



TECHNICAL CIRCULAR No. 040 of 23rd January 2012

To:	All Surveyors
Applicable to flag:	All Flags
Subject:	GAUGING Survey
Reference:	CLASS- Hull

Introduction

This document describes the standard CONARINA process for carrying out thickness measurement (TM) surveys and the review of these TMs. This process is applicable to all active vessels.

The primary responsibility for carrying out this Survey is held by the attending Surveyor.

Survey Instruction

- 1 The appropriate instruction for the classification survey (i.e., Annual Classification Survey of Hull, Intermediate Survey, or Special Periodical Survey of Hull) that has thickness measurement (TM) requirements shall be referenced and adhered to with regards to survey and reporting requirements. **Attachment Wastage Allowances should be reviewed prior to commencing gaugings.**
- 2 The purpose of thickness measurements are to establish, in conjunction with a visual examination, that the condition of the existing structure is, or will be after the required repairs, fit for continued service during the subsequent survey interval. Thickness measurements are used as a tool to assess ship structure; TMs are not a stand-alone method of inspection. The attending Surveyor shall confirm that the TMs taken are an actual representation of the condition of the structure. This shall be accomplished by personally examining and selecting particular areas to be gauged.
- 3 Thickness measurement may be required at the Annual Classification Survey and Intermediate Survey of Hull, and will depend on the conditions found at the

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time of survey, or if required due to suspect areas and/or substantial corrosion identified at the previous Special Periodic Survey - Hull.

The thickness measurement requirements for Intermediate Surveys for ESP vessels of more than 10 years of age is to be carried out to the same extent as the previous Special Survey. Thickness measurement requirements for Special Periodical Survey of Hull are based on age, size and type of vessel.

- 4 Prior to commencement of the required gauging surveys for ESP, ESDC and all other vessels, a "Survey Planning Meeting" is to be held between the attending surveyor(s), the owner's representative(s) in attendance and the thickness measurement (TM) Company representative(s) to ensure safe and efficient execution of surveys and thickness measurements to be carried out onboard the vessel. The communication of the following items should be agreed upon at the meeting by all three parties:
- reporting of thickness measurements on regular basis
 - prompt notification to the surveyor in case of findings including:
 - a.) excessive and/or extensive pitting/grooving of any significance
 - b.) structural defects including buckling, fractures and deformed structures
 - c.) detached and/or holed structure
 - d.) corrosion of welds
 - Upon completion of blasting and coating, tanks are to be evaluated for both structural and coating conditions. This must be discussed at the Survey Planning meeting and included in the Planning Document and/or meeting minutes to assure that the Owner is aware of this requirement prior to commencement of the blasting and coating.

Hull Thickness Measurement Companies are to be certified by CONARINA. Thickness measurement reports for vessels subject to the Enhanced Survey Program (ESP)

Thickness measurement reports for vessels other than ESP notation vessels are to be clearly presented with:

- Structural member identification by frame and strake locations and description of structure
- Sketches to supplement identification of the structural member
- Original scantling of structural member
- Maximum allowable diminution in mm/inches
- Gauged readings in mm/inches
- Diminution of structural member in mm/inches
- Percent diminution of structural member

The TM results signed by the operator are to be presented to the attending Surveyor,

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during the course of the survey, in a timely manner, preferably on a daily basis. TM firms failing to meet this requirement may be recommended to have their approval cancelled.

The Surveyor is not to be involved in any way in the actual thickness measurement process (taking of readings) or in recording readings (inputting readings into a computer spreadsheet) or any other method of recording the actual readings taken. These tasks are the sole responsibility of the gauging company personnel. The surveyor is to control the process, not participate in it.

Thickness measurements shall be witnessed by the attending Surveyor to the extent deemed necessary to confirm the following:

- Thickness Measurement firm knows what it is doing and knows where Thickness Measurements are to be taken.
- Thickness Measurements required by the Rules have been taken.
- Areas of substantial corrosion have been identified and all required additional Thickness Measurements have been taken.
- Areas requiring renewal have been identified.

The amount of supervision required depends on the age and condition of the ship. For example, a 15-year-old uncoated tanker may require more supervision than a 25-year-old tanker with good coating. However, this does not mean that the Surveyor must witness 2% or 5% of the Thickness Measurements. Given the nature of the tasks and the fact that every ship is different, it would be impossible to calculate how many Thickness Measurements a Surveyor should witness.

- 4.1 When an Owner requests attendance for a survey with thickness measurements due, the attending Surveyor shall check :
- Thickness measurement requirements
 - The requirement to use an CONARINA approved thickness measurement company
 - The maximum allowable wastage (or minimum allowable thickness) for the structure to be gauged

If an Owner elects to start the gauging before the overall survey, the attending Surveyor shall advise the Owner that the planned extent and locations of thickness measurements will be subject to confirmatory gauging, and where deemed necessary, additional gauging as a consequence of the overall survey may also be required. This should all be agreed to at the Survey Planning Meeting.

Prior to commencing the Thickness Measurements, the Surveyor shall:

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- Check type of equipment and verify that equipment is calibrated according to recognized national/international standards, and is properly labeled;
- Witness calibration appropriate for size and type of material;
- Be satisfied with operator's skills and competence; and
- Ensure that the thickness measurement operator will be using instruments that utilize a pulsed echo technique (either with oscilloscope or digital instruments having multiple echo). Single-echo instruments may be used on uncoated surfaces that have been properly cleaned.

4.2 The attending Surveyor shall determine the exact location and extent of Thickness Measurements to be taken, only after the overall survey has been carried out.

TMs are mainly taken to evaluate the extent of corrosion which may have a detrimental effect on the longitudinal strength of the hull girder. Hence, TM readings of the top and bottom of transverse sections are to be taken in a systematic manner under the supervision of the attending Surveyor.

Experience indicates that for gaugings on the deck in way of the girth belts the number of readings now being taken (usually 2 per plate) are not sufficient to indicate the actual average condition of the plating and internals in the belt. Therefore, in way of each girth belt on the deck a 5-point pattern of gaugings (the 5-point pattern is to be over a meter length) is to be taken between each longitudinal. In addition a 5-point pattern is to be taken of each longitudinal and each longitudinal girder. This is applicable to all ESP vessels; however, at the Surveyor's discretion this may also be applied to other vessels.

For tankers with poor coating condition or no coating in ballast tanks or cargo/ballast tanks, three (3) partial sections using a 5-point pattern are to be taken within these tanks across the deck including each longitudinal and each longitudinal girder. Belt readings are to be taken in the aft, center and forward bays avoiding if possible areas previously measured.

Under no circumstances are the Thickness Measurement locations to be left up to the Owner or the Thickness Measurement firm.

For example: during survey planning, it might be agreed that the Thickness Measurements in way of the transverse section will be taken in way of the aft end of the tank; however, during the overall survey, the Surveyor may find that the aft end of the tank is not in bad condition, but the forward end of the

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tank is in poor condition. If this is the case, then the Surveyor should recommend that the Thickness Measurement be taken in the forward end of the tank. Depending on conditions found, the Surveyor may want to take Thickness Measurements at both the forward and aft end of the tanks.

The purpose of the Survey Planning Meeting is to cover the basics of the survey. The meeting should not obligate the Surveyor or tie the Surveyor's hands in any way. The Surveyor and nobody else should control the process of taking thickness measurements.

Where Close-up Surveys are required, Thickness Measurements in way of Close-up areas must be carried out together with the Close-up Survey in order to carry out a proper survey.

In some cases an Owner may elect to do only the upper and middle parts of the tanks, leaving the bottom of the tanks for survey in drydock. CONARINA has no objection to this, provided the attending Surveyor is agreeable.

- 4.3 The Surveyor should have readily at hand during the survey the wastage limits so that as soon as the thickness measurements are known, additional measurements can be requested as necessary for marginal conditions or questionable measurements. This should be done also for adjacent or symmetrically opposite plates outside of the specified minimum thickness measurement locations, whenever excessive or serious areas of corrosion are found as well as when substantial corrosion is found.

The Surveyor should take an expanded gauging pattern to identify if the plate is actually wasted or not (not just a localized area) and then to identify the entire area to be renewed. If, in the course of this expanded gauging pattern, the Surveyor finds some substantial corrosion and the owner decides to stop renewal at the substantially corroded area, additional gaugings are required.

- 4.3.1 Upon completion of the thickness measurement survey, attending Surveyor must verify that:
- All required Thickness Measurements have been taken or specify additional gaugings.
 - If extent of thickness measurements have been reduced, the Surveyor's special consideration should be reported.
 - In case thickness measurements are partly carried out, the extent of remaining thickness measurements should be reported and is to be left on board for use of the next Surveyor.

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- Surveyor should confirm that the proper thickness measurement reporting forms were used if the ship is under the ESP program.
- Upon completion of the thickness measurements onboard, the surveyor should verify with the progress reports noted above, sign and keep the final preliminary thickness measurement report prepared and signed (hand or electronic signature is acceptable) by the operator.
- Upon review that the final gauging report (bound clean version) is consistent with the final preliminary report, the Surveyor is to countersign the cover page of this report. The Surveyor should keep the preliminary report as a minimum, until the review is completed.
- All repairs required as a result of Thickness Measurements have been completed and that these repairs have been examined and considered satisfactory.
- Thickness Measurement reports are indicating conditions found and not as renewed.
- Readings should indicate actual average condition based upon additional readings taken.
- Additional readings taken are to be reported.

4.3.2 The final TM report is to indicate vessel's name, CONARINA Class No., date, Gauging Technician's name and organization, and Surveyor's signature on first page.

4.4 Thickness measurement results found in excess of the allowable individual plate wastage limits are to be dealt with in the following manner:

- a. Localized wastage and pitting is to be dealt with to the satisfaction of the Surveyor and may require renewal.
- b. Wasted areas are to be repaired to the satisfaction of the Surveyor or noted as outstanding recommendations in the survey report.
- c. Any areas that were repaired are to be clearly identified on the thickness measurements results as "repaired" and the thickness of the renewed structure, if different from the original scantlings, is to be recorded in the thickness measurement report. Additionally, repairs are to be reported upon in the survey report.

4.5 Should the average wastage of either the top or bottom section, or the attached internals, of the girth belt exceed 10%, (note: for vessels under 61 meters (200 feet) length, 20% is the maximum average wastage of top or bottom section) the Surveyor shall notify the CONARINA Technical Office to fax the thickness measurement results for determination of hull girder section modulus using the gauged thicknesses.

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- 4.6 Examination of hatch coamings, including close up examination and thickness measurements, when required, is to be carried out both internally and externally from the deck. If it is determined by the attending surveyor that the hatches are not able to be placed in a situation that makes possible a meaningful external and internal examination of the hatch coaming (i.e., hatch cover placement, hydraulic pumps or piping, etc. blocking access), thickness measurement and hammer test, as may be deemed necessary by the attending surveyor should be carried out. Surveyor should withhold crediting the hatch coaming examination or should consider the subject item partially carried out, subject to reexamination when the access can be provided by dismantling piping or pumps in way.

These requirements apply to all oil tankers of 130m or greater in length (as defined in the International Convention of Load Lines in force) and over 10 years of age. The longitudinal strength of the ship's hull girder shall be evaluated during each Special Survey carried out after the vessel has reached 10 years of age.

The minimum number of transverse sections are as follows:

- 1) Two transverse sections if the renewal survey is commenced (first visit on board the vessel occurs) after the 10th but on, or before, the 15th anniversary date of delivery.
- 2) Three transverse sections if the renewal survey is commenced (first visit on board the vessel occurs) after the 15th anniversary date of delivery.

Substantial corrosion is an extent of corrosion such that assessment of corrosion pattern indicates wastage in excess of 75 % of the allowable margins, but still within the acceptable limits.

Substantial corrosion is identified by the Surveyor during the thickness measurement review. Substantial corrosion is to be documented in the survey report and in the condition evaluation report prepared during Special Survey examination.

For those vessels which require Drydocking Survey as part of Special Periodical Survey, thickness measurements carried out afloat for purpose of Special Periodical Survey will require confirmatory thickness measurements at time of drydocking for that Special Survey.

REFERENCES:

CONARINA CLASS RULES

ATTACHMENT:

Wastage allowances

Type	Refer to:
1.) Conventional Vessels 90 Meters and over	CONARINA RULES
2.) Conventional vessels under 90 Meters	CONARINA RULES
3.) Aluminum wastage allowance, Conventional Vessels under 90 Meters.	CONARINA RULES
4.) Steel or Aluminum Motor Pleasure Yachts; 24 Meters to 61 Meters in length	CONARINA RULES
5.) Drilling Units (Jack-ups, Column Stabilized Units, Surface Units)	CONARINA RULES

Plate thickness in inches			Corrosion level in inches							
			15 %	11.25 %	20 %	15 %	25 %	18.75 %	30 %	22.5 %
	Deci mal	Weight	Renewal	Substantial	<i>Renewal</i>	Substantial	Renewal	Substantial	Renewal	Substantial
1/4	0.250	10.20	0.21	0.22	0.20	0.21	0.19	0.20	0.18	0.19
5/16	0.313	12.75	0.27	0.28	0.25	0.27	0.23	0.25	0.22	0.24
3/8	0.375	15.30	0.32	0.33	0.30	0.32	0.28	0.30	0.26	0.29
7/16	0.438	17.85	0.37	0.39	0.35	0.37	0.33	0.36	0.31	0.34
1/2	0.500	20.40	0.43	0.44	0.40	0.43	0.38	0.41	0.35	0.39
9/16	0.563	22.95	0.48	0.50	0.45	0.48	0.42	0.46	0.39	0.44
5/8	0.625	25.50	0.53	0.55	0.50	0.53	0.47	0.51	0.44	0.48
3/4	0.750	30.60	0.64	0.67	0.60	0.64	0.56	0.61	0.53	0.58
7/8	0.875	35.70	0.74	0.78	0.70	0.74	0.66	0.71	0.61	0.68
1	1.000	40.80	0.85	0.89	0.80	0.85	0.75	0.81	0.70	0.78
1-1/4	1.250	51.00	1.06	1.11	1.00	1.06	0.94	1.02	0.88	0.97
1-1/2	1.500	61.20	1.28	1.33	1.20	1.28	1.13	1.22	1.05	1.16

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Plate thickness in inches converted to millimeters			Corrosion level in millimeters							
			15 %	11.25 %	20 %	15 %	25 %	18.75 %	30 %	22.5 %
Decimal	mm	Renewal	Substantial	Renewal	Substantial	Renewal	Substantial	Renewal	Substantial	
1/4	0.250	6.35	5.4	5.6	5.1	5.4	4.8	5.2	4.5	4.9
5/16	0.313	7.94	6.8	7.0	6.4	6.8	5.6	6.5	5.6	6.2
3/8	0.375	9.53	8.1	8.5	7.6	8.1	7.1	7.7	6.7	7.4
7/16	0.438	11.11	9.5	9.9	8.9	9.5	8.3	9.0	7.8	8.6
1/2	0.500	12.70	10.8	11.3	10.2	10.8	9.5	10.3	8.9	9.8
9/16	0.563	14.29	12.1	12.7	11.4	12.1	10.7	11.6	10.0	11.1
5/8	0.625	15.88	13.5	14.1	12.7	13.5	11.9	12.9	11.1	12.3
3/4	0.750	19.05	16.2	16.9	15.2	16.2	14.3	15.5	13.3	14.8
7/8	0.875	22.23	18.9	19.7	17.8	18.9	16.7	18.1	15.6	17.2
1	1.000	25.40	21.6	22.5	20.3	21.6	19.1	20.6	17.8	19.7
1-1/4	1.250	31.75	27.0	28.2	25.4	27.0	23.8	25.8	22.2	24.6
1-1/2	5.080	38.10	32.4	33.8	30.5	32.4	28.6	31.0	26.7	29.5

Plate thickness in millimeters	Corrosion level							
	15% Renewal	11.25% Substantial	20% Renewal	15% Substantial	25% Renewal	18.75% Substantial	30% Renewal	22.50% Substantial
5	4.3	4.4	4.0	4.3	3.8	4.1	3.5	3.9
5.5	4.7	4.9	4.4	4.7	4.1	4.5	3.9	4.3
6	5.1	5.3	4.8	5.1	4.5	4.9	4.2	4.7
6.5	5.5	5.8	5.2	5.5	4.9	5.3	4.6	5.0
7	6.0	6.2	5.6	6.0	5.3	5.7	4.9	5.4
7.5	6.4	6.7	6.0	6.4	5.6	6.1	5.3	5.8
8	6.8	7.1	6.4	6.8	6.0	6.5	5.6	6.2
8.5	7.2	7.5	6.8	7.2	6.4	6.9	6.0	6.6
9	7.7	8.0	7.2	7.7	6.8	7.3	6.3	7.0
9.5	8.1	8.4	7.6	8.1	7.1	7.7	6.7	7.4
10	8.5	8.9	8.0	8.5	7.5	8.1	7.0	7.8
10.5	8.9	9.3	8.4	8.9	7.9	8.5	7.4	8.1
11	9.4	9.8	8.8	9.4	8.3	8.9	7.7	8.5
11.5	9.8	10.2	9.2	9.8	8.6	9.3	8.1	8.9
12	10.2	10.7	9.6	10.2	9.0	9.8	8.4	9.3
12.5	10.6	11.1	10.0	10.6	9.4	10.2	8.8	9.7
13	11.1	11.5	10.4	11.1	9.8	10.6	9.1	10.1
13.5	11.5	12.0	10.8	11.5	10.1	11.0	9.5	10.5
14	11.9	12.4	11.2	11.9	10.5	11.4	9.8	10.9

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Plate thickness in millimeters	Corrosion level							
	15% Renewal	11.25% Substantial	20% Renewal	15% Substantial	25% Renewal	18.75% Substantial	30% Renewal	22.50% Substantial
14.5	12.3	12.9	11.6	12.3	10.9	11.8	10.2	11.2
15	12.8	13.3	12.0	12.8	11.3	12.2	10.5	11.6
15.5	13.2	13.8	12.4	13.2	11.6	12.6	10.9	12.0
16	13.6	14.2	12.8	13.6	12.0	13.0	11.2	12.4
16.5	14.0	14.6	13.2	14.0	12.4	13.4	11.6	12.8
17	14.5	15.1	13.6	14.5	12.8	13.8	11.9	13.2
17.5	14.9	15.5	14.0	14.9	13.1	14.2	12.3	13.6
18	15.3	16.0	14.4	15.3	13.5	14.6	12.6	14.0
18.5	15.7	16.4	14.8	15.7	13.9	15.0	13.0	14.3
19	16.2	16.9	15.2	16.2	14.3	15.4	13.3	14.7
19.5	16.6	17.3	15.6	16.6	14.6	15.8	13.7	15.1
20	17.0	17.8	16.0	17.0	15.0	16.3	14.0	15.5
20.5	17.4	18.2	16.4	17.4	15.4	16.7	14.4	15.9
21	17.9	18.6	16.8	17.9	15.8	17.1	14.7	16.3
21.5	18.3	19.1	17.2	18.3	16.1	17.5	15.1	16.7
22	18.7	19.5	17.6	18.7	16.5	17.9	15.4	17.1
22.5	19.1	20.0	18.0	19.1	16.9	18.3	15.8	17.4
23	19.6	20.4	18.4	19.6	17.3	18.7	16.1	17.8
23.5	20.0	20.9	18.8	20.0	17.6	19.1	16.5	18.2
24	20.4	21.3	19.2	20.4	18.0	19.5	16.8	18.6
24.5	20.8	21.7	19.6	20.8	18.4	19.9	17.2	19.0
25	21.3	22.2	20.0	21.3	18.8	20.3	17.5	19.4
25.5	21.7	22.6	20.4	21.7	19.1	20.7	17.9	19.8
26	22.1	23.1	20.8	22.1	19.5	21.1	18.2	20.2
26.5	22.5	23.5	21.2	22.5	19.9	21.5	18.6	20.5
27	23.0	24.0	21.6	23.0	20.3	21.9	18.9	20.9
27.5	23.4	24.4	22.0	23.4	20.6	22.3	19.3	21.3
28	23.8	24.9	22.4	23.8	21.0	22.8	19.6	21.7
28.5	24.2	25.3	22.8	24.2	21.4	23.2	20.0	22.1
29	24.7	25.7	23.2	24.7	21.8	23.6	20.3	22.5
29.5	25.1	26.2	23.6	25.1	22.1	24.0	20.7	22.9
30	25.5	26.6	24.0	25.5	22.5	24.4	21.0	23.3
30.5	25.9	27.1	24.4	25.9	22.9	24.8	21.4	23.6
31	26.4	27.5	24.8	26.4	23.3	25.2	21.7	24.0
31.5	26.8	28.0	25.2	26.8	23.6	25.6	22.1	24.4
32	27.2	28.4	25.6	27.2	24.0	26.0	22.4	24.8
32.5	27.6	28.8	26.0	27.6	24.4	26.4	22.8	25.2
33	28.1	29.3	26.4	28.1	24.8	26.8	23.1	25.6
33.5	28.5	29.7	26.8	28.5	25.1	27.2	23.5	26.0
34	28.9	30.2	27.2	28.9	25.5	27.6	23.8	26.4
34.5	29.3	30.6	27.6	29.3	25.9	28.0	24.2	26.7
35	29.8	31.1	28.0	29.8	26.3	28.4	24.5	27.1
35.5	30.2	31.5	28.4	30.2	26.6	28.8	24.9	27.5

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Plate thickness in millimeters	Corrosion level							
	15% Renewal	11.25% Substantial	20% Renewal	15% Substantial	25% Renewal	18.75% Substantial	30% Renewal	22.50% Substantial
36	30.6	32.0	28.8	30.6	27.0	29.3	25.2	27.9
36.5	31.0	32.4	29.2	31.0	27.4	29.7	25.6	28.3
37	31.5	32.8	29.6	31.5	27.8	30.1	25.9	28.7
37.5	31.9	33.3	30.0	31.9	28.1	30.5	26.3	29.1
38	32.3	33.7	30.4	32.3	28.5	30.9	26.6	29.5
38.5	32.7	34.2	30.8	32.7	28.9	31.3	27.0	29.8
39	33.2	34.6	31.2	33.2	29.3	31.7	27.3	30.2
39.5	33.6	35.1	31.6	33.6	29.6	32.1	27.7	30.6
40	34.0	35.5	32.0	34.0	30.0	32.5	28.0	31.0
45	38.3	39.9	36.0	38.3	33.8	36.6	31.5	34.9
50	42.5	44.4	40.0	42.5	37.5	40.6	35.0	38.8
55	46.8	48.8	44.0	46.8	41.3	44.7	38.5	42.6
60	51.0	53.3	48.0	51.0	45.0	48.8	42.0	46.5
65	55.3	57.7	52.0	55.3	48.8	52.8	45.5	50.4

Kindest Regards,
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