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INLAND TRANSPORT COMMITTEE

Working Party on Inland Water Transport

Working Party on the Standardization of
Technical and Safety Requirements in
Inland Navigation

(Twenty-third session, 19-21 March 2001,
agenda item 6)

**REQUIREMENTS OF MANOEUVRABILITY OF
INLAND NAVIGATION VESSELS**

**Transmitted by the Central Commission for the Navigation of
the Rhine (CCNR) and the Danube Commission**

Note: The Working Party at its twenty-first session invited Governments and river commissions to submit proposals on possibly reinforcing the text of chapter X concerning manoeuvrability prepared by the group of volunteers and approved by the Ad hoc group (TRANS/SC.3/WP.3/AC.2/2000/2) with specific basin-dependent manoeuvrability requirements (TRANS/SC.3/WP.3/42, paras. 16 to 18).

The CCNR resolution containing amendments to Chapter V of the Rhine Vessel Inspection Regulations (TRANS/SC.3/WP.3/R.99) concerning the manoeuvrability of high-speed vessels is reproduced below, together with the Recommendations of the Danube Commission concerning the technical and navigational characteristics of pushed convoys received from the two river commissions.

CENTRAL COMMISSION FOR THE NAVIGATION OF THE RHINE

PROTOCOL 21

High-speed vessels on the Rhine

**Amendments to the Rhine Vessel Inspection Regulations by means of
temporary requirements**

Resolution

The Central Commission,

concerned to encourage the development of modern modes of transport on the Rhine and to permit the operation of high-speed vessels without affecting the safety of traffic in general on the Rhine,

in order to ensure the identification of high-speed vessels in connection with the application of the Rhine traffic rules concerning them,

at the proposal of the Committee on the Inspection Regulations,

in accordance with article 1.06 of the Rhine Vessel Inspection Regulations,

adopts the amendment of articles 5.02 and 5.06 of the Rhine Vessel Inspection Regulations.

These amendments, as contained in paragraphs 1 and 2 of the annex to this resolution, shall be in force from 1 October 2001 to 30 September 2004.

Annex to protocol 21

1. *Article 5.02, paragraph 1, to read:*

“1. Navigability and manoeuvrability shall be verified by navigation tests. The following, in particular, shall be tested:

Speed (forward)	(art. 5.06);
Stopping capacity	(art. 5.07);
Navigability while going astern	(art. 5.08);
Capacity to take evasive action	(art. 5.09);
Turning capacity	(art. 5.10).”

2. *Article 5.06 is amended as follows:*

(a) *Heading to read:*

“§5.06

Speed (forward)”.

(b) *Add the following paragraph 3 to article 5.06:*

“3. The Inspection Commission shall check whether the vessel sailing light has the capacity to exceed a speed of 40 km/h relative to the water. If so, the following particular shall be included in paragraph 52 of the inspection certificate:

‘The vessel has the capacity to exceed a speed of 40 km/h relative to the water.’”

DANUBE COMMISSION

RECOMMENDATIONS CONCERNING THE TECHNICAL AND NAVIGATIONAL CHARACTERISTICS OF PUSHED CONVOYS

I. INTRODUCTION

The present Recommendations, which specify technical and navigational requirements for pushed convoys, contribute to increasing navigational safety and to creating favourable conditions for the development of push-towing. They generalize the experience acquired by the Danube countries in that domain on which the uniform, minimum standards stemming from the need to ensure navigational safety are based.

II. GENERAL PROVISIONS

2.1. Objectives and scope

The purpose of these Recommendations is to define the technical and navigational characteristics of pushed convoys.

These Recommendations shall apply on the Danube to all pushed-convoy vessels that will be built after the entry into force of the Recommendations.

2.2. Terms and definitions

The terms used in these Recommendations are fully in accordance with the terms and definitions contained in the Basic Provisions relating to Navigation on the Danube (DFND) and other documents adopted by the Danube Commission.

2.3. Relations with documents in force and the DFND

The provisions of these Recommendations are fully in accordance with the DFND and the local rules established by the Danube States and special river administrations and with other documents in force in the domain of push-towing. The provisions of these Recommendations derive from those of the above-mentioned documents and contribute to their uniform application.

III. TECHNICAL AND NAVIGATIONAL STANDARDS FOR PUSHED CONVOYS

The pusher shall always be sufficiently powerful and manoeuvrable to ensure safe upstream and downstream navigation for the pushed convoy; the technical and navigational characteristics of the pusher shall not be such as to hinder the movement of other vessels, in particular when passing through difficult sections (bends, shoals, bridges), and when overtaking, crossing or stopping.

3.1. Minimum speed

The pusher shall be able to maintain the convoy at a minimum speed of not less than 12 km/h in still water.

This condition is not required for pushers operating only in ports and roads.

3.2. Stopping distance and stopping time

The pusher shall be sufficiently powerful to bring the pushed convoy to a complete stop relative to the shore under the following conditions:

The distance travelled before stopping shall not exceed:

- upstream: 200 m or one convoy length;
- downstream: 600 m or three convoy lengths.

The stopping time of a convoy shall not exceed:

- upstream: three minutes;
- downstream: six minutes.

3.3. Manoeuvrability while going ahead

A pushed convoy shall have good manoeuvrability while going ahead, ensured by the pusher's capacity to keep a straight course and to change that course rapidly if necessary. The time required to put the rudder over from 40° on one side to 35° on the other using the main steering gear shall not exceed 28 seconds at a maximum speed of travel.

3.3.1. Capacity of the pusher to keep the convoy on a straight course

The time for which the convoy may be held on a straight course without the use of rudders shall be not less than one minute on average.

The number of course corrections required to keep the convoy on a straight course for five minutes shall be not more than five.

3.3.2. Capacity of the pusher to change the convoy's course rapidly

The time required to turn the convoy from a straight course by 10° and return it to the original straight course by putting the rudder over by $\pm 20^\circ$ shall not exceed five minutes when travelling upstream. In the case of evasive action, the distance required across the bed of the waterway shall not exceed 0.4 convoy lengths.

3.4. Manoeuvrability while going astern

A pushed convoy shall have adequate manoeuvrability while going astern and shall be capable of moving in the desired direction both when manoeuvring to stop and when prolonged movement astern is required for navigating reasons.

3.5. Capacity to effect lateral movement

The pusher shall, as far as possible, be capable of moving the convoy laterally, in a direction perpendicular to its axis, when, in the passage through narrows, shoals or bridges, during locking, overtaking or manoeuvring in ports or in accident situations, such a movement becomes necessary.

3.6. Turning time and turning space

The time required to turn a convoy through 180° shall not exceed 10 minutes. The turning space of the convoy shall not exceed 1.5 convoy lengths across the bed of the waterway, while drift downstream shall not exceed three convoy lengths. All means of ensuring turning manoeuvres should be used for this purpose.

METHODS FOR TESTING PUSHED CONVOYS

These methods of conducting tests and measurements to determine the technical and navigational characteristics of pushed convoys contained in Part III of the outline for the Recommendations on the subject, are designed to establish uniform principles for full-scale testing of pushed convoys.

Prior to testing, basic data relating to the pushed convoys and navigating conditions in the test area need to be determined.

During testing, a minimum of two sets of measurements of the parameters in question shall be taken, and the average value for each characteristic calculated. The analysis of the results obtained for each characteristic shall be based on the conclusions of the tests and the final values for the specific pushed convoy or standard convoy can thus be determined.

A. Basic data on navigating conditions in the test area

Full-scale tests shall be carried out on a straight section of the river where the flow is uniform and there is sufficient channel width and depth. Testing shall be conducted as far as possible, in calm weather or with wind speed not exceeding force two on the Beaufort scale.

The bank of the test area shall be equipped with intersection markers and, as far as possible, with range markers or buoys fitted with radar reflectors. The intersection markers shall be placed at specified distances from each other.

The characteristics of the navigating conditions at the test area shall include:

- location of the section (from km ... to km ...) and its length;
- date (day, month, year) and time of the test;
- weather conditions, visibility, wind speed and direction;
- water level at the nearest measuring post;
- average speed of current;
- average channel width;
- average channel depth.

B. Basic data on pushed convoys

Full-scale tests shall be carried out, as far as possible, with pushed convoys of maximum size navigating on the sector in question; the maximum dimensions shall be determined on the basis of practical experience, in the light of navigating conditions and the power and manoeuvrability of the pusher, while observing the conditions for navigational safety. On

sections where regulations govern the dimensions of pushed convoys, the size of the pushed convoy shall not exceed the prescribed maximum. The formation of the convoy, the number of units and the amount of the cargo to be carried should be chosen according to whether the direction of navigation is upstream or downstream.

Pushed convoy vessels being tested shall as far as possible be of the same type and of identical draught.

The characteristics of a pushed convoy are determined by the following:

- configuration of the pushed convoy;
- size of the pushed convoy (L_{\max} , B_{\max});
- displacement, deadweight of the pushed convoy and amount of cargo carried;
- data on the pushed vessels (L_{\max} , B_{\max} , $T_{\text{mean.eff}}$, D_{eff} , Q);
- data on the pusher (L_{\max} , B_{\max} , T_{\max} , N).

C. Methods for testing the various technical and navigational characteristics of pushed convoys

The distance and position of a pushed convoy during testing may be measured by means of range markers installed on the bank or by radar photography, whereby the images on the radar screen of the pusher are photographed at specific time intervals, or by any other means ensuring an accuracy of measurement of ± 10 m.

1. Speed

The speed of pushed convoys shall be measured moving both upstream and downstream, taking the following into account:

- (a) Preparation for testing:
- the length of the section to be navigated shall be, as far as possible, not less than 2 km;
 - before measurements are taken, the pushed convoy shall travel a distance of one kilometre with the pusher's engines at full power;
 - when the pusher's rudders are put over during testing, the deflection of the rudder blade shall not exceed $\pm 5^\circ$.

- (b) Values to be measured:
- distance travelled;
 - time required to travel this distance;
 - revolutions of the main engines.
- (c) Data to be calculated:
- speed of movement upstream relative to the bank;
 - speed of movement upstream relative to the water;
 - speed of movement downstream relative to the bank;
 - speed of movement downstream relative to the water.

The measurements of speed shall be used to determine the minimum speed of a pushed convoy relative to the bank in km/h which meets the conditions for safety of navigation even when passing through sections of the channel which are difficult to navigate.

2. Stopping distance and stopping time

These values shall be measured for convoys moving both upstream and downstream.

- (a) Preparation for testing:
- Before testing begins, the pushed convoy shall travel a distance of one kilometre with the pusher's engines at full power;
 - When the pusher's rudders are put over during testing, the deflection of the rudder blade shall not exceed $\pm 5^\circ$;
- (b) Values to be measured:
- revolutions of the main engines;
 - speed relative to the bank at the beginning of the tests;
 - time required:
 - to stop the engines when going full speed ahead;
 - to reverse the engines;
 - to put the engines into full speed astern;

- time required for the engines running at full speed astern to bring the convoy to a stop relative to the bank;
 - distance travelled relative to the bank, measured in periods of time, before the convoy is brought to a stop.
- (c) Values to be calculated:
- total distance travelled before stopping relative to the bank when navigating upstream;
 - total time required to stop the convoy relative to the bank when navigating upstream;
 - total distance travelled before stopping relative to the bank when navigating downstream;
 - total time required to stop the convoy relative to the bank when navigating downstream.

3. Manoeuvrability while going ahead

The evaluation of manoeuvrability while going ahead at full speed (100% of the rated power of the main engines), at medium speed (50% of the rated power) and at low speed (25% of the rated power), when navigating upstream and downstream shall consist in determining the ability of the pusher to keep the convoy on a straight course with minimum use of rudders, and its ability to change the convoy's course rapidly.

(a) Ability of the pusher to keep the convoy on a straight course

This ability shall be measured at full, medium and low speed upstream and downstream, and consists in the measurement of the following values:

- average time that a chosen course can be maintained without the use of rudders;
- number of turns of the rudder required to keep the convoy on the course specified and the average helm value over a period of five minutes.

(b) Ability of the pusher to change the convoy's course rapidly

This ability shall be measured at full and medium speed upstream, and consists in the measurement of the following values:

- time required to turn the convoy from its course by 10° by putting the rudder over 20°;
- time required to return the convoy to its original course and turn it from that course by 10° in the opposite direction by putting the rudder over 20° on the opposite side;

- time required to return the convoy to its original course by putting the rudder over up to $\pm 20^\circ$;
- distance covered, by periods of time;
- lateral movement of the convoy from the original straight course.

While navigating downstream, the above measurements shall be taken in the same way, except that the rudder shall be put over in varying positions of up to 20° , 30° and 40° .

The following may be determined from the measurements:

- the time required to turn the convoy by 10° , to turn it back, to turn it by 10° to the opposite side and to return the convoy to its original course;
- the distance travelled and the maximum lateral movement of the convoy while changing course.

4. Manoeuvrability while going astern

Manoeuvrability while going astern, upstream and downstream, shall be ensured by:

- the reverse rudders, or
- the forward and reverse rudders, or
- the rudders and engines.

Measurements of manoeuvrability while going astern are taken in the same way as those of manoeuvrability while going ahead, keeping in mind the maintenance of the chosen course and the ability to return to the original course after a turn; the difference between the tests lies in the fact that for the measurement of the manoeuvrability while going astern, the rudders may be put over to any position and the engines used.

On the basis of the analysis of the test results, the time for which the pushed convoy can maintain manoeuvrability while going astern by putting over the rudders and using the engines shall be determined.

5. Turning time and turning space

Turning ability shall be tested with pushed convoys in formation for upstream and downstream navigation by the following manoeuvres:

- 180° turn downstream;
- 180° turn upstream.

When turning manoeuvres are effected, any position of the pusher's rudders, any speed and any mode of operation of the main engines as well as the use of the bow rudder are permitted in order to turn as tightly as possible. The method of effecting this manoeuvre (position of the rudders, direction of the engines) shall be indicated for each kind of turn, and the following measurements shall be taken:

- speed relative to the bank before the tests;
- time required to turn through 180°;
- width of turning space, measured perpendicularly to the direction of the current;
- length of turning space, measured according to the direction of the current.

On the basis of the analysis of the test results, the following data shall be determined for the different cases:

- time required to turn through 180°;
- ratio of the width of the turning space to the length of the pushed convoy $B_0/L = \dots$;
- ratio of the length of the turning space to the length of the pushed convoy $L_0/L = \dots$.
