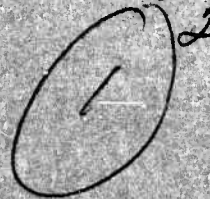


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640/90

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# WATERTOWN ARSENAL LABORATORY

## EXPERIMENTAL REPORT

NO. WAL. 640/90

### WELDING OF ARMOR

Summary of Ballistic Shock Test Results on  
1/2, 3/8, and 1/4 Inch Thick Homogeneous Armor "H" Plates Welded with  
Austenitic Electrodes and Tested at Aberdeen Proving Ground  
during the Period from 1 October 1942 through 31 March 1943

BY

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Experimental Report

No. WAL. 640/90

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Watertown Arsenal Laboratory  
Report Number WAL 640/90  
Problem D-3.2

17 November 1943

WELDING OF ARMOR

Summary of Ballistic Shock Test Results on  
1/2, 3/8, and 1/4 Inch Thick Homogeneous Armor "H" Plates  
Welded with Austenitic Electrodes and Tested at  
Aberdeen Proving Ground during the Period from  
1 October 1942 through 31 March 1943

OBJECT

To tabulate firing record data for subject plates and to present a comparison of ballistic shock performance of plates made with various materials and welding procedures.

SUMMARY

1. Data from Aberdeen Proving Ground firing records for 99 welded armor H plates have been tabulated on accompanying charts and tables.
2. Quality of armor plate appears to be the most significant variable for the three thicknesses of plate included in the tabulation.
3. There is little difference in ballistic shock test results between plates welded with the manganese and with the molybdenum modified type of austenitic electrodes. No significant trends for decreased weld cracking during ballistic testing are apparent for any of the variations in joint preparation or welding procedure.

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## INTRODUCTION

On the accompanying charts (Appendix A) are tabulated data taken from firing records representing qualification and development tests of 99 H plates. The tabulation includes all firing records received by this arsenal for H plates assembled from 1/2, 3/8, and 1/4 inch thick homogeneous armor by welding with austenitic electrodes and fired at Aberdeen Proving Ground during the period from 1 October 1942 through 31 March 1943.

Previous reports (WAL 640/84 and 640/89) have summarized ballistic test results for 1-1/2, 1, and 3/4 inch cast and rolled homogeneous armor H plates welded with austenitic electrodes and tested at Aberdeen Proving Ground during the same period as that covered by this report. An earlier report (WAL 640/73) dealt with 1-1/2 and 1 inch thick armor H plates welded with ferritic electrodes and tested at Aberdeen Proving Ground prior to 25 February 1943.

An index to fabricators, armor manufacturers, and electrode manufacturers is given in Table I. A summary of ballistic shock test specification requirements for H plates welded with austenitic electrodes and a key to the tabulation methods and symbols used in this report are included in Appendix A.

## GENERAL COMMENTS

Ballistic performance of H plates is best evaluated by amount of cracking for each round, but the cracking is influenced by the variables in the ballistic test as well as those introduced by the materials and welding procedure. The majority of the plates included in this tabulation were tested with a 37 mm., high explosive, projectile. This projectile is fired at a velocity which would result in a complete penetration of the plate if the high explosive charge in the projectile did not detonate before this happened. The use of higher velocities permits greater accuracy of firing. The energy delivered to the plate by the high explosive charge produces a considerable area of plate deformation without piercing the plate.

Lighter gages of plate are able to bow or deform more on projectile impact than 1 inch and heavier plates, so that the shock wave is probably dissipated more generally and the test is therefore somewhat less critical in showing up certain types of weld defects than for the heavy plates.

Table II shows the average plate and weld cracking in terms of variations in the conditions of ballistic testing. If the distance from the center of the impact to the center of weld is greater than 1-3/4 inches, the impact is not considered as a fair test of the weld.

In the summary tables that follow, the number of rounds outside the specification limit for velocity and location will be listed under remarks, and should be taken into consideration in comparing



effects of armor and welding variables. The effect of including these rounds in the averages is to lower the average cracking, but since a considerable amount of cracking was caused by unfair rounds, and since the proportion of fair to unfair rounds was approximately the same for any group of plates, the averages as shown appear to be suitable for indicating the more obvious effects of welding materials and procedures on ballistic performance. Cracking within 1/8 inch of the weld is included as weld cracking and the remainder as plate cracking. Inasmuch as virgin armor would not ordinarily develop cracking under the same testing conditions as those used for the H plate, and since development of plate cracking materially decreases the severity of the test on welds, it is necessary to consider plate cracking in evaluating performance of welded H plates.

#### HAND WELDED, 1/2 AND 3/4 INCH THICK ROLLED ARMOR H PLATES

Tables III through XIV show comparisons of average cracking per round for all the plates included in this tabulation in terms of welding fabricator, armor manufacturer and processing, electrode data, joint design, welding procedure, and radiographic soundness.

#### Fabricators - Tables III and IX

The performance of H plates welded by any one fabricator must be evaluated in terms of armor and electrodes used, as well as the welding procedure and inspection control.

#### Armor Data - Tables IV and X

The 1/2 inch plates include both machineable homogeneous and hard homogeneous armor. Since the two types overlap and a number of the plates could qualify as either type, all have been grouped together for this tabulation.

With the exception of two 3/8 inch thick, high carbon-manganese plates which cracked badly, no correlation is evident between chemical composition of the armor plate and ballistic performance. A high ratio of plate to weld cracking for some of the armor types is indicative of poor steel quality (cleanliness and directional properties). Previous tabulations (WAL 640/84) have shown that this variable may also affect amount of weld cracking.

Plate and weld cracking tend to increase with hardness of armor plate unless there has been a commensurate improvement in steel quality. The Ingersoll Steel 1/2 inch thick plates are an example of relatively good plate performance at high hardness level.

#### Electrodes - Tables V and XI

Firing record data on electrode compositions and coatings very frequently were incomplete or questionable. When an electrode was used on a small number of plates, the average weld cracking may have

been influenced unduly by other factors. There is little difference in ballistic performance between plates welded with Mn-Mo modified (weld analysis at least 1% Mn and .2% Mo) austenitic electrodes, and those with Mn modified (weld analysis at least 1% Mn and no Mo) austenitic electrodes.

#### Joint Design - Tables VI and XII

Double V joint preparation with 60° or 90° included angle appears superior to single V joints with 45° or 60° included angle for 1/2 inch plate, but a single V with 60° included angle is slightly superior for 3/8 inch plate. Root gap does not appear to be an important variable for these plates. The use of a copper backup strip appears advantageous for 1/2 inch plates, but not for the 3/8 inch plates.

#### Welding Procedure - Tables VII and XIII

The majority of both groups of plates were welded with 3 passes. Increase in number of passes for either the single or double V joint preparation does not correlate with any definite trend in ballistic performance.

The use of a combination of weaves and beads with multiple crown deposit appears more desirable than a full weave technique for the 1/2 inch plates, but a straight weave technique was quite satisfactory for 3/8 inch thick plates. Nine 1/2 inch plates with a single V bevel were welded with the first pass deposited from the back of the joint against a round brass backup bar. The welding of these plates was then completed from the front. All remaining single V plates employed a seal bead. Average weld cracking in the ballistic test is slightly less for the plates welded with a seal bead.

A preheat of 250° F. was used during welding of 14 of the 1/2 inch thick H plates. All remaining plates were welded with initial plate temperature between 70° and 110° F. No improvement in average weld cracking is shown for these preheated plates.

Although radiographic unsoundness is usually associated with increased weld cracking during the ballistic test, these two groups of plates show greater weld cracking for the plates which passed radiographic inspection than for those which failed, indicating that other factors were of greater importance for these particular plates.

#### HAND WELDED, 1/4 INCH THICK ROLLED ARMOR H PLATES

Seven H plates were welded with 1/4 inch thick rolled homogeneous armor plate (Charts Nos. 36 - 39). Four of the plates were tested with the 37 mm. H.E. M-54 projectile, and three plates with the 20 mm. H.E.1 MK.1 projectile. A high proportion of plate cracking was developed during ballistic testing for two of the four armor compositions used, indicating the importance of steel quality. No comparison of welding variables is possible for the limited number of plates. No preheating was used and all plates passed radiographic inspection.

TABLE 1

Index to Plates

Hand Welded 1/2 Inch Thick H Plates

| <u>Chart No.</u> | <u>No. of Plates</u> | <u>Fabricator</u>       | <u>Armor Mfr.</u>                             | <u>Electrode Mfr.</u>       |
|------------------|----------------------|-------------------------|---|-----------------------------|
| 1                | 1                    | American Car & Fdry.    | Jones & Laughlin                              | McKay                       |
| 2-3              | 4                    | American Locomotive     | Great Lakes<br>Youngstown<br>Follansbee       | Alloy Rods<br>Harnischfeger |
| 4-5              | 5                    | Buick                   | Youngstown<br>Great Lakes                     | Alloy Rods<br>Harnischfeger |
| 6                | 3                    | Ford                    | Ford  | Crucible<br>Arcos           |
| 7                | 2                    | General Motors          | Youngstown<br>Great Lakes<br>Jones & Laughlin | Lincoln Electric<br>McKay   |
| 8-13             | 18                   | Harmon-Herrington       | Great Lakes<br>Ingersoll                      | McKay                       |
| 14               | 3                    | So. Calif. Div. of G.M. | Great Lakes                                   | Page-Allegheny<br>McKay     |

Hand Welded 3/8 Inch Thick Rolled Homogeneous H Plates

|       |    |                      |  |  |
|-------|----|----------------------|--|--|
| 15    | 1  | American Car & Fdry. | Jones & Laughlin   | McKay  |
| 16    | 2  | Buick                | Republic   | Alloy Rods                                       |
| 17-29 | 36 | Chevrolet            | Chevrolet Forge<br>Great Lakes<br>Youngstown<br>Jones & Laughlin<br>E. C. Atkins | Crucible<br>Alloy Rods<br>Harnischfeger<br>McKay |
| 30    | 2  | Deere & Co.          | Standard Steel<br>Jones & Laughlin   | Lincoln Electric<br>Crucible                     |

TABLE 1 (cont.)

| Chart No.   | No. of Plates | Fabricator | Armor Mfgr.                                   | Electrode Mfgr.                               |
|---|---------------|------------|---|---|
| 31-35   | 15            | Ford       | Ford  | Crucible<br>Hollup<br>Arcos<br>Page-Allegheny |
| <u>Hand Welded 1/4 Inch Thick Rolled Homogeneous H Plates</u> |               |            |   |   |
| 36-37   | 4             | Buick      | Youngstown<br>Great Lakes<br>Jones & Laughlin | Alloy Rods<br>Harnischfeger                   |
| 38-39   | 3             | Ford       | Ford  | Crucible                                      |



TABLE II a

Ballistic Severity Table for 1/2 Inch Thick Rolled Homogeneous Armor H Plates

| Vel. f/s                         | 1st Round     |                           | 2nd Round     |                           | 3rd Round     |                           |
|----------------------------------|---------------|---------------------------|---------------|---------------------------|---------------|---------------------------|
|                                  | No. of Rounds | Average Cracking (Inches) | No. of Rounds | Average Cracking (Inches) | No. of Rounds | Average Cracking (Inches) |
| 1- $\frac{3}{4}$ "*<br>2600      | 8             | 3.5                       | 8             | 8.5                       | 8             | 11.1                      |
| 1- $\frac{3}{4}$ " - 3"*<br>2600 | 3             | 1.8                       | 5             | 0                         | 2             | 0.4                       |
| over 3"*<br>2600                 | 7             | 0                         | 4             | 0                         | 3             | 0.7                       |
| 1- $\frac{3}{4}$ "*<br>2600      | 2             | 0                         | 4             | 0                         | 3             | 0.7                       |
| 1- $\frac{3}{4}$ "-3"*<br>2600   | 2             | 0                         | 4             | 0                         | 3             | 0.7                       |
| over 3"*<br>2600                 | 2             | 0                         | 4             | 0                         | 3             | 0.7                       |

Projectile 37 MM HE M-54

| 4th Round     |                           | 5th Round     |                           |
|---------------|---------------------------|---------------|---------------------------|
| No. of Rounds | Average Cracking (Inches) | No. of Rounds | Average Cracking (Inches) |
| 8             | 9.8                       | 8             | 7.9                       |
| 5             | 0                         | 2             | 0.6                       |
| 4             | 0                         | 0             | 0                         |
| 2             | 0.6                       | 0             | 0                         |
| 2             | 0                         | 1             | 0                         |

\*Distance from center of impact to center of weld

TABLE II b

Ballistic Severity Table for 1/2 Inch Thick Hard Homogeneous Armor H Plates

| Vel. f/s    | 1st Round     |                            | 2nd Round     |                             | 3rd Round     |                             | Av. Weld Cracking (Inches) |
|-------------|---------------|----------------------------|---------------|-----------------------------|---------------|-----------------------------|----------------------------|
|             | No. of Rounds | Av. Weld Cracking (Inches) | No. of Rounds | Av. Plate Cracking (Inches) | No. of Rounds | Av. Plate Cracking (Inches) |                            |
| 1-3/4**     |               |                            |               |                             |               |                             |                            |
| 2100        | 2             | 0                          | 5.5           | 0                           | 14.8          |                             |                            |
| 2300        | 6             | 1.2                        | 9.9           | 1.3                         | 9.5           | 6                           | 13.3                       |
| 2600        |               |                            |               |                             |               |                             |                            |
| 1-3/4 - 3** |               |                            |               |                             |               |                             |                            |
| 2100        | 2             | 0                          | 0             | 0                           |               | 1                           | 0                          |
| 2300        | 1             | 0                          | 0             |                             |               | 1                           | 0                          |
| 2600        | 3             | 2.3                        | 2.9           | 1.4                         | 3.1           | 1                           | 0.8                        |
| over 3**    |               |                            |               |                             |               |                             |                            |
| 2100        | 1             | 0                          | 0             | 0                           | 0             | 1                           | 0                          |
| 2300        |               |                            |               |                             |               |                             |                            |
| 2600        | 3             | 0                          | 0             | 0                           | 0             | 1                           | 0                          |

Projectile 37 M. H3 1-54

\*\*Distance from center of impact to center of weld

TABLE II b (Cont.)

| Vel. f/s                 | No. of Rounds | 4th Round                   |                            | No. of Rounds | 5th Round                   |                            |
|--------------------------|---------------|-----------------------------|----------------------------|---------------|-----------------------------|----------------------------|
|                          |               | Av. Plate Cracking (Inches) | Av. Weld Cracking (Inches) |               | Av. Plate Cracking (Inches) | Av. Weld Cracking (Inches) |
| Projectile 37 MA EE M-54 |               |                             |                            |               |                             |                            |
| 1-3/4*                   | 1             | 0                           | 8.0                        |               |                             |                            |
| 2300                     |               |                             |                            | 2             | 0                           | 10.3                       |
| 2600                     | 5             | 1.2                         | 7.1                        |               |                             |                            |
| 1-3/4 - 3"*              |               |                             |                            |               |                             |                            |
| 2300                     | 1             | 1.0                         | 9.0                        | 1             | 7.0                         | 13.3                       |
| 2600                     |               |                             |                            |               |                             |                            |

\*Distance from center of impact to center of weld





TABLE II c (Cont.)

| Vel. f/s   | 4th Round     |                           | 5th Round     |                           | 6th Round     |                           |
|------------|---------------|---------------------------|---------------|---------------------------|---------------|---------------------------|
|            | No. of Rounds | Average Cracking (Inches) | No. of Rounds | Average Cracking (Inches) | No. of Rounds | Average Cracking (Inches) |
| 1-3/4"     | 9             | 1.1                       | 1             | 1.0                       | 0             | 1.0                       |
| 2100       | 1             | 0                         |               |                           |               |                           |
| 2300       |               | 13.5<br>14.3              |               |                           |               |                           |
| 1-3/4 - 3" | 2             | 0                         | 2             | 0                         | 1             | 0                         |
| 2100       |               |                           |               |                           |               |                           |
| 2300       |               |                           |               |                           |               |                           |
| over 3"    |               |                           | 1             | 0                         | 0             |                           |
| 2100       |               |                           |               |                           |               |                           |
| 2300       |               |                           |               |                           |               |                           |

Projectile 77E HE M-54

\*Distance from center of impact to center of weld

TABLE II d

Ballistic Severity Table for 1/4 Inch Thick Rolled Homogeneous Armor H Plates

| Vel. f/s                  | 1st Round                          |                        | 2nd Round                          |                        | 3rd Round                          |                        | 4th Round                          |                        |
|---------------------------|------------------------------------|------------------------|------------------------------------|------------------------|------------------------------------|------------------------|------------------------------------|------------------------|
|                           | Fo. of Av. Plate Cracking (Inches) | No. of Rounds Cracking | Fo. of Av. Plate Cracking (Inches) | No. of Rounds Cracking | Fo. of Av. Plate Cracking (Inches) | No. of Rounds Cracking | Fo. of Av. Plate Cracking (Inches) | No. of Rounds Cracking |
| 1-3/4"*                   | 0                                  | 4                      | 8.3                                | 9.4                    | 0                                  | 36.0                   |                                    |                        |
| 1800                      | 2                                  | 0                      |                                    |                        |                                    |                        |                                    |                        |
| 1-3/4 - 3"*               | 0                                  | 3.4                    |                                    |                        |                                    |                        |                                    |                        |
| 1500                      | 2                                  | 0                      |                                    |                        |                                    |                        |                                    |                        |
| Projectile 37 MM HEI M-54 |                                    |                        |                                    |                        |                                    |                        |                                    |                        |
| Projectile 29 MM HEI MK1  |                                    |                        |                                    |                        |                                    |                        |                                    |                        |
| 1-3/4"*                   | 0                                  | 1                      | 4.8                                | 0                      | 1                                  | 4.3                    | 0.5                                | 3.0                    |
| 1500-1600                 | 1                                  | 1                      | 0                                  | 0.8                    | 1                                  | 4.3                    | 6.5                                | 0                      |
| 1500-1700                 | 1                                  | 1                      | 0                                  | 0                      | 1                                  | 0                      | 7.5                                | 0                      |
| 1700-1800+1               | 1                                  | 1                      | 0                                  | 0                      | 2                                  | 2.4                    |                                    |                        |
| 1-3/4 - 3"*               | 4.8                                | 0                      |                                    |                        |                                    |                        |                                    |                        |
| 1500-1600                 | 1                                  |                        |                                    |                        |                                    |                        |                                    |                        |
| 1600-1700                 |                                    |                        |                                    |                        |                                    |                        |                                    |                        |
| 1700-1800                 |                                    |                        |                                    |                        |                                    |                        |                                    |                        |

\*Distance from center of impact to center of weld

TABLE II d (Cont.)

| Vel. f/s   | 5th Round  |  | 6th Round  |  | 7th Round  |  | 8th Round  |  |
|------------|--|--|--|--|--|--|--|--|
|            | No. of Av. Flate Av. Weld Rounds Cracking (Inches) | No. of Av. Flate Av. Weld Rounds Cracking (Inches) | No. of Av. Flate Av. Weld Rounds Cracking (Inches) | No. of Av. Flate Av. Weld Rounds Cracking (Inches) | No. of Av. Flate Av. Weld Rounds Cracking (Inches) | No. of Av. Flate Av. Weld Rounds Cracking (Inches) | No. of Av. Flate Av. Weld Rounds Cracking (Inches) | No. of Av. Flate Av. Weld Rounds Cracking (Inches) |
| 1-3/4**    |  |  |  |  |  |  |  |  |
| 1500-1600  |  |  |  |  |  |  |  |  |
| 1600-1700  | 1  | 0  | 0  | 0  | 1  | 6.5  | 0  | 1  |
| 1700-1800+ | 1  | 0  | 0  | 0  | 1  | 6.5  | 0  | 1  |
| 1-3/4-3**  |  |  |  |  |  |  |  |  |
| 1600-1700  |  |  | 1  | 5.8  | 0  |  |  |  |
| over 3**   |  |  | 1  | 0  | 0  |  |  |  |
| 1700-1800+ |  |  |  |  |  |  |  |  |

Projectile 20 M. E. I. M. K. I.

\*Distance from center of impact to center of weld

TABLE III

Fabricators of Hand Welded 1/2 Inch Thick Armor H Plates

| <u>Fabricators</u>                 | <u>No. of Plates</u> | <u>No. of Rounds</u> | <u>Av. Weld Crk/rd</u><br>(Inches) | <u>Av. Plate Crk/rd</u><br>(Inches) | <u>Remarks</u>   |
|------------------------------------|----------------------|----------------------|------------------------------------|-------------------------------------|--|
| Am. Car & Fry.                     | 1                    | 4                    | 3.0                                | 0                                   | 2 rds. outside 1 3/4" limit                              |
| Am. Locomotive                     | 4                    | 12                   | 6.5                                | 1.5                                 | 6 rds. outside 1 3/4" limit                              |
| Buick Motor                        | 5                    | 11                   | 6.5                                | 7.6                                 | 4 rds. outside 1 3/4" limit                              |
| Ford Motor                         | 3                    | 10                   | 5.7                                | 1.1                                 | 5 rds. outside 1 3/4" limit                              |
| General Motors                     | 2                    | 6                    | 1.2                                | 0                                   | 2 rds. outside 1 3/4" limit                              |
| Harmon-<br>Herrington Co.          | 18                   | 56                   | 6.4                                | 1.2                                 | 24 rds. outside 1 3/4" limit<br>11 rds. below spec. vel. |
| So. Cal. Div. of<br>General Motors | 3                    | 10                   | 1.2                                | 2.5                                 | 7 rds. outside 1 3/4" limit                              |



TABLE IV

Armor Data for Hand Welded 1/2 Inch Thick Rolled Armor E Plates

| Mfr.                    | Type                         | Chemical Composition   | Heat Treatment<br>Hrs. Hold | Quench             | BHN    | No. of Plates | No. of Rds. | AV. Crkz. / Rd.<br>Weld Plate<br>(Inches)(Inches) | Remarks |     |                              |
|-------------------------|------------------------------|--|-----------------------------|--------------------|--------|---------------|-------------|---|---------|-----|------------------------------|
| Follansbee<br>Steel Co. | III<br>In-Mn                 | .24 C  | 1640                        | 1                  | Water  | 350-          | 1           | 3   | 3.2     | 4.9 | 1 rd. outside 1 3/4" limit   |
|                         |                              | 1.48 Mn<br>.19 Si<br>.15 Cr<br>.50 Mo  | 980                         | 1                  | Air    | 352           |             |   |         |     |                              |
| Ford                    | II<br>Mn-Cr-<br>Mo           | .27 - .28 C  | 1650                        | 2                  | Platen | 341           | 3           | 10  | 1.1     | 5.6 | 5 rds. outside 1 3/4" limit  |
|                         |                              | .88 - 1.34 Mn<br>.24 - .28 Si<br>.46 - 1.95 Cr<br>.42 - .44 Mo               | 975                         | 3 1/4 - 4-1/2      | Air    |               |             |   |         |     |                              |
| Great<br>Lakes          | IV<br>Mn-Cr-<br>Mo-Si        | .29 - .33 C  | 1600-                       | 1/2-               | Water  | 320-          | 16          | 45  | 6.4     | 1.9 | 23 rls. outside 1 3/4" limit |
|                         |                              | .83 - .97 Mn<br>.68 - .80 Si<br>.53 - .75 Cr<br>.15 - .24 Mo<br>.07 - .11 Zr | 1700<br>650-<br>1000        | 2-1/4<br>1/2-<br>2 | Air    | 413           |             |   |         |     |                              |
| Ingersoll<br>Steel      | VI<br>Mn-Si-<br>Cr-Ni-<br>Mo | .29 - .30 C  | 1600                        | 1/2 - 1-1/2        | Water  | 363-          | 6           | 24  | 4.3     | 0.3 | 9 rds. outside 1 3/4" limit  |
|                         |                              | .75 - .95 Mn<br>.80 - .87 Si<br>.83 - 1.02 Cr<br>1.02 Ni<br>.43 - .45 Mo     | 900-<br>1000                | 1-<br>2            |        | 402           |             |   |         |     |                              |

TABLE IV (Cont.)

| Mfr.                        | Type      | Chemical Composition         | Heat Treatment |        | No. of Plates | No. of Eds. | Av. Crkg./Rd. Weld Plate (Inches) | Remarks                     |
|-----------------------------|-----------|------------------------------|----------------|--------|---------------|-------------|-----------------------------------|-----------------------------|
|                             |           |                              | Hrs. Hold      | Quench |               |             |                                   |                             |
| Jones & Laughlin            | III Mn-Mo | .25 C                        | 1              | Water  | 1             | 4           | 3.0                               | 2 rds. outside 1 3/4" limit |
|                             |           | 1.46 Mn                      | 2              |        |               |             |                                   |                             |
|                             |           | .22 Si<br>.43 Mo             |                |        |               |             |                                   |                             |
| Youngstown Sheet & Tube Co. | III Mn-Mo | .22 - .25 C                  | 1/2-           | Water  | 6             | 15          | 6.6                               | 7 rds. outside 1 3/4" limit |
|                             |           | 1.38 - 1.52 Mn               | 1-1/2          |        |               |             |                                   |                             |
|                             |           | .16 - .22 Si<br>.15 - .50 Mo | 1/2-<br>1      | Air    |               |             |                                   |                             |

TABLE V

## Electrode Data for Hand Welded 1/2 Inch Thick Rolled Armor H Plates

| Weld Metal           | Coating | No. Plates | No. Weld Rds. | Average Plate cracking per rd. (Inches) | Average Plate cracking per rd. (Inches) | Remarks                        |
|----------------------|---------|------------|---------------|---|---|--------------------------------|
| Alloy Rods           | Titania | 1          | 3             | 3.3                                     | 4.9                                     | 1 rd. outside<br>1 3/4" limit  |
| Brand                |         |            |               |   |   |                                |
| Armorarc B           |         |            |               |   |   |                                |
| Weld Metal Comp.     |         |            |               |   |   |                                |
| .10 C                |         |            |               |   |   |                                |
| 1.8 Mn               |         |            |               |   |   |                                |
| .50 Si               |         |            |               |   |   |                                |
| 20. Cr               |         |            |               |   |   |                                |
| 9.5 Ni               |         |            |               |   |   |                                |
| 2.5 Mo               |         |            |               |   |   |                                |
| Alloy Rods           | Lime    | 4          | 8             | 6.3                                     | 10.5                                    | 3 rds. outside<br>1 3/4" limit |
| Brand                |         |            |               |   |   |                                |
| Armorarc B           |         |            |               |   |   |                                |
| Weld Metal Comp.     |         |            |               |   |   |                                |
| .08 C                |         |            |               |   |   |                                |
| 1.04 Mn              |         |            |               |   |   |                                |
| .22 Si               |         |            |               |   |   |                                |
| 18.51 Cr             |         |            |               |   |   |                                |
| 9.79 Ni              |         |            |               |   |   |                                |
| 2.01 Mo              |         |            |               |   |   |                                |
| .04 V                |         |            |               |   |   |                                |
| .05 Cu               |         |            |               |   |   |                                |
| Alloy Rods           |         |            |               |   |   |                                |
| Brand                |         |            |               |   |   |                                |
| Chromarc             |         |            |               |   |   |                                |
| Weld Metal Comp.     |         |            |               |   |   |                                |
| Not Given            |         |            |               |   |   |                                |
| Alloy Rods           | Titania | 2          | 6             | 6.9                                     | 0.9                                     | 3 rds. outside<br>1 3/4" limit |
| Brand                |         |            |               |   |   |                                |
| Armorize<br>Rezistol |         |            |               |   |   |                                |
| Weld Metal Comp.     |         |            |               |   |   |                                |
| .07 C                |         |            |               |   |   |                                |
| 1.82 Mn              |         |            |               |   |   |                                |
| 20. Cr               |         |            |               |   |   |                                |
| 19. Ni               |         |            |               |   |   |                                |
| 2.0 Mo               |         |            |               |   |   |                                |

TABLE V (Cont.)

| Mfgr.         | Brand           | weld metal<br>Comp. | Coating | No. Plates | No. Rds. | Average<br>Weld cracking<br>per rd.<br>(Inches) | Average<br>Plate cracking<br>per rd.<br>(Inches) | Remarks        |
|---------------|-----------------|---------------------|---------|------------|----------|---|--|----------------|
| Harnischfeger | AW 3            | .15 C               | Lime    | 2          | 7        | 4.6   | 0  | 4 rds. outside |
|               |                 | 1.44 - 1.48 Mn      | Titania |            |          |   |  | 1 3/4" limit   |
|               |                 | .47 - .58 Si        |         |            |          |   |  |                |
|               |                 | 18.1 - 20.4 Cr.     |         |            |          |   |  |                |
|               |                 | 10.2 - 10.4 Ni      |         |            |          |   |  |                |
|               |                 | 1.61 - 1.84 Mo      |         |            |          |   |  |                |
| .05 V         |                 |                     |         |            |          |   |  |                |
| .08 Cu        |                 |                     |         |            |          |   |  |                |
| Lincoln       | Armorweld       | .10 C               | Lime    | 1          | 3        | 2.3   | 0  | 2 rds. outside |
|               |                 | 3.5 Mn              |         |            |          |   |  | 1 3/4" limit   |
|               |                 | .50 Si              |         |            |          |   |  |                |
|               |                 | 19. Cr              |         |            |          |   |  |                |
|               |                 | 8.5 Ni              |         |            |          |   |  |                |
| McKay         | Armorloy<br>A 5 | .10 C               | Lime    | 2          | 7        | 1.7   | 0  | 2 rds. outside |
|               |                 | 3.66 Mn             |         |            |          |   |  | 1 3/4" limit   |
|               |                 | 1.13 Si             |         |            |          |   |  |                |
|               |                 | 18.1 Cr             |         |            |          |   |  |                |
|               |                 | 10.2 Ni             |         |            |          |   |  |                |
| .47 Mo        |                 |                     |         |            |          |   |  |                |



TABLE V (Cont.)

| Mfr.            | Brand     | Weld Metal Comp.                     | Coating | No. Plates | No. Rds. | Average Weld cracking per rd. (Inches) | Average Plate cracking per rd. (Inches) | Remarks   |
|-----------------|-----------|--------------------------------------|---------|------------|----------|--|---|---|
| armorloy<br>▲ 5 |           | .10 - .12 C                          | Lime    | 18         | 56       | 5.4                                    | 1.2                                     | 24 rds. outside<br>1 3/4" limit<br>11 rds. below spec. vel. |
|                 |           | 3.78 - 4.20 Mn                       |         |            |          |  |   |   |
|                 |           | .33 - .49 Si                         |         |            |          |  |   |   |
|                 |           | 19.3 - 20.1 Cr<br>9.6 - 10.2 Ni      |         |            |          |  |   |   |
| armorloy        |           | .9 - .11 C                           | Lime    | 1          | 5        | 0                                      | 2.7                                     | 5 rds. outside<br>1 3/4" limit                              |
|                 |           | 4.6 - .70 Mn Si                      |         |            |          |  |   |   |
|                 |           | 19.2 - 19.9 Cr                       |         |            |          |  |   |   |
|                 |           | 10.15 Ni<br>.98 - 1.0 Mo             |         |            |          |  |   |   |
| armorloy        |           | .10 - .15 C                          | Lime    | 1          | 3        | 3.2                                    | 8.2                                     | 2 rds. outside<br>1 3/4" limit                              |
|                 |           | 3.75 - 4.02 Mn                       |         |            |          |  |   |   |
|                 |           | .49 - .53 Si                         |         |            |          |  |   |   |
|                 |           | 19.63 - 20.46 Cr<br>10.05 - 10.28 Ni |         |            |          |  |   |   |
| Page            | Stainless | .13 - .15 C                          | Lime    | 1          | 2        | 0.9                                    | 0                                       |   |
|                 |           | 3.62 - 4.52 Mn                       |         |            |          |  |   |   |
|                 |           | .18 - .25 Si                         |         |            |          |  |   |   |
|                 |           | 18.9 - 20.2 Cr<br>11.27 Ni           |         |            |          |  |   |   |

TABLE VI

Joint Design Data for 1/2 Inch Thick Rolled Armor H Plates

| Angle of Bevel | No. of Plates | No. of Rounds | Av. W. Cr/rd.<br>(Inches) | Av. Pl. Cr/rd.<br>(Inches) | Remarks   |
|----------------|---------------|---------------|---------------------------|----------------------------|---|
| 45° SV         | 15            | 47            | 5.9                       | 1.0                        | 26 rds. outside 1 3/4" limit<br>7 rds. below spec. vel. |
| 60° SV         | 3             | 6             | 14.6                      | 3.4                        | 3 rds. outside 1 3/4" limit                             |
| 60° DV         | 9             | 28            | 3.4                       | 3.9                        | 13 rds. outside 1 3/4" limit                            |
| 90° DV         | 9             | 28            | 4.8                       | 1.0                        | 8 rds. outside 1 3/4" limit<br>4 rds. below spec. vel.  |

| Root Gap<br>(Inches) | No. of Plates | No. of Rounds | Av. W. Cr/rd.<br>(Inches) | Av. Pl. Cr/rd.<br>(Inches) | Remarks  |
|----------------------|---------------|---------------|---------------------------|----------------------------|--|
| 1/8                  | 4             | 12            | 6.5                       | 1.46                       | 6 rds. outside 1 3/4" limit                              |
| 5/32                 | 4             | 14            | 1.7                       | 1.8                        | 9 rds. outside 1 3/4" limit                              |
| 3/16                 | 23            | 72            | 5.8                       | 1.0                        | 31 rds. outside 1 3/4" limit<br>11 rds. below spec. vel. |
| 1/4                  | 5             | 11            | 6.5                       | 7.6                        | 4 rds. outside 1 3/4" limit                              |

TABLE VI (Cont.)

Joint Design Data for 1/2 Inch Thick Rolled Armor H Plates

| Fac'ing | No. of Plates | No. of Rounds | Av. Pl. Cr/rd.<br>(Inches) | Av. Pl. Cr/rd.<br>(Inches) | Remarks  |
|---------|---------------|---------------|----------------------------|----------------------------|--|
| Corner  | 7             | 24            | 3.3                        | 1.5                        | 14 rds. outside 1 3/4" limit                             |
| Brass   | 18            | 56            | 5.4                        | 1.2                        | 24 rds. outside 1 3/4" limit<br>11 rds. below spec. vel. |
| Fore    | 11            | 29            | 5.1                        | 3.5                        | 12 rds. outside 1 3/4" limit                             |

TABLE VII

Welding Procedure for 1/2 Inch Thick Rolled Armor H Plates

| No. of Passes | No. of Plates | No. of Rounds | Average W. Cr/rd. (Inches) | Average Pl. Cr/rd. (Inches) | Remarks   |
|---------------|---------------|---------------|----------------------------|-----------------------------|---|
| SV            |               |               |                            |                             |   |
| 3             | 7             | 25            | 5.8                        | 1.4                         | 12 rds. outside 1 3/4" limit<br>7 rds. below spec. vel. |
| 4             | 7             | 18            | 8.9                        | 1.7                         | 8 rds. outside 1 3/4" limit                             |
| 6             | 2             | 7             | 1.6                        | 0                           | 4 rds. outside 1 3/4" limit                             |
| 8             | 2             | 6             | 7.2                        | .5                          | 3 rds. outside 1 3/4" limit                             |
| DV            |               |               |                            |                             |   |
| 2             | 1             | 3             | 3.8                        | 0                           | 1 rd. outside 1 3/4" limit                              |
| 3             | 8             | 25            | 5.1                        | 1.2                         | 7 rds. outside 1 3/4" limit<br>3 rds. below spec. vel.  |
| 4             | 3             | 11            | 2.5                        | 0                           | 7 rds. outside 1 3/4" limit                             |
| 5             | 5             | 11            | 6.4                        | 6.7                         | 4 rds. outside 1 3/4" limit                             |
| 12            | 1             | 3             | 3.3                        | 5.7                         | 2 rds. outside 1 3/4" limit                             |

TABLE VII (Cont.)

Welding Procedure for 1/2 Inch Thick Rolled Armor H Plates

| Deposition                                      | No. of Plates | No. of Pounds | Average                |                         | Remarks                      |
|---|---------------|---------------|------------------------|-------------------------|------------------------------|
|   |               |               | W. Cr./rd.<br>(Inches) | Pl. Cr./rd.<br>(Inches) |                              |
| SV<br>weaves<br>single crown                    | 14            | 43            | 7.1                    | 1.5                     | 22 rds. outside 1 3/4" limit |
|   |               |               |                        |                         | 7 rds. below spec. vel.      |
| combination<br>weaves & beads<br>multiple crown | 4             | 13            | 4.2                    | 0.2                     | 7 rds. outside 1 3/4" limit  |
|   |               |               |                        |                         |                              |
| DV<br>all weaves                                | 17            | 50            | 4.7                    | 2.1                     | 19 rds. outside 1 3/4" limit |
|   |               |               |                        |                         | 3 rds. below spec. vel.      |
| combination<br>weaves & beads<br>multiple crown | 1             | 3             | 3.3                    | 3.7                     | 2 rds. outside 1 3/4" limit  |
|   |               |               |                        |                         |                              |
| SV<br>scal bead                                 | 9             | 28            | 5.1                    | 1.0                     | 13 rds. outside 1 3/4" limit |
|   |               |               |                        |                         |                              |
| no scal bead                                    | 9             | 28            | 7.8                    | 1.4                     | 16 rds. outside 1 3/4" limit |
|   |               |               |                        |                         | 7 rds. below spec. vel.      |

TABLE VII (Cont.)  
Welding Procedure for 1/2 Inch Thick Rolled Armor H Plates

| Preheat °F | No. of Plates | No. of Rounds | Average W. Cr/Rd. (Inches) | Average Pl. Cr/Rd. (Inches) | Remarks  |
|------------|---------------|---------------|----------------------------|-----------------------------|--|
| 70° - 100° | 22            | 64            | 4.8                        | 2.4                         | 31 rds. outside 1 3/4" limit                             |
| 250°       | 14            | 45            | 6.2                        | 1.2                         | 19 rds. outside 1 3/4" limit<br>11 rds. below spec. vel. |

TABLE VIII  
Radiographic Data for 1/2 Inch Thick Rolled Armor H Plates

| Radiographic Results | No. of Plates | No. of Rounds | Average W. Cr/Rd. (Inches) | Average Pl. Cr/Rd. (Inches) | Remarks  |
|----------------------|---------------|---------------|----------------------------|-----------------------------|--|
| Passing              | 33            | 100           | 5.5                        | 1.9                         | 45 rds. outside 1 3/4" limit<br>11 rds. below spec. vel. |
| Failing              | 3             | 9             | 4.6                        | 1.8                         | 5 rds. outside 1 3/4" limit                              |

TABLE IX

## Fabricators of 3/8 Inch Thick Rolled Armor H Plates

| Fabricators       | No. of Plates | No. of Rounds | Average W. Cr/rd. (Inches) | Average Fl. Cr/rd. (Inches) | Remarks   |
|-------------------|---------------|---------------|----------------------------|-----------------------------|---|
|                   |               |               |                            |                             |   |
| Am. Car & Foundry | 1             | 3             | 2.8                        | 0                           | 1 rd. outside 1 3/4" limit  |
| Buick Motor Div.  | 2             | 5             | 11.7                       | 6.9                         | 1 rd. outside 1 3/4" limit  |
| Chevrolet Motor   | 36            | 100           | 6.5                        | 2.8                         | 37 rds. outside 1 3/4" limit<br>28 rds. above spec. vel.<br>3 rds. below spec. vel. |
| Deere & Co.       | 2             | 9             | 1.0                        | 0.1                         | 5 rds. outside 1 3/4" limit   |
| Ford Motor Co.    | 15            | 38            | 7.3                        | 1.7                         | 14 rds. outside 1 3/4" limit  |







TABLE XI

## Electrode Data for Hand Welded 3/8 Inch Thick Rolled Armor H Plates

| Mfr.       | Brand      | Weld Metal Comp. | Coating | No. Plates | No. Rds. | Average Weld cracking per rd. (Inches) | Average Plate cracking per rd. (Inches) | Remarks                        |
|------------|------------|------------------|---------|------------|----------|--|---|--------------------------------|
| Alloy Rods | Armorarc B | .09 - .11 C      |         | 2          | 5        | 11.7                                   | 6.9                                     | 1 rd. outside<br>1 3/4" limit  |
|            |            | 2.24 - 3.17 Mn   |         |            |          |  |   |                                |
|            |            | .31 - .41 Si     |         |            |          |  |   |                                |
|            |            | 13.5 - 19.6 Cr   |         |            |          |  |   |                                |
|            |            | 9.4 - 12.5 Ni    |         |            |          |  |   |                                |
|            |            | .06 - .19 Mo     |         |            |          |  |   |                                |
|            |            | .06 - .08 V      |         |            |          |  |   |                                |
| Arcos      | Caronang   | .10 - .13 C      | Titania | 8          | 19       | 9.2                                    | 5.0                                     | 6 rds. outside<br>1 3/4" limit |
|            |            | 1.25 - 1.41 Mn   |         |            |          |  |   | 10 rds. above<br>spec. vel.    |
|            |            | .31 - .38 Si     |         |            |          |  |   |                                |
|            |            | 17.6 - 20.4 Cr   |         |            |          |  |   |                                |
|            |            | 8.9 - 13.7 Ni    |         |            |          |  |   |                                |
|            |            | 2.43 - 3.29 Mo   |         |            |          |  |   |                                |
| Crucible   | Armorize A | .11 - .14 C      | Titania | 3          | 10       | 6.2                                    | 1.2                                     | 4 rds. outside<br>1 3/4" limit |
|            |            | 3.58 - 3.95 Mn   |         |            |          |  |   | 3 rds. above<br>spec. vel.     |
|            |            | .31 - .42 Si     |         |            |          |  |   | 1 rd. below<br>spec. vel.      |
|            |            | 12.5 - 19.7 Cr   |         |            |          |  |   |                                |
|            |            | 10.1 - 10.4 Ni   |         |            |          |  |   |                                |
|            |            | 1.17 - 1.18 Mo   |         |            |          |  |   |                                |

TABLE XI (Cont.)

| Mfr.                    | Brand | Weld Metal Comp. | Coating | No. Plates | No. Rds. | Average Weld cracking per rd. (Inches) | Average Plate cracking per rd. (Inches) | Remarks                 |
|-------------------------|-------|------------------|---------|------------|----------|--|---|-------------------------|
| Armorize<br>Rezistol    |       | .07 - .11 C      | Titania | 11         | 29       | 5.5                                    | 1.3                                     | 12 rds. outside         |
|                         |       | 1.82 - 1.98 Mn   |         |            |          |  |   | 1 3/4" limit            |
|                         |       | .18 - .27 Si     |         |            |          |  |   |                         |
|                         |       | 18.8 - 20.1 Cr   |         |            |          |  |   |                         |
|                         |       | 10.0 - 10.2 Ni   |         |            |          |  |   |                         |
|                         |       | 1.87 - 2.0 Mo    |         |            |          |  |   |                         |
| Harnischfeger<br>AW 3 C |       | .12 - .15 C      | Lime    | 4          | 8        | 8.4                                    | 4.3                                     | 2 rds. outside          |
|                         |       | 3.82 - 4.47 Mn   |         |            |          |  |   | 1 3/4" limit            |
|                         |       | .65 - .66 Si     |         |            |          |  |   | 4 rds. above spec. vel. |
|                         |       | 19.0 - 19.5 Cr   |         |            |          |  |   | 1 rd. below spec. vel.  |
|                         |       | 9.5 - 10.3 Ni    |         |            |          |  |   |                         |
|                         |       | 1.02 - 1.07 Mo   |         |            |          |  |   |                         |
| Kollup                  |       | Not Given        |         | 1          | 3        | 4.2                                    | 4.3                                     | 1 rd. outside           |
|                         |       |                  |         |            |          |  |   | 1 3/4" limit            |
| Lincoln<br>armorweld    |       | Not Given        | Lime    | 1          | 3        | 2.4                                    | 0                                       | 1 rd. outside           |
|                         |       |                  |         |            |          |  |   | 1 3/4" limit            |
| McKay<br>A 5            |       | .08 - .14 C      | Lime    | 5          | 12       | 8.4                                    | 3.1                                     | 5 rds. outside          |
|                         |       | 3.41 - 3.91 Mn   |         |            |          |  |   | 1 3/4" limit            |
|                         |       | .57 - 1.01 Si    |         |            |          |  |   | 2 rds. above spec. vel. |
|                         |       | 19.5 - 19.9 Cr   |         |            |          |  |   |                         |
|                         |       | 9.3 - 10.8 Ni    |         |            |          |  |   |                         |
|                         |       | 1.18 - 1.19 Mo   |         |            |          |  |   |                         |

TABLE XI (Cont.)

| Mfr. | Brand     | Weld Metal Comp.  | Coating | No. Plates | No. Rds. | Average Weld cracking per rd. (Inches) | Average Plate cracking per rd. (Inches) | Remarks  |
|------|-----------|---|---------|------------|----------|--|---|--|
|      | AC 5      | .12 C<br>4.41 Mn<br>.49 Si<br>13.5 Cr<br>10.0 Ni<br>.75 Ni                      | Lime    | 2          | 6        | 4.6                                    | 7.4                                     | 3 rds. outside<br>1 3/4" limit.<br>4 rds. above spec. vel.<br>1 rd. below spec. vel. |
|      |           | .09 - .12 C<br>4.26 - 4.45 Mn<br>.52 - .56 Si<br>19.1 - 20.1 Cr<br>8.4 - 9.6 Ni | Lime    | 2          | 9        | 1.7                                    | 0                                       | 6 rds. outside<br>1 3/4" limit   |
| Page | Stainless | Not Given   |         | 1          | 2        | 8.4                                    | 0                                       | 1 rd. outside<br>1 3/4" limit  |

TABLE XII

Joint Design Data for Hand Welded  $\frac{3}{8}$  Inch Thick Rolled Armor H Plates

| Angle of Bevel | No. of Plates | No. of Rounds | Average W. Cr/rd. (Inches) | Average Pl. Cr/rd. (Inches) | Remarks  |
|----------------|---------------|---------------|----------------------------|-----------------------------|--|
| 45° SV         | 11            | 29            | 7.8                        | 2.7                         | 12 rds. outside $1 \frac{3}{4}$ " limit  |
| 60° SV         | 8             | 23            | 5.2                        | 0.8                         | 8 rds. outside $1 \frac{3}{4}$ " limit   |
| 60° DV         | 36            | 100           | 6.4                        | 2.8                         | 36 rds. outside $1 \frac{3}{4}$ " limit<br>26 rds. above spec. vel.<br>3 rds. below spec. vel. |
| 90° DV         | 1             | 3             | 8.2                        | 0                           | 2 rds. outside $1 \frac{3}{4}$ " limit<br>2 rds. above spec. vel.                              |

TABLE XII (Cont.)

| Root Gap<br>(Inches) | No. of<br>Plates | No. of<br>Rounds | Average<br>W. Cr./rd.<br>(Inches) | Average<br>Pl. Cr./rd.<br>(Inches) | Remarks   |
|----------------------|------------------|------------------|-----------------------------------|------------------------------------|---|
| 1/8                  | 2                | 5                | 8.9                               | 7.3                                | 4 rds. outside 1 3/4" limit   |
| 1/8 - 1/4            | 5                | 14               | 6.8                               | 0.3                                | 3 rds. outside 1 3/4" limit   |
| 5/32                 | 1                | 2                | 11.0                              | 0                                  | 1 rd. outside 1 3/4" limit  |
| 5/32 - 1/4           | 1                | 2                | 9.6                               | 1.5                                |   |
| 3/16                 | 40               | 114              | 6.1                               | 2.4                                | 45 rds. outside 1 3/4" limit<br>28 rds. above spec. vel.<br>3 rds. below spec. vel. |
| 1/4                  | 6                | 15               | 7.8                               | 2.7                                | 4 rds. outside 1 3/4" limit   |

TABLE XIII

## Welding Procedure for Hand Welded 3/8 Inch Thick Rolled Armor H Plates

| No. of Passes | No. of Plates | No. of Rounds | Average W. Cr/rd. (Inches) | Average Pl. Cr/rd. (Inches) | Remarks   |
|---------------|---------------|---------------|----------------------------|-----------------------------|---|
| 2             | 1             | 3             | 9.1<br>SINGLE V            | 2.8                         | 1 rd. outside 1 3/4" limit  |
| 3             | 12            | 33            | 5.5                        | 2.5                         | 14 rds. outside 1 3/4" limit  |
| 4             | 6             | 16            | 8.5                        | 0.5                         | 3 rds. outside 1 3/4" limit   |
|               |               |               | DOUBLE V                   |                             |   |
| 3             | 14            | 46            | 3.8                        | 0.6                         | 21 rds. outside 1 3/4" limit<br>3 rds. above spec. vel.                             |
| 4             | 1             | 3             | 2.8                        | 0                           | 1 rd. outside 1 3/4" limit  |
| 6             | 22            | 54            | 8.9                        | 4.5                         | 14 rds. outside 1 3/4" limit<br>3 rds. below spec. vel.<br>25 rds. above spec. vel. |

TABLE XIII (Cont.)

| Deposition  | No. of Plates | No. of Rounds | Average             | Remarks   |
|---|---------------|---------------|---------------------|---|
|   |               |               | W. Cr./rd. (Inches) |   |
| weaves -<br>single crown                          | 15            | 49            | 3.7                 | 22 rds. outside 1 3/4" limit<br>3 rds. above spec. vel.                             |
|   |               |               | 0.6                 |   |
| combination of<br>lead & weave-<br>multiple crown | 22            | 54            | 8.9                 | 14 rds. outside 1 3/4" limit<br>3 rds. below spec. vel.<br>25 rds. above spec. vel. |
|   |               |               | 4.5                 |   |
|   |               |               |                     |   |
| <u>SINGLE V</u>                                   |               |               |                     |   |
| weaves -<br>single crown                          | 19            | 52            | 6.7                 | 12 rds. outside 1 3/4" limit  |
|   |               |               | 1.9                 |   |
| <u>BACKING</u>                                    |               |               |                     |   |
| Copper  | 16            | 45            | 6.7                 | 17 rds. outside 1 3/4" limit  |
|   |               |               | 2.1                 |   |
| None  | 40            | 110           | 6.4                 | 41 rds. outside 1 3/4" limit<br>28 rds. above spec. val.<br>3 rds. below spec. vel. |
|   |               |               | 2.6                 |   |



TABLE XIV

Radiographic Data for Hand Welded 3/8 Inch Thick Rolled Armor H Plates

| Radiographic Results | No. of Plates | No. of Rounds | Average W. Cr./rd. (Inches) | Average Fl. Cr./rd. (Inches) | Remarks   |
|----------------------|---------------|---------------|-----------------------------|------------------------------|---|
|                      |               |               |                             |                              |   |
| Passing              | 52            | 141           | 6.8                         | 2.7                          | 49 rds. outside 1 3/4" limit<br>27 rds. above spec. vel.<br>3 rds. below spec. vel. |
| Failing              | 4             | 14            | 3.6                         | 0                            | 9 rds. outside 1 3/4" limit<br>1 rd. above spec. vel.                               |

## KEY TO TABULATION METHOD AND SYMBOLS

Figure 2 is a sample tabulation of firing record data and gives a key to symbols and method of tabulation. A brief explanation of the items in the tabulation follows:

1. Identification of Test

Information in the first column identifies the test.

2. Armor Data

A. Plate Thickness

Plates in this tabulation are of 1/2, 3/8, and 1/4 inch thick homogeneous armor.

B. Type Armor

The following types of rolled homogeneous armor are used:

R (Rolled)

Typical Analysis

|     | <u>Type</u> | <u>C</u>                           | <u>Mn</u> | <u>Si</u> | <u>Cr</u> | <u>Mo</u> | <u>Ni</u> | <u>Zr</u> |
|-----|-------------|------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| I   | Mn-Ni-Cr-Mo | .26                                | 1.15      | .20       | .60       | .20       | 1.00      | B added   |
| II  | Mn-Cr-Mo    | .27                                | 1.30      | .25       | .55       | .42       |           |           |
| III | Mn-Mo       | .25                                | 1.60      | .22       | —         | .37       |           | Grainal   |
| IV  | Mn-Cr-Mo-Si | .27                                | .86       | .79       | .62       | .17       |           | .09       |
| V   | High Alloy  | (Compositions noted in tabulation) |           |           |           |           |           |           |
| VI  | Special     |                                    | "         | "         | "         | "         |           |           |

C. Carbon Content

Carbon content is listed whenever given.

D. Brinell Hardness Number (BHN)

Brinell hardness number on both the front and back of plates is tabulated when given.

E. Process

This refers to the melting practice and is tabulated as open hearth, electric, basic or acid.

F. Heat Treatment

The temperature, time of hold, and type of quench and draw are recorded as given.

### 3. Electrode Data

These data, often incomplete, are listed as given in each firing record.

#### A. Type

Since alloys are sometimes added to the coating, electrodes are typed according to the chemical analysis of the weld metal when given.

The electrodes are typed as follows:

##### (1) Austenitic)

I Mn-Mo Modified 18/8 (Cr-Ni-Fe Alloy)  
Weld Analysis - at least 1% Mn and .3% Mo

II Mn Modified 18/8 (Cr-Ni-Fe Alloy)  
Weld Analysis - at least 1% Mn and less than .3% Mo

III Mo Modified 18/8 (Cr-Ni-Fe Alloy)  
Weld Analysis - at least .3% Mo and less than 1% Mn

IV Special

#### B. and C. Trade Name and Coating

Trade names and types of coating are listed when given.

#### D. Current and Polarity

These data are tabulated as DC straight (str.), DC reversed (rev.), or AC.

### 4. Joint Design

#### A. Groove, etc.

This item includes the type of groove (Single V bevel or double V bevel), the included angle, and the width of the root face whenever given.

#### B. Root Gap

This is the distance between the plates as set up for welding.

#### C. Plate Preparation

This indicates whether the plate edges to be welded together were flame cut, ground, machined, buttered, etc.

5. Welding Procedure

A. Backing

Backing if used, i.e. backup bar, chill, filler and spacer strips, is noted.

B. Deposition

Figure 3 shows how the weld deposition is broken up into the root, body, and crown types. The size electrode is noted with the number of passes, type of passes, and the current and voltage. Passes are divided into two kinds: (1) layer, if the pass bridges the gap; and (2), bead, if the pass does not bridge the gap. Seal beads, when used, are noted with size electrode, current, and voltage.

C. Total Welding Time and Interpass Temperature

These are listed as given.

D. Remarks

Any comments on chipping, grinding, and other special techniques used and not noted above which affect the ballistic results are listed under "remarks."

6. Heat

Preheat and postheat are tabulated when given.

7. Ballistic Results

The type projectile used in testing is specified under the ballistic results. Hits, velocity, and location of each, cracking and remarks on cracking are listed. The types of weld and plate cracking are as follows:

- Type I Cracking in fusion or heat-affected zones on front and back of plate.
- Type II Cracking in fusion or heat-affected zones on one side of plate and weld metal on the other.
- Type III Cracking in weld metal on both front and back of plate.
- Type IV Star plate cracking.
- Type V Linear plate cracks.

The remarks on cracking and results of radiographic examination are recorded in the last column.

## SPECIFICATION REQUIREMENTS FOR "H" WELDED PLATES

The following extracts from Specification AXS-497, Rev. 3, describe the present ballistic shock test:

Paragraph F-3a. (2) "Shock Tests. The welded plate shown in Fig. 1 shall be tested as shown below. Fig. 1 shows the areas designated for shock impacts. For the purpose of description these are divided in four 'specified areas' one above and one below the crossbar on each of the two vertical leg welds. Aiming points are indicated in Fig. 1.

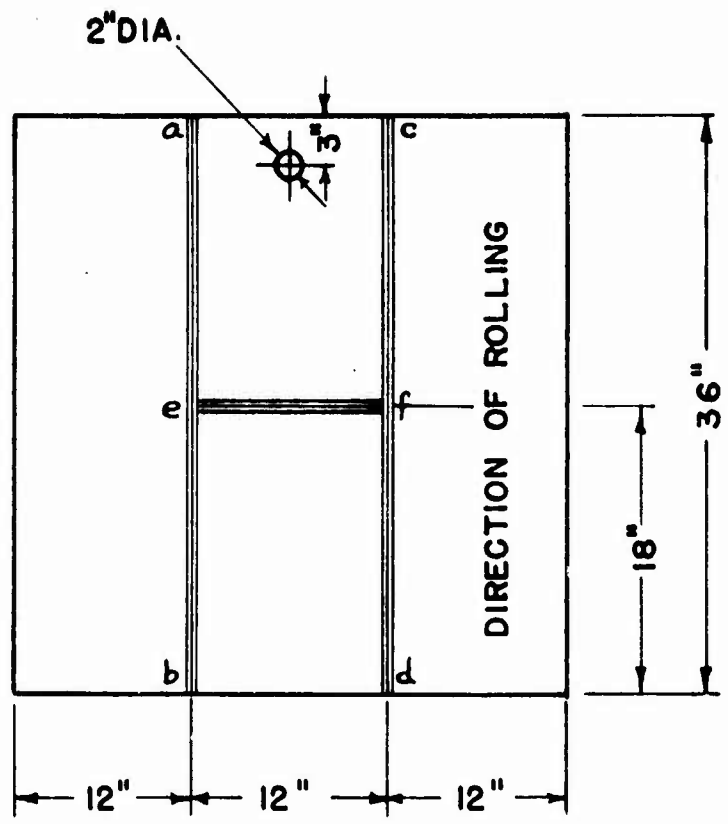
"If the first round falls outside of the one of the four specified areas, another round shall be fired at a second specified area. If the second impact falls outside of the specified area and no cracking occurs in the weld, another round will be fired at a third specified area. This shall be continued until an impact is obtained within one of the four specified areas, but no more than four rounds will be fired at one plate. If the plate withstands all four rounds, all of which fall outside the specified areas, and the weld is not cracked, the plate will be considered acceptable.

### BALLISTIC SHOCK TEST\*

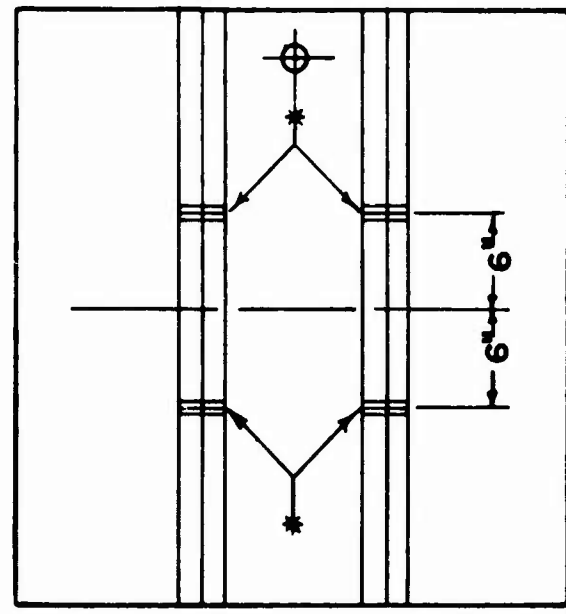
| Plate Thickness | Type | Projectile         | Striking Velocity f/s | Allowable Distance. Center of impact to center of weld | Maximum Allowable Cracking Weld | Maximum Allowable Cracking Plate |
|-----------------|------|--------------------|-----------------------|--|---------------------------------|----------------------------------|
| 1/2"            | R.H. | 37 mm. H.E. M54    | 2600                  | 1-3/4"   | 12"                             | 6"                               |
| 3/8"            | R.H. | 37 mm. H.E. M54    | 2100                  | 1-3/4"   | 15"                             | 6"                               |
| 1/4"            | R.H. | 37 mm. H.E. M54    | 1700                  | 1-3/4"   | —                               | —                                |
| 1/4"            | R.H. | 20 mm. H.E. 1 MK.1 | 1675                  | 1/2"   | —                               | —                                |

\* Specifications in a development stage during the period in which plates were tested.

WELD SEQUENCE:  
ab, cd, fe.



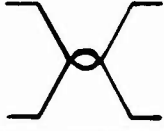
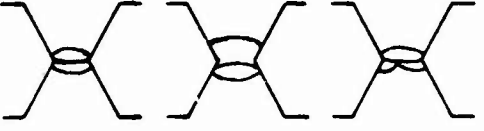
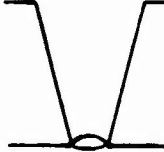
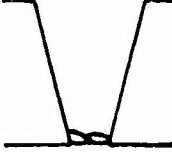
QUALIFICATION SHOCK TEST PLATE




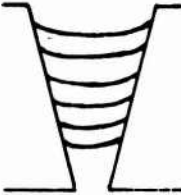




\* INTENDED AIMING POINTS

FIG. 1



| ROOT TYPES     | TYPE I  | TYPE II  |
|----------------|---|--|
| DOUBLE V BEVEL |  <p>SINGLE ROOT BEAD AT CENTER OF ROOT</p> |  <p>MORE THAN ONE BEAD AT ROOT</p>           |
| SINGLE V BEVEL |  <p>SINGLE BEAD BRIDGING ROOT GAP</p>      |  <p>MORE THAN ONE BEAD BRIDGING ROOT GAP</p> |

| BODY TYPES     | TYPE I   | TYPE II   | TYPE III   | TYPE IV   | TYPE V  |
|----------------|--|---|--|-----------|---------|
| DOUBLE V BEVEL |  <p>LAYERS ONLY</p>   |  <p>BEADS ONLY</p>   |  <p>LAYERS &amp; BEADS</p>   | UNIONMELT | SPECIAL |
| SINGLE V BEVEL |  <p>LAYERS ONLY</p> |  <p>BEADS ONLY</p> |  <p>LAYERS &amp; BEADS</p> | UNIONMELT | SPECIAL |



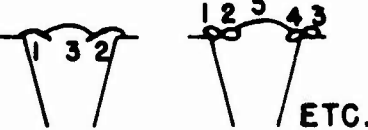
| CROWN TYPES               | TYPE I  | TYPE II  | TYPE III   |
|---------------------------|---|--|--|
| DOUBLE V & SINGLE V BEVEL |  <p>SINGLE CROWN SINGLE PASS BRIDGES GAP</p> |  <p>MULTIPLE CROWN LAST BEAD TOUCHES PARENT METAL</p> |  <p>MULTIPLE CROWN LAST BEAD DOES NOT TOUCH PARENT METAL</p> |

FIG. 3 WELD METAL DEPOSITION TYPES









| IDENTIFICATION  | PLATE TREATMENT   | PLATE TREATMENT  | PLATE TREATMENT                           | PLATE TREATMENT  | WELDED             | PROCEDURE          | NEAT               | BALLING SPECIFICATION                                  |                         | REMARKS           |
|---|---|--|---|--|--------------------|--------------------|--------------------|--|-------------------------|-------------------|
|   |   |  |   |  |                    |                    |                    | DATE OF TEST   | PLATE NO.               |                   |
| A. AD-344<br>B. 3/30/43<br>C. C-10<br>D. Youngstown<br>Sheet & Tube<br>Company<br>E. Alloy Rods Co.<br>F. Buick Motor<br>Division | A. 1/2"<br>B. R-111<br>(1.52Mn, .1981,<br>.02Cr, .33Mo)<br>C. .25<br>D. Face 388<br>Back 388<br>E. B.O.H.<br>F. 1600°F. 1/2<br>hr. Water<br>785°F. 1/2<br>hr. Air | A. A-I<br>(.08C, 1.04 Mn, .26Si,<br>18.97Cr,<br>10.08Ni,<br>2.01Mo,<br>.05V,<br>.05Cu)<br>B. Armorsarc<br>C. Lime<br>D. DC REV | A. 600V<br>B. 1/4"<br>C. Flame<br>Cutting | A. Not given<br>B. I 5/32" 1a 123 - 21<br>5/32" 1a 123 - 21<br>5/32" 1a 130 - 21<br>I 5/32" 2a 125 - 21<br>I 5/32" 2a 185 - 21<br>C. 103.6 mins. 750 - 190°F.<br>D. Cracking and grinding<br>after first pass. | A. None<br>B. None | A. None<br>B. None | A. None<br>B. None | 6"<br>U  | 37MM HE M-54 projectile | Passed radiograph |
| A. AD-344<br>B. 3/30/43<br>C. C-11<br>D. Youngstown<br>Sheet & Tube<br>Company<br>E. Alloy Rods Co.<br>F. Buick Motor<br>Division | A. 1/2"<br>B. R-111<br>(1.52Mn, .1981,<br>.02Cr, .33Mo)<br>C. .25<br>D. Face 388<br>Back 388<br>E. B.O.H.<br>F. 1600°F. 1/2<br>hr. Water<br>785°F. 1/2<br>hr. Air | A. A-I<br>(.08C, 1.04 Mn, .26Si,<br>18.97Cr,<br>10.08Ni,<br>2.01Mo,<br>.05V,<br>.05Cu)<br>B. Armorsarc<br>C. Lime<br>D. DC REV | A. 600V<br>B. 1/4"<br>C. Flame<br>Cutting | A. Not given<br>B. I 5/32" 1a 120 - 26<br>5/32" 2a 130 - 26<br>I 5/32" 2a 130 - 26<br>I 5/32" 2a 130 - 26<br>C. 103 mins. 750 - 205°F.<br>D. Grinding after first pass.  | A. None<br>B. None | A. None<br>B. None | A. None<br>B. None | X 9" Imp<br>D  | 37MM HE M-54 projectile | Passed radiograph |
| A. AD-344<br>B. 3/30/43<br>C. C-12<br>D. Youngstown<br>Sheet & Tube<br>Company<br>E. Alloy Rods Co.<br>F. Buick Motor<br>Division | A. 1/2"<br>B. R-111<br>(1.52Mn, .1981,<br>.02Cr, .33Mo)<br>C. .25<br>D. Face 388<br>Back 388<br>E. B.O.H.<br>F. 1600°F. 1/2<br>hr. Water<br>785°F. 1/2<br>hr. Air | A. A-I<br>(.10C, 1.36 Mn, .28Si,<br>18.51Cr,<br>9.79Ni,<br>2.25Mo,<br>.04V,<br>.09Cu)<br>B. Armorsarc<br>C. Lime<br>D. DC REV  | A. 600V<br>B. 1/4"<br>C. Flame<br>Cutting | A. Not given<br>B. I 5/32" 1a 123 - 21<br>5/32" 2a 140 - 21<br>I 5/32" 2a 140 - 21<br>I 5/32" 2a 140 - 21<br>C. 102 mins. 800 - 200°F.<br>D. Little cracking and grind-<br>ing after first pass.               | A. None<br>B. None | A. None<br>B. None | A. None<br>B. None | 1" 12 1/2" Imp<br>L D<br>3 1/2" O<br>D<br>12" Imp<br>U | 37MM HE M-54 projectile | Passed radiograph |

Steel Metal



| PARTS IDENTIFICATION  |  | PLATE INFORMATION  |   | MATERIALS  |                                      | TREATMENT  |                   | TESTING |         | RESULTS |         | REMARKS |         |
|---|--|--|---|--|--------------------------------------|--|-------------------|---------|---------|---------|---------|---------|---------|
| A. PART NO.   | B. DATE  | C. TYPE  | D. PLATE  | E. TYPE  | F. TYPE                              | G. TYPE  | H. TYPE           | I. TYPE | J. TYPE | K. TYPE | L. TYPE | M. TYPE | N. TYPE |
| AD-207<br>1/21/43<br>Ford Motor Co.<br>Crucible Steel<br>Ford Motor Co. | 1/2"<br>R-I<br>(.08Mn, .25S1,<br>.46Cr, .06Ni,<br>.42P)<br>C. 27<br>Face 341<br>B.O.H.<br>E. 1650°F.<br>2-1/2 hrs.<br>Platen<br>980°F. 4-1/2<br>hrs. Air | A-I<br>(.07C, 1.82<br>Mn, .26.00<br>Cr, 10.00<br>Ni, 2.00Co)<br>B. Armoxize<br>resistal<br>C. Jolly<br>D. DC REV | A. 45°SV<br>B. 3/16"<br>C. Flame<br>Cutting             | A. Copper<br>B. I 5/32" 1a 145 - 22<br>2. I 3/16" 1a 185 - 22<br>3. I 1/4" 1a 240 - 22<br>C. 1-2/3 hrs. 1410 - 2270°F.<br>D. Cracking and grinding<br>after first pass.  | 1 2600<br>2 2600<br>3 2600           | 5"<br>L<br>7/8"<br>D<br>1 1/4"<br>L<br>4 1/4"<br>D<br>2 1/4"<br>U<br>37mm. HE M-54 projectile                                      | Passed radiograph |         |         |         |         |         |         |
| AD-346<br>3/31/43<br>Ford Motor Co.<br>Aros Corp.<br>Ford Motor Co.     | 1/2"<br>R-V<br>(.99Mn, .24S1,<br>1.95Cr, .07Ni,<br>.4410)<br>C. 28<br>Face 341<br>Back 341<br>E. 1650°F. 2<br>hrs. Platen<br>975°F. 3/4<br>hr. Air       | A. A<br>B. Chromox<br>C. Manganese<br>D. DC REV  | A. 45°SV<br>B. 3/16"<br>C. Flame<br>Cutting             | A. Copper<br>B. I 5/32" 1a 150 - 22<br>2. I 3/16" 1a 190 - 22<br>3. I 2/16" 1a 190 - 22<br>C. 1-3/4 hrs. 1530 - 2060°F.<br>D. Cracking and grinding<br>after first pass. | 1 2600<br>2 2600<br>3 2600<br>4 2600 | 7/8"<br>R<br>3 1/4"<br>U<br>10 1/4"<br>D<br>2"<br>10 1/2"<br>R<br>0<br>1 1/4"<br>7/8"<br>Imp<br>D<br>O<br>II<br>II<br>20 1/4"<br>L | Passed radiograph |         |         |         |         |         |         |
| AD-346<br>3/31/43<br>Ford Motor Co.<br>Crucible Steel<br>Ford Motor Co. | 1/2"<br>R-II<br>(1.34Mn, .28S1,<br>.53Cr, .08Ni,<br>.42P)<br>C. 27<br>Face 341<br>Back 341<br>E. 1650°F.<br>2-1/2 hrs.<br>980°F. 4-1/2<br>hrs. Air       | A. A<br>B. Armoxize<br>resistal<br>C. Titania<br>D. DC REV   | A. 45°SV<br>B. 3/16"<br>C. Flame<br>Cutting<br>Grinding | A. Copper<br>B. I 5/32" 1a 160 - 22<br>2. I 3/16" 1a 195 - 22<br>3. I 1/4" 1a 250 - 22<br>C. 2-1/2 hrs. 1760 - 2560°F.<br>D. Cracking and grinding<br>after first pass.  | 1 2600<br>2 2600<br>3 2600           | 4"<br>R<br>7 1/4"<br>D<br>6 1/4"<br>Imp<br>U<br>3 1/4"<br>R<br>4 1/4"<br>U<br>37mm. HE V-54 projectile                             | Passed radiograph |         |         |         |         |         |         |

| A. PART NUMBER OR NAME OF TEST<br>B. DATE OF TEST<br>C. JUNE IDENTIFICATION NUMBER<br>D. SUBJECTS OF TEST<br>E. NUMBER OF TESTS                           | A. PLATE NUMBER<br>B. TYPE<br>C. CALIBER COMPANY<br>D. SIZE<br>E. PROCESS<br>F. YEAR TEST CONDUCTED  | A. TYPE<br>B. TRADE NAME<br>C. COATING<br>D. COMPOSITION<br>E. PURITY                            | A. ANALYSIS<br>B. ANAL. METHOD<br>C. PLATE PREPARATION | A. TEMPERATURE<br>B. DEPOSITION RATE<br>C. SPEED<br>D. MOUNT TYPE<br>E. MOUNT TYPE<br>F. COATING TYPE<br>G. TOTAL VOLU. TIME @ TEST TEMP.  | A. NONE<br>B. NONE | A. NONE<br>B. NONE | A. NONE<br>B. NONE | A. NONE<br>B. NONE | A. NONE<br>B. NONE | A. NONE<br>B. NONE | A. NONE<br>B. NONE                            |
|---|--|--|--|--|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|---|
| AD-42<br>10/3/42<br>31<br>Youngstown Sheet & Tube Company<br>Great Lakes Steel Corp.<br>Lincoln Electric Company<br>General Motors Truck & Coach Division | A. 1/2"<br>B. R-III Y<br>(.72Mn, .21Si, .42Mo)<br>C. R-IV G L<br>(.72Mn, .85Si, .66Cr, .16Mo, .11Zr)<br>D. .31<br>E. Face 341<br>Back 353<br>Face 321<br>Back 331<br>B.O.H.<br>F. 1600°F. Y<br>1/2 hr. Water<br>950°F. 2-1/2 hrs. Draw<br>1600°F. 3 L<br>1/2 hr. Water<br>950°F. 2-1/2 hrs. Draw | A. A-II<br>(.10C, 3.5 Mn, .50Si, 19.00Cr, 8.5Ni)<br>B. Armor-weld<br>C. Lime<br>D. DC REV        | A. 45°SV<br>B. 3/16"<br>C. Flame Cutting               | A. Not Given<br>B. 1. I 5/32" 1a 90 -<br>2. III 3/16" 1a 165 -<br>5/32" 1b 135 -<br>3. III 5/32" 2b 115 -<br>3/16" 1b 165 -<br>5/32" 1b 135 -<br>C. 6 hrs. 150° - 200°F.<br>D. Left and upper center sections by Great Lakes, right and lower center sections by Youngstown. | A. None<br>B. None | A. None<br>B. None | A. None<br>B. None | A. None<br>B. None | A. None<br>B. None | A. None<br>B. None | Passed radiograph                             |
| AD-42<br>10/3/42<br>33<br>Jones & Laughlin Steel Corp.<br>McKay Company<br>General Motors Truck & Coach Division  | A. 1/2"<br>B. R-IV G L<br>(.72Mn, .95Si, .66Cr, .16Mo, .11Zr)<br>C. J&L<br>D. Face 321<br>Back 353<br>Back 363<br>B.O.H.<br>E. 1600°F. G L<br>1/2 hr. Water<br>950°F. 2-1/2 hrs. Draw<br>1600°F. J&L<br>1/2 hr. Water<br>950°F. 2-1/2 hrs. Draw  | A. A-I<br>(.10C, 3.66 Mn, 1.13Si, 18.10Cr, 10.2Ni, .47Mo)<br>B. Armorloy<br>C. Lime<br>D. DC REV | A. 45°SV<br>B. 3/16"<br>C. Flame Cutting               | A. Not given<br>B. 1. I 5/32" 1a 90 -<br>2. I 1/4" 1a 240 -<br>3. III 5/32" 2b 115 -<br>3/16" 1b 165 -<br>5/32" 1b 135 -<br>C. 6 hrs. 150° - 200°F.<br>D. Left and lower center sections by Great Lakes, right and upper center sections by Jones & Laughlin.                | A. None<br>B. None | A. None<br>B. None | A. None<br>B. None | A. None<br>B. None | A. None<br>B. None | A. None<br>B. None | Passed radiograph<br>37mm. HE M-54 projectile |
| AD-42<br>10/3/42<br>33<br>Jones & Laughlin Steel Corp.<br>McKay Company<br>General Motors Truck & Coach Division  | A. 1/2"<br>B. R-IV G L<br>(.72Mn, .95Si, .66Cr, .16Mo, .11Zr)<br>C. J&L<br>D. Face 321<br>Back 353<br>Back 363<br>B.O.H.<br>E. 1600°F. G L<br>1/2 hr. Water<br>950°F. 2-1/2 hrs. Draw<br>1600°F. J&L<br>1/2 hr. Water<br>950°F. 2-1/2 hrs. Draw  | A. A-I<br>(.10C, 3.66 Mn, 1.13Si, 18.10Cr, 10.2Ni, .47Mo)<br>B. Armorloy<br>C. Lime<br>D. DC REV | A. 45°SV<br>B. 3/16"<br>C. Flame Cutting               | A. Not given<br>B. 1. I 5/32" 1a 90 -<br>2. I 1/4" 1a 240 -<br>3. III 5/32" 2b 115 -<br>3/16" 1b 165 -<br>5/32" 1b 135 -<br>C. 6 hrs. 150° - 200°F.<br>D. Left and lower center sections by Great Lakes, right and upper center sections by Jones & Laughlin.                | A. None<br>B. None | A. None<br>B. None | A. None<br>B. None | A. None<br>B. None | A. None<br>B. None | A. None<br>B. None | Passed radiograph<br>37mm. HE M-54 projectile |







| 1. NAME OF MANUFACTURER  | 2. TYPE OF TEST  | 3. TYPE OF DEFECT   | 4. TYPE OF DEFECT                      | 5. TYPE OF DEFECT   | 6. TYPE OF DEFECT  | 7. TYPE OF DEFECT          | 8. TYPE OF DEFECT | 9. TYPE OF DEFECT  | 10. TYPE OF DEFECT   | 11. TYPE OF DEFECT | 12. TYPE OF DEFECT | 13. TYPE OF DEFECT | 14. TYPE OF DEFECT | 15. TYPE OF DEFECT | 16. TYPE OF DEFECT | 17. TYPE OF DEFECT | 18. TYPE OF DEFECT | 19. TYPE OF DEFECT | 20. TYPE OF DEFECT |
|--|--|---|--|---------------------|--------------------|----------------------------|-------------------|--------------------|--|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| A. AD-211<br>B. 1/23/43<br>C. EV-439<br>D. Great Lakes Steel Corp.<br>E. McKay Company<br>F. Marmon-Herrington Co. Inc.  | A. 1/2"<br>B. H.N. IV<br>(.91Mn., .79S1, .64Cr., .21Mo., .09Zr.)<br>C. 28<br>D. Face 387<br>E. Back 416<br>F. B.O.N.<br>G. 1650°F.<br>H. 1-1/2 hrs.<br>I. Water<br>J. 680°F. 2 hrs. Draw | A. A-II (.10C, 3.83 Mn., .46S1, 20.0Cr) (10.0Mn) (.10C, 4.0 Mn., .46S1, 19.55Cr, 9.85Mn) B. Armorloy A-5 C. CaCO <sub>3</sub> D. DC REV | A. 45°SV<br>B. 1/16" RP<br>C. Grinding | A. Brass<br>B. None | A. 250°<br>B. None | I 23"<br>II 23"<br>III 23" | 9" D              | HE M-54 projectile | Passed radiograph<br>Some incomplete weld fusion                       |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |
| A. AD-211<br>B. 1/23/43<br>C. EV-4310<br>D. Great Lakes Steel Corp.<br>E. McKay Company<br>F. Marmon-Herrington Co. Inc. | A. 1/2"<br>B. H.N. IV<br>(.91Mn., .79S1, .64Cr., .21Mo., .09Zr.)<br>C. 28<br>D. Face 387<br>E. Back 416<br>F. B.O.N.<br>G. 1650°F.<br>H. 1-1/2 hrs.<br>I. Water<br>J. 680°F. 2 hrs. Draw | A. A-II (.10C, 3.83 Mn., .46S1, 20.0Cr) (10.0Mn) (.10C, 4.0 Mn., .46S1, 19.55Cr, 9.85Mn) B. Armorloy A-5 C. CaCO <sub>3</sub> D. DC REV | A. 45°SV<br>B. 1/16" RP<br>C. Grinding | A. Brass<br>B. None | A. 250°<br>B. None | I 23"<br>II 23"<br>III 23" | 9" D              | HE M-54 projectile | Passed radiograph  |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |
| A. AD-211<br>B. 1/23/43<br>C. EV-4311<br>D. Great Lakes Steel Corp.<br>E. McKay Company<br>F. Marmon-Herrington Co. Inc. | A. 1/2"<br>B. H.N. IV<br>(.91Mn., .79S1, .64Cr., .21Mo., .09Zr.)<br>C. 28<br>D. Face 375<br>E. Back 403<br>F. B.O.N.<br>G. 1650°F.<br>H. 1-1/2 hrs.<br>I. Water<br>J. 680°F. 2 hrs. Draw | A. A-II (.10C, 3.83 Mn., .46S1, 20.0Cr) (10.0Mn) (.10C, 4.0 Mn., .46S1, 19.55Cr, 9.85Mn) B. Armorloy A-5 C. CaCO <sub>3</sub> D. DC REV | A. 90°DV<br>B. 1/16" RP<br>C. Grinding | A. Brass<br>B. None | 250°<br>B. None    | I 23"<br>II 23"<br>III 23" | 9" D              | HE M-54 projectile | Passed radiograph<br>Some slag and small crater crack at weld junction |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |

| SPECIFICATION  | ANNEALING DATA   | PLATE DATA  | PLATE TREATMENT                        | PLATE ANALYSIS   | PLATE WEIGHT                                  | PLATE TYPE  | PLATE GRADE   | PLATE SIZE  | PLATE WEIGHT          | PLATE GRADE                                   | PLATE TYPE  | PLATE GRADE   | ANNEALING RESULTS   |    | REMARKS ON PASSING |
|--|--|---|--|--|---|---|---|---|-----------------------|---|---|---|---|----|--------------------|
|  |  |   |  |  |   |   |   |   |                       |   |   |   | LI  | ML |                    |
| A. AD-211<br>B. 1/23/43<br>C. EW-4312<br>D. Great Lakes Steel Corp.<br>E. McKay Company<br>F. Marmon-Harrington Co. Inc. | A. 1/2"<br>B. H.H. IV (.91Mn, .79Si, .64Cr, .21Mo, .09Zr)<br>C. .28<br>D. Face 375 Back 402<br>E. B.O.H.<br>F. 1650°F. 1-1/2 hrs. Water 860°F. 2 hrs. Draw | A. A-II (.10C, 3.83 Mn, .46Si, 20.0Cr, 10.0Mn) (.10C, 4.00 Mn, .46Si, 19.55Cr, 9.85Mn) B. Armorloy A-5 C. Ca Co D. DC NEV | A. 90°OV 1/16" RF B. 3/16" C. Grinding | A. Brass B. 1. I 3/16" 1a 145 - 2.4 1/4" U 3. Two layers 1/4" 2a 205 - C. 58 mins. 190° - 240°F. D. 3" total back of left leg chipped out in first pass. | 1 2600 X<br>2 2600                            | 11" D<br>2" 4 1/2" U  | Imp III   | 37MM HE M-54 projectile   | A. 250° F.<br>B. None | 1 2600 X<br>2 2600                            | 11" D<br>2" 4 1/2" U  | Imp III   | 54" Passed radiograph   |    |                    |
| A. AD-253<br>B. 2/12/43<br>C. EW-4317<br>D. Great Lakes Steel Corp.<br>E. McKay Company<br>F. Marmon-Harrington Co. Inc. | A. 1/2"<br>B. H.H. IV (.91Mn, .79Si, .64Cr, .21Mo, .09Zr)<br>C. .28<br>D. Face 402 Back 418<br>E. B.O.H.<br>F. 1650°F. 1-1/2 hrs. Water 860°F. 2 hrs. Draw | A. A-II (.10C, 3.83 Mn, .46Si, 20.0Cr, 10.0Mn) (.10C, 4.00 Mn, .46Si, 19.55Cr, 9.85Mn) B. Armorloy A-5 C. Ca Co D. DC NEV | A. 45°SV 1/16" RF B. 3/16" C. Grinding | A. Brass B. 1. I 3/16" 1a 130 - 2. I 3/16" 1a 170 - 3. I 1/4" 1a 200 - C. 3:31 hrs. 230° - 250°F. D. 63-1/2" chipped out in first pass.                  | 1 2100 2 1/2"<br>2 2300<br>3 2600             | 6 1/2" U<br>1" L<br>7 1/2" D<br>6 1/2" D<br>37MM HE M-54 projectile | Imp I<br>Imp II<br>Imp I<br>Imp V                               | Passed radiograph<br>Some slag inclusions and a little porosity | A. 250° F.<br>B. None | 1 2100 2 1/2"<br>2 2300<br>3 2600             | 6 1/2" U<br>1" L<br>7 1/2" D<br>6 1/2" D                        | Imp I<br>Imp II<br>Imp I<br>Imp V                               | Passed radiograph<br>Some slag inclusions and a little porosity |    |                    |
| A. AD-253<br>B. 2/12/43<br>C. EW-4320<br>D. Ingersoll Steel Co.<br>E. McKay Company<br>F. Marmon-Harrington Co. Inc.     | A. 1/2"<br>B. H.H. V (.89Mn, .81Si, 1.0Cr, 1.2Mn, .43Mo)<br>C. .29<br>D. Face 387 Back 402<br>E. Elec.<br>F. 1600°F. 1-1/2 hrs. Water 1000°F. 2 hrs. Draw  | A. A-II (.10C, 3.83 Mn, .46Si, 20.0Cr, 10.0Mn) (.10C, 4.00 Mn, .46Si, 19.55Cr, 9.85Mn) B. Armorloy A-5 C. Ca Co D. DC NEV | A. 45°SV 1/16" RF B. 3/16" C. Grinding | A. Brass B. 1. I 3/16" 1a 135 - 2. I 3/16" 1a 170 - 3. I 1/4" 1a 205 - C. 2:50 hrs. 250°F. D. 63" of chipping in first pass.                             | 1 2300 X<br>2 2600<br>3 2600 3 1/2"<br>4 2600 | 3" D<br>7" U<br>3" R<br>3" R<br>2" D<br>37MM HE M-54 projectile     | 3" D<br>7" U<br>3" R<br>3" R<br>2" D<br>37MM HE M-54 projectile | Passed radiograph<br>Crater cracks in crossbar                  | A. 250° F.<br>B. None | 1 2300 X<br>2 2600<br>3 2600 3 1/2"<br>4 2600 | 3" D<br>7" U<br>3" R<br>3" R<br>2" D<br>37MM HE M-54 projectile | 3" D<br>7" U<br>3" R<br>3" R<br>2" D<br>37MM HE M-54 projectile | Passed radiograph<br>Crater cracks in crossbar                  |    |                    |



| IDENTIFICATION<br>A. PERRY RECORD NO.<br>B. DATE OF TEST<br>C. PLATE NO.<br>D. JAMES MANUFACTURER<br>E. ELECTRODE MPAN.<br>F. ANODE FABRICATOR | ANODE DATA<br>A. PLATE THICKNESS<br>B. TYPE<br>C. GARDON CONTENT<br>D. SW<br>E. PROCESS<br>F. HEAT TREATMENT<br>G. TEMP TIME COURSE                                      | BLASTING MEDIA<br>A. TYPE<br>B. TRADE NAME<br>C. COATING<br>D. CURRENT & POLARITY  | JOINT DESIGN<br>A. GROOVE INCLUDED<br>B. ANGLE, ROOT FACE<br>C. ROOT GAP<br>D. PLATE PREPARATION | WELDS<br>A. SA GRIND<br>B. DEPOSITION SIZE EL. NO. TYPE AMT. V.<br>C. ROOT TYPE<br>D. SLOPE TYPE<br>E. WELDER TYPE<br>F. TOTAL WELDS TIME & ENTER PASS TEMPERATURE<br>G. REMARKS | HEAT<br>A. PRE<br>B. POST | BALLISTICS RESULTS                             |  | REMARKS ON CRACKING<br>RADIOGRAPHIC RESULTS, ETC.  |
|--|--|--|--|--|---------------------------|--|--|--|
|  |  |  |  |  |                           | H. VEL. F/IN                                   | I. LOCATION OF H. L. I. K. L. G. L. LOCAL TYPE AMT.  |  |
| A. AD-285<br>B. 3/3/43<br>C. EW-4324<br>D. Ingersoll Steel Co.<br>E. McKay Company<br>F. Marmon-Herrington Co. Inc.                            | A. 1/2" V<br>B. H.N. V (.85Mn, .80Si, .83Cr, 1.2Mn, .43Mo)<br>C. .30<br>D. Face 363 Back 388<br>E. B. Elec. 1600°F. 40 mins. Water 900°F. 1 hr. Draw<br>F. Armoryloy A-5 | A. A-II (.10C, .4.2 Mn, .42Si, .20.00Cr, 9.7Mn)* (.11C, 3.94 Mn, .47Si, 20.5Cr, 10.05Ni)*<br>B. Armoryloy A-5<br>C. Ga Co3<br>D. DC REV    | A. 90°DV 1/16" RF<br>B. 3/16" Mn, .42Si, .20.00Cr, 9.7Mn)*<br>C. Grinding                        | A. Brass<br>B. 1. I 3/16" 1a 140 -<br>2. &<br>3. Two layers 1/4" 2a 205 -<br>C. 2:15 hrs. 2400 - 2500°F.<br>D. Chipping after first pass.  | A. 2500 F.<br>B. None     | 1 2100<br>2 2600<br>3 2600<br>4 2600<br>5 2600 | 3 1/2" L D<br>7" X<br>1 1/4" U<br>5 1/2" X<br>9 1/2" R D<br>3" Imp II<br>6" Imp II<br>13" Imp II | Passed radiograph<br>Some incomplete penetration   |
| A. AD-285<br>B. 3/3/43<br>C. EW-4325<br>D. Ingersoll Steel Co.<br>E. McKay Company<br>F. Marmon-Herrington Co. Inc.                            | A. 1/2" V<br>B. H.N. V (.95Mn, .87Si, .98Cr, 1.2Mn, .44Mo)<br>C. .30<br>D. Face 363 Back 388<br>E. B. Elec. 1600°F. 40 mins. Water 900°F. 1 hr. Draw<br>F. Armoryloy A-5 | A. A-II (.10C, .4.20 Mn, .42Si, .20.8Cr, 9.7Mn)* (.11C, 3.94 Mn, .47Si, 20.5Cr, 10.05Ni)*<br>B. Armoryloy A-5<br>C. Ga Co3<br>D. DC REV    | A. 90°DV 1/16" RF<br>B. 3/16" Mn, .42Si, .20.8Cr, 9.7Mn)*<br>C. Grinding                         | A. Brass<br>B. 1. I 3/16" 1a 145 -<br>2. &<br>3. Two layers 1/4" 2a 205 -<br>C. 3 hrs. 2500 - 2600°F.<br>D. Cracking and chipping after first pass.                              | A. 2500 F.<br>B. None     | 1 2600<br>2 2600<br>3 2600<br>4 2600           | X 5 1/2" U<br>X Imp<br>3 1/2" R<br>3 1/2" L D<br>4 1/2" R D<br>4 1/2" O V<br>1 1/2" D            | Passed radiograph                                  |
| A. AD-345<br>B. 3/26/43<br>C. EW-4333<br>D. Great Lakes Steel Cor.<br>E. McKay Company<br>F. Marmon-Herrington Co. Inc.                        | A. 1/2" IV<br>B. H.N. IV (.91Mn, .79Si, .64Cr, .21Mo)<br>C. .28<br>D. Face 364 Back 364<br>E. B. Elec. 1650°F. 40 mins. Water 950°F. 1 hr. Draw<br>F. Armoryloy A-5      | A. A-II (.10C, .5.83 Mn, .46Si, .20.00Cr, 10.00Ni)* (.11C, 3.94 Mn, .47Si, 20.5Cr, 10.05Ni)*<br>B. Armoryloy A-5<br>C. Ga Co3<br>D. DC REV | A. 90°DV 1/16" RF<br>B. 3/16" Mn, .46Si, .20.00Cr, 10.00Ni)*<br>C. Grinding                      | A. Brass<br>B. 1. I 3/16" 1a 145 -<br>2. &<br>3. Two layers 1/4" 2a 205 -<br>C. 3 hrs. 2500°F.<br>D. Cracking and chipping after all passes.                                     | A. 2500 F.<br>B. None     | 1 2600<br>2 2600                               | 2" 6 1/2" R D<br>11" Imp I<br>11" Imp II<br>13 1/2" Imp II                                       | Failed radiograph<br>5" shallow cracks in crossbar |

\*Weld Metal





| IDENTIFICATION<br>A. PART NUMBER<br>B. DATE OF TEST<br>C. PLATE NO.<br>D. ORDER NUMBER<br>E. ORDER NUMBER<br>F. ORDER NUMBER<br>G. ORDER NUMBER | ANNEAL DATA<br>A. TYPE<br>B. TEMPERATURE<br>C. SOAK TIME<br>D. SOAK TIME<br>E. SOAK TIME<br>F. SOAK TIME<br>G. SOAK TIME   | MATERIAL<br>A. TYPE<br>B. TRADE NAME<br>C. GRAIN SIZE<br>D. GRAIN SIZE<br>E. GRAIN SIZE<br>F. GRAIN SIZE<br>G. GRAIN SIZE                      | SURFACE FINISH<br>A. TYPE<br>B. TYPE<br>C. TYPE<br>D. TYPE<br>E. TYPE<br>F. TYPE<br>G. TYPE | JOINT DESIGN<br>A. GROOVE, WELDED<br>B. BUTT WELD<br>C. BUTT WELD<br>D. BUTT WELD<br>E. BUTT WELD<br>F. BUTT WELD<br>G. BUTT WELD                                  | WELDING PROCEDURE<br>A. WELDING<br>B. WELDING<br>C. WELDING<br>D. WELDING<br>E. WELDING<br>F. WELDING<br>G. WELDING | HEAT TREATMENT<br>A. NONE<br>B. NONE<br>C. NONE<br>D. NONE<br>E. NONE<br>F. NONE<br>G. NONE | VELOCITY<br>A. NONE<br>B. NONE<br>C. NONE<br>D. NONE<br>E. NONE<br>F. NONE<br>G. NONE                        | BALLISTICS RESULTS<br>A. NONE<br>B. NONE<br>C. NONE<br>D. NONE<br>E. NONE<br>F. NONE<br>G. NONE | CHARACTERISTICS<br>A. NONE<br>B. NONE<br>C. NONE<br>D. NONE<br>E. NONE<br>F. NONE<br>G. NONE | REMARKS<br>A. NONE<br>B. NONE<br>C. NONE<br>D. NONE<br>E. NONE<br>F. NONE<br>G. NONE |
|---|--|--|---|--|---|---|--|---|--|--|
|   |  |  |   |  |   |   |  |   |  |  |
| A. AD-341<br>B. 3/26/43<br>C. EW-4339<br>D. Great Lakes Steel Corp.<br>E. McKay Company<br>F. Marmon-Herrington Co. Inc.                        | A. 1/2"<br>B. H.H. IV<br>(.97Mn, .73Si, .53Cr, .24Mo, .11Zr)<br>C. .28<br>D. Face 363<br>Back 375<br>E. B.O.H.<br>F. 1650°F. 2:15 hrs. Water<br>860°F. 1-1/2 hrs. Draw<br>960°F. 1 hr. | A. A-II<br>(.10C, 3.79 Mn, .33Si, .19.85Cr, 10.21Ni)*<br>(.12C, 3.90 Mn, .46Si, 20.10Cr, 9.60Ni)*<br>B. Armorloy A-5<br>C. Ca Co2<br>D. DC REV | A. 90°DV<br>1/16" RF<br>B. 3/16"<br>C. Grinding   | A. Brass<br>B. I 3/16" 1a 160 -<br>2a 210 -<br>3. Two layers<br>C. 4:05 hrs. 125° - 175°F.<br>D. Cracking and chipping after first and third passes.               | A. None<br>B. None  | 1 2800<br>2 2800<br>3 2800  | 3 1/2" 3" D<br>6 1/2" Imp II 4"<br>2 1/2" Imp I 10"<br>10"<br>37MM HE M-54 projectile                        | Passed radiograph   |  |  |
| A. AD-341<br>B. 3/26/43<br>C. EW-4340<br>D. Great Lakes Steel Corp.<br>E. McKay Company<br>F. Marmon-Herrington Co. Inc.                        | A. 1/2"<br>B. H.H. IV<br>(.97Mn, .73Si, .53Cr, .24Mo, .11Zr)<br>C. .28<br>D. Face 363<br>Back 375<br>E. B.O.H.<br>F. 1650°F. 2:15 hrs. Water<br>860°F. 1-1/2 hrs. Draw<br>960°F. 1 hr. | A. A-II<br>(.10C, 3.79 Mn, .33Si, .19.85Cr, 10.21Ni)*<br>(.12C, 3.90 Mn, .46Si, 20.10Cr, 9.60Ni)*<br>B. Armorloy A-5<br>C. Ca Co2<br>D. DC REV | A. 60°SV<br>1/16" RF<br>B. 3/16"<br>C. Grinding   | A. Brass<br>B. I 3/16" 1a 145 -<br>2a 145 -<br>3. I 1/4" 1a 21C<br>C. 4-1/2 hrs. 150° - 175°F.<br>D. Cracking after first pass. Chipping after first three passes. | A. None<br>B. None  | 1 2800<br>2 2800<br>3 2800  | 3 1/2" 2 1/2" D<br>7 1/2" Imp II 4"<br>1 1/2" Imp I 17"<br>II 11"<br>VI 4"<br>43"<br>37MM HE M-54 projectile | Passed radiograph   |  |  |
| A. AD-341<br>B. 3/26/43<br>C. EW-4341<br>D. Great Lakes Steel Corp.<br>E. McKay Company<br>F. Marmon-Herrington Co. Inc.                        | A. 1/2"<br>B. H.H. IV<br>(.97Mn, .73Si, .53Cr, .24Mo, .11Zr)<br>C. .28<br>D. Face 363<br>Back 375<br>E. B.O.H.<br>F. 1650°F. 2:15 hrs. Water<br>860°F. 1-1/2 hrs. Draw<br>960°F. 1 hr. | A. A-II<br>(.10C, 3.79 Mn, .33Si, .19.85Cr, 10.21Ni)*<br>(.12C, 3.90 Mn, .46Si, 20.10Cr, 9.60Ni)*<br>B. Armorloy A-5<br>C. Ca Co2<br>D. DC REV | A. 60°SV<br>1/16" RF<br>B. 3/16"<br>C. Grinding   | A. Brass<br>B. I 3/16" 1a 145 -<br>2a 145 -<br>3. I 1/4" 1a 210 -<br>C. 4:10 hrs. 150° - 225°F.<br>D. Cracking after first pass. Chipping after first two passes.  | A. None<br>B. None  | 1 2800<br>2 2800  | 1 1/2" Imp V 7"<br>2 1/2" Imp I 14"<br>II 11"<br>V 1 1/2"<br>136<br>37MM HE M-54 projectile                  | Passed radiograph   |  |  |

| IDENTIFICATION   | ANNEAL DATA   | WELDING DATA  | POST WELDING  | WELDING   | PRESSURE           | WELD                 | WELD                          | WELD                            | WELD                            | REMARKS ON DRAWING                    |   |
|--|---|---|---|---|--------------------|----------------------|-------------------------------|---------------------------------|---------------------------------|---------------------------------------|---|
| A. DRAWING NO.<br>B. DATE OF TEST<br>C. PLATE NO.<br>D. ANNEAL MANUFACTURER<br>E. ELEMENTS ANALYSIS<br>F. ANNEAL PROCEDURE | A. PLATE THICKNESS<br>B. TYPE<br>C. CARBON CONTENT<br>D. SIZE<br>E. PROCESS<br>F. HEAT TREATMENT<br>G. TENSILE TEST                           | A. TYPE<br>B. TRADE NAME<br>C. COATING<br>D. CURRENT & POLARITY | A. GROOVE, UNDRILLED<br>B. ROOT GAP<br>C. PLATE PREPARATION | A. WELDING<br>B. DEPOSITION<br>C. ROOT TYPE<br>D. WELD TYPE<br>E. WELD TYPE<br>F. TOTAL WELDING TIME & ENTER PMSO TEMPERATURE                           | A. 70°F<br>B. None | H. 1<br>I. 2<br>J. 3 | K. 2100<br>L. 2100<br>M. 2100 | N. 2 1/2"<br>O. 2"<br>P. 1 1/2" | Q. 7 1/2"<br>R. 2"<br>S. 5 1/2" | T. 6"<br>U. III<br>V. 2 1/2"<br>W. 6" | X. Passed radiograph<br>Y. Some slag inclusions<br>Z. Several small crater cracks |
| A. AD-175<br>B. 1/7/43<br>C. 1732-1<br>D. Jones & Laughlin Steel Corp.<br>E. McKay Company<br>F. American Gas Foundry Co.  | A. 3/8"<br>B. B-III<br>(1.60Mn, .2181, .46Co)<br>C. .27<br>D. Face 353<br>Back 356<br>E. B.O.H.<br>F. 1625°F. 1 hr full water<br>925°F. 2 hrs | A. A<br>B. Armory<br>A-5<br>C. ---<br>D. DC REV                 | A. 60°Dv<br>B. 3/16"<br>C. Flame Cutting<br>Grinding        | A. Copper<br>B. 1. II 5/32" 1a 135 - 30<br>5/32" 1a 140 - 30<br>2. 4<br>3. I 5/32" 1a 140 - 30<br>5/32" 1a 145 - 30<br>C. 5-1/2 hrs. 70° - 180°F.<br>D. | A. 70°F<br>B. None | H. 1<br>I. 2<br>J. 3 | K. 2100<br>L. 2100<br>M. 2100 | N. 2 1/2"<br>O. 2"<br>P. 1 1/2" | Q. 7 1/2"<br>R. 2"<br>S. 5 1/2" | T. 6"<br>U. III<br>V. 2 1/2"<br>W. 6" | X. Passed radiograph<br>Y. Some slag inclusions<br>Z. Several small crater cracks |

| IDENTIFICATION                                 |                 | ANNEAL DATA                                       |                         | SALT-BATH DATA             |  | MATERIAL DATA   |                 | TEST DATA          |                       | RESULTS                                  |         | REMARKS OR COMMENTS |                    |         |                            |                                  |         |              |              |  |   |                   |  |
|--|-----------------|---|-------------------------|----------------------------|--|---|-----------------|--------------------|-----------------------|--|---------|---------------------|--------------------|---------|----------------------------|----------------------------------|---------|--------------|--------------|--|---|-------------------|--|
| A. FORM NUMBER                                 | B. DATE OF TEST | C. PLATE NO.                                      | D. ANNEAL MANUFACTURER  | E. ELEMENTS W.P.A.         | F. ANNEAL PARAMETERS   | A. TYPE   | B. TRADE NAME   | C. COATING         | D. CURRENT & POLARITY | A. 450°SV                                | B. 1/4" | C. FLAME CUTTING    | A. NONE            | B. NONE | H. VOL. / MIN.             | I. LOCATION OF H. MARKS          | J. DATE | K. TEST TYPE | L. TEST UNIT |  |   |                   |  |
| A. AD-145<br>B. 12/23/42<br>C. W-66-67-68-69-1 |                 | A. 3/8"<br>B. R-V<br>(.75Mn, .23Si, .04Cr, .04Ni) | D. Republic Steel Corp. | E. Alloy Rods Co. Back 331 | F. Buick Motor Division<br>1600F. 1 hr<br>1550F. 1 hr<br>Caustic<br>850F. 2 hrs<br>Air | A. A-II<br>(.11C, .3.17 Mn, .41Si, 18.50Cr, 9.40Ni, .19Mo)        | B. Armorarc "B" | C. Extruded "B" AC |                       | A. 450°SV<br>B. 1/4"<br>C. Flame Cutting |         |                     | A. None<br>B. None |         | 1 2100                     | 1 1/4" L                         |         |              |              |  | 11" D<br>Imp V<br>I 51<br>V 27  | Passed radiograph |  |
| A. AD-145<br>B. 12/23/42<br>C. W-82-83-84-85-3 |                 | A. 3/8"<br>B. R-V<br>(.75Mn, .27Si, .04Cr, .03Ni) | D. Republic Steel Corp. | E. Alloy Rods Co. Back 311 | F. Buick Motor Division<br>1600F. 1 hr<br>1550F. 1 hr<br>Caustic<br>850F. 2 hrs<br>Air | A. A-II<br>(.09C, .2.84 Mn, .31Si, 15.65Cr, 10.55Ni, .06Mo, .08V) | B. Armorarc "B" | C. Extruded "B" AC |                       | A. 450°SV<br>B. 1/4"<br>C. Flame Cutting |         |                     | A. None<br>B. None |         | 1 2100<br>2 2100<br>3 2100 | 4 1/4" R<br>1 1/4" L<br>1 1/4" R |         |              |              |  | 8 1/4" U<br>6 1/4" D<br>Imp II<br>V 11<br>V 12<br>V 13<br>V 14<br>V 15<br>V 16<br>V 17<br>V 18<br>V 19<br>V 20<br>V 21<br>V 22<br>V 23<br>V 24<br>V 25<br>V 26<br>V 28<br>V 29<br>V 30<br>V 31<br>V 32<br>V 33<br>V 34<br>V 35<br>V 36<br>V 37<br>V 38<br>V 39<br>V 40<br>V 41<br>V 42<br>V 43<br>V 44<br>V 45<br>V 46<br>V 47<br>V 48<br>V 49<br>V 50<br>V 51<br>V 52<br>V 53<br>V 54<br>V 55<br>V 56<br>V 57<br>V 58<br>V 59<br>V 60<br>V 61<br>V 62<br>V 63<br>V 64<br>V 65<br>V 66<br>V 67<br>V 68<br>V 69<br>V 70<br>V 71<br>V 72<br>V 73<br>V 74<br>V 75<br>V 76<br>V 77<br>V 78<br>V 79<br>V 80<br>V 81<br>V 82<br>V 83<br>V 84<br>V 85<br>V 86<br>V 87<br>V 88<br>V 89<br>V 90<br>V 91<br>V 92<br>V 93<br>V 94<br>V 95<br>V 96<br>V 97<br>V 98<br>V 99<br>V 100 | Passed radiograph |  |



| IDENTIFICATION   | ANNEAL DATA  | SLURRY DATA  | JOINT DESIGN                            | WELDING   | PROCEDURE                   | HEAT                       | BALLISTICS RESULTS  |                          | REMARKS ON OPERATIONS |
|--|--|--|---|---|-----------------------------|----------------------------|---|--------------------------|-----------------------|
|  |  |  |   |   |                             |                            | H VEL. F/IN   | LOCATION OF H CRACKS     |                       |
| A. PART NUMBER NO.   | A. PLATE THICKNESS   | A. TYPE  | A. GROOVES, UNGLAZED                    | A. SA GRIND   | A. SIZE                     | A. NONE                    | L. I. L. II. L. III. V.   |                          |                       |
| B. DATE OF TEST  | B. GANES CONTENT   | B. TRADE NAME  | B. ROOT GAP                             | B. DEPOSITION   | B. SIZE EL. NO. TYPE AIR V. | B. NONE                    |   |                          |                       |
| C. PLATE NO.   | C. SW  | C. COATING   | C. PLATE PREPARATION                    | B. ROOT TYPE  | B. ROOT TYPE                |                            |   |                          |                       |
| D. JAMES MANUFACTURER  | D. PROCESS   | D. POLARITY  |   | B. ROOT TYPE  | B. ROOT TYPE                |                            |   |                          |                       |
| E. ELASTIC MOD.  | E. HEAT TREATMENT  |  |   | B. ROOT TYPE  | B. ROOT TYPE                |                            |   |                          |                       |
| F. ANNEAL PARAMETERS   | F. TEMP. TIME  |  |   | B. ROOT TYPE  | B. ROOT TYPE                |                            |   |                          |                       |
| A. AD-46<br>B. 10/1/42<br>C. XW-121-F<br>D. Chevrolet<br>E. Alloy Rods Co.<br>F. Chevrolet<br>Motor Co.      | A. 3/8"<br>B. R-IV<br>(.91Mn, .71Si, .59Cr, .23Mo)<br>C. .28<br>D. Face 331<br>Back 331<br>E. B.O.H.<br>F. 1600°F.<br>1-1/2 hrs.<br>Water<br>9150°F. 6<br>hrs. Air   | A. A-I<br>(.13C, 1.41 Mn, .31Si, 20.4Cr, 13.7Mn, 3.29Mo)<br>B. 3/16"<br>C. Machining<br>D. DC REV  | A. 60°DV<br>B. 1/16" RF<br>C. Machining | A. Not given<br>B. 1. I 1/8" la 110 - 24<br>2. & Five beads<br>3. 5/32" 3b 140 - 25<br>1/8" 2b 110 - 24<br>C. 10 hrs. 75° - 110°F.<br>D. Peening first pass.    | A. None<br>B. None          | 1 2300                     | 5 1/2" L<br>1 1/2" D<br>0 II<br>III<br>V<br>23<br>34  | 3 1/2" Passed radiograph |                       |
| A. AD-46<br>B. 10/1/42<br>C. XW-122-F<br>D. Chevrolet<br>E. McKay Company<br>F. Chevrolet<br>Motor Co.       | A. 3/8"<br>B. R-IV<br>(.91Mn, .71Si, .59Cr, .23Mo)<br>C. .28<br>D. Face 331<br>Back 331<br>E. B. O. H.<br>F. 1600°F.<br>1-1/2 hrs.<br>Water<br>9150°F. 6<br>hrs. Air | A. A-I<br>(.13C, 4.41 Mn, .49Si, 18.5Cr, 10.0Mn, .75Mo)<br>B. Armoxloy<br>C. Lime<br>D. DC REV     | A. 60°DV<br>B. 3/16" RF<br>C. Machining | A. Not given<br>B. 1. I 1/8" la 110 - 24<br>2. & Five beads<br>3. 5/32" 3b 140 - 25<br>1/8" 2b 110 - 24<br>C. 7 hrs. 80° - 150°F.<br>D. Peening first pass.     | A. None<br>B. None          | 1 2000<br>2 2300<br>3 2300 | 1 1/2" L<br>1 1/2" D<br>12" Imp<br>8" Imp<br>I 2"<br>II 1"<br>III 1 1/2"<br>V 10"<br>6 1/2" | Passed radiograph        |                       |
| A. AD-46<br>B. 10/1/42<br>C. XW-123-F<br>D. Chevrolet<br>E. Harnischfeger Corp.<br>F. Chevrolet<br>Motor Co. | A. 3/8"<br>B. R-IV<br>(.94Mn, .73Si, .47Cr, .23Mo)<br>C. .29<br>D. Face 321<br>Back 321<br>E. B. O. H.<br>F. 1600°F.<br>1-1/3 hrs.<br>Water<br>9150°F. 6<br>hrs. Air | A. A-I<br>(.13C, 3.82 Mn, .66Si, 19.00Cr, 10.3Mn, 1.02Mo)<br>B. 3/16"<br>C. Machining<br>D. DC REV | A. 60°DV<br>B. 1/16" RF<br>C. Machining | A. Not given<br>B. 1. I 1/8" la 110 - 24<br>2. & Five beads<br>3. 5/32" 3b 140 - 25<br>1/8" 2b 110 - 24<br>C. 9-1/2 hrs. 80° - 175°F.<br>D. Peening first pass. | A. None<br>B. None          | 1 2000<br>2 2300           | 3" R<br>1 1/2" L<br>6 1/2" Imp<br>I 7"<br>II 3"<br>V 12"<br>23"                             | Passed radiograph        |                       |

Weld Metal



| IDENTIFICATION<br>A. FOUNDRY NUMBER OR<br>B. DATE OF TEST<br>C. PLATE NO.<br>D. MANUFACTURER<br>E. ELEMENTS ANALYSIS<br>F. ANALYSIS PROCEDURE | ANNEAL DATA<br>A. PLATE THICKNESS<br>B. TYPE<br>C. GARDNER CERTIFY<br>D. BURN<br>E. PROCESS<br>F. HEAT TREATMENT<br>G. TEST TIME                               | SALTIMETER DATA<br>A. TYPE<br>B. TRADE NAME<br>C. COATING<br>D. CURRENT &<br>POLARITY   | GROOVE DEPTH<br>A. GROOVE DEPTH<br>B. GROOVE WIDTH<br>C. PLATE PREPARATION | WELDS<br>A. SIZE<br>B. DEPOSITION<br>C. ROOF TYPE<br>D. ROOF TYPE<br>E. ROOF TYPE<br>F. TOTAL WELDS TIME & ENTER PASS<br>TEMPERATURE                       | HEAT<br>A. MAX<br>B. MIN | SALTIMETER RESULTS                            |   |  | REMARKS |
|---|--|---|--|--|--------------------------|---|---|--|---------|
|   |  |   |  |  |                          | R VEL.<br>7/8                                 | LOCATION OF R<br>L.L. R.L. S.B.   | CRACKING<br>LOR TYPE ANY   |         |
| A. AD-60<br>B. 10/15/43<br>C. XV-125-F<br>D. Chevrolet<br>E. Alloy Rods Co.<br>F. Chevrolet<br>Motor Co.                                      | A. 3/8"<br>B. R-IV<br>(.94Mn, .73Si,<br>.47Cr, .23Mo)<br>C. 29<br>D. Face 321<br>Back 321<br>E. B.O.H.<br>F. 1600°F. 35<br>mins. Water<br>990°F. 4<br>hrs. Air | A. A-I<br>(.13C, 1.41<br>Mn, .31Si,<br>20.4Cr,<br>13.7Ni,<br>3.29Mo)<br>(.10C, 1.25<br>Mn, .38Si,<br>17.6Cr,<br>8.9Ni,<br>2.43Mo)<br>B. Argonarc<br>C. Tio<br>D. DC REV | A. 60°DV<br>B. 1/16"RF<br>C. 3/16"<br>D. Machining                         | A. Not given<br>B. I 1/8" la 110 - 24<br>2. & Five beads<br>3. 5/32" 3b 140 - 25<br>1/8" 2b 110 - 24<br>C. 6 hrs. 80° - 125°F.<br>D. Peening - first pass. | A. None<br>B. None       | 1 2100<br>2 2100 2"<br>3 2300 1 1/2"          | 4" L<br>6" D<br>8" U<br>1" Imp<br>D<br>II 12"<br>V 13"<br>30"   | Passed radiograph<br>Some slag in<br>crossbar<br>Incomplete fusion<br>in vertical legs |         |
| A. AD-60<br>B. 10/15/43<br>C. XV-127-F<br>D. Chevrolet<br>E. Alloy Rods Co.<br>F. Chevrolet<br>Motor Co.                                      | A. 3/8"<br>B. R-IV<br>(.91Mn, .71Si,<br>.59Cr, .23Mo)<br>C. 28<br>D. Face 311<br>Back 311<br>E. B.O.H.<br>F. 1600°F. 35<br>mins. Water<br>990°F. 4<br>hrs. Air | A. A-I<br>(.13C, 1.41<br>Mn, .31Si,<br>20.4Cr,<br>13.7Ni,<br>3.29Mo)<br>(.10C, 1.25<br>Mn, .38Si,<br>17.6Cr,<br>8.9Ni,<br>2.43Mo)<br>B. Argonarc<br>C. Tio<br>D. DC REV | A. 60°DV<br>B. 1/16"RF<br>C. 3/16"<br>D. Machining                         | A. Not given<br>B. I 1/8" la 110 - 24<br>2. & Five beads<br>3. 5/32" 3b 140 - 25<br>1/8" 2b 110 - 24<br>C. 7 hrs. 80° - 135°F.<br>D. Peening - first pass. | A. None<br>B. None       | 1 2100<br>2 2100 2"<br>3 2300 1 1/2"          | 2" R<br>3" D<br>9" U<br>2 1/2" Imp<br>D<br>I 10"<br>V 17"<br>27"  | Passed radiograph  |         |
| A. AD-60<br>B. 10/15/43<br>C. XV-128-F<br>D. Chevrolet<br>E. McKay Corp.<br>F. Chevrolet<br>Motor Co.   | A. 3/8"<br>B. R-IV<br>(.91Mn, .71Si,<br>.59Cr, .23Mo)<br>C. 28<br>D. Face 311<br>Back 311<br>E. B.O.H.<br>F. 1600°F. 35<br>mins. Water<br>990°F. 4<br>hrs. Air | A. A-I<br>(.13C, 4.41<br>Mn, .49Si,<br>18.5Cr,<br>10.0Ni,<br>.75Mo)<br>A-II<br>(.13C, 4.26<br>Mn, .53Si,<br>19.1Cr,<br>9.4Ni)<br>B. AC-5<br>C. Lines<br>D. DC REV       | A. 60°DV<br>B. 1/16"RF<br>C. 3/16"<br>D. Machining                         | A. Not given<br>B. I 1/8" la 110 - 24<br>2. & Five beads<br>3. 5/32" 3b 140 - 25<br>1/8" 2b 110 - 24<br>C. 8 hrs. 80° - 160°F.<br>D. Peening - first pass. | A. None<br>B. None       | 1 2100<br>2 2100 1 1/2"<br>3 2300<br>4 2100 X | 1 1/2" R<br>7 1/2" D<br>6" U<br>8" R<br>1" D<br>7" D<br>Imp<br>I 2 1/2"<br>II 3 1/2"<br>III 9"<br>V 4"<br>28 1/2" | Passed radiograph<br>Incomplete fusion<br>and slag present<br>in legs and<br>crossbar  |         |

| IDENTIFICATION   | ANNEALING DATA   | PLATE ANALYSIS                                       | HEAT TREATMENT   | WELDED             | PROBLEMS                                    | HEAT TREATMENT     | BALLISTIC RESULT                                    |  | REMARKS ON GRADING                           |                   |
|--|--|--|--|--------------------|---|--------------------|---|--|--|-------------------|
|  |  |  |  |                    |   |                    | N   | VEL. FT/S  |  |                   |
| A. PARTS LISTED  | A. PLATE ANALYSIS  | A. GRADE, INCL. S&S, ANGLE, SURF. FINISH             | A. BACKING   | A. BACKING         | A. BACKING                                  | A. NONE            | LI  | RI   | CRACKING                                     |                   |
| B. DATE OF TEST  | B. TYPE  | B. TENSILE   | B. TYPE  | B. TYPE            | B. TYPE                                     | B. NONE            | LI  | RI   | CRACKING                                     |                   |
| C. MANUFACTURER  | C. SIZE  | C. YIELD   | C. TYPE  | C. TYPE            | C. TYPE                                     | B. NONE            | LI  | RI   | CRACKING                                     |                   |
| D. SIZE  | D. TYPE  | D. YIELD   | D. TYPE  | D. TYPE            | D. TYPE                                     | B. NONE            | LI  | RI   | CRACKING                                     |                   |
| E. PROCESS   | E. TYPE  | E. YIELD   | E. TYPE  | E. TYPE            | E. TYPE                                     | B. NONE            | LI  | RI   | CRACKING                                     |                   |
| F. RELAY TREATMENT   | F. TYPE  | F. YIELD   | F. TYPE  | F. TYPE            | F. TYPE                                     | B. NONE            | LI  | RI   | CRACKING                                     |                   |
| G. YEAR TESTED   | G. TYPE  | G. YIELD   | G. TYPE  | G. TYPE            | G. TYPE                                     | B. NONE            | LI  | RI   | CRACKING                                     |                   |
| A. AD-60<br>B. 10/15/42<br>C. XV-136-F<br>D. Great Lakes<br>E. Alloy Rods Corp.<br>F. Chevrolet Motor Co.    | A. 3/8"<br>B. R-IV<br>(.91Mn, .71Si, .59Cr, .23Mo)<br>C. 28<br>D. Face 321<br>Back 321<br>E. B.O.H.<br>F. 1600°F. 35 mins. Water 965°F. 4 hrs. Air   | A. 60°DV.<br>B. 1/16" RF<br>C. 3/16"<br>D. Machining | A. Not given<br>B. 1. I 1/8" 1a 110 - 24<br>2. 4 5/32" 3b 140 - 25<br>3. Five beads 1/8" 2b 110 - 24<br>C. 10 hrs. 75° - 110°F.<br>D. Peening - first pass.    | A. None<br>B. None | 1 2100<br>2 2300<br>37MM HE M-54 projectile | A. None<br>B. None | 1" L<br>2 1/2" D<br>7" U<br>37MM HE M-54 projectile | I<br>II<br>III<br>I<br>II<br>III<br>I<br>II<br>III | 6"<br>10"<br>11"<br>11"<br>13"<br>41"<br>37" | Passed radiograph |
| A. AD-60<br>B. 10/15/42<br>C. XV-139-F<br>D. Great Lakes<br>E. Harnischfeger Corp.<br>F. Chevrolet Motor Co. | A. 3/8"<br>B. R-IV<br>(.91Mn, .71Si, .59Cr, .23Mo)<br>C. 28<br>D. Face 321<br>Back 321<br>E. B. O. H.<br>F. 1600°F. 35 mins. Water 965°F. 4 hrs. Air | A. 60°DV.<br>B. 1/16" RF<br>C. 3/16"<br>D. Machining | A. Not given<br>B. 1. I 1/8" 1a 110 - 24<br>2. 4 5/32" 3b 140 - 25<br>3. Five beads 1/8" 2b 110 - 24<br>C. 7-1/2 hrs. 80° - 120°F.<br>D. Peening - first pass. | A. None<br>B. 850  | 1 2100<br>2 2300<br>37MM HE M-54 projectile | A. None<br>B. 850  | 2" L<br>6 1/2" U<br>6" Imp<br>7 1/2" U<br>19"       | I<br>II<br>III<br>I<br>II<br>III<br>I<br>II<br>III | 6"<br>13"<br>19"<br>19"                      | Passed radiograph |
| A. AD-60<br>B. 10/15/42<br>C. XV-140-F<br>D. Great Lakes<br>E. Alloy Rods Corp.<br>F. Chevrolet Motor Co.    | A. 3/8"<br>B. R-IV<br>(.91Mn, .71Si, .59Cr, .23Mo)<br>C. 28<br>D. Face 321<br>Back 321<br>E. B.O.H.<br>F. 1600°F. 35 mins. Water 965°F. 4 hrs. Air   | A. 60°DV.<br>B. 1/16" RF<br>C. 3/16"<br>D. Machining | A. Not given<br>B. 1. I 1/8" 1a 110 - 24<br>2. 4 5/32" 3b 140 - 25<br>3. Five beads 1/8" 2b 110 - 24<br>C. 8 hrs.<br>D. Peening - first pass.                  | A. None<br>B. 850  | 1 2100<br>2 2300<br>37MM HE M-54 projectile | A. None<br>B. 850  | X 5" D<br>7" U<br>7" Imp<br>11" U<br>19"            | I<br>II<br>III<br>I<br>II<br>III<br>I<br>II<br>III | 6"<br>2"<br>2"<br>11"<br>19"                 | Passed radiograph |

| PLATE RECORD  |  | PLATE TREATMENT  |   | PLATE DATA  |                    | PLATE CONDITION                  |  | PLATE IDENTIFICATION  |                  | PLATE HISTORY   |                    | PLATE ANALYSIS     |                         | PLATE TESTING    |                   | PLATE NOTES      |                |
|---|--|--|---|---|--------------------|----------------------------------|--|---|------------------|-----------------|--------------------|--------------------|-------------------------|------------------|-------------------|------------------|----------------|
| A. PLATE NO.  | B. DATE OF TEST  | C. PLATE SIZE  | D. PLATE WEIGHT                         | E. PLATE TYPE   | F. PLATE GRADE     | G. PLATE THICKNESS               | H. PLATE WIDTH   | I. PLATE HEIGHT   | J. PLATE SURFACE | K. PLATE FINISH | L. PLATE TREATMENT | M. PLATE CONDITION | N. PLATE IDENTIFICATION | O. PLATE HISTORY | P. PLATE ANALYSIS | Q. PLATE TESTING | R. PLATE NOTES |
| A. AD-60<br>B. 10/15/42<br>C. XW-130-F<br>D. Great Lakes Steel Corp.<br>E. Alloy Node Co.<br>F. Chevrolet Motor Co.       | A. 3/8"<br>B. R-IV<br>(.76Mn, .70Si, .55Cr, .15Mo)<br>C. .26<br>D. Face 321 Back 321<br>E. B.O.N.<br>F. 1600°F. 35 mins. Water 915°F. 4 hrs. Air | A. A-I (.13C, 1.41 Mn, .31Si, 20.4Cr, 13.7Al, 3.29Mo)<br>B. O.N.<br>C. 17.6Cr, 8.9Ni, 2.43Mo)<br>D. Armox 400<br>E. DC REV | A. 60°DV<br>B. 3/16" RF<br>C. Machining | A. Not given<br>B. I 1/8" 1a 110 - 24<br>2.4<br>3. Five beads 5/32" 3b 140 - 25 1/8" 2b 110 - 24<br>C. 7-1/2 hrs. 700 - 140°F.<br>D. Peening - first pass | A. None<br>B. None | 1 2100<br>2 2300 3"<br>3 2300 3" | 7" D<br>64" U<br>54" D<br>Imp I 12"<br>III 3"<br>V 10"<br>E 4"                       | Passed radiograph   |                  |                 |                    |                    |                         |                  |                   |                  |                |
| A. AD-60<br>B. 10/16/42<br>C. XW-129-F<br>D. Great Lakes Steel Corp.<br>E. Harnischfeger<br>F. Chevrolet Motor Co.        | A. 3/8"<br>B. R-IV<br>(.94Mn, .73Si, .47Cr, .23Mo)<br>C. .29<br>D. Face 321 Back 321<br>E. B.O.N.<br>F. 1600°F. 35 mins. Water 990°F. 4 hrs. Air | A. A-I (.12C, 3.82 Mn, .68Si, 18.0Cr, 10.3Ni, 1.02Mo)<br>B. O.N.<br>C. 17.5Cr, 9.5Ni, 1.07Mo)<br>D. Armox 400<br>E. DC REV | A. 60°DV<br>B. 3/16" RF<br>C. Machining | A. Not given<br>B. I 1/8" 1a 110 - 24<br>2.4<br>3. Five beads 5/32" 3b 140 - 25 1/8" 2b 110 - 24<br>C. 7 hrs. 800 - 130°F.<br>D. Peening - first pass     | A. None<br>B. 8500 | 1 2100<br>2 2300 14"             | 14" R<br>6" D<br>54" U<br>Imp II 6"<br>III 8"<br>II 3"<br>III 7 1/2"<br>V 18"<br>34" | Passed radiograph<br>Some incomplete fusion and slag inclusions in legs |                  |                 |                    |                    |                         |                  |                   |                  |                |
| A. AD-60<br>B. 10/16/42<br>C. XW-130-F<br>D. Great Lakes Steel Corp.<br>E. Crucible Steel Corp.<br>F. Chevrolet Motor Co. | A. 3/8"<br>B. R-IV<br>(.94Mn, .73Si, .47Cr, .23Mo)<br>C. .29<br>D. Face 321 Back 321<br>E. B.O.N.<br>F. 1600°F. 35 mins. Water 990°F. 4 hrs.     | A. A-I (.11C, 3.95 Mn, .48Si, 19.6Cr, 10.1Ni, 1.18Mo)<br>B. O.N.<br>C. 17.5Cr, 9.5Ni, 1.07Mo)<br>D. Armox 400<br>E. DC REV | A. 60°DV<br>B. 3/16" RF<br>C. Machining | A. Not given<br>B. I 1/8" 1a 110 - 24<br>2.4<br>3. Five beads 5/32" 3b 140 - 25 1/8" 2b 110 - 24<br>C. 7-1/2 hrs. 800 - 180°F.<br>D. Peening - first pass | A. None<br>B. 8500 | 1 2100<br>2 2300 8"              | 3" R<br>6 1/2" D<br>24" U<br>Imp I 9"<br>II 7 1/2"<br>III 1 1/2"<br>39"              | Passed radiograph   |                  |                 |                    |                    |                         |                  |                   |                  |                |



| IDENTIFICATION   | ANNEAL AREA   | SALT BATH DATA  | POST BEEN                                       | WELDING   | PROCESSING         | HEAT               | BALLISTICS RESULTS |   | REMARKS ON QUALITY   |
|--|---|---|---|---|--------------------|--------------------|--------------------|---|--|
|  |   |   |   |   |                    |                    | WELT               | CRACKING  |  |
| A. PARTS TESTED  | A. PLATE THICKNESS  | A. TYPE   | A. GRAIN SIZE                                   | A. SAOING   | A. SAOING          | A. PHE             | WELT               | CRACKING  | REMARKS ON QUALITY   |
| B. DATE OF TEST  | B. TYPE   | B. THICKNESS  | B. GRAIN SIZE                                   | B. SAOING   | B. SAOING          | B. PHE             | WELT               | CRACKING  | REMARKS ON QUALITY   |
| C. PLATE NO.   | C. GRAIN ORIENT   | C. GRAIN ORIENT   | C. GRAIN ORIENT                                 | C. GRAIN ORIENT   | C. GRAIN ORIENT    | C. GRAIN ORIENT    | WELT               | CRACKING  | REMARKS ON QUALITY   |
| D. ANNEALING   | D. ANNEALING  | D. ANNEALING  | D. ANNEALING                                    | D. ANNEALING  | D. ANNEALING       | D. ANNEALING       | WELT               | CRACKING  | REMARKS ON QUALITY   |
| E. ELECTRODE WELD  | E. ELECTRODE WELD   | E. ELECTRODE WELD   | E. ELECTRODE WELD                               | E. ELECTRODE WELD   | E. ELECTRODE WELD  | E. ELECTRODE WELD  | WELT               | CRACKING  | REMARKS ON QUALITY   |
| F. ANNEALING   | F. ANNEALING  | F. ANNEALING  | F. ANNEALING                                    | F. ANNEALING  | F. ANNEALING       | F. ANNEALING       | WELT               | CRACKING  | REMARKS ON QUALITY   |
| A. AD-60<br>B. 10/16/42<br>C. XW-131-F<br>D. Great Lakes<br>Steel Corp.<br>E. Harnischfeger<br>Corp.<br>F. Chevrolet<br>Motor Company  | A. 3/8"<br>B. R-IV<br>(.94Mn, .71Si,<br>.47Cr, .23Mo)<br>C. .29<br>D. Face 311<br>Back 311<br>E. B.O.H.<br>F. 1900°F. 35<br>mins. Water<br>990°F. 4<br>hrs. Air | A. A-I<br>(.12C, 3.82<br>Mn, .66Si,<br>19.0Cr,<br>10.3Ni,<br>1.02Mo)<br>(.15C, 6.47<br>Mn, .65Si,<br>19.5Cr,<br>9.5Ni,<br>1.07Mo)*<br>B. AW-3-C<br>C. Lime<br>D. DC REV     | A. 60°DV<br>1/16"RF<br>B. 3/16"<br>C. Machining | A. Not given<br>B. 1. I 1/8" 1a 110 - 24<br>2. 4<br>3. Five beads<br>5/32" 3b 140 - 25<br>1/8" 2b 110 - 24<br>C. 8 hrs. 750 - 1300°F.<br>D. Peening - first pass. | A. None<br>B. None | A. None<br>B. None | 1 2100<br>2 2300   | I 6"<br>II 3"<br>III 1 1/2"<br>I 3"<br>II 1 1/2"<br>III 9"<br>35"           | Passed radiograph<br>Some scattered<br>areas of incom-<br>plete fusion             |
| A. AD-60<br>B. 10/16/42<br>C. XW-132-F<br>D. Great Lakes<br>Steel Corp.<br>E. Crucible Steel<br>Corp.<br>F. Chevrolet<br>Motor Company | A. 3/8"<br>B. R-IV<br>(.94Mn, .73Si,<br>.47Cr, .23Mo)<br>C. .29<br>D. Face 311<br>Back 311<br>E. B.O.H.<br>F. 1600°F. 35<br>mins. Water<br>990°F. 4<br>hrs. Air | A. A-I<br>(.11C, 3.95<br>Mn, .42Si,<br>19.6Cr,<br>10.1Ni,<br>1.18Mo)*<br>(.14C, 3.58<br>Mn, .31Si,<br>19.7Cr,<br>10.4Ni,<br>1.17Mo)*<br>B. Armorize<br>C. T102<br>D. DC REV | A. 60°DV<br>1/16"RF<br>B. 3/16"<br>C. Machining | A. Not given<br>B. 1. I 1/8" 1a 110 - 24<br>2. 4<br>3. Five beads<br>5/32" 3b 140 - 25<br>1/8" 2b 110 - 24<br>C. 8 hrs. 750 - 1300°F.<br>D. Peening - first pass  | A. None<br>B. None | A. None<br>B. None | 1 2100<br>2 2300   | I 6"<br>II 4"<br>III 4"<br>I 1 1/2"<br>II 5"<br>III 3"<br>V 8"<br>33"       | Passed radiograph<br>Some scattered<br>areas of incom-<br>plete fusion             |
| A. AD-6C<br>B. 10/16/42<br>C. XW-137-F<br>D. Great Lakes<br>Steel Corp.<br>E. McKay<br>Chevrolet<br>Motor Company                      | A. 3/8"<br>B. R-IV<br>(.91Mn, .71Si,<br>.59Cr, .23Mo)<br>C. .28<br>D. Face 321<br>Back 321<br>E. B.O.H.<br>F. 1600°F. 35<br>mins. Water<br>965°F. 4<br>hrs. Air | A. A-I<br>(.13C, 3.91<br>Mn, .01Si,<br>19.6Cr,<br>10.83Ni,<br>1.18Mo)*<br>(.14C, 3.81<br>Mn, .76Si,<br>19.9Cr,<br>9.41Ni,<br>1.19Mo)*<br>B. A-5<br>C. Lime<br>D. DC REV     | A. 60°DV<br>1/16"RF<br>B. 3/16"<br>C. Machining | A. Not given<br>B. 1. I 1/8" 1a 110 - 24<br>2. 4<br>3. Five beads<br>5/32" 3b 140 - 25<br>1/8" 2b 110 - 24<br>C. 7 hrs. 800 - 1600°F.<br>D. Peening - first pass  | A. None<br>B. None | A. None<br>B. None | 1 2100<br>2 2300   | I 4"<br>II 6"<br>III 3"<br>I 2 1/2"<br>II 1 1/2"<br>III 10"<br>VI 4"<br>43" | Passed radiograph<br>Some scattered<br>areas of slag<br>inclusions and<br>porosity |
|  |   |   |   |   |                    |                    |                    |   |  |

| DESCRIPTION  | MATERIAL DATA  | MATERIAL SPECIFICATION   | MATERIAL SOURCE                        | MATERIAL WEIGHT  | MATERIAL TYPE      | MATERIAL GRADE  | MATERIAL SIZE  | MATERIAL WEIGHT    | MATERIAL LOCATION  | MATERIAL CONDITION  | MATERIAL TESTS  | MATERIAL RESULTS | MATERIAL COMMENTS | MATERIAL IDENTIFICATION |    | MATERIAL DATE | MATERIAL BY |
|--|--|--|--|--|--------------------|---|--|--------------------|--|---|---|------------------|-------------------|-------------------------|----|---------------|-------------|
|  |  |  |  |  |                    |   |  |                    |  |   |   |                  |                   | LI                      | EL |               |             |
| A. AD-60<br>B. 10/16/42<br>C. XW-144-F<br>D. Great Lakes Steel Corp.<br>E. McKay Company<br>F. Chevrolet Motor Co.         | A. 3/8"<br>B. R-IV (.76Mn, .70Si, .55Cr, .15Mo)<br>C. 26<br>D. Face 321 Back 321<br>E. B.O.H.<br>F. 1600°F. 35 mins. Water 915°F. 4 hrs. Air | A. (.12C, 4.41 Mn, .49Si, 18.5Cr, 10.0Ni, .75Mo)<br>B. AC-5<br>C. Lime<br>D. DC REV        | A. 60°DV<br>B. 1/16"RF<br>C. Machining | A. Not given<br>B. 1. I 1/8" la 110 - 24<br>2. & 5/32" 3b 140 - 25<br>3. Five beads 1/8" 2b 110 - 24<br>C. 6 hrs. 80° - 135°F.<br>D. Peening - first pass.     | A. None<br>B. None | 1 2100<br>2 2300<br>3 2300                                      | X<br>4<br>3  | HE M-54 projectile | Imp<br>D<br>D<br>U   | III<br>III<br>O<br>III  | 44" Passed radiograph<br>6" Several orater<br>cracks in crossbar  |                  |                   |                         |    |               |             |
| A. AD-60<br>B. 10/17/42<br>C. XW-126-F<br>D. Great Lakes Steel Corp.<br>E. McKay Company<br>F. Chevrolet Motor Co.         | A. 3/8"<br>B. R-IV (.94Mn, .73Si, .47Cr, .23Mo)<br>C. 29<br>D. Face 321 Back 321<br>E. B.O.H.<br>F. 1600°F. 35 mins. Water 990°F. 4 hrs. Air | A. A-I (.13C, 3.91 Mn, 1.01Si, 19.6Cr, 10.83Ni, 1.16Mo)<br>B. AC-5<br>C. Lime<br>D. DC REV | A. 60°DV<br>B. 1/16"RF<br>C. Machining | A. Not given<br>B. 1. I 1/8" la 110 - 24<br>2. & 5/32" 3b 140 - 25<br>3. Five beads 1/8" 2b 110 - 24<br>C. 8 hrs. 85° - 140°F.<br>D. Peening - first pass.     | A. None<br>B. None | 1 2100<br>37MM HE M-54 projectile                               | 3 1/2" R   | HE M-54 projectile | Imp<br>O<br>U  | I<br>II<br>V<br>III   | 44" Passed radiograph<br>9" Few small crater<br>cracks along<br>section<br>crossbar<br>displaced<br>33" |                  |                   |                         |    |               |             |
| A. AD-60<br>B. 10/17/42<br>C. XW-144-F<br>D. Youngstown Sheet & Tube Company<br>E. McKay Company<br>F. Chevrolet Motor Co. | A. 3/8"<br>B. R-III (.42Mn, .15Si, .24Co)<br>C. 25<br>D. Face 341 Back 341<br>E. B.O.H.<br>F. 1600°F. 35 mins. Water 760°F. 4 hrs. Air       | A. A-I (.12C, 4.41 Mn, .49Si, 18.5Cr, 10.0Ni, .75Mo)<br>B. AC-5<br>C. Lime<br>D. DC REV    | A. 60°DV<br>B. 1/16"RF<br>C. Machining | A. Not given<br>B. 1. I 1/8" la 110 - 24<br>2. & 5/32" 3b 140 - 25<br>3. Five beads 1/8" 2b 110 - 24<br>C. 7-1/2 hrs. 80° - 140°F.<br>D. Peening - first pass. | A. None<br>B. None | 1 2100<br>2 2100<br>3 2300<br>4 2100<br>37MM HE M-54 projectile | 2 1/2" R<br>2" R<br>4 1/2" L<br>9 1/2" D<br>HE M-54 projectile | HE M-54 projectile | 7" D<br>3 1/2" U<br>1 1/2" Imp<br>U<br>Imp<br>D<br>U<br>HE M-54 projectile | I<br>II<br>III<br>V<br>I<br>II<br>III<br>III<br>III<br>III<br>III | Passed radiograph<br>Incomplete fuelion<br>throughout   |                  |                   |                         |    |               |             |

| IDENTIFICATION     |                 | ANODE AREA   |                                 | BLASTING DATA      |                     | JOINT DESIGN  |                              | WELDING                  |   | PROCEDURE                             |                       | HEAT                 |            | BALLISTICS RESULT                                   |              | REMARKS ON CRACKING |  |            |         |                   |          |                             |   |  |
|--------------------|-----------------|--------------|---------------------------------|--------------------|---------------------|---|------------------------------|--------------------------|---|---------------------------------------|-----------------------|----------------------|------------|---|--------------|---------------------|--|------------|---------|-------------------|----------|-----------------------------|---|--|
| A. FROM RECORD NO. | B. DATE OF TEST | C. PLATE NO. | D. ANODE MANUFACTURER           | E. ELECTRODE SPAR. | F. ANODE FABRICATOR | A. TYPE   | B. TRADE NAME                | C. COATING               | D. CURRENT & POLARITY                   | A. GROOVE, INCLUDING ANGLE, ROOT FACE | B. ROOT GAP           | C. PLATE PREPARATION | A. BACKING | B. DEPOSITION SIZE EL. NO. TYPE AIR V. I. ROOT TYPE | C. ROOT TYPE | D. CURRENT TYPE     | E. TOTAL WELDING TIME & ENTER PASS TEMPERATURE | A. NONE    | B. POST | N                 | VEL. F/S | LOCATION OF R. LI. EL. S.E. | CRACKING LOG TYPE ANY                   | REMARKS ON CRACKING RADIOGRAPHIC RESULTS, ETC. |
| A. AD-60           | 10/17/42        | XW-145-F     | Youngstown Sheet & Tube Company | Alloy Rods Co.     | Chevrolet Motor Co. | A. A-I (.13C, 1.41 Mn., 31S1, 20.4Cr, 13.7Ni, 3.29Mo)   | R-III (1.42Mn, .15S1, .24Mo) | Face 341 Back 341 B.O.H. | 1600°F, 35 hrs. Water 760°F, 4 hrs. Air | A. 60°DV, 1/16" RF                    | B. 3/16" C. Machining | A. Not given         | A. None    | 1   | 2100         | X                   | 3 1/2" Imp                                     | I II III V | 4"      | Passed radiograph |          |                             | Several small crater cracks in crossbar |  |
| A. AD-50           | 10/17/42        | XW-147-F     | Jones & Laughlin Steel Corp.    | Alloy Rods Co.     | Chevrolet Motor Co. | A. A-I (.13C, 1.41 Mn., 31S1, 20.4Cr, 13.7Ni, 3.29Mo)   | R-III (1.60Mn, .21S1, .46Mo) | Face 352 Back 352 B.O.H. | 1645°F, 35 hrs. Water 880°F, 4 hrs. Air | A. 60°DV, 1/16" RF                    | B. 3/16" C. Machining | A. Not given         | A. None    | 1   | 2100         | 1 1/2" L            | 6 1/2" Imp                                     | I II III   | 9"      | Passed radiograph |          |                             |   |  |
| A. AD-60           | 10/17/42        | XW-148-F     | Jones & Laughlin Steel Corp.    | McKay Company      | Chevrolet Motor Co. | A. A-I (.13C, 3.91 Mn., 0.1S1, 19.6Cr, 10.83Ni, 1.18Mo) | R-III (1.60Mn, .21S1, .46Mo) | Face 363 Back 363 B.O.H. | 1645°F, 35 hrs. Water 880°F, 4 hrs. Air | A. 60°DV, 1/16" RF                    | B. 3/16" C. Machining | A. Not given         | A. None    | 1   | 2100         | 3 1/2" L            | 7 1/2" D                                       | I II III   | 7 1/2"  | Passed radiograph |          |                             |   |  |
| A. AD-60           | 10/17/42        | XW-148-F     | Jones & Laughlin Steel Corp.    | McKay Company      | Chevrolet Motor Co. | A. A-I (.13C, 3.91 Mn., 0.1S1, 19.6Cr, 10.83Ni, 1.18Mo) | R-III (1.60Mn, .21S1, .46Mo) | Face 363 Back 363 B.O.H. | 1645°F, 35 hrs. Water 880°F, 4 hrs. Air | A. 60°DV, 1/16" RF                    | B. 3/16" C. Machining | A. Not given         | A. None    | 2   | 2100         | 2" R                | 7" U   | I II III   | 7"      | Passed radiograph |          |                             |   |  |
| A. AD-60           | 10/17/42        | XW-148-F     | Jones & Laughlin Steel Corp.    | McKay Company      | Chevrolet Motor Co. | A. A-I (.13C, 3.91 Mn., 0.1S1, 19.6Cr, 10.83Ni, 1.18Mo) | R-III (1.60Mn, .21S1, .46Mo) | Face 363 Back 363 B.O.H. | 1645°F, 35 hrs. Water 880°F, 4 hrs. Air | A. 60°DV, 1/16" RF                    | B. 3/16" C. Machining | A. Not given         | A. None    | 3   | 2100         | 1" R                | 7 1/2" U                                       | I II III   | 15"     | Passed radiograph |          |                             |   |  |
| A. AD-60           | 10/17/42        | XW-148-F     | Jones & Laughlin Steel Corp.    | McKay Company      | Chevrolet Motor Co. | A. A-I (.13C, 3.91 Mn., 0.1S1, 19.6Cr, 10.83Ni, 1.18Mo) | R-III (1.60Mn, .21S1, .46Mo) | Face 363 Back 363 B.O.H. | 1645°F, 35 hrs. Water 880°F, 4 hrs. Air | A. 60°DV, 1/16" RF                    | B. 3/16" C. Machining | A. Not given         | A. None    | 4   | 2300         | 1 1/2" L            | 5" D   | I II III   | 2"      | Passed radiograph |          |                             |   |  |
| A. AD-60           | 10/17/42        | XW-148-F     | Jones & Laughlin Steel Corp.    | McKay Company      | Chevrolet Motor Co. | A. A-I (.13C, 3.91 Mn., 0.1S1, 19.6Cr, 10.83Ni, 1.18Mo) | R-III (1.60Mn, .21S1, .46Mo) | Face 363 Back 363 B.O.H. | 1645°F, 35 hrs. Water 880°F, 4 hrs. Air | A. 60°DV, 1/16" RF                    | B. 3/16" C. Machining | A. Not given         | A. None    | 37MM  | HE           | M-54                | projectile                                     |            |         |                   |          |                             |   |  |





| MANUFACTURER |                 | ANNEAL MEDIA |                         | SURFACE FINISH      |                      | WELDING  |                  | PROCESSING |              | HEAT         |                        | BALLISTICS RESULTS |              | REMARKS ON CRACKING |           |        |        |        |        |        |          |         |            |  |
|--------------|-----------------|--------------|-------------------------|---------------------|----------------------|--|------------------|------------|--------------|--------------|------------------------|--------------------|--------------|---------------------|-----------|--------|--------|--------|--------|--------|----------|---------|------------|--|
| A. PART NO.  | B. DATE OF TEST | C. PLATE NO. | D. MANUFACTURER         | E. ELONGATION SPEC. | F. ANNEAL PARAMETERS | A. TYPE  | B. TRACE NAME    | C. COATING | D. CORROSION | E. POLARITY  | A. SA WELDING          | B. DEPOSITIONS     | C. SIZE EL.  | D. HA TYPE          | E. AIR V. | A. PHE | B. PHE | LI     | EL     | SEL    | LOC TYPE | ASTM    |            |  |
| AD-227       | 11/19/42        | XV-157-F     | E. C. Atkins            | 1.42-1.57Gr.        | 31-53Mo              | A-I (.10C, 1.25 Mn, .36Si, 17.6Cr, 8.9Ni, 2.43Mo)* | A. 60°DV 1/16"RF | B. 3/16"   | C. Grinding  | A. Not given | 1. I 5/32" 1a 140 - 25 | 2a 250 - 28        | 800 - 120°F. | first pass          | A. None   | 1      | 2100   | 1 1/2" | 1"     | 1"     | 1"       | HE M-54 | projectile | Passed radiograph<br>Some incomplete fusion                      |
| AD-227       | 11/21/42        | XV-159-F     | Chevrolet Forge         | .64Cr, .10Ni, .21Mo | 31                   | A-I (.10C, 1.25 Mn, .36Si, 17.6Cr, 8.9Ni, 2.43Mo)* | A. 60°DV 1/16"RF | B. 3/16"   | C. Grinding  | A. Not given | 1. I 5/32" 1a 140 - 25 | 2a 250 - 28        | 800 - 120°F. | first pass          | A. None   | 1      | 2100   | 3 1/2" | 3 1/2" | 3 1/2" | 3 1/2"   | HE M-54 | projectile | Passed radiograph  |
| AD-132       | 12/2/42         | XV-169-F     | Great Lakes Steel Corp. | .59Cr, .23Mo        | 341                  | A-I (.15C, 4.47 Mn, .65Si, 19.5Cr, 9.5Ni, 1.07Mo)* | A. 60°DV 1/16"RF | B. 3/16"   | C. Grinding  | A. Not given | 1. I 5/32" 1a 140 - 25 | 2a 250 - 28        | 750 - 120°F. | first pass          | A. None   | 1      | 2100   | 1 1/2" | 1 1/2" | 1 1/2" | 1 1/2"   | HE M-54 | projectile | Passed radiograph<br>Small crater crack near right weld junction |

| IDENTIFICATION  | ANNEAL DATA   | PLATE TENSILE DATA  | WELDING   | WELDS  | PROCEDURE   | WELT   | BALDWIN RESULTS  |   | REMARKS ON CRACKING RADIOGRAPHIC RESULTS, ETC. |   |
|---|---|---|---|--|---|--|--|---|--|---|
|   |   |   |   |  |   |  | WELT   | CRACKING  |  |   |
| A. PART NUMBER  | A. TYPE   | A. TYPE   | A. WELDING  | A. WELDS   | A. PROCEDURE  | A. WELT  | A. WELT  | A. CRACKING   | A. REMARKS                                     |   |
| B. DATE OF TEST   | B. PLATE NO.  | B. PLATE NO.  | B. TRADE NAME   | B. TRADE NAME  | B. PROCEDURE  | B. WELT  | B. WELT  | B. CRACKING   | B. REMARKS                                     |   |
| C. MANUFACTURER   | C. MANUFACTURER   | C. MANUFACTURER   | C. CHEMISTRY  | C. CHEMISTRY   | C. PROCEDURE  | C. WELT  | C. WELT  | C. CRACKING   | C. REMARKS                                     |   |
| D. ELECTRODE USED   | D. ELECTRODE USED   | D. ELECTRODE USED   | D. POLARITY   | D. POLARITY  | D. PROCEDURE  | D. WELT  | D. WELT  | D. CRACKING   | D. REMARKS                                     |   |
| E. WELDING  | E. WELDING  | E. WELDING  | E. WELDING  | E. WELDING   | E. PROCEDURE  | E. WELT  | E. WELT  | E. CRACKING   | E. REMARKS                                     |   |
| F. WELDING  | F. WELDING  | F. WELDING  | F. WELDING  | F. WELDING   | F. PROCEDURE  | F. WELT  | F. WELT  | F. CRACKING   | F. REMARKS                                     |   |
| A. AD-132<br>B. 12/2/42<br>C. XV-170-F<br>D. Great Lakes Steel Corp.<br>E. McKay Company<br>F. Chevrolet Motor Co.  | A. 3/8"<br>B. R-IV<br>C. (.91Mn, .71Si, .59Cr, .23Mo)<br>D. Face 341<br>E. Back 341<br>F. 1600°F, 35 mins, Water hrs. Air       | A. A-II (.13C, 4.26 Mn, .52Si, 19.1Cr, 9.4Ni)<br>B. 1/4"<br>C. Grinding<br>D. Face 341<br>E. Back 341<br>F. 1600°F, 35 mins, Water hrs. Air         | A. A-II (.13C, 4.26 Mn, .52Si, 19.1Cr, 9.4Ni)<br>B. 1/4"<br>C. Grinding<br>D. Face 341<br>E. Back 341<br>F. 1600°F, 35 mins, Water hrs. Air         | A. Not given<br>B. 1. I 5/32" la 140 - 25<br>C. Two layers 1/4" 2a 250 - 28<br>D. Peening - first pass | A. None<br>B. None<br>C. 7 hrs. 80° - 130°F.<br>D. Peening - first pass     | 1 2100<br>2 2100 1 1/2"<br>3 2100 3/4" 37MM HE M-54 projectile | X 4 1/2"<br>4"<br>9" 1 1/2"<br>12 1/2"                   | Imp II<br>III<br>5"<br>O III<br>12 1/2"                   | 6"<br>5"<br>12 1/2"                            | Passed radiograph<br>Large amount of incomplete weld fusion   |
| A. AD-132<br>B. 12/2/42<br>C. XV-171-F<br>D. Great Lakes Steel Corp.<br>E. Alloy Rods Co.<br>F. Chevrolet Motor Co. | A. 3/8"<br>B. R-IV<br>C. (.91Mn, .71Si, .59Cr, .23Mo)<br>D. Face 341<br>E. Back 341<br>F. 1600°F, 35 mins, Water hrs. Air       | A. A-I (.10C, 1.25 Mn, .38Si, 17.6Cr, 8.9Ni, 2.43Mo)<br>B. 1/4"<br>C. Grinding<br>D. Face 341<br>E. Back 341<br>F. 1600°F, 35 mins, Water hrs. Air  | A. A-I (.10C, 1.25 Mn, .38Si, 17.6Cr, 8.9Ni, 2.43Mo)<br>B. 1/4"<br>C. Grinding<br>D. Face 341<br>E. Back 341<br>F. 1600°F, 35 mins, Water hrs. Air  | A. Not given<br>B. 1. I 5/32" la 140 - 25<br>C. Two layers 1/4" 2a 250 - 28<br>D. Peening - first pass | A. None<br>B. None<br>C. 8 hrs. 80° - 130°F.<br>D. Peening - first pass     | 1 2100<br>2 2100 3/4" 37MM HE M-54 projectile                  | 2 1/2"<br>5 1/2"<br>6 1/2"<br>6 1/2"<br>6 1/2"<br>1 1/2" | Imp II<br>5"<br>D<br>U<br>Imp II<br>9"<br>II 5"<br>1 1/2" | 1"<br>1 1/2"                                   | Passed radiograph<br>1" crater crack near right weld junction |
| A. AD-201<br>B. 1/16/43<br>C. XV-173-F<br>D. E.C. Atkins<br>E. Harnischfeger Corp.<br>F. Chevrolet Motor Co.        | A. 3/8"<br>B. R-V<br>C. (.89Mn, .98Si, .65Cr, .55Ni, .27Mo)<br>D. Face 321<br>E. Back 321<br>F. 1645°F, 15 mins, Water hrs. Air | A. A-I (.15C, 4.47 Mn, .65Si, 19.5Cr, 9.5Ni, 1.07Mo)<br>B. 3/16"<br>C. Grinding<br>D. Face 321<br>E. Back 321<br>F. 1645°F, 15 mins, Water hrs. Air | A. A-I (.15C, 4.47 Mn, .65Si, 19.5Cr, 9.5Ni, 1.07Mo)<br>B. 3/16"<br>C. Grinding<br>D. Face 321<br>E. Back 321<br>F. 1645°F, 15 mins, Water hrs. Air | A. Not given<br>B. 1. I 5/32" la 140 - 25<br>C. Two layers 1/4" 2a 250 - 28<br>D. Peening - first pass | A. None<br>B. None<br>C. 5-1/2 hrs. 90° - 140°F.<br>D. Peening - first pass | 1 2100 4 1/2"<br>2 2100<br>3 2100<br>4 2100 X                  | 4 1/2"<br>4 1/2"<br>3 1/2"<br>4"                         | 6 1/2"<br>6 1/2"<br>3 1/2"<br>4"<br>D                     | 37MM HE M-54 projectile                        | Failed radiograph<br>Excessive amount of incomplete fusion    |

| IDENTIFICATION<br>A. PARTS DRAWING NO.<br>B. DATE OF TEST<br>C. PLATE NO.<br>D. WELDING MANUFACTURER<br>E. ELECTRODE SPEC.<br>F. WELDING PARAMETERS | ANNEAL DATA<br>A. PLATE THICKNESS<br>B. TYPE<br>C. GARDON CONTENT<br>D. SWH<br>E. PROCESS<br>F. HEAT TREATMENT<br>G. TEMPERATURE<br>H. TIME | ELECTRODE DATA<br>A. TYPE<br>B. TRADE NAME<br>C. COATING<br>D. CURRENT & POLARITY  | JOINT DESIGN<br>A. GROOVE UNDRILLED<br>B. SHOULDER ROOT FACE<br>C. ROOT GAP<br>D. PLATE PREPARATION | WELDING<br>A. BACKING<br>B. DEPOSITION<br>C. ROOT TYPE<br>D. ROOT TYPE<br>E. GROOVE TYPE<br>F. TOTAL WELDING TIME<br>G. WELDER<br>H. TEMPERATURE | HEAT<br>A. PRE-HEAT<br>B. POST-HEAT | M. VEL. FTS  | BALLISTICS RESULTS   |   |  | REMARKS ON CRACKS<br>A. TYPE<br>B. LOCATION OF H. CRACKS<br>C. CRACK TYPE<br>D. CRACK LENGTH |
|---|---|--|---|--|-------------------------------------|--|--|---|--|--|
|   |   |  |   |  |                                     |  | L. L. LOCATION OF H. CRACKS                                  | M. VEL. FTS   | N. CRACK TYPE  |  |
| A. AD-201<br>B. 1/16/43<br>C. XV-174-F<br>D. E.C. Atkins<br>E. McKay Company<br>F. Chevrolet Motor Co.  | A. 3/8"<br>B. R-V<br>C. (.89Mn, .98Si, .65Cr, .55Mn, .27Mo)<br>D. Face 321<br>Back 321<br>E. 1645°F. 15 mins. Water<br>1100°F. 2 hrs. Air   | A. A-II<br>(.12C, 4.25 Mn, .53Si, 19.1Cr, 9.4Ni)<br>(.09C, 4.45 Mn, .56Si, 20.1Cr, 9.6Ni)<br>B. AC-5<br>C. Lime<br>D. DC REV                       | A. 60°V<br>1/16" RF<br>B. 3/16"<br>C. Grinding  | A. Not Given<br>B. 1. I 5/32" Ia 140 - 25<br>2. 6/32" Ia 140 - 25<br>3. Two layers<br>C. 5-1/2 hrs. 800 - 110°F.<br>D. Peening - first pass      | A. None<br>B. None                  | 1 2100<br>2 2100<br>3 2100<br>4 2100<br>5 2100<br>6 2100 | 3 3/8" L<br>6" R<br>8 1/4" L<br>3" R<br>4 1/2" R<br>5 1/2" R | 3" Imp U<br>13 1/2" Imp D<br>5 1/2" Imp U<br>HE M-54 projectile | Failed radiograph<br>Excessive amount of slag inclusions and incomplete fusion |  |
| A. AD-201<br>B. 1/16/43<br>C. XV-174-F<br>D. E.C. Atkins<br>E. Crucible Steel Company<br>F. Chevrolet Motor Co.                                     | A. 3/8"<br>B. R-V<br>C. (.89Mn, .98Si, .65Cr, .55Mn, .27Mo)<br>D. Face 321<br>Back 321<br>E. 1645°F. 15 mins. Water<br>1100°F. 2 hrs. Air   | A. A-I<br>(.14C, 3.58 Mn, .31Si, 19.7Cr, 10.4Ni, 1.17Mo)<br>A-II<br>(.10C, 4.32 Mn, .71Si, 20.8Cr, 10.74Ni)<br>B. Armoxize<br>C. TiO2<br>D. DC REV | A. 60°V<br>1/16" RF<br>B. 3/16"<br>C. Grinding  | A. Not Given<br>B. 1. I 5/32" Ia 140 - 25<br>2. 6/32" Ia 140 - 25<br>3. Two layers<br>C. 5-1/2 hrs. 800 - 115°F.<br>D. Peening - first pass      | A. None<br>B. None                  | 1 2100<br>2 2100   | 37MM HE M-54 projectile                                      | 3" Imp U<br>X 13 1/2" Imp D<br>HE M-54 projectile               | Passed radiograph<br>Scattered slag and incomplete fusion throughout           |  |

Weld Metal

| IDENTIFICATION  | ANODE DATA   | ELECTROLYTE DATA  | CATHODE DATA   | WELDER  | WELDING PROCEDURE  | HEAT   | N VEL. GRAINING   | REMARKS ON CRACKING RADIOGRAPHS RESULTS, ETC. |
|---|--|---|--|---|--------------------|--|---|---|
| A. PART NUMBER<br>B. DATE OF TEST<br>C. PLATE NO.<br>D. ORDER NUMBER<br>E. CHEMICAL SYMBOL<br>F. MANUFACTURER | A. PLATE THROUGHNESS<br>B. TYPE<br>C. CATHODE CURRENT<br>D. DENS<br>E. PROCESS<br>F. WELD TREATMENT<br>G. WELD TIME                          | A. TYPE<br>B. NAME<br>C. COATING<br>D. CURRENT & POLARITY   | A. GROOVE INCLUDES<br>B. ANGLE, ROOT FACE<br>C. ROOT GAP<br>D. PLATE PREPARATION | A. BACKING<br>B. DEPOSITION<br>C. ROOT TYPE<br>D. ROOT TYPE<br>E. GROOVE TYPE<br>F. TOTAL WELDING TIME & WELDING TEMPERATURE    | A. None<br>B. Post | H VEL. GRAINING  | REMARKS ON CRACKING RADIOGRAPHS RESULTS, ETC.           |   |
| A. AD-201<br>B. 1/16/43<br>C. XW-176-F<br>D. E.C. Atkins Co.<br>E. Alloy Rods Co.<br>F. Chevrolet Motor Co.   | A. 3/8"<br>B. R-V<br>C. 89Mn, 96S1,<br>-55Cr, 55Ni,<br>-27Mo)<br>D. ---<br>E. B. Elec.<br>F. 1645CF-15<br>Weld Meter<br>1100CF-2<br>hrs. Air | A. A-I<br>(.10C, 1.25<br>Mn, 36S1,<br>17.6Cr,<br>8.9Ni,<br>2.43Mo)*<br>A-II<br>(.12C, 3.58<br>Mn, 26S1,<br>18.6Cr,<br>9.8Ni)*<br>B. Argon<br>C. T108<br>D. DC REV | A. 60°Dv<br>B. 1/16" RF<br>C. Grinding   | A. Not given<br>B. I 5/32" Ia 140 - 25<br>2.4<br>C. Two layers<br>1/4" 2a 250 - 28<br>800 - 1400° F.<br>D. Peening - first pass | A. None<br>B. None | 1 2100 3/4<br>2 2100 5" L L<br>3 2100 12" R U<br>4 2100 1 1/2" R D<br>5 2100 2" R D<br>6 2100 X 5" U | Passed radiograph<br>Small amount of<br>slag inclusions |   |
| 37MM HE M-54 projectile   |  |   |  |   |                    |  |   |   |
| Weld Metal  |  |   |  |   |                    |  |   |   |



| GENERAL INFORMATION  |   | PLATE TREATMENT  |                                     | PLATE ANALYSIS   |                    | WELDING  |  | PREPARATION  |                       | TEST                     |                   | RESULTS   |             | REMARKS  |             |
|--|---|--|-------------------------------------|--|--------------------|--|--|--|-----------------------|--------------------------|-------------------|-----------|-------------|----------|-------------|
| A. PART NO.  | B. DATE OF TEST   | C. PLATE NO.   | D. SURFACE PREPARATION              | E. PROCESS   | F. TREATMENT       | G. TYPE  | H. NAME  | I. ANALYSIS  | J. TENSILE            | K. ELONGATION            | L. BENDING        | M. IMPACT | N. HARDNESS | O. OTHER | P. COMMENTS |
| A. AD-300<br>B. 3/9/43<br>C. 1<br>D. Jones & Laughlin Steel Corp.<br>E. Lincoln Electric Company<br>F. Deere & Co. | A. 3/8"<br>B. R-111<br>(1.64Mn, .22Si, .40Mn)<br>C. .31<br>D. Face 331<br>Back 331<br>E. B.O.H.<br>F. 1600 F.<br>1-1/2 hrs.<br>Water spray<br>1000 F.<br>2-1/2 hrs.<br>Air Cool | A. A-1<br>(.12C, 4.00 Mn, .50Si, .20.SCr, 9.5Mn, .03Mo)<br>B. Armor-weld<br>C. Lins<br>D. DC REV                   | A. 450SV<br>B. 3/16"<br>C. ---      | A. Copper<br>B. I 5/32" la 150 - 24<br>I 1/4" la 210 - 28<br>3/16" 18B 190 - 26<br>C. 4 hrs.<br>D. Two fine cracks were out. | A. None<br>B. None | 1 2100<br>2 2100<br>3 2100                               | 4" R U<br>7" D<br>6 1/2" U   | 6" U<br>7" D<br>6 1/2" U                                     | Imp II<br>V<br>I<br>S | 37mm. HE M-54 projectile | Passed radiograph |           |             |          |             |
| A. AD-323<br>B. 3/12/43<br>C. 2<br>D. Jones & Laughlin Steel Corp.<br>E. Crucible Steel Corp.<br>F. Deere & Co.    | A. 3/8"<br>B. R-111<br>(1.64Mn, .22Si, .40Mn)<br>C. .31<br>D. Face 331<br>Back 331<br>E. B.O.H.<br>F. 1600 F.<br>1-1/2 hrs.<br>Water spray<br>1000 F.<br>2-1/2 hrs.<br>Air Cool | A. A-1<br>(.11C, 1.98 Mn, .18Si, 18.8Cr, 10.2Mn, 1.87Mo)<br>B. Armorize<br>C. Resistal<br>D. Titanium<br>E. DC REV | A. 450SV<br>B. 3/16"<br>C. Machined | A. Copper<br>B. I 5/32" la 145 - 24<br>I 1/4" la 220 - 28<br>3/16" 18B 190 - 26<br>C. 4 hrs.                                 | A. None<br>B. None | 1 2100<br>2 2100<br>3 2100<br>4 2100<br>5 2100<br>6 2100 | 1 1/2" R<br>3 1/2" L D<br>6" U<br>8 1/2" D<br>3" R U<br>2" 13 1/2" L D | 6" U<br>6" D<br>6" U<br>8 1/2" D<br>3" R U<br>2" 13 1/2" L D | 0 II<br>2"            | 37mm. HE M-54 projectile | Passed radiograph |           |             |          |             |

Weld Metal

| IDENTIFICATION   | ANNEAL DATA  | PLATE DATA  | WELD DATA   | WELDING PROCEDURE   | HEAT TREATMENT     | N | BALLISTIC RESULTS |  | REMARKS ON CRACKING RADIOGRAPHIC RESULTS, ETC.         |
|--|--|---|---|---|--------------------|---|-------------------|--|--|
|  |  |   |   |   |                    |   | VELOCITY          | CRACKING   |  |
| A. FORD ORDER NO.  | A. PLATE NUMBER  | A. TYPE   | A. GROOVE INCLUDES                                  | A. WELDING  | A. POST            | H | VELOCITY          | CRACKING   |  |
| B. DATE OF TEST  | B. TYPE  | B. TRADE NAME   | B. ANGLE, ROOT FACE                                 | B. DEPOSITION   | B. POST            |   |                   |  |  |
| C. PLATE NO.   | C. COATING   | C. ORIENT & POLARITY  | C. FLAME CUTTING                                    | C. 1. BODY TYPE   | C. POST            |   |                   |  |  |
| D. FORD MOTOR CO.  | D. .56Cr-.44Mo   | D. 2.0Mo  | D. 2.0Mo  | C. 2. GROUND TYPE   | C. POST            |   |                   |  |  |
| E. CRUCIBLE STEEL  | E. .24   | E. 1650OF. 2  | E. 1650OF. 2  | C. 3. HRS.  | C. POST            |   |                   |  |  |
| F. FORD MOTOR CO.  | F. 1650OF. 4   | F. 1000OF. 6  | F. 1000OF. 6  | D. GROUND CRATER  | D. POST            |   |                   |  |  |
| A. AD-228<br>B. 11/16/42<br>C. 7-31<br>D. Ford Motor Co.<br>E. Crucible Steel Corp.<br>F. Ford Motor Co. | A. 3/8"<br>B. R-II<br>(1.43Mn, .29Si, .56Cr, .44Mo)<br>C. .30<br>D. .24<br>E. B.O.H.<br>F. 1650OF. 4             | A. A-I<br>(.07C, 1.40 Mn, .27Si, 18.00Cr, 10.2Ni, 2.0Mo)<br>B. Armorize<br>C. Titanita<br>D. DC | A. 45°SV<br>B. 1/8"<br>C. Flame Cutting<br>Grinding | A. Copper<br>B. I 5/32" la 130 - 22<br>3. I 1/4" la 195 - 24<br>5/32" 198 130 - 22<br>C. 3 hrs. 1040 - 1300F.<br>D. Ground crater after first pass. Each pass was completely welded throughout the entire H joints before the subsequent pass was made. | A. None<br>B. None | 1 | 2100              | 2" L<br>5" Imp D<br>37mm. HE M-54 projectile                                   | II 16"<br>V 24"<br>42" cracks in crossbar and left leg |
| A. AD-166<br>B. 11/25/42<br>C. 7-71<br>D. Ford Motor Co.<br>E. Crucible Steel Corp.<br>F. Ford Motor Co. | A. 3/8"<br>B. R-II<br>(1.15Mn, .29Si, .54Cr, .05Ni, .40Mo)<br>C. .24<br>D. Face 341<br>E. B.O.H.<br>F. 1650OF. 2 | A. A-I<br>(.07C, 1.82 Mn, 20.09 Cr, 9.97Ni, 2.00Mo)<br>B. Armorize<br>C. Titanita<br>D. DC REV  | A. 45°SV<br>B. 3/16"<br>C. Grinding                 | A. Copper<br>B. I 3/16" la 155 - 22<br>3. I 3/16" la 175 - 22<br>5/32" 198 135 - 22<br>C. 3-1/2 hrs. 1700 - 2150F.<br>D. Ground crater after first pass.  | A. None<br>B. None | 1 | 2100              | X<br>3" Imp D<br>1" 10" Imp R<br>U<br>37mm. HE M-54 projectile                 | II 4"<br>I 7"<br>II 1"<br>20"                          |
| A. AD-166<br>B. 11/25/42<br>C. 7-74<br>D. Ford Motor Co.<br>E. Crucible Steel Corp.<br>F. Ford Motor Co. | A. 3/8"<br>B. R-II<br>(1.15Mn, .29Si, .54Cr, .05Ni, .40Mo)<br>C. .24<br>D. Face 341<br>E. B.O.H.<br>F. 1650OF. 2 | A. A-I<br>(.07C, 1.82 Mn, 20.09 Cr, 9.97Ni, 2.00Mo)<br>B. Armorize<br>C. Titanita<br>D. DC REV  | A. 45°SV<br>B. 1/4"<br>C. Flame Cutting             | A. Copper<br>B. I 3/16" la 170 - 22<br>3. I 1/4" la 235 - 22<br>5/32" 188 150 - 22<br>C. 2 hrs. 1390 - 1960F.<br>D. Grinding after first pass.  | A. None<br>B. None | 1 | 2100              | 2" R<br>9 1/2" D<br>2 2100<br>1" 5 1/2" Imp L<br>U<br>37mm. HE M-54 projectile | II 14"<br>III 1"<br>16"                                |

| SPECIMEN   |  | ANNEALING  |  | SURFACE PREP   |                    | TEST PROCEDURE                                       |  | WEIGHT                               |                    | BALLISTIC RESULT  |              | REMARKS ON CRACKING RADIOGRAPHIC RESULTS, ETC. |              |
|--|--|--|--|--|--------------------|--|--|--------------------------------------|--------------------|-------------------|--------------|--|--------------|
| A. FROM  | B. DATE OF TEST  | C. PLATE NO.   | D. PLATE NO.                             | E. PLATE NO.   | F. PLATE NO.       | G. PLATE NO.   | H. PLATE NO.                             | I. PLATE NO.                         | J. PLATE NO.       | K. PLATE NO.      | L. PLATE NO. | M. PLATE NO.                                   | N. PLATE NO. |
| A. FROM  | B. DATE OF TEST  | C. PLATE NO.   | D. PLATE NO.                             | E. PLATE NO.   | F. PLATE NO.       | G. PLATE NO.   | H. PLATE NO.                             | I. PLATE NO.                         | J. PLATE NO.       | K. PLATE NO.      | L. PLATE NO. | M. PLATE NO.                                   | N. PLATE NO. |
| A. FROM  | B. DATE OF TEST  | C. PLATE NO.   | D. PLATE NO.                             | E. PLATE NO.   | F. PLATE NO.       | G. PLATE NO.   | H. PLATE NO.                             | I. PLATE NO.                         | J. PLATE NO.       | K. PLATE NO.      | L. PLATE NO. | M. PLATE NO.                                   | N. PLATE NO. |
| A. AD-207<br>B. 1/21/43<br>C. W-95<br>D. Ford Motor Co.<br>E. Crucible Steel Corp.<br>F. Ford Motor Co.  | A. 3/8"<br>B. R-II<br>C. (1.27Mn, .24Si, .52Cr, .05Ni, .40Mo)<br>D. .27<br>E. ---<br>F. 1650°F. 2 hrs. Platen<br>975°F. 3-1/4 hrs. Air     | A. A-I<br>(.07C, 1.82 Mn, .20.09 Cr, .9.97Ni, 2.00Mo)<br>B. Armoxize resistal<br>C. Tivania<br>D. DC REV | A. 60°SV<br>B. 3/16"<br>C. Flame Cutting | A. Not given<br>B. I 3/16" la 180 - 25<br>2. I 3/16" la 180 - 25<br>3. I 3/16" la 180 - 25<br>C. 5/32" 1SB 125 - 35<br>D. ---  | A. None<br>B. None | 1 2100 2 1/2"<br>2 2100 2"<br>3 2100 2"<br>4 2100 1" | 5 1/2" D<br>5 1/2" U<br>7" D<br>6 1/2" U | I 15"<br>V 16"<br>projectile         | HE M-54            | Passed radiograph |              |  |              |
| A. AD-207<br>B. 1/21/43<br>C. W-96<br>D. Ford Motor Co.<br>E. Crucible Steel Corp.<br>F. Ford Motor Co.  | A. 3/8"<br>B. R-II<br>C. (1.27Mn, .24Si, .52Cr, .05Ni, .40Mo)<br>D. .27<br>E. ---<br>F. 1650°F. 2 hrs. Platen<br>975°F. 3-1/4 hrs. Air     | A. A-I<br>(.07C, 1.82 Mn, .20.09 Cr, .9.97Ni, 2.00Mo)<br>B. Armoxize resistal<br>C. Tivania<br>D. DC REV | A. 60°SV<br>B. 1/4"<br>C. Flame Cutting  | A. Not given<br>B. I 3/16" la 180 - 25<br>2. I 3/16" la 180 - 25<br>3. I 3/16" la 180 - 25<br>C. 5/32" 1SB 125 - 25<br>D. ---  | A. None<br>B. None | 1 2100 1 1/2"<br>2 2100 1 1/2"                       | X<br>5 1/2" U<br>L                       | I 9"<br>II 1"<br>I 4"<br>V 5"<br>30" | HE M-54 projectile | Passed radiograph |              |  |              |
| A. AD-346<br>B. 3/30/43<br>C. W-19<br>D. Ford Motor Co.<br>E. Page<br>F. Allegheny Co.<br>Ford Motor Co. | A. 3/8"<br>B. R-II<br>C. (1.27Mn, .24Si, .52Cr, .05Ni, .40Mo)<br>D. .27<br>E. ---<br>F. 1650°F. 2-1/2 hrs. Platen<br>975°F. 3-3/4 hrs. Air | A. A<br>B. ---<br>C. ---<br>D. DC REV  | A. 45°SV<br>B. 3/16"<br>C. Flame Cutting | A. Copper<br>B. I 5/32" la 145 - 22<br>2. I 3/16" la 190 - 22<br>3. I 5/32" 1SB 145 - 23<br>C. 3 hrs. 181° - 240°F.<br>D. Crster cracking and chipping after first pass. | A. None<br>B. None | 1 2100<br>2 2100                                     | 3" R D<br>3" R U<br>6" U                 | I 14"<br>II 2"<br>16"                | HE M-54 projectile | Passed radiograph |              |  |              |
|  |  | Weld Metal   |  |  |                    |  |  |                                      |                    |                   |              |  |              |



| GENERAL DATA   |   | ELECTRODE DATA                        |   | JOINT PREPARED                             |   | WELDING PROCEDURE                               |   | WELDING RESULTS  |  | REMARKS ON DAMAGING                             |   |
|--|---|---------------------------------------|---|--|---|---|---|--|--|---|---|
| A. TYPE OF TEST  | A. PLATE THICKNESS  | A. TYPE NAME                          | A. FACE FINISH  | A. BACK FINISH                             | A. POSITION   | A. SIZE   | A. WELDING                                      | A. LOCATION OF WELD  | A. WELDING   | A. WELDING                                      | A. WELDING                                      |
| B. DATE OF TEST  | B. TYPE   | B. COATING                            | B. SHOT BLAST   | B. SHOT BLAST                              | B. DEPOSITION   | B. SIZE EL. NO. TYPE                            | B. WELDING                                      | B. LOCATION OF WELD  | B. WELDING   | B. WELDING                                      | B. WELDING                                      |
| C. PLATE NO.   | C. CARBON CONTENT   | C. POLARITY                           | C. PLATE PREPARATION  | C. PLATE PREPARATION                       | C. BODY TYPE  | C. BODY TYPE                                    | C. BODY TYPE                                    | C. BODY TYPE   | C. BODY TYPE   | C. BODY TYPE                                    | C. BODY TYPE                                    |
| D. MANUFACTURER  | D. SIZE   | D. POLARITY                           | D. POLARITY   | D. POLARITY                                | D. COARSE TYPE  | D. COARSE TYPE                                  | D. COARSE TYPE                                  | D. COARSE TYPE   | D. COARSE TYPE   | D. COARSE TYPE                                  | D. COARSE TYPE                                  |
| E. ELECTRODE SPEC.   | E. PROCESS  | E. POLARITY                           | E. POLARITY   | E. POLARITY                                | E. TOTAL WELDING TIME & RETURN FROM TEMPERATURE   | E. TOTAL WELDING TIME & RETURN FROM TEMPERATURE | E. TOTAL WELDING TIME & RETURN FROM TEMPERATURE | E. TOTAL WELDING TIME & RETURN FROM TEMPERATURE                          | E. TOTAL WELDING TIME & RETURN FROM TEMPERATURE  | E. TOTAL WELDING TIME & RETURN FROM TEMPERATURE | E. TOTAL WELDING TIME & RETURN FROM TEMPERATURE |
| F. SAMPLE IDENTIFICATION   | F. WELDING TIME   | F. WELDING TIME                       | F. WELDING TIME   | F. WELDING TIME                            | F. WELDING TIME   | F. WELDING TIME                                 | F. WELDING TIME                                 | F. WELDING TIME  | F. WELDING TIME  | F. WELDING TIME                                 | F. WELDING TIME                                 |
| A. AD-203<br>B. 1/21/43<br>C. 8664-13-1<br>D. Ford Motor Co.<br>E. Crucible Steel Corp.<br>F. Ford Motor Co. | A. 3/8"<br>B. R-II<br>(1.20-.1.40Mn,<br>.20-.30Si,.50<br>.60Cr,.30-<br>.40Mo)<br>C. .25-.30<br>D. Face 302<br>Back 302<br>E. ---<br>F. ---                          | A. A<br>B. ---<br>C. ---<br>D. DC REV | A. 60°SV<br>B. 1/8"-1/4"<br>C. Flame<br>Cutting<br>Grinding | A. Not given<br>B. ---<br>C. ---<br>D. --- | 1. I 5/32" la 130 - 25<br>2. I 3/16" la 165 - 25<br>3. I 1/4" la 215 - 25<br>1SB 215 - 25<br>C. ---<br>D. ---       | A. None<br>B. None                              | 1 2100<br>2 2100                                | X<br>6 1/2" U<br>37mm. HE M-54 projectile                                | 7" D<br>6 1/2" U   | Passed radiograph                               |   |
| A. AD-242<br>B. 2/12/43<br>C. W-3<br>D. Ford Motor Co.<br>E. Hollup Corp.<br>F. Ford Motor Co.               | A. 3/8"<br>B. R-II<br>(1.20-.1.40Mn,<br>.20-.30Si,<br>.50-.65Cr,<br>.30-.40Mo)<br>C. .25-.30<br>D. Face 310<br>Back 290<br>E. ---<br>F. ---                         | A. A<br>B. ---<br>C. ---<br>D. DC REV | A. 60°SV<br>B. ---<br>C. ---<br>D. ---                      | A. Copper<br>B. ---<br>C. ---<br>D. ---    | 1. I 5/32" la 180 - 26<br>2. I 3/16" la 160 - 26<br>3. I 1/4" la 230 - 26<br>1SB 230 - 26<br>C. 120 mins.<br>D. --- | A. None<br>B. None                              | 1 2100<br>2 2100<br>3 2100                      | 7 1/2" U<br>3" R D<br>1 1/2" R U<br>37mm. HE M-54 projectile             | 7 1/2" U<br>3" R D<br>1 1/2" R U   | Passed radiograph                               |   |
| A. AD-265<br>B. 2/17/43<br>C. Ford Motor Co.<br>D. Alcos Corp.<br>E. Ford Motor Co.                          | A. 3/8"<br>B. R-II<br>(1.15Mn,.29Si,<br>.54Cr,.05Mn,<br>.40Mo)<br>C. .24<br>D. Back 331<br>E. ---<br>F. 1650°<br>3-1/2 hrs.<br>Platen<br>1000°<br>3-3/4 hrs.<br>Air | A. A<br>B. ---<br>C. ---<br>D. DC REV | A. 45°SV<br>B. 1/8"<br>C. Flame<br>Cutting                  | A. Copper<br>B. ---<br>C. ---<br>D. ---    | 1. I 5/32" la 135 - 22<br>3. I 3/16" la 185 - 22<br>1SB 135 - 22<br>1480 - 198°<br>C. 2 hrs.<br>D. ---              | A. None<br>B. None                              | 1 2100<br>2 2100<br>3 2100<br>4 2100            | 3 1/2" R U<br>4 1/2" D<br>2" R D<br>7 1/2" U<br>37mm. HE M-54 projectile | 3 1/2" R U<br>4 1/2" D<br>2" R D<br>7 1/2" U<br>Imp I 108"<br>III 2<br>V 34"<br>O V 24"<br>38" | Passed radiograph                               |   |



| PART NUMBER<br>A. PART NO.<br>B. PART NAME<br>C. QUANTITY<br>D. DRAWING NO.<br>E. MANUFACTURER<br>F. ASSEMBLY | PLATE NUMBER<br>A. TYPE<br>B. GRADE<br>C. SIZE<br>D. WEIGHT<br>E. TENSILE<br>F. YIELD  | TREATMENT<br>A. TYPE<br>B. TEMPERATURE<br>C. TIME<br>D. MEDIA<br>E. POLARITY | ANNEALING<br>A. TEMPERATURE<br>B. TIME<br>C. MEDIA<br>D. POLARITY | WELDING<br>A. PROCEDURE<br>B. WIRE<br>C. SPEED<br>D. CURRENT<br>E. VOLTAGE<br>F. POLARITY   | PRESSURE<br>A. TYPE<br>B. TEMPERATURE<br>C. TIME<br>D. MEDIA<br>E. POLARITY | HEAT TREATMENT<br>A. TYPE<br>B. TEMPERATURE<br>C. TIME<br>D. MEDIA<br>E. POLARITY | LOCATION OF MARKING                  | MARKING   | REMARKS   |                   |
|---|--|--|---|---|---|---|--------------------------------------|---|---|-------------------|
|   |  |  |   |   |   |   |                                      |   |   | 1                 |
| A. AD-371<br>B. 3/30/43<br>C. 8695E-1-7<br>D. Ford Motor Co.<br>E. Arco Corp.<br>F. Ford Motor Co.            | A. 3/8"<br>B. R-II<br>(1.20-1.40Mn,<br>.20-.30Si,<br>.50-.60Cr,<br>.30-.40Mo)<br>C. .25-.30<br>D. ---<br>E. ---<br>F. ---                                      | A. A<br>B. Chromang<br>C. 631CL<br>D. DC REV                                 | A. 60°SV<br>B. 1/8"-1/4"<br>C. Flame<br>Grinding                  | A. Copper<br>B. I 5/32"<br>Ia 120 - 25<br>2. I 3/16"<br>Ia 180 - 25<br>3. I 1/4"<br>Ia 220 - 25<br>18B 220 - 25<br>C. 4 hrs.<br>100° - 124°<br>D.   | A. 70° F<br>1 2100<br>B. None   | A. 70° F<br>1 2100<br>B. None   | 1 2100<br>2 2100<br>3 2100<br>4 2100 | 1 1/2"<br>R<br>1 1/2"<br>R<br>5/8"<br>L<br>5/8"<br>L<br>4 1/2"<br>U<br>37mm. HE M-54 projectile | 8"<br>D<br>7"<br>U<br>6 1/2"<br>D<br>4 1/2"<br>U<br>Imp I 36"                             | Passed radiograph |
| A. AD-371<br>B. 3/30/43<br>C. 8695E-1-8<br>D. Ford Motor Co.<br>E. Crucible Steel Corp.<br>F. Ford Motor Co.  | A. 3/8"<br>B. R-II<br>(1.20-1.40Mn,<br>.20-.30Si,<br>.50-.60Cr,<br>.30-.40Mo)<br>C. .25-.30<br>D. Face 302<br>E. Elec.<br>F. ---                               | A. A<br>B. Armorize<br>resistal<br>C. ---<br>D. DC REV                       | A. 45°SV<br>B. 1/8"-1/4"<br>C. Flame<br>Cutting<br>Grinding       | A. Copper<br>B. I 5/32"<br>Ia 120 - 25<br>2. I 3/16"<br>Ia 180 - 25<br>3. I 1/4"<br>Ia 220 - 25<br>18B 220 - 25<br>C. 4 hrs.<br>100°<br>D.  | A. 70° F<br>1 2100<br>B. None   | A. 70° F<br>1 2100<br>B. None   | 1 2100<br>2 2100                     | 1 1/2"<br>R<br>1 1/2"<br>R<br>7 1/2"<br>D<br>37mm. HE M-54 projectile                           | 9"<br>Imp I 29"<br>II V 4 1/2"<br>7 1/2"<br>Imp I 29"<br>II 1 1/2"<br>4 1/2"<br>Imp I 36" | Passed radiograph |
| A. AD-343<br>B. 3/30/43<br>C. 9<br>D. Ford Motor Co.<br>E. Crucible Steel Corp.<br>F. Ford Motor Co.          | A. 3/8"<br>B. R-II<br>(1.27Mn,.22Si,<br>.46Cr,.07Ni,<br>.40Mo)<br>C. .27<br>D. Face 341<br>Back 341<br>E. ---<br>F. 1650° F. 2<br>hrs<br>975° F. 3-1/4<br>hrs. | A. A<br>B. Armorize<br>resistal<br>C. Titanite<br>D. DC REV                  | A. 60°SV<br>B. 5/32"<br>C. Flame<br>Cutting<br>Grinding           | A. Not given<br>B. I 5/32"<br>Ia 100 - 22<br>2. I 3/16"<br>Ia 185 - 23<br>3. I 3/16"<br>Ia 190 - 24<br>5/32"<br>18B 140 - 23<br>C. 10:38 hrs. 800 - 110° F.<br>D. Grater orrake chipped and<br>ground after first and<br>second passes. | A. Yes<br>110° F.<br>B. None  | A. Yes<br>110° F.<br>B. None  | 1 2100<br>2 2100                     | 2 1/2"<br>R<br>1"<br>R<br>5 1/2"<br>U<br>37mm. HE M-54 projectile                               | 5 1/2"<br>D<br>Imp I 19"<br>III 2 1/2"<br>32"   | Passed radiograph |



| GENERAL INFORMATION  | PLATE DATA   | WELD DATA  | WELDING DATA   | WELDING PROCEDURE  | WELDING EQUIPMENT  | WELDING OPERATOR   | WELDING DATE   | WELDING LOCATION   | WELDING METHOD   | WELDING POSITION   | WELDING DEFECTS  | WELDING INSPECTION   | WELDING RESULTS  |  |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| A. PLATE NUMBER<br>B. DATE OF TEST<br>C. PLATE NO.<br>D. WELDING METHOD<br>E. WELDING POSITION<br>F. WELDING DEFECTS       | A. PLATE NUMBER<br>B. DATE OF TEST<br>C. PLATE NO.<br>D. WELDING METHOD<br>E. WELDING POSITION<br>F. WELDING DEFECTS | A. WELDING PROCEDURE<br>B. WELDING METHOD<br>C. WELDING POSITION<br>D. WELDING DEFECTS                   | A. WELDING PROCEDURE<br>B. WELDING METHOD<br>C. WELDING POSITION<br>D. WELDING DEFECTS | A. WELDING PROCEDURE<br>B. WELDING METHOD<br>C. WELDING POSITION<br>D. WELDING DEFECTS                     | A. WELDING PROCEDURE<br>B. WELDING METHOD<br>C. WELDING POSITION<br>D. WELDING DEFECTS | A. WELDING PROCEDURE<br>B. WELDING METHOD<br>C. WELDING POSITION<br>D. WELDING DEFECTS | A. WELDING PROCEDURE<br>B. WELDING METHOD<br>C. WELDING POSITION<br>D. WELDING DEFECTS | A. WELDING PROCEDURE<br>B. WELDING METHOD<br>C. WELDING POSITION<br>D. WELDING DEFECTS | A. WELDING PROCEDURE<br>B. WELDING METHOD<br>C. WELDING POSITION<br>D. WELDING DEFECTS | A. WELDING PROCEDURE<br>B. WELDING METHOD<br>C. WELDING POSITION<br>D. WELDING DEFECTS | A. WELDING PROCEDURE<br>B. WELDING METHOD<br>C. WELDING POSITION<br>D. WELDING DEFECTS | A. WELDING PROCEDURE<br>B. WELDING METHOD<br>C. WELDING POSITION<br>D. WELDING DEFECTS | A. WELDING PROCEDURE<br>B. WELDING METHOD<br>C. WELDING POSITION<br>D. WELDING DEFECTS | A. WELDING PROCEDURE<br>B. WELDING METHOD<br>C. WELDING POSITION<br>D. WELDING DEFECTS |
| A. AD-344<br>B. 3/30/43<br>C. A-15<br>D. Jones & Laughlin Steel Corp.<br>E. Harnischfeger Corp.<br>F. Buick Motor Division | A. 1/4"<br>B. R-III<br>(1.38Mn, .20Si, .021)<br>C. .21<br>D. Face 343<br>E. Back 341<br>F. 1800°F.<br>900°F. 1 hr    | A. A-1<br>(.1% C, 1.46 Mn, .47Si, .20% Cr, .021% S, 1.84% Al, .03% V)<br>B. AW-3<br>C. Lime<br>D. DC REW | A. 60°D<br>B. 3/16"<br>C. Flame Cutting  | A. Not given<br>B. Two layers 5/32" 115 - 21<br>C. 39.7 mins. 850 - 1550°<br>D. Grinding after first pass. | A. None<br>B. None   | 1800   | X  | 7 1/2" U   | Passed radiograph  |  |  |  |  |  |
|  |  |  |  |  |  | 21800  | 4"   | 44" Imp D  | I 7"<br>V 38"<br>103"  |  |  |  |  |  |
|  |  |  |  |  |  |  |  | 37MB HE M-54   | projectile   |  |  |  |  |  |
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| IDENTIFICATION   | MATERIALS DATA   | ANALYSIS DATA  | WELDING PROCEDURE                       | WELD               | N                                    | VEL. V/S   | BALLISTIC RESULTS                              |   | CHARACTER                            | REMARKS                              |  |                   |
|--|--|--|---|--------------------|--------------------------------------|--|--|---|--------------------------------------|--------------------------------------|--|-------------------|
|  |  |  |   |                    |                                      |  | LI   | EL  |                                      |                                      | SE   | IMP               |
| A. AD-261<br>B. 2/10/43.<br>C. W-84<br>D. Ford Motor Co.<br>E. Crucible Steel Corp.<br>F. Ford Motor Co. | A. 1/4"<br>B. R-II<br>(1.48Mn, .24Si, .59Cr, .04Ni, .37Mo)<br>C. .27<br>D. Face 341<br>E. B.O.H.<br>F. 1650°F., 2 hrs. Platen<br>9750p. 4-1/2 hrs. | A. A-I<br>(.07C, 1.82 Mn, 20.09Cr, 9.97Ni, 2.00Mo)<br>B. Arsenic<br>C. Titanite<br>D. DC REV | A. 450SV<br>B. 1/4"<br>C. Flame Cutting | A. None<br>B. None | 1<br>2<br>3<br>4<br>5<br>6           | 1650<br>1739<br>1816<br>1839<br>1849<br>1844                 | X<br>7"<br>6"<br>1"<br>1"<br>13"               | 6"<br>7"<br>6"<br>6"<br>10"<br>13"              | U<br>U<br>D<br>D<br>D<br>D           | I<br>V<br>V<br>V<br>V<br>V           | 32"<br>64"<br>74"<br>175"                          | Passed radiograph |
| A. AD-261<br>B. 2/10/43<br>C. W-85<br>D. Ford Motor Co.<br>E. Crucible Steel Corp.<br>F. Ford Motor Co.  | A. 1/4"<br>B. R-II<br>(1.48Mn, .24Si, .59Cr, .04Ni, .37Mo)<br>C. .27<br>D. Face 341<br>E. B.O.H.<br>F. 1650°F., 2 hrs. Platen<br>9750p. 4-1/2 hrs. | A. A-I<br>(.07C, 1.82 Mn, 20.09Cr, 9.97Ni, 2.00Mo)<br>B. Arsenic<br>C. Titanite<br>D. DC REV | A. 450SV<br>B. 1/4"<br>C. Flame Cutting | A. None<br>B. None | 1<br>2<br>3<br>4<br>5<br>6<br>7<br>8 | 1593<br>1580<br>1621<br>1598<br>1634<br>1681<br>1691<br>1636 | 2"<br>2"<br>1"<br>1"<br>2"<br>2"<br>12"<br>14" | 4"<br>7"<br>3"<br>10"<br>9"<br>5"<br>10"<br>14" | U<br>D<br>U<br>D<br>U<br>D<br>D<br>D | V<br>V<br>V<br>V<br>V<br>V<br>V<br>V | 42"<br>42"<br>42"<br>3"<br>52"<br>64"<br>5"<br>34" | Passed radiograph |





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## ABSTRACT:

Ballistic shock test results on 1/2 in., 3/8 in., and 1/4 in., thick homogeneous armor "H" plates welded with austenitic electrodes are outlined. Data from firing records for 99 welded armor H plates have been tabulated on accompanying charts and tables. Quality of armor plate appears to be the most significant variable for the three thicknesses of plate included in the tabulation. There is little difference in ballistic shock test results between plates welded with the manganese and with the molybdenum modified type of austenitic electrodes. No significant trends for decreased weld cracking during ballistic testing are apparent for any of the variations in joint preparation or welding procedure.

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