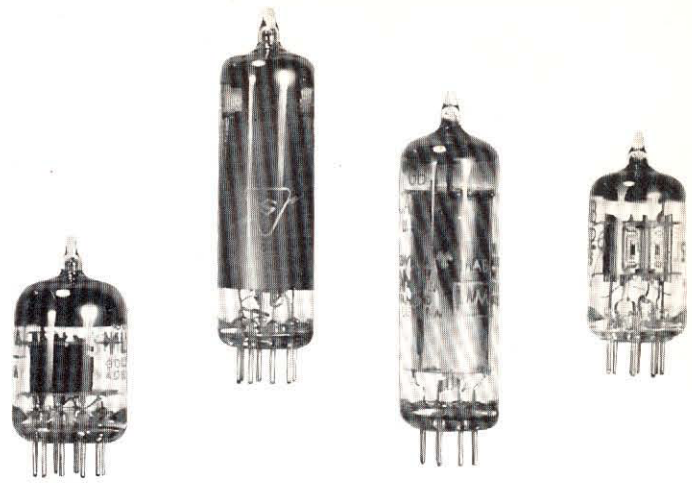


*Unsurpassed quality for  
reliable performance in critical  
commercial and industrial applications*



**SYLVANIA**  
**GOLD BRAND**  
**ELECTRONIC TUBES**

# GB GOLD BRAND TUBE TYPES

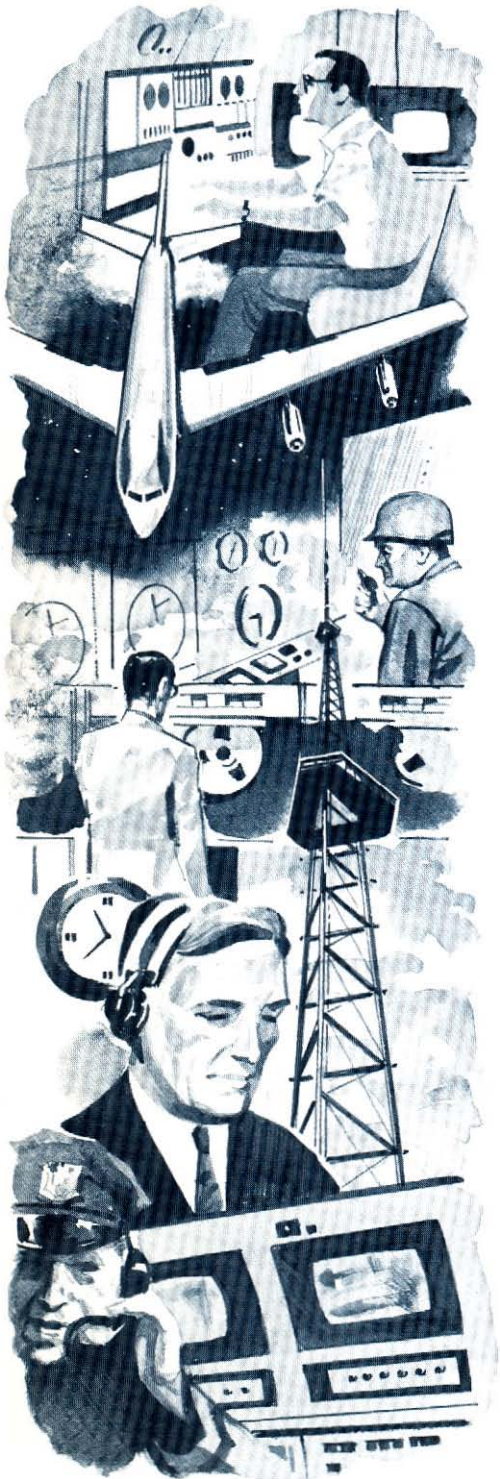


## Gold Brand tubes for commercial and industrial applications

Suggested GB Replacement	Prototype	Differences Between Prototype and GB Replacement	Suggested GB Replacement	Prototype	Differences Between Prototype and GB Replacement
GB-0A2WA	0A2	Note 1	GB-5751	12AX7	Note 1; Heater Current—
GB-0B2WA	0B2	Note 1			12AX7=300/150
GB-5Y3WGTA	5Y3GT	Note 1			Ma; GB-5751=
GB-6BQ7A	6BQ7A	Note 1			350/175 Ma
GB-6CY5	6CY5	Note 1	GB-5814A	12AU7	Note 1; Heater
GB-6DJ8	6DJ8	Note 1			Current—12AU7=
GB-1252/6U8A	6U8A	Note 1			300/150 Ma;
GB-6J4WA	6J4	Note 1			GB-5814A=
GB-6SL7WGT	6SL7GT	Note 1			350/175 Ma
GB-6SN7WGT	6SN7GT	Note 1	GB-5931	5U4G, GB	Note 1; Bulb—
GB-6X4WA	6X4	Note 1			5U4G=ST-16;
GB-6X5WGT	6X5GT	Note 1			5U4GB,
GB-7AK7	—	Note 1			GB-5931=T-12
GB-407A	407A	Note 1	GB-5932	6L6G, GA, GB, GC	Note 1; Bulb—
GB-408A	408A	Note 1			6L6G=ST-16
GB-5654	6AK5	Note 1			6L6GA=ST-14;
GB-1219/ 5670	—	Note 1; Suggested replacement for 2C51 and GB-5670 where Gm at low heater voltage is critical.	GB-5933	807	GB-5932, 6L6GB, GC=T-12
GB-1220/ 5654	—	Note 1; GB-1220/5654 features ferrite isolator to prevent parasitic oscillation in critical applications.	GB-6005	6AQ5	Note 1; Bulb—
		Note 1; Heater—	GB-6080	6AS7G, GA	807=ST-16;
GB-5670	2C51	2C51=300 Ma; GB-5670=350 Ma	GB-6101	6J6	GB-5933=T-12
GB-5687	5687	Note 1	GB-6135	6C4	Note 1
GB-5725	6AS6	Note 1			Note 1; Heater
GB-5726	6AL5	Note 1	GB-6136	6AU6	Current—
GB-5727	2D21	Note 1	GB-6186	6AG5	6C4=150 Ma;
GB-5749	6BA6	Note 1	GB-6189	12AU7	GB-6135=175 Ma
GB-5750	6BE6	Note 1	GB-6201	12AT7	Note 1
			GB-7327	—	Note 1
			GB-7550	—	Note 1

**NOTE 1:** GB Type manufactured and tested to meet Sylvania reliable GB specification.

# Reliability in diversified industrial usage



These applications demand the long life and stable performance that only Sylvania GB Gold Brand Tubes offer. The GB prefix denotes an outstanding product design—engineered to the specialized requirements of critical commercial and industrial service.

**GB BUILT-IN RELIABILITY** Qualities of GB Gold Brand Tubes are 10,000-hour life, exceptional stability, maximum uniformity, and extreme physical ruggedness.

These qualities are designed and built into GB Gold Brand Tubes—they cannot be tested in—through:

1. | The use of specialized processes, materials, and methods emanating from continuous research programs in metallurgy, chemistry, and basic tube technology. Built-in features and their contributions to elimination of common failure mechanisms are described on Pages 4 and 5.

2. | Uncompromising quality standards which are rigidly maintained at each development stage. The extent of this control program is best indicated by the fact that one out of every three plant employees is engaged in quality control.

3. | Automated production of tube parts and subassemblies for maximum uniformity.

Close cooperation between Sylvania and the customer in analyzing equipment field problems has also played an important role in successful attainment of mutual objectives.

**GB RELIABILITY ASSURANCE** GB Gold Brand Specifications are objective reliability standards and are the user's assurance of built-in reliability. GB Gold Brand Specifications embody many of the proven principles contained in military specifications, but are tailored to meet applications in commercial and industrial areas. Each Gold Brand Tube is controlled and tested according to the specifications for that particular type.

Typical tests and controls are: Multiple Life Tests at high temperature and room temperature conditions; 500 g Impact Shock Tests; Extended 2.5-g Fatigue and 10-g Vibration Tests; Thermal Shock Tests (Glass Strain); Low Pressure Breakdown (High Altitude); Basic Tube Parameters—controlled to 0.65% AQL; Noise and Vibration to 2.5% AQL; and Continuity & Shorts to 0.4% AQL.

These and other GB Gold Brand Tests and Controls are summarized on Pages 8 and 9 of this booklet.

Your Sylvania Representative will be pleased to discuss specific field problems and provide you with complete technical data for Sylvania GB Gold Brand Commercial & Industrial Tubes.

# Reliability through structural and pr

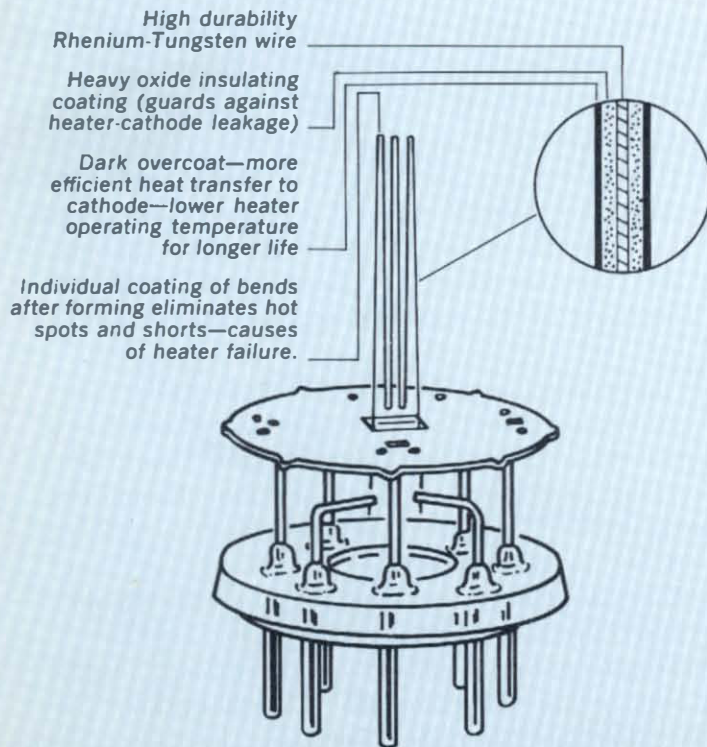
## High reliability heaters

Catastrophic failures of the heater-cathode complex, due to embrittlement or breakage of the heater, are virtually eliminated by the use of Rhenium-Tungsten wire.

Tests have proven Rhenium-Tungsten's superior qualities of ductility and high recrystallization temperature, after thousands of hours of life testing. Also the higher internal resistance of Rhenium wire versus ordinary wire allows the use of a larger diameter heater, adding substantially to the mechanical strength.

**A PROPERLY APPLIED AND PROCESSED "Dark Overcoat"** further enhances reliability through more efficient heat radiation to the cathode. This allows optimum cathode temperature to be maintained with a lower heater temperature resulting in increased stability and longer heater life.

The merits of both techniques are recognized and are applied to best advantage based on individual needs.



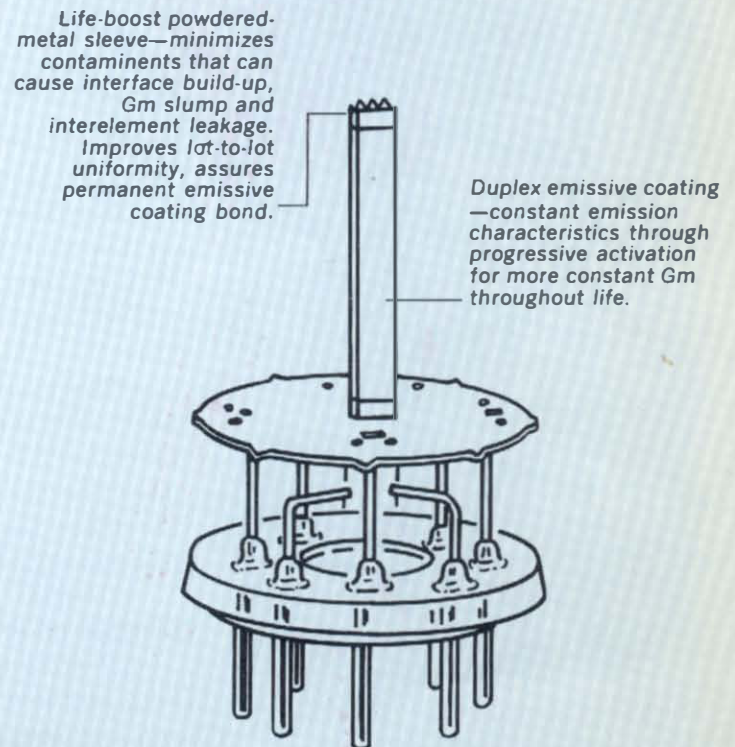
## Life boost cathode

Sylvania has long been recognized as a leader in the field of cathode technology. Several recent accomplishments have greatly increased cathode reliability and stability.

Life boost cathode sleeves, which are formed from base metal produced by cold-rolling a blend of powdered metals, have a distinct advantage in controlling sublimation and insulation resistance. The precise control of the mixing, that is achieved in the powdered state and subsequent cold processing, assures more uniform characteristics and excludes unwanted impurities to a degree never before achieved.

Inherent surface characteristics of the powdered metal permits exceptional adherence of the coating material, practically eliminating interface resistance and loose or flaking coatings.

Duplex cathode coatings have been developed which exhibit very stable life characteristics. These coatings are actually a mixture of different emissive materials, which are progressively activated throughout life. This built-in booster effect maintains the emissive level thereby reducing Gm slump during life by a marked percentage.



# Processing advances

## Bonded gold grids

Gold plated grids are not new to the area of reliable industrial tubes. Gold applied to the grid lateral wires has long been an effective measure in preventing both primary and secondary emission from the grid.

Methods of plating used in the past sometimes led to undesirable conditions of flaking and peeling of the gold. This resulted in the loss of protection against grid emission and the danger of interelement shorts and contamination of neighboring elements, especially the cathode.

Sylvania's Gold Brand research has developed a new plating process whereby the problems of the older methods are eliminated. A strong molecular bond is now achieved between the gold and the lateral wire, forming essentially one solid material rather than depending on adhesive action. Sylvania's gold grids remain gold grids throughout tube life.

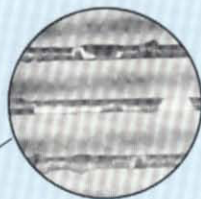
## High dissipation safety factor plates

Many different specialized techniques are used to achieve plate dissipation capabilities that amply fulfill application requirements. The most recent development is a laminated design comprised of as many as five different metals.

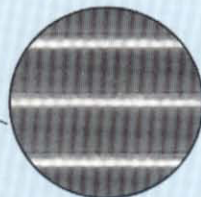
The new design conducts heat much more uniformly and radiates it much more efficiently. A higher dissipation safety factor is thereby obtained for critical applications and "hot spots" and resultant "gasing," which lead to premature replacement, are eliminated.

*Sylvania GB Gold Brand tubes are carefully design-engineered to application requirements and appropriate special materials and constructional features are utilized to assure built-in reliability. All special features noted are not necessarily included in any one GB tube type, but are employed based on thorough analysis of individual requirements.*

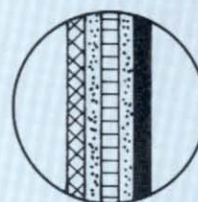
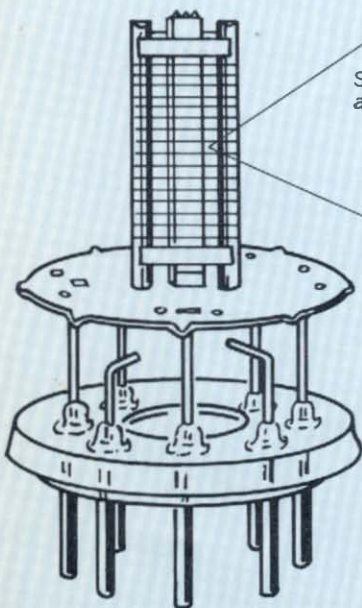
*New-process gold-plated grids—do not flake or peel to cause shorts; lasting protection against grid emission problems.*



*Severe case of plating peel as tube ages.*



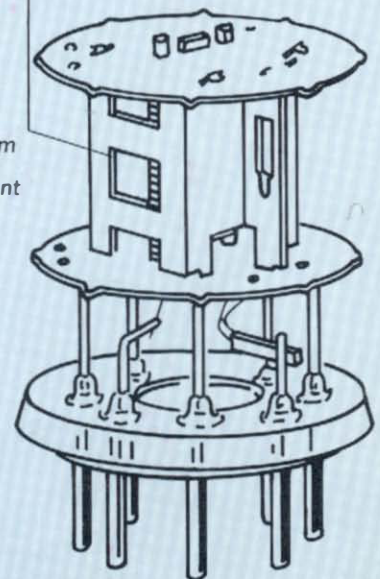
*New process molecular bond—no evidence of peeling whatsoever.*



*New laminated plate construction—Uniform heat conduction and dissipation—Eliminates hot-spots, often the cause of gasing; adds dissipation safety factor*

Nickel  
Steel  
Copper  
Aluminum

*(One of Several Different Combinations Used)*



## Gold Brand plus features

**STRATEGICALLY LOCATED ISOLATION MICAS** improve initial insulation resistance between elements and leads by containing getter flash.

**DOUBLE TOP AND BOTTOM MICAS** with more contact points support elements more securely by increasing bearing surface and providing tighter fit in bulb.

These two features greatly improve shock and vibration characteristics thereby minimizing microphonic tendencies under extreme conditions.

**CONTROLLED ATMOSPHERE WELDING**—by executing all welds in a reducing atmosphere, cleaner, more uniform and rugged welds are obtained. Weld splash is greatly reduced, minimizing loose and dangling metallic particles.

**GOLD PLATED PINS** on all miniature types resist corrosion and assure low resistance contact.

**NEW PRECISION CONTROLLED ANNEALING TECHNIQUES** result in the best glass quality ever offered the industry.

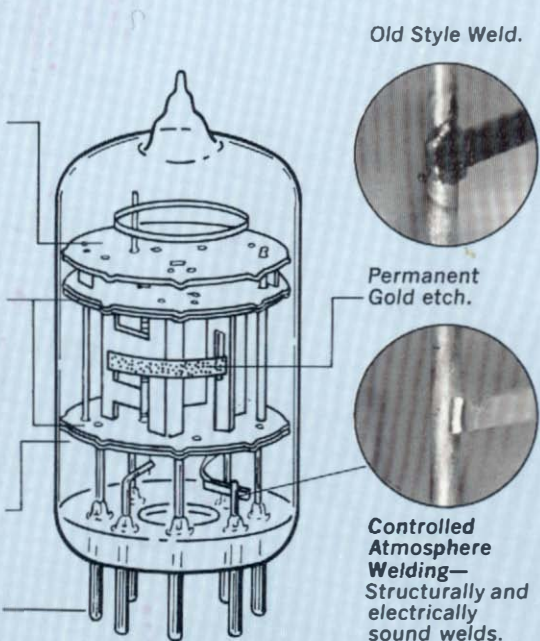
**QUALITY RIGHT DOWN TO THE ETCH**—special gold-ink etch for lasting identity.

**Isolation Mica**—  
Prevents possible formation of leakage paths due to getter flash.

**Double Top and Bottom Micras**—  
Added mechanical support for elements and mount in bulb.

**Strain Free Glass**—  
Thorough annealing precludes cracking and chipping for permanent seal.

**Gold Plated Pins**



**Old Style Weld.**

**Permanent Gold etch.**

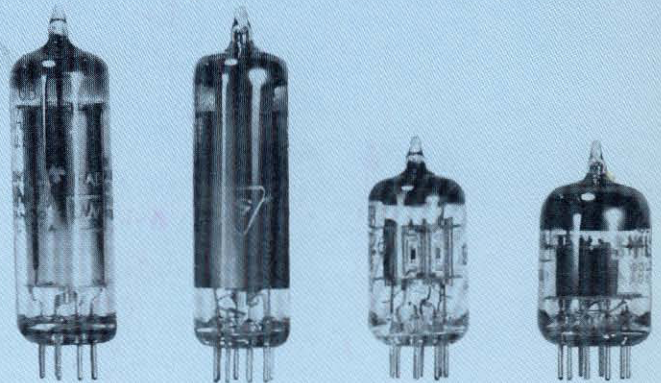
**Controlled Atmosphere Welding**—  
Structurally and electrically sound welds.

# 10,000 Hour Reliability

The Gold Brand line provides a design capability of 10,000 hours average life supported by millions of test hours of operation under the most demanding conditions.

**Electrical stability**  
**Maximum uniformity**  
**Extended life-span**  
**Physical ruggedness**  
**Long-range economy**

Examine and compare the special materials, constructions and processes used by Sylvania to build the elements of reliability into every Gold Brand tube.



# Assured reliability in actual application

These typical tests are from GB Gold Brand Acceptance Specifications—which are your assurance of built-in reliability and optimum performance in critical commercial and industrial applications.

MIL-E-1 Ref.	Test	AQL (%)	Limits					Units
			Min.	LAL	Bogey	UAL	Max.	
<b>MEASUREMENTS ACCEPTANCE TESTS</b>								
E-1301	Heater Current:		<p>These tests are typical of the controls imposed on the initial characteristics of Gold Brand tubes. Most basic tube parameters are controlled to .65% AQL while detrimental items such as Noise and Vibration are controlled to either 2.5% or 6.5% AQL. All Gold Brand types are controlled for reduced Ef characteristics and vibration at a 10 G level on a lot by lot basis.</p> <p>Continuity and shorts are controlled to an 0.4% AQL.</p>					mA
E-1336	Heater-Cathode Leakage:							μAdc
E-1266	Grid Current:							μAdc
E-1256	Plate Current (1):							mAdc
E-1256	Plate Current (2): Cutoff							μAdc
E-1306	Transconductance (1):							μmhos
E-1201	Continuity and Shorts							
D-20	Mechanical:							
E-1211	Insulation of Electrodes:							Meg
E-1306	Transconductance (2):	Sm						%
E-1256	Plate Current (1) Difference Between Sections	Δ Ef						
E-1256	Plate Current (3): Cutoff		mAdc					
E-1266	Grid Emission:		μAdc					
—	Pulse Cathode Current:		μAdc					
E-1241	RF Noise:		mAdc					
E-2201	Noise and Micro:							
—	AC Emission:		mAdc					
E-1316	Amplification Factor:							
E-1306	Transconductance (3): Special Controls Zero Bias, etc.		μmhos					
E-1331	Capacitance: All Applicable Measurements		pf					
E-1002	Low Pressure Voltage Breakdown: Pressure=21±=mm Hg.; Voltage=500 Vac							
E-1031	Vibration (1): 10 G's		mVac					
<b>DEGRADATION RATE ACCEPTANCE TESTS:</b>								
E-1041	Shock: High Impact Machine (500 G, 1 msec)		<p>These destructive tests are performed on either a lot or periodic basis. The shock test normally at a 500 G level is performed on a high impact shock machine designed especially for testing of electron tubes. After the Shock and Fatigue tests the tube samples are inspected for vibration, transconductance, heater-cathode leakage and grid current to tight control limits permitting only a small change in characteristics from the initial values.</p>					Hours
E-1031	Fatigue: G=2.5; F=25 cps min, 60 cps max; Fixed Frequency							
—	Post Shock and Fatigue Test End Points: Heater-Cathode Leakage Vibration (2) Transconductance (1) Grid Current							μAdc
—	Glass Strain Thermal Shock Test							mVac
—								μAdc

MIL-E-1 Ref.	Test	Allowable Defectives per Characteristic			Limits	Units
		AQL (%)	1st Sample	Combined Samples	Min. Max.	

**ACCEPTANCE LIFE TESTS:**

E-1506	<b>Heater Cycling Life Test:</b> (15,000 Cycles Min.) 1 min. on, 1 min. off					
4.7.1	<b>Stability Life Test:</b>					
4.7.3	Stability Life Test End Point: Change in Transconductance (1) of Individual Tubes $\Delta S_m$ t					%
E-1501	<b>Intermittent Life Test:</b> Stability Life Test Conditions; Bulb Temp. = Max. Rated					Hours
4.7.3	Intermittent Life Test End Points: <b>(500 Hours)</b> Inoperatives Grid Current Heater Current Change in Transconductance (1) of Individual Tubes $\Delta S_m$ t Transconductance (2) $\Delta S_m$ Ef Heater-Cathode Leakage Insulation of Electrodes Transconductance (1) Average Change Avg. $\Delta S_m$ t Interface Impedance Total Defectives					$\mu$ Adc mA % % $\mu$ Adc Meg % Ohms
4.7.3	Intermittent Life Test End Points: <b>(1000 Hours)</b> Inoperatives Grid Current Heater Current Change in Transconductance (1) of Individual Tubes $\Delta S_m$ t Transconductance (2) $\Delta S_m$ Ef Heater-Cathode Leakage Insulation of Electrodes Interface Impedance Total Defectives					$\mu$ Adc mA % % $\mu$ Adc Meg Ohms



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