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HIGH THROUGHPUT CONTINUOUS CRYOPUMP

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A cryocondensation pump with a unique regeneration mechanism that allows continuous operation has been constructed and tested. The pump features a device referred to as the "Snail" which removes the cryofrost layer as it is moved over the pumping surfaces. A forepump pumps the sublimed gas generated inside the Snail. The compression ratio of the pump is the ratio of the cryopump speed to the leakage conductance of the Snail. Deuterium has been pumped continuously at 30 torr·L/s at a speed of 2000 L/s and a compression ratio of 100. The pump, being all metal sealed and free of lubricating fluids, has many potential applications where ultraclean high throughput pumping is desirable. Since the pump regenerates on a time scale of 60 seconds, the inventory in the pump is minimized--an important consideration when pumping radioactive materials such as tritium. Test data and a videotape of the Snail removing the cryofrost will be shown.

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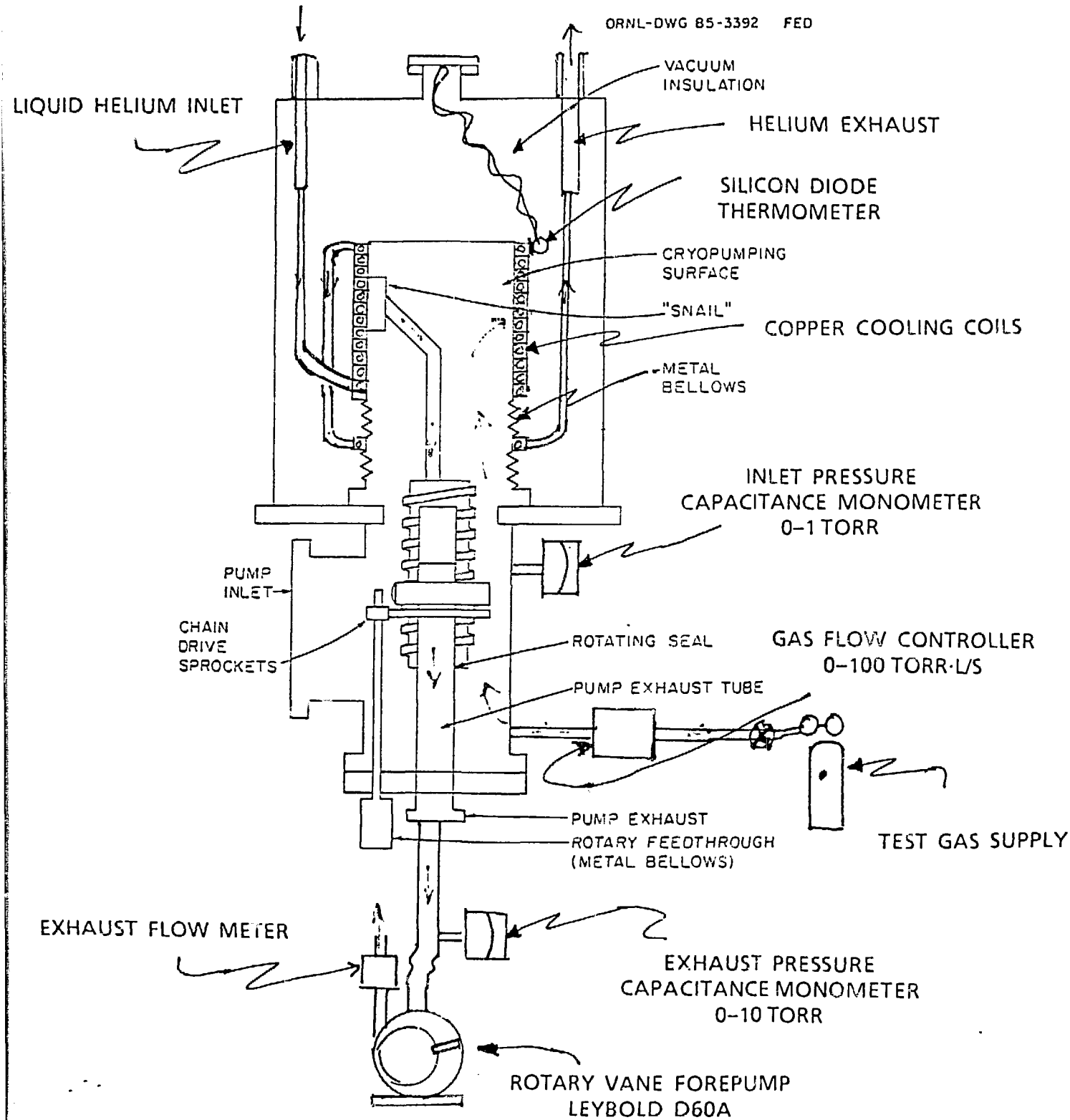
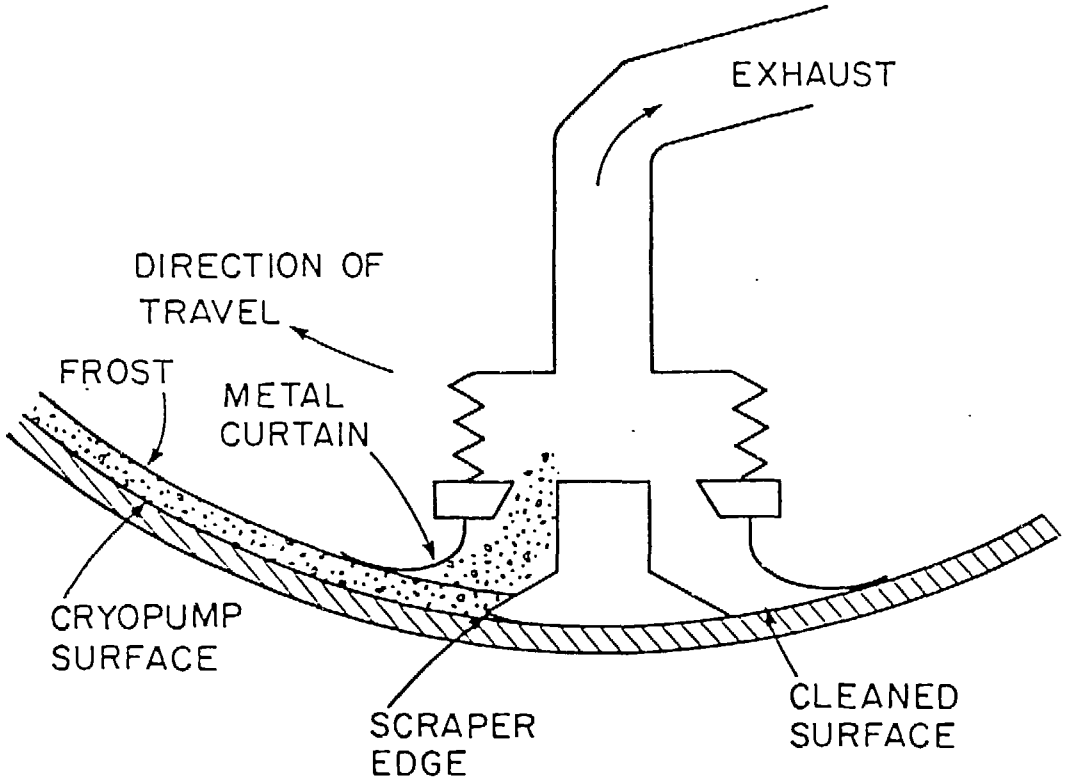
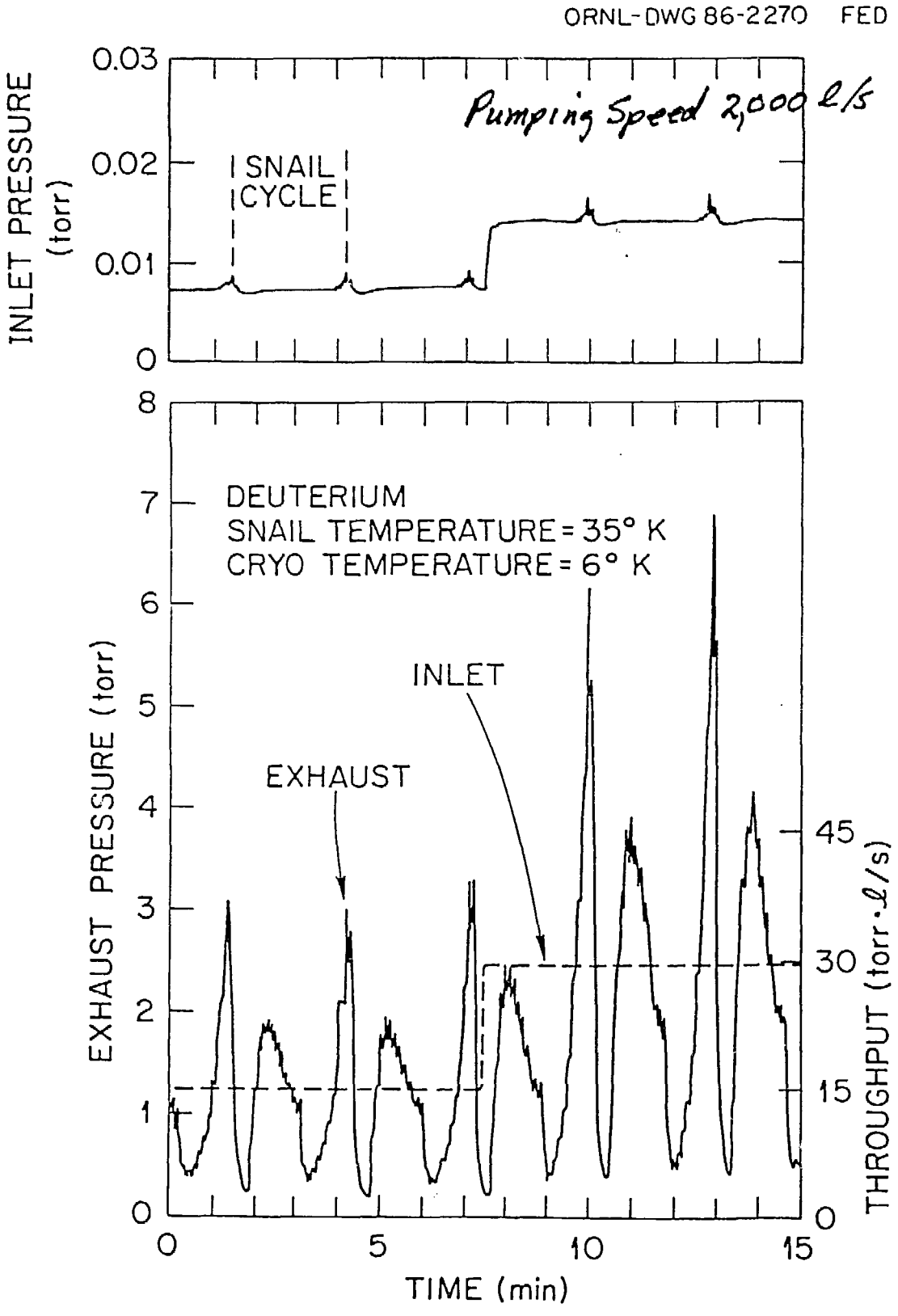

ORNL-DWG 85-3392 FED
LIQUID HELIUM INLET
VACUUM INSULATION
HELIUM EXHAUST
SILICON DIODE THERMOMETER
CRYOPUMPING SURFACE
"SNAIL"
COPPER COOLING COILS
METAL BELLOWS
INLET PRESSURE CAPACITANCE MONOMETER 0–1 TORR
PUMP INLET
CHAIN DRIVE SPROCKETS
ROTATING SEAL
GAS FLOW CONTROLLER 0–100 TORR·L/S
PUMP EXHAUST TUBE
PUMP EXHAUST
ROTARY FEEDTHROUGH (METAL BELLOWS)
TEST GAS SUPPLY
EXHAUST FLOW METER
EXHAUST PRESSURE CAPACITANCE MONOMETER 0–10 TORR
ROTARY VANE FOREPUMP LEYBOLD D60A

ORNL-DWG 85-3393 FED



SCHEMATIC OF "SNAIL"

SNAIL CRYOPUMP



Compression Ratio Test

SNAIL CRYOPUMP Compression Ratio ≥ 2,000

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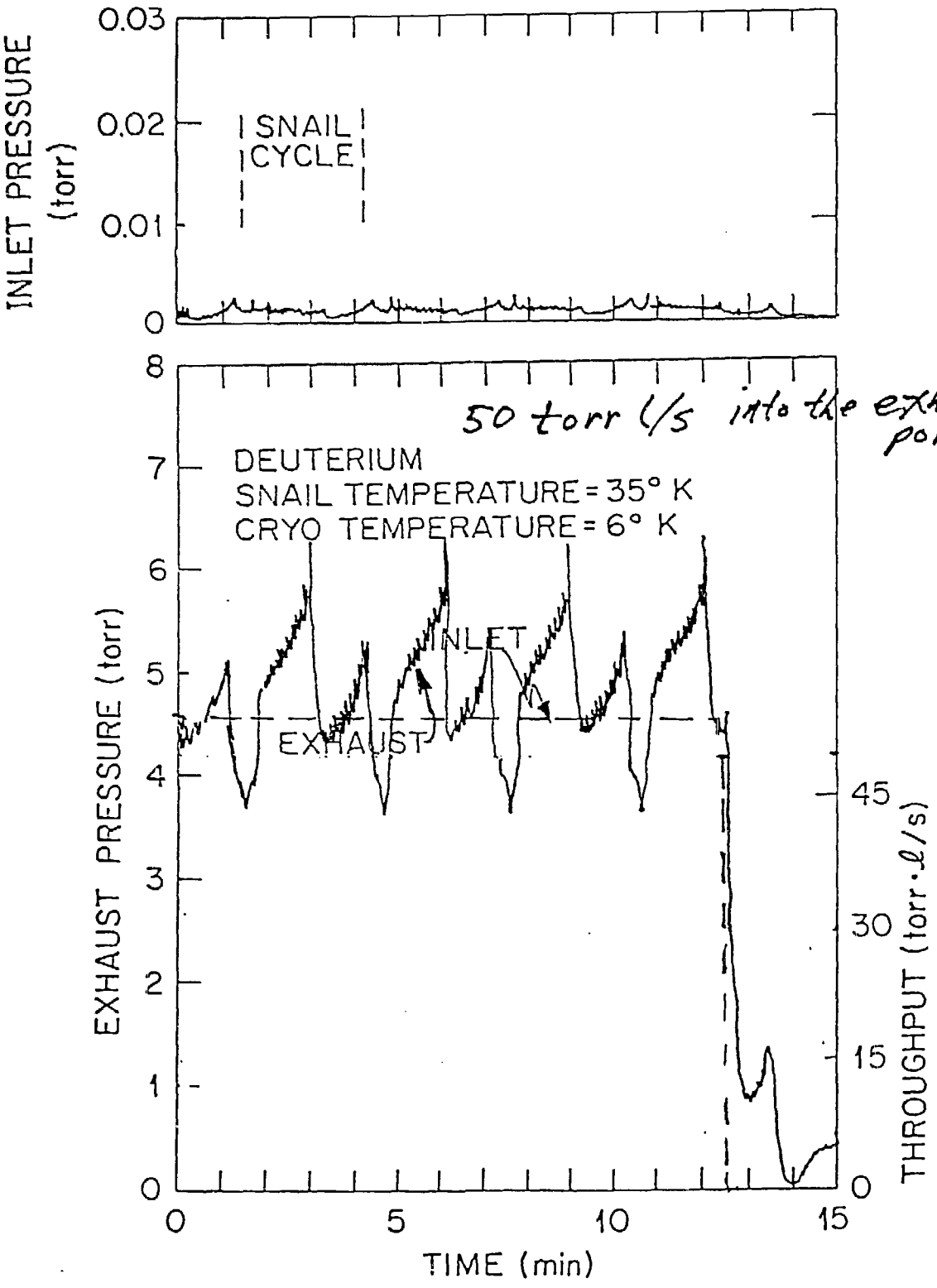
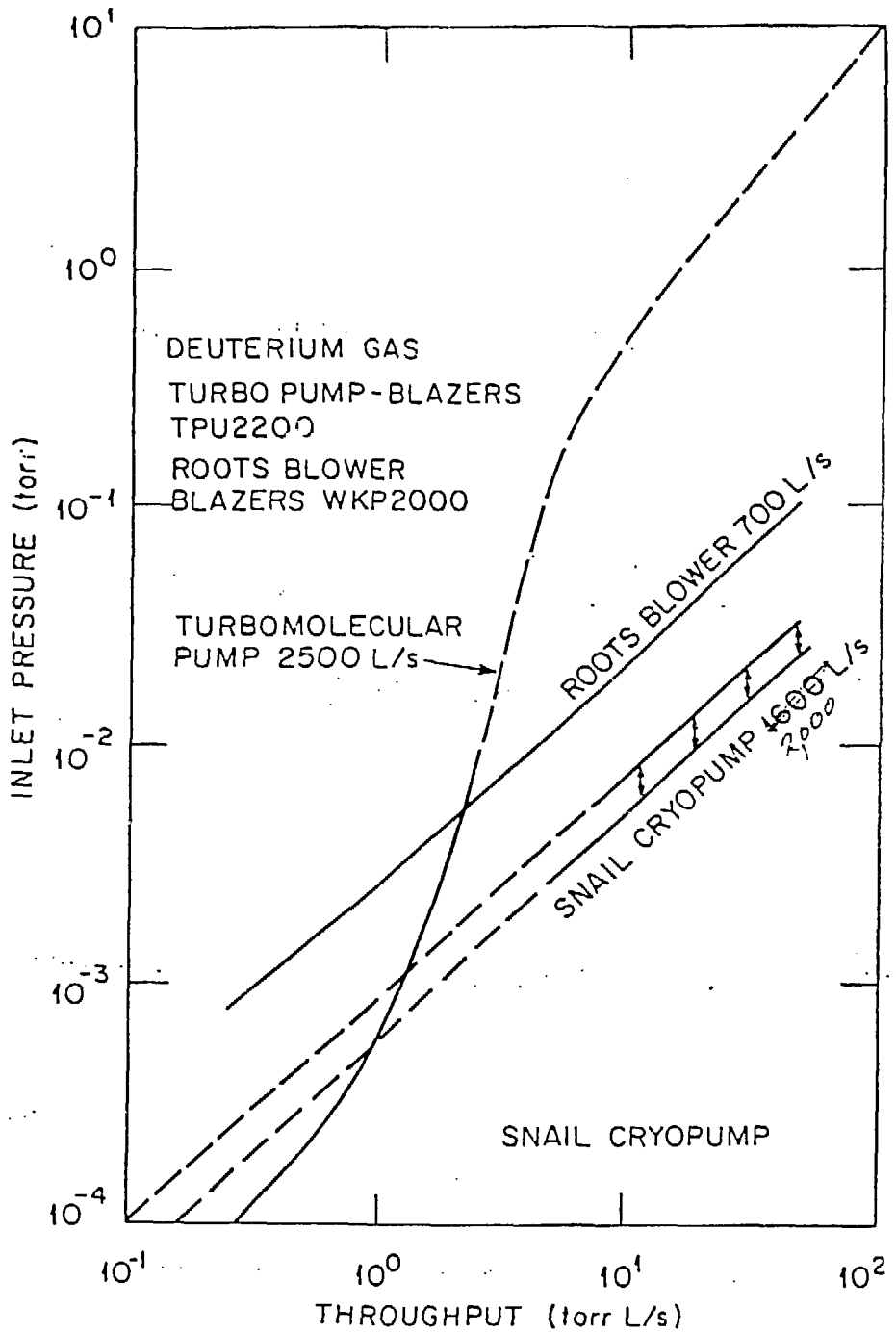


PUMPING PERFORMANCE OF THE "SNAIL" CRYOPUMP COMPARED TO A TURBO MOLECULAR PUMP AND A ROOTS-BLOWER



POTENTIAL APPLICATIONS

1. Fusion Energy Related

- Pumping tritium
- All metal sealed, dry pump, low inventory
- Pump limiters
  - High throughput
  - Conductance limitation already exists

- Pneumatic Pellet Guns
  - > 200 torr·L bursts of hydrogen propellant

2. Industrial

- High throughput - high speed
- Reactive gases
- Steady-state operation

3. Possible Alternative Forms

- Snail to regenerate high-speed pump
- Combined with Argon over-spray technique to pump He
- Snail-heater arrangement to continuously regenerate cryosorption pumps

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