



|   |   |  |                   |
|---|---|--|-------------------|
|  |  | <b>REFERENCE NO AY000447628-25F1</b>               | Rev : 4.0         |
|   |   |  | Date : 19/08/2018 |
| PO NO :   | CODE:DTR  | Final inspection check sheet for shipment/delivery |                   |

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### Propulsion Box

### FINAL INSPECTION CHECKSHEET



| Manufacture         | alstom Ubunye  |
|---------------------|----------------|
| Equipment           | Propulsion Box |
| Serial no           | TC-781         |
| Start activity date | 11/03/2024     |
| End activity date   | 11/03/2024     |



This symbol indicates that  
Activities are related to railway securities  
in order to

- Check if the behavior of the train under specific conditions corresponds to the effects provided in safety analyzes or;
- Check if the assumptions used in the safety

| Actions and verifications  | checked<br>OK / Not OK | re-checked<br>OK / Not OK | Def. Type A,B,C |
|--|------------------------|---------------------------|-----------------|
| <b>DOCUMENTS</b>   |                        |                           |                 |
| 1. Presence of production test reports completed dated and signed.                                       | OK                     |                           |                 |
| 2. Self-inspection & Component serial no   | OK                     |                           |                 |
| 3. Ensure that the production order is closed on the system  | OK                     |                           |                 |
| <b>GENERAL APPEARANCE</b>  |                        |                           |                 |
| 4. Cleanliness / debarring / chips / filings / wastes / dust / screw / washers / rivets                  | OK                     |                           |                 |
| 5. Appearance of paintwork / retouches / inclusions / splinters / scratches / missed bits                | OK                     |                           |                 |
| 6. Appearance of sheet metalwork / dents / self-tapping screws fastening                                 | OK                     |                           |                 |
| 7. Information plate - QR Code   | OK                     |                           |                 |
| 8. Fastening / maintaining of seals (sharp edge protection / integrity)                                  | OK                     |                           |                 |
| 9. Ensure there is no sign of leaks and coolant is filled up to the last line on the gauge below maximum | OK                     |                           |                 |
| <b>MOUNTING</b>  |                        |                           |                 |
| 9. Fastening fast lock in agate cover position   | OK                     |                           |                 |
| 10. Fastening fast lock HV cover and PM cover  | OK                     |                           |                 |

|   |   |   |                   |
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DT00000367945

|  |           |               |                   |               |                          |
|--|-----------|---------------|-------------------|---------------|--------------------------|
| 11.Mounting of resistors enclosure bottom cover  | OK        |               |                   |               |                          |
| 12.HV cover and PM cover   |           |               |                   |               |                          |
| Alignment of key lock by checking opening and closure.   | OK        |               |                   |               |                          |
| <b>Action verification</b>   | <b>OK</b> | <b>Not Ok</b> | <b>Recheck ok</b> | <b>Not ok</b> | <b>Defect type A,B,C</b> |
| 13. Mounting of terminal box covers.<br>Affixing of danger tag above and below.                          | OK        |               |                   |               |                          |
| 14.Mounting of water draining lower plugs (Agate side ,HV and PM)  | OK        |               |                   |               |                          |
| 15.Mounting of ID plate  | OK        |               |                   |               |                          |
| 16.Affixing of tags<br>Identify external and electrical connections                                      | OK        |               |                   |               |                          |
| 17.Affixing of danger tag and check that is done according to dimension on WI 5.129 and 5.130            | OK        |               |                   |               |                          |
| 18.Ensure correct clamp fitted on the cooling unit pipe.   | OK        |               |                   |               |                          |
| <b>WIRING</b>  |           |               |                   |               |                          |
| 19.Check of crimping / connections (lugs / pins / strands / insulator) and maintaining of the connectors | OK        |               |                   |               |                          |
| 20.Wiring: respect for minimum radii of curvatures and lengths / no loops or chewing                     | OK        |               |                   |               |                          |
| 21.Cable fasteners: fastening correct  | OK        |               |                   |               |                          |
| 22.Presence of protective measures against direct contacts: HV protective duct / flexi etc.              | OK        |               |                   |               |                          |
| 23.Presence and application of labels (flat and straight)  | OK        |               |                   |               |                          |
| 24. Check the present of LHD   | OK        |               |                   |               |                          |
| 25. Condition of cables: wires (damaged / no contact with sharp ends of ducts and/or rivets etc.)        | OK        |               |                   |               |                          |

#### COMMENTS

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ALSTOM UBUNYE



REFERENCE NO AY000447628-  
25F1

Rev : 4.0

Date : 19/08/2018

PO NO :

CODE:DTR

DTR0000367945

Final inspection check sheet for shipment/delivery

IN THE EVENT OF NON-CONFORMITY, ATTACHE THE NON-COMPLIANT EQUIPMENT LABEL ON THE PRODUCT


|                               |                           |                                    |                                 |
|-------------------------------|---------------------------|------------------------------------|---------------------------------|
| AU EPU<br><i>Nusi</i>         | Date<br><i>11/03/2024</i> | OK / Not OK<br><i>(circled OK)</i> | Signature<br><i>[Signature]</i> |
| AU Inspector<br><i>Mapule</i> | Date<br><i>11/03/2024</i> | OK / Not OK<br><i>(circled OK)</i> | Signature<br><i>[Signature]</i> |



|   |                                     |     |      |  |  |   |   |   |                      |   |            |
|---|-------------------------------------|-----|------|--|--|---|---|---|----------------------|---|------------|
| <div></div> <div>ALSTOM UBUNYE</div> | IDENTIFICATION & SERIALIZATION LIST |     |      |  |  |   |   |   |                      |   |            |
|   | CONFIGURATION LEVEL:                |     |      |  |  | 0 | 1 | 2 | 3                    | 4 | 5          |
| Equipment Code  | TC0781                              |     |      | Equipment Description                      |  |   |   |   |                      |   | 2024/03/09 |
| DTR0000367945   | TC0781                              |     |      | TRACTION CONVERTER                         |  |   |   |   |                      |   | 2024/03/09 |
| Component Code  | Serial Number                       | Qty | Rev. | Description                                |  |   |   |   | Drawing No. / Ref on |   |            |
| AY00000202906   |                                     | 1   | E    | CONVERTITORE DI TRAZIONE PRASA             |  |   |   |   | 553597               |   |            |
| AYD0000233323   |                                     | 1   | A    | KIT DOCUMENTAZIONE CONVERTITORE PRASA      |  |   |   |   | 1000DD               |   |            |
| AYD0000296679   |                                     | 1   | E    | ROUTINE TEST CERTIFICATE PRASA 3KV         |  |   |   |   | 1202CC               |   |            |
| AYD0000296683   |                                     | 1   | E    | PROCEDURA COLLAUDO PRASA 3KV               |  |   |   |   | 4044PC               |   |            |
| AYD0000296685   |                                     | 1   | F1   | ROUTINE TEST PROCEDURE PRASA 3KV           |  |   |   |   | 4044PC               |   |            |
| AYD0000315036   |                                     | 1   | E    | WS PROPULSION BOX                          |  |   |   |   | 495WS                |   |            |
| AYD0000315038   |                                     | 1   | C    | SI PROPULSION BOX                          |  |   |   |   | 126SI                |   |            |
| AYD0000315040   |                                     | 1   | B    | FI PROPULSION BOX                          |  |   |   |   | 25FI                 |   |            |
| AY00000164662   |                                     | 1   | E    | ASSIEME DI MONTAGGIO PROGETTO PRASA        |  |   |   |   | 556176               |   |            |
| AY00000185895   |                                     | 1   | D    | ASSIEME BT (CUST.2) + SCAMBIATORE          |  |   |   |   | 554161               |   |            |
| AY00000042588   | f000141369                          | 1   | B    | PULL DOWN CARD                             |  |   |   |   | 535135               |   |            |
| AY00000253771   |                                     | 1   | A    | ASSIEME CONTROLLO BT/MT                    |  |   |   |   | 555235               |   |            |
| AY00000292001   | LVMV 0478                           | 1   | E    | LV/MV CONTACTORS HARNESS                   |  |   |   |   | 513DD                |   |            |
| DTR0000174605   | 50930                               | 1   | B    | VENTILATION RACK                           |  |   |   |   |                      |   |            |
| DTR0000322004   | X68088                              | 1   | A    | AGATE AC3ME 044                            |  |   |   |   |                      |   |            |
| DTR0000363028   | 2402MP1249005                       | 1   | B    | COOLING UNIT                               |  |   |   |   |                      |   |            |
| DTR0000392691   | 2402MP124A05                        | 1   | A    | 400V MOTORFAN                              |  |   |   |   |                      |   |            |
| DTR0000392783   | 1057                                | 1   | A    | HEAT EXCHANGER 19 KW                       |  |   |   |   |                      |   |            |
| DTR0000393305   | 023-80/22-475                       | 1   | A    | MOTOR PUMP 400V                            |  |   |   |   |                      |   |            |
| AY00000185945   |                                     | 1   | D    | ASSIEME PM+AT (CUST.1) + CONDOTTO CENTRALE |  |   |   |   | 554162               |   |            |
| AY00000241031   |                                     | 1   | A    | ASSIEME CONTATTORE DI LINEA                |  |   |   |   | 555289               |   |            |
| DTR0000352557   | 2311MP1040009                       | 1   | A    | CONTACTOR 4000 V/600 A                     |  |   |   |   |                      |   |            |
| AY00000291132   |                                     | 1   | A    | ASSIEME TV                                 |  |   |   |   | 555502               |   |            |
| DTR0000271049   | 51222290010                         | 1   | A    | VOLTAGE TRANSDUCER 4 KV                    |  |   |   |   |                      |   |            |
| DTR0000271049   | 51222290011                         | 1   | A    | VOLTAGE TRANSDUCER 4 KV                    |  |   |   |   |                      |   |            |
| DTRP000321040   | 3113                                | 1   | U    | ONIX 233 XHP                               |  |   |   |   |                      |   |            |
| DTRP000322040   | 884                                 | 1   | P    | ONIX 233 VHP 1R                            |  |   |   |   |                      |   |            |
| DTR0000050054   | 123650012                           | 1   | A    | CURRENT SENSOR 1000A                       |  |   |   |   | V13804               |   |            |
| DTR0000050054   | 1232650022                          | 1   | A    | CURRENT SENSOR 1000A                       |  |   |   |   | V13804               |   |            |

|               |                  |   |    |   |        |
|---------------|------------------|---|----|---|--------|
| DTR0000050054 | 722099000759     | 1 | A  | CURRENT SENSOR 1000A                              | V13804 |
| DTR0000050054 | 722099793        | 1 | A  | CURRENT SENSOR 1000A                              | V13804 |
| DTR0000094298 | 171              | 1 | A1 | CAPACITOR 1.000 MF                                | V13802 |
| DTR0000094298 | 147              | 1 | A1 | CAPACITOR 1.000 MF                                | V13802 |
| DTR0000106563 | 5578             | 1 | A  | CAPACITOR BUS BAR                                 |        |
| DTR0000106564 | 2686             | 1 | B  | INTERCONNECTION BUS BAR                           |        |
| DTR0000106565 | 3773             | 1 | B  | REDUCED INTER. BUS BAR                            |        |
| DTR0000106566 | 6200             | 1 | A  | SHORT CAP. BUS BAR                                |        |
| DTR0000352147 | 2310MP1031023    | 1 | A4 | CONTACTOR 4000 V/60 A                             |        |
| DTR0000353584 | 124              | 1 | A  | CAPACITOR 1.333 MF                                |        |
| DTR0000363023 | 2311MP0978020A/B | 1 | B  | PIPING KIT  |        |
| AY00000219169 | AU0189           | 1 | F1 | LV HARNESS  | 406DD  |
| AY00000240077 | AU0303           | 1 | D1 | HV HARNESS  | 407DD  |
| AY00000278318 | AU00182          | 1 | E  | MV HARNESS  | 408DD  |
| AY00000278322 | F003701106       | 1 | C  | FIRE FIGHTING HARNESS                             | 409DD  |
| DTR0000359897 | 9825918          | 1 | C  | KEY LOCK SYSTEM                                   |        |
| DTR0000359897 | 9825919          | 1 | C  | KEY LOCK SYSTEM                                   |        |
| AY00000251587 |                  | 1 | C  | ASSIEME D'INGOMBRO CONVERTITORE<br>TRAZIONE PRASA | 554643 |



|   |              |                                     |   |                                     |
|---|--------------|-------------------------------------|---|-------------------------------------|
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|---|--------------|-------------------------------------|---|-------------------------------------|

## ROUTINE TEST CERTIFICATE

**PRASA TRACTION CONVERTER 3KV DTR0000367945**

*DRAWING N° 553597/...*

**CODICE N°**      **AYD0000296685**

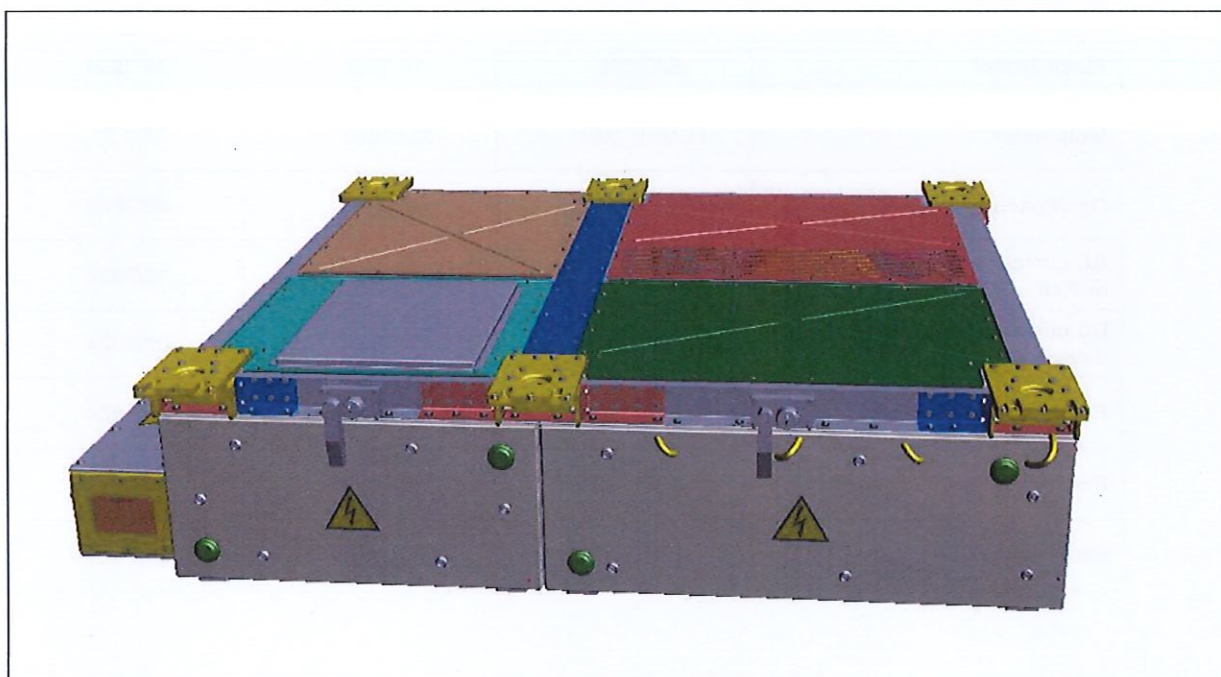
**PART N°**

**ROUTINE TEST PROCEDURE: N PC4044/...**

*We attest that the equipment has successfully undergone all the tests provided in the Routine Test Procedure.*

*JOINED WITH THE CORRESPONDING CONFORMITY DECLARATION (DC)*

*THIS DOCUMENT BECOMES A CERTIFICATION ACCORDING TO EN 10204 PAR. 3.1.b*



|   |              |                                     |   |                                     |
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|---|--------------|-------------------------------------|---|-------------------------------------|

## PRASA TRACTION CONVERTER 3KV DTR0000367945

Choose an item.

**TRACTION CONVERTER SERIAL NO:**

781

Choose an item.

**TEMPERATURA/TEMPERATURE °C.**

33.3°


**HUMIDITY RELATIVE.....%**

27.3

### 1. List of measuring devices used

| Equipment name              | Type               | Serial no.     | Next calibration date |
|-----------------------------|--------------------|----------------|-----------------------|
| Megger Tester               | FLUKE<br>1550C_5KV | 381963         | 09/2024               |
| Flash Tester                | EATON              | 107563         | 09/2024               |
| Multimeter                  | FLUKE_287          | 3563062        | 09/2024               |
| Oscilloscope                | TEKTRONIX          | C05196         | 09/2024               |
| AC current measuring device | DISPLAY_PANEL      | DTR01000043228 | 12/2024               |
| DC current measuring device | DISPLAY_PANEL      | DTR01000043228 | 09/2024               |
| Frequency generator         | TT1_(TG153)        | 493240         | 09/2024               |
| Phase rotation device       | FLUKE_9063         | 412096105      | 09/2024               |
| Earth continuity tester     | KIKUSUI            | YG006883       | 09/2024               |



|   |              |                                     |   |                                     |
|---|--------------|-------------------------------------|---|-------------------------------------|
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|---|--------------|-------------------------------------|---|-------------------------------------|

| Point | Description  |       | Value   | Result |
|-------|--|-------|---------|--------|
| 2.1   | Visual inspection  |       | /       | DONE   |
| 2.2   | Cabling verification   |       | /       | DONE   |
| 2.2.1 | Measure values resistance                                    |       |         |        |
|       | RS1  |       | 118.3KΩ | PASSED |
|       | RS2  |       | 118.4KΩ | PASSED |
|       | RS3  |       | 119.0KΩ | PASSED |
|       | R_CCZ1   |       | 66.1Ω   | PASSED |
|       | RCCZ2  |       | 67.9Ω   | PASSED |
|       | R_CCZ3   |       | 67.3Ω   | PASSED |
| 2.2.2 | Adjust of time Relay Q1-GMV Q2-GMV Q1-WP                     |       |         | DONE   |
| 2.3.1 | 1° Insulation test High Voltage Group A                      | Value | 1.84GΩ  | PASSED |
| 2.3.1 | Dielectric strength test High Voltage Group A                | Value | 25.4mA  | PASSED |
| 2.3.1 | 2° Insulation test High Voltage Group                        | Value | 893MΩ   | PASSED |
| 2.3.2 | 1° Insulation test Low Voltage Group without shields B       | Value | 2.91GΩ  | PASSED |
| 2.3.2 | Dielectric strength test Low Voltage without shields Group B | Value | 0.4mA   | PASSED |
| 2.3.2 | 2° Insulation test Low Voltage Group B without shields       | Value | 2.05GΩ  | PASSED |
| 2.3.3 | 1° Insulation test Low Voltage Group C with shields          | Value | 141GΩ   | PASSED |
| 2.3.3 | Dielectric strength test Low Voltage Group C                 | Value | 1.8mA   | PASSED |
| 2.3.3 | 2° Insulation test Low Voltage Group C                       | Value | 30.3GΩ  | PASSED |
| 2.3.4 | 1° Insulation test Medium Voltage Group D                    | Value | 4.32GΩ  | PASSED |
| 2.3.4 | Dielectric strength test Medium Voltage Group D              | Value | 0.6mA   | PASSED |
| 2.3.4 | 2° Insulation test Screen and MVB/Ethernet Group D           | Value | 5.8GΩ   | PASSED |
| 2.6.1 | Filled volume during Pre-Test and record how many litres     |       | 15.774ℓ | OK     |
| 2.6.2 | Verify the tightness of the glycol                           |       |         | OK     |

PRETEST TEST OPERATORS

SIPHO SHAPULA

KHUTSO MATLEJOANE

DATE OF PRETEST: 08/03/2024


|   |              |                                     |   |                                     |
|---|--------------|-------------------------------------|---|-------------------------------------|
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|---|--------------|-------------------------------------|---|-------------------------------------|

## FUNCTIONAL TESTING LOGIC INPUT TEST

Install software on the TBCU using a USB key or Ethernet cable (version:9.1.0) and launch the TrainTracer.


| Connector/pin | Project Ref                      | Value transition |
|---------------|----------------------------------|------------------|
| XCB2/8        | LI_NOT_INHIB                     | TRUE             |
| XCB2/7        | LI_NEB                           | TRUE             |
| XCB1/4        | LI_CAR_ID1                       | FALSE            |
| XCB1/5        | LI_CAR_ID2                       | TRUE             |
| XCB1/6        | LI_CAR_ID3                       | TRUE             |
| XCB1/7        | LI_CAR_ID4                       | TRUE             |
| XCB1/8        | LI_EDM                           | TRUE             |
| XCB1/9        | LI_TRACTION                      | TRUE             |
| XCB1/18       | LI_REVERSE                       | TRUE             |
| XCB1/28       | LI_DEMCL_HSCB                    | TRUE             |
| XCB1/29       | LI_HSCB_OP                       | TRUE             |
| XCB1/30       | LI_HSCB_CL                       | TRUE             |
| XCB1/19       | LI_MCB_400V_SUPPLY               | TRUE             |
| XCB1/20       | LI_TH1_LC                        | TRUE             |
| XCB1/21       | LI_TH2_LC                        | TRUE             |
| XCB1/17       | LI_FORWARD                       | TRUE             |
| XCB1/16       | LI_NOBRAKE                       | TRUE             |
| XCB1/45       | LI_PBRAKE_STAT                   | TRUE             |
| XCB1/43       | LI_ISOL                          | TRUE             |
| XCB1/31       | LI_HSCB_HOLD                     | TRUE             |
| XCB1/44       | LI_BRAKE_ISO                     | TRUE             |
| XCB1/52       | LI_SERVICE_BR_DC                 | TRUE             |
| XCB1/53       | LI_RESERVOIR_PS_OK               | TRUE             |
| XCB1/54       | LI_PARK_BR_DC                    | TRUE             |
| XCB1/55       | LI_PARK_BRAKE_RELEASE            | TRUE             |
| XCB1/56       | LI_REGULATOR_STAT                | TRUE             |
| XCB1/64       | LI_SUSP_DC                       | TRUE             |
| XCB1/42       | LI_PARK_BRPS_NOK(ebt6_in/ebt 21) | TRUE             |



|   |              |                                     |   |                                     |
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|---|--------------|-------------------------------------|---|-------------------------------------|





| Confirm Status                      |                          | Variable to force / action to do           | Check   |
|-------------------------------------|--------------------------|--|---|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> |  | Check the removal of the full-speed command to the fan<br>LI_K2_GMVC=0(digital input.xml) |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | LO_CK_WP=1                                 | Start pump LI_K_WPC=1(digital input.xml)  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | LO_CK1_GMV=1                               | Check the half-speed command to the fan<br>LI_K1_GMVC=1(digital input.xml)                |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | LO_CK2_GMV=1                               | Check the full-speed command to the fan<br>Don't start<br>LI_K2_GMVC=0(digital input.xml) |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | LO_CK1_GMV=0                               | Check the removal of the half-speed command to the fan<br>LI_K1_GMVC=0(digital input.xml) |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | LO_CK2_GMV=0                               | Check the removal of the full-speed command to the fan<br>LI_K2_GMVC=0(digital input.xml) |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | LO_CK2_GMV=1                               | Check the full-speed command to the fan<br>LI_K2_GMVC=1(digital input.xml)                |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | LO_CK1_GMV=1                               | Check the half-speed command to the fan<br>Don't start<br>LI_K1_GMVC=0(digital input.xml) |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | LO_CK2_GMV=0<br>LO_CK1_GMV=0<br>LO_CK_WP=0 | Pump and fans stop  |
|                                     |                          | Switch OFF 400 VAC on the simulator box    |   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | SBT7_9 =1                                  | Check that there is continuity between pin 32 and 33 of XCB2; LED "LO_TRAC IN" ON         |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | SBT7_9 =0                                  | Check that there is no continuity between pin 32 and 33 of XCB2 ; LED "LO_TRAC IN" OFF    |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | SBT7_10 =1                                 | Check that there is continuity between pin 40 and 41 of XCB2 ; LED "LO_BRAKE IN" ON       |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | SBT7_10 =0                                 | Check that there is no continuity between pin 40 and 41 of XCB2; LED "LO_BRAKE IN" OFF    |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | LO_AC_FAN=1                                | Check the start of the TBCU fans on the top of AGATE                                      |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | LO_AC_FAN=0                                | Check the stop of the TBCU fans on the top of AGATE                                       |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | LO_INH_TR=1<br>LO_CK_IC=1                  | Check the presence of 110 V on pin 31 of XCB2 ;<br>LED "LO_INH_TR" ON                     |




|   |              |                                     |   |                                     |
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|---|--------------|-------------------------------------|---|-------------------------------------|

## FUNCTIONAL TESTING LOGIC OUTPUT TEST

Refer to the Test Procedure (2.5.2)


| Confirm Status  |   | Variable to force / action to do | Check   |
|---|---|----------------------------------|---|
| CLOSE   |   | LO_CK_CCC=1                      | Check that capacitor charging contactor K-CCC closes<br>LI_K_CCCC=1 ;LED 43&53 OFF(digital input.xml)   |
| OPEN  |   | LO_CK_CCC=0                      | Check that capacitor charging contactor K-CCC opens<br>LI_K_CCCC=0; LED 43&53 ON(digital input.xml)   |
| CLOSE   |   | LO_CK_IC=1                       | Check that isolation contactor K-IC close<br>LI_K_ICC=1; LED 43&53 OFF(digital input.xml)   |
| OPEN  |   | LO_CK_IC=0                       | Check that isolation contactor K-IC opens<br>LI_K_ICC=0; LED 43&53 ON(digital input.xml)  |
| OK  | NOK   | LO_CK_WP=1                       | Check the command to start water pump<br>LI_K_WPC=1(digital input.xml)<br>Check also that the variable ai_cps = 1,6 bar +/-5% (analog input.xml)                            |
|  |  |                                  |   |
| OK  | NOK   | LO_CK_WP=0                       | Check the command to stop water pump<br>LI_K_WPC=0(digital input.xml); Check also that the variable ai cps = 0 bar +/-5% (analog input.xml)                                 |
|  |  |                                  |   |
| OK  | NOK   | LO_CK1_GMV=1                     | Check the half-speed command to the fan<br>LI_K1_GMVC=1(digital input.xml)<br>-Check with a rotation sense measurement instrument that the rotation sense is anti-clockwise |
|  |  |                                  |   |
| OK  | NOK   | LO_CK1_GMV=0                     | Check the removal of the half-speed command to the fan<br>LI_K1_GMVC=0(digital input.xml)   |
|  |  |                                  |   |
| OK  | NOK   | LO_CK2_GMV=1                     | Check the full-speed command to the fan<br>LI_K2_GMVC=1(digital input.xml)<br>-Check with a rotation sense measurement instrument that the rotation sense is anti-clockwise |
|  |  |                                  |   |
| OK  | NOK   | LO_CK2_GMV=0                     |   |

|   |              |                                     |   |                                     |
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| Confirm Status   | Variable to force / action to do | Check  |
|--|----------------------------------|--|
| <input checked="" type="checkbox"/> <input type="checkbox"/> | LO_INH_TR=0<br>LO_CK_IC=0        | Check that there is no 110 V on pin 31 of XCB2;<br>LED "LO_INH_TR" OFF                   |
| <input checked="" type="checkbox"/> <input type="checkbox"/> | LO_BRK_FLT=1                     | Check that there is continuity between pin 29 and<br>30 of XCB2 ; LED "LO_BRK_FLT" ON    |
| <input checked="" type="checkbox"/> <input type="checkbox"/> | LO_BRK_FLT=0                     | Check that there is no continuity between pin 29<br>and 30 of XCB2; LED "LO_BRK_FLT" OFF |

| Signal Label   | Check variable                   | Power supply Measured on the simulator AY317642 test point | Current / voltage to apply                    | TrainTracer must read   | Record the Value |
|----------------|----------------------------------|--|---|---|------------------|
| AI_FVMD        | ai_uf_fil                        | 48 vdc   | Apply 100 Vrms                                | 670 Vrms +/-5%  | <b>48.43V</b>    |
| AI_LVMD        | ai_vline                         | 30 vdc   | Apply 100 Vrms                                | 450 Vrms +/-5%  | <b>30.03V</b>    |
| AI_IR          | ff7_events_fault_recorder1/ai_ir | 48 vdc   | Apply 20 Arms                                 | 35 Arms +/-5%   | <b>48.43V</b>    |
| AI_IS          | ff7_events_fault_recorder1/ai_is | 48 vdc   | Apply 20 Arms                                 | 35 Arms +/-5%   | <b>48.42V</b>    |
| AI_IDC         | ai_idc                           | 48 vdc   | Apply 20 Arms                                 | 35 Arms +/-5%   | <b>48.42V</b>    |
| AI_IDIFF       | ai_idiff                         | 48 vdc   | Apply 20 Arms                                 | 35 Arms +/-5%   | <b>48.42V</b>    |
| AI_LOAD_PRES   | AI_LOAD_PRES                     | +15Vdc   | Put a 1k $\Omega$ resistor between XCSB/53-54 | 15 mA +/-5%   | <b>17V</b>       |
| AI_BR_CTR_PRES | AI_BR_CTR_PRES                   | +15Vdc   | Put a 1k $\Omega$ resistor between XCSB/5-6   | 15 mA +/-5%   | <b>14.275V</b>   |
| AI_CTS         | ai_cts                           | +15Vdc   |   | Check that the temperature read is the same of the temperature of the environment | <b>33.05V</b>    |











|   |              |                                     |   |                                     |
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| Signal Label | Check variable  | Power supply Measured on the simulator AY317642 test point | Current / voltage to apply | TrainTracer must read                  | Record the Value |
|--------------|---|--|----------------------------|--|------------------|
|              |   |  |                            | (measured with an external thermometer |                  |
| AI_CPS       | ai_cps  | +15Vdc   |                            | Verify pump pressure 1,6 bar +/-5%     | <b>1.640bar</b>  |
| XMD_Diode    | Put the DMM on DIODE mode and test PIN-42 & PIN-44 on XCB plug and measure the Voltage drop across the DIODE.                 |  |                            | A_DIODE VS K_DIODE                     | <b>0.517</b>     |
| XMD_Diode    | Put the DMM on DIODE mode and test PIN-42 on XCB plug and PIN-19 on XCB_F plug and measure the Voltage drop across the DIODE. |  |                            | A_DIODE VS K_DIODE                     | <b>0.517</b>     |
| XMD_Diode    | Swap the DMM leads to verify if the DIODE is blocking   |  |                            | K_DIODE VS A_DIODE                     | <b>OPEN</b>      |

## TESTING THE SPEED SENSORS


**NB: Refer to the test procedure (2.5.4)**

| Speed sensor | Pins on connector XCST | Voltage to be measured               | STATUS  |   |
|--------------|------------------------|--------------------------------------|---|---|
| MOT1_SP1/SP2 | 8, 11                  | 15V (+/- 5%) (led M1 on simulator ON |  |  |
| MOT2_SP1     | 42, 44                 | 15V (+/- 5%) (led M2 on simulator ON |  |  |
| MOT3_SP1     | 64, 66                 | 15V (+/- 5%) (led M3 on simulator ON |  |  |
| MOT4_SP1     | 98, 100                | 15V (+/- 5%) (led M4 on simulator ON |  |  |

## ANALOG OUTPUT TEST

Reset the TBCU and execute the service brake is controlled by generating a PWM signal, 0/15V 500 Hz. The waveform can be verified with an oscilloscope or with a multimeter in AC volt connecting the multimeter cable to the test point (29-39) on the simulator box.



|   |               |                       |  |                       |
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|  |      |
|--|------|
| Close the switches on the simulator: LI_NOT_INHIB, LI_TH1_LC, LI_TH2_LC, LI_CAR_ID1, LI_MCB400, LI_HSCB_OP, ( Check with that the related variable goes "TRUE" with TrainTracer dashboard "Digital input") | TRUE |
| Send the prm file "PRM_MAINT_AUTHOR"   | DONE |
| Send the prm file "LOW VOLTAGE TEST" and verify that the precharge is done (K_ICC and K-IC closed) and after 30 second fans and pump of the cooling unit start.  | TRUE |
| Close the switch LI_NEB on the simulator   | DONE |
| Send a prm file "OPEN LINE CONTACTOR" and verify that K_ICC (LI_K_CCC=0, LI_K_ICC=0) open and pump and fan stop.   | TRUE |
| Close the LI_HSCB_HOLD switch on simulator   | DONE |
| Verify that the orange light "Ready to start" on the HVPS remote control, placed on the side of the control desk, is light up.   | TRUE |
| Press the button start on the HVPS remote control  | DONE |
| Press the button "CLOSE HVC"   | DONE |
| Press the button V> ; V< for regulate the HV output  | DONE |
| Supply the traction converter with high voltage, at around 2200 volt   | DONE |
| Verify that the variable ai_vline = 3000V  | TRUE |
| The precharge sequence must start (LI_K_ICC=TRUE)  | TRUE |
| Raise voltage to 3kV then wait until the start of half speed ventilation and the pump  | DONE |

## INVERTER TEST

Open on the Dashboard INVERTER TEST

| Execute the below action to prepare for INVERTER testing                                       | Results  |
|--|----------|
| Write the variables: Inh_dtcomp_open = 1   | DONE     |
| Open the dashboard speed sensors1.xml and verify the variables are TRUE: Flt_speed_axle_0 to 5 | TRUE     |
| Force dsp2_wr_inv_b_manual_inv=1   | DONE     |
| Force dsp2_WR_inv_A_mod_manual=0,05  | DONE     |
| Force dsp2_wr_inv_b_fs_manual=1  | DONE     |
| Force dsp2_wr_inv_fq_fs_manual=45  | DONE     |
| Force tcu_b_dem_start_inv=1  | DONE     |
| Record the value of ai_ir_rms=200A +/- 15A   | 216.346A |
| Record the value of ai_is_rms=200A +/- 15A   | 217.411A |
| Run the INVERTER Test for 5min   | DONE     |

## CHOPPER TEST

Open on the Dashboard CHOPPER TEST

|   |              |                                     |   |                                     |
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| Variable to force    | Pins on connector XCSB where to connect oscilloscope               | Expected value<br>Check with multimeter   | Results |
|----------------------|--|---|---------|
| Mech_a_pwm_brake= 50 | 29,30(test point on simulator)<br>Between “-” and “PWM_brake_TEST” | Square wave 0/15 V 50Hz and 50%<br>duty-cycle(7,5V) VAC measured with<br>a multimeter | DONE    |

| Send Parameters                          | Verify if the variable is TRUE or FALSE   | Results |
|--|---|---------|
| Send parameter file setup<br>valvole.xml | Verify that the variable CEV3_RetourC1 and<br>CEV3_RetourC2 in dashboard “check_WDG_relay.xml”<br>are <b>TRUE</b> | TRUE    |
| Send parameter file<br>AO_WSP_ADM1.xml   | Verify that LED on simulator AO_WSP_ADM1 lamp   | TRUE    |
| Send parameter file<br>AO_WSP_ADM2.xml   | Verify that LED on simulator AO_WSP_ADM2 lamp   | TRUE    |
| Send parameter file<br>AO_WSP_DUMP1.xml  | Verify that the LED's AO_WSP_ADM1/AO_WSP_DUMP1<br>blinking on simulator   | TRUE    |
| Send parameter file<br>AO_WSP_DUMP2.xml  | Verify that the LED's AO_WSP_ADM2/AO_WSP_DUMP2<br>blinking on simulator   | TRUE    |

### HIGH VOLTAGE TEST

| Execute the below action to prepare for High Voltage and Modules testing  | Results |
|---|---------|
| Power off 110V supply on simulator to reset the TBCU  | DONE    |
| Switch off the Function wave generator  | DONE    |
| Connect +HV(TR1) and –HV(TR5), and the L load for the inverter (TR7,TR9,TR11,<br>according with page 2 of the traction converter schematics | DONE    |
| Connect the Brake rheostat to point TR12,TR15 of the traction converter   | DONE    |
| Connect the fast discharge resistor (from cubicle HV4) to pin2 of CF1 Dc link filter<br>condenser   | DONE    |
| Select the product under test to TC on the Control Desk   | DONE    |
| Select the HV catenary type to DC on the Control Desk   | DONE    |
| Close the switch K400 on the Control Desk   | DONE    |
| Close the switch FAN TC on the Control Desk   | DONE    |
| Switch on the main switch of the HVPS   | DONE    |
| Switch on the battery simulator   | DONE    |
| Press the reset button on the front of the HVPS   | DONE    |
| Close the Switch HVPS Authorization on the control desk   | DONE    |
| Press the Button “start infrared” on the control desk   | DONE    |
| Press the button “OUT of earth” on the control desk   | DONE    |
| Switch on the 110volt DC on the simulator and make the connection to the TBCU with<br>Train tracer  | DONE    |
| Send the High voltage.xml on Train_Tracer dashboard   | DONE    |



|   |                      |                                     |   |                                     |
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|---|----------------------|-------------------------------------|---|-------------------------------------|

**FUNCTIONAL TEST OPERATORS**

**KHUTSO MATLEJOANE**

**SIPHO SHAPULA**

**DATE OF FUNCTIONAL TEST:** 08/03/2024

**1. Updated by:**

A N. Mawelela B M.Mokheseng  
C S. Matlala

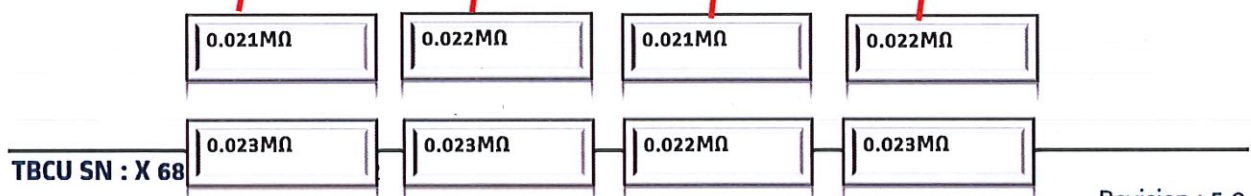
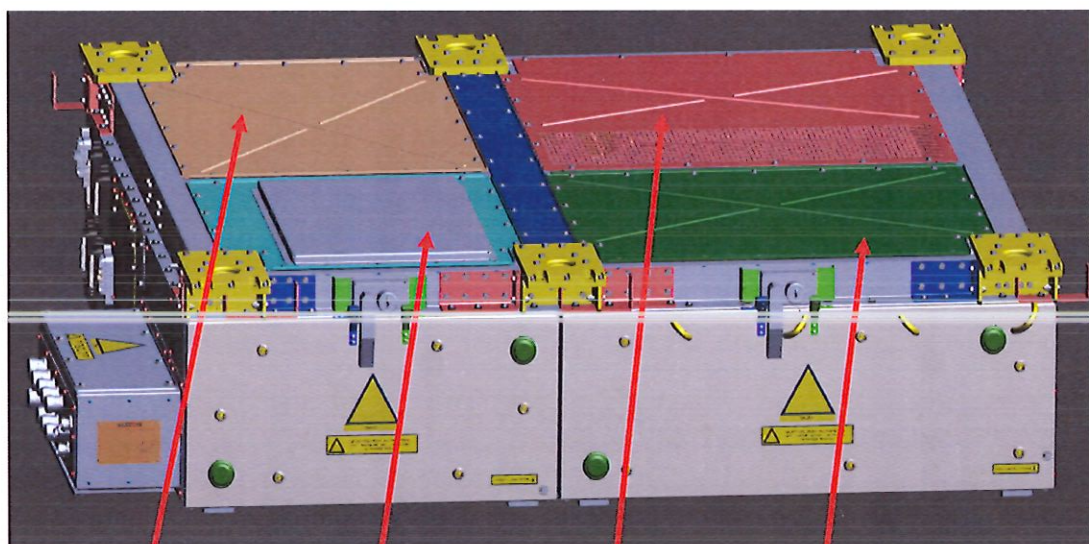


|   |               |                              |   |                                     |
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| Execute the below action to prepare for CHOPPER testing  | Results |
|--|---------|
| Force the variable K_BC_DC_OL_FORCED =0,03 to enable in open loop the rheostatic chopper after opening the Dashboard "anello aperto chopper.xml"               | DONE    |
| Verify that the variables ai_idc= 10Amp $\pm 5^\circ$ and record the Value   | 11.024A |
| Run the Chopper for 3 minutes  | DONE    |
| Force K_BC_DC_OL_FORCED =0 for stop chopper test   | DONE    |
| Send a prm file "OPEN LINE CONTACTOR" and verify that the precharge/line contactors are opens and pump-fans stops and the DC bus is discharged: ai_uf_fil < 50 | DONE    |
| Stop the HVPS with the button "STOP" on the remote control and switch off the 400 VAC and 110 Vdc.   | DONE    |
| Disconnect the TC from the test bench  | DONE    |
| Verify the level of the COOLANT, top up and record   | 2ℓ      |
| Total COOLANT on the TRACTION CONVERTER  | 17.774ℓ |

## COVER TEST

Record the values of the cover test on the blocks provided below.



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