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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**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **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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| **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  | $$\frac{V×A×60}{Travel speed}$$ |
| 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 | $$\frac{V×A×60}{Tr. speed}$$ |
| **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  | $$\frac{V×A×60}{Travel speed}$$ |
| 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  | $$\frac{V×A×60}{Travel speed}$$ |
| 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  | $$\frac{V×A×60}{Tr. speed}$$ |
| **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) | $$\frac{V×A×60}{Tr. speed}$$ |
| **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 | $$\frac{V×A×60}{Tr. speed}$$ |
| 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 – 25cm/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 – 25cm/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  | $$\frac{V×A×60}{Travel speed}$$ |
| **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 | $$\frac{V×A×60}{Tr. speed}$$ |
| **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) | $$\frac{V×A×60}{Tr. speed}$$ |
| **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** |