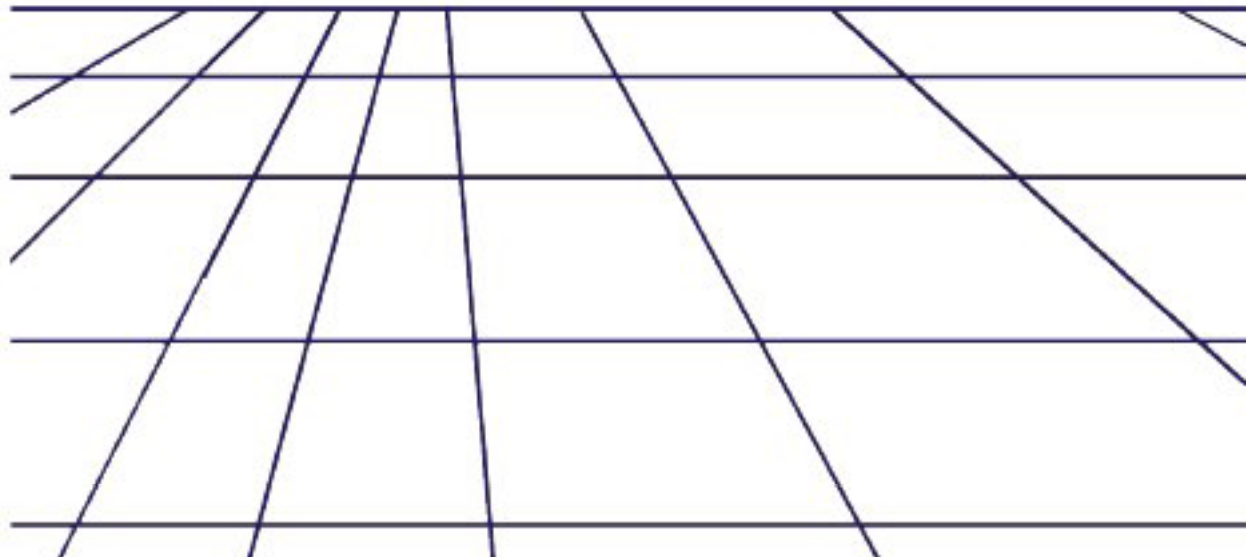


Mechanical Test

- Strain Gage Instrumentation
- Materials Testing Machines
- Materials Analysis Instruments
- Supercritical Fluid Extractor
- Automotive Testing
- Custom Engineering
- Supercritical Steam Materials Testing Systems
- 應力應變量測分析儀器
- 自動化量測軟體
- 物理材料分析儀器
- 自動車動力量測設備
- 高性能萬能材料試驗機
- 客製化量測控制儀器設備

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Profile

《Company Background, Business Philosophy》

Advance Instrument Inc (AI), established in 1997, is a technology base company to research, design and manufacture measuring instrumentation. Driven by her business philosophy of integrity and responsibility in servicing customers in all categories, the early stage of company had focused on the technological development and manufacture of the stress/strain measuring instruments. Later, with the professional capability, AI had developed a series of mechanical measurement instruments, devices and test equipments.

《Professional Capability》

AI currently has a full range of stress/strain measurement instruments, automotive power measurement equipments, automatic measuring software, high-performance universal material machines, and physical material analysis instruments. The systematic measurement equipment includes all kinds of mechanical, physical and harsh environments (high temperature, high pressure, corrosion) test systems. AI is famous to develop the customized measurement & control apparatuses with special functional systems.

《Core Advantage》

Up to now, AI has already become one of the world's top ten manufacturers with R & D and manufacturing expertise to produce the strain gage (gauge) instrumentation and with distribution channels in multiple regions of the world. The application and the measuring technology in AI has even taken the lead position which is far away from Taiwanese domestic agents in the instrumentation industry. Having substantial experience and know-how in system integration, AI had actively strived to meet customer needs and had drawn up a number of customized systems. Some are listed below:

- Multidirectional (Human) Pulling System, used for Physical Therapy medical studies
- Four Wheel Electric Scooter handle and front wheel side slip test systems
- Ultra-Supercritical Steam Materials Testing equipment, for future eco (environmental) friendly fire power plant on working conditions of 760 ° C, 400Bar
- High Temperature Hydrogen Storage test equipment
- Large specimen TGA (thermogravimetric analyzer) test system
- DHT Thermal Dilatometric Analysis
- TMA (thermo-mechanical performance analyzer)
- SOFC high temperature ceramic glue leak detection system
- SOFC automated lamination assembly system
- Nuclear power engineering uranium fuel sipping inspection, control and recording system
- Nuclear reactor detector tube swap and underwater tools, etc.

Many of the systems have already been applied with international patents.

For decades, AI has mostly cooperated with academic and research institutions. AI has therefore had the complete experience to work with academic research institutes with the collaborative partnerships and also with the experience to work with different industries, government sectors and academia institutions.



《Customers in Taiwan》

Through these years, AI has served many customers in the domestic market. About 75 % of the customers in Taiwan are the universities / graduate schools or research institutes. Some customers' names are listed as below:

- Most of the Mechanical Engineering Dept., Civil Engineering Dept., Material Science Dept. / Graduate schools in Taiwanese universities.
- Some Graduate Institutes of Clinical Dentistry School or Dentistry Dept. in the University.
- Some research centers in the government institutes like Academia Sinica, Institute of Nuclear Energy Research (INER), Metal Industries Research & Development Center, Chung Shan Institute of Science and Technology and Taiwan Electric Research & Testing Center; National Space Program Office.

Another 25% of the customers in Taiwan are in the industries. Some famous ones are Honda Taiwan, Sanyang Industry, Johnson Health Tech, Tatung, SanDisk, Siliconware Precision Industries, and Advantech.

《Customers outside Taiwan》

(USA) National Institute for Standards and Technology

(USA) Department of Civil and Environmental Engineering, University of California

(France) Laboratoire National d'Essais

(UK) Department of Earth Sciences, Durham University

(UK) BAE Systems

(KSA) Center of Excellence for Concrete Research and Testing, King Saud University

(India) Defence Metallurgical Research Laboratories, DRDO

(India) Centre for Civil Aircraft Design & Development, CSIR

(Belgium) Siemens AG

(Brazil) National Institute of Metrology, Quality and Technology

(Brazil) Universidade Federal do Rio Grande do Sul

(Israel) Israel Aerospace Industries

(Israel) Civil Engineering Department, Ariel University

(Thailand) King Mongkut's University of Technology Thonburi

《Future Vision》

We're now actively expanding our business and have scheduled to exploit the international market.

We are contacting with professional agents worldwide to represent our products and to give the needed service. We're also developing the economical models to satisfy the market. In another view of the marketing, we also try to get the representation of some extremely accurate instrument. Thus, supplying with our whole series of existing strain gages and load cells and to reinforce our capability and to enlarge our sales, we expect to have the brand of " Advance Instrument " listed among the physical measurement instrumentation field of the 10 industrial nations in the near future.





Profile

《公司背景、經營理念》

Advance Instrument Inc. 成立於 1997 年，是一家以技術為本位的量測儀器研發、設計、製造公司。本著誠信、責任的經營理念服務各領域客群。發展初期致力於應力應變量測儀器的技術研發與製造，爾後以專業的能力發展出一系列力學量測相關儀器、裝置與測試設備。

《專業能量》

本公司目前有一系列完整的應力應變量測分析儀器、自動車動力量測設備與自動化量測軟體、高性能萬能材料機、物理材料分析儀器。系統量測設備方面包含各式力學、物理及惡劣環境（高溫高壓腐蝕）測試系統；並以接受特殊功能的客製化量測控制儀器設備與系統著稱。

《競爭優勢》

發展至今，公司是全球前十位具研發暨製造專業應變規（計）儀器能力的廠商之一，並在全球多個區域設有經銷代理商。在量測技術與應用上更是領先國內代理同業甚遠。並以豐厚的系統整合能力，積極努力配合客戶需求而開發出多項客製化系統產品。例如：多方向人體牽拉系統、四輪電動代步車把手與前輪側偏系統、超超臨界蒸氣材料試驗設備（2020 年下世代環保火力電廠工作條件 760°C、400Bar）、高溫合金儲氫試驗設備、大試片 TGA 熱重分析儀、DHT 熱膨脹儀、TMA 熱機械性能分析儀、SOFC 高溫陶瓷膠測漏、SOFC 自動化疊片組裝系統、核電工程鈾燃料束啜吸檢查控制記錄系統、核反應爐偵檢管抽換及水下工具…等，其中多項都已申請國際專利申請。本公司客戶群多為學術研究機構，累積數十年合作經驗、因此也擁有完整的學術研究伙伴與產官學合作經驗。

《國內服務客群》

國內 75% 的客戶是各大學院校 / 研究所或研究機構，例如；台大應力、機械、土木、牙醫學院，海大機械、材料所，淡大航太所、清大動機所、中央土木、橋樑中心、逢甲機電、土木所、成大土木、機械所、高醫牙醫所及陸官土木系…等。國家地震研究、中央研究院天文所、原能會核研所、台電綜合電力研究所、高雄金屬中心及中山科學研究院航發中心（現更名漢翔工業）…等。

國內 25% 的客戶是產業界，例如：台灣本田（HONDA）、三陽工業（股）公司、喬山健康科技（股）公司、大同（股）公司、美商晟碟（HSanDisk）、矽品精密工業（股）公司、研華（股）公司…等。

《未來展望》

目前本公司積極擴展公司營業規模，並計畫性的開拓國際市場。我們正在跟全世界的專業代理聯絡來代理茂凱的產品並提供必要的服務。我們同時也在發展經濟型的產品來滿足市場。而從行銷的另一觀點，我們也爭取代理極端精密類的產品。所以以我們既有之全系列的應變規及負荷元之供應加上強化我們的專業能力及行銷規模，我們期待在不久的將來，Advance Instrument 的品牌將擠身於十大工業國的物理量測儀器領域中。



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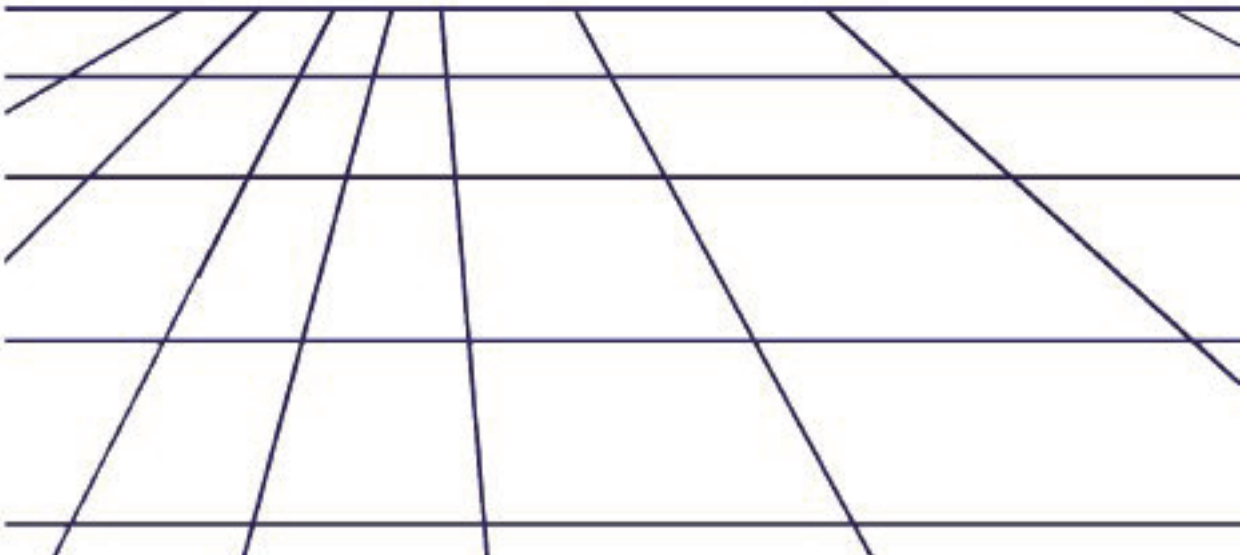
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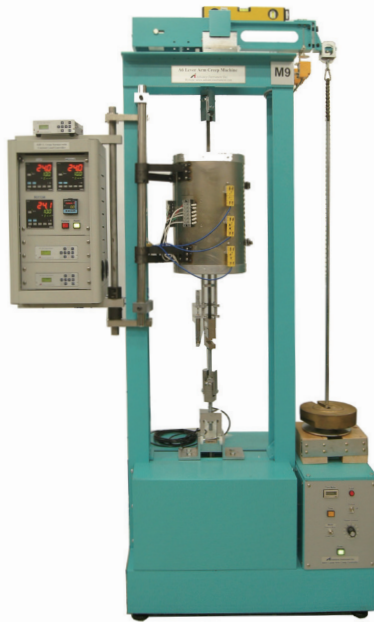
Mechanical Test

- High Strain Rate Material Test Equipment
- Material Creep Test Equipment
- Stress Corrosion Cracking (SCC) Test Equipment
- Universal Electromechanical Materials Test Equipment
- Mechanical Analysis
- Mechanical & Material Application Tester





A6 Series Lever Arm Creep Testing Machines



Features:

- Wide-frame construction
- Easy operation
- Four-position hardened knife edges
- Precision drawhead guide assembly
- Automatic beam leveling
- Weightless specimen loading
- Durable vibration isolator
- Vee-block supports
- Tool steel knife edges, easy replacement
- Hot-step loading, stress relaxation, constant stress, and more via A6-DAS frame control data logging system with A6-AP Win application software
- Option Weightless Loading Module

Applications:

- Creep tests
- Creep rupture tests
- Stress rupture tests
- Stress relaxation tests
- Constant stress tests
- Creep crack tests
- ISO 204:1997, ASTM E 139-06
- Definition of individual step less sequences of temperature
- Ambient or elevated temperature
- For long term tests (reaching more than 10.000hrs)
- Machine test and laboratory

Description:

A6 Series Lever Arm Creep Testing Machines is made up of modern creep and stress rupture test frames. After decades of hard work, these sturdy and durable systems have been tested by our clients, their consistent accuracy and reliability have been consistently confirmed by researchers and users.

The powerful standalone A6-DAS frame control data logger system and A6-AP Win application software, are frames that meet virtually all of creep testing requirements, both now and in the future.

A6 Series Creep Test Frame system is fully developed and designed by AI and third parties engineering team. From mechanical hardware to measuring tools and electronic equipment, controllers and software, we possess and pride ourselves of having high reputation on the performance accuracy of the equipment and can support customers with various testing requirements. Existing AI own and third parties equipment upgrade and modifications are also highly accepted by our customers. For more information and many other capabilities, please refer to the details on A6-DAS frame control data logger system.

A6 Series Creep Test Frame are servo control precision knife-edge lever arm testers with optional advanced Weightless Loading Module, SSRT Module, UTM Module, etc that can incorporate many of advanced design features.



A6 Series Lever Arm Creep Testing Machines

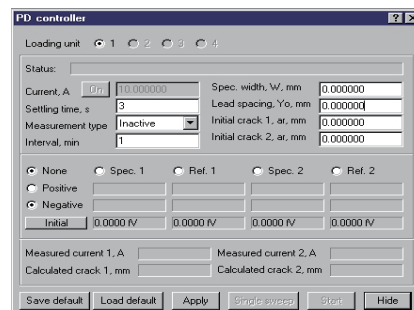
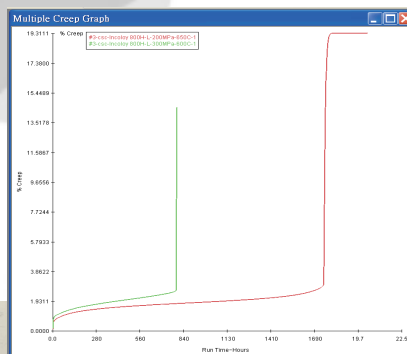
Specification: A6 Load Lever Arm Load Graph Frames

All A6 Lever Arm Creep Test Systems are enhanced by a wide range of optional accessories and frame configurations. These features and components include:

- Frame accessories: Load Train Compartments with Alignment Couplings, Adaptors, Specimen Grip, Compression Test Fixtures, etc.
- Environmental Test Equipment: Furnaces, Ovens/Cooling Chambers, Retorts.
- Instrument accessories: Extensometer Frames, Displacement Sensors, Signal Conditioner, etc.
- Test Control modules: Weightless Loading Module, Stress Relaxation Module, Constant Stress Module, etc.

	A6 Creep Testing Machine Frame			
Model	A6-30M	A6-50M	A6-100M	A6-200M
Capacity	30kN	50kN	100kN	100kN
*Lever Arm Ratios	30:1	50:1	100:1	100:1
*Column Width	480 mm	560 mm	560 mm	770 mm
Approximate Dimension W x D x H (mm)	900x520x2150	1170x520x2250	1250x620x2300	1550x620x2450
Drawhead Drive Speed	2.5-30.5 mm/min, Travel: 130 mm			
Load Accuracy	0.5% (down to 1% of Capacity, with certificate of calibration)			
Power Requirements	115 or 230 Vac, 50/60 Hz			
*Custom frames with varying size, draw head and arm ratios etc are provides.				
**AI also provide many kind Direct Load Testing, If any needed contact with us.				

- Calibrated load weights
Available Sizes (Metric Units, kgw or N)
 0.5 ± 0.0005 N, 25.0 ± 0.0075 N
 1.0 ± 0.0008 N, 50.0 ± 0.012 N
 2.5 ± 0.0014 N, 100.0 ± 0.019 N
 5.0 ± 0.0026 N, 150.0 ± 0.024 N
 10.0 ± 0.0048 N, 200.0 ± 0.029 N





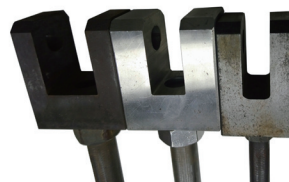
A6 Series Lever Arm Creep Testing Machines

Specification: A6 Load Train Accessories

A6 Lever Arm Creep Test Systems has a wide range of selective components, frame accessories and frame configurations, these accessories are precision-machined to meet toughest international standards.

Load Train Components include:

- Couplings (Alignment)
 - Quick-Change Coupling
 - Spherical Bearing Coupling
 - Quick-Change Spherical Bearing Coupling
 - Double Knife-Edge Alignment Couplings
 - Electrical Isolation Alignment Couplings
 - High-Temperature Alignment Couplings
- Adaptors
 - Pull Rods
 - Threaded Adaptors
 - Studs
- Specimen Grips
 - Threaded Couplings (Rod Specimen)
 - Button-head Couplings (Rod Specimen)
 - Clevis Couplings (Sheet/Rectangular Specimen)
 - Wedge Couplings (Sheet/Rectangular Specimen)
 - Compact Tension Test Clevis (CT Specimen) ASTM E399
- Compression Test Fixtures
 - 3 point bend test fixtures
 - 4 point bend test fixtures
 - Ring on Ring bend test fixtures
- High-Temperature Components Materials:
 - 17-4 PH Stainless Steel
 - High temperature Alloys, 713C, MAR-M246, Inco 718, etc.
- Weight elevators
 - Motor Drive, Air/Hydraulic drive
 - Manual lead screw drive



3-2

Material Creep Test Equipment



A6 Series Lever Arm Creep Testing Machines

Specification:

Extensometer frames / Displacements Sensors / Sensor Conditioners

All designs and manufactures standard as well as custom-made extensometer frames for a wide choice of creep hot tensile/compression test applications.

- Creep Testing Extensometer Frame (Maximum Temperature: 1100°C)
 - T112 Extensometer Frame Interchangeable specimen inserts Four-rod construction
 - T114 Extensometer Frame Cone pointed set screws for specimen attachment Four-rod construction
 - T121 Extensometer Frame Interchangeable specimen inserts or cone pointed set screws Dual Rod in tube construction
- Creep Testing Averaging Extensometer Frame (Maximum Temperature: 1100°C)
 - T124 Averaging Extensometer Frame Interchangeable specimen inserts Dual rod in tube construction Dual gauging platforms that provide adjustable gauge lengths 12 to 100 mm
 - T128 Averaging Extensometer Frame Interchangeable specimen inserts Six rod construction Dual gauging platforms that provide adjustable gauge lengths 12 to 100 mm
- CT Crack Length Testing Extensometer Frame (Maximum Temperature: 1100°C)
 - T122 CTT Extensometer Frame Crossheads designed to attach to CTT Specimen groove Single rod in tube construction
- Tensile testing Testing Extensometer Frame (Maximum Temperature: 1100°C)
 - T112-T Extensometer Interchangeable specimen inserts Four-rod construction
- Test on Retort Testing Extensometer Frame (Maximum Temperature: 1100°C)
 - T115 Extensometer Designed for high temperature creep testing within Retort Interchangeable specimen inserts Four-rod construction
- Plastic Creep Testing Testing Extensometer Frame (Maximum Temperature: 425°C)
 - T311 Extensometer Designed for creep testing of plastic and similar materials Dual Rod in tube construction

- Testing and Alignment Checking Frame (Room Temp.)
- T116 Creep Testing and Alignment Checking Extensometer

All Extensometer Frame Gauging (Sensors) Platforms designed for various types of displacement transducers or clip on extensometer.

- Displacement Sensors Force Displacement Sensor , LVDT, Digital Encoder, SLVC, Digital Dial Gage, Analog Dial Gage, Axial Extensometer (Tensile testing) etc.. Crack measurement instrument, DC/AC PD
- Displacement Sensors Signal Conditioner All kind of displacement sensor conditioner modules for data logger system.



3-2

Material Creep Test Equipment



A6 Series Lever Arm Creep Testing Machines

Specification: A6-DAS frame control data logger system and A6-AP Win application

A6-DAS frame control data logger system and A6-AP Win application software, are frames that meets virtually all of creep test requirements, both now and future.

A6-DAS frame control data logger system consists an embedded controller, a touch-screen display, a precision measurement unit, and a temperature control unit.

Each creep machine has an independent control unit and recording unit. It can be completely offline upon set up and operated by the touch screen display.

The A6-DAS frame control data logger system is an integrated system designed to replace cumbersome, time consuming and error-prone manual operating procedure, control equipment set-up, and data collection methods on test equipment adjustment controls inherent in long-term tests.

A6-DAS is equipped with modern touch-based embedded and decentralized control systems. It has complete testing machine control and data acquisition functions with real-time drawing functions.

The LCD touch panel displays essential test information and operator instructions, and are equipped with controls for frame, temperature controller, data logger, weight elevator operation, etc.

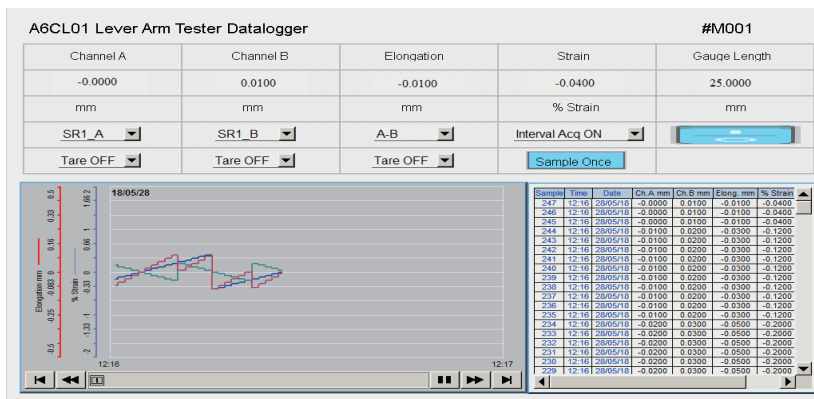
It's high capacity 128GB FLASH MEMORY is completely designed for various types of long time mechanical tests. This feature has standalone independent embedded control and data recorder. The recording device is designed to adapt to various conditions such as power interruptions encountered during long-term tests. It has the best security on long-term reliability and accuracy.

The A6-DAS has network TCP/IP communication capabilities. It can be link to hundreds of testing machines with the network system, and monitoring the status of each test at the remote site. Optional camera can also be installed to monitor overall machines performance. While with the use of TCP/IP, the whole test monitoring, including weight elevator; temperature control; accessories calibration; data acquisition control; etc. can be done remotely.

A6-DAS with A6-AP software can be use to perform post and aft analysis functions such as measurement, recording and curve mapping.

The A6-AP software package operates on a PC compatible computer running on Windows™ NT, Win7 operating system.

The A6-DAS consoles also provide TCP/IP reliable interface between frame hardware, accessories, and the host computer.



3-2

Material Creep Test Equipment

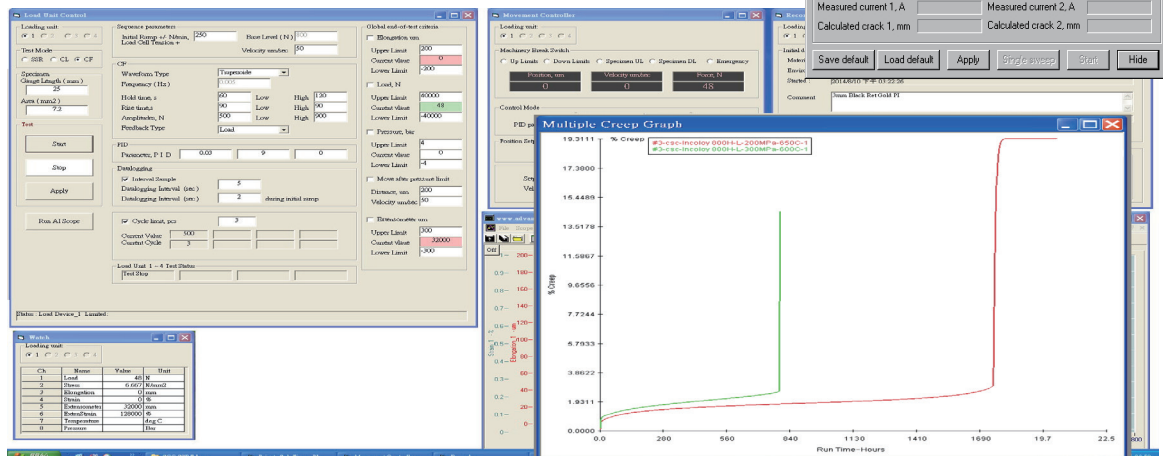


A6 Series Lever Arm Creep Testing Machines

Specification: A6-DAS frame control data logger system and A6-AP Win application

- A6-DAS frame control data logger
- A6-DAS (Standard Interfaces/Controls)
 - User Interface
 - 7" or 10" color LCD Touch Panel
 - HD 128GB FLASH
 - TCP/IP
 - Frame Controls
 - Automatic inch-down or drawhead control
 - Specimen break detection.
 - Elevator control
 - Extensometer (Displacements)
 - Adaptor to LVDT, SLVC, Laser, custom extensometers
 - Can be both channels from averaging extensometers
 - Furnace temperature control
 - 4 thermocouple input channels
 - One, two, or three zone furnace temperature control
 - Furnace power control
 - PID power control system
 - High-resolution thermocouple A/D
 - Multi-zone PID algorithms for precise temperature control.
 - High-level inputs
 - 4 input channels
 - Extensometer, temperature transmitter, etc.
 - Alarm
 - Furnace control
 - Automatic shutdown
 - Data log for all input channels
- A6-DAS (Optional Instrument/Controls)
 - Single or dual-channel extensometer signal conditioning :
 - Force linear displacement sensors, LVDT, or SLVC extensometer signal conditioning,
 - Custom extensometer amplifier configurations
 - Hot step loading modular
 - Automatic load control modular
 - Weightless testing modular
 - PDAP AC/DC Potential Drop Measuring Software
 - Custom Instrument/Controls

- A6-AP Win application software
 - Test Specifications
 - Test editor for creating and modifying procedures
 - ASTM standards E4, E8, E83, E139, E292, and ISO
 - Instrument Calibration
 - Extensometer calibration to ASTM E83
 - Thermocouple calibration correction.
 - Data Logger
 - Identification frame serial number maintains
 - Export all data associated with each trial
 - Instant access and reporting
 - Data is ASC II (*.csv)
 - Graphs/Plot
 - Creep, creep modulus, creep rate
 - Cold load, hot load; temperature
 - Multiple-specimen
 - Reports
 - Short/long form, Events
 - Calibration data for extensometers and thermocouples
 - Cold load, Hot load
 - Test specification
 - Creep data
 - System setups
 - Security
 - Multi-level password protection determines each user's privileges

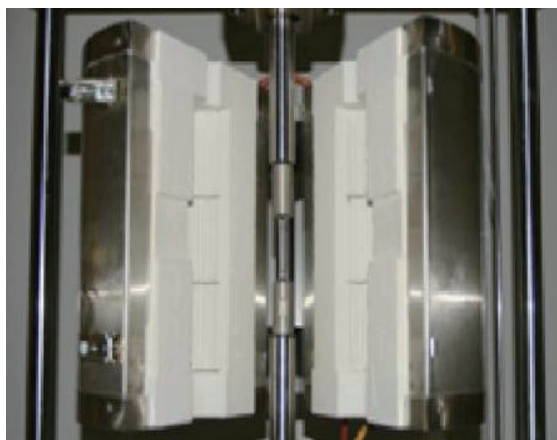




High Temperature Split Tube Furnace

Features:

- Machine Test and Laboratory
- Faster heat up
- Longer element life
- Lower shell temperatures
- Complete line of accessory
- Low watt-density heating elements
- Low K-factor vacuum-cast ceramic fiber insulation
- Wide variety of diameters, lengths, sizes, and configurations
- Easy replacement of failed elements
- Precise, Efficient, and Reliable
- Made to Customer Specifications
- Saving you time and money
- Heating elements Nichrome: 1850° F (1000° C)
- Optional elements Kanthal A1: 2200° F (1200° C)



Applications:

- General laboratory
- Machine Test
- Use for testing to ASTM standards
- Universal testing machines
- Creep/stress rupture test
- Stress corrosion cracking test
- High strain rate material test
- Bend fatigue test machines



Description:

Advance Instrument Inc. (AI) Series 4110 Tube and 4210 Split Tube Furnaces have been carefully designed and refined over many years to make them one of the most reliable and efficient laboratory furnaces available on the market today.

Standard construction features include low K-factor vacuum cast ceramic fiber insulation for superior energy retention and rigid structure, stainless steel shell and end flanges for both durability and appearance, and laboratory-replaceable heating elements manufactured under strict quality-controlled conditions in our own factory.

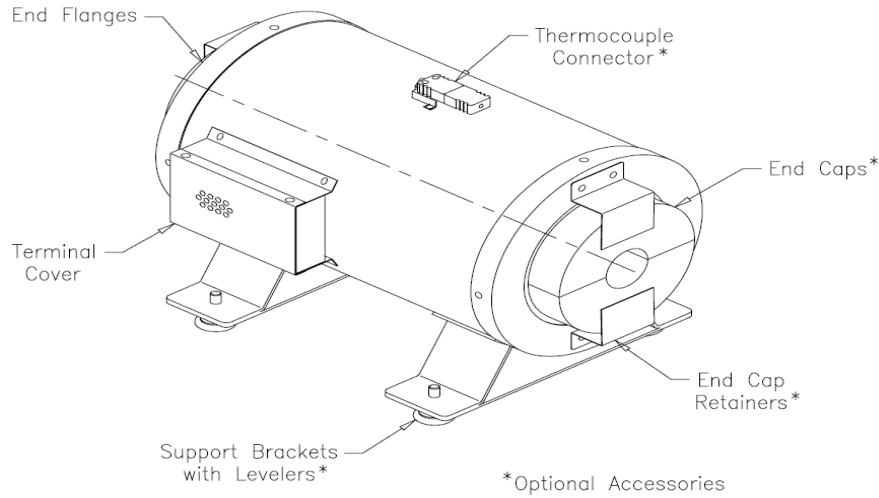
All Series 4110/4210 furnaces are built-to-order to your specific requirements, with a wide selection of available diameters, lengths, mounting arrangements, and accessory equipment, in a variety of configurations, including isothermal, gradient, adiabatic, and others.

Available options and accessories include heat-equalizing liners, extensometer slots and mounting flats, thermocouples, end caps, view ports, gas ports, cast bronze or brass heating elements, retorts, and more.

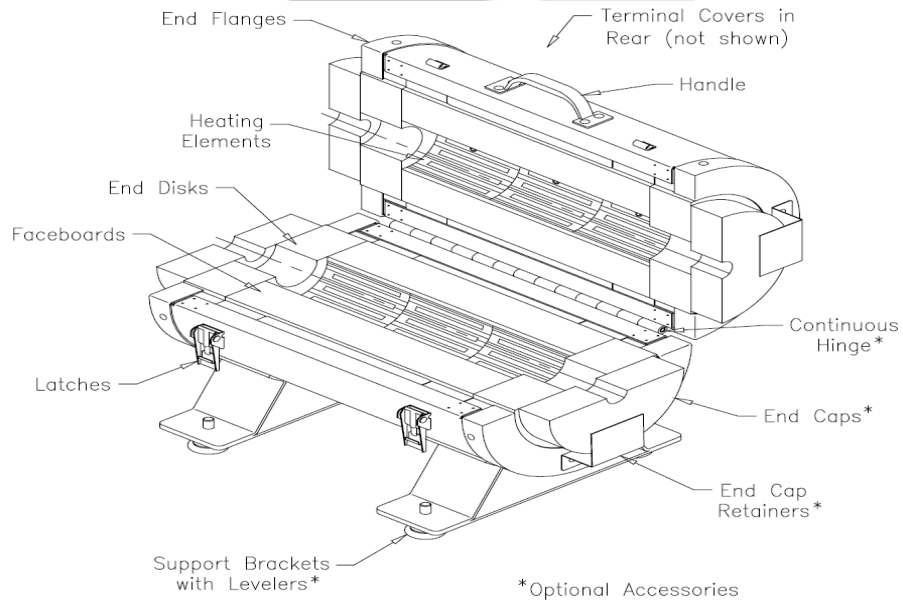


High Temperature Split Tube Furnace

Specification: Series 4110/4210 Furnace



Series 4110 Tube Furnace 1100° C Maximum



Series 4210 Split Tube Furnace 1200° C Maximum

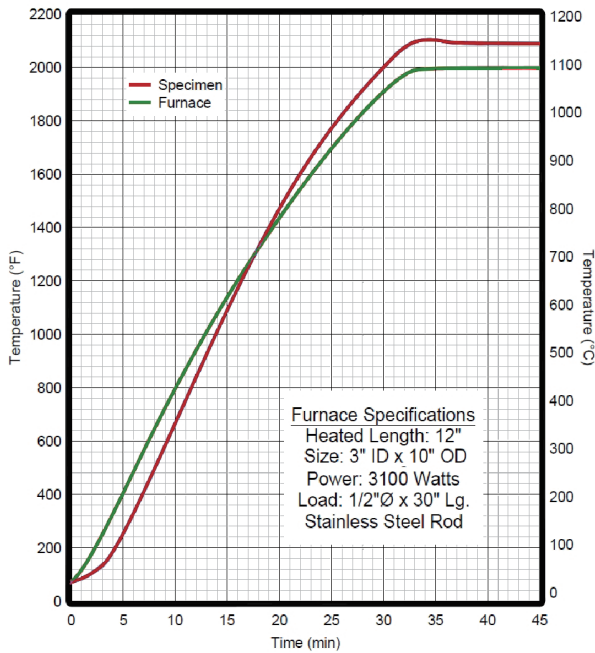


High Temperature Split Tube Furnace

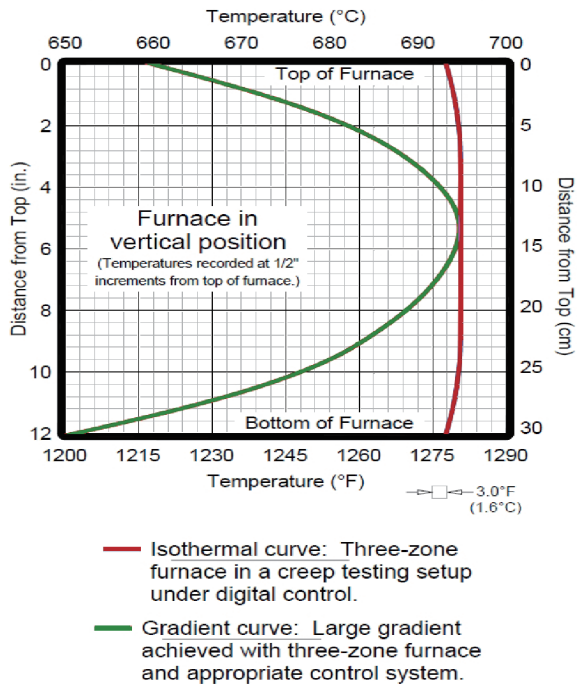
Specification: Series 4110/4210 Furnace

- Creep Testing Furnaces For the ultimate in precise temperature control and uniformity, AI furnaces can be combined with our exclusive computer creep system. This industry-leading hardware/software package automates every aspect of the creep testing process, including control, data acquisition, archiving, analysis, report generation, and much more.

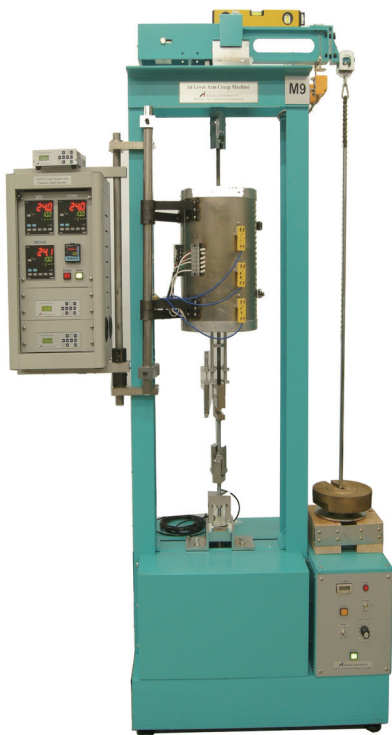
Typical Heatup Curve



Uniformity Curves
(Isothermal and Gradient Furnaces)



Other sizes supplied on request Length & zone construction made to order Heating elements and temperature range:
 Nichrome: 1850° F (1000° C)
 Kanthal A1: 2200° F (1200° C)



Typical 4110/4210 Furnace Sizes		
For service to 1650° F (900° C)	For service to 2000° F (1100° C)	For service to 2200° F (1200° C)
"ID" x "OD"	"ID" x "OD"	"ID" x "OD"
19.1mm x 152.4mm	19.1mm x 203.2mm	19.1mm x 254.0mm
25.4mm x 152.4mm	25.4mm x 203.2mm	25.4mm x 254.0mm
31.8mm x 152.4mm	31.8mm x 203.2mm	31.8mm x 254.0mm
41.1mm x 203.2mm	41.1mm x 254.0mm	41.1mm x 304.8mm
50.8mm x 203.2mm	50.8mm x 254.0mm	50.8mm x 304.8mm
60.5mm x 203.2mm	60.5mm x 254.0mm	60.5mm x 304.8mm
76.2mm x 203.2mm	76.2mm x 254.0mm	76.2mm x 304.8mm
95.3mm x 254.0mm	95.3mm x 304.8mm	95.3mm x 355.6mm
127.0mm x 254.0mm	127.0mm x 304.8mm	127.0mm x 355.6mm
139.7mm x 304.8mm	139.7mm x 355.6mm	139.7mm x 406.4mm
152.4mm x 304.8mm	152.4mm x 355.6mm	152.4mm x 406.4mm
177.8mm x 304.8mm	177.8mm x 355.6mm	177.8mm x 406.4mm
209.6mm x 406.4mm	209.6mm x 457.2mm	209.6mm x 508.0mm
304.8mm x 508.0mm	304.8mm x 558.8mm	304.8mm x 609.6mm



High Temperature Split Tube Furnace

Accessories : End Caps & Port Plugs, Temperature Sensors

• End Caps & Port Plugs

All furnaces are commonly supplied with removable and replaceable ends caps or port plugs.

These relatively inexpensive accessory items extend furnace life by absorbing “wear and tear” caused by the movement of fixtures, reactors, pull rods, etc., thereby preventing damage to the furnace insulation, which is considerably more expensive and time-consuming to replace.

All end caps and port plugs are also useful in situations where a number of different-sized bore diameters are required.

They can be easily interchanged, allowing a variety of possible configurations for a single furnace.

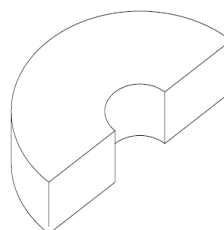


Fig. 1: End Caps



Fig. 2: Port Plugs

• Temperature Sensors

Furnaces from AI can be equipped with a number of different thermocouple types in a variety of mounting configurations.

Thermocouple connectors feature standard ANSI color coding and are available in types J, K, B, R, S, and Platinel-II.

Common mounting configurations include single connector with mounting bracket, duplex connector with mounting bracket, spring loaded for constant contact with a reactor or other vessel, and sealed for use in controlled-atmosphere furnaces, retort

T/C Type	Alloy Combination (+/-)	Max. Temperature	Limits of Error	Comments
ANSI "J"	Fe/Cu-45% Ni	1100°F (590°C)	2.2°C or 0.75%	Reducing, vacuum, inert. Limited use in oxidizing at high temperatures. Not recommended for low temperatures.
ANSI "K"	Ni-10% Cr/ Ni-2% Al-2% Mn-1% Si	2200°F (1200°C)	2.2°C or 0.75%	Clean oxidizing and inert. Limited use in vacuum or reducing. Wide temperature range. Most popular calibration.
ANSI "B"	Pt-30% Rh/Pt-6% Rh	3272°F (1800°C)	0.5% above 800°C	Oxidizing or inert. Do not use in metal tubes. Beware of contamination. High temperature. Common use in glass industry.
ANSI "R"	Pt-13% Rh/Pt	2700°F (1480°C)	1.5°C or 0.25%	Oxidizing or inert. Do not use in metal tubes. Beware of contamination. Precision high temperature.
ANSI "S"	Pt-10% Rh/Pt	2700°F (1480°C)	1.5°C or 0.25%	Oxidizing or inert. Do not use in metal tubes. Beware of contamination. Precision high temperature.
Platinel-II	Platinel-II/Platinel-II	2200°F (1200°C)	1.0%	More stable but more expensive substitute for type "K" thermocouples.

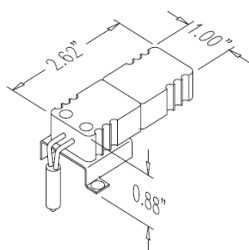


Fig. 3: Single Bracket

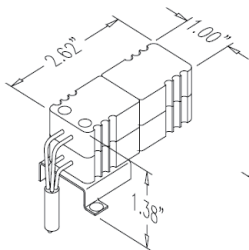


Fig. 4: Duplex Bracket

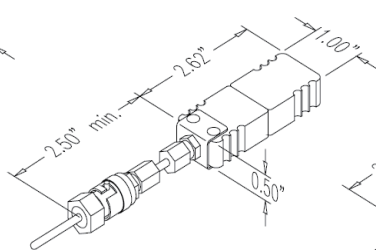


Fig. 5: Spring-Loaded

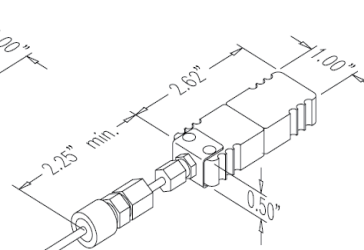


Fig. 6: Sealed



High Temperature Split Tube Furnace

Accessories :

Extensometer Flats & Slots, High Temperature Sample Supports, Zone Dividers

- Extensometer Flats & Slots

When performing creep, stress-rupture, and other tests, it is often necessary to have one or more precision extensometers in place to record dimensional changes that occur in a specimen throughout the process.

While some extensometers are designed to hang vertically from a specimen to take these measurements, many are intended to contact a specimen from one side, requiring a specially-configured furnace to provide clearance for the extensometer and, in some cases, to also provide support for it.

AI has extensive experience in designing such furnaces to suit extensometers from nearly every major supplier. When ordering, please have the information shown in Figure 1 (right) available:

- a) distance from surface of fl at to center of furnace;
- b) height of fl at;
- c) size (width & height) of access slot;
- d) sizes & locations (if necessary) of tapped holes for mounting of the extensometer. If available, please also provide the manufacturer and model number of the extensometer being used.

- High Temperature Sample Supports

For laboratory tests or industrial procedures that do not involve test frames, it is often necessary to have some method of providing support for samples or products that must be heated. AI meets this need with custom sample supports, specimen holders, and high-temperature pallets made from stainless steel or Inconel for use with fork trucks.

- Zone Dividers

Some heating applications involving gasses, liquids, or other substances require a sharp temperature gradient between furnace heating zones.

In such cases, AI furnaces can be constructed with insulating zone dividers to accommodate the required temperature difference

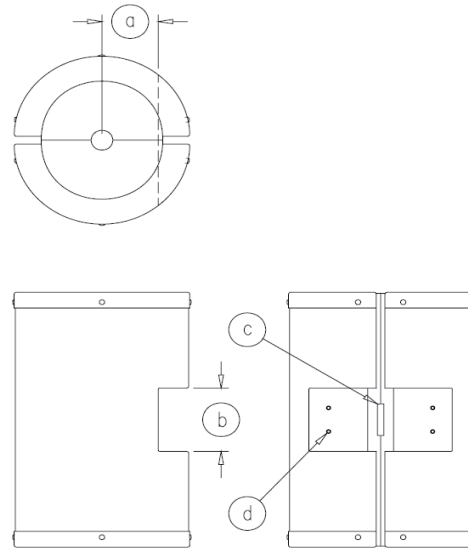


Fig. 1:
Split tube furnace constructed
for extensometer mounting

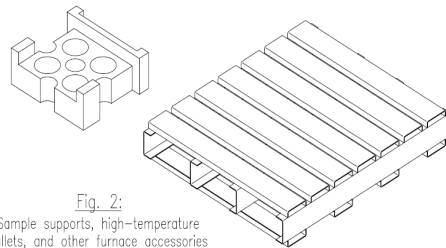


Fig. 2:
Sample supports, high-temperature
pallets, and other furnace accessories
suitable for any configuration.

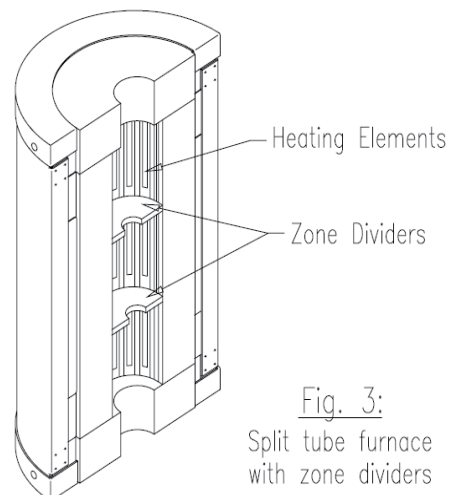


Fig. 3:
Split tube furnace
with zone dividers



High Temperature Split Tube Furnace

Accessories : Element Protection Shields, Sealed Terminal Covers, Perforated Heat Shields, Heat Equalizing Blocks, Access Ports

- Element Protection Shields

Upon breakage, some specimens or samples can create flying debris inside a furnace chamber. Other processes involve reactor vessels with high-pressure liquids or gasses, creating the possibility of pipe rupture.

In such cases, internal element protection shields are recommended to prevent damage to furnace heating elements.

Al tube and split tube furnaces can be supplied with either solid or perforated sheet metal shields, or they can be constructed with embedded ceramic tubes. Contact AI to discuss the best option for your application.

- Sealed Terminal Covers

When heating processes are being conducted in hazardous or corrosive environments, or where required by safety codes, AI furnaces can be supplied with sealed terminal covers. Sealed covers feature high-temperature silicone rubber gaskets and are supplied in either cast aluminum or formed stainless steel, depending upon the size, type, and power rating of the furnace.

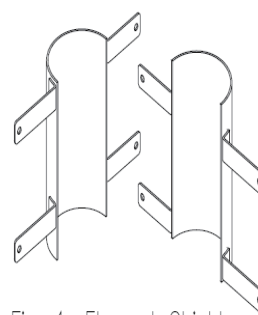


Fig. 1: Element Shields (for split tube furnaces)

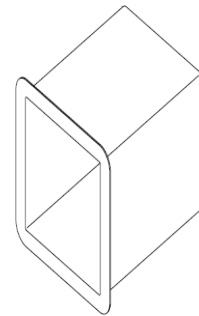


Fig. 2: Protective Liner

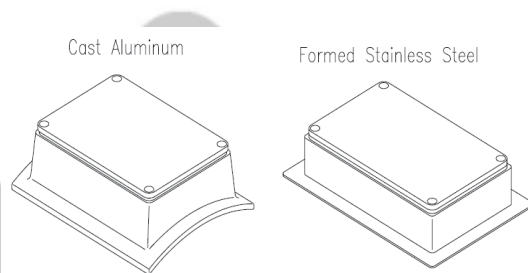


Fig. 3: Sealed Terminal Covers



High Temperature Split Tube Furnace

Accessories : Element Protection Shields, Sealed Terminal Covers, Perforated Heat Shields, Heat Equalizing Blocks, Access Ports

- Perforated Heat Shields

AI furnaces are designed for maximum efficiency and low external shell temperatures.

However, those who have experience working with high-temperature equipment know that any furnace will be relatively hot on the outside during operation and that appropriate safety precautions must be taken.

While this situation is acceptable in most laboratory environments, many manufacturing facilities that use AI equipment must meet stringent safety requirements for the protection of their workers.

To satisfy this need, AI furnaces can be supplied with external perforated sheet metal screens, which significantly reduce an operator's exposure to hot surfaces on the furnace shell.

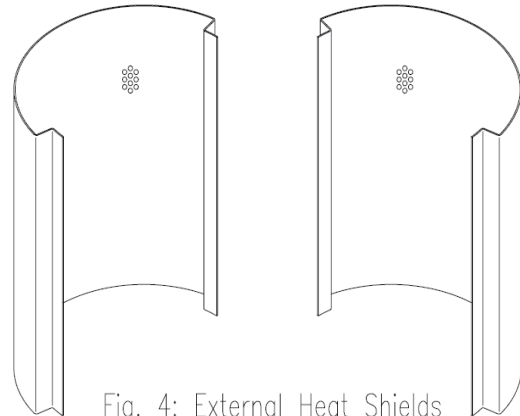


Fig. 4: External Heat Shields

Available for tube or box furnaces, solid or split, in a variety of configurations.





High Temperature Split Tube Furnace

Accessories : Element Protection Shields, Sealed Terminal Covers, Perforated Heat Shields, Heat Equalizing Blocks, Access Ports

- Heat Equalizing Blocks

Some applications require extreme temperature stability. Achieving this goal requires the addition of a stabilizing thermal mass, or core, to the inside of a heat zone.

AI furnaces can meet this need with the addition of heat equalizing blocks to help ensure that maximum temperature uniformity is maintained, either in a single furnace zone or along the entire length of a furnace.

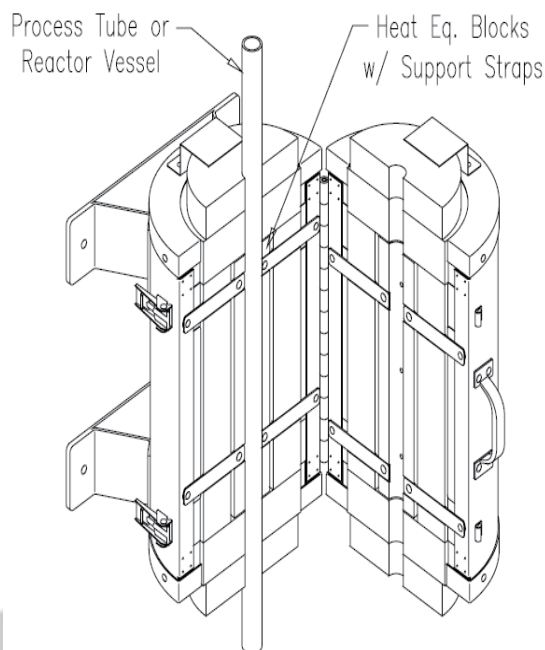
Though virtually any metal can serve as a core material, the most common alloy used in AI furnaces is AMPCO-18 cast aluminumbronze, chosen for its relatively high operating temperature (1100 ° F/600 ° C maximum) and its excellent thermal conductivity. Other materials that have been or could be used depending upon the process involved include stainless steel, aluminum, copper, nickel alloys such as Inconel, and others.

Common applications for heat-equalizing blocks include petrochemicals research, pilot plant development, gas and liquid pyrolysis, calibration, viscosity testing, and crystal growth. Custom blocks can be designed for use with any AI furnace and can include such additional features as thermocouple ports, cooling ports, removable blocks with lifting handles, etc.

- Access Ports

Because all AI furnaces are built-to-order, nearly any variety or type of access port can be placed wherever necessary to suit your requirements.

Types of ports include gas inlets and outlets, purging ports, cooling and vent ports, thermocouple ports and thermowells, load train ports, metal-lined ports, or whatever else your specifications demand.



3-2

Material Creep Test Equipment



High Temperature Split Tube Furnace

Mounting: Test Frame Mounting Assemblies, Structural Frames, Vertical Support Columns, UTM Baseplate

- Test Frame Mounting Assemblies

AI offers a number of standard test frame mounting assemblies, as shown on the following pages.

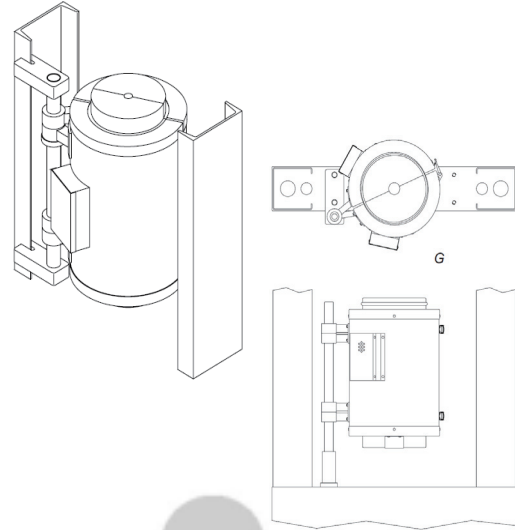
Mounting assemblies are suitable for use with tube, split tube, and split box furnaces and can be reversed for either left-hand or right-hand operation.

The accompanying diagrams demonstrate two-column test machines, but each assembly can easily be adapted to fit four, six, or any number of test frame support beams or columns.

As always, custom mounting inquiries are welcome.

- UTM Baseplate

Many universal testing machines do not provide a suitable means of mounting a furnace. In such cases, a miniature baseplate with furnace bar can be mounted to the lower crosshead of the machine, as shown in figure G.



G) UTM Baseplate Mounting Assembly:

Shown is a single pivot mounting assembly with a baseplate bracket. Any of the mounting assemblies on this page can be accommodated in this way.



High Temperature Split Tube Furnace

Mounting: Test Frame Mounting Assemblies, Structural Frames, Vertical Support Columns, UTM Baseplate

- Structural Frames

Many systems, including creep testing frames, industrial support structures, and “homemade” laboratory test frames, use structural steel beams in their design.

AI produces a wide array of structural frame clamps, furnace bar brackets, and mounting brackets to fit such configurations.

These components form the basis for mounting assemblies A, B, and C, shown at left.

A) Single Pivot Mounting Assembly:

This is the simplest and least expensive option for vertical mounting of a furnace on a structural frame.

B) Double Pivot Mounting Assembly:

Offering more versatility than a single pivot mounting assembly, this option allows some adjustment in the location of the furnace centerline, and it allows the furnace to easily swing out of the way when not in use.

C) Dual Double Pivot Mounting Assembly:

With both furnace halves able to move freely, this mounting assembly offers maximum versatility in setting up load train components and tests.

This configuration is also sometimes the only suitable option in restricted-space situations.

- Vertical Support Columns

Universal testing machines, fatigue testers, and other systems often feature vertical columns in their design.

AI produces mounting assemblies for these machines which are similar to the structural frame mounting options on the preceding page.

Vertical-column mounting assemblies are shown at left in figures D, E, and F.

D) Single Pivot Mounting Assembly:

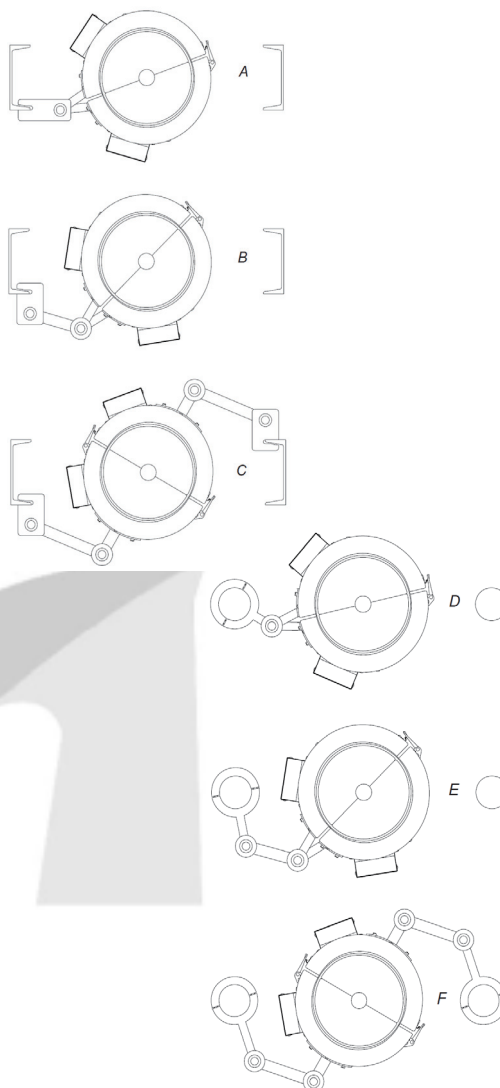
Similar to figure A on the previous page.

E) Double Pivot Mounting Assembly:

Similar to figure B on the previous page.

F) Dual Double Pivot Mounting Assembly:

Similar to figure C on the previous page.





High Temperature Split Tube Furnace

Accessories : Temperature Control Systems

- Complete Temperature Control Systems:
Shown above are examples of complete single and multi-zone furnace temperature control systems. Available features include cabinets with rack-mount panels, transformers, SCR units, gas/cooling supply systems, and other options.



Whatever your specific application may be, AI has the knowledge and experience to build a control system to suit all of your needs.
PC software for computerized configuration.

- Temperature Control Systems
It is obvious that a furnace can only be as precise as its control system.
Since the beginning, therefore, AI has placed great emphasis on providing complete, accurate temperature control systems using only the highest-quality components.

AI currently specializes in control systems using the three units shown below, which have been selected for their accuracy, versatility, and reliability.



Custom control systems are also available using any major-brand temperature controller, including Honeywell, Watlow, SHIMAX, OMRON, and others. Consult an AI sales engineer to discuss your ideal temperature control system.

- SHIMAX MAP6A / MAC6A Series Digital Controller (96 x 96 mm)
 - High Accuracy 0.1%Fs + 1 digit.
 - Program MAX 96steps 8patterns. (MAP6A)
 - MAX 4zone PID control.
 - Universal input. (Thermo couple RTD, DC voltage, DC current)
 - Sampling Period 50msec, 166.7msec, 250msec, 500msec.
 - PV-SV multi points compensation. (MAX11 points)
 - Space-saving Design : Panel depth 65 mm



MAC6A (W96 x H96mm)

MAP6A (W96 x H96mm)



3-2

Material Creep Test Equipment



High Temperature Split Tube Furnace

Accessories : Temperature Control Systems

- OMRON E5CN-H (48 x 48 mm)
Advanced Digital Temperature Controller
A New High-performance Controller: High Resolution, High Speed, and High Input Accuracy.
Logic Operations and Preventive Maintenance Function.
- High-resolution display with 5 digits/0.01° C display in a compact Controller (48 x 48 mm).
- High-speed sampling cycle of 60 ms.
- High Accuracy Thermocouple/Pt input: $\pm 0.1\%$ of PV, Analog input: $\pm 0.1\%$ FS
- Universal inputs on all models (thermocouple, PT, or analog input) to handle various sensors with one Controller.
- A PV/SV-status display function can be set to automatically alternate between displaying the status of the Temperature Controller (auto/ manual, RUN/ STOP, and alarms) and the PV or SV.
- Flexible contact outputs with logic operations (AND, OR, and delays) set from the Support Software (CX-Thermo Ver. 4.0)
- Preventive maintenance for relays in the Temperature Controller using a Control Output ON/OFF Counter.



3-2

Material Creep Test Equipment



Slow Strain Rate (Stress Corrosion) Test Machine



Description:

Established in 1997, Advance Instrument Inc (AI) strives to develop, maintain, and produce highly specialized and technically advanced measuring instruments and systems for the expanding needs of the measurement industry. As a company, AI provides the highest levels of customer support, emphasizing the ability to react quickly to customer's needs and requirements from the beginning of a project until final completion.

AI is today one of the leading developer and provider of loading devices for research and studies of materials under Slow Strain Rate (Stress Corrosion) tests. This device is design for studies of materials' corrosion, fatigue, tensile, load and creep test under normal temperature, atmospheric pressure, high temperature and pressure condition.

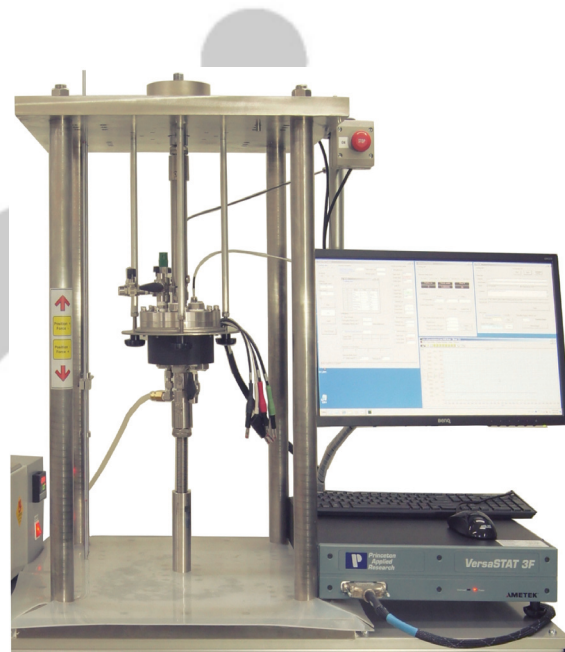
Corrosive test cntainers used by AI includes AISA316 stainless steel, HASTELLOY C-276 ALLOY, Inconel Alloy, PTFE or PVDF. These containers' do support high strength or supercritical H₂S corrosive environmental experiment.



By integrating ACPD or DCPD measurement system, corrosion cracking growth rate is measured automatically.

- International standards use in performing SCC-SSRT:
 - ISO7539
 - ASTM G129
 - NACE TM-0198/TM-0177
- AI's SCC-SSRT machine features:
 - High rigid overloading framework
 - Micro-step control, high-resolution and precision speed control
 - Dual displacement sensors, high-precision measurement of specimen's variable
 - Pressure balancing device
 - Water cooling system
 - Integrated computer controlled system
- Test experiments capabilities:
 - High temperature and pressure slow strain rate tensile test
 - High temperature and pressure constant load creep test
 - High Temperature and pressure corrosion fatigue test
 - CT crack growth rate measurement test
- Load capacity options:
 - 10KN
 - 30KN
 - 50KN
- Speed range:
 - $1 \times 10^{-3} \sim 1 \times 10^{-8}$ mm / s
- High temperature, normal pressure / high-pressure test container material options:
 - PTFE
 - PVDF
 - AISA 316 (stainless steel)
 - C276 (Hastelloy) / INCONEL
- AI's SCC-SSRT machine features:
 - High rigid overloading framework
 - Micro-step control, high-resolution and precision speed control
 - Dual displacement sensors, high-precision measurement of specimen's variable
 - Pressure balancing device
 - Water cooling system
 - Integrated computer controlled system

- Test experiments capabilities:
 - High temperature and pressure slow strain rate tensile test
 - High temperature and pressure constant load creep test
 - High Temperature and pressure corrosion fatigue test
 - CT crack growth rate measurement test
- Load capacity options:
 - 10KN
 - 30KN
 - 50KN
- Speed range:
 - $1 \times 10^{-3} \sim 1 \times 10^{-8}$ mm / s
- High temperature, normal pressure / high-pressure test container material options:
 - PTFE
 - PVDF
 - AISA 316 (stainless steel)
 - C276 (Hastelloy) / INCONEL





Description:

AI's slow strain rate stress corrosion testing systems is capable of meeting wide array of test experiments. Its system components include - main host machine, environmental vessel, control and auxiliary equipment. These devices utilize mechanical and electrochemical corrosion testing technology, thus is applicable for various load variations, temperature, pressure, tensile rate and environmental conditions.

AI have many years of experience in the design and manufacture of SSRT slow tensile stress corrosion testing system and corrosion fatigue testing systems.

Test Machine:

Slow strain rate stress corrosion test machine ensures test accuracy of slow strain velocity and flexibility effect. Design constructed in two type: Floor stand and Desktop. Load speed range is in between $1 \times 10^{-1} \sim 5 \times 10^{-9}$ mm / s, with maximum load capacity up to 50kN.

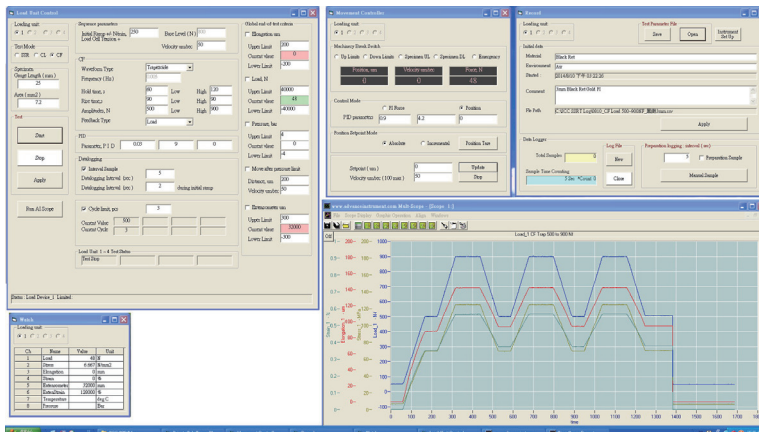
To assure the highest degree of accuracy on test results, the system is designed with a heavy-duty test stand for reducing system distortion, while ensuring accurate load and drive mechanism, thereby providing a constant tensile rate. Floor stand designed with an environmental vessel provides optimum workspace flexibility and has good permeability.

Displacement control:

Driven by high performance and accurate displacement control motor, AI displacement control system is comes with an easy-to-use software and displacement unit providing users with all the required functions.

Measurement and control system: Simple measurement procedure which coordinates displacement movement and measurement together. Advanced software and hardware features make the system capable of completing a variety of unique displacement movement and simultaneous measuring.

Micro-displacement system stepper motor: AI none gap micro-step drive mechanism enhance the level of the test system resolution. Each full step is divided into micro-steps to produce precise magnetic balance through adjustment coil's electric current. Through micro-displacement of each test cycle producing a multiple number of steps increases, thus greatly enhancing the displacement of the resolution.



3-3

Stress Corrosion Cracking (SCC) Test Equipment



Description:

Environmental chamber

AI offers an environment chamber for testing on normal room temperature-normal pressure to high temperature-high pressure at 30MPa, 600 °C . This high temperature-high pressure vessels are designed by AI for tensile test at high temperature and high pressure conditions requirements.



High temperature-high pressure vessels is comparable for use with AI stress ring, slow strain stress corrosion and corrosion fatigue testing machine.

Unique high temperature-high pressure vessels and pressure balancing devices provides users with a dynamic seal system, allowing stress and fatigue tests be carried out in a fully simulated corrosive environment.

Standard high-temperature chambers are made of 316 stainless steel. In application for more severe corrosive environments, AI also provides vessels made of C-276 Hastelloy, Inconel, Monel, and titanium, and other materials. Test conditions can make up 30MPa, 600 °C . For security, the chamber is designed with a metal locking ring and bolts.

Alloy tube is used to connect the environment chamber to the control panel, it can precisely control the feed-in and clearing of the test gas. The experimental temperature control system is controlled by an external heater through the computer.

Under normal environment application, the container may use heat-resistant glass, acid PTFE or PVDF, it is suitable from room temperature to 100 °C corrosion test temperature range.



Description:

All containers have electrochemical test system installation port, allowing simultaneous electrochemical and strain or fatigue test.

WINDOWS9X / NT / XP / 7 supported measuring and control system.

Measurement and control computing system developed by the AI. We offer the most advanced closed-loop control software of corrosion laboratories, test frame and high-temperature pressure vessel measurement and control systems around the world.

AI's instrument interface comes with a micro-step-motor drive control unit, load cell / LVDT signal modulator, the autoclave temperature control, surveillance systems and ACPD / DCPD measurement system.

Innovative and new technology on SSRT slow strain rate and CF corrosion fatigue testing machine have already put AI into the leading player in the field of corrosion test equipment manufacturer.



Stress Corrosion Cracking (SCC) Test Equipment



Description:

ACPD / DCPD Crack Growth Rate Automatic Measuring System

Upon test on slow tensile stress corrosion and corrosive fatigue tests, constant measurement of the crack growth rate is very important.

A-ACPD / DCPD provide AC and / or DC potentiometer method steering crack measuring system to provide accurate and convenient solution for the slow stretching and corrosion fatigue tests.

The potential amount of the host system, feedback coupling device, IEEE communications card and measurement software and other components.

Automatic measurement of crack growth rate at the maximum operating temperature and pressure conditions of the test machine environment chamber allowed, the maximum measurement accuracy can reach 0.1mm. Built-in typical measurement interval with open free setting, users can set up according to the actual application requirements.



Test System Auxiliaries: In order to accurately achieve a variety of corrosive environments, and extend test machine functionality, the test machine can be equipped with following auxiliaries:

Cycle Loop Test: Upon doing cycle loop test, constant supplement of additional and fresh medium into the environmental vessel will maintain the corrosion experiment consistency. This is carried out by a precise feeding pump, thus, the effect to the test would be very low and stable. Thereby, it will not destroy the environmental vessel.

Due to configurations with dissolved oxygen, conductivity and pH measurement systems, test personnel may use corrosive chemical indicators of the precise quantitative measurements, to achieve corrosion medium on the corrosion properties of accurate quantification.

High temperature-high pressure electrochemical system

Electrode reference of high temperature-high pressure: Patent through electrode chamber and electrode.

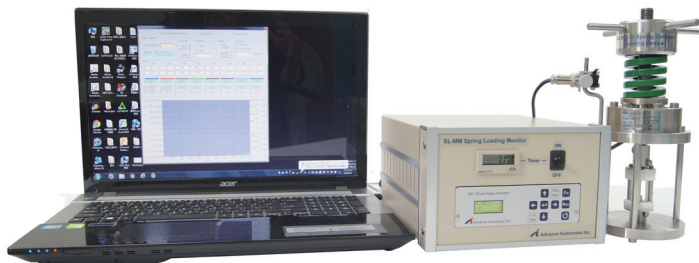
Depending on different experiment conditions, electrode chamber made of stainless steel, C276, and other materials can be be use. While chamber that is equipped with water cooling system is capable of doing more stable experiments on high temperature electrochemical test. Electrodes are made of Ag-AgCl, or insulated Zr-ZrO₂. Electrode highest operating temperature, 300 °C ; maximum pressure 15MPa



SL SCC-I3 Spring Constant Loading Device

Features:

- Accuracy
- Long-term stability
- Repeatability
- Convenience
- Economy
- Safety



Description:

Advance Instrument's SL SCC-I3 Spring Constant Loading Device and accessories, for testing of stress corrosion cracking in accordance with NACE Test Standard TM-01-77-90. The AI's SL SCC-I3 Spring Constant Loading Device provide an economical but effective way to accurately determine the Stress Corrosion Cracking (SCC) susceptibility of metals in different environments.

Testing with constant-load devices ensures that susceptible materials will separate completely. This result clearly identifies the material as susceptible and does not rely on finding part-through cracks.

Advance Instrument's SL SCC-I3 Spring Constant Loading Device are widely used in the production of high quality materials testing and research. The use of stress ring test available oil exploration, aerospace aviation, welding seals, sea shipping, food processing and other materials in a variety of acid, alkali materials corrosive effects of corrosive environments, and accurate understanding of the material load capacity, for the adjustment of a variety of professional and special metal materials provide a scientific basis.

SL SCC-I3 Spring Constant Loading Device is designed to meet the American Association of Corrosion Engineers (NACE) standard designed specifically due to high quality specialty materials, so under normal circumstances, can almost be reused many times.

AI's SL SCC-I3 Spring Constant Loading Device is to accurately determine the metal sulfide stress corrosion cracking due to the sensitivity of the most cost-effective means of testing under H₂S effect. In the purchase, maintenance and operation, the load device is much more economical than fixed. At present, this compact, economical, reliable, unique testing devices are increasingly favored by professionals and attention.

Each individual calibration SL SCC-I3 Spring Constant Loading Device are corresponding with a load cell, for the accurate determination of the loading of the sample. Constant Loading Device provides enduring uni-axial tensile load of the specimen. Stress measured by the load indicator. Entire method conform NACE TM-01-77 testing standards, and provide information to NACE MR-01-75 standard materials needed.

In order to accurately meet the needs of users, AI's SL SCC-I3 Spring Constant Loading Device using precision machining, with alloy steel, can be used for four kinds of load range, the maximum load of up to 250000psi (based on the diameter of 2mm sample); can using a standard wrench to adjust the bolts and nuts to quickly and easily change the tensile stress force on the ring, the ring by a thrust bearing stress load dispersion, prevent jamming.

In order to provide accurate test results, Advance Instrument's SL SCC-I3 Spring fixture on Constant Loading Device made of stainless steel to withstand the test environment can be completely corrosion. Standard test environment chamber with a transparent, well-made of durable polypropylene, the observer can always be directly observed on the specimen. Heat-resistant glass containers can be used as standard equipment. Environmental test chamber is sealed with O- ring gasket can completely prevent leakage.



SL SCC-I3 Spring Constant Loading Device

Specification:

The AI's High Temperature Vessel is delivered complete with thermocouple, o-ring seals, and vessel heaters. Precise temperature control is achieved through a Control. Specimens being tested are electrically isolated by means of nylon bushings, and all tube fittings are wrapped with Teflon[®] tape to positively prevent leakage. Record software can automatically record the stress on the test specimen, Elapsed Time Monitors and automatically end after specimen fracture timing.

• Base Instrument :

1. SL SCC-I3 Spring Constant Loading Device
Available Model : SL SCC-I3-xxkN-xxmm
xxkN : max load 10 / 20 / 30 / 50 kN
xxmm : 50% load elongation 9 / 15 / 30 mm
include Specimen breaker detector switch
Load cell, total error 0.05%, repeatability 0.03%
2. SL-MM Spring Loading Monitor
Load Indicator
Elapsed Time Monitors and Controls
Load record software, USB 2.0



Options :

- Standard Acrylic Vessel or Pyrex Containment Vessel
 - High Temperature Vessel, 316 stainless steel, Hastelloy C-276[®] or Custom vessels
 - Gas distributor
 - Linear displacement transducer or extensometer for specimen elongation measurements.
 - Datum-acquisition to computer for load, displacement, temperature, pressure... etc.
 - Customized electrochemistry measurements e.g. potential control and/or measurement system, including pH and redox.
 - Glass and polymer cells with different kinds of heating systems.
 - Other instruments and other AI's products can be integrated with loading units.
- All options are integrated to work with the same PC at Windows environment.
• Testing system applications can be contingent on clients' requirements or e.g. NACE TM-01-77-90 and ASTM G44.
• Integrated SL SCC-I3 Spring Constant Loading Device test system

Instrument and gas distributor can complete the connection and begin using in minutes. Standard control unit can use 110V / 220V-60 / 50Hz power supply. No maintenance during system operation.

It can be a number of tests simultaneously in a safe and accurate basis and without specialized personnel on duty throughout.





SCC-CL Advanced Auto Constant Load Testing Device

Description:

The basic design of the unit includes a compact ball screw driver actuator, with DC motor and planetary gear, and a load cell with a digital force indicator. There is, as well, a dial indicator with 0.01 mm graduations for measuring linear displacement during testing.

The force can be set from the front panel of a digital force indicator or from PC software. The specimen breakdown time can be seen either from a time counter at the front panel or from the PC.

AI's automatically operational constant load instrument is for the investigation of various forms of stress corrosion cracking (SCC) under different environmental conditions.

Specification:

- CL constant load testing
- Loading range: 10 \ 20 kN

Specification	10 kN model	20 kN model
Maximum axial load	10 kN	20 kN
Displacement range	30 mm	30 mm
Load accuracy	0.5% FS	
Serial port	RS-485 or RS-232	
Power supply	230 VAC or 110 VAC	



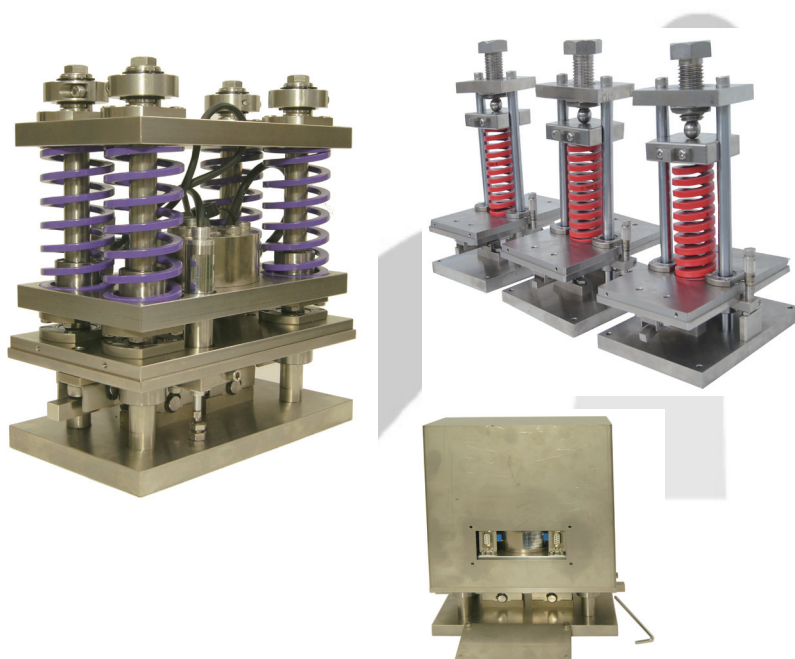
- Specimen Holder
 - Electrically isolated specimen holders for round or flat specimens are available in different standards.
 - Customized designs for the special applications are also available.



SCC-CL Advanced Auto Constant Load Testing Device

Specification:

- Linear displacement transducer or extensometer for specimen elongation measurements.
- Datum-acquisition to computer for load, displacement, temperature, pressure... etc.
- Customized electrochemistry measurements e.g. potential control and/or measurement system, including pH and redox.
- Low and high temperature autoclaves for 1, 2 or 4 loading units as standard.
- Glass and polymer cells with different kinds of heating systems.
- Other instruments and other AI's products can be integrated with loading units.
- All options are integrated to work with the same PC at Windows environment.
- Testing system applications can be contingent on clients' requirements or e.g. NACE TM0177 and ASTM G44.





SCC-SSRT Advanced SSRT / Constant Load / Corrosion Fatigue Loading Device

Description:



The SCC instruments of Advance Instrument (AI) are computer controlled, electromechanically operated loading devices. The loading unit can perform SSRT tests, constant load tests and cyclic fatigue tests. It is for the investigation of various forms of Stress Corrosion Cracking (SCC) under different environmental conditions.

The system consists of the loading units, datum acquisition unit, control system and the test vessel. The facility is designed for Constant Load Testing (CL), Slow Strain Rate Testing (SSRT) and Low Cycle Fatigue Testing (LCF).

The computer controls a motor that is loading the tensile specimen. The displacement rate is specified by the operator's computer software. The measured value from the load cell will be displayed on the computer screen by means of the software. The computer saves both the displacement and load data automatically. The data will be available for further management in ASCII format. The instrument fulfills the requirements presented in ASTM Practice G 129.

When constant load feature is used, the response of the load cell is used as a feedback signal to control the displacement so that the load cell measurement value is equal to the load set by the operator.

The loading device can perform low frequency cyclic fatigue tests. The cyclic loading can be performed either under load or strain control. The shape of the loading can be either of trapeze (a special case: saw tooth) or sinusoidal type. The maximum frequency depends on the amplitude.

The basic design of the unit includes a compact non-backlash ball screw driver actuator, with the motor, and a load cell with a digital force indicator. The computer controls the motor and saves the measured data.

The SSRT instrument is capable to perform SSRT / tensile tests, constant load tests and cyclic fatigue tests. Operational parameters are set up through the user-friendly software that allows the combination of various loading modes in sequences and in loops.





SCC-SSRT Advanced SSRT / Constant Load / Corrosion Fatigue Loading Device

Specification:

- SSRT: Slow strain rate testing
- CL: Constant load testing
- CF: Cyclic fatigue testing
- Loading range: 10 \ 20 \ 30 \ 50 kN

Model	SCC-SSRT-10	SCC-SSRT-20	SCC-SSRT-30	SCC-SSRT-50
Load Range	10 kN	20 kN	30 kN	50 kN
Displacement range	30 mm	30 mm	50 mm	50 mm
Load accuracy	< 0.1% FS			
Typical pull Rod speed range	$6 \times 10^{-7} - 9 \times 10^{-2}$ mm/s			

*** Other displacement rate ranges can be arranged through the gearbox modification.

- Testing cell
 - Testing cell will be made of different material depending on the needs. Due to the construction materials, various kinds of chemical environments can be applied.
 - The cell can be gas tight. It thus can be operated with slight over pressure and at about 120° C temperature if there is a heating bath available.
 - The specimen holders made of different material, for different purposes of usage, and positioned inside the cell.
 - There will be plugged ports for reference and counter electrode cables, temperature sensor and working electrode cable.
 - There will be a Hastelloy / Alloy C-276 coil in the testing cell, through which the user can pump cooling / heating media.
- Autoclave - Optional
 - The pressure vessel is designed, manufactured and inspected according to Pressure Equipment Directive PED 97/23/EC.
 - The autoclave vessel will be inspected and tested at the factory prior the shipment.
 - Autoclave construction of stainless steel.
 - Max. operational pressure can reach 200 bar.
 - Max. operational temperature can reach 360° C.
 - Computerized temperature control and pressure monitoring integrated with the SSRT software, including load compensation based on pressure and pull-rod cross-section.
 - Electrical lid lift for easy handling of the heavy autoclave lid and SS
 - Lid seal octagonal ring joint gasket.
 - With pressure gauge.
 - With a safety valve to avoid overpressurizing.
 - With Vessel heating system.
 - With temperature controller and PC-operated.
 - With resistance thermometer with stainless steel protection tube.
 - With surface thermocouple against overheating.
 - Electrical components and temperature controller assembled in electrical cabinet.





DCPD-U50 Ultra Precision DCPD Crack Growth Monitor



Features:

- Continuous DCPD
- Pulsed DCPD as standard
- Ultra Precision Differential signal amplifier with high bandwidth up to 10k Hz
- Gain Accuracy $\pm 0.1\%$,
- Gain : 20 ~ 50,000 by rotary switch, Accuracy 1%
- Triggering function, peak, trough, time interval and mid-point of load cycle waveform input.
- High Current O/P, up to 50A.
- Plug-in module
- Automatic bridge balance, with EEROM to preserve balance without power
- Built-in with four-pole Bessel low-pass filter with cutoff frequencies of 1 Hz, 10 Hz, 100 Hz, 1k, 10k Hz and wide-band
- Variable DC offsets and auto balance for the removal of standing voltages
- Two channels as standard, reference and specimen.

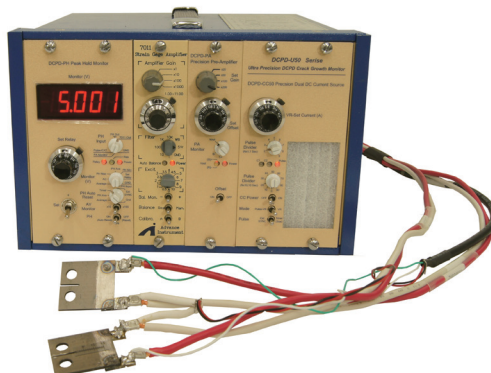
Applications:

- Dynamic Material Test
- Strain/Stress Analysis
- Dynamic Material Elasticity Testing
- Fatigue crack initiation
- Dynamic crack growth studies
- Condition monitoring
- Crack closure studies
- Stress corrosion testing
- Slow crack growth
- Crack initiation
- Crack sizing

Description:

The DCPD-U50 is a modern microprocessor based instrument for measuring crack depth in metals undergoing materials testing. Building on the success of the DCPD-U50 this new unit takes on board customer comments and suggestions, as shown in its impressive features list.

It utilises the pulsed direct current potential drop method (DCPD) which is an established technique covered by the ASTM 647 standard. The technique involves passing a constant current through the metal under test and measuring the resultant voltage drop that is created across the specimen. The presence of a growing defect will alter this voltage and by suitable calibration, a measure of the defect depth can be obtained.

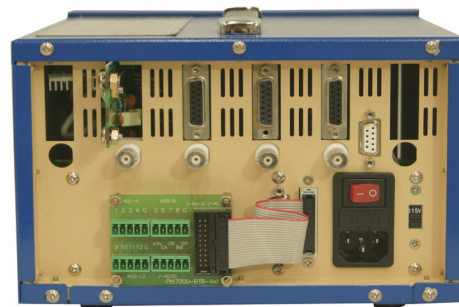




DCPD-U50 Ultra Precision DCPD Crack Growth Monitor

Specification:

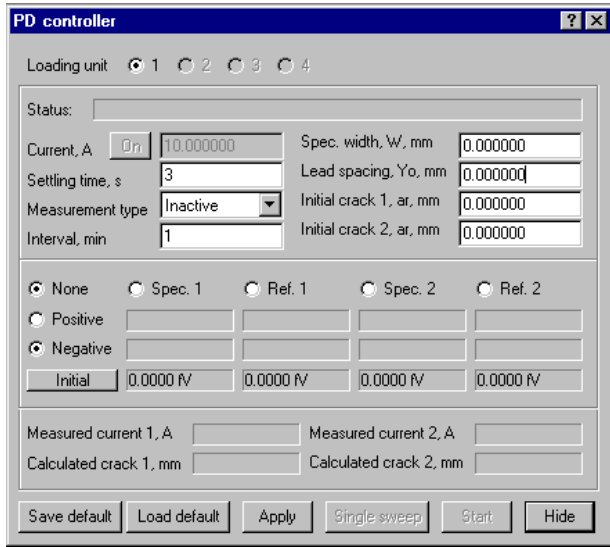
- Fatigue Pre Crack Initiation Measuring Performance:
 - CT Specimen, Steel, 20mm(W), 1.6mm(t)
 - Resolution < 0.02(mm)
 - Accuracy < 0.2(mm)
- Input:
 - Voltage Amplification Gains 20~ 5,000,000, Acc <1%
 - Drift 60nV/1000hrs (RTI)
 - Noise 100nV (RTI, 0.1~10Hz)
 - Stability is 0.01%
 - A/O Output, +/-5V real time
- Current Source:
 - 0~50A
 - Voltage: 2.5V max
 - Current Acc, 0.5%
 - Continuous Mode
 - Pulsed Mode, Synch with Peak Hold, duration 1~100sec
- Peak Hold:
 - Synch Input (TTL)
 - Reset : Synch Input (TTL) or Load Cycle Auto Reset (0.5~1kHz) or Time Interval Reset
 - +/-5V Output: A/O Max, A/O Min, A/O Average, A/O Continuous
- SR1 RS-232 Data logger
 - Data logger
 - 24bits Sinc^3
 - Display 6 digital resolution
 - Time Interval 0.05 Sec~24 hr.
 - Data Export Format *.csv
- Balance
 - Method: Manual / Automatic
 - Ranges (Auto ranging): ± 7.5 mV/V
 - Resolution 0.0012 mV/V
 - Balance time: 8 seconds
 - Manual vernier balance range: 0.1 V/Step, Max ± 5 V
- Amplifier
 - Input Impedance : 100M Ω
 - Input Common Voltage : ± 30 Vpp
 - Gain Step : 1, 10, 100, 1000 by rotary switch setting, Accuracy $\pm 0.1\%$ Max
 - Gain Linearity : < 0.01% Max
 - Common mode rejection: @ Gain = 1,000
 - DC to 10 kHz, >100 dB
 - Frequency response versus all gain (1~1,000), 10kHz @ -3 dB
 - Rise Time <0.1 μ sec
 - Stability (gain over X 100)
 - ± 5 μ V/° C, max, RTI (referred to input)
 - Noise (gain over X 100, all outputs)
 - 0.01 to 10 Hz: 25Vp-p RTI
- Filter
 - Characteristics
 - Low-pass active four-pole Butterworth standard
 - Frequencies (-3 \pm 1dB): 1 Hz, 10 Hz, 100Hz, 1k, 10kHz and wide-band
- Input & Output
 - Output : Low impedance terminal analog output
 - Out contact for Crack Alarm
- Operational Environment
 - Operation temperature: -10° C ~ 60° C
 - Storage: -20° C ~ 70° C
 - Humidity: Below 95% RH, non-condensing
- Power Requirement
 - Input: 110 / 220Vac \pm 10% 5 A
- Dimensions & Weight
 - Panel: 1.3" X 5.2" (33.4 X 133.3 mm)
 - Amplifier depth behind panel: 10.6" (270 mm)
 - Weight: 1.32 Lb (0.6 Kg)
- Optional Accessories
 - 6006C. 6- Modules enclosure with power supply.
 - 6012C. 12- Modules enclosure with power supply.





SCC-PDAP Potential Drop Measuring Software

2-5 Mechanical Test



Applications:

- Fatigue Initial Crack length measuring
- Fatigue Crack length measuring
- SCC Initial Crack length measuring
- SCC Crack length measuring
- Creep Initial Crack length measuring
- Creep Crack length measuring
- Inline Process crack length measuring

Description:

SCC-PDAP measurement uses a current flowing through the specimen to cause voltage drop, that can be measured and used to calculate crack length. The program controls a power-supply, that supplies constant current through the samples in either polarity, and a voltage meter with scanner, that measures the voltage drop from the specimen. In continuous mode, after measuring all voltages of single specimen, crack length is calculated using following formula:

It is important to realize that there are possible input values to variables that make the result a complex number, which is not logical. Therefore, in the program, all input values causing complex crack length are checked and if found, cause negative crack length value.

The single-specimen measurement cycle is as follows:

1. Connect positive polarity
2. Wait current settling time, defined by user in seconds
3. Measure positive specimen voltage-drop and reference
4. Measure current
5. Calculate crack length if continuous measurement mode (not single sweep)

$$\frac{W}{\pi} \cos^{-1} \left[\frac{\cosh\left(\frac{\pi}{W} Y_0\right)}{\cosh\left[\frac{V}{V_R} \cosh^{-1} \left[\frac{\cosh\left(\frac{\pi}{W} Y_0\right)}{\cos\left(\frac{\pi}{W} a_R\right)} \right] \right]} \right]$$

A single sweep always measures both specimens, so the previous measurement cycle is executed twice. The measured voltages are shown on the dialog. In continuous mode, there is a user-defined interval between measurements (equal to a single-sweep), and during this interval current is flowing through a short-circuit - the specimens are fully isolated from supply.

Measurement mode can be either static or dynamic. Static mode simple means that the measurements are executed as described above. In dynamic mode, the program waits after 2 and 5 for trigger before measuring voltages. The trigger comes from sequence-controller, and enables the measurement of crack length at peak of cyclic-fatigue waveform.

On: Switches current flow through the specimens on/off.

Initial: Sets the current voltages as the initial voltages for reference and crack.

Apply: acquires entered parameters from fields.

Single sweep: Reads all voltages once, but does not calculate crack. This is to be used for determining initial values.

Start/Stop: Starts or stops continuous measurement.



Ultra-Supercritical Steam Materials Test Systems



3-3

Stress Corrosion Cracking (SCC) Test Equipment

Features & Applications:

Features:

- Supercritical Steam test system
- High Pressure 360 Bar
- Up to 650° C
- Mass Flow 400kg/Hr
- Water chemistry sensors
- Recirculation loop
- Water purification instrument
- Chemical agent injection system

Applications:

- Oxidation/Reduction
- Heat Transfer
- Heat Flux
- Soil Erosion
- Quantitative
- Thermal Stability
- Estimated lifetime
- Oxidative stability
- Corrosion



Ultra-Supercritical Steam Materials Test Systems

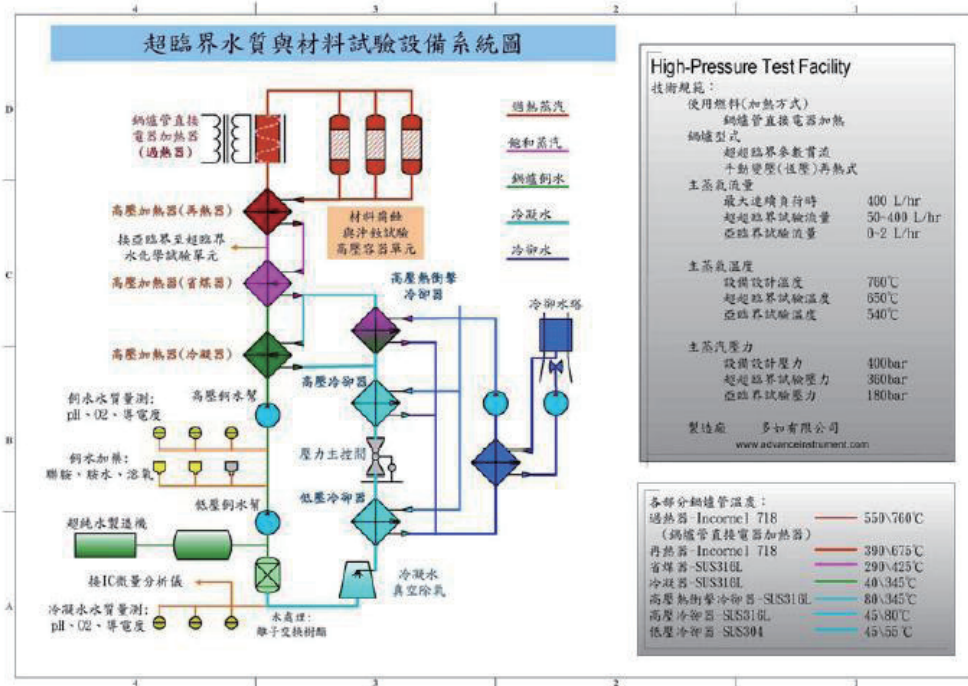


3-3

Stress Corrosion Cracking (SCC) Test Equipment

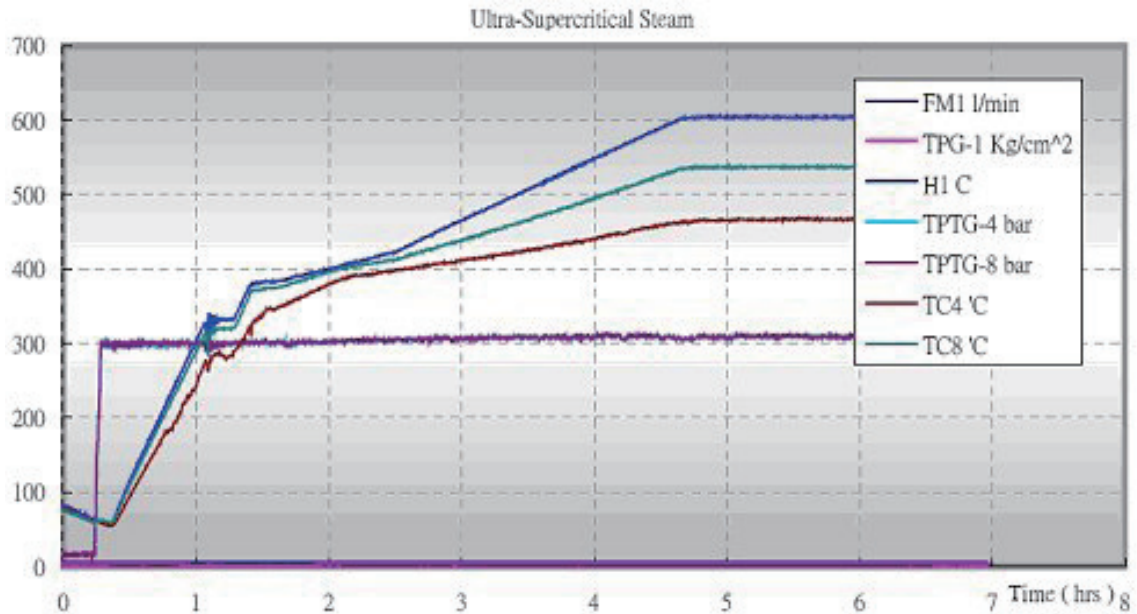
Description:

This test mainly comprises water supply system, the object to be tested, a pressurizer and a cooling system. In the water supply system, demineralized and deaerated water or boiler feedwater to which chemicals have been added to obtain the required water chemistry is provided in a feedwater tank. This water is injected into the test loop by a piston pump. To minimize flow oscillations caused by the pump's six pistons, a damping vessel is installed in the pump discharge line.



Equipment:

- Feed water instrument
- Feed water purification
- Chemical agent injection system
- High Pressure Recirculation loop
- High Pressure Heat Exchanger
- High Pressure Direction Boiler Tube Heating System
- High Pressure Test Vessel
- High Pressure Cooler
- Condenser instrument
- Data acquisition System



Impressive:

The broad and impressive range of applications for which the high-pressure test facility (360 bar, 650°C, 400 kg/min, 400 KW) installed in an accredited laboratory can be used underlines the flexibility of this test rig which, at the start of the new millennium, had been in operation for 6 years and will continue to be available for new research and development work in the future. There suits of the investigations performed at the test facility have enabled pioneering findings related to the design and operation of power plants using nuclear, fossil and renew-able energy sources as well as other industrial facilities to be made. The quality of the experimental data allows them to be used as a basis for developing computer programs fo ra wide variety of different issues.

Date	Time	Value	Unit
2000-01-01	00:00	100	l/min
2000-01-01	01:00	300	l/min
2000-01-01	02:00	350	l/min
2000-01-01	03:00	400	l/min
2000-01-01	04:00	450	l/min
2000-01-01	05:00	500	l/min
2000-01-01	06:00	550	l/min
2000-01-01	07:00	600	l/min
2000-01-01	08:00	600	l/min

