



## TEST NOTE

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<b>Test Note Number:</b> IS-006-09 <b>Date:</b> 18 <sup>th</sup> February, 2009	
<b>Title:</b> Commissioning Report on the Detonator Gallery RL 22G. <b>Material:</b> Carrick Detonator Incendive Testing. <b>Source:</b> Research and Technology Department.	
<b>Authorised for release:</b> Dr. Mike Taylor Technical Manager	
<b>Signature:</b>	

## REPORT

### 1. INTRODUCTION

Detonators and explosives used for underground mining operations in fiery mines; need to be tested to ensure that the explosives do not initiate methane which may be present in the mine. All safety precautions and procedures are laid down in terms of the Regulations promulgated under the Explosives Act, 1956 (Act 26 of 1956), and when relevant, under the Minerals Act, 1991 (Act 50 of 1991), and shall be strictly adhered to.

The African Explosives Limited (AEL) incendive testing Gallery, built in the 1970's, was decommissioned and demolished in July 2004, because of the need to reduce the AEL footprint.

The South African Bureau of Standards (SABS) has a similar testing facility which is located at Kloppersbos, thirty kilometers north of Pretoria. The cost of using this facility is prohibitive, and SABS are threatening to close this facility down.

A decision was taken by AEL to build a new detonator testing facility. This facility

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**Signed:**

would be used to test AEL's Carrick detonators in an incendive environment, to ensure compliance with the Explosives Act, as previously stated.



**AEL's Original Incendive Test Gallery.**



**Original Gallery Used in testing both Explosives and Detonators.**

## 2. DESIGN AND CONSTRUCTION

2.1 The aim of the project was to develop and build an explosive methane gas mixing facility, in order to test AEL's Carrick detonators, for the coal mining industry.

2.2A design review meeting was organised. An expert on gasses and product manager from Afrox, Mr. Hans Strydom was invited. He advised on safety equipment, handling procedures and the design of firewalls. A user requirement specification was drawn up and approved.

2.3Hazard studies two and three were concluded and an expenditure proposal approved.

2.4A site for the proposed Gallery was selected. The site chosen was the old BP-15 building located behind the EXCEL Plant in Fuse Department. This building will now be renamed RL 22G.

2.5Two expenditure proposals were raised, one for the civil works and one for the instrumentation. The civil works included:

- Clearing the site
- Removal of a concrete wall and the laying of a new floor screed.
- A new concrete ramp to the gas storage area.
- The laying of a 2,4m high weld mesh fence and gates around the site perimeter.
- A new firewall between the two different gas cylinder storage areas.
- The construction of a Control Room with polycarbonate protective windows.
- Erect wire and mesh barrier screens, with a lean-to roof over the Gallery Test area.
- Installation of the Gallery Test Pot.
- Painting and electrical works.

The Instrumentation included the procurement of:

- A methane analyser.
- Two flame arrestors.
- A dew point meter.
- A sparger or static mixer.
- A circulating pump.
- Two flow meters.
- A Coriolis mass flow meter.
- Two non-return valves.
- Four pressure regulators and gas cylinders.
- The Span gas and Zero gas used for calibration of the methane analyser.
- Ancillary stainless steel valves and piping.
- A 200m long air line from the Safety Fuse building.

- 2.6 An explosives license for the facility was approved by the Chief Inspector of Explosives.
- 2.7 Operating Instructions were drawn up prior to commissioning. These would be verified and updated once commissioning was complete.
- 2.8 Shortly after the completion of the Gallery, thieves removed copper earthing from the site, so an alarm was installed, and connected via radio to AEL's security department.



The New Detonator Gallery



The Test Pot



The Control Panel.

### 3. COMMISSIONING

#### 3.1 Operating Procedure:

- 3.1.1 Ten detonators were selected per test and the continuity of each one tested.
- 3.1.2 The resistances were recorded and then the leading wires of each detonator twisted together to prevent static build up.
- 3.1.3 All the valves in the gallery were closed.
- 3.1.4 At the gas bottle storage area the instrument air gas bottle was opened. The regulator was set at approximately 200kPa. and the main supply line valve opened.
- 3.1.5 The process for the methane line was the same. Checks for any gas leaks are essential. If any are found then stop all operations and fix the problem before continuing.

#### 3.2 Preparation of the Gallery Pot:

- 3.2.1 The pot was checked for cleanliness and moisture. This should be cleaned and dried if necessary.
- 3.2.2 The bottom flap must be closed and sealed. NOTE: If the seal is inadequate then the methane seeps through the seal and the methane levels cannot be maintained.
- 3.2.3 Three 250um black plastic sheets were fitted onto the top of the pot and sealed with the aid of the top aluminium flange.

- 3.3 Calibration:
  - 3.3.1 The methanometer should be powered up for at least an hour before calibration can be checked.
  - 3.3.2 The zero gas (nitrogen) should be calibrated first by applying the nitrogen gas to the methanometer and adjusting the electronic pot labeled "Zero" with a screwdriver.
  - 3.3.3 The span gas (methane in nitrogen) is calibrated to a known methane concentration, using the methanometer and adjusting the electronic pot labeled "Span" with a screwdriver.
  - 3.3.4 Calibration is valid for one day only, so the methanometer must be re-calibrated every day.
  
- 3.4 Preparing the Gas Mixture:
  - 3.4.1 Both the air valve from the control panel to the gallery pot, and the valve on the gallery pot, were opened.
  - 3.4.2 The instrument air valve was opened by about 45° and the flowmeter opened to about 80% of maximum flow level.
  - 3.4.3 The operator needs to keep an eye on the dew point meter, and check the dew point of the air in the pot. When the dew point drops to about 2 the flowmeter must be closed and then all the open valves should also be closed.
  - 3.4.4 The methane valve was opened and by using the flowmeter approximately 30 liters of methane added. This was metered in using the Coriolis meter. All the open valves were closed.
  - 3.4.5 The recycling air line valves and the air pump were opened. Keeping an eye on the methanometer after about ninety seconds the instrument should indicate the percentage methane present. Add either air or methane until the percentage methane is within the specified limits. These limits are 8,8 to 9,2 %.
  - 3.4.6 Once the gas mixture was correct, all valves were closed. All orifices were sealed with "Prestick", and then the three flexible hose couplings disconnected from the gallery pot.
  
- 3.5 Test Firing of the Gas Mixture:
  - 3.5.1 Ensure the Dew Point meter has been removed from the pot.
  - 3.5.2 A Carrick detonator was inserted into the brass guide and screwed into the pot. The wires were connected to the firing system.
  - 3.5.3 All personnel must retire to the Control Room, ensuring the two gates are closed.
  - 3.5.4 The detonator was initiated. NOTE: The detonator must fire but should not initiate the methane.
  - 3.5.5 This was repeated ten times, and when all detonators have been fired and do not initiate the methane, then the methane should be initiated using an aluminium Instantaneous Electric Detonator (IED), or a Shurstart with a small piece of igniter cord attached.
  - 3.5.6 The methane must initiate for the test to be successful.
  - 3.5.7 A total of fifty Carricks must be tested per delay, in order for the test to be concluded.
  - 3.5.8 The pass criteria for this test allows for two failures per fifty Carrick detonators tested.















**TABLE 15**

Carrick Delay No: 8  
 Methane % 8,95  
 Dew Point: 8.8  
 Relative Humidity: 36.1%  
 Temperature: 24,9°C

TEST No:	Carrick Delay No:	Detonator Fired	Gallery Initiated:
15	8	Yes	No
15	8	Yes	No
15	8	Yes	No
15	8	Yes	No
15	8	Yes	No
15	8	Yes	No
15	8	Yes	No
15	8	Yes	No
15	8	Yes	No
15	8	Yes	No
15	8	Yes	No
<b>15</b>	<b>AI IED</b>	<b>Yes</b>	<b>Yes</b>

**RESULT: PASS**

## 5. DISCUSSION

- 5.1.1 The Detonator Gallery works, and provides consistent results. Every time a detonator has fired in the Test Pot is has not initiated the methane / air mixture in the gallery, and whenever the gallery has been fired with either a Shurstart or an electric aluminium detonator, it has initiated, as required.
- 5.1.2 The design features and procedures laid down in the operating instructions appear to be logical and not awkward. The safety of the system is manageable.
- 5.1.3 After a full set of testing, the conveyor belting used to protect the steel pot is quite severely damaged and needs to be replaced.
- 5.1.4 During trials, the Coriolis mass flowmeter has stuck twice, allowing more methane into the system than the instrumentation indicates. This needs to be rectified by the suppliers.
- 5.1.5 The calibration of the methanometer before testing commences is simple and straight forward, however, the methanometer needs to be powered up for an hour before calibration can commence.
- 5.1.6 Three plastic 250um thick sheets have been found suitable for securing the gas when the ten shots are fired during testing. Every time the gallery has been initiated the gas explosion has burst all three plastic sheets. This is a positive indication that the test was successful.

- 5.1.7 The circulating pump operates on compressed air from the factory. The pressure is low however; the pump is able to circulate the air / methane mixture in approximately ninety seconds, which is an acceptable time.
- 5.1.8 The code for the security alarm is 6340, and has a 25 second delay period, when locking up, before the alarm is armed.

## **6. CONCLUSIONS**

- 6.1.1 The Gallery has worked successfully during commissioning.
- 6.1.2 The safety procedures and safety equipment appear to be adequate for the task at hand.
- 6.1.3 The conveyor belting inside the Test Pot needs to be replaced after each set of tests have been completed.
- 6.1.4 Hazard studies four five and six need to be conducted.

## **7. RECOMMENDATIONS**

- 7.1.1 The Gallery should be accredited as a testing facility by an approved accreditor.