Design Concept of Package Stowage and Retention Systems During the Road and Sea Transport

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1. Introduction

This paper describes the design concept of package stowage and retention systems, such packages should be restrained from movement within or on the conveyance during the transport operation, as required by the transport mode and regulations. The components of the package, its contents and their respective retention systems shall be designed so that the package integrity will not be affected under routine conditions of transport.

2. Design Concept and Requirements of Package Stowage and Retention systems

The integrity of the package shall not be impaired by the stresses imposed on the package or its attachment points by the tie-downs or other retention systems under either normal or accident conditions of transport accordance with the competent authority and regulations (Fig. 1. Package retention systems) [1].

In particular, the accelerations derived from routine conditions of transport should not cause any component of the package or its retention system to yield. Table 1 gives an indication of the magnitude of the acceleration factors which might be used for the design of the package and its retention system for routine conditions of transport. The values given for each mode would be in accordance with most national and international regulations. Table 2 details a limited number of such packages and other examples. And the specific systems, such as tie-down and lifting device that are structural parts of a package must consider its acceleration factors as follows [2, 3];

- Tie down : Longitudinal(10g), Lateral(5g) Vertical(2g)
- Lifting device : Vertical(3g)

Table 1. Acceleration factors for package retention system design [1]

Mode	Acceleration factors		
	Longitudinal	Lateral	Vertical
Road	2 g	1 g	2 g up, 3 g down
Rail	5 g	2 g	2 g up, 2 g down
Sea/ water	2 g	2 g	2 g up, 2 g down

3. Conclusion

This paper describes the design requirement of package stowage and retention systems. Also the package designers and users to ensure that the package systems were designed in compliance with those values specified by the relevant competent authorities and organizations. We are now

performing the research project, “development evaluation technology for vibration and shock load characteristics and PWR spent nuclear fuel integrity under normal conditions of load and sea transport” during 2018 to 2023. On the basis of survey and analysis above, development of the road and sea transport systems and related technologies that can be used optimally will be available.

Table 2. Acceleration factors for package retention system design for specific packages [1]

Type of package	Acceleration factors		
	Longitudinal	Lateral	Vertical
Certified fissile and Type B(U) or Type B(M) packages in the USA	10g	5g	2g
Radioactive material packages in Europe by rail	4g(1g)	0.5g	1g±0.3g
Carriage of irradiated nuclear fuel, plutonium and high level radioactive waste on vessels	1.5g	1.5g	1g up 2g down
Domestic barge transport of radioactive material packages by Sea/water	1.5g	1.6g	2g

Fig. 1. Package stowage and retention systems (Examples, AREVA TN).

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REFERENCES

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