

NAPIM Guidelines to DOT Regulations for Shipping Flammable and Combustible Materials[©]

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**NAPIM GUIDELINES TO DOT REGULATIONS
FOR SHIPPING
FLAMMABLE AND COMBUSTIBLE MATERIALS**

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GUIDELINES FOR COMPLIANCE WITH DOT REGULATIONS HM 181 REVISION Title 49 CFR 100-199

INTRODUCTION

In December 1990, the U.S. Department of Transportation (DOT) promulgated comprehensive new regulations for transporting hazardous materials. These new rules will affect all ink manufacturers to some degree, but will have the greatest impact on manufacturers of liquid inks. Known as HM-181, this complicated rule was published in the Federal Register of December 21, 1990 (55FR52402) covering 327 pages. The purpose of these guidelines is to acquaint printing ink manufacturers with the general provisions of the new DOT rules.

Ink manufacturers are cautioned that these guidelines are not meant to provide a detailed statement of the actual regulations. They are presented here only for the general guidance of ink manufacturers, especially for personnel in formulating and manufacturing departments, but are not a substitute for reading the regulations themselves. It is suggested that personnel concerned with complying with shipping regulations should familiarize themselves with the content of the DOT regulations. Failure to comply with DOT regulations pertaining to shipment of flammable and combustible materials can result in fine or imprisonment.

In general, these guidelines outline the requirements for packaging, labeling, marking and placarding of flammable and combustible materials. They also summarize special new rules: Or testing performance packing, shipper registration, and employee training. There are special exceptions for limited quantities in surface transportation and these exceptions are also summarized herein. "Tote" tanks are portable tanks under the regulations and require special attention for combustible materials.

EFFECTIVE DATES

The Rule became effective October 1, 1991 for sea and air transport. Voluntary compliance is permitted for ground transportation in the U.S. with the following extended times for compliance.

October 1, 1993 - Classifications on hazard communication provisions become effective.

October 1, 1994 - Standard must be met by package manufacturers.

October 1, 1996—Full Compliance for all shippers.

REFERENCES

These guidelines refer to DOT regulations contained in the "Code of Federal Regulations, Title 49" and appear in Parts 107-179. Members should obtain copies of 49CFR from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Visit <http://hazmat.dot.gov/pubs/pubs.htm> for additional information.

Parts 107-177 contain rules for shippers and carriers for handling hazardous material and are summarized in Table 172.101. Parts 178 and 179 basically contain DOT requirements for performance packaging and details on their construction and testing.

DEFINITIONS

The following definitions are taken from Part 171.8 and should be useful in understanding the regulations as they are

used in the DOT text.

Flash Point is the minimum temperature at which a liquid gives off vapor within a test vessel in sufficient concentration to form an ignitable mixture with air near the surface of the liquid. Standard tests used are Pensky-Martens Closed Tester (ASTM D93); Setaflash Closed Tester (ASTM D3278), or Tag Closed Tester (ASTM D56).

Flammable Liquid is any liquid having a flash point of not more than 60.5°C (141°F) with certain exceptions (See 173.120(a)(1)). Except when offered for transport by vessel or aircraft, a flammable liquid with a flash point at or above 38°C (100°F) that does not meet the definition of any other hazard class may be reclassified as a combustible liquid (See 173.120(b)(2)).

Combustible Liquid is any liquid that does not meet the definition of any other hazard class and has a flash point above 60.5°C (141°F) and below 93°C (200°F).

Limited Quantity is the maximum amount of a hazardous material for which there is a specific labeling and packaging exception.

Portable Tank is any bulk packaging over 110 gallon capacity designed primarily to be loaded onto a transport vehicle, and equipped with skids to facilitate handling of the tank by mechanical means. (Paraphrased - See 171.8.)

Viscous Liquid is a liquid material which has a measured viscosity in excess of 2500 centistokes at 25°C (77°F) when determined in accordance with ASTM D45-72 or ASTM D1200-70.

LIMITED QUANTITIES AND EXCEPTIONS (173.150)

The regulations provide certain exceptions for flammable and combustible liquids. They primarily concern the labeling and packaging of small quantities of flammables; aqueous solutions containing 24% or less alcohol by volume, and flammable liquids with a flash point at or above 38°C (100°F) reclassified as combustible.

Limited Quantities of flammable liquids (Class 3) are excepted from labeling requirements (unless offered for transportation by aircraft) and from packaging requirements when package and combination packaging shipments of limited quantities are not subject to placarding. However, each package must conform to the packaging requirement of subpart B and may not exceed 30 kg (66 lbs) gross weight. The following combination packagings are authorized:

- For flammable liquids in Packaging Group I inner packagings not over 0.5 L net capacity each in strong outer packagings.
- For flammable liquids in Packing Group II inner packagings not over 1.0 L (0.3 gallon) net capacity each, packed in strong outer packagings.
- For flammable liquids in Packing Group III, inner packagings not over 4.0 L (1 gallon) net capacity each, packed in strong outer packagings.

Aqueous Solution of Alcohol containing 24% or less alcohol by volume and no other hazardous material may be reclassified as a combustible liquid and is not subject to the packing requirements if it contains no less than 50% water (e.g. fully exempt). Note: A solution is defined in 171.8 as any homogeneous mixture of two or more chemical compounds or ele-

ments that will not undergo any segregation under conditions normal to transportation.

Flammable Liquids, as noted elsewhere in these guidelines, with a flash point at or above 38°C (100°F) and below 60.5°C (141°F) may be reclassified as combustible liquid except for transportation by vessel or aircraft. A combustible liquid that is in bulk packaging is excepted from packaging requirements but must comply with requirements for shipping papers, marking, identification numbers and placarding. Combustible liquid that is not classed as a hazardous substance (see below) is completely excepted if it has a flash point above 93°C (200°F).

Reused And Reconditioned Packagings and empty containers which had contained hazardous materials must conform to non-bulk packaging requirements and must meet the requirements of Sections 173.28 and 173.29.

HAZARDOUS MATERIALS TABLES **(172.101)**

Table 172.101 lists materials designated as hazardous materials for the purpose of transportation. For each listed material the table identifies the hazard class and the proper shipping name. In addition, the table references requirements pertaining to labeling, packaging, quantity limits on aircraft, and other information.

Hazardous Substance - In addition to hazardous materials listed in Table 172.101, Appendix A in this section lists materials which are also designated "hazardous substances." Hazardous substances are materials which were previously listed by CERCLA (SARA Title III) as hazardous substances for which spills above a reportable quantity must be reported. Appendix A also

lists the reportable quantity under SARA Title III. Some ink ingredients, such as toluene, are listed.

Flammable Ink is listed as Printing Ink, flammable, 3, UN1210, PGI, PGII or PGIII.

Combustible Ink is not listed in 172.101, which means that no specific shipping name is given for these materials. Section 172.101 (d)(4) permits flammable ink reclassified as combustible to be listed as Printing Ink, combustible, UN1210. DOT has informed NAPIM orally that this label may be used for other combustible printing inks. If a shipper elects to use the designation "Combustible Liquid N.O.S.," the ingredient(s) which give it a flash point in the combustible range must be identified.

SHIPPING PAPERS (172.202)

All shipping papers for regulated materials must indicate the five elements of the basic description:

1. The proper shipping name
2. The hazard class
3. The UN identification number
4. The packing group (PG)
5. The total quantity (weight or volume) of material covered by the description. Quantity must be expressed in SI (Metric) units.

For example, "PRINTING INK, FLAMMABLE, 3, UN1210, PGII," OR "INK, 3, UN1210, PGII." For other proper shipping names, hazard classes and UN identification numbers see 172.101.

For combustible materials (Totes and tank cars or trucks ONLY) the shipping paper would read, "Ink, Printer's, Combustible, UN1210." Remember, combustible materials in packagings of 110 gal-

lons or less are not regulated and are not subject to the shipping paper requirements.

One additional requirement. If the shipment is a limited quantity (see page 2), the words "Limited Quantity" or "LTD QTY" must follow the basic description. For example, a one pint sample of flammable ink must be described on the bill of lading as, "Ink, 3, UN1210, PGII, LTD QTY."

Shipping documents for regulated materials must include a certification that materials are properly classified, described, packaged, marked and labeled in accordance with applicable regulations. For exact wording of the shipper certification, see 49 CFR 172.204(a) and exceptions in 172.204 (b).

Note that shipping documents for AIR shipments require, in addition to the air bill, a "SHIPPER'S DECLARATION FOR DANGEROUS GOODS". Air transportation is significantly different from surface transportation of hazardous materials and requires a thorough understanding of the regulations published by the INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA). The quantities which may be air transported are severely limited. The limit for flammable ink is five liters on passenger aircraft and 60 liters on cargo aircraft. Many carriers will only accept hazardous materials tendered under the IATA regulations. (Ask your carrier for details).

Finally, many shipments are made by United Parcel Service (UPS). This company has its own "Hazardous Materials Guide" (red book) and it differs somewhat from the 49 CRF regulations. The principal difference is in the

packaging of hazardous materials. It is suggested that the UPS representative be contacted for this publication.

MARKINGS (172.301)

All containers of flammable liquids, regardless of quantity are required to be marked with the "Proper Shipping Name" (PSN) and the "Identification Number" (ID) for the material being shipped. For example, "Ink, Printer's, Flammable, UN1210" or "Flammable Liquid, N.O.S., UN1993."

Appropriate DOT markings are also required when shipping combustible liquids in containers over 110 gallons capacity (totes). For example, "Ink, Printer's, Combustible, UN1210." For flammable liquids in non-bulk containers, ie., drums, the usual methods of markings are stenciling; incorporation on the product label, or by using a combination hazard class label. (See Labeling below).

For flammable liquids and combustible liquids in bulk containers (Totes), either of three methods may be used:

1. Stencil the proper shipping name and ID number on two opposing sides of the tank with letters and numbers at least 2 inches in height.
2. Display orange panels (see 172.332) with the ID number of the material on two opposing sides of the tank along with the proper shipping name.
3. Display placards with the ID number included across the center area (see 172.332) in association with the proper shipping name.

There are no specific requirements regarding the size of the letters and numbers when marking drums and pails

containing flammable liquids (e.g. inks). Portable tanks, however, require letters and numbers at least 2 inches in height if option (1) above is used. The orange panels and/or the placards in (2) and (3) above require 3.9 inch numbers. See the referenced CFR sections for other dimensions.

Tank trucks (cargo tanks) do not require the proper shipping name to be marked on the vehicle, but do require the ID number to be displayed. This is usually accomplished by using "numbered" placards. (See PLACARDS below).

LABELING (172.400)

Except as indicated under "Limited Quantities & Exceptions," all outside packagings of flammable liquids (class 3) must be labeled with a DOT "Flammable Liquid" label placed near the marked Proper Shipping Name (see Markings). For Tote tanks, two labels must be used, one each on opposite sides or ends (172.406(e)(4)). Placards may be used instead of labels on tote tanks (see Placards).

No DOT labels are required on:

- Limited quantities of flammable liquids
- Combustible liquids with flash points at or above 60.5°C (141°F) and below 93°C (200°F).
- Flammable liquids with a flash point above 38°C (100°F) reclassified as combustible.
- Printing inks with flash points above 93°C (200°F).

DOT labels are available from many label supply houses. These suppliers offer combination labels which incorporate the proper shipping name and the UN or NA identification number on the same hazard class DOT diamond. In this way the application of the one label satisfies the marking re-

quirements discussed elsewhere in these guidelines. However, a combination label will not satisfy the marking requirement for tote tanks.

PLACARDS (172.504)

Flammable Liquids - "Flammable" placards are required on transport vehicles carrying over 1,000 pounds of drums, portable tanks (Totes), and tank trucks. The ID number markings requirement for portable tanks and tank trucks is usually met by using "numbered" placards.

Combustible Liquids - "Combustible" placards are required on transport vehicles carrying portable tanks (Totes), other containers of over 110 gallons capacity, and tank trucks of combustible liquids. The ID number marking requirement is usually met by using "numbered" placards. Drummed combustible materials do not require placards on the transport vehicle regardless of the aggregate weight. Keep in mind that transport vehicles carrying either flammable or combustible materials in portable tanks (Totes) must have both the ID markings on the containers and the "numbered" placard on the vehicle. Drum shipments of flammable materials require only the "flammable" placard on the vehicles. It is the shipper's responsibility to provide the proper placards.

PACKING GROUP (173.121)

Printing ink shipped under the shipping name, "Ink, Printer's Flammable" (Class 3) must be packaged in either Packing Group I, Group II or Group III, depending on flash point and initial boiling point.

Packing I must be used for printing inks with an initial boiling point of 35°C (95°F) or less.

Packing Group II must be used for printing inks with a flash point of less than 23°C (73°F) and initial boiling point of greater than 35°C (95°F).

Packing Group III may be used for printing inks with flash points equal to or greater than 23°C (73°F) and equal to or less than 60.5°C (141°F) with initial boiling points of more than 35°C (95°F) (See Table I, page 8).

Packaging requirements do not apply to combustible liquids in non-bulk packaging or, except for transport in vessels or aircraft, to materials reclassified as combustible in 173.120(b)(2) as explained above.

There is a special provision allowing the use of Packing Group III in containers of less than 7.9 gallons set forth in 173.121(b)(1). It involves a complicated relationship among viscosity, flashpoint, and toxicity. It can be avoided by the use of Packing Group II for materials with a flash point less than 23°C (73°F).

NON-BULK PACKAGING (173.202 & 203)

Flammable printing ink in either Packing Group II or Packing Group III may be shipped in a variety of containers set forth in Sections 173.202 and 203. The most common of these are:

- Open head metal containers (including kits) -IA2
- Closed head metal containers - 1 A 1 .
Open head plastic containers (including kits)- IH2

Specifications for these performance packing classes are set forth in Section 178.504 for steel containers and 178.509 for plastic containers. The container supplier must meet the specifications and performance testing requirements by October 1, 1994. Shippers (ink companies) must use these

performance packings by October 1, 1996. A reused container must be recertified (See 178.503(c)).

TOTE TANKS (173. 242 & 243)

Flammable printing inks in Packing Groups I, II or III in Totes must be shipped in DOT 51, 52, 53, 56, 57, or 60 portable tanks; 1M 101 and 102 portable tanks, or marine portable tanks conforming to 46 CFR Subpart 64.

RESPONSIBILITY FOR TESTING (178.600 - 609)

It is the joint responsibility of the shipper and packaging manufacturer to assure that each package offered for transportation is capable of passing prescribed performance tests. The shipper is responsible for proper closure and for shipping the package in the same configuration as tested. Copies of the test results should be on file at the shipper's headquarters.

Subpart M of Section 178 sets forth the performance testing of non-bulk packaging including tests for drop, leak proofness, hydrostatic pressure and stacking. Drop tests must be performed with the container full, either of the material to be shipped or with water. If water is used, the container manufacturer must be informed of the specific gravity of the material to be shipped, since different drop heights are required according to the specific gravity of the shipped material. It should be noted that it is the shipper's responsibility to ensure that the package meets the standards and tests for the packing group required for his product for both new and reconditioned containers.

DOT REGISTRATION FOR HAZARDOUS MATERIALS SHIPMENTS 107.601 & 606

Any person who offers for shipment or transport any hazardous materials in quantities as specified below must file a registration statement. Registration applies to any company that offers for transport or transports in a bulk packaging, container or tank having a capacity equal to or greater than 13,248 L (3,500 gallons) or more than 468 cubic feet; or a shipment of 2,170 Kg (5,000 lbs) gross weight of any hazardous materials for which placarding is required. For this rule, the term "shipment" is limited to the hazardous material being loaded at one loading facility. See Sections 107.601(a) (b)&(c). Prior to July 1, 1993, a bulk packaging, container or tank of less than 3,500 gallons is totally exempt. After July 1, 1993, containers of less than 3,500 gallons are covered if they weigh 5,000 pounds or more.

Registration Requirement (107.608)

The registration statement is designated as Form DOT F5800.2. It may be obtained from the Hazardous Materials Registration Program, DHM60, U.S. Department of Transportation, Washington, DC 20590-0001 or <http://hazmat.dot.gov>. The registration statement must be filed annually by June 30, or prior to the first shipment of hazardous materials covered by this rule. Registration applies to companies and not to individual shipping points.

Record Keeping (107.620)

The following records must be maintained at the company's principal place of business for a period of three years, and made available for inspection by DOT upon request: A copy of the registration statement filed with RSPA; a copy of the check or credit card billing statement

showing payment of the registration fee; the Certification of Registration issued by RSPA. In addition, each transport vehicle used to transport hazardous materials subject to this rule must carry a copy of the current Certificate of Registration or another document bearing the registration number identified as the "U.S. DOT Hazmat Reg. No."

TRAINING (172.700 - 172.704)

Effective July 1, 1992, all employees involved in the handling of hazardous materials must receive both general safety and job specific training. The training program must address safe loading, unloading, handling, storing and transporting of hazardous materials and emergency response for accidents involving the transport of hazardous materials (See 172.704). Training programs established to meet the OSHA Hazard Communication Standard may be used to satisfy most of the requirements of this DOT rule. Retraining is required once every three years.

SECURITY PLANS (172.800—172.804)

Effective September 25, 2003 all persons or organizations involved in the transporting hazardous materials are required to implement written security plans and train employees in the elements of the plan. In general, these requirements apply to shipping of:

- Radioactive material
- Explosives
- Materials poisonously inhaled
- Hazardous material in bulk packaging (\geq 3500 gals)
- Toxins
- Materials requiring placarding under 49CFR subpart F
- Hazmat shipments in other than bulk packaging 5000 or more requiring

placarding under 49CFR subpart F
Contact the NAPIM office for more details.

DRIVER QUALIFICATIONS

When operating outside of the shipper's municipality or commercial zone thereof, the driver must comply with all qualifications and regulations set forth in 49 CFR, Parts 390-397 (MOTOR CARRIER SAFETY REGULATIONS). This document is available from:

Superintendent of Documents
GPO
Washington, DC 20402.

A complete Driver Qualification file may be obtained for a nominal cost from:

J.J. Keller, Inc.
145 W. Wisconsin Avenue
Neenah, WI 54956

Effective April, 1992, the nationwide Commercial Drivers License (CDL) is now in effect. A CDL is required for any person who operates a vehicle with a Gross Vehicle Weight Rating (GVWR) of 26,001 pounds or more; any vehicle, regardless of GVWR, carrying 16 or more people; or any vehicle at any GVWR carrying hazardous materials in quantity to require placarding.

GENERAL CAUTIONS

1. All shipping papers for hazardous materials must contain the basic description required by DOT regulations (see SHIPPING PAPERS page 3).
2. Shipping papers for COMBUSTIBLE materials only require the basic description when in packagings over 110 gallons.
3. DOT hazard labels and placards must correspond to the hazard class(es) of the material(s).
4. DOT regulations also apply to all ship-

ments of regulated materials in company-owned vehicles except that the certification is not required on the bill of lading.

5. PORTABLE TANKS have no exceptions and require full compliance.

SOLVENTS

It is the responsibility of each shipper to determine the flash point of the material shipped. The NPIRI Raw Materials Data Handbooks, Volume 1 and Volume 3, show flash points of all solvents used in the ink industry.

However, flash points, especially of mixtures, should be determined by actual test.

SPECIAL WARNINGS

1. Small amounts of alcohols or glycol ethers can lower flash points below 93°C (200°F).
2. Replacing Ethanol with Isopropanol or n-Propanol results in still lower flash points.
3. Ethyl Acetate and MEK are very close to 20°F. Mixtures of these solvents and alcohols or hydrocarbons may have flash points below -6°C (20°F) (Azeotropic phenomenon).
4. Petroleum distillates such as Heptane, Naphthas etc., should be treated with caution because they vary batch to batch and because they form azeotropes with some oxygenated solvents.

TABLE 1		
Class 3 Packing Group Assignment		
Packing Group	Flash Point(Closed Cup)	Initial Boiling Point
I	—	≤ 35° C (95° F)
II	<23° C(73° F)	< 35° C (95° F)
III	≥23° C(73° F) ≤60.5° (141° F)	< 35° C (95° F)

**TABLE II
PARTIAL LIST OF SHIPPING INFORMATION**

FLASH POINT (Closed Cup)	PROPER SHIPPING NAME	HAZARD CLASS	ID NUMBER	PACKAGING GROUP*	LABELS REQUIRED
Flammables	Printing Ink, Flammable	3	UN1210	I, II or III	Flammable Liquid
Less than 60°C (140°F)	Flammable Liquids, N.O.S.***	3	UN1993	I or II or III	Flammable Liquid
	Denatured Alcohol	3	NA1986	II or III	Flammable Liquid
	Alcohols, N.O.S.***	3	UN1987	I or II or III	Flammable Liquid
	Paint (including paint, lacquer, enamel, stains, shellac solutions, varnish, polish, liquid, filler and liquid lacquer base)	3	UN1263	I, II or III	Flammable Liquid
Flammables Reclassified as Combustibles Above 28°C (100°F) and Below 60°C (140°F)	Printing Ink, Combustible	Combustible	UN1210	III	(none)
	Combustible Liquid, N.O.S.***	Combustible	NA1993*	III	(none)
	Paint (as above)	Combustible	UN1993	III	(none)
Combustibles Above 60°C (140°F) Below 95°C (200°F)	Printing Ink, Combustible	Combustible	UN1210	III	(none)
	Combustible Liquid, N.O.S.***	Combustible	NA1993*	III	(none)
	Paint (as above)	Combustible	NA1993*	III	(none)
Above 93°C (200°F)	Not Regulated				

* NA ID Numbers are valid only for shipments in the US and Canada.

** See Packaging Group Assignment table to determine the correct Packing Group.

*** When this name is used, the solvent ingredients that give the item a flash point in the Flammable or Combustible range must be identified.