Corbin 39 – the STIX issue – as for 22 06 2020

Summary

Introduction – the STIX formulation

Beyond the stability issue on (supposed) quasi flat water, an assessment of seaworthiness related to the dynamic effects in a seaway is of great importance, especially when it comes to long-distance cruising offshore. The issue was tackled in the 90's and endorsed by the International Standards Organization (ISO), to define a stability index, STIX, obtainable from the main dimensions of the yacht and its righting moment.

The detailed formulations are given in Annex 1, including two corrections found out in Boatdesign forum from the ones presented in « Principles of Yacht design » Lars Larsson- Rolf E Eliasson – 2nd Edition 2000.

The first correction concerns the FKR formulation :
FKR = (0,875 + 0,0833 FR) when FR > 1,5 (and not 0,0883)

The second correction was due to the fact that the STIX formulation finally adopted by ISO (in 2002) is slightly different from the one in PYD book of which status was (in 1999) the working group proposition to the ISO approval.

When LBS > 10 (the Corbin 39 case) :

STIX = (7 + 2,25 LBS) . (FDL.FBD.FKR.FIR.FDS.FWM.FDF)^0,5 (and not (8 + 2 ,2 LBS))

With these two corrections, the computation of the STIX numbers based on Annex 1 formulations gives exactly the same values as the ones given by some commercial tools.

Nevertheless, it is recommended to check the very last version, namely ISO 12217-2:2015 : https://www.iso.org/standard/68141.html
, in particular the loadcases for which the computation must be done. In the present document, we adopt the two displacement cases 14t and 15t already used and documented for the VPP issue.

The input data for the Corbin 39

To adress this issue, we rely on the Multisurf hull definition and related GZ curve, previously checked very close to the other approaches with Gene-Hull / Proxi 39 and Delfship + Archimede.

We consider the two displacement cases with their estimated center of gravity :

D 14 t ; Xg 4,504 m ; Zg 0,038 m
D 15 t ; Xg 4,485 m ; Zg 0,052 m

The input data are detailed in the Annex 2.

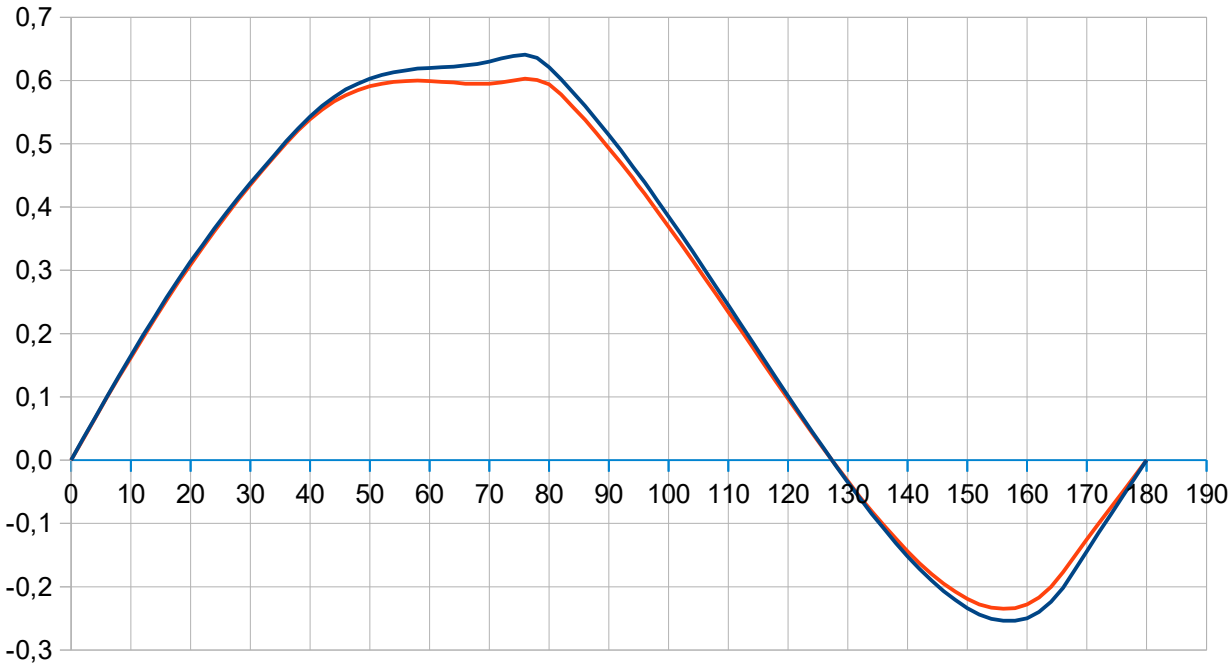
The respective GZ curve (computed with a step of 2° for a better accuracy, data given in Annex 3) allows the determination of **the angle of first downflooding ϕd occuring at the « main hatch top corner »** and of the angle of vanishing stability ϕv :

D 14 t >>> ϕd = 97,06° ; ϕv = 127,3°

D 15 t >>> ϕd = 94,7° ; ϕv = 127,4°

GZ (m) - Multisurf data

Blue : D 14000 kg & Zg 0,038 m ; Red : D 15000 kg & Zg 0,052 m



The STIX computation with Corbin 39 data is the object of a dedicated spreadsheet application where the owner/user can input :

- the sailplan parameters **As** and **hCE**, to take into account the various sailplans
- the **Zg** (in the « Other Zg cells » to take into account the real one which could differ from the ones we try to estimate at the best within the two displacement cases.

The presentation of the STIX application through its use to highlight on the influence of these two type of inputs is given here after and in Annex 2.

The areas ratio issue

The STIX does not take into account the GZ negative area (only indirectly through the angle of vanishing stability ϕv) which is representative for the unwanted stability of the boat knocked upside down, a possible occurrence when sailing in the southern oceans. Imoca class, after the terrible capsizes occuring during the Vendée globe events in the 90's, are very concerned by this aspect and added a « Stability curve area ratio » in their rules :
« *D.5.4 STABILITY CURVE AREA RATIO*
The positive area under the stability curve shall be at least 5 times greater than the negative area. »

So we add also this criteria in the STIX application.

The STIX number for the 7 sailplans

All other things supposed equal, one have just to input the parameters As (sails area) and ZCE (sails centroid/H0) of the various sailplans in the STIX application.

The As area to use within the STIX process is the Mainsail area + Fore triangle + if any the Mizzen sail (ketch option), representative of the sails for an upwind sailing.

The sails centroid use in the STIX formulation is hCE , the height / real waterline : so, one can introduce the ZCE / H0 previously determined and the sinkage for each displacement (0,13 m when D 14 t, 0,169 m when D 15 t), and then hCE = ZCE – Sinkage is computed and used in the application.

STIX values for the 7 sailplans and the 2 loadcases :

STIX	mk1 46'	mk1 51'	mk1 ketch	mk2 49'	mk1 46' bowsprit	mk1 51' bowsprit	mk1 51' boom shortened
D 14 t / Zg 0,038 m	42,0	41,0	41,9	40,7	41,5	40,3	41,9
D 15 t / Zg 0,052 m	41,1	40,4	41,1	40,1	40,9	39,7	41,1

With these Zg estimations, whatever the sailplans, the STIX is ~ 40 to 42, largely above 32 the threshold of the category A. Here after are the recopies of the STIX applications for each sailplan.

mk1 cutter 46' without bowsprit :

Data for the STIX formulation :

As (m2) : 71,1 m2 (Mainsail + Fore triangle)
ZCE : 6,65 m / H0 Sinkage : 0,13 m /H0 (D 14t) ; 0,169 m / H0 (D 15t)
(hCE = ZCE – Sinkage)

First flooding assumption : Main hatch top corner >>>		Corbin 39 D 14t PhiD 97,06° Zg (m) : 0,038	Corbin 39 D 15t PhiD 94,7° Zg (m) : 0,052
Input data			
Hull length excluded bolted on extensions (bowsprit, stem roller, etc...)	LH (m)	11,809	11,809
Hull width excluded bolted on extensions (cab rails, rub rails, etc …)	BH (m)	3,624	3,624
Displacement in minimum sailing conditions (inc. two crew, basic standard equipment but no payload)	mMSC (kg)	14000	15000
Length waterplane	Lwl (m)	10,018	10,112
Beam waterplane	Bwl (m)	3,466	3,497
Sail area (Mainsail + fore triangle)	As (m2)	**71,1**	**71,1**
Height of sail area centroid (/H0)	(m)	**6,65**	**6,65**
Height of immerse profile area centroid (/H0)	(m)	-0,571	-0,571
Height of waterline in current loading condition(/H0)	(m)	0,130	0,169
Data coming from the GZ Curve here below :			
Righting arm at 90°	GZ90° (m)	0,514	0,493
First occuring downfllooding angle	**PhiD (deg)**	**97,06**	**94,7**
Righting arm at downfllooding angle	GZD (m)	0,425	0,437
Angle of vanishing stability	AVS (deg)	127,3	127,4
Area under the GZ curve up to Min(PhiD, AVS)	AGZ (m.deg)	45,459	43,107
Computation of the STIX parameters			
	LBS (m)	10,615	10,678
	FL	0,993	0,994
(0,75 – 1,25)	FDL	1,141	1,158
	FB	1,597	1,561
(0,75 – 1,25)	FBD	1,093	1,098
	FR	7,761	8,024
(0,5 – 1,5)	FKR	1,500	1,500
(0,4 – 1,5)	FIR	1,095	1,101
(0,5 – 1,0)	FWM	1,000	1,000
(0,5 – 1,5)	FDS	0,837	0,793
(0,5 – 1,25)	FDF	1,078	1,052
	>> STIX	**42,0**	**41,1**
	Areas ratio	**6,3**	**6,6**

mk1 cutter 51' without bowsprit :

Data for the STIX formulation :

As (m2) : 77,3 m2 (Mainsail + Fore triangle)

ZCE : 7,14 m / H0 Sinkage : 0,13 m /H0 (D 14t) ; 0,169 m / H0 (D 15t)

(hCE = ZCE – Sinkage)

First flooding assumption : Main hatch top corner >>>		Corbin 39 D 14t PhiD 97,06° Zg (m) : 0,038	Corbin 39 D 15t PhiD 94,7° Zg (m) : 0,052
Input data			
Hull length excluded bolted on extensions (bowsprit, stem roller, etc...)	LH (m)	11,809	11,809
Hull width excluded bolted on extensions (cab rails, rub rails, etc …)	BH (m)	3,624	3,624
Displacement in minimum sailing conditions (inc. two crew, basic standard equipment but no payload)	mMSC (kg)	14000	15000
Length waterplane	Lwl (m)	10,018	10,112
Beam waterplane	Bwl (m)	3,466	3,497
Sail area (Mainsail + fore triangle)	As (m2)	**77,3**	**77,3**
Height of sail area centroid (/H0)	(m)	**7,14**	**7,14**
Height of immerse profile area centroid (/H0)	(m)	-0,571	-0,571
Height of waterline in current loading condition(/H0)	(m)	0,130	0,169
Data coming from the GZ Curve here below :			
Righting arm at 90°	GZ90° (m)	0,514	0,493
First occuring downfllooding angle	**PhiD (deg)**	**97,06**	**94,7**
Righting arm at downflloding angle	GZD (m)	0,425	0,437
Angle of vanishing stability	AVS (deg)	127,3	127,4
Area under the GZ curve up to Min(PhiD, AVS)	AGZ (m.deg)	45,459	43,107
Computation of the STIX parameters			
	LBS (m)	10,615	10,678
	FL	0,993	0,994
(0,75 – 1,25)	FDL	1,141	1,158
	FB	1,597	1,561
(0,75 – 1,25)	FBD	1,093	1,098
	FR	6,640	6,862
(0,5 – 1,5)	FKR	1,428	1,447
(0,4 – 1,5)	FIR	1,095	1,101
(0,5 – 1,0)	FWM	1,000	1,000
(0,5 – 1,5)	FDS	0,837	0,793
(0,5 – 1,25)	FDF	1,078	1,052
	>> STIX	**41,0**	**40,4**
	Areas ratio	**6,3**	**6,6**

mk1 Ketch 46' :

Data for the STIX formulation :

As (m2) : 73,5 m2 (Mizzen + Mainsail + Fore triangle)

ZCE : 6,73 m / H0 Sinkage : 0,13 m /H0 (D 14t) ; 0,169 m / H0 (D 15t)

(hCE = ZCE - Sinkage)

First flooding assumption : Main hatch top corner >>>		Corbin 39 D 14t PhiD 97,06° Zg (m) : 0,038	Corbin 39 D 15t PhiD 94,7° Zg (m) : 0,052
Input data			
Hull length excluded bolted on extensions (bowsprit, stem roller, etc...)	LH (m)	11,809	11,809
Hull width excluded bolted on extensions (cab rails, rub rails, etc …)	BH (m)	3,624	3,624
Displacement in minimum sailing conditions (inc. two crew, basic standard equipment but no payload)	mMSC (kg)	14000	15000
Length waterplane	Lwl (m)	10,018	10,112
Beam waterplane	Bwl (m)	3,466	3,497
Sail area (Mainsail + fore triangle)	As (m2)	**73,5**	**73,5**
Height of sail area centroid (/H0)	(m)	**6,73**	**6,73**
Height of immerse profile area centroid (/H0)	(m)	-0,571	-0,571
Height of waterline in current loading condition(/H0)	(m)	0,130	0,169
Data coming from the GZ Curve here below :			
Righting arm at 90°	GZ90° (m)	0,514	0,493
First occuring downflooding angle	**PhiD (deg)**	**97,06**	**94,7**
Righting arm at downflooding angle	GZD (m)	0,425	0,437
Angle of vanishing stability	AVS (deg)	127,3	127,4
Area under the GZ curve up to Min(PhiD, AVS)	AGZ (m.deg)	45,459	43,107
Computation of the STIX parameters			
	LBS (m)	10,615	10,678
	FL	0,993	0,994
(0,75 – 1,25)	FDL	1,141	1,158
	FB	1,597	1,561
(0,75 – 1,25)	FBD	1,093	1,098
	FR	7,417	7,667
(0,5 – 1,5)	FKR	1,493	1,500
(0,4 – 1,5)	FIR	1,095	1,101
(0,5 – 1,0)	FWM	1,000	1,000
(0,5 – 1,5)	FDS	0,837	0,793
(0,5 – 1,25)	FDF	1,078	1,052
	>> STIX	**41,9**	**41,1**
	Areas ratio	**6,3**	**6,6**

Sloop mk2 49' with bowsprit :

Sails input data for the STIX formulation

As (m2) : 81,4 m2 (Mainsail + Fore triangle)
ZCE : 7,01 m /H0 Sinkage : 0,13 m /H0 (D 14t) ; 0,169 m /H0 (D 15t)
hCE = ZCE - Sinkage

First flooding assumption : Main hatch top corner >>>		**Corbin 39 D 14t PhiD 97,06° Zg (m) : 0,038**	**Corbin 39 D 15t PhiD 94,7° Zg (m) : 0,052**
Input data			
Hull length excluded bolted on extensions (bowsprit, stem roller, etc...)	LH (m)	11,809	11,809
Hull width excluded bolted on extensions (cab rails, rub rails, etc …)	BH (m)	3,624	3,624
Displacement in minimum sailing conditions (inc. two crew, basic standard equipment but no payload)	mMSC (kg)	14000	15000
Length waterplane	Lwl (m)	10,018	10,112
Beam waterplane	Bwl (m)	3,466	3,497
Sail area (Mainsail + fore triangle)	As (m2)	**81,4**	**81,4**
Height of sail area centroid (/H0)	(m)	**7,01**	**7,01**
Height of immerse profile area centroid (/H0)	(m)	-0,571	-0,571
Height of waterline in current loading condition(/H0)	(m)	0,130	0,169
Data coming from the GZ Curve here below :			
Righting arm at 90°	GZ90° (m)	0,514	0,493
First occuring downfllooding angle	**PhiD (deg)**	**97,06**	**94,7**
Righting arm at downflloding angle	GZD (m)	0,425	0,437
Angle of vanishing stability	AVS (deg)	127,3	127,4
Area under the GZ curve up to Min(PhiD, AVS)	AGZ (m.deg)	45,459	43,107
Computation of the STIX parameters			
	LBS (m)	10,615	10,678
	FL	0,993	0,994
(0,75 – 1,25)	FDL	1,141	1,158
	FB	1,597	1,561
(0,75 – 1,25)	FBD	1,093	1,098
	FR	6,425	6,640
(0,5 – 1,5)	FKR	1,410	1,428
(0,4 – 1,5)	FIR	1,095	1,101
(0,5 – 1,0)	FWM	1,000	1,000
(0,5 – 1,5)	FDS	0,837	0,793
(0,5 – 1,25)	FDF	1,078	1,052
	>> STIX	**40,7**	**40,1**
	Areas ratio	**6,3**	**6,6**

mk1 cutter 46' with bowsprit :

Data for the STIX formulation :

As (m2) : 77,7 m2 (Mainsail + Fore triangle)

ZCE : 6,65 m Sinkage : 0,13 m (D 14t) ; 0,169 m (D 15t)

hCE = ZCE – Sinkage

First flooding assumption : Main hatch top corner >>>		Corbin 39 D 14t PhiD 97,06° Zg (m) : 0,038	Corbin 39 D 15t PhiD 94,7° Zg (m) : 0,052
Input data			
Hull length excluded bolted on extensions (bowsprit, stem roller, etc...)	LH (m)	11,809	11,809
Hull width excluded bolted on extensions (cab rails, rub rails, etc …)	BH (m)	3,624	3,624
Displacement in minimum sailing conditions (inc. two crew, basic standard equipment but no payload)	mMSC (kg)	14000	15000
Length waterplane	Lwl (m)	10,018	10,112
Beam waterplane	Bwl (m)	3,466	3,497
Sail area (Mainsail + fore triangle)	As (m2)	**77,7**	**77,7**
Height of sail area centroid (/H0)	(m)	**6,65**	**6,65**
Height of immerse profile area centroid (/H0)	(m)	-0,571	-0,571
Height of waterline in current loading condition(/H0)	(m)	0,130	0,169
Data coming from the GZ Curve here below :			
Righting arm at 90°	GZ90° (m)	0,514	0,493
First occuring downfllooding angle	**PhiD (deg)**	**97,06**	**94,7**
Righting arm at downfllooding angle	GZD (m)	0,425	0,437
Angle of vanishing stability	AVS (deg)	127,3	127,4
Area under the GZ curve up to Min(PhiD, AVS)	AGZ (m.deg)	45,459	43,107
Computation of the STIX parameters			
	LBS (m)	10,615	10,678
	FL	0,993	0,994
(0,75 – 1,25)	FDL	1,141	1,158
	FB	1,597	1,561
(0,75 – 1,25)	FBD	1,093	1,098
	FR	7,102	7,343
(0,5 – 1,5)	FKR	1,467	1,487
(0,4 – 1,5)	FIR	1,095	1,101
(0,5 – 1,0)	FWM	1,000	1,000
(0,5 – 1,5)	FDS	0,837	0,793
(0,5 – 1,25)	FDF	1,078	1,052
	>> STIX	**41,5**	**40,9**
	Areas ratio	**6,3**	**6,6**

mk1 cutter 51' with bowsprit :

Data for the STIX formulation :

As (m2) : 84,6 m2

ZCE : 7,14 m Sinkage : 0,13 m (D 14t) ; 0,169 m (D 15t)

hCE = ZCE – Sinkage

First flooding assumption : Main hatch top corner >>>		Corbin 39 D 14t PhiD 97,06° Zg (m) : 0,038	Corbin 39 D 15t PhiD 94,7° Zg (m) : 0,052
Input data			
Hull length excluded bolted on extensions (bowsprit, stem roller, etc...)	LH (m)	11,809	11,809
Hull width excluded bolted on extensions (cab rails, rub rails, etc …)	BH (m)	3,624	3,624
Displacement in minimum sailing conditions (inc. two crew, basic standard equipment but no payload)	mMSC (kg)	14000	15000
Length waterplane	Lwl (m)	10,018	10,112
Beam waterplane	Bwl (m)	3,466	3,497
Sail area (Mainsail + fore triangle)	As (m2)	**84,6**	**84,6**
Height of sail area centroid (/H0)	(m)	**7,14**	**7,14**
Height of immerse profile area centroid (/H0)	(m)	-0,571	-0,571
Height of waterline in current loading condition(/H0)	(m)	0,130	0,169
Data coming from the GZ Curve here below :			
Righting arm at 90°	GZ90° (m)	0,514	0,493
First occuring downfllooding angle	**PhiD (deg)**	**97,06**	**94,7**
Righting arm at downflloding angle	GZD (m)	0,425	0,437
Angle of vanishing stability	AVS (deg)	127,3	127,4
Area under the GZ curve up to Min(PhiD, AVS)	AGZ (m.deg)	45,459	43,107
Computation of the STIX parameters			
	LBS (m)	10,615	10,678
	FL	0,993	0,994
(0,75 – 1,25)	FDL	1,141	1,158
	FB	1,597	1,561
(0,75 – 1,25)	FBD	1,093	1,098
	FR	6,067	6,270
(0,5 – 1,5)	FKR	1,380	1,397
(0,4 – 1,5)	FIR	1,095	1,101
(0,5 – 1,0)	FWM	1,000	1,000
(0,5 – 1,5)	FDS	0,837	0,793
(0,5 – 1,25)	FDF	1,078	1,052
	>> STIX	**40,3**	**39,7**
	Areas ratio	**6,3**	**6,6**

mk1 cutter 51' boom shortened, without bowsprit :

Data for the STIX formulation :

As (m2) : 70,1 m2

ZCE : 7,08 m Sinkage : 0,13 m (D 14t) ; 0,169 m (D 15t)

hCE = ZCE - Sinkage

First flooding assumption : Main hatch top corner >>>		Corbin 39 D 14t PhiD 97,06° Zg (m) : 0,038	Corbin 39 D 15t PhiD 94,7° Zg (m) : 0,052
Input data			
Hull length excluded bolted on extensions (bowsprit, stem roller, etc...)	LH (m)	11,809	11,809
Hull width excluded bolted on extensions (cab rails, rub rails, etc ...)	BH (m)	3,624	3,624
Displacement in minimum sailing conditions (inc. two crew, basic standard equipment but no payload)	mMSC (kg)	14000	15000
Length waterplane	Lwl (m)	10,018	10,112
Beam waterplane	Bwl (m)	3,466	3,497
Sail area (Mainsail + fore triangle)	As (m2)	**70,1**	**70,1**
Height of sail area centroid (/H0)	(m)	**7,08**	**7,08**
Height of immerse profile area centroid (/H0)	(m)	-0,571	-0,571
Height of waterline in current loading condition(/H0)	(m)	0,130	0,169
Data coming from the GZ Curve here below :			
Righting arm at 90°	GZ90° (m)	0,514	0,493
First occuring downfllooding angle	**PhiD (deg)**	**97,06**	**94,7**
Righting arm at downflloding angle	GZD (m)	0,425	0,437
Angle of vanishing stability	AVS (deg)	127,3	127,4
Area under the GZ curve up to Min(PhiD, AVS)	AGZ (m.deg)	45,459	43,107
Computation of the STIX parameters			
	LBS (m)	10,615	10,678
	FL	0,993	0,994
(0,75 – 1,25)	FDL	1,141	1,158
	FB	1,597	1,561
(0,75 – 1,25)	FBD	1,093	1,098
	FR	7,385	7,632
(0,5 – 1,5)	FKR	1,490	1,500
(0,4 – 1,5)	FIR	1,095	1,101
(0,5 – 1,0)	FWM	1,000	1,000
(0,5 – 1,5)	FDS	0,837	0,793
(0,5 – 1,25)	FDF	1,078	1,052
	>> STIX	**41,9**	**41,1**
	Areas ratio	**6,3**	**6,6**

The STIX evolution when Zg is higher

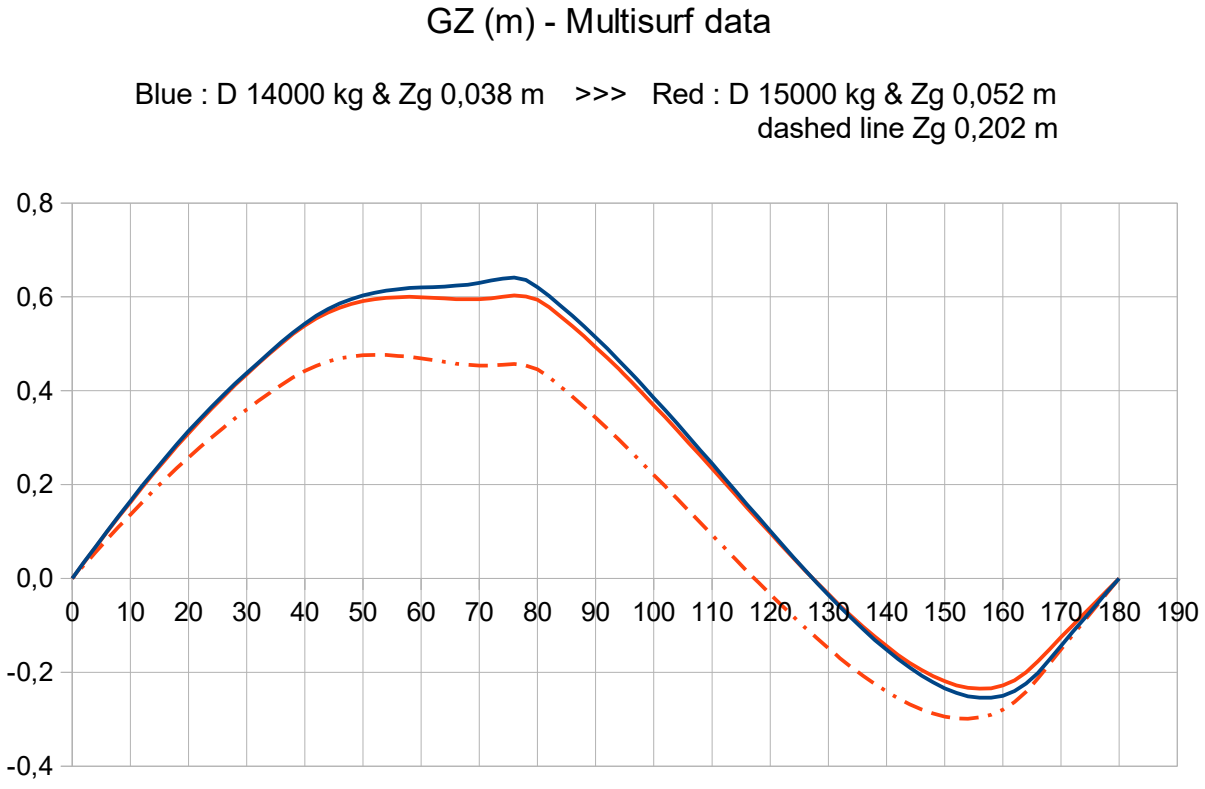
To illustrate the influence of a Zg higher than estimated, one supposes,from the D 14 t case, the addition of an extra 1 t at the height Z, starting with Z = 0,25 m (the geometrical center of the cabin) , and with a step of 0,25 m. Done with the mk2 49' sailplan. In the spreadsheet application, the GZ curve is automatically computed from the one with previous Zg0 through :

GZ(Zg, Phi) = GZ(Zg0, Phi) – (Zg-Zg0) sin(Phi)

Zg influence : D 14 t Zg 0,038 m **+ 1t at Z (m)** >> D 15 t at Zg

Z (m)	>> Zg (m)	STIX	AVS (°)	Areas ratio
0,25	0,052	40,1	127,3	6,6
0,50	0,069	39,2	126,3	6,1
0,75	0,086	38,3	125,2	5,6
1,00	0,102	37,4	124,1	5,2
1,25	0,119	36,5	123,0	4,8
1,50	0,136	35,6	121,9	4,4
1,75	0,152	34,7	120,8	4,1
2,00	0,169	33,8	119,6	3,8
2,25	0,186	32,9	118,5	3,5
2,50	0,202	32,0	117,3	3,2

>>> When Zg increases, the areas ratio at 5 is reached a lot before the STIX reaches 32



Annex 1 – the STIX formulation

When LBS > 10 (the Corbin 39 case) :

STIX = (7 + 2,25 LBS) . (FDL.FBD.FKR.FIR.FDS.FWM.FDF)^0,5

, where :

Base length factor :

LBS = (LH + 2.LWL) / 3

LH = Hull length (m) excluding bolted on extensions (bowsprit, stem roller, etc ...)
LWL = Waterline length (m) at the given displacement mMSC

Displacement length factor :

FDL = [0,6 + (15.mMSC.FL) / LBS^3 / (333 – 8.LBS)]^0,5 *(0,75 < FDL < 1,25)*

mMSC = displacement (kg) in minimum sailing condition (inc. two crew, basic standard equipment but not payload)

FL = (LBS / 11)^0,2

Beam displacement factor :

FB = (3,3 . BH) / (0,03 . mMSC)^(1/3)

If FB > 2,2 **FBD** = [(13,31 . BWL) / (BH . FB^3)]^0,5 *(0,75 < FBD < 1,25)*

If FB < 1,45 **FBD** = [(BWL . FB^2) / (1,682 . BH)]^0,5

If 1,45 ≤ FB ≤ 2,2 **FBD** = 1,118 . (BWL / BH)^0,5

BH = Hull width (m) excluding bolted on extensions (cap rails, rub rails, etc …)

BWL = Waterline beam (m) at the given displacement mMSC

Knockdown recovery factor

FR = GZ90 . mMSC / (2 . As . hCE)

If FR ≥ 1,5 **FKR** = 0,875 + 0,0833 FR *(0,5 < FKR < 1,5)*

If FR < 1,5 **FKR** = 0,5 + 0,333 FR

if ϕv < 90° **FKR** = 0,5

GZ90 = righting arm (m) at 90° heel

As = sail area (m2) (Mainsail + Fore triangle + Mizzen sail if any (ketch option))

hCE = height of center of sail area when the boat is upright

ϕv = angle of vanishing stability AVS (°)

Inversion recovery factor

If mMSC < 40000 kg **FIR** = ϕv / (125 – mMSC/1600) *(0,4 < FIR < 1,5)*

If mMSC > 40000 kg **FIR** = ϕv / 100

Dynamic stability factor

FDS = AGZ / (15,81 . LH^0,5) *(0,5 < FIR < 1,5)*

AGZ = the positive area under the GZ curve (m.deg), from 0 to minimum of (ϕd , ϕv)

Wind moment factor

If ϕd > 90° **FWM** = 1,0 *(0,5 < FWM < 1,0)*

If ϕd < 90° **FWM** = VAW / 17

VAW : the steady apparent windspeed to heel the vessel to ϕd when carrying full sail

VAW = [13 . mMSC . GZD / (As . hCE . (-hLP) . cos(ϕd)^1,3)]^0,5

GZD = righting arm at ϕd heel (m)

hLP = height of center (m) of lateral area below the waterline when the boat is upright (/H0, negative value)

Downflooding factor

FDF = ϕd / 90 *(0,5 < FDF < 1,25)*

Design category	A	B	C	D
STIX lower limit	32	23	14	5

Annex 2 – Spreadsheet application and Corbin 39 input data for STIX computation

In the « Input data » first section, the Corbin 39 data are already introduced. **The user can input either another sailplan (As, ZCE) or another Zg for the D 14t case and/or for the D 15 t case (in the second set of columns).**

In the « Data coming from the GZ curve » second section, the data automatically comes from the GZ curves (of which data are given in Annex 3) and the ϕd values for the 2 cases 14t and 15t.

In the third section, all the parameters included in the STIX formulation are computed, then the STIX itself and also the aeras ratio .

Corbin 39 - STIX spreadsheet application						
First flooding assumption : Main hatch top corner >>>		**Corbin 39 D 14t PhiD 97,06° Zg (m) :**	**Corbin 39 D 15t PhiD 94,7° Zg (m) :**		**Corbin 39 D 14t PhiD 97,06° Zg (m) :**	**Corbin 39 D 15t PhiD 94,7° Zg (m) :**
Input data		**0,038**	**0,052**	**Other Zg input >>**	**0,090**	**0,202**
Hull length excluded bolted on extensions (bowsprit, stem roller, etc…)	LH (m)	11,809	11,809		11,809	11,809
Hull width excluded bolted on extensions (cab rails, rub rails, etc …)	BH (m)	3,624	3,624		3,624	3,624
Displacement in minimum sailing conditions (inc. two crew, basic standard equipment but no payload)	mMSC (kg)	14000	15000		14000	15000
Length waterplane	Lwl (m)	10,018	10,112		10,018	10,112
Beam waterplane	Bwl (m)	3,466	3,497		3,466	3,497
Sail area (Mainsail + fore triangle)	As (m2)	**81,4**	**81,4**		**81,4**	**81,4**
Height of sail area centroid (/H0)	(m)	**7,01**	**7,01**		**7,01**	**7,01**
Height of immerse profile area centroid (/H0)	(m)	-0,571	-0,571		-0,571	-0,571
Height of waterline in current loading condition(/H0)	(m)	0,130	0,169		0,130	0,169
Data coming from the GZ Curve here below :						
Righting arm at 90°	GZ90° (m)	0,514	0,493		0,462	0,343
First occuring downfllooding angle	**PhiD (deg)**	**97,06**	**94,7**		**97,06**	**94,7**
Righting arm at downfllooding angle	GZD (m)	0,425	0,437		0,373	0,287
Angle of vanishing stability	AVS (deg)	127,3	127,4		124,1	117,3
Area under the GZ curve up to Min(PhiD, AVS)	AGZ (m.deg)	45,459	43,107		42,114	33,780
Computation of the STIX parameters						
	LBS (m)	10,615	10,678		10,615	10,678
	FL	0,993	0,994		0,993	0,994
(0,75 – 1,25)	FDL	1,141	1,158		1,141	1,158
	FB	1,597	1,561		1,597	1,561
(0,75 – 1,25)	FBD	1,093	1,098		1,093	1,098
	FR	6,425	6,640		5,775	4,613
(0,5 – 1,5)	FKR	1,410	1,428		1,356	1,259
(0,4 – 1,5)	FIR	1,095	1,101		1,068	1,014
(0,5 – 1,0)	FWM	1,000	1,000		1,000	1,000
(0,5 – 1,5)	FDS	0,837	0,793		0,775	0,622
(0,5 – 1,25)	FDF	1,078	1,052		1,078	1,052
	>> STIX	**40,7**	**40,1**		**38,0**	**32,0**
	Areas ratio	**6,3**	**6,6**		**5,0**	**3,2**

Annex 3 : Corbin 39 GZ data for the 2 loadcases D 14t and D 15t

Loadcase 1 : D14t Xg 4,505 m Zg 0,038 m Multisurf hull definition

Heel to Starboard degrees	0,0	2,0	4,0	6,0	8,0	10,0	12,0	14,0
Displacement kg	14000	14000	14000	14000	14000	14000	14000	14000
Draft at FP m	0,128	0,128	0,127	0,126	0,123	0,120	0,117	0,112
Draft at AP m	0,131	0,131	0,129	0,126	0,121	0,115	0,108	0,099
WL Length m	10,018	10,017	10,013	10,007	9,998	9,987	9,972	9,953
Immersed Depth m	1,811	1,810	1,809	1,805	1,799	1,789	1,776	1,760
WL Beam m	3,466	3,465	3,460	3,450	3,438	3,424	3,405	3,384
Wetted Area m^2	37,317	37,315	37,307	37,291	37,266	37,234	37,194	37,148
Waterpl. Area m^2	24,301	24,295	24,274	24,237	24,184	24,128	24,058	23,966
Prismatic Coeff.	0,543	0,543	0,543	0,544	0,545	0,546	0,547	0,549
Block Coeff.	0,217	0,217	0,218	0,219	0,221	0,223	0,226	0,230
LCB from Amidsh. (+ve fwd) m	-0,350	-0,351	-0,350	-0,350	-0,350	-0,350	-0,350	-0,350
VCB from DWL m	-0,388	-0,388	-0,388	-0,388	-0,389	-0,389	-0,389	-0,390
GZ m	0,000	0,034	0,067	0,100	0,133	0,165	0,197	0,23
LCF from Amidsh. (+ve fwd) m	-0,445	-0,445	-0,443	-0,441	-0,436	-0,433	-0,428	-0,420
TCF to zero pt. m	0,000	0,032	0,065	0,098	0,131	0,164	0,197	0,231
Max deck inclination deg	0,0	2,0	4,0	6,0	8,0	10,0	12,0	14,0
Trim angle (+ve by stern) deg	0,0	0,0	0,0	0,0	0,0	0,0	-0,1	-0,1

Heel to Starboard degrees	16,0	18,0	20,0	22,0	24,0	26,0	28,0	30,0
Displacement kg	14000	14000	14000	14000	14000	14000	14000	14000
Draft at FP m	0,107	0,101	0,093	0,085	0,075	0,064	0,051	0,037
Draft at AP m	0,089	0,077	0,063	0,048	0,030	0,011	-0,011	-0,034
WL Length m	9,931	9,906	9,882	9,875	9,869	9,863	9,855	9,845
Immersed Depth m	1,741	1,719	1,693	1,664	1,633	1,597	1,559	1,518
WL Beam m	3,361	3,337	3,310	3,283	3,256	3,231	3,206	3,186
Wetted Area m^2	37,101	37,052	37,003	36,956	36,912	36,857	36,804	36,776
Waterpl. Area m^2	23,891	23,811	23,728	23,648	23,593	23,492	23,434	23,414
Prismatic Coeff.	0,550	0,552	0,554	0,555	0,555	0,556	0,556	0,556
Block Coeff.	0,235	0,240	0,247	0,253	0,260	0,268	0,277	0,287
LCB from Amidsh. (+ve fwd) m	-0,350	-0,349	-0,349	-0,349	-0,349	-0,348	-0,348	-0,348
VCB from DWL m	-0,390	-0,390	-0,390	-0,389	-0,389	-0,388	-0,386	-0,385
GZ m	0,257	0,286	0,314	0,340	0,366	0,391	0,415	0,438
LCF from Amidsh. (+ve fwd) m	-0,414	-0,406	-0,397	-0,386	-0,379	-0,360	-0,346	-0,335
TCF to zero pt. m	0,266	0,300	0,335	0,370	0,405	0,441	0,475	0,509
Max deck inclination deg	16,0	18,0	20,0	22,0	24,0	26,0	28,0	30,0
Trim angle (+ve by stern) deg	-0,1	-0,1	-0,2	-0,2	-0,3	-0,3	-0,4	-0,4

Heel to Starboard degrees	32,0	34,0	36,0	38,0	40,0	42,0	44,0	46,0
Displacement kg	13999	14000	14000	13999	14000	13999	14000	13999
Draft at FP m	0,021	0,002	-0,019	-0,042	-0,067	-0,095	-0,124	-0,156
Draft at AP m	-0,061	-0,090	-0,122	-0,157	-0,194	-0,235	-0,278	-0,324
WL Length m	9,831	9,813	9,793	9,765	9,734	9,702	9,669	9,635

Immersed Depth m	1,474	1,426	1,376	1,323	1,268	1,211	1,152	1,092
WL Beam m	3,169	3,157	3,148	3,093	2,990	2,896	2,810	2,730
Wetted Area m^2	36,759	36,741	36,918	36,925	36,999	37,052	37,127	37,164
Waterpl. Area m^2	23,417	23,437	23,474	23,458	23,216	22,886	22,578	22,264
Prismatic Coeff.	0,557	0,557	0,558	0,559	0,561	0,563	0,566	0,569
Block Coeff.	0,297	0,309	0,322	0,342	0,370	0,401	0,436	0,475
LCB from Amidsh. (+ve fwd) m	-0,347	-0,347	-0,346	-0,346	-0,345	-0,345	-0,344	-0,343
VCB from DWL m	-0,383	-0,380	-0,378	-0,375	-0,372	-0,369	-0,368	-0,367
GZ m	0,460	0,482	0,504	0,524	0,543	0,560	0,574	0,586
LCF from Amidsh. (+ve fwd) m	-0,323	-0,310	-0,296	-0,284	-0,273	-0,258	-0,245	-0,226
TCF to zero pt. m	0,542	0,575	0,607	0,632	0,640	0,642	0,639	0,634
Max deck inclination deg	32,0	34,0	36,0	38,0	40,0	42,0	44,0	46,0
Trim angle (+ve by stern) deg	-0,5	-0,5	-0,6	-0,7	-0,8	-0,8	-0,9	-1,0

Heel to Starboard degrees	48,0	50,0	52,0	54,0	56,0	58,0	60,0	62,0
Displacement kg	13999	13999	14000	14000	14000	14000	14001	13999
Draft at FP m	-0,190	-0,227	-0,267	-0,310	-0,357	-0,410	-0,467	-0,532
Draft at AP m	-0,373	-0,426	-0,483	-0,546	-0,613	-0,687	-0,769	-0,860
WL Length m	9,600	9,562	9,494	9,409	9,376	9,385	9,413	9,473
Immersed Depth m	1,067	1,077	1,085	1,096	1,106	1,115	1,127	1,138
WL Beam m	2,673	2,633	2,607	2,593	2,590	2,600	2,624	2,667
Wetted Area m^2	37,222	37,236	37,237	37,190	37,061	36,984	36,838	36,533
Waterpl. Area m^2	22,000	21,747	21,539	21,339	21,126	21,071	21,043	21,083
Prismatic Coeff.	0,572	0,576	0,582	0,589	0,594	0,596	0,597	0,597
Block Coeff.	0,499	0,504	0,508	0,511	0,508	0,502	0,491	0,475
LCB from Amidsh. (+ve fwd) m	-0,343	-0,342	-0,342	-0,341	-0,340	-0,340	-0,339	-0,338
VCB from DWL m	-0,366	-0,366	-0,367	-0,369	-0,372	-0,375	-0,379	-0,384
GZ m	0,595	0,603	0,609	0,613	0,616	0,619	0,620	0,621
LCF from Amidsh. (+ve fwd) m	-0,211	-0,189	-0,176	-0,160	-0,161	-0,145	-0,134	-0,111
TCF to zero pt. m	0,625	0,613	0,599	0,584	0,565	0,542	0,514	0,488
Max deck inclination deg	48,0	50,0	52,0	54,0	56,0	58,0	60,0	62,0
Trim angle (+ve by stern) deg	-1,1	-1,2	-1,3	-1,4	-1,5	-1,6	-1,8	-1,9

Heel to Starboard degrees	64,0	66,0	68,0	70,0	72,0	74,0	76,0	78,0
Displacement kg	14001	14001	14001	13999	13999	13999	13999	14001
Draft at FP m	-0,605	-0,690	-0,788	-0,904	-1,040	-1,205	-1,422	-1,717
Draft at AP m	-0,960	-1,072	-1,199	-1,347	-1,526	-1,750	-2,038	-2,433
WL Length m	9,562	9,693	9,825	9,957	10,081	10,201	10,315	10,419
Immersed Depth m	1,148	1,161	1,174	1,187	1,202	1,212	1,213	1,231
WL Beam m	2,729	2,805	2,894	3,001	3,109	3,082	3,053	3,028
Wetted Area m^2	36,254	35,790	35,390	34,884	34,373	33,994	33,488	32,509
Waterpl. Area m^2	21,134	21,149	21,293	21,342	21,301	20,926	20,157	18,915
Prismatic Coeff.	0,597	0,594	0,593	0,593	0,596	0,600	0,605	0,608
Block Coeff.	0,456	0,432	0,409	0,385	0,362	0,358	0,358	0,352
LCB from Amidsh. (+ve fwd) m	-0,338	-0,337	-0,337	-0,337	-0,337	-0,336	-0,337	-0,336
VCB from DWL m	-0,391	-0,398	-0,407	-0,418	-0,430	-0,443	-0,455	-0,466
GZ m	0,622	0,624	0,626	0,630	0,635	0,639	0,641	0,636
LCF from Amidsh. (+ve fwd) m	-0,113	-0,132	-0,129	-0,120	-0,092	-0,075	-0,054	-0,061

TCF to zero pt. m	0,456	0,417	0,379	0,342	0,313	0,310	0,342	0,417
Max deck inclination deg	64,0	66,0	68,0	70,0	72,0	74,0	76,0	78,0
Trim angle (+ve by stern) deg	-2,1	-2,3	-2,4	-2,6	-2,9	-3,2	-3,6	-4,2

Heel to Starboard degrees	80,0	82,0	84,0	86,0	88,0	90,0	92,0	94,0
Displacement kg	14001	14001	14001	14001	14001	14001	14001	14001
Draft at FP m	-2,161	-2,837	-3,969	-6,238	-13,049	N/A	-14,202	-7,390
Draft at AP m	-3,000	-3,855	-5,275	-8,110	-16,601	N/A	-17,330	-8,839
WL Length m	10,498	10,572	10,644	10,715	10,785	10,855	10,917	10,980
Immersed Depth m	1,249	1,256	1,263	1,271	1,280	1,292	1,307	1,328
WL Beam m	2,102	2,026	1,981	1,961	1,949	1,938	1,930	1,923
Wetted Area m^2	31,534	31,503	31,512	31,539	31,581	31,633	31,690	31,747
Waterpl. Area m^2	17,696	17,420	17,217	17,058	16,939	16,855	16,788	16,733
Prismatic Coeff.	0,606	0,605	0,603	0,602	0,601	0,600	0,600	0,599
Block Coeff.	0,495	0,508	0,513	0,511	0,507	0,503	0,496	0,487
LCB from Amidsh. (+ve fwd) m	-0,336	-0,336	-0,336	-0,337	-0,337	-0,338	-0,338	-0,339
VCB from DWL m	-0,472	-0,478	-0,482	-0,486	-0,490	-0,494	-0,496	-0,499
GZ m	0,621	0,602	0,581	0,560	0,537	0,514	0,490	0,464
LCF from Amidsh. (+ve fwd) m	-0,090	-0,098	-0,103	-0,108	-0,112	-0,117	-0,120	-0,122
TCF to zero pt. m	0,503	0,502	0,496	0,488	0,479	0,468	0,456	0,444
Max deck inclination deg	80,0	82,0	84,0	86,0	88,0	90,0	92,0	94,0
Trim angle (+ve by stern) deg	-4,9	-6,0	-7,7	-10,9	-20,1	-90,0	-17,9	-8,5

Heel to Starboard degrees	96,0	98,0	100,0	102,0	104,0	106,0	108,0	110,0
Displacement kg	14001	14001	14001	14001	14001	14001	14000	14000
Draft at FP m	-5,121	-3,986	-3,305	-2,852	-2,528	-2,285	-2,097	-1,946
Draft at AP m	-6,004	-4,583	-3,729	-3,158	-2,749	-2,441	-2,200	-2,006
WL Length m	11,044	11,109	11,174	11,241	11,306	11,369	11,427	11,482
Immersed Depth m	1,351	1,373	1,393	1,411	1,427	1,441	1,453	1,463
WL Beam m	1,918	1,916	1,914	1,915	1,918	1,924	1,931	1,940
Wetted Area m^2	31,786	31,857	31,933	32,011	32,092	32,178	32,254	32,353
Waterpl. Area m^2	16,671	16,658	16,663	16,685	16,720	16,774	16,826	16,920
Prismatic Coeff.	0,599	0,599	0,598	0,598	0,598	0,598	0,598	0,598
Block Coeff.	0,477	0,467	0,458	0,449	0,441	0,433	0,426	0,419
LCB from Amidsh. (+ve fwd) m	-0,340	-0,341	-0,342	-0,343	-0,344	-0,345	-0,346	-0,348
VCB from DWL m	-0,501	-0,503	-0,504	-0,504	-0,504	-0,504	-0,503	-0,502
GZ m	0,439	0,412	0,385	0,358	0,330	0,302	0,273	0,245
LCF from Amidsh. (+ve fwd) m	-0,117	-0,122	-0,128	-0,132	-0,136	-0,140	-0,138	-0,142
TCF to zero pt. m	0,430	0,417	0,404	0,390	0,376	0,362	0,346	0,331
Max deck inclination deg	96,0	98,0	100,0	102,0	104,0	106,0	108,0	110,0
Trim angle (+ve by stern) deg	-5,2	-3,5	-2,5	-1,8	-1,3	-0,9	-0,6	-0,4

Heel to Starboard degrees	112,0	114,0	116,0	118,0	120,0	122,0	124,0	126,0
Displacement kg	14000	14000	14000	14000	14000	14000	14000	14000
Draft at FP m	-1,823	-1,720	-1,634	-1,560	-1,496	-1,440	-1,390	-1,346

Draft at AP m	-1,846	-1,713	-1,599	-1,501	-1,416	-1,341	-1,274	-1,215
WL Length m	11,538	11,595	11,654	11,680	11,650	11,620	11,589	11,559
Immersed Depth m	1,471	1,477	1,481	1,482	1,482	1,479	1,475	1,468
WL Beam m	1,952	1,966	1,983	2,002	2,022	2,045	2,068	2,094
Wetted Area m^2	32,458	32,572	32,690	32,816	32,930	33,049	33,201	33,295
Waterpl. Area m^2	17,036	17,173	17,329	17,507	17,688	17,911	18,134	18,396
Prismatic Coeff.	0,599	0,599	0,600	0,602	0,608	0,614	0,620	0,626
Block Coeff.	0,412	0,405	0,399	0,394	0,391	0,388	0,386	0,384
LCB from Amidsh. (+ve fwd) m	-0,349	-0,351	-0,352	-0,354	-0,355	-0,357	-0,358	-0,360
VCB from DWL m	-0,500	-0,498	-0,495	-0,492	-0,488	-0,484	-0,479	-0,474
GZ m	0,216	0,187	0,158	0,130	0,101	0,073	0,045	0,018
LCF from Amidsh. (+ve fwd) m	-0,146	-0,151	-0,154	-0,157	-0,157	-0,163	-0,173	-0,176
TCF to zero pt. m	0,316	0,301	0,285	0,270	0,254	0,239	0,223	0,209
Max deck inclination deg	112,0	114,0	116,0	118,0	120,0	122,0	124,0	126,0
Trim angle (+ve by stern) deg	-0,1	0,0	0,2	0,3	0,5	0,6	0,7	0,8

Heel to Starboard degrees	128,0	130,0	132,0	134,0	136,0	138,0	140,0	142,0
Displacement kg	13999	13999	13999	13999	14000	13999	13999	13999
Draft at FP m	-1,307	-1,272	-1,240	-1,211	-1,184	-1,161	-1,139	-1,119
Draft at AP m	-1,162	-1,114	-1,071	-1,031	-0,996	-0,963	-0,933	-0,906
WL Length m	11,527	11,491	11,443	11,406	11,386	11,368	11,350	11,333
Immersed Depth m	1,459	1,447	1,434	1,418	1,400	1,380	1,358	1,334
WL Beam m	2,121	2,152	2,185	2,220	2,259	2,299	2,344	2,390
Wetted Area m^2	33,466	33,526	33,702	33,946	33,954	34,176	34,459	34,747
Waterpl. Area m^2	18,642	18,952	19,259	19,562	19,972	20,382	20,753	21,223
Prismatic Coeff.	0,633	0,640	0,648	0,656	0,663	0,671	0,678	0,686
Block Coeff.	0,383	0,382	0,381	0,380	0,379	0,379	0,378	0,378
LCB from Amidsh. (+ve fwd) m	-0,361	-0,363	-0,364	-0,366	-0,367	-0,368	-0,369	-0,371
VCB from DWL m	-0,469	-0,463	-0,456	-0,449	-0,442	-0,434	-0,426	-0,417
GZ m	-0,009	-0,035	-0,060	-0,085	-0,108	-0,131	-0,152	-0,172
LCF from Amidsh. (+ve fwd) m	-0,190	-0,191	-0,201	-0,220	-0,215	-0,221	-0,245	-0,252
TCF to zero pt. m	0,193	0,180	0,166	0,152	0,142	0,132	0,120	0,112
Max deck inclination deg	128,0	130,0	132,0	134,0	136,0	138,0	140,0	142,0
Trim angle (+ve by stern) deg	0,9	0,9	1,0	1,1	1,1	1,2	1,2	1,3

Heel to Starboard degrees	144,0	146,0	148,0	150,0	152,0	154,0	156,0	158,0
Displacement kg	13999	13999	13999	13999	13999	13999	13999	13999
Draft at FP m	-1,101	-1,085	-1,070	-1,057	-1,045	-1,035	-1,026	-1,019
Draft at AP m	-0,882	-0,860	-0,839	-0,821	-0,806	-0,792	-0,780	-0,770
WL Length m	11,316	11,301	11,287	11,274	11,262	11,251	11,242	11,235
Immersed Depth m	1,307	1,278	1,246	1,212	1,176	1,137	1,095	1,051
WL Beam m	2,441	2,495	2,555	2,619	2,694	2,773	2,864	2,966
Wetted Area m^2	35,066	35,421	35,816	36,249	36,732	37,268	37,868	38,536
Waterpl. Area m^2	21,716	22,257	22,836	23,471	24,157	24,901	25,711	26,593
Prismatic Coeff.	0,694	0,702	0,711	0,720	0,729	0,738	0,748	0,757
Block Coeff.	0,378	0,379	0,380	0,382	0,383	0,385	0,387	0,390
LCB from Amidsh. (+ve fwd) m	-0,372	-0,373	-0,374	-0,374	-0,375	-0,376	-0,376	-0,377
VCB from DWL m	-0,408	-0,398	-0,388	-0,378	-0,366	-0,355	-0,343	-0,330
GZ m	-0,190	-0,207	-0,221	-0,234	-0,244	-0,251	-0,254	-0,254

LCF from Amidsh. (+ve fwd) m	-0,262	-0,270	-0,281	-0,288	-0,296	-0,304	-0,311	-0,317
TCF to zero pt. m	0,106	0,101	0,099	0,099	0,102	0,109	0,119	0,132
Max deck inclination deg	144,0	146,0	148,0	150,0	152,0	154,0	156,0	158,0
Trim angle (+ve by stern) deg	1,3	1,3	1,4	1,4	1,4	1,4	1,5	1,5

Heel to Starboard degrees	160,0	162,0	164,0	166,0	168,0	170,0	172,0	174,0
Displacement kg	13999	13999	13999	14000	14001	14000	14000	14000
Draft at FP m	-1,014	-1,011	-1,009	-1,010	-1,012	-1,015	-1,018	-1,019
Draft at AP m	-0,762	-0,757	-0,753	-0,751	-0,751	-0,751	-0,750	-0,750
WL Length m	11,229	11,224	11,222	11,223	11,225	11,228	11,230	11,231
Immersed Depth m	1,005	0,957	0,906	0,854	0,801	0,748	0,701	0,661
WL Beam m	3,085	3,228	3,401	3,618	3,708	3,697	3,687	3,679
Wetted Area m^2	39,273	39,744	40,615	41,477	42,001	42,361	42,377	42,390
Waterpl. Area m^2	27,538	28,556	29,613	30,612	31,144	31,038	30,951	30,884
Prismatic Coeff.	0,766	0,773	0,779	0,781	0,781	0,781	0,781	0,782
Block Coeff.	0,392	0,394	0,395	0,394	0,410	0,440	0,471	0,500
LCB from Amidsh. (+ve fwd) m	-0,377	-0,378	-0,378	-0,378	-0,379	-0,379	-0,379	-0,379
VCB from DWL m	-0,317	-0,303	-0,289	-0,275	-0,261	-0,248	-0,238	-0,231
GZ m	-0,250	-0,240	-0,224	-0,202	-0,173	-0,144	-0,114	-0,086
LCF from Amidsh. (+ve fwd) m	-0,322	-0,324	-0,323	-0,317	-0,309	-0,316	-0,321	-0,325
TCF to zero pt. m	0,150	0,172	0,197	0,220	0,219	0,183	0,146	0,109
Max deck inclination deg	160,0	161,9	163,9	165,9	167,9	169,9	171,9	173,8
Trim angle (+ve by stern) deg	1,5	1,5	1,5	1,5	1,5	1,6	1,6	1,6

Heel to Starboard degrees	176,0	178,0	180,0
Displacement kg	13999	13999	13999
Draft at FP m	-1,021	-1,021	-1,021
Draft at AP m	-0,750	-0,750	-0,750
WL Length m	11,233	11,233	11,233
Immersed Depth m	0,627	0,602	0,588
WL Beam m	3,673	3,670	3,669
Wetted Area m^2	42,398	42,403	42,406
Waterpl. Area m^2	30,835	30,806	30,797
Prismatic Coeff.	0,782	0,782	0,782
Block Coeff.	0,528	0,550	0,564
LCB from Amidsh. (+ve fwd) m	-0,380	-0,380	-0,379
VCB from DWL m	-0,225	-0,222	-0,221
GZ m	-0,057	-0,028	0,000
LCF from Amidsh. (+ve fwd) m	-0,328	-0,330	-0,331
TCF to zero pt. m	0,073	0,036	0,000
Max deck inclination deg	175,7	177,4	178,4
Trim angle (+ve by stern) deg	1,6	1,6	1,6

Loadcase 2 : D15t Xg 4,485 m Zg 0,052 m Multisurf hull definition
(Remind : Loadcase 2 derives from the Loadcase 1 by assuming an extra 1000 kg weight at Z 0,25 m, i.e. the approximate geometrical center of the cabin)

Heel to Starboard degrees	0,0	2,0	4,0	6,0	8,0	10,0	12,0	14,0
Displacement kg	15000	15000	15000	15000	15000	15000	15000	15000
Draft at FP m	0,160	0,160	0,159	0,157	0,155	0,152	0,149	0,144
Draft at AP m	0,177	0,177	0,176	0,172	0,168	0,163	0,156	0,148
WL Length m	10,112	10,111	10,108	10,103	10,095	10,085	10,072	10,057
Immersed Depth m	1,852	1,852	1,849	1,845	1,838	1,828	1,816	1,800
WL Beam m	3,496	3,494	3,490	3,483	3,472	3,459	3,443	3,425
Wetted Area m^2	38,327	38,324	38,315	38,299	38,278	38,250	38,217	38,180
Waterpl. Area m^2	24,877	24,871	24,850	24,814	24,766	24,705	24,636	24,564
Prismatic Coeff.	0,546	0,546	0,547	0,547	0,548	0,549	0,550	0,552
Block Coeff.	0,223	0,224	0,224	0,225	0,227	0,229	0,232	0,236
LCB from Amidsh. (+ve fwd) m	-0,371	-0,371	-0,372	-0,371	-0,371	-0,371	-0,370	-0,370
VCB from DWL m	-0,400	-0,400	-0,401	-0,401	-0,401	-0,402	-0,402	-0,402
GZ m	0,000	0,033	0,066	0,099	0,131	0,162	0,193	0,224
LCF from Amidsh. (+ve fwd) m	-0,463	-0,463	-0,462	-0,458	-0,454	-0,448	-0,442	-0,435
TCF to zero pt. m	0,000	0,032	0,064	0,095	0,128	0,160	0,194	0,227
Max deck inclination deg	0,1	2,0	4,0	6,0	8,0	10,0	12,0	14,0
Trim angle (+ve by stern) deg	0,1	0,1	0,1	0,1	0,1	0,1	0,0	0,0

Heel to Starboard degrees	16,0	18,0	20,0	22,0	24,0	26,0	28,0	30,0
Displacement kg	15000	15000	15000	15000	15000	15000	15000	15000
Draft at FP m	0,139	0,133	0,126	0,118	0,108	0,097	0,085	0,070
Draft at AP m	0,139	0,128	0,116	0,101	0,085	0,067	0,047	0,025
WL Length m	10,039	10,017	9,997	9,984	9,974	9,964	9,955	9,944
Immersed Depth m	1,781	1,759	1,733	1,705	1,673	1,638	1,600	1,558
WL Beam m	3,404	3,382	3,359	3,335	3,310	3,285	3,263	3,243
Wetted Area m^2	38,138	38,076	38,024	37,984	37,945	37,908	37,879	37,859
Waterpl. Area m^2	24,485	24,386	24,348	24,284	24,199	24,137	24,130	24,134
Prismatic Coeff.	0,553	0,555	0,556	0,558	0,559	0,559	0,560	0,561
Block Coeff.	0,240	0,246	0,251	0,258	0,265	0,273	0,282	0,291
LCB from Amidsh. (+ve fwd) m	-0,370	-0,370	-0,370	-0,370	-0,369	-0,369	-0,369	-0,369
VCB from DWL m	-0,403	-0,403	-0,403	-0,403	-0,402	-0,401	-0,400	-0,399
GZ m	0,253	0,282	0,309	0,336	0,362	0,387	0,412	0,435
LCF from Amidsh. (+ve fwd) m	-0,426	-0,412	-0,409	-0,399	-0,384	-0,371	-0,365	-0,358
TCF to zero pt. m	0,261	0,296	0,331	0,366	0,402	0,438	0,473	0,508
Max deck inclination deg	16,0	18,0	20,0	22,0	24,0	26,0	28,0	30,0
Trim angle (+ve by stern) deg	0,0	0,0	-0,1	-0,1	-0,1	-0,2	-0,2	-0,3

Heel to Starboard degrees	32,0	34,0	36,0	38,0	40,0	42,0	44,0	46,0
Displacement kg	15000	14999	15000	15000	14999	14999	15000	14999
Draft at FP m	0,054	0,036	0,015	-0,007	-0,031	-0,058	-0,086	-0,116
Draft at AP m	0,001	-0,027	-0,056	-0,089	-0,123	-0,160	-0,199	-0,240
WL Length m	9,933	9,920	9,904	9,885	9,864	9,833	9,802	9,769

Immersed Depth m	1,514	1,467	1,417	1,364	1,309	1,253	1,195	1,135
WL Beam m	3,225	3,212	3,181	3,069	2,969	2,877	2,793	2,716
Wetted Area m^2	37,832	37,824	37,841	37,940	38,265	38,374	38,245	38,328
Waterpl. Area m^2	24,094	24,122	24,147	23,866	23,532	23,178	22,790	22,441
Prismatic Coeff.	0,561	0,562	0,562	0,563	0,565	0,568	0,571	0,574
Block Coeff.	0,302	0,313	0,328	0,354	0,382	0,413	0,447	0,486
LCB from Amidsh. (+ve fwd) m	-0,368	-0,368	-0,367	-0,367	-0,367	-0,366	-0,366	-0,365
VCB from DWL m	-0,397	-0,395	-0,392	-0,390	-0,388	-0,386	-0,385	-0,385
GZ m	0,458	0,480	0,501	0,521	0,539	0,554	0,567	0,577
LCF from Amidsh. (+ve fwd) m	-0,337	-0,325	-0,312	-0,291	-0,277	-0,264	-0,245	-0,229
TCF to zero pt. m	0,542	0,576	0,607	0,618	0,622	0,622	0,620	0,615
Max deck inclination deg	32,0	34,0	36,0	38,0	40,0	42,0	44,0	46,0
Trim angle (+ve by stern) deg	-0,3	-0,4	-0,4	-0,5	-0,5	-0,6	-0,7	-0,7

Heel to Starboard degrees	48,0	50,0	52,0	54,0	56,0	58,0	60,0	62,0
Displacement kg	14999	14999	14999	15000	14999	15001	15000	15000
Draft at FP m	-0,149	-0,184	-0,223	-0,264	-0,309	-0,359	-0,414	-0,476
Draft at AP m	-0,284	-0,332	-0,383	-0,439	-0,500	-0,566	-0,639	-0,720
WL Length m	9,735	9,699	9,661	9,596	9,532	9,538	9,558	9,623
Immersed Depth m	1,113	1,123	1,133	1,144	1,154	1,164	1,176	1,187
WL Beam m	2,644	2,597	2,565	2,545	2,537	2,540	2,557	2,588
Wetted Area m^2	38,407	38,473	38,553	38,555	38,517	38,436	38,365	38,220
Waterpl. Area m^2	22,129	21,870	21,665	21,465	21,291	21,146	21,113	21,112
Prismatic Coeff.	0,578	0,581	0,585	0,591	0,597	0,599	0,601	0,600
Block Coeff.	0,511	0,517	0,521	0,524	0,524	0,519	0,509	0,495
LCB from Amidsh. (+ve fwd) m	-0,365	-0,364	-0,364	-0,363	-0,363	-0,363	-0,362	-0,362
VCB from DWL m	-0,385	-0,386	-0,387	-0,389	-0,392	-0,395	-0,399	-0,404
GZ m	0,585	0,591	0,595	0,598	0,599	0,600	0,599	0,598
LCF from Amidsh. (+ve fwd) m	-0,214	-0,199	-0,176	-0,165	-0,148	-0,143	-0,126	-0,118
TCF to zero pt. m	0,607	0,598	0,585	0,571	0,555	0,536	0,515	0,488
Max deck inclination deg	48,0	50,0	52,0	54,0	56,0	58,0	60,0	62,0
Trim angle (+ve by stern) deg	-0,8	-0,9	-0,9	-1,0	-1,1	-1,2	-1,3	-1,4

Heel to Starboard degrees	64,0	66,0	68,0	70,0	72,0	74,0	76,0	78,0
Displacement kg	15000	15001	15001	15001	15000	15000	14999	14999
Draft at FP m	-0,548	-0,627	-0,719	-0,830	-0,962	-1,122	-1,324	-1,595
Draft at AP m	-0,809	-0,911	-1,028	-1,158	-1,313	-1,503	-1,749	-2,083
WL Length m	9,707	9,836	9,966	10,087	10,195	10,304	10,415	10,516
Immersed Depth m	1,197	1,210	1,222	1,235	1,250	1,264	1,280	1,273
WL Beam m	2,637	2,708	2,795	2,893	3,012	3,078	3,053	3,028
Wetted Area m^2	38,005	37,599	37,218	36,730	36,239	35,724	35,358	34,785
Waterpl. Area m^2	21,180	21,171	21,337	21,461	21,630	21,554	21,112	20,270
Prismatic Coeff.	0,599	0,596	0,594	0,593	0,594	0,598	0,602	0,608
Block Coeff.	0,477	0,454	0,430	0,406	0,381	0,365	0,359	0,361
LCB from Amidsh. (+ve fwd) m	-0,362	-0,361	-0,360	-0,361	-0,361	-0,361	-0,361	-0,361
VCB from DWL m	-0,410	-0,417	-0,425	-0,435	-0,446	-0,459	-0,472	-0,484
GZ m	0,597	0,595	0,595	0,595	0,597	0,600	0,603	0,601
LCF from Amidsh. (+ve fwd) m	-0,115	-0,126	-0,131	-0,130	-0,130	-0,099	-0,082	-0,061

TCF to zero pt. m	0,458	0,426	0,388	0,348	0,306	0,280	0,286	0,325
Max deck inclination deg	64,0	66,0	68,0	70,0	72,0	74,0	76,0	78,0
Trim angle (+ve by stern) deg	-1,5	-1,7	-1,8	-1,9	-2,1	-2,2	-2,5	-2,9

Heel to Starboard degrees	80,0	82,0	84,0	86,0	88,0	90,0	92,0	94,0
Displacement kg	15001	15001	15001	15000	15001	15001	15001	15001
Draft at FP m	-1,985	-2,606	-3,653	-5,755	-12,070	N/A	-13,206	-6,888
Draft at AP m	-2,562	-3,300	-4,531	-6,990	-14,350	N/A	-15,062	-7,702
WL Length m	10,604	10,680	10,754	10,826	10,897	10,960	11,023	11,087
Immersed Depth m	1,306	1,314	1,322	1,331	1,340	1,352	1,366	1,386
WL Beam m	3,005	2,106	2,030	1,984	1,962	1,952	1,944	1,939
Wetted Area m^2	33,792	32,939	32,911	32,895	32,934	32,978	33,032	33,094
Waterpl. Area m^2	19,021	17,913	17,656	17,439	17,303	17,198	17,126	17,081
Prismatic Coeff.	0,610	0,609	0,607	0,606	0,605	0,604	0,603	0,603
Block Coeff.	0,353	0,495	0,507	0,512	0,511	0,506	0,500	0,491
LCB from Amidsh. (+ve fwd) m	-0,361	-0,361	-0,361	-0,362	-0,362	-0,363	-0,363	-0,364
VCB from DWL m	-0,494	-0,500	-0,505	-0,510	-0,514	-0,517	-0,520	-0,522
GZ m	0,594	0,578	0,558	0,538	0,516	0,493	0,470	0,446
LCF from Amidsh. (+ve fwd) m	-0,065	-0,093	-0,104	-0,100	-0,107	-0,112	-0,117	-0,121
TCF to zero pt. m	0,403	0,479	0,479	0,474	0,468	0,459	0,450	0,439
Max deck inclination deg	80,0	82,0	84,0	86,0	88,0	90,0	92,0	94,0
Trim angle (+ve by stern) deg	-3,4	-4,1	-5,2	-7,2	-13,2	-90,0	-10,8	-4,8

Heel to Starboard degrees	96,0	98,0	100,0	102,0	104,0	106,0	108,0	110,0
Displacement kg	15001	15001	15001	15000	15000	15000	15000	15000
Draft at FP m	-4,783	-3,730	-3,099	-2,679	-2,379	-2,155	-1,980	-1,841
Draft at AP m	-5,246	-4,016	-3,276	-2,780	-2,425	-2,158	-1,950	-1,782
WL Length m	11,151	11,217	11,283	11,345	11,398	11,452	11,506	11,562
Immersed Depth m	1,409	1,431	1,451	1,469	1,485	1,499	1,511	1,521
WL Beam m	1,935	1,932	1,932	1,934	1,937	1,943	1,950	1,961
Wetted Area m^2	33,162	33,230	33,285	33,364	33,446	33,533	33,625	33,724
Waterpl. Area m^2	17,058	17,045	17,027	17,050	17,090	17,148	17,226	17,325
Prismatic Coeff.	0,602	0,602	0,601	0,601	0,601	0,601	0,601	0,601
Block Coeff.	0,481	0,472	0,462	0,454	0,446	0,439	0,431	0,424
LCB from Amidsh. (+ve fwd) m	-0,365	-0,366	-0,367	-0,368	-0,369	-0,370	-0,371	-0,372
VCB from DWL m	-0,524	-0,526	-0,527	-0,527	-0,528	-0,527	-0,526	-0,524
GZ m	0,421	0,395	0,369	0,343	0,316	0,289	0,262	0,234
LCF from Amidsh. (+ve fwd) m	-0,126	-0,130	-0,126	-0,130	-0,133	-0,137	-0,141	-0,145
TCF to zero pt. m	0,429	0,417	0,405	0,393	0,380	0,368	0,355	0,342
Max deck inclination deg	96,0	98,0	100,0	102,0	104,0	106,0	108,0	110,0
Trim angle (+ve by stern) deg	-2,7	-1,7	-1,0	-0,6	-0,3	0,0	0,2	0,3

Heel to Starboard degrees	112,0	114,0	116,0	118,0	120,0	122,0	124,0	126,0
Displacement kg	15000	15000	15000	15000	15000	14999	14999	14999
Draft at FP m	-1,727	-1,632	-1,552	-1,484	-1,425	-1,373	-1,327	-1,287

Draft at AP m	-1,644	-1,528	-1,430	-1,345	-1,271	-1,207	-1,149	-1,098
WL Length m	11,619	11,677	11,706	11,676	11,645	11,614	11,583	11,549
Immersed Depth m	1,529	1,534	1,538	1,539	1,538	1,534	1,529	1,521
WL Beam m	1,973	1,988	2,005	2,024	2,047	2,070	2,097	2,125
Wetted Area m^2	33,827	33,923	34,045	34,165	34,297	34,409	34,486	34,648
Waterpl. Area m^2	17,441	17,563	17,728	17,912	18,113	18,324	18,572	18,808
Prismatic Coeff.	0,602	0,602	0,604	0,609	0,615	0,620	0,626	0,633
Block Coeff.	0,418	0,411	0,405	0,402	0,399	0,397	0,394	0,392
LCB from Amidsh. (+ve fwd) m	-0,374	-0,375	-0,376	-0,378	-0,379	-0,381	-0,382	-0,383
VCB from DWL m	-0,522	-0,520	-0,517	-0,513	-0,509	-0,505	-0,500	-0,494
GZ m	0,207	0,179	0,151	0,124	0,097	0,070	0,043	0,017
LCF from Amidsh. (+ve fwd) m	-0,148	-0,146	-0,150	-0,156	-0,162	-0,170	-0,171	-0,186
TCF to zero pt. m	0,328	0,314	0,301	0,287	0,273	0,258	0,245	0,230
Max deck inclination deg	112,0	114,0	116,0	118,0	120,0	122,0	124,0	126,0
Trim angle (+ve by stern) deg	0,5	0,6	0,7	0,8	0,9	1,0	1,1	1,1

Heel to Starboard degrees	128,0	130,0	132,0	134,0	136,0	138,0	140,0	142,0
Displacement kg	14999	14999	14999	14999	14999	14999	14999	14999
Draft at FP m	-1,251	-1,218	-1,189	-1,162	-1,138	-1,116	-1,096	-1,078
Draft at AP m	-1,052	-1,011	-0,974	-0,940	-0,910	-0,882	-0,856	-0,833
WL Length m	11,508	11,458	11,399	11,372	11,351	11,331	11,312	11,294
Immersed Depth m	1,511	1,499	1,485	1,469	1,450	1,429	1,406	1,380
WL Beam m	2,155	2,188	2,223	2,262	2,302	2,347	2,393	2,445
Wetted Area m^2	34,691	34,851	35,084	35,060	35,264	35,526	35,787	36,079
Waterpl. Area m^2	19,105	19,399	19,679	20,070	20,460	20,815	21,266	21,739
Prismatic Coeff.	0,640	0,648	0,656	0,663	0,670	0,678	0,685	0,693
Block Coeff.	0,390	0,389	0,389	0,387	0,386	0,385	0,384	0,384
LCB from Amidsh. (+ve fwd) m	-0,385	-0,386	-0,387	-0,388	-0,390	-0,391	-0,392	-0,393
VCB from DWL m	-0,488	-0,482	-0,475	-0,467	-0,460	-0,451	-0,443	-0,434
GZ m	-0,008	-0,033	-0,058	-0,081	-0,103	-0,124	-0,144	-0,163
LCF from Amidsh. (+ve fwd) m	-0,186	-0,196	-0,217	-0,213	-0,218	-0,241	-0,248	-0,257
TCF to zero pt. m	0,217	0,204	0,189	0,180	0,169	0,157	0,149	0,142
Max deck inclination deg	128,0	130,0	132,0	134,0	136,0	138,0	140,0	142,0
Trim angle (+ve by stern) deg	1,2	1,2	1,3	1,3	1,3	1,4	1,4	1,4

Heel to Starboard degrees	144,0	146,0	148,0	150,0	152,0	154,0	156,0	158,0
Displacement kg	14999	14999	14999	14999	14999	14999	14999	14999
Draft at FP m	-1,062	-1,047	-1,034	-1,022	-1,012	-1,004	-0,996	-0,991
Draft at AP m	-0,813	-0,794	-0,777	-0,762	-0,749	-0,738	-0,729	-0,722
WL Length m	11,277	11,262	11,248	11,235	11,224	11,214	11,206	11,200
Immersed Depth m	1,352	1,322	1,289	1,255	1,217	1,177	1,135	1,090
WL Beam m	2,498	2,557	2,620	2,691	2,768	2,856	2,952	3,061
Wetted Area m^2	36,406	36,764	37,156	37,593	37,734	38,269	38,862	39,520
Waterpl. Area m^2	22,251	22,803	23,408	24,053	24,760	25,518	26,334	27,212
Prismatic Coeff.	0,700	0,708	0,716	0,725	0,733	0,742	0,751	0,759
Block Coeff.	0,384	0,384	0,385	0,386	0,387	0,388	0,390	0,392
LCB from Amidsh. (+ve fwd) m	-0,394	-0,395	-0,395	-0,396	-0,397	-0,397	-0,398	-0,398
VCB from DWL m	-0,424	-0,414	-0,403	-0,392	-0,381	-0,369	-0,356	-0,343
GZ m	-0,180	-0,195	-0,208	-0,219	-0,228	-0,233	-0,235	-0,234

LCF from Amidsh. (+ve fwd) m	-0,267	-0,276	-0,284	-0,293	-0,301	-0,308	-0,315	-0,320
TCF to zero pt. m	0,136	0,133	0,132	0,133	0,137	0,144	0,154	0,168
Max deck inclination deg	144,0	146,0	148,0	150,0	152,0	154,0	156,0	158,0
Trim angle (+ve by stern) deg	1,5	1,5	1,5	1,5	1,5	1,6	1,6	1,6

Heel to Starboard degrees	160,0	162,0	164,0	166,0	168,0	170,0	172,0	174,0
Displacement kg	14999	14999	15000	15001	14999	15000	15000	15000
Draft at FP m	-0,987	-0,985	-0,985	-0,987	-0,990	-0,993	-0,995	-0,997
Draft at AP m	-0,716	-0,712	-0,711	-0,710	-0,710	-0,710	-0,710	-0,710
WL Length m	11,195	11,192	11,192	11,193	11,196	11,199	11,201	11,203
Immersed Depth m	1,043	0,994	0,943	0,890	0,837	0,785	0,739	0,700
WL Beam m	3,188	3,340	3,525	3,716	3,707	3,696	3,687	3,679
Wetted Area m^2	40,244	41,025	41,832	42,546	42,717	42,739	42,757	42,770
Waterpl. Area m^2	28,154	29,137	30,110	30,918	30,997	30,895	30,811	30,745
Prismatic Coeff.	0,766	0,773	0,776	0,776	0,777	0,778	0,778	0,778
Block Coeff.	0,393	0,394	0,393	0,395	0,421	0,450	0,479	0,507
LCB from Amidsh. (+ve fwd) m	-0,398	-0,399	-0,399	-0,399	-0,400	-0,400	-0,400	-0,400
VCB from DWL m	-0,330	-0,316	-0,301	-0,287	-0,274	-0,262	-0,253	-0,246
GZ m	-0,228	-0,217	-0,200	-0,177	-0,151	-0,125	-0,100	-0,075
LCF from Amidsh. (+ve fwd) m	-0,323	-0,325	-0,321	-0,313	-0,315	-0,322	-0,328	-0,332
TCF to zero pt. m	0,185	0,206	0,227	0,242	0,216	0,180	0,144	0,108
Max deck inclination deg	159,9	161,9	163,9	165,9	167,9	169,9	171,8	173,8
Trim angle (+ve by stern) deg	1,6	1,6	1,6	1,6	1,7	1,7	1,7	1,7

Heel to Starboard degrees	176,0	178,0	180,0
Displacement kg	14999	14999	14999
Draft at FP m	-0,998	-0,999	-0,999
Draft at AP m	-0,710	-0,710	-0,710
WL Length m	11,204	11,204	11,204
Immersed Depth m	0,667	0,642	0,628
WL Beam m	3,674	3,670	3,669
Wetted Area m^2	42,779	42,785	42,788
Waterpl. Area m^2	30,699	30,672	30,661
Prismatic Coeff.	0,779	0,779	0,779
Block Coeff.	0,533	0,554	0,566
LCB from Amidsh. (+ve fwd) m	-0,401	-0,401	-0,400
VCB from DWL m	-0,241	-0,238	-0,237
GZ m	-0,050	-0,025	0,000
LCF from Amidsh. (+ve fwd) m	-0,335	-0,337	-0,338
TCF to zero pt. m	0,072	0,036	0,000
Max deck inclination deg	175,7	177,4	178,3
Trim angle (+ve by stern) deg	1,7	1,7	1,7