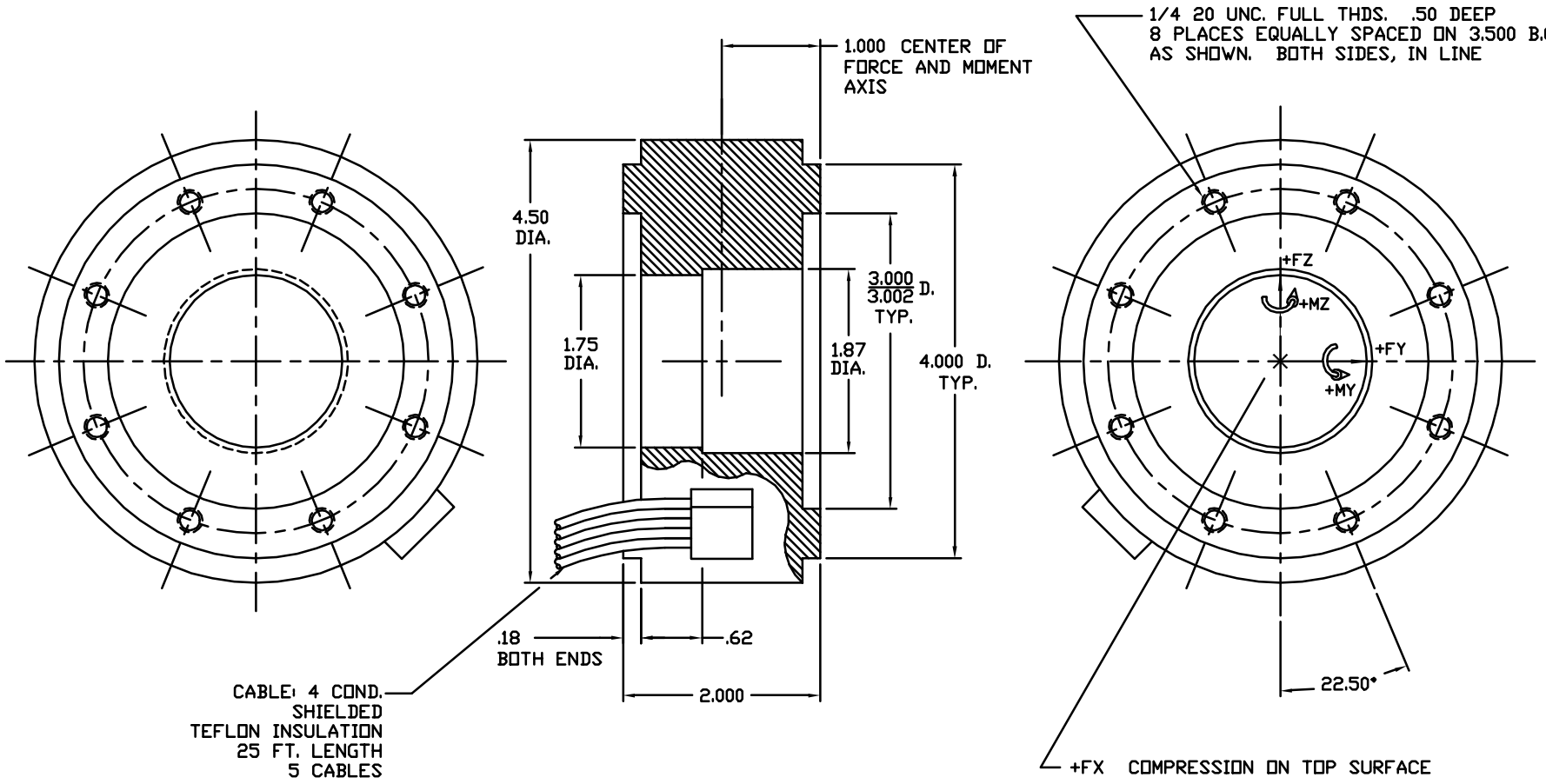
SCALE: FULL
DATE: 7/27/96
DRAWN BY: C.R. MORGAN
MODEL: 3540

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3540-D

SYM	REVISION	DATE
A	WAS DRG. B-3540	5/99



AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	5000 LBS.	1 mV/V NOM.
FY	2500 LBS.	1 mV/V NOM.
FZ	2500 LBS.	1 mV/V NOM.
MY	10000 LB-IN.	2 mV/V NOM.
MZ	10000 LB-IN.	2 mV/V NOM.

NONLINEARITY <1% OF FULL SCALE
CROSS TALK <5% OF FULL SCALE

WEIGHT ~1.9 LBS.

SYM	REVISION	DATE
C	WAS DRG. B-1971	5/99
B	+FX WAS TENSION	2/4/95
A	REDRAWN IN CAD	7/14/93

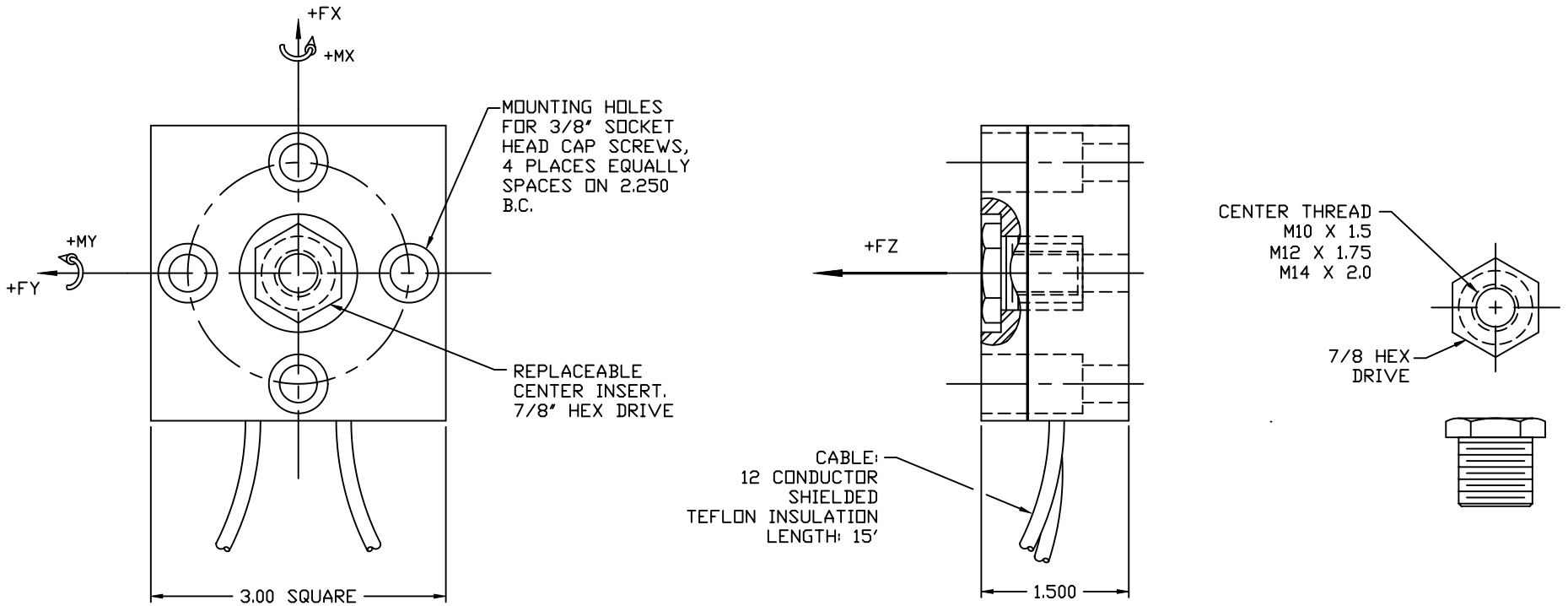
FIVE AXIS LOAD CELL

SCALE: FULL
DATE: 12/12/86
DRAWN BY: C.R.M./S.E.F.
MODEL: 1968

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-1968-D



AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	10K LBS.	2.0 mV/V NOMINAL
FY	10K LBS.	2.0 mV/V NOMINAL
FZ	10K LBS.	1.5 mV/V NOMINAL
MX	20K LB.-IN.	1.8 mV/V NOMINAL
MY	20K LB.-IN.	1.8 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSS TALK < 5% OF FULL SCALE

LOAD CELL IS PROVIDED WITH TWO INSERTS SHOWN AT RIGHT.

SYM	REVISION	DATE
A	WAS B-3235	08OCT99

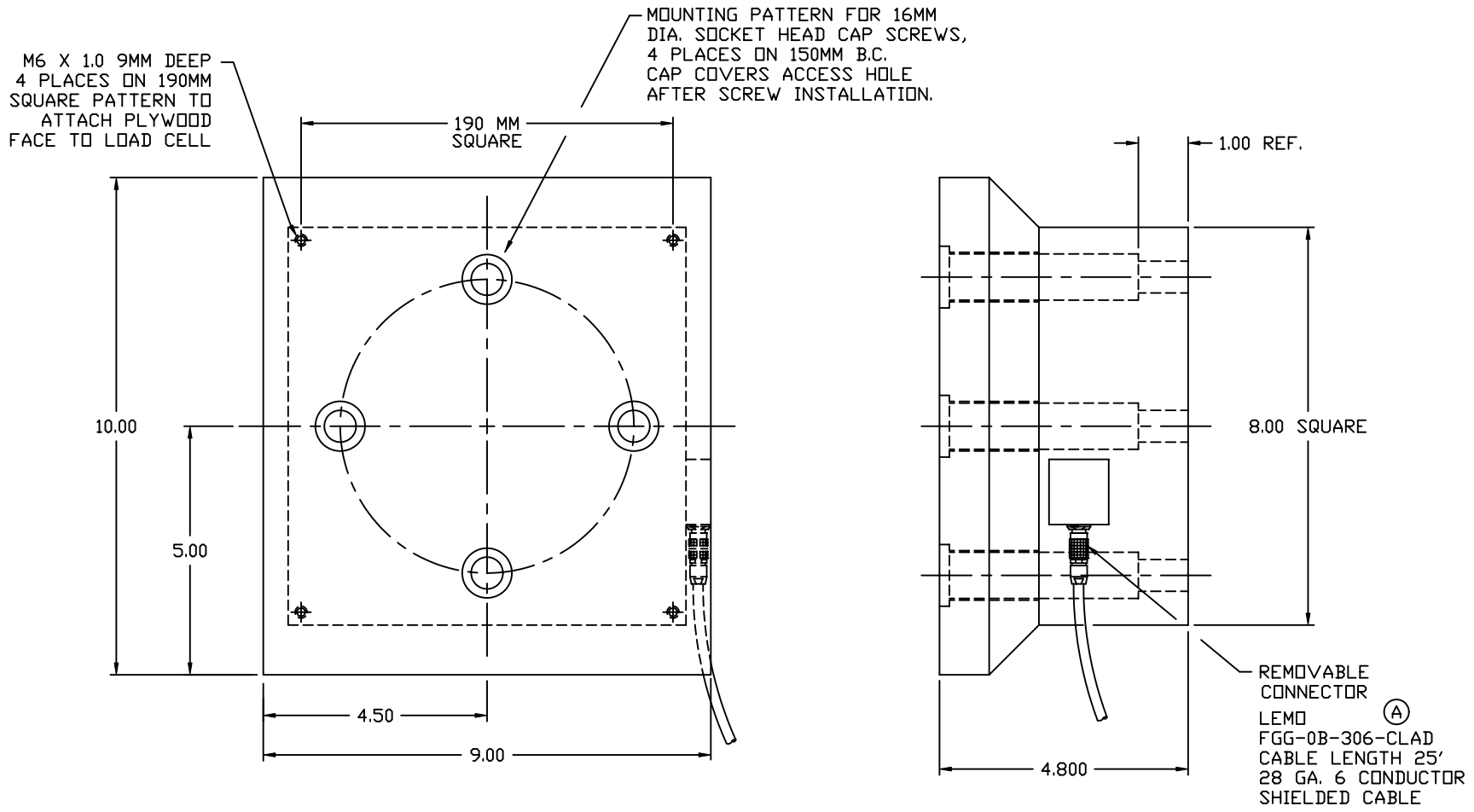
5 CHANNEL LOAD CELL

SCALE: FULL
DATE: 20FEB95
DRAWN BY: C.R. MORGAN
MODEL: 3235

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3235-D



BARRIER FACE LOAD CELL
CAPACITY: 80000 LBS.
OUTPUT @ CAPACITY: 2.0 mV/V NOMINAL
NONLINEARITY: < .35% OF FULL SCALE
BRIDGE RESISTANCE: 700 OHMS NOMINAL
CALCULATED NATURAL FREQUENCY > 5000 HZ
MAXIMUM SIDE LOAD: 80000 LBS.

SYM	REVISION	DATE
B	WAS DRG. B-3252	7/99
A	0B WAS 1B	4/95

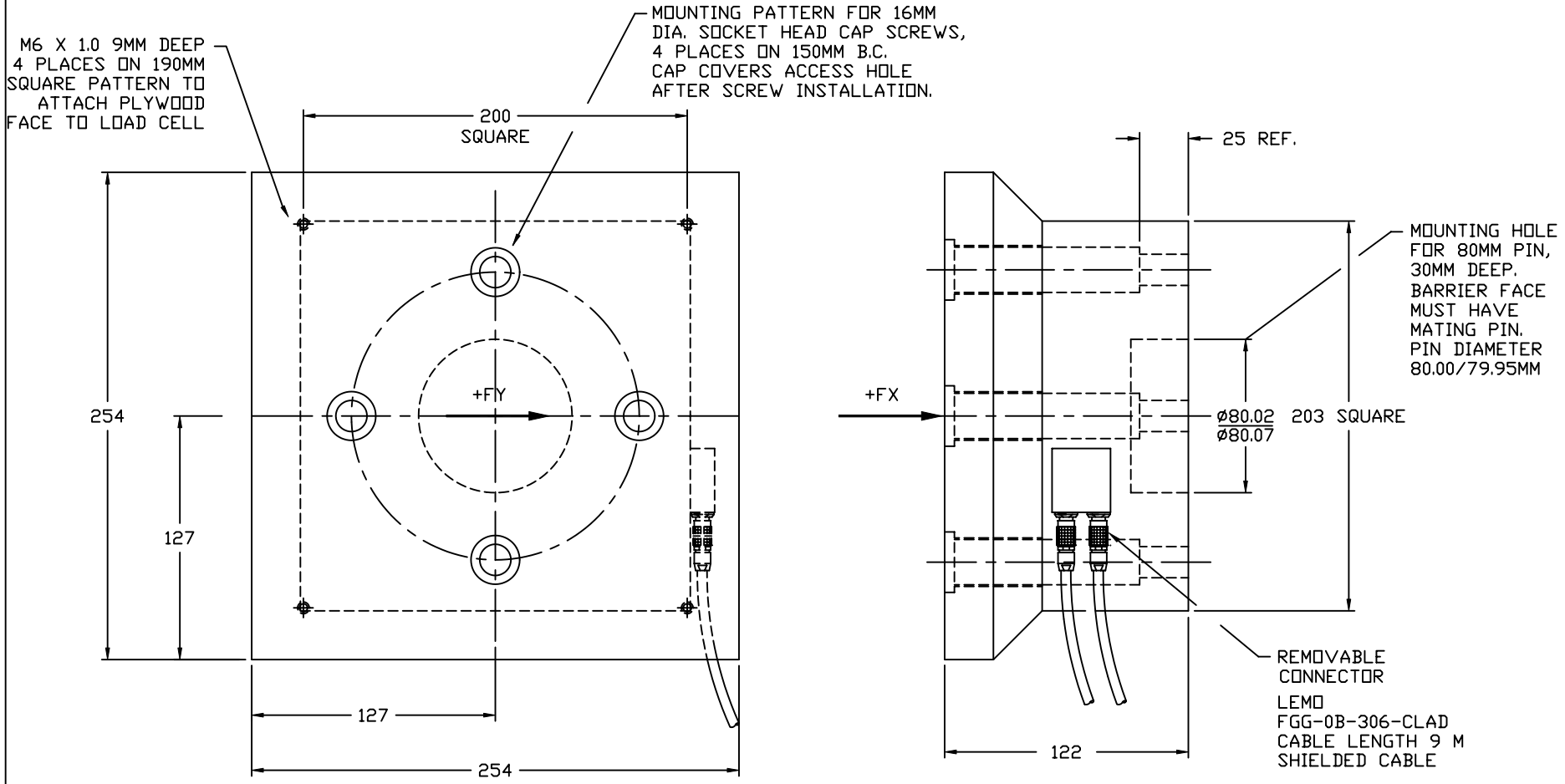
BARRIER FACE LOAD CELL

SCALE: .5X
DATE: 19MARCH95
DRAWN BY: C.R. MORGAN
MODEL: 3252

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3252-D



BARRIER FACE LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	300 KN	1.25 mV/V NOMINAL
FY	180 KN	2.0 mV/V NOMINAL

NONLINEARITY: < .5% OF FULL SCALE
BRIDGE RESISTANCE: 350 OHMS NOMINAL
CALCULATED NATURAL FREQUENCY > 5000 HZ

SYM	REVISION	DATE

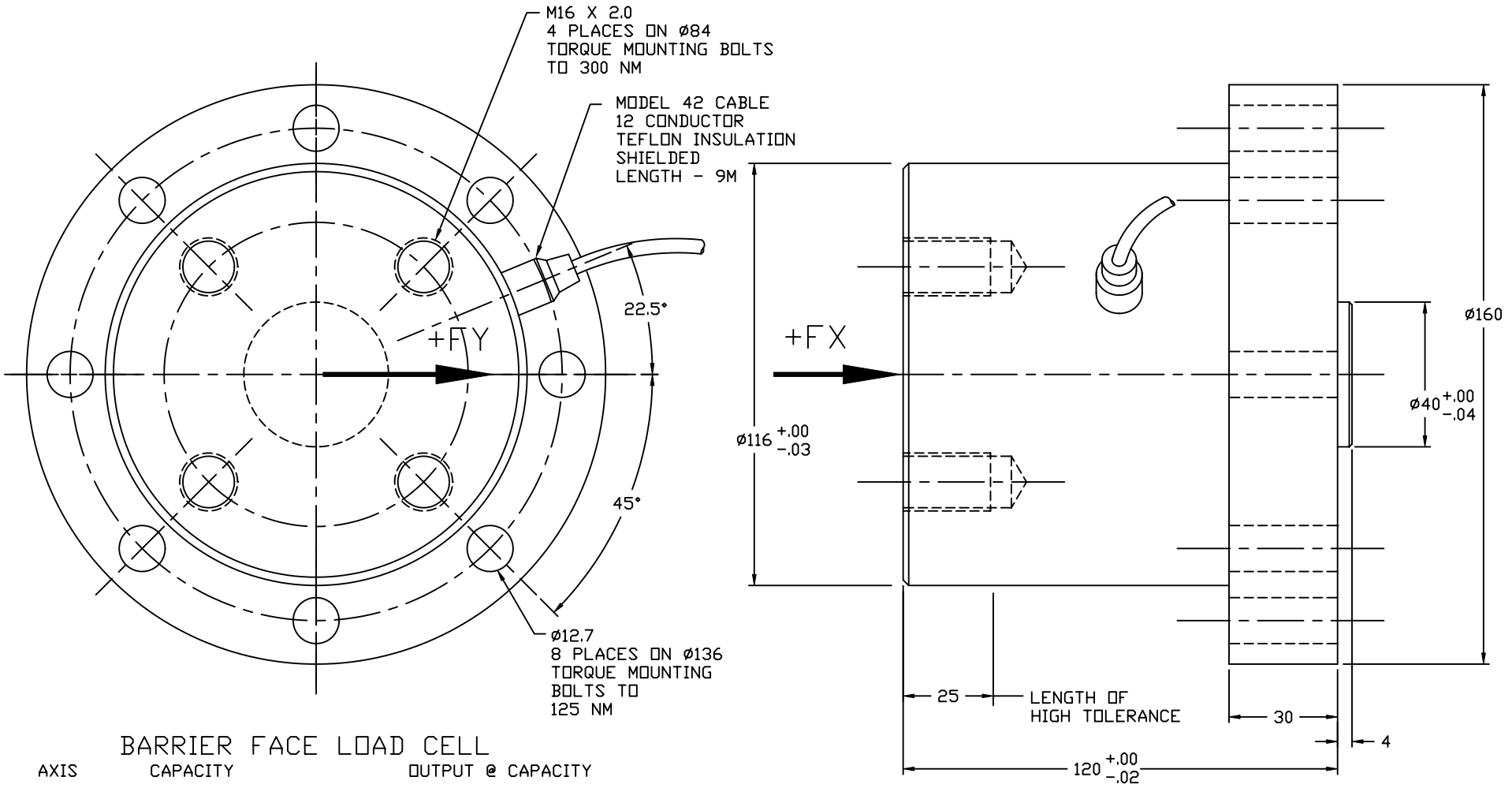
BARRIER FACE LOAD CELL

SCALE: .5X
DATE: 28MARCH97
DRAWN BY: C.R. MORGAN
MODEL: 3787

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3787-D



BARRIER FACE LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	350 KN (80K LBF)	1.5 mV/V NOMINAL
FY	175 KN (40K LBF)	1.8 mV/v NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE
MAXIMUM BENDING MOMENT NOT TO EXCEED 12000 NM

CALCULATED NATURAL FREQUENCY
FX > 6000 HZ
FZ > 8000 HZ

SYM	REVISION	DATE
A	WAS DRG. B-3830	6/99

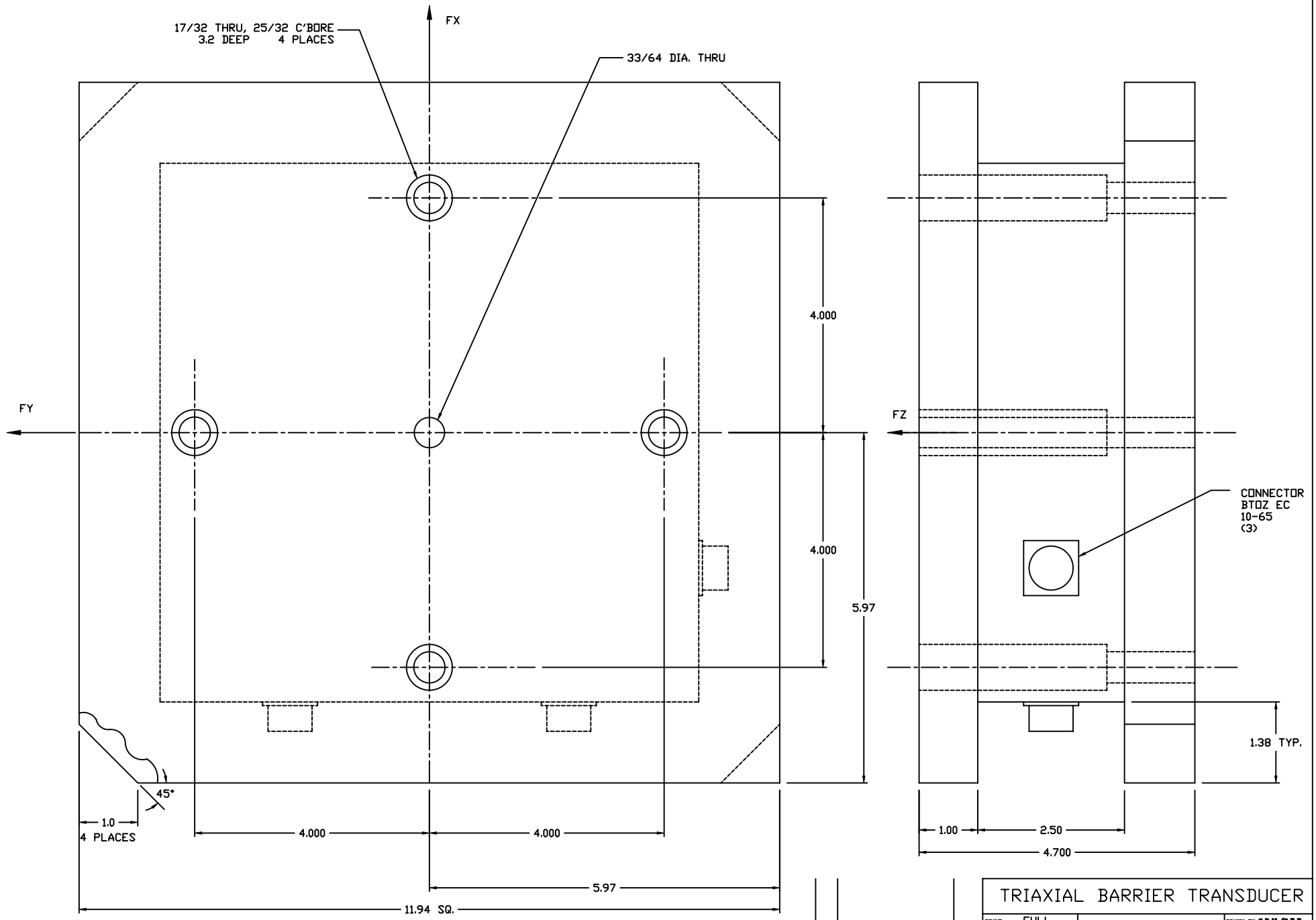
BARRIER FACE LOAD CELL - N1

SCALE: FULL
DATE: 2JUNE97
DRAWN BY: C.R. MORGAN
MODEL: 3830

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3830-D



AXIS CAPACITY
FX 25000 LBS.
FY 25000 LBS. NONLINEARITY <1% OF FULL SCALE
FZ 50000 LBS. CROSS TALK <5% OF FULL SCALE

SYM	REVISION	DATE
B	WAS DRG. C-1645	7/99
A	REDRAWN IN CAD	7/93

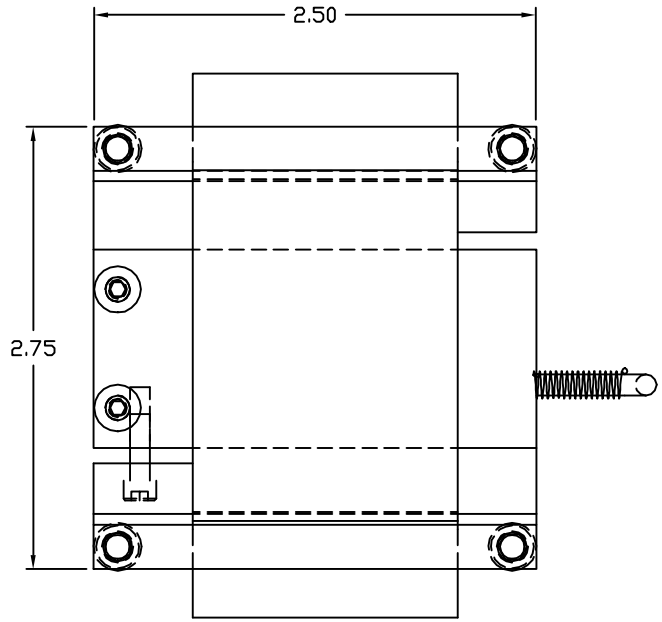
TRIAXIAL BARRIER TRANSDUCER

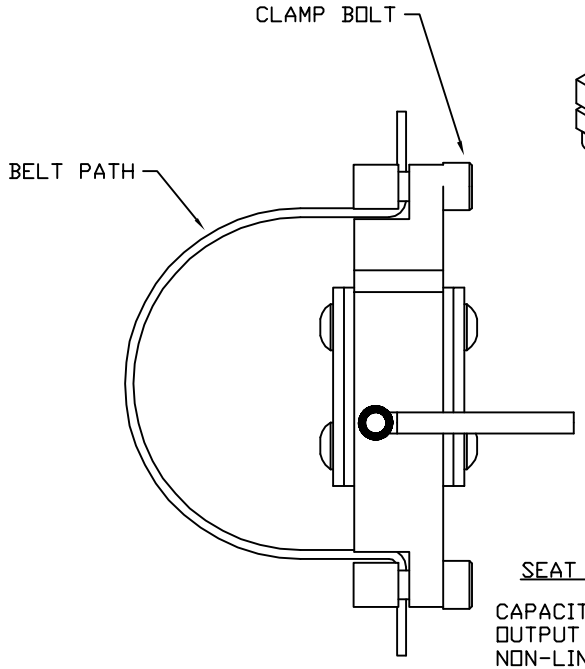
SCALE: FULL
DATE: 7/1/82
DRAWN BY: C.R.M./K.B.P.
MODEL: 1645

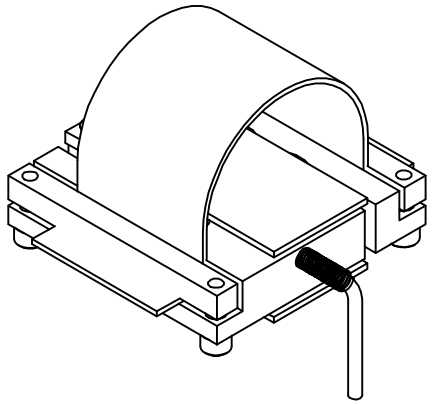
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125 ...
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: C-1645-D







SEAT BELT TENSION LOAD CELL

CAPACITY	100 LBS.
OUTPUT	1.5 mV/V NOMINAL
NON-LINEARITY	≤ 0.25% OF FULL SCALE
HYSTERESIS	≤ 0.25% OF FULL SCALE
BELT WIDTH	2.06 MAX.
BELT THICKNESS	0.06 MAX.
WEIGHT	~0.32 MAX.
CABLE LENGTH	10 FT.
OVERLOAD STOPS	SET AT 125 LBS.

OPTIONAL TEMPERATURE COMPENSATION

TEMP. EFFECT ON ZERO	≤ 0.002% OF F.S./°F
TEMP. EFFECT ON SPAN	≤ 0.002% OF F.S./°F

BELT TENSION LOAD CELL

SCALE:	2X		DRAWN BY: C.R. MORGAN
DATE:	31JUL00		MODEL: 4930

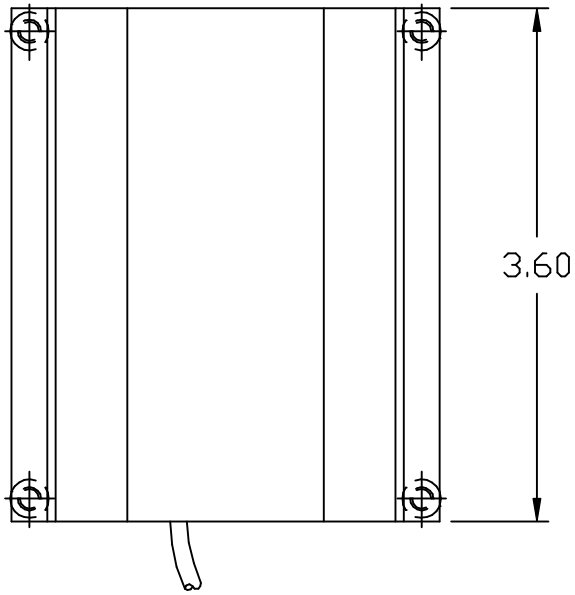
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4930-D

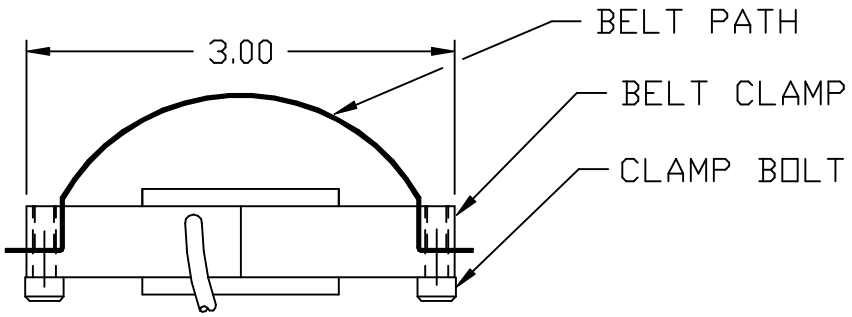
NEXT ASS'Y	QTY
PART USED ON	

SYM	REVISION	DATE



SEAT BELT TENSION LOAD CELL

CAPACITY	250 LBS.
OUTPUT	2mV/V NOMINAL
BELT WIDTH	3.06 MAX.
BELT THICKNESS	.06 MAX.
WEIGHT	~.5 LBS.
CABLE LENGTH	10′
OVERLOAD STOPS SET AT 300 LBS.	



SYM	REVISION	DATE
A	ADD OVERLOAD NOTE	10/99

BELT TENSION LOAD CELL MODEL 3452

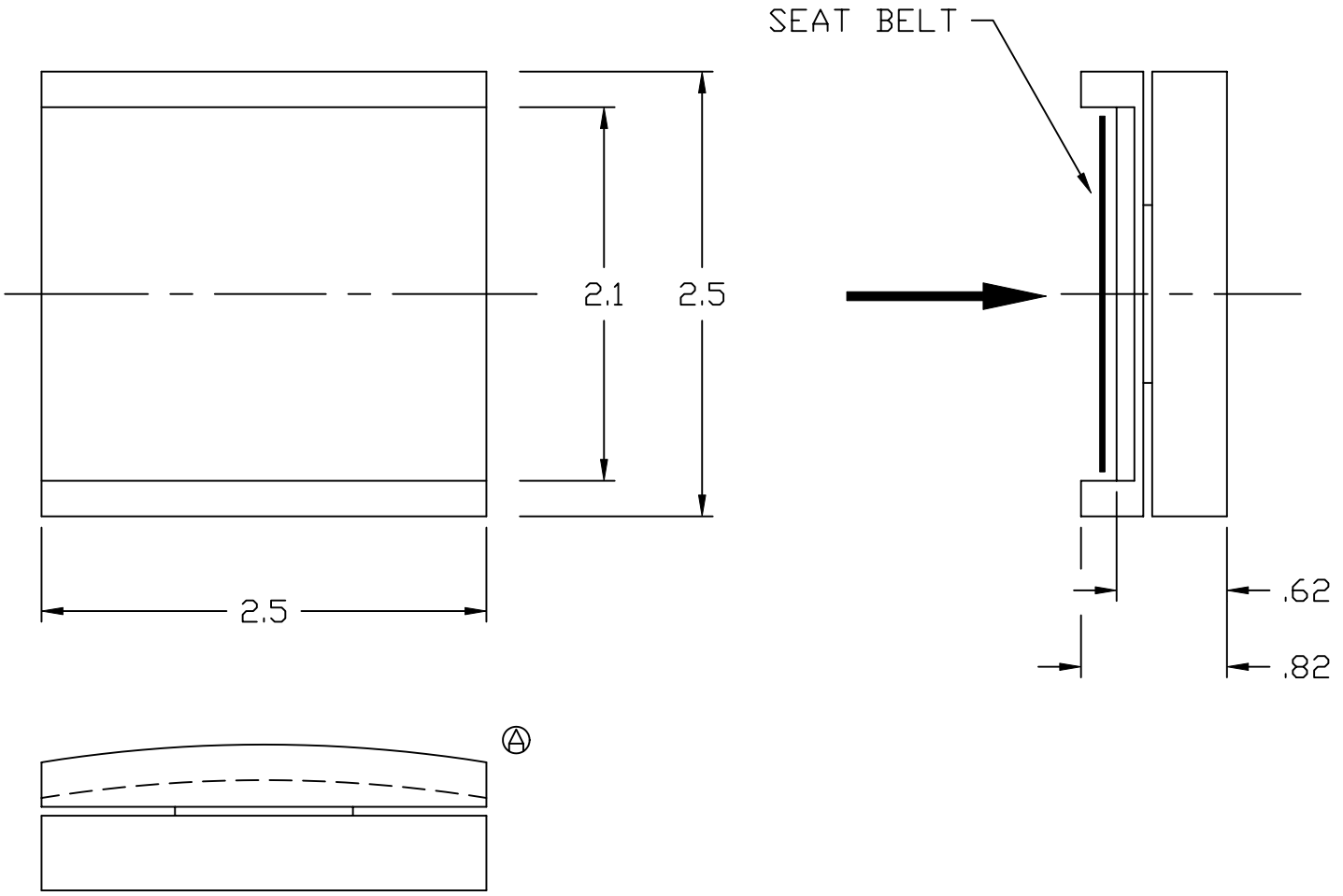
SCALE: .75		DRAWN BY: *C.R.M./S.E.F.*
DATE: 12/14/95		MODEL: 3452

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-3452-D



BELT CONTACT FORCE
LOAD CELL

CAPACITY: 1500 LBF
OUTPUT @ CAPACITY: 1.2 mV/V NOMINAL
NONLINEARITY < 1% OF FULL SCALE

SYM	REVISION	DATE
B	WAS A-3371	10/99
A	RADII ADDED TO PROFILE	8/95

SEAT BELT CONTACT FORCE LOAD CELL

SCALE: FULL

DATE: 19AUG95

DRAWN BY: C.R. MORGAN

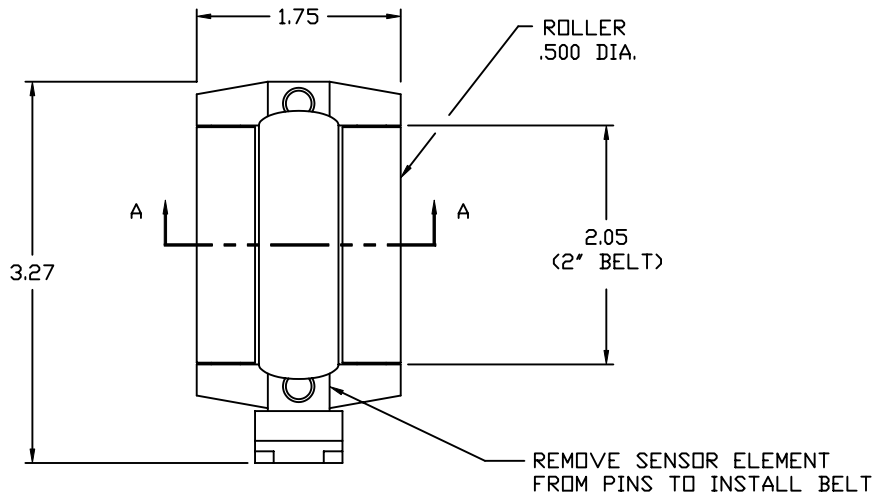
MODEL: 3371

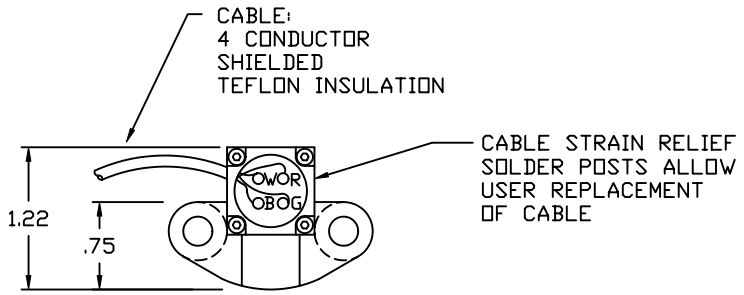
UNLESS OTHERWISE SPECIFIED

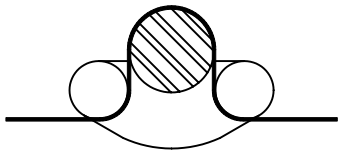
TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-3371-D







SEC A-A
BELT PATH

WEBBING LOAD CELL
CAPACITY 3000 LBS.
OUTPUT 2 mV/V NOM.
WEIGHT .58 LBS.
NONLINEARITY < 3% OF FULL SCALE
HYSTERESIS < 3% OF FULL SCALE

SYM	REVISION	DATE
B	WAS DWG B-3255	10/99
A	REV. SPEC. & TXT.	2/99

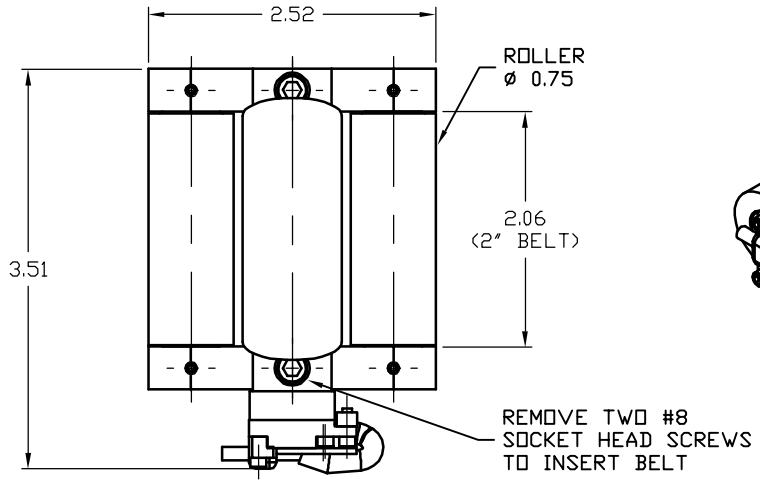
WEBBING LOAD CELL

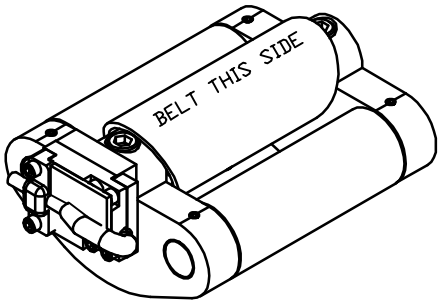
SCALE: FULL
DATE: 9/14/95
DRAWN BY: C.R. MORGAN
MODEL: 3255

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3255-D



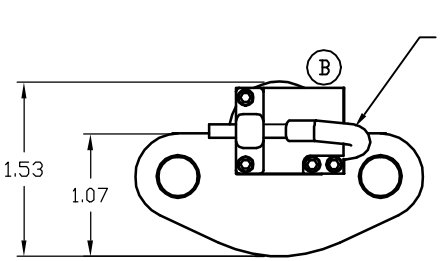


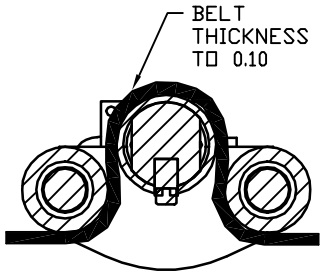
WEBBING LOAD TRANSDUCER

CAPACITY:	5000 LBS
OUTPUT:	2.0 mV/V NOMINAL
WEIGHT:	1.25 LBS

THE MODEL 2346 WEBBING LOAD CELL IS DESIGNED TO PROVIDE THE FOLLOWING FEATURES:

1. INSENSITIVE TO CONTACT. THE END PLATES ISOLATE THE SENSOR ELEMENT FROM CONTACT TO PREVENT ERRONEOUS READINGS WHEN THE LOAD CELL IS IN CONTACT WITH THE ATD OR SEAT.
2. INSENSITIVE TO BELT ANGLE. THE ROLLER SYSTEM GUIDES THE BELT ONTO THE SENSOR ELEMENT. THIS ALIGNMENT PREVENTS ERRORS WHEN THE BELT ENTRY AND EXIT FROM THE LOAD CELL ARE NOT PARALLEL.
3. LOW SENSITIVITY TO BELT THICKNESS. THE ROLLER SYSTEM GUIDES THE BELT ONTO THE SENSOR AT A 90° ANGLE. CHANGES IN BELT THICKNESS CAUSE MINOR CHANGES IN THIS ANGLE AND THUS, MINOR CHANGES IN OUTPUT.





BELT PATH

NEXT ASS'Y	QTY
PART USED ON	

SYM	REVISION	DATE
C	ADD TEXT	08/00
B	CHG STRN RELF	02/00
A	REDRWN TO MDT	02/00

5000 LBS. WEBBING LOAD CELL

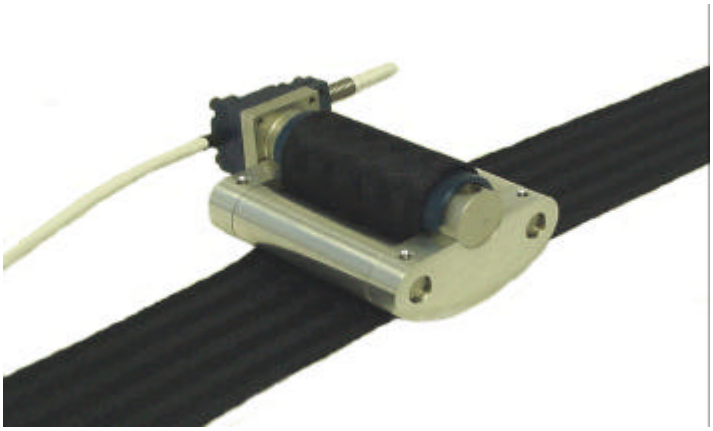
SCALE: FULL
DATE: 07FEB00
DRAWN BY: CRM
MODEL: 2346

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2346-D

ROBERT A. DENTON, INC.
2967 Waterview Dr., Rochester Hills, MI 48309
Tel (248) 852-5100 • Fax (248) 852-6060 • email: info@radenton.com • www.radenton.com



MODEL 5155 1 ½" WEBBING LOAD CELL

Applications:

The Model 5155 is designed for use on 1.5" (38 mm) webbing commonly used in automotive child seats. This load cell is useful where the larger 2" belt load cells are impractical to use due to size, full scale capacity or mass. The Model 5155 webbing load cell is designed to provide the following features making it superior to other designs: **1. Insensitive to Contact:** The end plates isolate the sensor element from contact to prevent erroneous readings when the load cell is in contact with the A.T.D. or seat. This is a common problem with child seats as there is very little free belt length available. **2. Insensitive to Belt Angle:** The roller system guides the belt onto the sensor element. This alignment prevents errors when the belt entry and exit from the load cell are not parallel. **3. Low Sensitivity to Belt Thickness:** The roller system guides the belt onto the sensor at a 90-degree angle. Changes in belt thickness cause minor changes in this angle and thus, minor changes in output. **3. User Replaceable Cable:** Cable damage on seat belt load cells is common due to dummy interaction. The cable attaches to large solder posts under the end cover. It can be easily replaced by the user without having to return it to the factory for repair.

Standard Ordering Configuration: 5155
For optional configurations, see load cell ordering guide or consult factory.

Specifications:

Channel	Capacity		Bridge Resistance (nom)	Output Sensitivity (nom)
	Metric	English		
FORCE	4.5 kN	1,000 lbf	350 ohms	1.9 mV/V

Non-linearity ..... less than 1.5% of full scale
Hysteresis..... less than 1.5% of full scale
Excitation..... 10 VDC nom. 15 VDC max
Assembly Mass (without cable) ..... (0.30 lb) 140 g

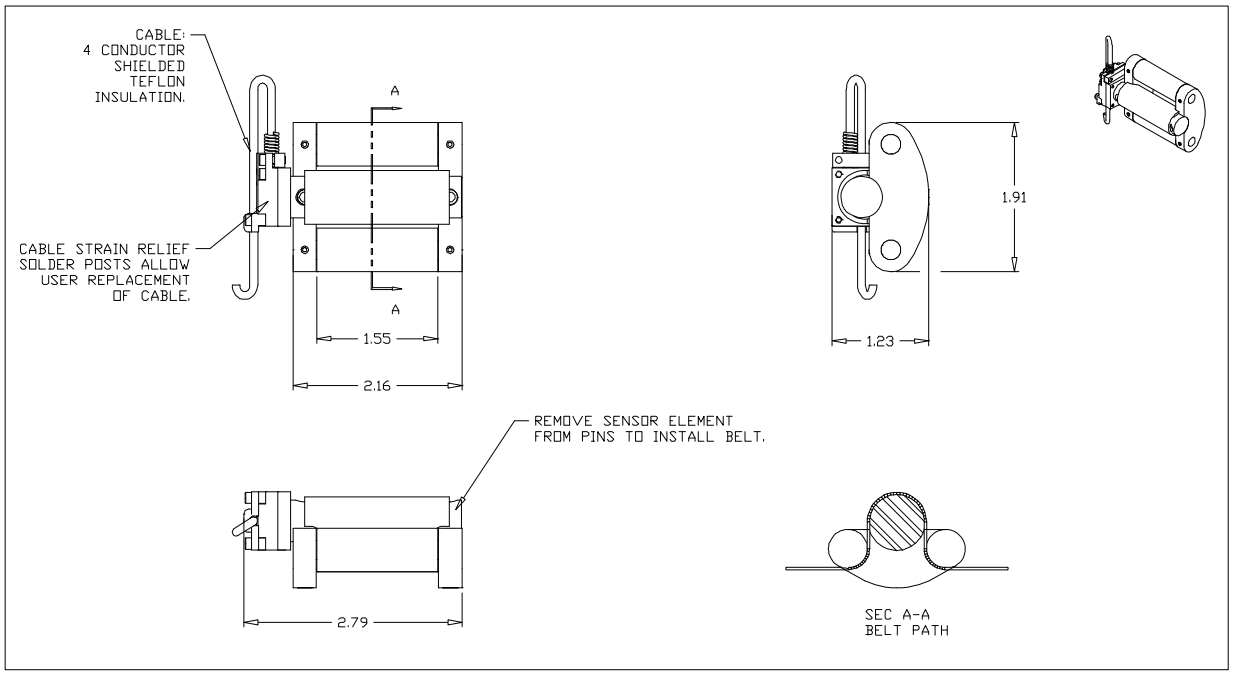
Wiring:

Force Channel	
Red	+Exc.
Green	+Sig.
Black	-Exc.
White	-Sig.

MODEL 5155 WEBBING LOAD CELL

NOTES

1. Use Denton Model 4126 calibration fixture. (Ref. Calibration Fixture drawing 5155-C)
2. If the model tag on the load cell includes a “G” suffix, the shield of the cable is grounded to the body of the part.
3. The standard cable length for this load cell is 9.1 meters (30’). If the cable is cut shorter, the calibration will change. Upon request, the load cell can be made and calibrated with a custom cable length.



Creating the Standard in Safety Measurement Since 1974

Robert A. Denton, Inc. maintains a high level of control over the manufacture of its products to ensure quality, accuracy and reliability. Continued improvement necessitates that we reserve the right to modify these specifications without notice.

Robert A. Denton, Inc., 2967 Waterview Drive, Rochester Hills, Michigan 48309
Tel: (248) 852-5100 • Fax: (248) 852-6060 • email: info@radenton.com
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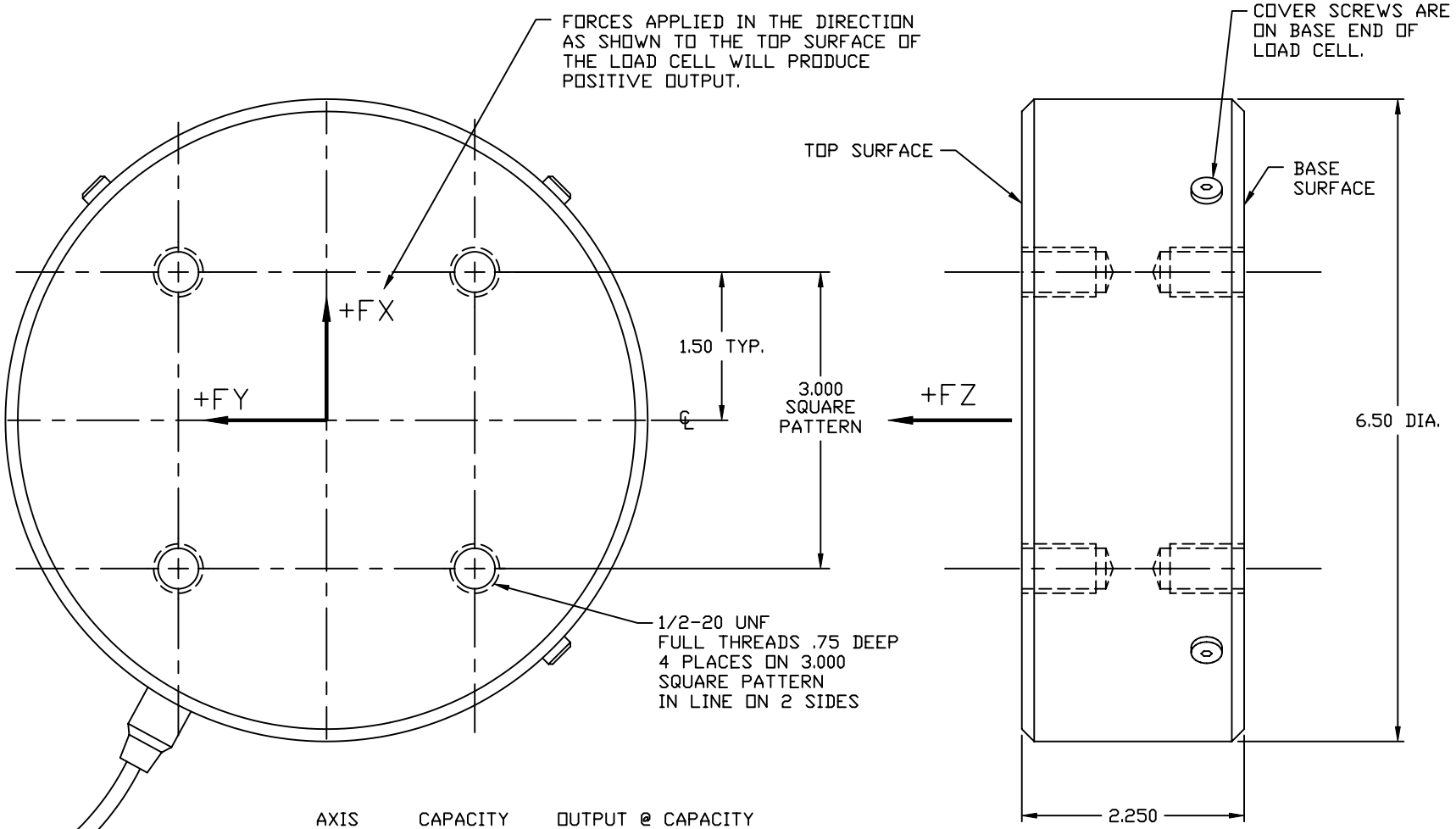


AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	10000 LBS.	2.5mV/V NOMINAL
FY	10000 LBS.	2.5mV/V NOMINAL
FZ	10000 LBS.	1.0mV/V NOMINAL

NONLINEARITY <1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE

MODEL 42 CABLE/CONNECTOR ASSEMBLY
12 CONDUCTOR
TEFLON INSULATION
SHIELDED
LENGTH - 30'

SYM	REVISION	DATE
C	MOVED CONNECTOR 15°	7/99
B	WAS DRG. B-2440	5/99
A	ADD POL. NOTE	9/97

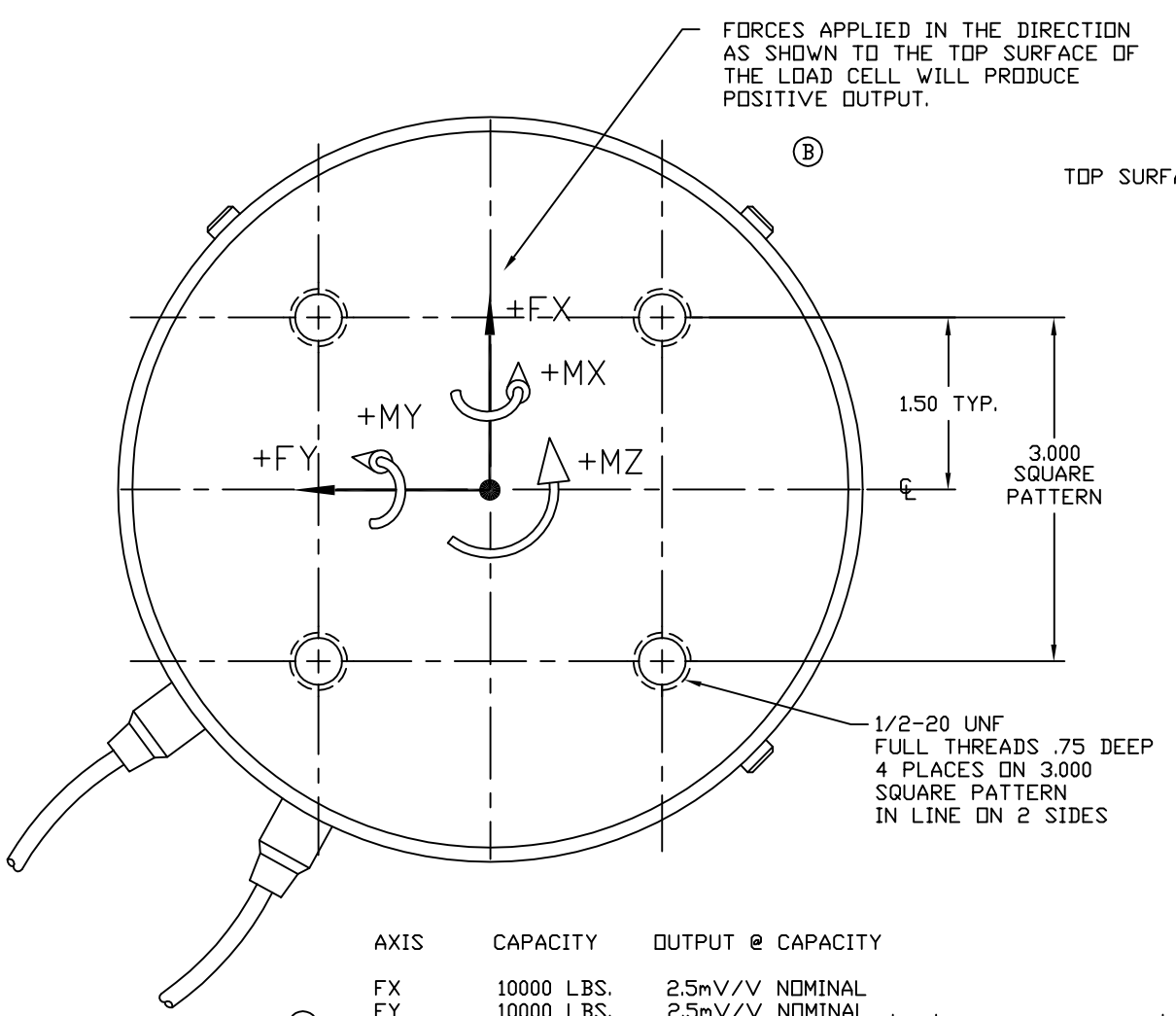
3 CHANNEL SEAT PAN LOAD CELL

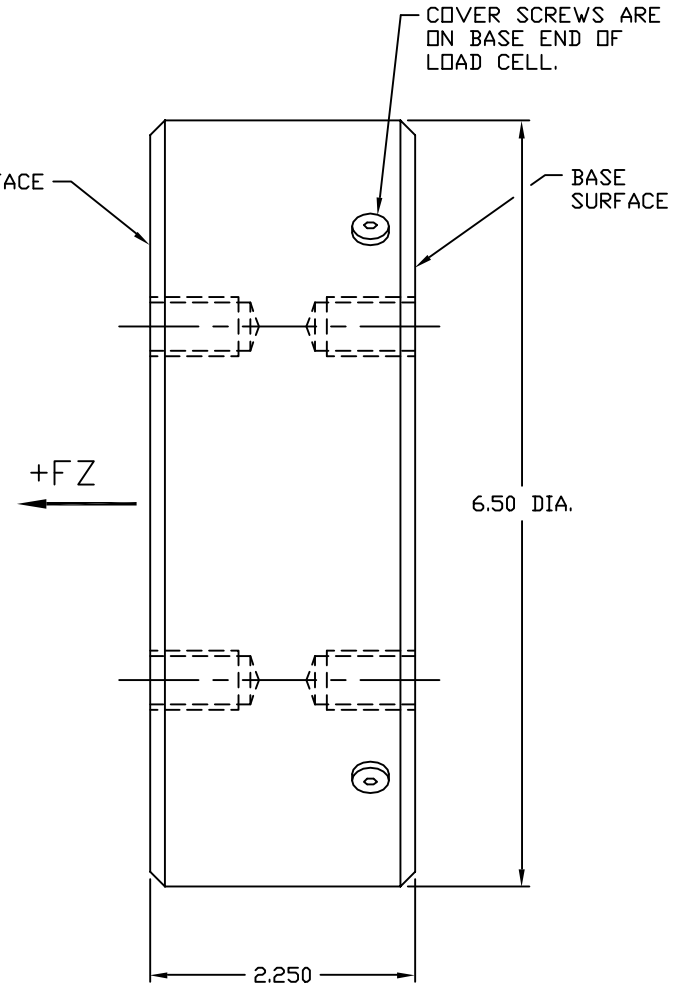
SCALE: FULL
DATE: 7/27/93
DRAWN BY: S.E. FOSTER
MODEL: 2177

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2177-D





AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	10000 LBS.	2.5mV/V NOMINAL
FY	10000 LBS.	2.5mV/V NOMINAL
FZ	10000 LBS.	1.0mV/V NOMINAL
MX	25000 LB-IN	1.8mV/V NOMINAL
MY	25000 LB-IN	1.8mV/V NOMINAL
MZ	20000 LB-IN	1.6mV/V NOMINAL

MODEL 42 REMOVABLE CABLE
12 CONDUCTOR
TEFLON INSULATION
SHIELDED
LENGTH - 30'

NONLINEARITY <1% OF FULL SCALE
CROSSTALK <5% OF FULL SCALE

SYM	REVISION	DATE
C	WAS DRG. B-2513	5/99
B	ADD NOTE	11/97
A	ADD CONN.	9/97

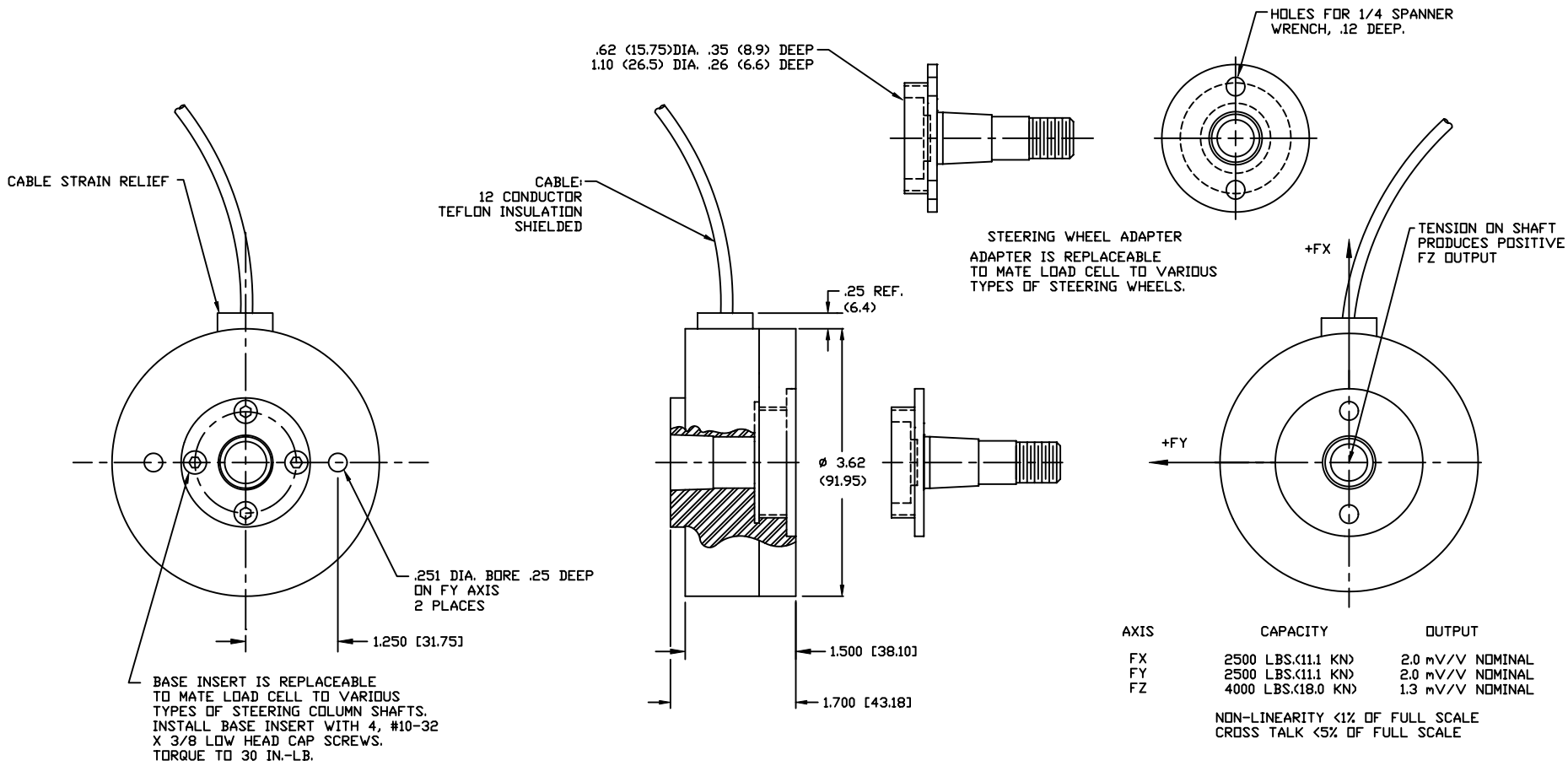
6 CHANNEL SEAT PAN LOAD CELL

SCALE: FULL
DATE: 7/27/93
DRAWN BY: S.E. FOSTER
MODEL: 2513

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2513-D



AXIS	CAPACITY	OUTPUT
FX	2500 LBS.(11.1 KN)	2.0 mV/V NOMINAL
FY	2500 LBS.(11.1 KN)	2.0 mV/V NOMINAL
FZ	4000 LBS.(18.0 KN)	1.3 mV/V NOMINAL

NON-LINEARITY <1% OF FULL SCALE
CROSS TALK <5% OF FULL SCALE

NOTE: THIS STEERING COLUMN LOAD CELL WILL BE PROVIDED WITH BLANK TOP ADAPTER AND BASE INSERT THAT WILL BE MACHINED BY THE CUSTOMER TO FIT THE STEERING WHEEL AND THE STEERING COLUMN SHAFT.

SYM	REVISION	DATE
A	WAS DRG. B-4188	7/99

STEERING COLUMN LOAD CELL

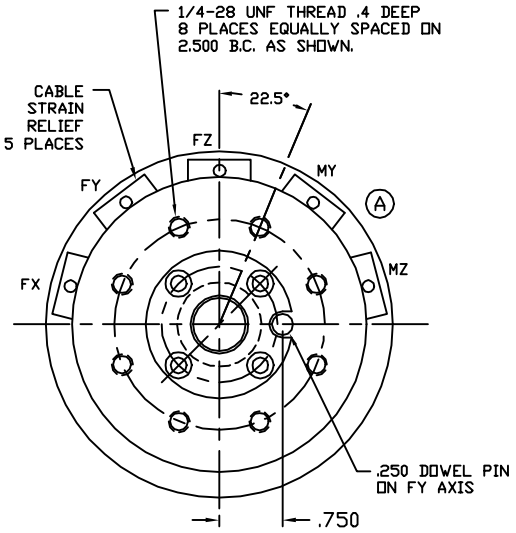
SCALE: .75X
DATE: 3AUG98
DRAWN BY: C.R. MORGAN
MODEL: 4188

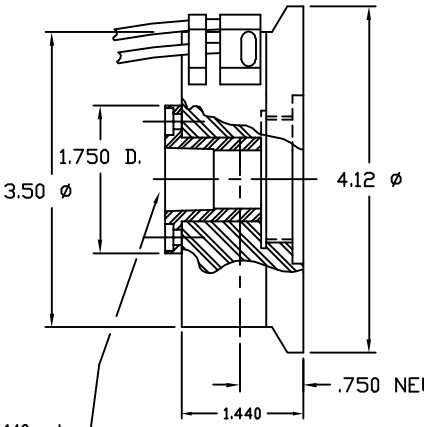
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

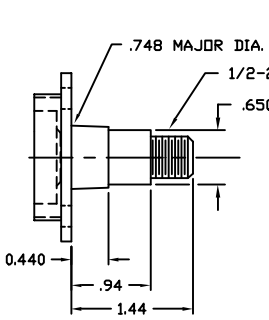
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

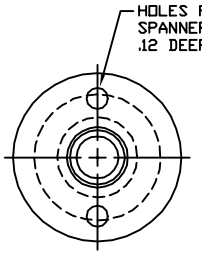
DRAWING NUMBER: B-4188-D

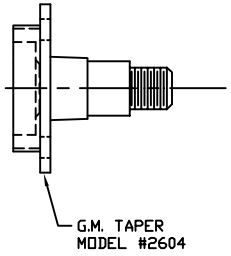
OPTIONAL ADAPTORS
TYPE: OPEL
BASE INSERT MODEL #3217
TOP ADAPTOR MODEL #3441

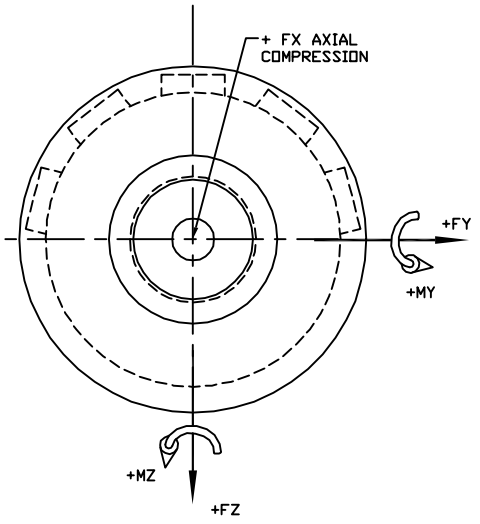






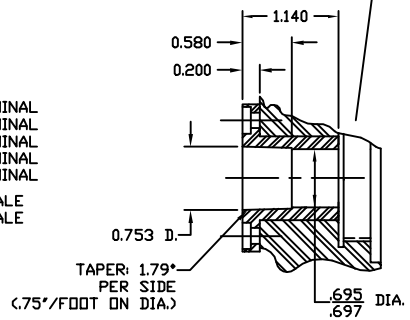






AXIS	CAPACITY	OUTPUT
FX	5000 LBS.	1.0 mV/V NOMINAL
FY	2500 LBS.	2.0 mV/V NOMINAL
FZ	2500 LBS.	2.0 mV/V NOMINAL
MY	10000 LB.-IN.	2.0 mV/V NOMINAL
MZ	10000 LB.-IN.	2.0 mV/V NOMINAL

NON-LINEARITY <1% OF FULL SCALE
CROSS TALK <5% OF FULL SCALE



INTERNAL TAPER DETAIL
G.M. BASE INSERT MODEL #3139

STEERING COLUMN SHOWN WITH G.M. INSERTS.
INSERTS FOR OTHER MANUFACTURES AVAILABLE.

SYM	REVISION	DATE
A	CORRECT LABEL	1/97

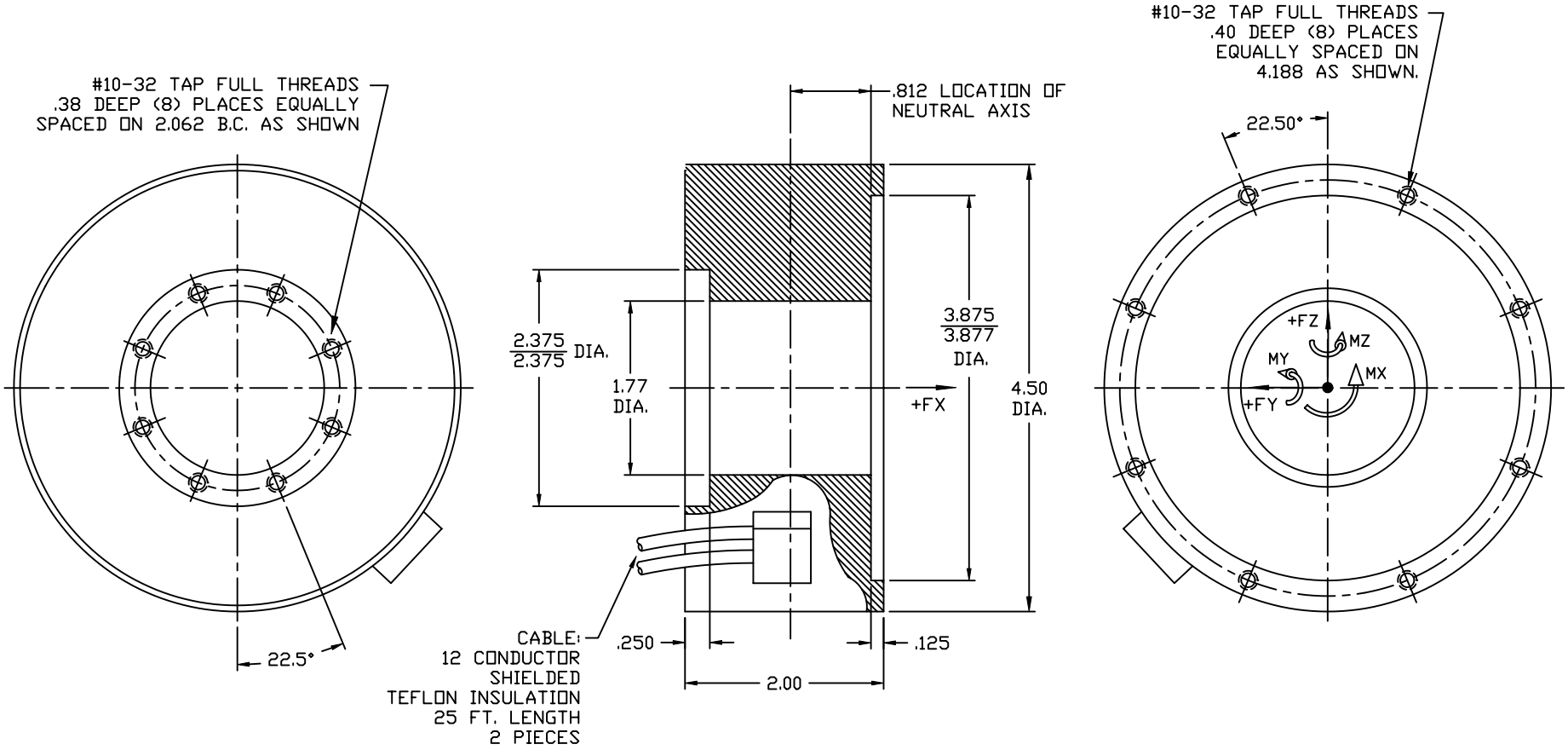
STEERING COLUMN WITH REPLACEABLE INSERT

SCALE: .75X
DATE: 3/9/92
DRAWN BY: C.R. MORGAN
MODEL: 3480

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3480-D



AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	5000 LB.	1.0 mV/V NOM.
FY	2500 LB.	2.0 mV/V NOM.
FZ	2500 LB.	2.0 mV/V NOM.
MX	5000 IN.-LB.	1.0 mV/V NOM.
MY	10,000 IN.-LB.	2.0 mV/V NOM.
MZ	10,000 IN.-LB.	2.0 mV/V NOM.

NON-LINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT ~1.7 LB.

SYM	REVISION	DATE
A	WAS DRG. B-3868	6/99

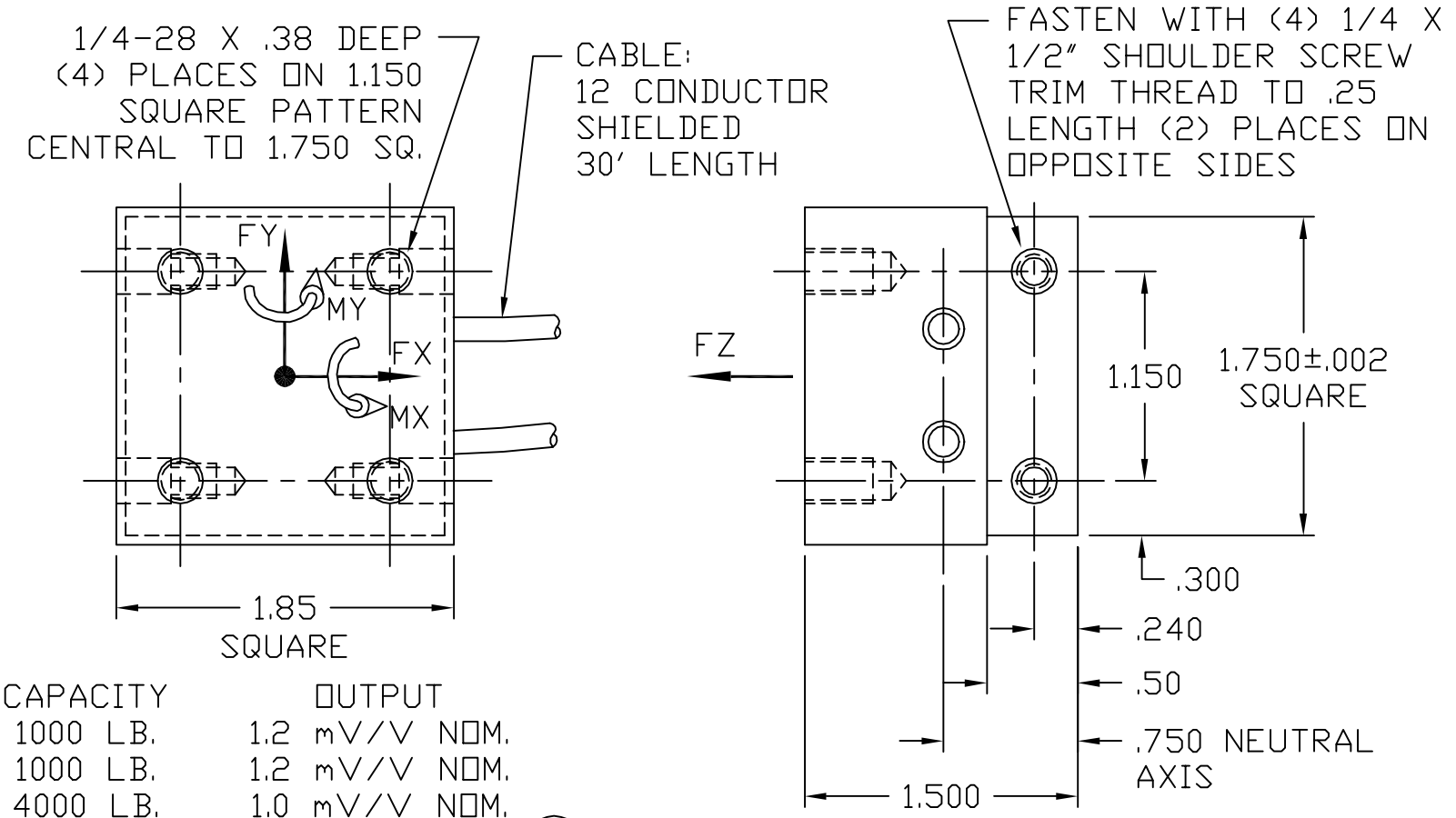
6 CHANNEL STEERING COLUMN

SCALE: FULL
DATE: 9/17/97
DRAWN BY: C.R. MORGAN
MODEL: 3868

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3868-D



AXIS	CAPACITY	OUTPUT
FX	1000 LB.	1.2 mV/V NOM.
FY	1000 LB.	1.2 mV/V NOM.
FZ	4000 LB.	1.0 mV/V NOM.
MX	2000 IN-LBF	2.0 mV/V NOM.
MY	2000 IN-LBF	2.0 mV/V NOM.

(C)

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT: 1LB.

SHEAR CAPSULE LOAD CELL

SCALE: FULL		DRAWN BY: C.R. MORGAN
DATE: 9/23/89		MODEL: 2281

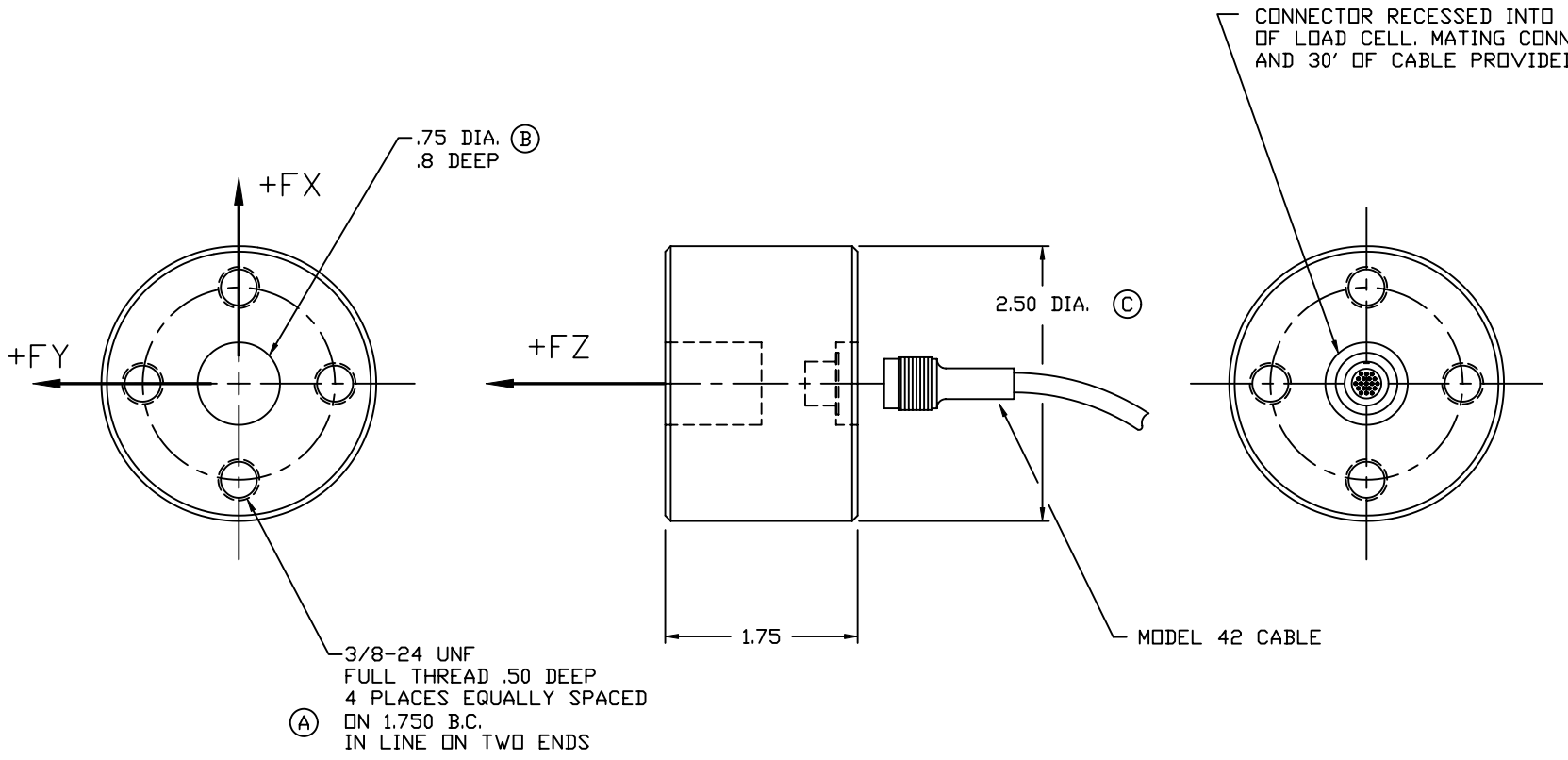
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

SYM	REVISION	DATE
C	CORRECT UNIT	4/00
B	WAS DRG. A-2281	5/99
A	REDRAWN IN CAD	2/98

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-2281-D



TRI-AXIAL B-PILLAR LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	5000 LBS.	1.4 MV/V NOMINAL
FY	5000 LBS.	1.4 MV/V NOMINAL
FZ	10000 LBS.	1.0 MV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSS-TALK < 5% OF FULL SCALE

SYM	REVISION	DATE
D	WAS B-2655	9/99
C	DIA. WAS 3.00	8/25/92
B	DIA. WAS 1.0	8/25/92
A	B.C. WAS 2.250	8/25/92

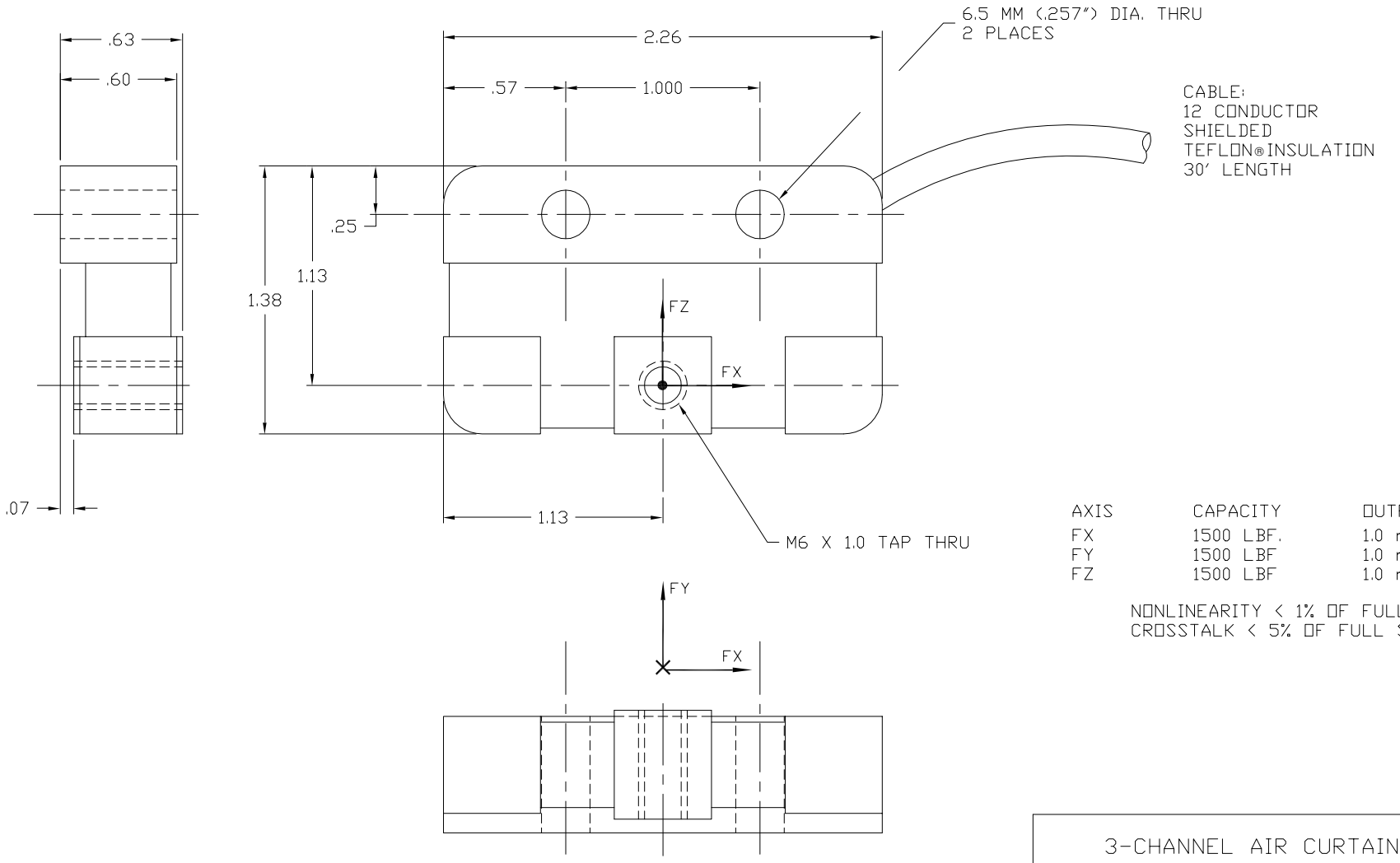
B-PILLAR LOAD CELL

SCALE: 8/7/92
DATE: FULL
DRAWN BY: C.R. MORGAN
MODEL: 2655

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2655-D



AXIS	CAPACITY	OUTPUT
FX	1500 LBF.	1.0 mV/V NOMINAL
FY	1500 LBF	1.0 mV/V NOMINAL
FZ	1500 LBF	1.0 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
A	FIX CAPACITY LABELS	28MAR00 PJD

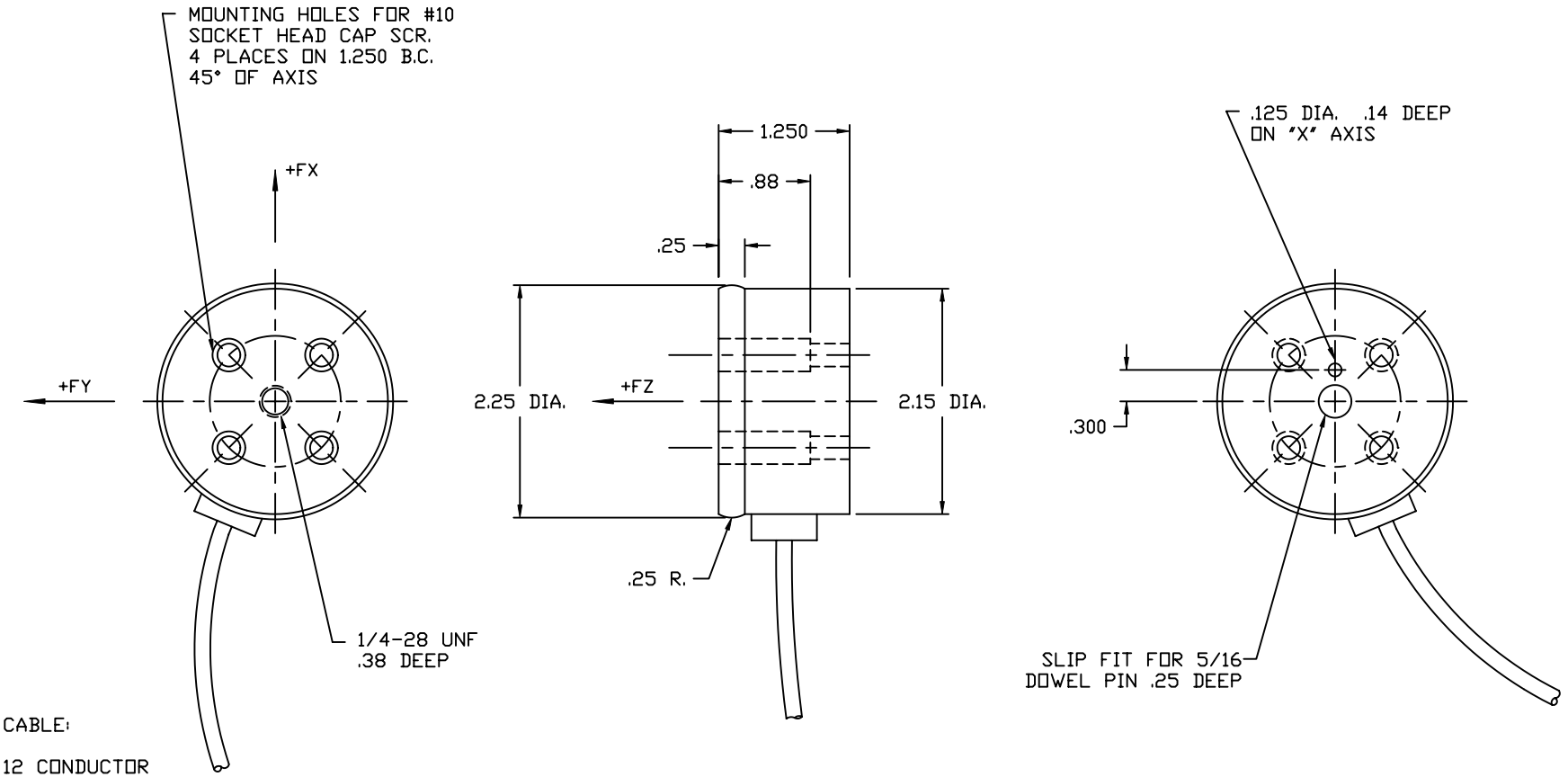
3-CHANNEL AIR CURTAIN LOAD CELL

SCALE: 2X
DATE: 5JAN00
DRAWN BY: C.R. MORGAN
MODEL: 4639

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4639-D



CABLE:

12 CONDUCTOR
SHIELDED
TEFLON NSULATED
15' LENGTH

MODEL M1516 LOAD CELL

CHANNEL	CAPACITY	OUPUT @ CAPACITY	BRIDGE RESISTENCE
FX	3000 LBS.	2.3 mV/V NOM.	350 Ω
FY	3000 LBS.	2.3 mV/V NOM.	350 Ω
FZ	4500 LBS.	1.8 mV/V NOM.	480 Ω

CROSS-TALK <5% OF FULL SCALE
NON-LINEARITY <1% OF FULL SCALE

SYM	REVISION	DATE
A	REDRAWN IN CAD	12/93

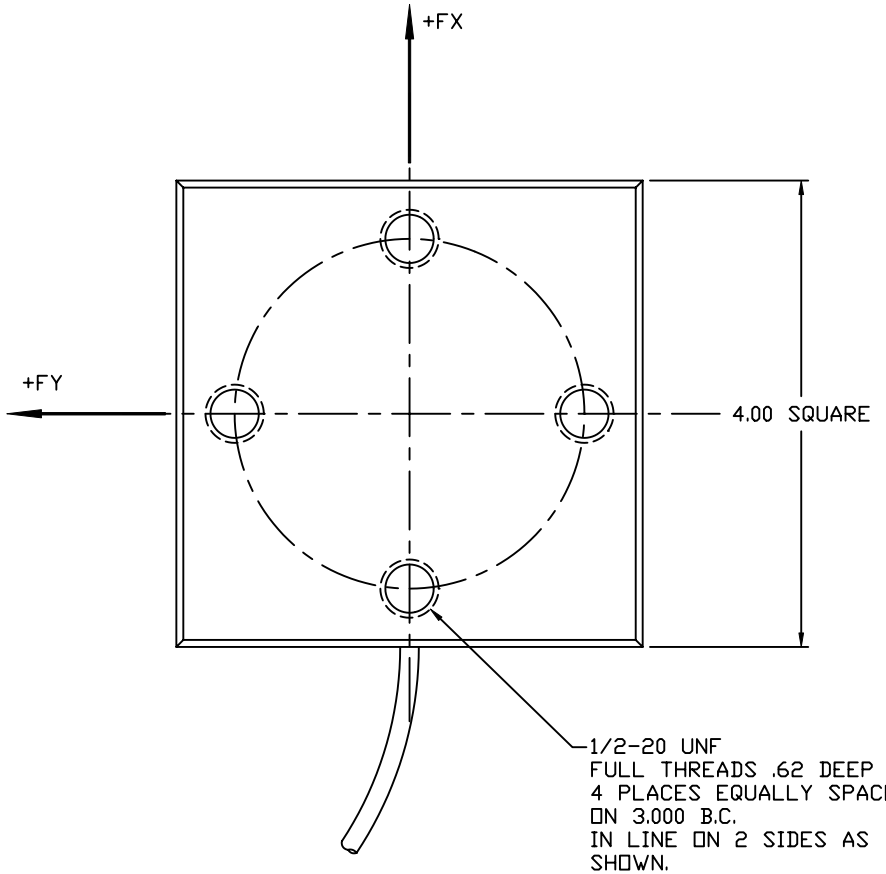
TRI-CHANNEL LOAD CELL

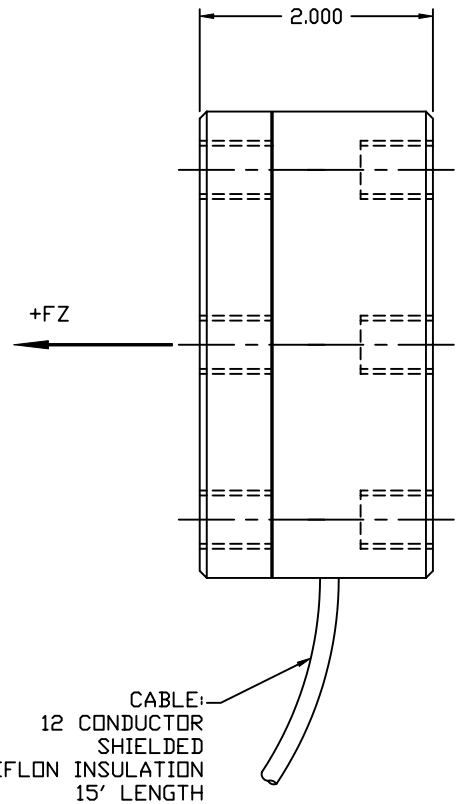
SCALE:	FULL		DRAWN BY: C.R.M./S.E.F.
DATE:	3/9/89		MODEL: M1516

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125√
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2236-D





MODEL 2880

AXIS	CAPACITY	OUTPUT @ CAPACITY NOMINAL
FX	1500 LBS.	2 mV/V
FY	1500 LBS.	2 mV/V
FZ	3000 LBS.	1 mV/V

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
WEIGHT: 2.1 LBS.

SYM REVISION DATE

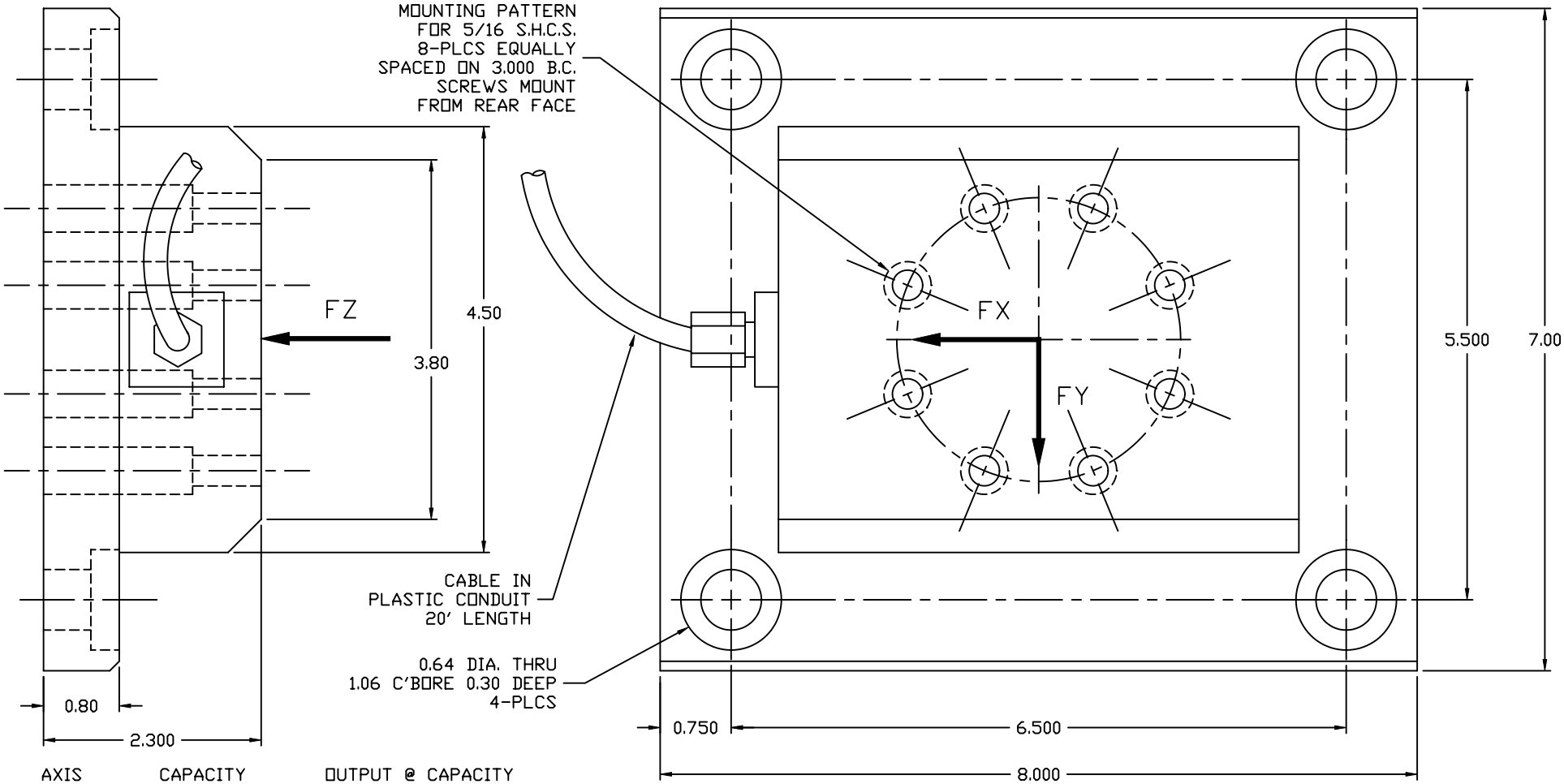
TRIAXIAL LOAD CELL

SCALE: FULL
DATE: 7/17/93
DRAWN BY: C.R. MORGAN
MODEL: 2880

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125√
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2880-D



AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	3000 LBS.	1.25 mV/V NOMINAL
FY	3000 LBS.	1.25 mV/V NOMINAL
FZ	6000 LBS.	1.25 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE
TEMPERATURE EFFECT ON ZERO - .005% PER °F
TEMPERATURE EFFECT ON SPAN - .005% PER °F
NON-MEASURED BENDING MOMENT CAPACITY - 7500 IN.-LB MY
MAXIMUM OVERLOAD - 200% OF FULL SCALE

SYM	REVISION	DATE
B	WAS DRG. B-4004	7/99
A	ADD FY AXIS	3/98

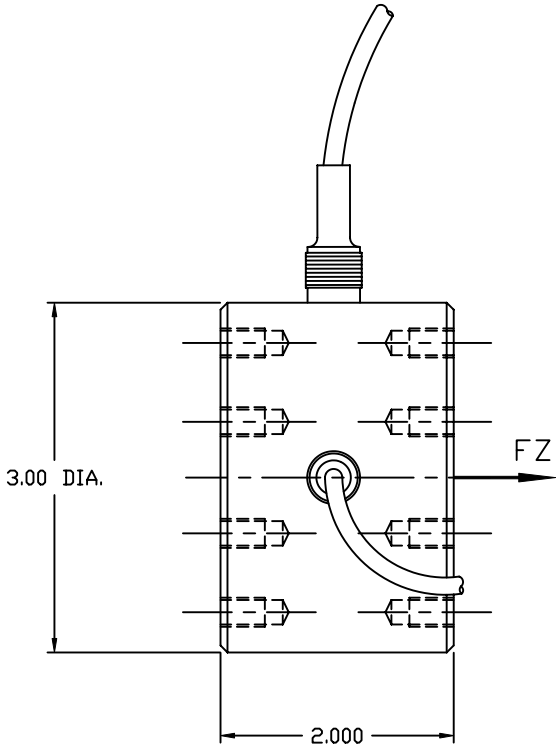
3 CHANNEL LOAD CELL

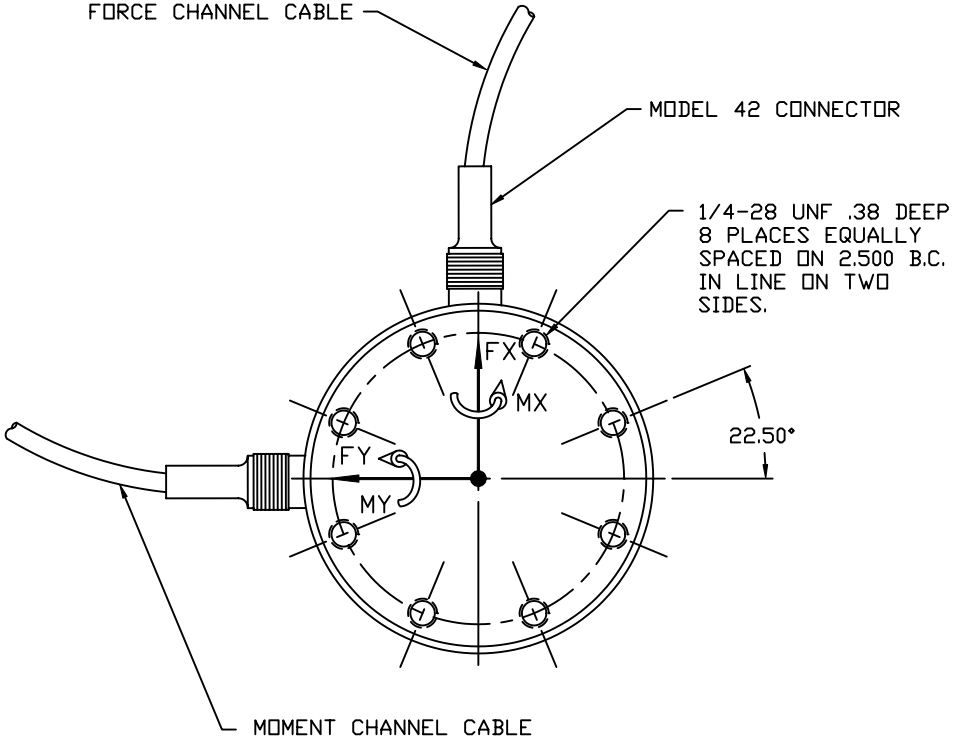
SCALE: FULL
DATE: 6JAN98
DRAWN BY: C.R. MORGAN
MODEL: 4004

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4004-D





FIVE CHANNEL LOAD CELL

AXIS	CAPACITY	OUTPUT
FX	10000 LBS.	1.5 mV/V NOM.
FY	10000 LBS.	1.5 mV/V NOM.
FZ	15000 LBS.	1.0 mV/V NOM.
MX	20000 LB*INS	2.4 mV/V NOM.
MY	20000 LB*INS	2.4 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
B	WAS DWG B-3118	10/99
A	REV. MOMENT CAP.	3/95

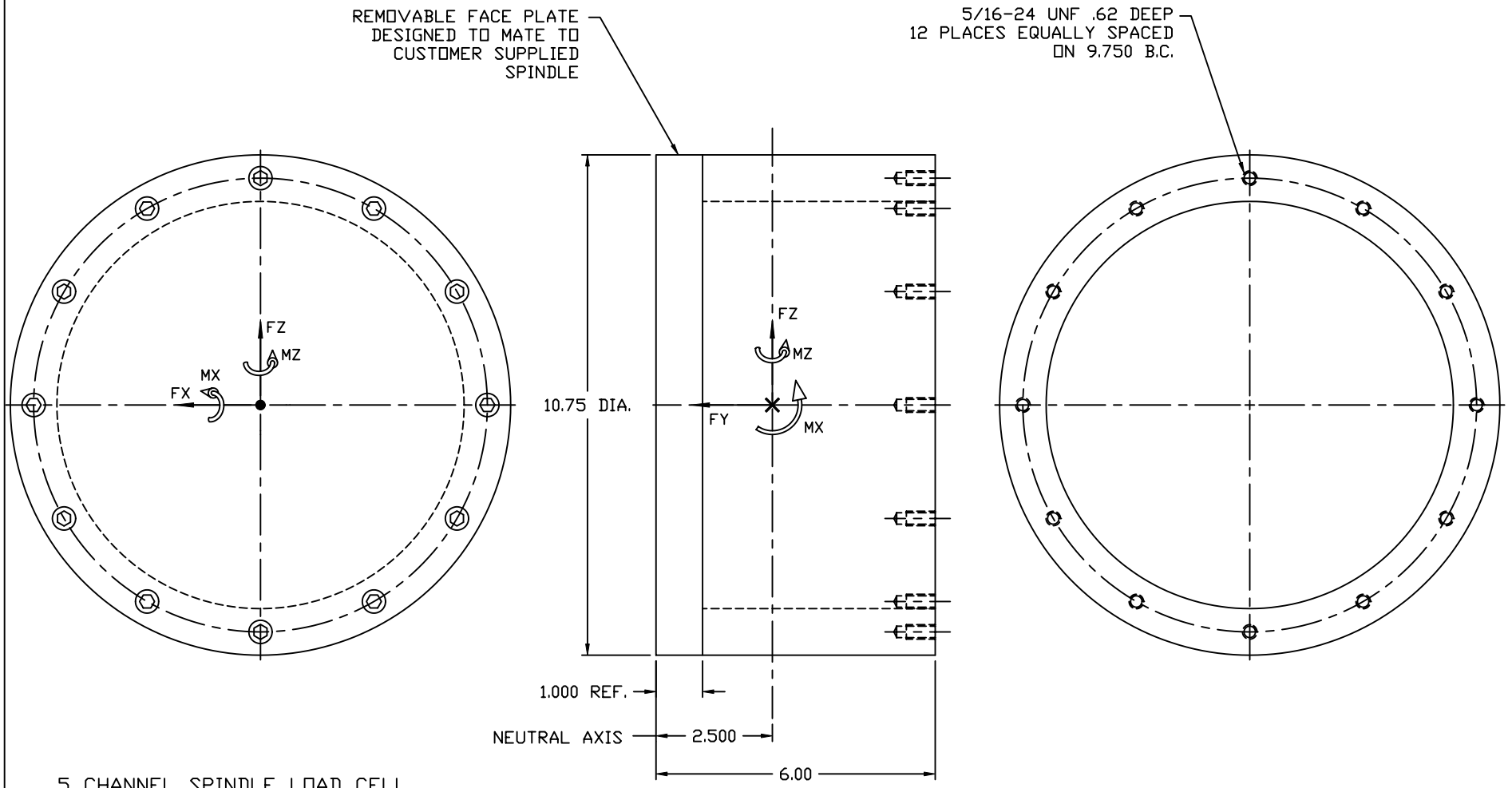
FIVE CHANNEL LOAD CELL

SCALE: FULL
DATE: 27AUG94
DRAWN BY: C.R. MORGAN
MODEL: 3118

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3118-D



5 CHANNEL SPINDLE LOAD CELL

AXIS	CAPACITY	OUTPUT
FX	1000 LBS.	2.0 mV/V NOM.
FY	1000 LBS.	1.0 mV/V NOM.
FZ	1000 LBS.	2.0 mV/V NOM.
MX	12000 LB*INS	1.5 mV/V NOM.
MZ	12000 LB*INS	1.5 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
A	WAS B-3124	08OCT99

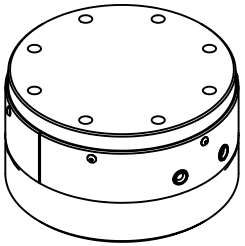
5 CHANNEL SPINDLE LOAD CELL

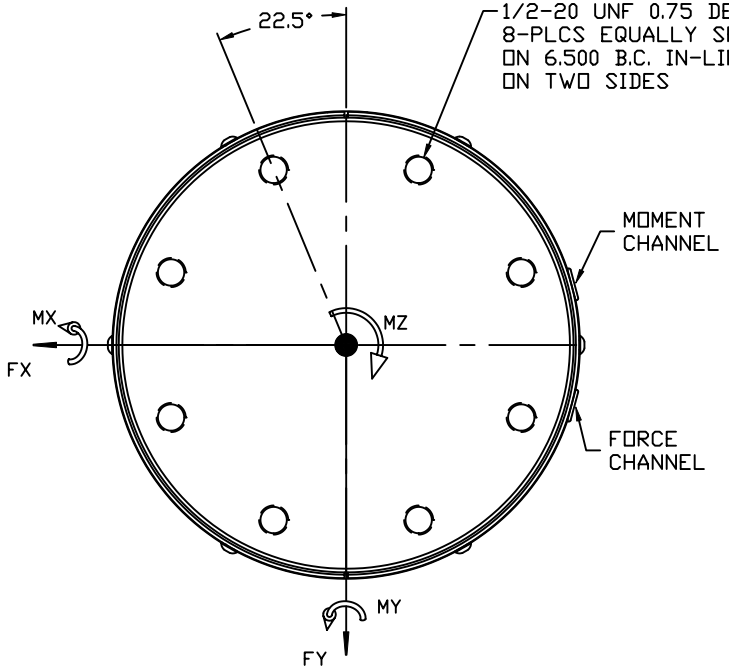
SCALE: .5X
DATE: 30SEPT94
DRAWN BY: C.R. MORGAN
MODEL: 3124

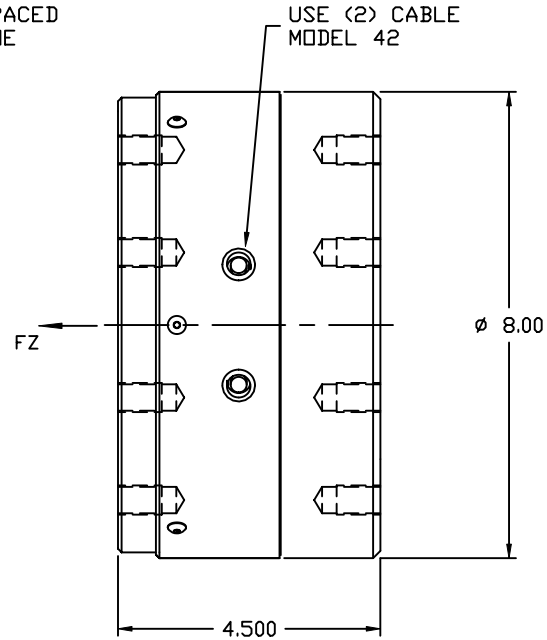
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3124-D







SIX CHANNEL LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	40000 LBF	2.0 mV/V NOMINAL
FY	40000 LBF	2.0 mV/V NOMINAL
FZ	60000 LBF	1.5 mV/V NOMINAL
MX	180000 IN-LBF	1.5 mV/V NOMINAL
MY	180000 IN-LBF	1.5 mV/V NOMINAL
MZ	60000 IN-LBF	1.0 mV/V NOMINAL

NON-LINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

NEXT ASS'Y	QTY
PART USED ON	

SYM	REVISION	DATE

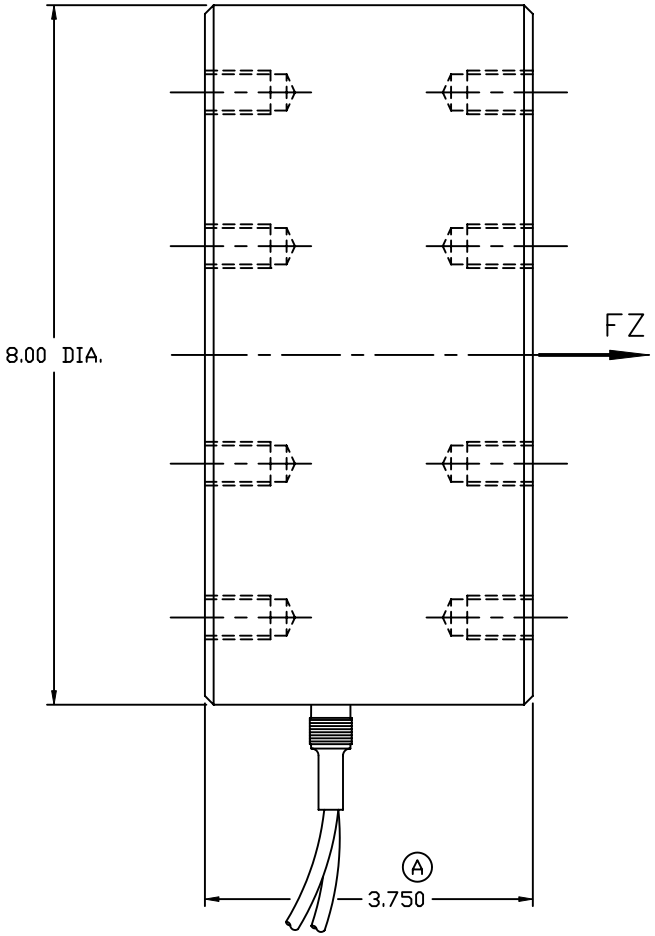
SIX CHANNEL LOAD CELL

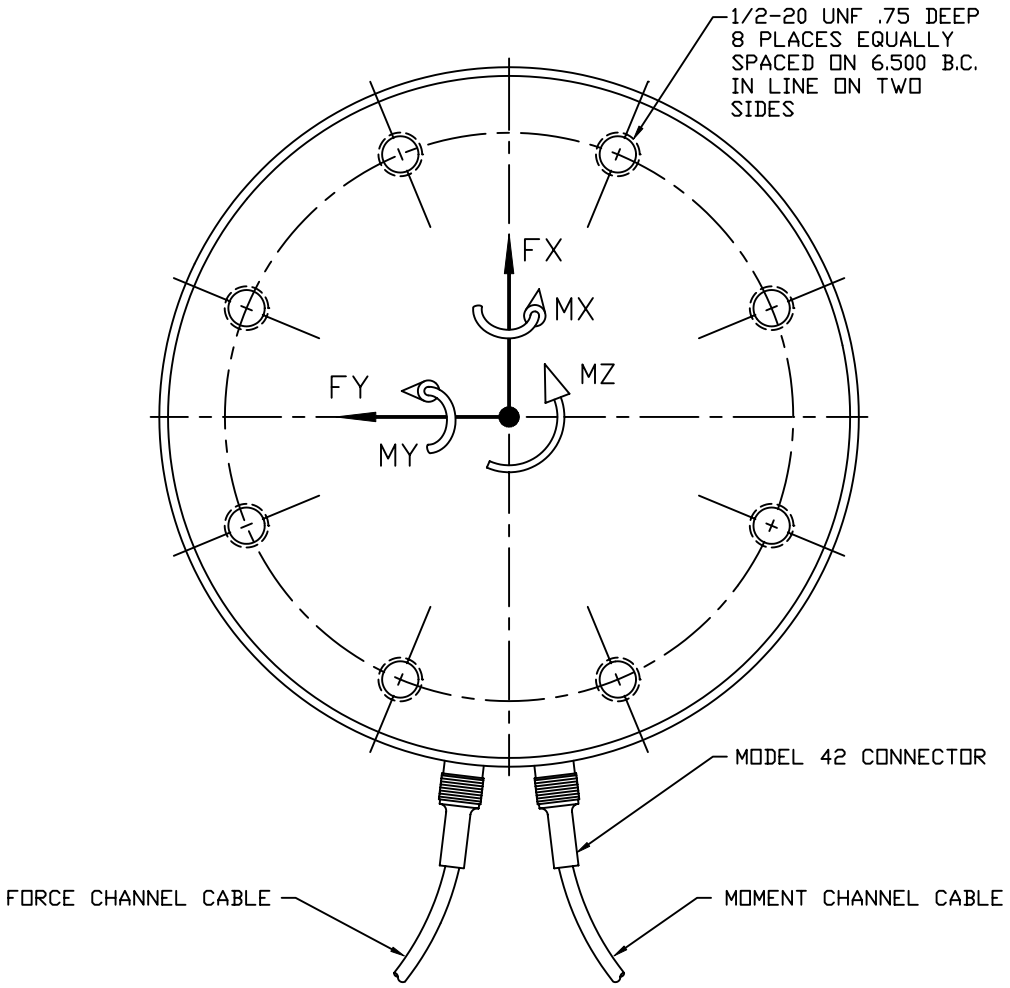
SCALE: .5X			DRAWN BY: rdupont
DATE: 19JUL99			MODEL: 3100

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125√
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3100-D





SIX CHANNEL LOAD CELL

AXIS	CAPACITY	OUTPUT
FX	10000 LBS.	1.5 mV/V NOM.
FY	10000 LBS.	1.5 mV/V NOM.
FZ	15000 LBS.	1.0 mV/V NOM.
MX	90000 LB*INS	1.5 mV/V NOM.
MY	90000 LB*INS	1.5 mV/V NOM.
MZ	15000 LB*INS	1.0 mV/V NOM.

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE
B	WAS DRG. B-3101	5/99
A	REV. DIM.	3/95

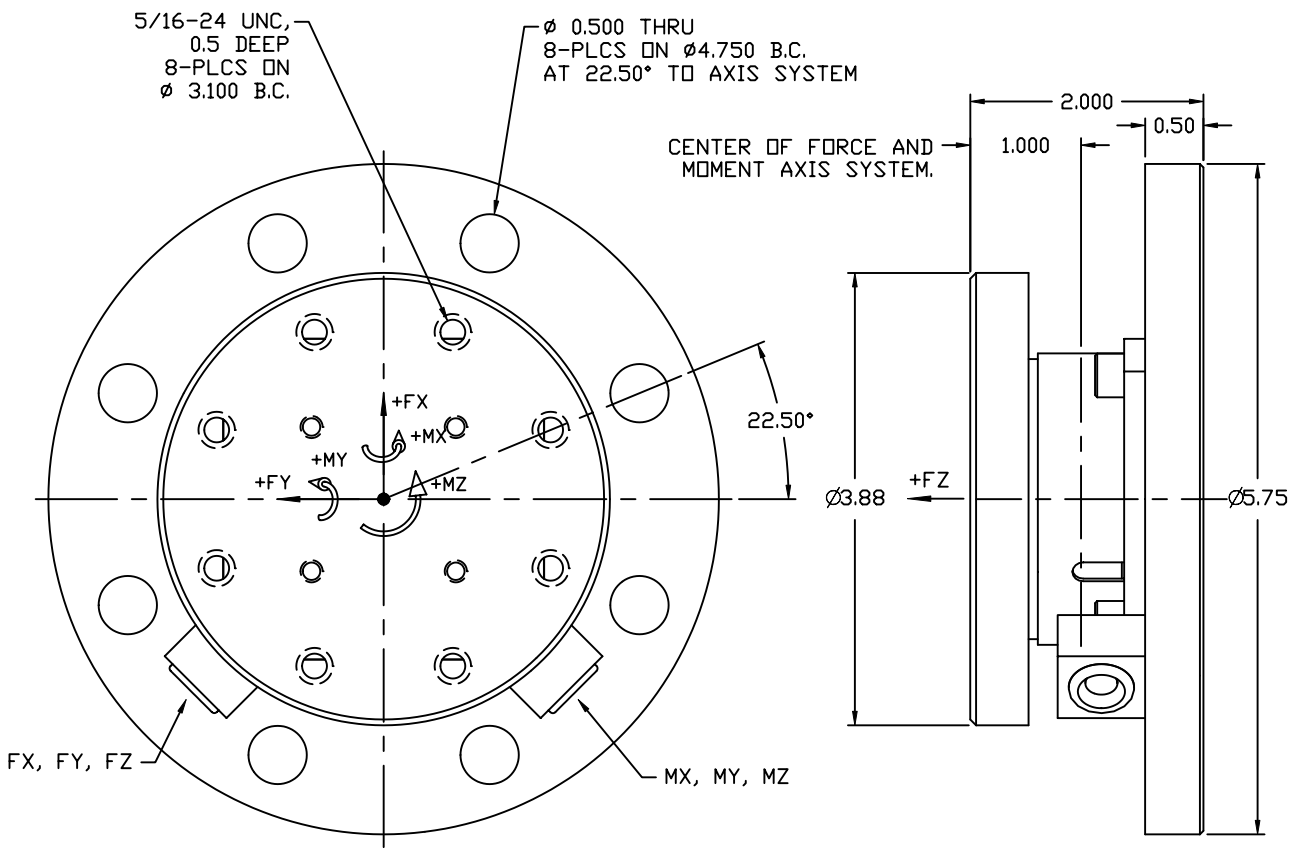
SIX CHANNEL LOAD CELL

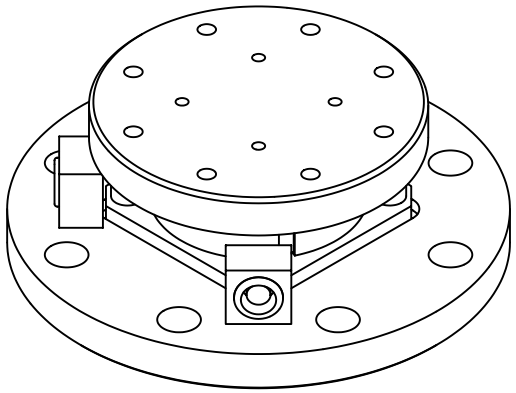
SCALE: .75X
DATE: 27AUG94
DRAWN BY: C.R. MORGAN
MODEL: 3101

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3101-D





6-CHANNEL LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	200 LBF	1.8 mV/V NOMINAL
FY	200 LBF	1.8 mV/V NOMINAL
FZ	500 LBF	0.8 mV/V NOMINAL
MX	500 IN-LBF	1.3 mV/V NOMINAL
MY	500 IN-LBF	1.3 mV/V NOMINAL
MZ	300 IN-LBF	1.3 mV/V NOMINAL

NONLINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

SYM	REVISION	DATE

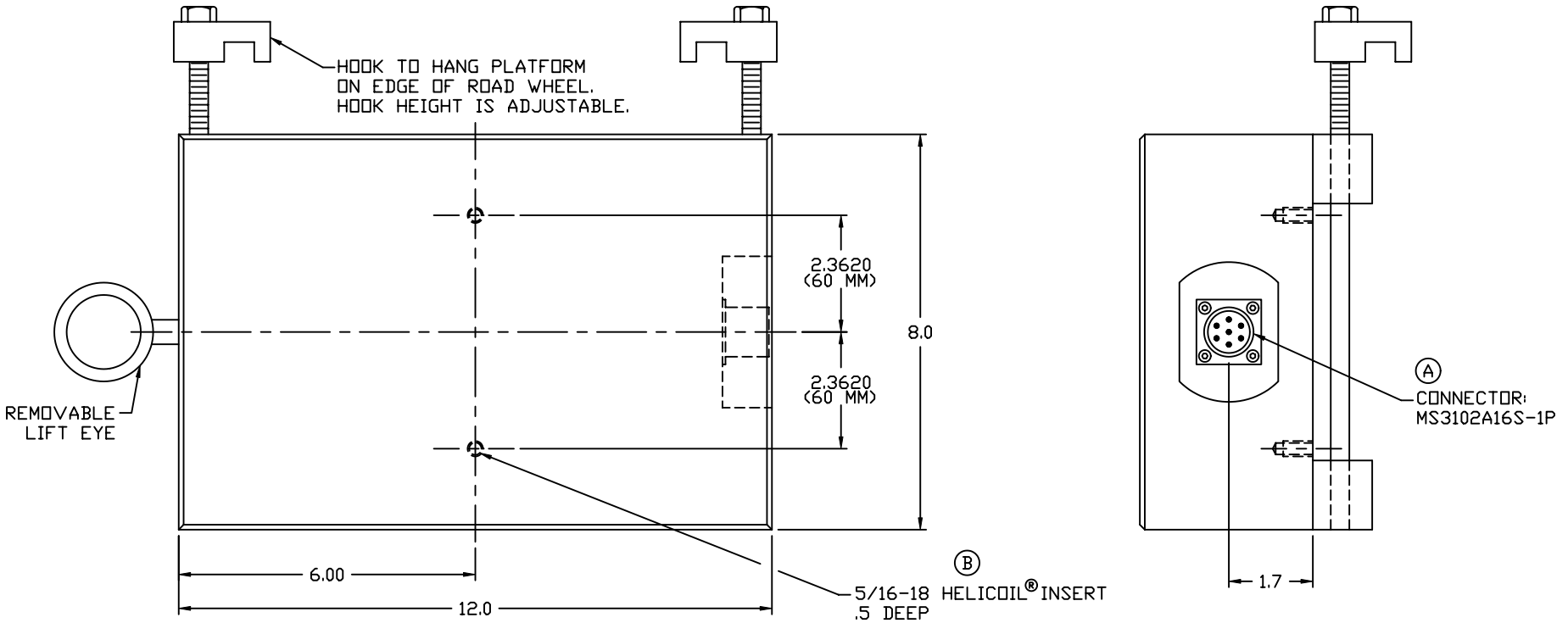
6-CHANNEL LOAD CELL

SCALE: FULL | DRAWN BY: RDUPONT
DATE: 24MAY99 | MODEL: 4386

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4386-D



SPECIFICATIONS

CAPACITY: 4000 LBF
OUTPUT @ CAPACITY: 2mV/V NOMINAL
ACCURACY: ± .15% OF RANGE MAXIMUM ERROR
BRIDGE RESISTANCE: 350 OHMS NOMINAL

SYM	REVISION	DATE
C	WAS DRG. B-3632	6/99
B	INSERT NOTE	8/96
A	CONN. RECESS	8/96

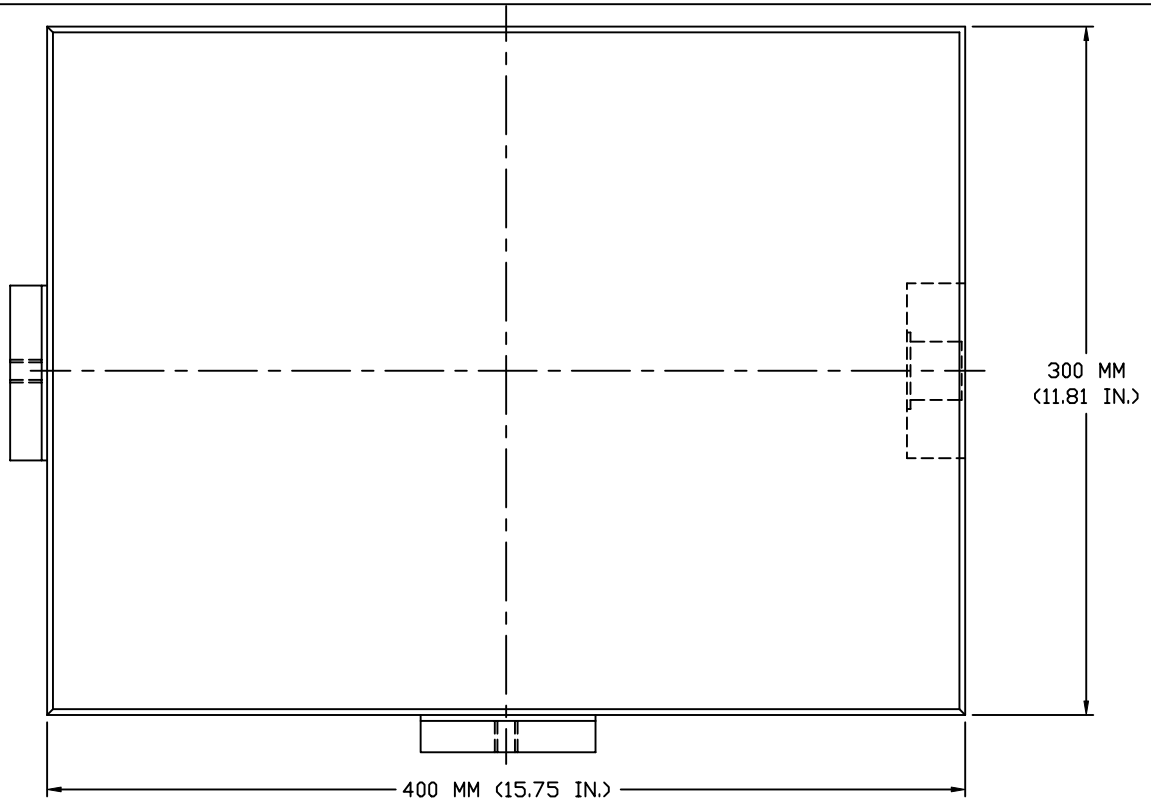
LOAD PLATE - 4000 LBF

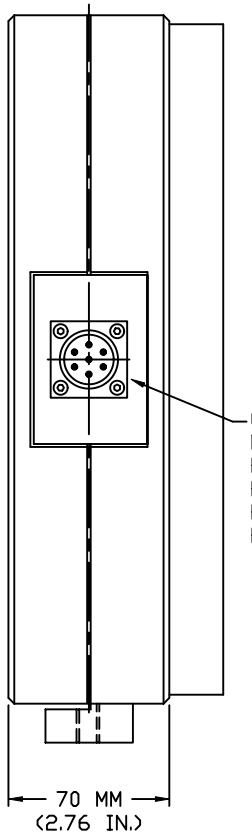
SCALE: .5X
DATE: 8AUG96
DRAWN BY: C.R. MORGAN
MODEL: 3632

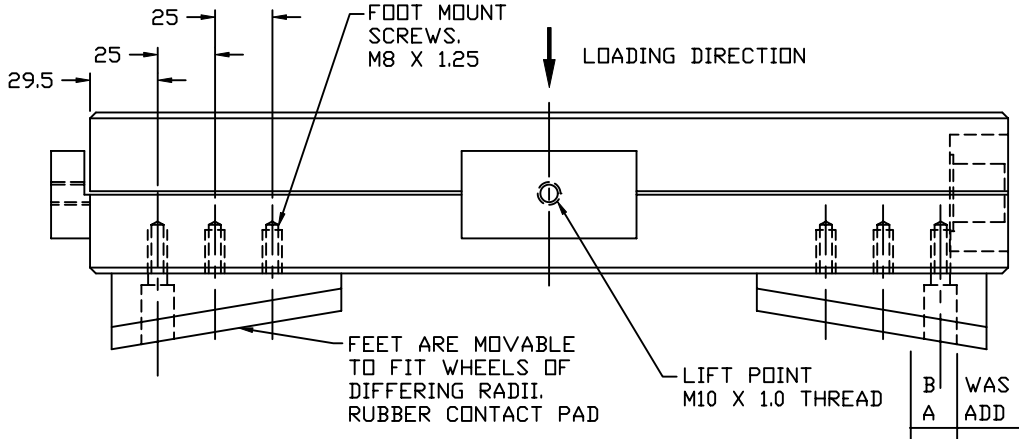
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3632-D







SPECIFICATIONS

CAPACITY: 5000 KG
OUTPUT @ CAPACITY: 2mV/V NOMINAL
ACCURACY: ± .15% OF RANGE MAXIMUM ERROR
BRIDGE RESISTANCE: 350 OHMS NOMINAL
PLATFORM WEIGHT: ~50 LBS.

SYM	REVISION	DATE
B	WAS DRG. B-3580	5/99
A	ADD DETAILS	1/97

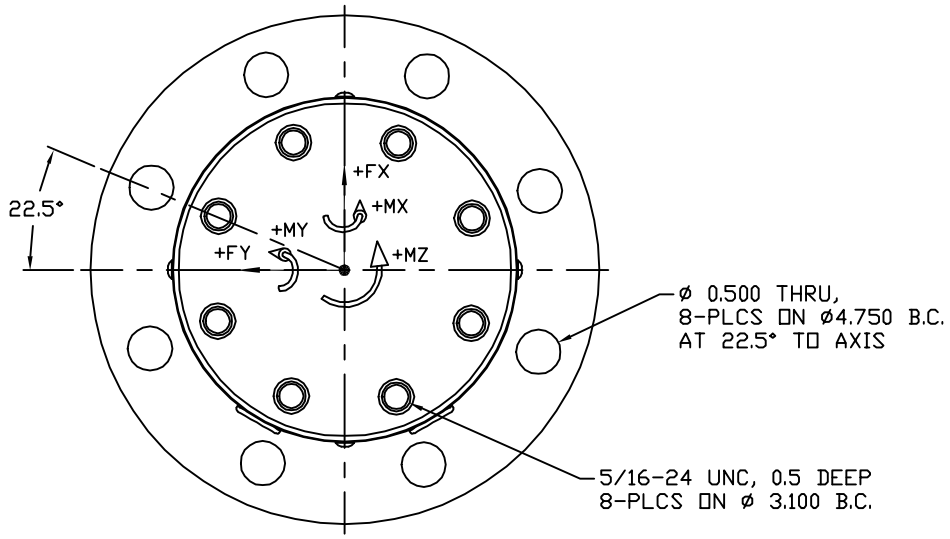
LOAD PLATE - 5000 KG

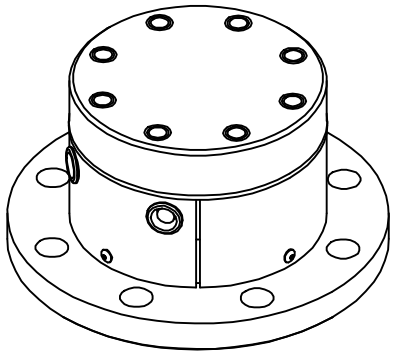
SCALE: .5X		DRAWN BY: C.R. MORGAN
DATE: 12AUG96		MODEL: 3580

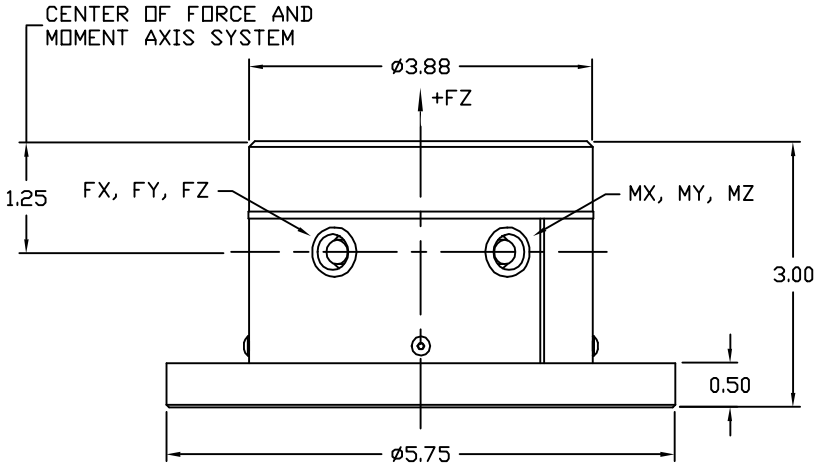
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3580-D







6-CHANNEL LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	1000 LBF	1.3 mV/V NOMINAL
FY	1000 LBF	1.3 mV/V NOMINAL
FZ	2500 LBF	1.3 mV/V NOMINAL
MX	3000 IN-LBF	1.5 mV/V NOMINAL
MY	3000 IN-LBF	1.5 mV/V NOMINAL
MZ	1800 IN-LBF	1.5 mV/V NOMINAL

NON-LINEARITY < 1% OF FULL SCALE
CROSSTALK < 5% OF FULL SCALE

4526	1
NEXT ASS'Y	QTY
PART USED ON	

SYM	REVISION	DATE

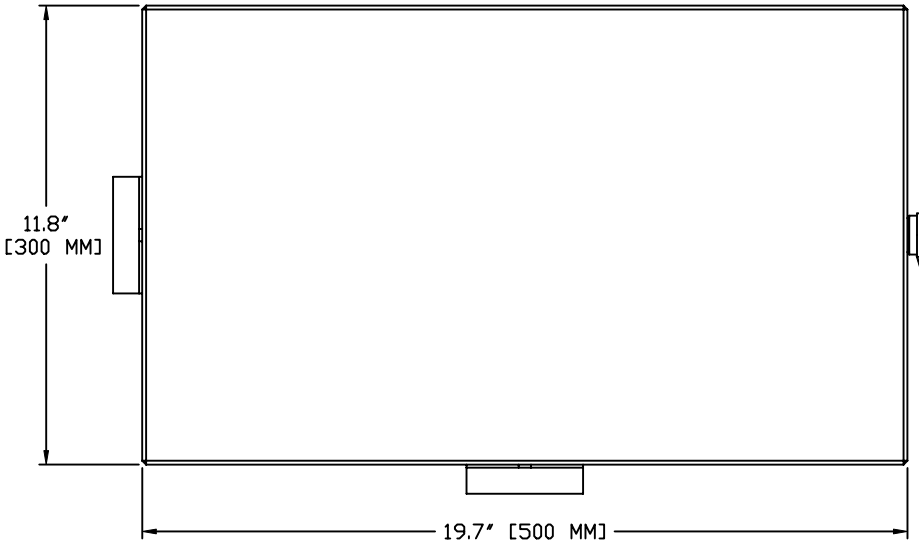
6-CHANNEL LOAD CELL

SCALE: .75X		DRAWN BY: rdupont
DATE: 22OCT99		MODEL: 4526

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

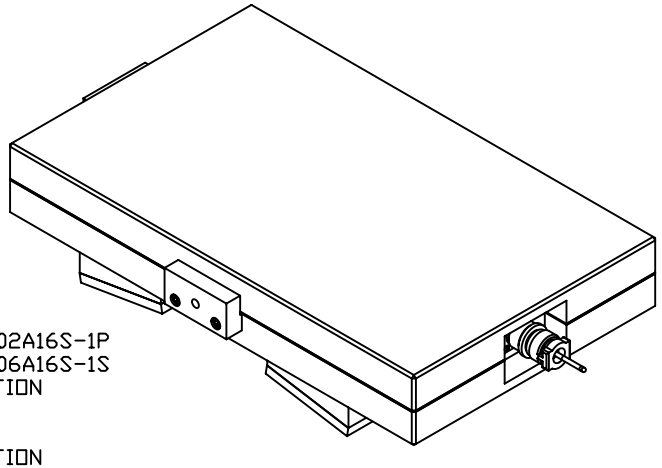
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4526-D



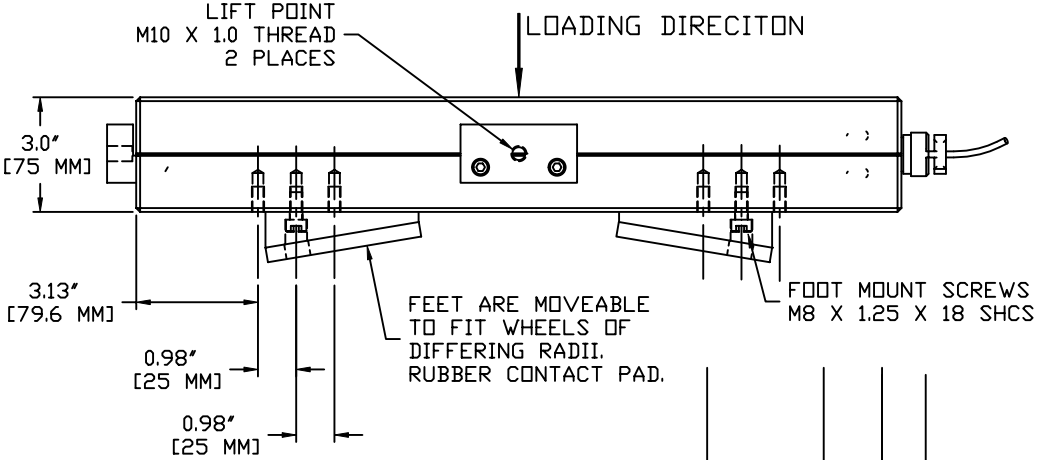
SPECIFY CABLE
LENGTH WHEN
PLACING ORDER

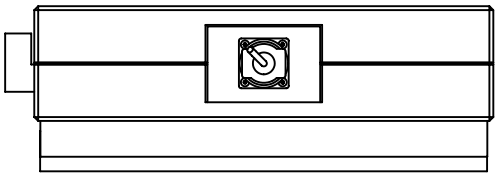
CONNECTOR:
RECEPTACLE MS3102A16S-1P
PLUG MS3106A16S-1S
PIN A + EXCITATION
PIN B + OUTPUT
PIN C - OUTPUT
PIN D - EXCITATION



SPECIFICATIONS

CAPACITY: 8000 KG
OUTPUT @ CAPACITY: 2mV/V NOMINAL
ACCURACY: ± .15% OF RANGE MAXIMUM ERROR
BRIDGE RESISTANCE: 350 OHMS NOMINAL
PLATFORM WEIGHT: ~88 LBS.





NEXT ASS'Y	QTY
PART USED ON	

8000 KG PLATFORM LOAD CELL

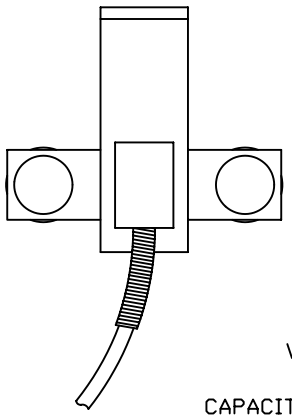
SCALE:	1/3		DRAWN BY: P. DEPINET
DATE:	22SEP99		MODEL: 4433

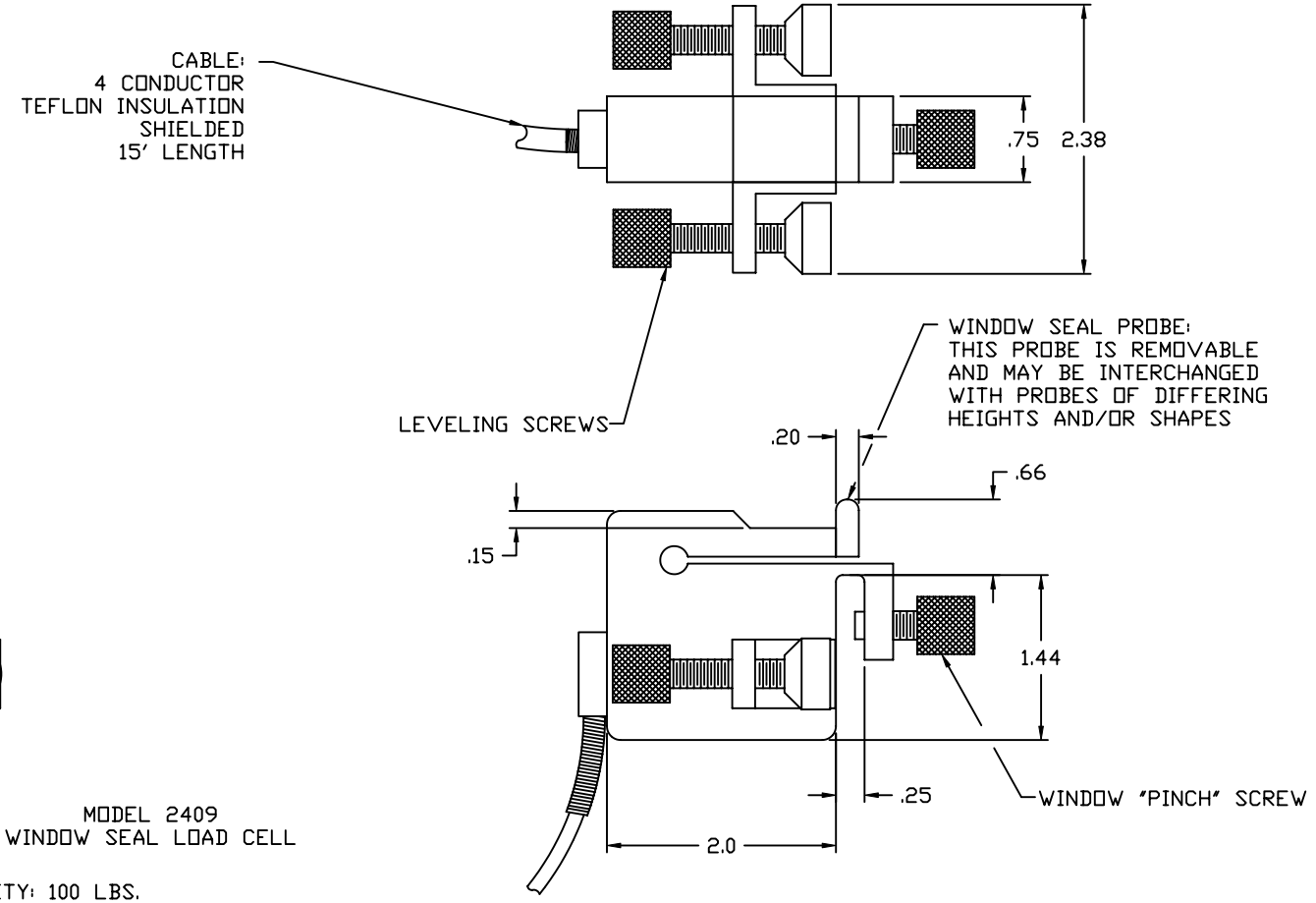
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4433-D





MODEL 2409
WINDOW SEAL LOAD CELL

CAPACITY: 100 LBS.
OUTPUT AT CAPACITY: 2.0 mV/V NOMINAL
NONLINEARITY: < .5% OF FULL SCALE

SYM	REVISION	DATE
C	ADDED SPRING	7/99
B	WAS DRG. B-2409	7/99
A	REDRAWN	12/92

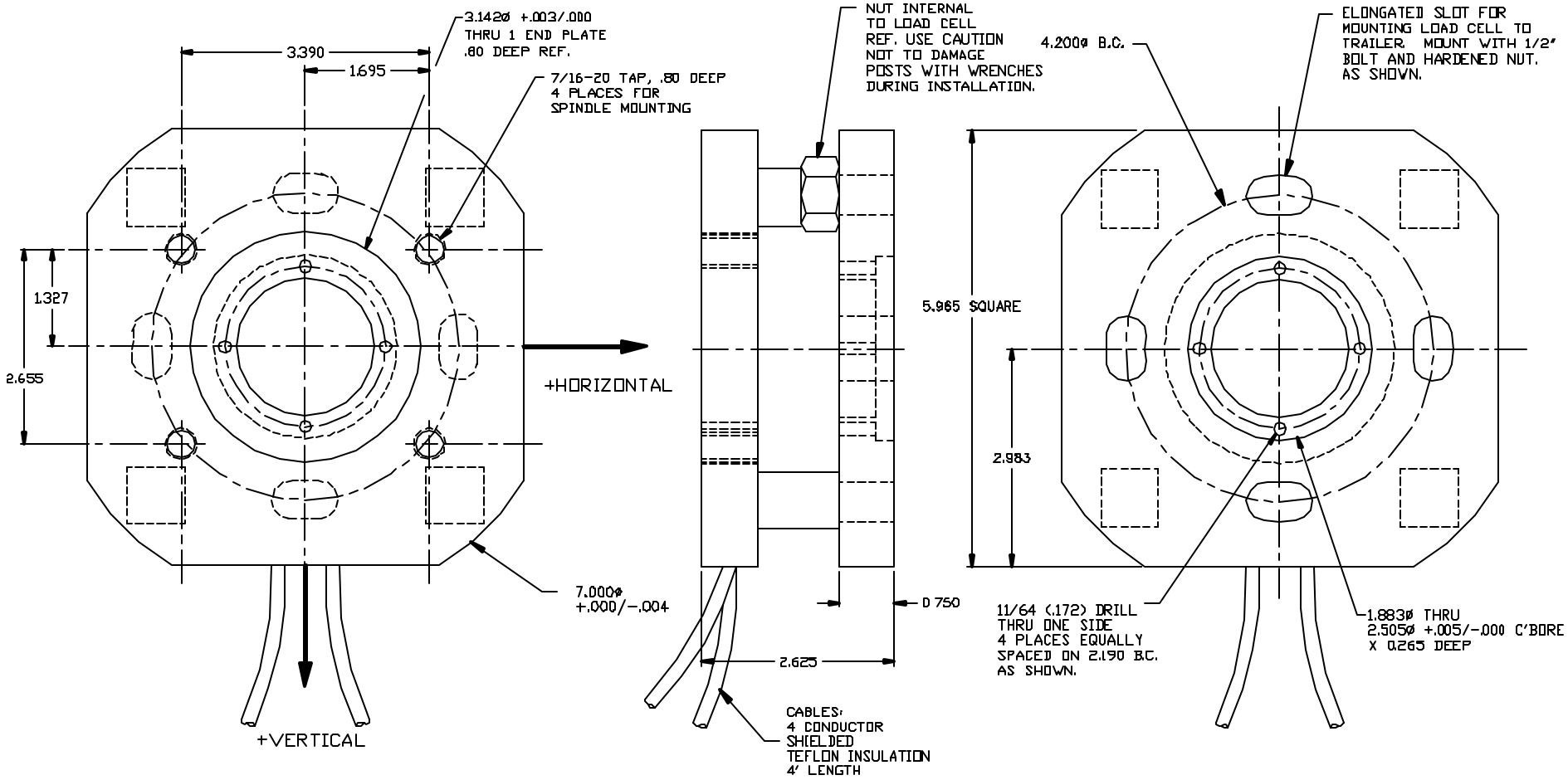
WINDOW SEAL FORCE LOAD CELL

SCALE: FULL
DATE: 7/30/90
DRAWN BY: C.R. MORGAN
MODEL: 2409

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2409-D



TRACTION LOAD CELL

AXIS	CAPACITY	OUTPUT
FX (HORIZONTAL)	2000 LBF.	.6 mV/V NOMINAL
FZ (VERTICAL)	2000 LBF.	.6 mV/V NOMINAL

NONLINEARITY < .25% OF FULL SCALE
HYSTERESIS < .25% OF FULL SCALE
CROSSTALK < 3% OF FULL SCALE

SYN	REVISION	DATE
A	WAS C-2527	9/99

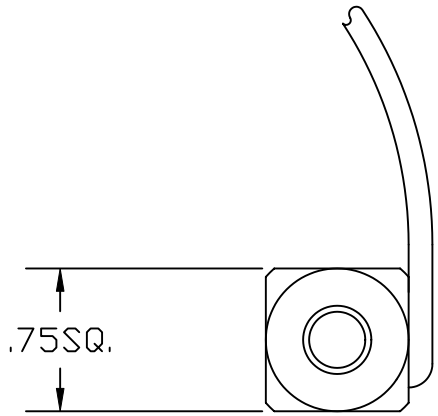
SKID TRAILER LOAD CELL

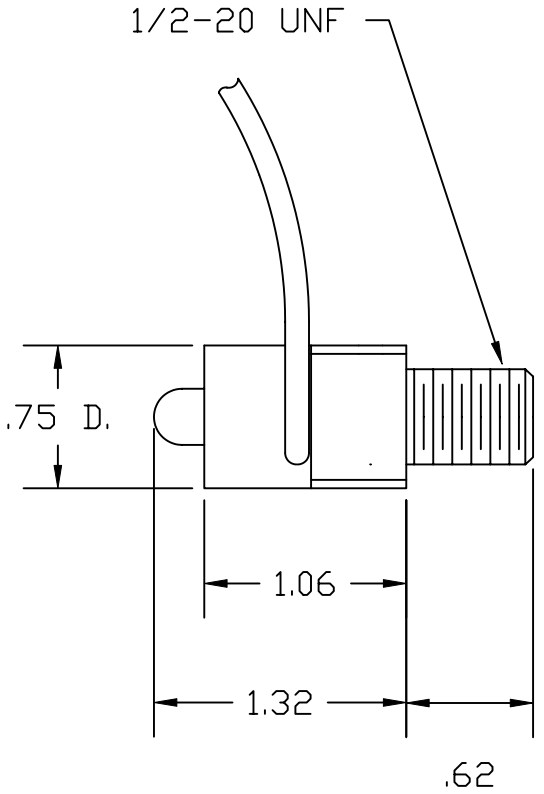
SCALE: FULL | DRAWN BY: CRM
DATE: 5JUNE95 | MODEL: 2527

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2527-D





CAPACITY: 1000 LBS.
OUTPUT: 2mV/V NOM.
@ CAPACITY
TEMPERATURE COMPENSATED
NONLINEARITY <1% OF FULL SCALE

COMPRESSION LOAD CELL

SCALE: FULL			DRAWN BY:
DATE: 12/5/91			MODEL: 2571

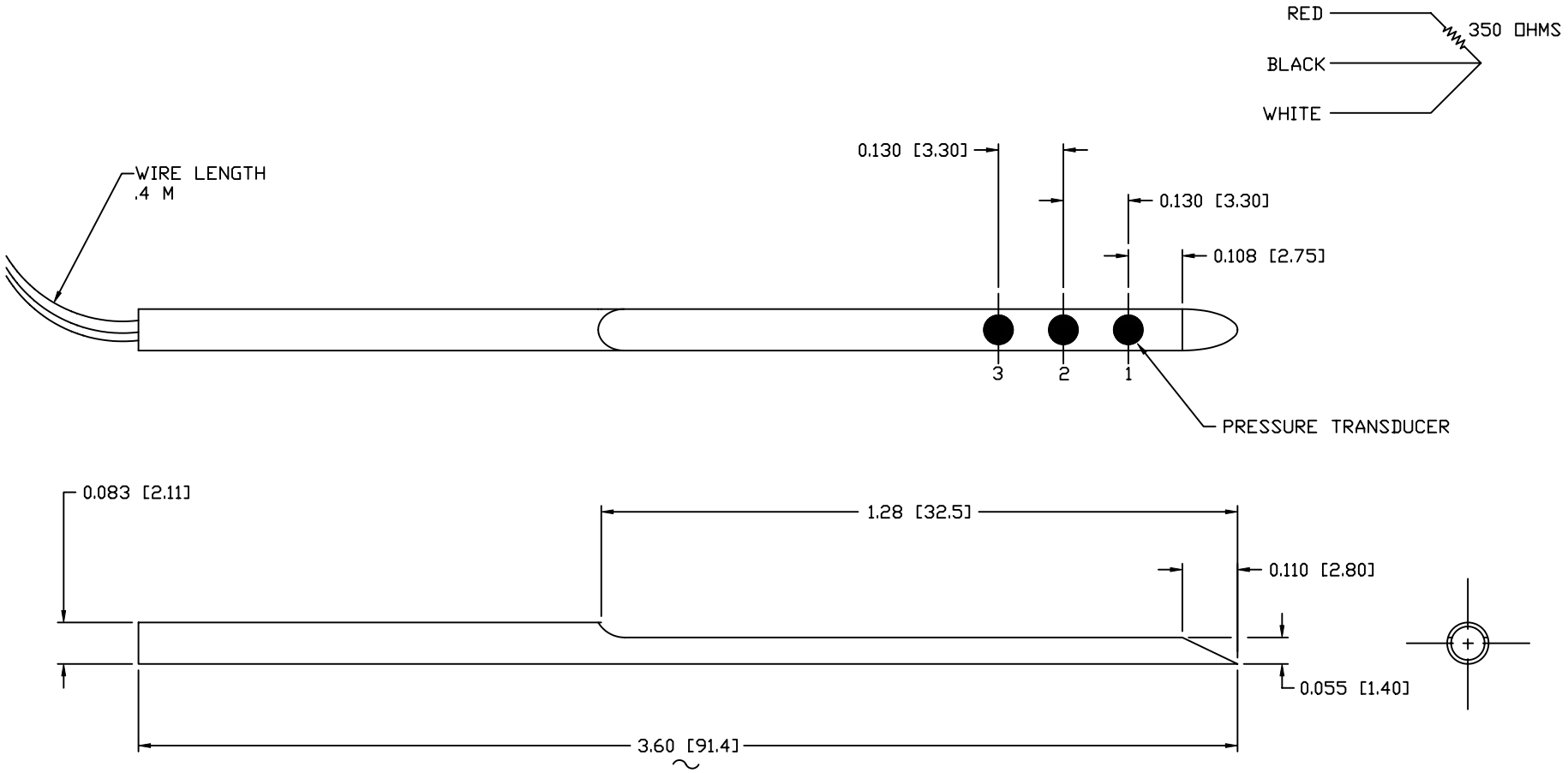
UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30′		DIMENSION LIMITS HELD AFTER PLATING

SYM	REVISION	DATE
A	WAS DRG. A-2571	7/99

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-2571-D



NOTES:
1. MATERIAL: .083 DIA. (14 GA.) STAINLESS STEEL
2. CAPACITY: 200 PSI
   OUTPUT @ CAPACITY: .5 mV/V NOMINAL
   BRIDGE RESISTANCE: 350 OHMS
   1/4 BRIDGE CONFIGURATION

NEEDLE - 3 SENSORS

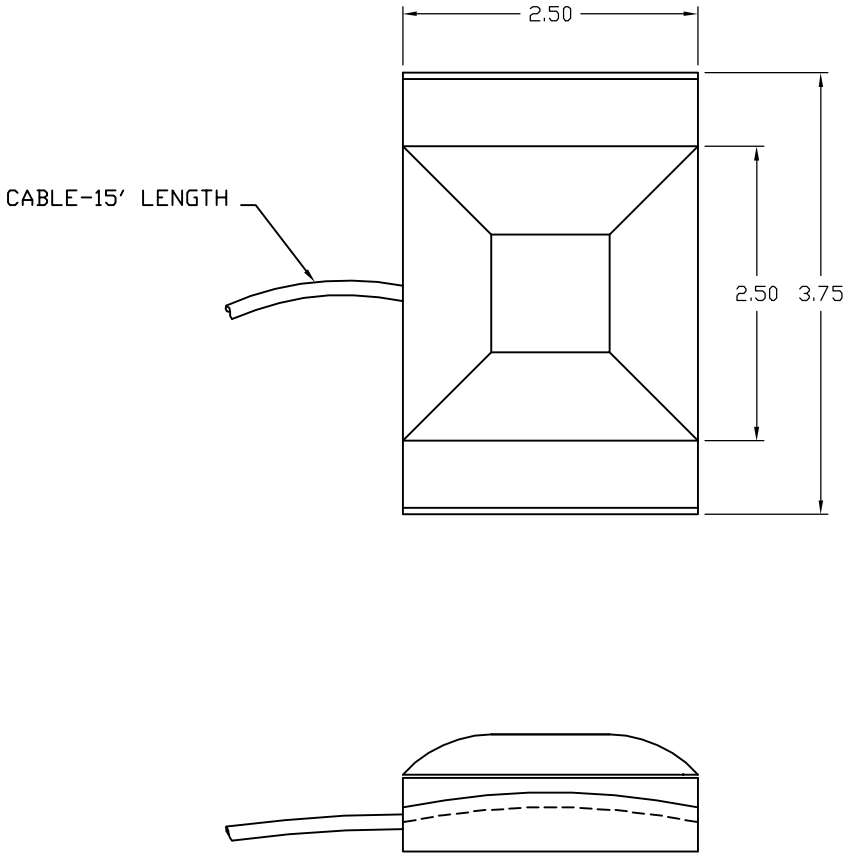
SCALE: 5X			DRAWN BY: C.R. MORGAN
DATE: 1/8/93			MODEL: PTR

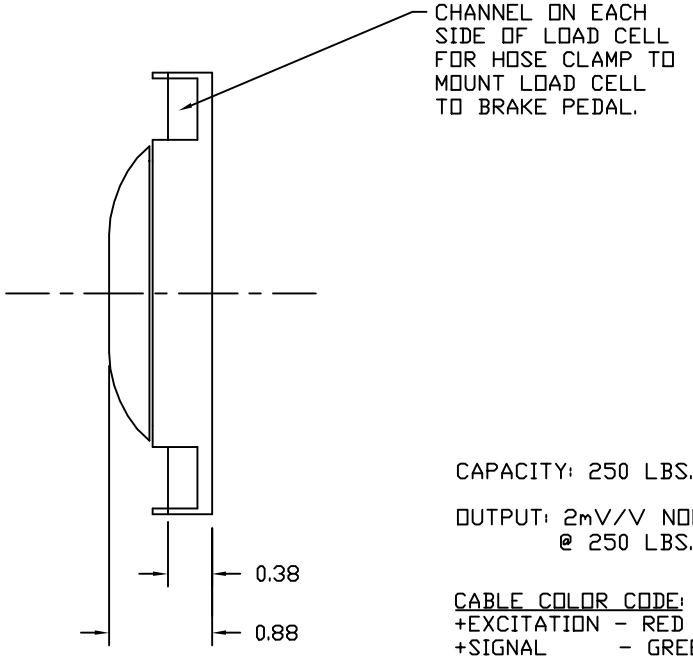
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-2993-D

SYM REVISION DATE





CAPACITY: 250 LBS.

OUTPUT: 2mV/V NOM.
@ 250 LBS.

CABLE COLOR CODE:
+EXCITATION - RED
+SIGNAL - GREEN
-EXCITATION - BLACK
-SIGNAL - WHITE

LOAD CELL SPECIFICATIONS:
1. NON-LINEARITY < .15% OF FULL SCALE.
2. HYSTERESIS < .15% OF FULL SCALE.
3. BRIDGE RESISTANCE < 700 OHMS NOMINAL.
4. ZERO BALANCE < 1% OF FULL SCALE.
5. COMPENSATED TEMPERATURE 70°F TO 170°F.
6. OPERATING TEMPERATURE -40°F TO 200°F.
7. RECOMMENDED EXCITATION 10VDC, 15V MAX.

SYM	REVISION	DATE
C	ADD SPECS.	4/00
B	UPDATE BASE	4/00
A	WAS B-3346	11OCT99

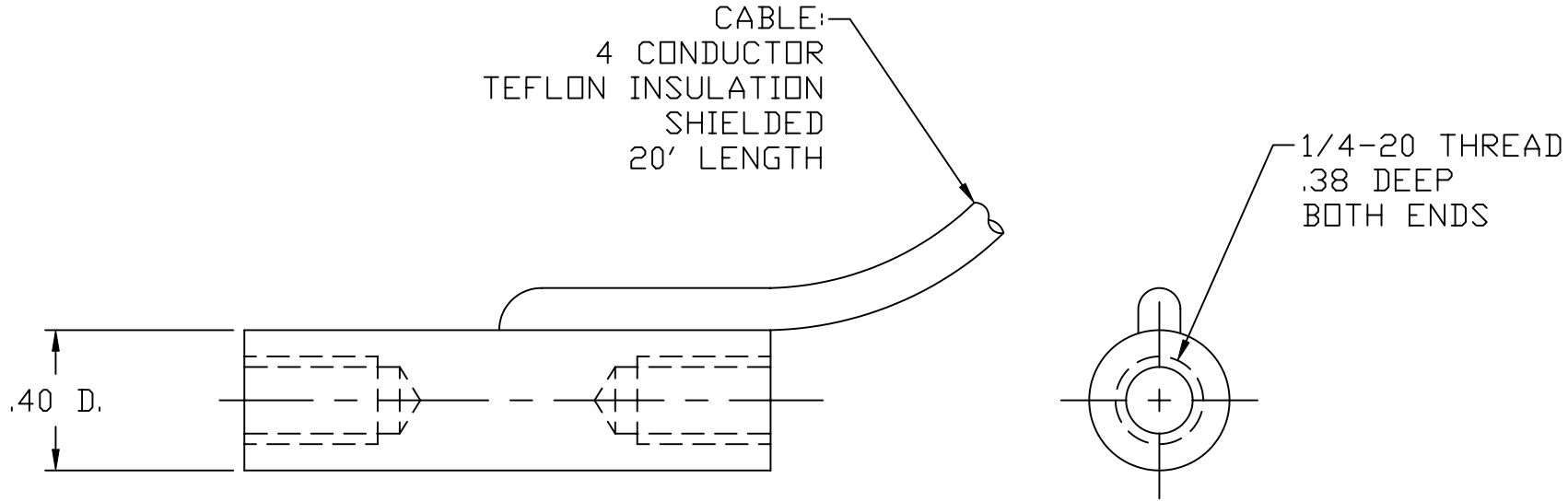
PEDAL FORCE LOAD CELL

SCALE: FULL
DATE: 26JULY95
DRAWN BY: P. M. LUKENS
MODEL: 3346

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3346-D



TENSION LOAD CELL
CAPACITY: 1000 LBF
OUTPUT @ CAPACITY: 1.3 mV/V NOMINAL
NONLINEARITY: <.5% OF FULL SCALE

1 K TENSION LOAD CELL

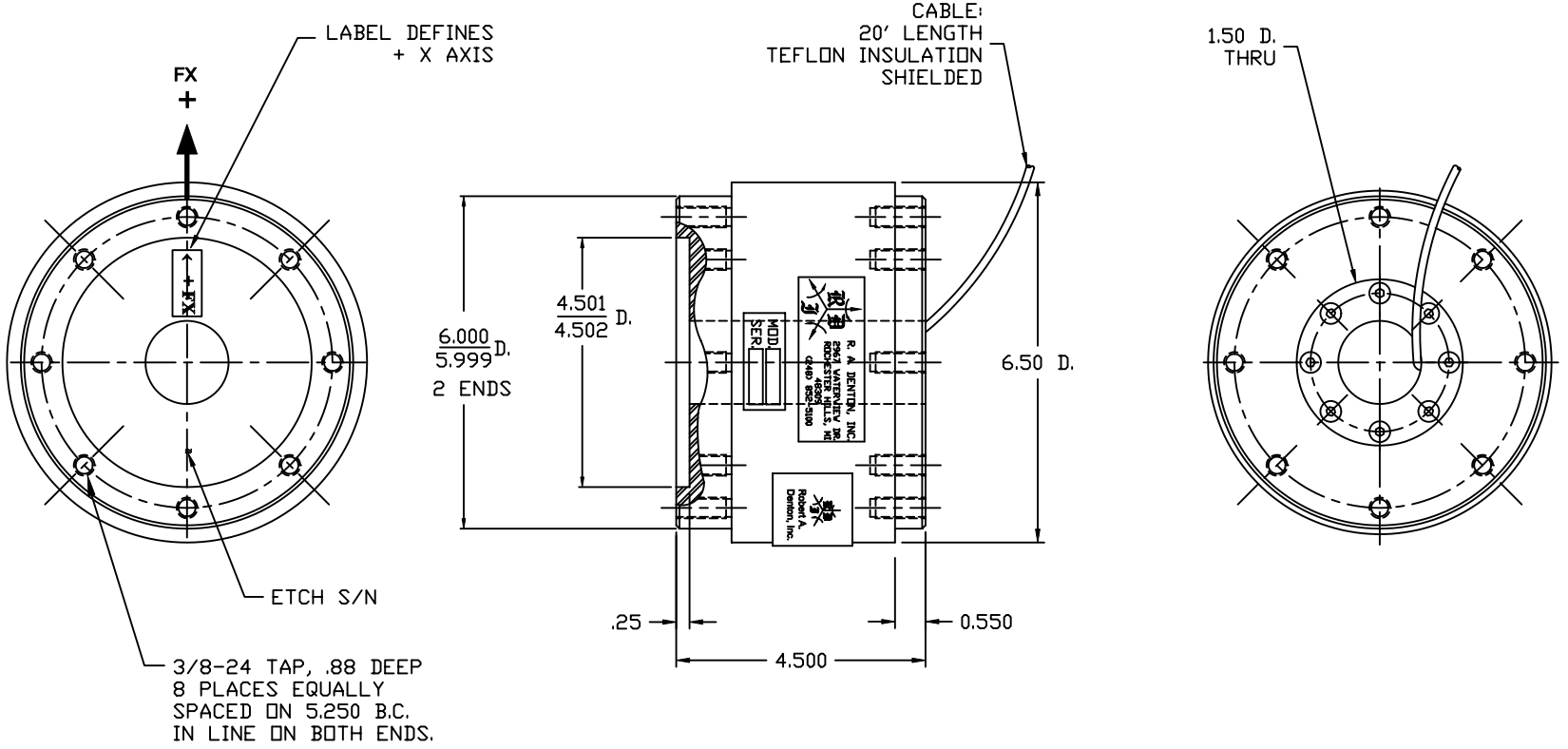
SCALE: 2X		DRAWN BY: *C.R. MORGAN*
DATE: 23MAY96		MODEL: 3555

UNLESS OTHERWISE SPECIFIED

TWO PLACE DECIMALS	± .010	SURFACE FINISH 125
THREE PLACE DECIMALS	± .005	REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30'		DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: A-3555-D



MODEL 3845 ROLLING RESISTANCE LOAD CELL
CAPACITY: 400 LBF.
OUTPUT @ CAPACITY: 2mV/V NOMINAL
NON-LINEARITY < .1% OF FULL SCALE
HYSTERESIS < .2% OF FULL SCALE
CROSSTALK< .1% OF FULL SCALE FROM 5000 IN-LB.
MX OR 4000 LBF. FZ
TEMPERATURE EFFECT ON ZERO ±.01%OF FULL SCALE/℃
TEMPERATURE EFFECT ON SPAN ±.01%OF READING/℃

NEXT ASS'Y	QTY
PART USED ON	

SYM	REVISION	DATE
B	DRWG# WAS B-3845	6/99
A	TEMP. LABEL NOTES	5/99

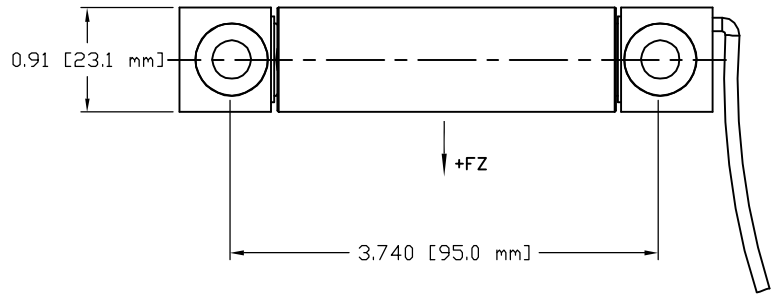
ROLLING RESISTANCE LOAD CELL

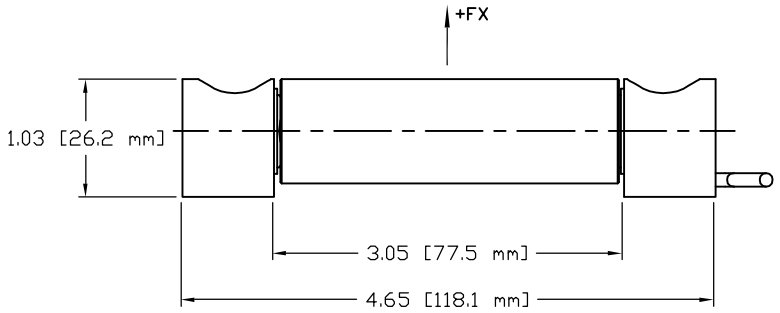
SCALE: .5X
DATE: 10OCT98
DRAWN BY: C.R. MORGAN
MODEL: 3845

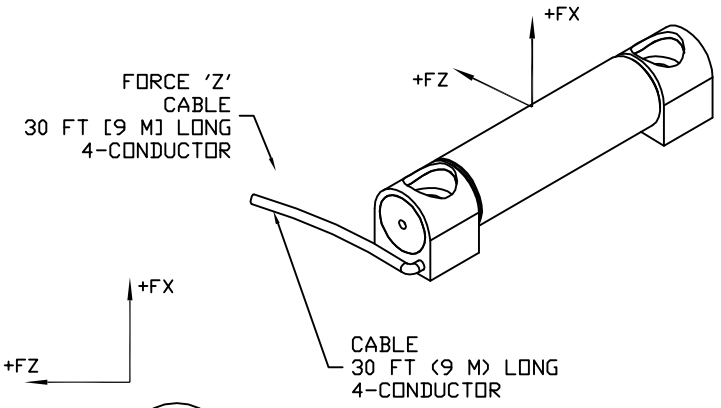
UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

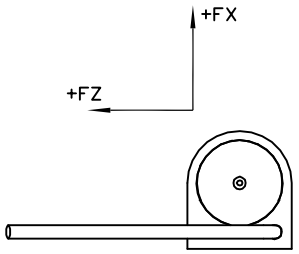
ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-3845-D









MODEL 4438

SHOULDER BELT ANCHOR LOAD CELL

AXIS	CAPACITY	OUTPUT @ CAPACITY
FX	5000 LBS (22 kN)	2.2 VOLTS NOMINAL
FZ	5000 LBS (22 kN)	2.2 VOLTS NOMINAL

COLOR CODE
RED: +POWER (+12VDC NOMINAL)
BLACK: GROUND (POWER AND SIGNAL)
GREEN: FZ CHANNEL OUTPUT
WHITE: FX CHANNEL OUTPUT

CAUTION:

THE MODEL 4438 CONTAINS AN INTERNAL AMPLIFIER.
ATTACHMENT OF THE OUTPUT LINES TO THE INPUT VOLTAGE WILL PERMANENTLY DAMAGE THE AMPLIFIER.

SYM	REVISION	DATE

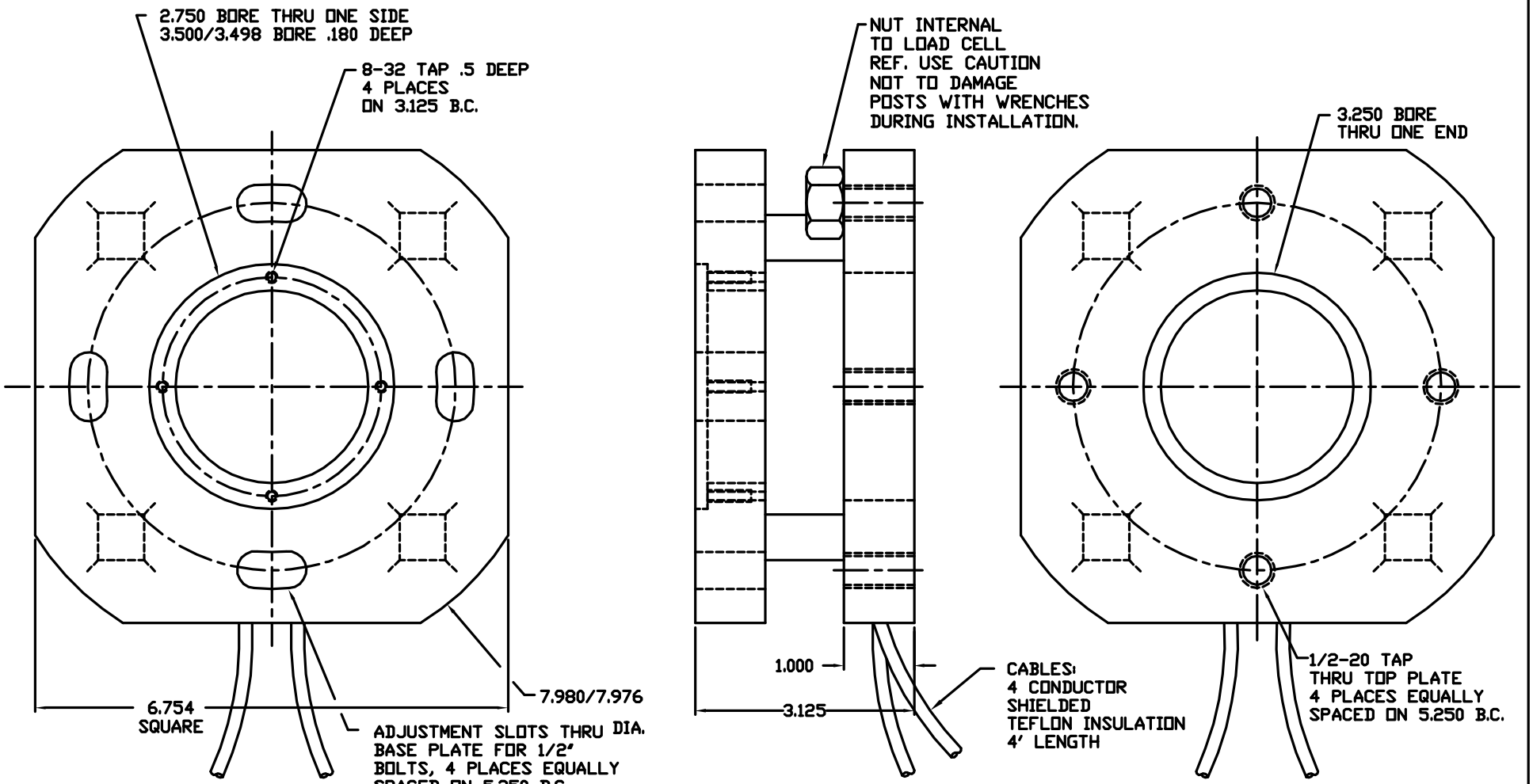
SHOULDER BELT ANCHOR

SCALE: FULL
DATE: 15JUN99
DRAWN BY: RDUPONT
MODEL: 4438

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010
THREE PLACE DECIMALS ± .005
ANGLES ± 0° 30'
SURFACE FINISH 125
REMOVE ALL BURRS & SHARP EDGES
DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4438-D



TRACTION LOAD CELL

AXIS	CAPACITY	OUTPUT
FX (HORIZONTAL)	4000 LBF.	.6 mV/V NOMINAL
FZ (VERTICAL)	4000 LBF.	.6 mV/V NOMINAL

NONLINEARITY < .3% OF FULL SCALE
HYSTERESIS < .3% OF FULL SCALE
CROSSTALK < 3% OF FULL SCALE

SYM	REVISION	DATE
A	WAS MODEL 3038	10/99

4K SKID TRAILER LOAD CELL

SCALE: NONE | DRAWN BY: CRM
DATE: 13OCT99 | MODEL: 4548

UNLESS OTHERWISE SPECIFIED
TWO PLACE DECIMALS ± .010 SURFACE FINISH 125
THREE PLACE DECIMALS ± .005 REMOVE ALL BURRS & SHARP EDGES
ANGLES ± 0° 30' DIMENSION LIMITS HELD AFTER PLATING

ROBERT A. DENTON, INC.
ROCHESTER HILLS, MICHIGAN

DRAWING NUMBER: B-4548-D

Hybrid II 50th Percentile Male

H-II50M (Model SA-150-M002)

The Hybrid II 50th Percentile Adult Male Test Dummy was developed by General Motors in 1972 to assess lap/shoulder belt systems. The Hybrid II was the first dummy designed to achieve acceptable repeatability and good durability.

The Hybrid II mimics the size, shape, and limb ranges of motion of the 50th percentile adult male. In 1973 it became the first dummy to be specified in the Federal Motor Vehicle Safety Standard (FMVSS) 208 for compliance testing of vehicles equipped with passive restraints.

The Hybrid II 50th Percentile Adult Male is constructed of an internal superstructure (bones) made from a variety of materials, including steel, aluminum, brass, delrin, and a number of complex castings. The outer covering is made of an engineered vinyl or a combination of vinyl and foam materials. Denton ATD, Inc. manufactures the Hybrid II in accordance with the requirements of the official NHTSA approved drawing package.

The Hybrid II 50th Percentile Male ATD is specified under Title 49 CFR 572, Subpart B

The calibration tests performed prior to shipment include:

- Head Drop
- Neck Flexion
- Thorax Impact
- Lumbar Flexion
- Knee Impact

Standard equipment included in the base price of this device:

- Accelerometer mounts for head and chest *
- Structural replacements for all load cells.

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds (lbs.)	Kilograms
Head	11.2	5.1
Upper Torso	41.5	18.9
Lower Torso	35.9	16.3
Upper Arm	4.8	2.2
Lower Arm & Hand	4.8	2.2
Upper Leg	18.4	8.4
Lower Leg & Foot	9.7	4.4
Total Weight	**164**	**74.6**

DIMENSIONS:	Inches	Centimeters
Head Circumference	22.5	57.2
Head Width	6.1	15.5
Head Length	7.7	19.6
Shoulder to Shoulder	18.1	45.5
Shoulder Pivot Height	22.1	56.1
Buttock to Knee Pivot	20.4	51.8
Knee Pivot Height	19.6	49.8
Sitting Height	**35.7**	**90.7**

Denton ATD, Inc. 10317 U.S. Highway 250 North, Milan, Ohio 44846-9570
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Creating the New Standard in ATDs

Revision: 01/29/03

Hybrid III 5th Percentile Female

H-III5F (Model 880105-000)

The Hybrid III 5th Percentile Female ATD is a smaller scaled version of the Hybrid III 50th Percentile Male ATD. This ATD is used in test situations where the representation is needed for the minimum anthropomorphic dimensions for the adult female population. The Small Female design and test corridors were established by the Society of Automotive Engineers (SAE) for the 5th Percentile representation. In 2000, design revisions of the Small Female improved the it's ability to evaluate airbag dynamics in Out Of Position (OOP) testing. The HIII5F is provided completely tested and certified.

New design features incorporated into the 2000 revision of the Small Female include:

- Modified chest jacket design.
- Upper and lower rib stops.
- Additional accelerometer mounts in the Thoracic Spine and Sternum for V*C measurement capabilities.
- Cable bushings added to the lumbar spine and neck.
- 45 degree feet with ankle bumpers and heel pads.
- Modified femurs with bumpers.

The Hybrid III-5th Percentile Female ATD is specified under Title 49 CFR Part 572, Subpart O.

The calibration tests performed prior to shipment include:

- Head Drop
- Neck Flexion and Extension
- Thorax Impact
- Torso Flexion
- Knee Impact and Knee Slider

Standard equipment included in the base price of this device:

- Chest Deflection Potentiometer
- Knee Slider Potentiometers
- Accelerometer mounts for head, chest, sternum, thoracic spine and pelvis*
- Structural replacements for all load cells.

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds (lbs.)	Kilograms
Head	8.23	3.74
Neck	2.00	0.91
Upper Torso	26.50	12.05
Lower Torso	29.20	13.27
Upper Arm	2.60	1.18
Lower Arm w/ Hand	2.60	1.18
Upper Leg	6.90	3.14
Lower Leg w/ Foot	8.95	4.06
Total Weight	**108.03**	**49.00**

DIMENSIONS:	Inches	Centimeters
Head Circumference	21.20	53.85
Head Breadth	5.60	14.22
Head Depth	7.20	18.29
Buttock to Knee Length	21.00	53.34
Knee Pivot Height	16.00	40.64
Hip Pivot From Backline	5.80	14.73
Hip Pivot Height	3.30	8.38
Sitting Height	**31.00**	**78.74**

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Revision: 01/29/03

Hybrid III 50th Percentile Male

H-III50M (Model 78051-218-R99)

The Hybrid III-50th Percentile Male ATD was developed by General Motors Corporation under NHTSA contract beginning in 1973. This development program was undertaken to improve the impact response of the test dummy to more closely approximate that of humans, based upon the biomechanical data available.

Having nearly twenty years of test and evaluation history behind it, the Hybrid III-50th Percentile Male ATD can accommodate a wide range of instrumentation and transducers. Optional equipment is available from, literally, the head to the feet, making this device one of the most versatile test devices for compliance testing, research and development, or aerospace applications. It is the test device of choice for FMVSS 208 testing.

The Hybrid III 50th Percentile Male ATD is specified under Title 49, CFR Part 572, Subpart E.

The calibration tests performed prior to shipment include:

- Head Drop
- Neck Flexion and Extension
- Thorax Impact
- Knee Impact and Knee Slider
- Hip Joint Range of Motion
- Foot Compression

Standard equipment included in the base price of this device:

- Chest Deflection Potentiometer
- Knee Slider Potentiometers
- Accelerometer mounts for head, chest and pelvis*
- Structural replacements for all load cells.

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds (lbs.)	Kilograms
Head	10.0	4.55
Neck	3.4	1.55
Upper Torso	37.9	17.23
Lower Torso	50.8	23.09
Upper Arm	4.4	2.00
Lower Arm	3.75	1.70
Hand	1.25	0.57
Upper Leg	13.2	6.00
Lower Leg	12.0	5.45
Total Weight	**171.3**	**77.86**

DIMENSIONS:	Inches	Centimeters
Head Circumference	22.5	59.7
Head Breadth	6.1	15.5
Head Depth	7.7	20.3
Buttock to Knee Pivot	23.3	59.2
Knee Pivot Height	19.4	49.5
Hip Pivot From Backline	5.40	13.7
Hip Pivot Height	3.40	8.6
Sitting Height	**34.8 .2**	**88.4**

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Revision: 01/29/03

Hybrid III 95th Percentile Large Male

H-III95M (Model 880995-0000)

The Hybrid III 95th Percentile Large Male ATD is a larger scaled version of the Hybrid III-50th Percentile Male ATD. This dummy is used in test situations where the representation is needed for the maximum anthropomorphic dimensions for the adult male population. The 95th Male design and test corridors were established by the Society of Automotive Engineers (SAE) for the 95th Percentile representation. Although this dummy is not currently specified under Title 49 CFR Part 572, many manufacturers are using this device for research and development studies. FMVSS Standard 202 does require the use of the 95th Percentile for head restraint evaluation to reduce the frequency and severity of neck injury in rear end and other collisions.

New Design features incorporated into the 2002 release of the large male include:

- Neck and Lumbar cable isolation bushing
- 3 Thorax and 3 Sternum accelerometers
- ASIS load cell capability
- Ball Bearing Knee Slider

The Hybrid III-Large Male ATD is tested to the prevailing SAE corridors specified for this device.

The calibration tests performed prior to shipment include:

- Head Drop
- Neck Flexion and Extension
- Thorax Impact
- Knee Impact and Ball Bearing Knee Slider
- Torso Flexion

Standard equipment included in the base price of this device:

- Chest Deflection Device
- Knee Slider Potentiometer
- Accelerometer mounts for head, chest, sternum, thoracic and pelvis*
- Structural replacements for all load cells

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds (lbs.)	Kilograms
Head	10.90	4.94
Neck	3.70	1.68
Upper Torso	49.20	22.32
Lower Torso	66.80	30.30
Upper Arm	6.20	2.81
Lower Arm w/ Hand	5.8	2.06
Upper Leg	18.1	8.21
Lower Leg	12.68	5.75
Foot	3.50	1.59
Total Weight	**223.2**	**101.5**

DIMENSIONS:	Inches	Centimeters
Head Circumference	22.5	57.15
Head Breadth	6.10	15.49
Head Depth	7.70	19.56
Buttock to Knee Pivot	22.4	56.90
Knee Pivot Height	21.0	53.34
Hip Pivot from Backline	5.60	14.22
Hip Pivot Height	4.20	10.67
Sitting Height	**36.80**	**93.47**

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Creating the New Standard in ATDs

Revision: 01/29/03

BioSID

(Model 940700-000)

The Biofidelic Side Impact Dummy (BioSID) was developed through the cooperative efforts of the Side Impact Task Force, an SAE Committee. This program was undertaken to improve the impact responses of side impact mannequins by meeting the biofidelity requirements developed by TC22/SC12/WG5. Although not required for certification use under Title 49CFR, Part 571 (214) or 572, the BioSID has proven an effective R&D tool.
The head and torso are from the Hybrid III 50th Percentile Dummy (Part 572). Conversion from left side to right side impact testing is accomplished by rotating the entire upper torso 180 degrees and reconnecting the shoulder block and neck assembly in the forward position. Shoulder, thoracic and abdominal rib assemblies are constructed from a strong steel with damping material applied to the inside of the steels. The pelvis has a zippered skin and flesh unit with crushable foam pelvic inserts. Iliac wings are removable. A straight lumbar spine is used. Similar to the Hybrid II 50th Percentile, the legs have a modified steel block to replace the knee sliders.

The BioSID is tested to prevailing SAE corridors specified for this device.

The calibration tests performed prior to shipment include:

- Head Drop (lateral)
- Neck Pendulum (lateral)
- Thorax Impact (with and without arm)
- Pelvis Impact
- Abdominal Impact
- Shoulder Impact

Standard equipment included in the base price of this device:

- Six (6) String Potentiometers for Ribs
- Accelerometer mounts for head, shoulder ribs, upper, middle and lower thoracic ribs, upper and lower abdominal ribs, upper spine (T1) and lower spine (T12) and pelvis*

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds (lbs.)	Kilograms
Head	10.0	4.6
Neck	3.4	1.5
Upper Torso	56.5	25.7
Lower Torso	46.7	21.2
Upper Leg	13.2	6.0
Lower Leg	12.5	5.7
Total Weight	**168.0**	**76.2**

DIMENSIONS:	Inches	Centimeters
Shoulder Pivot Height	20.2	51.3
H-Point Height	3.75	9.5
Buttock Knee Length	23.3	59.2
Shoulder Width	16.5	41.9
Knee Pivot Height	19.4	49.2
Sitting Height	**34.8**	**88.4**

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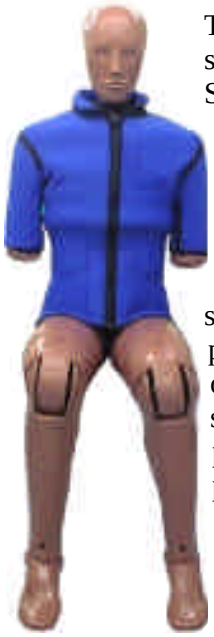
Creating the New Standard in ATDs

Revision: 01/29/03

EuroSID-1

E-SID (Model 960715-000)



The EUROSID-1™ is a Side Impact test device designed to the specifications stated in E.C.E. Regulation No. 95, Annex 6: Technical Description of the Side Impact Dummy. The EUROSID-1™ was developed to evaluate occupant protection during lateral impacts.

The EUROSID-1™ represents a 50th percentile adult male without lower arms. The head is from the Hybrid III 50th percentile dummy (part 572) and the legs are from the Hybrid II. The thorax consists of three identical rib modules which can be assembled in the spine box for either left or right hand side impacts. The abdomen is constructed of a metal casting covered with a polyurethane foam that incorporates curved, weighted rubber slabs. The shape of the pelvic bone is representative of the human pelvis at points impacted in a side impact, and at points where the car seat and the belt interact with the pelvis. The removable iliac wings are constructed of special polyurethane plastic. A straight lumbar is used. The rubber suit covers the thorax, upper arms and lower pelvic region.

The EUROSID-1™ is tested to the prevailing E.C.E. corridors specified for this device.

The calibration tests performed prior to shipment include:

- Head Drop (lateral)
- Neck Pendulum (lateral)
- Shoulder Impact
- Abdominal Impact
- Lumbar Pendulum
- Pelvis Impact
- Rib Assembly Drop

Standard equipment included in the base price of this device:

- Chest Deflection Potentiometers
- Accelerometer mounts for head, T1, T12 and pelvis*
- Structural replacements for all load cells.

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds (lbs.)	Kilograms
Head	7.9 - 9.7	3.6 - 4.4
Neck	2.0 - 2.4	0.9 - 1.1
Thorax	46.1 - 52.7	20.9 - 23.9
Arm	2.6 - 3.1	1.2 - 1.4
Abdomen	9.9 - 12.1	4.5 - 5.5
Pelvis	24.3 - 28.7	11.0 - 13.0
Leg	25.3 - 29.8	11.5 - 13.5
Total Weight	**157.6 - 159.8**	**71.5 - 72.5**

DIMENSIONS:	Inches	Centimeters
Sitting Height	35.3 - 35.9	897 - 911
Seat to Shoulder Joint	21.7 - 22.1	552 - 562
Seat to H-Point	3.8 - 3.9	96 - 100
Seat to Arm	9.3 - 9.7	237 - 247
Buttock Knee Length	23.8 - 24.2	605 - 615
Shoulder / Arm width	18.8 - 19.2	477 - 487
Pelvis Width	13.8 - 14.2	350 - 360
Sole to Seat, Sitting	17.8 - 18.1	451 - 461

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Creating the New Standard in ATDs

Revision: 03/08/02

SID

(Model SA-SID-M001)

The Side Impact Dummy (SID) was originally developed under NHTSA contract to the University of Michigan. This program was undertaken to develop a manikin capable of producing human-like responses when impacted in the lateral direction during an automotive side impact crash. This Title 49 CFR Part 572, Subpart F device is the only ATD specified as meeting the requirements of FMVSS Standard No. 214. (Side Impact Protection).

MAJOR FEATURES:

- The head, neck and neck bracket are from the Hybrid II-50th Percentile Male Test Dummy, Part 572, Subpart B.
- The thorax is totally unique from the bottom of the neck bracket to the top of the lumbar spine.
- The pelvis is modified from the Hybrid II-50th Percentile Male Test Dummy, to make the flesh more uniform on each impacted side.
- The legs are also from the Subpart B Test Dummy with the exception of the link rods which have been modified to incorporate femur posts to permit motion laterally of the knee casting relative to the upper leg.
- The mandatory instrumentation for compliance test include one accelerometer each mounted at the T12 position on the thoracic spine, accelerometers mounted at the top and bottom of the rib bar and an accelerometer mounted in the pelvis.

OPTIONAL EQUIPMENT:

Provisions for optional instrumentation include the mounting of accelerometers in the head and the T1 position. Load cells are available

The calibration tests performed prior to shipment include:

- Head Drop
- Neck Flexion
- Thorax Impact
- Lumbar Flexion
- Pelvis Impact
- Knee Impact
- Damper Impact
- Abdominal Compression

Standard equipment included in the base price of this device:

- Rib Displacement Transducer
- Accelerometer mounts for head, upper and lower torso, upper and lower rib and pelvis*
- Lumbar Spine Bushings for noise reduction

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds (lbs.)	Kilograms
Head	10.0	4.6
Neck	1.9	0.86
Upper Torso	65.2	29.6
Lower Torso	36.9	16.8
Leg Assembly	27.4	12.5
Total Weight	**169.0**	**76.8**

DIMENSIONS:	Inches	Centimeters
Head Circumference	22.5	57.2
Head Width	6.1	15.5
Head Length	7.7	19.6
Buttock to Knee	20.4	51.8
Knee Pivot to Floor	19.6	49.8
Sitting Height	**35.4**	**89.9**

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Creating the New Standard in ATDs

Revision: 01/29/03

SID/HIII

Full ATD (Model 96-SIDH3-M001) Conversion Kit (Model 96-SIDH3-KIT)

The SID/HIII, a combination of the SID and the Hybrid III 50th, was adopted into part 572 on September 1, 1998 for use in the Federal Motor Vehicle Safety Standard (FMVSS) No.201, Head Impact Protection.

The SID/HIII combines the body of the Side Impact Dummy (Part 572, subpart F) with the head and neck of the Hybrid III 50th male. A new neck bracket was designed for SID/HIII in order to sustain the seated height of the SID. Revisions to the SID's shoulder foam pads were also incorporated. The new dummy is approximately 1.2 lbs. heavier than the SID

SID/HIII is to be used in Standard 201 for the evaluation of 'dynamically deployed interior head protection systems'. The test involves a vehicle propelled sideways at a speed of 29 km/h (18 mph) into a 254 mm (10 inch) rigid pole.

The specifications and calibration requirements are now incorporated as Subpart M – *Side Impact Hybrid Dummy 50th Percentile Male* in the Code of Federal Regulations (CFR) Part 572, Anthropomorphic Test Dummies.

The calibration tests performed prior to shipment include:

- Head Drop (lateral)
- Neck Lateral
- Thorax Impact
- Pelvis Impact

Standard equipment included in the base price of this device:

- Chest Deflection Potentiometer
- Accelerometer mounts for head, T1, T12, upper and lower rib and pelvis*
- Structural replacements for all load cells.

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds (lbs.)	Kilograms
Head	10.0	4.6
Neck	2.8	1.3
Upper Torso	65.6	29.8
Lower Torso	36.9	16.8
Leg Assembly	27.4	16.1
Total Weight	**170.3**	**77.4**

DIMENSIONS:	Inches	Centimeters
Head Circumference	22.5	59.7
Head Width	6.1	15.5
Head Length	7.7	20.3
Buttock to Knee	20.4	51.8
Knee Pivot to Floor	19.6	49.8
Sitting Height	**35.4**	**89.9**

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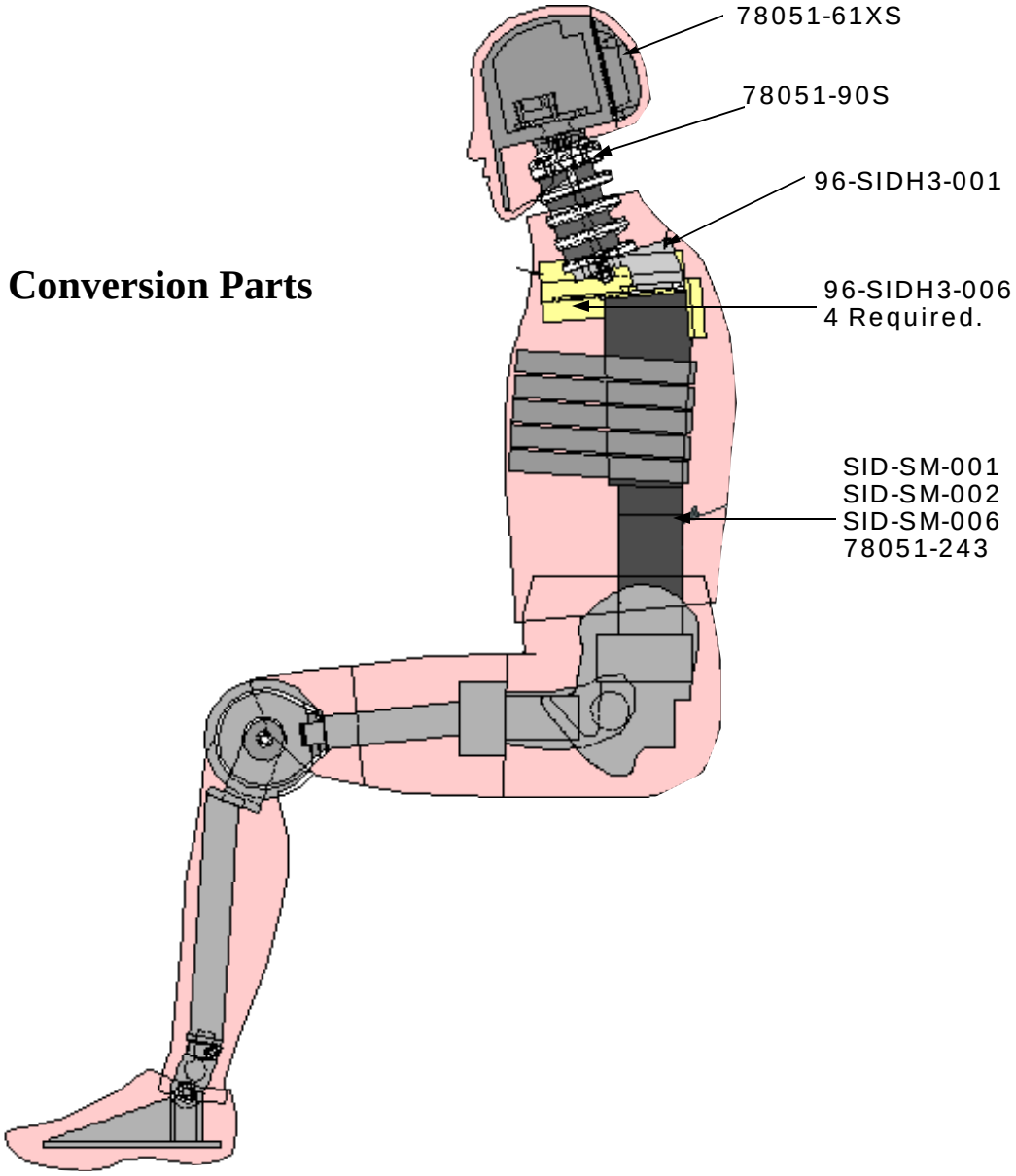
Revision: 01/29/03

SID/HIII

Full ATD (Model 96-SIDH3-M001) Conversion Kit (Model 96-SIDH3-KIT)

Conversion Parts



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Creating the New Standard in ATDs

Revision: 01/29/03

FAA Hybrid III 50th Percentile Male

FAA-H-III50M (Model FAA-H3-M001)

The FAA Hybrid-III 50th Percentile Male ATD is a dummy produced under a cooperative between the Federal Aviation Administration (FAA), Civil AeroMedical Institute (CAMI), Denton ATD, Inc., and Robert A. Denton, Inc., for the sole purpose of Federal Aviation seat certifications.

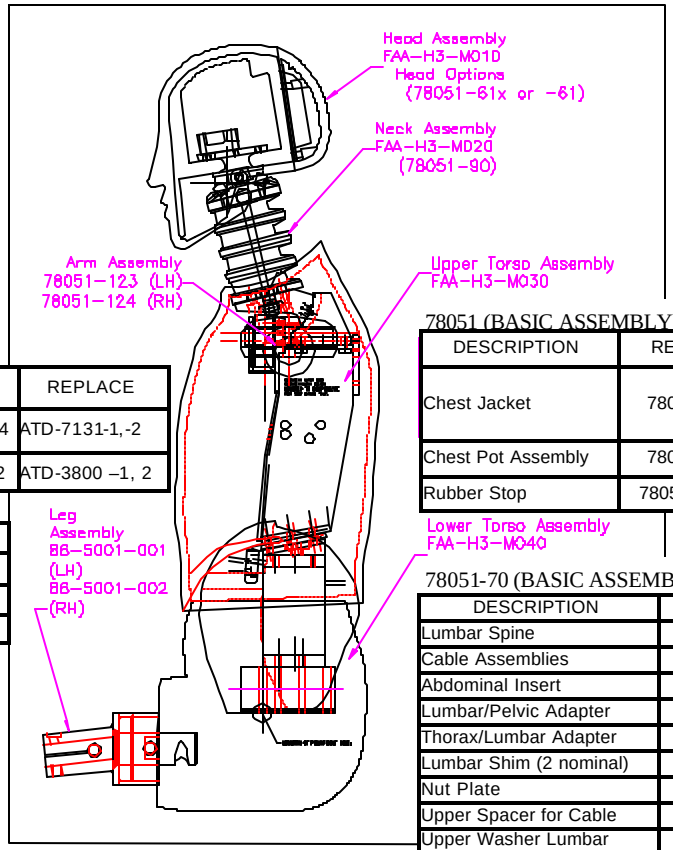
The FAA dummy utilizes standard components from both the Hybrid II and Hybrid III ATD's. The primary design goal was to create a Hybrid III dummy that would produce lumbar spine responses equivalent to those of the Hybrid II and may be used as an optional dummy in aviation seat certification. FAA regulations utilize pass/fail criteria on lumbar and pelvic loading during vertical test conditions. The straight lumbar spine of the Hybrid II is important to aircraft seat certification based on the desired compressive axial force and the kinematics of the erect-spine seated posture and resultant head trajectory.

The head, neck, thorax and lower limbs of the FAA ATD are standard Hybrid III.

For a complete design review and validation testing, see SAE paper 1999-01-1609 "A Lumbar Spine Modification to the Hybrid III ATD for Aircraft Seat Tests."

The FAA Hybrid III
Modifications consist of:

- A unique new upper lumbar-thorax adapter.
- Modified Hybrid II chest flesh jacket.
- Standard Hybrid II lumbar column.
- Standard Hybrid II abdominal insert.
- Hybrid II upper leg elements
- Denton model 1891 Hybrid II lumbar load cell and pelvic



78051 (BASIC ASSEMBLY)

DESCRIPTION	REMOVE	REPLACE
Chest Jacket	78051-169	FAA-H3-003 or Modified ATD 3151-6
Chest Pot Assembly	78051-317	
Rubber Stop	78051-85 (2)	

DESCRIPTION	REMOVE	REPLACE
Upper Leg Structural Assy.	78051-43 & 44	ATD-7131-1,-2
Upper Leg Flesh	78051-41, -42	ATD-3800 –1, 2

FOOT AND ANKLE OPTIONS	
Foot Ankle Assembly	78051-614, -615 or
Ankle Assembly	B-1889
Foot	78051-284, -285

78051-70 (BASIC ASSEMBLY)

DESCRIPTION	REMOVE	REPLACE
Lumbar Spine	78051-66	ATD-7102
Cable Assemblies	78051-69	ATD-7107
Abdominal Insert	78051-52	ATD-3250-2
Lumbar/Pelvic Adapter	78051-53	ATD-7116
Thorax/Lumbar Adapter		FAA-H3-001
Lumbar Shim (2 nominal)		ATD-7144
Nut Plate		FAA-H3-002
Upper Spacer for Cable		SID-SM-002
Upper Washer Lumbar Cable		78051-243
Upper Femur Options		78051-50, -51
		Or 78051-114, -115

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Creating the New Standard in ATDs

Revision: 01/29/03

BioRID-II

Model ARA-001

The **Biofidelic Rear Impact Dummy II** (BioRID-II) was developed in collaboration with Denton ATD, Inc. and the Department of Machine and Vehicle Design at Chalmers University of Technology in Götenburg, Sweden to meet the need for a testing tool to measure automotive seat and head restraint performance in rear end collisions. It allows for repeatable and reproducible evaluations of neck injuries during low speed rear-end collisions.

The BioRID-II was developed as a 50th percentile male dummy to measure responses in low speed rear-end impact tests. The dummy is comprised of an articulated thoracic-lumbar spine and neck made from a composite material. Each human spinal pivot point is reproduced in the BioRID-II. The torso construction includes a water filled abdomen and a pliable molding fitted around the flexible spinal assembly and attached through spine torso pins protruding outward from the central structure. Torsion bars are used in each of the Thoracic-Lumbar pivot joints to control the motion.The motion of the cervical vertebra are controlled by cables which are attached to neck-muscle substitutes and dampers. Also included between the vertebra are elastomer bumpers to control the end of travel response.

The arms and legs are standard Hybrid III 50th components.The molded pelvis is a modified Hybrid III 50th type with increased range of motion about the H Point.The head is a modified Hybrid III 50th. The BioRID-II performance has been validated against low speed volunteer data.

The BioRID has been shown to be an effective device for evaluating the designs of car seat systems during low impact rear collisions.

The calibration tests performed prior to shipment include:

- Neck Extension
- Damper Calibrations

Standard equipment included in the base price of this device:

- Accelerometer mounts for head, chest and pelvis*
- Structural replacement for upper neck load cell
- User's manual

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds (lbs.)	Kilograms
Head	10.0	4.55
Torso (Upper and Lower)	92.1	41.86
Upper Arm	4.4	2.0
Lower Arm with Hand	5.0	2.27
Upper Leg	13.2	6.0
Lower Leg with Foot	12.0	5.45
Total Weight	**171.3**	**77.86**

DIMENSIONS:	Inches	Centimeters
H-Point Above Seat	3.3	8.4
H-Point from Seat Rear	5.3	13.5
Thigh Clearance	5.5	14.0
Buttock to Knee Length	22.8	57.9
Knee Pivot Height	19.1	48.5
Foot Length	9.9	25.1
Foot Breadth	3.6	9.1
Seated Height	**34.6**	**87.8**

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Creating the New Standard in ATDs

Revision: 02/18/03

Pedestrian

(Model PED)

"Sit and Stand" Pedestrian versions of the popular Hybrid II 50th Percentile Male, Hybrid III 50th Percentile Male, Hybrid III 95th Percentile Large Male and the Hybrid III 5th Percentile Small Female are available. Because of their unique design, Pedestrian ATDs have a varied range of applications including assessment of vehicle component interaction and vehicle contact points. These dummies are complete and certified with all standard upper torso calibration (according to model), allowing for head and thorax injury assessment. The Pedestrian series of ATDs are equipped with a straight lumbar spine, a modified pelvic structure and knee slider replacements.

Hybrid III Pedestrian
Includes:

- Chest Deflection Transducer
- Six-Axis Neck Transducer Structural Replacement
- Accelerometer Mountings for Head, Chest, and Pelvis. User specified at time of order placement

**Other instrumentation available but not included

Hybrid II Pedestrian
Includes:

- Accelerometer Mounts for the Head and Chest. User specified at time of order placement

Hybrid III 50th Pedestrian Components.

78051-60P	Pelvis (Pedestrian)
78051-41P	Hip Flesh, Left
78051-42P	Hip Flesh, Right
78051-53P	Lumbar Spine Bracket
78051-88P	Lumbar to Thoracic Adaptor
78051-66P	Lumbar Spine
78051-24P	(2) Knee Slider Replacement, Inboard
78051-25P	(2) Knee Slider Replacement, Outboard

SA-150-M002PED Hybrid II 50th Percentile Male Pedestrian Test Dummy

78051-218-PED Hybrid III 50th Percentile Male Pedestrian Test Dummy

880995-000-P Hybrid III 95th Percentile Male Pedestrian Test Dummy

880105-1PED Hybrid III 5th Percentile Female Pedestrian Test Dummy

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Creating the New Standard in ATDs

Revision: 03/08/02

HURD - 116 lbs

Model 116-0000

Denton ATD, Inc. and Robert A. Denton, Inc. formed a cooperative alliance with Veridian Engineering, Inc. to design, develop and produce the "Hybrid Universal Research Dummy" (HURD). The HURD manikin has been developed for the aerospace industry as an advanced supplement to the GARD dummy.

The HURD incorporates the following features:

- Newer type of manikin for more readily available replacement parts
- Increased limb motion for more realistic human simulation
- Newer joint design for better adjustment of joint resistance frictions
- Rib type chest design which more closely matches human response
- Up-to-date instrumentation mounting capability which follows the currently accepted aerospace testing practices
- Capability for on-board data acquisition with support batteries and instrumentation
- Head allows mounting of a 6-axis load cell
- Neck is an automotive Hybrid II for more realistic head kinematics
- Numerous interchangeable parts with those used on other modern ejection test manikins
- Upgradeable for additional instrumentation capability

Standard equipment included in the base price of this device:

- Accelerometer mounts for head, chest, sternum, thoracic and pelvis*
- Structural replacements for all load cells

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds	Kilograms
Head	10.5 ± .26	4.77
Neck	2.0 ± .05	0.9
Neck Bracket	2.7 ± .07	1.23
Angular Mount Block	0.6 ± .01	.27
Universal Chest Box	5.6 ± .14	2.55
Back Plate	1.4 ± .04	0.64
Instrumentation	10.5 ± .26	4.77
Ribs (6)	1.7 ± .04	0.77
Bib with Strips	1.0 ± .03	0.45
Clavicle	5.4 ± .13	2.45
Chest jacket	5.2 ± .13	2.36
Abdominal Insert	0.9 ± .02	0.4
Pelvis with Femurs	15.3 ± .38	6.95
Legs	28.6 ± .71	13.0
Spine	4.7 ± .12	2.14
Shoulder Forks & Hardware	2.4 ± .06	1.09
Arms	9.9 ± .25	4.5
Lower Torso Ballast	8.6	3.9
TOTAL WEIGHT	**116.9**	**53.14**

DIMENSIONS:	Inches	Centimeters
Seated Height	32.9 ± .8	83.56
Eye Sitting Height	28.4 ± .7	72.13
Head Length	9.2 ± .2	23.37
Head Breadth	6.9 ± .2	17.526
Head Circumference	23.5 ± .6	59.69
Thumb Tip Reach	27.7 ± .7	70.358
Shoulder Height	18.7 ± .5	47.498
Shoulder Breadth	14.4 ± .4	36.576
Chest Breadth	9.9 ± .2	25.146
Chest Depth	9.4 ± .2	23.876
Chest Circumference	33.7 ± .8	85.598
Waist Circumference	29.7 ± .7	75.438
Hip Breadth	11.4 ± .3	28.956
Popliteal Height	16.7 ± .4	42.42
Knee Height	19.1 ± .5	48.51
Buttock - Knee	22.0 ± .6	55.88
Foot Length	8.7 ± .2	22.098
Foot Breadth	3.3 ± .1	8.38
STATURE	**61.0**	**154.94**

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Creating the New Standard in ATDs

Revision: 01/29/03

HURD - 132 lbs

Model 132-0000

Denton ATD, Inc. and Robert A. Denton, Inc. formed a cooperative alliance with Veridian Engineering, Inc. to design, develop and produce the "Hybrid Universal Research Dummy" (HURD). The HURD manikin has been developed for the aerospace industry as an advanced supplement to the GARD dummy.

The HURD incorporates the following features:

- Newer type of manikin for more readily available replacement parts
- Increased limb motion for more realistic human simulation
- Newer joint design for better adjustment of joint resistance frictions
- Rib type chest design which more closely matches human response
- Up-to-date instrumentation mounting capability which follows the currently accepted aerospace testing practices
- Capability for on-board data acquisition with support batteries and instrumentation
- Head allows mounting of a 6-axis load cell
- Neck is an automotive Hybrid II for more realistic head kinematics
- Numerous interchangeable parts with those used on other modern ejection test manikins
- Upgradeable for additional instrumentation capability

Standard equipment included in the base price of this device:

- Accelerometer mounts for head, chest, sternum, thoracic and pelvis*
- Structural replacements for all load cells

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds	Kilograms
Head	10.6 ± .11	4.82
Neck	2.8 ± .03	1.27
Neck Bracket	2.8 ± .03	1.27
Angular Mount Block	0.6 ± .01	0.27
Universal Chest Box	5.6 ± .06	2.55
Back Plate	1.4 ± .01	0.64
Instrumentation	10.7 ± .11	4.86
Ribs (6)	1.7 ± .02	0.77
Bib with Strips	1.0 ± .01	0.45
Clavicle	7.7 ± .08	3.5
Chest jacket	4.4 ± .04	2.0
Abdominal Insert	0.9 ± .01	0.4
Pelvis	23.8 ± .24	10.81
Legs	31.5 ± .32	14.32
Spine	10.7 ± .11	4.86
Shoulder Forks & Hardware	2.4 ± .02	1.09
Arms	9.8 ± .10	4.45
Spine Spacer	1.0 ± .01	0.45
Chest Box Ballast	1.7 ± .02	0.77
TOTAL WEIGHT	**131.0 ± 1.31**	**59.55**

DIMENSIONS:	Inches	Centimeters
Seated Height	33.6 ± .8	85.34
Eye Sitting Height	28.5 ± .7	72.39
Head Length	7.9 ± .2	20.07
Head Breadth	7.2 ± .2	182.88
Head Circumference	22.8 ± .6	57.91
Thumb Tip Reach	27.5 ± .7	69.85
Shoulder Height	21.0 ± .5	53.34
Shoulder Breadth	21.5 ± .5	54.61
Chest Breadth	10.2 ± .3	25.91
Chest Depth	8.7 ± .2	22.1
Chest Circumference	31.5 ± .8	80.01
Waist Circumference	30.3 ± .8	76.96
Hip Breadth	11.6 ± .3	29.46
Popliteal Height	15.1 ± .4	38.35
Knee Height	19.0 ± .5	48.26
Buttock - Knee	21.8 ± .5	55.27
Foot Length	8.8 ± .2	22.35
Foot Breadth	3.4 ± .1	8.64
STATURE	**61.5 ± .5**	**156.21**

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Creating the New Standard in ATDs

Revision: 01/29/03

HURD - 202 lbs

Model 202-0000

Denton ATD, Inc. and Robert A. Denton, Inc. formed a cooperative alliance with Veridian Engineering, Inc. to design, develop and produce the "Hybrid Universal Research Dummy" (HURD). The HURD manikin has been developed for the aerospace industry as an advanced supplement to the GARD dummy.

The HURD incorporates the following features:

- Newer type of manikin for more readily available replacement parts
- Increased limb motion for more realistic human simulation
- Newer joint design for better adjustment of joint resistance frictions
- Rib type chest design which more closely matches human response
- Up-to-date instrumentation mounting capability which follows the currently accepted aerospace testing practices
- Capability for on-board data acquisition with support batteries and instrumentation
- Head allows mounting of a 6-axis load cell
- Neck is an automotive Hybrid II for more realistic head kinematics
- Numerous interchangeable parts with those used on other modern ejection test manikins
- Upgradeable for additional instrumentation capability

Standard equipment included in the base price of this device:

- Accelerometer mounts for head, chest, sternum, thoracic and pelvis*
- Structural replacements for all load cells

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds	Kilograms
Head	10.5 ± .1	4.77
Neck	2.0 ± .02	0.91
Neck Spacer (#202-1030)	0.8 ± .01	0.36
Neck Bracket	2.8 ± .03	1.27
Neck Spacer (#202-2030)	0.4 ± .00	0.18
Angular Mount Block	0.6 ± .01	0.27
Universal Chest Box	5.5 ± .06	2.5
Back Plate	1.1 ± .01	0.5
Instrumentation	10.7 ± .11	4.86
Ribs (6)	4.0 ± .04	1.82
Bib with Strips	1.4 ± .01	0.64
Clavicle	11.4 ± .11	5.18
Chest jacket	8.4 ± .08	3.82
Abdominal Insert	2.4 ± .02	1.09
Pelvis with Femurs	38.7 ± .39	17.59
Legs	61.2 ± .61	27.82
Spine	10.2 ± .10	4.64
Shoulder Forks & Hardware	4.8 ± .05	2.18
Arms	25.1 ± .25	11.42
TOTAL WEIGHT	**202.0 + 2.02**	**91.82**

DIMENSIONS:	Inches	Centimeters
Seated Height	38.6 ± 1.0	98.0
Eye Sitting Height	33.4 ± .8	84.8
Head Length	8.2 ± .2	20.8
Head Breadth	7.2 ± .2	18.3
Head Circumference	23.0 ± .6	58.4
Thumb Tip Reach	32.6 ± .8	82.8
Shoulder Height	26.0 ± .7	66.0
Shoulder Breadth	22.8 ± .6	57.9
Chest Breadth	14.6 ± .4	37.1
Chest Depth	11.4 ± .3	28.9
Chest Circumference	44.9 ± 1.1	114.0
Waist Circumference	37.8 ± .9	96.0
Hip Breadth	17.6 ± .4	44.7
Popliteal Height	19.0 ± .5	48.3
Knee Height	23.8 ± .6	60.5
Buttock - Knee	25.5 ± .6	64.8
Foot Length	10.4 ± .3	26.4
Foot Breadth	4.1 ± .1	10.4
STATURE	**73.6 ± .5**	**186.9**

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Creating the New Standard in ATDs

Revision: 01/29/03

HURD - 212 lbs

Model 212-0000

Denton ATD, Inc. and Robert A. Denton, Inc. formed a cooperative alliance with Veridian Engineering, Inc. to design, develop and produce the "Hybrid Universal Research Dummy" (HURD). The HURD manikin has been developed for the aerospace industry as an advanced supplement to the GARD dummy.

The HURD incorporates the following features:

- Newer type of manikin for more readily available replacement parts
- Increased limb motion for more realistic human simulation
- Newer joint design for better adjustment of joint resistance frictions
- Rib type chest design which more closely matches human response
- Up-to-date instrumentation mounting capability which follows the currently accepted aerospace testing practices
- Capability for on-board data acquisition with support batteries and instrumentation
- Head allows mounting of a 6-axis load cell
- Neck is an automotive Hybrid II for more realistic head kinematics
- Numerous interchangeable parts with those used on other modern ejection test manikins
- Upgradeable for additional instrumentation capability

Standard equipment included in the base price of this device:

- Accelerometer mounts for head, chest, sternum, thoracic and pelvis*
- Structural replacements for all load cells

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds	Kilograms
Head	10.6 ± .11	4.82
Neck	2.0 ± .02	0.9
Neck Spacer (#212-1030)	2.3 ± .02	1.05
Neck Bracket	2.8 ± .03	1.27
Neck Spacer (#212-2030)	1.2 ± .01	0.55
Angular Mount Block	0.6 ± .01	0.27
Universal Chest Box	5.5 ± .06	2.5
Back Plate	1.1 ± .01	0.5
Instrumentation	10.7 ± .11	4.86
Ribs (6)	4.0 ± .04	1.82
Bib with Strips	1.4 ± .01	0.64
Clavicle	11.3 ± .11	5.14
Chest jacket	8.3 ± .08	3.77
Abdominal Insert	2.5 ± .02	1.14
Pelvis with Femurs	38.7 ± .39	17.59
Legs	61.2 ± .61	27.82
Spine	12.8 ± .13	5.82
Spine Spacer (#212-3030)	2.6 ± .03	1.18
Shoulder Forks & Hardware	4.8 ± .05	2.18
Arms	25.2 ± .25	11.45
Ballast	2.6 ± .03	1.18
TOTAL WEIGHT	**212.0 ± 2.12**	**96.45**

DIMENSIONS:	Inches	Centimeters
Seated Height	39.3 ± 1.0	99.82
Eye Sitting Height	34.0 ± .9	86.36
Head Length	8.4 ± .2	21.34
Head Breadth	7.2 ± .2	18.29
Head Circumference	23.0 ± .6	58.42
Thumb Tip Reach	32.7 ± .8	83.06
Shoulder Height	26.5 ± .7	67.31
Shoulder Breadth	22.8 ± .6	57.91
Chest Breadth	14.6 ± .4	37.08
Chest Depth	11.3 ± .3	28.70
Chest Circumference	44.6 ± 1.1	113.28
Waist Circumference	37.3 ± .9	94.74
Hip Breadth	17.5 ± .4	44.45
Popliteal Height	19.0 ± .5	48.26
Knee Height	23.8 ± .6	60.45
Buttock - Knee	25.5 ± .6	64.77
Foot Length	10.4 ± .3	26.42
Foot Breadth	4.1 ± .1	10.41
STATURE	**73.6 ± .5**	**186.94**

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Creating the New Standard in ATDs

Revision: 01/29/03

CAMI Newborn and 6-Month-Old Infant

Newborn (Model SA100N) Infant (Model SA1001**)**

The CAMI (Civil Aeronautical Medical Institute) Newborn Infant and 6-Month Old Infant ATDs were developed for the evaluation of child restraint systems as defined in CFR 49, Part 571, Standard No. 213.

The dummies consist of steel and aluminum weights attached to leather skeletons wrapped in layers of foam padding and covered with a stitched cloth outer shell.

The CAMI New Born Infant ATD is specified under Title 49 CFR Part 572, Subpart K.

The CAMI 6-Month Old Infant ATD is specified under Title 49 CFR Part 572, Subpart D.

WEIGHTS:	Pounds (lbs.)	Kilograms
NEW BORN	7.45	3.39
6-MONTH OLD	17.40	7.91

DIMENSIONS:		
NEW BORN	**Inches**	**Centimeters**
Head Circumference	13.80	35.05
Chest Circumference	13.70	34.80
Standing Height	19.85	50.42
6-MONTH OLD	**Inches**	**Centimeters**
Head Circumference	17.00	43.18
Waist Circumference	17.50	44.45
Seated Height	17.50	44.45
Standing Height	26.25	66.68

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Creating the New Standard in ATDs

Revision: 01/29/03

CRABI 12-Month-Old Child

CRABI (Model 921022-000)

The CRABI (Child Restraint Air Bag Interaction) 12-Month Old Child ATD was developed in 1993 by a Society of Automotive Engineers (SAE) Task Force for the purpose of testing forward and rearward facing child restraints.

The CRABI's head is constructed of a metal and fiberglass skull with a molded urethane skin. The neck is a segmented construction made of rubber and aluminum intervertabral discs. The torso is composed of a thoracic spine box, chest foam supports, chest foam and a torso flesh made of molded urethane with nylon netting reinforcement. The abdomen is open cell urethane foam. The pelvis assembly consists of an aluminum weldment with a flexible molded rubber spine and a mounting configuration for a six-channel load cell between the lumbar spine and pelvis. The limbs are aluminum and plastic bones molded into urethane.

The CRABI 12-Month Old Child ATD is specified under Title 49 CFR Part 572, Subpart R

The calibration tests performed prior to shipment include:

- Head Drop (frontal and rear)
- Neck Flexion and Extension
- Thorax Impact

Standard equipment included in the base price of this device:

- Accelerometer mounts for head, chest and pelvis*
- Structural replacements for all load cells.

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds (lbs.)	Kilograms
Head	5.81	2.64
Neck	.84	.38
Torso	8.10	3.68
Arm	1.32	.60
Leg	2.31	1.05
Total Weight	**22.00**	**10.00**

DIMENSIONS:	Inches	Centimeters
Head Breadth	5.10	12.95
Head Depth	6.20	15.75
Buttock to Knee Pivot	7.23	18.36
Knee Pivot Height	6.80	17.27
Hip Pivot From Backline	1.78	4.52
Hip Pivot Height	1.30	3.3
Sitting Height	**18.25**	**46.36**

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Creating the New Standard in ATDs

Revision: 01/29/03

Hybrid II 3 and 6-Year-Old Child

H-II3C (Model SA-103-C002) and H-II2C (Model SA-106-C001)

Hybrid II 3-Year-Old Child

SA-103-C002

As specified in Title 49 CFR Part 572, Subpart C.
Usage and testing requirements are specified in Title 49 CFR Part 571, Standard No. 213. This device is fully authorized for use in child safety restraint testing for both automotive and aircraft.

The Three Year Old Child Dummy is constructed with a fully articulating pelvis to allow this ATD to be used in either the seated or the upright and erect (standing) positions. This device is sold in the Tested and Certified condition. The calibration tests performed prior to shipment include: Head Impact • Neck Flexion • Thorax Impact • Lumbar Flexion.

WEIGHTS:	Pounds (lbs.)	Kilograms
Head	5.8	2.63
Neck	1.0	.45
Torso	12.9	5.85
Upper Arm	.7	.64
Lower Arm & Hand	.6	.54
Upper Leg	3.9	3.54
Lower Leg & Foot	1.6	1.45
Total Weight	**33.3**	**15.10**

DIMENSIONS:	Inches	Centimeters
Head Circumference	19.3	49.0
Head Length	6.7	17.0
Buttock to Knee	12.7	32.3
Knee to Floor	10.4	26.4
Hip Joint Height	2.5	6.4
Hip Joint to Seatback	3.1	7.9
Sitting Height	**22.5**	**57.2**

Hybrid II 6-Year-Old Child

SA-106-C001

As specified in Title 49 CFR Part 572, Subpart I.
Usage and testing requirements are specified in Title 49 CFR Part 571, Standard No. 213. This device is fully authorized for use in child safety restraint testing for both automotive and aircraft.

The Six Year Old Child Dummy is constructed with a fully articulating pelvis to allow this ATD to be used in either the seated or the upright and erect (standing) positions. This device is sold in the Tested and Certified condition. The calibration tests performed prior to shipment include: Head Impact • Neck Flexion • Thorax Impact • Knee Impact • Lumbar Flexion • CG.

WEIGHTS:	Pounds (lbs.)	Kilograms
Head	6.0	2.72
Neck	1.4	.64
Upper Torso	11.5	5.22
Lower Torso	8.4	3.81
Arm	4.2	1.91
Upper Leg	9.8	4.44
Lower Leg	6.0	2.72
Total Weight	**47.3**	**21.46**

DIMENSIONS:	Inches	Centimeters
Head Circumference	21.6	54.9
Head Length	7.0	17.8
Buttock to Knee	15.1	38.4
Knee to Floor	14.4	36.6
Hip Joint Height	1.5	3.8
Hip Joint To Seatback	3.0	7.6
Sitting Height	**25.4**	**65.0**
Standing Height	**47.3**	**120.1**

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Creating the New Standard in ATDs

Revision: 01/29/03

Hybrid III 3-Year Old Child

H-III3C (Model 210-0000)

The Hybrid III 3-Year Old Child was originally designed in 1992 as a collaboration between the SAE Biomechanics Committee and the National Highway Transport Safety Administration (NHTSA). This ATD was designed to allow frontal loading in both sitting and standing postures and was upgraded in 1997 for the evaluation of "Out of Position" (OOP) airbag aggressiveness testing. Size and weight specifications for the Hybrid III 3-Year Old are based on child anthropometric studies.

The head is constructed of a fiberglass skull with a molded vinyl head and cap skin and a segmented neck made of molded rubber for human-like flexion and extension. The torso is composed of a steel thoracic spine weldment with three damped, spring steel rib assemblies and a chest potentiometer. The Torso flesh is molded urethane with nylon netting reinforcement. The pelvis assembly consists of an aluminum weldment with a flexible molded rubber spine and a mounting configuration for a six-channel load cell between the lumbar spine and pelvis. The limbs are steel and aluminum bones molded into urethane.

The Hybrid III 3-Year Old Child ATD is specified under Title 49 CFR Part 572, Subpart P

The calibration tests performed prior to shipment include:

- Head Drop
- Neck Flexion and Extension
- Thorax Impact
- Torso Flexion

Standard equipment included in the base price of this device:

- Chest Deflection Potentiometer
- Accelerometer mounts for head, chest , sternum, thoracic spine and pelvis*
- Structural replacements for all load cells.

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds (lbs.)	Kilograms
Head	6.00	2.73
Neck	1.74	.79
Upper Torso w/ Jacket	15.43	7.01
Upper Arm	.97	.44
Lower Arm w/ Hand	1.01	.46
Upper Leg	2.23	1.01
Lower Leg	1.34	.61
Foot	.68	.31
Total Weight	**35.65**	**16.17**

DIMENSIONS:	Inches	Centimeters
Head Circumference	20.00	50.80
Head Breadth	5.35	13.59
Head Depth	6.89	17.50
Buttock to Knee Length	11.51	29.24
Knee Pivot Height	9.81	24.92
Hip Pivot From Backline	2.44	6.20
Hip Pivot Height	1.55	3.94
Sitting Height	**21.50**	**54.61**

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Creating the New Standard in ATDs

Revision: 1/29/03

Hybrid III 6-Year-Old Child

H-III6C (Model 127-0000)

The Hybrid III 6-Year Old Child was originally begun in 1986 as a collaboration between the Centers for Disease Control and Prevention (CDC) and Ohio State University. The Society of Automotive Engineers (SAE) and the National Highway Traffic Safety Administration (NHTSA) also contributed to the design and testing requirements. The goal was to define the size, weight and impact response characteristics for a 6-year old child dummy and incorporate them with the same biofidelty and measurement capacities as the Hybrid III 50th Percentile Adult Male ATD.

Size and weight specifications for the Hybrid III 6-Year Old Child are based on anthropometric studies of the characteristic dimensions of 6-year old boys and girls. The biofidelic impact response corridors for the head, neck, thorax and knees correspond to the Hybrid III 50th Percentile Adult Male response scaled for size and weight.

The Hybrid III 6 Year Old Child was upgraded in 1997 for the evaluation of "Out of Position" (OOP) airbag aggressiveness testing.

The Hybrid III 6-Year Old Child ATD is specified under Title 49 CFR, Part 572, Subpart N.

The calibration tests performed prior to shipment include:

- Head Drop
- Neck Flexion and Extension
- Thorax Impact
- Knee Impact
- Torso Flexion

Standard equipment included in the base price of this device:

- Chest Deflection Transducer
- Accelerometer mounts for head, chest , sternum, thoracic spine and pelvis*
- Structural replacements for all load cells

*User must specify the accelerometer manufacturer and type at the time of order placement

WEIGHTS:	Pounds (lbs.)	Kilograms
Head	7.66	3.47
Neck	1.20	.54
Upper Torso	12.25	5.57
Lower Torso	13.75	6.24
Upper Arm	1.05	.48
Lower Arm w/hand	1.37	.62
Upper Leg	3.20	1.45
Lower Leg and Foot	2.75	1.25
Total Weight	**51.60**	**23.41**

DIMENSIONS:	Inches	Centimeters
Head Circumference	20.50	52.07
Head Breadth	5.60	14.22
Head Depth	6.80	17.27
Knee Pivot Height	12.40	31.50
Buttock to Knee Pivot	13.90	35.31
Hip Pivot Height	2.7	6.86
Hip Pivot From Backline	3.7	9.40
Sitting Height	25.00	63.50

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Creating the New Standard in ATDs

Revision: 01/29/03

Thor-LX Version 3.2

Model Number T1LXM000

Applications

Thor-LX Advanced Lower Leg Version 3.2 is part of the NHTSA advanced dummy effort. It exhibits improved biofidelic response and is designed to fit either the Thor or the HIII 50th dummies.

Design features of the Thor-LX

-Humanlike ankle motion in flexion/plantar flexion and inversion/eversion directions.
-Achilles tendon representation
-Humanlike foot performance in dynamic loading
-Compliant axial loading in tibia shaft

Performance Requirements

The Thor-LX performance is examined according to two sets of criterion
-Mandatory certification requirements
-Design reference guidelines

Mandatory Requirements

Quasi-Static tests for inversion/eversion. Moments and angle measured.

- At 6 N.m angle 17.5 - 21.3 degrees
- At 23 N.m angle 29.3 - 35.9 degrees

Dynamic impact to ball of foot. Ankle resistive moment and tibia compressive force are measured

- Force 3058 - 3738 N
- Moment 76.2 - 93.2 N. m

Dynamic impact to heel of foot. Tibia compressive is force measured

- Force 2694 - 3292 N

Design Reference Guidelines

In addition to the mandatory certification tests, design reference guidelines are estasblished

- Quasi-Static in Dorsiflexion with and without achilles tendon and plantar-flexion. Moment and angle measured
- Dynamic impact test to ball and heel. Moment and angle are measured.

Instrumentation

The Thor-LX uses the Denton HIII 50th Upper and Lower Tibia load cells and 3-axis rotary poteniometer in the ankle. A tri-axial accelerometer can be mounted in the foot.

- Model 4353J 4-Channel Upper Tibia Load Cell
- Model 4509J 5-Channel Upper Tibia Load Cell
- Model 4929J 5-Channel Lower Tibia Load Cell
- Model 5145J 1-Channel Achilles Load Cell

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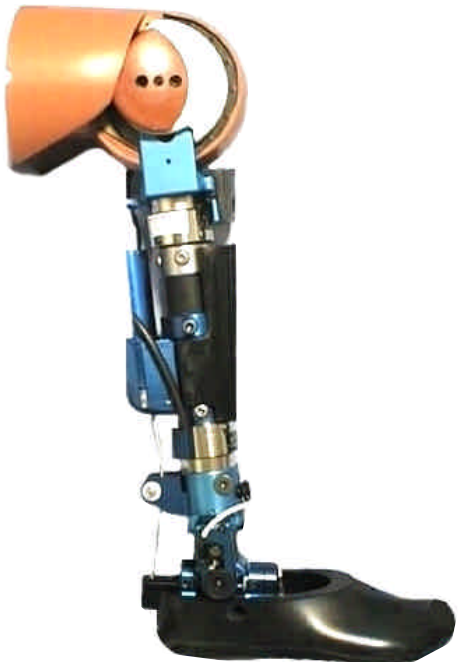
Revision: 03/08/02

Thor-FLX Version 1.0

Model Number T2LXM000



Applications

Thor-FLX Advanced Lower Leg Version 1.0 is part of the NHTSA advanced dummy effort. It exhibits improved biofidelic response and is designed to fit either the Thor Female or the HIII 5th Percentile Female dummies.

Design features of the Thor-LX

-Humanlike ankle motion in flexion/plantar flexion and inversion/eversion directions.
-Achilles tendon representation
-Humanlike foot performance in dynamic loading
-Compliant axial loading in tibia shaft

Performance Requirements

The Thor-FLX performance is examined according to two sets of criterion
-Mandatory certification requirements
-Design reference guidelines

Mandatory Requirements

Quasi-Static tests for inversion/eversion. Moments and angle measured.
- At 8 N.m angle 19.2 - 23.4 degrees
- At 17 N.m angle 28.5 - 34.9 degrees

Dynamic impact to ball of foot. Ankle resistive moment and tibia compressive force are measured
- Force 2294 - 2804 N
- Moment 39.6 - 48.4 N. m

Dynamic impact to heel of foot. Tibia compressive force is measured
- Force 1987 - 2429 N

Design Reference Guidelines

In addition to the mandatory certification tests, design reference guidelines are estasblished
- Quasi-Static in Dorsiflexion with and without achilles tendon and plantar-flexion. Moment and angle measured
- Dynamic impact test to ball of foot. Moment and angle are measured.

Instrumentation

The Thor-FLX uses Denton Upper and Lower Tibia load cells and three single-axis rotary potentiometers in the ankle. A tri-axial accelerometer can be mounted in the foot.
- Model 4825 4-Channel Upper Tibia Load Cell
- Model 4826 5-Channel Lower Tibia Load Cell
- Model 5145J 1-Channel Achilles Load Cell

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Revision: 02/08/03

5th and 95th Ball Bearing Knee Sliders

5th Model Number: 880105-800 95th Model Number: 880995-650

DENTON ATD, INC.

INTRODUCTION

Denton ATD Ball Bearing Knee Slider units have been designed for the Hybrid III 5% Small Female and the 95th% Large Male Test Dummies. The Ball Bearing Slider is a knee slider mechanism which does not bind under high off-axis loading. Older knee slider designs allowed measurement of tibia-femur displacement with Hybrid III style test dummies. However, when subjected to off-axis or combined loading, the internal friction caused them to "stick". This new slider uses ball bearing technology to virtually eliminate friction under any loading conditions. Assemblies are available as direct replacements on existing ATDs.

FEATURES

The Advance Lower Extremity (ALEX) development project had the goal of developing biofidelic lower extremities with advanced injury prediction capabilities for frontal crash test dummies. The testing identified a need for improvement in the sliding knee mechanism.

The Vehicle Research and Test Center conducted a study in 1994 to evaluate four prototype knee slider designs and compared their performance to that of the standard knee slider. The V.R.T.C evaluation was conducted with a series of tests developed to simulate a broad range of moderate to severe impact environments that the knee sliders may encounter. In each test, a fully instrumented Hybrid III 50th Percentile dummy lower extremity, containing the prototype knee slider, was impacted below the knee by a variety of masses at different orientations and speeds. The results of Denton ATD's Ball slider proved to be outstanding. The stiffness response of the ball slider is very repeatable at all input energies tested and in all cases its response fell into tight corridors. When tested with varying knee flexion angles, the ball slider responds very similarly in stiffness despite a significant, though relatively slight, change in initial load. Large axial tibia loads show only minimal changes in initial load and stiffness.

Denton ATD's Ball Bearing Knee Slider unit consists of a right and left side slider assembly. Knee assemblies are included in the complete package.

Each knee assembly includes:

***** Inboard Slider Assembly

***** Outboard Slider Assembly

***** Machined Knee, Modified

* String Potentiometer, Miniature

* Potentiometer String Pot Assembly

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Revision: 02/18/03

50th Ball Bearing Knee Slider

Model Number: EX-593

INTRODUCTION

Denton ATD 50th Ball Bearing Knee Slider units have been designed for the Hybrid III 50% Male Test Dummies. The Ball Bearing Slider is a knee slider mechanism which does not bind under high off-axis loading. Older knee slider designs allowed measurement of tibia-femur displacement with Hybrid III style test dummies. However, when subjected to off axis or combined loading, the internal friction caused them to "stick". This new slider uses ball bearing technology to virtually eliminate friction under any loading conditions. Assemblies are available as direct replacements on existing ATDs.

FEATURES

The Advanced Lower Extremity (ALEX) development project had the goal of developing biofidelic lower extremities with advanced injury prediction capabilities for frontal crash test dummies. The testing identified a need for improvement in the sliding knee mechanism.

The Vehicle Research and Test Center conducted a study in 1994 to evaluate four prototype knee slider designs and compared their performance to that of the standard knee slider. The V.R.T.C evaluation was conducted with a series of tests developed to simulate a broad range of moderate to severe impact environments that the knee sliders may encounter. In each test, a fully instrumented Hybrid III 50th Percentile dummy lower extremity, containing the prototype knee slider, was impacted below the knee by a variety of masses at different orientations and speeds. The results of Denton ATD's Ball Slider proved to be outstanding. The stiffness response of the ball slider is very repeatable at all input energies tested and in all cases its response fell into tight corridors. When tested with varying knee flexion angles, the ball slider responds very similarly in stiffness despite a significant, though relatively slight, change in initial load. Large axial tibia loads show only minimal changes in initial load and stiffness.

Denton ATD's 50th Ball Bearing Knee Slider unit consists of a right and left side slider assembly. Knee assemblies are included in the complete package.

Each knee assembly includes*:*

***** Inboard Slider Assembly

***** Outboard Slider Assembly

***** Machined Knee, Modified

* String Potentiometer, Miniature

* Potentiometer String Pot Assembly

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Revision: 02/18/03

Zippered Lower Leg Flesh

Model Number 78051-73SE, 74SE, 880105-601SE, 880995-602E

Zippered Lower Leg Flesh for the

Hybrid III 5th Percentile Female
Hybrid III 50th Percentile Male
Hybrid III 95th Percentile Male

Easy access to instrument cables

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Creating the New Standard in ATDs

Revision: 2/18/02

Dummy Chair

Denton ATD, Inc. offers a variety of dummy chairs that are ideal for crash test dummy storage and transportation within the laboratory or testing facility.

Dummy Chair Features:

- Light weight
- Solid framework
- Drawer for storage of dummy documentation, tools, etc.
- Bracket for dummy cabling
- Latching mechanism on two wheels
- Pelvis not in contact with surface

Dummy Chair Specifications for:

Hybrid III 5th Percentile Female:

- Weight: 68.8 lbs (31.2 kg)
- Seating Height: 23.6" (600 mm)
- Width of Chair: 21.7" (550 mm)

Hybrid III 50th Percentile Male

- Weight: 71.4 (32.4 kg)
- Seating Height: 23.6" (600 mm)
- Width of Chair: 21.7" (550 mm)

Hybrid III 95th Percentile Male

- Weight: 72.8 lbs (33.0 kg)
- Seating Height: 23.6" (600 mm)
- Width of Chair: 21.7" (550 mm)

EuroSID:

- Weight: 72.8 lbs (33.0 kg)
- Seating Height: 23.6" (600 mm)
- Width of Chair: 21.7" (550 mm)

DOTSID:

- Weight: 72.8 lbs (33.0 kg)
- Seating Height: 23.6" (600 mm)
- Width of Chair: 21.7" (550 mm)

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Creating the New Standard in ATDs

Revision: 03/08/02

Dummy Calibration Laboratories

Expert Consultation, Construction and Installation

A complete calibration laboratory from Denton ATD guarantees the quality and precision manufacture of test equipment designed specifically for the advanced dummy calibrations required of today's facilities.

Along with the design and construction of calibration test fixtures, the professionals at Denton ATD offer expert consultation and final installation of comprehensive "turn-key" laboratories as well as individual components.

Laboratory management is simplified when integrated with Denton ATD's laboratory software packages, creating a convenient and consistent testing environment.

Calibration Lab Equipment

- Head Drop Test Stand
- Neck Pendulum Test Stand
- Thorax Impact Test Stand
- Knee Impact / Knee Slider Test Stand
- Abdominal Compression Test Stand
- Lumbar Flexion Test Stand
- Center of Gravity Test Equipment
- Pelvic Compression Test Stand
- Hip Flexion Test Stand
- E-SID Rib Module Test Stand
- "Automated" Torso Flexion Test Stand
- Data Acquisition Systems
- Calibration Lab Software
- Dummy Management Software
- Training Videos for Hybrid-III and SID Calibrations.
- Signal Waveform Generator

Head Drop Test Stand

Model Number: TF-100

DENTON ATD, INC.

INTRODUCTION

The TF-100 Head Drop Test Stand is a complete fixture used for evaluating performance characteristics of the head assembly. Head drop tests are required for the Hybrid III Family, Hybrid II 50th, BioSID, SID/HIII, ES-2 and EuroSID-1. This fixture conforms to the specifications as written in the United States Code of Federal Regulations, Title 49, Part 572.

DESCRIPTION

The Head Drop Test is accomplished by suspending the head assembly by a light-weight cable suspension system. An adjustment screw on the release mechanism allows for easy positioning of the head assembly. The head is dropped from a specified height onto a 2-inch thick steel plate.

The release mechanism consists of an electromagnet and a small steel drop plate. The control box for the electromagnet can be powered by 110VAC or 230VAC. An infrared emitter and detector is used as a trigger for a data acquisition system or an event indicator.

The three (3) accelerometers required for the test are not included.

Dimensions	Fixture	Work Area
Length	2.0 ft	5.0 ft
Width	2.7 ft	3.0 ft
Height	6.6 ft	—

Standard Equipment

- Welded Steel Frame
- Impact Plate: Part 572 Compliant
- Head Suspension Frame
- Magnetic Release Mechanism
- Infrared Event Switch
- Height Gage for the Hybrid III Family
- Bubble Level

Optional Equipment

- Head Suspension Systems are available for the following dummies:
  - *Hybrid III 50th/Hybrid III 95th
  - *Hybrid III 5th/Hybrid III 10 Y.O.
  - *Hybrid III 6 Y.O.
  - *Hybrid III 3 Y.O.
  - *CRABI 12-Month-Old
  - *Hybrid II 50th
  - *SID-HIII/BioSID
  - *EuroSID-1
  - *ES-2
- Hybrid II 50th Head Leveling Tool
- Hybrid II 50th Height Gage
- EuroSID/SID-HIII/BioSID Height Gage

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Revision: 02/14/03

Neck Pendulum Test Stand

Model Number: TF-200

DENTON ATD, INC.

DESCRIPTION

The neck pendulum test is accomplished by releasing the pendulum and allowing it to fall freely to achieve a given impact velocity. The aluminum honeycomb stops the pendulum with a specified acceleration versus time pulse.

Velocity measurements are made by means of an infrared velocity measurement system. This system is made up of an infrared emitter, detector, and a precision slotted vane. The slotted vane is attached to the pendulum, and when dropped, the vane passes between the infrared emitter and detector generating a series of on/off pulses that can be converted into velocity by the data acquisition system.

Honeycomb material is positioned on four (4) aluminum dowel pins mounted on the face of the back stop which locates this material in the proper position between the pendulum striker plate and the back stop.

An upper neck load cell and one uniaxial accelerometer required for the test are not included.

Dimensions	Fixture	Work Area
Length	11.0 ft	13.0 ft
Width	2.5 ft	5.0 ft
Height	12.9 ft	—

INTRODUCTION

The TF-200 Neck Pendulum Test Stand is a complete system used for the calibration and testing of the neck component for the Hybrid III family, Hybrid II 50th, SA-106C, SA-103C, BioSID, EuroSID-1, ES-2, SID-HIII and SID-IIs. The neck can be tested in both the flexion and extension modes. The neck performance specifications for these tests are velocity at impact, pendulum acceleration, total rotation of the head/neck system, moment about the occipital condyle, and force.

The neck pendulum is in compliance with the specifications as written in the United States Code of Federal Regulation, Title 49, Part 572 relating to weight, center-of-gravity, moment of inertia, and mounting location of the pendulum accelerometer.

Standard Equipment

- 'A' frame welded steel structure
- Pendulum assembly; Part 572 compliant
- Structural back stop
- 2-Potentiometer unit
- Pendulum rope hoist
- Snap Release Mechanism
- Infrared velocity measurement system
- Mechanical Angle Indicator
- Torque wrench 0 - 30 in-lb.
- Calibration unit for potentiometers

Optional Equipment

- Neck Mounting Adaptation packages are available for the following dummies:
  - *Hybrid III 50th/Hybrid III 95th
  - *Hybrid III 5th
  - *Hybrid III 10 Y.O.
  - *Hybrid III 6 Y.O.
  - *Hybrid III 3 Y.O.
  - *CRABI 12-Month-Old
  - *Hybrid II 50th
  - *SA-106C
  - *SA-103C
  - *SID-HIII
  - *EuroSID-1
  - *ES-2
- Condyle Pin Removal Fixture
- Hybrid III 5th/Hybrid III 6 Y.O. Adapter Plate for condyle pin removal fixture
- Aluminum honeycomb 4 ft x 8 ft x 6 inches
- Aluminum honeycomb 4 ft x 8 ft x 3 inches
- Scissors
- Electric hoist
- Electro-mechanical quick release
- Electronic inclinometer with display

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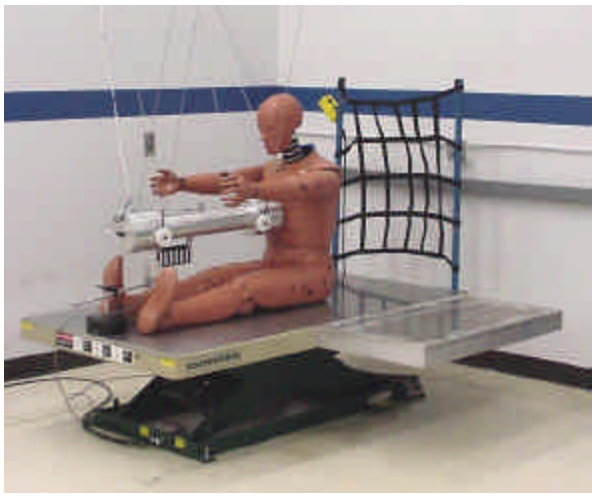
Revision: 02/14/03

Thorax Impact Test Stand

Model Number: TF-300



INTRODUCTION

The Thorax Impact Test Stand is used in the calibration and testing of Hybrid III family, Hybrid II 50th, SA-106C, SA-103C, BioSID, EuroSID-1, ES-2, SID-HIII, SID and SID-IIs. The Thorax Impact Test Stand conforms to the specifications as written in the United States Code of Federal Regulations, Title 49, Part 572.

DESCRIPTION

The impact probe is suspended from the structural frame by means of four aircraft grade cables. Two additional cables are attached at the rear of the probe to restrict roll and lateral motion of the probe during the drop. All cables are attached to the probe by means of light-weight sheaves, allowing for rapid installation. Turnbuckles are spliced and swaged into the suspension cables to allow for accurate re-positioning of the probe when necessary.

The one uniaxial accelerometer and chest potentiometer required for this test are not included.

Standard Equipment

- Structural frame assembly
- Probe suspension cables and mounting hardware
- Hydraulically assisted lift table with adjustable height and stainless steel top
- Rope hoist with snap release
- Mechanical Pelvic Angle Gage Assembly
- Infrared velocity measurement system
- Dummy setup probe pointer
- Dummy restraint net
- Mechanical angle indicator
- Bubble level

Dimensions	Fixture	Work Area
Length	19.8 ft	23.0 ft
Width	6.2 ft	9.0 ft
Height	15.0 ft	—

Optional Equipment

- Thorax Impact Adaptation packages are available for the following dummies:

  *Hybrid III 50th/Hybrid III 95th
  *Hybrid III 5th
  *Hybrid III 10 Y.O.
  *Hybrid III 6 Y.O.
  *Hybrid III 3 Y.O.
  *CRABI 12-Month-Old
  *Hybrid II 50th
  *SA-106C
  *SA-103C
  *SID-HIII
  *SID
  *BioSID
  *EuroSID-1
  *ES-2

- Electric Hoist
- Electro-Mechanical Quick Release

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Revision: 02/18/03

Knee Impact/Slider Test Stand

Model Number: TF-400

DENTON ATD, INC.

INTRODUCTION

The TF-400 Knee Impact / Knee Slider Test Stand is a dual system used for the calibration and testing of the Hybrid III series knee flesh and knee insert dynamic responses. The knee impact test evaluates the response characteristics of the knee assembly under a direct in-line impact at the centerline of the knee cap. The knee slider test evaluates the response characteristics of the sliding knee components or the relative motion of the tibia with respect to the femur bone.

DESCRIPTION

The probe is suspended from the upper structure by six (6) aircraft grade cables. Turnbuckles are spliced and swaged into the suspension cables to allow adjustment and repositioning of the probe when necessary. A precision velocity vane is attached to the under side of the probe and is used in conjunction with the infrared emitter/detector system to make accurate velocity measurements. A uniaxial accelerometer is affixed to the rear surface of the probe so that its sensitive axis is in-line with the centerline of the probe.

The Hybrid III knee assembly (knee flesh, rubber knee insert, knee casting, and femur load cell simulator) and lower leg assembly are attached to the mounting plate on the side of the impact base. The probe is drawn back and connected to the release. The probe is then released by a trigger on the release mechanism. On its free fall to the knee, the velocity vane passes between the infrared emitter and detector which generates a series of on/off pulses that can be converted to velocity by a data acquisition system.

The one uniaxial accelerometer, femur load cell and knee potentiometer required for this test are not included.

Dimensions	Fixture	Work Area
Length	8.0 ft	16.0 ft
Width	3.8 ft	4.0 ft
Height	9.5 ft	—

Standard Equipment

- Structural steel frame
- An “A” frame low profile impact base
- Mounting adapter for knee attachment
- Probe suspension cables with mounting hardware
- (2) probe release assemblies
- (2) velocity vanes
- (2) infrared velocity measurement systems
- Bubble Level

Optional Equipment

Knee Impact Adaptation Packages are available for the following dummies:

- Hybrid III 50th/Hybrid 95th
- Hybrid III 5th
- Hybrid III 10 Y.O.
- Hybrid III 6 Y.O.

Knee Slider Adaptation packages are available for the following dummies:

- Hybrid III 50th
- Hybrid III 5th
- Hybrid III 95th

SID Damper Adaptation Package

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Revision: 02/17/03

Lumbar Flexion Test Stand

Model Number: TF-600

INTRODUCTION

The TF - 600 Lumbar Flexion Test Stand is used to check the flexion rate of the molded rubber lumbar spine assembly of the Hybrid II dummy.

DESCRIPTION

The Lumbar Test Stand is made of a welded steel table with a horizontally mounted pelvis attachment bracket, a push type force gauge, and an angle indicator.

The thorax, lumbar spine, pelvis, and upper legs (excluding the knee) are assembled and positioned onto the table surface. The assembly is mounted using a rear horizontal bracket aligned with the pelvic instrument cavity and two femur link rods.

The magnetic based angle indicator is attached to the thoracic instrument cavity, and the thorax is flexed forward 50 degrees and then rearward as necessary to return it to its initial upright position. The forward force should be applied at a rate of 0.5 degrees to 1.5 degrees per second, recording the loads achieved at 0, 20, 30, and 40 degrees.

Dimensions	Fixture	Work Area
Length	2.1 ft	6.0 ft
Width	2.3 ft	4.0 ft
Height	1.8 ft	—

Standard Equipment

- Lumbar flexion table with mounting bracket for Hybrid II
- Force gauge
- Mechanical Angle Indicator

Optional Equipment

- 3-Year-Old (103C) adaptation package
- 6-Year-Old (106C) adaptation package
- Electronic Inclinometer Display

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Creating the New Standard in ATDs

Revision: 02/17/03

Foot Compression Test Stand

Model Number: TF-78051-600

INTRODUCTION

The Model TF-78051-600 Foot Compression Test Stand is a complete, automated test fixture for performing the foot sole inspection tests outlined in the Hybrid III 5th Percentile Small Female and Hybrid III 95th Percentile Large Male SAE User's Manuals and the Hybrid III 50th Percentile Male SAE and NHTSA User's Manuals.

DESCRIPTION

When the sole of the Hybrid III dummy's foot is compressed by applying a load through the ankle, certain defined compression stiffness characteristics should be met.

The foot with heel pad and ankle is attached to the ankle bracket adapter and positioned level on the fixture's flat metal surface plate. A downward force is then loaded through the ankle ball by the motorized screw assembly at a controlled rate.

The Foot Compression Test Stand supplies the customer's Data Acquisition System with analog outputs for force and displacement.

Dimensions	Fixture	Work Area
Total Length	2.3 ft	5.0 ft
Total Width	2.3 ft	3.0 ft
Total Height	4.9 ft	—

STANDARD EQUIPMENT

The complete stand includes all equipment, including sensors, required to perform the Hybrid III Foot Compression Test.

- Linear Drive Mechanism with 3-inch stroke and 500 lb. capacity
- Linear Potentiometer for Deflection Measurement
- Digital Controller with keypad and LCD display
- User configurable software
- Analog outputs available from the controller for data collection from external DAS source
- Power requirements: 100 - 240 VAC, 50 - 60 HZ

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Revision: 02/14/03

Hip Calibration Test Stand

Model Number V00039

DENTON ATD, INC.

INTRODUCTION

Denton ATD, Inc. now offers a test fixture to perform the Hip Calibration Test for the Hybrid III dummy. The Denton ATD Hip Calibration Test Fixture is designed to meet all of the requirements for both SAE and 49 CFR part 572 test procedures in NHTSA's final ruling on the Femur Modification amendment.

DESCRIPTION

- Precision alignment and guide system to achieve the angular alignment and guiding requirements in the Test Procedure.
- Quick and easy pelvis installation and setup. No adjustments required.
- Reaction moment is measured directly. No conversions or calculations, weights or approximations to induce errors in the moment measurement.
- Angle is measured on the same centerline as the moment. This centerline is lined up with the center of rotation of the femur by matching tolerances for precise alignment. This provides maximum accuracy and requires no setup adjustments.
- Femur inboard/outboard angle can be set at any angle 0 ±13 degrees, in 1 degree increments, with quick release dowel pin. Precise machining assures that these angles are accurate relative to the midsagittal plane.
- Test Stand is controlled by a digital controller. No external computer is required for operation.
- Analog outputs from the sensors can be connected to a test lab's data acquisition system to collect data. Therefore, separate procedures are not necessary for verifying J211 compliance and for data archival. Company standard data, printout, and plot formats are used since all data is collected using the same methods and equipment as with any other test.
- The digital controller has a keypad and LCD display. Simple menus are used to change test setups and parameters for special tests.
- The test can be stopped at either a flexion angle or a moment level. These setups are entered through the digital controller menus.
- Angular velocity is set through a digital controller menu.
- The Test stand automatically determines the zero angle at the beginning of each test. A digital output is provided to signal the test lab data acquisition system when the angle passes through zero. No operator adjustments or setups are necessary.
- Test Stand operates off 120/250 VAC, 50/60 Hz.
- Test Stand does not apply an axial pull load through the femur.
- The digital controller displays the test results immediately upon test completion. This can be used as a cross-check of the test lab data acquisition system and for quick checks of pelvis-femur combinations.

Standard Equipment

- Hip Calibration Test Fixture, Complete

This includes all equipment required to do Hybrid III 50th testing according to the SAE or 49 CFR Part 572 test procedures described.

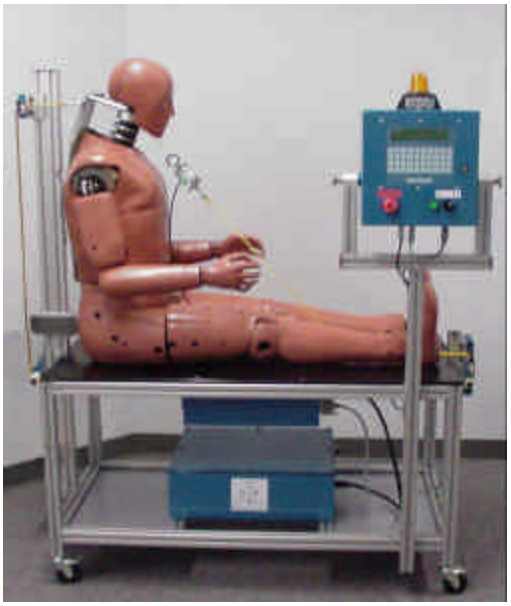
Optional Equipment

- Hybrid III 5th Female Attachments
- Hybrid III 95th Male Attachments
- Potentiometer Calibration Fixture

Dimensions	Fixture	Work Area
Length	3.0 ft	5.0 ft
Width	5.0 ft	7.0 ft
Height	6.8 ft	—

Automated Torso Flexion Test Stand

Model Number TMA-001



The Denton Automated Torso Flexion Test Stand is capable of performing the certification test on all the test dummies specified by the U.S., National Highway Traffic Safety Administration (NHTSA) (Title 49 CFR, Part 572) and the tests designed by the Society of Automotive Engineers (SAE) (found in each ATDs respective Engineering Aids). The Denton Automated Torso Flexion Test Stand can perform the flexion test for the unregulated H-III95M. By following the software setup descriptions in the manual, the operator can quickly and easily add new test configurations.

The test stand includes all the mounting hardware and transducers (load cell and angle sensor) necessary to perform the torso flexion test on the H-III3C, H-III6C and H-III5F. The software is configured for these three dummies but tests for up to eight dummy types can be stored and each dummy type can be configured for up to four different tests (NHTSA, SAE, Company and Other). Not only can up to thirty-two different tests be stored but all corridors and test parameters for each test can be easily adjusted by the customer through the controller unit key pad. This provision allows the customer to modify the testing software without expensive upgrades or purchasing new dummy type configurations.

The test stand is fully automated. After starting the software, the integrated control unit will conduct the full forty minute test without supervision or aid. The test stand is integrated with a single-board computer that controls the drive motor and clutches and collects, analyzes and displays the quick results in standard engineering units for easy operation. All testing functions are performed through the integrated controller unit with a user-friendly key pad on the test stand. The easy to use built-in software allows the operator to check and calibrate the transducers with a real-time voltage display. It also provides the added flexibility of performing tests in “manual” mode to allow the operator to move the upper torso through its range of motion, or to any position, and view transducer outputs throughout the entire range of motion. Analog outputs for the force and angle are provided on the bottom of the controller so that data can be collected by the user’s DAS and software.

An optional ASA software package for use with a personal computer allows the operator to store digital test data. The stored data can be exported to Excel or a similar software package.

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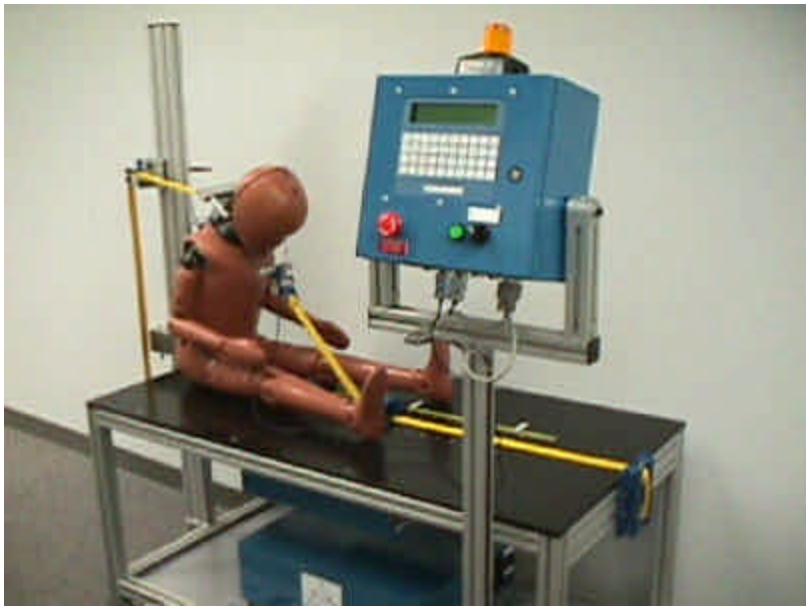
Automated Torso Flexion Test Stand

Model Number TMA-001



Instrumentation: The Denton Automated Torso Flexion Stand uses one uniaxial load cell (capacity: 890 N (200 lbf)) and one angle sensor (range: ±70°). Both are included with the fixture.

Features

- Mounting Hardware included for: H-III3C, H-III6C, H-III5F.
- Fully automatic test operation; requires no operator assistance after initial program setup.
- Performs NHTSA (see 49CFR, Part 572) and SAE (see individual Engineering Aids) tests.
- User configurable software.
- Operator can change or add up to 32 different tests.
- Programmable pull rate, wait times, on/off safety devices (light, beeper).
- Portable; the test can be conducted in any level area.
- Power requirements are 100-240 VAC, 50-60 Hz, 300 watts
- Additional external warning light and enclosure switches can be easily added.
- Built-in transducer calibration software.
- "Manual" mode for adjusting dummy position using force or angle input.
- Table and Pulling hardware labeled for each ATD to eliminate setup error and minimize setup time.
- Warranty: One-year for parts and workmanship.

Test Stand Specifications :

Capacity: 200 lbf and up to 65° (from vertical)
Length: 1.4 m (4.7 ft)
Width: 0.8 m (2.5 ft)
Height: 1.6 m (5.1 ft)

Optional Equipment:

- Hybrid III 95th Male Mounting Hardware
- Hybrid III 10-Year-Old Mounting hardware
- ASA Communication Software

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Abdominal Compression Test Stand

Model Number: TF-900

INTRODUCTION

The TF-900 Abdominal Compression Test Stand is a complete fixture for the calibration of the Hybrid II abdomen as described in the Federal Motor Vehicle Safety Standard (FMVSS) No. 208, Occupant Crash Protection, and as specified in 49 CFR, Part 572.

FEATURES

The test dummy's thorax, lumbar, and pelvis are assembled and placed horizontally on its back and positioned onto the test fixture's surface table. A six (6) inch diameter and eighteen (18) inch long cylinder is placed across the abdomen symmetrically with the midsagittal plane. A vertical downward force is then applied through the cylinder at a rate between 0.25 and 0.35 inches per second. The fixture guides the cylinder down without any significant lateral or rotational movement

Dimensions		
Total Height	32.5 in.	.82 m.
Total Width	24	.61
Total Depth	36	.91

Standard Equipment

The complete stand includes all equipment, including sensors, required to perform Hybrid II abdominal compression calibration.

- Structural frame
- Pelvis position backstop
- Half-cylinder
- Load cell
- Electric linear actuator with built in linear potentiometer for both displacement and velocity
- Control Box

EuroSID Thorax Certification Test Stand

Model Number: V00364

INTRODUCTION

The V00364 EuroSID Thorax Certification Test Stand is a complete fixture for the calibration and testing of the rib components for the EuroSID-1 and ES-2 dummies.

The fixture is designed to test EuroSID-1 and ES-2 rib modules at the velocities specified for certification. Inspection tests for the rib alone and damper tests can also be performed.

DESCRIPTION

The tower is constructed of structural steel tubing with a maximum height of 22.7 ft. The tower height itself is adjustable to a lower 11.5 ft. when the upper extension piece is removed. This allows for more flexibility in lab installations where only whole rib module testing is required.

Tests are performed by raising the free fall impactor to a specified height. Using an electromagnetic release system, the impactor is released and guided down by two cables.

Once the probe impacts the rib module, a linear potentiometer mounted within the module measures peak deflection.

Velocity measurements are made by means of an infrared velocity measurement system. This system is made up of an infrared emitter, detector, and a precision slotted vane. The slotted vane is attached to the impactor, and when dropped, the vane passes between the infrared emitter and detector generating a series of on/off pulses that can be transmitted into velocity by the use of Denton ATD's data acquisition system coupled with EuroSID-1 analysis software. An accelerometer is used to determine time zero.

Two (2) impactors with varying masses are used to perform individual tests. A 7.78 kg impactor is used for rib module and rib alone testing, and a 1.0 kg impactor is used for damper testing.

A rib linear potentiometer and an impact accelerometer required for the test are not included.

Standard Equipment

- Welded tower structure
- (2) impactors, 7.78 / 1.0 kg
- Infrared velocity measurement system
- Electromagnetic release
- Mounting brackets for damper and potentiometer
- Rib Module mount plate
- Rope Hoist

Dimensions	Fixture	Work Area
Length	2.1 ft	5.0 ft
Width	4.0 ft	5.0 ft
Height	22.7 ft	—

SERVICES

Complimenting our equipment production, engineering/crash test services, and training programs, the new Denton ATD Service Center provides a wealth of important secondary services. Through this unique program, customers can call on the expertise of experienced Denton ATD personnel in special areas that may be too costly or time-consuming to handle themselves. In many cases, substantial savings can be realized by entrusting these secondary operations to Denton ATD personnel.

Dummy Recalibration Services

Dummy Management & Dummy Fleet Maintenance

Spare Components

ATD Pre-Test Instrumentation

Connector Installation & Wiring Repair

Cable System & ID Module Retrofit

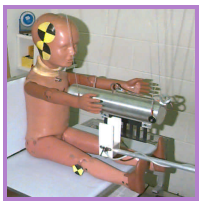
Data Acquisition System Certification

Technician Training & Support

Denton ATD employs a talented staff of engineers who are available to assist you with your projects or answer questions related to:

- Biomechanical (ATD) Design
- Test Equipment Hardware Design
- Customer Technical Support
- On-Site Training and Seminars
- Calibration Laboratory Certification
- Finite Element Modeling

Recalibration Services Denton ATD offers complete recalibration services for test dummies. Complete dummies and assemblies may be sent for recalibration tests in our in-house Calibration Test Lab.

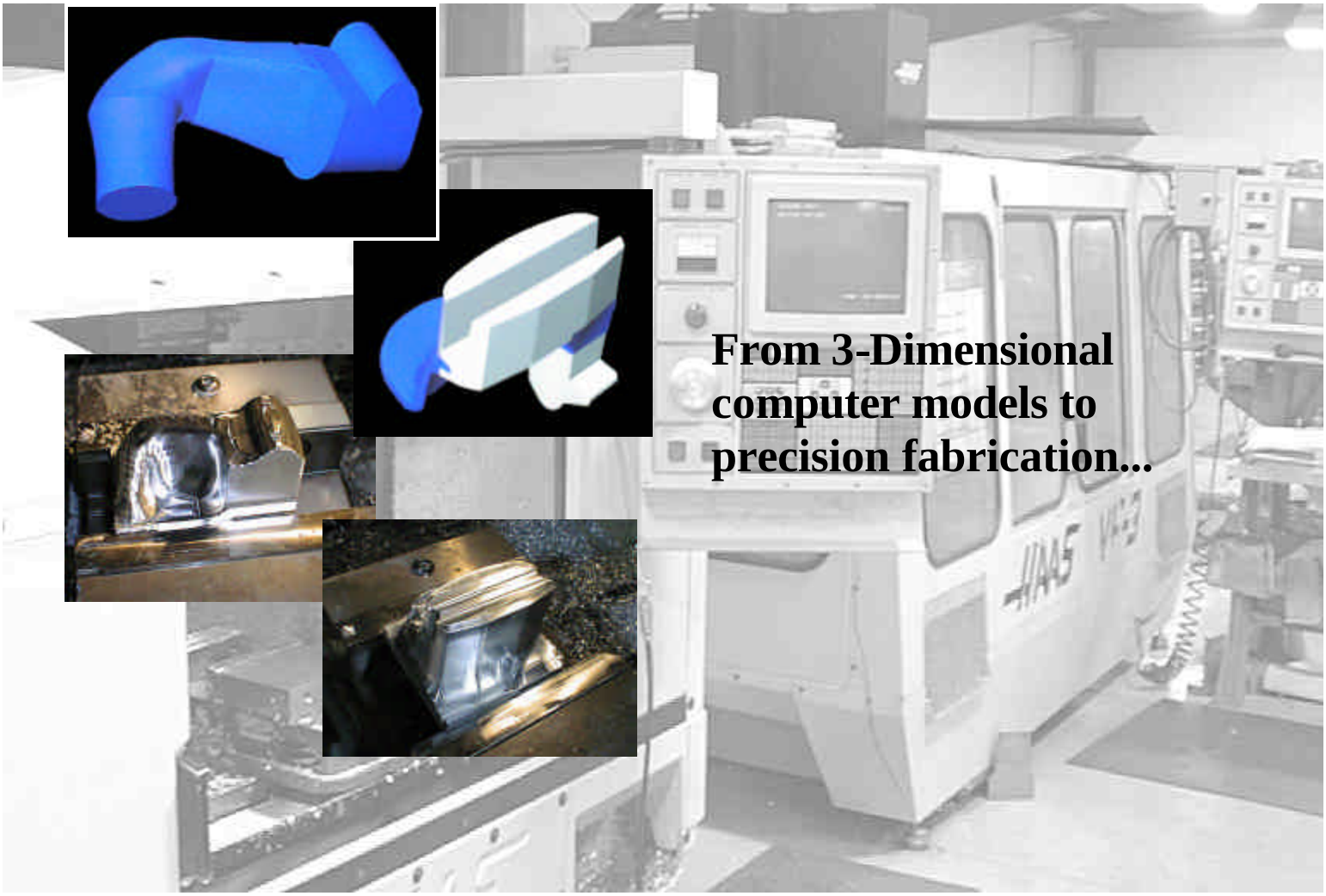


Remolding Services (replacement of vinyl) are provided for most ATDs. Calibration testing is included where specified. Denton ATD also offers component remolding.

The professionals at Denton ATD will work with your team to offer specialized on or off-site training in areas such as FMVSS 100 and 200 Series testing, ATD calibration-use and history, and instrumentation utilization.

DENTON ATD, INC.

3-D Computer Design Manufacturing



DENTON ATD's state-of-the-art 3-Dimensional computer aided manufacturing capabilities permit precision design and rapid fabrication of tooling for prototypes.

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Signal Waveform Generator

INTRODUCTION

Denton ATD now offers Calibration Lab Data Acquisition Evaluations. Utilizing a Signal Waveform Generator (SWG) combined with specialized hardware and customized signal processing software, Denton ATD can evaluate a laboratory's DAS to see if it meets J211 specifications. For clarification in this document, the term "SWG" is the complete system composed of the ARB and ODB.

FEATURES

The SWG in use for lab evaluations is a PC based Arbitrary Waveform (ARB) Generator and Output Distribution Box (ODB). The ARB is programmed with different sets of waveforms that are injected into the evaluating facility's DAS. These waveforms were developed by NHTSA to be used in their original SWG the "Blue Box." This combination of ARB and ODB is the current upgrade to the SWG and has been proven to be an adequate replacement.

The DAS evaluation is conducted separately from any calibration tests. The facility being tested sets up an actual test and connects the ODB directly to each sensor interface. The SWG then triggers the DAS, which stores each of the corresponding waveforms. After the waveforms are collected, the data is converted into the proper format for software processing. The software used is the same software that NHTSA uses in evaluating their contractors. Once data analysis is completed, reports are generated illustrating the test results in correlation to J211 specifications.

Of the waveform sets, there are two waveform groups consisting of rectangle, half-sine, stair, crash, and sum-of-sines patterns. The rectangle and stair waveforms are used to determine channel time accuracy, amplitude accuracy, and amplitude overshoot. The half sine pulse is used to measure channel-to-channel time differences. The sum-of-sines waveform is used to measure channel frequency response. The half sine and crash waveforms are used to determine HIC values.

The ODB box adequately supplies transducer level voltages to the sensor interfaces. The ODB and ARB are used in conjunction due to the limited output channels from the ARB. The ARB has only 2 analog outputs, 3 digital outputs, and 2 digital inputs. The ODB divides the analog signals into user selectable transducer voltage levels and distributes them to many output channels. The voltage levels that are available on Denton ATD's ODB are +/-500mV, +/-200mV, +/-50mV, +/-20mV, +/-10mV, +/-5mV. The correct voltage level selected would closely match the transducer's full scale voltage.

By following the designs and recommendations from the ESV Paper 96-S9-W-27, " An Upgrade System For Crash Test Data System Evaluation," authored by John E. Nickles and Randa Radwan Samaha, Denton ATD has built and tested a complete SWG to be used in lab evaluations.

Please contact Denton ATD for a formal quotation for a Calibration Lab Data Acquisition Evaluation utilizing a Signal Waveform Generator (SWG) combined with specialized hardware and customized signal processing software.

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