

**FOLLOW UP INSPECTION  
IN SERVICE**

PREPARED BY:

ANDERS BROBERG  
TECHNICAL MANAGER



## **Table of content:**

Presentation of Stena Bulk AB.

There are no shortcuts to maintain high standard ships.

Preparation for tank inspection.

Tank maintenance.

### **Attachments:**

1. Instructions for Tank Inspection.
2. Instructions for Cargo Tank Blasting.
3. Summary of tanker fleet bottom pitting repair dates.
4. Corrosion control/Coating repairs.
5. Interior Tank View, 3 different drawings for reporting.
6. Type of cracks - Wing tank structure members.
7. Wing tank crack locations list.

# **FOLLOW UP INSPECTION IN-SERVICE**

## **Presentation of Stena Bulk AB and Concordia Maritime AG with management companies.**

The Stena group is a family business which started in shipping not too long ago. Mr. Sten A. Olsson invested in his first coaster 1946. The founder is still actively involved in the daily business which now employs around 10.800. The shipping division of Stena today consists of Stena Ro-Ro, Stena Bulk, Stena Drilling, Stena Line and Concordia Maritime.

In the group we have two wholly owned ship management companies. Northern Marine Management in Glasgow and Universe Tankship in New York. Our Concordia class ships have, for very good reason's, made the head lines as show pieces of what good inspection and maintenance schemes mean for large tankers. The ships were built here in Japan by IHI, Kure in the early and mid 70's. They were not highly technically sophisticated tankers but built to a very robust standard, built to last and serve her owner for many years.

Our tankers are owned either by the family owned Stena Bulk AB or by the publicly listed company Concordia Maritime. In practice there is no difference in the way the ships are operated and managed.

When Concordia bought Universe Tankship it was decided that the large crews and the way the vessels had been operated would remain the same as it had been during Mr. Ludwig's ownership. Therefore, we can confirm the success as of systematic tank maintenance, strictly controlled the management.

It is not so easy to separate inspection and maintenance, for Stena, these two disciplines always go hand in hand.

Our ships have always been manned by large crews, always between 36-40 men. A group of the crew is especially trained to find structural defects in the hull and take appropriate action.

Steel repairs have been left to skilled welders but minor defects such as smaller pittings as well as break down of the coating have been taken care of by the ship's staff.

## **There are no short cuts to maintain high standard ships.**

We would like to state that there are no short cuts to maintaining a high standard. It takes a good new building specification and thereafter a lot of sweating but maybe more than that, it takes a lot of cash to do the job properly. However, far less than you preserve by doing a good job.

This paper will deal only with tank inspection and maintenance on U/VLCCs. This should however not be interpreted that we, in Stena, put less emphasis on deck and engine maintenance.

It is of utmost importance that the drive for quality work is deeply rooted within the organisation. That means that maintenance (in competition with other issues) has to be one of the top priorities from the CEO and down. Onboard it is the Master who has to carry the responsibility for the work. The Master can not be the type who spends his days in a white shirt in his office, he has to take an active part in the work. That means he has to often enter the tanks and inspect the work, this is really the best guarantee that the workers in the tanks will do a top quality job. It can not be stressed enough, the importance of commitment to the maintenance work from the senior officers on-board.

Stena Bulk and Concordia have through the years had as policy to use every single long ballast passage to inspect and repair tanks as well as cargo systems. This work has been done according to a schedule made up for each individual vessel. Each ship has a squad dedicated to hull inspection and maintenance. The work has been thoroughly followed up by a dedicated superintendent in the office who also regularly attend the vessels to follow up the work onboard.

We will here cover basically two types of inspection, primarily the inspections done on a regular basis by the ship's staff and secondly inspections done by more qualified personnel like class surveyors and hull superintendents.

On a single hull tanker, the main problem faced by the surveyor is access, how to reach all the different parts of the ship.

On a double hull tanker the problem is partly the same when it comes to the cargo tanks but the main problem is the enormous increase of area to be inspected compared with a single hull tanker.

The hull inspection of a tanker has to include all different type of tanks. On a tanker you have cargo tanks, ballast tanks, combined cargo/ballast tanks, coated/uncoated tanks, fore- and after peak tanks. In addition you have void spaces/cofferdams, bunker tanks, lube oil tanks, E/R double bottom tanks and fresh water tanks.

## Preparation

Before entering a tank you have to prepare yourself with proper equipment and there are a number of precautions to be taken.

- For cargo tank inspection, make sure that you have an experienced chief officer onboard who knows his job. There is nothing as frustrating as climbing down in a not properly cleaned tank.
- Wear a hard hat, safety shoes and carry a powerful lamp (ex-proof, if not gas free).
- Remember to bring a pocket size notebook and a pen, don't believe that you will be able to remember all the observations you've made until you're out of the tank. If the conditions are very humid, in order to protect the note book keep it in a small plastic bag.
- Depending on type and condition of the tank, bring a hammer, a UT-thickness gauge and a scraper.
- Never enter any space without checking the atmosphere for oxygen and toxic gas, even a space like a chain locker can be a death trap.
- Inform the officer on duty of your intentions and have a member of the crew stand-by at the tank entrance with a breathing apparatus ready for use. He should also have a stretcher or other means of getting a person out of a tank.
- Follow the tank entry procedure as described in the ship's safety manual.
- In order to keep the deck clean, ask for a container with saw dust to clean your boots in after the tank inspection is completed.
- Try to collect information from the ship you are inspecting or sister ships what defects can be expected and where they are likely to be found. If there are no records of previous defects it is important to try to estimate where it is most likely that a defect will occur.  
To just go inside a tank at the size of a cathedral with the purpose of looking for defects and not have any idea where and what to look for will be an extremely time consuming task.  
Conclusion: Experience is very useful.
- Finally, try to plan the inspections in such a way that you avoid tank inspection in very warm areas of our planet. It is almost impossible to carry out a proper inspection when the tank temperature is in the range 60-70°C.

As mentioned above, especially on tankers carrying Crude Oil or Heavy Fuel Oil proper tank cleaning as a preparation of the inspection is of utmost importance. Oil residues can hide most type of defects.

The most convenient way to move around in a tank on a single hull U/VLCC and in the cargo tanks of a double hull tanker is by rafting, that means to move around the tank using a rubber dinghy. You need a raft of good quality, especially if the tanks are corroded. Pieces of corroded steel can easily fall on the raft and puncture it if the quality of the raft is poor.

The raft is usually too big to enter into the tank after it has been inflated so that has to be done inside the tank and the raft has to be deflated each time it has to be moved to another tank.

Assuming you are carrying out a periodical- or a CAP-survey with two surveyors, which is often the case, you need a minimum 4 rafts to get the job done efficiently.

On a single hull tanker the inspection process is very straight forward, you raft the tanks at a few different levels, in order either to satisfy the Class or the owner's own interests.

In a double hull tanker the access in the ballast tanks is in general easier, you can walk around in the tanks and that way cover most areas, this is applicable not only to the tanks in the cargo area but also to the fore and after peaks.

The above is said with the exception of the hopper tanks which are more complicated spaces to inspect. If there are no permanent means of access, the area has to be inspected either from a raft or from a ladder which of course can be somewhat complicated. It should also be mentioned that the hopper tanks can vary a lot in size, in most cases it can be assumed that the raft will pass through the openings in the transverse web frames but that may not always be the case.

New ways in terms of access of cargo tanks has been developed recently, a few companies offer rental of smaller cherry pickers than can be disassembled and lowered into a tank. In the Stena Sphere we don't have any experience of such but it is definitely an interesting alternative.

Universe Tankship has developed some very useful tools for recording of inspection results.

It can always be argued if it is the right approach to send crew members down to carry out tank inspection. However, our experience is, that with proper guidance and instructions the crew can do a lot. In addition of course the tanks have to be inspected by a hull expert, that is usually a superintendent often together with a class or CAP surveyor.

In all its simplicity the reports have proven very helpful to carry out tank inspection and maintenance.

Enclosed are a set, not complete, but examples of the type of forms that have been used as instructions to the ships' staff and as reports to the office.

With these instructions and reports there is an incentive for the crew to thoroughly inspect all tanks and report any deficiencies.

### **Tank Maintenance.**

We have found grit blasting to be the most cost effective way to cover larger areas for maintenance. The annual consumption of grit on our ships is probably on the high side compared with other companies.

Much attention is given horizontal surfaces. Moderate pittings are filled up by welding

The method has through the years proven to be a very cost effective way to maintain the vessels with a CAP 1 rating.

# Tank inspection for corrosion control.

## 1.0 Scope

This procedure is applicable to all VLCCs operated by the company.

## 2.0 Responsibilities

The Master shall coordinate tank inspections based upon the vessel's schedule and trading pattern.

The Chief Mate shall ensure that tank inspections are performed and recorded according to this procedure.

Deck Officers shall assist with tank inspections under supervision of the Chief Mate.

## 3.0 Procedure

### 3.1 General

- The primary purpose of this program is to survey, track and record tank bottom pitting in cargo/ballast tanks for repair and re-coating.
- The Inspection program shall be coordinated in conjunction with the Supervisor – Coatings in the New York Office.
- The Enclosed Space Entry procedure must be followed prior to any tank inspection.

### 3.2 Inspection and Recording

- Results of tank inspections shall be recorded on the Tank Inspection Report indicating name of vessel, name of inspector and date of inspection.
- Conditions of tanks shall be recorded as follows:

#### Symbols For Bottom Pittings

0	No Pitting
0-R	No Pitting with Rust Spots
A	1-5 Pittings
B	6-10 Pittings

#### Symbols For Fittings In Tanks

LA	Ladder
HA	Handrail
AN	Anodes
TU	Tubing: Hydraulic and Tank Gage



C	11-15 Pittings	WWGR	Walkway Gratings
D	16-20 Pittings		
E	21-25 Pittings		
F	26-30 Pittings		
G	31+ Pittings		

Example:

<b>Code</b>	<b>Total Number of Pits</b>	<b>Deepest Pit</b>
A2	1-5	2 mm
B12	6-10	12 mm
C8	11-15	8 mm

- A copy of each Tank Inspection Report shall be forwarded to the New York Office.

#### 4.0 Records

Tank Inspection Report

# Cargo Tank Blasting.

## 1.0 Scope

This procedure is applicable to cargo tank blasting operations on all company tankers.

## 2.0 Responsibilities

The Master and Chief Officer shall plan all tank work based upon the vessel's trading pattern and weather conditions.

The Chief Officer shall supervise all cargo tank blasting and ensure that all safety precautions are observed.

## 3.0 Procedure

### 3.1 Primary Areas to be Treated

- Priority I - Bottom Plates under Bell Mouth Suction
  - Areas underneath bell mouth suction are prone to pitting.
  - To inspect and repair these pittings, the bell mouth must be removed by disconnecting flanges at suction pipe.
  - Deep pittings shall be built up by welding, then blasted and the area coated with two coats of ATMC 620 (78 HB). **If the vessel contains high tensile steel, contact the M&R Department for guidance.**
- Priority II - Bottom Plates
  - Any corroded or pitted area found on bottom plates shall be treated.
- Priority III - Horizontal Girders (Platforms)
  - Only pittings over 6mm deep shall be treated.
- Miscellaneous Fittings in Tank
  - This includes piping, tubing, handrails, ladders, anodes, walkway gratings and supports, etc. except dresser couplings.
  - All are to be treated with two coats of ATMC 620 (78HB). Surface preparation by gritblasting is **not** recommended.
- When carrying out this operation, tanks surrounding slop tanks are to be done at the same time or voyage. On the VLCCs, this means No. 5 Port/Starboard, No. 5 Center/Slop tanks where welding may be required for pittings under bell mouth suction.

### **3.2 Tank Bottom Cleaning/Marking**

For tank bottom pitting repairs these steps must be followed:

- Clean and muck the tank bottom.
- Pump out water and strip dry.
- Remaining water in rear frame spaces, where bell mouth suctions are located, must be stripped with portable submersible and mucked dry.
- Wipe and brush pitting area with solvent to remove oil residue and free of contamination.
- Mark pitting with white marking paint by circling each pitting or group of pittings for easy visibility during blasting. This is a must!

### **3.3 Blasting**

The following guidance is for Concordia Class vessels. For other vessels, refer to the M&R Dept. for guidance.

#### Tank Ventilation and Lighting

- Install blower with long ducting to reach blasting area.
- Install cargo tank lighting.
- Carry three- (3) battery type flashlight. When fogged, the plastic lenses must be replaced by cutting from a roll of plastic sheet 1-mm thick.

#### Vacuum Blaster "Educt-O-Matic"

- This shall be used only for isolated pittings on tank bottom plates and horizontal girders.
- It is very slow but avoids damage to the good existing coating near pittings.
- Nozzle and Hoses - Compact unit, only one size required. A long air hose is needed to lead unit to tank bottom.
- Use SAE G40 grit (steel grit). This grit can be reused four (4) times, but it must be cleaned with degreaser before each reuse. Grit hoses are not required.
- If steel grit is not available, use normal grit and discard after using.

#### Smaller Blasters "Clemco 1028 or 1042"

- Use this machine for larger pitting areas on tank bottom plates and horizontal girders including fittings in tank.
- Nozzle Sizes: CT 2 - 1/8" diameter, CT 3 - 3/16" diameter.
- Grit Hose Size: 1/2" diameter; Grit Hose Length: 100 - 150 feet
- Grit Size: 40-70 mesh is normal grit. If this is not available, sift 10 - 40 mesh grits to get small size grit. This type of machine is usually supplied with a sieve.

- This operation requires three persons: one person with a walkie-talkie on deck to control blasting machine and refill grits. Two persons are in the tank - one to do the actual blasting while the other carries a walkie-talkie and flashlight to guide and assist.
- The machine remains on the deck and only lead long grit hoses to tank bottom through butterworth holes. This method proves to be the most efficient as the two persons in the tank only carry half inch hoses while going up and down between longitudinals and transverse frame spaces.
- The remote control at deadman handle is not necessary.

Big Blasting Machine - Clemco 1648 or Japanese made.

- This machine is not recommended for use in tanks as it uses too much grit and requires an excessive clean-up effort.
- The large grit hoses are too heavy to handle and cause damage to the good existing coating near pittings.

### **3.3 Tank Bottom Cleaning after Blasting**

- After blasting, push grit from top of longitudinals; then clean area with a brush or broom and remove grit/dust to next frame or deck.
- An air hose to blow blasted surfaces may be helpful
- The person(s) or persons applying the first coat shall carry an additional clean paintbrush to remove any grit remaining in pittings.

### **4.0 Records**

Tank Inspection Report  
Deck Maintenance Report



## CORROSION CONTROL/COATING REPAIRS

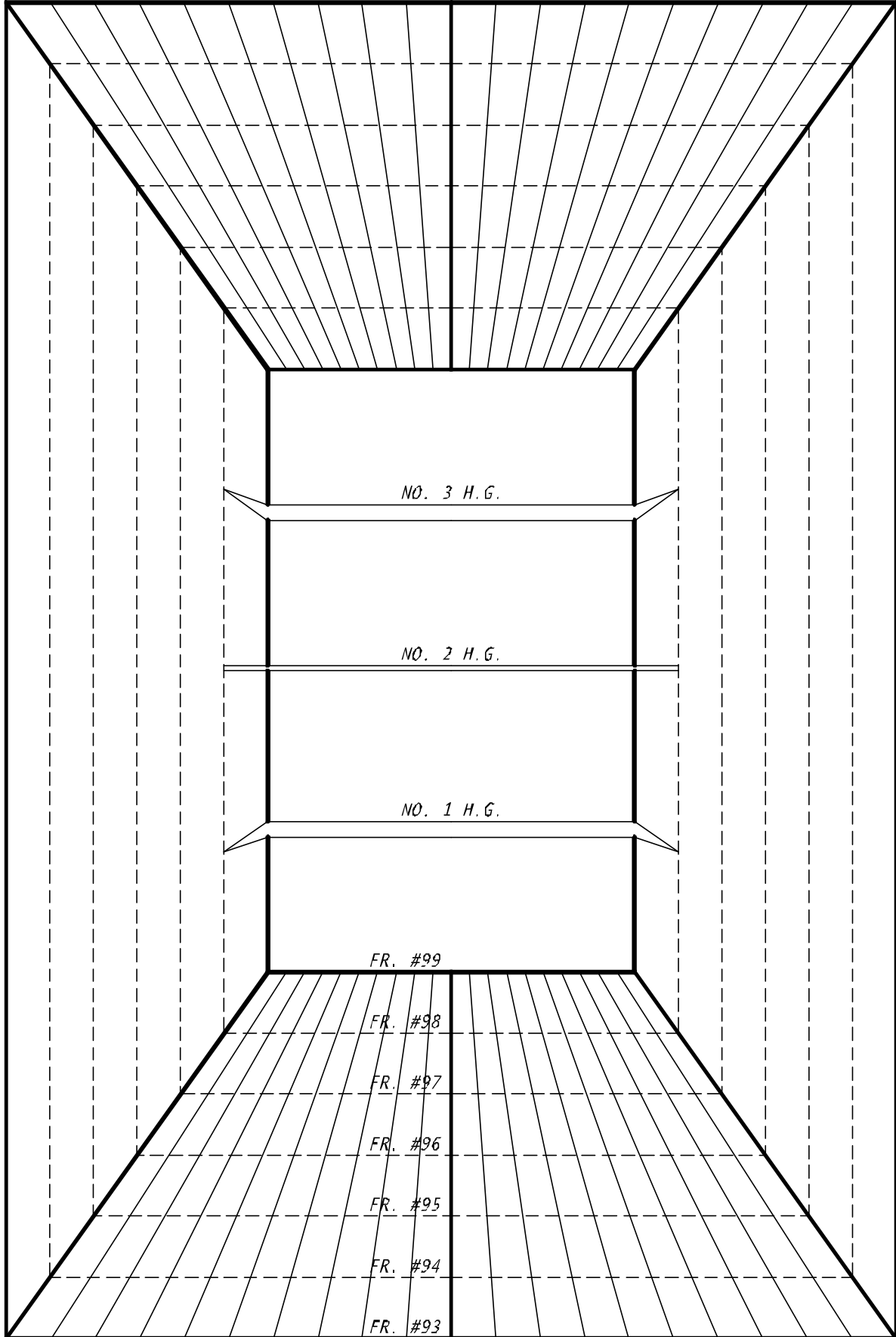
Vessel: S.S. STENA CONCORDIADate: 13-Jul-00

Tank No		Mucking		Removal of Bellmouth			Bottom Pitting Repair			H.G. Pitting Repair		Sideshell Longitudinal		Bulkhead Longitudinal		Remarks
		Date	Person	Date	Person	Dpth	Date	Person	Dpth	Date	Person	Date	Person	Date	Person	
No. 1	C	7/99	Hris/lone/Fred	4/95	Sequ/Lega/Ragg		7/99	Hris/lone/Fred	4		NA		NA		NA	
	P	7/99	Hris/lone/Fred	6/97	Rade/Call/Tila*	1*	7/99	Hris/lone/Fred	5		Good	4/95	Sequ/Lega/Ragg	4/95	Sequ/Lega/Ragg	Lower 5 long's "last frame only
	S	7/99	Hris/lone/Fred	6/97	Rade/Call/Tila*	1*	7/99	Hris/lone/Fred	6		Good	4/95	Sequ/Lega/Ragg		Good	Last frame only
No. 2	C	1/00	Hris/Duho/Fred	2/95	Sequ/Lega/Ragg		1/00	Hris/Duho/Fred	10	12/95	Good	7/95	Aft bhd	3/98	Partial	Deepest pit 15mm 12/98
	P	7/99	Hris/lone/Fred	7/99	Hris/lone/Fred		7/99	Hris/lone/Fred	4	7/99	Hris/lone/Fred	8/96	Dhil/Ruse/Ween	8/96	Dhil/Ruse/Ween	Insp. only. "L" bhd leak (partial)
	S	7/99	Hris/lone/Fred	7/99	Hris/lone/Fred		7/99	Hris/lone/Fred	3	7/99	Hris/lone/Fred	8/96	Dhil/Ruse/Ween	8/96	Dhil/Ruse/Ween	
No. 3	C	2/99	Hris/Gacu/Mano	9/95	Walk/Call/Moss		2/99	Hris/Gacu/Mano	4	2/99	Hris/Gacu/Mano					12/95 See 12/20/95 rpt for info from Sequ/Kape*
	P	2/99	Hris/Gacu/Mano	2/99	Hris/Gacu/Mano		2/99	Hris/Gacu/Mano*	4	5/93	Arso/Rade					Last & fwd frame only
	S	2/99	Hris/Gacu/Mano	2/99	Hris/Gacu/Mano		2/99	Hris/Gacu/Mano*	10	5/93	Arso/Rade					Last & fwd frame only
No. 4	C	1/00	Hris/Duho/Fred	7/96	Dhil/Ruse/Ween		1/00	Hris/Duho/Fred	15	1/00	Hris/Duho/Fred		NA		NA	12/98 Deepest pit 19mm
	P	12/98	Hris/Duho/Fred	2/96	Sequ/Kape/Ween		12/98	Hris/Duho/Fred	15	12/98	Hris/Duho/Fred	2/96	L #29 30 31	2/96	L #28 29 30*	7/96 3/4" type crack repaired
	S	12/98	Hris/Duho/Fred	2/96	Sequ/Kape/Ween		1/00	Hris/Duho/Fred	15	1/00	Hris/Duho/Fred	2/96	L #29 30 31*	2/96	L #28 29 30	7/96 L 31 to L 41 blast/coat holes
No. 5	C	5/99	Hris/lone/Cozi	7/96	Dhil/Ruse/Ween		5/99	Hris/lone/Cozi	6	6/99	Hris/lone/Fred		NA		NA	Good
	P	5/99	Hris/lone/Cozi	12/98	Toma/Kape/Lope		5/99	Hris/lone/Cozi	6	5/99	Hris/lone/Cozi	2/95	Sequ/Lega/Ragg*	2/95	Sequ/Lega/Ragg*	Up to "L" No. 32
	S	5/99	Hris/lone/Cozi	12/98	Toma/Kape/Lope		5/99	Hris/lone/Cozi	6	5/99	Hris/lone/Cozi	2/95	Sequ/Lega/Ragg*	2/95	Sequ/Lega/Ragg*	Up to "L" No. 34
Slop Tank		5/99	Hris/lone/Cozi	12/98	Toma/Kape/Lope*		5/99	Hris/lone/Cozi	3	5/99	Hris/lone/Cozi		Good		Good	Stripping suction only
No. 6	P															
	S															
E. Peak							5/97	Toma/Alan/Tila		5/97	Toma/Alan/Tila*					Top & middle spaces
A. Peak		12/98	Toma/Kape/Lope				2/97	Toma/Kape/Lope*		5/97	Toma/Call/Lope*		5/97	Toma/Call/Lope*		Completed

- ◆ No. 3C Underdeck and Bulkheads instead of Sideshell and Bulkhead Longitudinals. - 10/97 Completed fwd bhd (Rade/Call/Tila) - 10/97 84-86 btm "T"
- 7/97 No. 1C, P/S underdeck completed. - 3/98 No. 2C above No. 3 HG "T" bhd, 99-97 stbd "L" - 4/97 No. 2C aft "T" bhd partially done (Toma/Alan/Tila)
- 4/97 No. 4C aft "T" bhd partial (Toma/Kape/Tila) - 3/97 Fr. 102-104, 3/4 done. bhd 91-93 "P" "L" bhd. - 7/97 Partial (Rade/Call/Tila)
- 11/97 No. 4C aft "T" bhd partial (Rade/Call/Tila) - 2/98 No. 2C port lower "L" bhd. - 9/99 No. 3C btm "T" 76-81, 10ft above btm. - 11/97 "T" bhd again partial (Rade/Call/Tila)

INTERIOR TANK VIEW. SKETCH FOR COATING SURVEY.  
NO. 2 CENT. T'K (FR. #93 TO FR. #99).  
LOOKING FWD (1/2).

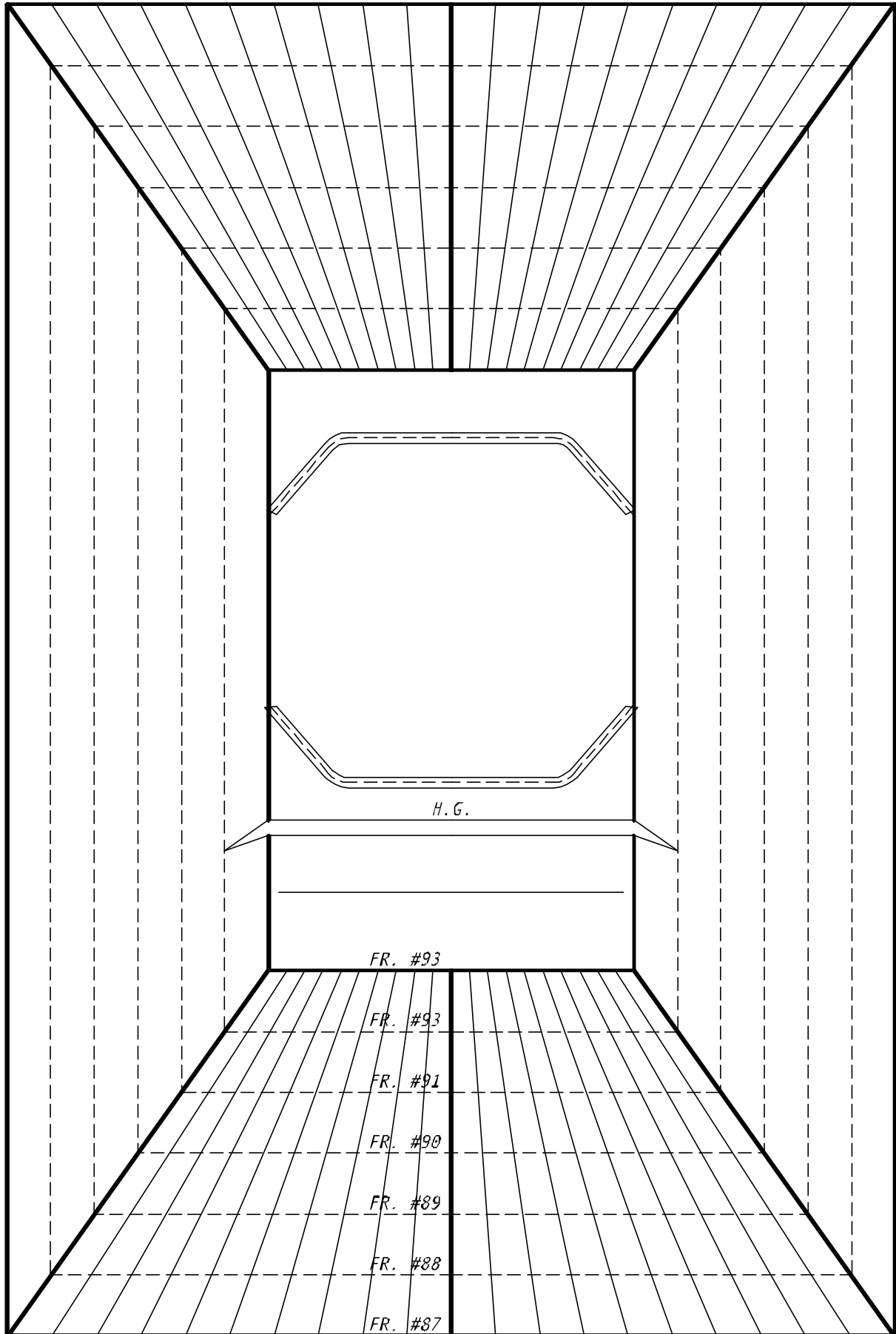
#10 P #9 P #7 P #5 P #3 P #1 P CL #1 S #3 S #5 S #7 S #9 S #10 S



#10 D #9 D #7 D #5 D #3 D #1 D #1 C #3 C #5 C #7 C #9 C #10 C

INTERIOR TANK VIEW. SKETCH FOR COATING SURVEY.  
NO. 2 CENT. T'K (FR. #87 TO FR. #93).  
LOOKING FWD (2/2).

#10 P #9 P #7 P #5 P #3 P #1 P CL #1 S #3 S #5 S #7 S #9 S #10 S

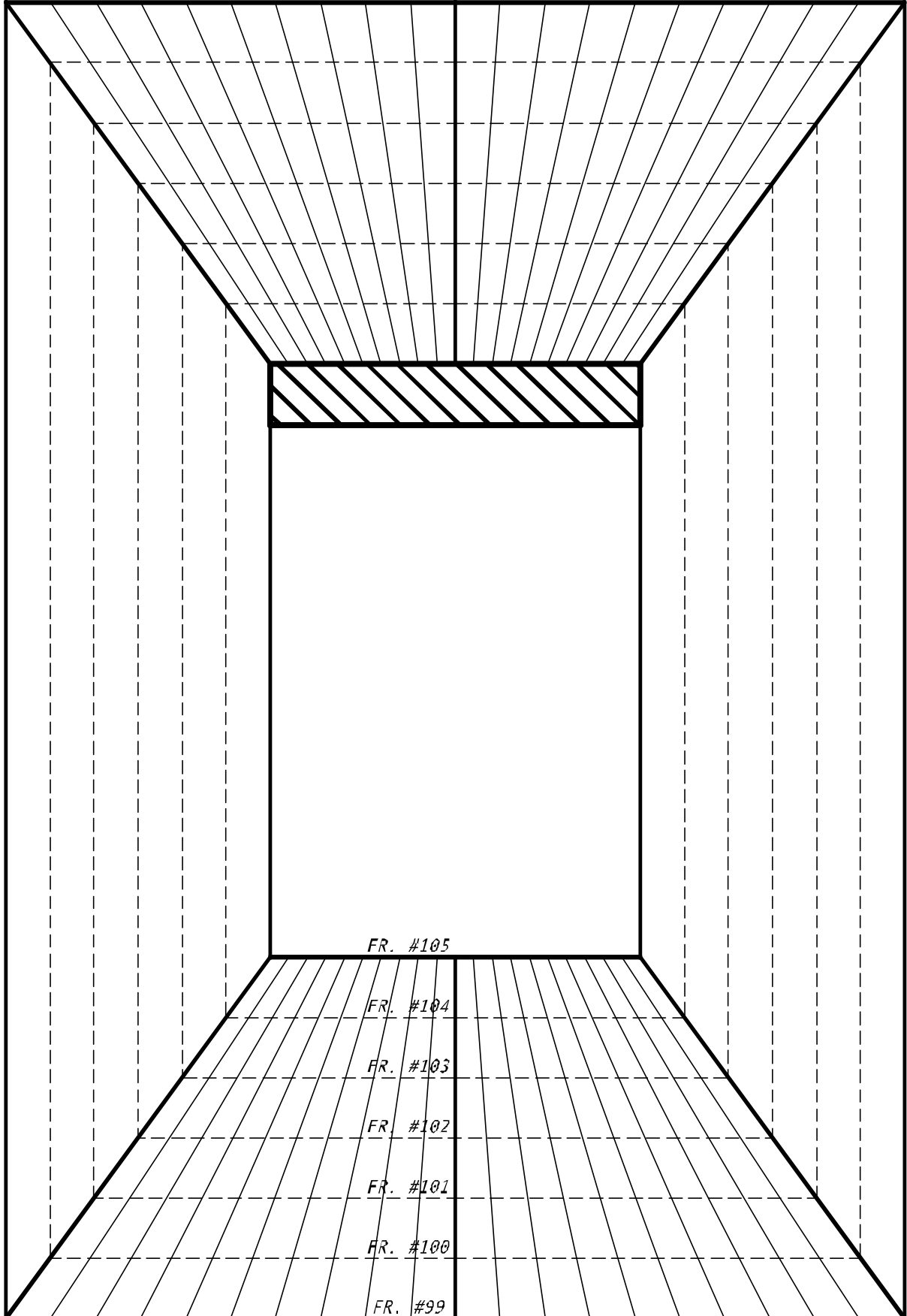


#10 D #9 D #7 D #5 D #3 D #1 D #1 C #2 C #5 C #7 C #9 C #10 C



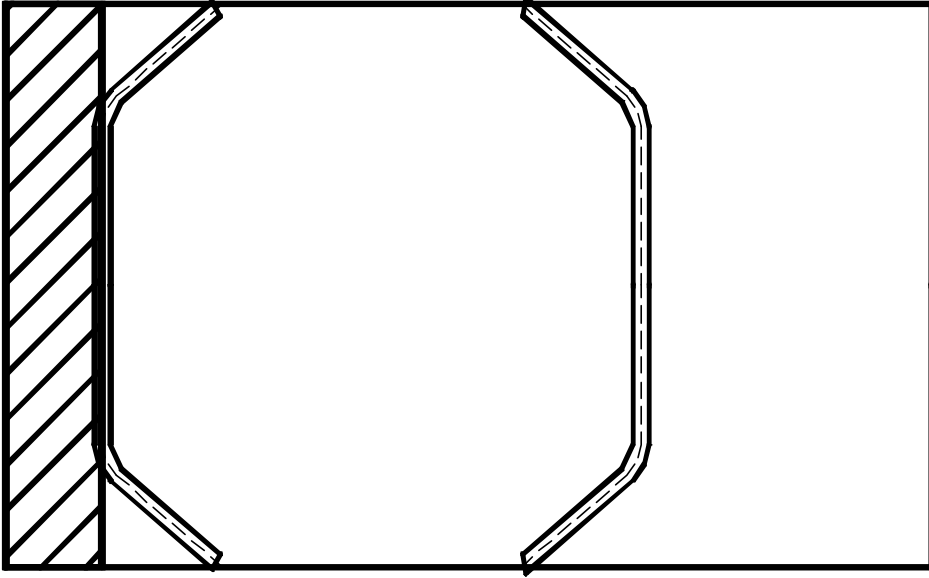
INTERIOR TANK VIEW. SKETCH FOR COATING SURVEY.  
NO. 1 CENT. T'K (FR. #99 TO FR. #105).  
LOOKING FWD (1/2).

#10 P #9 P #7 P #5 P #3 P #1 P CL #1 S #3 S #5 S #7 S #9 S #10 S

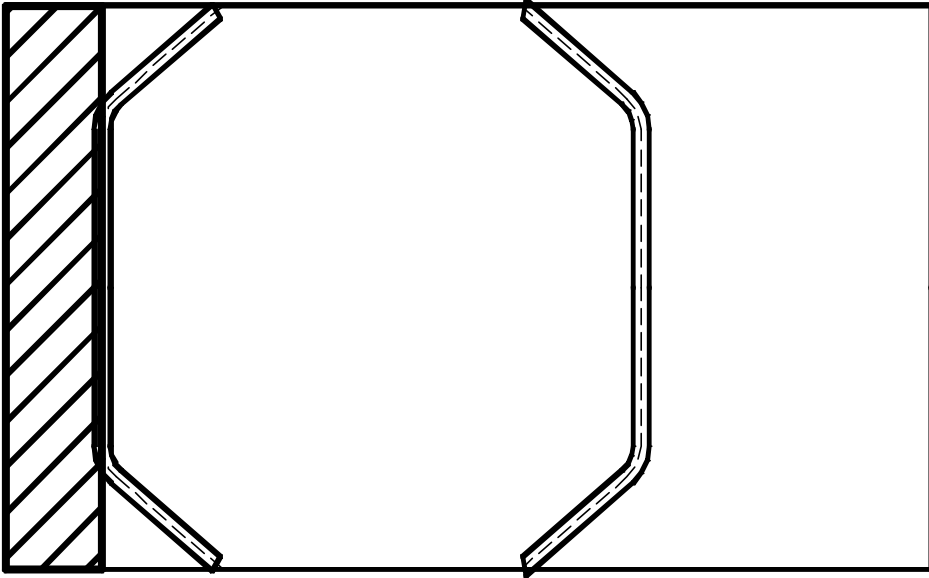


#10 D #0 D #7 D #5 D #3 D #1 D #1 C #2 C #5 C #7 C #0 C #10 C

FR. #103



FR. #104



The stripes indicate that the area is coated.

ALL TANKER VESSELS (EXCEPT STENA CONVOY)

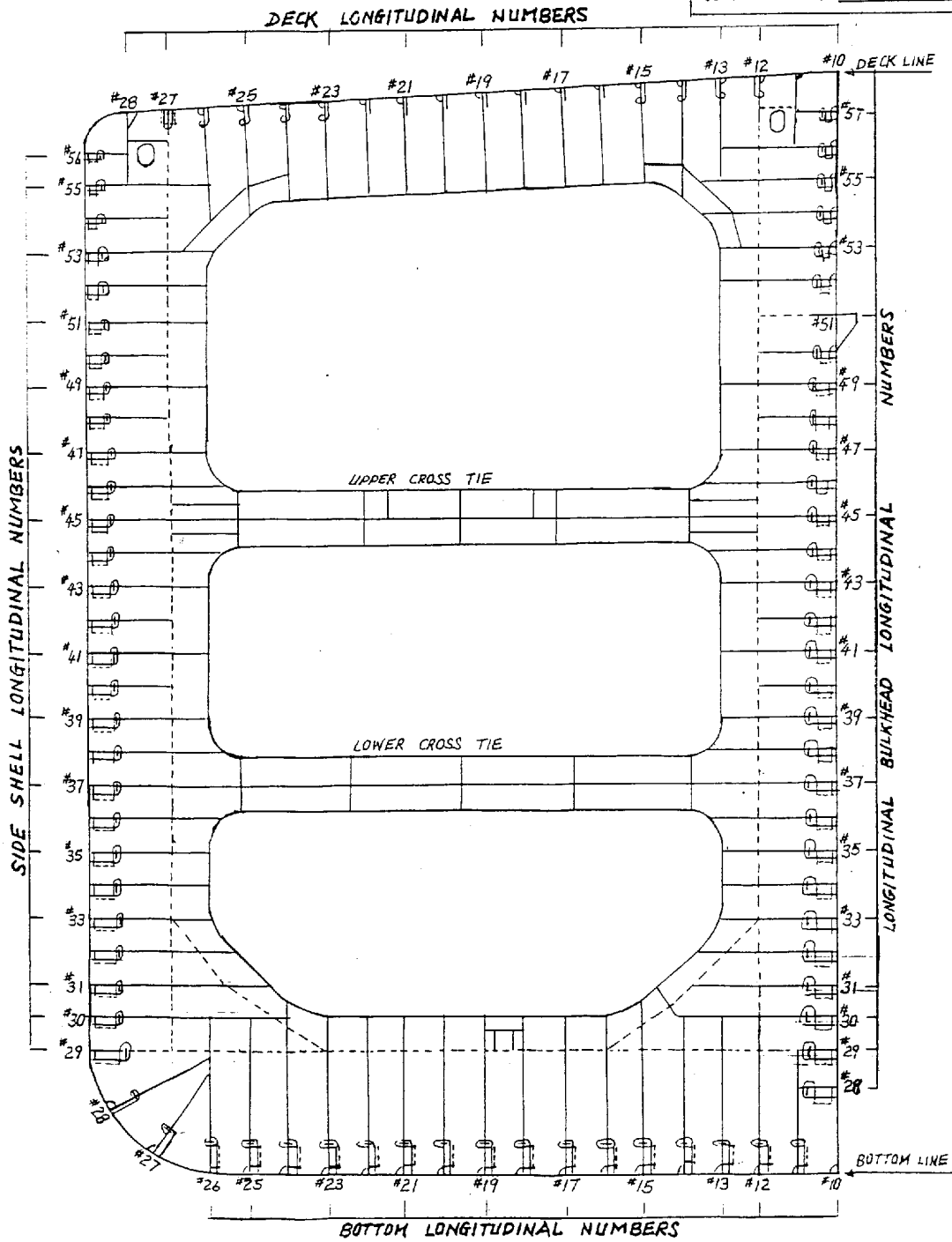
DATE: \_\_\_\_\_

TYPE OF CRACKS - WING TANK STRUCTURE MEMBERS

INSPECT BY: \_\_\_\_\_

REPAIRED BY: \_\_\_\_\_

REPORTED BY: \_\_\_\_\_

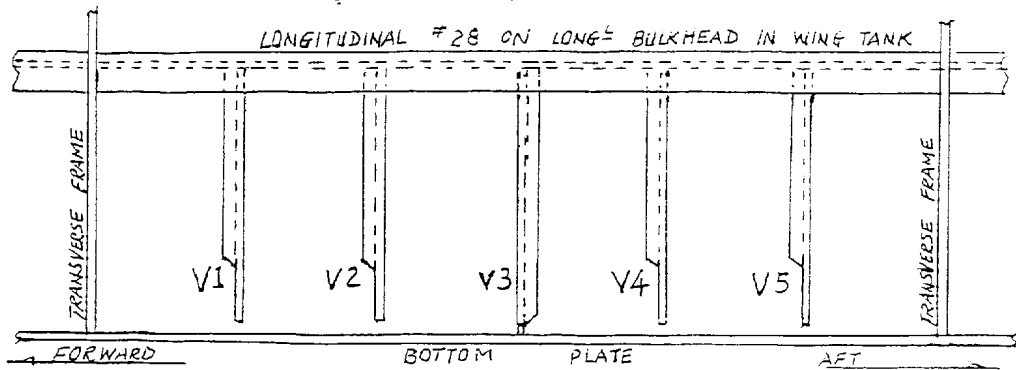




ALL TANKER VESSELS - TANK NO.  
LOCATION & TYPE OF CRACKS - VERTICAL STIFFENERS  
ON LONGITUDINAL BULKHEAD IN WING TANKS

<u>BETWEEN</u> <u>FRAME NO.</u>	<u>TYPE &amp;</u> <u>LOCATION</u>	<u>CRACK</u> <u>LENGTH</u>	<u>CROP &amp;</u> <u>RENEWED</u>	<u>WELDED</u> <u>ONLY</u>

DATE FOUND \_\_\_\_\_  
 DATE REPAIRED \_\_\_\_\_  
 INSPECTED BY \_\_\_\_\_  
 REPAIRED BY \_\_\_\_\_



TYPE V3

TYPE V1, V2, V4, V5

