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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. **GENERAL INFORMAYION :**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Serial No. |  |  | Rated Voltage | 100/110/120 VAC  |
| Make |  | Aux. Voltage | 80 – 265 VAC/DC |
| ORDER NO. | RS 454 004 - AA | MODEL NO. | SPAU 341 C3 |
| Frequency |  60 Hz | VT Ratio | 13.8 kV/120V |
| Rated Current | 5A |  | CT Ratio | 2510/1A |

Reference Voltage Us Ud = Um - UpBandwidth ΔUs Up = Us ± Uz ± Uci = UrevTime delay T1 Us = Reference Voltage Time delay T2 Uz = Line Drop CompensationOvercurrent blocking I> Uci = Circulating Current compensationUndervoltage blocking U< Urev = Reduce Set Voltage valueOvervoltage detection U> Ud = Difference VoltageUr line drop compensation Up = Control VoltageUx line drop compensationChecksum of switchgroup SGF1Checksum of switchgroup SGF2Reduce Set Voltage (RSV)1. **MECHANICAL CHECKS AND VISUAL INSPECTION:**

|  |  |  |
| --- | --- | --- |
| ITEM | DESCRIPTION | CHECKED |
| 1 | Inspect for physical damage / defects. |  |
| 2 | Check tightness of all connections. |  |
| 3 | Test Switch checked for correct function. |  |
| 4 | Watchdog contact.  |  |

ELECTRICAL TESTS: With relay energized condition

|  |  |  |
| --- | --- | --- |
| ITEM | DESCRIPTION | CHECKED |
| 1 | Measured auxiliary supply. |  |
| 5 | Relay healthy (green) LED working. |  |
| 6 | OUT (Yellow) LED working. |  |

1. **OPERATING VALUE CHECK:**

Rated Voltage = 100 VCAL ∆Us = (U2-U1)/(U1+U2) \*100 REG=(U1+U2)/2**SGF1/7= 0 & SGF1/8 = 0 ( Un=100 V )**SGF1/7= 1 & SGF1/8 = 0 ( Un=110 V ) SGF1/7= 0 & SGF1/8 = 1 ( Un=120 V )

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SET VALUE** | **OPERATE VALUE (V)** | **EXPECTRED VALUE** | **REG** | **CAL ∆Us** |
| **REF. VOLT****( Us )** | **BANDWIDTH ∆Us** | **RAISE (U1)** | **LOWER (U2 )** | **RAISE** | **LOWER** |
| **0.9 Un=90 V** | **2%** |  |  | **88** | **92** |  |  |
| **I.0 Un=100V** | **4%** |  |  | **96** | **104** |  |  |
| **1.1 Un=110 V** | **6%** |  |  | **104** | **116** |  |  |

OPERATING TIME CHECK (T1):∆Us = 2% x Un T2 = 0 Un = 100 V Us = 1.0 x UnInverse time calculation : T1 /2(B-1)  B=Ud / ∆UsSGF1/5= 0 Definite Time & SGF1/5= 1 Inverse Time

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **SET TIME T1 SEC** | **OPERATION** | **APPLIED****( V )** | **OPERATING TIME (SEC)** | **EXPECTED TIME****(SEC)** | **INV.dif.****Limits msec** | **LIMITS****msec**  |
| **DEFINITE** | **INVERSE** | **DEFINITE** | **INVERSE** |
| **10 SEC** | **RAISE** |  **97** |  |  | **10** | **7.99** | **+/-3% of set value** | **+/-1% of set value** |
| **LOWER** |  **103** |  |  | **10** | **6.37** | **+/-3% of set value** | **+/-1% of set value** |
| **20 SEC** | **RAISE** |  **97** |  |  | **20** | **15.74** | **+/-3% of set value** | **+/-1% of set value** |
| **LOWER** |  **103** |  |  | **20** | **12.78** | **+/-3% of set value** | **+/-1% of set value** |

OPERATING TIME CHECK (T2):∆Us = 2% x Un T1 = 15 Un = 100 VUs = 1.0 x UnInverse time calculation : T1 /2(B-1)  B=Ud / ∆Us

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **SET TIME T1 SEC** | **OPERATION** | **APPLIED****( V )** | **OPERATING TIME (SEC)** | **EXPECTED TIME****(SEC)** | **INV.dif.****Limits msec** | **LIMITS****msec**  |
| **DEFINITE** | **INVERSE** | **DEFINITE** | **INVERSE** |
| **10 SEC** | **RAISE** |  **97** |  |  | **5** | **3.19** | **+/-3% of set value** | **+/-1% of set value** |
| **LOWER** |  **103** |  |  | **5** | **4.04** | **+/-3% of set value** | **+/-1% of set value** |
| **20 SEC** | **RAISE** |  **97** |  |  | **10** | **7.95** | **+/-3% of set value** | **+/-1% of set value** |
| **LOWER** |  **103** |  |  | **10** | **6.37** | **+/-3% of set value** | **+/-1% of set value** |

1. **OPERATING PULSE DURATION (OPD) :**

|  |  |
| --- | --- |
| **SET** | **Measured Time** |
|
| **1.5 Sec** |  |

1. **UNDERVOLTAGE BOLCKING U<:**

∆Us = 2% x Un T1 = 0 T2 = 0 Un = 100 V Us = 1.0 x Un SGF2/4= 1, Binary Output Contact = X2 (5,6)

|  |  |  |
| --- | --- | --- |
| **Setting % Un** | **Expected Voltage** | **Measured Values** |
| Pickup | Drop Off |
| 70 % | 70 V |  |  |
| 80 % | 80 V |  |  |

1. **OVERVOLTAGE DETECTION U>:**

∆Us = 2% x Un T1 = 0 T2 = 0 Un = 100 V Us = 1.0 x Un SGF2/5 = 1, SGF2/2 = 0, Binary Output Contact = X2 (7,8)

|  |  |  |
| --- | --- | --- |
| **Setting % Un** | **Expected Voltage** | **Measured Values** |
| Pickup | Drop Off |
| 110 % | 110 V |  |  |
| 120 % | 120 V |  |  |

1. **OVERCURRENT BOLCKING I>:**

∆Us = 2% x Un T1 = 0 T2 = 0 Un = 100 V Us = 1.0 x Un In = 1 A SGF2/5 = 1, SGF2/2 = 0, Binary Output Contact = X2 (7,8)

|  |  |  |
| --- | --- | --- |
| **Setting % In** | **Expected Current** | **Measured Values** |
| Pickup | Drop Off |
| 1 In | 1 A |  |  |
| 1.5 In | 1.5 A |  |  |

1. **LINE DROP COMPENSATION CHECK (LDC):**

∆Us = 5% x Un T1 = 0 T2 = 0 Un = 100 V Us = 1.0 x Un In = 1 A **UR & UX = 0**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SET COPENSATION** | **RAISE** | **LOWER** | **REG** | **CAL.****∆Us** |
| **OPERATE** | **EXPECTED** | **OPERATE** | **EXPECTED** |
| **UR & UX=0** |  | **95** |  | **105** |  |  |

**UX =0**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SET COPENSATION** | **RAISE** | **LOWER** | **REG** | **CAL.****∆Us** |
| **OPERATE** | **EXPECTED** | **OPERATE** | **EXPECTED** |
| **UR = 5%** |  | **100** |  | **110** |  |  |

Angle between V& I set at 0o for R compensation CAL ∆Us = (U2-U1)/(U1+U2) \*100 REG=(U1+U2)/2 UNn=Un + UR**UR =0**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SET COPENSATION** | **RAISE** | **LOWER** | **REG** | **CAL.****∆Us** |
| **OPERATE** | **EXPECTED** | **OPERATE** | **EXPECTED** |
| **UX = 10%** |  | **105** |  | **115** |  |  |

Angle between V& I set at 90o for R compensation CAL ∆Us = (U2-U1)/(U1+U2) \*100 REG=(U1+U2)/2 UNn=Un +UX**UR =0**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SET COPENSATION** | **RAISE** | **LOWER** | **REG** | **CAL.****∆Us** |
| **OPERATE** | **EXPECTED** | **OPERATE** | **EXPECTED** |
| **UX = 15%** |  | **80** |  | **90** |  |  |

Angle between V& I set at 270o for R compensation CAL ∆Us = (U2-U1)/(U1+U2) \*100 REG=(U1+U2)/2 UNn=Un –UX |