## استانداردهای مختلف پایداری شناورها

برای بررسی پایدار بودن شناور، استانداردهای مختلفی وجود دارد که بر حسب نوع شناور می‌توان یک یا چندین استاندارد را انتخاب کرد. برای آشنایی بیشتر و جلوگیری از برداشتهای متفاوت، اصل متن استانداردها ارائه شده‌اند.

1) IMO A167 Intact Stability criteria

Area under GZ curve up to 30 degrees > 0.055
Area under GZ curve from 30 to 40 deg. or downflood > 0.03
Area under GZ curve up to 40 deg. or downflood > 0.09
Maximum GZ to be at least 0.20 metre at 30 degrees or above
Maximum GZ to be at an angle > 25 degrees
Initial GM to be at least 0.15 metres

2) IMO 749 Intact Stability Criteria for non - passenger

Area under GZ curve up to 30 degrees > 0.055
Area under GZ curve from 30 to 40 deg. or downflood > 0.03
Area under GZ curve up to 40 deg. or downflood > 0.09
Initial GM to be at least 0.15 metres
GZ to be at least 0.20m at an angle > 30 degrees
Max GZ to be at an angle > 30 degrees
IMO Weather Criterion ( Maximum Initial Angle Of Heel )
IMO Weather Criterion ( Areas )

3) IMO A749 Intact stability Criteria Passenger

Area under GZ curve up to 30 degrees > 0.055
Area under GZ curve from 30 to 40 deg. or downflood > 0.03
Area under GZ curve up to 40 deg. or downflood > 0.09
Initial GM to be at least 0.15 metres
GZ to be at least 0.20m at an angle > 30 degrees
Max GZ to be at an angle > 30 degrees
Angle of heel for passenger crowding < 10 degrees
Angle of heel for turning < 10 degrees
IMO Weather Criterion ( Maximum Initial Angle Of Heel )
IMO Weather Criterion ( Areas )

4) MARPOL 73/78 (Oil tankers)

Final waterline below down-flood point & within 20 deg. range
Final waterline below prot. openings & within 20 deg. range
Final equilibrium angle for DECK EDGE IMMERSED < 25 degrees
Final equilibrium angle for DECK EDGE NOT IMMERSED < 30 degrees
Range of positive GZ to be > 20 degrees
Maximum GZ to be at least 0.1 metre within the 20 degree range
Area under GZ curve within 20 degree range > 0.0175

5) Load Line (Oil Tankers > 150m, bulk carriers > 100m)

Final waterline below down-flooding point
Final equilibrium angle for DECK EDGE IMMERSED < 15 degrees
Final equilibrium angle for DECK EDGE NOT IMMERSED < 17 degrees
GM at least 0.05m in upright position after flooding

6) Passenger Ship Rules (S. I. No. 1216)

Margin line not to be immersed
GM at least 0.05m in upright position after flooding
Final equilibrium angle for unsymmetrical flooding < 7 degrees
Range of positive GZ to be > 7 degrees
Maximum GZ to be at least 0.05 metre within positive range
Final equilibrium angle for unsymmetrical flooding < 20 degrees
Range of positive GZ to be > 5 degrees
Maximum GZ to be at least 0.03 metre within positive range

7) RO-RO Ship Rules

Margin line not to be immersed
GM at least 0.05m in upright position after flooding
Final equilibrium angle for unsymmetrical flooding < 7 degrees
Range of positive GZ to be > 7 degrees
Maximum GZ to be at least 0.05 metre within positive range
Range of positive GZ to be > 5 degrees
Maximum GZ to be at least 0.03 metre within positive range

8) 1990 Passenger Ship Rules (One compartment flooding)

Range of positive GZ to be > 15 degrees
Area under GZ curve up to 22 degrees or down-flood > 0.015
Maximum GZ to be at least 0.10 metres within positive range
GM at least 0.05m in equilibrium position after flooding
Range of positive GZ to be > 7 degrees
Maximum GZ to be at least 0.05 metres within positive range

9) 1990 Passenger Ship Rules (Two or more comp. flooding)

Range of positive GZ to be > 15 degrees
Area under GZ curve up to 27 degrees or down-flood > 0.015
Maximum GZ to be at least 0.10 metres within positive range
GM at least 0.05m in equilibrium position after flooding
Range of positive GZ to be > 7 degrees
Maximum GZ to be at least 0.05 metres within positive range

10) Chemical Tankers IMO A212 for L > 150

Range of positive GZ to be > 20 degrees (Final stage)
Maximum GZ to be at least 0.1 metre within the 20 degree range
Range of positive GZ to be > 20 degrees (Final stage)
Final equilibrium angle for DECK EDGE NOT IMMERSED < 17 degrees
Unprotected openings not immersed within 20 deg. range

11) NES 109 Intact stability criteria

Area under GZ curve up to 30 degrees > 0.080
Area under GZ curve from 30 to 40 deg. or downflood > 0.048
Area under GZ curve up to 40 deg. or downflood > 0.133
Maximum GZ to be at least 0.30 metre
Maximum GZ to occur above 30 deg. heel
Initial GM to be at least 0.30 metres
Wind heeling: A1 >= 1.4 x A2
Wind heeling: GZc < 60% GZmax
Angle of heel due to beam winds less than 30 degrees
High speed turning : Max. heel angle 20
High speed turning : GZc/GZmax < 0.6
High speed turning : Area A > 0.4 of total area

Lifting of heavy weights : Max. heel angle 15
Lifting of heavy weights : GZc/GZmax < 0.5
Lifting of heavy weights : Area A > 0.5 of total area
Crowding of personnel : Max. heel angle 15
Crowding of personnel : GZc/GZmax < 0.6
Crowding of personnel : Area A > 0.4 of total area
Towing : Max. heel angle 15
Towing : GZc/GZmax < 0.6
Towing : Area A > 0.4 of total area
Ship must not loll - GM at 0 must be positive
Angle of vanishing stability less than 70 degrees

12) NES 109 Damaged stability criteria

Angle of list or loll < 20 degrees
Wind heeling: A1 > Figure 9 value
Wind heeling: A1 >= 1.4 x A2
Wind heeling: GZc < 60% GZmax

13) IMO A469 Intact Stability criteria for Offshore Supply Vessels

Area under GZ curve up to position of max GZ
Area under GZ curve from 30 to 40 deg. or downflood > 0.03
Maximum GZ to be at least 0.20 metre at 30 degrees or above
Maximum GZ to be at an angle > 15 degrees
Initial GM to be at least 0.15 metres

14) SPECIAL PURPOSE SHIPS IMO A534

Final waterline below down-flooding point
Final equilibrium angle < 7 degrees
GM at least 0.05m in upright position after flooding
Range of positive GZ to be > 20 degrees
Maximum GZ to be at least 0.1 metre within the 20 degree range

15) USSR 1987 PASSENGER SHIPS

Final equilibrium angle for DECK EDGE IMMERSED < 15 degrees
Final equilibrium angle for DECK EDGE NOT IMMERSED < 17 degrees
Range of positive GZ to be > 20 degrees
Maximum GZ to be at least 0.1 metre within the 20 degree range
GM at least 0.0m in upright position after flooding
Deck edge not immersed at equilibrium angle

16) GAS CARRIERS

Final equilibrium angle < 30 degrees
Range of positive GZ to be > 20 degrees
Maximum GZ to be at least 0.1 metre within the 20 degree range
Area under GZ curve within 20 degree range > 0.0175
Final waterline below down-flooding point

17) Grain criteria

Initial GM to be at least 0.30 metres
Angle of heel grain heeling moments <= 12 degrees
Residual dynamic stability
Area under GZ curve up to 30 degrees > 0.055
Area under GZ curve from 30 to 40 deg. or downflood > 0.03
Area under GZ curve up to 40 deg. or downflood > 0.09
Maximum GZ to be at least 0.20 metre at 30 degrees or above
Maximum GZ to be at an angle > 25 degrees

18) Norwegian Fishing Vessel

Area under GZ curve up to 30 degrees > 0.055
Area under GZ curve from 30 to 40 deg. or downflood > 0.03
Area under GZ curve up to 40 deg. or downflood > 0.09
Maximum GZ to be at least 0.20 metre at 30 degrees or above
Area under GZ curve up to 30 degrees > 0.055
Initial GM to be at least 0.15 metres
GZ between 40 and 65 degrees > 0.1
Range of positive GZ at least 80 degrees

19) CHEMICAL TANKERS IMO A212 L < 150

Range of positive GZ to be > 20 degrees (Final stage)
Maximum GZ to be at least 0.1 metre within the 20 degree range
Unprotected openings not immersed within 20 deg. range
Maximum Value of equilibrium angle < 25 degrees

20) NES 109 Intact with ice

Area under GZ curve up to 30 degrees > 0.051
Area under GZ curve from 30 to 40 deg. or downflood > 0.03
Area under GZ curve up to 40 deg. or downflood > 0.085
Maximum GZ to be at least 0.24 metre
Maximum GZ to occur above 30 deg. heel
Initial GM to be at least 0.15 metres
Wind heeling: A1 >= 1.4 x A2
Wind heeling: GZc < 60% GZmax
Angle of heel due to beam winds <= 30 degrees
Ship must not loll - GM at 0 must be positive
Angle of vanishing stability <= 70 degrees

21) German Ministry of Transport for L <= 100

Area under GZ curve up to 30 degrees > 0.055
Area under GZ curve from 30 to 40 deg. or downflood > 0.03
Area under GZ curve up to 40 deg. or downflood > 0.09
Initial GM to be at least 0.15 metres
Positive range of stability > 50 degrees
For stability range between 50 & 60 dgrs GZ increased by 10mm < 60 dgrs
Par 3.2.8 Ships with large wind lateral plan

22) Mobile Offshore Drilling Units

MODU Intact Stability Weather Criterion

23) ABS criterion for Submarine & Submersible at underwater

$$BG_{\min} = \frac{n.w.N.d}{W.\tan q}$$

Where:

n = 0.1 (**This represents 10 percent of the people aboard moving simultaneously**)

w = 79.5 kg per person (**for passenger submersibles, w may be taken as 72.5 kg per person**)

d = the interior length of the main cabin accessible to personnel, in mm.This should not include machinery compartments if they are separated from the main cabin with a bulkhead.

N = total number of people onboard the submersible.

W = the total weight (**in units consistent with w**) of the fully loaded submersible, not including soft ballast.

q = 25 degrees (**representing the maximum safe trim angle. A smaller angle may be required if battery spillage or malfunction of essential equipment would occur at 25 degrees. This assumes that each person has an individual seat that is contoured or upholstered so that a person can remain in it at this angle**).