



NEGATIVE ION SOURCES

National Electrostatics Corp.

Direct Extraction Negative Duoplasmatron Ion Source

The NEC Direct Extraction Negative Duoplasmatron Ion Source (Negative Duoplasmatron) is a displaced intermediate (Zwischen) electrode duoplasmatron as developed by Moak, Lawrence, Beauchamp, McKibben, et al. This source has been supplied with a wide variety of Pelletron® systems throughout the world and has proven to be very reliable with simple, routine operation.

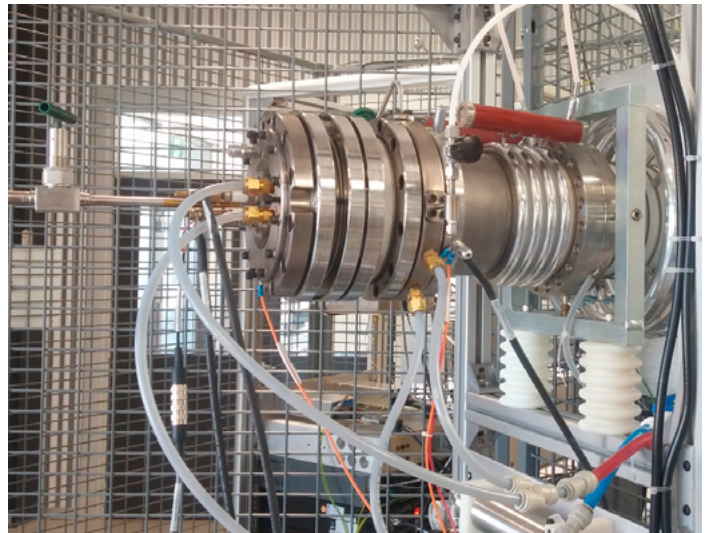
APPLICATIONS

The Negative Duoplasmatron is useful for producing modest currents of negative ions from many molecular gases. It will produce currents of H⁻, O⁻, NH₂⁻, CN⁻, C⁻ and other ions from diatomic or molecular gases which upon contact with a duoplasmatron arc have a good probability of breaking up into positive and negative ions. This source will not produce currents of N⁻ from N₂ gas because of the instability of the N⁻ ion or negative ions from the atomic gases such as helium, argon, etc.

DESIGN

A plasma discharge is maintained in the source which provides the supply of ions. It is a hot cathode type source where a hot filament emits electrons which sustain the plasma by making ionizing collisions with the gas molecules. The plasma at the Zwischen tip is focused by a magnet located inside the source. Gas is let into the source through the anode flange.

Permanent magnets are attached to opposite sides of the extractor with the poles attracting each other in order to deflect electrons out of the beam to prevent loading of the preacceleration tube or gap lens. The gap voltage determines the energy of the beam entering the preacceleration tube.



PERFORMANCE

Typical H⁻ output for the Simple Negative Duoplasmatron is 5 to 10 μAmps within the proper emittance $3 \pi \text{ mm mR (MeV)}^{1/2}$ for efficient transmission through an accelerator system. In addition, the intermediate electrode can be adjusted to produce currents of positive ions if the extraction polarity is reversed.

OPTIONS AND ACCESSORIES

Two versions of the Negative Duoplasmatron source are available: simple and liquid cooled. The simple version has a permanent magnet to provide the magnetic field at the Zwischen tip. The liquid cooled version contains an electromagnet with a source coil that is insulated electrically from the magnet housing and cooled by circulating Low Odor Base Solvent (LOBS) or equivalent coolant.

The anode is also cooled by coolant circulating through the anode flange. This allows for higher analyzed beam currents of up to 28 μ A H⁻ with a standard aperture and filament.

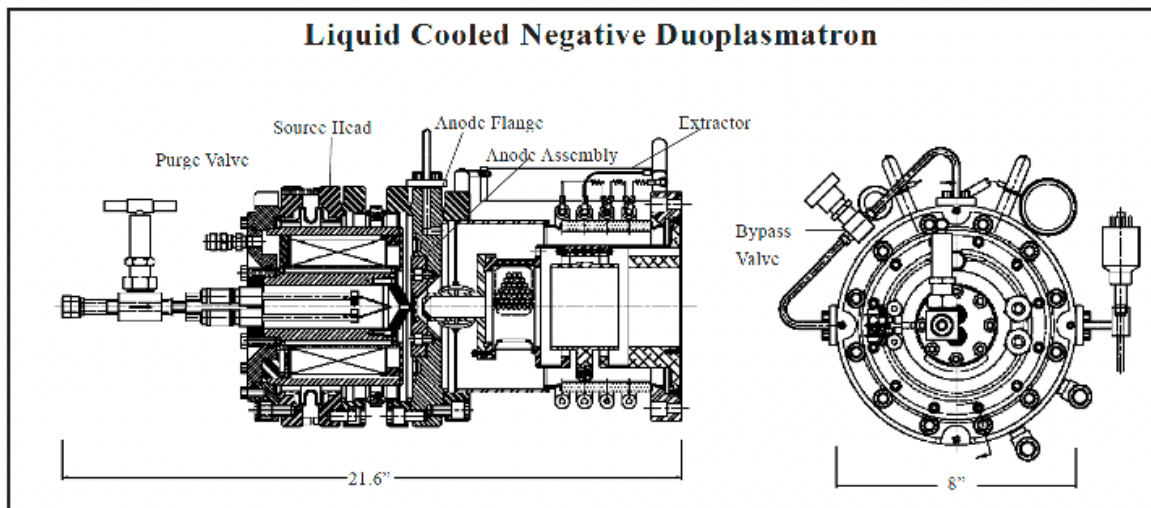
Source gas bottle assemblies with mass flow controllers are available in single, double, and triple unit sizes.

Double or triple unit assemblies are recommended when a gas mixture is required. Separate source gas metering units allow the precise mixing of the gases.

All necessary power supplies are also available.

SPECIFICATIONS

Filament Current:	25 to 35 ADC for 0.025" Tungsten Wire
Arc Voltage:	150-160 VDC (simple); 20-170 (liquid cooled) 0.1-2.5 ADC (simple and liquid cooled)
Extractor Voltage:	4-7kV (simple) 4-15kV (liquid cooled)
Extractor Current:	0.2-1.5mA (simple and liquid cooled)
Zwischen Displacement:	0.060" Off Axis
Gas Consumption:	8-12 atm cc/hr
Beam Emittance (rr'E1/2)	3 π mm mR (MeV) ^{1/2}



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