ADDENDUM #1 TO THE GRAIN STABILITY CALCULATION FORM

TO BE COMPLETED WHEN A TABLE OF MAXIMUM ALLOWABLE HEELING MOMENTS IS NOT PROVIDED IN THE VESSEL’S APPROVED GRAIN LOADING BOOKLET. IN SUCH A CASE, COMPLIANCE WITH PERTINENT GRAIN REGULATIONS MUST BE DETERMINED FROM A PLOT OF THE STABILITY CURVE. PREPARE ONE ADDENDUM FOR EACH STAGE OF THE VOYAGE AND USE THE RESULTS TO COMPLETE THE SUMMARY PART OF THE GRAIN STABILITY CALCULATION FORM.

CHECK ONE:

- DEPARTURE FROM: _____________________________
- INTERMEDIATE
- ARRIVAL AT: _____________________________

IDENTIFICATION OF CROSS CURVES OF STABILITY: _____________________________ (SEE NOTE 1)

BASIC DATA:

- DISPLACEMENT (FROM PART II) ...
- KGV (FROM PART II) ...
- GM (FROM PART II) ...
- GRAIN HEELING MOMENT (FROM PART III) ...
- ANGLE OF FLOODING (SEE NOTE 2) ...
- \( \lambda_0 \) HEELING ARM AT ANGLE 0° (GRAIN HEELING MOMENT ÷ DISPLACEMENT) ...
- \( \lambda_{40} \) HEELING ARM AT ANGLE 40° (0.8 x HEELING ARM AT 0°) ...
- ASSUMED KG OF THE CROSS CURVES ...
- GZ CORRECTION FACTOR (ASSUMED KG – KGV) ...

MAY BE “+” OR “−”, RETAIN SIGN

TABLE OF RIGHTING ARMS (GZ): INCLUDE DATA FROM 0° TO 60° (MINIMUM)

<table>
<thead>
<tr>
<th>ANGLE OF INCLINATION ( \theta )</th>
<th>SINE ( \theta )</th>
<th>GZ (FROM CROSS CURVES)</th>
<th>SINE ( \theta ) x CORRECTION FACTOR (OBSERVE SIGN)</th>
<th>CORRECTED GZ</th>
</tr>
</thead>
</table>

NOTES:

1. THIS INFORMATION IS REQUIRED ONLY IF CROSS CURVES OF STABILITY (OR TABULAR DATA) ARE NOT FURNISHED IN THE VESSEL’S APPROVED GRAIN LOADING BOOKLET.

2. THE ANGLE OF FLOODING MEANS AN ANGLE OF HEEL AT WHICH OPENINGS IN THE HULL, SUPERSTRUCTURES OR DECK HOUSES, THAT CANNOT BE CLOSED WEATHER-TIGHT, IMMERSE. SMALL OPENINGS THROUGH WHICH PROGRESSIVE FLOODING CANNOT TAKE PLACE NEED NOT BE CONSIDERED.

3. THIS METHOD APPLIES IN THE USUAL CASE WHERE THREE POINTS DESCRIBE THE RIGHTING ARM CURVE BETWEEN THE ANGLE OF HEEL AND THE LIMITING ANGLE; IF NOT, APPLY SIMPSON’S RULE USING FIVE STATIONS INSTEAD OF THREE AS SHOWN.

4. METER DEGREES DIVIDED BY 57.3 = METER RADIANS; FOOT DEGREES DIVIDED BY 188 = METER RADIANS.
**PLOT OF STABILITY CURVE:**

**DETERMINE FROM THE ABOVE PLOT:** **ANGLE OF HEEL** (THE FIRST INTERSECTION OF THE RIGHTING ARM CURVE WITH THE HEELING ARM CURVE)

\[ \text{DEGREES} \]

**LIMITING ANGLE**

(40 DEGREES, OR
THE ANGLE OF FLOODING, OR
THE ANGLE AT WHICH THERE IS MAXIMUM DIFFERENCE BETWEEN THE RIGHTING ARM CURVE AND THE HEELING ARM CURVE)

\[ \text{DEGREES} \]

**RESIDUAL AREA CALCULATION:** **STATION SPACING** \( (S) \) = \( \frac{(\text{LIMITING ANGLE} - \text{ANGLE OF HEEL})}{2} \)

\[ \text{SEE NOTE 3} \]

\[ \text{ANGLE OF INCLINATION} \quad \text{RIGHTING ARM} \quad \text{HEELING ARM} \quad \text{DIFFERENCE} \quad \text{PRODUCT} \]

<table>
<thead>
<tr>
<th>Angle of Inclination</th>
<th>Righting Arm</th>
<th>Heeling Arm</th>
<th>Difference</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle of Heel</td>
<td></td>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Angle of Heel + S°</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Angle of Heel + 2S°</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**SUM**

\[ \frac{\text{SUM} \times S}{3} = \text{RESIDUAL AREA} = \frac{\text{m}^\circ}{3} = \frac{\text{mr}}{\text{Ft}^\circ} \]

(SEE NOTE 4)