BEYOND MEASURE

SCION INSTRUMENTS

Reference Manual

Transformer Gas Analyzer

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Section contents

INTRODUCTION

Certain faults in electrical transformers may result in the production of gases, which remain dissolved in the transformer fluid. The transformer fluid and insulating materials will break down into a few easily identifiable by-products when subjected to fault conditions.
Identification and quantification of these gases can provide an early indication of developing problems in the equipment.

ASTM methods D3613, D2945 and D3612 describe sampling, gas extraction and analysis procedures respectively.

The components of interest in the extracted gas are typically hydrogen, oxygen, nitrogen, carbon monoxide, carbon dioxide, methane, ethane, ethylene and acetylene.
The Transformer Gas Analyzer Channel is an analytical tool principally developed for the determination of these components.

The sample is simultaneously injected into two individual channels by means of a
10 port gas sampling valve equipped with two sample loops. A molecular sieve column separates the lighter gases like hydrogen, oxygen, nitrogen, methane and carbon monoxide while a porous polymer column separates the other carbon gases. A methanizer-FID combination ensures that the carbon oxide gases are detected at low ppm levels.

For a real understanding of the flow scheme, see also the **states of operation** in section 3 of this manual.

The instrument is tuned during Final Test to its proper settings. Do not change any flow or pressure settings unless it is requested.

INSTRUMENT SPECIFICATIONS

Every instrument is fully tested; the results of the tests, as well as the methods used during these tests, are presented as part of this manual (refer to section 1).

START UP

At initial START-UP as well as after a longer idle period, follow the instructions below:

- *Connect all the gases to the instrument.*
- *Switch the power on.*
- *Load the appropriate method.*
- *Check the flow settings.*
- *Condition the system as described in this manual.*
- *Do not make any changes to the methods.*
- *The system is ready for injections.*

For a new system there is no need to do any flow measurement or flow tuning before power-up.
The instrument is tuned and tested in the Factory in Goes.

INSTALLATION OF COLUMNS, FLOW AND PRESSURE SETTING

Tuning of the analyzer is only necessary in case new columns are installed or after flow or pressure settings have been changed. Before new columns may be installed, they need to be preconditioned!!

Make sure, the instrument is connected to the minimum gas supply conditions as indicated in the 456-GC pre-installation manual.

For more detailed information concerning the configuration of the instrument, please, refer to the drawing section (section 6 of this manual). The factory drawing indicates which flow and pressure controls are being used. The drawing also outlines the way the analyzer channel has been incorporated into the gas chromatograph.

Regularly check and replace filters maintaining the supply quality as described in the pre installation requirements.

Replacement columns:

BRP2059	Molsieve 13X 45/60, 3ft * 1/8" Inert Steel
BRP2068	Hayesep N 80/100, 6ft * 1/8" Inert Steel
BRP2056	Flame out buffer (OV101 on GHP, 2ft * 1/8" Inert Steel)

Tuning the TGA channel

Tuning is only necessary when new columns have to be installed or by malfunctioning of the GC. Connect the columns according the flow schematics given in Section 6 and adjust the pressures (if necessary) at an oven temperature of 70°C.

Take very good care not to create any dead volume!

- Set valve 1 and 2 in the (-) position.
- Turn of all flows to the FID.
- While measuring the flow at the exit of the FID, adjust the H_2 flow for the methanizer at 20 ml/min.
- Turn of the H_2 supply from the methanizer.
- Set the front EFC-24 flow (flow over the Molsieve column) until there is 30 ml/min Ar coming out the exit of the FID.
- Switch valve 2 to the (+) position. And set the middle EFC-24 flow (flow over Delay and Hayesep column) until there is 30 ml/min Ar coming out the exit of the FID.
- Adjust the digital manual flow controller for the reference TCD flow at 30 m/min.
- Open the H_2 supply.
- Program the method as given in the OPERATION section.

Check all connections for leakage. If big leaks are detected it may advisable to repeat flow tuning.

After stabilization of the TCD and FID signal the system is ready for determination of the optimal column selection time.

Inject a gas mixture with hydrogen, oxygen, nitrogen, methane and carbon monoxide at the molecular sieve column. After elution of the CO peak, valve 2 can be switched in the (+) position for elution of the components from the Hayesep column.

OPERATION

Operational method is preloaded in the instrument.

Listed below is an example method; settings determining the application may be different.

Sample delivery:

	V1 (GSV)	V2 (CS)
Initial	-	-
0.1	+	-
3.0	+	+
9.9	-	-

Flow/Pressure:

Front EFC-24 (Ar):

	Pressure (psi)	Hold (min)
Initial	27.5	10

Total Flow: 60 ml/min

Middle EFC-24 (Ar):

	Pressure (psi)	Hold (min)
Initial	38.5	10

Total Flow: 60 ml/min

Column Oven:

	Temp (°C)	Rate (°C/min)	Hold (min)	Total (min)
Initial	70	--	10	10

Valve oven:

Temp 100(°C)

Methanizer oven:

Temp: 400 °C
Hydrogen flow: 20 ml/min

Detector (front TCD):

Temp: 200 °C
Range: 0.05
Time cons: slow
Fila temp: 254 °C

Fila max:	390 °C
Polarity:	negative

DEFC 13:

Reference flow:	30 ml/min Ar

Detector (middle FID):

Temp:	300 °C
Range:	12
Time constant:	slow

Middle DEFC 11:

Make up:	0 ml/min (Ar)
Hydrogen:	10 ml/min
Air:	300 ml/min

This method is only valid in case the instrument is equipped with one Transformer Gas Analyzer channel only.
Refer to section 1 for the actual method(s), whenever the instrument has combined channels.

Never interrupt an analytical run. The complete cycle has to finish!

TROUBLE SHOOTING

For problems related to the basic hardware and electronics of the gas chromatograph, as well as injectors and detectors, refer to the 456-GC user reference manual.

In case of any analytical problem, it is always advised to record an analysis using a reference sample. The result, including full details can be submitted to your local Scion Instrument service department to judge performance.

Fig. 1 and fig. 2 show chromatograms of the FID and TCD tracks respectively. In case of decreasing retention times of the Molecular Sieve column, this column needs reconditioning. Conditioning needs to be done in a different oven under nitrogen or helium at a temperature of 350 °C overnight.

Check the status of the humidity filter in case of conditioning is needed. The cause might be saturation of this filter.

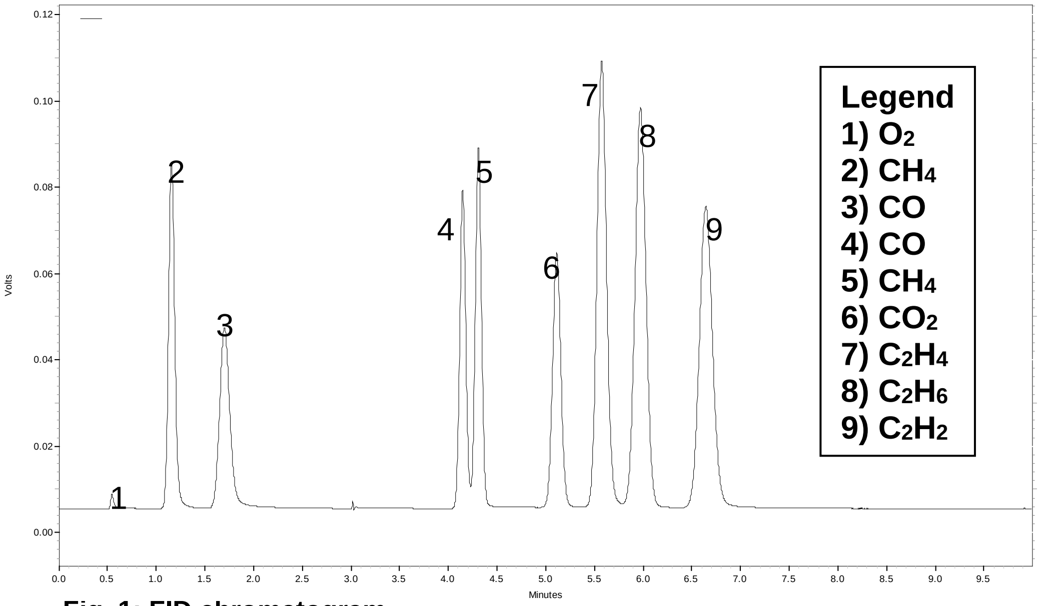


Fig. 1: FID chromatogram

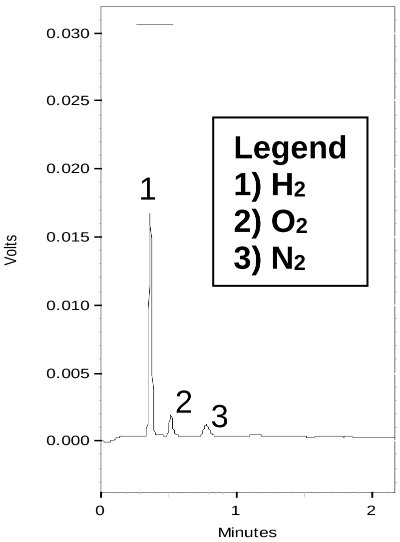
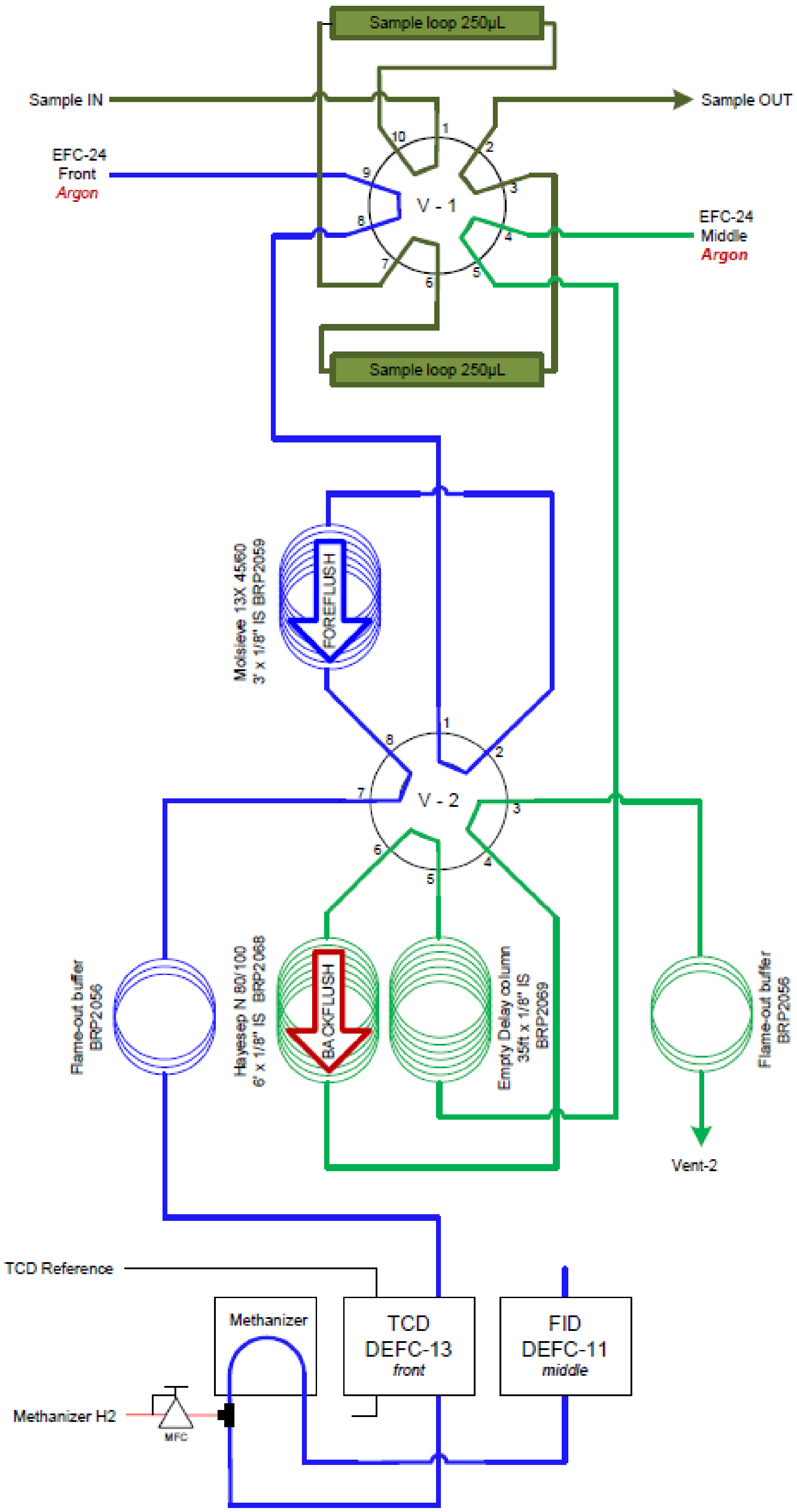


Fig. 2: TCD chromatogram

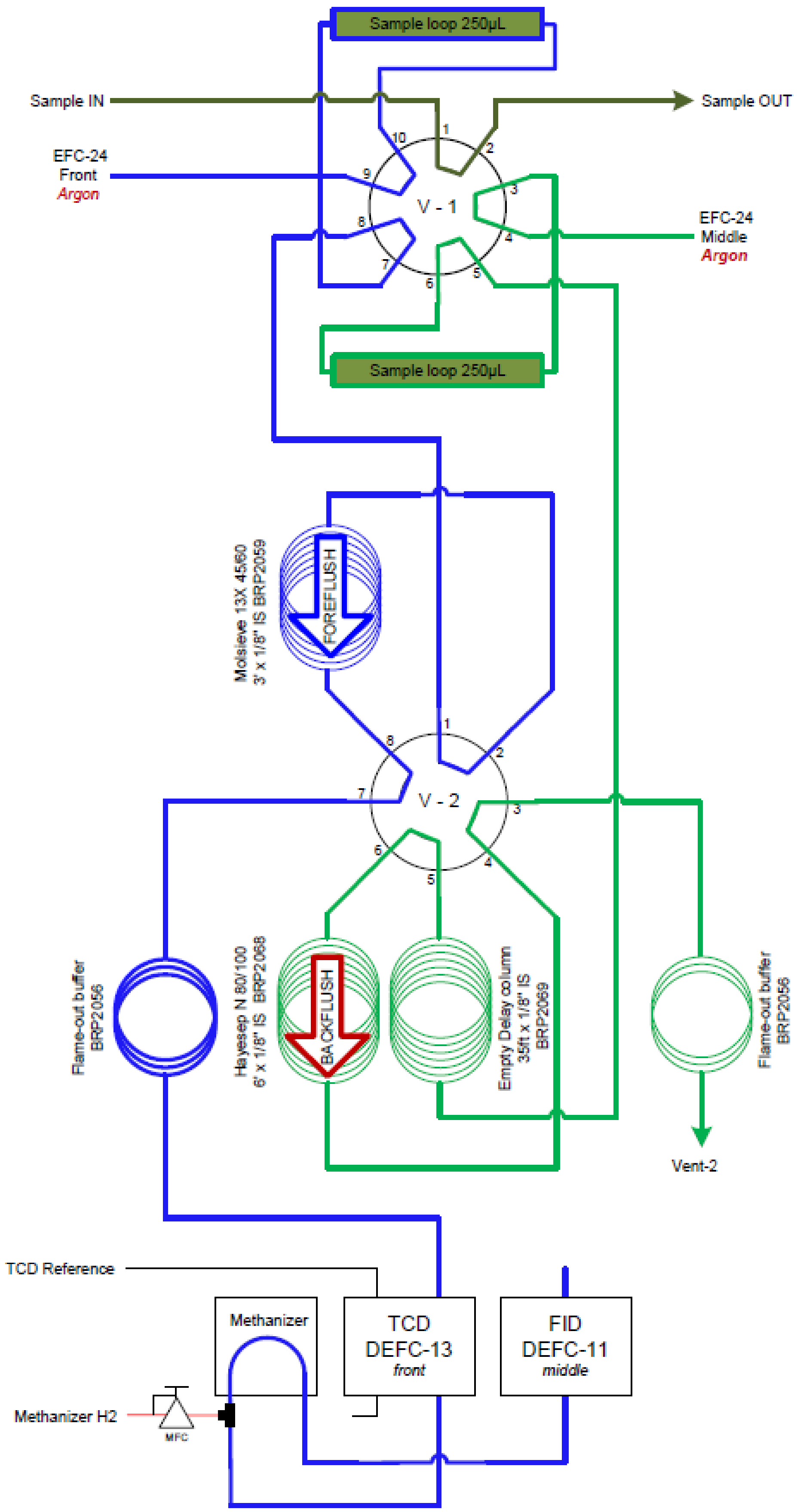
STEP BY STEP

Step by step drawings for the Transformer Gas Analyzer Channel

Load Position: Valve -1, Valve -2



Inject Position: Valve +1, Valve -2



Backflush position: Valve +1, Valve +2