FIRELAB
Reg.no. 2005/087037/23
P O Box 72169
LYNNWOOD RIDGE
0040
kobus@firelab.co.za
peet@firelab.co.za

Phone: (012) 349 2929
Fax: (012) 349 1519
Cell: 082 892 4565
Cell: 082 321 4269

Our reference: FTC 17/184 (Rev. 1)

Off Grid Innovations (Pty) Ltd
PO Box 440
LANSERIA
1748

Attention: Mr. Allan Goldberg

6 December 2017

Dear Sir

ASSESSMENT OF THE FIRE SAFETY AND FIRE PROPERTIES OF THE I HARVEY BASIC POWER GENERATOR FOR OFF GRID HOUSEHOLDS

FIRELAB was requested to assess the fire safety properties and use of the **iHarvey** basic power generator for off-grid households. The intended use is for the simultaneous provision of light and the charging of USB devices.

*Figure: Identification of **iHarvey Power Generator***

FIRELAB

1. GENERAL

The information regarding the **iHarvey Power Generator** submitted for assessment can be found in the following documentation:

- **iHarvey Fact sheet**
- **Comparative Evaluation Report of Emissions from Selected Paraffin Lamps and a Paraffin Thermoelectric Generator**
- **Material Data sheets of the following compounds:**
  - **ABS material**
  - **Formolene material**
  - **Polyphthalamide (PPA) material**
  - **Ultramid A3K material**

2. FIRE PROPERTIES ASSESSMENT

The fire safety evaluation of the **iHarvey Power Generator** was based on the suitability of the material used in the construction of the generator and the safety aspects of the generator during use.

Comments will also be made regarding possible fire safety requirements and/or comments about the safe use of the power generator.

2.1 MATERIAL PROPERTIES

1. The plastic materials used in the manufacturing of different components of the power generator were specially selected based on the specific material properties for the respective use applications in the generator. It was critical in the selection of the materials to ensure that it is not only suitable in the manufacturing process but also suitable for use as a safe component in the unit.

2. The generator has to contain fuel safely and at the same time also being exposed to heat. All the moldable materials used in the construction are polymeric and would be combustible if tested in accordance with **SANS 10177 – 5**. It is therefore important that although tested, that the maximum exposure temperatures be well below the respective ignition temperatures and even more so below the softening temperatures for the components being exposed to temperatures.

3. We have evaluated the material properties of the respective materials with regard to the specific use or application in the power generator from its suitability point of view and conducted an in-use test to determine the maximum exposure temperatures that can be expected during operation.

2.2 OPERATING PROPERTIES – TEMPERATURE PROFILES

The purpose for the determination of the maximum operating temperatures of the **iHarvey Power Generator** was to establish whether the polymer materials used in the shielding/construction of the outer components were suitable and will not soften or ignite during operation.

The areas of interest to monitor were identified as the Inner Chimney, the Top Flange between the Chimney and generator and the plastic Chimney Sleeve with housing for the insect repellant. Three Type-T thermocouples (TC) were placed on the abovementioned areas and data measured and recorded every 20 seconds using a Data logger for the full duration of the test.

The **iHarvey Power Generator** was filled with 1.15 liter of Illuminating Paraffin before the test was started. The Data logger was started before the wig was lighted and flame height adjusted in accordance with the user instruction and left to operate until the paraffin was completely consumed.

Power was generated for a period of 30 hours and 41 minutes without adjustment of the wig or re-filling of the Paraffin tank.

The maximum, minimum and average temperatures measured on the Chimney, Top Flange and Chimney Sleeve is depicted in Figure 2.2.1 and given in Table 2.2.1. The Time required for the Temperature to reach a Stable Operating Temperature is depicted in Figure 2.2.2.

Off Grid Innovations – iHarvey Power Generator			
Description	**Chimney**	**Top Flange**	**Chimney Sleeve**
Minimum Temperature (°C)	168.0	196.3	131.1
Average Temperature (°C)	174.7	210.7	144.7
Maximum Temperature (°C)	181.3	222.2	161.4
Time at Maximum Temperature (hh:mm)	23:27	01:43	01:47

Start to Stable Operating Temperature (hh:mm:ss)	00:17:20
Total Power Generation Time (hh:mm:ss)	30:41:20
Amount of Paraffin used (liter)	1.15

*Table 2.2.1: Temperature and Times results from **iHarvey Power Generator** Test*

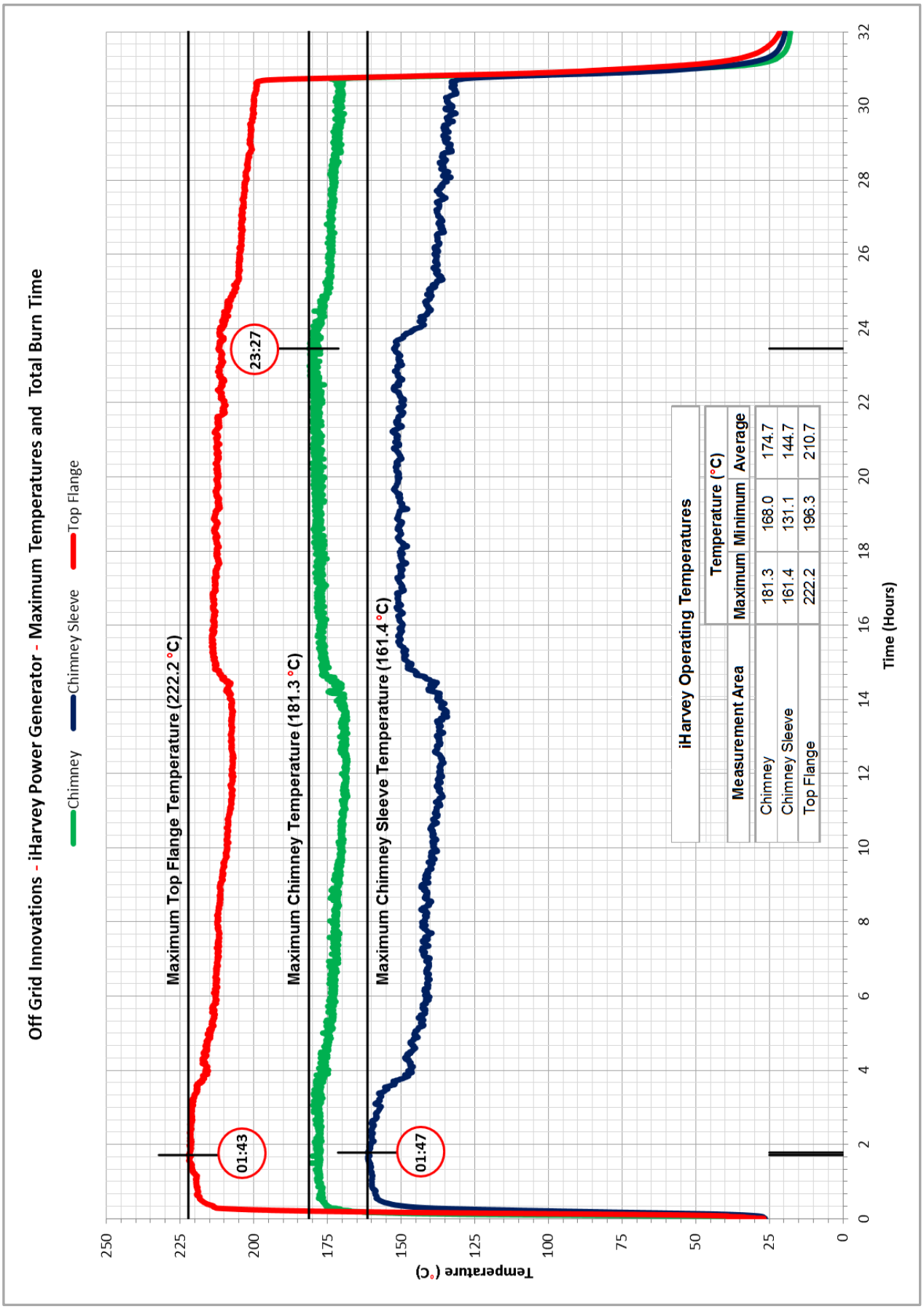

*Figure 2.2.1: Temperatures measured during the test of the **iHarvey Power Generator***

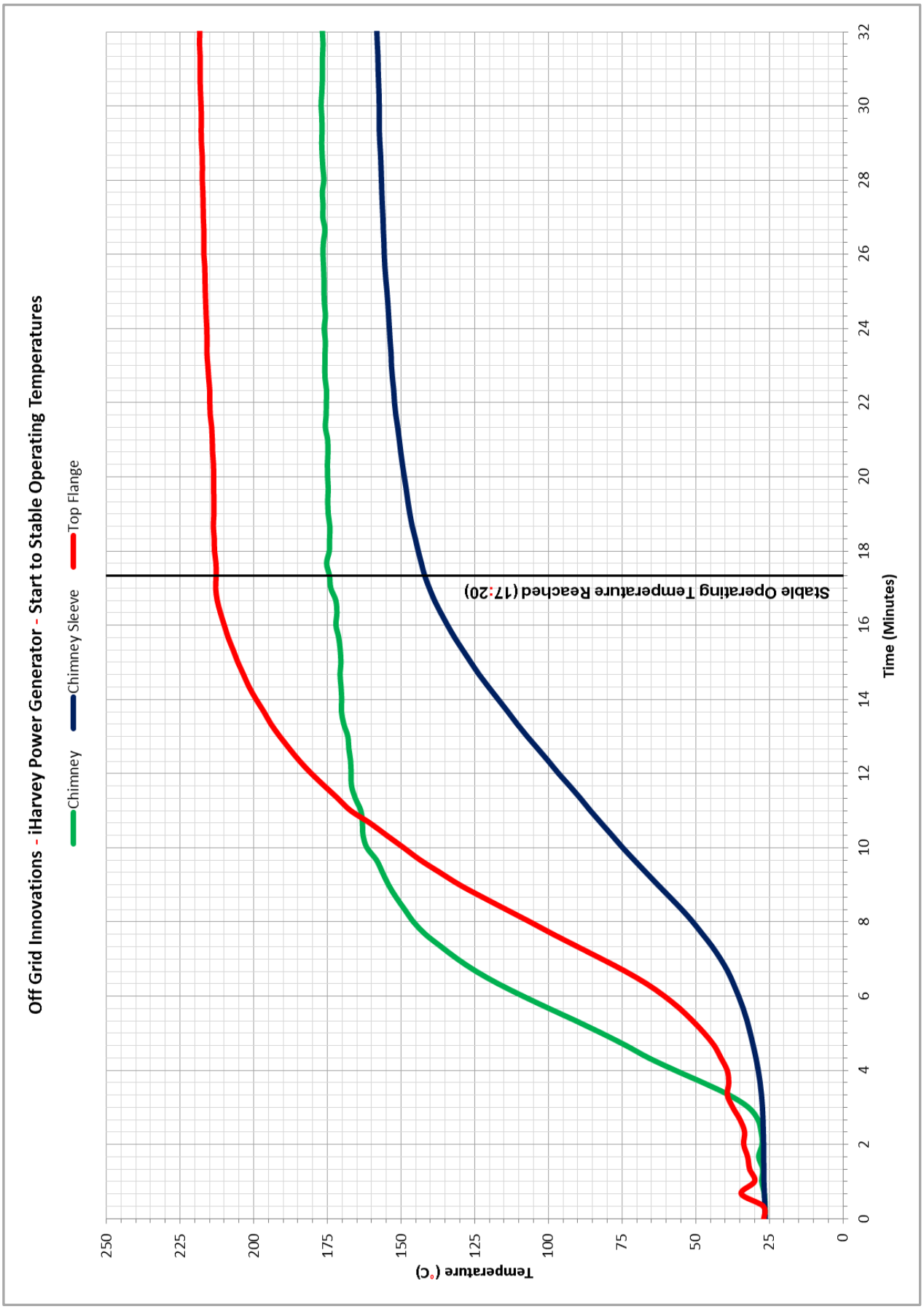

Figure 2.2.2: Stable Operating Temperatures

*Figure 2.2.3: Test setup for **iHarvey Power Generator** with Data logger*

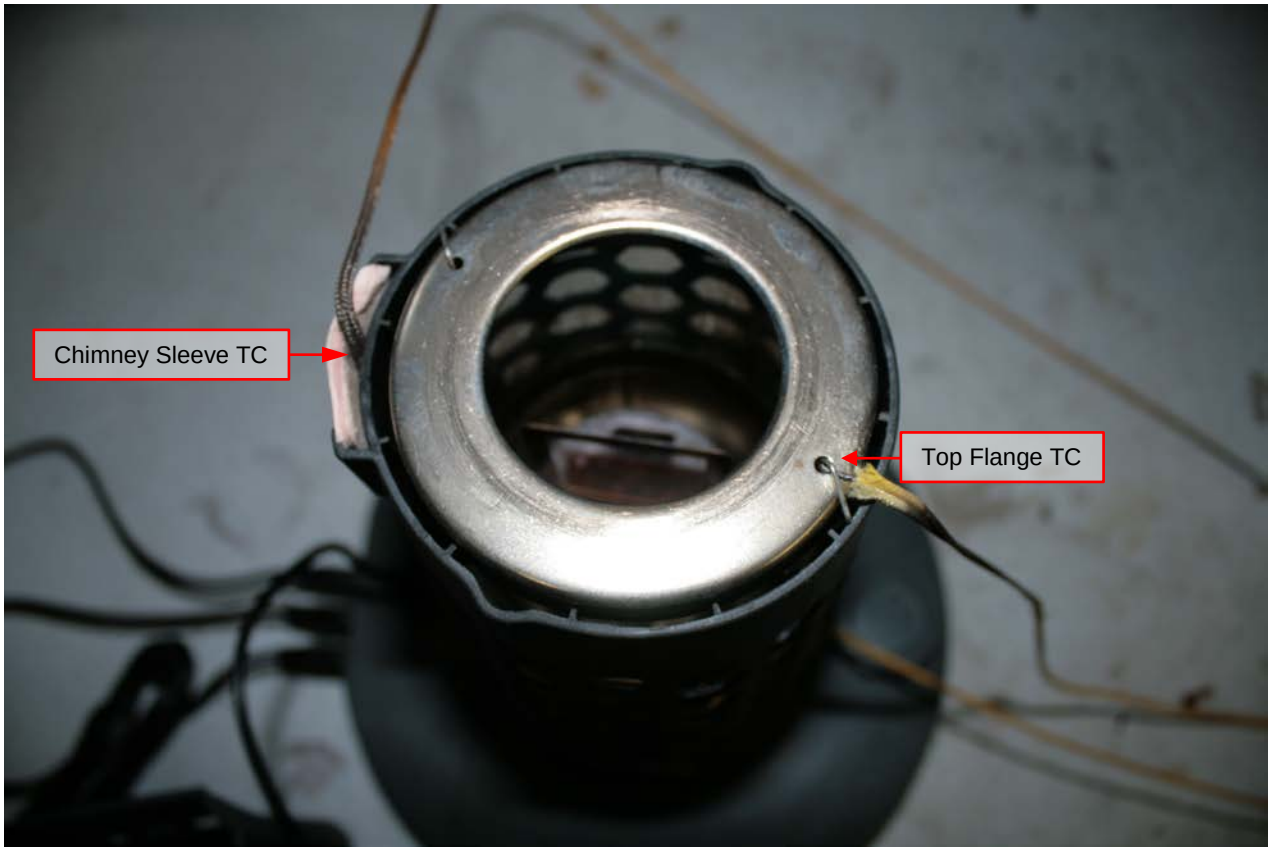

Figure 2.2.4: Placement of Thermocouples (TC) on the Top Flange and Chimney Sleeve

Figure 2.2.5: Chimney TC was placed through outer metal casing onto inner chimney pipe

Figure 2.2.6: Green light; adequate heat for power generation – Blue light; Excess power available

Figure 2.2.7: Red light; Excessive heat for power generation – Blue light; Excess power available

3. DISCUSSION AND RECOMMENDATIONS

It should be noted from the temperatures recorded that the Chimney temperature is not stabilizing over a test cycle of a full tank. It is therefore recommended that the generator not be used continuously for more than 30 hours.

All the temperatures recorded during the evaluation where found to be well below the softening and ignition temperatures of the various polymer components used. The temperatures measured is low enough to not ignite any item placed outside or adjacent to the footprint of the unit and care should be taken not to lean objects against the chimney of the unit.

The **iHarvey Power Generator** must be placed in a position where it will be used prior to filling the tank and igniting the wig and it should not be moved once the unit is in operation as spillage of paraffin was noted at the adjustment area and USB generator input plug when moving the generator with a full tank.

In support of the above (spillage) liquid refueling containers must be contained to a maximum of one (1) liter packaging. The selling of the liquid (paraffin) containers could also assist in entrepreneurs in a small business.

4. CONCLUSION

The **iHarvey Power Generator** was found to be safe for use provided it is not overfilled and moved during operation. The maximum temperature recorded at the positions where well below critical temperature properties of the polymeric materials used.

We trust this assessment report would assist you in meeting the requirements of your client and the approval of the project. Should there be any other uncertainties regarding the contents of the document, please do not hesitate to contact me immediately.

Yours faithfully

JS Strydom
BSc (Construction Management) UP
FIRELAB