Office for Product Safety & Standards

PRISM: Risk Assessment (With Supplementary Rationale) – Non-Compliant Room / Space Heater

1. THE PRODUCT

The product in question is a fan based plug-in room/space heater which was supplied on an online marketplace via eight sellers. The product has permanent labelling in the Chinese language only, and what appears to be an Australian three-pin plug is attached to the power cord. A plug-in adapter for connection to the UK supply outlet is included with the product, but it is not one which permanently attaches (requiring the use of a tool to remove).

Note: As this is a worked example further product details are not provided here, but would normally include:

- Manufacturer/brand
- Model
- Batch numbers and any other coding
- Quantities supplied and over what time period
- How the matter came to the attention of the market surveillance authority (e.g. complaint, intelligence or ports and borders work).
- Details of any reported incidents or injuries
- Photographs of the product and packaging that, where possible, capture the hazard and identify the product.

2. THE HAZARDS

The product was subject to testing by a competent laboratory, with the following assessment scope:

Screening check: […] was commissioned to evaluate the above product. The aim of the assessment is to ensure that the product is of a suitable build quality and has adequate overall safety, referring to the relevant UK Regulations and test standards. The following screening checks are based on key areas from these requirements and do not constitute a full statutory assessment.

The report concluded the following:

'The product does not meet the requirements of the Plugs and Sockets (Safety) Regulations 1994 because the product did not feature a UK plug face. The product also requires improvements to documentation and markings. If the product is intended for the UK market the rated voltage of the product did not cover the UK

nominal voltage of 230VAC. Proof should be obtained that the product is suitable for the UK variation of 240VAC (10%+/-6%). It cannot be demonstrated but there is a potential hazard of overheating/fire.

The test laboratory gave this a 'high hazard' rating.[1]

The instructions supplied are in Chinese, as is all of the product labelling, including warnings/control indications/ratings etc. An English version of the instructions was subsequently supplied for the sample following a request from the MSA, and this omitted a warning about the product being suitable for indoor use only. It is not clear whether the lack of English instructions was limited to the sample or the whole batch of products.

The product does not carry a conformity assessment mark, either CE or UKCA, and is not marked with a UK importer/manufacturer's postal details or nominal voltage. Most importantly the product is missing either the instruction in English not to cover or the associated pictogram (which is also permitted).

There are multiple actual or potential routes to injury for this product. Primary amongst these is the risk presented by a product which has to be plugged in using an adaptor, which presents the risk of damage or wear and tear to this leading to resistive heating or electric shock.

Secondary risks include foreseeable misuse arising from lack of warnings, markings or indications relating to safe operation leading to further risk of fire and electric shock.

Finally, it must be acknowledged that there are a significant number of unknowns relating to the product's design and construction arising from lack of evidence of conformity assessment, both in relation to design risk management but also production control – this product may not be representative of the whole in design, production or specification, and some products may have additional or different hazards. Whilst this is impossible to estimate in a meaningful way, such considerations are relevant to the risk evaluation.

From the evidence supplied, the primary hazard is the electric current giving rise to the risk of electric shock.

Summary:

A number of factors, such as the confirmation of design parameters which were not tailored towards the UK or European markets, the lack of verifiable conformity assessment evidence, and the fact that injuries arising from the hazards identified could be life threatening or otherwise significant all indicate that a full risk assessment should be undertaken.

The product presents the following deficiencies:

- Lack of approved UK plug, and supply of an adaptor which does not provide an earth connection, leading the product to have no effective earthing circuit and therefore not having the intended or designed level of protection provided by Class I construction in foreseeable fault conditions. Although adaptors can

[1] This must be distinguished from a risk assessment however, as the hazard is merely a characteristic which has the potential to cause harm. The risk of this must also consider the likelihood and severity of that harm. A 'high hazard' rating means that the laboratory believes that the hazard is significant.

present both fire and electric shock hazards due to constructional deficiencies, damage and wear and tear, this particular adaptor presents an additional hazard by design.
- Lack of pictogram or warnings indicating that the product should not be covered. This presents a fire hazard given the foreseeable behaviour of consumers.
- Lack of effective operating instructions or control indications, which can lead to foreseeable consumer use beyond the product's design parameters.

3. WHO WILL BE HARMED?

Any person who interacts with the product in a way where they touch it can potentially be harmed due to contact with a dangerous current. Anyone in the vicinity of the product while it is plugged in could touch it to either switch it on or off, control the heat output or, in some circumstances, brush up against it accidentally.

This scenario does not indicate that there is potential for harm to people other than those directly interacting with the product.

4. HARM SCENARIO

From the evidence supplied, the primary risk (that of electric shock) arises from the lack of an approved UK plug and the supply of an adaptor to permit the product to be plugged into the supply.

The test report indicates that:

The travel adaptor does not create a connection with the earth pin. The product itself has adequate earthing to the Australian plug face

It is estimated that this particular harm scenario will be the highest risk (probability multiplied by severity) for this product, as the information indicates that it is present on all units supplied and basically means that the product only has one level of protection. Legislation and best practice indicates that all electrical products must have redundancy of protective measures.

Other risks not included in this scenario include:

- Risk of fire starting in the appliance through malfunction or thermal action.
- Electric shock arising from the action of inserting or removing the plug from the socket outlet.
- Thermal or other risks arising from lack of English language instructions or operational indicators leading to increased risk of foreseeable misuse, for example drying wet clothes on the product.

Whilst a fire risk arises from the use of this adaptor, it is suggested that the extent of this risk is more difficult to determine on the basis of the available information, because a key variable to the risk is the unit's behaviour during wear, tear, use and abuse. In contrast, the lack of an effective earth leads to the probability of electric shock under fault conditions for all units which are used with this adaptor and does not rely on the unknown variable of the adaptor's conditions of use.

In addition, the plug face does not have the dimensional protections in terms of creepage distances as is required in the UK and this presents additional risk when inserting and withdrawing the adaptor from the socket, particularly with wet hands

and the like, but again it is suggested that this is not the primary risk when the appliance itself can be considered not to be earthed.

Consideration of these other risks and the associated harm scenarios may be required if the initial harm scenario does not indicate a clear and serious risk.

Simply, if we make the assumption that the adaptor will always be used, then the further steps leading to injury are:

Step 1: A fault occurs within the product at some point during its lifetime, which leads to energisation of the appliance's metal frame.

Step 2: The user, or somebody else, touches the appliance, either while it is in use or to switch it on or off. The electrical installation it is plugged into is such that the secondary protection residual current device, designed to limit hazardous currents which users can be exposed to, to 30mA, is either not working or not present. An electric shock therefore results.

Step 3: The electric shock results in injury.

5. SEVERITY OF HARM

In this harm scenario the user is likely to receive a significant electric shock, which could have life altering or fatal consequences. Note that even where the installation's protective systems (RCD for example) are in place and effective, there is still the possibility that the limited current shock will cause harm (depending on the health of the person exposed and what they are standing on etc), but this is much less likely, so therefore this scenario will not be further considered.

Other methods of usage which will mitigate the identified risk, such as plugging the product in to another adaptor or cutting off the plug and replacing it with a BS 1363 plug, are discounted for the purposes of this analysis because whilst possible, it is unlikely that this action would be taken in all but a very few cases.

This scenario can foreseeably result in a level 4 injury. Electric shock above levels presented by current limiting devices result in serious burns, disruption or even ceasing of the heart rhythm and other serious and potentially life changing injuries.

6. PROBABILITY OF HARM

The following probabilities can be estimated using the available data and knowledge of human behaviour:

Step 1: A fault occurs within the product at some point during its lifetime, which leads to the energisation of the appliance's metal frame.

This is difficult to determine with any certainty and is dependent on the product's design and construction, the demographic of the user, and the number of times it is used, moved or handled. A rough estimation is that in approximately 10% of instances a fault which would utilise the earthing protection will occur during the product's lifetime. This could result from the product getting damp or wet, internal conductors becoming detached, a fault in the heating element running to earth, and a number of other causes besides. Each one would necessitate a low impedance path to earth to protect the user, which this appliance does not have when plugged into the electricity supply via the travel adaptor it is supplied with.

If the appliance did have an effective earthing circuit this would be the type of fault which leads to the tripping of any residual current device present.

This is the step in the injury scenario with the greatest uncertainty and can be adjusted as part of a sensitivity analysis as necessary.

Probability: 0.1

Step 2: The user, or somebody else, touches the appliance, either while it is in use or to switch it on or off and the electrical installation that the product is plugged into is such that the secondary protection residual current device, designed to limit to 30mA the hazardous currents which users can be exposed to, is either not working or not present. An electric shock results.

It is almost inevitable that the user will touch the appliance at some point during its use, either to move or adjust it or to operate the controls. The fault (which would run to earth in circumstances where the protection is present) would not be apparent and would be unlikely to stop the appliance operating.

This probability of electric shock can be determined by reference to statistics which are kept in the UK and which are available via an open access internet search. Multiple variables all lead to the same absence of this secondary protection, and this can be estimated to be within the region of 5%, which is a combination of those older properties which have not yet been rewired with modern consumer units and those which have ineffective residual current protection. Whilst potentially an underestimate, this is illustrative and can be adjusted as part of a sensitivity analysis as necessary.

Probability: 0.05

Step 3: The electric shock results in injury.

The probability of the electric shock resulting in a very severe (level 4) injury would depend upon such factors as the physiology and state of health of the person affected, the nature of the contact including the part of the body coming into contact with the appliance and the resultant pathway of the current through the body, the person's ability to release from the contact (let go), whether the skin at the point of contact is dry or moist, and the floor material on which the person is standing. The likelihood of the shock producing a level 4 injury is estimated to be 50%.

Probability: 0.5

Compound probability = 0.1 x 0.05 x 0.5 = 0.0025

7. LEVEL OF RISK

This is a relatively simple injury scenario based on a three-step approach. It is simplified but is illustrative of the risk, and multiplying the probabilities of the three steps provides a 0.0025 (or 1 in 400) probability of a level 4 injury. Other risks arising from damage to the adaptor and resistive heating, or electric shock hazards present in the shape of it which lead to risk, have not been assessed on the basis that the assessed risk (with reference to Table 3 of PRISM) is **serious** and therefore the necessary action will arise from this assessment. Since the total number of product items in use is not known and in this case cannot be reasonably estimated, it is not possible to adjust the risk level to account for product prevalence.

8. UNCERTAINTY

Although there are only three steps in this injury scenario, the first has significant uncertainty attached to it as there is both a behavioural and a product component to the risk. Faults can and do occur in earthed appliances during their lifetime and this depends on construction, use, storage conditions, environmental conditions and a range of other factors. When faults do occur these are generally unreported because RCDs activate without harm to the user, and the product is considered broken and disposed of. Therefore any probability is an estimate, but is an informed one based on experience of electrical products and user behaviours.

Overall, this risk assessment has a **medium** level of uncertainty.

Sensitivity Analysis

Step 1 of the harm scenario has the greatest uncertainty, and if the probability is reduced by a factor of ten this gives a step probability of 0.01 and a risk outcome probability of 0.00025 or 1 in 4,000, which at severity level 4 remains **serious risk.**

RISK EVALUATION

This product presents a serious risk. In single fault conditions within the product, if there are either fault conditions on the installation or it has not been modernised with appropriate protective devices, this can lead to serious injury or even death for anyone touching it. It is necessary to touch the appliance to operate it.

Further, there is the potential for an increased probability of this product being used in circumstances where the installation may not have been modernised, because such heating products are more likely to be used in properties where central heating is absent. In addition, it is suggested that such products are more likely to be used by older people, and in turn their properties are less likely to have been modernised with protective measures within the installation. Because a product of this nature should present only a low risk when fully compliant, the risk differential in this case is significant.

Serious risks are normally considered intolerable, and this case is no exception. It cannot be tolerable that a necessary protective measure is absent from an electrical device, and that potentially vulnerable people are placed at serious risk because of it. In reality all individuals can be considered vulnerable to this particular risk, as there can be no hazard recognition. Some form of corrective action (most likely a recall) will therefore be necessary and will need to be carried out diligently to ensure that the risk is reduced to a tolerable level.

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