
WORK PROCEDURE FOR

**OPERATION AND MAINTENANCE OF
CALORIMETERS AND CHROMATOGRAPHS
PART 1: DANALYZERS UNDER DIRECTION FROM
OFGEM**

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SEPTEMBER 2015

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FOREWORD

This Work Procedure was approved by gas Transmission and the Gas Distribution Policy Manager on 20/09/15 for use by managers, engineers and supervisors throughout National Grid Gas.

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BRIEF HISTORY

First published as T/PR/GQ3 Editorial update to reflect demerger November 2000 Editorial update to reflect Safety Case version 3 taking into account issues as detailed in the comments below. Additionally, compliance with mandatory terms along with the removal of no specific normative phrases. Editorial update to comply with GRM Editorial update for National Grid re-branding	March 2001 June 2001 July 2004 October 2004 October 2005	EPSG/L01/255
Changing of gas day from 06:00 to 05:00	September 2015	

KEY CHANGES (Identify the changes from the previous version of this document)

Section	Amendments
Appendix B	Gas times changed from 06:00 to 05:00

DISCLAIMER

This document is provided for use by National Grid Gas and such of its contractors as are obliged by the terms and conditions of their contracts to comply with this document. Where this document is used by any other party it is the responsibility of that party to ensure that this document is correctly applied.

MANDATORY AND NON-MANDATORY REQUIREMENTS

In this document:

shall: indicates a mandatory requirement.

should: indicates best practice and is the preferred option. If an alternative method is used then a suitable and sufficient risk assessment shall be completed to show that the alternative method delivers the same, or better, level of protection.

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WORK PROCEDURE FOR OPERATION AND MAINTENANCE OF CALORIMETERS AND CHROMATOGRAPHS PART 1: DANALYZERS UNDER DIRECTION FROM OFGEM

INTRODUCTION

These procedures outline the requirements for the operation and maintenance of a calorimeter or chromatograph under direction from Ofgem under Section 12 of the Gas Act 1996. The document outlines the requirements for the ongoing operation and maintenance to Danalyzers under contract from the NTS Asset Business.

1. SCOPE

These procedures apply to all installations where calorimeters or chromatographs have been installed for the purpose of deriving calorific value, and/or gas composition under direction from Ofgem under Section 12 of the Gas Act 1996

2. REFERENCES

For all documents referenced within this specification unless otherwise specified the latest editions of the documents apply, including addenda and revisions.

3. GENERAL

All repairs or replacements should be notified to the NTS Asset Business, Process and Gas Quality group.

The HPMIS asset database shall be changed to reflect changes to or replacement of the following assets:

The Danalyzer (Sites>Summary>Gas Quality Instrumentation form)

The Calibration Gas (Locations>Cylinders and Sites>Summary>Gas Quality Instrumentation forms)

The Test Gas (Locations>Cylinders and Sites>Summary>Gas Quality Instrumentation forms)

Maintenance of the UPS system supporting the CV measurement system is specified in T/PR/NTI1.

4. SAMPLE POINT AND PRESSURE REDUCTION SYSTEM

The operator shall ensure that a continuous supply of gas is available to the Danalyzer from all directed sample points.

The sample point valve should not be closed unless required for safety reasons. Any closure of the valve should be notified immediately to the NTS Asset Business, Process and Gas Quality group and the Ofgem or their designated service provider.

The operator shall ensure that any valves within the AGI that are sealed by Ofgem to ensure that gas flows past or through the volume metering and CV measurements remain sealed unless:

Valve shall be opened to maintain continuity of supply

Valve shall be opened to allow maintenance

In either case, the operator shall contact Ofgem or their designated service provider to inform them of the seal being broken. In the case of planned maintenance, Ofgem should be informed ahead of the work.

The sample lines between the sample point and the high pressure regulator unit and this unit and the low pressure regulation system should be visually inspected on an annual basis. The sampling systems should be leak checked if the sample gas pressure falls below 0.5 barg at the outlet from the low pressure regulation system.

Pressure reduction systems should be maintained in line with the appropriate maintenance procedures. The heaters, thermostats and power supplies to them should be visually inspected on an annual basis or when the sample gas temperature falls below 0 °C.

Components or the whole unit should be replaced on failure or when required under the maintenance procedures.

The temperature transducers shall be maintained as specified in T/PR/NTI1 test CT16.

The Genie membrane filter should be maintained if it has been shown that it is restricting flow to the Danalyzer.

The operator should ensure that the fast loop flow rate is maintained at the designated flow rate, or an indicated 100 l/hr (on the Krone 25-250 nl/hr DK800 rotameter flow indicator) where no record of correct flow rate is available. The flow rate shall be checked on a 6 monthly site visit and following any adjustments to the sample supply system.

The sample gas regulators shall be set to deliver gas at the following pressures:

Stage	Pressure
1st	10 ±1 barg
2nd	2.5 ±0.2 barg
Final (to Danalyzer)	1.5 ±0.2 barg

The flow rate for each Danalyzer stream shall be appropriately set as indicated on the flow rotameter indicator and balanced across all streams. Normally the common needle control valve (and each of the blocking valves) is set wide open^{*1} with the flow rate being set with the individual stream needle control valve. All flow rates should be within ±5% of indicated reading of each other or better and set up according to the correct procedure.

All the as found regulator and rotameter settings should be recorded in GMR0008 as described in test CT21.

(Forecast: 1 hour at frequency 2 visits per year).

Note

Some Danalyzers are fitted with a Porter or Rotary flow rotameter indicator scaled:-
0-100 cc/min at STP^{*2}.

Where a Brooks flow rotameter is fitted it is labelled:-
0-10 (x10) scc/min air@ 70.0 °F @14.7 lbs/in² absolute.

In either case, stream flow rates of 60% of the indicated range should be fixed. (ie 60 (Porter) or 6 (x10) (Brooks) cc/min (ml/min)). Whilst performing this check, it is not unusual for the indicator ball in the rotameter to stick. A gentle tap is normally sufficient to release it. No greater force than this is to be applied.

^{*1} As with all multi-turn valves, when leaving in the open position, the valve should be operated to the end stop and then turned back approximately quarter turn. In subsequent valve operations this practice helps to determine the valve position in subsequent use without the application of unnecessary force.

5. DANALYZER

The operator shall accompany the Ofgem Gas Examiner when inspecting the Danalyzer and accompanying equipment. (Forecast: ½ day at frequency 4 visits per year).

The operator shall provide access to the evaluation engineer from the contracted service provider, see Appendix A (Forecast 1½ days at frequency 1 visit per year).

NOTE: Responsibility for ensuring that the Danalyzer meets the requirements of the letter of approval and annexes remains with the operator at all times.

Generally, the Danalyzer shall be operated in accordance with the Daniels “Danalyzer 500/2551 Gas Chromatograph Instruction Manual”

The configuration of the Daniels controller shall be maintained according to the Letter of Approval and general requirements at all times. Specifically the following parameters shall be as defined:

NTables	1
CalCasCV	As on certificate for cylinder in use
T1CStrm	1
NCalRuns	3
NAverage	2
RFDevPC	10 %
AutoCal	YES
ARptWCal	YES
Normalsd	YES
ACInt	24 Hour
CVTable	Ref15_15
CVUnits	MJperM3
EndDay	6 Hour

In addition:

The order of components in the Component Table 1 shall be maintained as elution order, that is:

C6+
 Propane
 i-Butane
 n-Butane
 neo-Pentane
 i-Pentane
 n-Pentane
 Nitrogen
 Methane
 Carbon Dioxide
 Ethane

The Component Table 1 concentrations, ConcT1 for component n, shall be set to the values on the certificate accompanying the calibration gas mixture in use.

The component code for the C6+ peak shall be set to 139, n-hexane.

The order of components in the Component Alarm table shall be maintained as CV, Un-normalised total and components in elution order, that is:

CV
 Un-normalised Total
 C6+
 Propane
 i-Butane
 n-Butane
 neo-Pentane
 i-Pentane
 n-Pentane
 Nitrogen
 Methane
 Carbon Dioxide
 Ethane

The Component 2, Un-normalised total, alarm values, Al2Low and Al2High, shall be set to 90 and 110 respectively.

The component alarms, AlnLow and AlnHigh for component n, shall be set to the lower and upper mole% limits respectively as given in the Letter of Approval. Where the lower limit is zero and the component is not neo-pentane the lower limit should be set to a small discrete value such as 0.000001. The lower alarm limit for neo-Pentane should be set to 0.

All components shall be configured within the Component Table 1 as being variable and calculated on the basis of the peak area.

Except where the Danalyzer is under repair it shall run continuously in RUN mode. The operator shall ensure that the status of the Danalyzer is correct.

The power supply to the Danalyzer shall be maintained operational.

The operator should maintain a monthly record of the status of the Danalyzer as a record of the configuration and chromatogram from the Danalyzer. The configuration should be as a GCTALK electronic file. The chromatogram should be recorded using the function in the Danint suite using the calibration gas.

The operator shall provide resources to respond to alarm calls 24 hours a day, for every day of the year. The operator shall attend an alarm call placed by the transmission system operator within 2 hours of receipt of the call. The operator shall make a first line assessment of the problem with the Danalyzer.

The operator should correct the following problems:

Calibration failure as a result of the Danalyzer missing neo-pentane
Pre-amp adjust and pre-amp fail alarms

On demonstration that they possess competent personnel, the operator may carry out repairs to Danalyzers arising from:

Failed solenoid valves
Failed/damaged 2551 controller that needs replacement

Where the operator is not able to provide competent Danalyzer repairs, the operator shall inform NTS Asset Business, Process and Gas Quality. The operator shall call and provide access and supervision to the Danalyzer maintenance contractor.

6. CARRIER GAS

The operator is responsible for the purchase of and cylinder rental for high grade helium for use as the Danalyzer carrier gas. The helium should be purchased against the National Grid Gas supply agreement, see Appendix A. (Forecast 7 cylinders per year)

The operator shall ensure that at least one cylinder with greater than 15 bar gauge pressure is connected via the helium delivery system to the Danalyzer at all times.

The operator shall co-ordinate access for the delivery of any helium cylinders.

The cylinder regulators should be inspected and maintained as per the appropriate maintenance procedures.

The cylinder regulator outlet pressure should be maintained at 10 bar +/- 1 bar gauge.

All the as found regulator settings should be recorded in GMR0008 as described in test CT21.

The pressure transducers shall be maintained as specified in T/PR/NT11 test CT15.

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7. CALIBRATION AND TEST GASES

The operator shall ensure that calibration and test gas mixtures at pressures higher than 6 barg are available to the Danalyzer at the appropriate time, typically 08:00 daily for the calibration gas and 05:00 on the 2nd day of each month for the test gas.

NTS Asset Business should make certified calibration and test gases available through a distribution service. The operator shall arrange delivery and site access for the appropriate gas from the distribution service provider.

The operator shall ensure that the cylinder asset data within HPMS is amended to reflect changes in the calibration and test gas cylinders.

The operator shall ensure that the temperature of the calibration gas at the time of Danalyzer calibration is maintained above the temperature specified within the Letter of Approval, typically 10 °C.

The operator shall ensure that the outlet pressure from the test and calibration gases are maintained at 1.5 +/- 0.2 barg at all times.

All the as found regulator settings should be recorded in GMR0008 as described in test CT21.

The pressure transducers and temperature transmitters shall be maintained as specified in T/PR/NT11, test CT15.

8. ALLEN BRADLEY OPEN CONTROLLER

The operator shall provide first line support to the Allen-Bradley including the replacement of faulty modules.

NTS Asset Business should provide replacement modules and ancillary components to include replacement monitors, keyboards or mice. The spares should be provided via its spares supplier, see Appendix A, or may source them directly. The NTS Asset Business should provide specialist support through external contracts.

The operator shall check after any changes to the Allen-Bradley or Danint software suite, and at least once per month, that communication between the Allen-Bradley and the telemetry outstation is intact. The check should include at least a validation that the instantaneous CV is correctly transferred from Danint to the appropriate memory address.

9. DANINT SOFTWARE

The operator shall ensure that the configuration of the Danint software is correctly maintained, in particular:

The composition, CV, and cylinder details are correctly entered into the test function of the software. The operator shall ensure that all details are correctly transcribed from the test gas certificate.

The descriptions for the Danalyzer streams are correctly entered into the Feeder description function of the software. The details for test and calibration gases shall be entered as the digits only from the cylinder number. The sample points should be identified as Off(LDZ) or Feeder No. Direction, e.g. Offtake(EM) or Feeder 2S.

The configuration of the software shall be maintained as Appendix B.

The operator shall ensure that with the exception of times when GCTALK is run for the operation or repair of the Danalyzer, the Danint suite is kept operational.

The NTS Asset Business, Process and Gas Quality group should provide development to and support of the Danint suite through its contractor.

10. REMOTEWARE DATA TRANSMISSION SYSTEM

The operator should ensure that the connectivity of the components is maintained and for providing first line response to detected faults.

The NTS Asset Business, Process and Gas Quality should provide support contracts to the hardware and software and manage data receipt section of the RemoteWare system. P&GQ should also manage first line support to the telephone lines provided as part of the system.

In the event of failure of both the telemetry and RemoteWare data routes to System Operation, Hinckley, to provide all of the data required under the daily process, the operator shall provide data from the CV measurement as requested by the NTS Asset Business.

11. TRACKER

The operator shall replace the Tracker batteries every six months.

NTS Asset Business shall provide support to the Trackers as:

Provision of spares including replacement batteries

Provision of support contract

12. TESTING OF APPARATUS

The operator shall ensure that all Danalyzers are tested at an interval not exceeding 35 days. Whilst the test is automatically triggered by the Danint suite, the operator shall ensure that the automatic test provides a test result that is within the permitted tolerance and repeating the test should this not be the case. The operator shall ensure a manual test is carried out as soon as possible should for reasons of failure of the Danalyzer, Danint suite, Allen-Bradley or supply of test gas, the automatic test not be carried out correctly.

13. COMPLIANCE WITH REGULATION

The operator should ensure that the operation of the Danalyzers continues to meet National Grid Gas's obligations under Section 12 of the Gas Act and ensuing regulations.

NTS Asset Business Process and Gas Quality shall provide first line contact with the Ofgem or their designated service provider to include:

Proposals for approved apparatus and equipment

Responses to communications from Ofgem or their designated service provider.

The operator shall provide assistance to P&GQ in responding to enquiries from Ofgem or their designated service provider.

The operator shall ensure that a site log is maintained containing the data as required by Ofgem under the Direction to Measure, and Process and Gas Quality as the asset manager.

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APPENDIX A

TERMS OF REFERENCE

PURPOSE

Provide the requirements on an operator for the operation and maintenance of a Danalyzer under direction from Ofgem arising from their powers under Section 12 of the Gas Act.

Define the contractual requirements under the agreement between NTS Asset Business and the contractor

SCOPE

Sample point and Pressure reduction system

Danalyzer - Daniels 500 process gas chromatograph operating with a model 2551 controller

Support services to Danalyzer as:

- Carrier gas (helium) including delivery system
- Calibration gas including delivery system
- Test gas (as used to test the Danalyzer under Regulation 6 (e) of the Gas (Calculation of Thermal Energy) Regulations 1996 as amended 1997) including delivery system

Allen Bradley Open Controller - provided for the collection, analysis and distribution of data required under the direction to measure

Danint software suite including:

- DANINT.EXE
- EODAVE.EXE
- GETEST.EXE

RemoteWare data transmission system including:

- Shiva Access port
- Netware hub (where employed)
- RemoteWare software
- ISDN telephone wire
- Tracker

DELIVERABLES

Danalyzer maintained to the requirements of Direction by Ofgem.

MANAGEMENT PROCESS

Responsibility for the CV measurement assets falls to the Process and Gas Quality Engineer reporting to the NTS Asset Business Asset Manager.

The contract with the operator is managed by the NTS Asset Business Contract Manager.

REFERENCES

The Gas Act 1996

The Gas (Calculation of Thermal Energy) Regulations 1996

The Gas (Calculation of Thermal Energy)(Amendment) Regulations 1997

Letter of Approval (appropriate to site) with appendices and schedule

Direction to measure (appropriate to site)

APPENDIX B**DANINT SOFTWARE CONFIGURATION (4 OCTOBER 1999)****CONFIG.DAT** - DANINT configuration. 1st set <F1> (Configuration)

COM1:9600,E,7,1,CD0,CS0,DS0,OP0,RS	Serial Port Settings
05:00	End of Day Time for 24 hr period
04:00-2	Automatic 35 day test time
8	No. of hours for LOSS of record
D:	Hard disk drive to be used
\\DATA\	Directory to be used
	Floppy disk drive to be used
D:	Temporary disk drive to be used
3	Stream Sequence
Y	Is this a flow wt. Aver. CV site
3	Streams connected to Flow Computer
0	Max. hrs between non-zero flow

GETEST.DAT - 35-day test gas composition. 1st set <F11> (BG Test)

123456	OFGAS cylinder number.
96/Dxx	OFGAS certificate number.

All values below should be taken from OFGAS cylinder cert.

3.5273	N2	NITROGEN -
1.3613	CO2	CARBON DIOXIDE
86.747	CH4	METHANE
5.816	C2H6	ETHANE
1.7594	C3H8	PROPANE
.199	iC4	i-BUTANE
.3615	nC4	n-BUTANE
.0032	neoC5	neo-PENTANE
.0773	iC5	i-PENTANE
.0752	nC5	n-PENTANE
.0724	C6	HEXANE
39.01	CV	(ISO6976:1995 value)

FEDEDESC.DAT - stream descriptions. 2nd set <F1> (Feeder Desc.)

CYLINDER #	Cylinder number of Calibration Gas.
CYLINDER #	Cylinder number of Gas Examiners Test Gas.
OFFTAKE (LDZ)	or FEEDER No. for a direct feeder measurement and not an offtake.
Stream 4	or label as stream 3 example if in use (multi-stream sites).
Stream 5	or label as stream 3 example if in use (multi-stream sites).

BSTIME.DAT - British summer time dates.

e.g. 28,3,31,10 should not need to be changed until next year.

DANINT.DAT - Danalyzer no. & location.

e.g. 3.6	should be 3.6 only
"UK 52 J 604"	Danalyzer serial number
"BLABY"	site name
"1234"	site number

RUN.DAT - extra programs (site specific).e.g. DANFLO.EXE
DANCAL.EXE
DANGET.EXE
END**YMMDD.DAT** - Current year letter (E=1999) and month and day

e.g. "E0120" 20th January 1999

STREAMn.ALM - n = 1,2,3,4,5 (stream no.), alarm descriptions.

It is important the order is as below.

```
"CV-DRY ", "N"
"TOTUNRML ", "N"
"HEXANE ", "N"
"PROPANE ", "N"
"1-BUTANE ", "N"
"N-BUTANE ", "N"
"NEO-C5 ", "N"
"IPENTANE ", "N"
"NPENTANE ", "N"
"NITROGEN ", "N"
"METHANE ", "N"
"C O 2 ", "N"
"ETHANE ", "N"
" ", "Y"
" ", "Y"
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APPENDIX C

MONITORING GAS USAGE USING HPMIS

An effective method for tracking the usage of carrier (helium), test and calibration gases and for identifying problems with the delivery system is through HPMIS. The system contains the end of day pressures in all cylinder gases and this information should be used to both monitor current levels and forecast the remaining time for gas from the cylinder.

METHOD

Start HPMIS

From the **GQ Data** pull-down menu select **End of day**

In the end of day summary form Select the Location, Instrument and Gas Day.

Hint

The Location and Instrument can be easily selected by clicking on the button next to each entry box. The information is listed alphabetically and items can be speedily selected by immediately the find box appears typing the first few letters for the item. Once the item is highlighted, pressing return will select it.

Cylinder pressures are towards the bottom of the form

Hint

The scroll bar at the right hand side can be used to display the lower values.

The end of day values give an indication of the levels of gas in each cylinder

Hint

The minimum operating or usage levels of the gases are:

Gas Type	Minimum pressure
Helium	10 bar
Test Gas	10 bar
Calibration gas	10 bar

Note, the indicated pressure for the helium cylinders when no longer in use may be lower than 10 bar.

Comparison of levels between consecutive days or across longer periods will give an indication of the remaining time for gas from the cylinder and may indicate if a problem has developed.

Hint

For indication, the typical pressure drops

Gas Type	Typical pressure drop
Helium	3 - 3.5 bar per day
Test Gas	negligible across month
Calibration gas	1 bar per month

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ENDNOTE

Comments

Comments and queries regarding the technical content of this document should be directed to:

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SSR Directorate
National Grid
National Grid House
Warwick Technology Park
Gallows Hill
Warwick
CV34 6DA

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