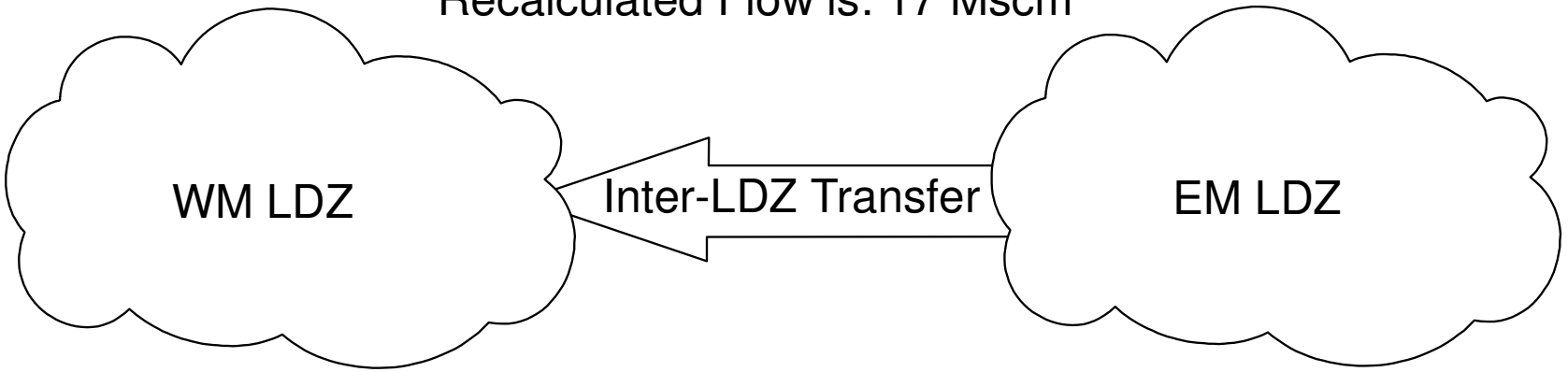
# Atherstone EM to WM Transfer
# Measurement Error WM014

NGGD Ref no. MER/UKD/182/13

## Over-registration of 12 Mscm

| | |
|---|---|
| Start Date: | 14 March 2012 |
| End Date: | 20 February 2013 |
| Discovered: | 20 February 2013 |
| Corrected: | 20 February 2013 |
| Reported: | 21 February 2013 |

Reported Flow was: 29 Mscm
Recalculated Flow is: 17 Mscm




Unless stated otherwise all volumes are for the real dry gas at ISO Standard Reference conditions of 15ºC and 1.01325 bar.

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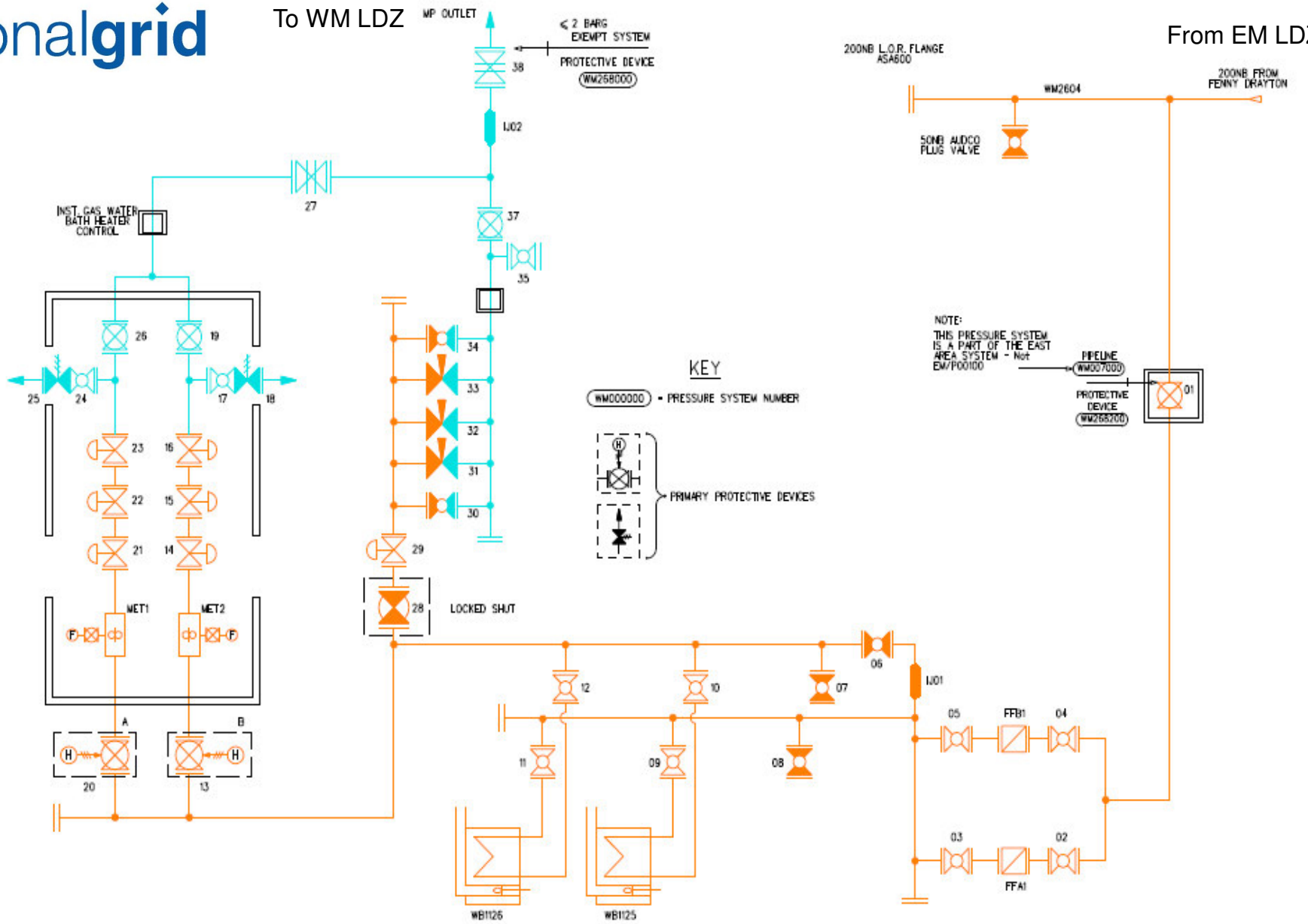


# Atherstone Inter-LDZ Transfer Installation

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# BACKGROUND

Gas is supplied to part of the UKD network via the EM to WM Inter-LDZ transfer. The Atherstone installation forms part of this transfer. The site meter system comprises a twin stream rotary turbine meter. The Offtake feeds a medium pressure system via pressure controlled regulators. The relative density and calorific value is measured with a Tracker.

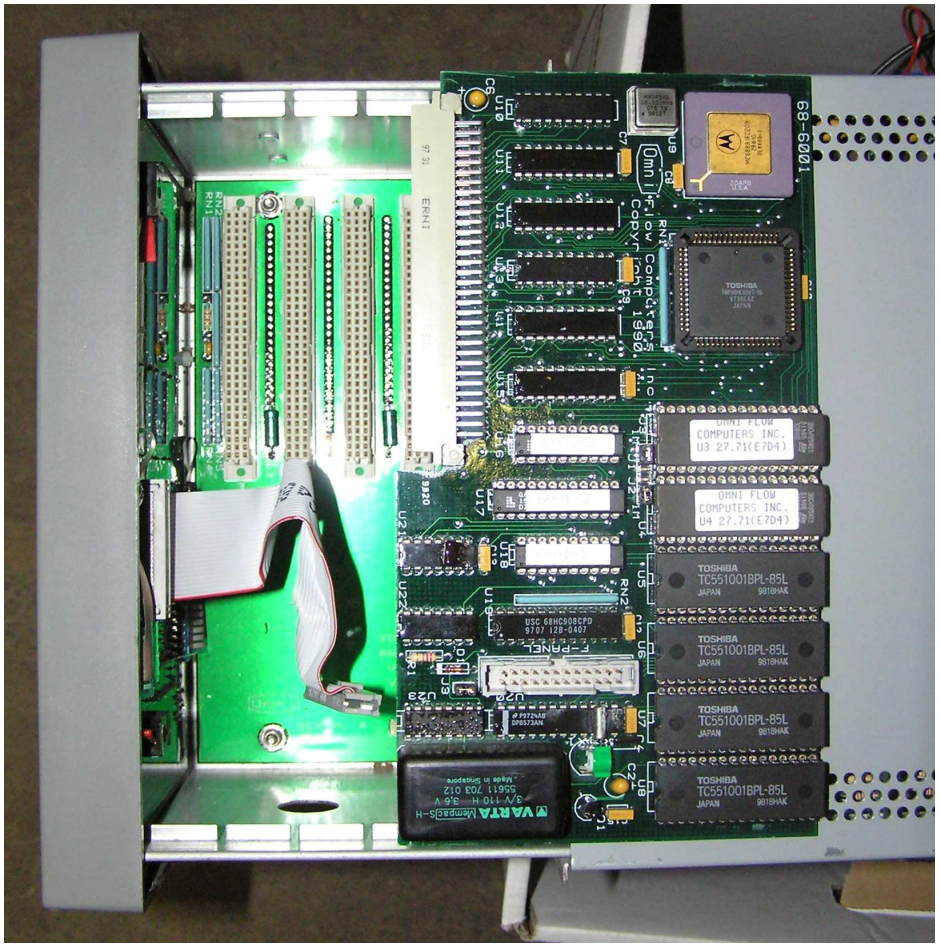
On the 19th February 2013 the Measurement and Process Group of Network Integrity was contacted because the technicians performing the detailed T/PR/ME/2 validation had some queries regarding the CP1 test.

Upon investigation, it was established that the flow computer was discovered to be calculating the density and compression factor Z incorrectly.

## CAUSES

Following the swapping of an Omni flow computer CPU to deal with on board battery backup failure, a different version of EPROM firmware was inadvertently deployed. Whilst this was still applicable to a gas application, the version in question was not fully compatible with the OmniCom version that was resident on the supervisory system.

No obvious incompatibility was noted at the time, but from retrospective study, it is believed that at least one Modbus data location had changed/been introduced between the respective firmware versions. Following a later attempted full T/PR/ME/2 validation, it was noted that the density calculation was not being undertaken appropriately. Further investigation revealed that the compression factor Z was being reported in excess of 1. The route cause was traced to an inappropriately set Base Pressure figure in the Fluid Product setup area in the firmware that was installed. Such a configuration option is not available in the present NGGD normally deployed versions of firmware.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Omni 6000 Flow Computer CPU (EPROM-type)
Back-up Battery and EPROM Location
plus OmniCom Start-up Screen

## CAUSES (CONT)

OmniCom, installed on the supervisory system did not display this erroneous Base Pressure value in the Fluid Product setup area and all impressions given lead the operative to conclude that all was well with the resulting installation.

It is concluded that the firmware which was inadvertently installed was of a later build to that normally installed by NGGD and that the earlier version of OmniCom was not able to address the data point in question. In the absence of the capability of OmniCom to configure this parameter, it is concluded that the inappropriate default value (together with default engineering units) was auto-set by the firmware without the technician's knowledge.

As a result, the reference conditions for the AGA8 calculation were inappropriately set which resulted in incorrect density and compression factor Z derivation. This in turn impacted upon the reported flow rate.

CAUSES (CONT)

$$Q = \left\{ \frac{\left( \frac{F \times 3600}{MF} \right) \times D}{1.22541 \times RD} \right\}$$

Following extensive testing in a controlled environment, it was concluded that the unintended setup resulted in a calculation that was not always repeatable. For this reason, it was decided that gas density would be recalculated from first principles using CV, RD, CO2, P and T and the AGA8 Gross Characterisation method before applying the flow calculation. This reconstituted flow was then compared with the reported flow to derive appropriate correction factors for the duration.

## RECOMMENDATIONS AND LEARNING

As a general principle, and unless instructed otherwise, the same firmware version shall always remain resident pre/post works.

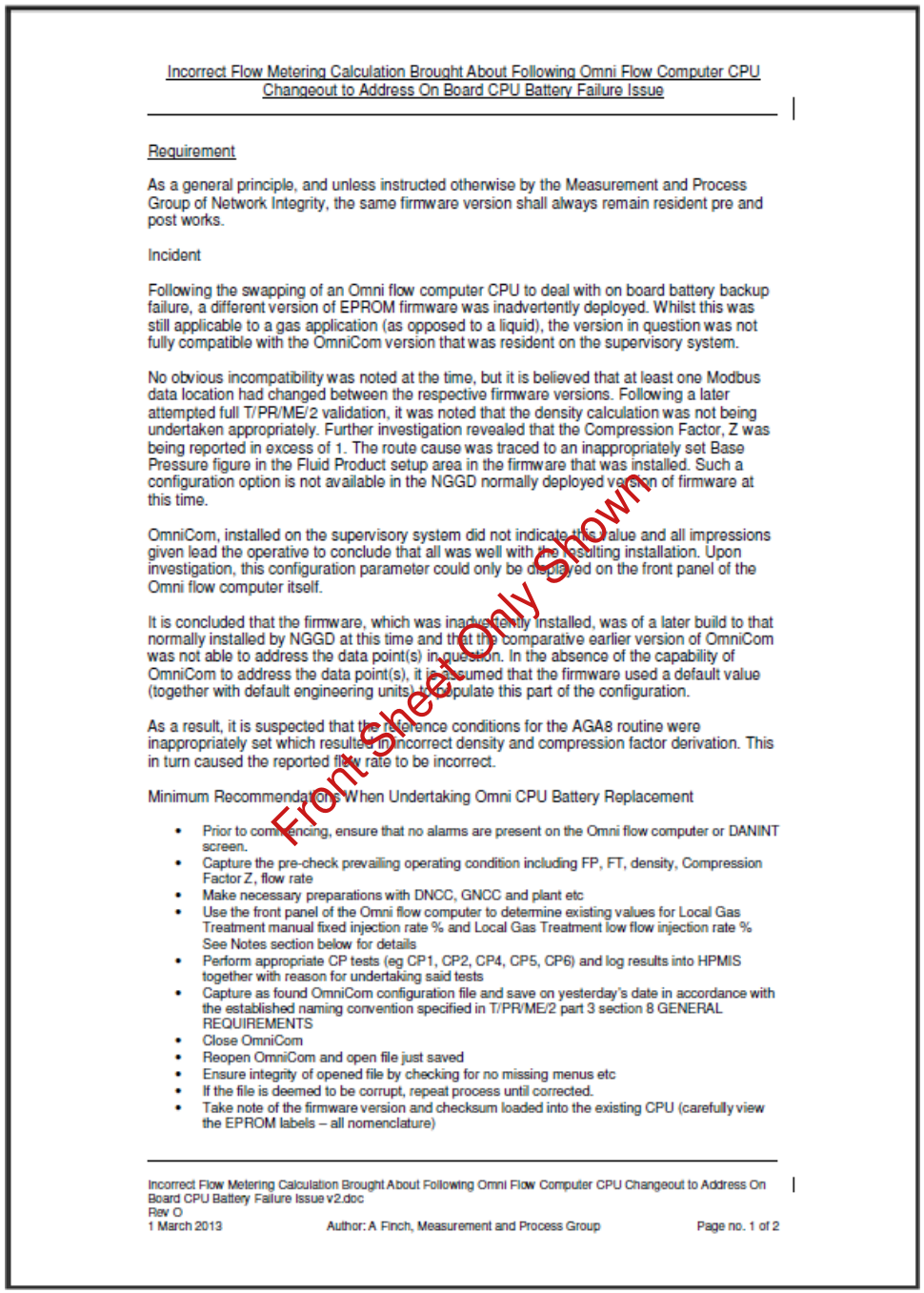
In the event that an exchange CPU is intended to be deployed to undertake this work, and it is not populated with the correct version of firmware, it is permissible, with care, to remove the EPROMs from the outgoing CPU and install them into the incoming CPU.

In addition to applying standard pre and post checks, it is also recommended that additional attention is paid to the calculated compression factor Z and density. Any suspect values are required to be investigated before declaring the work complete.

## ACTIONS UNDERTAKEN

- Networks have been briefed 4 March 2013 in writing and again in person 14 March 2013 in a metering review meeting
- Procedure reviewed
- Entire NGGD fleet studied for residence of appropriate firmware
- Error assessed and quantified

# Technician Briefing Note Following Discovery of Issue



Incorrect Flow Metering Calculation Brought About Following Omni Flow Computer CPU Changeout to Address On Board CPU Battery Failure Issue

Requirement

As a general principle, and unless instructed otherwise by the Measurement and Process Group of Network Integrity, the same firmware version shall always remain resident pre and post works.

Incident

Following the swapping of an Omni flow computer CPU to deal with on board battery backup failure, a different version of EPROM firmware was inadvertently deployed. Whilst this was still applicable to a gas application (as opposed to a liquid), the version in question was not fully compatible with the OmniCom version that was resident on the supervisory system.

No obvious incompatibility was noted at the time, but it is believed that at least one Modbus data location had changed between the respective firmware versions. Following a later attempted full T/PR/ME/2 validation, it was noted that the density calculation was not being undertaken appropriately. Further investigation revealed that the Compression Factor, Z was being reported in excess of 1. The route cause was traced to an inappropriately set Base Pressure figure in the Fluid Product setup area in the firmware that was installed. Such a configuration option is not available in the NGGD normally deployed version of firmware at this time.

OmniCom, installed on the supervisory system did not indicate this value and all impressions given lead the operative to conclude that all was well with the resulting installation. Upon investigation, this configuration parameter could only be displayed on the front panel of the Omni flow computer itself.

It is concluded that the firmware, which was inadvertently installed, was of a later build to that normally installed by NGGD at this time and that the comparative earlier version of OmniCom was not able to address the data point(s) in question. In the absence of the capability of OmniCom to address the data point(s), it is assumed that the firmware used a default value (together with default engineering units) to populate this part of the configuration.

As a result, it is suspected that the reference conditions for the AGA8 routine were inappropriately set which resulted in incorrect density and compression factor derivation. This in turn caused the reported flow rate to be incorrect.

Minimum Recommendations When Undertaking Omni CPU Battery Replacement

- Prior to commencing, ensure that no alarms are present on the Omni flow computer or DANINT screen.
- Capture the pre-check prevailing operating condition including FP, FT, density, Compression Factor Z, flow rate
- Make necessary preparations with DNCC, GNCC and plant etc
- Use the front panel of the Omni flow computer to determine existing values for Local Gas Treatment manual fixed injection rate % and Local Gas Treatment low flow injection rate % See Notes section below for details
- Perform appropriate CP tests (eg CP1, CP2, CP4, CP5, CP6) and log results into HPMIS together with reason for undertaking said tests
- Capture as found OmniCom configuration file and save on yesterday's date in accordance with the established naming convention specified in T/PR/ME/2 part 3 section 8 GENERAL REQUIREMENTS
- Close OmniCom
- Reopen OmniCom and open file just saved
- Ensure integrity of opened file by checking for no missing menus etc
- If the file is deemed to be corrupt, repeat process until corrected.
- Take note of the firmware version and checksum loaded into the existing CPU (carefully view the EPROM labels – all nomenclature)

Incorrect Flow Metering Calculation Brought About Following Omni Flow Computer CPU Changeout to Address On Board CPU Battery Failure Issue v2.doc
Rev O
1 March 2013 Author: A Finch, Measurement and Process Group Page no. 1 of 2

Front Sheet Only Shown

## Document Control

Superseded documents

| Version | Status | Date | Unique ref | Author(s) |
|---|---|---|---|---|
| | | | | |

Version History

| Version | Status | Date | Author(s) | Summary of Changes |
|---|---|---|---|---|
| 0 | Draft | 14/02/2012 | Andrew Finch | Original version produced for comment as part of NIBR0005 |
| 02 | Second Draft | 05/09/2013 | Andrew Finch | Re-worked with comments received as part of NIBR0005 |
| A | First Release | 08/03/2012 | Andrew Finch | Spurned from NIBR0005 for separate and independent use |
| | | | | |

Template Utilised

This shall record the template details for the above-approved version.

| Version | Date | TD Reference | Title |
|---|---|---|---|
| 2 | Jan 2002 | TD 0110 | General Purpose Template |

Reviewers

| Name | Role | Business Area |
|---|---|---|
| Piers Eldridge | Integrity Officer | Network Strategy (Distribution) |
| | | |
| | | |
| | | |
| | | |

Management Approval

| Name | Role | Business Area |
|---|---|---|
| Stuart Gibbons | Standard Manager | Network Integrity (Distribution) |
| | | |

Distribution

| Name | Business Area | Format |
|---|---|---|
| As required | National Grid Gas Distribution only | pdf & hardcopy (as necessary) |
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# NetworkIntegrity

# Omni Flow Computer CPU Module (Card) Backup Battery Replacement Guidance

(Incorporating configuration, calibration and password settings reinstatement)

This document is not intended to be exhaustive and a definitive comprehensive guide. Its intention is merely to provide sufficient information to allow a suitably competent person to undertake CPU back-up battery replacement in a controlled and robust manner whilst mitigating against any anticipated resulting metering integrity issues. This procedure may be used in whole or in part or in conjunction with other procedures as necessary. The effectiveness of the approach taken should be reported to the Measurement and Process Group of Network Integrity.

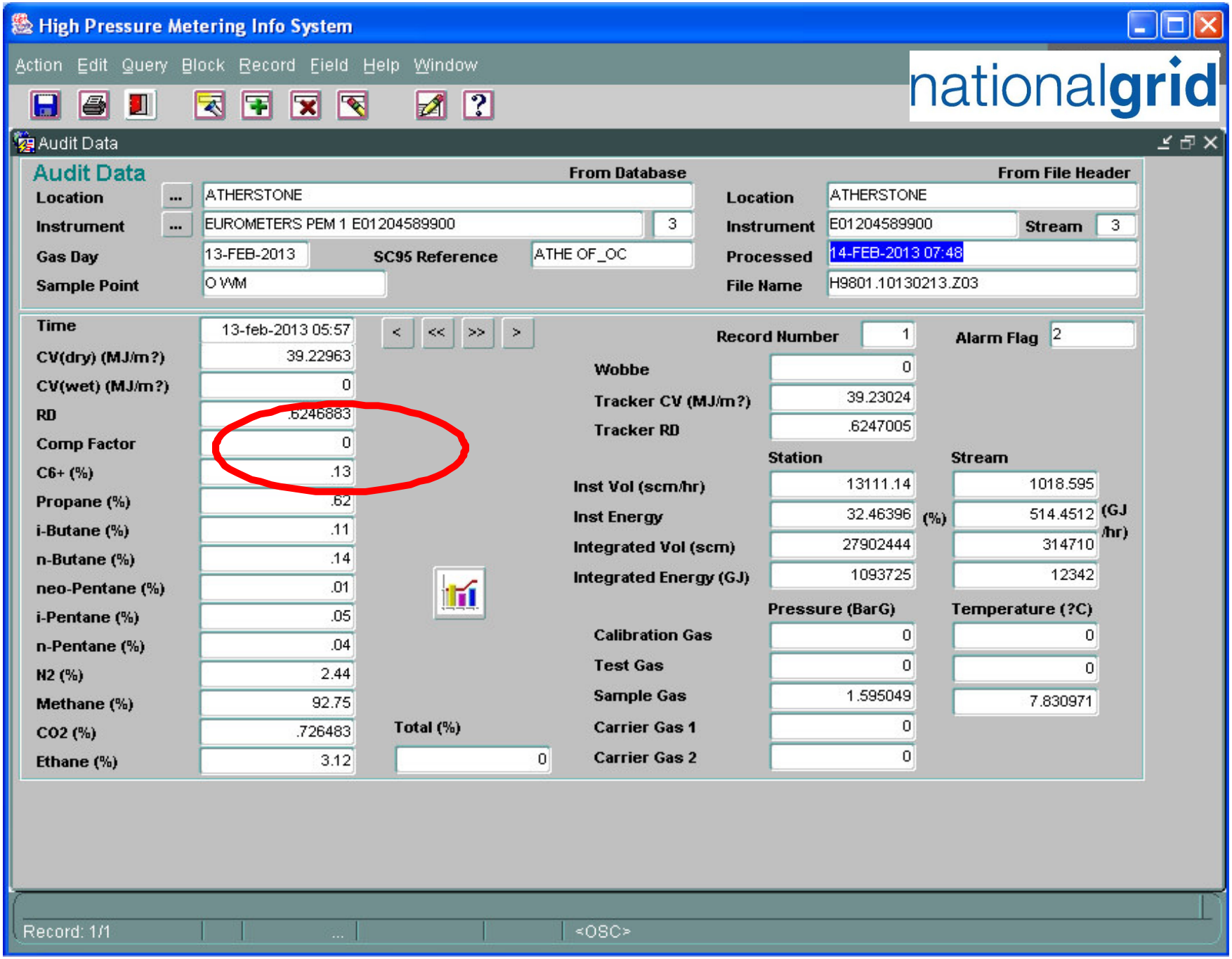
In the interest of continual document improvement, the author of this document welcomes constructive feedback. Please feel free to make direct contact.



| | |
|---|---|
| Author (current version): | Andrew Finch |
| Unique Document Reference: | NIBR0006.doc |
| Version: | A |
| Status: | Draft Release |
| Live document location | Teamdata on 'Thai07\Vol1'\Network Integrity\E&M\Archetype\Briefs |
| Date Issued: | 8 March 2013 |

## IN SUMMARY

- Issue understood
- Robust methodology deployed
- Simple calculation
- Impact known
- Error relates to a part of the total EM to WM transfer (difficult to spot the issue by inspecting the aggregate flow)
- Atherstone is a pressure-controlled site (difficult to obtain meaning from pre and post flow checks)
- Compression Factor Z (at operating conditions) from the flow computer provided the main alert that something was wrong.
- Compression Factor is not routine check parameter.
- Compression Factor Z in process data files uploaded to HPMIS is sourced by the supervisory system on site from a gas chromatograph and as such will be Z at reference conditions as opposed operating conditions. In the case of a Tracker only build (i.e. Atherstone), the value in the file is always zero.



## IN SUMMARY (CONT)

Given the nature of this error, NGGD believes that it is not necessary for an ITE to be appointed. This belief is based upon the fact that whilst the size of the error is significant for the installation in question, owing to the fact that RbD shippers within each LDZ are the counterparties, the total sums of money changing hands will not substantial. The energy in cash terms will be debited to shippers (RbD) within one LDZ, based on their market share within that LDZ, and will be credited back to shippers (RbD) in the other LDZ based on their market share in that LDZ. This will mean that some shippers will receive a net credit and some a net debit. In addition, Atherstone forms part of an aggregate EM to WM transfer, so only part of that total is affected.

The nature of the error is not one that we believe would benefit from the appointment of an expert and it may in fact only serve to delay the resolution of the error. We have approached NTS and they are willing to go through the normal check and balance that they apply to all meter errors.

end of presentation