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| **طرح نگهداشت و افزایش تولید 27 مخزن** | | | | | | | |
| **WPS & PQR (TOWER, COLUMNS, REBOILER, DRUMS, FILTERS & EXCHANGERS)**  **نگهداشت و افزایش تولید میدان نفتی بینک** | | | | | | | |
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|  |  |  |  |  |  |  |
| V00 | APR. 2025 | IFA | MFS | M.Fakharian | S.Faramarzpour |  |
| **Rev.** | **Date** | **Purpose of Issue/Status** | **Prepared by:** | **Checked by:** | **Approved by:** | **CLIENT Approval** |
|  | | | | | | |
| **Status:** | **IFA: Issued For Approval**  **IFI: Issued For Information**  **AFC: Approved For Construction** | | | | | |

**REVISION RECORD SHEET**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **PAGE** | **V00** | **V01** | **V02** | **V03** | **V04** |  | **PAGE** | **V00** | **V01** | **V02** | **V03** | **V04** |
| **1** | X |  |  |  |  | **66** |  |  |  |  |  |
| **2** | X |  |  |  |  | **67** |  |  |  |  |  |
| **3** | X |  |  |  |  | **68** |  |  |  |  |  |
| **4** | X |  |  |  |  | **69** |  |  |  |  |  |
| **5** | X |  |  |  |  | **70** |  |  |  |  |  |
| **6** | X |  |  |  |  | **71** |  |  |  |  |  |
| **7** | X |  |  |  |  | **72** |  |  |  |  |  |
| **8** | X |  |  |  |  | **73** |  |  |  |  |  |
| **9** | X |  |  |  |  | **74** |  |  |  |  |  |
| **10** | X |  |  |  |  | **75** |  |  |  |  |  |
| **11** | X |  |  |  |  | **76** |  |  |  |  |  |
| **12** | X |  |  |  |  | **77** |  |  |  |  |  |
| **13** | X |  |  |  |  | **78** |  |  |  |  |  |
| **14** | X |  |  |  |  | **79** |  |  |  |  |  |
| **15** | X |  |  |  |  | **80** |  |  |  |  |  |
| **16** | X |  |  |  |  | **81** |  |  |  |  |  |
| **17** | X |  |  |  |  | **82** |  |  |  |  |  |
| **18** | X |  |  |  |  | **83** |  |  |  |  |  |
| **19** | X |  |  |  |  | **84** |  |  |  |  |  |
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| **50** |  |  |  |  |  | **115** |  |  |  |  |  |
| **51** |  |  |  |  |  | **116** |  |  |  |  |  |
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| **53** |  |  |  |  |  | **118** |  |  |  |  |  |
| **54** |  |  |  |  |  | **119** |  |  |  |  |  |
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| **60** |  |  |  |  |  | **125** |  |  |  |  |  |
| **61** |  |  |  |  |  | **126** |  |  |  |  |  |
| **62** |  |  |  |  |  | **127** |  |  |  |  |  |
| **63** |  |  |  |  |  | **128** |  |  |  |  |  |
| **64** |  |  |  |  |  | **129** |  |  |  |  |  |
| **65** |  |  |  |  |  | **130** |  |  |  |  |  |

WPS BINAK

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| **WPS No.** | **Process** | **PWHT** | **PQR No.**  **(Coupon thk.)** | **WPS qualified Thk.**  **(mm)** | **Material** |
| W01 | SMAW+GTAW | YES | It will be finalized later. | 5-25 | P Number: 1 to P Number:1 |
| W02 | SMAW | YES | It will be finalized later. | 5-25 | P Number: 1 to P Number:1 |
| W03 | SMAW+GTAW | YES | It will be finalized later. | 5-50 | P Number: 1 to P Number:1 |
| W04 | SMAW | YES | It will be finalized later. | 5-50 | P Number: 1 to P Number:1 |
| W05 | SMAW | YES | It will be finalized later. | 5-200 | P Number: 1 to P Number:1 |
| W06 | SMAW | NO | It will be finalized later. | 5-200 | P Number: 8 to P Number:1 |
| W07 | SMAW | NO | It will be finalized later. | 5-20 | P Number: 8 to P Number:8 |
| W08 | SMAW+GTAW | NO | It will be finalized later. | 5-20 | P Number: 8 to P Number:8 |
| W09 | GTAW | Yes | It will be finalized later. | 5-30 | P Number: 8 to P Number:8 |
| W10 | GTAW | Yes | It will be finalized later. | 5-30 | P Number: 1 to P Number:1 |
| W11 | GTAW | Yes | It will be finalized later. | 5-30 | P Number: 1 to P Number:1 |
| W12 | SMAW | Yes | It will be finalized later. | 5-50 | P Number: 1 to P Number:1 |
| W13 | SMAW+SAW | Yes | It will be finalized later. | 5-50 | P Number: 1 to P Number:1 |

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| **WELDING PROCEDURE SPECIFICATIONS (WPS) [ASME BPVC – SEC IX] [2019]** | | | | | | | | |
| **WPS No.** | W01 | **Sup. PQR No.** | | PX | |  | |  |
| **Welding process:** GTAW + SMAW | | | | **Type:** | | Manual | Auto |  |
| **JOINT DESIGN (QW-402)** | | | | | | | | |
| Groove | Single bevel/Double Bevel | |  |  | |  |  |  |
| Backing | Yes (for SMAW) | |  | Backing material | | | Weld metal | |
| **BASE METAL (QW-403)** | |  |  |  | |  |  |  |
| Material: | SA516 – Gr.70N/ SA106– Gr.B N/ SA182– F 316 L/SA 234 WPB | | | To | | SA516 – Gr.70N/ SA106– Gr.B N/ SA182– F 316 L /SA 234 WPB | | |
| P-No. | 1 | G-No. | 1 / 2 | to | | P-No. | 1 | G-No. 2/1 |
| T qualified (mm): | | 5 – 24 | Max. pass thick. (mm) | | | ≤ 13 |  |  |
| **FILLER METALS (QW-404)** | |  |  |  | |  |  |  |
|  | **Root** | **Filling & Cap** | |  | |  | |  |
| SFA No. | 5.18 | 5.1 |  |  | |  |  |  |
| AWS No. | ER70S-6 | E7018-H4 | |  | |  |  |  |
| F-No. | 6 | 4 |  |  | |  |  |  |
| A-No. | 1 | 1 |  |  | |  |  |  |
| Size (mm) | 2.4 | 2.5 – 4 |  |  | |  |  |  |
| Form | Solid rod | Covered electrode | |  | |  |  |  |
| Trade name | AMA | AMA | |  | |  |  |  |
| Max deposit (mm) | 10 | 190 |  |  | |  |  |  |
| Baking | N.A. | 2 h @ 300 – 350 ℃ | |  | | | |  |
| **POSITIONS (QW-405)** | |  |  | **POSTWELD HEAT TREATMENT (QW-407)** | | | | |
| Positions | 1~3G, 5G | |  | Temp. rage (℃) | | | 595 – 620 |  |
| Progression | All but downhill | |  | Time range (min) | | | 95 | |
| **PREHEAT (QW-406)** | |  |  | **GAS (QW-408)** | | |  |  |
| Temp. (℃) (min) | | 10 |  |  | | Gas | Mixture | Flow rate |
| Inter-pass temp. (℃) (max) | | 250 |  | Shielding | | N.A. | — | — |
| **ELECTRICAL CHARACTERISTICS (QW-409)** | | | |  | |  |  |  |
| Layer | Process | Polarity | Amp. | Voltage | | Travel speed (cm/min) | Heat input (J/mm) | |
| Root **(1)** | GTAW | DCEN | 70 – 120 | 15 – 22 | | 10 – 25 |  | |
| Filling & cap **(2)** | SMAW | DCEP | 65 – 190 | 15 – 45 | | 10 – 25 |  | |
| **TECHNIQUE (QW-410)** | |  |  |  | |  |  |  |
|  |  | **Root** |  | **Filling & cap** | |  |  |  |
| Orifice or gas cap size (mm) | | 10 – 16 |  | N.A. | |  |  | |
| String / weave |  | Both |  | Both | |  |  |  |
| Initial and Inter-pass Cleaning | | Brushing / grinding | | Brushing / grinding | | |  | |
| Method of back gouging | | None |  | | None |  |  |  |
| Multiple / single pass (per side) | | Multiple |  | Multiple | |  |  |  |
| **MFS** | | **TPI** | | | | **Client** | | |

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| **WELDING PROCEDURE SPECIFICATIONS (WPS) [ASME BPVC – SEC IX] [2019]** | | | | | | | |
| **WPS No.** | W02 | **Sup. PQR No.** | | PX |  | |  |
| **Welding process:** SMAW | | | | **Type:** | Manual |  |  |
| **JOINT DESIGN (QW-402)** | | | | | | | |
| Groove | Double V/Single Bevel | |  |  |  |  |  |
| Backing | No | |  | Backing material | | N.A. | |
| **BASE METAL (QW-403)** | |  |  |  |  |  |  |
| Material: | SA516 – Gr.70N/ SA106– Gr.B N/ SA182– F 316 L /SA 234 WPB | | | To | SA516 – Gr.70N/ SA106– Gr.B N/ SA182– F 316 L /SA 234 WPB | | |
| P-No. | 1 | G-No. | 2 | to | P-No. | 1 | G-No. 2/1 |
| T qualified (mm): | | 5-24 | Max. pass thick. (mm) | | ≤ 13 |  |  |
| **FILLER METALS (QW-404)** | |  |  |  |  |  |  |
|  |  | Root, filling & cap | |  |  | |  |
| SFA No. |  | 5.1 |  |  |  |  |  |
| AWS No. |  | E7018-H4 | |  |  | |  |
| F-No. |  | 4 |  |  |  |  |  |
| A-No. |  | 1 |  |  |  |  |  |
| Size (mm) |  | 2.5 – 4 |  |  |  |  |  |
| Form |  | Covered electrode | |  |  | |  |
| Trade name |  | AMA | |  |  | |  |
| Max deposit (mm) | | 200 |  |  |  |  |  |
| Flux |  | N.A. |  |  |  | |  |
| Baking |  | 2 h @ 300 – 350 ℃ | |  |  | |  |
| **POSITIONS (QW-405)** | |  |  | **POSTWELD HEAT TREATMENT (QW-407)** | | | |
| Positions | 1~3G & 5G | |  | Temp. rage (℃) | | 595 – 620 |  |
| Progression | All but downhill | |  | Time range (min) | | 95 | |
| **PREHEAT (QW-406)** | |  |  | **GAS (QW-408)** | |  |  |
| Temp. (℃) (min) | | 10 |  |  | Gas | Mixture | Flow rate |
| Inter-pass temp. (℃) (max) | | 250 |  | Shielding | N.A. | — | — |
| **ELECTRICAL CHARACTERISTICS (QW-409)** | | | |  |  |  |  |
| Layer | Process | Polarity | Amp. | Voltage | Travel speed  (cm/min) | Heat input | |
| Root, filling & cap | SMAW | DCEP | 65-190 | 15 – 30 | 10 – 25 |  | |
| **TECHNIQUE (QW-410)** | |  |  |  |  |  |  |
|  |  | Root |  |  | Filling & cap | |  |
| String / weave |  | Both |  |  | Both |  |  |
| Initial and Inter-pass Cleaning | | Brushing / grinding | |  | Brushing / grinding | |  |
| Method of back gouging | | Arc-air gouging + grinding | | |  |  |  |
| Multiple / single pass (per side) | | Multiple |  |  | Multiple |  |  |
| **MFS** | | **TPI** | | | **Client** | | |

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| **WELDING PROCEDURE SPECIFICATIONS (WPS) [ASME BPVC – SEC IX] [2019]** | | | | | | | | | |
| **WPS No.** | W03 | **Sup. PQR No.** | | | PX | |  | |  |
| **Welding process:** GTAW + SMAW | | | | | **Type:** | | Manual | Auto |  |
| **JOINT DESIGN (QW-402)** | | | | | | | | | |
| Groove | Single bevel | |  | |  | |  |  |  |
| Backing | Yes (for SMAW) | | |  | Backing material | | | Weld metal | |
| **BASE METAL (QW-403)** | |  |  | |  | |  |  |  |
| Material: | SA106 – Gr. B / SA 105 N/ SA234-WPB | | | | To | | SA516 – Gr.70/ SA106 – Gr. B/ SA234-WPB/ SA 105 N | | |
| P-No. | 1 | G-No. | 1 / 2 | | to | | P-No. | 1 | G-No. 2 |
| T qualified (mm): | | 5 – 30 | Max. pass thick. (mm) | | | | ≤ 13 |  |  |
| **FILLER METALS (QW-404)** | |  |  | |  | |  |  |  |
|  | **Root** | **Filling & Cap** | | |  | |  | |  |
| SFA No. | 5.18 | 5.1 |  | |  | |  |  |  |
| AWS No. | ER70S-6 | E7018-H4 | | |  | |  |  |  |
| F-No. | 6 | 4 |  | |  | |  |  |  |
| A-No. | 1 | 1 |  | |  | |  |  |  |
| Size (mm) | 2.4 | 2.5 – 4 |  | |  | |  |  |  |
| Form | Solid rod | Covered electrode | | |  | |  |  |  |
| Trade name | AMA | AMA | | |  | |  |  |  |
| Max deposit (mm) | 10 | 190 |  | |  | |  |  |  |
| Baking | N.A. | 2 h @ 300 – 350 ℃ | | |  | | | |  |
| **POSITIONS (QW-405)** | |  |  | | **POSTWELD HEAT TREATMENT (QW-407)** | | | | |
| Positions | 1~3G, 5G | |  | | Temp. rage (℃) | | | 595 – 620 |  |
| Progression | All but downhill | |  | | Time range (min) | | | 95 | |
| **PREHEAT (QW-406)** | |  |  | | **GAS (QW-408)** | | |  |  |
| Temp. (℃) (min) | | 100 |  | |  | | Gas | Mixture | Flow rate |
| Inter-pass temp. (℃) (max) | | 250 |  | | Shielding | | N.A. | — | — |
| **ELECTRICAL CHARACTERISTICS (QW-409)** | | | | |  | |  |  |  |
| Layer | Process | Polarity | Amp. | | Voltage | | Travel speed (cm/min) | Heat input (J/mm) | |
| Root **(1)** | GTAW | DCEN | 70 – 120 | | 15 – 22 | | 10 – 25 |  | |
| Filling & cap **(2)** | SMAW | DCEP | 65 – 190 | | 15 – 45 | | 10 – 25 |  | |
| **TECHNIQUE (QW-410)** | |  |  | |  | |  |  |  |
|  |  | **Root** |  | | **Filling & cap** | |  |  |  |
| Orifice or gas cap size (mm) | | 10 – 16 |  | | N.A. | |  |  | |
| String / weave |  | Both |  | | Both | |  |  |  |
| Initial and Inter-pass Cleaning | | Brushing / grinding | | | Brushing / grinding | | |  | |
| Method of back gouging | | None | |  | | None |  |  |  |
| Multiple / single pass (per side) | | Multiple |  | | Multiple | |  |  |  |
| **MFS** | | **TPI** | | | | | **Client** | | |

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| **WELDING PROCEDURE SPECIFICATIONS (WPS) [ASME BPVC – SEC IX] [2019]** | | | | | | | | | |
| **WPS No.** | W04 | **Sup. PQR No.** | | | PX | |  | |  |
| **Welding process:** SMAW | | | | | **Type:** | | Manual | Auto |  |
| **JOINT DESIGN (QW-402)** | | | | | | | | | |
| Groove | Single bevel | |  | |  | |  |  |  |
| Backing | Yes (for SMAW) | | |  | Backing material | | | Weld metal | |
| **BASE METAL (QW-403)** | |  |  | |  | |  |  |  |
| Material: | SA106 – Gr. B / SA 105 N/ SA234-WPB | | | | To | | SA106 – Gr. B / SA 105 N/ SA234-WPB/ SA516 – Gr.70 | | |
| P-No. | 1 | G-No. | 1 / 2 | | to | | P-No. | 1 | G-No. 2 |
| T qualified (mm): | | 5 – 30 | Max. pass thick. (mm) | | | | ≤ 13 |  |  |
| **FILLER METALS (QW-404)** | |  |  | |  | |  |  |  |
|  |  | **Root,Filling & Cap** | | |  | |  | |  |
| SFA No. |  | 5.1 |  | |  | |  |  |  |
| AWS No. |  | E7018-H4 | | |  | |  |  |  |
| F-No. |  | 4 |  | |  | |  |  |  |
| A-No. |  | 1 |  | |  | |  |  |  |
| Size (mm) |  | 2.5 – 4 |  | |  | |  |  |  |
| Form |  | Covered electrode | | |  | |  |  |  |
| Trade name |  | AMA | | |  | |  |  |  |
| Max deposit (mm) |  | 35 |  | |  | |  |  |  |
| Baking |  | 2 h @ 300 – 350 ℃ | | |  | | | |  |
| **POSITIONS (QW-405)** | |  |  | | **POSTWELD HEAT TREATMENT (QW-407)** | | | | |
| Positions | 1~3G, 5G | |  | | Temp. rage (℃) | | | 595 – 620 |  |
| Progression | All but downhill | |  | | Time range (min) | | | 95 | |
| **PREHEAT (QW-406)** | |  |  | | **GAS (QW-408)** | | |  |  |
| Temp. (℃) (min) | | 100 |  | |  | | Gas | Mixture | Flow rate |
| Inter-pass temp. (℃) (max) | | 250 |  | | Shielding | | N.A. | — | — |
| **ELECTRICAL CHARACTERISTICS (QW-409)** | | | | |  | |  |  |  |
| Layer | Process | Polarity | Amp. | | Voltage | | Travel speed (cm/min) | Heat input (J/mm) | |
| Root **(1)** | GTAW | DCEN | 70 – 120 | | 15 – 22 | | 10 – 25 |  | |
| Filling & cap **(2)** | SMAW | DCEP | 65 – 190 | | 15 – 45 | | 10 – 25 |
| **TECHNIQUE (QW-410)** | |  |  | |  | |  |  |  |
|  |  | **Root** |  | | **Filling & cap** | |  |  |  |
| Orifice or gas cap size (mm) | | 10 – 16 |  | | N.A. | |  |  | |
| String / weave |  | Both |  | | Both | |  |  |  |
| Initial and Inter-pass Cleaning | | Brushing / grinding | | | Brushing / grinding | | |  | |
| Method of back gouging | | None | |  | | None |  |  |  |
| Multiple / single pass (per side) | | Multiple |  | | Multiple | |  |  |  |
| **MFS** | | **TPI** | | | | | **Client** | | |

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| **WELDING PROCEDURE SPECIFICATIONS (WPS) [ASME BPVC – SEC IX] [2019]** | | | | | | | |
| **WPS No.** | W05 | **Sup. PQR No.** | | PX |  | |  |
| **Welding process:** SMAW | | | | **Type:** | Manual |  |  |
| **JOINT DESIGN (QW-402)** | | | | | | | |
| Fillet |  | |  |  |  |  |  |
| Backing | Yes | |  | Backing material | | Base metal | |
| **BASE METAL (QW-403)** | |  |  |  |  |  |  |
| Material: | SA516 – Gr.70 / SA283 – Gr.C | | | To | SA516 – Gr.70/ SA283 – Gr.C | | |
| P-No. | 1 | G-No. | 2/1 | to | P-No. | 1 | G-No. 2/1 |
| T qualified (mm): | | All | Max. pass thick. (mm) | | ≤ 13 |  |  |
| **FILLER METALS (QW-404)** | |  |  |  |  |  |  |
|  |  | **Root, filling & cap** | |  |  | |  |
| SFA No. |  | 5.1 |  |  |  |  |  |
| AWS No. |  | E7018-H4 | |  |  | |  |
| F-No. |  | 4 |  |  |  |  |  |
| A-No. |  | 1 |  |  |  |  |  |
| Size (mm) |  | 2.5 – 4 |  |  |  |  |  |
| Form |  | Covered electrode | |  |  | |  |
| Trade name |  | AMA | |  |  | |  |
| Max deposit (mm) | | N.A. |  |  |  |  |  |
| Baking | | 2 h @ 300 – 350 ℃ | |  |  |  |  |
| **POSITIONS (QW-405)** | |  |  | **POSTWELD HEAT TREATMENT (QW-407)** | | | |
| Positions | 1 ~ 3F | |  | Temp. rage (℃) | | 595 – 620 |  |
| Progression | All but downhill | |  | Time range (min) | | 95 | |
| **PREHEAT (QW-406)** | |  |  | **GAS (QW-408)** | |  |  |
| Temp. (℃) (min) | | 10 |  |  | Gas | Mixture | Flow rate |
| Inter-pass temp. (℃) (max) | | 250 |  | Shielding | N.A. | — | — |
| **ELECTRICAL CHARACTERISTICS (QW-409)** | | | |  |  |  |  |
| Layer | Process | Polarity | Amp. | Voltage | Travel speed  (cm/min) | Heat input | |
| Root, filling & cap | SMAW | DCEP | 65 – 190 | 15 – 30 | 10 – 25 |  | |
| **TECHNIQUE (QW-410)** | |  |  |  |  |  |  |
|  |  | **Root** |  |  | **Filling & cap** | |  |
| String / weave |  | Both |  |  | Both |  |  |
| Initial and Inter-pass Cleaning | | Brushing / grinding | |  | Brushing / grinding | |  |
| Method of back gouging | | N.A. | | |  |  |  |
| Oscillation |  | N.A. |  |  | N.A. |  |  |
| Multiple / single pass (per side) | | Multiple |  |  | Multiple |  |  |
| **MFS** | | **TPI** | | | **Client** | | |

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| **WELDING PROCEDURE SPECIFICATIONS (WPS) [ASME BPVC – SEC IX]** | | | | | | | |
| **WPS No.** | W06 | **Sup. PQR No.** | | PX |  | |  |
| **Welding process:** SMAW | | | | **Type:** | Manual |  |  |
| **JOINT DESIGN (QW-402)** | | | | | | | |
| Groove FILLET | | |  |  |  |  |  |
| Backing | No | |  | Backing material | | - | |
| **BASE METAL (QW-403)** | |  |  |  |  |  |  |
| Material: | SA-240 -304 | | | To | SA-516-70/ SA106 – Gr. B/SA 234 WPB N | | |
| P-No. | 8 | G-No. | 1 | to | P-No. | 1 | G-No. 2 |
| T qualified (mm): | | All | Max. pass thick. (mm) | | ≤ 13 |  |  |
| **FILLER METALS (QW-404)** | |  |  |  |  |  |  |
|  |  | Root, filling & cap | |  |  | |  |
| SFA No. |  | 5.4 |  |  |  |  |  |
| AWS No. |  | E309L-16 | |  |  | |  |
| F-No. |  | 5 |  |  |  |  |  |
| A-No. |  | 8 |  |  |  |  |  |
| Size (mm) |  | 2.4~3.2 |  |  |  |  |  |
| Form |  | Covered electrode | |  |  | |  |
| Trade name |  | AMA (1464JA) | |  |  | |  |
| Max deposit (mm) | | N.A. |  |  |  |  |  |
| Baking | | 2 h @ 350 – 400 ℃ | | | |  |  |
| **POSITIONS (QW-405)** | |  |  | **POSTWELD HEAT TREATMENT (QW-407)** | | | |
| Positions | 1 ~3G & 5G | |  | Temp. rage (℃) | | N.A. |  |
| Progression | All but downhill | |  | Time range (min) | | — | |
| **PREHEAT (QW-406)** | |  |  | **GAS (QW-408)** | |  |  |
| Temp. (℃) (min) | | N. A |  |  | Gas | Mixture | Flow rate |
| Inter-pass temp. (℃) (max) | | 250 |  | Shielding | N.A. | — | — |
|  | |  |  | Trailing | — | — | — |
| **ELECTRICAL CHARACTERISTICS (QW-409)** | | | |  |  |  |  |
| Layer | Process | Polarity | Amp. | Voltage | Travel speed | Heat input | |
| Root, filling & cap | SMAW | DCEP | 65-160 | 15-45 | 6-12 (cm/min) |  | |
| **TECHNIQUE (QW-410)** | |  |  |  |  |  |  |
|  |  | SMAW | |  |  | |  |
| String / weave |  | Both |  |  |  |  |  |
| Initial and Inter-pass Cleaning | | Brushing / grinding | |  |  | |  |
| Method of back gouging | | N.A. | | |  |  |  |
| Oscillation |  | N.A. |  |  |  |  |  |
| Multiple / single Electrode | | Single |  |  |  |  |  |
| Multiple / single pass (per side) | | Single |  |  |  |  |  |
| **MFS** | | **TPI** | | | **Client** | | |

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| **WELDING PROCEDURE SPECIFICATIONS (WPS) [ASME BPVC – SEC IX] [2019]** | | | | | | | |
| **WPS No.** | W07 | **Sup. PQR No.** | | P0X |  | |  |
| **Welding process:** SMAW | | | | **Type:** | Manual |  |  |
| **JOINT DESIGN (QW-402)** | | | | | | | |
| Groove | Single V, bevel, Double V | |  |  |  |  |  |
| Backing | No, yes | |  | Backing material | | N.A., Base metal | |
| **BASE METAL (QW-403)** | |  |  |  |  |  |  |
| Material: | SA312-TP316L/SA 182 F316L/SA 240 316L/ SA403-WP316L | | | To | SA312-TP316L/SA 182 F 316L/SA 240 316L/ SA403-WP316L | | |
| P-No. | 8 | G-No. | 1 | to | P-No. | 8 | G-No. 1 |
| T qualified (mm): | | 5 – 20 | Max. pass thick. (mm) | | ≤ 13 |  |  |
| **FILLER METALS (QW-404)** | |  |  |  |  |  |  |
|  |  | **Root, filling & cap** | |  |  | |  |
| SFA No. |  | 5.4 |  |  |  |  |  |
| AWS No. |  | E316L-16 | |  |  | |  |
| F-No. |  | 5 |  |  |  |  |  |
| A-No. |  | 8 |  |  |  |  |  |
| Size (mm) |  | 2.4 – 4 |  |  |  |  |  |
| Form |  | Covered electrode | |  |  | |  |
| Trade name |  | AMA | |  |  | |  |
| Flux |  | N.A. |  |  |  | |  |
| Baking |  | 2 h @ 300 – 350 ℃ | |  |  | |  |
| **POSITIONS (QW-405)** | |  |  | **POSTWELD HEAT TREATMENT (QW-407)** | | | |
| Positions | 1~3G & 5G | |  | Temp. rage (℃) | | N.A. |  |
| Progression | All but downhill | |  | Time range (min) | | — | |
| **PREHEAT (QW-406)** | |  |  | **GAS (QW-408)** | |  |  |
| Temp. (℃) (min) | | N.A. |  |  | Gas | Mixture | Flow rate |
| Inter-pass temp. (℃) (max) | | 175 |  | Shielding | N.A. | — | — |
| **ELECTRICAL CHARACTERISTICS (QW-409)** | | | |  |  |  |  |
| Layer | Process | Polarity | Amp. | Voltage | Travel speed (cm/min) | Heat input (J/mm) | |
| Root, filling & cap | SMAW | DCEP | 65 – 190 | 15 – 30 | 10 – 25 | 230 – 3400 | |
| **TECHNIQUE (QW-410)** | |  |  |  |  |  |  |
|  |  | **Root, filling & cap** | |  |  | |  |
| String / weave |  | Both |  |  |  |  |  |
| Initial and Inter-pass Cleaning | | Brushing / grinding | |  |  | |  |
| Method of back gouging | | grinding | | |  |  |  |
| Multiple / single pass (per side) | | Multiple |  |  |  |  |  |
| **MFS** | | **TPI** | | | **Client** | | |

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| **WELDING PROCEDURE SPECIFICATIONS (WPS) [ASME BPVC – SEC IX]** | | | | | | | |
| **WPS No.** | W08 | **Sup. PQR No.** | | P0X |  | |  |
| **Welding process:** GTAW + SMAW | | | | **Type:** | Manual |  |  |
| **JOINT DESIGN (QW-402)** | | | | | | | |
| Groove | Single V / Single bevel | |  |  |  |  |  |
| Backing | Yes (for SMAW) | |  | Backing material | | Weld metal | |
| **BASE METAL (QW-403)** | |  |  |  |  |  |  |
| Material: | SA 312-TP316L/SA403-WP316L/SA182-F316 L | | | To | SA 312-TP316L/SA 403-WP316L /SA182-F316 L | | |
| P-No. | 8 | G-No. | 1 | to | P-No. | 8 | G-No.1 |
| T qualified (mm): | | 5-20 | Max. pass thick. (mm) | | ≤ 13 |  |  |
| **FILLER METALS (QW-404)** | |  |  |  |  |  |  |
|  |  | Root | |  | Filling & cap | |  |
| SFA No. |  | 5.9 |  |  | 5.4 |  |  |
| AWS No. |  | ER316-L | |  | E316L-16 | |  |
| F-No. |  | 6 |  |  | 5 |  |  |
| A-No. |  | 8 |  |  | 8 |  |  |
| Size (mm) |  | 2.4 |  |  | 2.5 – 4 |  |  |
| Form |  | Soild |  |  | Covered electrode | |  |
| Trade name |  | AMA (30-13M) | |  | AMA | |  |
| baking | | - |  |  | 2 h @ 350 – 400 ℃ | |  |
| **POSITIONS (QW-405)** | |  |  | **POSTWELD HEAT TREATMENT (QW-407)** | | | |
| Positions | 1~3G & 5G | |  | Temp. rage (℃) | | N. A |  |
| Progression | For 3G & 5G Up hill | |  | Time range (min) | | N. A | |
| **PREHEAT (QW-406)** | |  |  | **GAS (QW-408)** | |  |  |
| Temp. (℃) (min) | | N. A |  |  | Gas | Mixture | Flow rate |
| Inter-pass temp. (℃) (max) | | 175 |  | Shielding | Ar. | 99.997% | 10-15 l/min |
|  | |  |  | backing | Ar. | 99.997% | 10-15 l/min |
| **ELECTRICAL CHARACTERISTICS (QW-409)** | | | |  |  |  |  |
| Layer | Process | Polarity | Amp. | Voltage | Travel speed (cm/min) | Heat input | |
| Root **(1)** | GTAW | DCEN | 70-140 | 10-12 | 7.5-15 |  | |
| Filling & cap **(2)** | SMAW | DCEP | 65-140 | 22-26 |
| **TECHNIQUE (QW-410)** | |  |  |  |  |  |  |
|  |  | GTAW (Root) | |  | SMAW (Filling & cap) | |  |
| String / weave |  | Both |  |  | Both |  |  |
| Initial and Inter-pass Cleaning | | Brushing / grinding | |  | Brushing / grinding | |  |
| Method of back gouging | | N.A. |  |  | N.A. |  |  |
| Oscillation |  | N.A. |  |  | N.A. |  |  |
| Multiple / single Electrode | | Single |  |  | Single |  |  |
| Multiple / single pass (per side) | | Single |  |  | Multiple |  |  |
| **MFS** | | **TPI** | | | **Client** | | |

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| **WELDING PROCEDURE SPECIFICATIONS (WPS)**  **(Section IX, ASME Boiler and Pressure Vessel Code)** | | | | | | | |
| **Organization Name** | | Masnouat Felezi Sangin (MFS) Co. | | | | | |
| **WPS No.** | W09 | **Sup. PQR No.** P0X | |  |  | |  |
| **Welding process:** GTAW | | | | **Type:** | Manual/  Semi Automate(orbital ) |  |  |
| **JOINT DESIGN (QW-402)** | |  |  |  |  |  |  |
|  | | | | | | | |
| Groove | Single bevel | |  |  |  |  |  |
| Backing | N.A. | |  | Backing material | | Base Metal | |
| **BASE METAL (QW-403)** | |  |  |  |  |  |  |
| Material: | SA-213 TP316L | | | To | SA-182 F316L | | |
| P-No. | 8 | G-No. | 1 | to | P-No. | 8 | G-No. 1 |
| T qualified (mm): | | 1.5-10 | Max. pass thick. (mm) | | ≤ 13 |  |  |
| **FILLER METALS (QW-404)** | |  |  |  |  |  |  |
|  |  | GTAW | |  |  | |  |
| SFA No. |  | 5.9 |  |  |  |  |  |
| AWS No. |  | ER-316L | |  |  | |  |
| F-No. |  | 6 |  |  |  |  |  |
| A-No. |  | 8 |  |  |  |  |  |
| Size (mm) |  | 2.4 |  |  |  |  |  |
| Form |  | Bare solid rod | |  |  | |  |
| Trade name |  | AMA (30-13M) | |  |  | |  |
| Flux |  | N.A. |  |  |  |  |  |
| **POSITIONS (QW-405)** | |  |  | **POSTWELD HEAT TREATMENT (QW-407)** | | | |
| Positions | 1~3G | |  | Temp. rage (℃) | | - |  |
| Progression | Uphill |  |  | Time range (min) | | - | |
| **PREHEAT (QW-406)** | | (As per Sec. VIII) | | **GAS (QW-408)** | |  |  |
| Temp. (℃) (min) | | N.A. |  |  | Gas | Mixture | Flow rate |
| Inter-pass temp. (℃) (max) | | 175 |  | Shielding | Ar. | 99.997% | 10-15 l/min |
|  | |  |  | Trailing | — | — | — |
|  |  |  |  | Backing | — | — | — |
| **ELECTRICAL CHARACTERISTICS (QW-409)** | | | |  |  |  |  |
| Layer | Process | Polarity | Amp. | Voltage | Travel speed | Maximum Heat input (J/mm) | |
| All | GTAW | DCEN | 70 – 120 | 15 – 22 | 10 – 25  cm/min | (V×A×60)/(Travel speed) | |
| **TECHNIQUE (QW-410)** | |  |  |  |  |  |  |
|  |  | GTAW |  |  |  | |  |
| Orifice or gas cap size (mm) | | 4 – 10 |  |  |  |  |  |
| String / weave |  | Both |  |  |  |  |  |
| Initial and Inter-pass Cleaning | | Brushing / grinding | |  |  | |  |
| Single/multiple electrode | | Single | |  |  | |  |
| Method of back gouging | | N.A. |  |  |  |  |  |
| Oscillation |  | N.A. |  |  |  |  |  |
| Multiple / single pass (per side) | | Multiple |  |  |  |  |  |
| **MFS** | | **TPI** | | | **Client** | | |
| **WELDING PROCEDURE SPECIFICATIONS (WPS)**  **(Section IX, ASME Boiler and Pressure Vessel Code)** | | | | | | | |
| **Organization Name** | | Masnouat Felezi Sangin (MFS) Co. | | | | | |
| **WPS No.** | W10 | **Sup. PQR No.** P0X | |  |  | |  |
| **Welding process:** GTAW | | | | **Type:** | Manual |  |  |
| **JOINT DESIGN (QW-402)** | |  |  |  |  |  |  |
|  | | | | | | | |
| Groove | Single bevel | |  |  |  |  |  |
| Backing | N.A. | |  | Backing material | | Base Metal | |
| **BASE METAL (QW-403)** | |  |  |  |  |  |  |
| Material: | SA-266 Gr. 2 N | | | To | SA-179 N | | |
| P-No. | 1 | G-No. | 2 | to | P-No. | 1 | G-No. 1 |
| T qualified (mm): | | 10-1.5 | Max. pass thick. (mm) | | ≤ 13 |  |  |
| **FILLER METALS (QW-404)** | |  |  |  |  |  |  |
|  |  | GTAW | |  |  | |  |
| SFA No. |  | 5.18 |  |  |  |  |  |
| AWS No. |  | ER70S-6 | |  |  | |  |
| F-No. |  | 6 |  |  |  |  |  |
| A-No. |  | 8 |  |  |  |  |  |
| Size (mm) |  | 2.4 |  |  |  |  |  |
| Form |  | Bare solid rod | |  |  | |  |
| Trade name |  | AMA (30-13M) | |  |  | |  |
| Flux |  | N.A. |  |  |  |  |  |
| **POSITIONS (QW-405)** | |  |  | **POSTWELD HEAT TREATMENT (QW-407)** | | | |
| Positions | 1~3G | |  | Temp. rage (℃) | | - |  |
| Progression | Uphill |  |  | Time range (min) | | - | |
| **PREHEAT (QW-406)** | | (As per Sec. VIII) | | **GAS (QW-408)** | |  |  |
| Temp. (℃) (min) | | N.A. |  |  | Gas | Mixture | Flow rate |
| Inter-pass temp. (℃) (max) | | 250 |  | Shielding | Ar. | 99.997% | 10-15 l/min |
|  | |  |  | Trailing | — | — | — |
|  |  |  |  | Backing | — | — | — |
| **ELECTRICAL CHARACTERISTICS (QW-409)** | | | |  |  |  |  |
| Layer | Process | Polarity | Amp. | Voltage | Travel speed | Maximum Heat input (J/mm) | |
| All | GTAW | DCEN | 70 – 120 | 15 – 22 | 10 – 25  cm/min | (V×A×60)/(Travel speed) | |
| **TECHNIQUE (QW-410)** | |  |  |  |  |  |  |
|  |  | GTAW |  |  |  | |  |
| Orifice or gas cap size (mm) | | 4 – 10 |  |  |  |  |  |
| String / weave |  | Both |  |  |  |  |  |
| Initial and Inter-pass Cleaning | | Brushing / grinding | |  |  | |  |
| Single/multiple electrode | | Single | |  |  | |  |
| Method of back gouging | | N.A. |  |  |  |  |  |
| Oscillation |  | N.A. |  |  |  |  |  |
| Multiple / single pass (per side) | | Multiple |  |  |  |  |  |
| **MFS** | | **TPI** | | | **Client** | | |

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| **WELDING PROCEDURE SPECIFICATIONS (WPS) [ASME BPVC – SEC IX] [2019]** | | | | | | | | | |
| **WPS No.** | W11 | **Sup. PQR No.** | | | PX | |  | |  |
| **Welding process:** GTAW | | | | | **Type:** | | Manual | Auto |  |
| **JOINT DESIGN (QW-402)** | | | | | | | | | |
| Groove | Single bevel | |  | |  | |  |  |  |
| Backing | N. A | | |  | Backing material | | | N.A. | |
| **BASE METAL (QW-403)** | |  |  | |  | |  |  |  |
| Material: | SA106 – Gr. B /SA 234 WPB N | | | | To | | SA106 – Gr. B SA 182 F316 L/SA 234 WPB N | | |
| P-No. | 1 | G-No. | 1 / 2 | | to | | P-No. | 1 | G-No. 2 |
| T qualified (mm): | | 5 – 30 | Max. pass thick. (mm) | | | | ≤ 13 |  |  |
| **FILLER METALS (QW-404)** | |  |  | |  | |  |  |  |
|  | **GTAW** |  | | |  | |  | |  |
| SFA No. | 5.18 |  |  | |  | |  |  |  |
| AWS No. | ER70S-6 |  | | |  | |  |  |  |
| F-No. | 6 |  |  | |  | |  |  |  |
| A-No. | 1 |  |  | |  | |  |  |  |
| Size (mm) | 2.4 |  |  | |  | |  |  |  |
| Form | Solid rod |  | | |  | |  |  |  |
| Trade name | AMA |  | | |  | |  |  |  |
| Max deposit (mm) | 10 |  |  | |  | |  |  |  |
| Baking | N.A. |  | | |  | | | |  |
| **POSITIONS (QW-405)** | |  |  | | **POSTWELD HEAT TREATMENT (QW-407)** | | | | |
| Positions | 1~3G, 5G | |  | | Temp. rage (℃) | | | 595 – 620 |  |
| Progression | All but downhill | |  | | Time range (min) | | | 95 | |
| **PREHEAT (QW-406)** | |  |  | | **GAS (QW-408)** | | |  |  |
| Temp. (℃) (min) | | 100 |  | |  | | Gas | Mixture | Flow rate |
| Inter-pass temp. (℃) (max) | | 250 |  | | Shielding | | N.A. | — | — |
| **ELECTRICAL CHARACTERISTICS (QW-409)** | | | | |  | |  |  |  |
| Layer | Process | Polarity | Amp. | | Voltage | | Travel speed (cm/min) | Heat input (J/mm) | |
| Root, Filling & cap | GTAW | DCEN | 70 – 120 | | 15 – 22 | | 10 – 25 |  | |
| **TECHNIQUE (QW-410)** | |  |  | |  | |  |  |  |
|  |  | **Root** |  | | **Filling & cap** | |  |  |  |
| Orifice or gas cap size (mm) | | 10 – 16 |  | | N.A. | |  |  | |
| String / weave |  | Both |  | | Both | |  |  |  |
| Initial and Inter-pass Cleaning | | Brushing / grinding | | | Brushing / grinding | | |  | |
| Method of back gouging | | None | |  | | None |  |  |  |
| Multiple / single pass (per side) | | Multiple |  | | Multiple | |  |  |  |
| **MFS** | | **TPI** | | | | | **Client** | | |

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| **WELDING PROCEDURE SPECIFICATIONS (WPS) [ASME BPVC – SEC IX] [2019]** | | | | | | | |
| **WPS No.** | W12 | **Sup. PQR No.** | | PX |  | |  |
| **Welding process:** SMAW | | | | **Type:** | Manual |  |  |
| **JOINT DESIGN (QW-402)** | | | | | | | |
| Groove | Double V | |  |  |  |  |  |
| Backing | No | |  | Backing material | | N.A. | |
| **BASE METAL (QW-403)** | |  |  |  |  |  |  |
| Material: | SA516 – Gr.70N | | | To | SA516 – Gr.70N | | |
| P-No. | 1 | G-No. | 2 | to | P-No. | 1 | G-No. 2 |
| T qualified (mm): | | 5 – 50 | Max. pass thick. (mm) | | ≤ 13 |  |  |
| **FILLER METALS (QW-404)** | |  |  |  |  |  |  |
|  |  | Root, filling & cap | |  |  | |  |
| SFA No. |  | 5.1 |  |  |  |  |  |
| AWS No. |  | E7018-H4 | |  |  | |  |
| F-No. |  | 4 |  |  |  |  |  |
| A-No. |  | 1 |  |  |  |  |  |
| Size (mm) |  | 2.5 – 4 |  |  |  |  |  |
| Form |  | Covered electrode | |  |  | |  |
| Trade name |  | AMA | |  |  | |  |
| Max deposit (mm) | | 200 |  |  |  |  |  |
| Flux |  | N.A. |  |  |  | |  |
| Baking |  | 2 h @ 300 – 350 ℃ | |  |  | |  |
| **POSITIONS (QW-405)** | |  |  | **POSTWELD HEAT TREATMENT (QW-407)** | | | |
| Positions | 1~3G & 5G | |  | Temp. rage (℃) | | 595 – 620 |  |
| Progression | All but downhill | |  | Time range (min) | | 95 | |
| **PREHEAT (QW-406)** | |  |  | **GAS (QW-408)** | |  |  |
| Temp. (℃) (min) | | 100 |  |  | Gas | Mixture | Flow rate |
| Inter-pass temp. (℃) (max) | | 250 |  | Shielding | N.A. | — | — |
| **ELECTRICAL CHARACTERISTICS (QW-409)** | | | |  |  |  |  |
| Layer | Process | Polarity | Amp. | Voltage | Travel speed  (cm/min) | Heat input | |
| Root, filling & cap | SMAW | DCEP | 65-190 | 15 – 30 | 10 – 25 |  | |
| **TECHNIQUE (QW-410)** | |  |  |  |  |  |  |
|  |  | Root |  |  | Filling & cap | |  |
| String / weave |  | Both |  |  | Both |  |  |
| Initial and Inter-pass Cleaning | | Brushing / grinding | |  | Brushing / grinding | |  |
| Method of back gouging | | Arc-air gouging + grinding | | |  |  |  |
| Multiple / single pass (per side) | | Multiple |  |  | Multiple |  |  |
| **MFS** | | **TPI** | | | **Client** | | |

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| **WELDING PROCEDURE SPECIFICATIONS (WPS) [ASME BPVC – SEC IX] [2019]** | | | | | | | | | |
| **WPS No.** | W13 | **Sup. PQR No.** | | | PX | |  | |  |
| **Welding process:** SMAW + SAW | | | | | **Type:** | | Manual | Auto |  |
| **JOINT DESIGN (QW-402)** | | | | | | | | | |
| Groove | Double V | |  | |  | |  |  |  |
| Backing | Yes (for SAW) | | |  | Backing material | | | Weld metal | |
| **BASE METAL (QW-403)** | |  |  | |  | |  |  |  |
| Material: | SA516 – Gr.70N | | | | To | | SA516 – Gr.70N | | |
| P-No. | 1 | G-No. | 2 | | to | | P-No. | 1 | G-No. 2 |
| T qualified (mm): | | 5 – 50 | Max. pass thick. (mm) | | | | ≤ 13 |  |  |
| **FILLER METALS (QW-404)** | |  |  | |  | |  |  |  |
|  |  | **Root** | | | **Filling & cap** | |  | |  |
| SFA No. |  | 5.1 |  | | 5.17 | |  |  |  |
| AWS No. |  | E7018-H4 | | | EM12K | |  |  |  |
| F-No. |  | 4 |  | | 6 | |  |  |  |
| A-No. |  | 1 |  | | 1 | |  |  |  |
| Size (mm) |  | 2.5 – 4 |  | | 4 | |  |  |  |
| Form |  | Covered electrode | | | Bare electrode | |  |  |  |
| Trade name |  | AMA | | | AMA | |  |  |  |
| Max deposit (mm) |  | 8 |  | | 192 | |  |  |  |
| Flux |  | N.A. |  | | AMA (OP139TT) | | |  |  |
| Baking |  | 2 h @ 300 – 350 ℃ | | | 2 h @ 300 – 350 ℃ | | | |  |
| **POSITIONS (QW-405)** | |  |  | | **POSTWELD HEAT TREATMENT (QW-407)** | | | | |
| Positions | 1G | |  | | Temp. rage (℃) | | | 595 – 620 |  |
| Progression | All but downhill | |  | | Time range (min) | | | 95 | |
| **PREHEAT (QW-406)** | |  |  | | **GAS (QW-408)** | | |  |  |
| Temp. (℃) (min) | | 100 |  | |  | | Gas | Mixture | Flow rate |
| Inter-pass temp. (℃) (max) | | 250 |  | | Shielding | | N.A. | — | — |
| **ELECTRICAL CHARACTERISTICS (QW-409)** | | | | |  | |  |  |  |
| Layer | Process | Polarity | Amp. | | Voltage | | Travel speed (cm/min) | Heat input (J/mm) | |
| Root | SMAW | DCEP | 65 – 190 | | 15 – 30 | | 10 – 25 | (V×A×60)/(Tr.speed) | |
| Filling &Cap | SAW | DCEP | 500-600 | | 25 – 35 | | 50 – 80 |
| **TECHNIQUE (QW-410)** | |  |  | |  | |  |  |  |
|  |  | **Root** |  | | **Filling & cap** | |  |  |  |
| Contact tube to work distance | | N.A. |  | | 25 – 38 mm | |  |  | |
| String / weave |  | Both |  | | Both | |  |  |  |
| Initial and Inter-pass Cleaning | | Brushing / grinding | | | Brushing / grinding | | |  | |
| Method of back gouging | | None | |  | | None |  |  |  |
| Multiple / single pass (per side) | | Multiple |  | | Multiple | |  |  |  |
| **MFS** | | **TPI** | | | | | **Client** | | |

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| **WELDING PROCEDURE SPECIFICATIONS (WPS) [ASME BPVC – SEC IX]** | | | | | | | |
| **WPS No.** | W14 | **Sup. PQR No.** | | PX |  | |  |
| **Welding process:** SMAW | | | | **Type:** | Manual |  |  |
| **JOINT DESIGN (QW-402)** | | | | | | | |
| Groove FILLET | | |  |  |  |  |  |
| Backing | No | |  | Backing material | | - | |
| **BASE METAL (QW-403)** | |  |  |  |  |  |  |
| Material: | SA-240 -304 | | | To | SA312 TP 316L | | |
| P-No. | 8 | G-No. | 1 | to | P-No. | 1 | G-No. 2 |
| T qualified (mm): | | All | Max. pass thick. (mm) | | ≤ 13 |  |  |
| **FILLER METALS (QW-404)** | |  |  |  |  |  |  |
|  |  | Root, filling & cap | |  |  | |  |
| SFA No. |  | 5.4 |  |  |  |  |  |
| AWS No. |  | E308L-16 | |  |  | |  |
| F-No. |  | 5 |  |  |  |  |  |
| A-No. |  | 8 |  |  |  |  |  |
| Size (mm) |  | 2.5~4 |  |  |  |  |  |
| Form |  | Covered electrode | |  |  | |  |
| Trade name |  | AMA (1460JA) | |  |  | |  |
| Max deposit (mm) | | N.A. |  |  |  |  |  |
| Baking | | 2 h @ 350 – 400 ℃ | | | |  |  |
| **POSITIONS (QW-405)** | |  |  | **POSTWELD HEAT TREATMENT (QW-407)** | | | |
| Positions | 1 ~3G & 5G | |  | Temp. rage (℃) | | N.A. |  |
| Progression | All but downhill | |  | Time range (min) | | — | |
| **PREHEAT (QW-406)** | |  |  | **GAS (QW-408)** | |  |  |
| Temp. (℃) (min) | | 10 |  |  | Gas | Mixture | Flow rate |
| Inter-pass temp. (℃) (max) | | 250 |  | Shielding | N.A. | — | — |
|  | |  |  | Trailing | — | — | — |
| **ELECTRICAL CHARACTERISTICS (QW-409)** | | | |  |  |  |  |
| Layer | Process | Polarity | Amp. | Voltage | Travel speed | Heat input | |
| Root, filling & cap | SMAW | DCEP | 65-160 | 15-45 | 6-12 (cm/min) |  | |
| **TECHNIQUE (QW-410)** | |  |  |  |  |  |  |
|  |  | SMAW | |  |  | |  |
| String / weave |  | Both |  |  |  |  |  |
| Initial and Inter-pass Cleaning | | Brushing / grinding | |  |  | |  |
| Method of back gouging | | N.A. | | |  |  |  |
| Oscillation |  | N.A. |  |  |  |  |  |
| Multiple / single Electrode | | Single |  |  |  |  |  |
| Multiple / single pass (per side) | | Single |  |  |  |  |  |
| **MFS** | | **TPI** | | | **Client** | | |