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Storage Guideline

Compatibility of Explosives: Types E, I, P, C, F, R and S

Explosives Regulatory Division
Explosives Safety and Security Branch
Lands and Minerals Sector

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Canada 

Introduction

This guideline is intended to assist licensees of the Explosives Regulatory Division (ERD) in determining the suitability for storage of multiple explosives together in the same licensed magazine. Please refer to the *Explosives Regulations, 2013* Subsection 36(2) for a description of the "Types" of explosives referenced in this document.

When different Types of explosives are stored in a licensed magazine, they must be compatible for storage. Some explosives are incompatible for combined storage, regardless of their Type. This document is to be used as a guide for the safe storage of explosives of Types E, I, P, C, F, R and S.

Explosives are deemed to be compatible if combined storage does not increase the likelihood of an initiation, or if there is an initiation, the magnitude of the effects. Additionally, there are regulatory requirements for the storage of explosives which must be met.

The objective of this document is to outline storage compatibilities based on the Types of explosives, as opposed to the compatibility groups for transport. Compatibility groups do not take into account the intended use of the explosive, and hazards to other explosives that arise based on the intended use. Storage based solely on compatibility groups can be more restrictive, or not restrictive enough. For example, Type E articles and Type I articles are not compatible, however, 1.4S articles (classification of many Type I articles) are considered safe for transport with most other transport compatibility groups. This example illustrates one of the discrepancies between the using the Types of explosives versus transport classifications for determining storage compatibility. This document intends to clarify all cases of storage compatibility.

The storage compatibility of Type D explosives is assessed on a case-by-case basis by the ERD. Please contact the ERD for further information regarding this Type of explosives. In most cases, Type D is assigned with the purpose of restricting access. Often, Type D explosives storage compatibility can be assessed based on an analogy with another Type of explosive outlined in the regulations. The guidance provided in this document is applicable to Type D products that are analogous to other Types of explosives.

Document Summary

This guideline has four tables:

- Table 1: Breakdown of the 12 groups of Type S explosives.
- Table 2: Storage compatibilities within Type S for each group.
- Table 3: Storage compatibility for Types E, I, P, C, F, and R.
- Table 4: Storage compatibility between Type S groups and Types E, I, P, C, F, and R.

A "Y" represents that two types/groups are compatible for storage, and an "N" signifies that they are incompatible. Notes found in Tables 3 and 4 are outlined at the end of the document.

Type S: Group Breakdown and Compatibility within Type S Products

Table 1, below, shows the 12 groups of Type S products. The groups are derived from the transport classifications assigned to the explosives when they are authorized in Canada. These transport classifications are in line with the UN number based on the UN Recommendations on the Transport of Dangerous Goods: Model Regulations. The groups for Type S in Table 1 are based on the current list of authorized explosives in Canada, which is subject to change. If the authorized Type S product does not fit into one of the groups in this table, please contact the ERD.

Table 1: Type S Breakdown into Groups

	S.1							S.2						
Group	I	II	III	IV	V	VI	VII	I	II	III	IV	V	VI	VII**
Transport Class	1.3G	1.4B	1.4C	1.4E	1.4G	1.4S	NC1 *	1.1G	1.2C	1.3C	1.3G	1.4C	1.4S	NC1 *

* NC1 = Not Class 1

** Type S.2, Group VII are reactive targets and are dealt with based on the unique nature of the products

Table 2 outlines the compatibility of various Type S groups with other Type S groups. Due to the varied nature of Type S articles, some incompatibilities are present between groups. Table 2 can be found on the following page.

Table 2: Type S Compatibility with Other Type S Articles

	S.1							S.2						
Group	I	II	III	IV	V	VI	VII	I	II	III	IV	V	VI	VII
I	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
II	N	Y	N	N	N	Y	Y	N	N	N	N	N	Y	N
III	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
IV	N	N	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y	N
V	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
VI	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
VII	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
I	Y	N	N	N	Y	Y	Y	Y	N	N	Y	N	Y	N
II	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
III	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
IV	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
V	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
VI	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
VII	N	N	N	N	N	N	Y	N	N	N	N	N	N	Y

Storage Compatibilities for Types E, I, P, C, F, R and S

Storage compatibilities are broken down into two tables. Table 3 is for the compatibilities of Types E, I, P, C, F, and R, and all of their sub-types. Table 4 shows the compatibility of each subtype of E, I, P, C, F, and R with each group from Type S.

Table 3: Storage Compatibilities for Types E, I, P, C, F, and R

	E.1 ^{1, 3}	E.2	E.3	I	P.1	P.2	C.1 ⁵	C.2	C.3	F.1	F.2 ⁶	F.3 ⁷	F.4	R.1	R.2	R.3
E.1 ^{1, 3}	Y	Y	Y	N	Y ²	Y ²	Y	Y	Y	N	N	N	N	Y ²	Y ²	N
E.2	Y	Y	Y	N	Y ²	Y ²	Y	Y	Y	N	N	N	N	Y ²	Y ²	N
E.3	Y	Y	Y	N	Y ²	Y ²	Y	Y	Y	N	N	N	N	Y ²	Y ²	N
I	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
P.1	Y ²	Y ²	Y ²	N	Y	Y	Y ⁴	Y ⁴	Y ⁴	N	N	N	N	Y	Y	N
P.2	Y ²	Y ²	Y ²	N	Y	Y	Y ⁴	Y ⁴	Y ⁴	N	N	N	N	Y	Y	N
C.1 ⁵	Y	Y	Y	N	Y ⁴	Y ⁴	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
C.2	Y	Y	Y	N	Y ⁴	Y ⁴	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
C.3	Y	Y	Y	N	Y ⁴	Y ⁴	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
F.1	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N
F.2 ⁶	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N
F.3 ⁷	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N
F.4	N	N	N	N	N	N	Y	Y	Y	N	N	N	Y	N	N	Y
R.1	Y ²	Y ²	Y ²	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y ⁸
R.2	Y ²	Y ²	Y ²	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y ⁸
R.3	N	N	N	N	N	N	Y	Y	Y	N	N	N	Y	Y ⁸	Y ⁸	Y

Table 4: Compatibility of Type S Articles with Other Types of Explosives

	Type S.1 ⁹							Type S.2 ⁹						
	I	II	III	IV	V	VI	VII	I	II	III	IV	V	VI	VII
E.1 ^{1, 3}	N	N	Y ²	Y	N	Y ²	Y	N	N	Y ²	N	Y ²	Y ²	N
E.2	N	N	Y ²	Y	N	Y ²	Y	N	N	Y ²	N	Y ²	Y ²	N
E.3	N	N	Y ²	Y	N	Y ²	Y	N	N	Y ²	N	Y ²	Y ²	N
I	N	Y	N	N	N	N	Y	N	N	N	N	N	N	N
P.1	N	N	Y ^A	Y	N	Y ^B	Y	N	Y	Y	N	Y ^A	Y ^B	N
P.2	N	N	Y ^A	Y	N	Y ^B	Y	N	Y	Y	N	Y ^A	Y ^B	N
C.1 ⁵	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
C.2	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
C.3	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
F.1	Y	N	N	N	Y	Y	Y	N	N	N	Y	N	Y	N
F.2 ⁶	Y	N	N	N	Y	Y	Y	Y	N	N	Y	N	Y	N
F.3 ⁷	Y	N	N	N	Y	Y	Y	N	N	N	Y	N	Y	N
F.4	N	N	N	N	N	Y	Y	N	N	N	N	N	Y	N
R.1	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
R.2	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
R.3	N	N	N	N	N	Y	Y	N	N	N	N	N	Y	N

Notes for Compatibility Tables

1. Type E primary explosive substances must be segregated from all other explosives.
 2. Products can be stored together as long as all articles and substances have passed UN Test Series 3.
 - UN Test Series 3 results show whether a substance or article is suitable for transport. Any article/substance that does not pass UN Test Series 3 is too sensitive for Transport.
 - If an article or substance is packaged for transport, then it has passed Test Series 3.
 - For example, if PETN is being processed and is stored in a drying building or has been dried, it would no longer pass Test Series 3.
 3. Type E.1 articles of UN Number UN0359 must be stored separately from all other articles.
 4. Types P and C can be stored together, if stored separately from one another (for example, separated by a wooden barrier).
 5. Type C.1 articles of UN Number UN0338 can only be stored with other Type C articles.
 6. Type F.2 articles of UN Numbers UN0333, UN0334, UN0335 and UN0336 can only be stored with other Type F.1 or F.2 articles.
 7. Type F.3 articles of UN Number UN0255 can only be stored with other Type F.3 articles.
 8. Type R.3 explosives can be stored with other Type R explosives, as long as they are separated from one another (for example, separated by a wooden barrier).
 9. Type S (S.1 and S.2) articles that are initiators are not to be stored with Type E explosives.
- A. Type S.1, Group III and Type S.2, Group V can be stored with Type P, if stored separately from one another (for example, separated by a wooden barrier).
- B. Type S.1, Group VI and Type S.2, Group VII can be stored with Type P, if stored separately from one another (for example, separated by a wooden barrier).

N.B.: Consult with an explosives inspector from the Explosives Regulatory Division for guidance on the storage of explosive substances which have not passed all UN Test Series 3.