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SLS.14/Circ.458
21 May 2012

INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974

Equivalent arrangements accepted in accordance with regulation I/5

Communication by the Government of Sweden

The Secretary-General of the International Maritime Organization has the honour to transmit herewith the text of a communication by the Government of Sweden in respect of equivalent arrangements for the maximum rudder angle and time limit at full service speed required by regulation II-1/29.3.2, accepted by the Government of Sweden in accordance with regulation I/5 for the **Stena Danica** (IMO No.7907245).

The Secretary-General would be grateful if steps could be taken to bring this information to the attention of the appropriate authorities.

SWEDISH TRANSPORT AGENCY

Letter 1 (5)

Date
25 April 2012

Reference
TSS 2012-786

Copy to

International Maritime Organization
4 Albert Embarkment
LONDON SE1 7SR
United Kingdom

Notification of equivalence in accordance with SOLAS 74 chapter I, part A, regulation 5

The Government of Sweden by the Swedish Transport Agency has on 25th of April 2012 approved a flap rudder arrangement equipped with a system that limits the rudder angle to a maximum of 20 degrees, at speeds over 15 knots, as equivalent to the requirements in SOLAS chapter II-1, regulation 29.3.2 with regard to the maximum rudder angle and time limit at full service speed.

The approval is in accordance with the provisions of SOLAS chapter I, part A, regulation 5.

Name of ship:	STENA DANICA
Call sign:	SKFH
IMO number:	7907245
Ship type:	Ro-ro passenger ship

The Swedish Transport Agency hereby gives notification of the approval of the equivalent arrangement. Please find enclosed a report covering the equivalent arrangement and test results from manoeuvrability trials.

Yours faithfully

Tomas Åström
Deputy Maritime Director

Enclosure
Report of equivalence regarding rudder arrangements on Stena Danica

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SWEDISH TRANSPORT AGENCY

Date
25 April 2012

Reference
TSS 2012-786

Report of equivalence regarding rudder arrangements on Stena Danica

The Maritime department of the Swedish Transport Agency has in accordance with SOLAS 74 chapter 1, regulation 5, approved an equivalent solution to chapter II-1, regulation 29.3.2 on the ro-pax ferry Stena Danica, IMO no. 7907245. The approval also includes an equivalence to IMO resolution MSC.137(76) refered to by a non mandatory foot note in regulation 28.

Stena Danica is a 28727 gross tonnage ro-ro passenger ship having a length of 139,97 meters (length according to ICLL article 2(8)).

Background

Stena Danica has been rebuilt with the installation of new high-efficient flap rudders. Due to the increased lateral forces at full speed and full rudder angle, the steering gear do not manage to push the rudders back until the speed drops down and the pressure on the rudders decreases. Besides that the rudder arrangement cannot fulfil the time limit in SOLAS chapter II-1, regulation 29.3.2, it is not acceptable that the rudders when in the position of maximum rudder angle, can be locked in maximum turn, even if it is for a limited time. Due to this, a rudder angle limitation system has been installed, limiting the rudder angle to maximum 20 degrees at speeds over 15 knots.

Regulations

SOLAS chapter II-1, regulation 28 refers to the Standards for ship manoeuvrability MSC.137(76). This resolution should be used to evaluate the manoeuvrability performance of a ship and requires a turning circle manoeuvre, zig-zag manoeuvre 10°/10° and zig-zag manoeuvre 20°/20°. Turning circle manoeuvre to be performed with 35° rudder angle. .

SOLAS chapter II-1, regulation 29.3.2 stipulates that the steering gear shall be capable of putting the rudders over from 35° on one side to 35° on the other side with the ship at its deepest seagoing draught and running ahead at maximum ahead service speed and, under the same conditions, from 35° on either side to 30°on the other side in not more than 28 seconds.

Manoeuvrability trials

Manoeuvrability trials were conducted on the 26th of March 2012. Trials were performed at maximum service speed and with the rudder angle limitation system in use, i.e. for the turning circle manoeuvre the tests were performed with a rudder angle of 20°. All the tests were witnessed by the Swedish Transport Agency.

The Swedish Transport Agency has reviewed the results of the manoeuvrability trials performed. The result shows that even though the rudder angel is limited to maximum 20°, the ship meets all the recommendations for maneuverability in accordance with IMO resolution MSC.137 (76)). A short summary of the results is presented in table 1 to 3.

Table 1: Turning circle

Rudder 20° Speed ~20 knots	Advance [m]	Requirement advance (m/Lpp ≤ 4,5)	Tactic [m]	Requirement tactic (m/Lpp ≤ 5)
Port	512	3,8	521	3,9
Starbord	452	3,4	471	3,5

Table 2: Zig-zag 10°/10°

Rudder 10° Speed ~20 knots	1st overshoot [°]	Requirement 1st overshoot ≤ 10°	2nd overshoot [°]	Requirement 2nd overshoot ≤ 20°
Port	8	ok	9	ok
Starbord	8	ok	9	ok

Table 3: Zig-zag 20°/20°

Rudder 20° Speed ~20 knots	1st overshoot [°]	Requirement 1st overshoot ≤ 25°	2nd overshoot [°]	Requirement 2nd overshoot -
Port	18	ok	17	-
Starbord	22	ok	14	-

The ability to put the rudder from maximum angle from one side to the other side and vice verse, has been tested. These tests have also been performed with the rudder angle limitation system in use. Since the rudder angle is limited to maximum 20° they have no possibility to fulfil regulation 29.3.2. However, to be able to make a somewhat relevant comparison with the time limit requirement in regulation 29.3.2, the corresponding rudder angle velocity has been calculated, i.e. the requirement to turn the rudder from 35° on one side to 30° on the other side in under 28 seconds results in a required rudder angle velocity greater than 2.32 degree/seconds (°/s). The results from the tests are presented in table 4.

Table 4: Rudder test from 20° to 20° (SOLAS requirement for 35° to 30° on less than 28 seconds equals an requirement of an rudder angle velocity greater than 2,32°/s)

Speed ~20 knots	Time PS rudder [s]	Time SB rudder [s]	Requirement [≤ 28 s]	angle velocity PS rudder [≥2,32°/s]	angle velocity SB rudder [≥2,32°/s]
Port to starbord	15,4	16,0	ok	2,60	2,47
Starbord to port	15,1	16,2	ok	2,65	2,50

The performance of the new rudder arrangement including the rudder angle limitation system has been compared with the old rudder arrangement that did not have any limiting system. A comparison between the results of the turning circle test shows a small differences in manoeuvrability without any pronounced advantage or a disadvantage for the new arrangement. Results presented in table 5.

Table 5: Comparsion of manoeuvrability old and new rudders

Turning circle to starboard	Advance [m]	Advance factor [m/Lpp]	Tactic [m]	Tactic factor [m/Lpp]
Old rudder 35° at 21 knots	426	3,2	476	3,6
New rudder 20° at 21 knots	452	3,4	471	3,5
Turning circle to port side				
Old rudder 35° at 21 knots	463	3,5	583	4,4
New rudder 20° at 21 knots	512	3,8	521	3,9

Equivalence

The safety level for manoeuvrability performance is set by the combined requirements in SOLAS chapter II-1, regulation 28 and 29. Parts of the manoeuvrability tests in accordance with MSC.137(76) that regulation 28 refers to, are normally to be conducted with a rudder angle of 35°. This is in line with regulation 29.3.2 that also refers to 35° rudder angle for the time limit to put the rudder from maximum angle at one side to maximum angle at the other side.

Manoeuvrability trials have been conducted in accordance with regulation 28 and 29, but with the difference that the maximum rudder angle has been limited to maximum 20° instead of 35°.The results from the manoeuvrability trials shows that the new rudder arrangement meets all the requirements for manoeuvrability in accordance with resolution MSC.137(76) which is referred to by regulation 28. It does not fulfil the

requirements in regulation 29.3.2 with respect to the rudder angle. However, a evaluation of the rudder angle velocity that corresponds to the requirements in regulation 29.3.2 indicates some equivalence.

The trials also shows that the new rudder arrangement provides the same level of manoeuvrability at 20° rudder angle as the old rudder arrangement did at a rudder angle of 35°.

Based on the test results from the manoeuvrability trial the Swedish Transport Agency considers the arrangement with flap rudders and a rudder angle limitation system to provide an equivalent safety level as the level corresponding to SOLAS chapter II-1, regulation 28 and 29.
