



HRP Job Aid

Power Supplies

Power Supplies

ECCN

Power supplies, direct current, high power	3A226
Power supplies, direct current, high voltage	3A227
Vacuum induction furnace, power supplies	2B226

Key Terms

A **power supply** is a device that supplies electric power to one or more electric loads (i.e., the load is an electrical component that consumes electric power).

Power supplies are sometimes referred to as electric **power converters**.

The term **DC power supply** is used to describe a large range of products used in computers, telecommunications, and other electrical power applications.

Power supplies **especially designed or prepared** to create a steady magnetic field for the separation of uranium isotopes using the electromagnetic isotope separation process are subject to the export licensing authority of the U.S. Nuclear Regulatory Commission (see 10 CFR Part 110).

Key Applications

Most power supplies *will not* be export controlled. Those that are export controlled are often custom built especially for these types of applications:

- Fusion energy research
- Particle beam weapons research
- Electrostatic painting
- Industrial X-ray systems
- Medical imaging and cyclotrons

High-Power DC Power Supplies (ECCN 3A226)

Information to Investigate

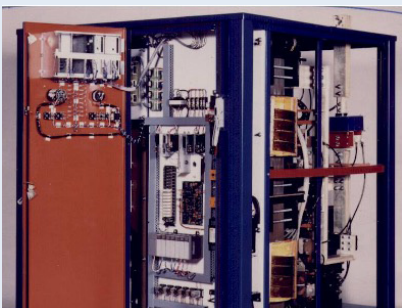
Technical parameters to investigate are high current (≥ 500 A), voltage (≥ 100 V), and current or voltage stability ($< 0.1\%$).

Note: Nameplates on power supplies usually identify both hazards to the operator and the output voltage and current.

Key Features

Only be concerned about the following high-power (i.e., high current) direct current (DC) power supplies:

- High current (≥ 500 A)
- Very large and enclosed in a metal casing
 - Typically sheet metal enclosures measure from $2 \times 4 \times 6$ ft to $6 \times 8 \times 10$ ft
- Large blowers for cooling or external fittings for liquid cooling often present
- Banks of transformers, large capacitors, circuitry, thick wiring, three-phase, and silicon controlled rectifier (SCR)
 - Three-phase power input is required for export-controlled DC power supplies. A single-phase source cannot generate enough power.
 - Incoming three-phase inputs are connected to a step-down transformer, which is then fed into an SCR.
 - The SCR converts the alternating current (AC) source into a pulsating DC supply.



A typical high-power DC power supply



A typical high-current power supply showing the arrangement of internal components. (1) water tubes for cooling the SCRs, (2) bank of SCRs, (3) transformers for three-phase power, (4) choke (inductor), (5) bank of capacitors

High-Voltage DC Power Supplies (ECCN 3A227)

Information to Investigate

Technical parameters to investigate are **high voltage** ($\geq 20,000$ V), current (≥ 1 A), and current or voltage stability (better than 0.1%).

Note: Nameplates on power supplies usually identify hazards to the operator and the output voltage and current.

Key Features

Only be concerned about the following high voltage DC power supplies:

- High voltage: $\geq 20,000$ V
- Heavy: Dry unit weights (without mineral oil) from 2,200 to 33,000 lb
- Large: Outer dimensions ranging from 4 × 6 × 6 ft to 8 × 10 × 12 ft
 - Smaller units have a fork-lift skid design
 - Larger units have lifting eye-hooks on the top
 - Large metal enclosures with access doors and panels
 - Internal components and high-voltage terminals are further apart than is typical in low-voltage power supplies
 - May have an energy storage bank or may be capable of being filled with high-grade mineral oil
- Precautions about the presence of capacitors
 - DC power supplies will contain large capacitors to store electrical energy and filter power supply output. Capacitors can retain electrical energy long after being connected in a circuit and are capable of producing a lethal shock if a person touches both contacts
 - Old power supplies may have oil contaminated with PCBs
- Warning labels, such as "Caution High-Voltage" or "DC Voltage"



A 33,000 V, 10 A high-voltage power supply unit with radiators (left) and controls (front)



High-voltage capacitors, with shunting conductor (top)

Power Supplies for Vacuum Induction Furnaces (ECCN 2B226)

Information to Investigate

- Is the power supply associated with a facility that has used furnaces for heating or melting metals?
- Is the power supply rated at a power output of ≥ 5 kW?

Note: Vacuum induction furnaces are used to heat or melt metal. Nameplates on the furnace vessel or its power supply can provide useful information (manufacturer, model number, power rating).

Key Features

Only be concerned about the following power supplies used for vacuum induction furnaces:

- Power output of ≥ 5 kW
- Especially designed for use with vacuum induction furnaces that can operate above 1,562°F (850°C) and have induction coils 24 in. (600 mm) or less in diameter



Export-controlled power supply for use with vacuum induction furnace. Note, the multiple high voltage warning signs



From left to right, power supply, vacuum induction furnace vessel, and controls

DOE/NNSA High Risk Property



<https://hrp.doe.gov>

<https://ecap.doe.gov>



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