FINAL REPORT
(YSB Interim Report R6-1-0469)

ENVIRONMENTAL EXPOSURE OF SAMPLE MODEL MARINE FUEL TANKS

UL ASSIGNMENT 65WW63
File MM-36

UL ASSIGNMENT 65WW32
File MM-10

UNDERWRITERS' LABORATORIES, INC.
333 OLD HOOK ROAD • WESTWOOD, NEW JERSEY 07675 TEL: 201-664-5300
an independent, not-for-profit organization testing for public safety

File MM-36
Assignment 65WW63

and

File MM-10
Assignment 65WW32

REPORT

on

ENVIRONMENTAL EXPOSURE OF SAMPLE MODEL MARINE FUEL TANKS

(Final - YSB Report R6-1-0469)

CONTRACTS: Allegheny-Ludlum Steel Corp. - 10 March 1965 with Supp'l. Agreement

USCG #Tcg-10-135-A - (with Supp'l. Agreements) - 18 July 1965 (Including Modifications To Date)

DATE: 27 February 1970

REPORT ON:

Completion of three years environmental exposure of sample Model Marine Fuel Tanks (without listing and labeling) as outlined in YSB Procedure R-6 and examined in YSB interim report R6-1-0469.

ITEMS COVERED:

1) One set of stainless steel tanks, Alloy No. 304, furnished by and under contract with Allegheny-Ludlum Steel Corporation.

2) One set of stainless steel tanks, Alloy No. 316(L), resistance welded. Purchased by Yacht Safety Bureau, Inc. under contract with USCG.

3) One set of stainless steel tanks, Alloy No. 316(L), tungsten inert gas welded. Purchased by Yacht Safety Bureau, Inc. under contract with USCG.

4) One set of terneplate tanks, proprietary model of Mirax Corp., purchased by Yacht Safety Bureau, Inc. under contract with USCG.

5) One set of Hot-Dip galvanized steel tanks for use as "control" samples. Purchased by Yacht Safety Bureau, Inc.

GENERAL:

The object of this report is to summarize conditions found after the three years exposure to a salt water marine environment, and to supplement the conclusion section of the YSB interim report R6-1-0469 on this test.

SHORE BOX TANKS:

In initially establishing the test procedure for this study, it was recognized that boats are stored ashore in a static condition for long periods and that the test program should cover that conditon, as well as the actual salt air exposure conditions encountered afloat. For this purpose sample tanks identical to those on the test hull were installed in a ventilated box located on shore. Although the basic exposure conditions were identical none of the shore box tanks were perforated.

REFERENCES:

1) "Interim Report - Environmental Exposure of Sample Model Marine Fuel Tanks", YSB Report R6-1-0469 dated 18 April 1969.

2) YSB Project R-6 (Tentative), "Environmental Exposure Testing of Sample Model Marine Fuel Tanks", dated 19. August 1965, with Addendum No. 1.

3) "Fire Protection Standard For Motor Craft" (NFPA No. 302) (ANSI Standard Z120.1 - 1968)

4) Naval Research Laboratory Memorandum Report 1795 - "The Corrosion Behavior of Stainless Steels in Sea Water".

DESCRIPTION OF ANALYSIS:

Upon return of the exposure hull to the Marine Department of Underwriters' Laboratories, Inc. the individual items were removed, partial cleaning of exterior surfaces was accomplished, and examination of the tanks, plus completion of photographic records was initiated. The concept of weight comparison mentioned in Reference 2 was discarded as meaningless due to the negligible amounts of lost metal on relatively heavy objects, plus the fact that deterioration sufficient to render some tanks useless was quite apparent by visual examination.

Photographs and comments are submitted in order to corroborate the conclusions reached.

Because of the hazard of transporting the test hull with fuel in the tanks, the tanks were flushed with water in September 1969 and drained. At the time the tanks were removed for inspection, approximately three (3) months later, it was found that some water remained in a number of the tanks. This fact should be specifically noted because of the possible effect on corrosion of those tanks. Notwithstanding the fact that the presence of water for the three (3) month period was unintentional, the presence of some water is not considered an abnormal exposure condition.

It does effect the results that depend upon comparisons among tanks that were not subjected the the same conditions

H.C. 5/13/70

GUM CONTENT:

At six month intervals, concurrent with change of fuel, gasoline samples were withdrawn and analyzed for existent gum content in accordance with ASTM-D439. Results of these tests indicate that excess gum formation is not induced by contact with any of the metals used in this test. However, it is interesting to note that significantly higher levels of gum were found in the fuel from the pairs of tanks which were alternately empty and full. This was attributed to the fact that the fuel was pumped back and forth through copper lines and brass fittings, and is still not considered analogous to service conditions - in which gasoline passes through the piping only once.

HULL TEMPERATURES:

During the third year of exposure, temperatures inside the hull were monitored by a combination of manual and graph recording of data. In both instances the thermometer and recorder probe were located approximately at deck level on the aft face of the bulkhead between the number 3 and 4 holds. During this period of manual monitoring readings were taken during regular working hours only, whereas the temperature recorder was in operation at all times, except as noted.

Time Period		Deg. F Lowest Temp.	Deg. F Highest Temp.
June	1968	78	98
July	1968	79	102
August	1968	87	102
September	1968	no valid data recorder improperly adjusted	
October	1968	50	86
November	1968	38	80
December	1968	26	65
January	1969	26	70
February	1969	30	68
March	1969	45	75
April	1969	48	83
May	1969	57	91

It should be noted that the temperature ranges noted are probably not as great as would be the case had temperatures been taken in the engine space of an operational boat in these waters, during the same time period. Obviously temperature is one of the factors involved in rate of corrosion, but just what effect other conditions would have produced is purely a matter of conjecture.

CONCLUSION:

1. Since issuance of the interim report, several of the opinions expressed therein have been confirmed.

2. Failures occurred in each of the tank materials under test - with the exception of the Galvanized Steel Tanks.

3. Inasmuch as a study of the included photographs and related comment reveals that deterioration of the Nos. 304 and 316(L) Stainless Steel Alloys was quite similar in character and rate of growth, it may be concluded that there is little to choose between the two, as far as corrosion resistance of this type is concerned.

4. No actual perforations were noted in the welded areas of either the tungsten inert gas welded or resistance welded tanks. However, it should be noted that pitting was more prevalent in the resistance welds.

5. While most of the actual failures of the various stainless steel tanks occurred in "induced areas", it must be recognized that similar areas would undoubtedly be created, perhaps inadvertently, in any given fuel tank installation. Also, the Galvanized Steel Tanks, which had the same type of "induced areas" and identical exposure conditions, suffered no ill effects as a result.

6. Failures or deep pitting in the Terneplate tanks were likely to occur at almost any area of exposed surface. Photograph Nos. 44, 64 and 65, showing perforations through the tank bottom illustrate the case in point, although this was one of the tanks inadvertently subjected to fresh water as mentioned on page 2. Areas close to tank fittings were also noted as being extremely susceptible to pitting and perforations as illustrated by Figs. 41 and 66.

7. Because each type of tank under test failed during the environmental exposure period, whereas the control sample tanks withstood the exposure admirably and are still completely serviceable, it is felt that there is no justification whatsoever for including Stainless Steel Alloy No. 304, or Alloy No. 316(L), or Terneplate on the advisory lists of materials suitable for the fabrication of Marine Fuel Tanks for fixed installation.

Report by:

Richard P. Ketcham

RICHARD P. KETCHAM
Project Engineer
Marine Department

Reviewed by:

Robert Loeser

ROBERT LOESER
Associate Managing Engineer
Marine Department

E. S. Terwilliger

E. S. TERWILLIGER
Managing Engineer
Marine Department

I N D E X

NOTE: Numbers on tanks and panels indicate actual locations during test. Numbers without suffix were in ventilated shore box. Numbers suffixed "H" were on board floating hull. A print identifying exact locations is attached.

Final Inspection Report
FIG. NO. 1

Project: 65WW32
File: MM-10

Tank No. 17H

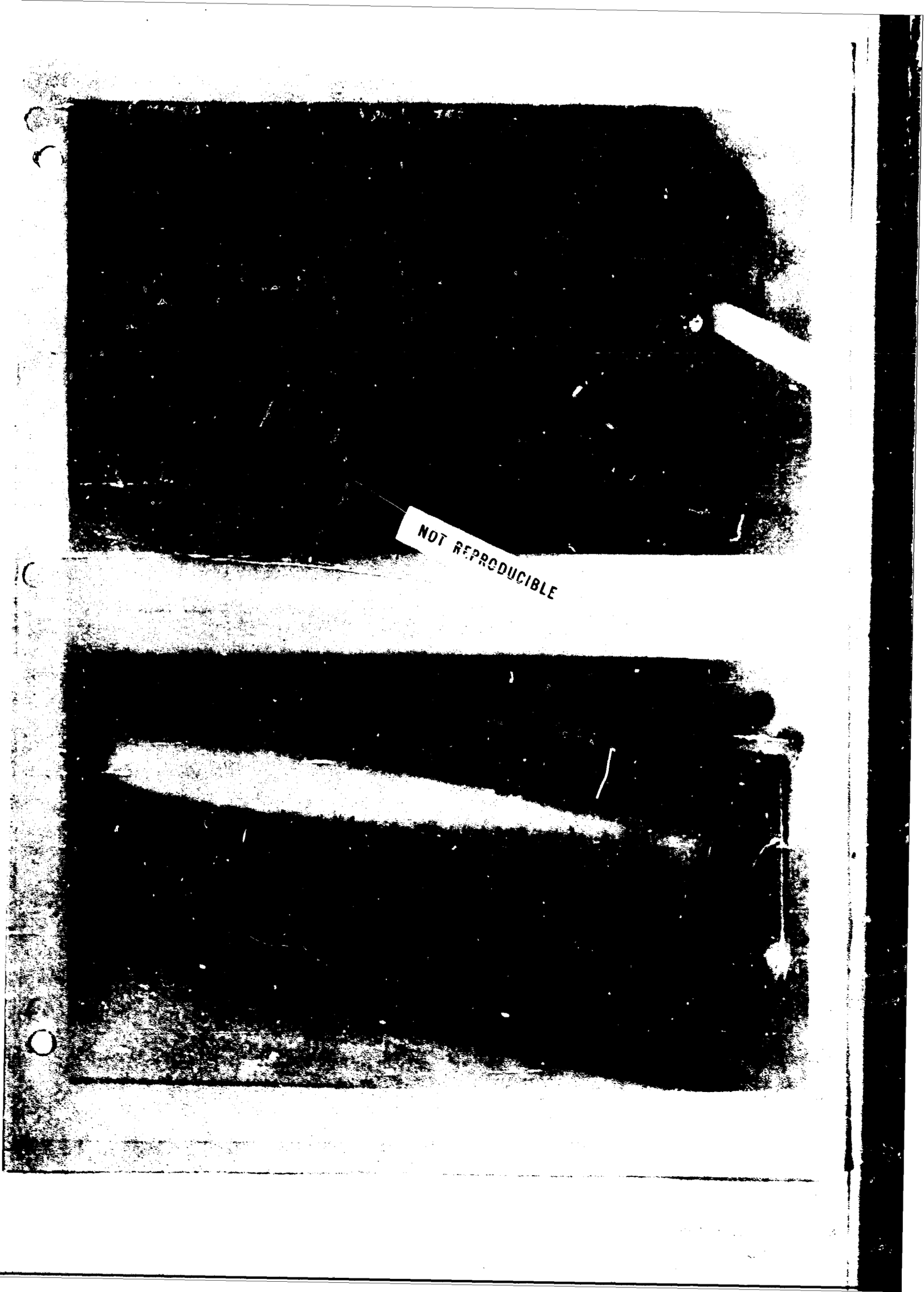
Rectangular, Alloy No. 304 Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull - filled with gasoline. Tank was de-fueled after two years' exposure, as a safety precaution, due to perforations which had occurred by that time.

Comment on Photo:

Surfaces generally have mottled appearance, with rust streaks. Rectangular area between fittings (top view) indicates location of sea water reservoir during test. Perforations may be seen on upper surface of tank, in way of reservoir bedding area. Perforations are circled and numbered 1, 2, 6 and 7. See Fig. No. 2 for close-up of the perforations.



Final Inspection Report
FIG. NO. 2

Project: 65WW32
File: MM-10

Tank No. 17H

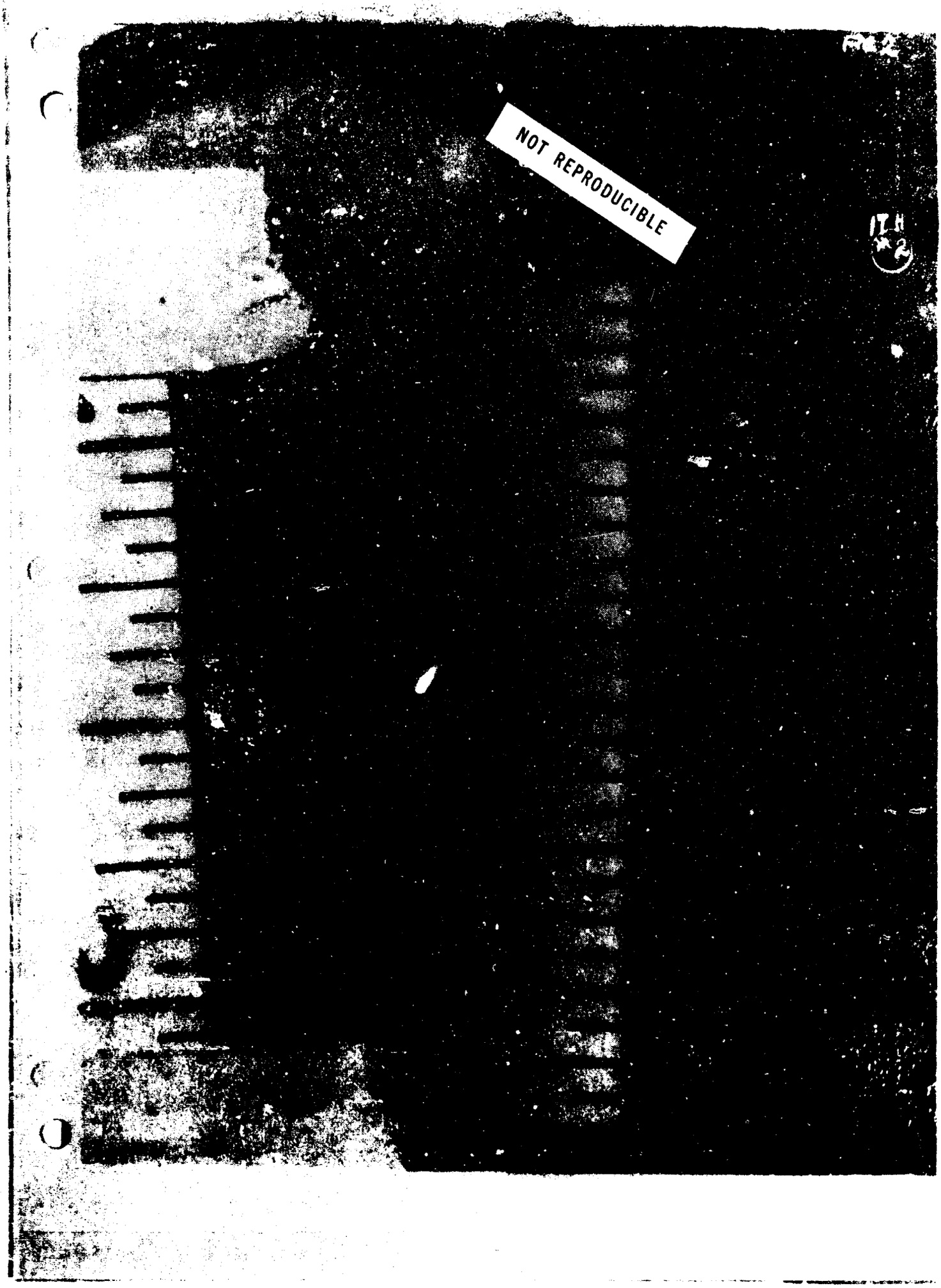
Rectangular, Alloy No. 304 Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull - filled with gasoline (two years)

Comment on Photo:

Close-up views of perforated areas shown in Photo No. 1. Perforations are typical of crevice corrosion in "induced areas" where moisture can remain trapped - in these cases under the salt water reservoir.


NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 3

Project: 65WW32
File: MM-10

Tank No. 16H

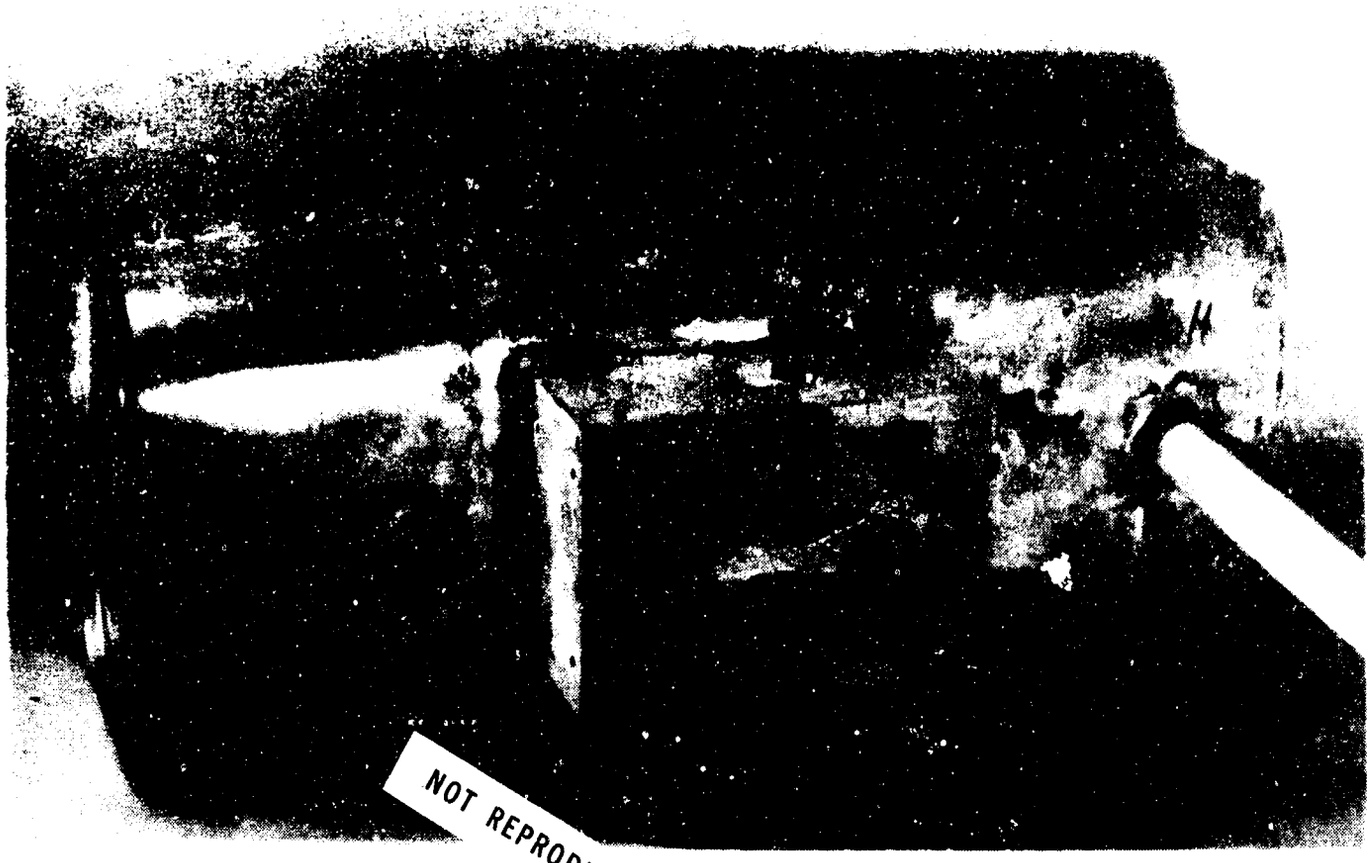
Rectangular, Alloy No. 304 Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull - empty throughout test.

Comment on Photo:

Top and bottom views of tank before removal of reservoir, and black bedding compound in way of wood-metal faying surfaces. Corrosion in way of welded seam and end chock liner is circled and marked 1, 5, 6 and 7. See Figs. No. 4 and 5.



Final Inspection Report
FIG. NO. 4

Project: 65WW32
File: MM-10

Tank No. 16H

Rectangular, Alloy No. 304 Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull - empty throughout test

Comment on Photo:

General view of top surface of tank in way of sea water reservoir location. Numbered, marked areas 1 - 7 (inclusive) are perforated (see Fig. No. 5). Areas 8 - 13 (inclusive) show considerable pitting, with depths of up to 0.021".

Other areas of tank show less severe pitting and corrosion.


NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 5

Project: 65WW32
File: MM-10

Tank No. 16H

Rectangular, Alloy No. 304 Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull - empty throughout test

Comment on Photo:

Close-up views of marked areas 1, 5, 6 & 7 of Fig. No. 4. Perforations and surrounding pitted surfaces are clearly visible. See Fig. No. 4 for location.

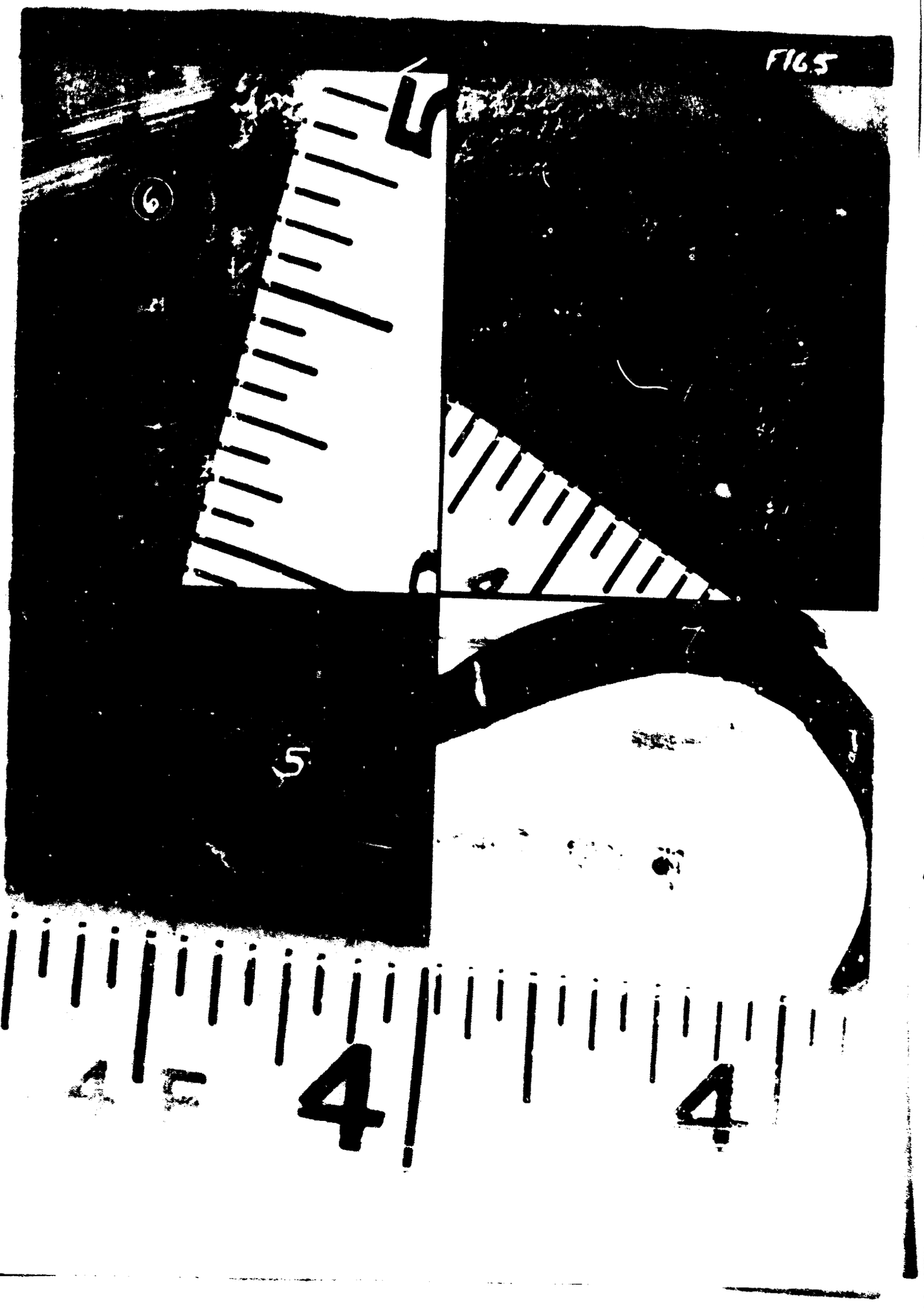


FIG 5
6
5
7
4
4

Final Inspection Report
FIG. NO. 6

Project: 65WW32
File: MM-10

Tank No. 2H

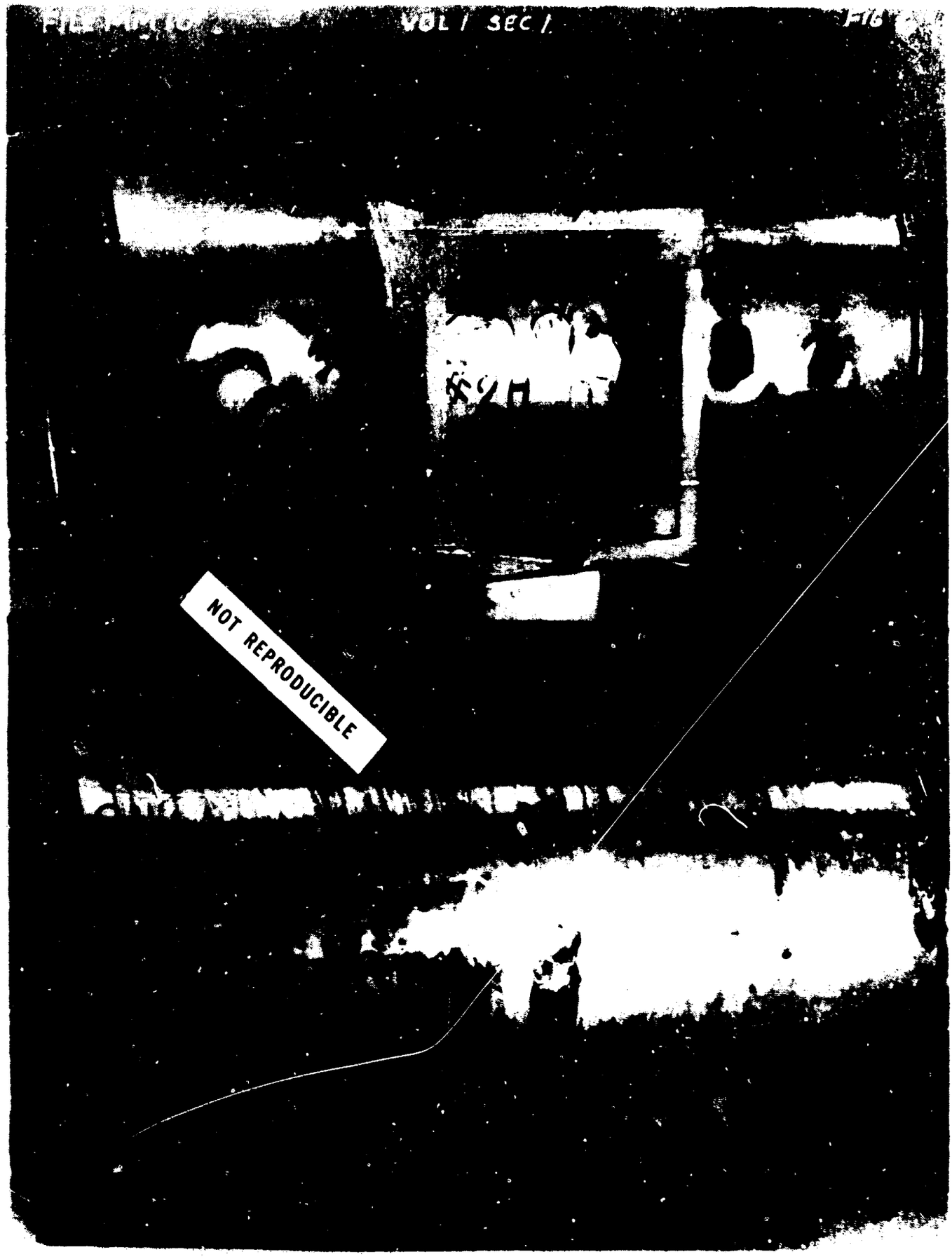
Cylindrical, Alloy No. 304 Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull. Alternately empty and full for first two years. Full during third year.

Comment on Photo:

Upper and lower surfaces of tank before removal of sea water reservoir and bedding compound. General mottling and discoloration is evident. Numbered areas indicate pits and perforations. See Fig. No. 7 for close-up views.


VOL I SEC I
FIG
NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 7

Project: 65WW32
File: MM-10

Tank No. 2H

Cylindrical, Alloy No. 304 Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull. Alternately empty and full for first two years. Full during third year.

Comment on Photo:

Crevice corrosion pitting and perforations in way of sea water reservoir. Index No. 1, 2, 3 and 8 are perforated. No. 2 shows severe corrosion pitted to .029".

NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 8

Project: 65WW32
File: MM-10

Tank No. 2H

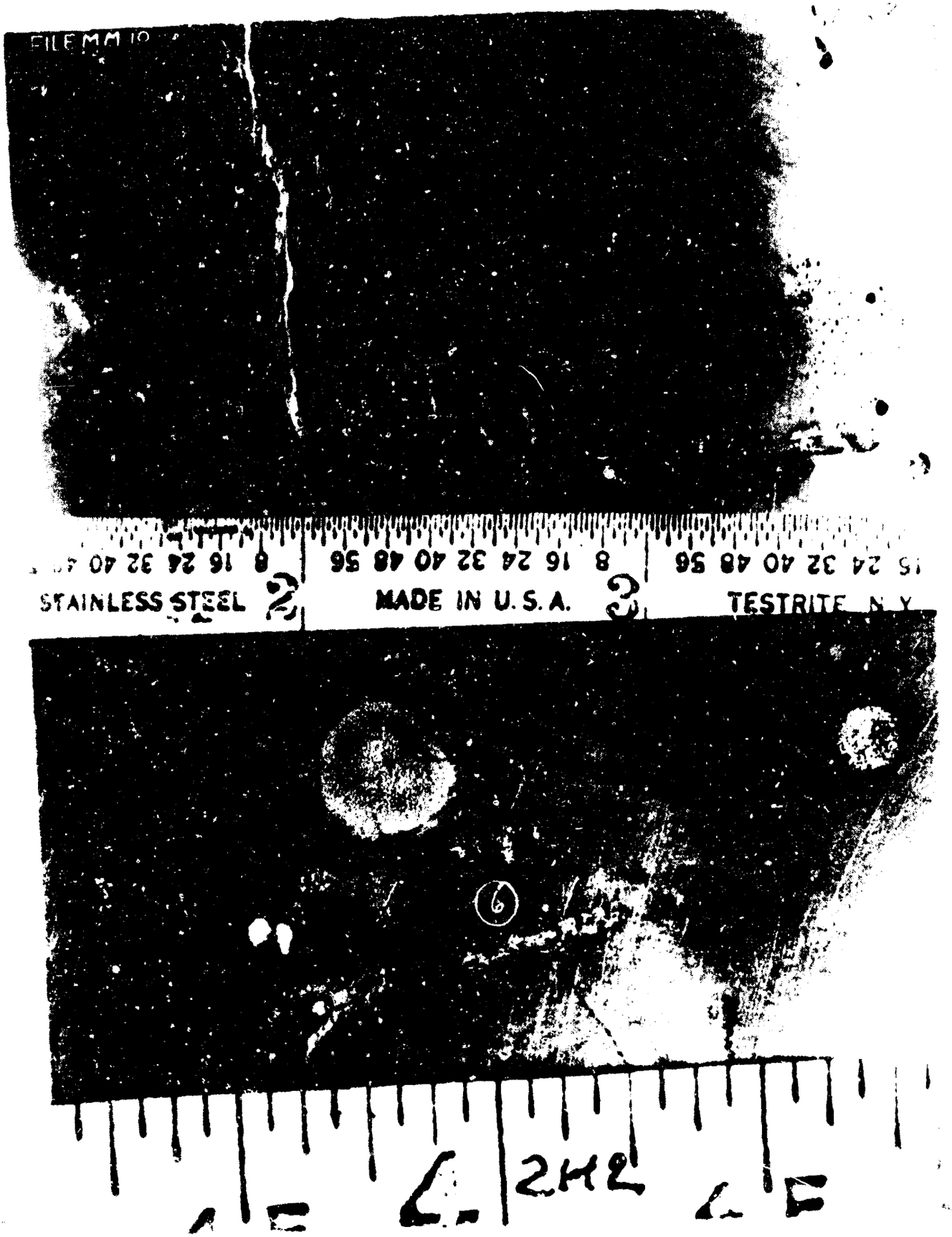
Cylindrical, Alloy No. 304 Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull. Alternately empty and full for first two years. Full during third year.

Comment on Photo:

Close-up views of perforations indicated by Nos. 2 & 3 in Fig. No. 6.


FILE MM 10
STAINLESS STEEL
MADE IN U.S.A.
TESTRITE N.Y.
6
2
3
4
5

Final Inspection Report
FIG. NO. 9

Project: 65WW32
File: MM-10

Tank No. 2

Rectangular, Alloy No. 304 Stainless Steel, Electrically Welded

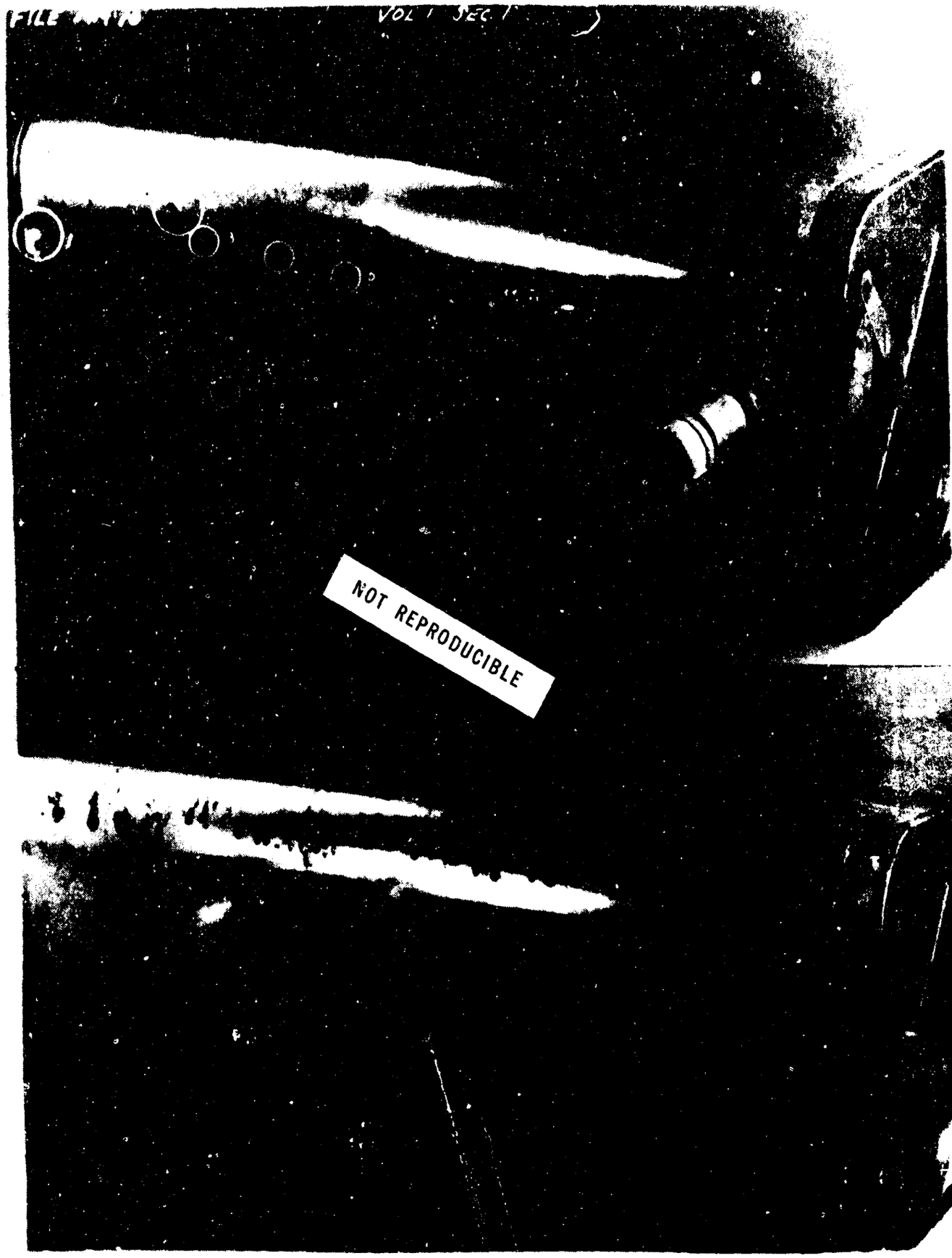
Exposure Conditions:

Empty, in ventilated shore box

Comment on Photo:

Upper surface of tank. Circled spots indicate clusters of small pits. Over 50 such spots were found to exist. Each spot consisted of numerous small pits averaging 0.004 - 0.006 inch in diameter and up to 0.004 inch depth. It is significant that these spots occurred in "open", as opposed to "induced" areas, and that exposure conditions of this tank were not as stringent as those generally encountered in service.

Lower surface of tank showing corrosion "weeping" from welded seam such "weeping" though superficial in nature, will provide moistrue pockets at which crevice corrosion will occur.


VOL I SEC I
NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 10

Project: 65WW32
File: MM-10

Tank No. 7

Cylindrical, Alloy No. 304 Stainless Steel, Electrically Welded

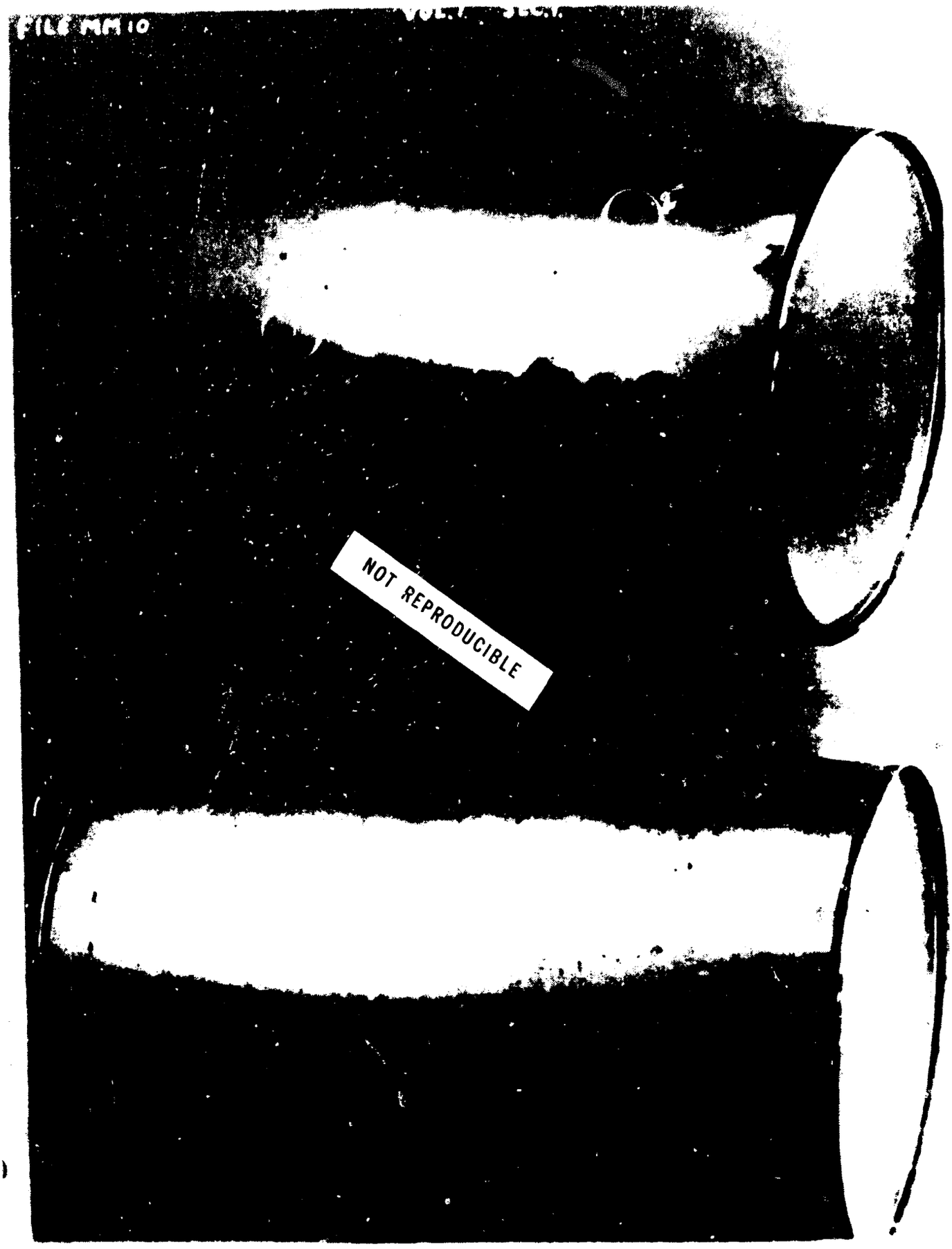
Exposure Conditions:

Empty in ventilated shore box

Comment on Photo:

Upper surfaces and one end plate of tank. Clusters of pits, averaging 0.003 to 0.004 inch diameter are clearly visible on open areas of tank, as well as in way of fuel suction and vent fittings. Greatest pit depth is approximately 0.003 inches.

Under surfaces of tank show mottled effect and "weeping" of corrosion from welded seam, as well as clusters of shallow pits, up to 0.003 inch depth.


FILE MM 10
NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 11

Project: 65WW32
File: MM-10

Tank No. 22H

Cylindrical, Alloy No. 304 Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull, alternately empty and full for two years. Full of gasoline third year.

Comment on Photo:

Upper and lower surfaces of tank dulled and streaked by light corrosion. Major areas of corrosion are within "induced" area of sea water reservoir, but some spots are noted in open areas. Many rust streaks emanate from welded longitudinal seam. While no perforations occurred corrosion to a depth of .026 inch was measured at No. 2, No. 3 and No. 7.

Final Inspection Report
FIG. NO. 12

Project: 65WW32
File: MM-10

Tank No. 19H

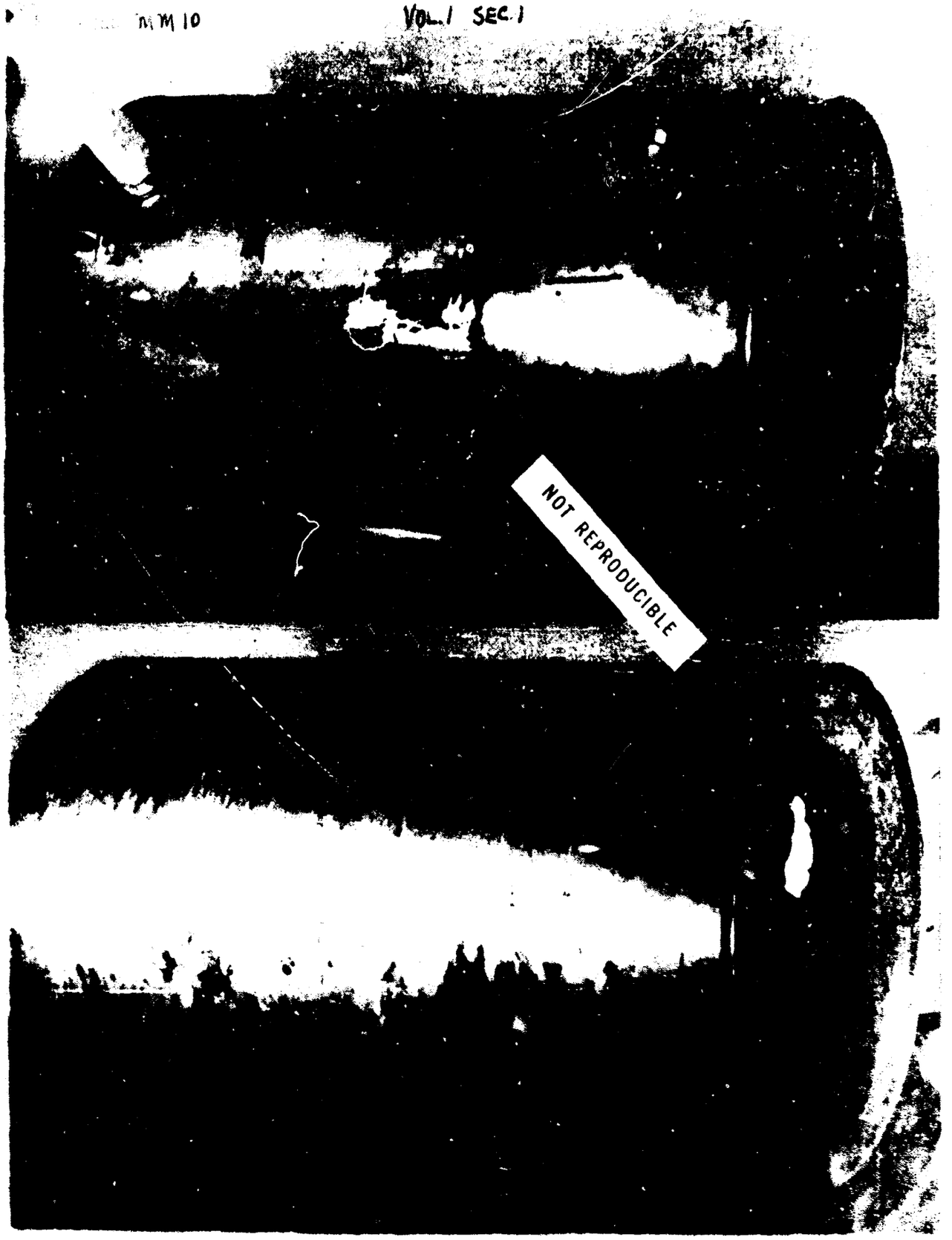
Cylindrical, Alloy No. 304 Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull, empty of fuel for three years

Comment on Photo:

Upper and lower surfaces of tank dulled and streaked by corrosion. Perforation occurred at No. 1 above rule. This is the inside edge of salt water reservoir.


NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 13

Project: 65WW32
File: MM-10

Tank No. 19H

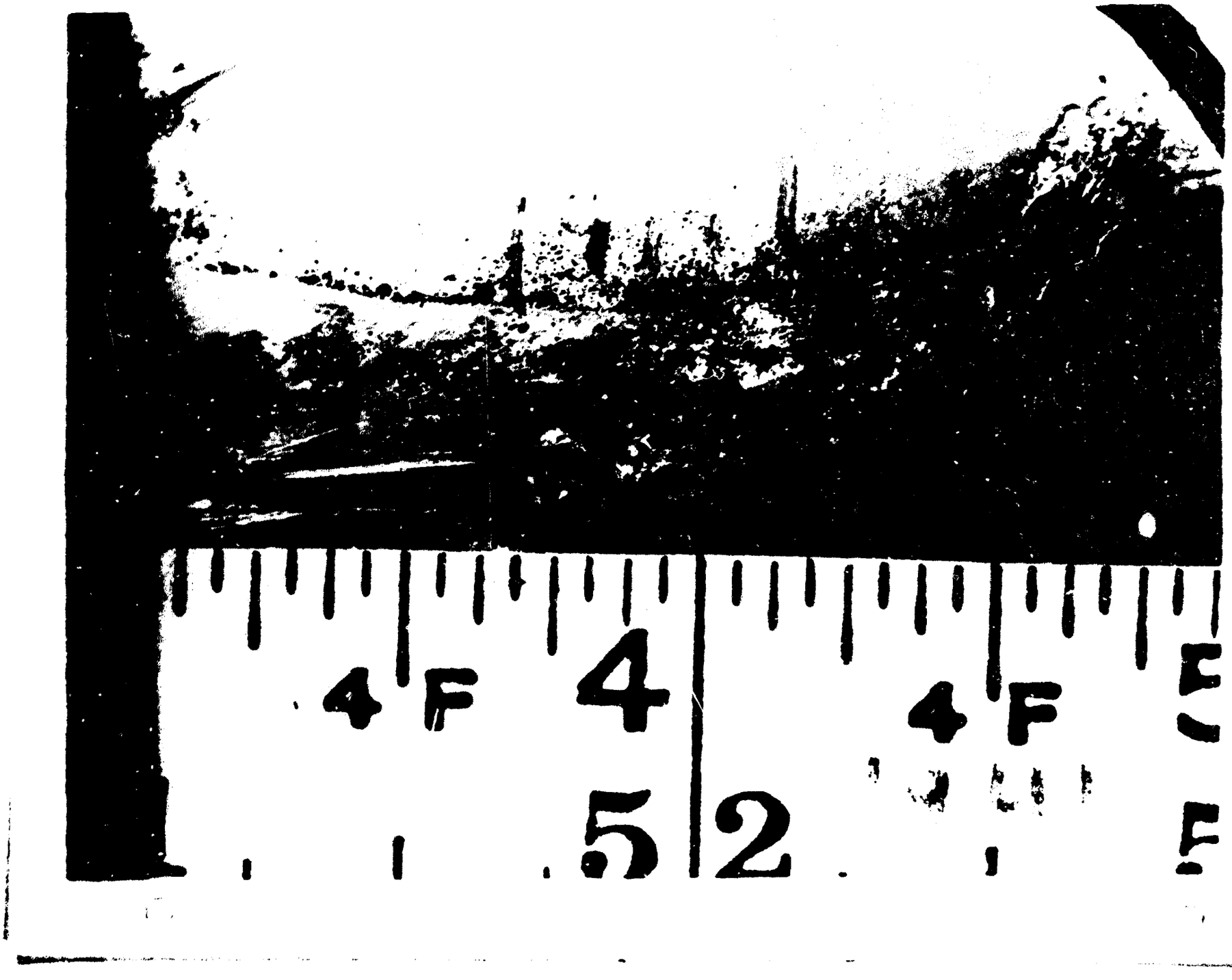
Cylindrical, Alloy No. 304 Stainless Steel, Electrically Welded

Exposure Conditons:

Aboard hull, empty of fuel for three years

Comment on Photo:

Close-up of perforated area noted on Figure No. 12.


4F 4
4F
5 2

Final Inspection Report
FIG. NO. 14

Project: 65WW32
File: MM-10

Panel No. 2

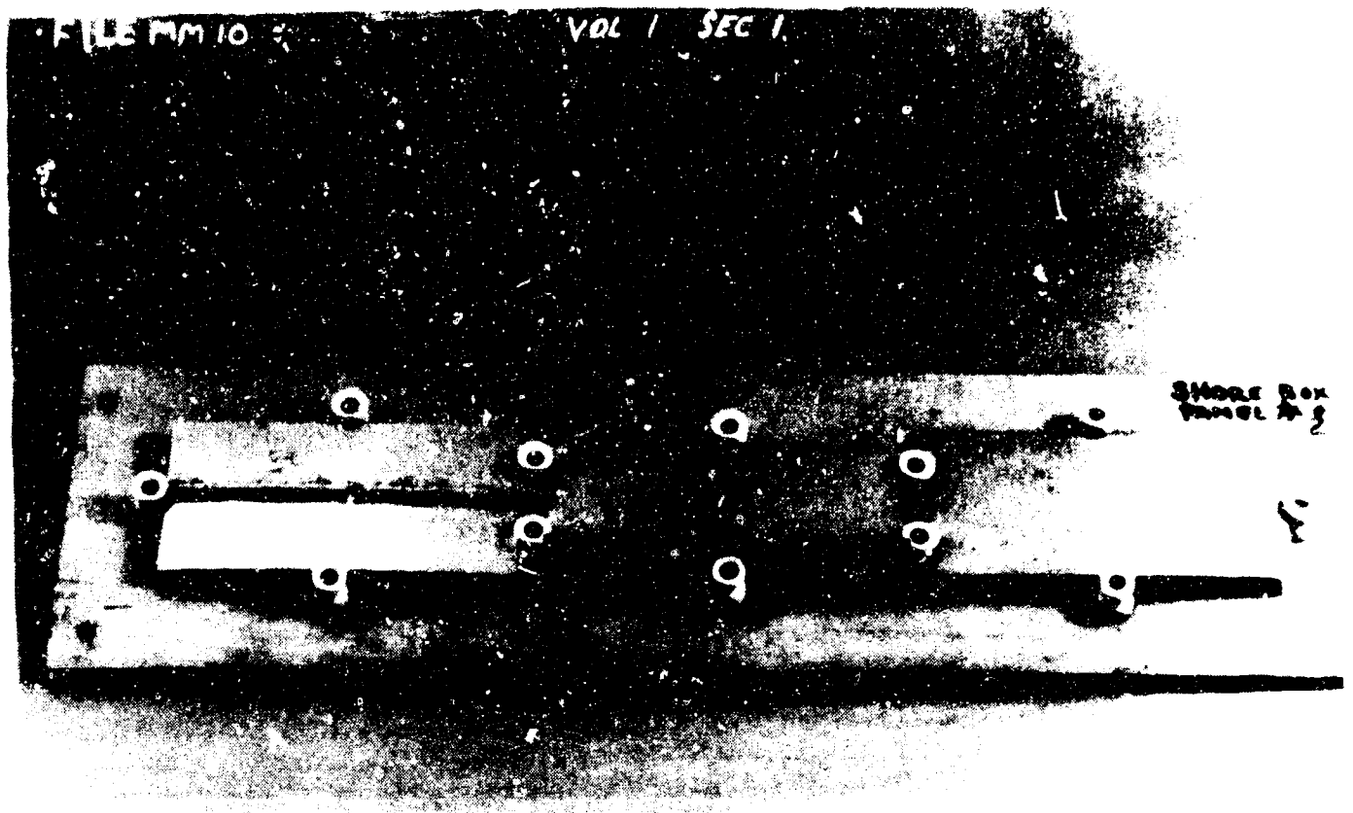
Alloy No. 304, Stainless Steel

Exposure Conditions:

In ventilated shore box

Comment on Photo:

Panels have been uniformly dulled, and lightly spotted. Corrosion was noted in a continuous line along the resistance weld in one panel. Maximum pit depth approximately 0.003 inch.


FILE MM 10
VOL I SEC 1

Final Inspection Report
FIG. NO. 15

Project: 65WW63
File: MM-36

Tank No. 18H

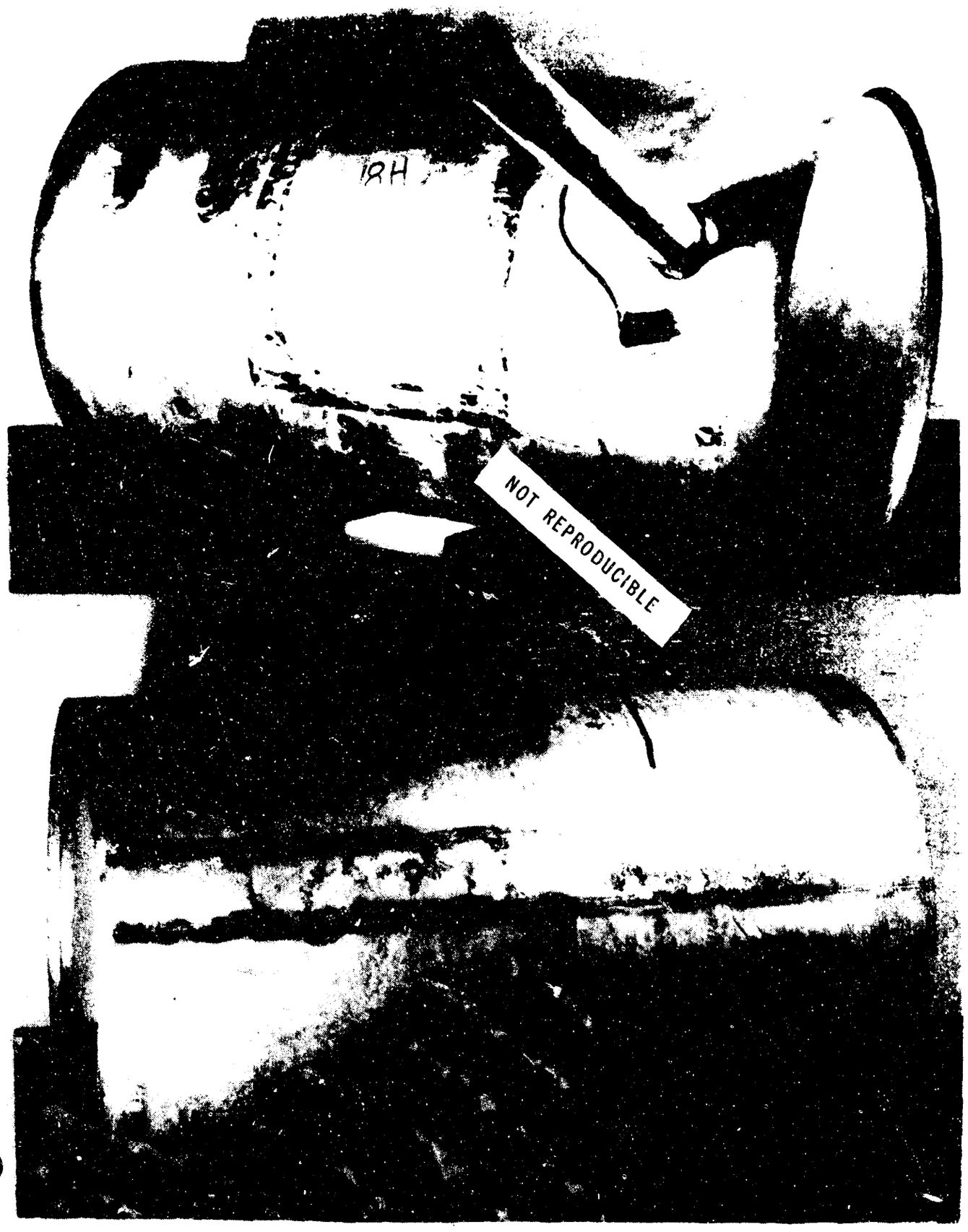
Cylindrical, Alloy No. 316(L) Stainless Steel, Gas Welded.

Exposure Conditions:

Aboard Hull, empty through test.

Comment on Photo:

Top and bottom surfaces of tank showing corrosion and discoloration along welded seams, as well as numerous areas of minor pitting. No perforated areas were found, but crevice penetrations up to 0.009 inch (about 25% of shell thickness) were measured.


IRH
NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 16

Project: 65WW63
File: MM-36

Tank No. 4H

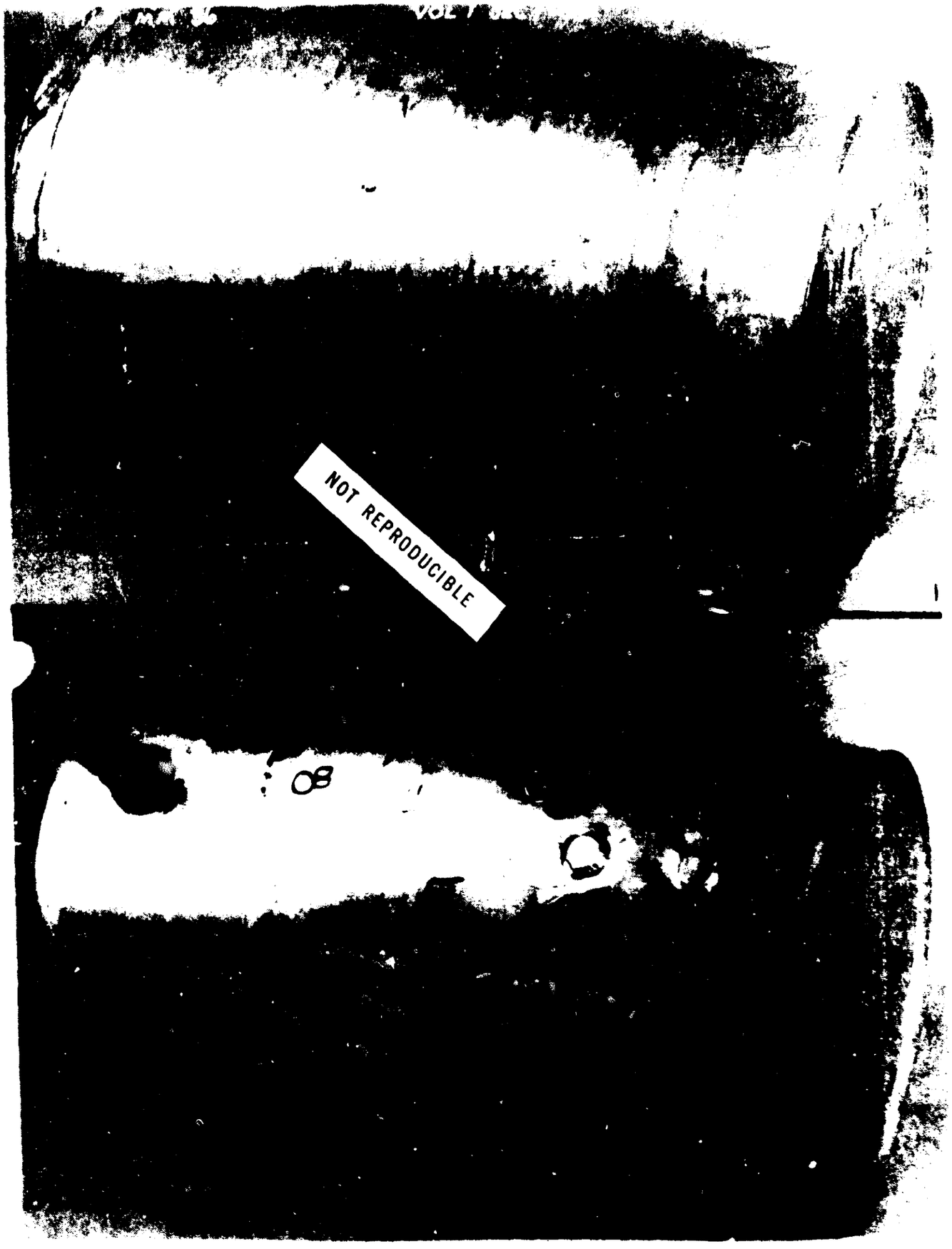
Cylindrical, Alloy No. 316(L) Stainless Steel, Gas Welded

Exposure Conditions:

Aboard Hull. Alternately empty and full, first two years. Full for entire third year.

Comment on Photo:

Lower and upper surfaces of tank showing rust streaks and corrosion spots in way of welds, fitting, and sea water reservoir. Numbered areas indicate deep pitting in way of sea water box location. See Fig. No. 17 for representative close-ups.


NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 17

Project: 65WW63
File: MM-36

Tank No. 4H

Cylindrical, Alloy No. 316(L) Stainless Steel, Gas Welded

Exposure Conditions:

Aboard Hull. Alternately empty and full, first two years. Full for entire third year.

Comment on Photo:

Close-up view of representative pitted areas indicated in Photo No. 14. No complete penetration was found, but pit depths up to 0.025 inch were measured.

VOL SEC

FIG 17

Final Inspection Report
FIG. NO. 18

Project: 65WW63
File: MM-36

Tank No. 1

Rectangular, Alloy No. 316(L) Stainless Steel, Gas Welded

Exposure Conditions:

In ventilated shore box, empty

Comment on Photo:

Upper surface shows characteristic mottling of open areas. Marked clusters of shallow (up to 0.003 inch) pits indicate that material is susceptible to corrosion in un-induced areas, under relatively mild environmental conditions.

Lower surface of tank shows streaks from welded seam and numerous mottled areas, including discoloration of spot welds at center baffle.


NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 19

Project: 65WW63
File: MM-36

Tank No. 8

Cylindrical, Alloy No. 316(L) Stainless Steel, Gas Welded

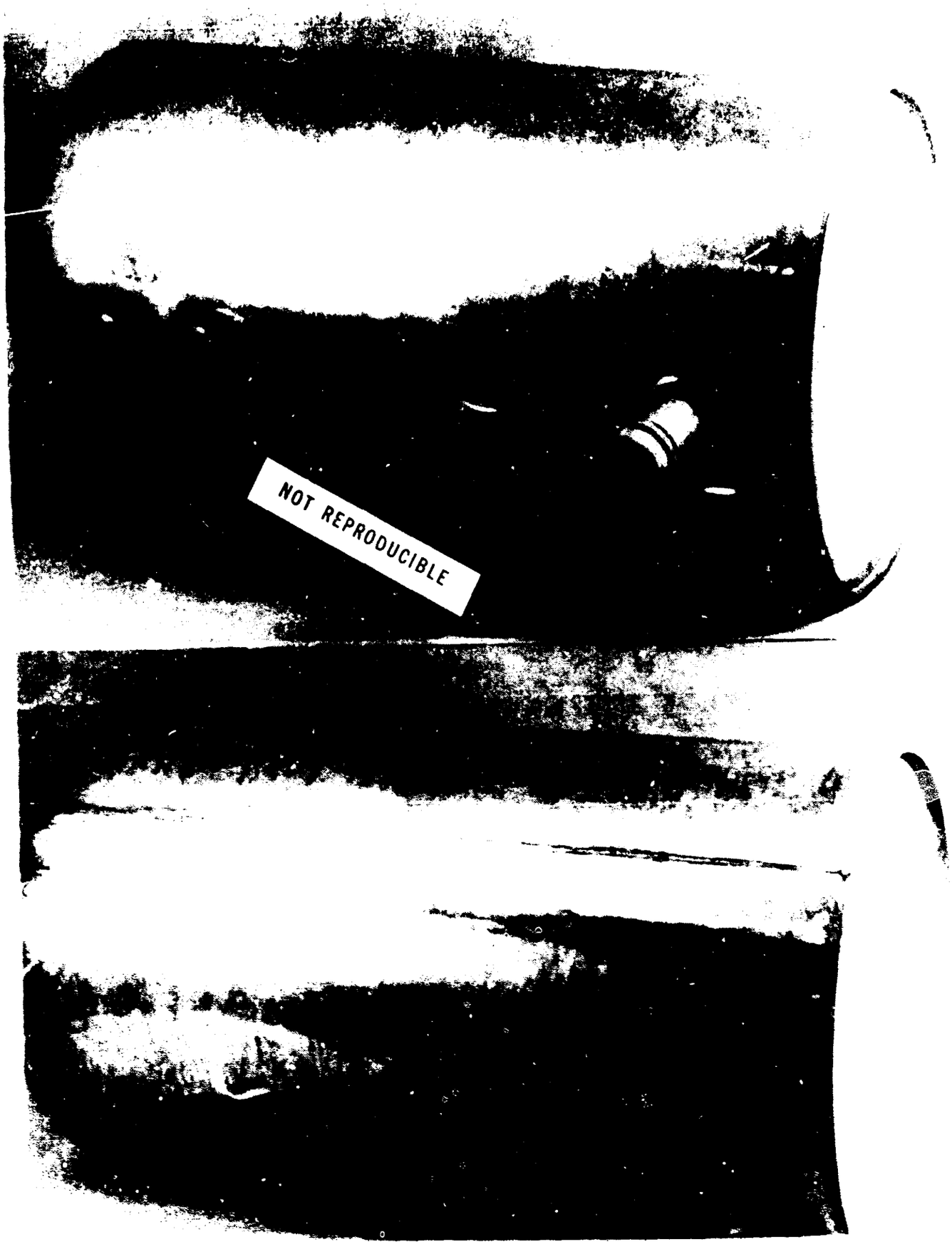
Exposure Conditions:

In ventilated shore box, empty.

Comment on Photo:

Upper surfaces of tank show contrast between generally mottled and discolored area and bright metal which had been under neoprene padded strapping. Minor pitting, 0.001 to 0.003 inch, in clusters, noted especially near tank fittings.

Lower surfaces of tank show discoloration and corrosion in way of welded seams. Shallow pitting, up to 0.003 inch, noted in this area.


NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 20

Project: 65WW63
File: MM-36

Tank No. 25H

Cylindrical Alloy No. 316(L) Stainless Steel, Gas Welded

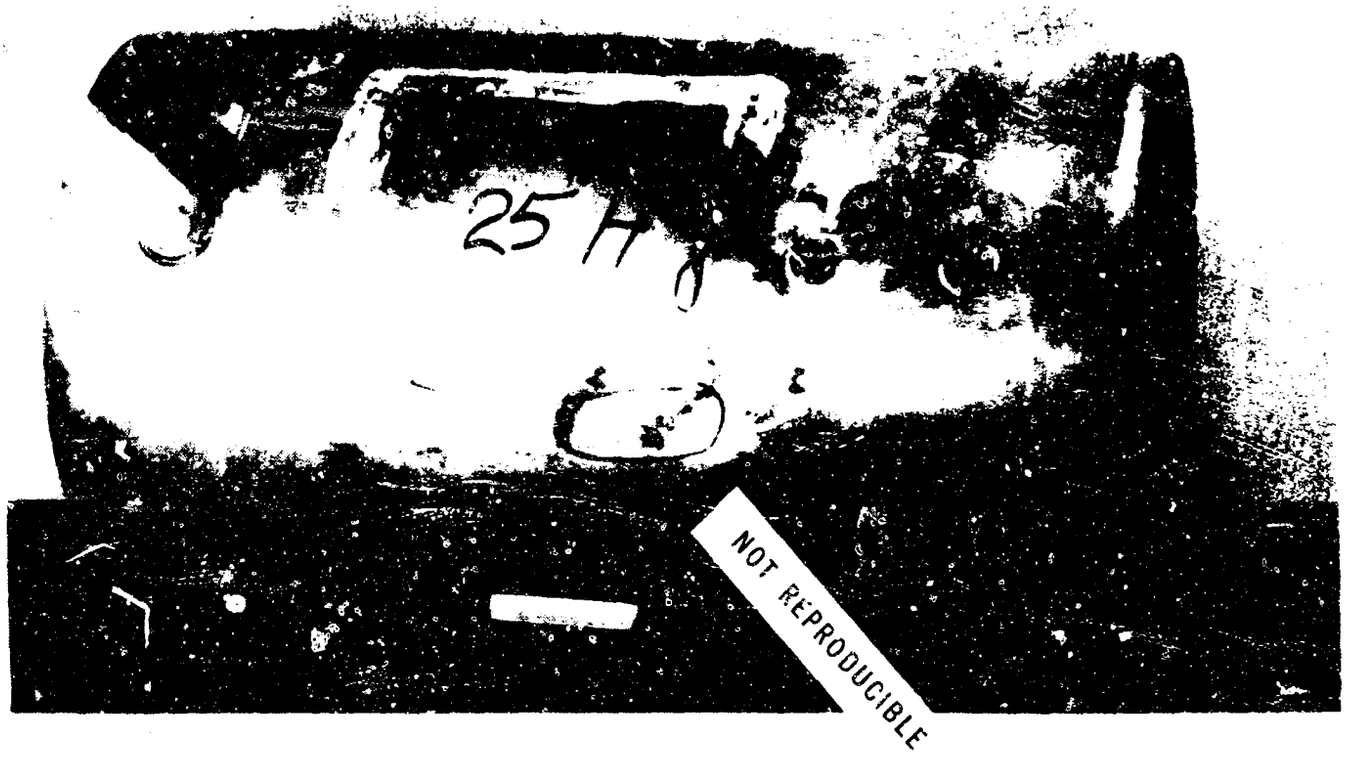
Exposure Conditions:

Aboard hull, empty

Comment on Photo:

Upper and lower surfaces of tank show numerous crevices in way of sea water reservoir, and along longitudinal welded seam. No perforations were noted, but pits up to a depth of approximately 0.028 inch were measured. Fig. No. 21 provides close-up view of perforations at #1 and #2.

FILE MM36 VOL I SEC I



Final Inspection Report
FIG. NO. 21

Project: 65WW63
File: MM-36

Tank No. 25H

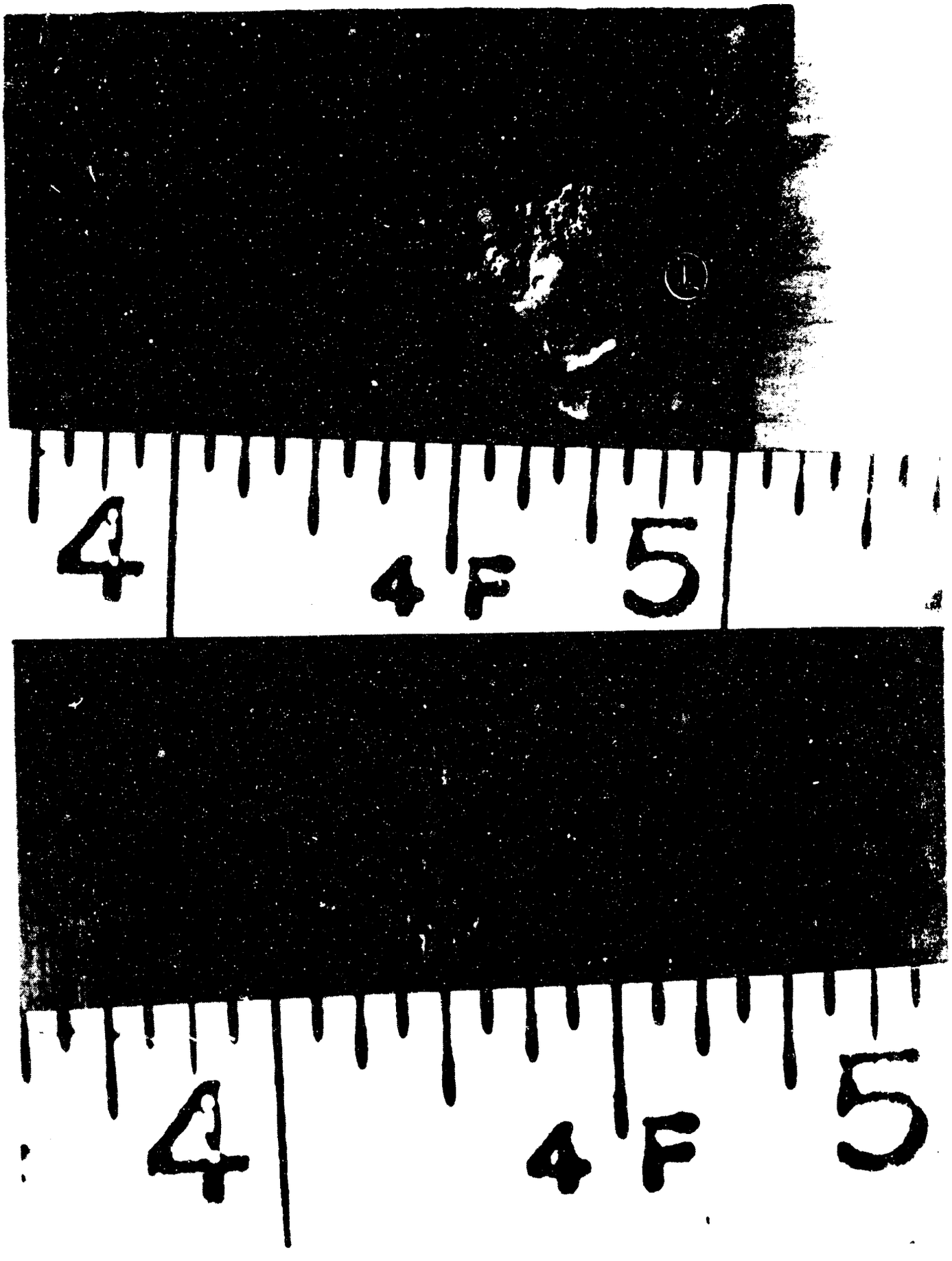
Cylindrical, Alloy No. 316(L) Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull, alternately empty and full for two years. Full of gasoline third year.

Comment on Photo:

Close-up of perforations shown in way of sea water reservoir faying surface, Photo No. 20.


4
4F
5
4
4F
5

Final Inspection Report
FIG. NO. 22

Project: 65WW63
File: MM-36

Tank No. 21H

Cylindrical, Alloy No. 316(L) Stainless Steel, Gas Welded

Exposure Conditions:

Aboard hull, full of gasoline

Comment on Photo:

Upper and lower surfaces of tank show considerable discoloration and many pitted areas. No perforations were noted, but penetrations up to 0.030 inch were measured. Obviously, this leaves very little intact metal and perforations would occur in a short additional time.

FILE MM36

VOL. I SEC. I

Final Inspection Report
FIG. NO. 23

Project: 65WW63
File: MM-36

Tank No. 32H

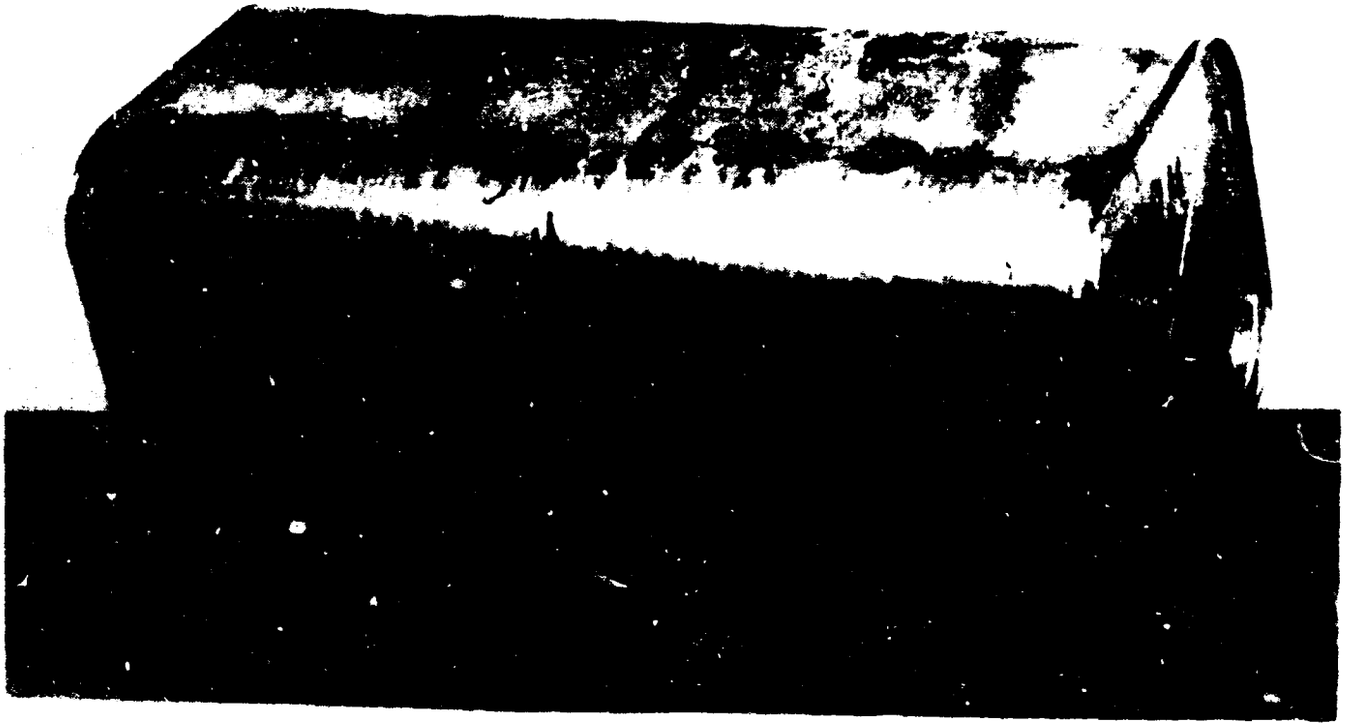
Rectangular, Alloy No. 316(L) Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull, empty

Comment on Photo:

Upper and lower surfaces of tank show areas of corrosion, as indicated on the photo. It should be noted that "open", as well as "induced" areas were affected. No complete penetrations were noted. See Fig. No. 22 for view of deep etch.



Final Inspection Report
FIG. NO. 24

Project: 65WW63
File: MM-36

Tank No. 32H

Rectangular, Alloy No. 316(L) Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull, empty

Comment on Photo:

Close-up view of two representative corrosion spots, located in "induced" areas of Fig. No. 23.


16 8 16 24 32 40 48 56
FILE
MADE IN U.S.A.
TEST

Final Inspection Report
FIG. NO. 25

Project: 65WW63
File: MM-36

Tank No. 23H

Rectangular, Alloy No. 316(L) Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull, full of gasoline

Comment on Photo:

Upper and lower surfaces of tank show corrosion pitting in open and "induced" areas. Two perforations were noted in way of sea water reservoir faying surface. See Fig. No. 26 for close-up of indexes 1 and 2.

Final Inspection Report
FIG. NO. 26

Project: 65WW63
File: MM-36

Tank No. 23H

Rectangular, Alloy No. 316(L) Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull, full of gasoline

Comment on Photo:

Close-up views of perforations noted in Fig. No. 25.

MADE IN U.S.A.
8 16 24 32 40 48 56
8 16 24
8 16 24 32 40 48 56
TESTRITE N.Y.
8 16 24 32

Final Inspection Report
FIG. NO. 27

Project: 65WW63
File: MM-36

Tank No. 3H

Cylindrical, Alloy No. 316(L) Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull, full of gasoline

Comment on Photo:

Upper and lower surfaces of tank, indicating major areas of pitting - along longitudinal welded seams, and "induced" in way of sea water reservoir faying surfaces. Fig. No. 28 provides close-up views of perforated area.

Final Inspection Report
FIG. NO. 28

Project: 65WW63
File: MM-36

Tank No. 3H

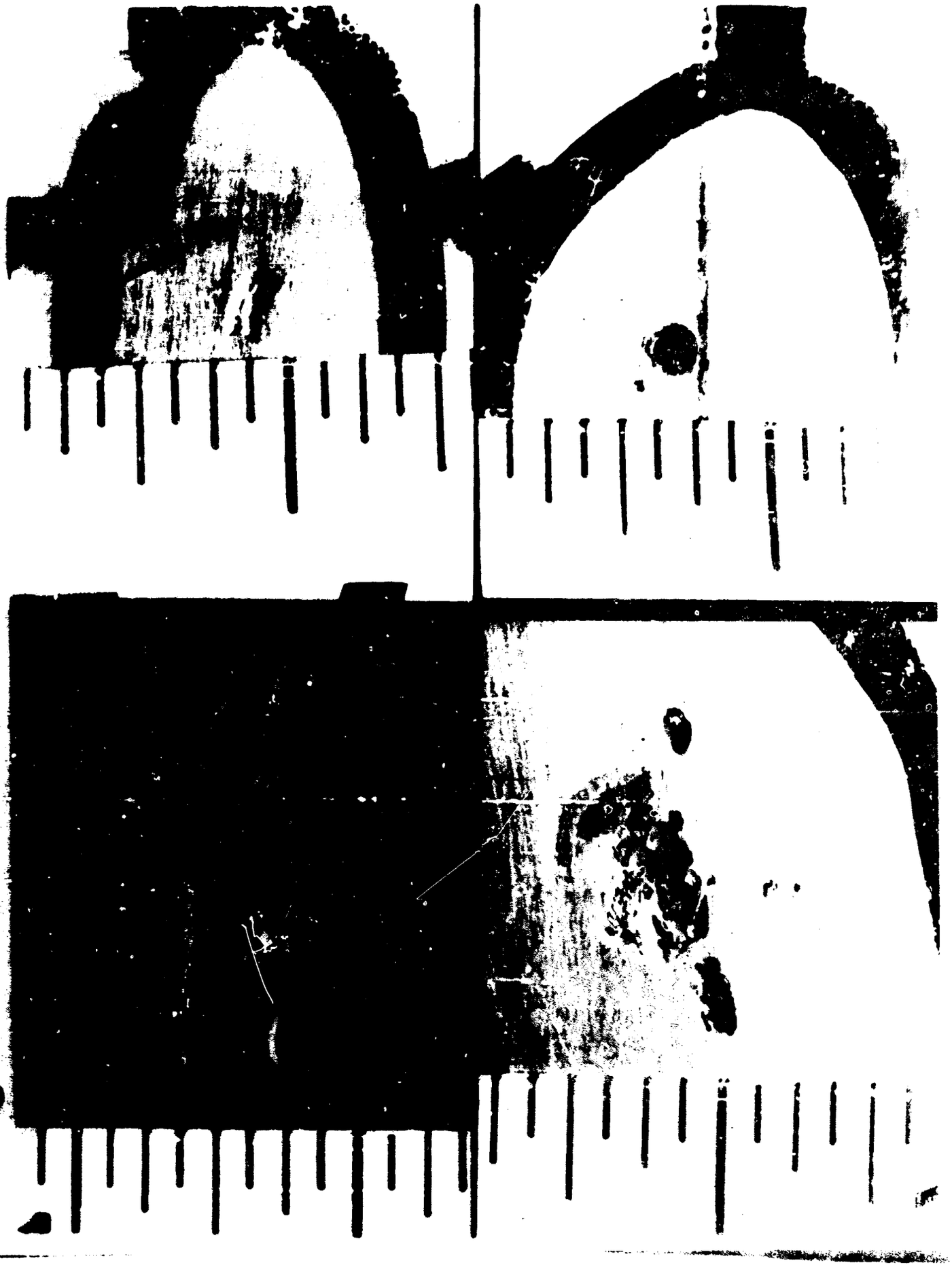
Cylindrical, Alloy No. 316(L) Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull, full of gasoline

Comment on Photo:

Close-up views of corrosion found in way of sea water reservoir faying surfaces. Note character of perforations, indicating that corrosion started on exterior and worked inward. Deeply pitted spots would eventually penetrate the material completely. See Fig. No. 27 for location.



Final Inspection Report
FIG. NO. 29

Project: 65WW63
File: MM-36

Tank No. 14H

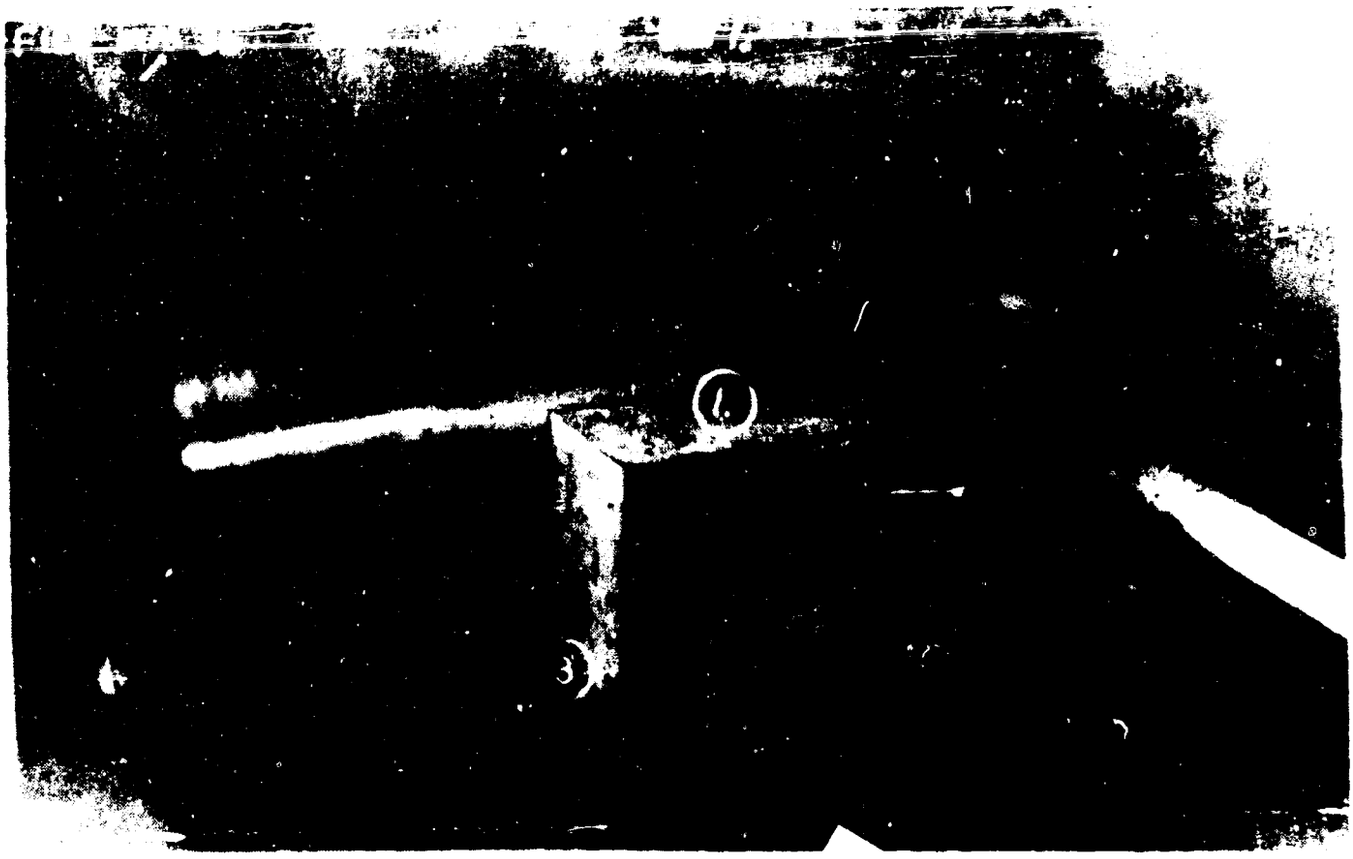
Rectangular, Alloy No. 316(L) Stainless Steel, Gas Welded

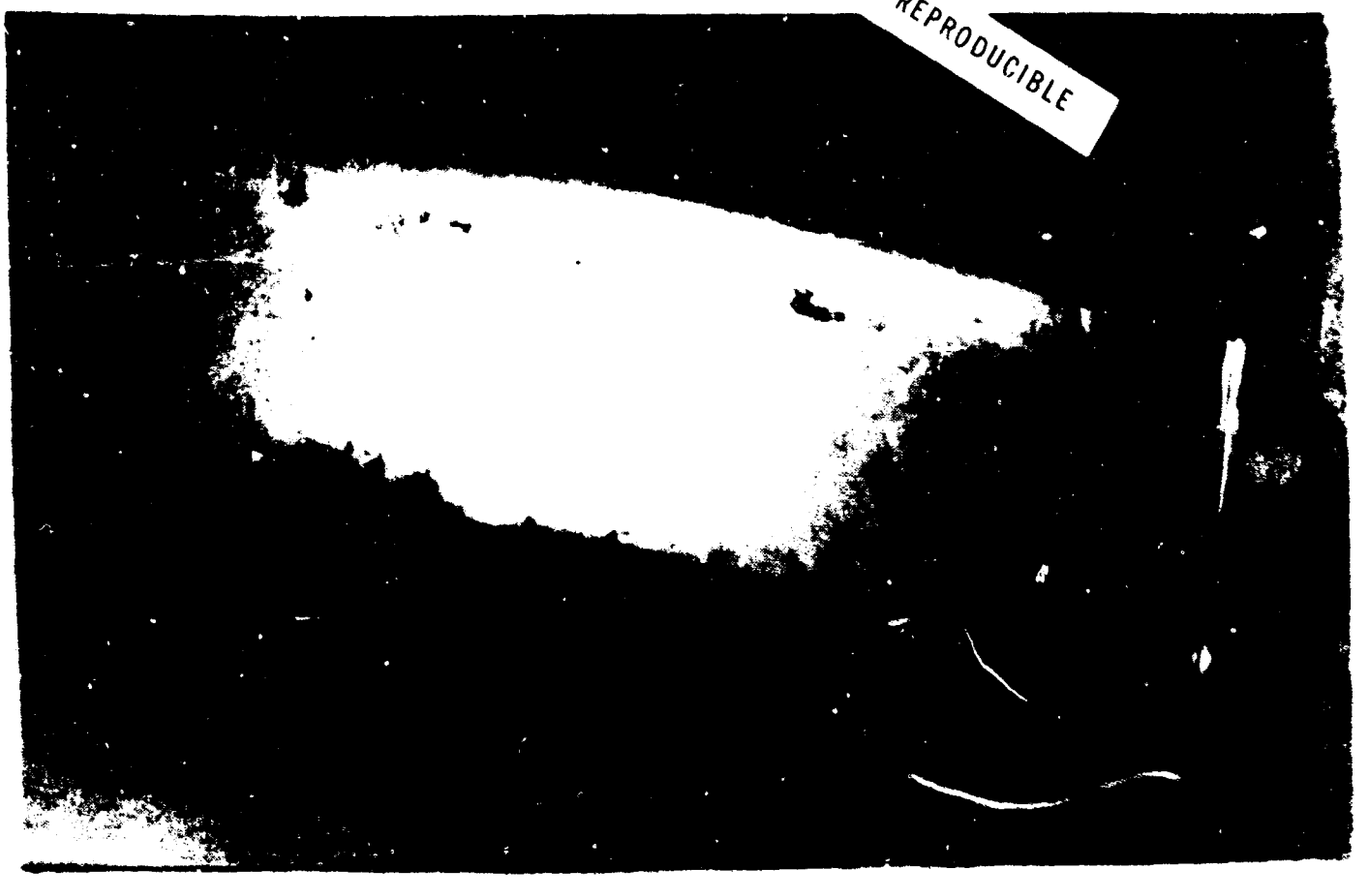
Exposure Conditions:

Aboard hull, empty throughout test

Comment on Photo:

Upper surface of tank, before removal of sea water reservoir, shows stains and pitted areas near suction and vent fittings. Lower surface shows pits and corrosion spots in "open" areas. See Fig. No. 30 for representative corrosion.





Final Inspection Report
FIG. NO. 30

Project: 65WW63
File: MM-36

Tank No. 14H

Rectangular, Alloy No. 316(L) Stainless Steel, Gas Welded

Exposure Conditions:

Aboard hull, empty throughout test

Comment on Photo:

Close-up views of corrosion in way of sea water reservoir faying surfaces. No. 1 shows several small perforations. No. 3 is an area pitted to a depth approximately 0.024 inch. See Photo No. 29 for location.

Final Inspection Report
FIG. NO. 31

Project: 65WW63
File: MM-36

Tank No. 1H

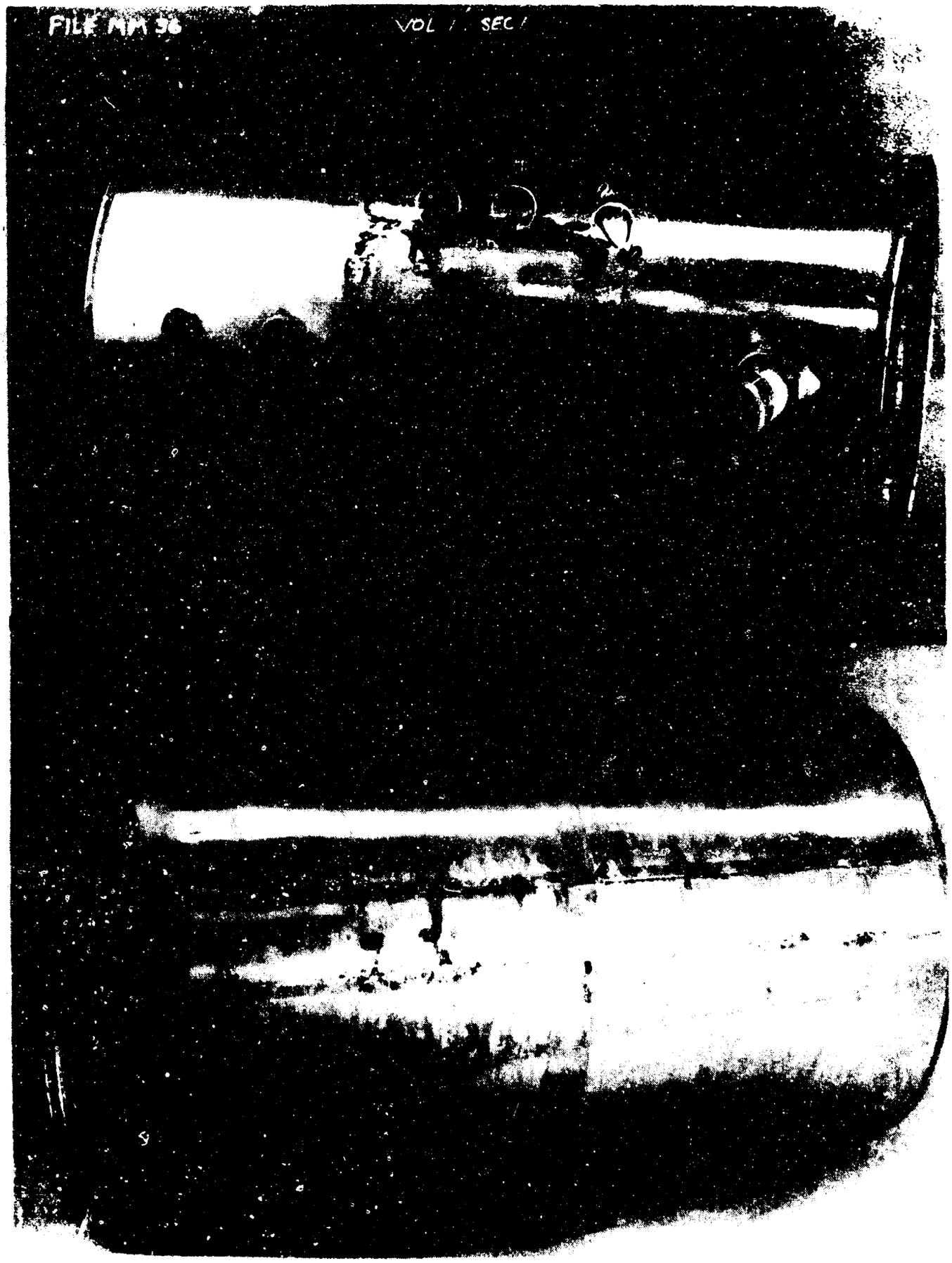
Cylindrical, Alloy No. 316(L) Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull, alternately empty and full for first two years. Full of gasoline third year

Comment on Photo:

Upper and lower surfaces of tank indicating areas of corrosion in way of sea water reservoir and along longitudinal welded seams. Heavy black spots on upper surfaces are adhering bedding compound. Close-up of indexed areas 1, 2, 3 and 4 on Fig. No. 32.


FILE MM 96
VOL I, SEC I

Final Inspection Report
FIG. NO. 32

Project: 65WW63
File: MM-36

Tank No. 1H

Cylindrical, Alloy No. 316(L) Stainless Steel, Electrically Welded

Exposure Conditions:

Aboard hull, alternately empty and full for first two years. Full of gasoline third year

Comment on Photo:

Close-up view of corrosion found in way of sea water reservoir faying surfaces. Note perforations in the typical crevices formed. See Fig. No. 31 for location.

H2-45
H3-45
1
2
3

Final Inspection Report
FIG. NO. 33

Project: 65WW63
File: MM-36

Tank No. 18

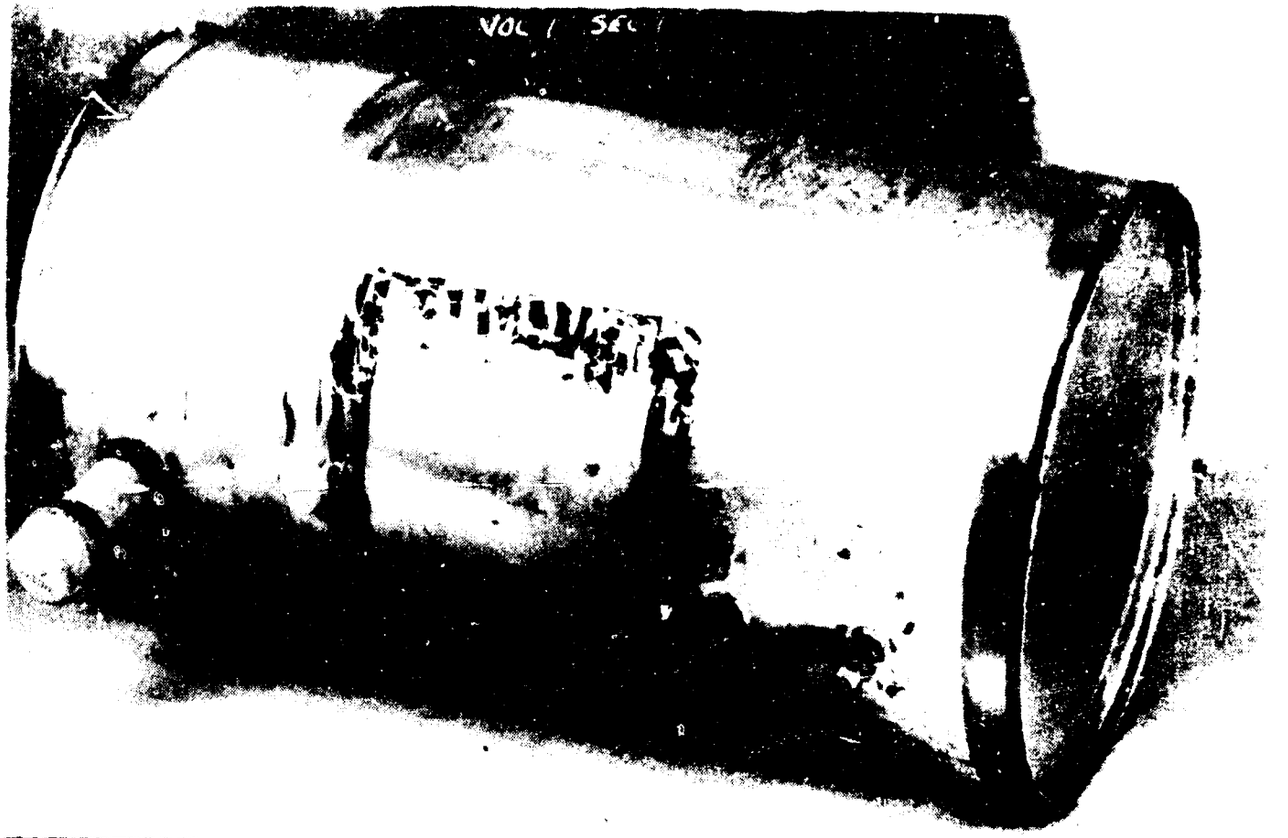
Cylindrical, Alloy No. 316(L) Stainless Steel, Electrically Welded

Exposure Conditions:

In ventilated shore box, empty

Comment on Photo:

Upper and lower surfaces of tank which had been fitted with a sea water reservoir. Even though this reservoir was never flooded, it should be noted that several pits - ranging from 0.005 inch to 0.008 inch in depth - were found in this susceptible area. Tank surfaces, in general, show discoloration and rust streaks near welds and fittings.


VOL I SEC I


Bait

Final Inspection Report
FIG. NO. 34

Project: 65WW63
File: MM-36

Tank No. 3

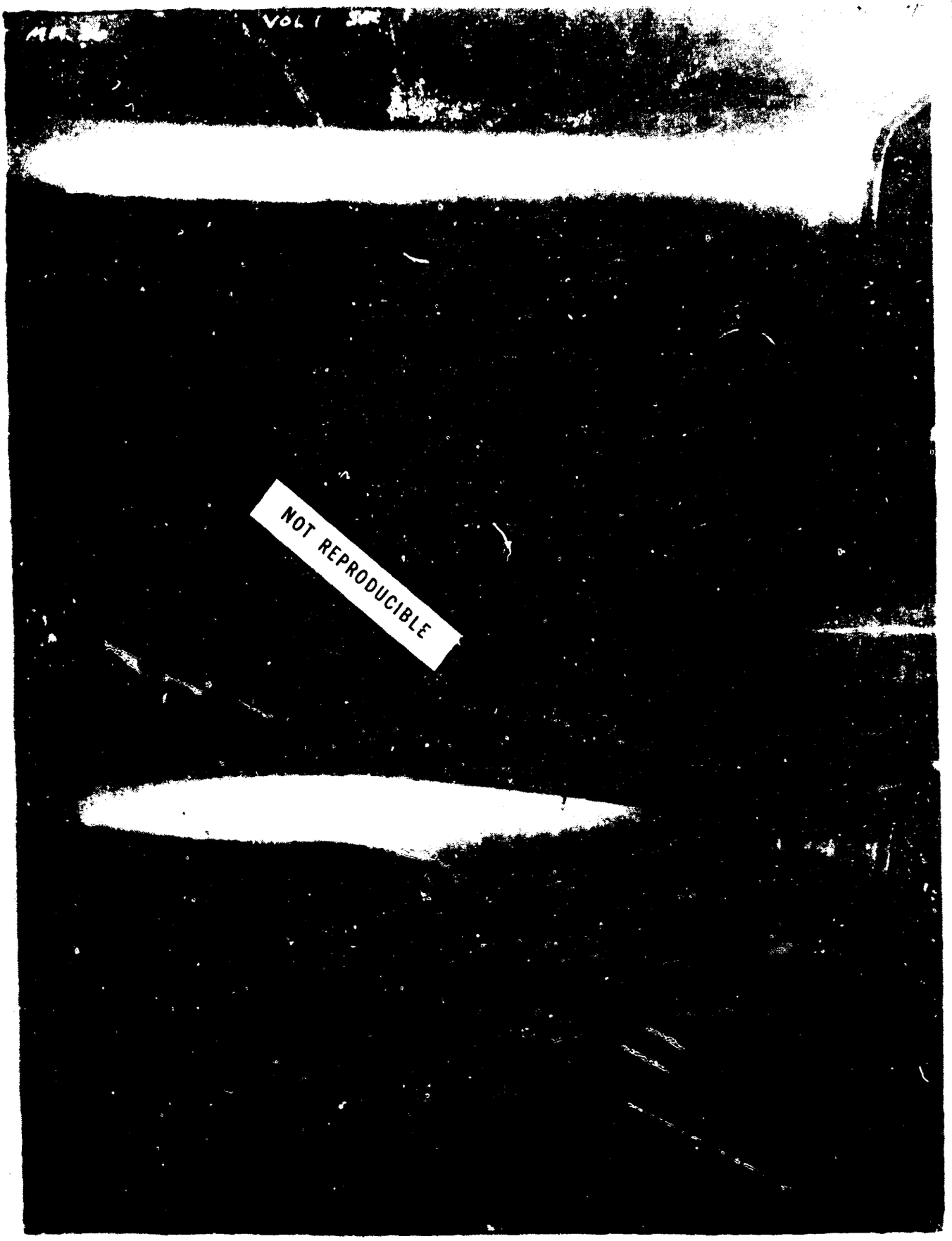
Rectangular, Alloy No 316(L) Stainless Steel, Electrically Welded

Exposure Conditions:

In ventilated shore box, empty

Comment on Photo:

Surfaces of tank show characteristic mottling and staining, which precedes pitting. Numerous shallow (0.002 inch) pits were found at longitudinal welded seam - which forms a natural crevice.


VOL I
NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 35

Project. [illegible]53
File: MM-36

Panels No. 3

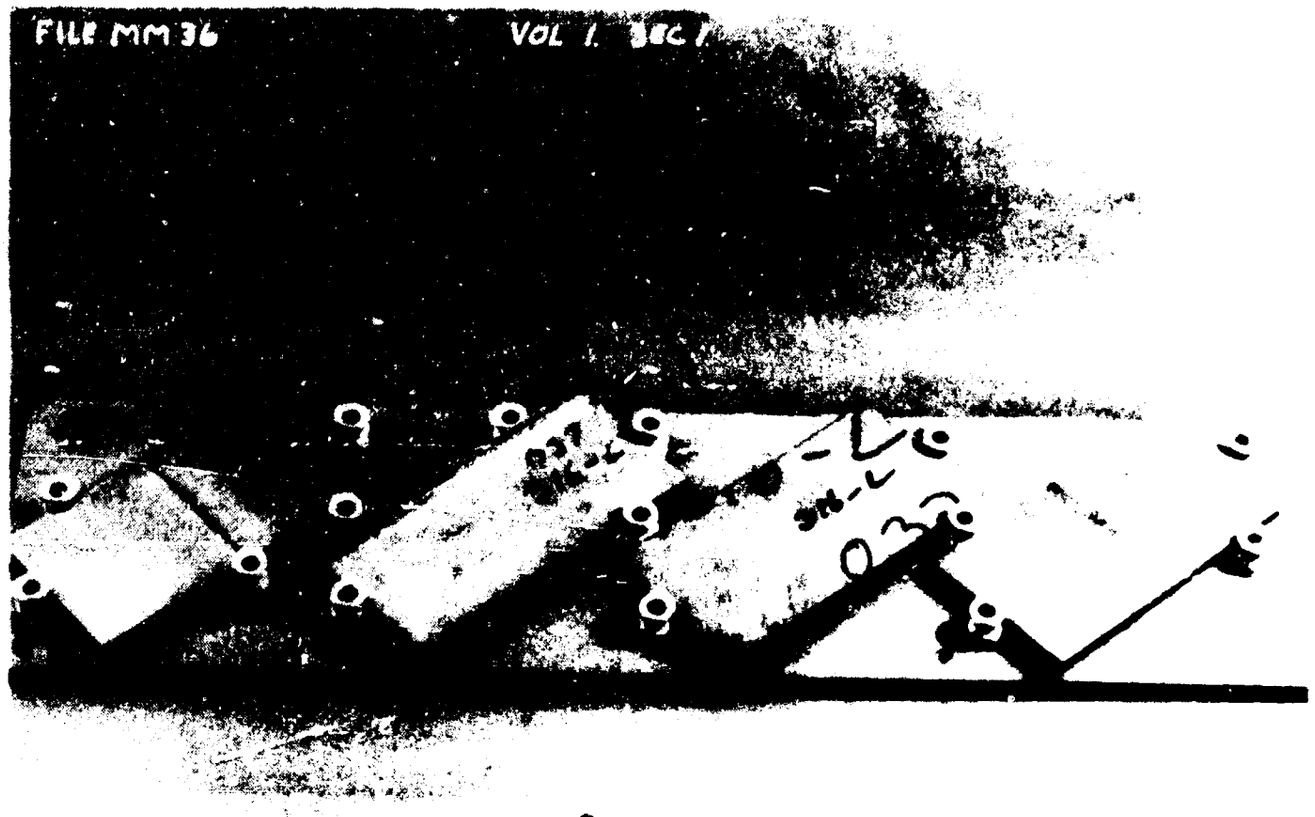
Alloy No. 316 (L) Stainless Steel

Exposure Conditions:

In ventilated shore box

Comment on Photo:

Metal is less bright than before exposure. Many spots of corrosion are present. Maximum pit depth was measured at approximately 0.003 inch. As far as susceptibility to corrosion is concerned it appears that the inert gas weld method is slightly superior to resistance welding.


FILE MM 36
VOL I

Final Inspection Report
FIG. NO. 36

Project: 65WW63
File: MM-36

Tank No. 26H

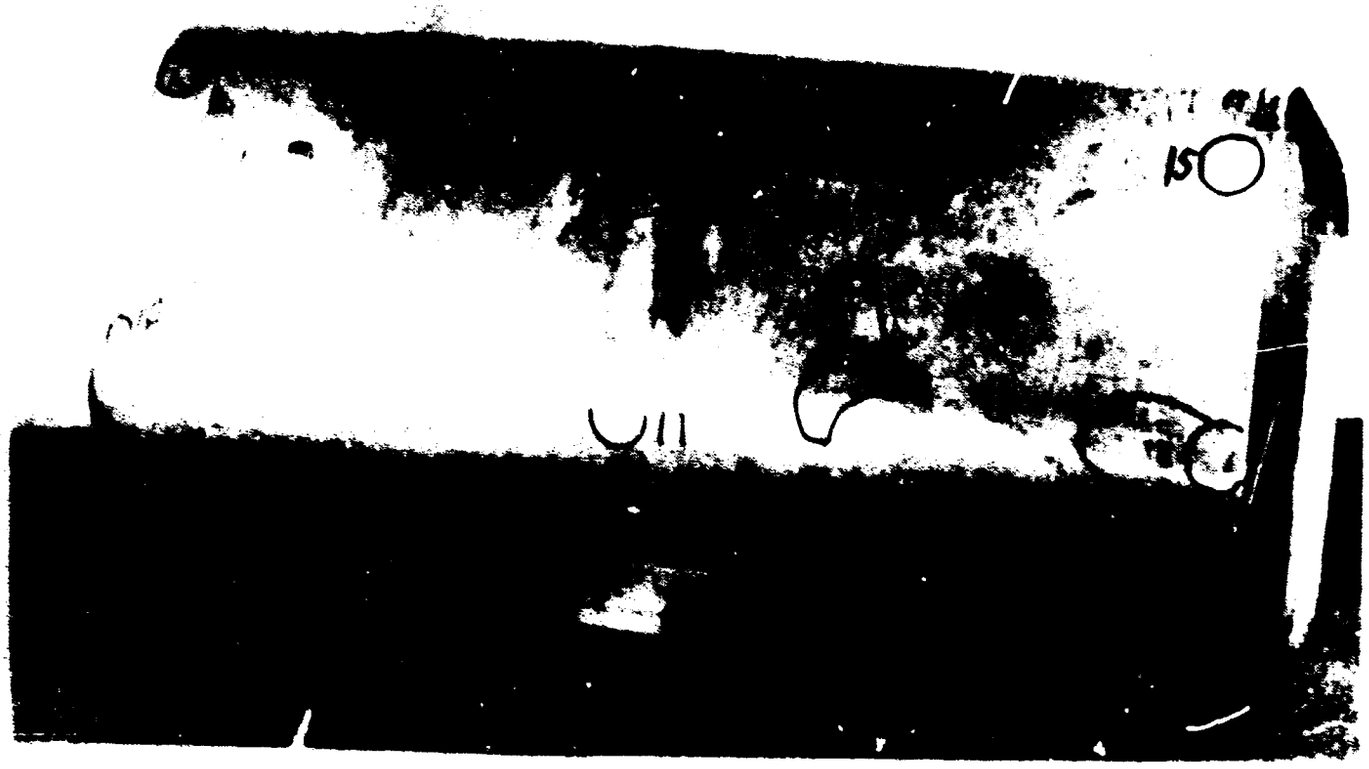
Rectangular, Alloy No. 316(L) Stainless Steel, Gas Welded

Exposure Conditions:

Aboard hull, full of gasoline

Comment on Photo:

Upper surfaces uniformly dulled and stained by small rust deposits. Area of sea water reservoir has three points, identified as 1, 2 and 3 of severe corrosion. Perforation occurred at No. 1. Bottom surface has numerous areas of etching. See Fig. No. 35 for close-up views.



Final Inspection Report
FIG. NO. 37

Project: 65WW63
File: MM-36

Tank No. 26H

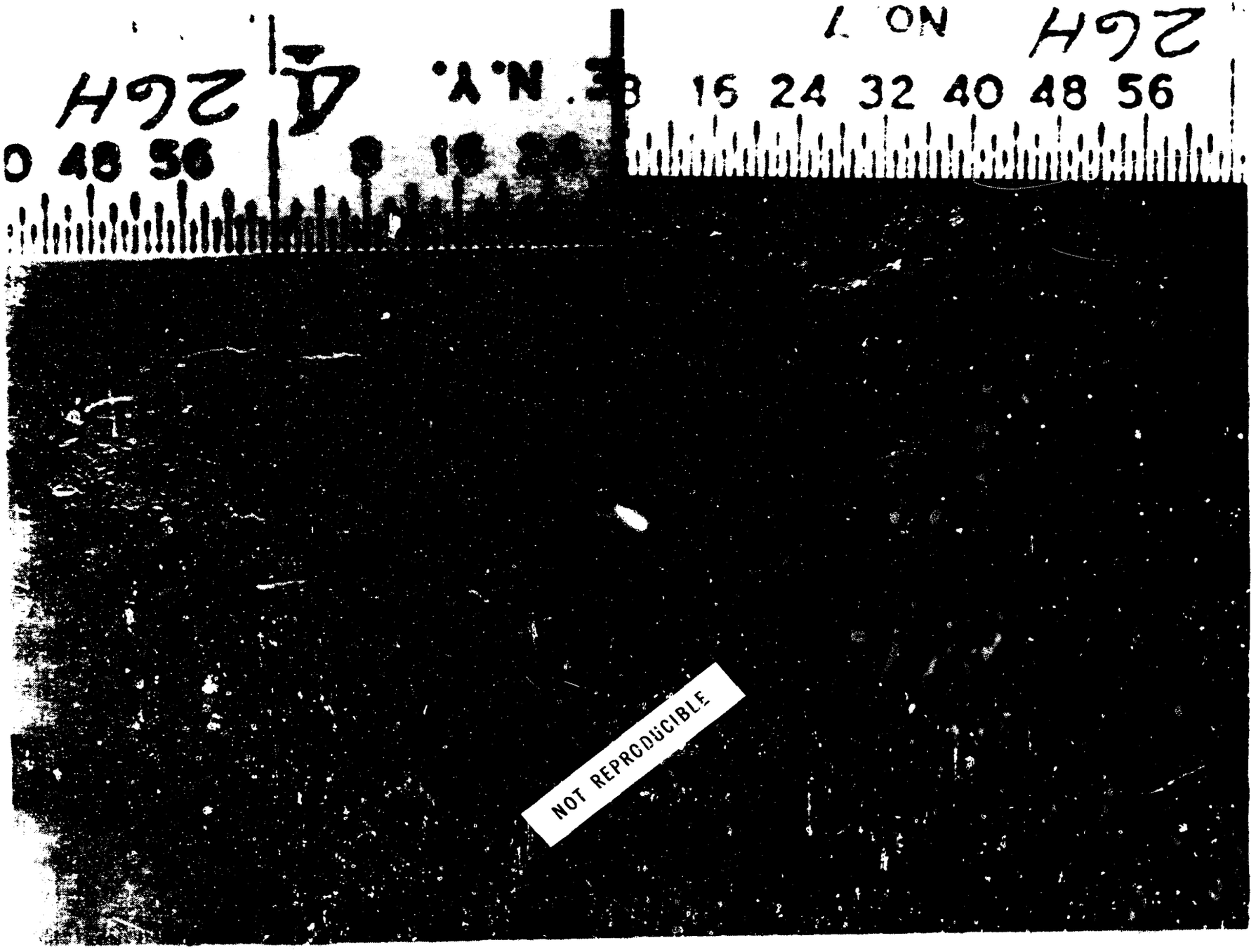
Rectangular, Alloy No. 316(L) Stainless Steel, Gas Welded

Exposure Conditions:

Aboard hull, full of gasoline

Comment on Photo:

Perforation depicted in Figure No. 1 and etching in Figure No. 2. See Fig. No. 36 for locations.


NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 38

Project: 65WW63
File: MM-36

Tank No. 11H

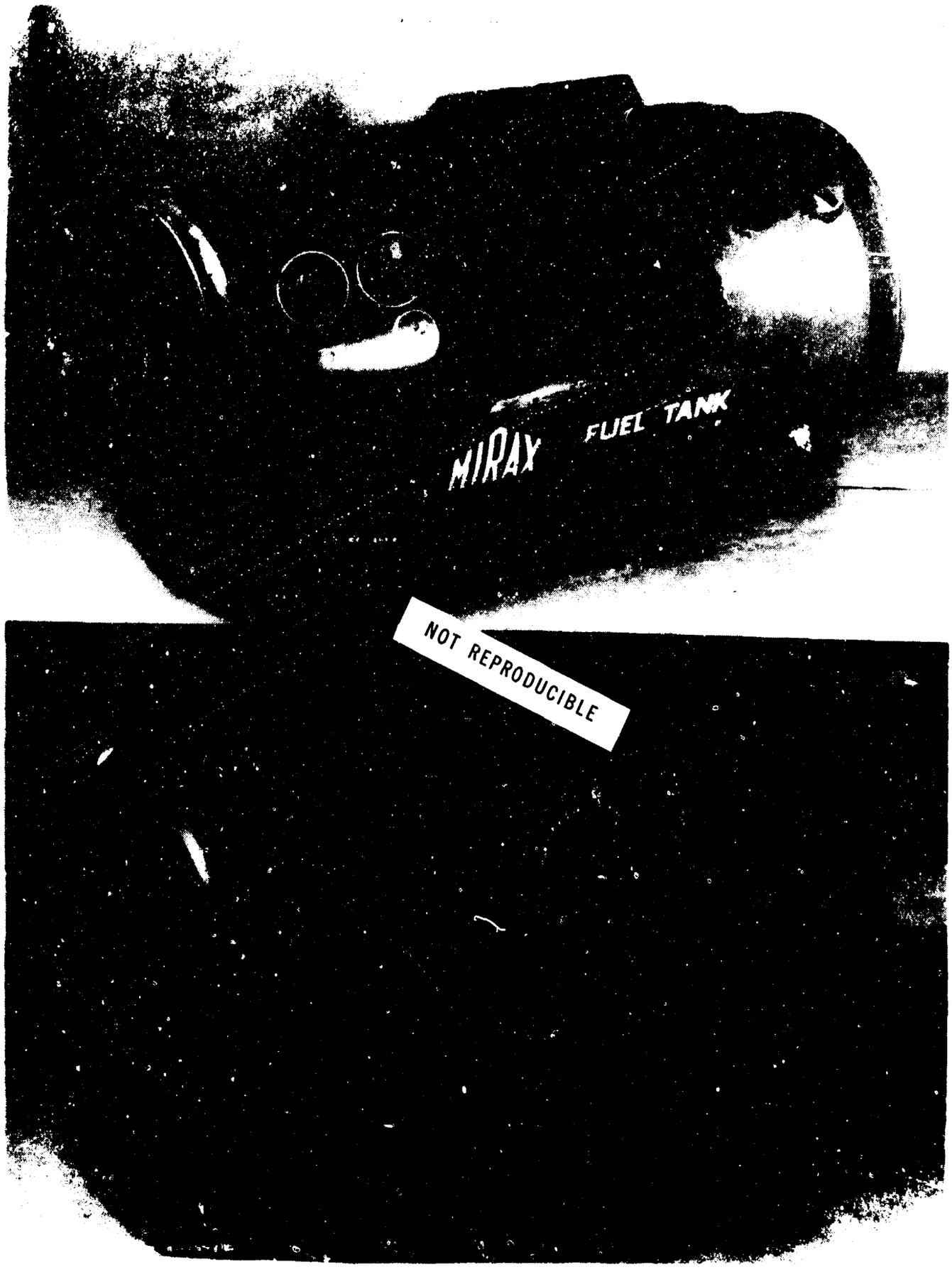
Cylindrical, Terneplate

Exposure Conditons:

Aboard hull, empty

Comment on Photo:

Upper and lower surfaces of tank show generally good condition of paint and terne coating. Pitting - to a depth of approximately 0.010 inch - was measured near vent fitting. Shell was perforated just below plug fitting shown at left of upper view. Interior photo marked Fig. No. 67 at the end of this report reveals no corrosion on interior surfaces due to protective grease-like coating.



Final Inspection Report
FIG. NO. 39

Project: 65WW63
File: MM-36

Tank No. 12H

Cylindrical, Terneplate

Exposure Conditions:

Aboard hull, filled with gasoline

Comment on Photo:

Upper and lower surfaces of tank show an infinite number of pits, to a depth of approximately 0.024 inch. No perforations were noted, but areas close to sea water reservoir, welded seam, and fittings would not withstand much more exposure. Interior photo marked Fig. No. 66 at end of this report reveals corrosion of interior surfaces occurred in the top radius of the tank. Humid air trapped between fuel and upper surface is the probable cause.

Final Inspection Report
FIG. NO. 40

Project: 65WW63
File: MM-36

Tank No. 15H

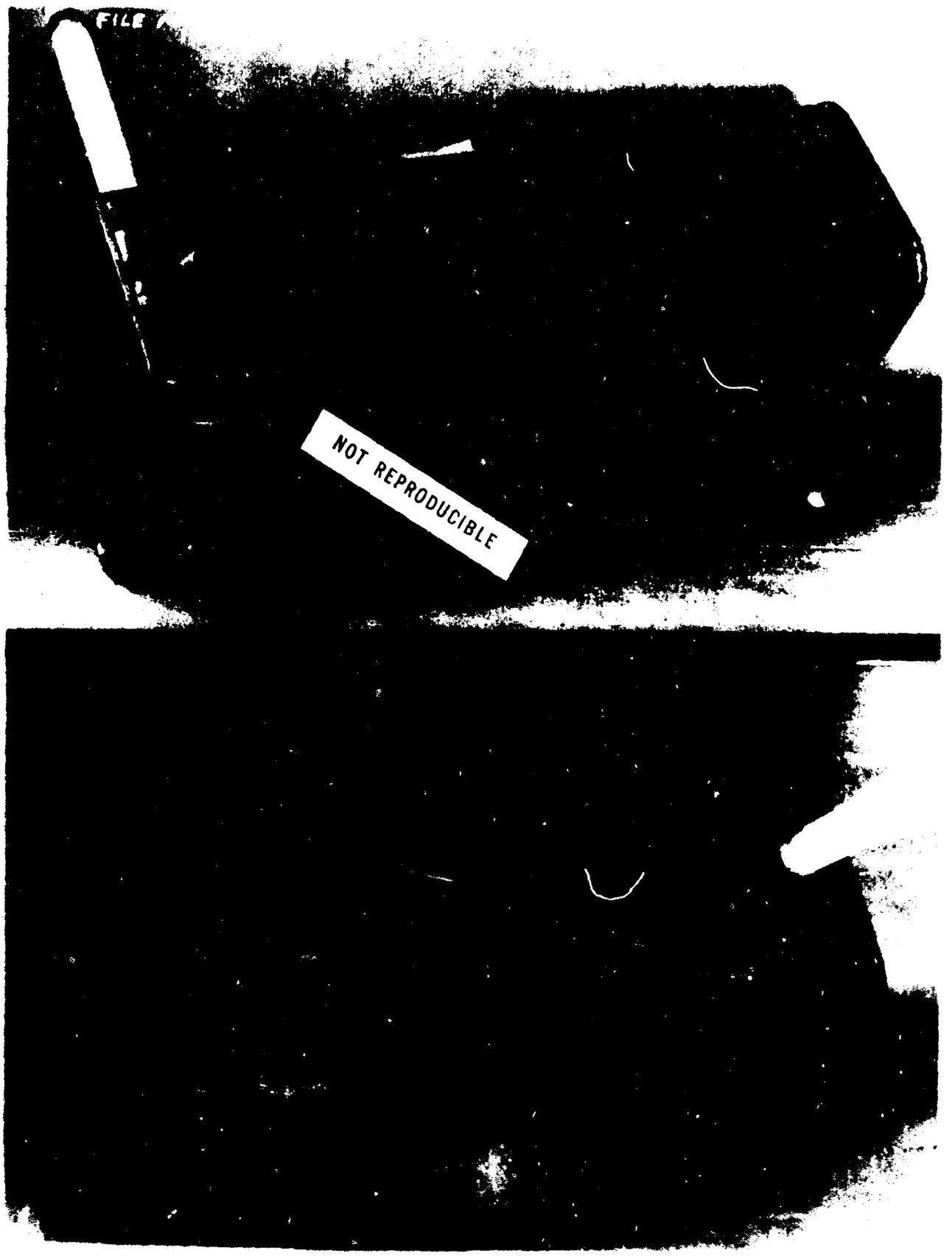
Rectangular, Terneplate

Exposure Conditions:

Aboard hull, filled with gasoline

Comment on Photo:

Upper and lower surfaces of tank show corrosion in way of longitudinal welded seam and near tank fittings. No perforations were found in tank, but considerable pitting, to a depth of approximately 0.020 inch, was observed. See Fig. No. 41 for close-up views.


FILE
NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 41

Project: 65WW63
File: MM-36

Tank No. 15H

Rectangular, Terneplate

Exposure Conditions:

Aboard hull, filled with gasoline

Comment on Photo:

Close-up views of pitting in open area of tank, and near fittings. The brass fitting (suction line) shown at lower left was found to have two radial holes extending through one side of wall between the head and threaded shank. See Fig. No. 40 for location.


PILE MM
5 F 2

Final Inspection Report
FIG. NO. 42

Project: 65WW63
File: MM-36

Tank No. 27H

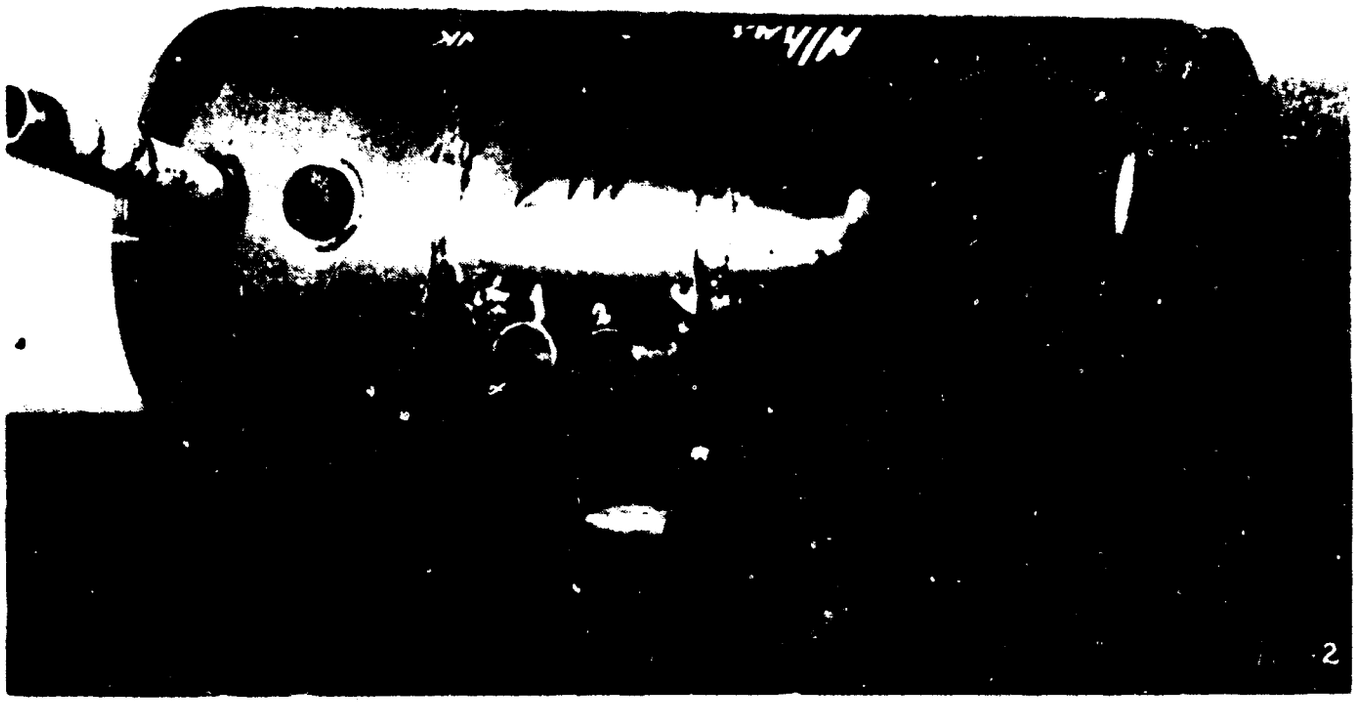
Cylindrical, Terneplate

Exposure Conditions:

Aboard hull, alternately empty and full for two years. Full for third year

Comment on Photo:

Upper and lower surfaces of tank show generally good condition except for corrosion build-up near fittings and along longitudinal welded seam. See Fig. No. 43.



Final Inspection Report
FIG. NO. 43

Project: 65WW63
File: MM-36

Tank No. 27H

Cylindrical, Terneplate

Exposure Conditions:

Aboard hull, alternately empty and full for two years.
Full for third year

Comment on Photo:

Close-up view of pitted areas where paint, and some of the terne coating were destroyed in way of sea water reservoir.
See Fig. No. 42 for location.

VOL I
FIG 43
NOT REPRODUCIBLE
STAINLESS STEEL
MADE IN U.S.A.
TESTRITE N.Y.
NO 7

Final Inspection Report
FIG. NO. 44

Project: 65WW63
File: MM-36

Tank No. 3OH

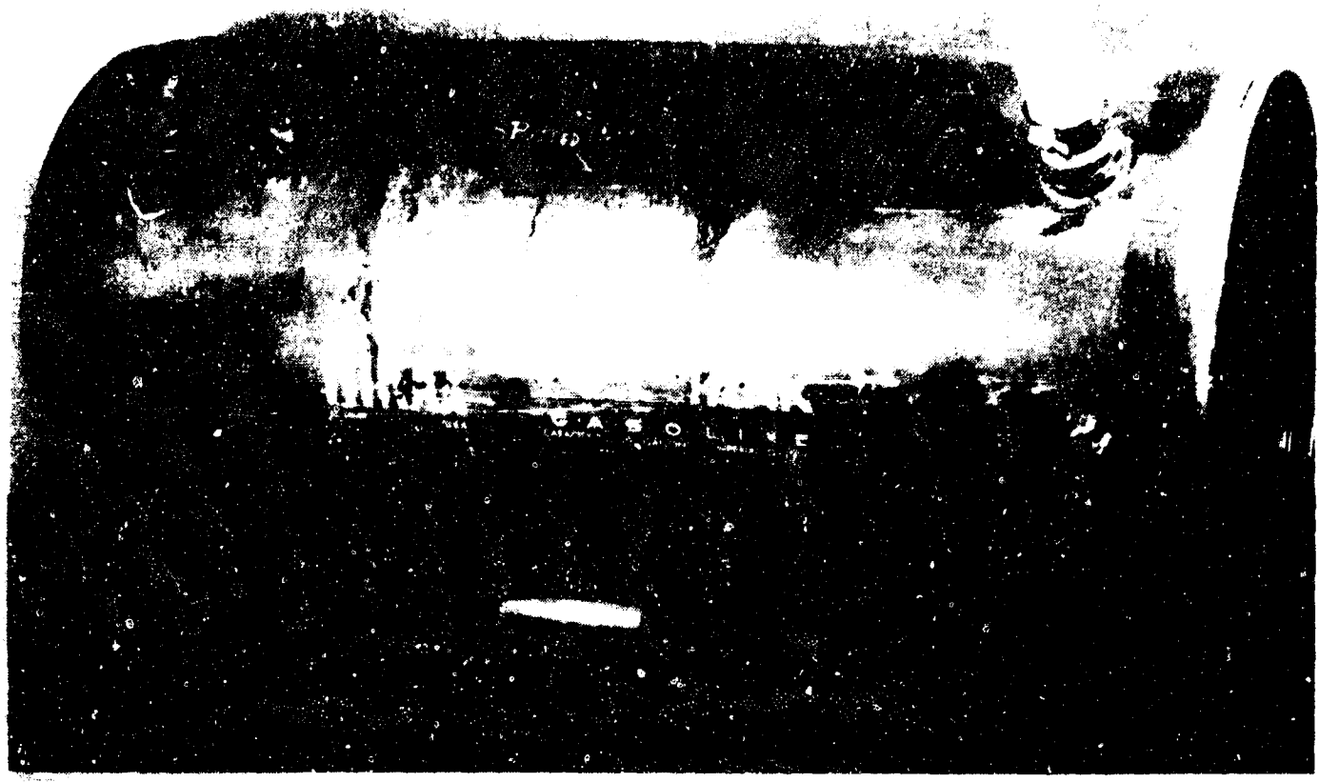
Cylindrical, Terneplate

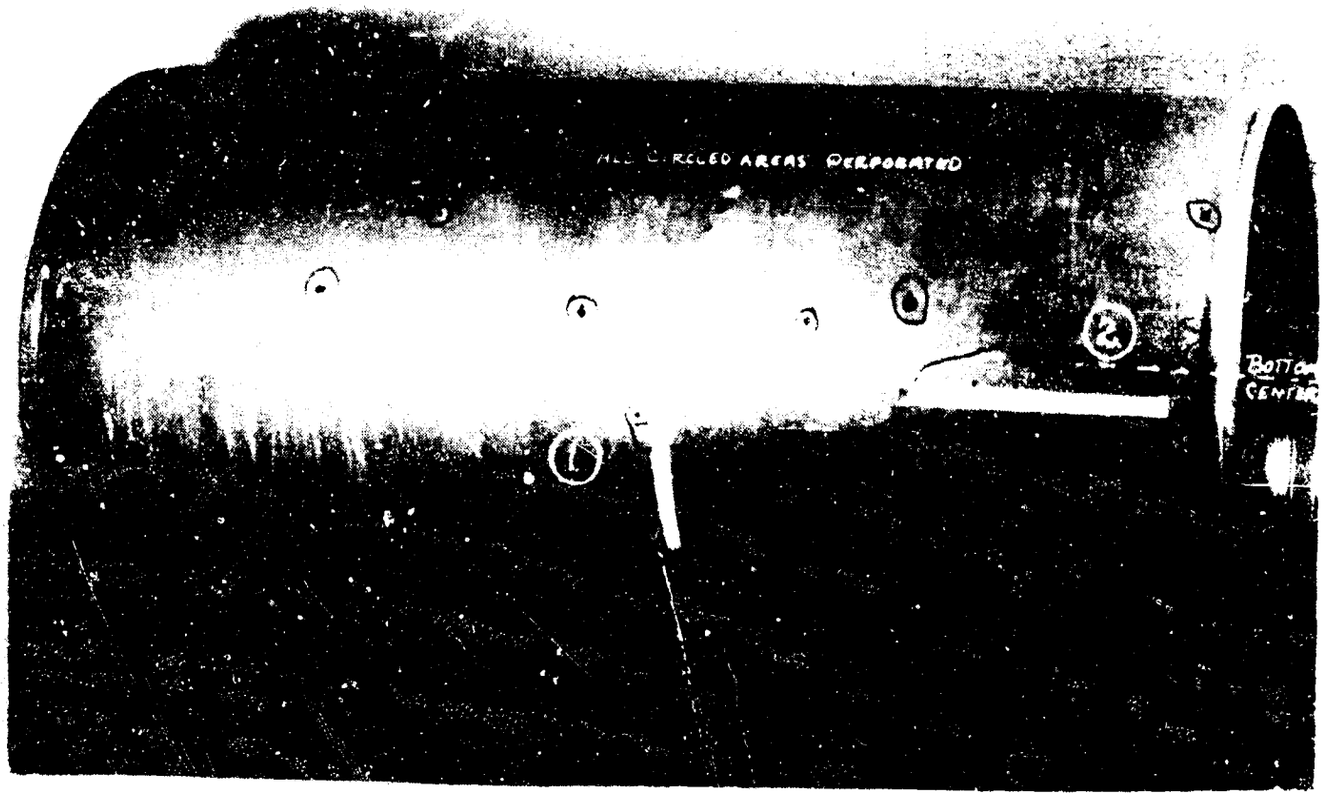
Exposure Conditions:

Aboard hull, empty

Comment on Photo:

Upper surface shows destruction of paint and pitting in way of sea water reservoir. Bubbling of paint near fittings is indicative of corrosion build-up underneath. Lower surface shows extent of perforations, originating from interior condensation. See Fig. No. 45 for close-up of perforated areas 1 and 2. Interior photos - Fig. Nos. 64 and 65 at the end of this report show more clearly the extent of corrosion caused by water remaining in the tank.


GASOLINE


ALL CIRCLED AREAS PERFORATED
1
2

Final Inspection Report
FIG. NO. 45

Project: 65WW63
File: MM-36

Tank No. 30H

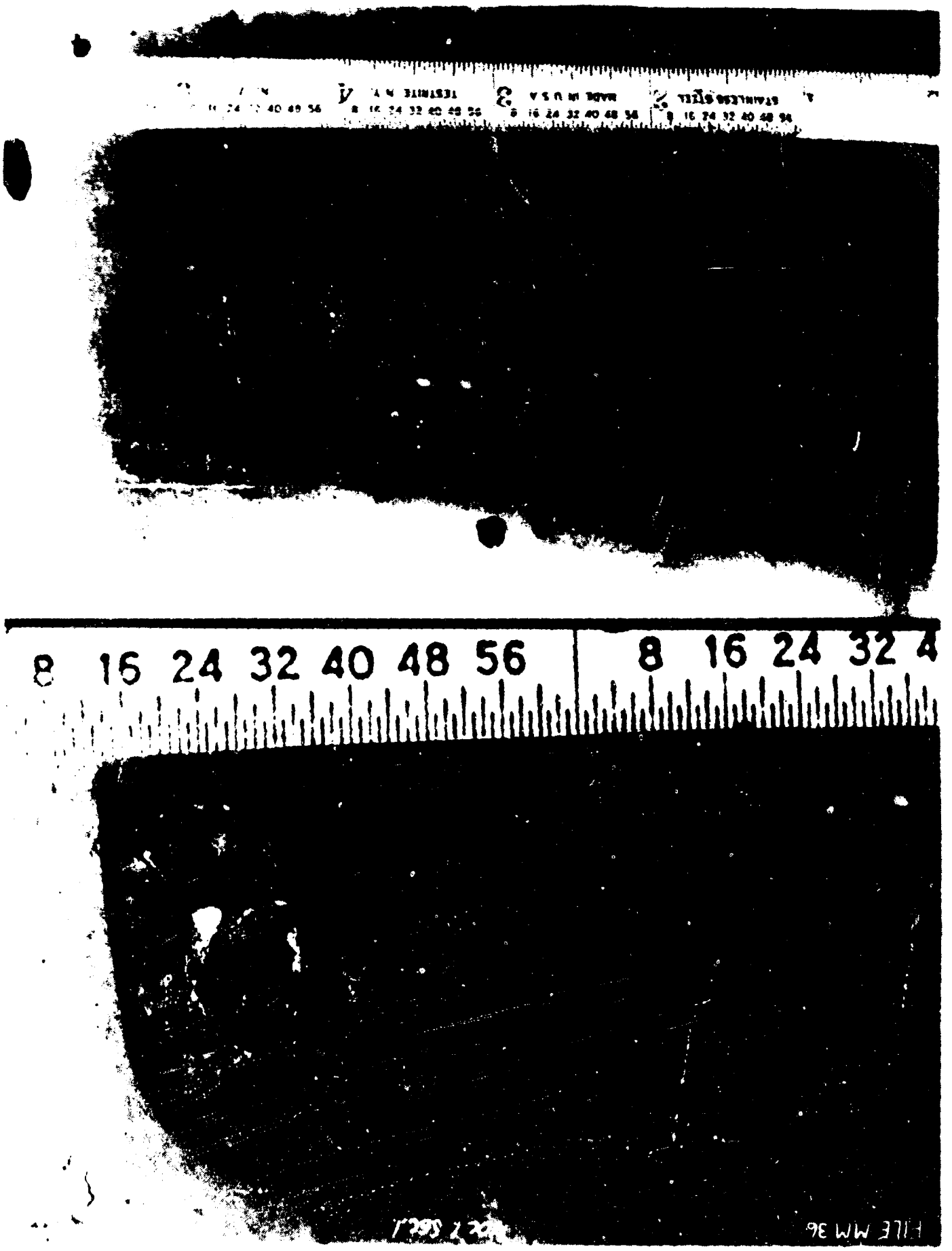
Cylindrical, Ternepiate

Exposure Conditions:

Aboard hull, empty

Comment on Photo:

Close-up views of the two perforated areas indicated by tape on Fig. No. 44.


8 16 24 32 40 48 56
8 16 24 32 40 48 56
8 16 24 32 40 48 56
8 16 24 32 4

Final Inspection Report
FIG. NO. 46

Project: 65WW63
File: MM-36

Tank No. 31H

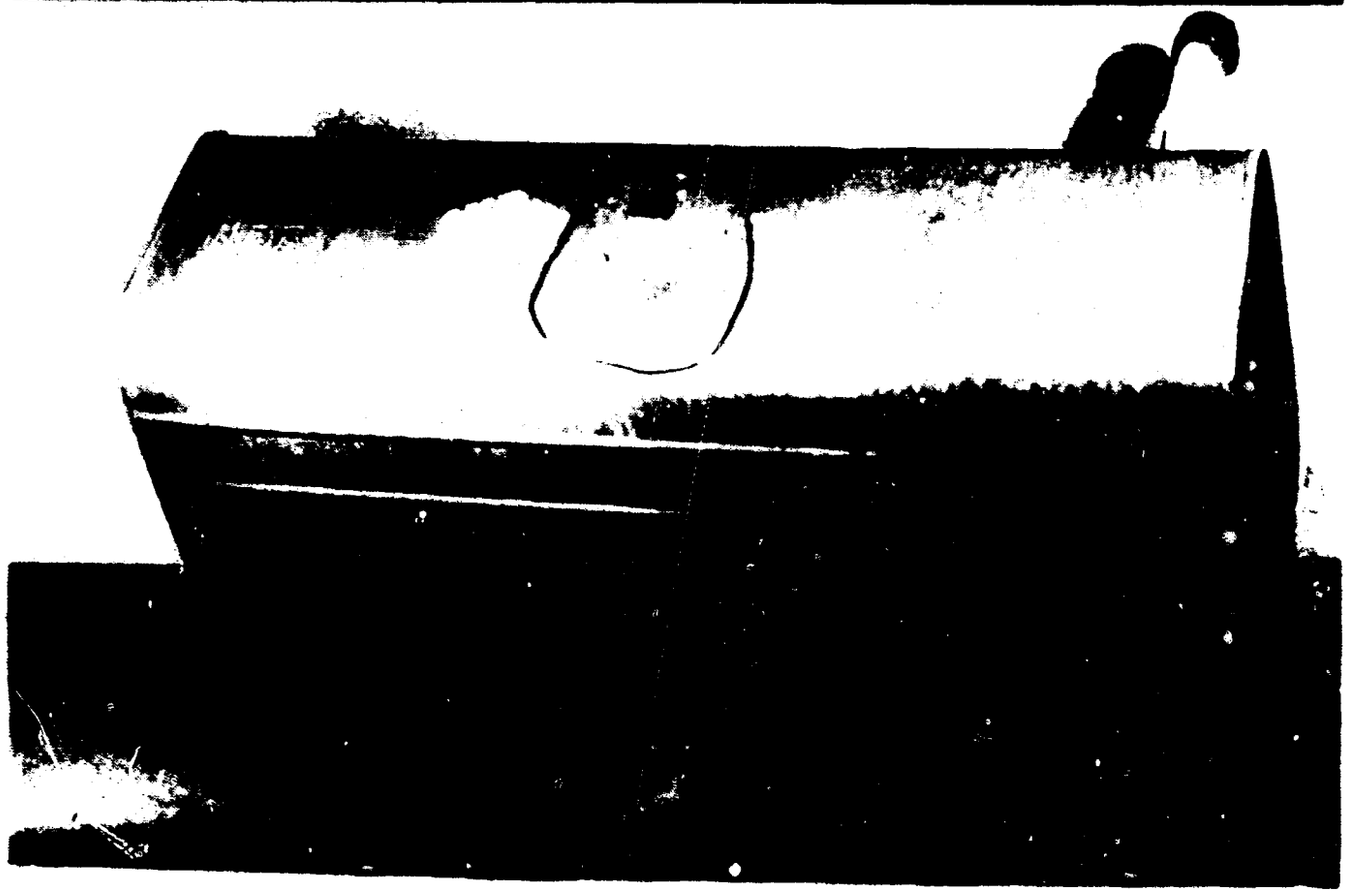
Rectangular, Tern plate

Exposure Conditions:

Aboard hull, empty

Comment on Photo:

Upper and lower surfaces show the tank to be in generally good condition. Some pitting occurred in way of sea water reservoir, near fittings and along welded seam. Circled area on tank side shows heavy corrosion and deterioration of both paint and terne coating.



Final Inspection Report
FIG. NO. 47

Project: 65WW63
File: MM-36

Tank No. 8H

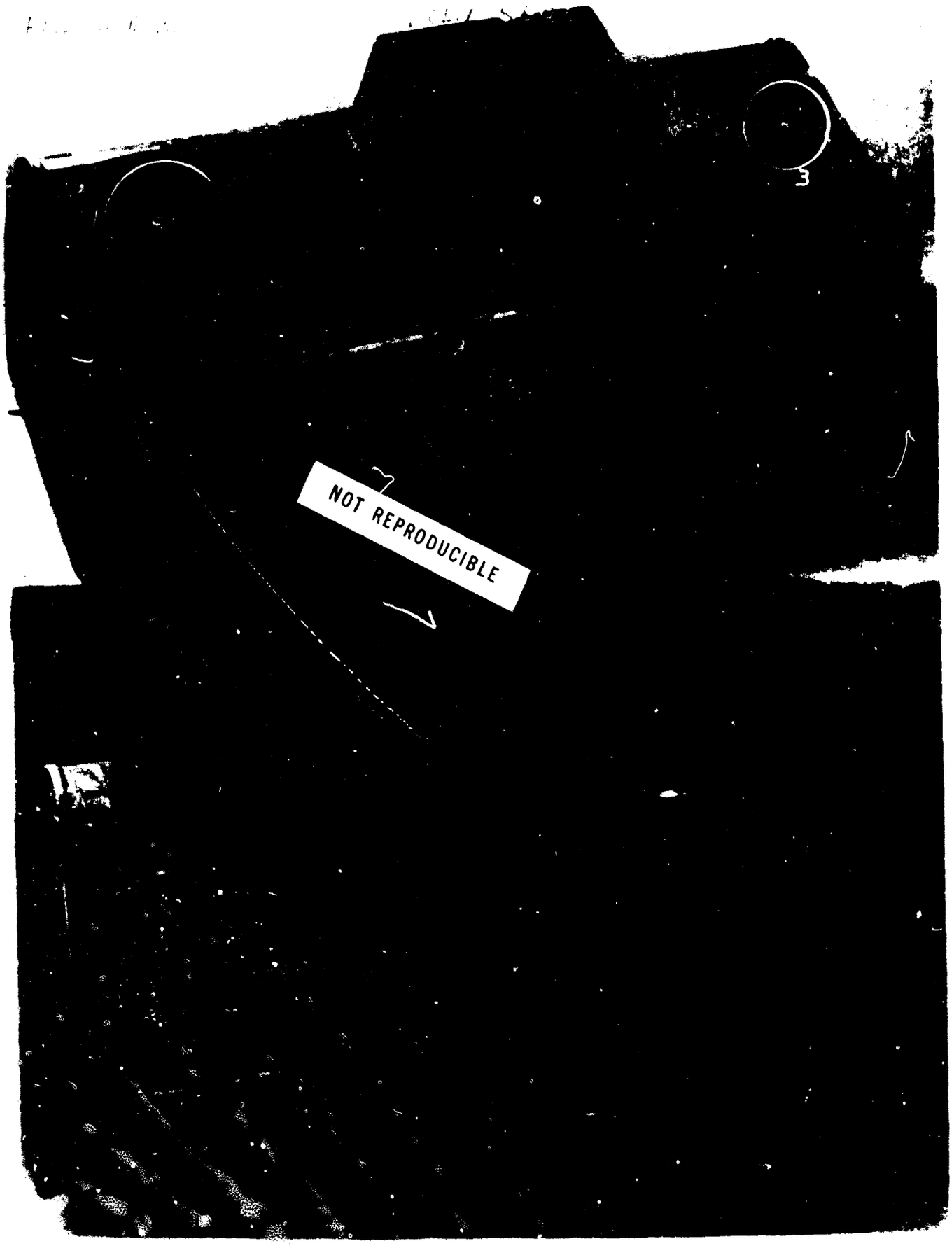
Rectangular, Terneplate

Exposure Conditions:

Aboard hull, empty

Comment on Photo:

Upper surface shows considerable deterioration of paint and terne coating, due in part to mechanical damage. Tank was located in an area subject to "heavy traffic" of maintenance and inspection personnel. Many pitted areas are present - especially in way of sea water reservoir, welded seam, end flanges, and tank fittings. Perforations noted at No. 1, 2 and 3.


NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 48

Project: 65WW63
File: MM-36

Tank No. 6

Rectangular, Terneplate

Exposure Condtions:

In shore box, empty

Comment on Photo:

Upper surfaces of tank show generally good condition of tank. However paint is blistered in way of fittings, on Figures 1, 2, 3 and 4, end flanges, and welded seam. Over 100 corrosion spots were noted.

XRAY

Final Inspection Report
FIG. NO. 49

Project: 65WW63
File: MM-36

Tank No. 6

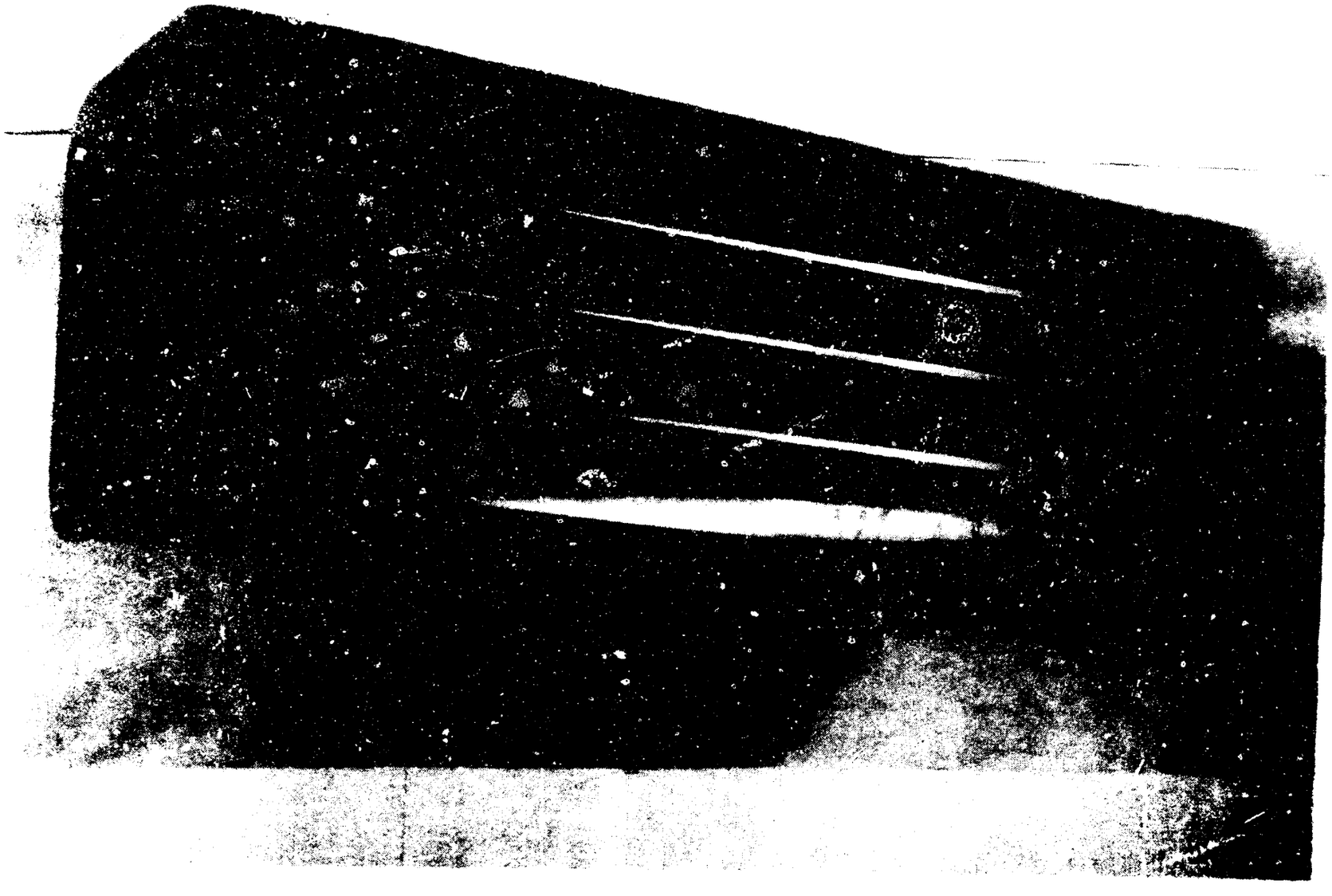
Rectangular, Terneplate

Exposure Conditions:

In shore box, empty

Comment on Photo:

Under surfaces of tank show generally good condition, but some paint had peeled in way of integral stiffeners and weeping rust streaks, emanating from longitudinal welded seam, are clearly visible. Reverse of Fig. No. 48.



Final Inspection Report
FIG. NO. 50

Project: 65WW63
File: MM-36

Tank No. 5

Cylindrical, Terneplate

Exposure Conditions:

In ventilated shore box, empty

Comment on Photo:

Generally good condition of tank is evident. However paint had blistered in way of fittings, and welded seam showed corrosion. In all some 20 pits were counted, with depths to about 0.003 inch.


NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 51

Project: 65WW63
File: MM-36

Panel No. 4

Terneplate

Exposure Conditions:

In ventilated shore box

Comment on Photo:

Paint and terne coating are largely intact. Many corrosion spots were noted, particularly along cut edges and on unpainted interior surfaces. Maximum pit depth was measured at 0.005 inch.

Panel #1

Final Inspection Report
FIG. NO. 52

Project: 65WW63
File: MM-36

Panel No. 1

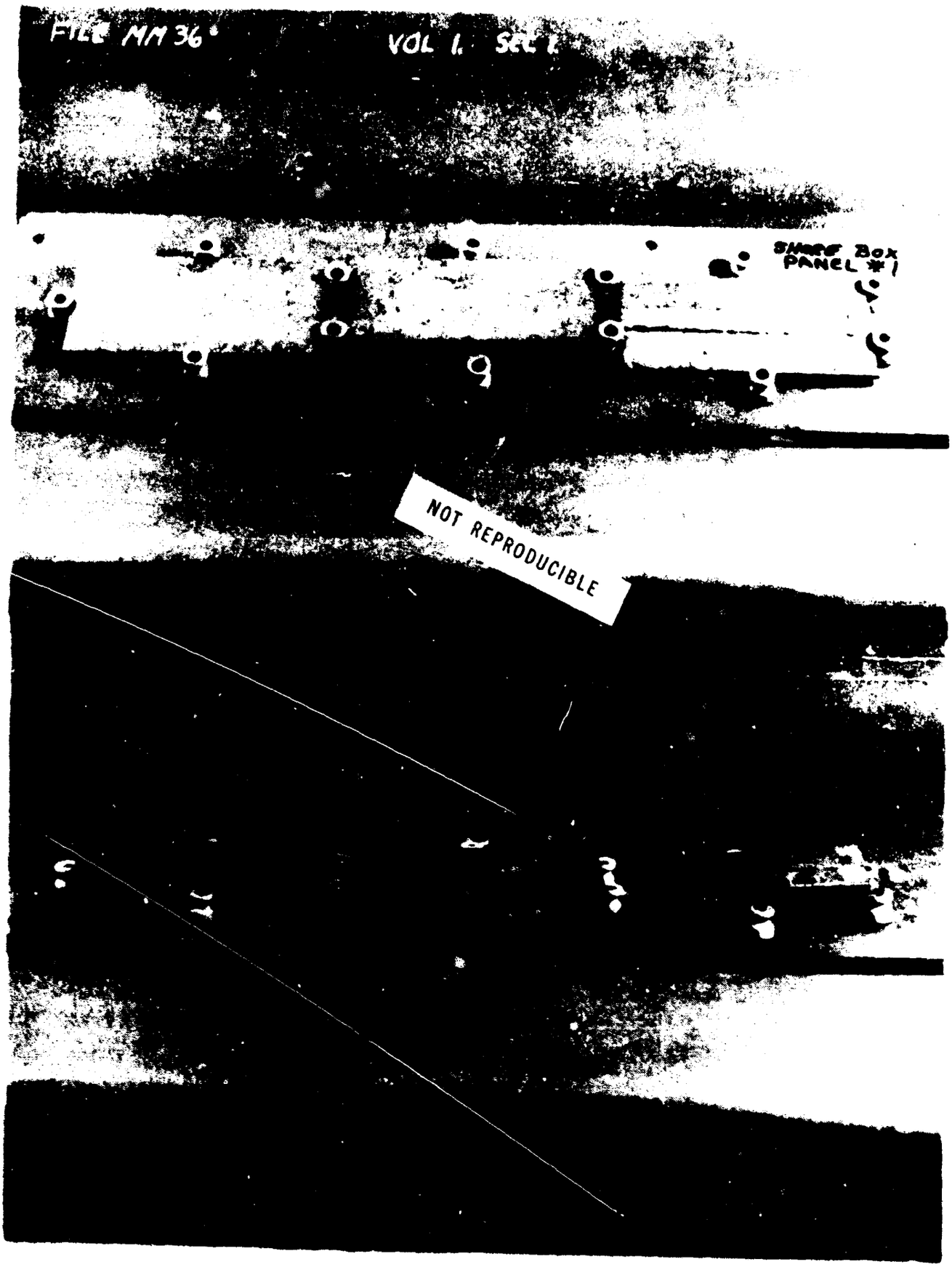
Galvanized Steel

Exposure Conditions:

In ventilated shore box

Comment on Photo:

Panels are slightly stained, which is indicative that the sacrificial coating is just starting to be used. Many small pits, approximately 0.001 inch, are present but filled with zinc. This material appears to have withstood the exposure period better than any of the other metals similarly exposed.


FILE MM 36
VOL 1. SEC 1
SHEAR BOX PANEL #1
NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 53

Project: 65WW63
File: MM-36

Tank No. 29H

Rectangular, Galvanized Steel

Exposure Conditions:

Aboard hull, empty

Comment on Photo:

Upper and lower surfaces of tank show characteristic "chalking" of sacrificial zinc coating. Only negligible corrosion spots were found, except at welded closure flange.

Arrows point to the pitted and perforated cadmium plated fuel level transmitter plate. This is not a part of the listed tank.


29H

Final Inspection Report
FIG. NO. 54

Project: 65WW63
File: MM-36

Tank No. 24H

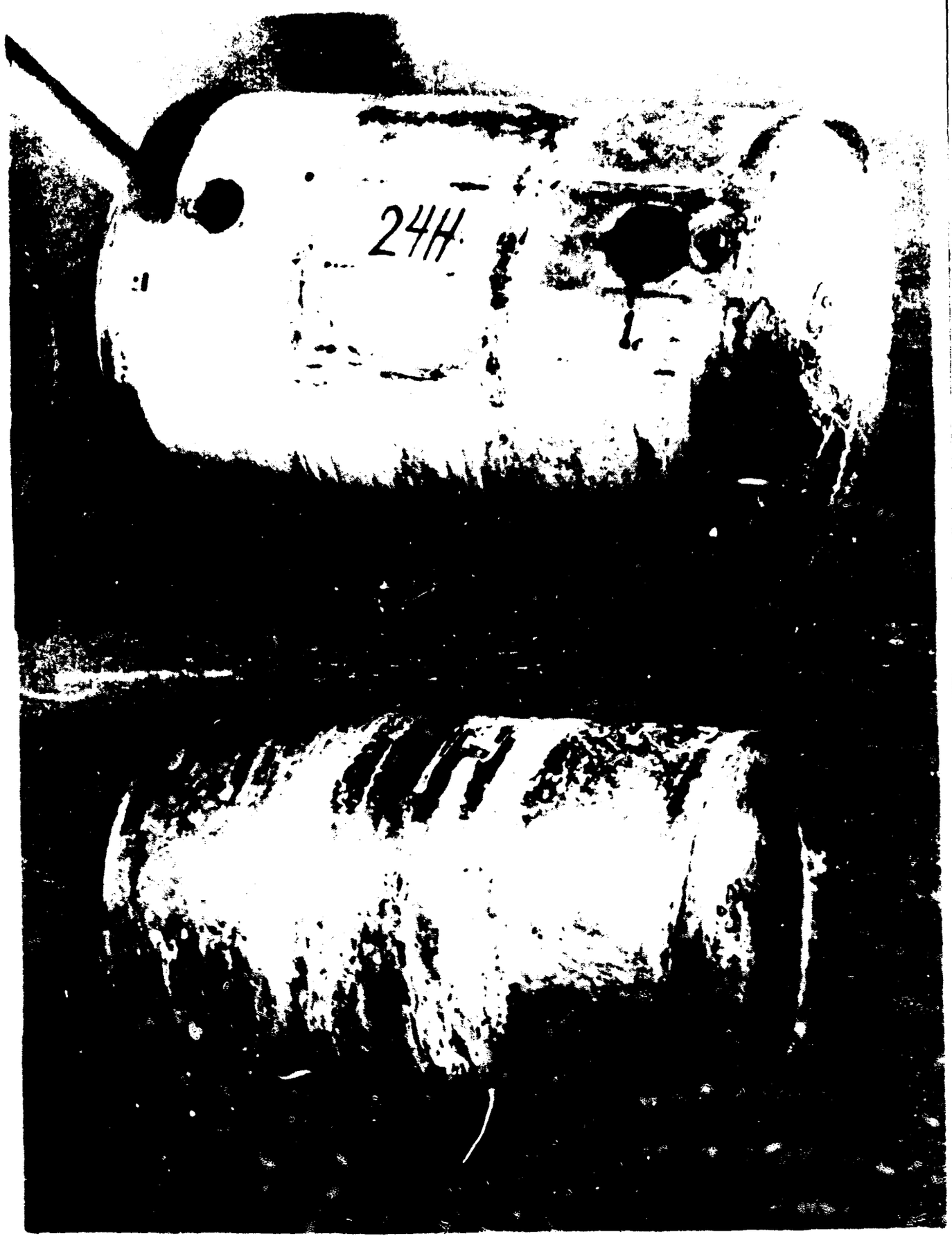
Cylindrical, Galvanized Steel

Exposure Conditions:

Aboard hull, empty

Comment on Photo:

Tank, in general, is in good condition. There is heavy rust in way of end closure flange, which is painted after welding has destroyed local zinc coating. However, thickness of metal at this point is ample to permit considerably longer exposure of this type without failure.


24H

Final Inspection Report
FIG. NO. 55

Project: 65WW63
File: MM-36

Tank No. 20H

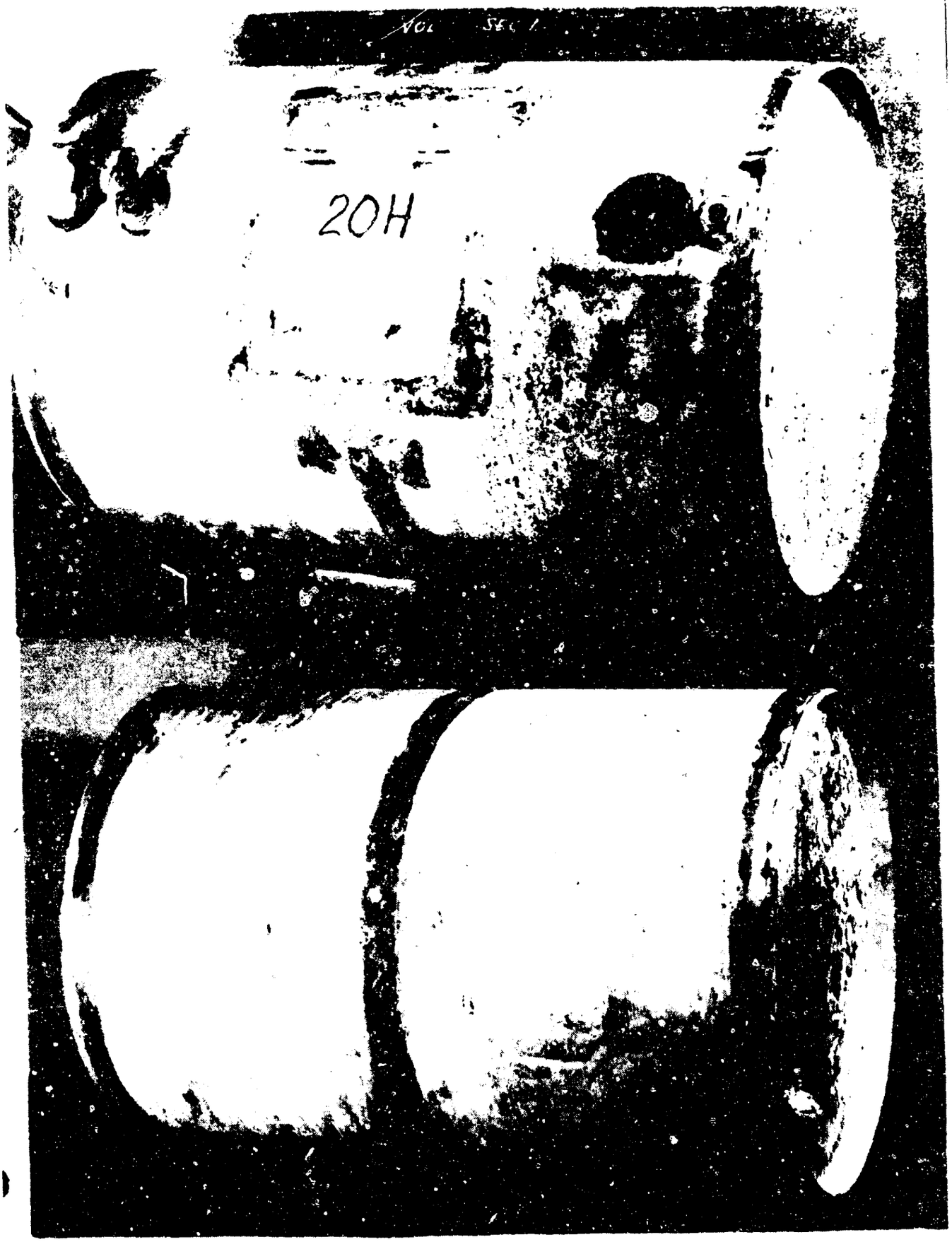
Cylindrical, Galvanized Steel

Exposure Conditions:

Aboard hull, full of gasoline

Comment on Photo:

Welded. painted closure flange shows considerable corrosion. Shallow pitting (0.002 inch) in this area is not considered significant due to the thickness of metal.


20H

Final Inspection Report
FIG. NO. 56

Project: 65WW63
File: MM-36

Tank No. 13H

Rectangular, Galvanized Steel

Exposure Conditions:

Aboard hull, filled with gasoline

Comment on Photo:

Upper and lower surfaces of tank show characteristic "chalking" of sacrificial zinc coating. Dark areas show protection from environment provided by chock liners and hold-down straps. Aside from the fuel level transmitter plate, the only area of corrosion is in way of the painted end flange.

Final Inspection Report
FIG. NO. 57

Project: 65WW63
File: MM-36

Tank No. 5H

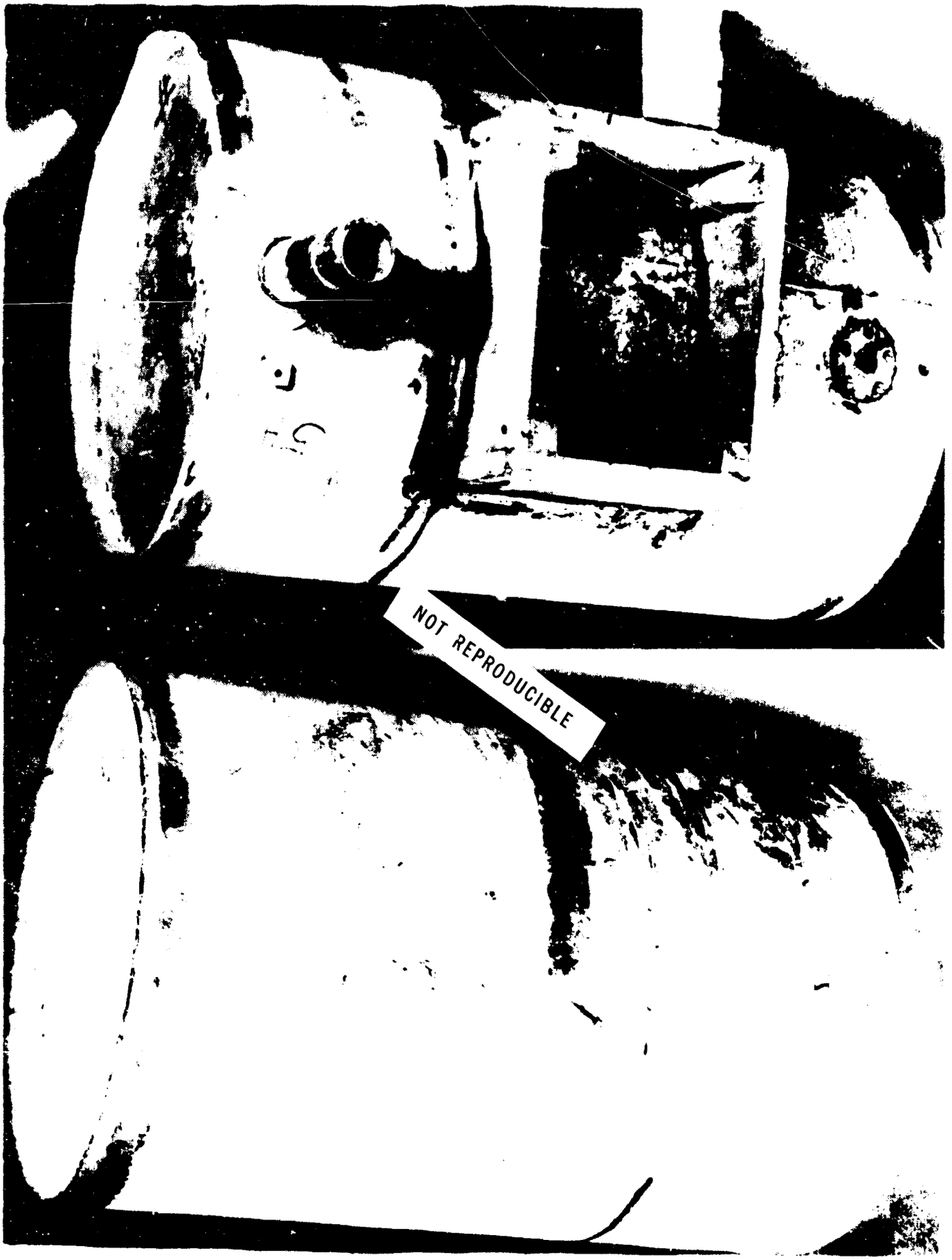
Cylindrical, Galvanized Steel

Exposure Conditions:

Aboard hull. Alternately empty and full first two years. Full of gasoline third year.

Comment on Photo:

Views of upper and lower surfaces show tank to be in good serviceable condition. Dark lines emanating from corner of sea water reservoir are streaks of bedding compound - not corrosion.



Final Inspection Report
FIG. NO. 58

Project: 65WW63
File: MM-36

Tank No. 9

Cylindrical, Galvanized Steel

Exposure Conditions:

In ventilated shore box, empty

Comment on Photo:

Upper surfaces and end plate reveal a tank in almost new condition. The light corrosion visible on the painted end flange is quite negligible. As may be noted, the zinc coating has not "chalked" to the same extent as on the tanks subjected to more rigorous conditions aboard the hull.

Final Inspection Report
FIG. NO. 59

Project: 65WW63
File: MM-36

Tank No. 4

Rectangular, Galvanized Steel

Exposure Conditions:

In ventilated shore box, empty

Comment on Photo:

Upper surfaces of this tank show that chalking of the zinc coating has started, and that there is light corrosion present in way of the painted weld at left end of picture. There is no pitting visible and the tank is completely serviceable.


E MM 36
VOL 1 SEC 1
NOT REPRODUCIBLE

Final Inspection Report
FIG. NO. 60

Project: 65WW63
File: MM-36

Panels No. 36H

Alloy No. 316(L) Stainless Steel, Alloy No. 304 Stainless Steel and Galvanized Steel

Exposure Conditions:

Aboard hull, on ceramic insulaters

Comment on Photo:

General spotting and incipient pitting. Corrosion build up along lower edges in way of weld on No. 304 panel. Galvanized steel panel slightly discolored.

3C H
3/6 -
H DACA

Final Inspection Report
FIG. NO. 61

Project: 65WW63
File: MM-36

Panels No. 35H

Alloy No. 316(L) Stainless Steel, Alloy No. 304 Stainless Steel and Galvanized Steel

Exposure Conditions:

Aboard hull, on ceramic insulaters

Comment on Photo:

Stainless Steel panels slightly discolored with corrosion build up along lower edges. Outer face somewhat spotted - Galvanized panel slightly "chalky" no corrosion noted on Galvanized panel.


FILE MA 90
FIG 61
5H

Final Inspection Report
FIG. NO. 62

Project: 65WW63
File: MM-36

Panels No. 37H

Alloy No. 316(L) Stainless Steel, Alloy No. 304 Stainless Steel and Galvanized Steel

Exposure Conditions:

Aboard hull, on ceramic insulaters

Comment on Photo:

Both 316(L)and 304 alloys show pitting and minor corrosion on both faces and corrosion build up along lower edges. Galvanized panel slightly discolored - considerable "chalking" of zinc coating but no corrosion.

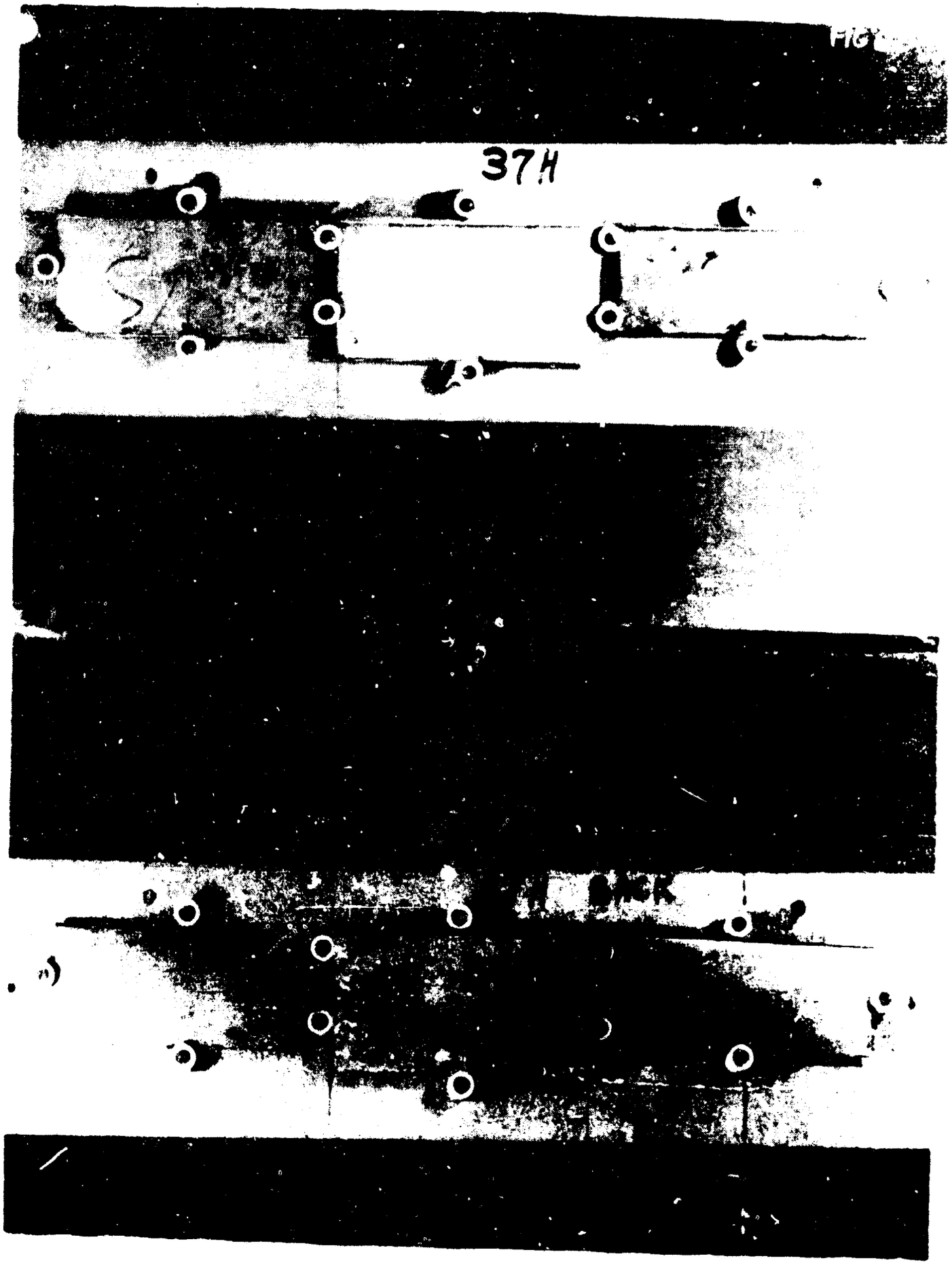


FIG
37H

Final Inspection Report
FIG. NO. 63

Project: 65WW63
File: MM-36

Panels No. 38H

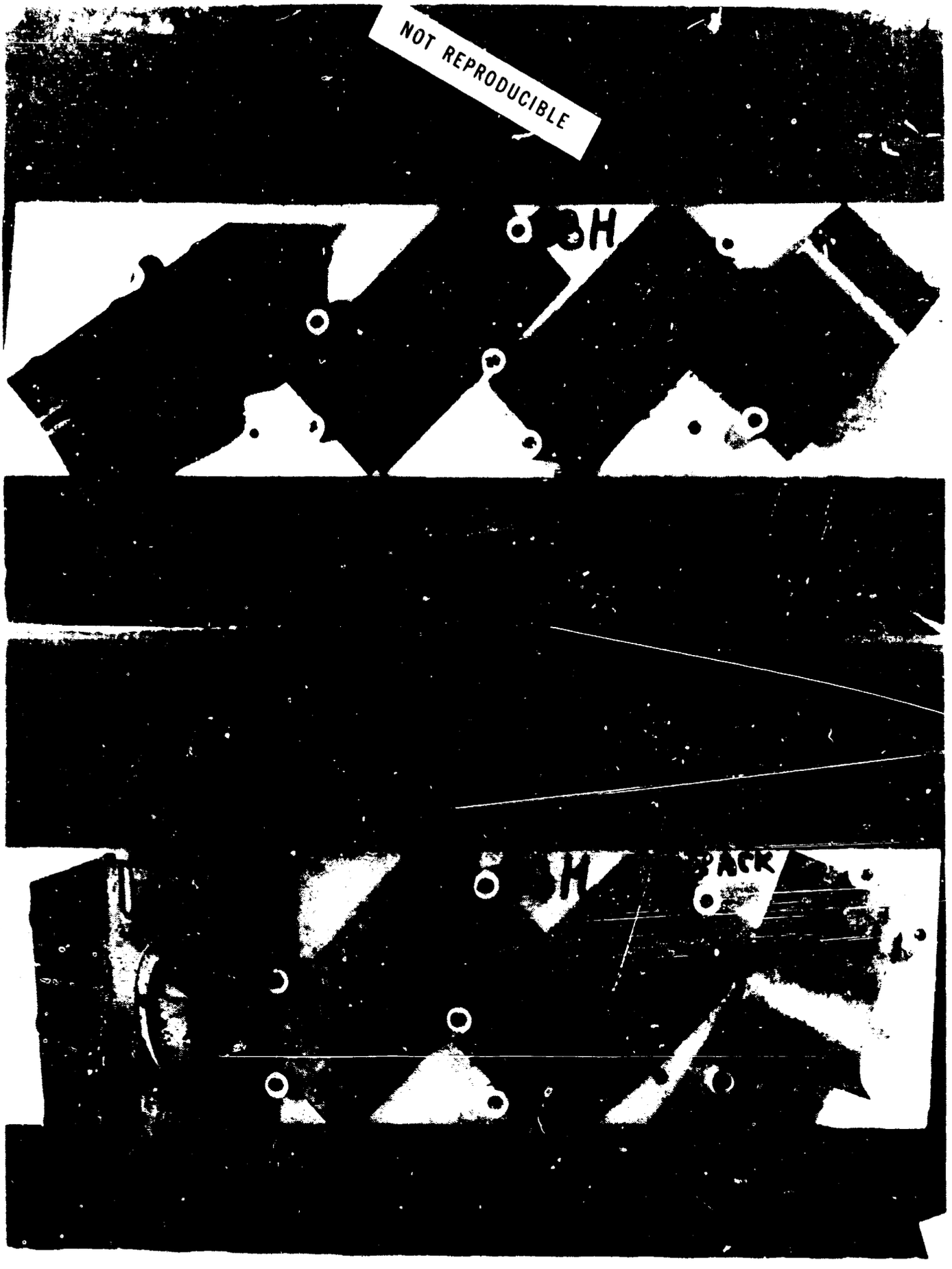
Terneplate

Exposure Conditions:

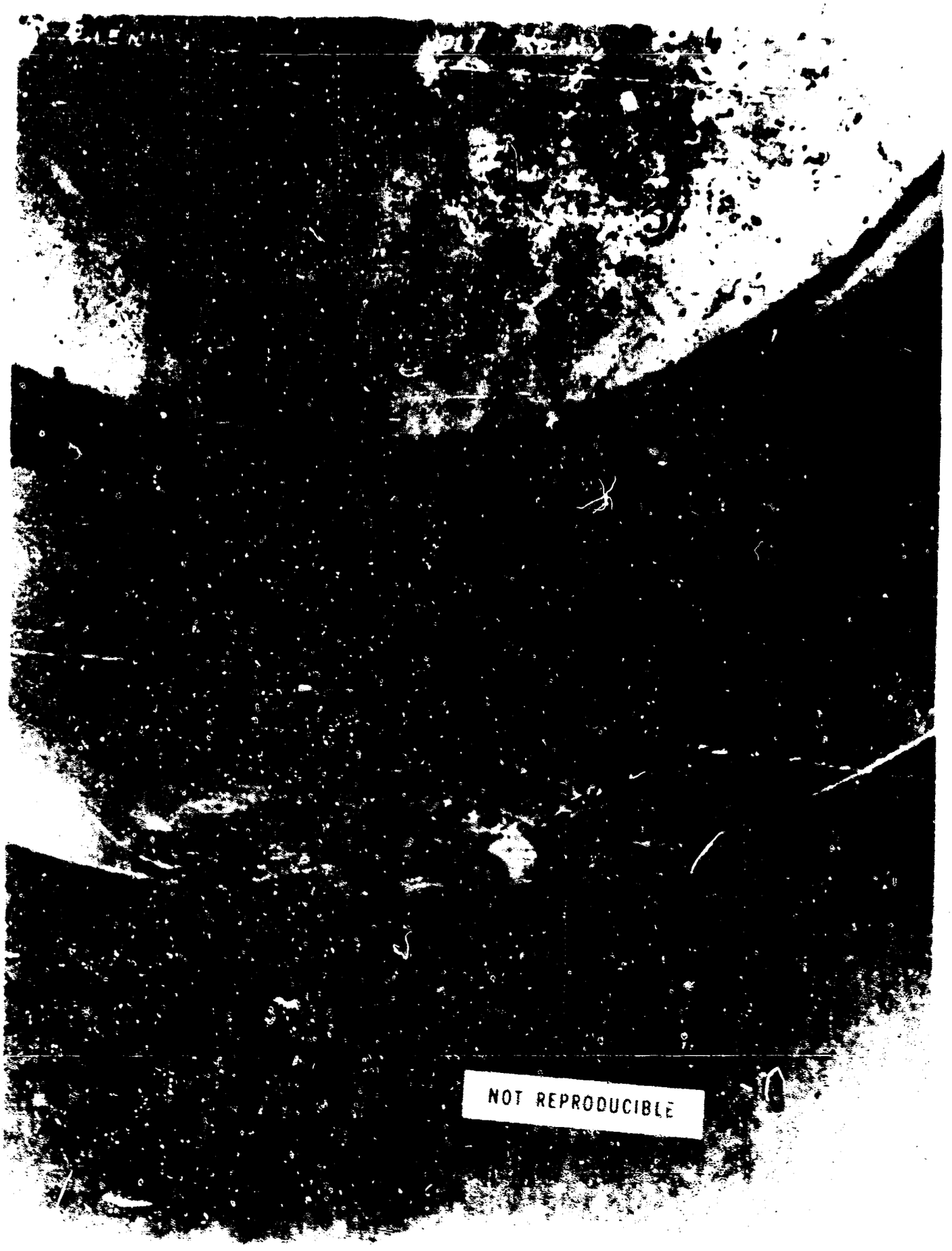
Aboard hull, on ceramic insulaters

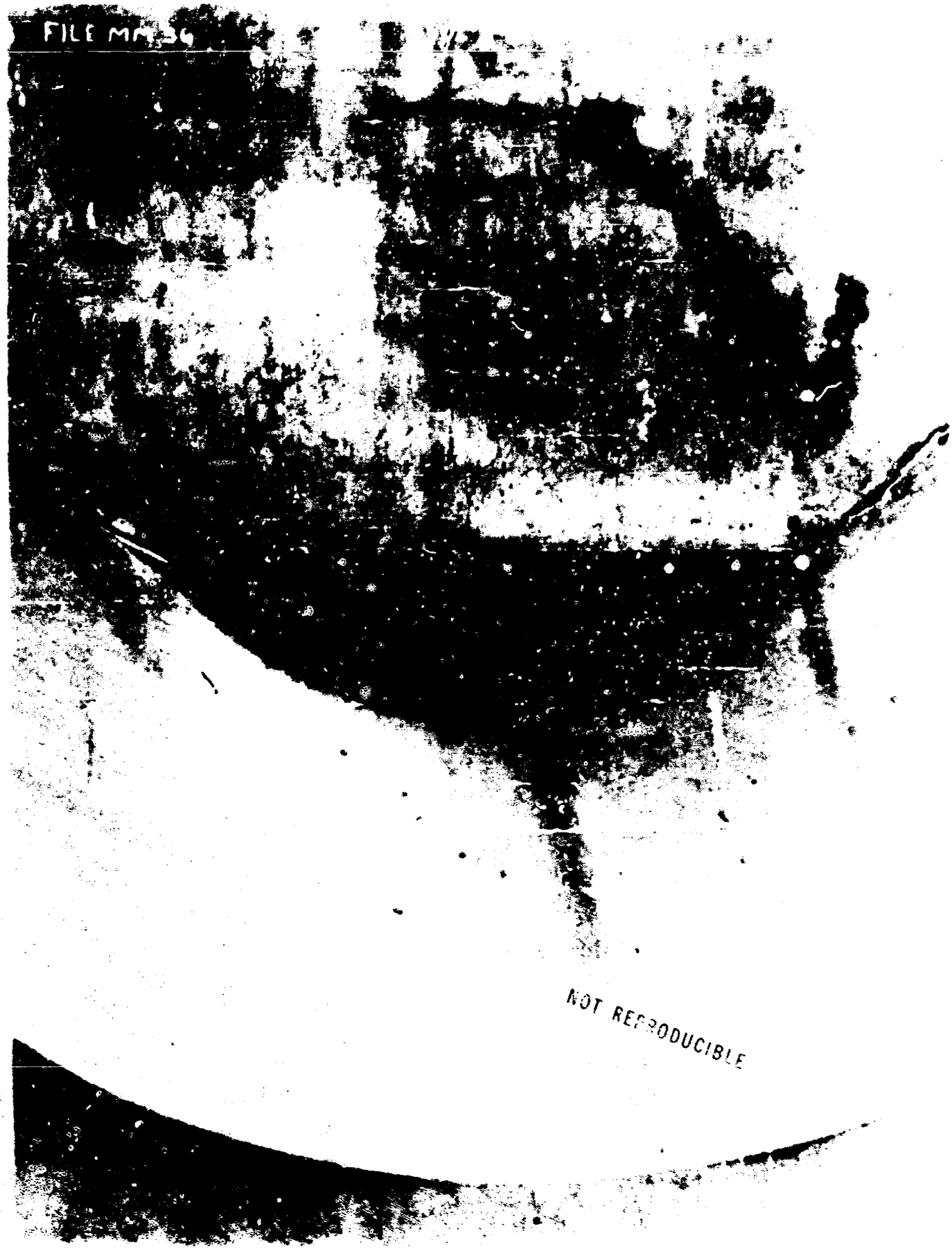
Comment on Photo:

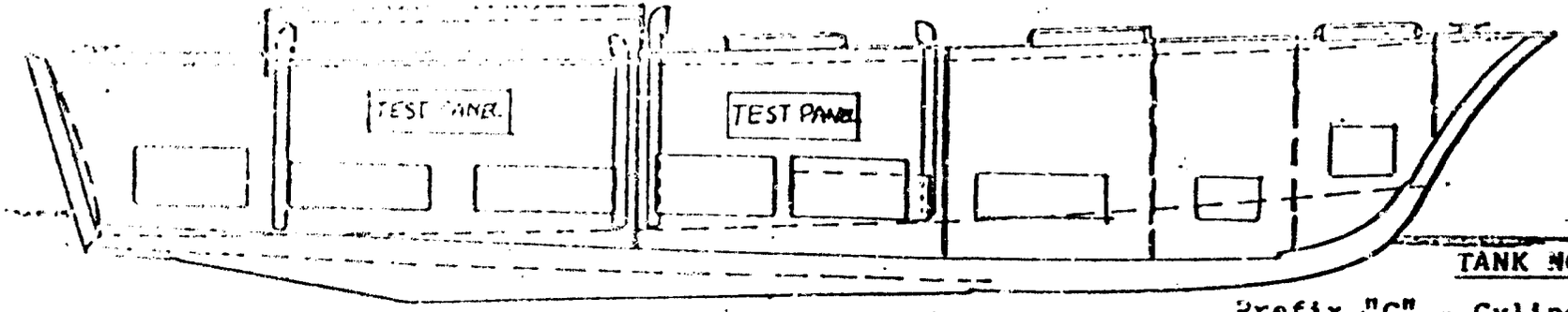
Paint coating blistered and peeling - all edges badly corroded. Pitting noted along weld and all internal unpainted surfaces.




NOT REPRODUCIBLE


NOT REPRODUCIBLE


FILE MR-36
NOT REPRODUCIBLE



NOTE: RACKS FOR MOUNTING METAL TEST PANELS TO BE FITTED TO BHDS

TANK NOTES

Prefix "C" - Cylindrical
" "R" - Rectangular
316(E)-316(L) Stainless Steel Electric Weld
316(G)-316(L) Stainless Steel Gas Weld
304 - 304 Stainless Steel
T/P - Terneplate
G/S - Galv. Steel
Suffix "E"-Empty
" "F"-Full
" "T"-Transfer

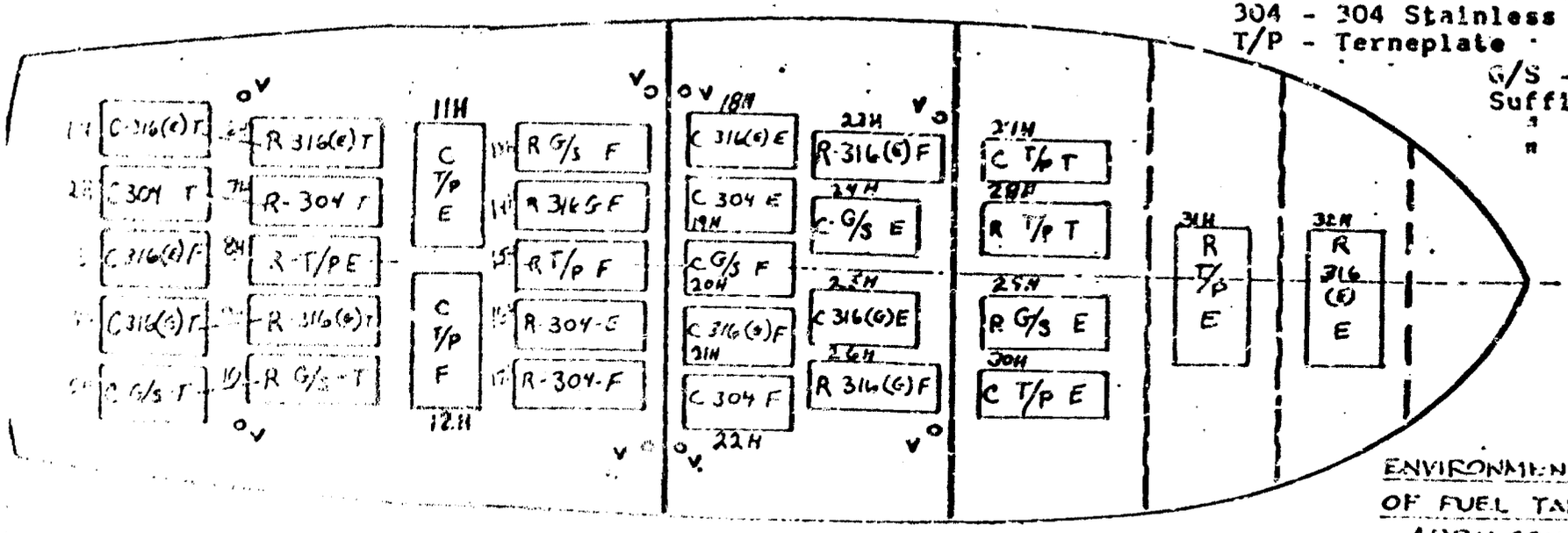


DIAGRAM Nº 1

ENVIRONMENTAL EXPOSURE OF FUEL TANK MATERIALS — ARRANGEMENT OF TANKS

FILE MM-36 ASSIGNMENT 05W003
FILE MM-10 ASSIGNMENT 05W012

INTERIM REPORT

ENVIRONMENTAL EXPOSURE OF SAMPLE MODEL MARINE FUEL TANKS

YSB REPORT R6-1-0469

Tel. 664-6300 Code 201

A non-profit
public service organization

YACHT SAFETY BUREAU
INCORPORATED
336 OLD HOOK ROAD, WESTWOOD, N. J. 07675

INTERIM REPORT

ENVIRONMENTAL EXPOSURE OF SAMPLE MODEL MARINE FUEL TANKS

YSB REPORT R6-1-0469

CONTRACTS: Allegheny-Ludlum Steel Corp. - 10 March 1965
with Supp'l. Agreement

USCG #CG-10-135-A - (with Supp'l. Agreements) -
18 July 1965

DATE: 18 April 1969

REPORT ON:

Completion of two year environmental exposure of sample Model Marine Fuel Tanks, as outlined in YSB Procedure R-6.

ITEMS COVERED:

1) Set of tanks, Alloy No. 304, resistance welded, furnished by and under contract with Allegheny-Ludlum Steel Company.

2) 1 Set of tanks, Alloy No. 316(L), resistance welded, purchased by YSB under contract with USCG.

3) 1 Set of tanks, Alloy No. 316(L), tungsten inert gas welded, purchased by YSB under contract with USCG.

   Note: All of the stainless steel tanks were fabricated by the Allcraft Manufacturing Company, Cambridge, Mass. Except for materials and welding techniques the tanks are in all respects similar to their YSB listed "Monel" fuel tanks, of approximately 24 gallons capacity, each. The cylindrical tanks are 16 inches diameter by 30 inches long. The rectangular tanks are 14 inches wide, 12 inches high, and 36 inches long, with approximately 3 inch radii. The tanks are fabricated of 0.031" and of 0.037" sheet.

4) 1 Set of terneplate tanks, proprietary model of Mirax Corp., purchased by YSB under contract with USCG.

   Note: These tanks are fabricated of 20 gauge (0.035"), long terne steel, meeting Fed. Spec. QQT-191A, Grade 3, Commercial Quality, with red enamel coating. End plates are attached to shell with rolled-lock soldered seams and resistance lap welded longitudinal seams. The cylindrical tanks are approximately 15 inches diameter by 35 inches long, with approximately 26 gallons capacity. The rectangular tanks have overall dimensions of approximately 14-1/4 inches width, 11-1/2 inches height and 38-1/4 inches length. Capacity is approximately 24 gallons.

5) 1 Set of Hot-Dip galvanized steel fuel tanks purchased by YSB, for use as "control" samples.

   Note: These tanks were fabricated by the Everts & Overdeer Corporation, in accordance with practice on YSB listed tanks. All tanks are of 14 gauge (nominal 0.0747") rolled, commercial quality steel sheet. Hot dip galvanizing was accomplished after making all welds, except the end plate closure weld. The closure weld area was coated with zinc chromate. Cylindrical tanks are approximately

18 inches diameter by 30 inches long and have a capacity of about 30 gallons each. The rectangular tanks are 35 inches long, 14 inches wide, and 12 inches deep, with a capacity of approximately 24 gallons each.

6) Numerous other equipment items aboard the vessel, for environmental exposure testing, do not form a part of either of the subject contracts, and hence, will not be covered by this interim report.

REFERENCES:

1) YSB Project R-6 (Tentative), "Environmental Exposure Testing of Sample Model Marine Fuel Tanks", dated 19 August 1965, with Addendum No. 1.

2) "Fire Protection Standard for Motor Craft" (NFPA No. 302) (USA Standard Z120.1-1968).

3) Quarterly R-6 Reinspection Reports Nos. 1 - 8 (incl.).

4) Naval Research Laboratory Memorandum Report 1795 - "The Corrosion Behavior of Stainless Steels in Sea Water".

HISTORICAL BACKGROUND OF TEST:

For many years Reference (2), which is highly regarded by both inspection authorities and boat builders, has by omission not recognized certain materials as being suitable for the fabrication of marine fuel tanks.

Stainless steels were not recognized because of susceptibility to "crevice corrosion" when in a marine environment. Similarly, terne plate was considered unsuitable because mechanical damage to, or "holidays" in the lead coating would hasten corrosion of the sheet steel base metal through galvanic action.

In recent years the vastly increased amount of pleasure boating has led to a search, by both builders and equipment manufacturers, for additional fuel tank materials. In some instances unfamiliarity with the marine environment, coupled with a competitive business impulse to effect economies where possible, has led to the rather extensive use of materials other than those specifically mentioned by the NFPA committee. Another factor affecting the situation has been the semi-wartime national economy with availability of some materials rather critical - and invariably priced accordingly.

Because of the growing controversy regarding the use of certain materials in marine fuel tanks, the present project was undertaken by the YSB, under the joint sponsorship of the Allegheny-Ludlum Steel Company, and the U.S. Coast Guard.

The object of the test is simply to provide valid data upon which to base an opinion upon the acceptability of the itemized materials for the intended usage, and if the accumulated data warrants, to seek recognition of these specific metals in Reference (2).

The galvanized steel tanks, although on board for comparison purposes, are considered a part of the test.

OBJECT:

The object of this report is to summarize the condition of the itemized tanks as a result of the two year exposure to a marine environment, as described in Reference (1).

DESCRIPTION:

For ready analysis of corrosion progress vs. time, the following notes, which are applicable to Reference (3) attached have been prepared:

1. Alloy No. 304 Stainless Steel - Spotting and superficial discoloration started to appear within the first six months, generally noted at welds and on end flanges. No pitting was definitely observed before nine months of exposure. After fifteen months, pitting was noted in way of one of the tank top weights, which had been lifted for inspection. Further external pitting was noted at subsequent inspections. Two year inspection, which called for temporary removal of straps, water-boxes and weights, disclosed external pitting of all No. 304 tanks aboard, and of these, two tanks were perforated - in way of the removed water boxes. One perforated tank was defueled and filled with fresh water; the other was returned to YSB for closer examination.

2. Alloy No. 316(L) - Stainless Steel, Resistance Welds - Spotting and superficial discoloration started to appear within the first six months, mainly in way of welds and fittings. First external pitting observed at nine month inspection. Pitting in open areas noted on twenty-one month inspection. On two year inspection, five of the six tanks aboard had pits - mostly in way of straps, water-boxes and weights. No perforations noted, but one tank returned to YSB for closer examination.

3. Alloy No. 316(L) - Stainless Steel, Gas Welds - Spotting and discoloration followed patterns similar to above. At twelve month inspection, definite external pitting was observed in way of weight, additional pitting noted on subsequent inspections. At two year inspection all six tanks aboard showed pitting, mostly in induced areas. One tank (full rectangular) was perforated. This tank was defueled and filled with fresh water as a safety precaution. One tank returned to YSB for closer examination.

4. Terneplate Tanks - A total of eight terneplate tanks were installed - the additional two tanks having been scratched and abraded intentionally. The three month inspection showed some red corrosion in horizontal abraded areas, but vertical areas remained bright. Paint started to bubble within three months, indicating corroding action below the surface. Flanges and welded areas showed some corrosion by the end of six months' exposure. Build-up of paint bubbles and corrosion at welds and fittings continued, but at the end of two years no actual perforations were observed. One tank was returned to the YSB for closer examination.

5. Galvanized Steel Tanks - At the end of three months characteristic "chalking" of the sacrificial zinc coating was observed. The closure plate flanges, painted after final welding show rust where the protective paint has chipped off, but show little evidence of corrosion pitting. At the end of twenty-four months exposure the general appearance remained the same with no apparent loss of the overall zinc coating including those areas under the weighted blocks. There were no tank failures. The surface of the cadmium plated fuel gauge transmitters were completely rusted but show no evidence of failure. One tank was returned to the YSB for closer examination.

GENERAL:

It should be noted that, in all instances, the R-6 procedure calls for flooding of the tank top water boxes, with sea water, for a one week period every three months. These pine boxes were bedded to the tank surfaces with a commercial bedding compound which provided reasonably watertight joints. It is probable, however, that moisture worked its way into the faying surfaces, and that stagnant sea water has been present in these areas during most of the two year exposure. It should also be noted that all perforations in the stainless tanks occurred in what might be termed "induced areas". However, general incipient pitting was noted in open areas.

OBSERVATIONS ON TANKS RETURNED FOR EXAMINATION:

The following comments are related to Photographs 1 through 27 attached as part of this report.

PHOTOGRAPH NO. 1 - One-half of Alloy No. 304 Stainless Steel Tank, showing fill pipe and location of water box. Most of the bedding compound has been removed. Arrow and numeral 4 show location of corrosion shown in Photograph No. 4.

PHOTOGRAPH NO. 2 - Second half of Alloy No. 304 Stainless Steel Tank showing fuel feed and vent connections. The remains of the bedding compound adjacent to the cut edge indicates the location of one end of the water box. The arrow and numeral 1 point to the corrosion shown in Photograph No. 3. The corrosion in the upper right hand corner of the water box near the numeral 2 is shown in Photographs Nos. 5 and 6. The tank is also corroded to the right and left of the fuel pickup connection, near number 3, and to the right of the vent connection. All three areas appear to indicate the outline of tape marks. Since there was no tape of any type across the fittings during the exposure period, it is probable that the fittings may have been covered with tape during shipment prior to installation and the residual adhesive from the tape induced the corrosion. See Photograph No. 7 of the tank surface adjacent to numeral 3.

PHOTOGRAPH NO. 3 - See Photograph No. 2 for location. A piece of white paper was placed in back of the corroded area to more clearly outline the extent of the penetration. The particular area was completely beneath the bedding compound. Pitting adjacent to the hole is approximately .024 inch in depth.

PHOTOGRAPH NO. 4 - See Photograph No. 1 for location. The point of penetration and adjacent pitted area lie along the inside edge of the bedding compound used to secure the water box to the tank.

PHOTOGRAPHS NOS. 5 and 6 - See Photograph No. 2 for location. Both photographs are of the same corroded area which occurred beneath the bedding compound used to secure the water box to the tank surface. Using a microscope and dial indicator, the maximum pit depth was measured at .020.

PHOTOGRAPH NO. 7 - See Photograph No. 2 for location. The photograph shows one section of an area 2 inches long and 3/4 inch in width covered with numerous pits estimated to be .005 inches in depth (average). As indicated, the corroded area appears to cover an area that may have been covered by 3/4 inch wide tape prior to the test. There is no record to confirm this fact.

PHOTOGRAPH NO. 8 - One-half of Alloy No. 316(L) Gas Welded Stainless Steel Tank showing fill pipe and bedding compound outlining position of water box. Arrow and numeral 1 point to corrosion

shown in Photograph No. 10. Bracketed area with numeral 2 is the location of small corrosion pits shown in Photograph No. 11. Although not visible in photograph of the tank, Photograph No. 12 is of series of small pits on bottom tank surface clear of all bedding compound, chocks or strapping.

PHOTOGRAPH NO. 9 - Second half of Alloy No. 316(L) Stainless Steel Tank showing fuel feed pickup and tank vent connections. Arrow and numeral 4 show position of corrosion spot shown in Photograph No. 13. Arrow and numeral 5 show position of two large pits shown in Photograph No. 14.

PHOTOGRAPH NO. 10 - See Photograph No. 8 for location. The "paw print" shaped corrosion was located beneath the bedding compound which was removed in the area of the pitting. The pits are approximately .016 inch deep or approximately one-half of the tank thickness.

PHOTOGRAPH NO. 11 - See Photograph No. 8 for location of random pitting. The particular area shown includes approximately 14 individual pits of varying depth. The deepest pit is approximately .015 inch deep and all are located on a surface that was covered with bedding compound.

PHOTOGRAPH NO. 12 - The pitted area shown is not visible in Photograph No. 8, but is located on the bottom surface of that tank section. The area includes approximately 50 to 100 pits that follow what appears to be a scratch mark. The pits are estimated to be up to .005 inch in depth. No known reason for crevice corrosion existed in this area.

PHOTOGRAPH NO. 13 - See Photograph No. 9 for location. This relatively shallow pit was located in an area covered with bedding compound.

PHOTOGRAPH NO. 14 - See Photograph No. 9 for location. The two large pits are positioned near the inside edge of the tank surface covered with bedding compound. Using a microscope fitted with a dial indicator, the maximum pit depth was measured at .020 inches on the smaller pit and .024 inches along the edge of the larger pit.

PHOTOGRAPH NO. 15 - Two sections of Alloy 316(L) Resistance Welded Stainless Steel Tank. Outline of water box and position of weighted block are clearly evident. Arrows and numerals 1, 2 and 3 mark major pitted areas beneath the water box bedding compound. Using the microscope and dial indicator, pit depths to .020 inches were measured. Arrow and numeral 4 mark a pitted area along the edge of the resistance weld which was probably under the tank strap when installed. Due to the similarity of pitting on this tank with the other 316(L) tank, close-ups are not included.

PHOTOGRAPH NO. 16 - Interior view of two sections of Alloy 316(L) Resistance Welded Tank. No evidence of corrosion present.

PHOTOGRAPH NO. 17 - Two sections of Terneplate Tank showing general view of top and side surfaces. The position of the wet box is evident on both sections. Although not clear in the black and white photograph, all of the paint under the bedding compound came off with removal of the wet box and compound. Photograph No. 19 shows a small area of the corroded surface at the upper end of the short section adjacent to the small circled numeral 1. Photograph No. 20 is a close-up of the corrosion adjacent to the fuel feed pickup tube shown as the lower fitting of the short tank section.

PHOTOGRAPH NO. 18 - Bottom view of two tank sections shown in Photograph No. 17. The paint coating is chipped in many areas, but the lead coating appears to be intact.

PHOTOGRAPH NO. 19 - See Photograph No. 17 for location. The surface corrosion shown is of a loose surface type. When removed, most of the lead coating under the surface scale was intact but the scattered corrosion pitting was measured between .010 to .015 inch in depth. Spot checks of samples indicated that the material thickness varies between .044 and .030 inches and that the thickness of metal remaining at the base of one pit was .021 inches.

PHOTOGRAPH NO. 20 - See Photograph No. 17 for location. General peeling of painted surface and scale corrosion around fitting spud.

PHOTOGRAPH NO. 21 - Interior view of two tank sections shown in Photograph No. 17. The surfaces show considerable rust discoloration that was probably induced when the tanks were washed out with water. The small dark areas particularly evident on the baffle, mark holidays in the lead coating where the base metal has rusted and bled through.

PHOTOGRAPH NO. 22 - Two sections of Hot Dipped Galvanized Steel Tank showing general view of top and side surfaces. The position of the wet box is evident on both sections. Photograph No. 25 is a close-up photograph of the tank surface along the edge of the area that had been covered with bedding compound. The particular area is adjacent to the numeral 1 at the upper left corner of the wet box (larger tank section). There is no evidence of corrosion of the base steel except along the edges of the final closure. Photograph No. 26 is a close-up view of the painted edge and Photograph No. 27 of the fuel gauge transmitter and fuel pickup connection.

PHOTOGRAPH NO. 23 - Interior view of tank sections shown in Photograph No. 22. The galvanized coating is completely intact with a few minute spots of rust that can be wiped off with no evidence of corrosion pitting.

PHOTOGRAPH NO. 24 - Interior view of tank section with final closure plate welded after galvanizing. Except for approximately 4 tiny specks of rust in the lower right corner (not evident in black and white photograph), there is no evidence of failure of the galvanized coating or of corrosion of the base steel.

PHOTOGRAPH NO. 25 - See Photograph No. 22 for location. The surface discoloration (white) and flaking shown is confined to the zinc coating with no indication of corrosion of the base steel. When the area was cleaned, the zinc coating was intact and there was no evidence of pitting.

PHOTOGRAPH NO. 26 - Photograph No. 26 is of a typical section of the painted flange shown at the top of the short tank section in Photograph No. 22. Although better than 90 percent of the paint along the edge is intact, some of the paint has flaked off as shown. Most of the flange is still galvanized and all evidence of rust is confined to those areas where the final weld destroyed the zinc coating. There is some evidence of minor pitting of the unprotected weld deposit material. The pitting is estimated to be approximately .003 inch in depth with a total material thickness of 3/16 to 1/4 inch.

PHOTOGRAPH NO. 27 - Photograph No. 27 is of the Fuel Gauge Transmitter and Fuel Feed Pickup Connection shown in Photograph No. 22. The flaking around the fuel gauge transmitter is apparently confined to the galvanized coating of the tank. When the transmitter was removed and the surface cleaned, no pitting was evident.

CONCLUSION:

The following observations appear to be valid:

1. Although the most severe corrosion of the stainless tanks occurred in (what might be termed) "induced areas", or emanated from such areas, there is justification for scepticism regarding acceptability of No. 304 and No. 316(L) stainless steel tanks. Presumably, any material (piece of wood, cloth, or dirt) placed on a tank in service could create a situation sufficient to hold moisture in contact with the metal long enough to provide the differential aeration which causes pitting. Once pitting starts, the corrosion by-products operate to make the process self-generating at an accelerating rate.

2. There would appear to be little difference in the corrosion characteristics of Alloy No. 304 and No. 316(L) in this type of exposure. While the actual start of pitting on 316(L) stainless may take a bit longer than on 304, under identical exposure conditions, the problem remains essentially the same and the corrosion process occurs at a rate similar to that of the 304.

3. The different welding techniques employed on the No. 316(L) tanks would apparently indicate that the tungsten inert gas method provides fewer moisture pockets than does the resistance method. However, this is somewhat academic as the major failures were noted to be well away from the welds.

4. Although the overall appearance of the terneplate tanks indicate that the lead coating is generally very effective, the measured depth of corrosion pitting would indicate that the tank removed probably would have failed within approximately 12 months.

5. Aside from corrosion in way of the painted closure flange, which has a sufficient thickness of metal to withstand further environmental exposure of this type, the galvanized steel tanks appear to be in very good condition.

6. Each of the tanks returned to the YSB was cut open and examined internally. In no instance was there evidence of pitting originating inside a tank. Welded areas appeared to be in satisfactory condition, but there was slight evidence of local corrosion build-up in way of small adhering particles of weld spatter.

7. Final judgment of the various metals for use in marine fuel tanks will be made following completion of the extended environmental exposure period.

TEST REPORT BY:

Richard P. Ketcham

PHOTOGRAPHS AND RELATED COMMENTS BY:

Robert Loeser, Asst. Gen. Mgr.

REVIEWED BY:

Robert Loeser, Asst. Gen. Mgr.

E. S. Terwilliger

E.S. Terwilliger, Exec. Vice-Pres.

DATE ISSUED: 18 April 1969

PHOTO NO. 1

PHOTO NO. 2

PHOTO NO. 3

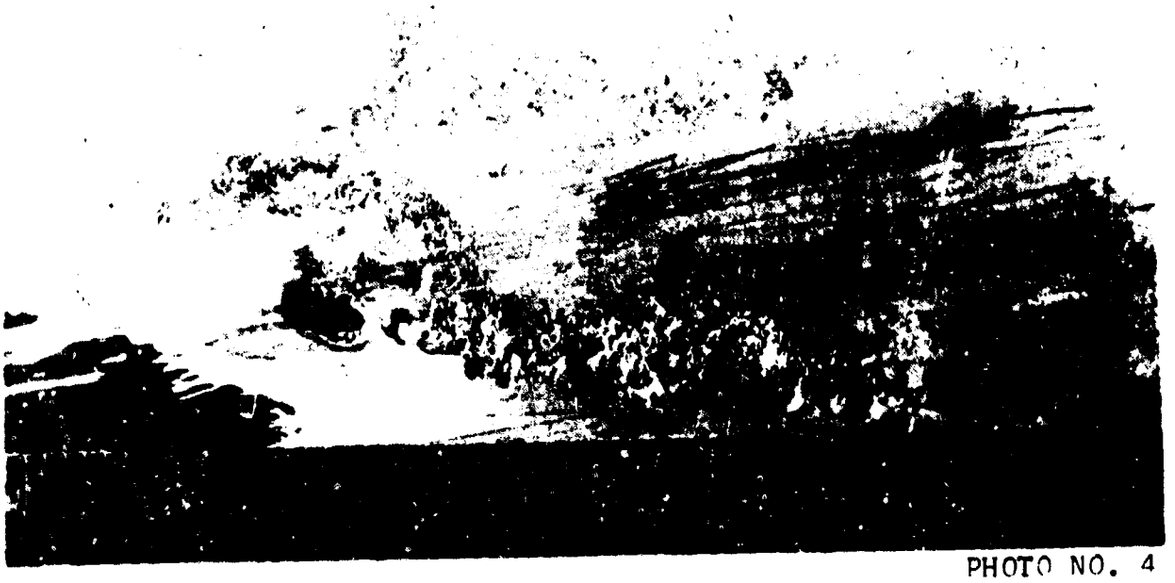


PHOTO NO. 4

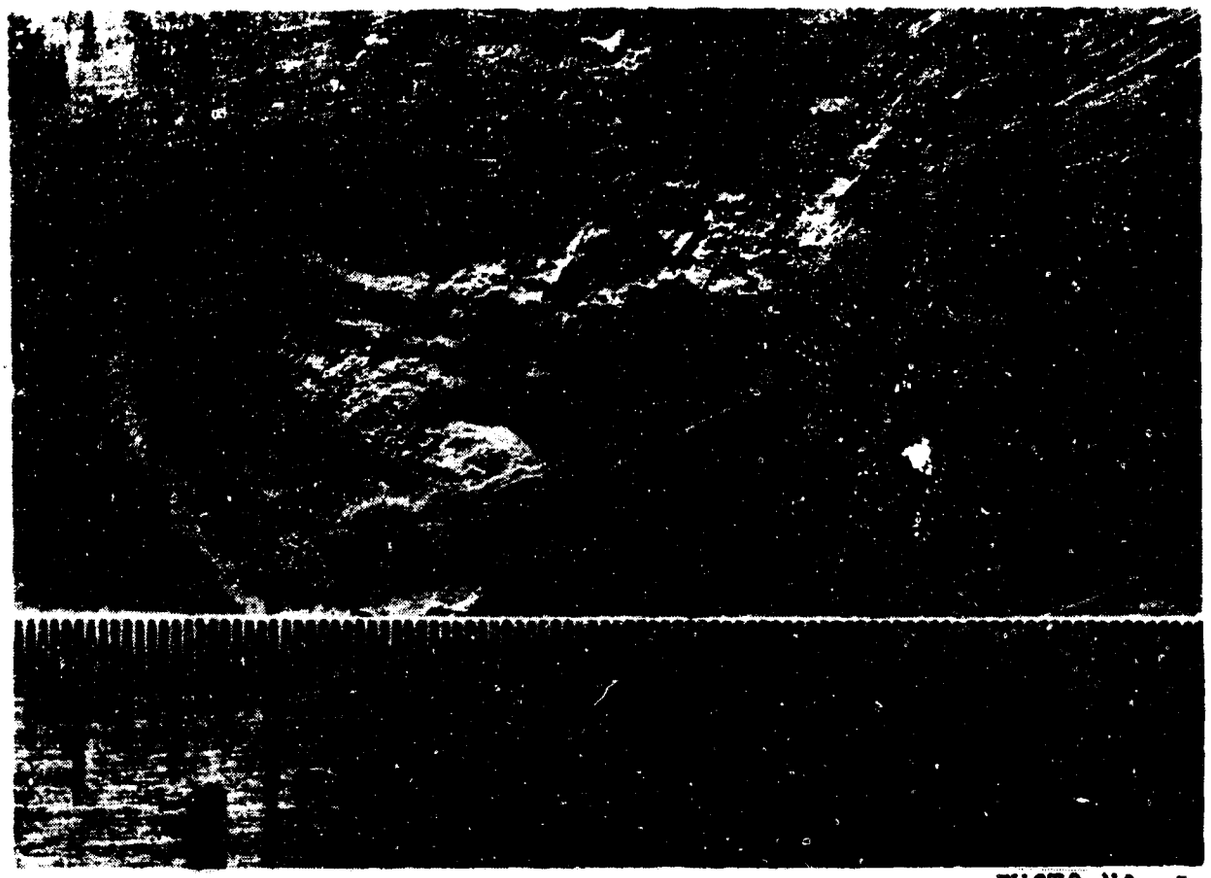


PHOTO NO. 5

PHOTO NO. 6

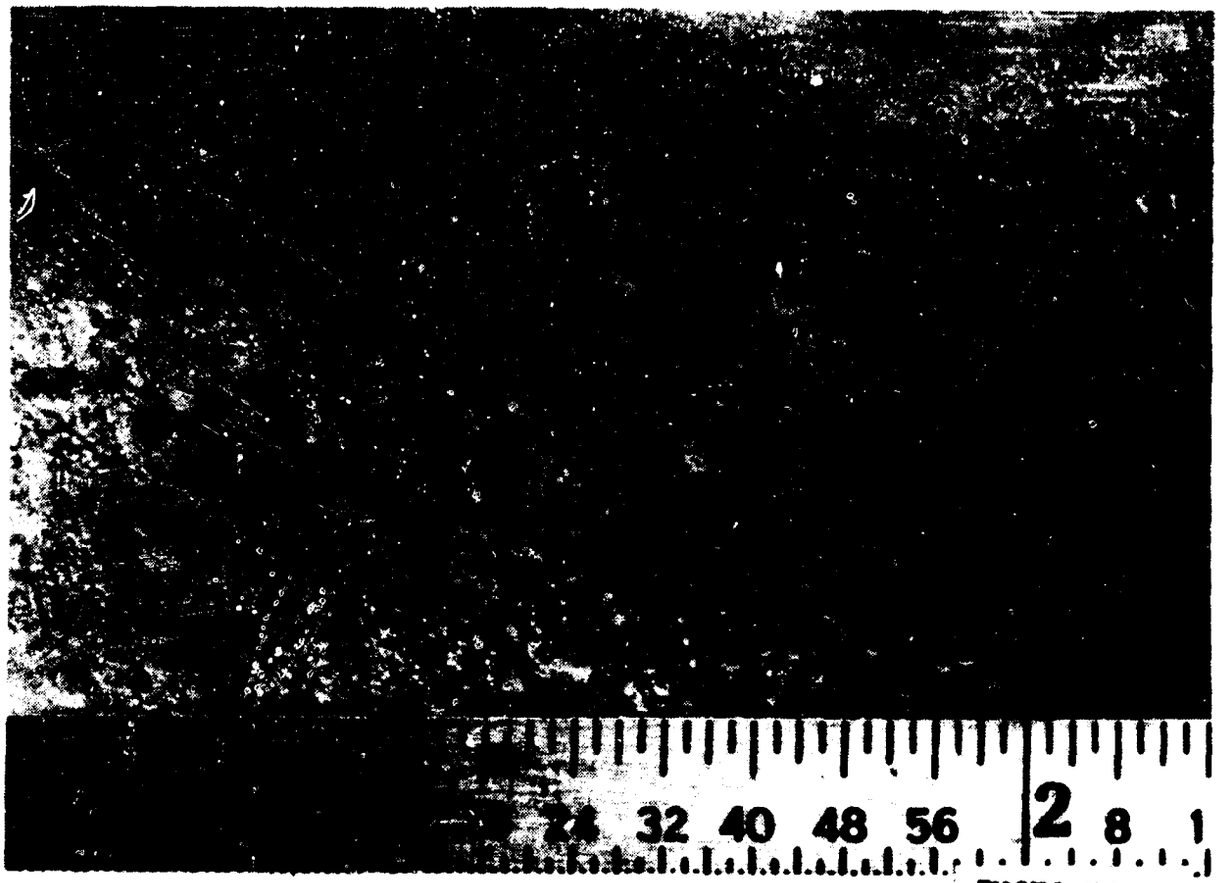


PHOTO NO. 7

PHOTO NO. 8

PHOTO NO. 9

PHOTO NO. 10

PHOTO NO. 11

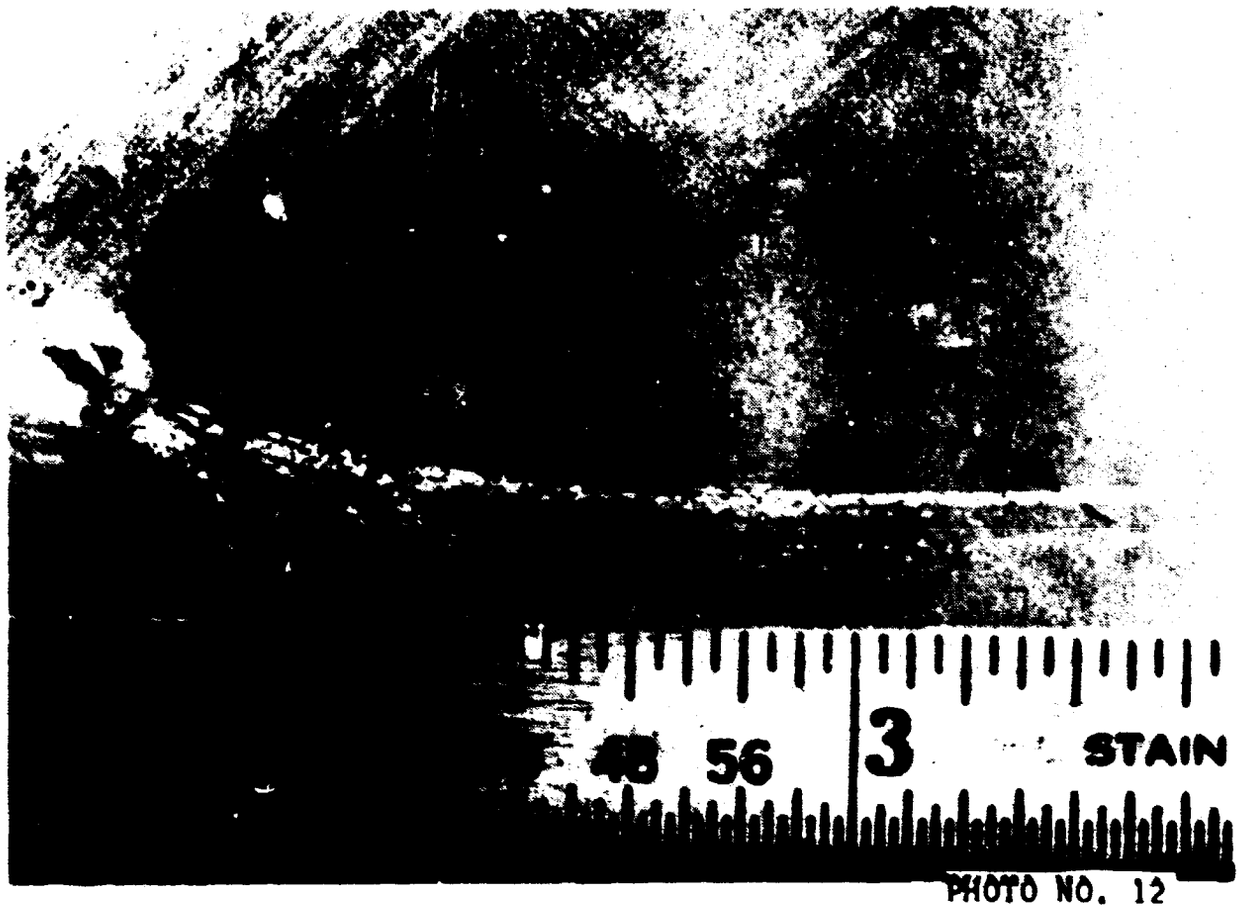


PHOTO NO. 12

PHOTO NO. 13

PHOTO NO. 14

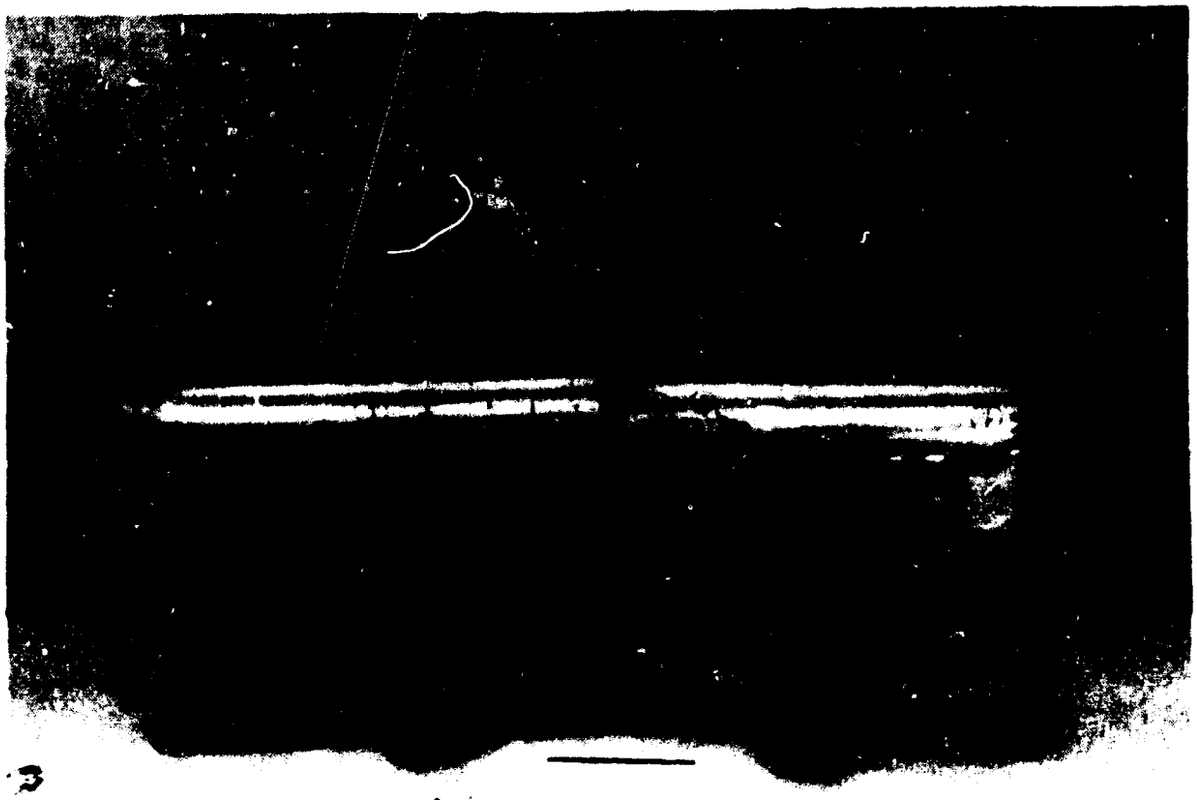


PHOTO NO. 15

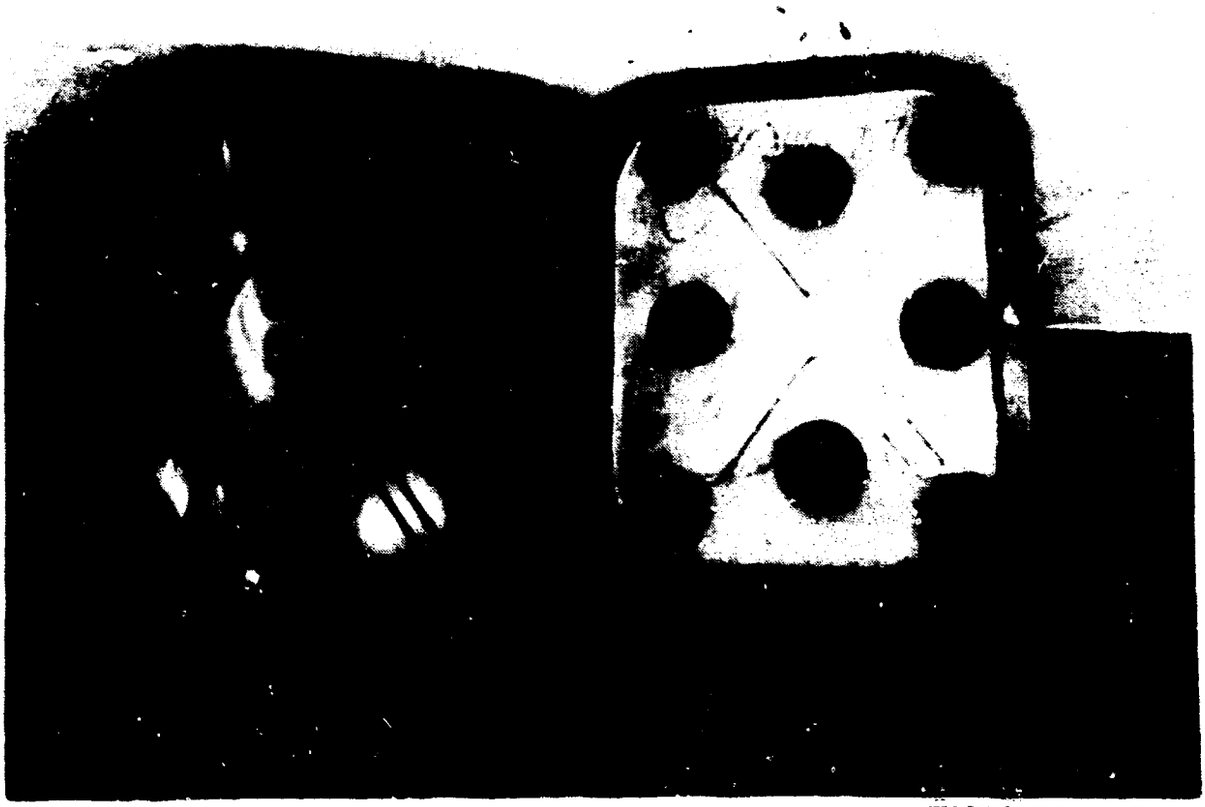


PHOTO NO. 16

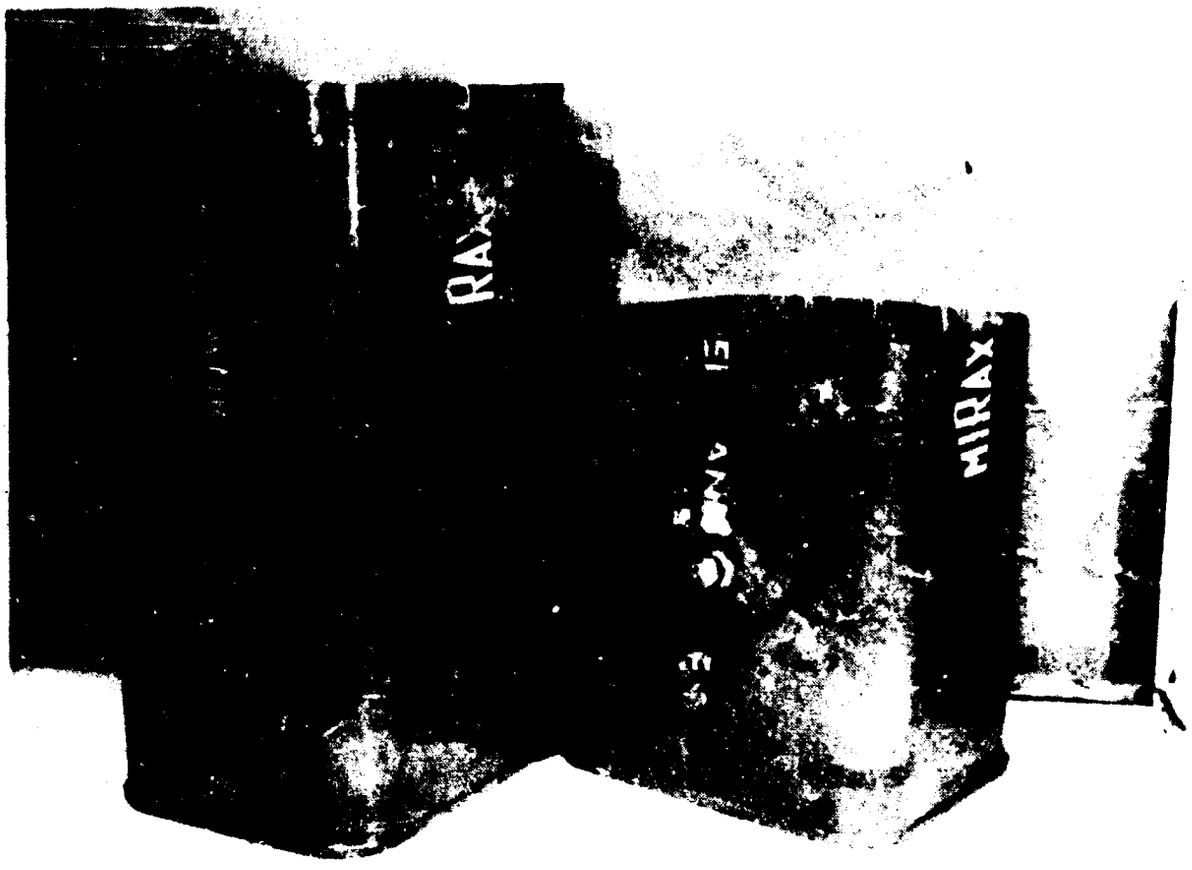


PHOTO NO. 17

PHOTO NO. 18

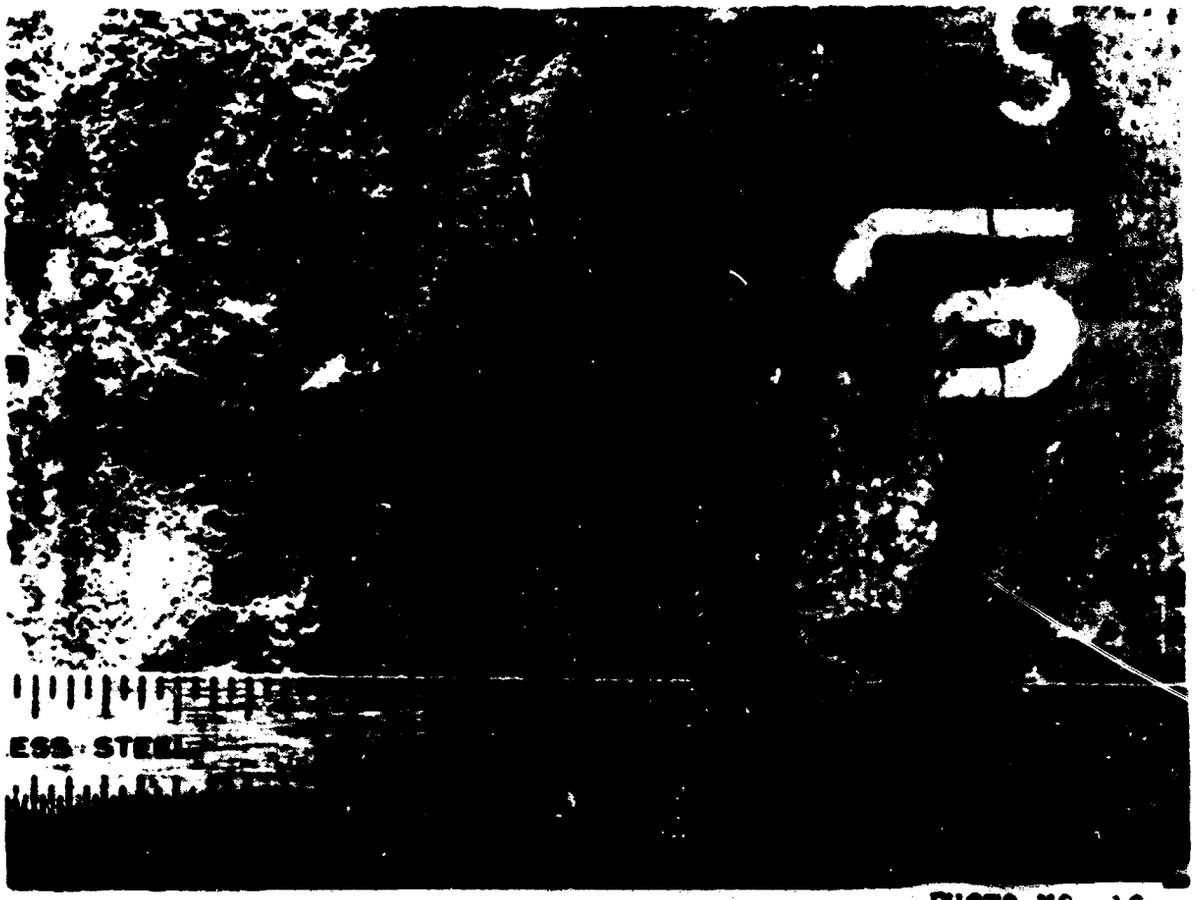


PHOTO NO. 19

PHOTO NO. 20

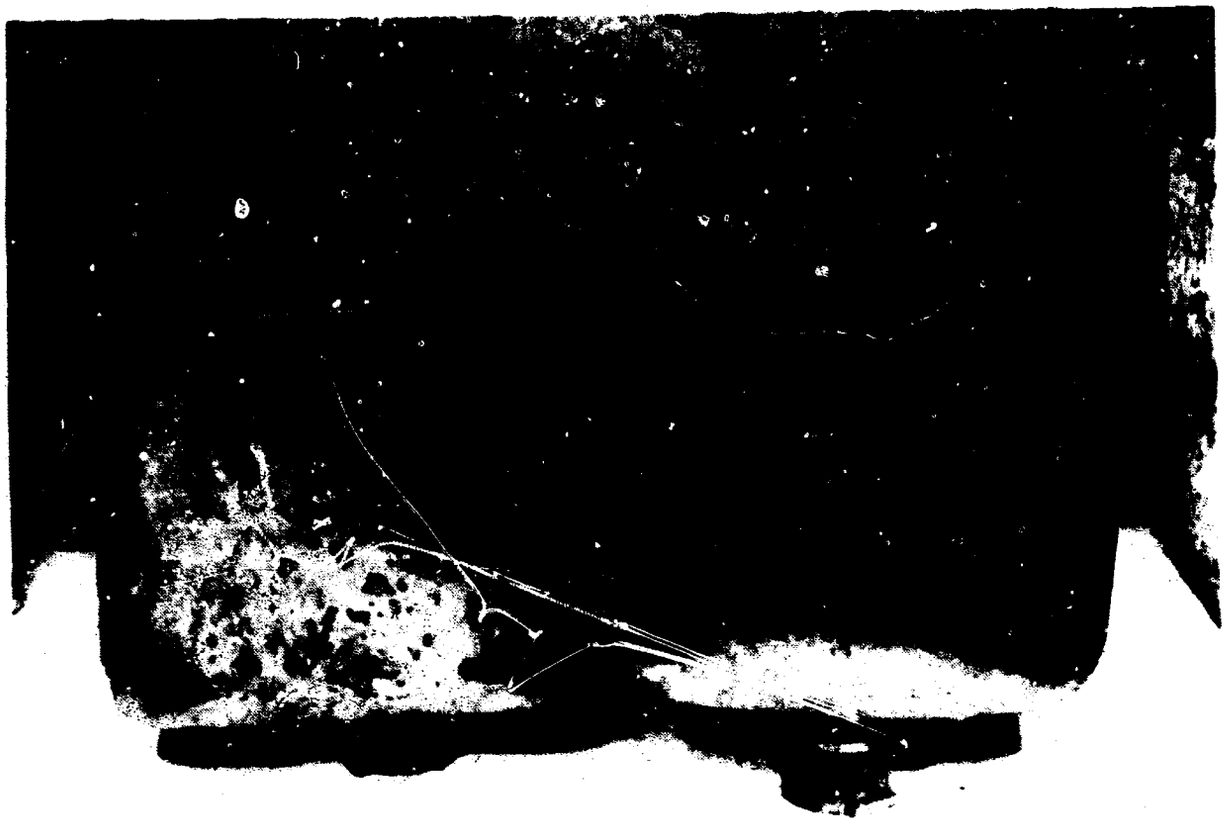


PHOTO NO 21

PHOTO NO. 22

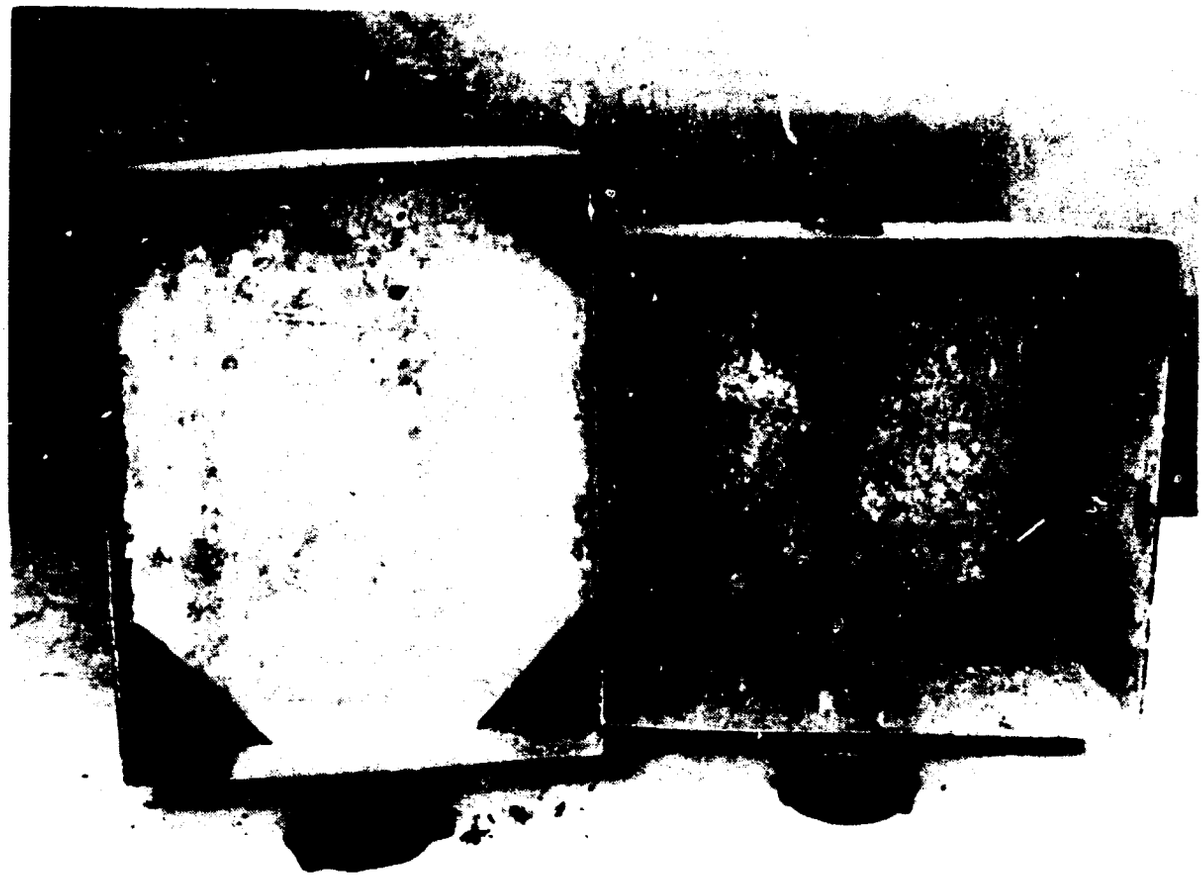


PHOTO NO. 23

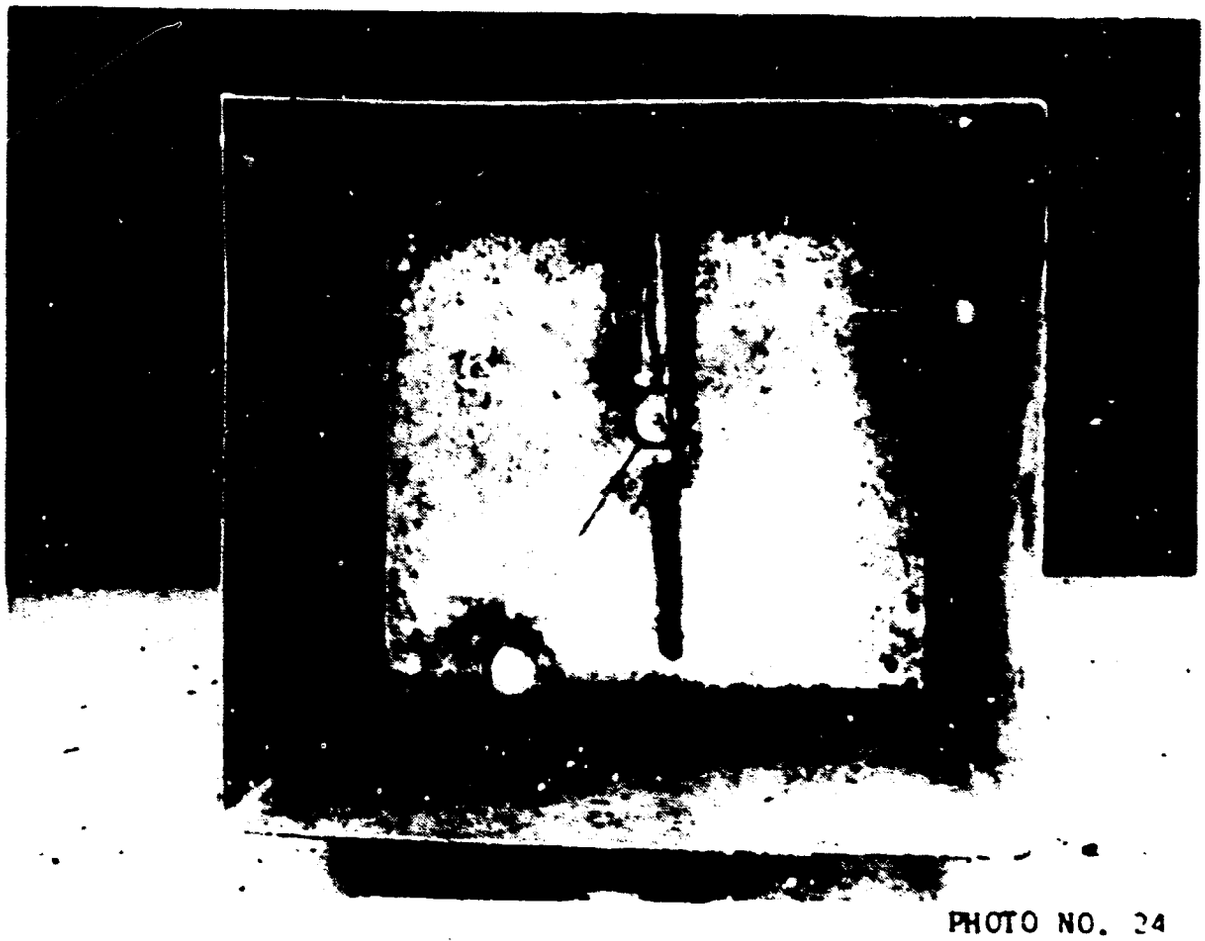


PHOTO NO. 24

PHOTO NO. 25

PHOTO NO. 26

PHOTO NO.27

Tel. 664-8300 Code 201

A non-profit
public service organization

YACHT SAFETY BUREAU
INCORPORATED
336 OLD HOOK ROAD, WESTWOOD, N. J. 07675

MEMORANDUM: R-6 REINSPECTION NO.1

PLACE: INCO CORROSION LABORATORY,
WRIGHTSVILLE BEACH, N.C.

DATE: 9, NOVEMBER 1966

BY: R. P. KETCHAM - YACHT SAFETY BUREAU, INC.

The writer, in company with Mr. John Ziemanski of Allegheny-Ludlum Steel Corporation, inspected all tanks and other equipment undergoing environmental exposure. George Simpson, Lt., (USCG) of the Wilmington, N. C., OCMI Office, was present during part of the inspection.

A detailed report of conditions is in the Yacht Safety Bureau file, but the following general statements appear to be of interest:

1. Maintenance of hull and equipment items by INCO personnel appears to be excellent.

2. No serious corrosion problems appear to have developed to date.

3. Slight, superficial corrosion spots noted on both the Nos. 304 and 316 stainless tanks - both afloat and in the ventilated boxes ashore.

4. Galvanized tanks, fill pipes, etc., show oxidation and "chalking" of zinc. Painted areas in way of end plate welds show definite signs of corrosion.

5. Terneplate tanks, in general, appeared good. Those that had been scratched intentionally showed local corrosion in the abraded areas. One T/P tank had an area of "bubbling" paint - probably indicative of a build-up of corrosion below the coating.

6. Electrical system was completely operative and all components appeared to be in good condition.

7. Bottom paint (hull) is flaking in way of boottop, and shows fouling in lower areas. At time of launching, paint recommended by Baltimore Copper Paint Company as compatible was used. Possibly topside surfaces were too hot for proper adherence at the time of painting.

8. It is suggested that, in order to facilitate proper inspection, stainless steel hold-down straps be cut in way of tank top reservoirs - with ends secured to reservoir sides.

9. It is further suggested that the re-fueling inspections (6 mo. increments) should allow 2 full days at the site.

10. Through the efforts of Mr. V. G. Taylor, it was determined that the specified gum tests of fuel can be performed in Atlanta, at approximately $7.50/test, with fuel samples shipped REA.

ITEM	LOCATION	REMARKS
STEWART-WARNER GAUGE TRANSMITTER	EACH GALV. TANK	DISCOLOURED - RUST STARTING (ON ALL)
BRASS LOOPS	(5) HOLD No 1 - PORT (6) HOLD No 4 - S.	DISCOLOURED - PITTING & ENCRUSTATION STARTING
LOVETT PUMPS	HOLDS 2, 3 & 4	APPEARS OK
PAR PUMPS	HOLDS 1, 3 & 4	
HEINEMANN CKT BKRS.	HOLD 2	
PAR BLOWER	HOLD 2	
W-C BLOWERS	HOLDS 1, 3, & 4	
BROWNING METALS GATE VALVE	HOLD 4 - STB'D	
OCEAN CHEM. PAINT (1) COAT	GRAY RESERVOIRS ON RECT. TANKS	
OCEAN CHEM. PAINT (2) COATS	GRAY RESERVOIRS ON CYL. TANKS	
BELDEN WIRING		
IMP. EASTMAN FITTGS.		

SEA CALM
NO WIND
AIR TEMP ± 75° F
WATER TEMP ± 68° F
BRIGHT SUN

— PROJECT R-6 —

EQUIPMENT CLASS. - MISCELLANEOUS
INSPECTION No: 1
DATE: 9 NOVEMBER 1966
INSPECTED BY: K. KETTMAN

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - AFT STBD - INB'D.	APPEARANCE OK.
EMPTY RECTANGULAR	HOLD 1 - FWD.	" "
FULL CYLINDRICAL	HOLD 4 - 3RD ROW ℄	" "
FULL RECTANGULAR	HOLD 3 - FWD. PORT - WING	DISCOLORED IN WAY OF FLOOR LINE TESTS.
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW PORT - WING	APPEARANCE OK
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW PORT - WING	" "
EMPTY CYLINDRICAL	SHORE BOX	" "
EMPTY RECTANGULAR	SHORE BOX	SLIGHT PITTING - TOP SURFACE
PANELS	HOLDS 3 & 4.	APPEARANCE OK.
PANELS	SHORE BOX	" "
		NOT REPRODUCIBLE

— PROJECT R-6 —

EQUIPMENT CLASS.-S.S.-316L (ELECTRODE)

INSPECTION Nº: 1

DATE: 9 NOVEMBER 66

INSPECTED BY: J. KEENAN

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - ~~AFT~~ FWD. PORT - INB'D	SOME DISCOLORATION MINOR PITS NEAR FITTINGS
EMPTY RECTANGULAR	HOLD 4 - 1ST ROW STBD - INB'D.	SOME DISCOLORATION NEAR WELDS
FULL CYLINDRICAL	HOLD 3 - AFT STBD. - WING	APPEAR: OK
FULL RECTANGULAR	HOLD 4 - 1ST ROW STBD. - WING	MINOR SPOTS NEAR VENT & FITTED
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW PORT - INB'D.	MINOR SPOTS IN VICINITY OF FITTINGS.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW PORT - INB'D.	SUPERFICIAL SPOT - INSIDE RECEIVER FWD/OUTBD.
EMPTY CYLINDRICAL	SHORE BOX	SUPERFICIAL SPOTS - END TIE
EMPTY RECTANGULAR	SHORE BOX	APPEAR: OK
PANELS	HOLDS 3 & 4	" "
PANELS	SHORE BOX	" "

— PROJECT R-6 —

EQUIPMENT CLASS. S.S. - ALLOY Nº 304

INSPECTION Nº: 1

DATE: 9 November 66

INSPECTED BY: J. KETCHAM

YACHT SAFETY BUREAU INC
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - FWD. ROW PORT - INB'D	IN GENERAL - ZINC
EMPTY RECTANGULAR	HOLD 2 STB'D - INB'D.	COATING "CHALKING" &
FULL CYLINDRICAL	HOLD 3 - AFT ROW &	PAINT IN WAY OF WELDS
FULL RECTANGULAR	HOLD 4 - 1ST ROW PORT - WING	END PLTS. SHOW. TRUST TUBE
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW STBD - WING	CAGE ANTI TRUST. TRUSTING. SOME
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STBD - WING	SCALING OF GALV. COAT
EMPTY CYLINDRICAL	SHORE BOX	CONDITIONS IN SHORE BOXES.
EMPTY RECTANGULAR	SHORE BOX	SIMILAR, BUT NOT AS SEVERE.
PANELS	HOLDS 3 & 4	
PANELS	SHORE BOX	

"ENCOR" PRESSURE SENSITIVE LABELS ADHERING OK

— PROJECT R-6 —

EQUIPMENT CLASS.-GALVANIZED STEEL TANKS
INSPECTION Nº: 1
DATE: 9 November 66
INSPECTED BY: F. Kettenhofen

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - FWD. STBD. - INB'D.	WATCH AFT TIE, BOTTOM, AT WELD
EMPTY RECTANGULAR	HOLD 4 - 1ST ROW PORT - INB'D.	WATCH INBOARD WELDED SEAM.
FULL CYLINDRICAL	HOLD 3 - AFT STBD - INB'D.	SUPERFICIAL SPOTS - TOP FWD. INB'D.
FULL RECTANGULAR	HOLD 3 - FWD. STBD - WING	APPEARS OK
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW STBD - INB'D	" "
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STBD. - INB'D.	" "
EMPTY CYLINDRICAL	SHORE BOX	" "
EMPTY RECTANGULAR	SHORE BOX	SLIGHT PITTING - INBD. SEAM WELD
PANELS	HOLDS 3 & 4	APPEAR OK
PANELS	SHORE BOX	" "

— PROJECT R-6 —

EQUIPMENT CLASS.- S.S.- 316 L (GAS WELDED)
INSPECTION Nº: 1
DATE: 9 NOVEMBER 66
INSPECTED BY: K. KOTCHAR

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 4 - ATHW PORT	PAINT BUBBLING WITH TRACE. WATER INB'D. TO LOW SEAMS
* EMPTY CYLINDRICAL	HOLD 2 STBD - WING	SLIGHT RUSTING IN ABRADED AREAS.
EMPTY RECTANGULAR	HOLD 4 - 2ND ROW ℄	PAINT BUBBLING & WORN ON TOP SURFACE, RUST FORMING
* * EMPTY RECTANGULAR	HOLD 1 - AFT	RUSTING IN ABRADED AREAS.
FULL CYLINDRICAL	HOLD 4 - ATHW STBD	APPEARS OK
FULL RECTANGULAR	HOLD 4 - 1ST ROW ℄	" "
TRANSFER CYLINDRICAL	HOLD 2 PORT - WING	RUST SPOT, FWD. FLANGE ABOUT "11 O'CLOCK"
TRANSFER RECTANGULAR	HOLD 2 PORT - INB'D.	WATER INB'D WELDED SEAM - AFT
EMPTY CYLINDRICAL	SHORE BOX	APPEARS OK
EMPTY RECTANGULAR	SHORE BOX	" "
PANELS	HOLD 3 - AFT BHD. (S) HOLD 4 - AFT (S)	" "
PANELS	SHORE BOX	" "

* AFT INB'D. CORNER (INSIDE RESERVOIR) FINISH FLAKED OFF - ABOUT 2"x 3/4" FWD. END HAS 4"x4"x 3/16" "X" SCRATCH.

* { FORE & AFT SCRATCH, 3 1/4" x 3/32", TOP, STBD.
* { PAINT SANDED OFF, TOP, PORT (NEAR FILL) APPROX 1 1/2" x 1/2"

— PROJECT R-6 —

EQUIPMENT CLASS.-TERNEPLATE TANKS
INSPECTION Nº: 1
DATE: 9 [illegible]
INSPECTED BY: J. [illegible]

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD N.J.

REINSPECTION REPORT

Date: 28 February 1967

MFR: Various - R-6 Environmental Exposure Test. INCO Corrosion Lab, (Harbor Island), Wrightsville Beach, N.C.

PRODUCT: Various Fuel Tanks, Pumps, Electrical Equip't, etc.

YSB REPORT NO. None

PERSONS INTERVIEWED: Messrs: V.G. Taylor and L.T. Davis

DATE OF INSPECTION: 23 & 24 February 1967

SUGGESTED DATE OF NEXT INSPECTION: 15 May 1967

COMMENTS:

1. Specific detailed comment on attached sheets.

2. Hull and equipment receiving good maintenance and supervision.

3. Added "Fram" filter & filter/separator to transfer manifold systems. Units located at engine stringers, Sta. 9, P/S.

4. Suggest that the following operations be accomplished during the May '67 reinspection:

   a) Haul boat for bottom scrub-down & repainting as well as topside touch-up paint.

   b) Consider removal of S/S strapping over S.W. tank top reservoirs to permit periodic inspection of metal surfaces in way of weights.

5. All tanks were emptied, and labeled samples withdrawn for INCO personnel to send, via REA, to Law & Co., Atlanta to perform gum analysis tests.

6. Left instructions with INCO to re-fuel the tanks on Monday, 27 February. Each filler pipe was marked (on deck). 20 gals of regular grade leaded gasoline to be put into each tank so marked.

7. Removed fuel was in 55 gal. drums on the pier. INCO personnel given permission to dispose of this gasoline as they "saw fit".

8. Lt. Simpson, (OCMI-Wilmington) put in an appearance at INCO just after writer had left. He was assured, by tel/con, that U.S.C.G. would receive a copy of written report.

INSPECTION BY: Richard P. Ketcham

ITEM	LOCATION	REMARKS
STEWART-WARNER GAUGE TRANSMITTER	EACH GALV. TANK	SOME DISCOLORATION & RUST ON ALL CLOSURE FRTS.
BRASS LOOPS	(2) HOLD Nº1 - PORT (6) HOLD Nº4 - &,	DISCOLORED - PITTING & ENCRUSTATION STARTED, BUT NOT SEVERE.
LOVETT PUMPS	HOLDS 2, 3 & 4	APPEAR OK
PAR PUMPS	HOLDS 1, 3 & 4	
HEINEMANN CKT BKRS.	HOLD 2	
PAR BLOWER	HOLD 2	
W-C BLOWERS	HOLDS 1, 3, & 4	
BROWNING METALS GATE VALVE	HOLD 4 - STB'D	
OCEAN CHEM. PAINT (1) COAT	GRAY RESERVOIRS ON RECT. TANKS	
OCEAN CHEM. PAINT (2) COATS	GRAY RESERVOIRS ON CYL. TANKS	
BELDEN WIRING		
IMP. EASTMAN FITTGS.		
FRAM FILTER & SEPARATOR	ENG. & IRDER - STA. 9. P/S	INSTALLED UNDER SEPARATE AGREEMENT - 23 FEB. 67

SEA ~ CHOPPY

WIND ~ SSW ~ 5-25 KTS.

AIR TEMP ~ 42°-60° F

WATER TEMP ≃ 46° F

BRIGHT SUN

— PROJECT R-6 —

EQUIPMENT CLASS. - MISCELLANEOUS

INSPECTION Nº: 2

DATE: 23 & 24 FEB. 67

INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD, N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - FWD STBD - INB'D.	SLIGHT DISCOLORATION AT WELDS
EMPTY RECTANGULAR	HOLD 1 - FWD.	SUPERFICIAL CORROSION ALONG LONG'L. SEAM
FULL CYLINDRICAL	HOLD 4 - 3RD ROW ¢.	APPEARS OK
FULL RECTANGULAR	HOLD 3 - FWD. PORT - WING	DISCOLORATION IN WAY OF FITTINGS, AT LONG'L. SEAM, & AT LONG TERM.
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW PORT - WING	SLIGHT DISCOLORATION - BOTTOM OF FWD. EDGE.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW PORT - WING	SOME DISCOLORATION AT LONG'L. SEAM.
EMPTY CYLINDRICAL	SHORE BOX	APPEARS OK
EMPTY RECTANGULAR	SHORE BOX	WATCH TOP SURFACE FOR PITTING
PANELS	HOLDS 3 & 4	APPEARS OK
PANELS	SHORE BOX	APPEARS OK

— PROJECT R-6 —

EQUIPMENT CLASS.-S.S.-316L (ELEC. WELDED)
INSPECTION Nº: 2
DATE: 23 & 24 FEB. 67
INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - AFT PORT - INB'D	POSSIBLE PITT'G. NEAR FITTINGS. DISCOLORATION AT END TRT. WELD.
EMPTY RECTANGULAR	HOLD 4 - 1ST ROW STBD - INB'D.	DISCOLORED AND STREAKING NEAR CLOSURE WELDS.
FULL CYLINDRICAL	HOLD 3 - AFT STBD. - WING	SUPERFICIAL RUST & DISCOLORATION AT WELDS & NEAR FITTINGS.
FULL RECTANGULAR	HOLD 4 - 1ST ROW STBD. - WING	SUPERFICIAL DISCOLORATION ON TOP & AT WELDS.
TRANSFER CYLINDRICAL	HOLD 4 - 2ND ROW PORT - INB'D.	MINOR SPOTS ON TOP AND AT WELDS
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW PORT - INB'D.	WATCH TOP SURFACE - INSIDE RESERVOIR & AFT OUTBOARD
EMPTY CYLINDRICAL	SHORE BOX	SUPERFICIAL SPOTS - END TRT.
EMPTY RECTANGULAR	SHORE BOX	APPEARS OK
PANELS	HOLDS 3 & 4	APPEARS OK
PANELS	SHORE BOX	APPEARS OK

— PROJECT R-6 —

EQUIPMENT CLASS. S.S. - ALLOY Nº 304

INSPECTION Nº: 2

DATE: 23 & 24 FEB. 67

INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - FWD. ROW PORT - INB'D	IN GENERAL ~ TANKS ALCARD
EMPTY RECTANGULAR	HOLD 2 STB'D - INB'D.	SHOW CONSIDERABLE OXIDATION.
FULL CYLINDRICAL	HOLD 3 - AFT ROW ℄	PAINTED CLOSURE WELDS AT END PT
FULL RECTANGULAR	HOLD 4 - 1ST ROW PORT - WING	SHOW RUST, CONSIDERABLE BUILD-UP
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW STBD - WING	OF CORROSION IN WAY OF CONTACT WITH COPPER LINES & BRASS
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STBD - WING	SCREWS (AS AT FUEL GAGES)
EMPTY CYLINDRICAL	SHORE BOX	CONDITIONS IN SHORE BOXES
EMPTY RECTANGULAR	SHORE BOX	SIMILAR, BUT LESS PRONOUNCED
PANELS	HOLDS 3 & 4	SOME OXIDATION
PANELS	SHORE BOX	SLIGHT OXIDATION

NOTE: "EVCOR" PRESSURE SENSITIVE LABELS ADHERING WELL.

— PROJECT R-6 —

EQUIPMENT CLASS.-GALVANIZED STEEL TANKS
INSPECTION Nº: 2
DATE: 23 & 24 FEB. 67
INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD, N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - FWD. STBD. - INB'D.	DISCOLORATION - BOTTOM OF END FLANGES AT WELDS
EMPTY RECTANGULAR	HOLD 4 - 1ST ROW PORT - INB'D.	DISCOLORATION ALONG LONG'L. SEAM
FULL CYLINDRICAL	HOLD 3 - AFT STBD - INB'D.	SUPERFICIAL SPOTTING - TOP SURFACE, FWD.
FULL RECTANGULAR	HOLD 3 - FWD. STBD - WING	DISCOLORATION NEAR FITINGS & AT LONG'L. SEAM.
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW STBD - INB'D	CHECK FOR PITTING IN WAY OF HOLD DOWN STRAP LINERS (FWD)
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STBD. - INB'D.	DISCOLORATION AT BONDING TERM. WELD, FILL COVN., AND LONG'L SEAM.
EMPTY CYLINDRICAL	SHORE BOX	APPEARS OK
EMPTY RECTANGULAR	SHORE BOX	POSSIBLE PITTING IN WAY OF BOND'G. TERM. WELD.
PANELS	HOLDS 3 & 4	APPEAR OK
PANELS	SHORE BOX	APPEAR OK.

— PROJECT R-6 —

EQUIPMENT CLASS. - S.S. - 316 L (GAS WELDED)

INSPECTION Nº: 2

DATE: 23 & 24 FEB. 67

INSPECTED BY: R. KETTENAM

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 4 - ATHW PORT	SLIGHT RUST @ FWD ~ CHIPPED PAINT. PAINT BUBBLES ON TOP NEAR FITTG
EMPTY CYLINDRICAL	HOLD 2 STBD - WING	SLIGHT RUSTING IN ABRADED AREAS WHICH STILL SHOW SOME BRIGHT METAL
EMPTY RECTANGULAR	HOLD 4 - 2ND ROW ℄	PAINT BUBBLES - TOP SURFACE - PITT FWD OF RESERVOIR - INBD.
* * EMPTY RECTANGULAR	HOLD 1 - AFT	RUST IN WAY OF ABRADED AREAS CORROSION OF REGISTERED PAINT & FITGS
FULL CYLINDRICAL	HOLD 4 - ATHW STBD	PAINT CHIPPED - 12 O'CLOCK INTOBRD FLANGE
FULL RECTANGULAR	HOLD 4 - 1ST ROW ℄	PAINT LOOSENING - AFT, TOP. NO RUST YET - WATCH.
TRANSFER CYLINDRICAL	HOLD 2 PORT - WING	RUST SPOT - FWD FLANGE "11 O'CLOCK" & TOP - JUST FWD OF RESERVOIR
TRANSFER RECTANGULAR	HOLD 2 PORT - INB'D.	WATCH INB'D WELDED SEAM - NEAR CTR.
EMPTY CYLINDRICAL	SHORE BOX	APPEARS OK.
EMPTY RECTANGULAR	SHORE BOX	APPEARS OK
PANELS	HOLD 3 - AFT BHD. (S) HOLD 4 - AFT (S)	APPEAR OK
PANELS	SHORE BOX	APPEAR OK

{AFT INB'D. CORNER (INSIDE RESERVOIR) FINISH FLAKED OFF - ABOUT 2"x 3/4"
{FWD. END HAS 4"x4"x 3/16" "X" SCRATCH.

* {FORE & AFT SCRATCH, 3 1/4"x 3/32", TOP, STBD.
* {PAINT SANDED OFF, TOP, PORT (NEAR FILL) APPROX 1 1/2"x 1/2"

— PROJECT R-6 —

EQUIPMENT CLASS.-TERNEPLATE TANKS
INSPECTION NO: 2
DATE: 23 & 24 FEBRUARY 1967
INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD N.J.

REINSPECTION REPORT

Date: 15 May 1967

MFR: Various- R-6 Environmental Exposure Test. INCO Corrosion Lab., (Harbor Island), Wrightsville Beach, N.C.

PRODUCT: Various Fuel Tanks, Pumps, Electrical Equipment, etc.

YSB REPORT NO.: None

PERSONS INTERVIEWED: Messrs. V.G. Taylor and L.T. Davis

DATE OF INSPECTION: 10, 11, 12 May 1967

SUGGESTED DATE OF NEXT INSPECTION: 14 August 1967

COMMENTS:

1. Specific detailed comment on attached sheets.

2. Maintenance of hull and all equipment is highly satisfactory.

3. Boat was hauled (at Bradley Creek "66 Marina") prior to trip. Yard personnel wire brushed and repainted bottom. Writer "touched-up" topsides and replaced eroded bronze ground plt. bolt with monel bolt.

4. Boat re-launched and towed to INCO property with "Platanode". Berthing arrangement has been changed to a position on exposure float - rather than off sheet piling. This is a better spot - more wave action as well as easier mooring and greater accessibility.

5. In general, tanks and equipment are in fine, usable condition. There is some evidence of corrosion in all instances but there is nc apparent hazardous condition.

6. One of the Bendix fuel pumps (No. 4) which had been on a transfer/discharge manifold became inoperative on 23 March 1967. INCO personnel traded it for No. 1 - which had been on a discharge manifold. Pump should be replaced at next inspection.

7. INCO personnel specifically mentioned utility of "PAR" bilge pumps. Claimed filters to the very easily cleaned and entire concept very good.

8. Mr. Taylor would like to show "Sea Safe America" as a part of Sea Horse Inst. meeting in September.

9. No representatives of contracting second parties were present at any time.

INSPECTION BY: Richard P. Ketcham

ITEM	LOCATION	REMARKS
STEWART-WARNER GAUGE TRANSMITTER	EACH GALV. TANK	CONSIDERABLE OXIDATION OF TANK RT ON ALL "ON BOARD" INSTALLATIONS.
BRASS LOOPS	(a) HOLD No 1 - PORT (c) HOLD No 4 - &,	— APPEAR SLIGHTLY GREEN — QUITE DISCOLORED - SOME PITTING
LOVETT PUMPS	HOLDS 2, 3 & 4	ALL SEEM OK
PAR PUMPS	HOLDS 1, 3 & 4	HOLD No 1 LOOKS OK. OTHERS SHOW RUST ON MOTOR HOUSG. & HOLD DOWN BOLTS.
HEINEMANN CKT BKRS.	HOLD 2	ALL OK
PAR BLOWER	HOLD 2	OK
W-C BLOWERS	HOLDS 1, 3, & 4	OK
BROWNING METALS GATE VALVE	HOLD 4 - STB'D	SOME DISCOLORATION OF EXPOSED GATE. OPERATES EASILY
OCEAN CHEM. PAINT (1) COAT	GRAY RESERVOIRS ON RECT. TANKS	APPEARS OK
OCEAN CHEM. PAINT (2) COATS	GRAY RESERVOIRS ON CYL. TANKS	APPEARS OK
BELDEN WIRING		APPEARS OK
IMP. EASTMAN FITTGS.		SOME DISCOLORATION
FRAM FILTERS	HOLD No 4 P/S	BOTH APPEAR NEW
FLOTHERCHOC	HOLD No 4 @ MAST	NYLON SHOWS WEATHERING PLASTIC APPEARS OK

— PROJECT R-6 —

EQUIPMENT CLASS. - MISCELLANEOUS

INSPECTION No: 3

DATE: 11 & 12 MAY 1967

INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD, N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - AFT PORT - WING	SOME DISCOLORATION - GENERAL SUPERFICIAL SPOTS
EMPTY RECTANGULAR	HOLD 1 - FWD.	POSSIBLE SLIGHT PIT - TOP (3). DISCOLORED IN WAY OF SEAMS & FITTINGS.
FULL CYLINDRICAL	HOLD 4 - 3RD ROW &	SLIGHT DISCOLORATION - FWD END TRT.
FULL RECTANGULAR	HOLD 3 - FWD. PORT - WING	SOME CORROSION AT LONG'L. WELD. & BAND'G. TERMINAL.
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW PORT - WING	SUPERFICIAL SPOTS AT WELDS & END TRTS.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW PORT - WING	DISCOLORED AT LONG'L WELD & ON TOP NEAR FITTINGS.
* EMPTY CYLINDRICAL	SHORE BOX	POSSIBLE CREVICE CORROSION - "1 O'CLOCK" NEAR FILL.
EMPTY RECTANGULAR	SHORE BOX	SLIGHT DISCOLORATION IN GENERAL
PANELS	HOLDS 3 & 4	OK
PANELS	SHORE BOX	OK.

* WIND BLOWN SAND IN FINE LAYER ON TANKS IN SHORE BOXES. NO EFFORT MADE TO REMOVE IT, BUT SOME WIPING DONE TO CHECK METAL BELOW.

— PROJECT R-6 —

EQUIPMENT CLASS.-S.S.-316L (ELEC.WELDED)
INSPECTION Nº: 3
DATE: 11 & 12 MAY
INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - AFT PORT - INB'D	SUPERFICIAL SPOTS - UPPER SURFACE, & END TBT WELD.
EMPTY RECTANGULAR	HOLD 4 - 1ST ROW STBD - INB'D.	TOP & LONG'L SEAMS DISCOLORED. POSSIBLE START OF PITS ON END TBT.
FULL CYLINDRICAL	HOLD 3 - AFT STBD. - WING	SPOTS AT WELDS, FITTINGS, AND NEAR RESERVOIR.
FULL RECTANGULAR	HOLD 4 - 1ST ROW STBD. - WING	DISCOLORATION AT LONG'L WELD & TOP - NEAR BKND'G. TERM.
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW PORT - INB'D.	RUST AT END TBT WELD. WATCH TOP SURFACE NEAR FITTGS.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW PORT - INB'D.	POSSIBLE PITTING (TOP, INB'D) WATCH LONG'L WELD.
EMPTY CYLINDRICAL	SHORE BOX	DISCOLORATION - END TBTS & TOP.
EMPTY RECTANGULAR	SHORE BOX	DISCOLORED ALONG LONG'L. WELD.
PANELS	HOLDS 3 & 4	OK
PANELS	SHORE BOX	OK

— PROJECT. R-6 —

EQUIPMENT CLASS. S.S. - ALLOY Nº 304

INSPECTION Nº: 3

DATE: 11 & 12 MAY 67

INSPECTED BY: R. KETHAM

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - FWD. ROW PORT - INB'D	ENTIRE SURFACE CHALKY APPEARANCE SOME FLAKING AT PAINTED WELD.
EMPTY RECTANGULAR	HOLD 2 STB'D - INB'D.	ALL GALV. TANKS SHOW OXIDATION OF SURFACES, WITH RED RUST
FULL CYLINDRICAL	HOLD 3 - AFT ROW &	APPEARING AT THE PAINTED END BT WELDS, SOME BUBBLING
FULL RECTANGULAR	HOLD 4 - 1ST ROW PORT - WING	OF GALVANIZING WAS NOTED — PARTICULARLY ON HORIZONTAL
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW STBD - WING	FLAT SURFACES, CERTAINLY THERE IS NO DAMAGE APPARENT
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STBD - WING	THAT COULD BE CONSIDERED SERIOUS.
EMPTY CYLINDRICAL	SHORE BOX	TANKS IN SHORE BOXES ALSO
EMPTY RECTANGULAR	SHORE BOX	SHOW OXIDATION — BUT LESS SEVERE THAN "ON BOARD"
PANELS	HOLDS 3 & 4	OK
PANELS	SHORE BOX	OK

"EVCOR" LABELS ARE LEGIBLE AND WELL ADHERED.

— PROJECT R-6 —

EQUIPMENT CLASS.-GALVANIZED STEEL TANKS

INSPECTION Nº: 3

DATE: 11 & 12 MAY 1967

INSPECTED BY: R. KETTMAN

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - FWD. STBD. - INB'D.	SUPERFICIAL SPOTS - TOP, NEAR FITTGS. & AT END TBT WELD.
EMPTY RECTANGULAR	HOLD 4 - 1ST ROW PORT - INB'D.	DISCOLORED AND SUPERFICIAL RUST AT WELD SEAMS & BONG'G. TERMINAL.
FULL CYLINDRICAL	HOLD 3 - AFT STBD - INB'D.	END TBT WELD DISCOLORED SUPERFICIAL SPOTS ON TOP.
FULL RECTANGULAR	HOLD 3 - FWD. STBD - WING	DISCOLORED AT WELDS AND NEAR FITT'GS.
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW STBD - INB'D	WELDS SHOW OXIDATION & WATCH SURFACES IN WAY OF CHRK LINERS.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STBD. - INB'D.	SUPERFICIAL DISCOLORATION IN WAY OF WELDS.
EMPTY CYLINDRICAL	SHORE BOX	DISCOLORED AT WELDS
EMPTY RECTANGULAR	SHORE BOX	DISCOLORED AT WELDS
PANELS	HOLDS 3 & 4	OK
PANELS	SHORE BOX	OK

— PROJECT R-6 —

EQUIPMENT CLASS.- S.S. - BIG LIGAS WELDED

INSPECTION Nº: 3

DATE: 11 & 12 MAY 1967

INSPECTED BY: R. KETCHAM

YACHT SAFETY SURVEYING
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 4 - ATHW PORT	PAINT, BUBBLES & SLIGHT PITTG. NEAR FITTINGS.
* EMPTY CYLINDRICAL	HOLD 2 STBD - WING	"X" ON FWD END TBT. STILL BRIGHT. SOME RUSTG. INSIDE RESERVOIR.
EMPTY RECTANGULAR	HOLD 4 - 2ND ROW ℄	PAINT FLAKING @ FITTINGS. SOME DISCOLORATION AT LONG'L WELD.
* EMPTY RECTANGULAR	HOLD 1 - AFT	PAINT BLISTERED IN WAY OF FITTGS & IN RESERVOIR.
FULL CYLINDRICAL	HOLD 4 - ATHW STBD	NO CHANGE APPARENT FROM INSP. Nº 2.
FULL RECTANGULAR	HOLD 4 - 1ST ROW ℄	PAINT BUBBLING NEAR FITTGS. SLIGHT PITTING - TOP SURFACE. RUST @ LONG'L. WELD.
TRANSFER CYLINDRICAL	HOLD 2 PORT - WING	SLIGHT PITTING - TOP SURFACE. FWD - AT "11 O'CLOCK"
TRANSFER RECTANGULAR	HOLD 2 PORT - INB'D.	LONG'L. SEAM SHOWS SOME RUST'G.
EMPTY CYLINDRICAL	SHORE BOX	PAINT BUBBLES NEAR FITTINGS SOME RUST & PAINT HOLIDAYS
EMPTY RECTANGULAR	SHORE BOX	RUST, AT LONG'L. SEAM
PANELS	HOLD 3 - AFT BHD. (S) HOLD 4 - AFT (S)	SLIGHT RUSTING.
PANELS	SHORE BOX	RUST & HOLIDAYS & RUSTY WELD

* AFT INB'D. CORNER (INSIDE RESERVOIR) FINISH FLAKED OFF - ABOUT 2" x 3/4" FWD. END HAS 4" x 4" x 3/16" "X" SCRATCH.

* {FORE & AFT SCRATCH, 3 1/4" x 3/32", TOP, STBD. — STILL BRIGHT
* {PAINT SANDED OFF, TOP, PORT (NEAR FILL) APPROX 1 1/2" x 1/2" RUSTING!

— PROJECT R-6 —

EQUIPMENT CLASS. - TERNEPLATE TANKS
INSPECTION Nº: 3
DATE: 11 & 12 MAY 67
INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD N.J.

23 August 1967

REINSPECTION REPORT

MFR: Various - R-6 Environmental Exposure Test. INCO Corrosion Lab. (Harbor Island), Wrightsville Beach, N.C.

PRODUCT: Various Fuel Tanks, Pumps, Electrical Equipment, etc.

YSB REPORT NO. NONE

PERSONS INTERVIEWED: Messrs: V.G. Taylor, L.T. Davis, J. Garriss (INCO)
John Ziemianski (Allegheny-Ludlum Steel)

DATE OF INSPECTION: 15, 16, 17 August 1967

SUGGESTED DATE OF NEXT INSPECTION: 8-10 November 1967

COMMENTS:

1. See attached sheets for specific details.

2. Maintenance of hull and all equipment is most satisfactory.

3. The Hull has developed some leaks in way of transom and starboard chine, . Leaks are not considered serious at the present time - occasional bilge pump operation is sufficient to keep bilges relatively dry. Writer suggested that, if the condition becomes difficult to control, the hull should be hauled (at Bradley Creek) for repairs.

4. Tanks, in general, appear to be in good, usable condition. However, one tank top reservoir was removed (for an unrelated test) and the weighted neoprene lined block was lifted to check on tank surface. Evidence of crevice corrosion was found to exist in this hitherto inaccessible location. One pit was estimated to have a depth of approximately 0.008" to 0.009" - or about 1/4 of the total tank wall thickness.

5. In view of the above described condition - with the potential hazard involved - it is again suggested that all such weights be made removable to permit proper inspection of th tank surfaces. It would be desirable to accomplish this at the next scheduled reinspection.

6. All fuel, except that contained in the generator service tank, was pumped to dockside drums. A labeled sample from each tank was shipped to Law & Co., Atlanta, Ga., for analysis, in accordance with the requirements.

7. Tanks were re-filled with fresh fuel. A sample of fuel, as delivered, was included in the shipment for analysis.

8. Bottoms of fire extinguishers aboard should be wire-brushed and greased to prevent further build-up of corrosion.

9. It is suggested that new dock-lines be provided at the next inspection. The three "No Smoking or Open Flame" warning signs are quite weathered and should also be replaced.

10. A 4-1/2' length of "Flexaust" 4" dia. aluminum vent duct was fitted for corrosion study.

11. No U.S.C.G. representative was present during the reinspection.

INSPECTION BY: Richard P. Ketcham

ITEM	LOCATION	REMARKS
STEWART-WARNER GAUGE TRANSMITTER	EACH GALV. TANK	TOP PTS. SHOW RED RUST.
BRASS LOOPS	(2) HOLD Nº2 STB'D (6) HOLD Nº4 - ⚓	SLIGHT PITTING - (Nº 2) GEN'L. DISCOLOR & APPRECIABLE PITTING (Nº4)
LOVETT PUMPS	HOLDS 2, 3 & 4	LOOK & OPERATE OK
PAR PUMPS	HOLDS 1, 3 & 4	MOTOR CASINGS, ASSY BOLTS, FEET QUITE RUSTY. OPERATE VERY WELL.
HEINEMANN CKT BKRS.	HOLD 2	LOOK & OPERATE OK
PAR BLOWER	HOLD 2	LOOK & OPERATE OK
W-C BLOWERS	HOLDS 1, 3, & 4	LOOK & OPERATE OK
BROWNING METALS GATE VALVE	HOLD 4 - STB'D	OPERATES FREELY - SEALS WELL.
OCEAN CHEM. PAINT (1) COAT	GRAY RESERVOIRS ON REFT. TANKS	LOOKS OK
OCEAN CHEM. PAINT (2) COATS	GRAY RESERVOIRS ON CYL. TANKS	LOOKS OK - REMOVED ONE BOX FOR FIRE TEST.
BELDEN WIRING		LOOKS OK
IMP. EASTMAN FITTGS.		LOOK OK { NIPPLES TO SUCTION PICK-UP TUBES CORRODED
FRAM FILTERS	HOLD 4 ~ P/S	NAMEPLT LOOSE ON SMALL UNIT. BOTH UNITS LOOK OK. NO CORROSION EVIDENT.
FLOTHERCHOC	HOLD 4 @ MAST	CLOTH ENVELOPE BADLY DETERIORATED DUE TO U.V. BUBBLES OK
FLEXAUST	HOLD 3 - PORT - FWD.	FITTED AL. VENT DUCT TO 4" BLOWER

— PROJECT R-6 —

EQUIPMENT CLASS. - MISCELLANEOUS
INSPECTION Nº: 4
DATE: 15 AUG. 1967
INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD, N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3-AFT PORT-INB'D	SLIGHT PITTING NEAR VENT DISCOLORED AT WELDS.
EMPTY RECTANGULAR	HOLD 4-1ST ROW STB'D-INB'D.	DISCOLORED IN WAY OF RESERVOIR, END FLGE., LONG'L SEAM & FITTINGS.
FULL CYLINDRICAL	HOLD 3-AFT STB'D WING	RUST SPOTS IN WAY OF RESERVOIR FAYING SURFACE & WELDS. POSSIBLE PITTING INB'D, OF SUCTION.
FULL RECTANGULAR	HOLD 4-1ST ROW STB'D. WING	RUST AT BOND'G. TERM'L. TOP SURFACE DISCOLORED AT RESERVOIR, WELDS.
TRANSFER CYLINDRICAL	HOLD 4-3RD ROW PORT-INB'D	RUST STREAKS FROM RESERVOIR. END FLGE. WELD RUSTED.
TRANSFER RECTANGULAR	HOLD 4-2ND ROW PORT-INB'D.	DISCOLORED IN WAY OF BOND'G. TERM'L., RESERVOIR, & WELDS.
EMPTY CYLINDRICAL	SHORE BOX	SLIGHT DISCOLORATION ON TOP & END TRT.
EMPTY RECTANGULAR	SHORE BOX	DISCOLORED AT WELDS.
PANELS	HOLDS 3&4	APPEAR OK
PANELS	SHORE BOX	APPEAR OK

— PROJECT R-6 —

EQUIPMENT CLASS: S.S.- ALLOY Nº 304
INSPECTION Nº: 4
DATE: 15 AUG. 1967
INSPECTED BY: R. KETCHAM

NOTE: VISIBLE SURFACES OF TANKS APPEAR OK AFTER 1 YR. CONTINUOUS EXPOSURE.

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD, N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - FWD. ROW PORT - INB'D	TANKS IN GENERAL, APPEAR
EMPTY RECTANGULAR	HOLD 2 STB'D - INB'D.	CHALKY. INVARIABLY THE
FULL CYLINDRICAL	HOLD 3 - AFT ROW &	PAINTED END FLANGES SHOW
FULL RECTANGULAR	HOLD 4 - 1ST ROW PORT - WING	FLAKY, RED RUST. SLIGHT
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW STBD - WING	EVIDENCE OF CORROSION IN
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STBD - WING	WAY OF FITINGS.
EMPTY CYLINDRICAL	SHORE BOX	LESS CHALKING NOTED ON
EMPTY RECTANGULAR	SHORE BOX	SHORE TANKS. SLIGHT RUST @ PAINT
PANELS	HOLDS 3 & 4	APPEAR OK
PANELS	SHORE BOX	APPEAR OK

— PROJECT R-6 —

EQUIPMENT CLASS.-GALVANIZED STEEL TANKS

INSPECTION Nº: 4

DATE: 15 AUGUST 1967

INSPECTED BY: R. KERHAM

NOTE: PRESSURE SENSITIVE LABELS ARE WELL ADHERED & LEGIBLE. DUE TO THICKNESS OF FLANGE, CORROSION NOTED IS NOT CONSIDERED SERIOUS. TANKS APPEAR COMPLETELY FIT FOR FURTHER SERVICE.

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD, N.J.

ITEM	LOCATION	REMARKS
* EMPTY CYLINDRICAL	HOLD 3 - FW.D. STBD. - INB'D.	DISCOLORATION AT CHOCK STRAPS, FITT'GS, RESERVOIR & WELDS. AFT FLGE (6 O'CLOCK)
EMPTY RECTANGULAR	HOLD 4 - 1ST ROW PORT - INB'D.	RUST STREAKS AT BONDING TERM'L., LONG'L WELD, & NEAR FITTINGS
FULL CYLINDRICAL	HOLD 3 - AFT STBD - INB'D.	SPOTS ON TOP SURFACE AND ON END FLGE (6 O'CLOCK)
FULL RECTANGULAR	HOLD 3 - FWD. STBD - WING	DISCOLORED AT SUCTION FITT'G, BOND'G. TERM'L. & LONG'L WELD.
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW STB'D - INB'D	SUPERFICIAL SPOTTING AT END TRT & WELDS.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STBD. - INB'D.	RUST STREAKS FROM RESERVOIR. BOND'G TERM'L & WELDS SHOW CORROSION
EMPTY CYLINDRICAL	SHORE BOX	SOME CONDENSATE FORMING INSIDE SPOTS AT WELDS.
EMPTY RECTANGULAR	SHORE BOX	SPOTS AT WELDS. SOME GENERAL DISCOLORATION
PANELS	HOLDS 3 & 4	APPEAR OK - SLIGHT DISCOLORATION.
PANELS	SHORE BOX	APPEAR OK.

— PROJECT R-6 —

EQUIPMENT CLASS.-S.S.-316 L (GAS WELDED)
INSPECTION Nº: 4
DATE: 15 AUGUST 1967
INSPECTED BY: R. KERHAM

* WHILE THE VISIBLE SURFACES OF THESE TANKS APPEAR TO HAVE WITHSTOOD 1 YR. CONTINUOUS EXPOSURE SATISFACTORILY, THE S.W. RESERVOIR ON THIS TANK WAS REMOVED. (IN CONJUNCTION WITH ANOTHER TEST) TANK SURFACES UNDER THE WEIGHTED CHOCK. LINER (NORMALLY INACCESSIBLE) WERE EXAMINED, AND SHOWED EVIDENCE OF CREVICE CORROSION. (ONE PIT IN THE .031" MATERIAL ESTIMATED TO BE SOME .008"-.009" DEEP) IT SEEMS LIKELY THAT SIMILAR CONDITIONS WOULD BE FOUND WITHIN

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - AFT PORT - WING	SUPERFICIAL SPOTS NEAR FITTINGS & RUST AT WELDS.
EMPTY RECTANGULAR	HOLD 1 - FWD.	DISCOLORED AT WELDS, FITTINGS, & IN WAY OF CHOCK-STRAPS.
FULL CYLINDRICAL	HOLD 4 - 3RD ROW &	SLIGHT DISCOLORATION AT WELDS.
FULL RECTANGULAR	HOLD 3 - FWD. PORT - WING	SOME RUSTING AT FITTINGS, RESERVOIRS & WELDS.
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW PORT - WING	DISCOLORATION AT WELDS & BOND'G TERM'L.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW PORT - WING	RUST'G AT BONDING TERM'L & LONG'L WELD.
EMPTY CYLINDRICAL	SHORE BOX	DISCOLORATION - NEAR FILL
EMPTY RECTANGULAR	SHORE BOX	DISCOLORATION AT WELDS
PANELS	HOLDS 3 & 4	APPEAR OK
PANELS	SHORE BOX	APPEAR OK

— PROJECT R-6 —

EQUIPMENT CLASS.-S.S.-316L (ELEC.WELDED)

INSPECTION Nº: 4

DATE: 15 AUGUST 1967

INSPECTED BY: R. KETCHAM

NOTE: VISIBLE, EXTERNAL PORTIONS OF TANKS APPEAR OK AFTER 1 YR. CONTINUOUS EXPOSURE. WELDED AREAS SHOW SOME ACTION.

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 4 - ATHW PORT	PAINT CHIPPED & BUBBLING NEAR FITTINGS & AT END FLANGE.
EMPTY CYLINDRICAL	HOLD 2 STBD - WING	SOME PITS NEAR FITTINGS.
EMPTY RECTANGULAR	HOLD 4 - 2ND ROW ℄	PAINT FLAKING & SLIGHT PITS NEAR FITTINGS.
EMPTY RECTANGULAR	HOLD 1 - AFT	PITS NEAR SUCTION FITTING
FULL CYLINDRICAL	HOLD 4 - ATHW STBD	PAINT CHIPPED - SUPERFICIAL RUST AT END FLANGE (6 O'CLOCK) & FITTINGS.
FULL RECTANGULAR	HOLD 4 - 1ST ROW ℄	PITTING & RUST NEAR VENT & FILL & ALONG LONG'L. SEAM.
TRANSFER CYLINDRICAL	HOLD 2 PORT - WING	RUST ON FWD. FLANGE (9 & 10 O'CLOCK) BUBBLES & SOME PITS NEAR FITTINGS.
TRANSFER RECTANGULAR	HOLD 2 PORT - INB'D.	RUST - FWD. FLANGE AT BOTTOM. SOME SPOTS NEAR FITTINGS.
EMPTY CYLINDRICAL	SHORE BOX	SLIGHT RUSTING NEAR FITTINGS
EMPTY RECTANGULAR	SHORE BOX	& IN WAY OF CHIPPED PAINT.
PANELS	HOLD 3 - AFT. BHD. (S) HOLD 4 - AFT (S)	RUSTING ALONG EDGES
PANELS	SHORE BOX	SLIGHT RUST AT WELDS

* {AFT INB'D. CORNER (INSIDE RESERVOIR) FINISH FLAKED OFF - ABOUT 2" x 3/4" SHOWS RUST
{FWD. END HAS 4" x 4" x 3/16" "X" SCRATCH. → STILL BRIGHT METAL

* {FORE & AFT SCRATCH, 3 1/4" x 3/32", TOP, STBD. - SHOWS SOME RUST
* {PAINT SANDED OFF, TOP, PORT (NEAR FILL) APPROX 1 1/2" x 1/2" - RUSTED & PITTING

— PROJECT R-6 —

EQUIPMENT CLASS. - TERNEPLATE TANKS
INSPECTION Nº: 4
DATE: 15 AUGUST 1967
INSPECTED BY: R. KETCHAM

NOTE: IN GENERAL, THESE TANKS APPEAR TO HAVE WITHSTOOD ONE YEAR'S CONTINUOUS EXPOSURE SATISFACTORILY.

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD, N.J.

REINSPECTION REPORT

DATE: 20 November 1967

MFR: Various - R-6 Environmental Exposure Test - INCO Corrosion Lab (Harbor Island), Wrightsville Beach, N.C.

PRODUCT: Various Fuel Tanks, Pumps, Electrical Equipment, Etc.

YSB REPORT: None

PERSONS INTERVIEWED: Messrs:

V. G. Taylor	INCO
L. T. Davis	"
J. Garriss	"
J. Ziemianski	A-L Steel Co.

DATE OF INSPECTION: 8, 9, 10 November 1967

SUGGESTED DATE OF NEXT INSPECTION: 19-23 February 1968

COMMENTS:

1. See attached sheets for specific details.

2. INCO personnel continue excellent maintenance of hull and all equipment.

3. Hull leakage does not appear to have increased, and only intermittent pumping of bilges is required.

4. Considerable marine growth, barnacles, etc. visible on hull underbody. Apparently poor adhesion of bottom paint to original priming coat applied by the builder. Writer believes hull can remain afloat through the winter, but an underbody examination should be conducted as soon as practicable in the spring.

5. There appears to be very little additional deterioration of the visible tank surfaces. The pit noted in preceding report seems to be unchanged - but some additional slight pitting was noted in the same reservoir.

6. Several additional reservoir weights were removed, temporarily, for proper inspection of tank surface. Samples of each metal aboard were checked. There was some evidence of crevice corrosion noted on the stainless tanks - but this is in very early stages, and appears to follow no definable pattern.

7. It is premature to arrive at any conclusions, but it is observed that more corrosion appears to form in way of welds on the resistance-welded 316L (& 304) tanks than on the shielded-gas welded 316L tanks.

8. Galvanized tanks appear to be in good condition except in way of painted flanges where there is ample metal thickness to allow for corrosion.

9. Terneplate tanks show deterioration in areas where paint has chipped, and in areas of fittings and welds.

10. Electrical and other equipment on board appears quite usable and in good condition.

11. Dock lines and warning signs were not replaced at this time.

12. Mr. Ziemianski wishes to explore the feasibility of providing anodic protection for SS tanks. (Presumably this would be in the form of zincs). Further, he would like to place a small tank, so equipped, aboard the hull in such manner that it would be continually exposed to stagnant salt water for an accelerated test of, say, 6 months duration. This appears reasonable, but writer suggests that two (2) similar tanks, (except that only one be protected) should be identically exposed.

INSPECTION BY: R. P. Ketcham

ITEM	LOCATION	REMARKS
STEWART-WARNER ANGE TRANSMITTER	EACH GALV. TANK	TOP PTS CORRODED & PITTING
BRASS LOOPS	HOLD 2 - STB'D HOLD 4 - P	SOME DISCOLOR & PITTING QUITE GREEN & APPRECIABLE PITTING
LOVETT PUMPS	HOLDS 2, 3 & 4	APPEAR OK - OPERATE OK
PAR PUMPS	HOLDS 1, 3 & 4	OPERATE OK - MOTOR CASINGS, MOUNTS, ASSY BOLTS PITTED &
HEINEMANN CKT BKRS.	HOLD 2	OPERATE OK. OPENED PANEL - CONNECTIONS & APPEARANCE SATISFACTORY
PAR BLOWER	HOLD 2	LOOK & OPERATE OK
W-C BLOWERS	HOLDS 1, 3, & 4	LOOK & OPERATE OK
BROWNING METALS GATE VALVE	HOLD 4 - STB'D	OPERATES FREELY -
OCEAN CHEM. PAINT (1) COAT	GRAY RESERVOIRS ON RECT. TANKS	LOOK OK
OCEAN CHEM. PAINT (2) COATS	GRAY RESERVOIRS ON CYL. TANKS	REMOVED 2 RESERVOIRS FOR FIRE TEST - REPLACED WITH SIMILAR
BELDEN WIRING	—	LOOKS FINE
IMP. EASTMAN FITTGS.	—	LOOK OK
FRAM FILTERS	HOLD 4 - P/S.	SOME CORROSION AT MOUNTING BOLTS & ON HEADS. CASES APPEAR OK
FLOTHER CHOC	HOLD 4 & TOPSIDE	REMOVED SAMPLE - NYLON CASING ON SUPERSTRUCTURE COMPLETELY DETERIORATED
FLEXAUST (AL) DUCT	HOLD 3 - PORT - FWD ON W-C 4TH BLOWER	APPEARS NEW - NO CORROSION NOTED
VARIOUS ELEC. FUEL PUMPS	HOLD 4 - FWD - PORT	PLACED LOW IN HOLD

— PROJECT R-6 —

EQUIPMENT CLASS. - MISCELLANEOUS

INSPECTION Nº: 5

DATE: 9 Nov 67

INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 4 - ATHW. PORT	RUST IN WAY OF CHIPPED PAINT AND FITTING WELDS.
* EMPTY CYLINDRICAL	HOLD 2 STB'D. - WING	PITTING, RUST, & BUBBLING PAINT NEAR FITTINGS.
EMPTY RECTANGULAR	HOLD 4 - 2ND ROW &	RUST AT FITTINGS AND LONG'L. WELD
* * EMPTY RECTANGULAR	HOLD 1 - AFT	PITTED NEAR SUCTION FITTING RUSTY AT LONG'L. SEAM
FULL CYLINDRICAL	HOLD 4 - ATHW STB'D.	RUSTY & PITTING AT FITTINGS & WELDS
FULL RECTANGULAR	HOLD 4 - 1ST ROW &	PITTING & PAINT BUBBLES AT WELDS & FITTINGS
TRANSFER CYLINDRICAL	HOLD 2 - PORT WING	RUST AT WELDS & FITTINGS
TRANSFER RECTANGULAR	HOLD 2 PORT - INB'D.	SOME RUST AT END FLANGE & WELDS
EMPTY CYLINDRICAL	SHORE BOX	SOME RUST & PITTING NEAR FITTINGS
EMPTY RECTANGULAR	SHORE BOX	DISCOLORED IN WAY OF CHIPPED PAINT
PANELS	HOLD 3-AFT BHD (S) HOLD 4 - AFT (S)	SLIGHT RUST AT EDGES & WELDS
PANELS	SHORE BOX	DISCOLORED & RUST AT WELDS

{ AFT INB'D. CORNER (INSIDE RESERVOIR) FINISH FLAKED OFF - RUST PRESENT ABOUT 2"x 3/4"
{ FWD. END TRT. HAS 4"x4"x 3/16" "X" SCRATCH — STILL BRIGHT METAL!

* { FORE & AFT SCRATCH, 3 1/4" x 3/32", TOP, STB'D. — RUST & SOME PITTING
* { PAINT SANDED OFF, TOP, PORT (NEAR FILL) APPROX. 1 1/2" x 1 1/2" - RUSTED & PITTING

— PROJECT R-6 —

EQUIPMENT CLASS: TERNEPLATE TANKS
INSPECTION Nº: 5
DATE: 9 NOV 67
INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3-AFT PORT-INB'D	RUST AT WELDS - SUPERFICIAL SPOTS START OF PITTING UNDER WEIGHT
EMPTY RECTANGULAR	HOLD 4-1ST ROW STB'D-INB'D.	STREAKS AT LONG'L WELD SOME SUPERFICIAL SPOTS
FULL CYLINDRICAL	HOLD 3-AFT STB'D WING	RUST AT END FLANGE SOME SPOTTING ON TOP SURFACE.
FULL RECTANGULAR	HOLD 4-1ST ROW STB'D. WING	SPOTS & STREAKS IN WAY OF WELDS & FITTINGS
TRANSFER CYLINDRICAL	HOLD 4-3RD ROW PORT-INB'D	SOME SPOTS ON TOP SURFACE AND AT WELDS.
TRANSFER RECTANGULAR	HOLD 4-2ND ROW PORT-INB'D.	SPOTS AT FITTINGS & WELDS REMOVED WEIGHT- NO PITTING NOTED
EMPTY CYLINDRICAL	SHORE BOX	SLIGHTLY DISCOLORED AT END TRT & TOP
EMPTY RECTANGULAR	SHORE BOX	SOME STREAKING AT WELDS
PANELS	HOLDS 3 & 4	SLIGHT SPOTTING
PANELS	SHORE BOX	APPEAR OK

— PROJECT R-6 —

EQUIPMENT CLASS: S.S.- ALLOY NO 304
INSPECTION Nº: 5
DATE: 9 Nov 67
INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD, N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - AFT PORT - WING	SUPERFICIAL SPOTS AT FITTINGS RUST STREAKS AT WELDS.
EMPTY RECTANGULAR	HOLD 1 - FWD.	SOME SPOTS. DISCOLORATION IN WAY OF WELDS.
FULL CYLINDRICAL	HOLD 4 - 3RD ROW &	SUPERFICIAL SPOTS. DISCOLORED AT WELDS
FULL RECTANGULAR	HOLD 3 - AFT PORT - WING	DISCOLORED & STREAKED AT RESERVOIR & WELDS
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW PORT - WING	SPOTTED & DISCOLORED NEAR WELDS & FITTINGS
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW PORT - WING	SPOTS ON TOP SURFACE - STREAKS AT WELDS. DRIED SALT COVERED.
EMPTY CYLINDRICAL	SHORE BOX	SLIGHT DISCOLORATION - AT FITTINGS
EMPTY RECTANGULAR	SHORE BOX	DISCOLORATION AT WELDS.
PANELS	HOLDS 3 & 4	APPEAR OK
PANELS	SHORE BOX	APPEAR OK

— PROJECT R-6 —

EQUIPMENT CLASS.-S.S.-316L (ELEC. WELDED)
INSPECTION Nº: 5
DATE: 9 Nov. 67
INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD, N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - FWD. STBD. - INB'D.	CREVICE PIT NOTED IN INSP. Nº 4 NOT CHANGED APPRECIABLY - ADDT'L. PITS STARTED, HOWEVER.
EMPTY RECTANGULAR	HOLD 4 - 1ST ROW PORT - INB'D.	STREAKS AT WELDS & FLANGES. RUST AT BONDG. TERM'L. START OF PITTING UNDER WEIGHT.
FULL CYLINDRICAL	HOLD 3 - AFT STBD - INB'D.	SPOTS & DISCOLORATION - LOWER QUADRANT OF FLANGE. PITTING IN RESERVOIR.
FULL RECTANGULAR	HOLD 3 - FWD. STBD - WING	DISCOLORED AT WELDS, FITTINGS, & RESERVOIR.
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW STBD - INB'D	SPOTS ON END RT & FLANGE. STREAKS AT WELDS.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STBD. - INB'D.	STREAKS AT WELDS. BONDING TERM'L. SHOWS CORROSION.
EMPTY CYLINDRICAL	SHORE BOX	SOME SPOTS AT WELDS.
EMPTY RECTANGULAR	SHORE BOX	SPOTS AT WELDS. SOME DISCOLORATION & SUPERFICIAL RUST.
PANELS	HOLDS 3 & 4	APPEAR OK - SLIGHT SPOTTING.
PANELS	SHORE BOX	APPEAR OK.

— PROJECT R-6 —

EQUIPMENT CLASS. - S.S. - 316 L (GAS WELDED)

INSPECTION Nº: 5

DATE: 9 Nov 67

INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD, N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - FWD. ROW PORT - INB'D.	ALL TANKS IN HULL SHOW
EMPTY RECTANGULAR	HOLD 2 STB'D - INB'D.	CONSIDERABLE "CHALKING" OF THE ZINC COATING.
FULL CYLINDRICAL	HOLD 3 - AFT ROW	END FLANGES, IN WAY
FULL RECTANGULAR	HOLD 4 - 1ST ROW PORT - WING	OF PAINTED SURFACES INVARIABLY SHOW CONSIDERABLE FLAKY CORROSION. SOME
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW STB'D - WING	CORROSION NOTED AT FITTINGS. OTHERWISE THESE TANKS
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STB'D. - WING	APPEAR TO BE IN GOOD CONDITION.
EMPTY CYLINDRICAL	SHORE BOX	SLIGHT AMOUNT OF CHALKING & SOMEWHAT LESS END FLANGE
EMPTY RECTANGULAR	SHORE BOX	CORROSION AT PAINTED SURFACES.
PANELS	HOLDS 3 & 4	"CHALKING" OF ZINC COATING.
PANELS	SHORE BOX	SLIGHT "CHALKING"

— PROJECT R-6 —

EQUIPMENT CLASS: GALVANIZED STEEL TANKS

INSPECTION Nº: 5

DATE: 9 Nov. 67

INSPECTED BY: R. KETCHAM

NOTE: PRESSURE SENSITIVE LABELS WELL ADHERED & LEGIBLE.

(PAPER SHIPPING TAGS STILL LEGIBLE & IN POSITION)

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD, N.J.

REINSPECTION REPORT

DATE: 7 March 1968

MANUFACTURER: Various - R-6 Environmental Exposure Test - INCO Corrosion Lab (Harbor Island), Wrightsville Beach, North Carolina

PRODUCT: Various Fuel Tanks, Pumps, Electrical Equipment, Etc.

YSB REPORT: None

PERSONS INTERVIEWED:

Messrs: W. W. Kirk - INCO
V. G. Taylor- INCO
L. T. Davis - INCO
J. Garriss - INCO
E. Lotter - Fram Corp.
D. Thornton - Fram Corp.

DATE OF INSPECTION: 26 - 29 February 1968

SUGGESTED DATE OF NEXT INSPECTION: 16 - 17 May 1968

COMMENTS:

1. See attached sheets for specific details.

2. Hull is scuffed and there is considerable marine growth on the underbody. A check on the presence of marine borers, and repainting will be a desirable preventive measure as soon as practicable.

3. Routine maintenance of hull and equipment by INCO personnel is excellent, as is the cooperation rendered by all concerned.

4. In general, tank and equipment deterioration does not appear to have progressed very much since the last report. In the writer's opinion, it seems doubtful if a meaningful projection of longevity can be made upon completion of the contracted two year exposure period. In view of the relatively large expenditures of money and time incurred to date, extensions of the contracted exposure time to a point at which reasonable prognoses can be made would certainly seem worthy of serious consideration.

5. Tanks were de-fueled and re-filled during this reinspection. Samples from each tank were sent to Law & Co. Lab., in Atlanta, for gum content analysis.

6. The fuel filter and filter/separator were removed and examined in the presence of the Fram Corp. representatives. In spite

of the metals used in these devices, very little deterioration was noted following a full year's exposure low in the bilge.

7. The specially fabricated tanks, to be placed aboard for the benefit of the Allegheny-Ludlum Steel Co., were not completed in time for this reinspection.

8. Mr. Ziemianski was unable to be present for this reinspection, and no representative of the U. S. Coast Guard appeared.

INSPECTION BY: R. P. Ketcham

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 4 - ATHW. PORT	PAINT BUBBLING & CHIPPED. RED RUST SHOWING.
EMPTY CYLINDRICAL	HOLD 2 STB'D. - WING	PITS NEAR FITTINGS - PAINT BUBBLES - TOP SURFACE.
EMPTY RECTANGULAR	HOLD 4 - 2ND ROW &	RUST AT LONG'L. WELD & IN WAY OF FITTGS. SOME PAINT BUBBLES.
EMPTY RECTANGULAR	HOLD 1 - AFT	PAINT BUBBLES ON TOP & IN RESERVOIR. SOME RED RUST
FULL CYLINDRICAL	HOLD 4 - ATHW STB'D.	STREAKS AT WELD. NO APPRECIABLE BUBBLES OR RUST.
FULL RECTANGULAR	HOLD 4 - 1ST ROW &	CORROSION AT FITTGS & WELD. PAINT CHIPPED & BUBBLING.
TRANSFER CYLINDRICAL	HOLD 2 - PORT WING	PITS AT FITTGS. CORROSION AT END FLANGE & WELDS.
TRANSFER RECTANGULAR	HOLD 2 PORT - INB'D.	PAINT BUBBLES & CORROSION NEAR FITTGS. & AT WELDS.
EMPTY CYLINDRICAL	SHORE BOX	SOME RUST & SLIGHT PITTING NEAR FITTGS.
EMPTY RECTANGULAR	SHORE BOX	SOME DISCOLORATION IN WAY OF CHIPPED PAINT.
PANELS	HOLD 3-AFT BHD (S) HOLD 4 - AFT (S)	CORROSION AT EDGES & WELDS.
PANELS	SHORE BOX	DISCOLORED AT EDGES & WELDS.

... { AFT. INB'D. CORNER (INSIDE RESERVOIR) FINISH FLAKED OFF - ABOUT 2"x3/4" RED RUST.
FWD. END TRT. HAS 4"x4"x 3/16" "X" SCRATCH - STILL SHOWS BRIGHT METAL

* { FORE & AFT SCRATCH, 3 1/4" x 3/32", TOP, STB'D. HEAVY CORROSION - NO HOLES
* { PAINT SANDED OFF, TOP, PORT (NEAR FILL) APPROX. 1 1/2" x 1 1/2" HEAVY CORROSION - NO HOLES

— PROJECT R-6 —

EQUIPMENT CLASS: TERNEPLATE TANKS
INSPECTION Nº: 6
DATE: 28 FEBRUARY 1968
INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD, N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - AFT PORT - WING	SUPFICL SPOTS - CORROSION AT 6 O'CLOCK, FWD. FLANGE.
MPTY RECTANGULAR	HOLD 1 - FWD.	SLIGHT PIT ON TOP (PORT) AFT. CORROSION AT WELDS & FITTGS.
FULL CYLINDRICAL	HOLD 4 - 2ED ROW	CORROSION AT WELDS, FLANGES, & FITTGS.
FULL RECTANGULAR	HOLD 3 - FWD. PORT - WING	STREAKS FROM RESERVOIR. CORROSION AT BEND'G. TERM'L & AFTEND FLANGE.
TRANSFER CYLINDRICAL	HOLD 4 - 2ED ROW PORT - WING	SLIGHT CORROSION & DISCOLORATION AT WELDS.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW PORT - WING	DISCOLORED & CORRODED AT FITTGS & WELDS.
EMPTY CYLINDRICAL	SHORE BOX	SLIGHT DISCOLORATION AT
EMPTY RECTANGULAR	SHORE BOX	FITTGS & WELDS.
PANELS	HOLDS 3 & 4	SOME DISCOLORATION.
PANELS	SHORE BOX	LOOK OK

— PROJECT R-6 —

EQUIPMENT CLASS.-S.S.-316L (ELEC.WELDED)

INSPECTION Nº: 6

DATE: 28 FEBRUARY 1968

INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - FWD STBD. - INB'D.	DISCOLORED AT FLANGE. SOME FITTING IN RESERVOIR.
EMPTY RECTANGULAR	HOLD 4 - 1ST ROW PORT - INB'D.	DISCOLORED AT WELDS AND FITTINGS.
FULL CYLINDRICAL	HOLD 3 - AFT STBD - INB.D.	CORROSION AT 6 O'CLOCK ON ENG. FLANGE. SOME DISCOLORATION.
FULL RECTANGULAR	HOLD 3 - FWD. STBD - WING	CORROSION AT BOND'G. TERM'L & FITT'GS.
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW STBD - INB'D	DISCOLORED AT WELDS & FITT'GS.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STBD. - INB'D	CORROSION AT FWD. FLANGE, BOND'G. TERM'L. & FILL.
EMPTY CYLINDRICAL	SHORE BOX	SOME DISCOLORATION &
EMPTY RECTANGULAR	SHORE BOX	SUPERFICIAL RUST.
PANELS	HOLDS 3 & 4	DISCOLORED AT BOTTOM
PANELS	SHORE BOX	SLIGHT DISCOLORATION.

— PROJECT R-6 —

EQUIPMENT CLASS.-S.S.-316 L (GAS WELDED)

INSPECTION Nº: G

DATE: 28 FEBRUARY 1968

INSPECTED BY: R. KETEHAM

YACHT SAFETY BUREAU INC
336 OLD HOOK RD
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3-AFT PORT-INB'D	CORROSION - 6 O'CLOCK - FWD. FLANGE DISCOLORATION AT RESERVOIR
EMPTY RECTANGULAR	HOLD 4-1ST ROW STB'D-INB'D.	SOME RUST AT FITTINGS AND ALONG LONG'L. WELD.
FULL CYLINDRICAL	HOLD 3-AFT STB'D WING	DISCOLORED AT FWD. FLANGE, RESERVOIR, & LONG'L SEAM.
FULL RECTANGULAR	HOLD 4-1ST ROW STB'D. WING	POSSIBLE PIT - TOP, AFT, INB'D. DISCOLORED AT RESERVOIR FITTGS. & LONG'L WELD.
TRANSFER CYLINDRICAL	HOLD 4-3RD ROW PORT-INB'D	CORROSION AT FLANGE & FITTINGS. STREAKS FROM RESERVOIR.
TRANSFER RECTANGULAR	HOLD 4-2ND ROW PORT-INB'D.	CORROSION AT WELD & FLANGE. TOP DISCOLORED. POSSIBLE PIT-AFT, OUTB'D.
EMPTY CYLINDRICAL	SHORE BOX	SLIGHT DISCOLORATION- TOP & END RT.
EMPTY RECTANGULAR	SHORE BOX	DISCOLORATION AT WELDS.
PANELS	HOLDS 3 & 4	SOME SPOTS & DISCOLORATION.
PANELS	SHORE BOX	SAND & SLIGHT SPOTS.

— PROJECT R-6 —

EQUIPMENT CLASS: S.S.- ALLOY Nº 304
INSPECTION Nº: 6
DATE: 28 FEBRUARY 1968
INSPECTED BY: R. KETTENHAM

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD, N J.

ITEM	LOCATION	REMARKS
STEWART-WARNER GAUGE TRANSMITTER	EACH GALV. TANK	TOP SURFACES CORRODED.
BRASS LOOPS	HOLD 1 - (P) HOLD 4 - (S)	OXIDIZED - SOME PITTING. HEAVY OXIDATION & PITTING
LOVETT PUMPS	HOLDS 2, 3 & 4	SCREENS OXIDIZED - ALL PUMPS OPERABLE.
PAR PUMPS	HOLDS 1, 3 & 4	No 1 - OK, No 3 - RUSTY MOTOR CASE & MNTG. FEET - No 4 - LOOKS OK. ALL RUN OK
HEINEMANN CKT BKRS.	HOLD 2	100% OPERATIONAL - LOOK OK
PAR BLOWER	HOLD 2	LOOKS OK - OPERABLE
W-C BLOWERS	HOLDS 1, 3, & 4	LOOK OK - ALL OPERABLE
BROWNING METALS GATE VALVE	HOLD 4 - STB'D	HAND WHEEL RUSTY - BZ. PARTS GREEN. WORKS EASILY.
OCEAN CHEM. PAINT (1) COAT	GRAY RESERVOIRS ON RECT. TANKS	OK
OCEAN CHEM. PAINT (2) COATS	GRAY RESERVOIRS ON CYL. TANKS	OK
BELDEN WIRING		OK
IMP. EASTMAN FITTGS.		OK
FRAM FILTERS	HOLD 4 - P/S.	BOTH UNITS REMOVED & RETURNED TO YSB FOR TEST. LOOKS OK.
FLEXAUST (AL) DUCT	HOLD 3 - P - FWD. ON W-C 4" BLOWER	NO CORROSION NOTICED
VARIOUS ELEC. FUEL PUMPS	HOLD 4 - P - FWD	PITTING ON PLATED AUTOFUSE RUSTED BKT. & WASHERS ON CARTER DUPREE LOOKS NEW.

FEB	27	28	29
AIR TEMP	55	55	35
WATER TEMP	44	44	44
SEA	CALM	CHOP	ROUGH
WIND	N/W-5	S/E-10	W-25

— PROJECT R-6 —

EQUIPMENT CLASS. - MISCELLANEOUS

INSPECTION No: 6

DATE: 26-29 FEBRUARY 1968

INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD N.J.

BOTTOM OF FIRE EXT. (HUNG IN #2 HATCHWAY) BADLY CORRODED

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - FWD. ROW PORT - INB'D.	ALL TANKS SHOW
EMPTY RECTANGULAR	HOLD 2 STB'D - INB'D.	CONSIDERABLE "CHALKING"
FULL CYLINDRICAL	HOLD 3 - AFT ROW ℄	OF ZINC. PAINTED END
FULL RECTANGULAR	HOLD 4 - 1ST ROW PORT - WING	FLANGES CORRODED, AND
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW STB'D - WING	SHOW EROSION.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STB'D. - WING	
EMPTY CYLINDRICAL	SHORE BOX	LESS CHALKING THAN ON BOAT
EMPTY RECTANGULAR	SHORE BOX	SOME CORROSION @ FLANGES.
PANELS	HOLDS 3. 4	SHOWS SOME ZINC SACRIFICE
PANELS	SHORE BOX	GOOD CONDITION

PAPER & FOIL LABELS STILL INTACT & ADHERED. PAPER MORE LEGIBLE DUE TO ZINC SACRIFICE

— PROJECT R-6 —

EQUIPMENT CLASS: GALVANIZED STEEL TANKS
INSPECTION Nº: 6
DATE: 28 FEBRUARY 1968
INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD
WESTWOOD, N.J.

REINSPECTION REPORT

DATE: 15 May 1968

MANUFACTURER: Various - R-6 Environmental Exposure Test
INCO Corrosion Lab (Harbor Island),
Wrightsville Beach, N. C.

PRODUCT: Various Fuel Tanks, Pumps, Electrical Equipment, etc.

YSB REPORT: None

PERSONS INTERVIEWED:

Messrs: W. W. Kirk - INCO
L. T. Davis - INCO
J. Garriss - INCO
P. Bunch - LCDR - (USCG)
J. Ziemianski - Allegheny - Ludlum Steel

DATE OF INSPECTION: 8 - 10 May 1968

SUGGESTED DATE OF NEXT INSPECTION: 12 August 1968

COMMENTS:

1. See attached sheets for specific details.

2. Hull maintenance, adherence to test procedures, and cooperation by INCO personnel is excellent.

3. It would appear that deterioration of the tanks and equipment, to date, has not been severe. However, internal surfaces have not been inspected and many of the exterior surfaces are inaccessible to all but the most cursory examination.

4. Because of the condition outlined above, it was felt by all present that an extension of the exposure period beyond the scheduled removal date of August 1968 would be likely to yield more valid data upon which to base an opinion regarding suitability of the various materials. It was suggested by the writer that any such extension be contemplated on an incremental basis (as an economy move) with continuance of exposure dependent upon results of quarterly inspections.

5. If the recommended extension of exposure period is to be effected, provision for it should be made in the YSB contracts with Allegheny-Ludlum and the U. S. Coast Guard.

6. The exposure hull is definitely in need of topside touch-up work and bottom scrubbing/painting. Due to the known presence of marine borers in this area, the work should be accomplished without delay, and should be done without regard to a decision on continuance of the test.

7. The Fram fuel filter and filter/separator units were re-installed in their former locations for further exposure.

8. If a decision is reached in favor of continuing the test, the following work should also be authorized:

   1) Check and re-charge dry chemical extinguishers.

   2) Replace dock lines.

   3) Replace "No Smoking or Open Lights" signs.

INSPECTION BY: Richard P. Ketcham
Richard P. Ketcham

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 4 - ATHW. PORT	PAINT BUBBLES & CORROSION IN WAY OF FITTINGS.
* EMPTY CYLINDRICAL	HOLD 2 STB'D. - WING	PAINT BUBBLES & CORROSION AT ALL FITTINGS.
EMPTY RECTANGULAR	HOLD 4 - 2ND ROW &	PAINT CHIPPED & BUBBLED, CONSIDERABLE CORROSION AT FITTINGS.
* * EMPTY RECTANGULAR	HOLD 1 - AFT	CONDENSATE ON TOP. CORROSION UNDER PAINT BUBBLES.
FULL CYLINDRICAL	HOLD 4 - ATHW STB'D.	SLIGHT CORROSION AT FITTINGS & WELDS.
FULL RECTANGULAR	HOLD 4 - 1ST ROW &	RUST STREAKS FROM WELDS. PAINT CHIPPED & BUBBLING. CORROSION AT FITTINGS.
TRANSFER CYLINDRICAL	HOLD 2 - PORT WING	CORROSION AT FITTINGS & FOR'D. END FLANGE (6 & 9 o'CLOCK)
TRANSFER RECTANGULAR	HOLD 2 PORT - INB'D.	CORROSION AT FOR'D. END FLANGE, LONG'L. SEAM & NEAR FITTINGS.
EMPTY CYLINDRICAL	SHORE BOX	SLIGHT CORROSION AT FITT'GS. & WELDS
EMPTY RECTANGULAR	SHORE BOX	SLIGHT CORROSION AT FITT'G'S & WELDS
PANELS	HOLD 3-AFT BHD (S) HOLD 4 - AFT (S)	SLIGHT CORROSION AT WELDS & EDGES.
PANELS	SHORE BOX	VERY SLIGHT CORROSION

& { AFT INB'D. CORNER (INSIDE RESERVOIR) FINISH FLAKED OFF - ABOUT 2" x 3/4" RUSTED
FWD. END TRT. HAS 4" x 4" x 3/16" "X" SCRATCH - STILL BRIGHT METAL

* { FORE & AFT SCRATCH, 3 1/4" x 3/32", TOP, STB'D. - WELL CORRODED - NOT HOLED THRU
* { PAINT SANDED OFF, TOP, PORT (NEAR FILL) APPROX. 1 1/2" x 1 1/2" - CORRODED - NOT HOLED THRU

— PROJECT R-6 —

EQUIPMENT CLASS: TERNEPLATE TANKS
INSPECTION Nº: 7
DATE: 9 MAY 68
INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD, N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 2 - AFT PORT - WING	CORROSION AT WELDS. PIT ON TOP, 2" FWD. OF SUCTION TUBE.
EMPTY RECTANGULAR	HOLD 1 - FWD.	SMALL PIT - (TOP, PORT, AFT) CORROSION AT BOND'G. TERM'L & WELDS.
FULL CYLINDRICAL	HOLD 4 - 3RD ROW &	SLIGHT DISCOLORATION AT WELDS & FITT'GS.
FULL RECTANGULAR	HOLD 2 - FWD. PORT - WING	PIT STARTED ~(TOP, 3" AFT / INB'D. OF VENT) CORR. AT BAND'G. TERM'L & LOW OUTBD ON END FLGE.
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW PORT - WING	POSSIBLE PIT - AFT INB'D. QUADRANT OF SUCTION FITT'G.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW PORT - WING	DISCOLORED AT WELDS & FITTINGS.
EMPTY CYLINDRICAL	SHORE BOX	SLIGHTLY DISCOLORED AT WELDS
EMPTY RECTANGULAR	SHORE BOX	SLIGHTLY DISCOLORED AT WELDS.
PANELS	HOLDS 3 & 4	SOME DISCOLORATION AT WELDS & EDGES.
PANELS	SHORE BOX	SLIGHT DISCOLORATION.

— PROJECT R-6 —

EQUIPMENT CLASS. SS-316L (ELEC. WELDED)
INSPECTION NO.: 7
DATE: 9 MAY 68
INSPECTED BY: R.P. KETCHAM

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 2 - FWD STBD. - INB'D.	PITTING IN RESERVOIR. CORROSION AT VENT FITG & AFT FLANGE (6 O'CLOCK)
EMPTY RECTANGULAR	HOLD - 1ST ROW PORT - INB'D	CORROSION AT FILL & BOND'G TERM'L. DISCOLORED AT WELDS.
FULL CYLINDRICAL	HOLD 3 - AFT STB'D - INB'D.	POSSIBLE PIT - SHELL TRT. ~ 2 O'CLOCK, FWD. CORROSION AT END FLGE.
FULL RECTANGULAR	HOLD 3 - FWD STBD - WING	CORROSION AT LOWER AFT FLANGE, BOND'G. TERM'L & SUCTION FITG.
TRANSFER CYLINDRICAL	HOLD 4 - 2 ND ROW STBD - INB'D	SUPERFICIAL SPOTS AT WELDS, FITTINGS, END TRT.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STB'D - INB'D.	CORROSION AT BOND'G. TERM'L AND FORD & AFT FLANGES.
EMPTY CYLINDRICAL	SHORE BOX	SLIGHT DISCOLORATION
EMPTY. RECTANGULAR	SHORE BOX	SLIGHT DISCOLORATION
PANELS	HOLDS 3 & 4	SLIGHT GENERAL CORROSION
PANELS	SHORE BOX	SOME DISCOLORATION

— PROJECT R-6 —

EQUIPMENT CLASS. SS-316L (GAS WELDED)
INSPECTION Nº: 7
DATE: 9 MAY 68
INSPECTED BY: R.P. KERNAM

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD
WESTWOOD, N.J.

ITEM	LOCATION	REMARKS
STEWART-WARNER. GAUGE TRANSMITTER	EACH GALV. TANK	BADLY CORRODED TOP RTS. SOME APPEAR BARELY USABLE
BRASS "L" OOPS	HOLD 1 (P) HOLD 4 (S)	SLIGHT PITTG & DISCOLORATION CONSIDERABLE OXIDATION & PITTING
LOVETT PUMPS	HOLDS 2, 3 & 4	SCREENS & PIGTAIL CLIPS OXIDIZED. ALL OPERATING OK
PAR PUMPS	HOLDS 1, 3 & 4	CORROSION AT MOTOR HOUSING, ASS'Y BOLTS & NUTS. ALL OPERATING OK
HEINEMANN CKT BKRS.	HOLD 2	APPEARS OK - OPERATES
PAR BLOWER	HOLD 2	APPEARS OK - OPERATES
W-C BLOWERS	HOLDS 1, 3, & 4	APPEAR OK - OPERATE
BROWNING METALS GATE VALVE	HOLD 4 - STB'D	OXIDIZING - HAND WHEEL CORRODED OPERATES BASILY
OCEAN CHEM. PAINT (1) COAT	GRAY RESERVOIRS ON RECT. TANKS	APPEARS OK
OCEAN CHEM. PAINT (2) COATS	GRAY RESERVOIRS ON CYL. TANKS	APPEARS OK
BELDEN WIRING		APPEARS OK
IMP. EASTMAN FITTGS.		SOME DISCOLORATION - APPEAR OK
FRAM FILTERS	HOLD 4 - P/S	REINSTALLED ~ ROW 2 ATHW. CHOCK, AFT
FLEXAUST (AL) DUCT	ON W-C 4" BLOWER HOLD 3 - P - FWD	CORROSION & PITTING IN WAY OF HORIZONTAL BEND.
VARIOUS ELEC FUEL PUMPS	HOLD 4 - P - FWD	AUTOPULSE REPLACED FAILED AUTOPULSE IN TRANSFER SYSTEM - HOLD NO 2

— PROJECT R-6 —

WIND - ENE @ 5 - 10
SEA CALM
AIR TEMP 70° - 75° F
WATER TEMP 68° F

EQUIPMENT CLASS. - MISCELLANEOUS
INSPECTION NO: 7
DATE: 9 MAY 68
INSPECTED BY: R.P. KETCHAM

BOAT BOTTOM FOUL.
WARNING SIGNS WEATHERED
FIRE EXTINGUISHERS OVERDUE FOR SERVICE

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3-AFT PORT-INB'D	FWD FLGE. DISCOLORED. POSSIBLE PIT AT SUCTION FITT'G - 11 O'CLOCK.
EMPTY RECTANGULAR	HOLD 4-1ST ROW STB'D-INB'D.	CORROSION AT END FLANGE. POSSIBLE PIT JUST INB'D OF SUCTION.
FULL CYLINDRICAL	HOLD 3-AFT STB'D WING	CORROSION AT END FLANGE (6 O'CLOCK) & LONG'L WELD. PIT INB'D OF VENT FITT'G.
FULL RECTANGULAR	HOLD 4-1ST ROW STB'D. WING	PIT NEAR SUCTION FITT'G. CORROSION AT BOND'G TERM'L. & WELDS.
TRANSFER CYLINDRICAL	HOLD 4-3RD ROW PORT-INB'D	DISCOLORED AT WELDS & FITT'GS.
TRANSFER RECTANGULAR	HOLD 4-2ND ROW PORT-INB'D.	CORROSION AT BOND'G. TERM'L. END FLGE. & WELD. PIT, 3" INB'D/END OF SUCTION.
EMPTY CYLINDRICAL	SHORE BOX	SOME DISCOLORATION ~ WELDS & FITTGS.
EMPTY RECTANGULAR	SHORE BOX	SOME DISCOLORATION ~ WELDS & FITTGS
PANELS	HOLDS. 3 & 4	SLIGHT CORROSION
PANELS	SHORE BOX	SOME DISCOLORATION

— PROJECT R-6 —

EQUIPMENT CLASS: S.S.- ALLOY № 304
INSPECTION №: 7
DATE: 9 MAY 68
INSPECTED BY: R.P. KETCHAM

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD, N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - FWD. ROW PORT - INB'D	CORROSION/EROSION AT PAINTED END FLANGE. CHALKY ZINC.
EMPTY RECTANGULAR	HOLD 2 STB'D - INB'D.	CORROSION/EROSION AT PAINTED END FLANGE.
FULL CYLINDRICAL	HOLD 3 - AFT ROW &	CORROSION/EROSION AT PAINTED END FLANGE
FULL RECTANGULAR	HOLD 4 - 1ST ROW PORT - WING	CORROSION/EROSION AT PAINTED END FLANGE.
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW STBD - WING	CORROSION/EROSION AT PAINTED END FLANGE.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STBD - WING	CORROSION/EROSION AT PAINTED END FLANGE
EMPTY CYLINDRICAL	SHORE BOX	ZINC CHALKING - CORROSION AT END FLANGE
EMPTY RECTANGULAR	SHORE BOX	CORROSION AT END FLANGES.
PANELS	HOLDS 3 & 4	SLIGHT CORROSION - EDGES
PANELS	SHORE BOX	CHALKING & SLIGHT CORROSION

METAL FOIL & PAPER SHIPPING LABELS STILL WELL ADHERED.

— PROJECT R-6 —

EQUIPMENT CLASS.-GALVANIZED STEEL TANKS
INSPECTION Nº: 7
DATE: 9 MAY 68
INSPECTED BY: R.T.R. KETTENBURG

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD N.J.

REINSPECTION REPORT

DATE: 23 September 1968

MANUFACTURER: Various - R-6 Environmental Exposure Test,
INCO Corrosion Lab (Harbor Island),
Wrightsville Beach, N. C.

PRODUCT: Various Fuel Tanks, Pumps, Electrical Equipment, etc.

YSB REPORT: None

PERSONS INTERVIEWED:

Messrs: W. W. Kirk - INCO
V. G. Taylor - INCO
L. T. Davis - INCO
J. Garriss - INCO
J. Ziemianski - Allegheny - Ludlum Steel

DATE OF INSPECTION: 14 - 22 August 1968

SUGGESTED DATE OF NEXT INSPECTION: 13 - 15 November 1968

COMMENTS:

1. This inspection, coming at the end of the 2 year exposure period originally projected, is intended to go into greater detail than the inspection reports furnished quarterly during this period.

2. See attached sheets for specific details on the various items.

3. INCO personnel continue to be most cooperative and meticulous in handling of the detail work connected with the test.

4. All exterior surfaces of the test hull have been cleaned and repainted. Hull appears to be in very good condition, but still has a slight leak at starboard chine, aft.

5. Inasmuch as the more complete examination did reveal several failures of stainless steel tanks, question arose regarding the advisability of extending the exposure phase. However, it was felt that, because most failures occurred in induced areas, the additional time would furnish a better base for a projection of longevity on the various materials.

6. It should be noted that, to date of inspection, no actual failure of a Terne-Plate tank had occurred. In the case of these tanks corrosion, in general, is quite prevalent and it appears that one or more failures - in non-induced areas - may occur in the near future.

7. One rectangular tank, of each metal, was removed from the hull for closer examination. These tanks were shipped to the YSB office, after being gas-freed.

8. A record of outside vs. hull interior temperatures was kept for several weeks early in the summer. As a matter of interest, this record is included herewith. A "Rustrak" temperature recorder, installed in the aft compartment of the hull, should furnish more complete data in this regard for the duration of the test.

9. Allegheny-Ludlum is experimenting with the principle of cathodic protection on stainless steel. To this end, two small cylindrical tanks (Terne-coated stainless) were installed, empty, in the hull. Salt water reservoirs and weights were fitted as on the other tanks. Intentional scratches were made in the Terne-coating. Details of the tank alloy, welding technique, and coating will be provided by Allegheny-Ludlum.

10. It is anticipated that an extremely complete examination of certain of the removed tanks will be made in October. Following this, an addendum to this report will be furnished.

INSPECTION BY: Richard P. Ketcham
Richard P. Ketcham

ITEM	LOCATION	REMARKS
STEWART-WARNER GAUGE TRANSMITTER	EACH GALV. TANK	EACH ATTACHMENT PT. SHOWS CONSIDERABLE CORROSION
BRASS LOOPS	HOLD 1 (P) HOLD 4 (S)	DISCOLORED & START OF PITTING CONSIDERABLE PITTING & DISCOLORATION
LOVETT PUMPS	HOLDS 2,3 & 4	ALL OPERATING OK INTAKE SCREENS DISCOLORED
PAR PUMPS	HOLDS 1, 3 & 4	ALL OPERATING OK, SOME CORROSION ON EXTERNAL METAL PARTS.
HEINEMANN CKT BKRS.	HOLD 2	ALL OPERATING SATISFACTORILY APPEAR OK FROM OUTSIDE
PAR BLOWER	HOLD 2	APPEARS & OPERATES WELL
W-C BLOWERS	HOLDS 1, 3, & 4	ALL OPERATING, APPEAR OK
BROWNING METALS GATE VALVE	HOLD 4 - STB'D	HAND WHEEL CORRODED, REMOVE PARTS GREEN, WORK ALL RIGHT
OCEAN CHEM. PAINT (1) COAT	GRAY RESERVOIRS ON RECT. TANKS	IN GOOD CONDITION
OCEAN CHEM. PAINT (2) COATS	GRAY RESERVOIRS ON CYL. TANKS	IN GOOD CONDITION
BELDEN WIRING	GENERAL	IN APPARENTLY GOOD CONDITION
IMP. EASTMAN FITTGS.	GENERAL	IN APPARENTLY GOOD CONDITION
FRAM FILTERS	HOLD 4 ~ P/S	SLIGHT CORROSION - HOUSING ETC. FILTER BOWLS APPEAR SERVICEABLE
FLEXAUST (AL) DUCT	ON W-C # BLOWER HOLD 3 (P) FWD	PITTING & DISCOLORATION AT LOW POINTS OF BENDS.
VARIOUS ELEC FUEL PUMPS	HOLD 4 (P) FWD	CORROSION ON MOUNTS & BASE OF CARELLI PUMPS

— PROJECT R-6 —

SEA & WEATHER

DURING INSPECTION TRIP AIR TEMP. VARIED FROM LOW 80s TO 100°F +. WIND, MOSTLY SSE, WAS BETWEEN 0-15 KTS. SEA RAN FROM SMOOTH TO CHOPPY. SEA WATER TEMPERATURE IN UPPER 70s

EQUIPMENT CLASS. - MISCELLANEOUS
INSPECTION Nº: 8
DATE: 14 AUGUST 1968
INSPECTED BY: R. KETCHUM

YACHT SAFETY BUREAU, INC
336 OLD HOOK RD.
WESTWOOD, N.J.

	ITEM	LOCATION	REMARKS
	EMPTY CYLINDRICAL	HOLD 3-AFT PORT-INB'D	SLIGHT PITT'G, IN WAY OF WEIGHT - FWD, OUTB'D.
	EMPTY RECTANGULAR	HOLD 4-1ST ROW STB'D-INB'D.	PITT'G. IN WAY OF BOX'S WEIGHT, CREVICE AT AFT END. LOWER EDGE AFT END FLANGE CORRODED.
	FULL CYLINDRICAL	HOLD 3-AFT STB'D WING	PIT UNDER BOX, FWD. END, INCORR'D.
*	FULL RECTANGULAR	HOLD 4-1ST ROW STB'D. WING	TOP CORNERS SHOWS PITTING AFT STRAP, HOLES THROUGH AT AFT INTR'L CORNER.
	TRANSFER CYLINDRICAL	HOLD 4-3RD ROW PORT-INB'D	PITT'G. IN WAY OF WEIGHT FWD. $\frac{1}{2}$.
* *	TRANSFER RECTANGULAR	HOLD 4-2ND ROW PORT-INB'D.	HOLES IN TOP CORNERS, SEE ATTACHED SHEET
	EMPTY CYLINDRICAL	SHORE BOX	SOME DISCOLORATION
	EMPTY RECTANGULAR	SHORE BOX	SOME DISCOLORATION
	PANELS	HOLDS 3&4	CORROSION, DISCOLORATION, & POSSIBLE PITTING.
	PANELS	SHORE BOX	SOME DISCOLORATION

* FUEL DRAINED, TANK FILLED WITH F.W.

** FUEL DRAINED, TANK REMOVED & SENT TO YARD.

— PROJECT R-6 —

EQUIPMENT CLASS: S.S.- ALLOY Nº 304

INSPECTION Nº: 8

DATE: 16 AUGUST 1968

INSPECTED BY: R. KUTCHIN

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD, N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - FWD. ROW PORT - INB'D	CORROSION AT PAINTED END FLANGE. NONE NOTED UNDER BOX OR STRAPS.
EMPTY RECTANGULAR	HOLD 2 STB'D - INB'D.	NO EVIDENCE OF CORROSION UNDER BOX OR STRAPS.
FULL CYLINDRICAL	HOLD 3 - AFT ROW &	SOME CORROSION UNDER WEIGHT, & AT PAINTED FLANGE. CLEAN UNDER BOX AND STRAPS.
FULL RECTANGULAR	HOLD 4 - 1ST ROW PORT - WING	CORROSION AT FITTG. & PAINTED FLANGE
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW STBD - WING	SOME CORROSION AT WELD, IN WAY OF WEIGHT.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STBD - WING	CORROSION AT PAINTED FLANGE, STARTING UNDER WEIGHT.
EMPTY CYLINDRICAL	SHORE BOX	SOME CORROSION AT PAINTED FLANGE.
EMPTY RECTANGULAR	SHORE BOX	SOME CORROSION AT PAINTED FLANGE.
PANELS	HOLDS 3 & 4	CHALKY - NO CORROSION NOTED
PANELS	SHORE BOX	SOME CHALKING - NO CORROSION

— PROJECT R-6 —

EQUIPMENT CLASS.-GALVANIZED STEEL TAN

INSPECTION Nº: 8

DATE: 16 AUGUST 1962

INSPECTED BY: R. KEELL

YACHT SAFETY BUREAU INC
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 4 - ATHW. PORT	PITT'G. IN BOX, & IN WAY OF PAINT BUBBLES — TOP SURFACE.
EMPTY CYLINDRICAL	HOLD 2 STB'D. - WING	SOME CORROSION IN WAY OF FWD. STRAP.
EMPTY RECTANGULAR	HOLD 4 - 2ND ROW &	PITTING INSIDE BOX, BUT NOT IN WAY OF WEIGHT.
EMPTY RECTANGULAR	HOLD 1 - AFT	PAINT BUBBLES & CORROSION AT FITTGS. LOOSE SCALE UNDER STRAPS.
FULL CYLINDRICAL	HOLD 4 - ATHW STB'D.	PITT'G. STARTED IN WAY OF WEIGHTS.
FULL RECTANGULAR	HOLD 4 - 1ST ROW &	PITTING UNDER PAINT BUBBLES ON TOP SURFACE.
TRANSFER CYLINDRICAL	HOLD 2 - PORT WING	CORROSION AT WELDS & IN WAY OF FITTINGS.
TRANSFER RECTANGULAR	HOLD 2 PORT - INB'D.	CORROSION AT WELDS & IN WAY OF FITTINGS.
EMPTY CYLINDRICAL	SHORE BOX	SOME BUBBLES & CORROSION AT WELDS & FITTINGS
EMPTY RECTANGULAR	SHORE BOX	SOME BUBBLES & CORROSION AT WELDS & FITTINGS.
PANELS	HOLD 3-AFT BHD (S) HOLD 4 - AFT (S)	DISCOLORED AT BOTTOM EDGES & WELDS.
PANELS	SHORE BOX	SLIGHT CORROSION AT WELD.

* AFT INB'D. CORNER (INSIDE RESERVOIR) FINISH FLAKED OFF - ABOUT 2"x3/4" CORROSION STARTED
  FWD. END TRT. HAS 4"x4"x3/16" "X" SCRATCH — STILL TIGHT.
* FORE & AFT SCRATCH, 3 1/4" x 3/32", TOP, STB'D. — SCALY, [illegible] RUST.
* PAINT SANDED OFF, TOP, PORT (NEAR FILL) APPROX. 1½"x1½" CONSIDERABLE RUST

— PROJECT R-6 —

EQUIPMENT CLASS: TERNEPLATE TANKS
INSPECTION Nº: 8
DATE: 14 AUGUST 1968
INSPECTED BY: R. KISTENMACHER

IN ALL CASES, PAINT ON TOP SURFACES PEELED WITH REMOVAL OF THE RESERVOIR BOXES.

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD, N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - AFT PORT - WING	DISCOLORED AT WEIGHT. START OF PITTG. TOP, AFT, INT'D.
EMPTY RECTANGULAR	HOLD 1 - FWD.	SOME PITTG UNDER STRAP TOP (S) CORROSION AT FITTINGS & WELDS.
FULL CYLINDRICAL	HOLD 4 - 3RD ROW	SLIGHT PITTG IN WAY OF WEIGHT. DISCOLORED & CORRODED AT FITTINGS.
FULL RECTANGULAR	HOLD 3 - FWD. PORT - WING	DISCOLORED & SPOTTED UNDER WEIGHT, AFT END, INT'D.
TRANSFER CYLINDRICAL	HOLD 4 - 3RD ROW PORT - WING.	PITTING STARTED UNDER WEIGHT. CORROSION AT WELDS.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW PORT - WING	PITS & CREVICES UNDER INT'D. PART OF TANK.
EMPTY CYLINDRICAL	SHORE BOX	DISCOLORED AT WELDS.
EMPTY RECTANGULAR	SHORE BOX	DISCOLORED AT WELDS.
PANELS	HOLDS 3 & 4	SPOTTED AND DISCOLORED AT WELDS & PANEL EDGES.
PANELS	SHORE BOX	SLIGHT DISCOLORATION

— PROJECT R-6 —

EQUIPMENT CLASS. SS-316L (ELEC. WELDED)

INSPECTION Nº: 8

DATE: 14 AUGUST 1968

INSPECTED BY: R. KETCHAM

YACHT SAFETY BUREAU INC.
336 OLD HOOK RD.
WESTWOOD N.J.

ITEM	LOCATION	REMARKS
EMPTY CYLINDRICAL	HOLD 3 - FWD STBD. - INB'D.	SOME SLIGHT PITTING NOTED IN WAY OF WEIGHT.
EMPTY RECTANGULAR	HOLD 4 - 1ST ROW PORT - INB'D	CREVICE PITTING IN WAY OF BOX - AFT, INB'D. CORNER.
FULL CYLINDRICAL	HOLD 3 - AFT STB'D - INB'D.	CORROSION AT LOWER AFT FLANGE. SLIGHT PITTG, OPEN SURFACE, 20 O'CLOCK FWD.
FULL RECTANGULAR	HOLD 3 - FWD STBD - WING	HOLE IN TOP SURFACE, IN WAY OF BOX. FUEL REMOVED & GAS FREED.
TRANSFER CYLINDRICAL	HOLD 4 - 3 RD ROW STBD - INB'D	CORROSION, BOTTOM OF FWD. FLANGE. PIT UNDER WT. ~ FWD. INB'D.
TRANSFER RECTANGULAR	HOLD 4 - 2ND ROW STBD - INB'D.	PITS AT AFT END OF WEIGHT & AFT INB'D EDGE OF BOX.
EMPTY CYLINDRICAL	SHORE BOX	SOME DISCOLORATION
EMPTY RECTANGULAR	SHORE BOX	SOME DISCOLORATION
PANELS	HOLDS 3 & 4	SLIGHT CORROSION ~ EDGE & WELD
PANELS.	SHORE BOX	SOME DISCOLORATION

— PROJECT R-6 —

EQUIPMENT CLASS. SS-316L (GAS WELDED)
INSPECTION Nº: 3
DATE: 16 AUGUST 1968
INSPECTED BY: R. KATSIAK

YACHT SAFETY BUREAU, INC.
336 OLD HOOK RD.
WESTWOOD N.J.

UNCLAS

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)
UNDERWRITERS' LABORATORIES INC.

2a. REPORT SECURITY CLASSIFICATION
UNCLASSIFIED

2b. GROUP
13/10

3. REPORT TITLE
ENVIRONMENTAL EXPOSURE OF SAMPLE MODEL MARINE FUEL TANKS
(BOTH INTERIM AND FINAL REPORTS)

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
INVESTIGATIVE 19 JULY 1965 — 27 FEB. 1970

5. AUTHOR(S) (First name, middle initial, last name)
CORPORATE

6. REPORT DATE
27 FEB. 1970

7a. TOTAL NO. OF PAGES
223

7b. NO. OF REFS
0

8a. CONTRACT OR GRANT NO.
TC6-10-136-A

b. PROJECT NO. Allegheny-Ludlum Steel Corp. 10 March 65 with supply agreement

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)
UL 65 WW 63 FILE MM 36
UL 65 WW 32 FILE MM 10

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
NONE

10. DISTRIBUTION STATEMENT
unlimited

11. SUPPLEMENTARY NOTES
None

12. SPONSORING MILITARY ACTIVITY
U.S. COAST GUARD (DAT)

13. ABSTRACT

Report covering the completion of 3 years of environmental exposure of sample Model Marine Fuel Tanks (without listing and labeling) as outlined in YSB Procedure R-6 and as examined in YSB Interim report R-6-1-0469

DD FORM 1 NOV 65 1473

UNCLAS

Security Classification