SERVICE REPORT

Job Number:	SE0766 Sage:		
Customer:	Uni of Agustin, Arequipa, Peru		
Contact:	Dr Juan Lopa / GINA A. MARRON DAZA		
Instrument:	HS2022, IsoEArth+, µCarbs, HT-EA, CryoFlex, TOC		
Date of Visit:	5TH – 9TH October 2026		
Engineer:	David Harris		
Reason for Visit:			
PM service of instruments			
Service Contract?	**Yes** / ~~No~~	Expires:	31 July 2027
Warranty?	~~Yes~~ / No	Expires:	N/A
Tick as Applicable:	~~Call Out~~ / Routine Service ~~/ Warranty / Emergency~~ / Contract Visit		

Details of Visit:

Engineer arrived on site. Instruments all are in good condition – All OK.

HS2022 & IsoEArth+ both active and in good working condition – All OK

HT-EA, CryoFlex, µCarbs & CETAC X2 all currently off line.

Customer reports high He consumption. Engineer to investigate.

Customer requests carousel autosampler cleaning due to possible contamination from honey samples.

HS2022

All comms with software respond as expected – All OK.
Pre-Service Ref Gas spec results as follows.
Ref. 5 second pulse
Precision. n=5, 5 sec pulse.
Linearity. n=6, 1, 2, 4, 6, 8, 10 sec pulses

N_2 Peak Shape (2/1) = Pass
N_2 Ref Gas Stability (2/1) = Pass

CO_2 Peak Shape (2/1) = Pass
CO_2 Ref Gas Stability (2/1) = Pass
CO_2 Peak Shape (3/1) = Pass
CO_2 Ref Gas Stability (3/1) = Pass

CO (from CO_2 Ref Gas) Peak Shape (3/1) = Pass
CO (from CO_2 Ref Gas) Stability (3/1) = Pass

Ref Gas ^{15}N Precision = 0.055‰ S.D.
Ref Gas ^{15}N Linearity = 0.295‰ S.D.

Ref Gas ^{13}C Precision = 0.052‰ S.D.
Ref Gas ^{13}C Linearity = 0.107‰ S.D.
Ref Gas ^{18}O Precision = 0.105‰ S.D.
Ref Gas ^{18}O Linearity = 0.271‰ S.D.

Engineer carried out PM Service routine.

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Proceeded to vent instrument and carry out PM service.

Customer reports oil leak on rotary pump. Customer suspects oil filter has an issue and has ordered new part to replace. New oil mist filter fitted. Gasket also tightened down. User to monitor situation. No leak noted post service work.

Removed rotary pump, drained old oil and replaced for new – All OK.

Removed Source, removed old filament. Fitted new filament – All OK.

Fitted new copper gasket and PTFE ferrules to inlets – All OK.

Pumped down instrument. All OK. (1.0^{e-08} mBar vac achieved over night)

Conditioned filament. All OK.

Emissions OK in standby mode at approx. 55uA with trap @ 50uA. Trap & Emission readbacks are stable. – All OK.

Retuned instrument as required – All OK.

No magnet move required – All OK.

Final Ref Gas spec results as follows.
Ref. 5 second pulse
Precision. n=5, 5 sec pulse.
Linearity. n=6, 1, 2, 4, 6, 8, 10 sec pulses

N_2 Peak Shape (2/1) = Pass
N_2 Ref Gas Stability (2/1) = Pass

CO_2 Peak Shape (2/1) = Pass
CO_2 Ref Gas Stability (2/1) = Pass
CO_2 Peak Shape (3/1) = Pass
CO_2 Ref Gas Stability (3/1) = Pass

CO (from CO_2 Ref Gas) Peak Shape (3/1) = Pass
CO (from CO_2 Ref Gas) Stability (3/1) = Pass

Ref Gas ^{15}N Precision = 0.034‰ S.D.
Ref Gas ^{15}N Linearity = 0.078‰ S.D.

Ref Gas ^{13}C Precision = 0.016‰ S.D.
Ref Gas ^{13}C Linearity = 0.038‰ S.D.
Ref Gas ^{18}O Precision = 0.092‰ S.D.
Ref Gas ^{18}O Linearity = 0.178‰ S.D.

SO_2 peak shape measured via trapping loop from combusted sample on IsoEArth+ system
SO_2 Peak Shape (2/1) = Pass
SO_2 Stability (2/1) = Pass

µCarbs

Activated CETAC & Heated blocks for testing. Both respond as normal – All OK.

Investigated unit for possible leaks. Leak found in at needle (post V4). This is connected to the flush gas function. Pressure behind valve 4 is too high for the valve to hold. He leaking across V4 when closed.

Replumbed system so that He pressure is controlled by gasbox regulator (not direct from He cylinder). With He pressure down at 20psi V4 does not leak. Replumbing will have no operational effect to normal use. Issue resolved.

Flow meter calibrated – All OK.

Tested blank response on flushed vials. Blanks good – All OK.

Customer provided carbonate samples and acid for testing.

Flushed acid needle with acid – All OK.

Tested µCarbs with breath sample batch. n=5, 6ml vials. Results good – All OK.

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Tested µCarbs with acid dosed samples in flushed vials. n=5, 6ml vials.. Results good – All OK.

He carrier Flow = 60ml/min
He carrier Pressure = 23psi
He flush Flow = 40ml/min
He flush Pressure = 23psi
GC temp = 70°C

CO2 from breath ^{13}C Precision = 0.057‰ S.D.
CO2 from breath ^{18}O Precision = 0.154‰ S.D.
CO2 from acid dosed carbonates ^{12}C Precision = 0.019‰ S.D.
CO2 from acid dosed carbonates ^{18}O Precision = 0.059‰ S.D.

IsoEArth+

Customer had requested the tube couplings connecting to water trap be replaced for new part. Parts built & swapped out for new. No leaks found – All OK.

Investigated unit for possible He leaks – No He leaks found.

Possible O_2 leak found on gas cylinder. High blank peaks had been monitored. Air trapped within O_2 line outside of IsoEArth+ system. O_2 pressure holds inside system. Engineer tightened all connections to O_2 cylinder & backline plumbing. Also purged O_2 line within IsoEArth+ & at CryoFlex unit. Blank peak came down as a result – All OK.

Furnaces cooled off to carry out work to unit (removing couplings, cleaning autosampler).

Furnaces re-heated to normal NCS operating temps (Comb = 1000°C, Equi= 860°C, Redu=600°C) – All OK.

GC oven set to 130°C overnight to bake out & clean – All OK.

Carousel autosampler removed and cleaned with ethanol as requested by user. Damaged found to Oring between drop chute and main body of autosampler. O-ring replaced for new – All OK.

Leak checked combustion pathway – Pass.

Slightly high N_2 background noted (approx. 3.0^{e-10} on major beam).

Source pressure fluctuating. Adjusted isolation crimp to stabilise. S vac pressure approx. 4.9^{e-06} mBar– All OK.

SO_2 peak shaped tuned via combusted samples. Peak shape good. 2/1 stability good.

During initial NCS testing incorrect SO_2 tuning saved. This resulted in poor data. SO_2 tuning re-checked and confirmed. NCS testing repeated. Results good.

NCS triple analysis carried using weighed 1.0mg cystine samples. n=5. Drift corrected.

N&C linearity analysis carried out using AS BEET MIX liquid samples.
Linearity batch range = N 10-200µg, C 25-500µg, n=6, results drift corrected.
He Flow = 60ml/min
He Pressure = 23psi
O_2 Flow = 80ml/min
O_2 Pressure = 23psi
GC temp = 70°C

Combustion ^{15}N Precision = 0.065‰ S.D.
Combustion ^{13}C Precision = 0.034‰ S.D.
Combustion ^{34}S Precision = 0.169‰ S.D.
*Combustion ^{34}S Precision = 0.056‰ S.D. * Outlier sample removed*

Combustion ^{15}N Linearity = 0.150‰ S.D.
Combustion ^{13}C Linearity = 0.232‰ S.D.

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HT-EA

HT-EA furnace cooled upon engineer's arrival.

System left with standby flow of approx. 20ml/min.

Increased furnace temp to 1400°C. Furnace response as normal – All OK.

GC oven set to 130°C overnight to bake out & clean – All OK.

Blank samples tested – Pass

Cystine samples used for testing & analysis.

GC oven temp dropped to 50°C to increase separation between N_2 & CO sample peaks. Separation now good for analysis.

Adjusted CO tuning as required – All OK

CO background within acceptable parameters for pyrolysis analysis.

S vac pressure approx. 4.9^{e-06} mBar when open – All OK.

^{18}O precision analysis (CO) carried out using weighted cystine samples 0.5mg, n=6, results drift corrected.
He Flow = 80ml/min
He pressure = 20psi
GC temp = 50°C
Furnace temp = 1400°C

Pyrolysis ^{18}O Precision = 0.152‰ S.D.

Due to time constrains it was not possible to switch to "low mass" mode for HD analysis.

Engineer to assist with dial in to check HD tuning & Ref Gas batches.

Customer to run HD samples at a later date as required.

CryoFlex

CryoFlex & CETAC deactivated upon engineer's arrival.

Activated system. All comms OK. All systems respond as normal – All OK.

GC columns baked out at 130°C over night.

Customer provided Liquid N_2 for analysis. User interested in N_2O analysis for future studies.

System also tested for N_2 analysis to check functionality of sub-sample loop.

Investigated units for possible leaks. Leak found on connection at bypassed furnace union. Graphite ferrule within union damaged. Removed Graphite ferrule and replaced for standard 16-16 PTFE ferrule. Leak checked system. System now passes – All OK.

Tested system with samples from air with GC oven set to 30°C. Separation between CO_2 & N_2O sample peak poor. Dropped system down to room temp (approx. 21°C). Separation now improved, however sample peaks still do not have enough separation for accurate analysis.

Customer notes that the TOC setup uses GC 2 (30m Rt®-Q-BOND capillary column). This could have caused the column to deteriorate and require to be replaced.

Advise customer to purchase spare GC2 column for CryoFlex to aid with CO_2 / N_2O separation.

He carrier Flow = 20ml/min
He system Pressure = 8psi
He flush Flow = 40ml/min

GC1 carrier flow = 4.5ml/min
GC2 carrier flow = 1.7ml/min
GC temp = ~20°C (room temp)

Cryo-trapped samples from air (N_2O) ^{15}N Precision = 0.080‰ S.D.

Cryo-trapped samples from air (N_2O) ^{18}O Precision = 5.909‰ S.D.
Sub-sample loop samples from air (N_2) ^{15}N Precision = 4.554‰ S.D.

Results poor for N_2O analysis. Most likely cause for this is that GC2 (30m Rt®-Q-BOND capillary column) is damaged/contaminated. Separation is poor between CO_2 & N_2O during batch work.

Sample peaks are also low due to lack of N_2O in sample size (Major beam height approx. 0.15nA). Samples could be viewed to be below the levels of detection. System is already optimised for allowing the maximum volume of sample into the MS Ion source. Further optimisation not possible.

Advise user to replace CO/CO_2 scrubber tubes for new. Also repeat analysis using larger sample sizes.

Advise customer to purchase spare GC2 column (30m Rt®-Q-BOND capillary column) for CryoFlex to aid with CO_2 / N_2O separation.

Additional

Engineer adjusted methods and timings as required for best data.

Engineer adjusted events to minimise helium waste on IsoEArth+ & HT-EA by closing autosampler purge when not required.

N.B. This will mean that the TCD detector will be offline during analysis.

Service complete

Recommendations:

- Purchase spare GC2 column for CryoFlex to aid with CO_2 / N_2O separation
- Keep HT-EA furnace at 1000C while not in use to avoid oxidation of heating element.

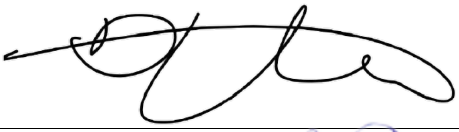
Follow Up:

- Dial in session to be arranged for HD testing

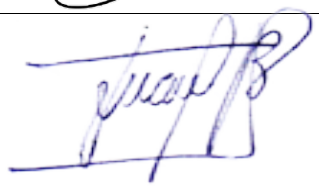
SERVICE REPORT

Parts Used:	*Stock Number:*	*Quantity:*	*Charge:*
Service kit	SC90011	1	Included in service
		Total:	N/A

Engineer: David Harris Date: 09 Oct 2026

Signed: 

Customer: Date: 16 Oct 2026

Signed: 

NOTES:

N/A

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