

## Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals

Sub-Committee of Experts on the  
Transport of Dangerous Goods

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Item 2.(A) of the provisional agenda

**Listing, classification and packing : Proposals of amendments to the  
list of dangerous goods of Chapter 3.2**

### Transport of Heat Pipes

Transmitted by the expert from Spain

#### Background

1. Ibérica del Espacio, S.A. is a high tech Spanish company working in the Aerospace sector that mainly offers its services in the field of thermal control for satellite applications. For several years now Ibérica del Espacio S.A. manufactures a wide range of products under the general name of “Heat Pipe”, designed specifically to the customer’s demand and specifications.
2. A Heat Pipe is a heat-transfer device that combines the principles of both thermal conductivity and phase transition to efficiently manage the transfer of heat between two solid interfaces. At the hot interface within a heat pipe, which is typically at a very low pressure, a liquid in contact with a thermally conductive solid surface turns into a vapor by absorbing heat from that surface. The vapor condenses back into a liquid at the cold interface, releasing the latent heat. The liquid then returns to the hot interface through either capillary action or gravity action where it evaporates once more and repeats the cycle. In addition, the internal pressure of the heat pipe can be set or adjusted to facilitate the phase change depending on the demands of the working conditions of the thermally managed system. Commonly, the fluids used for this purpose are Propylene (UN1077), Toluene (UN1294) and Anhydrous Ammonia (UN1005).
3. Due to the very strict requirements in terms of material selection, performance, quality control, reliability and service life imposed by satellite manufacturers, every single Heat Pipe unit is tested to the highest standards (the pressure requirements are even more restrictive than those for any approved ADR container) to guarantee its operation for the complete satellite life of 15-18 years.
4. Therefore a Heat Pipe may be viewed not only as a piece of equipment containing a gas, but also as the primary container for transportation purposes.
5. Nowadays, some of the gases mentioned above can be air transported both under their own UN number (referring to the gas as a “raw material” packaged inside an approved ADR container) or under an alternative UN number (UN3363 for instance) when included as a working fluid in apparatus.

6. Only Anhydrous Ammonia (UN1005) is forbidden for air transport so the operator can only apply for a special disposition A2 under very particular conditions.
7. In addition, Heat Pipes are neither included under any of the current UN numbers listed by ICAO nor regulated by the DIRECTIVE 97/23/EC for pressure equipment due to the little amount of gas they contain.
8. To warranty the safe working and storage of the Heat Pipes manufactured by Ibérica del Espacio, S.A., the company has developed a complete manufacturing and testing procedure which is much more demanding than the existing regulation for any pressure equipment for any industrial application if the amount of gas was enough to be considered.
9. Apart from the safety level provided by the Heat Pipe itself, acting as the primary container for the gas, the equipment is further protected against external factors such as impacts, dust, humidity, etc ... by an external container ATA 300 Cat I/II/III.

## Proposal

10. These products are safe for transport but, due to the lack of provisions that can apply to them, they are classified under UN numbers which are not really applicable to them. With the aim to transport these products in the safest way possible, we are seeking for solutions that can solve the problem. We seek advice from the TDG as regards of creating a new UN number, UNXXX HEAT PIPE, defining this as an apparatus containing any kind of fluid (including eventually forbidden gases) below a certain quantity, and subject to very strict manufacturing, testing and packaging requirements approved by the main institutions in the aerospace industry.
11. This new UN number might be used for the transportation of Heat Pipes containing certain Division 2.1, 2.2 and 2.3 liquefied and compressed gases.
  12. The provisions to be applied will be:
    - Packaging: The components of spacecraft are over-packed in a container according to ATA 300 Cat I/II/II.
    - Gas amount: Not to exceed 1 Liter / 1 Kg per Heat Pipe.
    - Testing: Welds must be radiographically inspected and certified by a third authorized party.
  13. Pressure Pneumatically tested to pressure at least 1.5 times the vapour pressure of the lading at 100° C (212° F) without failure and must have a minimum burst pressure of at least 1,400 psig.
  14. The aim of this document is to acknowledge the Sub-Committees input on this issue and consider whether Spain shall put forward a proposal in the next meeting.