



INTEGRATED SERVICE COMPANY, L.L.C.
 1900 N. 161st. E. AVENUE
 TULSA, OKLAHOMA 74116

Welding Procedure Specification (WPS)

WPS No.: 1-S-1 Date: 6/28/1994 Rev. No.: 0

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Supporting PQR(s): P1-E-1

Weld Type: Groove and fillet welds

| | | | |
|--|--|---|---------|
| BASE METALS (QW-403) | | | |
| P-No. <u>1</u> Thickness Range: <u>0.1875 in. to 1.5000 in.</u> | | | |
| to P-No. <u>1</u> | | | |
| PREHEAT (QW-406) | | POSTWELD HEAT TREATMENT (QW-407) | |
| Minimum Preheat Temperature: <u>50</u> °F | | PWHT Type: <u>No PWHT will be performed</u> | |
| Maximum Interpass Temperature: <u>500</u> °F | | PWHT Temperature : <u>None</u> °F | |
| Preheat Maintenance: <u>None after weldment</u> | | PWHT Holding Time: <u>None</u> | |
| Weld Process / Method Weld Deposit Limit POSITION (QW-405) Position of Joint Weld Progression FILLER METAL (QW-404) AWS Classification SFA Spec. / F-No. A-No. or Chemical Composition Filler Metal Trade Name Pass Greater Than 1/2": Filler Metal Size (in.) ELECTRICAL (QW-409) Welding Amperage Range Welding Voltage Range Travel Speed (in/min) Max. Heat Input (J/in) Current Type and Polarity TECHNIQUE (QW-410) Peening Stringer or Weave Bead | 1st Process SMAW / Manual 0.0000 in. to 1.5000 in. | | |
| | All Positions | | |
| | Vertical up | | |
| | E7018 | | |
| | 5.1 / 4 | | |
| | 1 | | |
| | n/r | | |
| | No | | |
| | 1/8 | 5/32 | 3/16 |
| | 90-160 | 110-200 | 200-300 |
| | n/r | n/r | n/r |
| | Var. | Var. | Var. |
| | None | | |
| | DCEP (reverse) | | |
| | None | | |
| Stringer and weave bead | | | |
| (1) No peening done with this procedure. No pass greater than 1/2" allowed. Preheat to 175F if "T" > 1" and C > 0.30%; To 200F if 1.25 < "T" <= 1.5" | | | |

INTEGRATED SERVICE COMPANY, L.L.C.

Welding Procedure Specification (WPS)

WPS No.: I-S-1

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JOINT DESIGN (QW-402)

Weld Type: Groove and fillet welds

| Joint Type | Backing | Root Opening | Groove Angle | Root Face | Groove Radius |
|---------------------|----------------------|--------------|----------------|------------|---------------|
| Single-V groove | no backing | 3/16" max. | 50 degree min. | 1/8" max. | |
| Single-bevel groove | no backing | 3/16" max. | 45 degree min. | 1/8" max. | |
| Single-V groove | gouged & back welded | 1/4" max. | 50 degree min. | 3/16" max. | |
| Double-bevel groove | gouged & back welded | 1/4" max. | 45 degree min. | 3/16" max. | |
| Double-V groove | gouged & back welded | 1/4" max. | 45 degree min. | 3/16" max. | |
| Square groove | T-joint | 1/32" max. | | | |
| Square groove | no backing | 3/32" max. | | | |

Fillet Welds: All (QW-451.4)

Retainers: None

See fabrication drawing.

WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL THOSE FOUND ON A JOB. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR A DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.

Initial and Interpass Cleaning: With wire brush clean 1" both sides of weld joint.

Method of Back Gouging: Grind until all defects are removed.

Minimum preheat must be maintained during thermal cutting, tacking, and welding operations.

Welds shall be cleaned between each pass. When completed, remove all slag and projections.

We certify that the statements in this specification are correct and in accordance with the requirements of Section IX of the ASME Code.

By: *David S. Glaves*

David S. Glaves

6/28/1994

Date

QC Manager



INTEGRATED SERVICE COMPANY, L.L.C.
 1900 N. 161st. E. AVENUE
 TULSA, OKLAHOMA 74116

Procedure Qualification Record (PQR)

PQR No.: PI-E-1

Date: 3/17/1975

WPS No.: 1-S-1

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| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|-------------|--|--|---------------|--|--|---------------|--|--|-------------|--|--|-------|--|--|-----|---|---|---|--|--|-----|--|--|--------|--|--|----|--|--|-----|------|---|--------|---------|---|----|-------|---|-----|-----|---|------|--|--|----------------|--|--|-------------------------|--|--|
| JOINT DESIGN (QW-402) Weld Type: Groove weld Groove Type: Single-V groove Backing: Open butt, no back weld Root Opening: 1/8 in. Root Face: 1/16 in. Groove Angle: 60 ° | | BASE METALS (QW-403) Specification Type and Grade: SA-515, Grade 70 to SA-515, Grade 70 P-No. 1 Group No. 2 to P-No. 1 Group No. 2 Thickness (in.): 0.7500 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PREHEAT (QW-406) Minimum Preheat Temperature: 50 °F Maximum Interpass Temperature: 500 °F Preheat Maintenance: None after weldment | | POSTWELD HEAT TREATMENT (QW-407) Type: No PWHT performed PWHT Temperature: None °F PWHT Holding Time: None hr. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Weld Process / Method POSITION (QW-405) Position of Joint Weld Progression FILLER METAL (QW-404) AWS Classification SFA Spec. / F-No. A-No. or Chemical Composition Filler Metal Trade Name Weld Deposit 't' (in.) Pass Greater Than 1/2": Filler Metal Size (in.) ELECTRICAL (QW-409) Amperage Used Voltage Used Travel Speed (in/min) Max. Heat Input (J/in) Current Type and Polarity TECHNIQUE (QW-410) Stringer or Weave Bead | <table border="1"> <tr> <td colspan="3">1st Process</td> </tr> <tr> <td colspan="3">SMAW / Manual</td> </tr> <tr> <td colspan="3">3G - Vertical</td> </tr> <tr> <td colspan="3">Vertical up</td> </tr> <tr> <td colspan="3">E7018</td> </tr> <tr> <td>5.1</td> <td>/</td> <td>4</td> </tr> <tr> <td colspan="3">1</td> </tr> <tr> <td colspan="3">n/r</td> </tr> <tr> <td colspan="3">0.7500</td> </tr> <tr> <td colspan="3">No</td> </tr> <tr> <td>1/8</td> <td>5/32</td> <td>-</td> </tr> <tr> <td>90-110</td> <td>110-150</td> <td>-</td> </tr> <tr> <td>20</td> <td>22-23</td> <td>-</td> </tr> <tr> <td>4-9</td> <td>4-9</td> <td>-</td> </tr> <tr> <td colspan="3">None</td> </tr> <tr> <td colspan="3">DCEP (reverse)</td> </tr> <tr> <td colspan="3">Stringer and weave bead</td> </tr> </table> | | | 1st Process | | | SMAW / Manual | | | 3G - Vertical | | | Vertical up | | | E7018 | | | 5.1 | / | 4 | 1 | | | n/r | | | 0.7500 | | | No | | | 1/8 | 5/32 | - | 90-110 | 110-150 | - | 20 | 22-23 | - | 4-9 | 4-9 | - | None | | | DCEP (reverse) | | | Stringer and weave bead | | |
| 1st Process | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SMAW / Manual | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3G - Vertical | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vertical up | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E7018 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.1 | / | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| n/r | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.7500 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| No | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1/8 | 5/32 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 90-110 | 110-150 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | 22-23 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4-9 | 4-9 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| None | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DCEP (reverse) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Stringer and weave bead | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) Peening was not used with this weld test. No Pass > 1/2" t. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

INTEGRATED SERVICE COMPANY, L.L.C.

Procedure Qualification Record (PQR)

PQR No.: P1-E-1

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Tensile Test (QW-150)

| Specimen No. | Diameter (in.) | Area (in ²) | Ultimate Total Load (lb) | Ultimate Unit Stress (PSI) | Failure Type and Location |
|--------------|----------------|-------------------------|--------------------------|----------------------------|---------------------------|
| 1 | 0.521 | 0.213 | 17100 | 80300 | Weld metal |
| 2 | 0.521 | 0.213 | 17400 | 81700 | Weld metal |

Guided Bend Tests (QW-160)

| Type and Figure No. | Result | Type and Figure No. | Result |
|---------------------|--------------|---------------------|--------------|
| QW-462.2 Side bend | Satisfactory | QW-462.2 Side bend | Satisfactory |
| QW-462.2 Side bend | Satisfactory | QW-462.2 Side bend | Satisfactory |

Hardness Test - Brinell hardness

| Location | Readings | | | | | |
|------------|----------|-----|-----|--|--|--|
| SA-515 HAZ | 187 | 185 | 180 | | | |
| Weld Metal | 180 | 170 | 185 | | | |

Welder's Name: Herman Kohlmeyer I.D.: Stamp No.: K

PQR was done and welding of coupon was witnessed by: Cust-O-Fab Inc

Test conducted by: Metlab Testing Services Lab Test No.: P1-E-1

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

By: David Glaves David S. Glaves 3/17/1975 QC Manager
Date



INTEGRATED SERVICE COMPANY, L.L.C.
 1900 N. 161st. E. AVENUE
 TULSA, OKLAHOMA 74116

Welding Procedure Specification (WPS)

WPS No.: 1-S-10 Date: 7/30/2008 Rev. No.: 0

Supporting PQR(s): 7024-A

Weld Type: Groove and fillet welds

| | | |
|--|---|--|
| BASE METALS (QW-403) P-No. <u>1</u> Thickness Range: <u>0.0625 in. to 0.7500 in.</u> to P-No. <u>1</u> | | |
| PREHEAT (QW-406) Minimum Preheat Temperature: <u>60</u> °F Maximum Interpass Temperature: <u>400</u> °F Preheat Maintenance: <u>None</u> | | POSTWELD HEAT TREATMENT (QW-407) PWHT Type: <u>No PWHT will be performed</u> PWHT Temperature: <u>None</u> °F PWHT Holding Time: <u>None</u> |
| Weld Process / Method Weld Deposit Limit POSITION (QW-405) Position of Joint Weld Progression FILLER METAL (QW-404) AWS Classification SFA Spec. / F-No. A-No. or Chemical Composition Pass Greater Than 1/2": Filler Metal Size (in.) ELECTRICAL (QW-409) Welding Amperage Range Welding Voltage Range Travel Speed (in/min) Max. Heat Input (J/in) Current Type and Polarity TECHNIQUE (QW-410) Peening Stringer or Weave Bead Multiple / Single Pass (per side) | 1st Process SMAW / Manual 0.7500 in. maximum <hr/> Flat only <hr/> N/A <hr/> E7024 <hr/> 5.1 / 1 <hr/> 1 <hr/> No <hr/> 5/32 3/16 1/4 <hr/> 170-240 220-300 260-350 <hr/> n/r n/r n/r <hr/> Var. Var. Var. <hr/> None <hr/> DCEP (reverse) <hr/> None <hr/> Stringer and weave bead <hr/> Multipass | |

INTEGRATED SERVICE COMPANY, L.L.C.

Welding Procedure Specification (WPS)

WPS No.: 1-S-10

Rev. No.: 0

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JOINT DESIGN (QW-402)

Weld Type: Groove and fillet welds

| Joint Type | Backing | Root Opening | Groove Angle | Root Face | Groove Radius |
|-----------------|----------------------|--------------|--------------|-----------|---------------|
| Single-V groove | No backing | 3/16" max | 50 deg min | 1/8" max | |
| Single bevel | No backing | 3/16" max | 45 deg min | 1/8" max | |
| Single-V groove | Gouged & back welded | 1/4" max | 50 deg min | 3/16" max | |
| Double bevel | Gouged & back welded | 1/4" max | 45 deg min | 3/16" max | |
| Double-V groove | Gouged & back welded | 1/4" max | 45 deg min | 3/16" max | |
| Square groove | T-joint | 1/32" max | | | |
| Square groove | No backing | 3/32" max | | | |

Fillet Welds: All fillet sizes on all base metal thicknesses and all diameters.

Retainers: None

WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL THOSE FOUND ON A JOB. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR A DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.

Initial and Interpass Cleaning: With wire brush clean 1 inch (25 mm) on both sides of weld joint

Method of Back Gouging: When required, grind until all defects are removed.

Minimum preheat must be maintained during thermal cutting, tacking, and welding operations.

Welds shall be cleaned between each pass. When completed, remove all slag and projections.

We certify that the statements in this specification are correct and in accordance with the requirements of Section IX of the ASME Code.

By: David Haas Date: 7/30/2008 QC Process Manager

David Haas

Date



INTEGRATED SERVICE COMPANY, L.L.C.
 1900 N. 161st. E. AVENUE
 TULSA, OKLAHOMA 74116

Procedure Qualification Record (PQR)

PQR No.: 7024-A

Date: 10/21/1987

WPS No.: 1-S-10

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| | | | |
|--|--|--|--|
| JOINT DESIGN (QW-402) Weld Type: Groove weld Groove Type: Single-V groove Backing: Open butt, no back weld Root Opening: 3/32 in. Root Face: 1/8 in. Groove Angle: 60 ° | | BASE METALS (QW-403) Specification Type and Grade: SA-36 to SA-36 P-No. 1 Group No. 1 to P-No. 1 Group No. 1 Thickness (in.): 0.3750 | |
| PREHEAT (QW-406) Minimum Preheat Temperature: 100 °F Maximum Interpass Temperature: 400 °F Preheat Maintenance: None after welding | | POSTWELD HEAT TREATMENT (QW-407) Type: No PWHT performed PWHT Temperature: None °F PWHT Holding Time: None hr. | |
| Weld Process / Method POSITION (QW-405) Position of Joint Weld Progression FILLER METAL (QW-404) AWS Classification SFA Spec. / F-No. A-No. or Chemical Composition Filler Metal Trade Name Weld Deposit 't' (in.) Pass Greater Than 1/2": Filler Metal Size (in.) ELECTRICAL (QW-409) Amperage Used Voltage Used Travel Speed (in/min) Max. Heat Input (J/in) Current Type and Polarity TECHNIQUE (QW-410) Stringer or Weave Bead | 1st Process SMAW / Manual IG - Flat N/A E7024 5.1 / 1 1 n/r 0.3750 No 1/8 5/32 3/16 195 225 255 24 27 28 3-5 5-7 6-8 None DCEP (reverse) Stringer and weave bead | | |
| (1) Peening was not used with this weld test. | | | |

INTEGRATED SERVICE COMPANY, L.L.C.

Procedure Qualification Record (PQR)

PQR No.: 7024-A

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Tensile Test (QW-150)

| Specimen No. | Width (in.) | Thickness (in.) | Area (in ²) | Ultimate Total Load (lb) | Ultimate Unit Stress (PSI) | Failure Type and Location |
|--------------|-------------|-----------------|-------------------------|--------------------------|----------------------------|---------------------------|
| 1 | 1.000 | 0.375 | 0.375 | 28000 | 74700 | Base metal |
| 2 | 1.000 | 0.375 | 0.375 | 28000 | 74700 | Base metal |

Guided Bend Tests (QW-160)

| Type and Figure No. | Result | Type and Figure No. | Result |
|-----------------------|------------|-----------------------|------------|
| QW-462.3(a) Face bend | Acceptable | QW-462.3(a) Root bend | Acceptable |
| QW-462.3(a) Face bend | Acceptable | QW-462.3(a) Root bend | Acceptable |

Hardness Test - Brinell hardness

| Location | Readings | | | | | | |
|------------|----------|-----|-----|--|--|--|--|
| SA-36 BM | 198 | 181 | 196 | | | | |
| SA-36 HAZ | 188 | 182 | 190 | | | | |
| Weld metal | 160 | 163 | 188 | | | | |

Visual Examination: Satisfactory

Liquid Penetrant Test: Satisfactory

Added hardness, visual and penetrant results January 12, 2009.

Welder's Name: Charlie Wood

I.D.:

Stamp No.: A

PQR was done and welding of coupon was witnessed by: Cust-O-Fab

Test conducted by: Tulsa Testing and Insp.

Lab Test No.: 7024-A

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

By: *David S. Glaves*

David S. Glaves

10/21/1987

Date

QC Manager



INTEGRATED SERVICE COMPANY, L.L.C.
 1900 N. 161st. E. AVENUE
 TULSA, OKLAHOMA 74116

Welding Procedure Specification (WPS)

WPS No.: 1-S-6 Date: 2/24/1999 Rev. No.: 2 Date: 7/16/1999 Page 1 of 2

Supporting PQR(s): 99-010016-2

Weld Type: Groove and fillet welds

| | | |
|---|---|---|
| BASE METALS (QW-403) | | |
| P-No. <u>1</u> Thickness Range: <u>0.1875 in. to 0.8640 in.</u> | | |
| to P-No. <u>1</u> | | |
| PREHEAT (QW-406) | | POSTWELD HEAT TREATMENT (QW-407) |
| Minimum Preheat Temperature: <u>60</u> °F | | PWHT Type: <u>No PWHT will be performed</u> |
| Maximum Interpass Temperature: <u>550</u> °F | | PWHT Temperature: <u>None</u> °F |
| Preheat Maintenance: <u>None after weldment</u> | | PWHT Holding Time: <u>None</u> |
| Weld Process / Method Weld Deposit Limit POSITION (QW-405) Position of Joint Weld Progression FILLER METAL (QW-404) AWS Classification SFA Spec. / F-No. A-No. or Chemical Composition Filler Metal Trade Name Pass Greater Than 1/2": Filler Metal Size (in.) ELECTRICAL (QW-409) Welding Amperage Range Welding Voltage Range Travel Speed (in/min) Max. Heat Input (J/in) Current Type and Polarity TECHNIQUE (QW-410) Peening Stringer or Weave Bead | 1st Process SMAW / Manual <u>0.0000 in. to 0.2500 in.</u> <hr/> All Positions <u>Any</u> <hr/> E6010 <u>5.1 / 3</u> <hr/> <u>1</u> <hr/> <u>n/r</u> <hr/> <u>No</u> <hr/> <u>3/32 1/8 5/32</u> <hr/> <u>60-90 80-120 110-165</u> <hr/> <u>n/r n/r n/r</u> <hr/> <u>Var. Var. Var.</u> <hr/> <u>None</u> <hr/> <u>DCEP (reverse)</u> <hr/> <u>None</u> <hr/> <u>Stringer and weave bead</u> | |
| (1) <u>No peening done with this procedure.</u> | | |
| Revision 2: <u>Progression.</u> | | |
| Preheat to 175F if "T" > 1" and C > 0.30%; To 200F if 1.25" < "T" <= 1.5" | | |

INTEGRATED SERVICE COMPANY, L.L.C.

Welding Procedure Specification (WPS)

WPS No.: 1-S-6

Rev. No.: 2

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JOINT DESIGN (QW-402)

Weld Type: Groove and fillet welds

| Joint Type | Backing | Root Opening | Groove Angle | Root Face | Groove Radius |
|---------------------|----------------------|--------------|----------------|------------|---------------|
| Single-V groove | no backing | 3/16" max. | 50 degree min. | 1/8" max. | |
| Single-bevel groove | no backing | 3/16" max. | 45 degree min. | 1/8" max. | |
| Single-V groove | gouged & back welded | 1/4" max. | 50 degree min. | 3/16" max. | |
| Double-bevel groove | gouged & back welded | 1/4" max. | 45 degree min. | 3/16" max. | |
| Double-V groove | gouged & back welded | 1/4" max. | 45 degree min. | 3/16" max. | |
| Square groove | T-joint | 1/32" max. | | | |
| Square groove | no backing | 3/32" max. | | | |

Fillet Welds: All (QW-451.4)

Retainers: None

See fabrication drawing.

WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL THOSE FOUND ON A JOB. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR A DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.

Initial and Interpass Cleaning: With wire brush clean 1" both sides of weld joint.

Method of Back Gouging: When required, grind until all defects are removed.

Minimum preheat must be maintained during thermal cutting, tacking, and welding operations.

Welds shall be cleaned between each pass. When completed, remove all slag and projections.

We certify that the statements in this specification are correct and in accordance with the requirements of Section IX of the ASME Code.

By: *David S. Graves*

David S. Graves

2/24/1999 QC Manager

Date



INTEGRATED SERVICE COMPANY, L.L.C.
1900 N. 161st. E. AVENUE
TULSA, OKLAHOMA 74116

Procedure Qualification Record (PQR)

PQR No.: 99-010016-2

Date: 1/8/1999

WPS No.: 1-S-6

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| | | | | | | |
|--|--|--|--|------|---|---|
| JOINT DESIGN (QW-402) Weld Type: Groove weld Groove Type: Single-V groove Backing: Open butt, no back weld Root Opening: 1/8 in. Root Face: 1/16 in. Groove Angle: 75 ° | | BASE METALS (QW-403) Specification Type and Grade: SA-106, Grade B to SA-106, Grade B P-No. 1 Group No. 1 to P-No. 1 Group No. 1 Thickness (in.): 0.4320 Diameter (in.): 6.6250 | | | | |
| PREHEAT (QW-406) Minimum Preheat Temperature: 60 °F Maximum Interpass Temperature: 350 °F Preheat Maintenance: None | | POSTWELD HEAT TREATMENT (QW-407) Type: No PWHT performed PWHT Temperature: None °F PWHT Holding Time: None hr. | | | | |
| Weld Process / Method POSITION (QW-405) Position of Joint Weld Progression FILLER METAL (QW-404) AWS Classification SFA Spec. / F-No. A-No. or Chemical Composition Filler Metal Trade Name Weld Deposit 't' (in.) Pass Greater Than 1/2": Filler Metal Size (in.) ELECTRICAL (QW-409) Amperage Used Voltage Used Travel Speed (in/min) Max. Heat Input (J/in) Current Type and Polarity TECHNIQUE (QW-410) Stringer or Weave Bead | 1st Process SMAW / Manual | | 2nd Process SMAW / Manual | | | |
| | 6G - 45 degree pipe | | 6G - 45 degree pipe | | | |
| | Vertical up and down | | Vertical up and down | | | |
| | E6010 | | E7018 | | | |
| | 5.1 / 3 | | 5.1 / 4 | | | |
| | 1 | | 1 | | | |
| | n/r | | n/r | | | |
| | 0.1250 | | 0.3070 | | | |
| | No | | No | | | |
| | 3/32 | - | - | 1/8 | - | - |
| | 90 | - | - | 100 | - | - |
| | 23 | - | - | 24 | - | - |
| | Var. | - | - | Var. | - | - |
| | None | | None | | | |
| DCEP (reverse) | | DCEP (reverse) | | | | |
| Stringer bead | | Stringer bead | | | | |
| (1) Peening was not used with this weld test. Revised to define root pass progression up, fill passes down. | | | | | | |

INTEGRATED SERVICE COMPANY, L.L.C.

Procedure Qualification Record (PQR)

PQR No.: 99-010016-2

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Tensile Test (QW-150)

| Specimen No. | Width (in.) | Thickness (in.) | Area (in ²) | Ultimate Total Load (lb) | Ultimate Unit Stress (PSI) | Failure Type and Location |
|--------------|-------------|-----------------|-------------------------|--------------------------|----------------------------|---------------------------|
| 1 | 0.743 | 0.399 | 0.296 | 24110 | 81500 | Ductile - BM |
| 2 | 0.745 | 0.384 | 0.286 | 23890 | 83500 | Ductile - BM |

Guided Bend Tests (QW-160)

| Type and Figure No. | Result | Type and Figure No. | Result |
|---------------------|--------------|---------------------|--------------|
| QW-462.2 Side bend | Satisfactory | QW-462.2 Side bend | Satisfactory |
| QW-462.2 Side bend | Satisfactory | QW-462.2 Side bend | Satisfactory |

Hardness Test - Brinell hardness

| Location | Readings | | | |
|------------|----------|-----|-----|--|
| SA-106 BM | 150 | 150 | 160 | |
| SA-106 HAZ | 185 | 185 | 190 | |
| Weld Metal | 190 | 190 | 185 | |

Welder's Name: Jesse Hobbs

I.D.:

Stamp No.: JH

PQR was done and welding of coupon was witnessed by: Cust-O-Fab Service Co.

Test conducted by: Sherry Laboratories

Lab Test No.: 99-010016-2

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

By: *David S. Glaves*

David S. Glaves

1/8/1999

Date

QC Manager



INTEGRATED SERVICE COMPANY, L.L.C.
 1900 N. 161st. E. AVENUE
 TULSA, OKLAHOMA 74116

Welding Procedure Specification (WPS)

WPS No.: I-S-4 Date: 1/8/1999 Rev. No.: 0

Supporting PQR(s): 99-010016-2

Weld Type: Groove and fillet welds

| | | | | | | |
|--|--|---|--|--------|--------|---------|
| BASE METALS (QW-403) | | | | | | |
| P-No. <u>I</u> Thickness Range: <u>0.1875 in. to 0.8640 in.</u> | | to P-No. <u>I</u> | | | | |
| PREHEAT (QW-406) | | POSTWELD HEAT TREATMENT (QW-407) | | | | |
| Minimum Preheat Temperature: <u>60</u> °F | | PWHT Type: <u>No PWHT will be performed</u> | | | | |
| Maximum Interpass Temperature: <u>350</u> °F | | PWHT Temperature : <u>None</u> °F | | | | |
| Preheat Maintenance: <u>None</u> | | PWHT Holding Time: <u>None</u> | | | | |
| Weld Process / Method Weld Deposit Limit POSITION (QW-405) Position of Joint Weld Progression FILLER METAL (QW-404) AWS Classification SFA Spec. / F-No. A-No. or Chemical Composition Pass Greater Than 1/2": Filler Metal Size (in.) ELECTRICAL (QW-409) Welding Amperage Range Welding Voltage Range Travel Speed (in/min) Max. Heat Input (J/in) Current Type and Polarity TECHNIQUE (QW-410) Peening Stringer or Weave Bead Multiple / Single Pass (per side) | 1st Process SMAW / Manual 0.2500 in. maximum | | 2nd Process SMAW / Manual 0.6140 in. maximum | | | |
| | All Positions | | All Positions | | | |
| | Any | | Vertical up | | | |
| | E6010 | | E7018 | | | |
| | 5.1 / 3 | | 5.1 / 4 | | | |
| | I | | I | | | |
| | No | | No | | | |
| | 3/32 | 1/8 | 5/32 | 3/32 | 1/8 | 5/32 |
| | 60-90 | 80-120 | 110-165 | 70-110 | 90-160 | 130-220 |
| | n/r | n/r | n/r | n/r | n/r | n/r |
| | Var. | Var. | Var. | Var. | Var. | Var. |
| | None | | None | | | |
| | DCEP (reverse) | | DCEP (reverse) | | | |
| | None | | None | | | |
| | Stringer bead | | Stringer bead | | | |
| Multipass | | Multipass | | | | |

INTEGRATED SERVICE COMPANY, L.L.C.

Welding Procedure Specification (WPS)

WPS No.: 1-S-4

Rev. No.: 0

Page 2 of 2

JOINT DESIGN (QW-402)

Weld Type: Groove and fillet welds

| Joint Type | Backing | Root Opening | Groove Angle | Root Face | Groove Radius |
|-----------------|----------------------|--------------|--------------|-----------|---------------|
| Single-V groove | No backing | 3/16" max | 50 deg min | 1/8" max | |
| Single bevel | No backing | 3/16" max | 45 deg min | 1/8" max | |
| Single-V groove | Gouged & back welded | 1/4" max | 50 deg min | 3/16" max | |
| Double bevel | Gouged & back welded | 1/4" max | 45 deg min | 3/16" max | |
| Double-V groove | Gouged & back welded | 1/4" max | 45 deg min | 3/16" max | |
| Square groove | T-joint | 1/32" max | | | |
| Square groove | No backing | 3/32" max | | | |

Fillet Welds: All fillet sizes on all base metal thicknesses and all diameters.

Retainers: None

WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL THOSE FOUND ON A JOB. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR A DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.

Initial and Interpass Cleaning: With wire brush clean 1 inch (25 mm) on both sides of weld joint

Method of Back Gouging: When required, grind until all defects are removed.

Minimum preheat must be maintained during thermal cutting, tacking, and welding operations.

Welds shall be cleaned between each pass. When completed, remove all slag and projections.

We certify that the statements in this specification are correct and in accordance with the requirements of Section IX of the ASME Code.

By: *David S. Glaves*

David S. Glaves

1/8/1999

Date

QC Manager



INTEGRATED SERVICE COMPANY, L.L.C.
 1900 N. 161st. E. AVENUE
 TULSA, OKLAHOMA 74116

Procedure Qualification Record (PQR)

PQR No.: 99-010016-2

Date: 1/8/1999

WPS No.: 1-S-4

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| | | | | | | |
|--|--|--|--|------|---|---|
| JOINT DESIGN (QW-402) Weld Type: Groove weld Groove Type: Single-V groove Backing: Open butt, no back weld Root Opening: 1/8 in. Root Face: 1/16 in. Groove Angle: 75 ° | | BASE METALS (QW-403) Specification Type and Grade: SA-106, Grade B to SA-106, Grade B P-No. 1 Group No. 1 to P-No. 1 Group No. 1 Thickness (in.): 0.4320 Diameter (in.): 6.6250 | | | | |
| PREHEAT (QW-406) Minimum Preheat Temperature: 60 °F Maximum Interpass Temperature: 350 °F Preheat Maintenance: None | | POSTWELD HEAT TREATMENT (QW-407) Type: No PWHT performed PWHT Temperature: None °F PWHT Holding Time: None hr. | | | | |
| Weld Process / Method POSITION (QW-405) Position of Joint Weld Progression FILLER METAL (QW-404) AWS Classification SFA Spec. / F-No. A-No. or Chemical Composition Filler Metal Trade Name Weld Deposit 't' (in.) Pass Greater Than 1/2": Filler Metal Size (in.) ELECTRICAL (QW-409) Amperage Used Voltage Used Travel Speed (in/min) Max. Heat Input (J/in) Current Type and Polarity TECHNIQUE (QW-410) Stringer or Weave Bead | 1st Process SMAW / Manual | | 2nd Process SMAW / Manual | | | |
| | 6G - 45 degree pipe | | 6G - 45 degree pipe | | | |
| | Vertical up and down | | Vertical up and down | | | |
| | E6010 | | E7018 | | | |
| | 5.1 / 3 | | 5.1 / 4 | | | |
| | 1 | | 1 | | | |
| | n/r | | n/r | | | |
| | 0.1250 | | 0.3070 | | | |
| | No | | No | | | |
| | 3/32 | - | - | 1/8 | - | - |
| | 90 | - | - | 100 | - | - |
| | 23 | - | - | 24 | - | - |
| | Var. | - | - | Var. | - | - |
| | None | | None | | | |
| DCEP (reverse) | | DCEP (reverse) | | | | |
| Stringer bead | | Stringer bead | | | | |
| (1) Peening was not used with this weld test. Revised to define root pass progression up, fill passes down. | | | | | | |

INTEGRATED SERVICE COMPANY, L.L.C.

Procedure Qualification Record (PQR)

PQR No.: 99-010016-2

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Tensile Test (QW-150)

| Specimen No. | Width (in.) | Thickness (in.) | Area (in ²) | Ultimate Total Load (lb) | Ultimate Unit Stress (PSI) | Failure Type and Location |
|--------------|-------------|-----------------|-------------------------|--------------------------|----------------------------|---------------------------|
| 1 | 0.743 | 0.399 | 0.296 | 24110 | 81500 | Ductile - BM |
| 2 | 0.745 | 0.384 | 0.286 | 23890 | 83500 | Ductile - BM |

Guided Bend Tests (QW-160)

| Type and Figure No. | Result | Type and Figure No. | Result |
|---------------------|--------------|---------------------|--------------|
| QW-462.2 Side bend | Satisfactory | QW-462.2 Side bend | Satisfactory |
| QW-462.2 Side bend | Satisfactory | QW-462.2 Side bend | Satisfactory |

Hardness Test - Brinell hardness

| Location | Readings | | | | | | |
|------------|----------|-----|-----|--|--|--|--|
| SA-106 BM | 150 | 150 | 160 | | | | |
| SA-106 HAZ | 185 | 185 | 190 | | | | |
| Weld Metal | 190 | 190 | 185 | | | | |

Welder's Name: Jesse Hobbs

I.D.:

Stamp No.: JH

PQR was done and welding of coupon was witnessed by: Cust-O-Fab Service Co.

Test conducted by: Sherry Laboratories

Lab Test No.: 99-010016-2

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

By: *David S. Glaves*

David S. Glaves

1/8/1999

Date

QC Manager



Welding Procedure Specification (WPS)

WPS No.: 1-TS-1 Date: 7/20/1994 Rev. No.: 0

Supporting PQR(s): 92-159-1

Weld Type: Groove and fillet welds

| | | | | | | |
|---|---------------------------|---|-----------------------------|--|----------------------|--|
| BASE METALS (QW-403) | | | | | | |
| P-No. <u>1</u> Thickness Range: <u>0.1875 in. to 1.5000 in.</u> | | | | | | |
| to P-No. <u>1</u> | | | | | | |
| PREHEAT (QW-406) | | POSTWELD HEAT TREATMENT (QW-407) | | | | |
| Minimum Preheat Temperature: <u>200</u> °F | | PWHT Type: <u>No PWHT will be performed</u> | | | | |
| Maximum Interpass Temperature: <u>550</u> °F | | PWHT Temperature : <u>None</u> °F | | | | |
| Preheat Maintenance: <u>None after weldment</u> | | PWHT Holding Time: <u>None</u> | | | | |
| Weld Process / Method Weld Deposit Limit POSITION (QW-405) Position of Joint Weld Progression GAS (QW-408) Shielding Gas / CFH Trailing Gas / CFH Backing Gas / CFH FILLER METAL (QW-404) AWS Classification SFA Spec. / F-No. A-No. or Chemical Composition Filler Metal Trade Name Filler Metal Product Form Consumable Insert Pass Greater Than 1/2": Filler Metal Size (in.) ELECTRICAL (QW-409) Welding Amperage Range Welding Voltage Range Travel Speed (in/min) Max. Heat Input (J/in) Current Type and Polarity Tungsten Type / Size Pulsed Current TECHNIQUE (QW-410) Peening Stringer or Weave Bead Multiple / Single Pass (per side) Nozzle / Gas Cup Size | 1st Process | | 2nd Process | | | |
| | GTAW / Manual | | SMAW / Manual | | SMAW / Manual | |
| | 0.0000 in. to 0.3750 in. | | 0.0000 in. to 1.1250 in. | | | |
| | All Positions | | All Positions | | | |
| | Any | | Vertical up | | | |
| | 100% Argon / 27-36 | | | | | |
| | None / - | | | | | |
| | None / - | | | | | |
| | ER70S-2 | | E7018 | | | |
| | 5.18 / 6 | | 5.1 / 4 | | | |
| | 1 | | 1 | | | |
| | n/r | | n/r | | | |
| | Bare (Solid) | | | | | |
| | None | | No | | | |
| | 1/16 3/32 1/8 | | 5/32 3/16 7/32 | | | |
| | 70-150 80-180 130-275 | | 130-220 200-300 250-350 | | | |
| | n/r n/r n/r | | n/r n/r n/r | | | |
| | Var. Var. Var. | | Var. Var. Var. | | | |
| | None | | None | | | |
| | DCEN (straight) | | DCEP (reverse) | | | |
| EWTh-2 / 1/16" - 3/16" | | | | | | |
| None | | | | | | |
| None | | None | | | | |
| Stringer and weave bead | | Stringer and weave bead | | | | |
| Multipass | | | | | | |
| # 5 to # 10 | | | | | | |
| (1) No peening done with this procedure. | | | | | | |
| No pass greater than 1/2" allowed. | | | | | | |
| Preheat to 200 Deg.F. for repairs. | | | | | | |
| Preheat to 175F if "T" > 1" and C > 0.30%; To 200F if 1.25 < "T" <= 1.5" | | | | | | |

INTEGRATED SERVICE COMPANY, L.L.C.

Welding Procedure Specification (WPS)

WPS No.: 1-TS-1

Rev. No.: 0

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JOINT DESIGN (QW-402)

Weld Type: Groove and fillet welds

| Joint Type | Backing | Root Opening | Groove Angle | Root Face | Groove Radius |
|---------------------|----------------------|--------------|----------------|------------|---------------|
| Single-V groove | no backing | 3/16" max. | 50 degree min. | 1/8" max. | |
| Single-bevel groove | no backing | 3/16" max. | 45 degree min. | 1/8" max. | |
| Single-V groove | gouged & back welded | 1/4" max. | 50 degree min. | 3/16" max. | |
| Double-bevel groove | gouged & back welded | 1/4" max. | 45 degree min. | 3/16" max. | |
| Double-V groove | gouged & back welded | 1/4" max. | 45 degree min. | 3/16" max. | |
| Square groove | T-joint | 1/32" max. | | | |
| Square groove | no backing | 3/32" max. | | | |

Fillet Welds: All (QW-451.4)

Retainers: None

See fabrication drawing.

WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL THOSE FOUND ON A JOB. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR A DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.

Initial and Interpass Cleaning: With wire brush clean 1" both sides of weld joint.

Method of Back Gouging: Grind until all defects are removed.

Minimum preheat must be maintained during thermal cutting, tacking, and welding operations.

Welds shall be cleaned between each pass. When completed, remove all slag and projections.

We certify that the statements in this specification are correct and in accordance with the requirements of Section IX of the ASME Code.

By: *David S. Glaves*

David S. Glaves

7/20/1994

Date

QC Manager



INTEGRATED SERVICE COMPANY, L.L.C.
1900 N. 161st. E. AVENUE
TULSA, OKLAHOMA 74116

Procedure Qualification Record (PQR)

PQR No.: 92-159-1

Date: 1/10/1992

WPS No.: 1-TS-1

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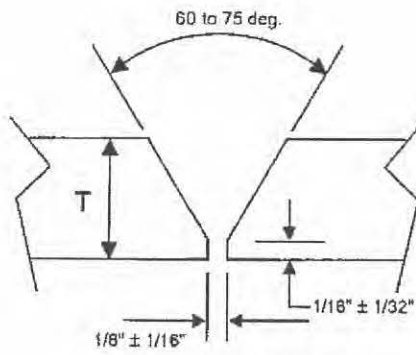
| | |
|--|---|
| JOINT DESIGN (QW-402) Weld Type: Groove weld Groove Type: Single-V groove Backing: Open butt, no back weld Root Opening: 1/8 in. Root Face: 1/32 in. Groove Angle: 60-70 ° None | BASE METALS (QW-403) Specification Type and Grade: SA-516, Grade 70 to SA-516, Grade 70 P-No. 1 Group No. 2 to P-No. 1 Group No. 2 Thickness (in.): 0.7500 None |
| PREHEAT (QW-406) Minimum Preheat Temperature: 175 °F Maximum Interpass Temperature: 450 °F Preheat Maintenance: None after weldment None | POSTWELD HEAT TREATMENT (QW-407) Type: No PWHT performed PWHT Temperature: None °F PWHT Holding Time: None hr. N/A |

| | 1st Process GTAW / Manual | 2nd Process SMAW / Manual |
|-----------------------------------|------------------------------|------------------------------|
| Weld Process / Method | GTAW / Manual | SMAW / Manual |
| POSITION (QW-405) | IG - Flat | IG - Flat |
| Position of Joint | N/A | N/A |
| Weld Progression | N/A | N/A |
| Notes | None | None |
| GAS (QW-408) | | |
| Shielding Gas / CFH | 100% Argon / 30 | |
| Trailing Gas / CFH | None / - | |
| Backing Gas / CFH | None / - | |
| FILLER METAL (QW-404) | | |
| AWS Classification | ER70S-2 | E7018 |
| SFA Spec. / F-No. | 5.18 / 6 | 5.1 / 4 |
| A-No. or Chemical Composition | 1 | 1 |
| Filler Metal Trade Name | n/r | n/r |
| Filler Metal Product Form | Bare (Solid) | |
| Consumable Insert | None | |
| GTAW Flux | N/A | |
| Weld Deposit 't' (in.) | 0.1875 | 0.5625 |
| Pass Greater Than 1/2": | | No |
| Filler Metal Size (in.) | 3/32 - - | 5/32 3/16 - |
| ELECTRICAL (QW-409) | | |
| Amperage Used | 120 - - | 175 225 - |
| Voltage Used | 18 - - | 24 28 - |
| Travel Speed (in/min) | Var. - - | Var. - - |
| Max. Heat Input (J/in) | NR | NR |
| Current Type and Polarity | DCEN (straight) | DCEP (reverse) |
| Tungsten Type / Size | EWTh-2 / 1/8 | |
| Pulsed Current | None | |
| TECHNIQUE (QW-410) | | |
| Thermal Processes: | No | No |
| Stringer or Weave Bead | Stringer bead | Stringer bead |
| Multiple / Single Pass (per side) | Multipass | Multipass |
| Nozzle / Gas Cup Size | # 8 | |

(1) (1) Peening was not used with this weld test.
 (2) No Pass > 1/2" t.
 10-20-08; corrected typo "No Thermal Processes".

(2) None

Joint Detail Image



SINGLE VEE GROOVE

INTEGRATED SERVICE COMPANY, L.L.C.

Procedure Qualification Record (PQR)

PQR No.: 92-159-1

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Tensile Test (QW-150)

| Specimen No. | Width (in.) | Thickness (in.) | Area (in ²) | Ultimate Total Load (lb) | Ultimate Unit Stress (PSI) | Failure Type and Location |
|--------------|-------------|-----------------|-------------------------|--------------------------|----------------------------|---------------------------|
| 1 | 0.754 | 0.760 | 0.573 | 43400 | 75700 | Base metal |
| 2 | 0.750 | 0.755 | 0.566 | 43000 | 76000 | Base metal |

Guided Bend Tests (QW-160)

| Type and Figure No. | Result | Type and Figure No. | Result |
|---------------------|--------------|---------------------|--------------|
| QW-462.2 Side bend | Satisfactory | QW-462.2 Side bend | Satisfactory |
| QW-462.2 Side bend | Satisfactory | QW-462.2 Side bend | Satisfactory |

Hardness Test - Brinell hardness

| Location | Readings | | |
|------------|----------|-----|-----|
| SA-516 BM | 140 | 156 | 146 |
| SA-516 HAZ | 167 | 174 | 174 |
| Weld Metal | 149 | 140 | 156 |

Visual Examination: Satisfactory

None

Welder's Name: Paul Stokes I.D.: - Stamp No.: R

PQR was done and welding of coupon was witnessed by: Integrated Service Company LLC

Test conducted by: Metlab Testing Services Lab Test No.: 92-159-1

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

By: R. Laird Roy Laird 1/10/1992 MFG QC Manager
Date



INTEGRATED SERVICE COMPANY, L.L.C.
 1900 N. 161st. E. AVENUE
 TULSA, OKLAHOMA 74116

Welding Procedure Specification (WPS)

WPS No.: I-F-1 Date: 7/13/1994 Rev. No.: 0

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Supporting PQR(s): 90-1884-6 ; 92-2474

Weld Type: Groove and fillet welds

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|--------------------|--|--|-----------------------------|--|--|--------------------------|--|--|---------------|--|--|-------------|--|--|--------------------|---|-------|------|---|---|------|---|---|--------|--|--|------|---|---|---|--|--|-----|--|--|------------|--|--|------|--|--|----|--|--|-------|--|-------|--|--|------|---------|--|---------|--|--|---------|-------|--|-------|--|--|-------|------|--|------|------|--|--|----------------|--|--|--------------|--|--|------|--|--|-------------------------|--|--|-----------|--|--|-----------|--|--|---------|--|--|
| BASE METALS (QW-403) P-No. <u>1</u> Thickness Range: <u>0.0625 in. to 1.5000 in.</u> to P-No. <u>1</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PREHEAT (QW-406) Minimum Preheat Temperature: <u>50</u> °F Maximum Interpass Temperature: <u>600</u> °F Preheat Maintenance: <u>None after weldment</u> | POSTWELD HEAT TREATMENT (QW-407) PWHT Type: <u>No PWHT will be performed</u> PWHT Temperature : <u>None</u> °F PWHT Holding Time: <u>None</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Weld Process / Method Weld Deposit Limit POSITION (QW-405) Position of Joint Weld Progression GAS (QW-408) Shielding Gas / CFH Trailing Gas / CFH Backing Gas / CFH FILLER METAL (QW-404) AWS Classification SFA Spec. / F-No. A-No. or Chemical Composition Filler Metal Trade Name Filler Metal Product Form Supplemental Filler Metal Pass Greater Than 1/2": Filler Metal Size (in.) ELECTRICAL (QW-409) Welding Amperage Range Welding Voltage Range Travel Speed (in/min) Max. Heat Input (J/in) Current Type and Polarity Transfer Mode TECHNIQUE (QW-410) Peening Stringer or Weave Bead Multiple / Single Pass (per side) Nozzle / Gas Cup Size Contact Tube to Work Distance | <table border="1"> <tr> <td colspan="3" style="text-align: center;">1st Process</td> </tr> <tr> <td colspan="3" style="text-align: center;">FCAW / Semiautomatic</td> </tr> <tr> <td colspan="3" style="text-align: center;">0.0000 in. to 1.5000 in.</td> </tr> <tr> <td colspan="3" style="text-align: center;">All Positions</td> </tr> <tr> <td colspan="3" style="text-align: center;">Vertical up</td> </tr> <tr> <td style="text-align: center;">75% Argon, 25% CO2</td> <td style="text-align: center;">/</td> <td style="text-align: center;">23-30</td> </tr> <tr> <td style="text-align: center;">None</td> <td style="text-align: center;">/</td> <td style="text-align: center;">-</td> </tr> <tr> <td style="text-align: center;">None</td> <td style="text-align: center;">/</td> <td style="text-align: center;">-</td> </tr> <tr> <td colspan="3" style="text-align: center;">E71T-1</td> </tr> <tr> <td style="text-align: center;">5.20</td> <td style="text-align: center;">/</td> <td style="text-align: center;">6</td> </tr> <tr> <td colspan="3" style="text-align: center;">1</td> </tr> <tr> <td colspan="3" style="text-align: center;">n/r</td> </tr> <tr> <td colspan="3" style="text-align: center;">Flux cored</td> </tr> <tr> <td colspan="3" style="text-align: center;">None</td> </tr> <tr> <td colspan="3" style="text-align: center;">No</td> </tr> <tr> <td style="text-align: center;">0.035</td> <td style="text-align: center;"> </td> <td style="text-align: center;">0.045</td> </tr> <tr> <td></td> <td style="text-align: center;"> </td> <td style="text-align: center;">1/16</td> </tr> <tr> <td style="text-align: center;">120-200</td> <td style="text-align: center;"> </td> <td style="text-align: center;">170-270</td> </tr> <tr> <td></td> <td style="text-align: center;"> </td> <td style="text-align: center;">225-300</td> </tr> <tr> <td style="text-align: center;">19-24</td> <td style="text-align: center;"> </td> <td style="text-align: center;">22-26</td> </tr> <tr> <td></td> <td style="text-align: center;"> </td> <td style="text-align: center;">25-28</td> </tr> <tr> <td style="text-align: center;">Var.</td> <td style="text-align: center;"> </td> <td style="text-align: center;">Var.</td> </tr> <tr> <td colspan="3" style="text-align: center;">None</td> </tr> <tr> <td colspan="3" style="text-align: center;">DCEP (reverse)</td> </tr> <tr> <td colspan="3" style="text-align: center;">Globular arc</td> </tr> <tr> <td colspan="3" style="text-align: center;">None</td> </tr> <tr> <td colspan="3" style="text-align: center;">Stringer and weave bead</td> </tr> <tr> <td colspan="3" style="text-align: center;">Multipass</td> </tr> <tr> <td colspan="3" style="text-align: center;">1/2"-3/4"</td> </tr> <tr> <td colspan="3" style="text-align: center;">1/2"-1"</td> </tr> </table> | 1st Process | | | FCAW / Semiautomatic | | | 0.0000 in. to 1.5000 in. | | | All Positions | | | Vertical up | | | 75% Argon, 25% CO2 | / | 23-30 | None | / | - | None | / | - | E71T-1 | | | 5.20 | / | 6 | 1 | | | n/r | | | Flux cored | | | None | | | No | | | 0.035 | | 0.045 | | | 1/16 | 120-200 | | 170-270 | | | 225-300 | 19-24 | | 22-26 | | | 25-28 | Var. | | Var. | None | | | DCEP (reverse) | | | Globular arc | | | None | | | Stringer and weave bead | | | Multipass | | | 1/2"-3/4" | | | 1/2"-1" | | |
| 1st Process | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FCAW / Semiautomatic | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0000 in. to 1.5000 in. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| All Positions | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vertical up | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 75% Argon, 25% CO2 | / | 23-30 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| None | / | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| None | / | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E71T-1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.20 | / | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| n/r | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Flux cored | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| None | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| No | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.035 | | 0.045 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1/16 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 120-200 | | 170-270 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 225-300 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19-24 | | 22-26 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 25-28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Var. | | Var. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| None | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DCEP (reverse) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Globular arc | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| None | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Stringer and weave bead | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Multipass | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1/2"-3/4" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1/2"-1" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) No peening done with this procedure. No pass greater than 1/2" allowed. Preheat to 175F if "T" > 1" and C > 0.30%; To 200F if 1.25 < "T" <= 1.5" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

INTEGRATED SERVICE COMPANY, L.L.C.

Welding Procedure Specification (WPS)

WPS No.: 1-F-1

Rev. No.: 0

Page 2 of 2

JOINT DESIGN (QW-402)

Weld Type: Groove and fillet welds

| Joint Type | Backing | Root Opening | Groove Angle | Root Face | Groove Radius |
|---------------------|----------------------|--------------|----------------|------------|---------------|
| Single-V groove | no backing | 3/16" max. | 50 degree min. | 1/8" max. | |
| Single-bevel groove | no backing | 3/16" max. | 45 degree min. | 1/8" max. | |
| Single-V groove | gouged & back welded | 1/4" max. | 50 degree min. | 3/16" max. | |
| Double-bevel groove | gouged & back welded | 1/4" max. | 45 degree min. | 3/16" max. | |
| Double-V groove | gouged & back welded | 1/4" max. | 45 degree min. | 3/16" max. | |
| Square groove | T-joint | 1/32" max. | | | |
| Square groove | no backing | 3/32" max. | | | |

Fillet Welds: All (QW-451.4)

Retainers: None

See fabrication drawing.

WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL THOSE FOUND ON A JOB. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR A DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.

Initial and Interpass Cleaning: With wire brush clean 1" both sides of weld joint.

Method of Back Gouging: Grind until all defects are removed.

Minimum preheat must be maintained during thermal cutting, tacking, and welding operations.

Welds shall be cleaned between each pass. When completed, remove all slag and projections.

We certify that the statements in this specification are correct and in accordance with the requirements of Section IX of the ASME Code.

By: *David S. Graves*

David S. Graves

7/13/1994

Date

QC Manager



INTEGRATED SERVICE COMPANY, L.L.C.
 1900 N. 161st. E. AVENUE
 TULSA, OKLAHOMA 74116

Procedure Qualification Record (PQR)

PQR No.: 90-1884-6

Date: 4/4/1990

WPS No.: 1-F-1

Page 1 of 2

| | | | | | | | | | | | | |
|---|---|--|-------|--------------------|---|----|------|---|---|------|---|---|
| JOINT DESIGN (QW-402) Weld Type: Groove weld Groove Type: Single-V groove Backing: Open butt, no back weld Root Opening: 1/8 in. Root Face: 1/16 in. Groove Angle: 60 ° | | BASE METALS (QW-403) Specification Type and Grade: SA-516, Grade 70 to SA-516, Grade 70 P-No. 1 Group No. 2 to P-No. 1 Group No. 2 Thickness (in.): 0.7500 | | | | | | | | | | |
| PREHEAT (QW-406) Minimum Preheat Temperature: 50 °F Maximum Interpass Temperature: 400 °F Preheat Maintenance: None after weldment | | POSTWELD HEAT TREATMENT (QW-407) Type: No PWHT performed PWHT Temperature: None °F PWHT Holding Time: None hr. | | | | | | | | | | |
| POSITION (QW-405) Position of Joint Weld Progression GAS (QW-408) Shielding Gas / CFH Trailing Gas / CFH Backing Gas / CFH FILLER METAL (QW-404) AWS Classification SFA Spec. / F-No. A-No. or Chemical Composition Filler Metal Trade Name Filler Metal Product Form Supplemental Filler Metal Weld Deposit 't' (in.) Pass Greater Than 1/2": Filler Metal Size (in.) ELECTRICAL (QW-409) Amperage Used Voltage Used Travel Speed (in/min) Max. Heat Input (J/in) Current Type and Polarity Transfer Mode TECHNIQUE (QW-410) Stringer or Weave Bead Multiple / Single Pass (per side) Nozzle / Gas Cup Size Contact Tube to Work Distance | 1st Process FCAW / Semiautomatic | | | | | | | | | | | |
| | 1G - Flat | | | | | | | | | | | |
| | N/A | | | | | | | | | | | |
| | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">75% Argon, 25% CO2</td> <td style="width: 20%; text-align: center;">/</td> <td style="width: 20%; text-align: center;">25</td> </tr> <tr> <td>None</td> <td style="text-align: center;">/</td> <td style="text-align: center;">-</td> </tr> <tr> <td>None</td> <td style="text-align: center;">/</td> <td style="text-align: center;">-</td> </tr> </table> | | | 75% Argon, 25% CO2 | / | 25 | None | / | - | None | / | - |
| | 75% Argon, 25% CO2 | / | 25 | | | | | | | | | |
| | None | / | - | | | | | | | | | |
| | None | / | - | | | | | | | | | |
| | E71T-1 | | | | | | | | | | | |
| | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">5.20</td> <td style="width: 20%; text-align: center;">/</td> <td style="width: 20%; text-align: center;">6</td> </tr> </table> | | | 5.20 | / | 6 | | | | | | |
| | 5.20 | / | 6 | | | | | | | | | |
| | 1 | | | | | | | | | | | |
| | n/r | | | | | | | | | | | |
| | Flux cored | | | | | | | | | | | |
| | None | | | | | | | | | | | |
| | 0.7500 | | | | | | | | | | | |
| | No | | | | | | | | | | | |
| | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">0.0450</td> <td style="width: 30%; text-align: center;">-</td> <td style="width: 30%; text-align: center;">-</td> </tr> </table> | | | 0.0450 | - | - | | | | | | |
| | 0.0450 | - | - | | | | | | | | | |
| | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">200-225</td> <td style="width: 30%; text-align: center;">-</td> <td style="width: 30%; text-align: center;">-</td> </tr> </table> | | | 200-225 | - | - | | | | | | |
| | 200-225 | - | - | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">20-24</td> <td style="width: 30%; text-align: center;">-</td> <td style="width: 30%; text-align: center;">-</td> </tr> </table> | | | 20-24 | - | - | | | | | | | |
| 20-24 | - | - | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">12-22</td> <td style="width: 30%; text-align: center;">-</td> <td style="width: 30%; text-align: center;">-</td> </tr> </table> | | | 12-22 | - | - | | | | | | | |
| 12-22 | - | - | | | | | | | | | | |
| 27000 | | | | | | | | | | | | |
| DCEP (reverse) | | | | | | | | | | | | |
| Globular arc | | | | | | | | | | | | |
| Stringer and weave bead | | | | | | | | | | | | |
| Multipass | | | | | | | | | | | | |
| 5/8" | | | | | | | | | | | | |
| 1/2"-1" | | | | | | | | | | | | |
| (1) Peening was not used with this weld test. No Pass > 1/2" t. Added Impact Test per Lab#99-050033-1 | | | | | | | | | | | | |

INTEGRATED SERVICE COMPANY, L.L.C.

Procedure Qualification Record (PQR)

PQR No.: 90-1884-6

Page 2 of 2

Tensile Test (QW-150)

| Specimen No. | Width (in.) | Thickness (in.) | Area (in ²) | Ultimate Total Load (lb) | Ultimate Unit Stress (PSI) | Failure Type and Location |
|--------------|-------------|-----------------|-------------------------|--------------------------|----------------------------|---------------------------|
| 1 | 0.982 | 0.760 | 0.746 | 66200 | 88700 | Base metal |
| 2 | 0.982 | 0.755 | 0.741 | 65500 | 88400 | Base metal |

Hardness Test - Vickers hardness

| Location | Readings | | | | | | | | |
|------------|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| SA-516 BM | 167 | 156 | 168 | 156 | 167 | 156 | | | |
| SA-516 HAZ | 174 | 170 | 170 | 173 | 170 | 173 | 175 | 170 | 168 |
| Weld Metal | 172 | 176 | 174 | 166 | 167 | 170 | 168 | 165 | |

Visual Examination: Satisfactory

Liquid Penetrant Test: Satisfactory

Deposit Chemistry: C=0.06, Mn=1.35, P=0.009, S=0.016, Si=0.58, Cu=0.01, Ni=0.05, Cr=0.03, Mo=0.02

No addition/deletion of supplemental filler metal or powder filler metal.

Vickers hardness test performed by Weeks Lab. 8-21-08 for Inserv.

Welder's Name: Ron Cody

I.D.:

Stamp No.: T

PQR was done and welding of coupon was witnessed by: Cust-O-Fab Inc

Test conducted by: Metlab Testing Services

Lab Test No.: 90-1884-6

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

By: *David S. Graves*

David S. Graves

8/21/2008

Date

QC Manager



INTEGRATED SERVICE COMPANY, L.L.C.
 1900 N. 161st. E. AVENUE
 TULSA, OKLAHOMA 74116

Procedure Qualification Record (PQR)

PQR No.: 92-2474

Date: 4/22/1992

WPS No.: I-F-1

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| | | | |
|---|--|--|--|
| JOINT DESIGN (QW-402) Weld Type: Groove weld Groove Type: Single-V groove Backing: Open butt, no back weld Root Opening: 1/8 in. Root Face: 1/16 in. Groove Angle: 60 ° | | BASE METALS (QW-403) Specification Type and Grade: SA-516, Grade 70 to SA-516, Grade 70 P-No. 1 Group No. 2 to P-No. 1 Group No. 2 Thickness (in.): 0.3750 | |
| PREHEAT (QW-406) Minimum Preheat Temperature: 60 °F Maximum Interpass Temperature: 450 °F Preheat Maintenance: None after weldment | | POSTWELD HEAT TREATMENT (QW-407) Type: No PWHT performed PWHT Temperature: None °F PWHT Holding Time: None hr. | |

| | | | |
|---|---|---|----|
| Weld Process / Method POSITION (QW-405) Position of Joint Weld Progression GAS (QW-408) Shielding Gas / CFH Trailing Gas / CFH Backing Gas / CFH FILLER METAL (QW-404) AWS Classification SFA Spec. / F-No. A-No. or Chemical Composition Filler Metal Trade Name Filler Metal Product Form Supplemental Filler Metal Weld Deposit 't' (in.) Pass Greater Than 1/2": Filler Metal Size (in.) ELECTRICAL (QW-409) Amperage Used Voltage Used Travel Speed (in/min) Max. Heat Input (J/in) Current Type and Polarity Transfer Mode TECHNIQUE (QW-410) Stringer or Weave Bead Multiple / Single Pass (per side) Nozzle / Gas Cup Size Contact Tube to Work Distance | 1st Process FCAW / Semiautomatic | | |
| | IG - Flat | | |
| | N/A | | |
| | 75% Argon, 25% CO2 | / | 25 |
| | None | / | - |
| | None | / | - |
| | E71T-1 | | |
| | 5.20 | / | 6 |
| | I | | |
| | n/r | | |
| | Flux cored | | |
| | None | | |
| | 0.3750 | | |
| | No | | |
| | 0.0450 | | - |
| | 170-270 | | - |
| | 24-28 | | - |
| | Var. | | - |
| None | | | |
| DCEP (reverse) | | | |
| Globular arc | | | |
| Stringer and weave bead | | | |
| Multipass | | | |
| 5/8" | | | |
| 1/2"-3/4" | | | |

(1) Peening was not used with this weld test.
 Revised to indicate globular arc FCAW transfer mode.

INTEGRATED SERVICE COMPANY, L.L.C.

Procedure Qualification Record (PQR)

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Tensile Test (QW-150)

| Specimen No. | Width (in.) | Thickness (in.) | Area (in ²) | Ultimate Total Load (lb) | Ultimate Unit Stress (PSI) | Failure Type and Location |
|--------------|-------------|-----------------|-------------------------|--------------------------|----------------------------|---------------------------|
| 1 | 0.758 | 0.354 | 0.268 | 23800 | 88800 | Base metal |
| 2 | 0.756 | 0.334 | 0.253 | 22400 | 88500 | Base metal |

Guided Bend Tests (QW-160)

| Type and Figure No. | Result | Type and Figure No. | Result |
|---------------------|--------------|---------------------|--------------|
| QW-462.2 Side bend | Satisfactory | QW-462.2 Side bend | Satisfactory |
| QW-462.2 Side bend | Satisfactory | QW-462.2 Side bend | Satisfactory |

Hardness Test - Brinell hardness

| Location | Readings | | |
|------------|----------|-----|-----|
| SA-516 BM | 156 | 170 | 159 |
| SA-516 HAZ | 163 | 183 | 174 |
| Weld Metal | 187 | 192 | 200 |

Welder's Name: Rick Barbee I.D.: Stamp No.: YY

PQR was done and welding of coupon was witnessed by: Cust-O-Fab Inc

Test conducted by: Metlab Testing Services Lab Test No.: 92-2474

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

By: *David S. Glaves*

David S. Glaves

4/22/1992

Date

QC Manager