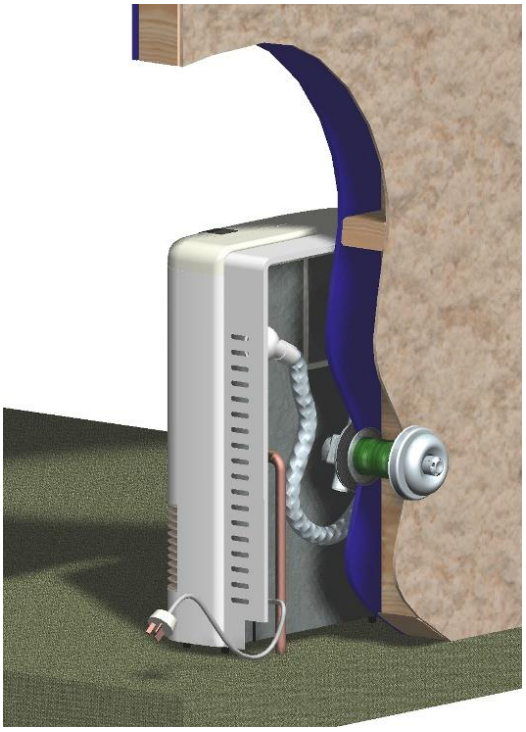
Rinnai New Zealand

Energysaver flue test report – May 2016

Test to determine the effect of connecting a Rinnai direct mushroom flue on a Vanluk MG100-18-60 penetration seal.



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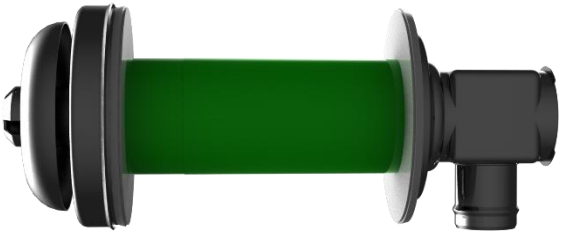
Background

Rinnai NZ was contacted by Overclad and asked to test the suitability of one of their cladding penetration seals when used with a Rinnai direct mushroom flue, which is used with a number of Rinnai Energysaver power flued gas heaters. In addition, Rinnai was supplied with a sample of Trespa 8.0 mm cladding material by Décortech and asked to determine what impact if any the flue temperatures would have on this material.



Aim

- Establish what temperature the cladding penetration seal obtains when the seal is placed in its normal functional position in contact with the outer part of the mushroom flue.

- Determine if the seal is degraded or damaged by being in contact with the flue during normal operation.

- Determine, if during normal operation of the flue and the temperatures it generates, if there is any adverse impact on the 8 mm Trespa cladding material.

Test methodology

A Rinnai Energysaver power flue heater (NG) was set up in a test environment and fitted with a direct mushroom flue. A Vanluk MG-100-18-60 cladding penetration seal was fitted to the flue in its normal functional position.

Thermocouples were placed onto the flue and penetration seal to measure the temperatures obtained during operation. The thermocouples were retained in position with aluminium self-adhesive tape where required.

The heater was started and allowed to operate for 1.5 hours on its highest output setting before any measurements were taken.

After 1.5 hours of continuous operation, using an electronic thermometer connected to the thermocouple, temperatures were taken.

This image shows the thermocouples in position on the flue. One thermocouple is measuring the temperature of the outer flue, and one is positioned between the flue outer and the penetration seal to determine the temperature at the point of contact. An additional thermocouple is placed onto the seal material, approximately 30 mm from the flue/seal contact face to determine temperature at that point.

Figure 1: General arrangement of thermocouples on flue and Vanluk MG-100-18-16 penetration seal

This image shows the position of an ambient air temperature thermocouple positioned out of the air flow of both the flue gas and heat output of the appliance.

Figure 2: Ambient air temperature thermocouple position

Figure 3: Measured air temperature 28.6 °C

Figure 4: Temperature of outer flue 37.0 °C

Figure 5: Temperature between outer flue and penetration seal 36.3 °C

Figure 6: Temperature of thermocouple in seal material 31.6 °C

Results in tabular format

Reference	Measurement	Temperature °C
A	Ambient air temperature	28.6
B	Outer flue temperature	37.0
C	Temperature at flue/seal junction	36.3
D	Temperature of seal 30 mm from the flue	31.6
E	Rise of **C** above ambient (C-A)	7.7
F	Rise of **D** above ambient (D-A)	3.0

In addition, the temperature of the mushroom flue was determined at a point likely to be closest to or in contact with any cladding material in a given installation.

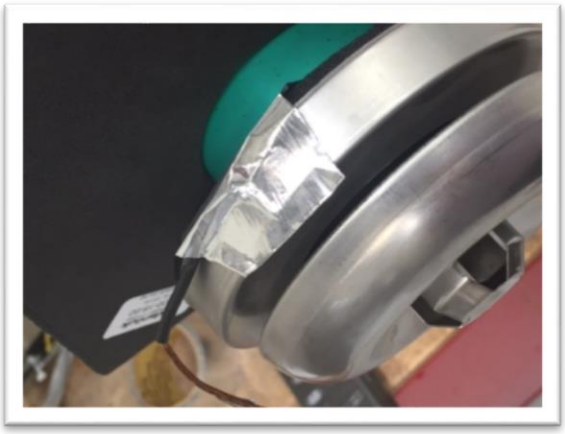
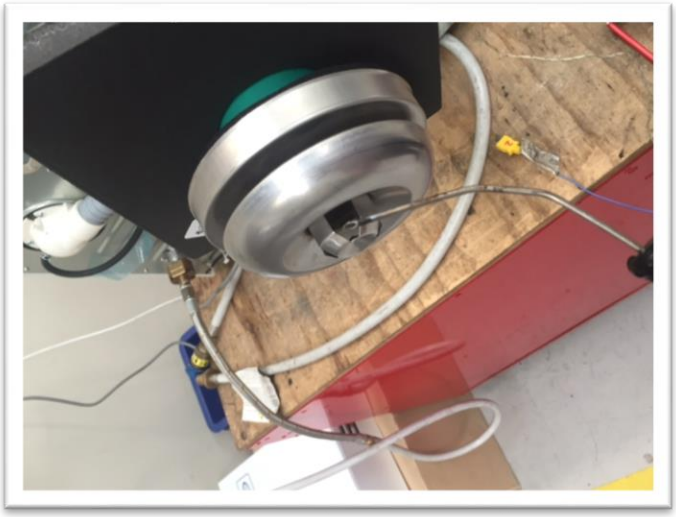


Figure 7: Location of thermocouple on the mushroom flue adjacent to likely cladding material

Figure 8: 30.8 °C , temperature recorded at the mushroom flue



A hand held thermocouple was used to determine the flue gas exit temperature from the appliance. This was measured at the point of exit from the flue. This was not in contact with any seal or cladding material.

N.B: This temperature quickly dissipated as evidenced by the mushroom temperature result recorded in figure 8.

Figure 9: Temperature measurement with hand held thermocouple at flue gas exit point

Figure 10: 89.3 °C, temperature recorded at flue gas exit point

Results in tabular format

Ref.	Measurement	Temp. °C
A	Ambient air temperature	28.6
G	Outer flue temperature	89.3
H	Stainless steel mushroom flue temp. adjacent to likely cladding material	36.3
I	Temperature of seal 30 mm from the flue	31.6
J	Rise of **D** above ambient (D-A)	3.0

The Vanluk MG-100-18-60 penetration seal was also inspected for any change of state or other issues following the test. No issues were noted and the seal material was not damaged, or in any way degraded by the test.

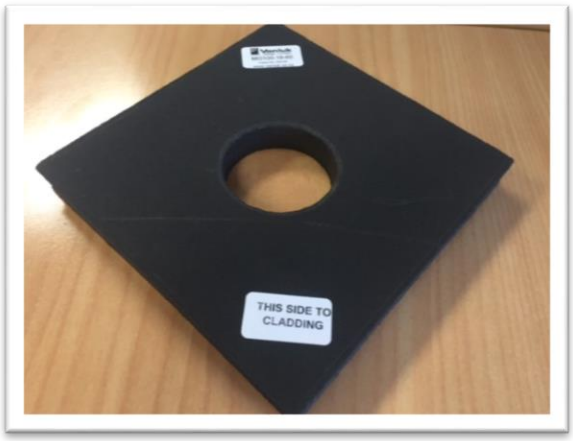


Figure 11: Vanluk MG-100-18-60 penetration seal as supplied

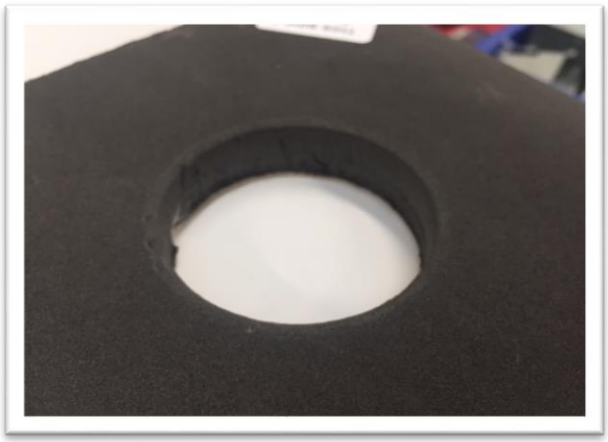


Figure 11: Vanluk MG-100-18-60 post-test condition

In addition to the above testing, additional testing was undertaken with a sample of 8 mm Trespa cladding material. The cladding was prepared by cutting a hole central to the sample to allow the flue to fit through with an approximate all round clearance of 5 mm. The flue component was then fitted and the Vanluk MG-100-18-60 seal was placed in its typical functional position.

Thermocouples were attached to the cladding and the heater was run on maximum for one hour. Another thermocouple was positioned to establish the ambient temperature of the test environment.

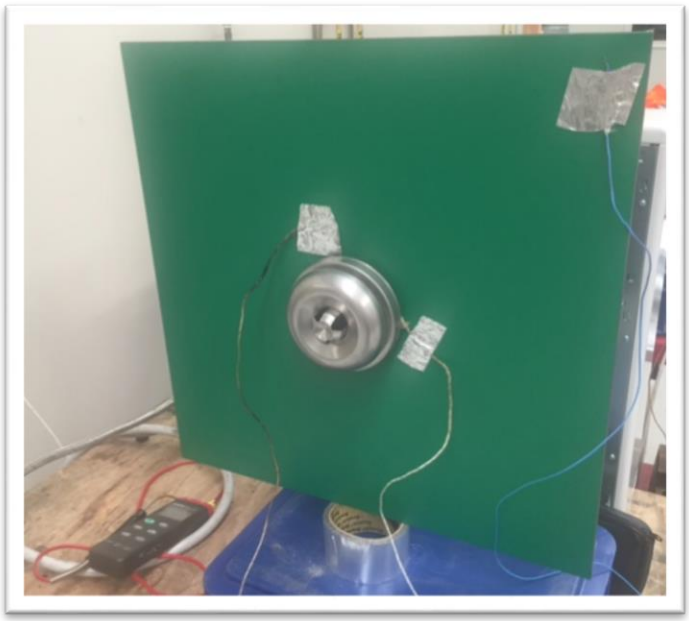


Figure 13: Test setup for the Trespa cladding material

Ref.	Measurement	Temp. °C
A	Ambient air temperature	27.3
L	Thermocouple between flue and Trespa cladding	31.6
M	Thermocouple 30 mm above the flue outlet	28.7
N	Thermocouple 270 mm above and offset from the flue terminal	27.3

A test was carried out to establish if the flue gas plume from the appliance could directly affect the cladding material. An Anemometer was used to establish flue gas speed and the temperature when placed in the direct path of the flue gas.

Figure 14: Anemometer placed in the pathway of the flue gas

Figure 15: Results from Anemometer 54 ° C and 1.28 m/s air speed

The Anemometer was then placed closer to the Trespa cladding and the flue gas speed and temperature were measured.

Figure 16: Position of Anemometer close to the Trespa cladding

Figure 17: Results from Anemometer 2 and no air speed

The results indicate that there is no direct impingement of the flue gas onto the Trespa cladding material. Further validated by a series of FLIR images, which were taken of the test setup to determine if the flue was heating any part of the cladding material, refer images on next page.

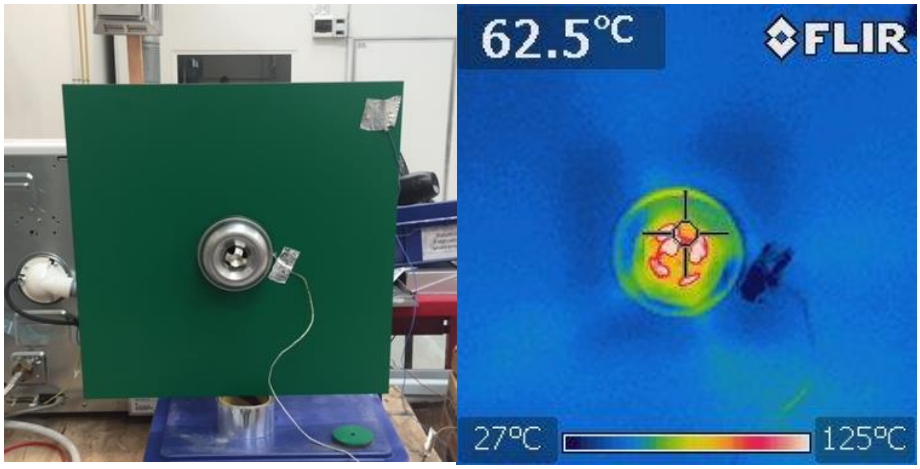


Figure 18: Shows the FLIR and normal light image of the test setup. Note in the FLIR image the cladding remains a uniform colour, which is reflected in the temperature recorded.

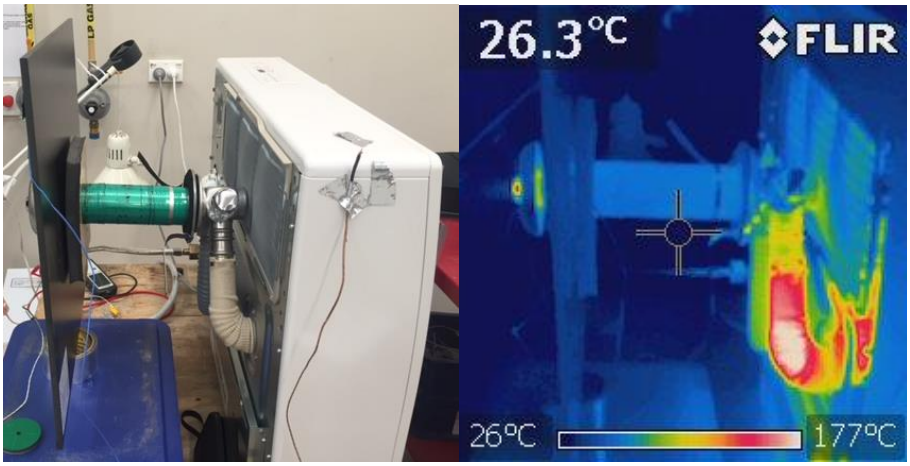


Figure 19: This shows the test setup, showing minimal heating in the FLIR image of the Trespa cladding and Vanluk MG-100-18-60 seal

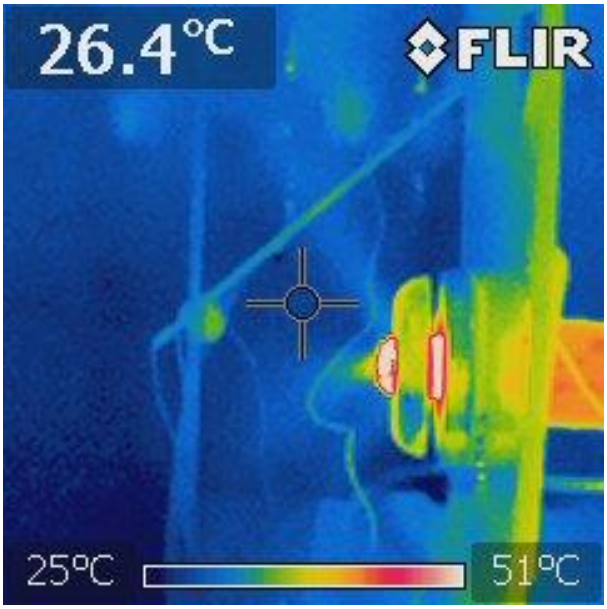


Figure 20: Showing the flue gas plume exiting the flue termination

Conclusion

From the testing it is reasonable to conclude that the Rinnai direct mushroom stainless steel flue used with the Rinnai Energysaver gas space heater does not pose an adverse temperature hazard to either the Vanluk MG-100-18-60 penetration seal or the Trespa cladding material.

This is consistent with the existing Rinnai product statement and instruction that the flue is zero clearance rated for combustible materials.