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| **طرح نگهداشت و افزایش تولید 27 مخزن** | | | | | | |
| **TBE FOR TRANSFORMERS**  **نگهداشت و افزایش تولید میدان نفتی بینک** | | | | | | |
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| D01 | Sep. 2024 | IFI | H.Shakiba | M.Fakharian | M.Sadeghian |  |
| D00 | Nov. 2023 | IFI | H.Shakiba | M.Fakharian | S.Faramarzpour |  |
| **Rev.** | **Date** | **Purpose of Issue/Status** | **Prepared by:** | **Checked by:** | **Approved by:** | **Client Approval** |
| **Class:3** | | **Client Doc. Number:** **F0Z-709328** | | | | |
| **Status:** | **IDC: Inter-Discipline Check**  **IFC: Issued For Comment**  **IFA: Issued For Approval**  **AFD: Approved For Design**  **AFC: Approved For Construction**  **AFP: Approved For Purchase**  **AFQ: Approved For Quotation**  **IFI: Issued For Information**  **AB-R: As-Built for Client Review**  **AB-A: As-Built –Approved** | | | | | |

**REVISION RECORD SHEET**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **PAGE** | **D00** | **D01** | **D02** | **D03** | **D04** |  | **PAGE** | **D00** | **D01** | **D02** | **D03** | **D04** |
| **1** | X | X |  |  |  | **51** |  |  |  |  |  |
| **2** | X | X |  |  |  | **52** |  |  |  |  |  |
| **3** | X | X |  |  |  | **53** |  |  |  |  |  |
| **4** | X | X |  |  |  | **54** |  |  |  |  |  |
| **5** | X | X |  |  |  | **55** |  |  |  |  |  |
| **6** | X | X |  |  |  | **56** |  |  |  |  |  |
| **7** | X | X |  |  |  | **57** |  |  |  |  |  |
| **8** | X | X |  |  |  | **58** |  |  |  |  |  |
| **9** | X | X |  |  |  | **59** |  |  |  |  |  |
| **10** | X | X |  |  |  | **60** |  |  |  |  |  |
| **11** | X | X |  |  |  | **61** |  |  |  |  |  |
| **12** | X | X |  |  |  | **62** |  |  |  |  |  |
| **13** | X | X |  |  |  | **63** |  |  |  |  |  |
| **14** | X | X |  |  |  | **64** |  |  |  |  |  |
| **15** | X | X |  |  |  | **65** |  |  |  |  |  |
| **16** | X | X |  |  |  | **66** |  |  |  |  |  |
| **17** | X | X |  |  |  | **67** |  |  |  |  |  |
| **18** | X | X |  |  |  | **68** |  |  |  |  |  |
| **19** | X | X |  |  |  | **69** |  |  |  |  |  |
| **20** | X | X |  |  |  | **70** |  |  |  |  |  |
| **21** | X | X |  |  |  | **71** |  |  |  |  |  |
| **22** | X | X |  |  |  | **72** |  |  |  |  |  |
| **23** | X | X |  |  |  | **73** |  |  |  |  |  |
| **24** | X | X |  |  |  | **74** |  |  |  |  |  |
| **25** | X |  |  |  |  | **75** |  |  |  |  |  |
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| **TBE for 1250 KVA Power Transformers** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Item** | **Description** | **Purchaser Requirement** | **Iran Transfo** | **Status** | **Kian Transfo** | **Status** | **Arya Transfo** | **Status** |
| **1.Generel** | | | | | | | | |
| 1.1 | Manufacturer's Name | By Vendor | Iran Transfo | **A** | Kian Transfo | **A** | Arya Transfo Co | **A** |
| 1.2 | Transformer Tag Number | GCS-TR-001 & GCS-TR-002 | Ok | **A** | Ok | **A** | Ok | **A** |
| 1.3 | Quantity | 2 | Ok | **A** | Ok | **A** | Ok | **A** |
| 1.4 | Standard | IPS-M-EL-152 (3)  BK-GNRAL-PEDCO-000-EL-SP-0004 | Ok | **A** | Ok | **A** | Ok | **A** |
| 1.5 | Kind/Construction of Transformer | Oil Immersed, Hermetically Sealed With Pillow Nitrogen, Separate High & Low Windings, Two Winding | Ok | **A** | Hermetic Gas Cushion | **A** | Ok | **A** |
| 1.6 | Rated Power in Service Condition | 1250 kVA | 1250 KVA | **A** | Ok | **A** | Ok | **A** |
| 1.7 | Supply Frequency | 50 Hz ± 5 % | Ok | **A** | Ok | **A** | Ok | **A** |
| 1.8 | Winding Connection/Vector Group | Dyn11 | Dyn11 | **A** | Ok | **A** | Ok | **A** |
| 1.9 | Location | Outdoor Under Shelter, Safe Area | Ok | **A** | Ok | **A** | Ok | **A** |
| 1.10 | Primary Winding Rated Voltage | 11kV | 11kV | **A** | Ok | **A** | Ok | **A** |
| 1.11 | Secondary Winding Rated Voltage | 0.42 KV | 0.42 KV | **A** | Ok | **A** | Ok | **A** |
| 1.12 | Tapping Range | ±5%, ±2.5% & 0 , Off Load | Ok | **A** | Ok | **A** | Ok | **A** |
| 1.13 | Tapping Place | On HV Winding | On HV Side | **A** | Ok | **A** | Ok | **A** |
| **2. Environmental Conditions (Process Basis Of Design, BK-GNRAL-PEDCO-000-PR-DB-0001)** | | | | | | | | |
| 2.1 | Ambient Temperature Range | 0 ~ 52°C | 0 ~ 55°C | **A** | Ok | **A** | 55°C | **A** |
| 2.2 | Installation Elevation | 12m (Above Sea Level) | Ok | **A** | Ok | **A** | Ok | **A** |
| 2.3 | Area Pollution Class | Class 4 (Very High) | Ok | **A** | Ok | **A** | 31 mm/Kv CD | **A** |
| 2.4 | Seismic Loads | Zone 3 UBC | Ok | **A** | Ok | **A** | Ok | **A** |
| 2.5 | Relative Humidity | 100% | Ok | **A** | Ok | **A** | Ok | **A** |
| 2.6 | Cooling System | ONAN | ONAN | **A** | Ok | **A** | Ok | **A** |
| 2.7 | Primary Cooling Media | Mineral Oil | Mineral Oil | **A** | Ok | **A** | Ok | **A** |
| **3. Primary Winding Voltage Rating** | | | | | | | | |
| 3.1 | Highest System Voltage | 12kV | 12kV | **A** | Ok | **A** | Ok | **A** |
| 3.2 | Rated Lightning Impulse Withstand Voltage | 75kV | 75kV | **A** | Ok | **A** | Ok | **A** |
| 3.3 | Rated Short Duration Power Frequency Withstand Voltage(rms) | 28kV | 28kV | **A** | Ok | **A** | Ok | **A** |
| **4. Secondary Winding Voltage Ratings** | | | | | | | | |
| 4.1 | Highest System Voltage | 1 kV | 1.1 | **A** | Ok | **A** | Ok | **A** |
| 4.2 | Rated Lightning Impulse Withstand Voltage | 3 kV | N.A | **A** | Ok | **A** | N.A Acc to IEC | **A** |
| 4.3 | Rated Short Duration Power Frequency Withstand Voltage(rms) | 1 kV | 3 Kv | **A** | Ok | **A** | 3 Kv | **A** |
| 4.4 | Primary Winding | Delta Winding | Delta | **A** | Ok | **A** | Ok | **A** |
| 4.5 | Secondary Winding | Star, (Solidly Grounded) | Ok | **A** | Ok | **A** | Ok | **A** |
| 4.6 | Insulation Type | By Vendor | PSP & Paper | **A** | Uniform | **A** | Uniform | **A** |
| 4.7 | Insulation Class | Class A (Shall Be Suggested By Vendor) | Class A | **A** | Class A | **A** | Ok | **A** |
| 4.8 | Average Winding Temperature Rise (55°C Ambient) | 65°C, Acc. to IEC 60076-2, Clause 4.2 | 50°C | **A** | 50°C | **A** | 50°C over 55°C ambient | **A** |
| 4.9 | Top Oil Temperature Rise (55°C ambient) | 60°C, Acc. to IEC 60076-2, Clause 4.2 | 45°C | **A** | 45°C | **A** | 45°C over 55°C ambient | **A** |
| 4.10 | Oil Preservation System | Not Applicable (Sealed Type) | N.A | **A** | N.A | **A** | N.A | **A** |
| 4.11 | Short Circuit Level of HV System | Primary: 25 kA | Ok for Network | **A** | Ok | **A** | Confirmed for Network Study | **A** |
| 4.12 | Short Circuit Withstand Duration | Primary: 1 S | 1s | **A** | Ok | **A** | Ok | **A** |
| 4.13 | Required Short Circuit Impedance @75°C | 5% | 5% | **A** | 5% | **A** | Ok | **A** |
| 4.14 | Zero Sequence Impedance | By Vendor | ~5% | **A** | 4.46 | **A** | ~4% | **A** |
| 4.15 | X/R Ratio at Principal Tap | By Vendor | 3.91 | **A** | 4.59 | **A** | ~3.6% | **A** |
| 4.16 | Efficiency at Full Load & PF=0.8 Lag (100% Load) | By Vendor | 98.32 | **A** | 98.94 | **A** | 98.15 | **A** |
| 4.17 | Efficiency at Full Load & PF=0.8 Lag (75% Load) | By Vendor | 98.66 | **A** | 99.15 | **A** | 98.51 | **A** |
| 4.18 | Efficiency at Full Load & PF=0.8 Lag (50% Load) | By Vendor | 98.94 | **A** | 99.3 | **A** | 98.8 | **A** |
| **5. Primary Winding Characteristics** | | | | | | | | |
| 5.1 | Reactance [Ω] | By Vendor | - | **A** | After Test | **A** | ~7 | **A** |
| 5.2 | Resistance[Ω] @ 75°C | By Vendor. | 1.529 | **A** | After Test | **A** | ~2 | **A** |
| **6. Secondary Winding Characteristics** | | | | | | | | |
| 6.1 | Reactance[Ω] | By Vendor | - | **A** | After Test | **A** | ~0.002 | **A** |
| 6.2 | Resistance[Ω] @ 75°C | By Vendor | 0.00056 | **A** | After Test | **A** | ~0.0006 | **A** |
| **7.Tolerances** | | | | | | | | |
| 7.1 | Voltage Ratio at Principal Tap & No-Load | ±0.5 % | ±0.5 % | **A** | ±0.5 % | **A** | Ok | **A** |
| 7.2 | Voltage Ratio at Other Tapping | ±0.5 % | ±0.5 % | **A** | ±0.5 % | **A** | Ok | **A** |
| 7.3 | Voltage | ±10 % | ±10 % | **A** | ±10 % | **A** | Ok | **A** |
| 7.4 | Frequency | ±5 % | ±5 % | **A** | ±5 % | **A** | Ok | **A** |
| 7.5 | Short Circuit Impedance at Principal Tap | ±10% of Declared Value | Ok | **A** | ±10% of Declared Value | **A** | Ok | **A** |
| 7.6 | Short Circuit Impedance at Other Tapping | ±15% of Declared Value | Ok | **A** | ±15% of Declared Value | **A** | Ok | **A** |
| 7.7 | Anticipated Unbalance Loading in Percent of Rated Power | 10 % | Ok | **A** | 10 % | **A** | Ok | **A** |
| 7.8 | Core Construction | Laminated Silicon Steel | Ok | **A** | Laminated Silicon Steel | **A** | Ok | **A** |
| 7.9 | Flux Density in the Magnetic Circuit @Nominal Frequency & Voltage | By Vendor | 1.67 T | **A** | 1.68 T | **A** | ~1.7 | **A** |
| 7.10 | No-Load Loss [W] | By Vendor | 2000 | **A** | 1730 | **A** | 1800 | **A** |
| 7.11 | Full Load Total Loss [W] | By Vendor | 16000 | **A** | 14930 | **A** | 17000 | **A** |
| 7.12 | Inrush Current | By Vendor | 602 A | **A** | 0.65 KA | **A** | HV: ~0.5 KA foe 0.6 sec | **A** |
| 7.13 | Short Circuit Loss | By Vendor | 16000 | **A** | 13200 | **A** | 17000 | **A** |
| 7.14 | I2R Loss at Rated Current & Principal Tap | By Vendor | 14000 | **A** | 11600 | **A** | 15500 | **A** |
| 7.15 | Stray Load Loss at Rated Current & Principal Tap | By Vendor | 2000 | **A** | 1600 | **A** | 1500 | **A** |
| 7.16 | 11 kV Cables Size & Number | 1x3x95  CU/SM/XLPE/SM/SC/PVC/SWA/PVC | By Customer | **A** | Acc to Request | **A** | Ok | **A** |
| 7.17 | External Terminations, Primary Side (Exposed Bushings/Cable Box) | Cable Box | Cable Box | **A** | Cable Box | **A** | Ok | **A** |
| 7.18 | 0.42 kV Cable Size & Number | 14x(1x300)  CU/XLPE/Bd/AWA/PVC | By Customer | **A** | Acc to Request | **A** | Ok | **A** |
| 7.19 | Type & Size of Cable Glands (Power Cable) | Industrial,  Primary: M90  Secondary: M40 | By Customer | **A** | Acc to Request | **A** | Cable gland is out of vendor scope | **A** |
| 7.20 | Type & Size of Cable Glands (Control Cable) | 12x2.5,  CU/PVC/SWA/PVC, M25 | By Customer | **A** | Acc to Request | **A** | Acc to Arya Transfo Standard | **A** |
| 7.21 | Bushing Type | Acc .to IPS 152 | DT 20Nf 250 | **A** | Acc .to IPS 152 | **A** | Ok | **A** |
| 7.22 | Dimension (W X D X H) [mm] | By Vendor | 2606 x 2153 x 2477 | **A** | 2120 x 1350 x 1980 | **A** | 2900 x 2400 x 2250 | **A** |
| 7.23 | Weight [kg] | By Vendor | 5413 | **A** | 4050 | **A** | 5175 | **A** |
| 7.24 | Weight of Transformer Without Oil | By Vendor | 4154 | **A** | 2710 | **A** | 4130 | **A** |
| 7.25 | Noise Level (at 1m From Transformer) [db] | Less Than 85 dB(A) | Ok | **A** | 70 | **A** | Ok | **A** |
| 7.26 | Oil Volume [liter] | By Vendor | 1407 | **A** | 1450 | **A** | 1200 | **A** |
| 7.27 | Oil Weight [kg] | By Vendor | 1259 | **A** | 1380 | **A** | 1045 | **A** |
| 7.28 | Oil Characteristics (Name/ Type/ Flash Point) | Acc. to IEC 60296 | IEC 60296 | **A** | Acc. to IEC 60296 | **A** | Mineral/140c | **A** |
| **8.Auxiliary Equipment** | | | | | | | | |
| 8.1 | Top Oil Thermometer  (in Thermometer Pocket) | Required (Can Be Measured at Low Oil Level) | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.2 | Thermostat for Oil Temperature | Dial Type / with Alarm & Trip Switches | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.3 | Oil Level Gauge | Magnetic Dial or Glass Type | Magnetic Dial | **A** | Magnetic Dial | **A** | Ok | **A** |
| 8.4 | Oil Filling Plug, Drain Valve, Isolating Valve | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.5 | Oil Level Indicator With Contacts (Low & High) | Required (Magnetic Type) | Ok | **A** | Magnetic Type | **A** | Ok | **A** |
| 8.6 | Winding Temperature Indicator with Alarm & Trip Contacts | Required (Shall be Located Close to Low Voltage Windings) | Ok (LV Side Phase 2V) | **A** | Ok | **A** | Ok | **A** |
| 8.7 | Oil Drain / Sampling Device | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.8 | Air Dehydrating Breathed | Not Required | N.A | **A** | NA | **A** | Ok | **A** |
| 8.9 | Neutral Current Transformer | Core 1: 2000/1A, 5P10 ,10VA | 2000/1A, 5P10, 10VA | **A** | 2000/1A, 5P10, 10VA | **A** | Ok | **A** |
| 8.10 | CT to be Supplied by (Transformer Manufacturer/Purchaser) | Transformer Manufacturer | Ok | **A** | PEJVAK | **A** | Ok | **A** |
| 8.11 | Earth Terminal | Two Terminals on The Bottom of Tank | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.12 | Upper Filter Connection With Standard Seal Valve & a Plug Serving | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.13 | Pressure Relief Valve with Contact (Shall be Operated by Internal Pressure of Nitrogen) | Required | Ok | **A** | Ok | **A** | Pressure relief with trip for oil pressure | **A** |
| 8.14 | Gas Pressure & Vacuum Indicator for Internal Pressure of Nitrogen Gas | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.15 | Terminal Box With Gland Plate | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.16 | Instrument and CT Secondary Terminal Box | Required (Min IP55) | IP 55 | **A** | Ok | **A** | Ok | **A** |
| 8.17 | Arching Horn | Not Required | N.A | **A** | NA | **A** | Ok | **A** |
| 8.18 | Drain Valve | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.19 | Lifting and Pulling Eyes | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.20 | Lugs | Fixed to Tanks for Lifting the Complete Transformer | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.21 | HV Terminal Box with Gland Plate | Required (Min IP55) | IP 55 | **A** | Ok | **A** | Ok | **A** |
| 8.22 | LV Terminal Box with Gland Plate | Required (Min IP55) | IP 55 | **A** | Ok | **A** | Ok | **A** |
| 8.23 | Wheels, Bidirectional (Turnable by 90°) | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.24 | Transformer Radiator | By Vendor (Welded/Bolted) | Bolted | **A** | Welded | **A** | Bolted | **A** |
| 8.25 | Transformer Cover | To be Welded to Tank With a Continuous Weld | Bolted | **N** | Ok | **A** | Cover will be bolted | **N** |
| 8.26 | Thickness of Radiator Plate | By Vendor | 1.2 mm | **A** | 1.25 mm | **A** | 1.2 mm | **A** |
| 8.27 | Thickness of Tank Wall, Base & Cover | By Vendor | 8, 8, 8 mm | **A** | 8 mm | **A** | 6, 8, 6 mm | **A** |
| 8.28 | Tank Painting Specification | By Vendor | Acc to Iran Trasfo Painting Procedure | **A** | Poly Uthane | **A** | RAL 7032 | **A** |
| 8.29 | Radiator Painting Specification | By Vendor | Acc to Iran Trasfo Painting Procedure | **A** | Poly Uthane | **A** | RAL 7032 | **A** |
| 8.30 | Tank and Radiator Color | By Vendor | RAL 7032 | **A** | 7032 | **A** | RAL 7032 | **A** |
| 8.31 | Radiator Connection | Detachable & Shall be Bolted to Tank | Ok | **A** | Bolted | **A** | Ok | **A** |
| 8.32 | Rating Plate | Stainless Steel | Ok | **A** | Stainless Steel | **A** | Ok | **A** |
| 8.33 | Accessory Equipment Contacts Current / Voltage Rating | 5A / 250VAC | Acc to Catalogue | **A** | 5A / 250VAC | **A** | 2A / 230VAC | **A** |
| 8.34 | Accessory Equipment Contacts Type | Dry Type –DPDT/ 230VAC | SPDT | **A** | Ok | **A** | Ok | **A** |
| 8.35 | Routine Tests Including | IEC60076 | IEC60076 | **A** | IEC60076 | **A** | Ok | **A** |
| 8.36 | a) Measurement of Winding Resistance | Witness & Report | Ok | **A** | Witness & Report | **A** | Acc to Contract | **A** |
| 8.37 | b) Measurement of Voltage Ratio & Check of Voltage Vector Relationship | Witness & Report | Ok | **A** | Witness & Report | **A** | Acc to Contract | **A** |
| 8.38 | c) Measurement of Impedance Voltage (Principal Tapping) Short-Circuit Impedance & Load Loss | Witness & Report | Ok | **A** | Witness & Report | **A** | Acc to Contract | **A** |
| 8.39 | d) Measurement of No-Load Loss & Current | Witness & Report | Ok | **A** | Witness & Report | **A** | Acc to Contract | **A** |
| 8.40 | e) Impedance & Load Losses at Rated Current on Principal Tap | Witness & Report | Ok | **A** | Witness & Report | **A** | Acc to Contract | **A** |
| 8.41 | f) Applied Potential & Induced Potential Tests | Witness & Report | Ok | **A** | Witness & Report | **A** | Acc to Contract | **A** |
| 8.42 | g) Dielectric tests | Witness & Report | Ok | **A** | Witness & Report | **A** | Acc to Contract | **A** |
| 8.43 | Type Test | Test Report on the Same Design Transformer is Required | Ok | **A** | Ok | **A** | Acc to Contract | **A** |
| 8.44 | Painting & Finish | Manufacture Standard | Ok | **A** | Manufacture Standard | **A** | Ok | **A** |
| 8.45 | Test Report on CTs | * turns ratio error * Excitation Characteristics * Secondary resistance * Verification of low leakage flux | - | **A** | Ok | **A** | - | **A** |
| 8.46 | Special Tools if Any | By Vendor | - | **A** | NA | **A** | NA | **A** |
| 8.47 | Deviation from This Specification if Any | By Vendor | Attached | **A** | No Deviation | **A** | Red items | **A** |

**Status Legends:**

A=Acceptable

N=Not Acceptable

N/A=Not Applicable

INA=Information Not Available

C=Clarification is Required

CA= Conditionally Acceptable

M = Requirement is Mandatory

| **TBE for 800 KVA Power Transformer** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Item** | **Description** | **Purchaser Requirement** | **Iran Transfo** | **Status** | **Kian Transfo** | **Status** | **Arya Transfo** | **Status** |
| **1.Generel** | | | | | | | | |
| 1.1 | Manufacturer's Name | By Vendor | Iran Transfo | **A** | Kian Transfo | **A** | Arya Transfo Co | **A** |
| 1.2 | Transformer Tag Number | GCS-TR-003 (Fire Water Transformer) | Ok | **A** | Ok | **A** | OK | **A** |
| 1.3 | Quantity | 1 | Ok | **A** | 1 | **A** | OK | **A** |
| 1.4 | Standard | IPS-M-EL-152 (3)  BK-GNRAL-PEDCO-000-EL-SP-0004 | Ok | **A** | Ok | **A** | OK | **A** |
| 1.5 | Kind/Construction of Transformer | Oil Immersed, Hermetically Sealed With Pillow Nitrogen Separate High & Low Windings Two Winding | Ok | **A** | Gas Cushion | **A** | OK | **A** |
| 1.6 | Rated Power in Service Condition | 800 kVA | 800 kVA | **A** | 800 kVA | **A** | OK | **A** |
| 1.7 | Supply Frequency | 50 Hz ± 5 % | Ok | **A** | 50 Hz ± 5 % | **A** | OK | **A** |
| 1.8 | Winding Connection/Vector Group | Dyn11 | Dyn11 | **A** | Dyn11 | **A** | OK | **A** |
| 1.9 | Location | Outdoor Under Shelter, Safe Area | Outdoor | **A** | Outdoor | **A** | OK | **A** |
| 1.10 | Primary Winding Rated Voltage | 11kV | 11 | **A** | 11 | **A** | OK | **A** |
| 1.11 | Secondary Winding Rated Voltage | 3.45 KV | 3.45 | **A** | 3.45 | **A** | 3.45 | **A** |
| 1.12 | Tapping Range | ±5%, ±2.5% & 0 , Off Load | Ok | **A** | Ok | **A** | OK | **A** |
| 1.13 | Tapping Place | On HV Winding | On HV Side | **A** | On HV Winding | **A** | OK | **A** |
| **2. Environmental Conditions (Process Basis Of Design, BK-GNRAL-PEDCO-000-PR-DB-0001)** | | | | | | | | |
| 2.1 | Ambient Temperature Range | 0 ~ 52°C | 0 ~ 55°C | **A** | 0 ~ 52°C | **A** | 55°C | **A** |
| 2.2 | Installation Elevation | 12m (Above Sea Level) | Ok | **A** | 12m (Above Sea Level) | **A** | OK | **A** |
| 2.3 | Area Pollution Class | Class 4 (Very High) | Ok | **A** | Class 4 (Very High) | **A** | 31 mm/Kv CD | **A** |
| 2.4 | Seismic Loads | Zone 3 UBC | Ok | **A** | Zone 3 UBC | **A** | OK | **A** |
| 2.5 | Relative Humidity | 100% | Ok | **A** | 100% | **A** | OK | **A** |
| 2.6 | Cooling System | ONAN | ONAN | **A** | ONAN | **A** | OK | **A** |
| 2.7 | Primary Cooling Media | Mineral Oil | Mineral Oil | **A** | Mineral Oil | **A** | OK | **A** |
| **3. Primary Winding Voltage Rating** | | | | | | | | |
| 3.1 | Highest System Voltage | 12kV | 12kV | **A** | 12 | **A** | OK | **A** |
| 3.2 | Rated Lightning Impulse Withstand Voltage | 75kV | 75kV | **A** | 75 | **A** | OK | **A** |
| 3.3 | Rated Short Duration Power Frequency Withstand Voltage (rms) | 28kV | 28kV | **A** | 28 | **A** | OK | **A** |
| **4. Secondary Winding Voltage Ratings** | | | | | | | | |
| 4.1 | Highest System Voltage | 3.6 kV | 3.6 | **A** | 3.6 | **A** | OK | **A** |
| 4.2 | Rated Lightning Impulse Withstand Voltage | 20 kV | 40 | **A** | 20 | **A** | OK | **A** |
| 4.3 | Rated Short Duration Power Frequency Withstand Voltage(rms) | 10 kV | 10 | **A** | 10 | **A** | OK | **A** |
| 4.4 | Primary Winding | Delta Winding | Delta | **A** | Delta Winding | **A** | OK | **A** |
| 4.5 | Secondary Winding | Star, (Neutral Grounding Resistors (NGR)) | Ok | **A** | Star, NGR | **A** | OK | **A** |
| 4.6 | Insulation Type | By Vendor | PSP & Paper | **A** | By Vendor | **A** | Uniform | **A** |
| 4.7 | Insulation Class | Class A (Shall Be Suggested By Vendor) | Class A | **A** | Class A | **A** | OK | **A** |
| 4.8 | Average Winding Temperature Rise (55°C Ambient) | 65°C, Acc. to IEC 60076-2, Clause 4.2 | 50°C | **A** | 50°C | **A** | 50°C over 55°C ambient | **A** |
| 4.9 | Top Oil Temperature Rise (55°C ambient) | 60°C, Acc. to IEC 60076-2, Clause 4.2 | 45°C | **A** | 45°C | **A** | 45°C over 55°C ambient | **A** |
| 4.10 | Oil Preservation System | Not Applicable (Sealed Type) | N.A | **A** | NA | **A** | N.A | **A** |
| 4.11 | Short Circuit Level of HV System | Primary: 25 kA | Ok for Network | **A** | Primary: 25 kA | **A** | Confirmed for Network Study | **A** |
| 4.12 | Short Circuit Withstand Duration | Primary: 1S | 1s | **A** | Primary: 1S | **A** | OK | **A** |
| 4.13 | Required Short Circuit Impedance @75°C | 5% | 5% | **A** | 5% | **A** | Ok | **A** |
| 4.14 | Zero Sequence Impedance | By Vendor | ~5% | **A** | 4.62 | **A** | ~ 4% | **A** |
| 4.15 | X/R Ratio at Principal Tap | By Vendor | 3.9 | **A** | 4.72 | **A** | ~3.6 % | **A** |
| 4.16 | Efficiency at Full Load & PF=0.8 lag (100% Load) | By Vendor | 98.22 | **A** | 98.83 | **A** | 98.11 | **A** |
| 4.17 | Efficiency at Full Load & PF=0.8 lag (75% Load) | By Vendor | 98.58 | **A** | 98.91 | **A** | 98.46 | **A** |
| 4.18 | Efficiency at Full Load & PF=0.8 lag (50% Load) | By Vendor | 98.9 | **A** | 98.99 | **A** | 98.75 | **A** |
| **5. Primary Winding Characteristics** | | | | | | | | |
| 5.1 | Reactance [Ω] | By Vendor | - | **A** | After Test | **A** | ~12.5 | **A** |
| 5.2 | Resistance[Ω] @ 75°C | By Vendor. | 3.234 | **A** | After Test | **A** | ~3.4 | **A** |
| **6. Secondary Winding Characteristics** | | | | | | | | |
| 6.1 | Reactance[Ω] | By Vendor | - | **A** | After Test | **A** | ~0.25 | **A** |
| 6.2 | Resistance[Ω] @ 75°C | By Vendor | 0.06933 | **A** | After Test | **A** | ~0.07 | **A** |
| **7.Tolerances** | | | | | | | | |
| 7.1 | Voltage Ratio at Principal Tap & No-Load | ±0.5 % | ±0.5 % | **A** | ±0.5 % | **A** | Ok | **A** |
| 7.2 | Voltage Ratio at Other Tapping | ±0.5 % | ±0.5 % | **A** | ±0.5 % | **A** | Ok | **A** |
| 7.3 | Voltage | ±10 % | ±10 % | **A** | ±10 % | **A** | Ok | **A** |
| 7.4 | Frequency | ±5 % | ±5 % | **A** | ±5 % | **A** | Ok | **A** |
| 7.5 | Short Circuit Impedance at Principal Tap | ±10% of Declared Value | Ok | **A** | ±10% of Declared Value | **A** | Ok | **A** |
| 7.6 | Short Circuit Impedance at Other Tapping | ±15% of Declared Value | Ok | **A** | ±15% of Declared Value | **A** | Ok | **A** |
| 7.7 | Anticipated Unbalance Loading in Percent of Rated Power | 10 % | 10 % | **A** | 10 % | **A** | Ok | **A** |
| 7.8 | Core Construction | Laminated Silicon Steel | Ok | **A** | Laminated Silicon Steel | **A** | Ok | **A** |
| 7.9 | Flux Density in the Magnetic Circuit @Nominal Frequency & Voltage | By Vendor | 1.7 T | **A** | 1.67 T | **A** | ~1.7 | **A** |
| 7.10 | No-Load Loss [W] | By Vendor | 1100 | **A** | 1150 | **A** | 1300 | **A** |
| 7.11 | Full Load Total Loss [W] | By Vendor | 10500 | **A** | 9650 | **A** | 11000 | **A** |
| 7.12 | Inrush Current | By Vendor | 377 A | **A** | 0.42 KA | **A** | HV: ~0.3kA for 0.6sec | **A** |
| 7.13 | Short Circuit Loss | By Vendor | 10500 | **A** | 8500 | **A** | 11000 | **A** |
| 7.14 | I2R Loss at Rated Current & Principal Tap | By Vendor | 9900 | **A** | 7400 | **A** | 10200 | **A** |
| 7.15 | Stray Load Loss at Rated Current & Principal Tap | By Vendor | 600 | **A** | 1100 | **A** | 800 | **A** |
| 7.16 | 11 kV Cables Size & Number | 1x3x95  CU/SM/XLPE/SM/SC/PVC/SWA/PVC | By Customer | **A** | Acc to Request | **A** | Ok | **A** |
| 7.17 | External Terminations, Primary Side (Exposed Bushings/Cable Box) | Cable Box | Cable Box | **A** | Cable Box | **A** | Ok | **A** |
| 7.18 | 3.45 kV Cable Size & Number | 1x3x95  CU/SM/XLPE/SM/SC/PVC/SWA/PVC | By Customer | **A** | Acc to Request | **A** | Ok | **A** |
| 7.19 | Type & Size of Cable Glands (Power Cable) | Industrial,  Primary: M90  Secondary: M75 | By Customer | **A** | Acc to Request | **A** | Cable gland is out of vendor scope | **A** |
| 7.20 | Type & Size of Cable Glands (Control Cable) | 12x2.5,  CU/PVC/SWA/PVC, M25 | By Customer | **A** | Acc to Request | **A** | Acc. to Arya transfo standard | **A** |
| 7.21 | Bushing Type | Acc .to IPS 152 | DT 20Nf 250 | **A** | Ok | **A** | Ok | **A** |
| 7.22 | Dimension (W X D X H) [mm] | By Vendor | 2192 x 1860 x 2055 | **A** | 2050 x 1150 x 1890 | **A** | 2300 x 2360 x 2100 | **A** |
| 7.23 | Weight [kg] | By Vendor | 3898 | **A** | 2820 | **A** | 3860 | **A** |
| 7.24 | Weight of Transformer Without Oil [kg] | By Vendor | 3098 | **A** | 1950 | **A** | 3070 | **A** |
| 7.25 | Noise Level (at 1m from Transformer) [db] | Less Than 85 dB(A) | Ok | **A** | 65 | **A** | Ok | **A** |
| 7.26 | Oil Volume [liter] | By Vendor | 894 | **A** | 970 | **A** | 900 | **A** |
| 7.27 | Oil Weight [kg] | By Vendor | 800 | **A** | 870 | **A** | 790 | **A** |
| 7.28 | Oil Characteristics (Name/ Type/ Flash Point) | Acc. to IEC 60296 | IEC 60296 | **A** | IEC 60296 | **A** | Mineral/140c | **A** |
| **8.Auxiliary Equipment** | | | | | | | | |
| 8.1 | Top Oil Thermometer (in Thermometer Pocket) | Required (Can Be Measured at Low Oil Level) | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.2 | Thermostat for Oil Temperature | Dial Type / with Alarm & Trip Switches | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.3 | Oil Level Gauge | Magnetic Dial or Glass Type | Magnetic Dial | **A** | Magnetic Dial | **A** | Ok | **A** |
| 8.4 | Oil Filling Plug, Drain Valve, Isolating Valve | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.5 | Oil Level Indicator With Contacts (Low & High) | Required (Magnetic Type) | Ok | **A** | Magnetic Type | **A** | Ok | **A** |
| 8.6 | Winding Temperature Indicator with Alarm & Trip Contacts | Required (Shall be Located Close to Low Voltage Windings) | Ok (LV Side Phase 2V) | **A** | Ok | **A** | Ok | **A** |
| 8.7 | Oil Drain / Sampling Device | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.8 | Air Dehydrating Breathed | Not Required | N.A | **A** | NA | **A** | Ok | **A** |
| 8.9 | Neutral Current Transformer | Core 1: 100/1A, 5P10 ,10VA | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.10 | CT to be Supplied by (Transformer Manufacturer/Purchaser) | Transformer Manufacturer | Ok | **A** | PEJVAK | **A** | Ok | **A** |
| 8.11 | Earth Terminal | Two Terminals on The Bottom of Tank | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.12 | Upper Filter Connection With Standard Seal Valve & a Plug Serving | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.13 | Pressure Relief Valve with Contact (Shall be Operated by Internal Pressure of Nitrogen) | Required | Ok | **A** | Ok | **A** | Pressure relief with trip contact for oil pressure | **A** |
| 8.14 | Gas Pressure & Vacuum Indicator for Internal Pressure of Nitrogen Gas | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.15 | Terminal Box With Gland Plate | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.16 | Instrument and CT Secondary Terminal Box | Required (Min IP55) | IP 55 | **A** | Ok | **A** | Ok | **A** |
| 8.17 | Arching Horn | Not Required | N.A | **A** | Ok | **A** | Ok | **A** |
| 8.18 | Drain Valve | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.19 | Lifting and Pulling Eyes | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.20 | Lugs | Fixed to Tanks for Lifting the Complete Transformer | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.21 | HV Terminal Box with Gland Plate | Required (Min IP55) | IP 55 | **A** | Ok | **A** | Ok | **A** |
| 8.22 | MV Terminal Box with Gland Plate | Required (Min IP55) | IP 55 | **A** | Ok | **A** | Ok | **A** |
| 8.23 | Wheels, Bidirectional (Turnable by 90°) | Required | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.24 | Transformer Radiator | By Vendor (Welded/Bolted) | Bolted | **A** | Ok | **A** | Bolted | **A** |
| 8.25 | Transformer Cover | To be Welded to Tank With a Continuous Weld | Bolted | **A** | Ok | **A** | Cover will be bolted | **A** |
| 8.26 | Thickness of Radiator Plate | By Vendor | 1.2 mm | **A** | 1.25 mm | **A** | 1.2 | **A** |
| 8.27 | Thickness of Tank Wall, Base & Cover | By Vendor | 8, 8, 8 mm | **A** | 8 mm | **A** | 6, 6, 6 | **A** |
| 8.28 | Tank Painting Specification | By Vendor | Acc to Irans Transfo Painting Procedure | **A** | Poly Uthane | **A** | RAL 7032 | **A** |
| 8.29 | Radiator Painting Specification | By Vendor | Acc to Irans Transfo Painting Procedure | **A** | Poly Uthane | **A** | RAL 7032 | **A** |
| 8.30 | Tank and Radiator Color | By Vendor | RAL 7023 | **A** | 7032 | **A** | RAL 7032 | **A** |
| 8.31 | Radiator Connection | Detachable & Shall be Bolted to Tank | Ok | **A** | Bolted | **A** | Ok | **A** |
| 8.32 | Rating Plate | Stainless Steel | Ok | **A** | Stainless Steel | **A** | Ok | **A** |
| 8.33 | Accessory Equipment Contacts Current / Voltage Rating | 5A / 250VAC | Acc to Catalogue | **A** | 5A / 250VAC | **A** | 2A, 230Vac | **A** |
| 8.34 | Accessory Equipment Contacts Type | Dry Type –DPDT/ 230VAC | SPDT | **N** | Ok | **A** | Ok | **A** |
| 8.35 | Routine Tests Including | IEC 60076 | Ok | **A** | IEC 60076 | **A** | Ok | **A** |
| 8.36 | a) Measurement of Winding Resistance | Witness & Report | Ok | **A** | Witness & Report | **A** | Acc. to contract | **A** |
| 8.37 | b) Measurement of Voltage Ratio & Check of Voltage Vector Relationship | Witness & Report | Ok | **A** | Witness & Report | **A** | Acc. to contract | **A** |
| 8.38 | c) Measurement of Impedance Voltage (Principal Tapping) Short-Circuit Impedance & Load Loss | Witness & Report | Ok | **A** | Witness & Report | **A** | Acc. to contract | **A** |
| 8.39 | d) Measurement of No-Load Loss & Current | Witness & Report | Ok | **A** | Witness & Report | **A** | Acc. to contract | **A** |
| 8.40 | e) Impedance & Load Losses at Rated Current on Principal Tap | Witness & Report | Ok | **A** | Witness & Report | **A** | Acc. to contract | **A** |
| 8.41 | f) Applied Potential & Induced Potential Tests | Witness & Report | Ok | **A** | Witness & Report | **A** | Acc. to contract | **A** |
| 8.42 | g) Dielectric tests | Witness & Report | Ok | **A** | Witness & Report | **A** | Acc. to contract | **A** |
| 8.43 | Type Test | Test Report on the Same Design Transformer is Required | Ok | **A** | Ok | **A** | Acc. to contract | **A** |
| 8.44 | Painting and Finish | MFR Standard | Ok | **A** | Ok | **A** | Ok | **A** |
| 8.45 | Test Report on CTs | * turns ratio error * Excitation Characteristics * Secondary resistance * Verification of low leakage flux |  | **A** | Ok | **A** | - | **A** |
| 8.46 | Special Tools if Any | By Vendor |  | **A** | NA | **A** | NA | **A** |
| 8.47 | Deviation from This Specification if Any | By Vendor | Attached | **A** | No Deviation | **A** | Red items | **A** |

**Status Legends:**

A=Acceptable

N=Not Acceptable

N/A=Not Applicable

INA=Information Not Available

C=Clarification is Required

CA= Conditionally Acceptable

M = Requirement is Mandatory

**Conclusion Table:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Item** | **Equipment** | **Vendor** | **Vendor** | **Vendor** |
| **Iran Transfo** | **Kian Transfo** | **Arya Transfo** |
| **1** | **1250 KVA** | Accepted | Accepted | Accepted |
| **2** | **800 KVA** | Accepted | Accepted | Accepted |

**Conclusion Note:**

**Iran Transfo**

1. Item 4.2 of 1250 KVA Transformer: Vendor will not consider Lightning impulse withstand for LV Side.
2. According to item 7.7.3 of IPS-M-EL-152(3), the cover of the tank (item 8.25) for sealed type transformer shall be welded to the tank with a continuous weld. But vendor cannot meet this criteria & will supply bolted.
3. Item 8.38, Accessory Equipment Contacts shall be “Dry Type –DPDT/ 230VAC” but vendor will supply “SPDT”.

**Kian Transfo**

1. Dimension & weight of transformer differs from 2 other vendors & it is smaller.
2. No deviation list has been issued by vendor.

**Arya Transfo**

1. Item 4.2 of 1250 KVA Transformer: Vendor will not consider Lightning impulse withstand for LV Side.
2. According to item 7.9.1 of IPS-M-EL-152(3), Pressure relief device can be set to operate when internal pressure of nitrogen exceeds to 0.7 barg. But vendor will supply relief valve operation by oil.
3. According to item 7.7.3 of IPS-M-EL-152(3), the cover of the tank (item 8.25) for sealed type transformer shall be welded to the tank with a continuous weld. But vendor cannot meet this criteria & will supply bolted.