UR S27 "Strength Requirements for Fore Deck Fittings and Equipment"

Part A. Revision History

Version no.	Approval date	Implementation date when applicable
Rev.6 (June 2013)	25 June 2013	1 July 2014
Rev.5 (May 2010)	24 May 2010	-
Rev.4 (Nov 2004)	30 November 2004	-
Rev.3 (July 2004)	5 July 2004	-
Rev.2 (Nov 2003)	7 November 2003	-
Corr.1 (July 2003)	14 July 2003	-
Rev.1 (Mar 2003)	27 March 2003	-
NEW (Nov 2002)	29 November 2002	1 January 2004*

**** Note:***
Actual implementation date is dependent on vessel age, therefore the resolution text should be consulted for full details.

- **Rev.6 (June 2013)**

.1 Origin for Change:

☑ Suggestion by IACS Member in Statutory Panel September 2011

.2 Main Reason for Change:

A question was raised in the Statutory Panel with background in approval of a car carrier for which design pressure in UR S27 became applicable to hold ventilator on the upper deck on large car carrier, almost 22 m above summer water line. This was considered unreasonable.

.3 List of non-IACS Member classification societies contributing through the TC Forum and/or participating in IACS Working Group:

None.

.4 History of Decisions Made:

After discussion within the Hull Panel, it was concluded that the pressure in UR S27 is to be modified to avoid unreasonable requirements e.g. for cargo hold ventilators on car carriers. It was agreed to prepare a transition of the pressure formula of S27.4.1.1 to eliminate the abrupt "on-off" application at 0.1L or 22m height above the summer load waterline.

.5 Other Resolutions Changes

None.

.6 Dates:

Original proposal: *2011, made by a Hull Panel member*
Panel submission to GPG: *05 June 2013*
GPG Approval: *25 June 2013 (Ref. 13145_IGc)*

- **Rev.5 (May 2010)**

.1 Origin for Change:

☑ Based on IACS Requirement *(Common Structural Rules for Bulk Carriers and Double Hull Oil Tankers)*

.2 Main Reason for Change:

Following the introduction of the IACS Common Structural Rules for Bulk Carriers and Double Hull Oil Tankers, Hull Panel were tasked to review all the UR S files to consider whether or not they are applicable to ships covered by the CSR.

.3 List of non-IACS Member classification societies contributing through the TC Forum and/or participating in IACS Working Group:

None.

.4 History of Decisions Made:

After review it was decided that for CSR oil tankers the requirements of UR S27 are superseded by those of the Common Structural Rules and therefore do not apply. For CSR bulk carriers the requirements of UR S27 concerning air pipes and ventilators still apply, but those for windlasses are superseded by the Common Structural Rules and do not apply.

.5 Other Resolutions Changes

All UR S files, except UR S8, S9, S15, S16, S19, S22, S23, S30 and S31.

.6 Dates:

Original proposal: *2007, made by Hull Panel Task 50*
Panel submission to GPG: *19 April 2010*
GPG Approval: *24 May 2010 (Ref. 10051_IGd)*

- **Rev.4 (Nov 2004)**

See TB document in Part B.

- **Rev.3 (July 2004)**

Addition of 'Contracted for Construction' footnote – no TB document available.

- **Rev.2 (Nov 2001)**

See TB document in Part B.

- **Corr.1 (July 2003)**

Editorial improvements/corrections – no TB document available.

- **Rev.1 (Mar 2003)**

See TB document in Part B.

- **NEW (Nov 2002)**

See TB document in Part B.

Part B. Technical Background

List of Technical Background (TB) documents for UR S27:

Annex 1. **TB for Original Resolution (Nov 2002)**

See separate TB document in Annex 1.

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Annex 2. **TB for Rev.1 (Mar 2003)**

See separate TB document in Annex 2.

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Annex 3. **TB for Rev.2 (Nov 2003)**

See separate TB document in Annex 3.

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Annex 4. **TB for Rev.4 (Nov 2004)**

See separate TB document in Annex 4.

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Annex 5. **TB for Rev.6 (June 2013)**

See separate TB document in Annex 5.

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Note: *There are no separate Technical Background (TB) documents for Corr.1 (July 2003), Rev.3 (July 2004) and Rev.5 (May 2010).*

Technical Background

UR S 27 (New, November 2002)

This technical background (TB) is developed in line with Annex 2 of IACS Internal Information No. 15.

1. Scope and objectives

1.1 The reopened Derbyshire formal inquiry published its report in December 2000. Mr Justice Coleman's Recommendations are summarised in Section 14 of the report, in which there are a number of recommendations addressed to IACS and Classification Societies.
Further to the discussion at C42 in December 2000 it was decided to form a Small Group in order to make proposals for the way forward on Mr Justice Coleman's Recommendations. Subsequently AHG/FDF was established to initially consider two issues, which were:

- Strength Requirements for Fore Deck Fittings and Equipment; and
- Prevention of Water Ingress through Fore Deck Openings

1.2 This UR addresses recommendations 10 and 17 of the above report. During the RFA it was identified that the loss of rotating type ventilator heads on the fore deck was likely to have been one of the first events to have occurred in the ship loss sequence. Damage to air and vent pipes leading to further water ingress was also considered to have occurred. Evidence from the wreck further showed that the port windlass had been lost.

2. Points of discussions and possible discussions.

2.1 AHG/FDF determined that increasing air or ventilator pipe thickness for the smaller sizes did not in general yield sufficient strength. Hence it was decided to require additional brackets, which allows the continuance in the main of current pipe thickness standards.

2.2 For ventilators, the forces acting on the closing device should be sustainable with the head in any open or closed position. The combination of horizontal forces, vertical forces and tilting moments acting on a rotating type mushroom ventilator head are such as to render this device unsuitable for application in the areas defined in clause 2 of the UR.

2.3 AHG/FDF considered that hidden corrosion in the bolts securing the windlass was a potential problem that required inspection. However as this could not be quantified for design purposes, nor can be easily inspected, the group considered that the required safety factor should take this into account. Hence a safety factor of 2.0 on bolt proof strength was agreed. Reference for the definition of bolt proof strength is ISO 898-1.

2.4 For the calculation of windlass forces in the direction of the shaft, a factor '*f*' is included to simplify determination of the effective area exposed to the water flow, taking into consideration part shielding of one disc or component by another. A simple relationship as a function of *B/H* is determined, with a maximum value of 2.5

appropriate to a large multi-disc windlass. The applied pressure in this direction was also increased to reflect the greater shape coefficient of an actual windlass disc compared to the simplified outline shape used for the model tests.

2.5 The group agreed that the ship type category, general dry cargo ship, was for the carriage of dry cargo loaded through hatch covers, and did not include special purpose ships such as Container Ships, Vehicle Carriers and Ro-Ro ships.

3. Source/derivation of proposed requirements

3.1 The group established information regarding current industry standards and practices from national and international standards such as Japanese Industry Standards, Korean Industry Standards, DIN, Italian shipyards' practices and ISO standard.

3.2 The velocity of water over the fore deck, and the pressures to be applied to the windlass were obtained from results of a program of sea keeping model tests of three bulk carriers conducted at MARIN **(Ref. 1).** AHG/WD-SL determined a water velocity over the fore deck of 13.5 m/sec (reference 'Amended formula for load model of UR S21', supplied to AHG/EBC July 2002). In these tests, the ship speed, even when operating at full engine power, was reduced by wave forces to be close to zero. The direction of water flow was found to be variable, depending on the ships heading, shape of the bow, location of the equipment etc. The requirements in the UR are therefore irrespective of any particular direction.

3.3 The shape factors for air or ventilator pipes and their closing device were based on the MODU code. The slamming factor was taken as that due to momentum. Resulting pressures were correlated with measurements from the above model tests, such that the combination of water velocity, slamming and shape factors corresponded to the maximum measured forces on a cylinder located on the fore deck, as supplied to the AHG. A further coefficient C_p provides for protection from a breakwater or forecastle, but not from the bulwark. The model tests showed that a large wall of water is formed by the presence of the ship's bow, and collapses onto the deck immediately behind the bulwark. The slope of the bulwark then tends to direct the water onto any pipes or fittings located behind, and thus effectively gives little protection in extreme seas.

3.4 Measured forces on the windlasses were supplied to the AHG, as obtained directly from the above sea keeping model tests. The pressure to be applied to the windlass perpendicular to its shaft was obtained from the maximum measured force in this direction divided by the projected area. The maximum measured force parallel to the shaft leads to a nominal pressure of about 100 kPa, but in recognition of the much increased resistance to flow in this direction for a real windlass compared to the idealised and smooth model, this was increased to 150 kPa. It was also found from comparing significant values of forces that differences between intact and flooded conditions were not large.

4. Decision by Voting if any

The technical requirements in this proposed UR were considered by all members of the AHG and agreed unanimously. The implementation scheme, which is contained in square brackets, is to be decided by GPG.

Note by the Permanent Secretariat

1. As the 1966 Load Line uses “ventilators” in Regulation 19, the term “vent” was replaced by “ventilator” except in 5.1.5 and 5.1.6 where “vent pipes” was replaced by “ventilators”.
2. Council agreed that a note should be added to Table 1 and 2 for other air pipe / ventilator heights.
3. For pipe diameter 40A and 50A in Table 1, a noted was added
   “Not permitted for new ships – reference UR P1”.
4. New sentence 1.3 was added to take account of the integrated windlass & winch type of design.
5. Implementation scheme was harmonized with that of URs S 31 and S 26.
6. Date of approval: 14 November 2002 (2219_ICd).

References [1]:

1. Seakeeping Tests for a Capesize Bulk Carrier – Phase 1, MARIN Report No. 16548-1-SMB November 2000.

2. Seakeeping Tests for a Capesize Bulk Carrier – Phase 2. MARIN Report No. 16541-1-SMB February 2002

3. Seakeeping Tests for a Panamax Bulk Carrier – Phase 3. MARIN Report No.16635-1-SMB February 2002.

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Submitted by the AHG/FDF Chairman
29 July 2002

Technical Background

UR S 27 (Rev.1, March 2003)

This technical background (TB) is developed in line with Annex 2 of IACS Internal Information No. 15.

1. Scope and objectives

To provide more flexibility to the designer for air pipes and ventilators.

2. Points of discussions and possible discussions.

The AHG/FDF Chairman reported on 10 March 2003:

In 4.1.1, two values are defined for the shape coefficient Cd, namely 0.5 for pipes and 1.3 for the heads of air pipes or ventilators. Mr Cooper, ABS has raised the possibility that in order to reduce loads, a vent head may in some circumstances be designed of cylindrical form with its axis in the vertical direction. In this circumstance, the value of 1.3 which is applicable to heads with plane side surfaces becomes rather severe. However, on the other side, the value of 0.5 would not account for the effect of disturbed water flow around a short cylinder.

The Chairman AHG/FDF suggested the following in order to give more flexibility to the designer.

Cd = shape coefficient
~~(0.5 for pipes and 1.3 for air pipe or ventilator head~~)
= <u>0.5 for pipes, 1.3 for air pipe or ventilator heads in general, 0.8 for an air pipe or ventilator head of cylindrical form with its axis in the vertical direction.</u>

GPG/Council approved on 24 March 2003.

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25 March 2003

Technical Background

S26 (Rev.1, Nov 2003) & S27(Rev.2, Nov 2003)

Part A: S26.2.2 (Rev.1, Nov 2003) + S27.2.2(Rev.2, Nov 2003)

1. Objective:

To clarify the ships to which S26 and S27 shall apply.

2. Points raised by BV (s/n 3142):

.1 "Ore carriers" are not mentioned in S26/S27 para 2.2. It needs to be clarified.

.2 "Refrigerated cargo ships, livestock carriers, deck ships, dedicated forest product carriers and dedicated cement carriers" do not seem to be excluded from the scope of application. It needs to be clarified.

3. GPG Discussion

.1 Failure to explicitly include "ore carriers" in the scope of application statements in S26/27 was just an oversight. It was agreed that "Ore carriers" should be explicitly mentioned.

.2 The proposal to align the scope of application for "general dry cargo ships" with that of UR Z7.1 was not agreed. It would exempt more vessels from the application of S26/27. The scope of application of S26/S27 was based on considerations of freeboard – not on alignment with Z7.1 (3142_ABc dated 29 September 2003).
But, it was agreed to include "combination carriers(as defined in UR Z11)" in the scope of application of S26/S27 for clarity.

4. Conclusion

.1 Para 2.2 of S26 and S27 was amended to the above effect.
.2 Council approved it on 7 Nov 2003.

Part B: S27.5.1.1(Rev.2, Nov 2003)

1. Objective

To clarify the scope of application of S27.5.1.1 to existing ships.

2. Points raised by ABS (s/n 3059a):

.1 ABS suggested that S27.5.1.1 does not mean that closing devices of air pipes *(~~and ventilators~~ : this wording "and ventilators" was deleted as UR P3 does not cover "ventilators"*) on all existing ships subject to S27 need to be upgraded to comply with the current UR P3. GPG agreed.

.2 GPG did not agree to the view that if an air pipe or ventilator closing device has to be replaced to comply with the other requirements of S27, the new closing device should comply with the current UR P3. (3059aABa, 25 July 2003)
NK pointed out that though some types of air pipe heads satisfying the requirements of UR P3(Rev.1) may be in the market it should be noted that a type of air pipeheads widely applied on board ships built in Asian builders is yet to fully comply the new requirement despite the effort of manufacturers. The identified problem is being addressed by the manufacturer and it is likely that an improved prototype is to be tested in a short time (3059aNKb, 3 Oct 2003).

3. Conclusion

.1 A footnote was added to S27.5.1.1 as indicated in para.2.1 above.
.2 Council approved it on 7 Nov 2003.

End.

Prepared by the Permanent Secretariat
30 October 2003

Technical Background
UR S 27 (Rev. 4, Nov. 2004)

1. Objective

To add a footnote to UR S 27 clarifying that UR S27 does not apply to the cargo tank venting systems and the inert gas systems of oil tankers.

2. Background

According to NK, the AHG/FDF had previously agreed that S27 was not applicable to dedicated cargo tank venting systems (3059bNKa, 24 September 2004).

3. Discussion

3.1 BV suggested that the oil tankers are submitted to the same sea condition than sustain by the bulk-carriers; so logically all vent pipes situated in the fore quarter of the existing oil tankers can be subject also to sea damages.

Therefore, these pipings should comply with UR S27, unless it is demonstrated by statistics that no damage occurred on forward part of the oil tanker in the same or less sea condition than encountered by the" Derbyshire " and there was no oil pollution consecutive to these damages (3059bBVa, 27/09/2004).

3.2 Members expressed the view that if the tanker's venting systems are to comply with UR S27, it should be demonstrated by statistics that there were reported damages on forward part of oil tankers. NK had not seen any such damage reports (3059bNKb, 01/10/2004).

3.3 Tanker vent masts are quite substantial structures owing to other design requirements and we are not aware that there is a history of wave damage of such structures (3059bABa, 01/10/2004).

3.4 GPG agreed to add a note to achieve the above objective.

3.5 Council confirmed that S27 is not applicable to the cargo tank venting and inert gas systems on all ~~oil~~ **tankers**. Approved on 30 November 2004(3059bICb).

29 October 2004
Prepared by the Permsec

Technical Background Document
UR S27, Rev. 6 (June 2013)

1. Objective / Scope

According to UR S27 the dimensioning velocity V of water over the fore deck is 13.5 m/s for exposed items located less than 22m or 0.1L (whichever is the lesser) above the summer load waterline. The objective of this document is to adjust the velocity V to be applied in S27-4.1.1 taking the actual height of the item into account.

2. Source of Proposed Requirements

The proposed requirements are based on the technical justifications for the current requirements, current practice within industry, and discussion within the Hull Panel (via correspondence and at Hull Panel Meetings).

3. Technical Basis and Rationale

1. Items located higher than 22m or 0.1L above the summer load waterline, whichever is the lesser, will not experience impact loads. We will refer to this limiting height of items as d_1. The background for this limiting height is not available. Taking the relevant probability level into account it is very difficult to define the limiting height based on model tests (or full scale measurements) even for very comprehensive tests. The limiting height is associated with significant uncertainties.

2. In scantling draft conditions the exposed deck items on ships with a low deck height are not expected to encounter impact velocity in excess of V=13.5 m/s. The minimum height of such items above the waterline is denoted d_2 in this document. The background for the threshold velocity 13.5 m/s applied in UR S27 is model tests of Panamax and Capesize bulk carriers with freeboards 5.4m and 6.7m.

3. Experimental studies by B. Buchner 2002 concludes that the actual velocity V at items on deck is reasonable explained by dam-breaking models. From regressions of these experiments it was proposed that $V \propto \sqrt{h}$ $V \propto \sqrt{h}$where h denotes the actual height of water above the deck. Buchner proposed a modified Rayleigh distribution of the relative motion at the bow in order to deduce extreme value distribution of h . This distribution contains heuristic ship specific constants. However, the classical Rayleigh distribution is conservative in this context and is assumed.

4. The extreme value distribution of h for various deck heights d above the waterline can be simulated assuming the classical Rayleigh distribution of relative bow motion. Monte Carlo simulations have been carried out by DNV for a reasonable range or standard deviations of relative motions at the bow. The

95% percentile h_{95} of the extreme value distribution of h indicates an approximate linear relation between h_{95} and d.

5. The forward speed is assumed small. It should be noted that the experiments by B. Buchner 2002 were carried out for FPSOs at zero forward speed. One hull panel member questioned if this is conservative or not, compared to cases where forward speed is considered? This issue is two-folded. In terms of velocity amplitudes it is usually higher loads associated with forward speed. However, in this task the essential issue is the relative variation of the impact speed with respect to d given that the limiting velocity amplitudes in the previous rule properly accounted for forward speed effects. We are not aware of studies regarding forward speed effects on the velocity shape. The forward speed effect on the shape is expected to be small for typical ULS conditions.

4. Summary of Changes

As a consequence we propose the following approximation of V

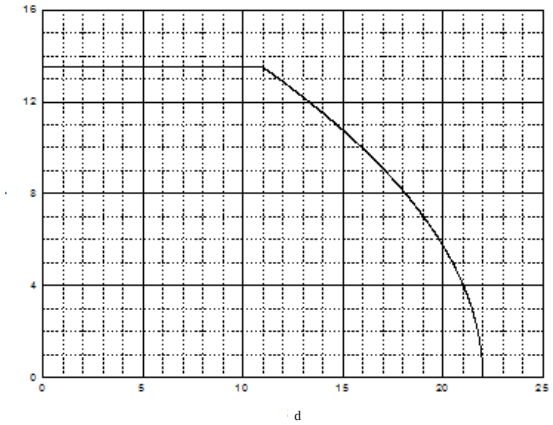
$$V = \begin{cases} 0 & , \quad d \geq d_1 \\ 13.5 \cdot \sqrt{\dfrac{d_1 - d}{d_1 - d_2}} & , \quad d_1 > d > d_2 \\ 13.5 & , \quad d \leq d_2 \end{cases}$$

The value of Zd_1 is precisely defined in 3.1. The value of Zd_2 is explained in 3.2. A lower bound of Zd_2 can be assumed by considering the minimum freeboard and forecastle on e.g. Capesize carriers. It follows that a lower value of Zd_2 could be about 7m. By increasing the parameter Zd_2 the values of V becomes more conservative. Similar to Zd_1 the value of Zd_2 should take the ship length into account. Due to limited available experimental data a conservative value of Zd_2 is needed. As a consequence we propose the following threshold.

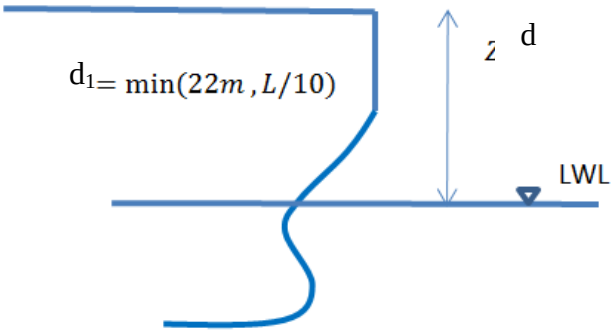
$$d_2 = \alpha \cdot d_1 \ , \qquad \alpha = 0.5$$

Hence

$$V = \begin{cases} 0 & , \quad d \geq d_1 \\ 13.5 \cdot \sqrt{\dfrac{1 - \frac{d}{d_1}}{1 - \alpha}} & , \quad d_1 > d > \alpha \cdot d_1 \\ 13.5 & , \quad d \leq \alpha \cdot d_1 \end{cases}$$



Example:V (d) in case L=300m, $\alpha = 0.5$



References:
B. Buchner 2002 "Green Water on Ship type Offshore Structures", PhD thesis, Delft

5. Points of Discussion

None

6. Attachments, if any

None

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