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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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| 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 |  |  |  |  | **51** |  |  |  |  |  |
| **2** | X |  |  |  |  | **52** |  |  |  |  |  |
| **3** | X |  |  |  |  | **53** |  |  |  |  |  |
| **4** | X |  |  |  |  | **54** |  |  |  |  |  |
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| **TBE for 1250 KVA Power Transformers** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Item** | **Description** | **Purchaser Requirement** | **Iran Transfo** | **Status** | **Kian Transfo** | **Status** | **Aria Transfo** | **Status** |
| **1.Generel** | | | | | | | | |
| 1.1 | Manufacturer's Name | By Vendor | Iran Transfo | A | Kian Ttransfo | A | Aria Ttransfo | 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 | OK | A | OK | A |
| 1.6 | Rated Power in Service Condition | 1250 kVA | OK | 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 | OK | 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 | OK | A | OK | A | OK | A |
| 1.11 | Secondary Winding Rated Voltage | 0.42 KV | OK | 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 | OK | 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 | OK | A | OK | A | OK | 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 | C |
| 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 | OK | A | OK | A | OK | A |
| 2.7 | Primary Cooling Media | Mineral Oil | OK | A | OK | A | OK | A |
| **3. Primary Winding Voltage Rating** | | | | | | | | |  |  |  |  |
| 3.1 | Highest System Voltage | 12kV | OK | A | OK | A | OK | A |
| 3.2 | Rated Lightning Impulse Withstand Voltage | 75kV | OK | A | OK | A | OK | A |
| 3.3 | Rated Short Duration Power Frequency Withstand Voltage(rms) | 28kV | OK | A | OK | A | OK | A |
| **4. Secondary Winding Voltage Ratings** | | | | | | | | |  |  |  |  |
| 4.1 | Highest System Voltage | 1 kV | 1.1 KV | A | 1 kV | A | 1 KV | A |
| 4.2 | Rated Lightning Impulse Withstand Voltage | 3 kV | N.A | C | 3 kV | A | N.A | C |
| 4.3 | Rated Short Duration Power Frequency Withstand Voltage(rms) | 1 kV | 3 KV | A | 1 kV | A | 3 KV | A |
| 4.4 | Primary Winding | Delta Winding | OK | 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 | Class A | A |
| 4.8 | Average Winding Temperature Rise (55°C Ambient) | 65°C, Acc. to IEC 60076-2, Clause 4.2 | 53°C | C | 65°C | C | 53°C | C |
| 4.9 | Top Oil Temperature Rise (55°C ambient) | 60°C, Acc. to IEC 60076-2, Clause 4.2 | 48°C | C | 60°C | C | 48°C | C |
| 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 | OK | A |
| 4.12 | Short Circuit Withstand Duration | Primary: 1 S | OK | A | OK | A | OK | A |
| 4.13 | Required Short Circuit Impedance @75°C | 5% | OK | A | 6% | N | OK | A |
| 4.14 | Zero Sequence Impedance | By Vendor | ~5% | A | 5.46 | A | ~4% | A |
| 4.15 | X/R Ratio at Principal Tap | By Vendor | 4.13 | A | 5.59 | 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 | - | C | After Test | C | ~7 | C |
| 5.2 | Resistance[Ω] @ 75°C | By Vendor. | 1.9048 | C | After Test | C | ~2 | C |
| **6. Secondary Winding Characteristics** | | | | | | | | |
| 6.1 | Reactance[Ω] | By Vendor | - | C | After Test | C | ~0.002 | C |
| 6.2 | Resistance[Ω] @ 75°C | By Vendor | 0.00057 | C | After Test | C | ~0.0006 | C |
| **7.Tolerances** | | | | | | | | |
| 7.1 | Voltage Ratio at Principal Tap & No-Load | ±0.5 % | OK | A | OK | A | OK | A |
| 7.2 | Voltage Ratio at Other Tapping | ±0.5 % | OK | A | OK | A | OK | A |
| 7.3 | Voltage | ±10 % | OK | A | OK | A | OK | A |
| 7.4 | Frequency | ±5 % | OK | A | OK | A | OK | A |
| 7.5 | Short Circuit Impedance at Principal Tap | ±10% of Declared Value | OK | A | OK | A | OK | A |
| 7.6 | Short Circuit Impedance at Other Tapping | ±15% of Declared Value | OK | A | OK | A | OK | A |
| 7.7 | Anticipated Unbalance Loading in Percent of Rated Power | 10 % | OK | A | OK | A | OK | A |
| 7.8 | Core Construction | Laminated Silicon Steel | OK | A | OK | 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 T | A |
| 7.10 | No-Load Loss [W] | By Vendor |  | A | 1.73 KW | A | 1.8 KW | A |
| 7.11 | Full Load Total Loss [W] | By Vendor |  | A | 14.93 KW | A | 17 KW | A |
| 7.12 | Inrush Current | By Vendor | 602 A | A | 650 A | A | ~500 A for 0.6sec | A |
| 7.13 | Short Circuit Loss | By Vendor | 16 KW | A | 13.2 KW | A | 17 KW | A |
| 7.14 | I2R Loss at Rated Current & Principal Tap | By Vendor | 14 KW | A | 11.6 KW | A | 15.5 KW | A |
| 7.15 | Stray Load Loss at Rated Current & Principal Tap | By Vendor | 2 KW | A | 1.6 KW | A | 1.5 KW | A |
| 7.16 | 11 kV Cables Size & Number | 1x3x95  CU/SM/XLPE/SM/SC/PVC/SWA/PVC | - | A | OK | A | OK | A |
| 7.17 | External Terminations, Primary Side (Exposed Bushings/Cable Box) | Cable Box | OK | A | OK | A | OK | A |
| 7.18 | 0.42 kV Cable Size & Number | 14x(1x300)  CU/XLPE/Bd/AWA/PVC | - | A | OK | A | OK | A |
| 7.19 | Type & Size of Cable Glands (Power Cable) | Industrial,  Primary: M90  Secondary: M40 | - | A | OK | A | Out of vendor scope | A |
| 7.20 | Type & Size of Cable Glands (Control Cable) | 12x2.5,  CU/PVC/SWA/PVC, M25 | - | A | OK | A | OK | A |
| 7.21 | Bushing Type | Acc .to IPS 152 | DT 20NF 250 | A | DT 20NF 250 | A | DT 20NF 250 | A |
| 7.22 | Dimension (W X D X H) [mm] | By Vendor | 2606x2153x2477 | A | 2120x1350x1980 | C | 2900x2400x2250 | A |
| 7.23 | Weight [kg] | By Vendor | 5413 | A | 4050 | C | 5175 | A |
| 7.24 | Weight of Transformer Without Oil | By Vendor | 4154 | A | 2710 | C | 4130 | A |
| 7.25 | Noise Level (at 1m From Transformer) [db] | Less Than 85 dB(A) | OK | A | OK | A | OK | A |
| 7.26 | Oil Volume [liter] | By Vendor | 1407 | A | 1450 | C | 1200 | C |
| 7.27 | Oil Weight [kg] | By Vendor | 1259 | A | 1380 | C | 1045 | C |
| 7.28 | Oil Characteristics (Name/ Type/ Flash Point) | Acc. to IEC 60296 | OK | A | OK | A | Mineral/140c | C |
| **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 | OK | 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 2 V) | 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 | N.A | A | OK | A |
| 8.9 | Neutral Current Transformer | Core 1: 2000/1A, 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 | Pressure Relief Device with trip contact (Oil type) | C | OK | C | Pressure Relief Device with trip contact (Oil type) | C |
| 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 | N.A | 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 | IP 55 | A | OK | A |
| 8.22 | LV Terminal Box with Gland Plate | Required (Min IP55) | IP 55 | A | IP 55 | 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 | C | OK | A | Bolted | C |
| 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 | According to manufacture Painting Procedure | A | Poly Uthane | A | RAL 7032 | A |
| 8.29 | Radiator Painting Specification | By Vendor | According to manufacture 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 | OK | A | OK | A |
| 8.32 | Rating Plate | Stainless Steel | OK | A | OK | A | OK | A |
| 8.33 | Accessory Equipment Contacts Current / Voltage Rating | 5A / 250VAC | OK | A | OK | A | 2A / 230VAC | C |
| 8.34 | Accessory Equipment Contacts Type | Dry Type –DPDT/ 230VAC | - | C | OK | A | OK | A |
| 8.35 | Routine Tests Including | IEC60076 | OK | A | OK | A | OK | A |
| 8.36 | a) Measurement of Winding Resistance | Witness & Report | OK | A | OK | A | Acc. To contract | A |
| 8.37 | b) Measurement of Voltage Ratio & Check of Voltage Vector Relationship | Witness & Report | OK | A | OK | A | Acc. To contract | A |
| 8.38 | c) Measurement of Impedance Voltage (Principal Tapping) Short-Circuit Impedance & Load Loss | Witness & Report | OK | A | OK | A | Acc. To contract | A |
| 8.39 | d) Measurement of No-Load Loss & Current | Witness & Report | OK | A | OK | A | Acc. To contract | A |
| 8.40 | e) Impedance & Load Losses at Rated Current on Principal Tap | Witness & Report | OK | A | OK | A | Acc. To contract | A |
| 8.41 | f) Applied Potential & Induced Potential Tests | Witness & Report | OK | A | OK | A | Acc. To contract | A |
| 8.42 | g) Dielectric tests | Witness & Report | OK | A | OK | 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 | OK | A | OK | A |
| 8.45 | Test Report on CTs | * turns ratio error * Excitation Characteristics * Secondary resistance * Verification of low leakage flux |  | C | OK  OK  OK | A |  | C |
| 8.46 | Special Tools if Any | By Vendor |  | A | - | A | No | 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** | **Aria Transfo** | **Status** |
| **1.Generel** | | | | | | | | |
| 1.1 | Manufacturer's Name | By Vendor | Iran Transfo | A | Kian Transfo | A | Aria Transfo | A |
| 1.2 | Transformer Tag Number | GCS-TR-003 (Fire Water Transformer) | OK | A | OK | A | OK | A |
| 1.3 | Quantity | 1 | 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 | OK | A | OK | A |
| 1.6 | Rated Power in Service Condition | 800 kVA | OK | 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 | OK | 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 | OK | A | OK | A | OK | A |
| 1.11 | Secondary Winding Rated Voltage | 3.45 KV | OK | 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 | OK | 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 | OK | A | OK | A | OK | A |
| 2.2 | Installation Elevation | 12m (Above Sea Level) | 1000 m | C | OK | A | OK | A |
| 2.3 | Area Pollution Class | Class 4 (Very High) | OK | A | OK | A | 31mm/KV CD | C |
| 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 | OK | A | OK | A | OK | A |
| 2.7 | Primary Cooling Media | Mineral Oil | OK | A | OK | A | OK | A |
| **3. Primary Winding Voltage Rating** | | | | | | | | |
| 3.1 | Highest System Voltage | 12kV | OK | A | OK | A | OK | A |
| 3.2 | Rated Lightning Impulse Withstand Voltage | 75kV | OK | A | OK | A | OK | A |
| 3.3 | Rated Short Duration Power Frequency Withstand Voltage (rms) | 28kV | OK | A | OK | A | OK | A |
| **4. Secondary Winding Voltage Ratings** | | | | | | | | |
| 4.1 | Highest System Voltage | 3.6 kV | OK | A | OK | A | OK | A |
| 4.2 | Rated Lightning Impulse Withstand Voltage | 20 kV | 40 KV | A | 20 kV | A | OK | A |
| 4.3 | Rated Short Duration Power Frequency Withstand Voltage(rms) | 10 kV | 10 KV | A | OK | A | OK | A |
| 4.4 | Primary Winding | Delta Winding | OK | A | OK | A | OK | A |
| 4.5 | Secondary Winding | Star, (Neutral Grounding Resistors (NGR)) | OK | C | OK | C | OK | C |
| 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) | OK | A | OK | A | OK | A |
| 4.8 | Average Winding Temperature Rise (55°C Ambient) | 65°C, Acc. to IEC 60076-2, Clause 4.2 | 53°C | C | 65°C | C | 53°C | C |
| 4.9 | Top Oil Temperature Rise (55°C ambient) | 60°C, Acc. to IEC 60076-2, Clause 4.2 | 48°C | C | 60°C | C | 48°C | C |
| 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 | OK for Network | A |
| 4.12 | Short Circuit Withstand Duration | Primary: 1S | OK | A | OK | A | OK | A |
| 4.13 | Required Short Circuit Impedance @75°C | 5% | OK | A | 6% | N | OK | A |
| 4.14 | Zero Sequence Impedance | By Vendor | ~5% | A | 5.62 | A | ~4% | A |
| 4.15 | X/R Ratio at Principal Tap | By Vendor | 3.8 | A | 5.72 | 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 | 98.55 | 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 | - | C | AFTER TEST | C | ~12.5 | C |
| 5.2 | Resistance[Ω] @ 75°C | By Vendor. | 3.296 | C | AFTER TEST | C | ~3.4 | C |
| **6. Secondary Winding Characteristics** | | | | | | | | |
| 6.1 | Reactance[Ω] | By Vendor | - | C | AFTER TEST | C | ~0.25 | C |
| 6.2 | Resistance[Ω] @ 75°C | By Vendor | 0.06933 | C | AFTER TEST | C | ~0.07 | C |
| **7.Tolerances** | | | | | | | | |
| 7.1 | Voltage Ratio at Principal Tap & No-Load | ±0.5 % | OK | A | OK | A | OK | A |
| 7.2 | Voltage Ratio at Other Tapping | ±0.5 % | OK | A | OK | A | OK | A |
| 7.3 | Voltage | ±10 % | OK | A | OK | A | OK | A |
| 7.4 | Frequency | ±5 % | OK | A | OK | A | OK | A |
| 7.5 | Short Circuit Impedance at Principal Tap | ±10% of Declared Value | OK | A | OK | A | OK | A |
| 7.6 | Short Circuit Impedance at Other Tapping | ±15% of Declared Value | OK | A | OK | A | OK | A |
| 7.7 | Anticipated Unbalance Loading in Percent of Rated Power | 10 % | OK | A | OK | A | OK | A |
| 7.8 | Core Construction | Laminated Silicon Steel | OK | A | OK | A | OK | A |
| 7.9 | Flux Density in the Magnetic Circuit @Nominal Frequency & Voltage | By Vendor | 1.69 T | A | 1.67 T | A | ~1.7 T | A |
| 7.10 | No-Load Loss [W] | By Vendor |  | A | 1.15 kW | A | 1.3 kW | A |
| 7.11 | Full Load Total Loss [W] | By Vendor |  | A | 9.65 kW | A | 11 kW | A |
| 7.12 | Inrush Current | By Vendor | 377 A | A | 420 A | A | ~300 A for 0.6sec | A |
| 7.13 | Short Circuit Loss | By Vendor | 10.5 KW | A | 8.5 kW | A | 11 kW | A |
| 7.14 | I2R Loss at Rated Current & Principal Tap | By Vendor | 9.9 KW | A | 7.4 kW | A | 10.2 kW | A |
| 7.15 | Stray Load Loss at Rated Current & Principal Tap | By Vendor | 0.6 KW | A | 1.1 kW | A | 0.8 kW | A |
| 7.16 | 11 kV Cables Size & Number | 1x3x95  CU/SM/XLPE/SM/SC/PVC/SWA/PVC | OK | A | OK | A | OK | A |
| 7.17 | External Terminations, Primary Side (Exposed Bushings/Cable Box) | Cable Box | OK | A | OK | A | OK | A |
| 7.18 | 3.45 kV Cable Size & Number | 1x3x95  CU/SM/XLPE/SM/SC/PVC/SWA/PVC | OK | A | OK | A | OK | A |
| 7.19 | Type & Size of Cable Glands (Power Cable) | Industrial,  Primary: M90  Secondary: M75 | OK | A | OK | A | Out of vendor scope | A |
| 7.20 | Type & Size of Cable Glands (Control Cable) | 12x2.5,  CU/PVC/SWA/PVC, M25 | OK | A | OK | A | OK | 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 | 2192x1828x2055 | A | 2050x1150x1890 | C | 2300x2360x2100 | A |
| 7.23 | Weight [kg] | By Vendor | 3898 | A | 2820 | C | 3860 | A |
| 7.24 | Weight of Transformer Without Oil | By Vendor | 3098 | A | 1950 | C | 3070 | A |
| 7.25 | Noise Level (at 1m from Transformer) [db] | Less Than 85 dB(A) | OK | A | OK | 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 | OK | A | OK | A | Mineral/140c | C |
| **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 | OK | 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 2 V) | 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 | N.A | A | OK | A |
| 8.9 | Neutral Current Transformer | Core 1: 630/1A, 5P10 ,10VA  ~~Core 2: 630/1A, Class X~~ | OK | C | 2000/1A, 5P10 ,10VA | C | OK | C |
| 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 | Pressure Relief Device with trip contact (Oil type) | A | OK | A | OK | 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 | C | OK | A | Bolted | C |
| 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, 6, 6 mm | A |
| 8.28 | Tank Painting Specification | By Vendor | According to manufacture Painting Procedure | A | POLY UTHANE | A | RAL 7032 | A |
| 8.29 | Radiator Painting Specification | By Vendor | According to manufacture 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 | OK | A | OK | A |
| 8.33 | Accessory Equipment Contacts Current / Voltage Rating | 5A / 250VAC | OK | A | OK | A | 2A / 230VAC | C |
| 8.34 | Accessory Equipment Contacts Type | Dry Type –DPDT/ 230VAC | - | C | - | C | OK | A |
| 8.35 | Routine Tests Including | IEC60076 | OK | A | OK | A | OK | A |
| 8.36 | a) Measurement of Winding Resistance | Witness & Report | OK | A | OK | A | Acc. To contract | A |
| 8.37 | b) Measurement of Voltage Ratio & Check of Voltage Vector Relationship | Witness & Report | OK | A | OK | A | Acc. To contract | A |
| 8.38 | c) Measurement of Impedance Voltage (Principal Tapping) Short-Circuit Impedance & Load Loss | Witness & Report | - | C | OK | A | Acc. To contract | A |
| 8.39 | d) Measurement of No-Load Loss & Current | Witness & Report | OK | A | OK | A | Acc. To contract | A |
| 8.40 | e) Impedance & Load Losses at Rated Current on Principal Tap | Witness & Report | OK | A | OK | A | Acc. To contract | A |
| 8.41 | f) Applied Potential & Induced Potential Tests | Witness & Report | OK | A | OK | A | Acc. To contract | A |
| 8.42 | g) Dielectric tests | Witness & Report | OK | A | OK | 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 |  | C | OK | A |  | C |
| 8.46 | Special Tools if Any | By Vendor |  | A | NA | A | No | 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** | **Aria Transfo** |
| **1** | **1250 KVA** | Conditionally Acceptable | Conditionally Acceptable | Conditionally Acceptable |
| **2** | **800 KVA** | Conditionally Acceptable | Conditionally Acceptable | Conditionally Acceptable |

**Conclusion Note:**

**General**

1. Item 4.5 of 800KVA transformer (secondary side) shall be changed to Earthed via NGR. Therefore second core of CT is not required & all vendors shall delete related CT it item 8.9. Data sheet shall be revised in next revision.
2. According to motor starting, the nominal rated voltage of 800KVA transformer shall be 11/3.45 KV. The related data sheet shall be revised.
3. The word “Hermitic” shall be changed to “Hermetic” in data sheet.

**Iran Transfo**

1. Item 4.2 of 1250 KVA Transformer: Vendor will not consider Lightning impulse withstand for LV Side.
2. According to item 7.9.1 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.

**Kian Transfo**

1. The Short Circuit Impedance of 1250 & 800 KVA transformer is 6% which is not acceptable.
2. Dimension & weight of transformer differs from 2 other vendors. While the dimension of transformer is smaller, but the required oil is more than 2 others. Items 7.22 & 7.26 shall be clarified.
3. No deviation list & outline drawing have been issued by vendor.

**Aria 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.