

MINISTÈRE
DE LA DÉFENSE
ET DES
ANCIENS COMBATTANTS



DGA Aeronautical Systems

« Fire Safety Department »

Powerplant Task Group
Progress of the survey and test results

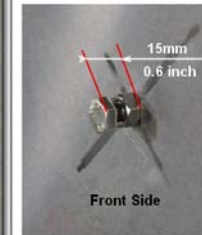


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12 labs are more or less involved in the action

- Element
- Jehier
- Akro Fireguard
- University of Cincinnati
- SNECMA
- DGA
- LEFAE
- FAA
- Airbus
- Honeywell
- GE
- Fire Precaution
- Environ Lab

7 labs performed the tests on aluminium plate



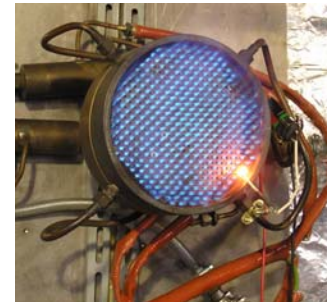
4 labs have received the sets of bolts & nuts but
the test results are still waited
(2 did not reply to the survey)

1 lab did not reply technical element to the survey and
did not ask the materials for the tests to be performed



About the 10 labs involved in the survey

- 9 labs perform the tests according to the ISO2685 and AC20.135 (or chap12 of the handbook)
- 1 lab only perform the tests according to the AC20.135 (using on oil burner)



- 7 labs use the 2 kinds of burners (oil & gas) (but only 3 labs provided test results from the 2 burners)
- 2 labs only use an oil burner
- 1 lab only use a gas burner



About the 10 labs involved in the survey

Test configurations :

Position of the burner during tests (and calibration) :

- 4 labs perform the tests on horizontal position only
- 4 labs can also perform the test on vertical or various positions
- 1 lab perform the test on vertical position only
- 1 lab perform the calibration on vertical position but did not reply for the configuration during the tests

The labs usually do the calibration with the burner on the same position than the test position



Calibration

Thermocouples

Thermocouple junctions should be : Exposed and non-aspirated (according to the ISO2685 standard)

→ 2 labs use unexposed thermocouples

→ 2 labs use aspirated thermocouples



Calibration

Heat Flux Measurement

On 9 replies :

- 2 labs use water-cooled calorimeters (allowed in AC 20135 and chap12 of the handbook (but not described in the ISO2685))
- 7 labs use the heat transfer device described in the ISO standard.



Calibration

Heat Flux Measurement

381mm exposed, the rest is insulated

Significant differences on the heat transfer device :

→ **length of the copper tube** : varying from 374mm to 635mm (*the insulated ends can contribute to heat the water by heat conduction and modify the measurement (and calibration)*) (higher length of heat transfer => lower power of the burner)

→ **localisation of the inlet/outlet water T° measurement** seems varying (from 150mm of the end of the copper tube to 228 (ISO requirement))

→ **Calculation of the heat flux** :

* length of the heat transfer device tube exposed to the flame taken into account for the calculation:

- propane burner : 152mm to 173mm (higher length => higher power of the burner)

- oil burner : 280mm to 330mm (higher length => higher power of the burner)



GAS BURNER (8)

It seems that all gas burners are home made (or home made by request to a supplier)



Main differences :

Internal diameter (requirement : 171mm) : varies from 152mm (to be confirmed) to 171mm

Additional element : 1 inch disk above the internal nozzle to spread out flame T°
(1 lab (no test result from this lab))

Flame monitoring :

Monitoring the GAS/AIR PRESSURES (5 labs) or the GAS/AIR FLOW RATES (2 labs)



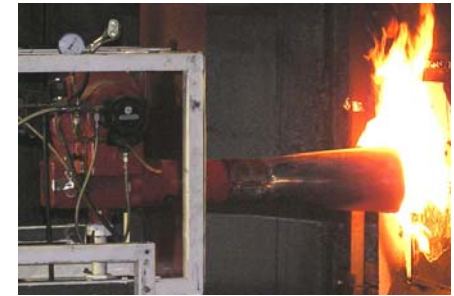
Gas pressure : from 46 to 56 mm H2O

Air pressure : **from 204 to 480 mm H2O**

(ISO 2685 indication : differential pressures : gas 45 mm H2O / Mixing Air 435 mm H2O)



OIL BURNER (9)



6 different burners :

3 Park burners / 1 Carlin modified / 1 Carlin 210CRD / 1 Weishaupt WL 20A / 1 Blue Angel / 1 AFG Series (B2503)
/ 1 no reply

Main differences :

Various additional elements :

- Disk to reduce the opening instead of the air tube reducing cone
- Multiple hole in disk
- Raised fuel nozzle height to minimize fuel from hitting air duct
- Lowered exhaust nozzle on air tube to get flame out of the nozzle (?)
- Additional flame guide inside the cone
- 3 axis adjustment of the positioning of the nozzle

Various nozzles :

- Various trademark : Monarch, Govmark (?), Steinen, Delevan
- Various spray angles : from 60° to 90°
- Nominal Flow rate : from 2 to 2.25 gal per hour

Various oils : Diesel / Jet A / Aviation fuel (Av Gas) / NATO F34 (equiv to LP8)



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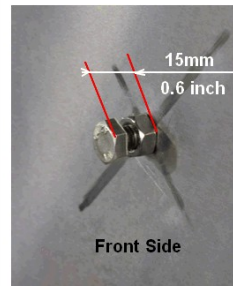
Test results



Test samples :

2024 T3 aluminium plate 60 x 60 cm / 3mm thickness

(with a bolt fitted in the center of the plate to simulate the critical part to be tested and improve the repeatability of the tests)

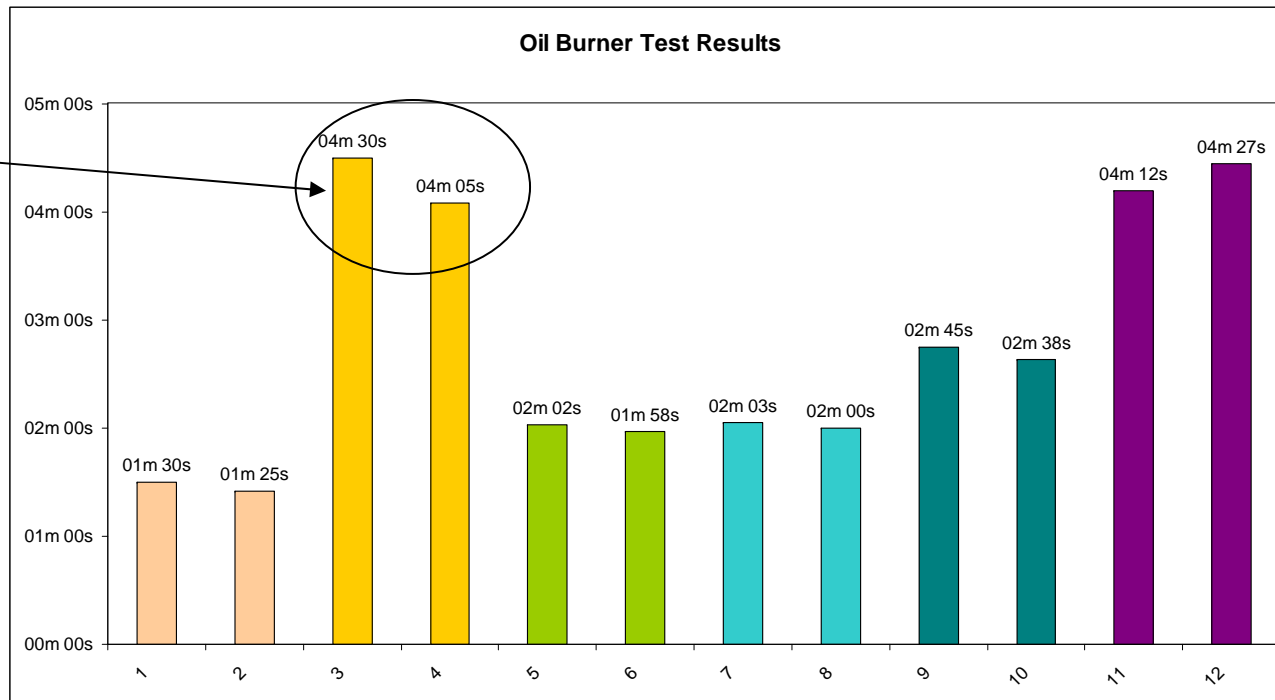




OIL BURNER TEST RESULTS

Good repeatability / Bad reproducibility / scattered results (up to 200%)

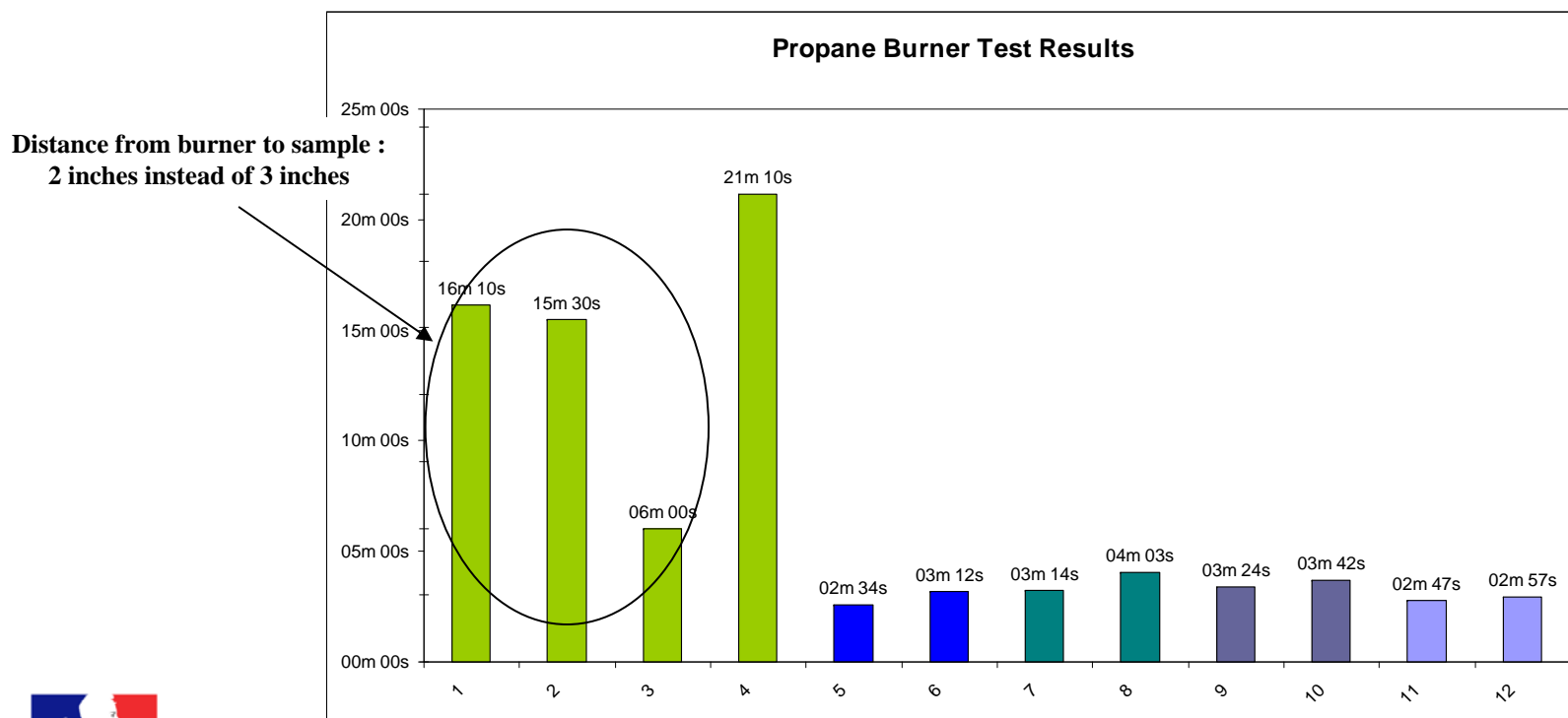
NexGen Burner





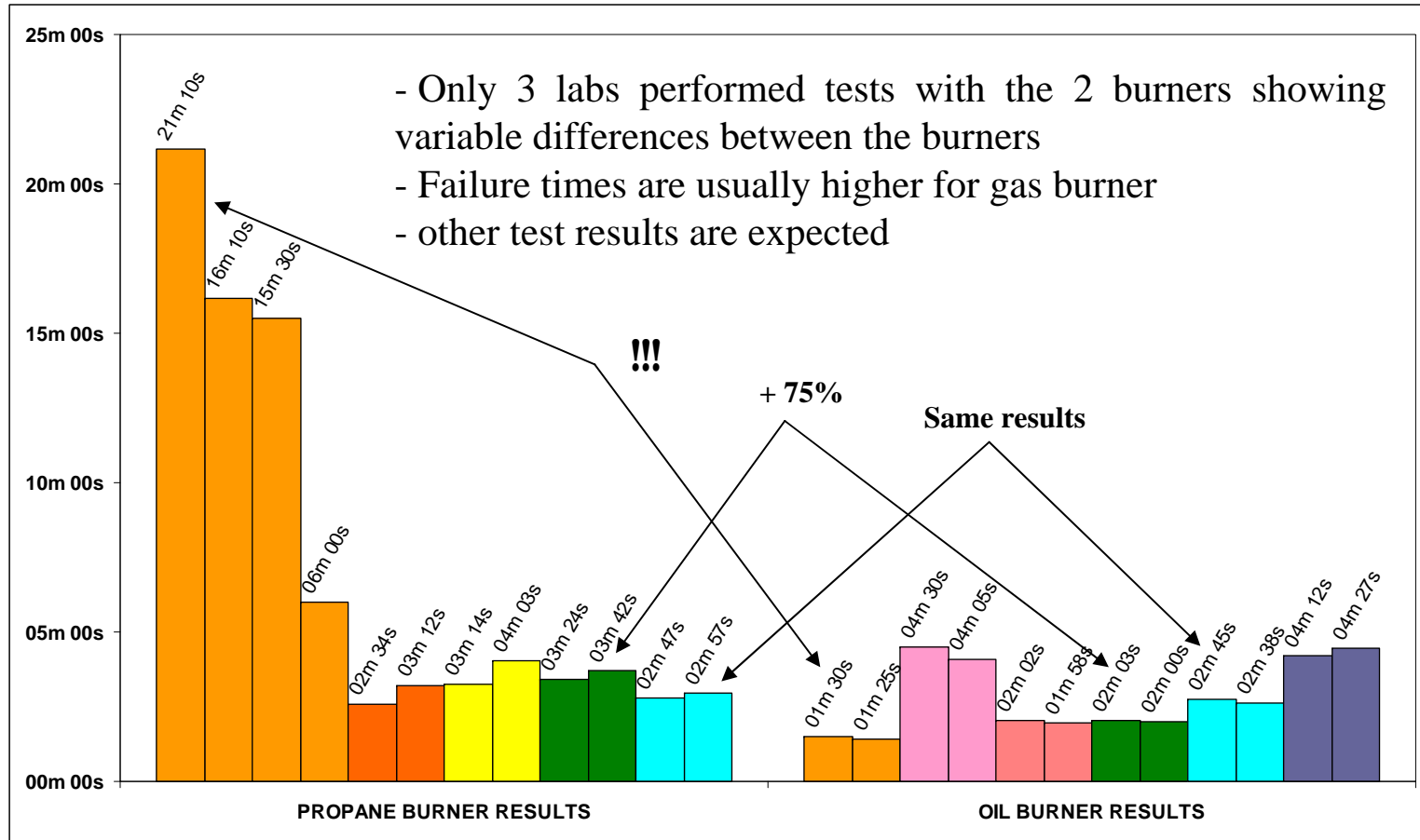
GAS BURNER TEST RESULTS

Quite good repeatability / Bad reproducibility





GAS BURNER / OIL BURNER





Conclusions

- Many differences between labs (equipments, calibration, additional elements)
- Good repeatability of the test results
- Bad reproducibility (between labs)

- Failure times usually higher for gas burner
- Differences / discrepancies need to be explained (oil burner and gas burner)

- Test results are still expected