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A REMOTE WELDING TECHNIQUE FOR HIGH EXPLOSIVES CONTAINERS

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ABSTRACT

Samples of high explosives for environmental testing have been successfully enclosed in all-welded assemblies. Proper container design, fixturing, welding power supply, and welding parameters ensure the safe, timely completion of the task.

INTRODUCTION

High costs associated with the machining and fabrication of conventional containers for compatibility experiments stimulated a search to develop different techniques. The all-welded container is a result of these studies.

Samples of high explosives for environmental testing have been successfully enclosed in welded assemblies. The design and welding technique allow the containers to be reused several times. The atmosphere in the containers can be sampled as required either by attaching a valve or by using a pinch-seal tube. Proper container design, fixturing, welding power supply, and welding parameters ensure the safe, successful completion of the task. Figure 1 shows some all-welded compatibility experiments in an oven.

The containers are 127 mm (5 in.) diameter and have various lengths. Different types of containers are shown in Fig. 2. The containers are made from 1 mm and 1.7 mm (0.040 in. and 0.065 in.) welded-wall Type 304, 316 or 321 stainless-steel tubing. The tubing is cut to length, and the ends are flared to give a 21 mm (13/16 in.) wide flange on each end. The flanging die set is shown in Fig. 3. End caps are made from 1.7 mm or 2.4 mm (1/16 in. or 3/52 in.) flat stock blanked out of sheets.

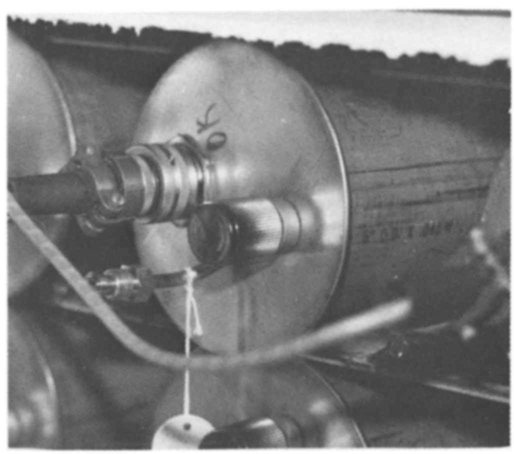

Figure 1

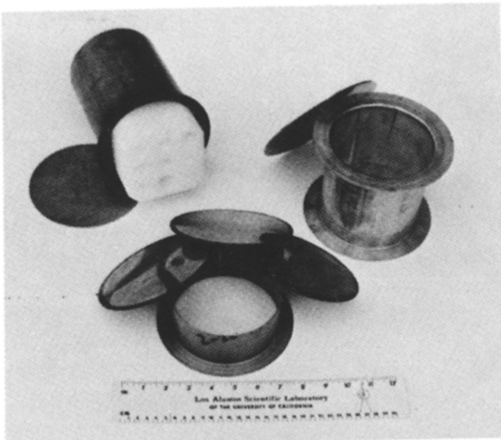

Figure 2

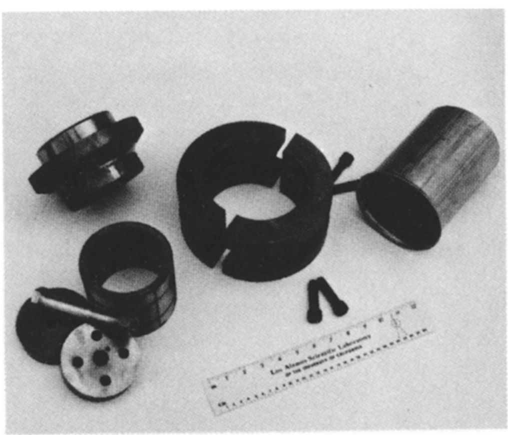

Figure 3

The welding fixture, shown in Fig. 4, is a rotary table modified for added stability and remote operation. The joints are melt-down welds and require no filler rod. The torch is positioned 15° from vertical and is perpendicular to the horizontal axis of rotation. A Linde Model HW-17 air-cooled torch is positioned by a roller follower to maintain correct electrode location relative to the weld joint.

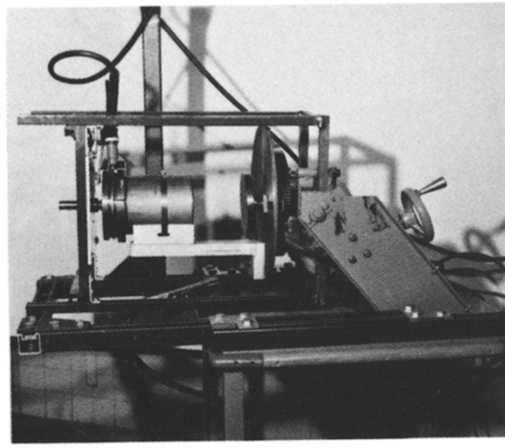

Figure 4

The welding power supply is shown in Fig. 5. It is a Miller Gold Star Model A/BP. The machine is run in the DC straight-polarity mode. The amperage control is set at the "local" position, and the contactor control is set at the "remote" position. A Varian Model G10 recorder records the welding amperage as a function of time to ensure the reproducibility of weld conditions. The welding torch and ground cables are run through the shield wall between the

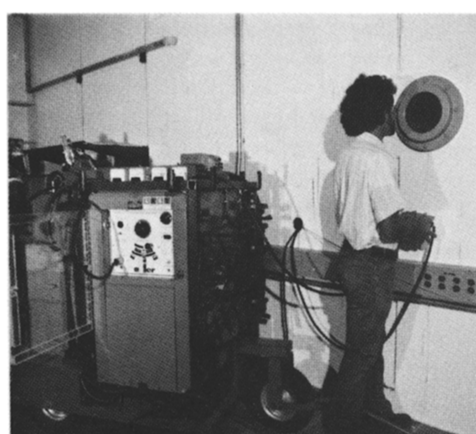

Figure 5

operator and operations area. The operator watches the welding operation through the viewing port, using a mirror. The building in which the welding operation is located is designed to protect the operator from an accidental detonation. The welding power supply is locked out when the operator is in the operations room. The remote welding contactor switch is interlocked so that the welding fixture must be rotating before the torch can be turned on.

Copper chill blocks are used to minimize heat conduction into the walls of the container. The chill blocks are designed to provide uniform cooling of the weld joint. As an added safety precaution, they are large enough to handle the point deposition of heat from an entire weld cycle if the fixture fails to rotate. Polyethylene inserts (Fig. 2) are used when possible to isolate the experiment from contact with the metal container.

Test welds are made and temperature profiles along the inner surfaces of the containers are measured to determine the maximum temperature to which the contents of the container can be exposed. A welding procedure is developed for each specific assembly, based on the results of these tests. The procedure must be approved by the experimenter, the welding engineer, and an independent group safety expert. A sample LASL WX-2 welding procedure is shown in Fig. 6.

Container lids are designed with a valve, pinch-tube or electrical connectors as required, depending on the type of test. Pinch-tube welding is shown in Fig. 7.

The containers are opened in the inert glove box shown in Fig. 8, using a modified Fein nibbler. The weld is uniformly nibbled away so that the container may be reused.

This seal-welding has developed into a production method that promises to reduce the cost of compatibility tests. About 70% of the containers welded are sealed with one welding pass. Twenty-five per cent require two weld passes (note that the weld and chill blocks must be cool before the second pass). The remaining five per cent require additional passes to obtain a leak-tight seal.

The need for repeated welding passes, to obtain a leak-tight seal can be attributed to poor fit-up of the pieces, misalignment of the torch, and misadjustments during the welding setup.

Problems with poor fit-up have been solved by requiring more uniform flanges and lids. The roller follower has been modified to eliminate riding up on the flange and bending of the guide pins that have caused weld skip in the past.

The welded container makes the environmental testing of explosives considerably cheaper. Assembly of the experiments is fairly fast, reliable, and safe. Future work will be directed toward improving the flanging dies and speeding up production.

BIOGRAPHY

Richard A. Hildner graduated with a BSME in 1967. Mr. Hildner worked for Battelle Northwest on nuclear reactor experimental thermal hydraulics. When WADCO (later known as Westinghouse Hanford Co.) took over the Fast Flux Test Facility in 1970, Mr. Hildner went to work for Test Engineering and Expediting as a project engineer, testing materials for use in fast flux reactor

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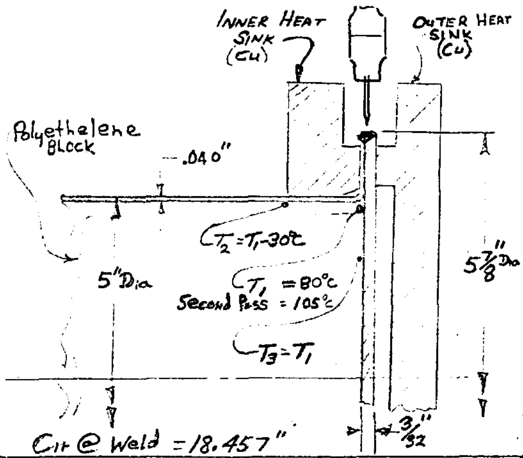
GROUP WX-2

PROCEDURE NO. WX-2-1

W E L D I N G   P R O C E D U R E

REMOTE GAS TUNGSTEN ARC WELDING PROCESS



BASE MATERIAL & FORM 304, 316 or 321 SST - Matt Down
NO. PASSES As req'd but must have 5 minutes cool ...
ELECTRODE MATERIAL & DIA. W-2% Th 3/32 dia
HEAT TREAT. None
FIT-UP METHOD Spring loaded heat sink
COLLET SIZE NA
WELD POSITION Vertical
GAS & FLOW RATE (CFH)
SHIELD 15
PURGE None
LAP-OVER 30° (time x 1.08)
TYPE BACKING Cu Heat Sinks
ARC LENGTH .040 to .063 ELEC. LENGTH 3/8" post cup
GAS CUP SIZE No 7 Gas Lens
WELDING CURRENT & POLARITY 110/115 Amps DC Straight
WELDING MACHINE NO. Miller Gold Star No 223...
WELDING HEAD NO. Linde HW-17
ELECTRODE TIP ANGLE 8 to 10°
ELECTRODE TIP DIAMETER .015 to .025
ADDTIONAL REMARKS: Must Cool between passes 5 minutes. Leave on Heat Sinks 2 minutes. Cool heat sinks with H_2O before ...

CONTAINER DRAWING NUMBER	JOINT ASSEMBLY NUMBER	DATE	WELDING OPERATOR
27Y-196049	1	5/23/77	Herman Roybal
EXPERIMENT DRAWING NUMBERS	**TYPES OF EXPLOSIVES**	**DATE**	**EXPERIMENTER**
13Y-107384-C-1 27Y-196061-D1	X0298	5/26/77	Dan Loughran

PROCESS VALUES

PRE-PURGE TIME, SEC	None	FIXTURE SPEED, RPM	1.15 rev/min
INITIAL CURRENT, AMP	105 (70%)	FIXTURE SPEED TIME, SEC.	52 (/rev)
WELD CURRENT, AMP	110/115 (20%)	HIGH FREQUENCY	Start
WELD CURRENT RANGE, AMP	10-160	HIGH FREQUENCY LEVEL, %	100
POST PURGE TIME, SEC	15 sec	ARC VOLTAGE	10
WELD TIME, SEC	57	ARC START METHOD	Manual Remote

THIS PROCEDURE MUST BE REVIEWED BY THE EXPERIMENTER, AND THE WELDING ENGINEER

PREPARED BY: R.A. Hildner

PROCEDURE NO. WX-2-1

TOTAL NO. OF ASS'Y THIS ORDER: 36

WELDING SOP NO. 9.1

WELDING AESOP NO. (IF APPLICABLE) 135

EXPERIMENT SOP NO. 7.1

EXPERIMENT AESOP NO. (IF APPLICABLE) Addum 9 (Addium)

APPROVED TO WELD:
EXPERIMENTER [illegible] DATE: 5/27/77
WELDING ENGINEER [illegible] DATE: 5/26/77
1234 5/26/...

Figure 6

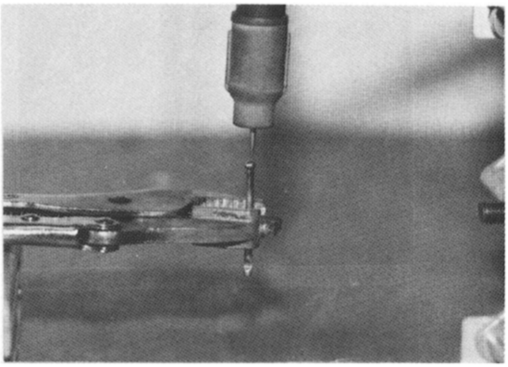


Figure 7

environments. Mr. Hildner joined the Los Alamos Scientific Laboratory in 1973 as a staff member, working on a Transuranic Waste Incineration system. Later he joined Group WX-2 at LASL as group mechanical engineer responsible for special devices used in the synthesis and testing of explosive and weapon components.

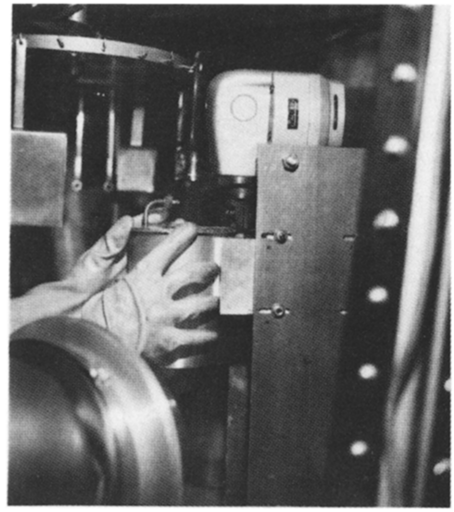


Figure 8