

11 – Installation Report

Client:	University of Texas		
Quotation Number:		Date:	
Job Number:	IN1376	Date:	10 Aug 2026

Contact:	Ryan Hladyniuk		
Date of Visit:	10 Aug 2026	No. of Days:	9
Engineer:	Henry Connell Cooke		
System:	HS2022 (20402/4-2025/1376) Iso-EArth (10202/11-2025/1376) Cryo-Flex (10802/8-2025/1376) Elite Furnace Model TSV15/16/125 (3898/01/26) LSX-213 G2+ with Isosell (261211)		

Details of visit:

Day 1

- Arrived with all Sercon systems still in boxes and gas lines in place to the edge of the desk
- Each system (barring laser) was unboxed, inspected and lifted onto the table. No damage observed. Desk layout provides ample space around the back of each system, but not much space between systems to remove side panels
- PC set up and connection was established with 2022, Iso and Cryo without problem
- Source was removed, filament observed to look in good working condition so not replaced for new. A couple of barrels had loosened, but source looked otherwise unaffected by transit
- Oil added to rotary pump and installed
- Pumps switched on, but rotary did not start. System has been built for 240 V, supplied by customers own UPS, but UPS only provides 240 through a different sort of plug socket. Pumps cannot be switched on until a female IEC to NEMA 6-20P cable is purchased or made
- He, O₂, CO₂, N₂ and compressed air lines all made up and plumbed into the back of each system where required. Each line was leak checked with snoop/He detector, no leaks found
- Iso furnaces set to heat, to see if they would work at 120V. Furnaces heated very slowly and combustion plateaued around 750°C. Elite furnace wouldn't even start heating with 120V
- Cryo He plumbed in and GC installed, ~6mL/min going into the GC with ~2 mL/min making it out. GC baked out overnight

Day 2

- Customer obtains NEMA 6-20P plugs and rewires them into the cables that Sercon provided. HS2022, Iso and Elite furnace are now plugged into 240V as required
- Customer shown how to make combustion, reduction and water trap tubes. Furnaces are cleared of plastic debris from the top stopper that had not been removed before heating the day prior. Tubes are placed in furnace before heating
- Despite source being tested for continuity before switching on the pumps, a short circuit was found between HT and HP when vacuum reached 4.4E-7. Pumps switched off and source removed, with the top HP barrel being repositioned further away from the feedthrough. Source reinstated and system pumped down again
- Furnaces reach full temperature and pass a pressure test. Pressure increased from 25 to 34 PSI over 5 minutes pressurisation, before falling to 32 after 10 minutes of V6 being closed
- Since the filament was not new, source switched on at 3.2E-7 vacuum, and CO₂ peak observed. N₂ not tested until vacuum improved on day 3

Day 3

- System had lost comms overnight. HS2022 electronics restarted along with the PC, comms regained
- Vacuum of 8.2E-8 formed overnight
- Magnet positioning and tuning carried out to find good CO₂ and N₂ Peak shapes

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- Reference gas specs completed: Precision CO₂ = 0.01 ‰ and N₂ = 0.03 ‰. Linearity CO₂ = 0.09 ‰ and N₂ = 0.25 ‰. If you change linear regression from true to false for N₂. Linearity improves to 0.15 ‰, but precision becomes 0.06 ‰
- After only 3 blank runs, N₂ blank has a height of 8.2E-11
- Test samples dropped to observe combustion and set accurate windows. Good combustion and peak separation is observed. N₂ peak is slightly smaller than typical with a peak height of ~4 nA from 100 ug sample. CO₂ is a nice large peak surpassing 10nA from 400 ug
- Combustion precision ran: CO₂ = 0.04 ‰ and N₂ = 0.37 ‰
- N₂ retuned and another combustion precision ran overnight

Day 4

- Arrive to a vacuum of 5.8E-8
- N₂ combustion precision improved but still not passing at 0.25 ‰.
- Combustion Linearity also ran, N₂ = 0.24 ‰, but CO₂ had very poor 1.6 ‰. A couple of spikes were observed in the last two samples, for both CO₂ and N₂
- N₂ and CO₂ ref gas stability showed no sign of spiking, but spiking maintained in ref gas precision runs, even after restarting electronics and tightening the trapping loop crimp from 4.0E-6 to 3.1 E-6
- Pumps switched off and source removed. Cracked ceramic on the trap screw fell apart when loosening the screw, explaining intermittent spiking and HT voltage could arc to the trap. New ceramic and new filament installed; source reinstated and system pumped down
- After ~3 hours, system reached 1.6E-7 and filament was conditioned, taking 4 switches before firing

Day 5

- Arrived to a vacuum of 5.8E-8
- CO₂ and N₂ tuning completed. Ref gas precision CO₂ = 0.06 ‰ and N₂ = 0.05, Linearity CO₂ = 0.09, N₂ = 0.18
- Combustion linearity completed. N₂ = 0.11, CO₂ = 0.24 for n=5, removing the smallest sample, making the CO₂ linear working range 100 – 500 ug, or 6.8E-8 – 3.2E-7 beam area
- Customer ran their two smallest standards to see if losing the smallest sample from the linearity would be impactful. The first standard had a beam area of 1.19E-7, well within the working range. The second standard had a beam area of 2.6E-8, which is below the smallest failed sample from the linearity run anyway, (4.7E-8). Customer agreed they were happy with this linear working range.
- Combustion precision completed. N₂ = 0.12 ‰, CO₂ = 0.09 ‰ when replacing erroneous sample 3 with the final 'TEST' sample. Sample 3 was likely slightly contaminated, since it ~10% larger than the rest of the samples and is more than 1.0 away from the rest
- Dual RGI method created while providing customer software training. Customer ran their own material using new method, and achieved results with very good accuracy and precision

Day 6

- System lost comms over the weekend once again. Newest version of the software (60.0.2) installed, and 2022 USB was moved to a USB2 port
- Cryo system readbacks appear faulty. GC temps reads back random values 40-60°C without actually heating. EPC is correctly setting pressure but readbacks fluctuate from 0-11 PSI. New thermocouple does not change anything. Correct voltage is being supplied to the board whether the system is running at 120 or 240 V. New board is needed to heat the GC and provide accurate readbacks
- Teledyne engineer arrives and spends the day setting up the laser

Day 7

- Laser is setup ready to start sampling
- Customer shown how to make combustion tube, with just ~3 cm chromium oxide in the middle of the tube. Flow path is set up using peek tubing from laser into the furnace, and from furnace into the back of the cryo
- He flow from laser is initially set to 20 mL/min. No leaks are detected and flow out of V8 vent is 18.5
- Initial testing is completed at 10mL/min, with no peak observed. Laser flow increased to 20 mL/min and peak observed after the run had finished. Flow increased further to 30 mL/min and run time extended to 900 seconds. Peak observed with ~15 nA peak height and no tailing

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- Shipment did not include trigger cable. Trigger relay was replaced within the 2022 after it did not appear to light up, and individual wires are connected to/from the correct pins on the 2022 and laser, to emulate the trigger cable. Cable to be shipped ASAP
- Timings set up for RGI method with sample arriving after ~800 seconds. Test run overnight on IAEA C3 cellulose standard with a delta value of -24.7 vs PDB.
- Laser settings used as follows: Fluence = 6.06 J/cm² Rep rate = 10 Iteration Count = 1 Spot size = 100 um scan speed = 50 um/s line length 500 um

Day 8

- Overnight run of 10 samples shows good accuracy and precision overall. Two of the first three samples are inaccurate, but the following 7 give precision of 0.12 ‰ with an average value of -24.7, exactly as it should be.
- Customer runs their own samples with unknown delta values, to get used to laser functionality

Day 9

- Customer continues to run their own samples

Test	CO2 Precision ‰	N2 Precision ‰
Ref gas precision n = 5	0.06	0.05
Ref gas linearity n = 6	0.09	0.18
Combustion precision. 100 ug N, 400 ug C, n = 5	0.09	0.12
Combustion linearity. 20 – 200 ug N, n=6, 100-500 ug C, n = 5	0.24	0.20
Laser ablation. RGI n = 7	0.12	N/A

Recommendations:

- Customer is warned that potential problems with air conditioning will affect stability and sample results.
- Customer is warned that systems are too close together to properly access side panels, potentially causing problems if maintenance is needed

Faults and Shortages:

- New board to be sent out to replace faulty Cryo board. To be replaced by customer
- Trigger cable to be sent out

Follow up:

Please contact me at henry.cooke@sercongroup.com or service@sercongroup.com if you need any further guidance or have any questions. Especially reach out regarding the replacement of the Cryo board and addition of the trigger cable, and keep in touch with questions/updates regarding CO method development.

Engineer:
Henry Cooke

Date: 20 Aug 2026

Signed:

Henry Connell Cooke