Glow Wire Test

The glow-wire is a specified loop of resistance wire, which is electrically heated to a specified temperature.
The tip of the glow-wire is brought into contact with a test specimen for a specific period of time and a range of observations and measurements made, dependant upon the particular test procedure.

08e29 “regular” and 08e29 CSP

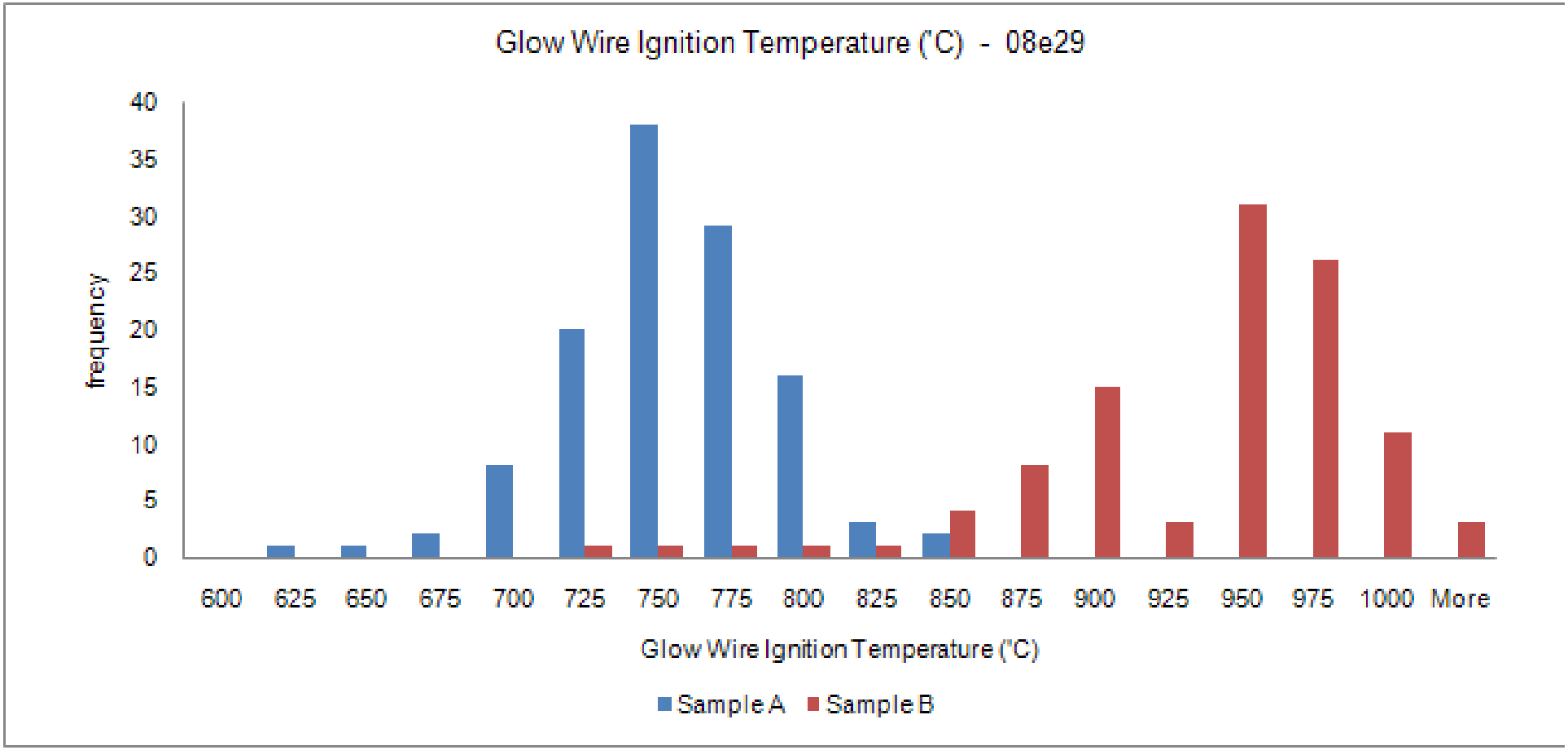
- Same technical requirements for each program
- Test for ignition at specific temperatures
- Determine the glow wire ignition temperature

- Sample A (and CSP rounds 1, 3, 5) was an acrylic with relatively low ignition temperature and tendency to continue burning once ignited
- Sample B (and CSP rounds 2, 4, 6) was PVC with higher ignition temperature, and tendency to self extinguish when heat source removed

Assessment of participants

- Only where 75% consensus occurred.
- (both samples had at least one test temperature with ‘borderline’ results)

[redacted]


Glow Wire Ignition Temperature (°C) - 08e29
frequency
40
35
30
25
20
15
10
5
0
600
625
650
675
700
725
750
775
800
825
850
875
900
925
950
975
1000
More
Glow Wire Ignition Temperature (°C)
Sample A
Sample B

Introduction to - Glow Wire Test

- The glow-wire is made from nickel/chromium (80/20) wire, with an overall nominal diameter of 4 mm. The wire is formed into a loop as detailed in figure 1.
- The glow-wire is heated by a simple electric circuit as shown in figure 2.
- There shall be no feedback mechanism or circuit to maintain the temperature.
- Due to the high currents involved, it is essential that the electrical connections for the glow-wire are capable of carrying the current without affecting the performance or long-term stability of the circuit. NOTE 1 The typical current necessary for heating the tip to a temperature of 960 °C is between 120 A and 150 A.
- The test apparatus shall be so designed that the glow-wire is kept in a horizontal plane and that it applies a force of 1,0 N ± 0,2 N to the test specimen during the application of the glow-wire. The force shall be maintained at this value when the glow-wire or the test specimen is moved horizontally one towards the other.
- The penetration of the tip of the glow-wire into and through the test specimen shall be limited to 7 mm ± 0,5 mm.

Equipment “Issues” Identified in PTP

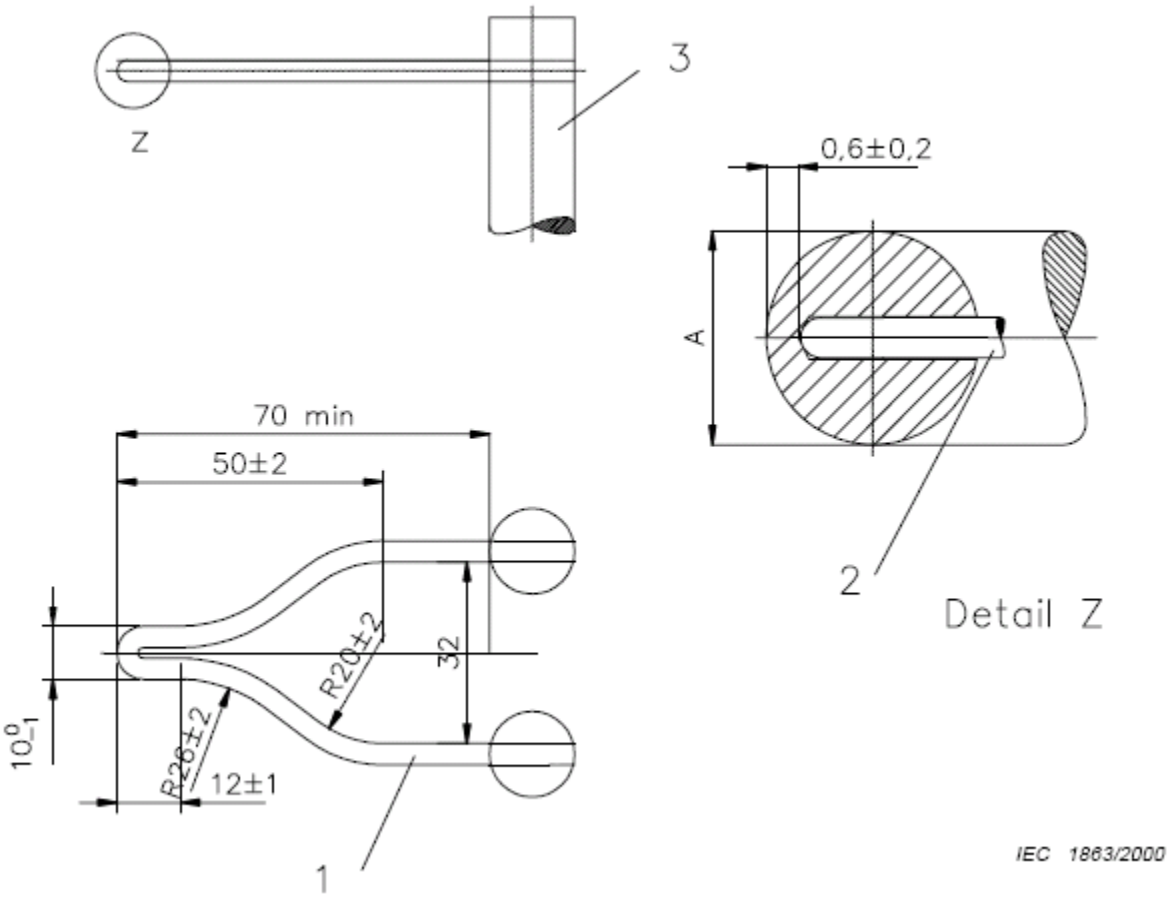
- Safety
  - Removal of fumes
  - Protection of staff from fumes
- Integrity of GW tip
  - Clean
  - Undamaged
  - Frequency of checking
  - Dimensions
- Position of TC within tip

- The force with which the GW is applied to the sample under test
  - (this was found more as a corrective action, than initially, and may be a good “preventive” measure, since it seems not to be commonly considered at outset)

Safety

- Fumes generated when plastic combusts are frequently toxic, and sometimes carcinogenic
- Protection of staff from these effects should be a priority

GW loop


Z
3
0,6±0,2
A
2
Detail Z
70 min
50±2
R20±2
32
10 0 -1
R26±2
12±1
1
IEC 1863/2000

Glow wire tip

- Has specified dimensions – (diameter and shape)
- Made from material with low reactivity
- When used, plastic material can remain on the tip (and influence burning).
  - Temperature applied to sample may not be accurate
  - Contact area may not be correct, and pressure may not be evenly applied
  - Combustion may be affected by chemical interaction as the residue may interfere with the sample under test

- If the tip is damaged (cracks, fissures, shape change)
- List?

GW dimensions

- Ultimately, the contact area should be correct, otherwise the energy applied to the sample will be applied to a different area. (and diffused / concentrated relative to the requirement)

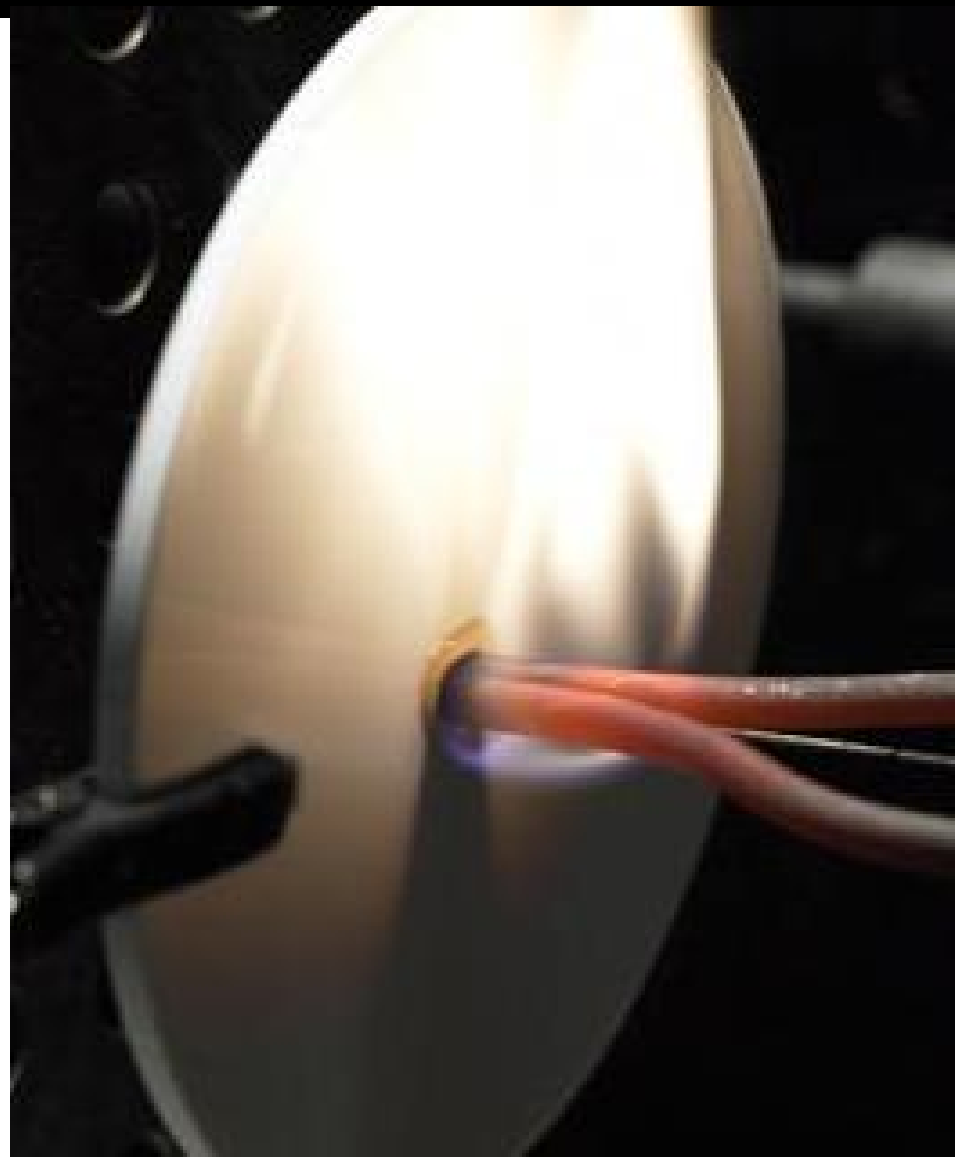
Thermocouple position

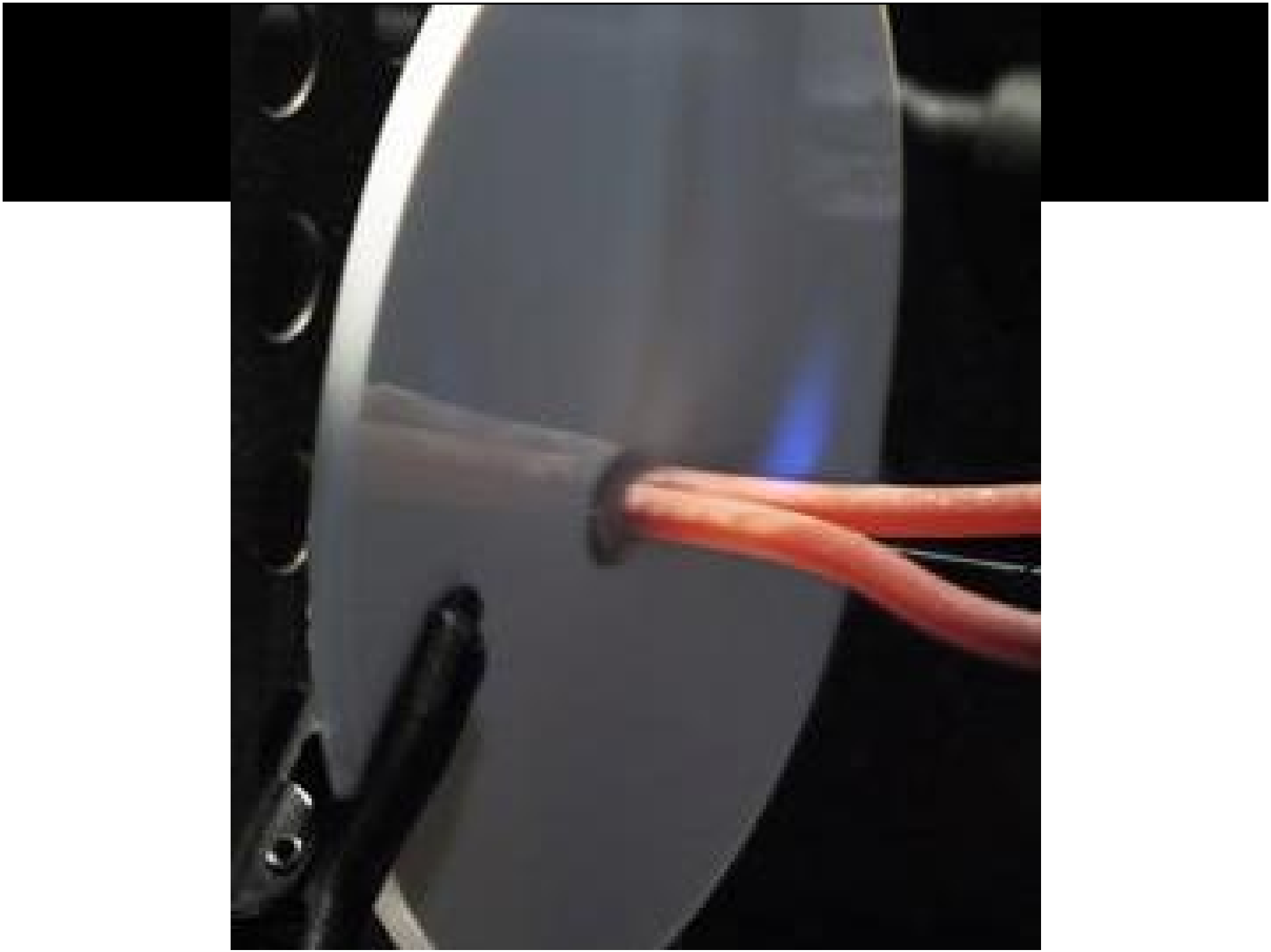
- The material of the GW loop is difficult to work with. Hard and brittle.
- It is critical to make contact between TC and loop within cavity drilled in the back of the loop.
- >50% of high outlying results are due to technician “not noticing” the TC had “slipped”.
  - How to prevent? How to notice?

Application Force

- The force applied is part of the overall energy equation.

What is ignition?





There seems to be disagreement:

- Is burning of escaping gas classified as ignition of the sample?
- What about a “flash” of flames immediate to contact of the loop with the sample?
- Escaping gas, and “flash” are not considered to be “burning” by some bodies

- Discussion? (We should come to an agreement to promote consistency in testing results)

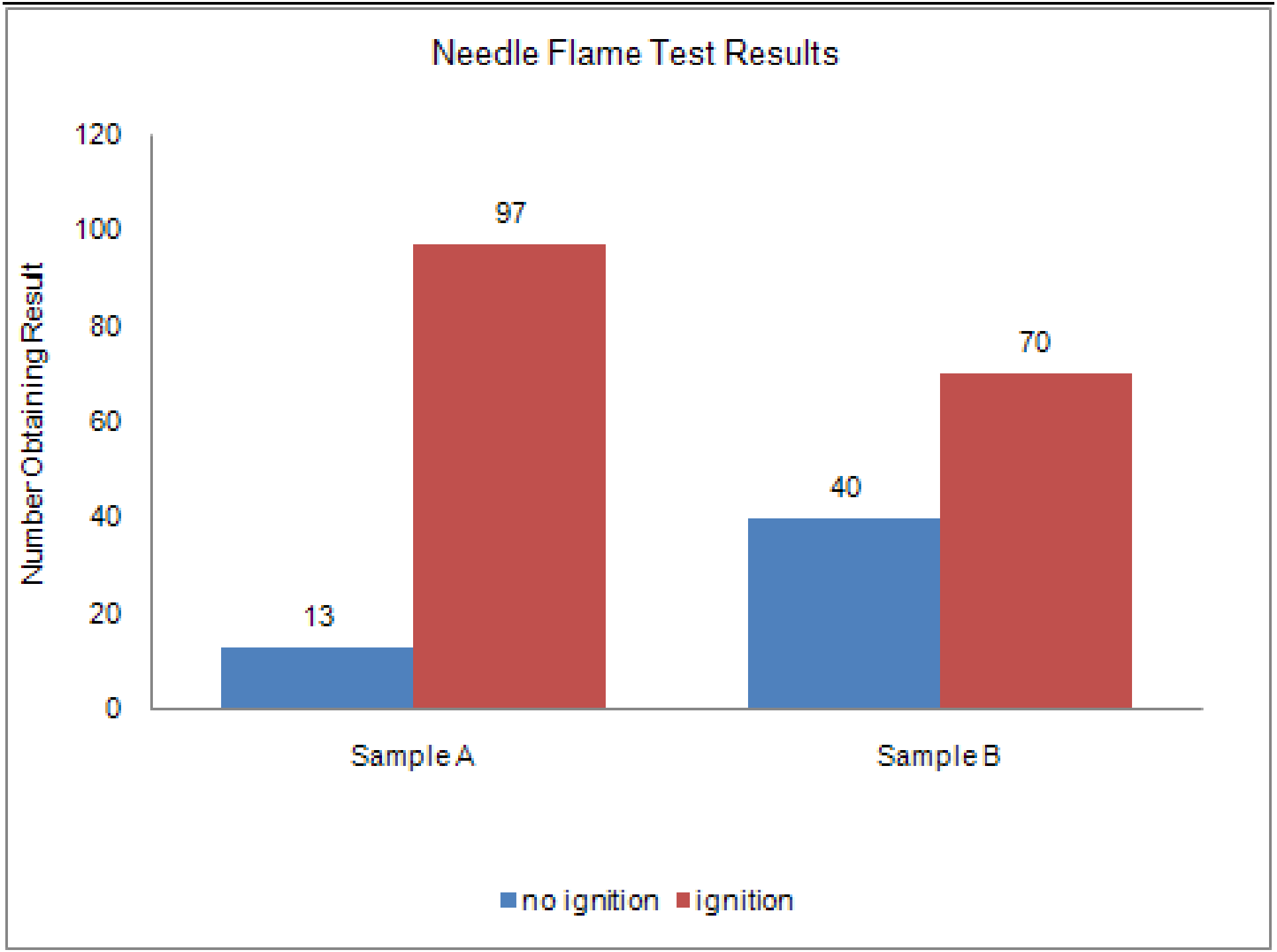
Task

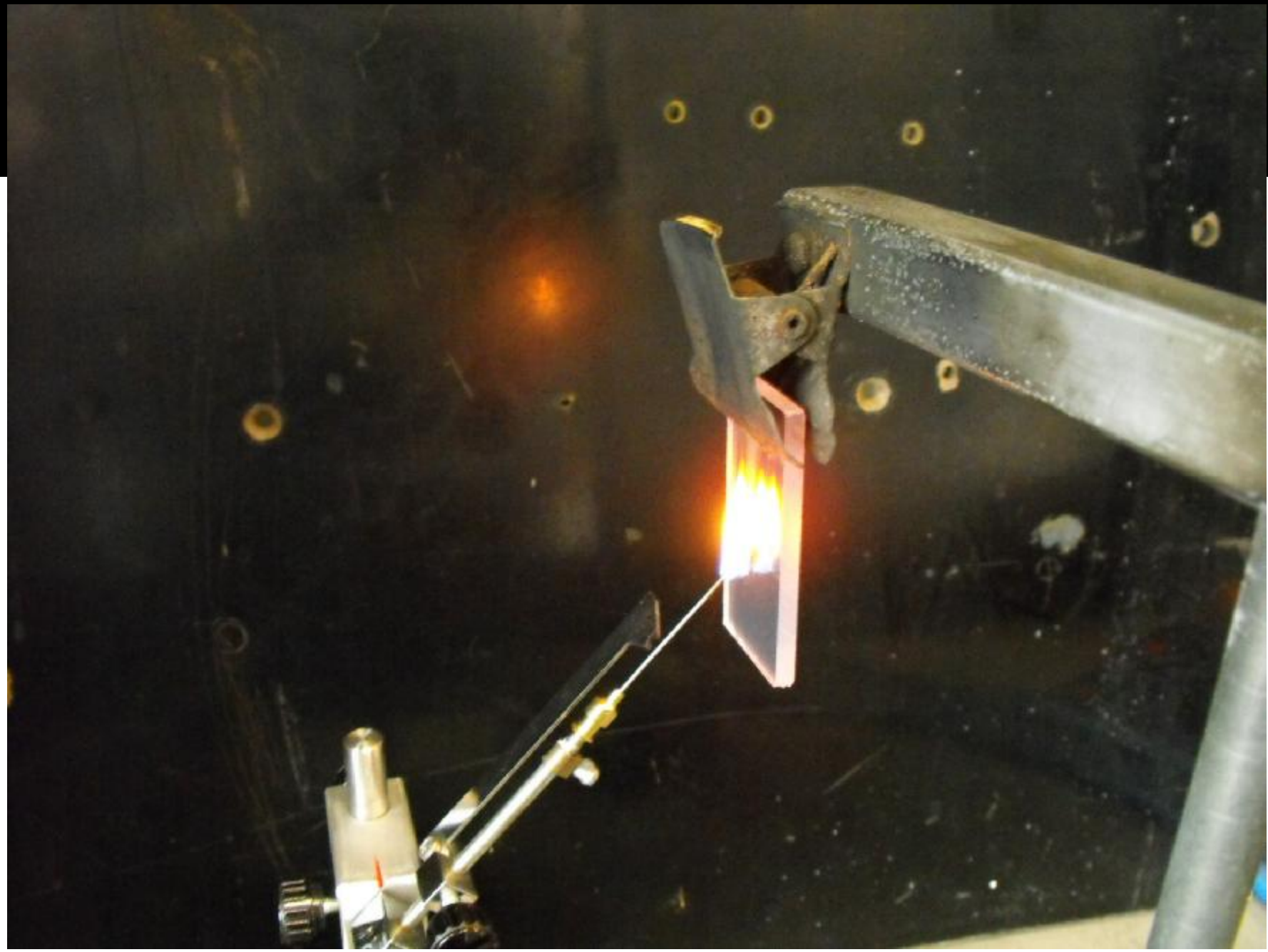
- Complete the handout for glow wire test
- Identify all the steps in the testing process
- Highlight the possible risks of obtaining inaccurate test results
- Prioritise them
- Suggest some mitigating activities that could be implemented as preventive actions

Needle Flame Test

“Part 2” of 08e29 and 08e29CSP

- Samples were the same as for the glow wire test. Chosen because one was clearly expected to burn, and the other had “slower” ignition characteristics.


Needle Flame Test Results
Number Obtaining Result
120
100
80
60
40
20
0
97
70
40
13
Sample A
Sample B
no ignition
ignition



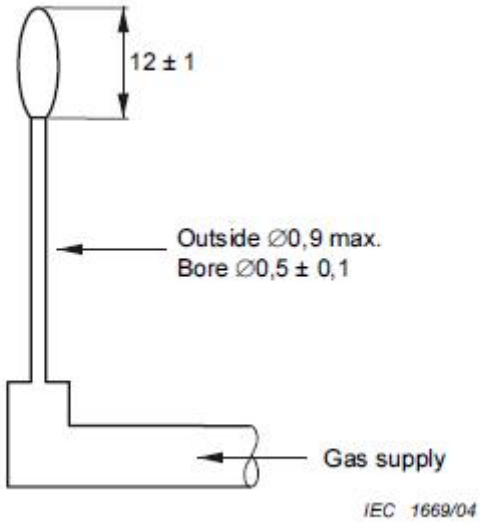


Figure 1a – Flame adjustment

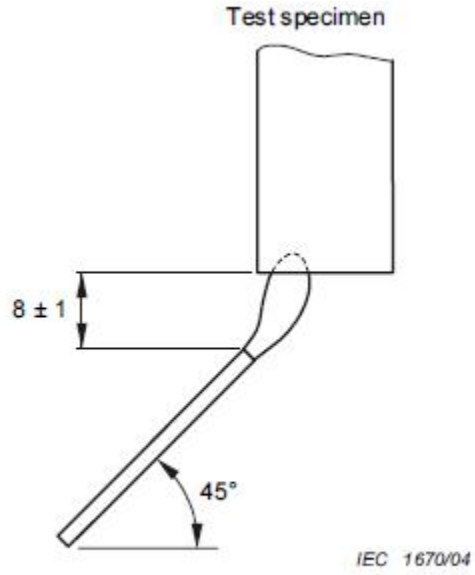


Figure 1b – Test position (example)

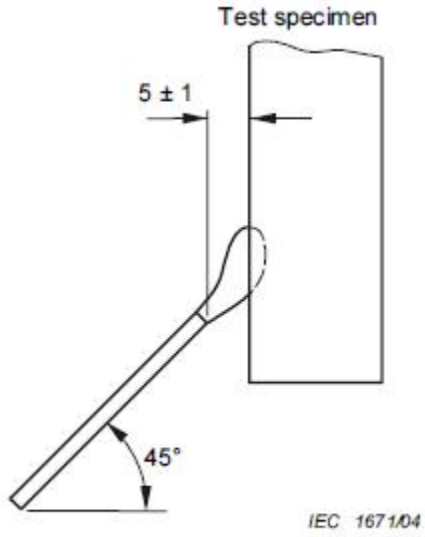


Figure 1c – Test position (example)

4 General description of the test

Warning

Precautions shall be taken to safeguard the health of the personnel conducting tests against:

- the risks of explosion or fire;
- the inhalation of smoke and/or toxic products;
- toxic residues.

The test is performed to determine that, under defined conditions, the test flame does not cause ignition of parts, or that a combustible part ignited by the test flame has a limited duration of burning or a limited extent of burning, without spreading fire by flames or burning or glowing particles falling from the test specimen.

This test determines the effects on the test specimen of a small flame such as may arise from other ignited components and the relevant product specification shall specify the duration of flame application and the criteria for acceptance.

5 Description of the test apparatus

5.1 Burner

The burner to produce the test flame shall consist of a tube at least 35 mm long with a bore of 0,5 mm ± 0,1 mm and an outer diameter not exceeding 0,9 mm.

NOTE The tubing specified in ISO 9626 [1][1] (0,8 mm normal walled or thin walled) meets the requirements in this standard for an internal diameter of 0,5 mm ± 0,1 mm and an outside diameter no greater than 0,9 mm.

The burner is supplied with butane or propane gas having a purity of at least 95 %. There shall be no air admitted to the burner tube.

5.2 Flame

With the axis of the burner in the vertical position, the gas supply is adjusted so that the length of the flame is 12 mm ± 1 mm, when viewed in subdued light against a dark background (see Figure 1a). The flame shall be confirmed using the apparatus and procedure detailed in Annex A. The test time for the temperature to increase from 100 °C ± 5 °C to 700 °C ± 3 °C shall be 23,5 s ± 1,0 s.

5.3 Laboratory fumehood/chamber

The laboratory fumehood/chamber shall have an inside volume of at least 0,5 m^3. The chamber shall provide a draught-free environment, whilst allowing normal thermal circulation of air past the test specimen. The chamber shall permit observation of the test in progress. The inside surfaces of the walls shall be of a dark colour.

[redacted]

For safety and convenience, it is desirable that this enclosure (which can be completely closed) be fitted with an extraction device, such as an exhaust fan, to remove products of combustion, which may be toxic. The extraction device shall be turned off during the test and turned on immediately after the timing measurements have been made. A positive closing damper may be needed.

NOTE Placing a mirror in the chamber, to provide a rear view of the test specimen, has been found to be useful.

5.4 Specified layer

- IFM specified no “specified layer” for the PTP

[redacted]

5.5 Timing device

The timing device shall have a tolerance of not more than 0,5 s.

Selection of sample portion to be tested

If the test specimen is a suitable part cut from a larger unit, care shall be taken to ensure that in this particular case the test flame is not applied incorrectly, for example to an edge created by cutting.

[redacted]

A.1 Confirmation of the test flame – Principle

The time for the temperature of the copper block, described in Figure A.1 to increase from 100 °C ± 5 °C to 700 °C ± 3 °C shall be 23,5 s ± 1,0 s, when the flame confirmatory test arrangement of Figure A.2 is used.

NOTE Detailed background information for the confirmation of a test flame can be found in IEC 60695-11-40 [2].

Most corrective actions relating to needle flame test

- Dark background of chamber
- Test not performed in chamber at all
- Calibration of flame using copper block
- Is observation “burning” ??

Group exercise

- Complete the handout for needle flame test
- Identify all the steps in the testing process
- Highlight the possible risks of obtaining inaccurate test results
- Prioritise them
- Suggest some mitigating activities that could be implemented as preventive actions