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DEPARTMENT OF THE NAVY
MARE ISLAND NAVAL SHIPYARD
VALLEJO, CALIFORNIA 94592

IN REPLY REFER TO:
138-Ser 53
10310
1 May 1981

406 EA
INFO
403 BY

From: Commander, Mare Island Naval Shipyard
To: Commander, Naval Facilities Engineering Command, Pacific Division

Subj: Trip to Pacific Division Naval Facilities Command, 22 through 29 April 1981; report on

Encl: (1) Agenda OICC MIDPAC, Construction review conference 24-28 April 1981

1. Purpose. The purpose of the Trip was to provide welding engineering consulting service in support of the Red Hill POL Facility Modernization Project, Pearl Harbor, Hawaii. Enclosure (1) is the program agenda for 24 through 28 April 1981. Persons met during the visit were:

OICC/ROICC	Position/Association
[redacted]	OICC
	Deputy OICC
	OICC MIDPAC
	ROICC Pearl
	AREICC Pearl
	Project CME
NAVY	
(b) (6)	PACDIV, Code 04, Director of Design
	PACDIV, Code 04, Project Design Engineer
	NAVFAC, Code 04B3, POL Consultant
	NAVFAC, Code 04B4, Metallurgical Consultant
	PACDIV 05A
	MINSY, Chief Welding Engineer
Private Industry	
Mr. Rolland (Pete) Peterson	Peabody Testing, Consultant in Testing Methods for Container Vessels
Mr. Tom Weirich	Private Consultant, Vacuum and other Testing Methods for Container Vessels
R. A. Sodestrom	Hallanger Engineers

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Hawaii Dredging Co., Contractor Personnel

Roger Marley	Project Superintendent
Les Cummings	Project Welding Superintendent
W. E. Brown	
Jim Mgreau	
John Wright	Clark Painting
Ed Wallace	
Bill Coleman	
A. G. Lee	

2. Discussion and Observations. Reported to ROICC Pearl Office on Thursday, 23 April 1981 at 0730. A briefing on subject project, including the current status, was provided by Mr. John Muchemore of the ROICC office. Visited the Red Hill Project site the afternoon of 23 April. Attended project conference at OICC headquarters at Pearl Harbor Naval Shipyard at 0900 on 24 April 1981 as shown on enclosure (1). Visited the Red Hill Project the remainder of the day reviewing/discussing tank repair procedures/techniques. Saturday, 25 April visited the Red Hill Project for continued viewing and discussing of the tank modernization/repair program. The discussion included an informal meeting with contractor personnel Mr. Roger Marley and Mr. Les Cummings. Discussions of observations and information obtained at the Red Hill Project site is as follows:

a. The majority of the weld repair work has been done with the Shielded Metal Arc (SMA-covered electrode) process. Some Gas Metal Arc Process (GMA) equipment (i.e. apparently three units) is being used in Tank No. 15 for welding in conjunction with the weld/backing strip encapsulation (i.e. canning). The GMA process utilizes 0.045 inch diameter solid wire electrode with carbon dioxide (CO_2) gas shielding of the arc and molten weld puddle. CO_2 is an effective atmosphere shielding gas however, it is not able to sustain a smooth metal transfer to the weld puddle. The result is a somewhat unstable arc and noticeable weld spatter on the base material and the gas shield cup and contact tip of the welding torch/gun. The CO_2 shielded GMA process has advantages over the SMA process of increased weld deposition however, the spatter factor requires clean up of the base metal/weld and frequent cleaning of the weld torch shielding gas cup and contact tip. If the gas cup/contact tip are not properly and frequently cleaned of spatter accumulation this can interrupt or distort the gas shield resulting in weld porosity and/or weld deposit oxide inclusions.

b. Cleaning of SMA and GMA weld deposits is apparently being accomplished by wire brushing and/or grinding. Tightly adherent SMA slag and GMA oxide scale are not readily/completely removed by these

methods. Remnant slag or scale in weld ripples, along weld toes or in way of weld starts and stops can mask weld defects/potential leak areas.

c. It appears that vertical and semi-overhead position welding is done progressing vertically down. This technique is effective however, experienced welder skill is required to avoid weld cold shuts and/or slag and oxide inclusions which could be a source of leaks.

d. Testing of the encapsulation welds for leaks is done by visual and vacuum box inspection. It would appear that the encapsulation canning could be readily used for air pressure testing with evaluation by soap testing and/or ultrasonic audio leak detection. An alternative would be to introduce a trace element/gas such as freon into the backing strip canned volume and check for leaks using a detector such as a halogen type sensor.

e. Magnetic particle inspection (M.T.) is done on ground potential weld repair areas in the barrel and bottom dome sections of the tanks (i.e. the upper dome welds are encapsulated and M.T. is not done). The M.T. is done with the AC yoke method using red or grey powder. Under the tank interior lighting conditions yellow or white M.T. powder might be more visible making rejectable linear indications more readily discernable.

3. Recommendations.

a. Welding Process/equipment.

(1) Expand the use of the GMA process to fully realize the advantage of the increased weld deposition rate.

(2) Change to flux core self shielding electrode. Advantages are:

(a) Elimination of the CO_2 shielding gas (i.e. gas cost, plus regulators, hoses, etc. to bring the gas to the welding torch).

(b) Improved arc stability resultant from the arc stabilizing/ionizing ingredients in the flux. These agents also act to deoxidize the molten weld puddle and refine the weld metal thereby increasing the tolerence for welding on dirty material (i.e. oil, rust, etc.).

(c) A further increased weld deposition rate with some reduction in weld spatter. The spatter reduction reduces the torch

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maintenance factor (i.e. minimizes the frequency of need to clean accumulated spatter from the torch contact tip area).

(3) Use of the Lincoln LN-22 or equivalent electrode/wire feeder. Advantages are the equipment is specifically designed for flux core electrode and the feed drive motor runs on the welding current/voltage. The latter feature eliminates the need for a separate 115 volt power supply to drive the wire feed motor as required for most conventional electrode wire feeders. The elimination of the need for the shielding gas and a separate 115V supply makes the portability nearly equivalent to the SMA (i.e. covered electrode) process.

b. Weld Cleaning. Use air driven needle guns for weld cleaning. Advantages are rapid and more complete cleaning of weld slag and oxide/scale. A thoroughly cleaned weld will provide added assurance that the welder will visually detect weld flaws and/or inconsistencies and fix them as a part of the in process welding operation. This approach should minimize rework to repair leaks. An alternative would be to use vacublast equipment with angular steel grit for weld area and weld deposit cleaning.

c. Welding Technique/Procedures. Train and/or test welders in the procedure and technique they will be using on the job. This should include fillet welding vertically down and horizontally on 1/4 inch thick patch plates and vertical down, horizontal and overhead position fillet welds of encapsulation cans to 1/4 inch thick plate. Advantages to be realized would be improved welder performance and weld quality on the job with a reduced possibility of weld flaws/leaks.

d. Upper Dome Welds. Require encapsulation/canning of the upper dome backing straps/welds as a standard procedure in lieu of the backing strap seal welding option currently in the contract. Require that the canning weld area be cleaned, preferably by blasting to bright metal, prior to fitting and welding the canning. An alternate that could be considered is vacublasting the weld area after fitting/tack welding the canning. This could be done immediately prior to welding. The only concern would be trapping steel grit in the faying area of the canning/dome plating. Excessive amounts of angular steel blasting grit trapped in an area where it could be incorporated in the molten weld deposit could raise the carbon content of the weld and cause cracking (i.e. steel blasting grit is normally high in carbon content). Weld tests should be conducted to check this factor. Require that canning welds be tested by introducing continuous air pressure behind the canning and using a bubble solution to test. Canning sections could be predrilled (i.e. approx 1/4 inch hole) for introducing the air for testing. Air introduction could be done with a rubber molded air hose nozzel that is inserted in the predrilled hole. Air flow/volume should

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be such that a 3-10 pound positive pressure is established within the encapsulation volume. The predrilled hole could be closed by plug welding. Advantages to be realized are:

(1) A standardized procedure that can be preplanned for efficiency from tank to tank.

(2) Improved welding conditions (i.e. minimum potential for oil or other weld contamination with attendant weld defects) which would expedite welding with minimized weld defects/leaks.

(3) Expedited weld testing with increased assurance that all weld defects/leaks will be found and the completed/tested welds will be defect free. It should be noted that continuous air pressure bubble testing will find both large and small leaks vice vacuum testing where the pressure differential (i.e. delta P) dictates the size flaw detected.

e. Magnetic Particle Inspection (M.T.). The purpose of the M.T. inspection is not apparent. If there is an indication, the presence of a leak is verified by vacuum box testing. Repair is accomplished with a doubler patch plate. It is suggested that the purpose served by the M.T. Inspection be reevaluated. If it is considered that a purpose is served it is suggested that yellow or white M.T. powder be used. The lighter colors would provide improved ability to detect flaws under the tank interior lighting/background conditions.

4. The above recommendations/suggestions are provided as requested. If further service can be provided or additional information on the recommendations/suggestions is desired, please contact Welding Engineering Division, MINSY. Autovon 252-2415/2276 or Commercial-Area Code 707-646-2276/2415.

[redacted]

By direction

Copy to:
CICC, Pearl Harbor, Hawaii
PACDIV, Code 04 ([redacted])
ROICC, Pearl
AREICC, Pearl
NAVFAC, Code 04B4 ([redacted])

AGENDA

24 April 1981

0800 Meet at ROICC PEARL

0900 Kick-off Briefing — OICC MID PAC
- OICC MIDPAC Remarks
- Conference Overview
- Project Brief
  - Description/Status
  - Design/Repair Concepts
  - Contract Procedures
  - Problems

1030 Visit Red Hill Tanks

1230 LUNCH

1330 Working Sessions/Visit to RED HILL Tanks

A. Review/Investigation Tank Repair Procedures

(1) Brush Blast
(2) Cleaning
(3) Inspection
(4) Weld Repairs
  (a) Upper Dome - Backer Strips
    -Seal Weld
    -Encapsulation - of Flange
      Cleaning, Wire Brush
  (b) Barrel
  (c) Lower Dome
  (d) Attachments
(5) Testing
  (a) Visual
  (b) Dye Penetrant
  (c) Magnaflux
  (d) Vacuum
  (e) Helium
(6) White Metal Blast
(7) Coating
  (a) Brush Prime Visual Inspection
  (b) Holiday Testing
  (c) Coating Materials
(8) Tank Serviceability
  (a) Methods to Determine and to Locate Leaks.
  (b) Measurement Problems
  (c) Temperature Change

Enclosure (1) to MINS ltr
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1 May 1981

B. Jobsite Interviews

(1) Government Inspectors/CMEs
(2) Contractor Personnel
    (a) CQC Staff
    (b) Project Superintendent
    (c) Trade Foreman -
        Welding
        Coating

25 April 1981

0800 - 1600 Continuous RED HILL Visits

Tank Inspections
7 - Leak Repairs
13 - White Metal Blast, Coating
15 - Weld Repairs - Upper Dome + Barrel
16 - Brush Blast, Existing Conditions

26 April 1981

0900 Further Jobsite Visit
(As Required)

27 April 1981

0800 - 1200 Working Session OICC MID PAC

1200 - 1600 Summarize Recommendations

28 April 1981

0800 Conference with Contractor OICC MID PAC