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# Introduction

This document lists and describes verification tests that have to be achieved during the commissioning of the LEBT Vacuum Control Systems [3].

# Issuing organisation

This document is written by Integrated Control Division from the Machine Directorate of ESS.

# System characteristics

## System purpose

The Proton Beam Vacuum Control System [1] is the system that controls vacuum equipment’s installed on the LINAC at ESS.

## System overview

The Proton Beam Vacuum System [1] is split into several subsystems. Each of these subsystems has its own control sub-system.

This document is dedicated to the LEBT Vacuum Control subsystem [3].

Vacuum devices that this document refers to are represented on vacuum layout [8] of the LEBT Vacuum System.

LEBT Vacuum Control System is listed into the ESS Functional Breakdown Structure [10]: =ESS.ACC.G01.G01.

## Notation for description

Devices that this document refers to are identified with their device mnemonic defined by the “Vacuum Symbols and ICS naming” [5] document and by their names issued from the ESS Naming Service [11].

Hardware electrical interfaces that this document refers to are defined by the electrical diagram designed [6] by Vacuum Group, part of the Specialized Technical Services Group of the Accelerator Division of the Machine Directorate

# Verification identification

Any anomalies founds during the verification tests shall be identified and solved. The following test won’t be fulfilled until the entire test is compliant with the expected result.

## Support Environment

All the vacuum components that this document refers to are located in the accelerator tunnel [10]: **+ESS.G01.090.1001.100**.

All vacuum control equipment and control equipment that this document refers to are located in a rack in the Front End building [10]: **+ESS.G01.090.5005.102.001**.

Involved personnel to perform these tests are both ICS division and vacuum group.

The verification shall involve at least one person on site to validate that the remotely controlled hardware device targeted by the test is the desired one to be actuated. This person is preferably the representative of the Vacuum Group.

The verification test shall involve at least one person on the control room or using control room operation screen to assess status feedback on the GUI screen. This person is preferably the representative of the ICS Division.

Responsible officer for this test is the Vacuum Group or its representative.

## Configuration

Configuration to be checked during the validation test:

* Vacuum System: Proton Beam Vacuum System (**=ESS.ACC.G01.K01**).
* Vacuum Sub-system: LEBT Vacuum System (**=ESS.ACC.G01.G01.K01**).
* Vacuum Layout: ISRC + LEBT Vacuum Diagram [8].
* Electrical Diagram: Accelerator Vacuum Controls - Wiring diagrams vacuum control racks [6].

Control configuration:

* Graphical Interface: Proton-Beam-Vacuum.bob
* EPICS IOC:
  + VacS-ACCV:VAC-IOC-11010.
  + VacS-ACCV:VAC-IOC-DAQ001
* PLC Project: =ESS.ACC.G01.K01.ap14.

## Setup

Vacuum system shall be leak tight and ready to be pumped to perform the following tests.

# Test Cases “LEBT-010:VAC-VPSU" (Rack Power Supply)

## Test case LEBT-010:VAC-VPSU-00000

### Support Environment.

See 4.1 for generic support environment.

### Configuration

See 4.2 for generic configuration.

### Setup

See 4.3 for generic setup.

All the vacuum control equipment shall be disconnected from the power strip and any device should be energized before starting tests describe by Table 1.

### Primary pump & Primary Pump Controller Verification: Procedure

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VPSU-00010: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| No requirements | **No requirements** | **No requirements** | **No requirements** | **No requirements** | **No requirements** |

#### LEBT-010:VAC-VPSU-00000: Procedure of verification

Table 1 LEBT-010:VAC-VPSU-00000: Local Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPSU-00010\_VT-00001 | Verification of the 3-phases power supply. | Tripp -FC41 in ESS.G01.90.5005.102.001.U10. | Assess the “400VAC Error”. | □ |
| LEBT-010:VAC-VPSU-00010\_VT-00002 | Verification of the DC power supply - Warning Limit. | Connect a calibrated load on the 24VDC power supply. | Assess the “24VDC Warning. | □ |
| LEBT-010:VAC-VPSU-00010\_VT-00003 | Verification of the DC power supply - Error. | Connect a calibrated load on the 24VDC power distribution module: -QB10 in ESS.G01.90.5005.102.001.U10. | Assess the “24VDC Error”. |  |
| Wait the automatic reset of the error. | Assess the “Auto-Reset” status. | □ |
| Disconnect the calibrated load. | Assess that the error disappear. | □ |
| Re-connect the calibrated load to trip the power supply and wait the Auto-Reset time-out. | Assess the “24VDC Error”.  Assess the “Auto-Reset ” failure status on the GUI panel. | □ |
| LEBT-010:VAC-VPSU-00010\_VT-00004 |  | Reset the error from the GUI. | Assess that the “Error” and “CB Fail” status has disappeared on the GUI panel. | □ |

# Test Cases “ISRC-010:VAC" (Ion Source)

## Test case ISRC-010:VAC-VPM-00011

### Pressure Manometer Verification: Support Environment.

See 4.1 for generic support environment.

### Pressure Manometer Verification: Configuration

See 4.2 for generic configuration.

### Pressure Manometer Verification: Setup

See 4.3 for generic setup.

### Pressure Manometer Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the device.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### ISRC-010:VAC-VPM-00011: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| ISRC-010:VAC-VPM-00011\_CR.01 | ISRC-010:VAC-VPM-00011\_MR.01 | ISRC-010:VAC-VPM-00011\_DAR.01 | ISRC-010:VAC-VPM-00011\_CsR.01 | ISRC-010:VAC-VPM-00011\_SR.01 | ISRC-010:VAC-VPM-00011\_IR.01 |
|  | ISRC-010:VAC-VPM-00011\_MR.02 |  |  |  |  |
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#### ISRC-010:VAC-VPM-00011: Procedure of verification

ISRC-010:VAC-VPM-00011\_VT-00001: Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 2 ISRC-010:VAC-VPM-00011: Control & Monitoring.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| ISRC-010:VAC-VPM-00011\_VT-00002 | Assess the pressure value. | Read pressure on the GUI panel. | Assess the pressure on the GUI panel. | □ |
| Corroborate the pressure on the GUI panel with the pressure display on the monometer. | □ |
| ISRC-010:VAC-VPM-00011\_VT-00003 | Verify the pressure archiving. | Open archiving appliance. | Assess the value of the archived pressure. | □ |
| ISRC-010:VAC-VPM-00011\_VT-00004 | Test the low pressure alarm. | Create or simulate a drop-down of the pressure read by the pressure manometer. | Assess that the alarm is active on the control room. | □ |
| It is also possible to modify the alarm threshold. | Write down the initial threshold before modification:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Write down the threshold set for the test:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Assess that the alarm is active on the control room. | □ |
| Write down value set after the test:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

## Test case ISRC-010:VAC-VVA-01100

### Angle Valves & Gates Valves Verification: Support Environment.

See 4.1 for generic support environment.

### Angle Valves & Gates Valves Verification: Configuration

See 4.2 for generic configuration.

### Angle Valves & Gates Valves Verification: Setup

See 4.3 for generic setup.

Angle valve or gate valve shall be connected and shall not be open before starting the test.

A simulator can be used instead of the valve to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the valve.

The GUI panel shall show that the valve to be check is free of errors before starting the verification procedure.

### Angle Valves & Gates Valves Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the valve.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### ISRC-010:VAC-VVA-01100: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to the requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| *ISRC-010:VAC-VVA-01100\_CR.01* | *ISRC-010:VAC-VVA-01100\_MR.01* | *ISRC-010:VAC-VVA-01100\_DAR.01* | *ISRC-010:VAC-VVA-01100\_CsR.01* | *ISRC-010:VAC-VVA-01100\_SR.01* | *ISRC-010:VAC-VVA-01100\_IR.01* |
| *ISRC-010:VAC-VVA-01100\_CR.02* | *ISRC-010:VAC-VVA-01100\_MR.02* | *ISRC-010:VAC-VVA-01100\_DAR.02* |  | **LEBT-010:VAC-VEG-1001\_SR.01** |  |
| *ISRC-010:VAC-VVA-01100\_CR.03* | *ISRC-010:VAC-VVA-01100\_MR.03* | *ISRC-010:VAC-VVA-01100\_DAR.03* |  |  |  |
|  | *ISRC-010:VAC-VVA-01100\_MR.04* |  |  |  |  |
|  | *ISRC-010:VAC-VVA-01100\_MR.05* |  |  |  |  |
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#### ISRC-010:VAC-VVA-01100: Procedure of verification

ISRC-010:VAC-VVA-01100\_VT-00001: Pump Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 3 ISRC-010:VAC-VVA-01100: Remote & Manual Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| ISRC-010:VAC-VVA-01100\_VT-00002 | Assess the closed status of the valve. | No action required because the valve shall already be closed. | Assess the “Close” status on the GUI panel. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00003 | Assess the “Undefined” status of the valve. | Disconnect the control cable from the connector on the valve.  Wait that “Undefined” time-out elapsed. | Assess the “Undefined” status on the GUI panel. | □ |

Table 4 ISRC-010:VAC-VVA-01100: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| ISRC-010:VAC-VVA-01100\_VT-00004 | Verify the manual remote control of the valve. | Set “Manual” mode using the detailed GUI panel of the valve. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before opening the valve. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00005 | Verify the opening function. | Verify that there are no active interlocks applied to the valve.  Open the valve through the GUI panel. | Assess the “Open” status on the GUI panel. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00006 | Verify the closing function. | Close the valve through the GUI panel. | Assess the “Close” status on the GUI panel. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 5 ISRC-010:VAC-VVA-01100: First “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| ISRC-010:VAC-VVA-01100\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| ISRC-010:VAC-VVA-01100\_VT-00009 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00010 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 6 ISRC-010:VAC-VVA-01100: Second “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| ISRC-010:VAC-VVA-01100\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| ISRC-010:VAC-VVA-01100\_VT-00016 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00017 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 7 ISRC-010:VAC-VVA-01100: First “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| ISRC-010:VAC-VVA-01100\_VT-00021 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00022 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| ISRC-010:VAC-VVA-01100\_VT-00023 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00024 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00025 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00026 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00027 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 8 ISRC-010:VAC-VVA-01100: Second “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| ISRC-010:VAC-VVA-01100\_VT-00028 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00029 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| ISRC-010:VAC-VVA-01100\_VT-00030 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00031 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00032 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00033 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00034 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 9 ISRC-010:VAC-VVA-01100: Third “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| ISRC-010:VAC-VVA-01100\_VT-00035 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00036 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| ISRC-010:VAC-VVA-01100\_VT-00037 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00038 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00039 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00040 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| ISRC-010:VAC-VVA-01100\_VT-00041 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

Table 10 ISRC-010:VAC-VVA-01100: Pressure Interlock (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| ISRC-010:VAC-VVA-01100\_VT-00042 | Verify the closure of the valve in case of raise of the pressure into the first vacuum sector. | Start the vacuum system and set the nominal conditions to produce beam. Open the valve. | Assess that the valve is open. | □ |
| Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VGC-10000** (Relay **8**)  Write down the actual setting of the relay:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
|  | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the closure of the valve. | □ |
| Re-establish the interlock. | Interlock is healthy. | □ |
| Write down the threshold set after the test:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

Table 11 ISRC-010:VAC-VVA-01100: Access Interlock (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| ISRC-010:VAC-VVA-01100\_VT-00043 | Verify the closure of the valve in case of access of person in the tunnel. | Start the vacuum system and set the nominal conditions to produce beam. Open the valve. | Assess that the valve is open. | □ |
| Request an access to the MCR or simulate it according to the electrical diagram [6]. | Assess that the valve closes. | □ |

## Test case ISRC-010:VAC-VVMC-01100

### Mass Flow Meter & Mass Flow Meter Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Mass Flow Meter & Mass Flow Meter Controller Verification: Configuration

See 4.2 for generic configuration.

### Mass Flow Meter & Mass Flow Meter Controller Verification: Setup

See 4.3 for generic setup.

Mass flow meter shall be under the nominal vacuum range before proceeding to the test.

Mass flow meter shall be connected and shall be close before starting the test.

Mass flow meter controller shall be energized and shall not display any error to start the verification procedure.

### Mass Flow Meter & Mass Flow Meter Controller Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the mass flow meter.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### ISRC-010:VAC-VVMC-01100: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| ISRC-010:VAC-VVMC-01100\_CR.01 | ISRC-010:VAC-VVMC-01100\_MR.01 | ISRC-010:VAC-VVMC-01100\_DAR.01 | ISRC-010:VAC-VEVMC-01100\_CsR.01 | ISRC-010:VAC-VEVMC-01100\_SR.01 | ISRC-010:VAC-VEVMC-01100\_IR.01 |
|  | ISRC-010:VAC-VVMC-01100\_MR.02 |  | ISRC-010:VAC-VEVMC-02200\_CsR.01 | ISRC-010:VAC-VEVMC-02200\_SR.01 | ISRC-010:VAC-VEVMC-02200\_IR.01 |
|  | ISRC-010:VAC-VVMC-01100\_MR.03 |  | ISRC-010:VAC-VEVMC-10001\_CsR.01 | ISRC-010:VAC-VEVMC-10001\_SR.01 | ISRC-010:VAC-VEVMC-10001\_IR.01 |
|  | ISRC-010:VAC-VVMC-01100\_MR.04 |  |  |  |  |
|  | ISRC-010:VAC-VVMC-01100\_MR.05 |  |  |  |  |
|  | ISRC-010:VAC-VVMC-01100\_MR.06 |  |  |  |  |
|  | ISRC-010:VAC-VVMC-01100\_MR.07 |  |  |  |  |
|  | ISRC-010:VAC-VVMC-01100\_MR.08 |  |  |  |  |
|  | ISRC-010:VAC-VVMC-01100\_MR.09 |  |  |  |  |
|  | ISRC-010:VAC-VVMC-01100\_MR.10 |  |  |  |  |
|  | ISRC-010:VAC-VVMC-01100\_MR.11 |  |  |  |  |

#### ISRC-010:VAC-VVMC-01100: Procedure of verification

ISRC-010:VAC-VVMC-01100\_VT-00001: Pump Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 12 ISRC-010:VAC-VVMC-01100: Control & Monitoring (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| ISRC-010:VAC-VVMC-01100\_VT-00002 | Assess the partial opening. | Partially open the mass flow meter through the GUI panel. | Assess the partial opening on the GUI panel. | □ |
| Assess the partial opening on the mass flow meter controller | □ |
| ISRC-010:VAC-VVMC-01100\_VT-00003 | Assess the partial closing. | Partially close the mass flow meter through the GUI panel. | Assess the partial closing on the GUI panel. | □ |
| Assess the partial closing on the mass flow meter controller | □ |

Table 13 ISRC-010:VAC-VVMC-01100: Control & Monitoring (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| ISRC-010:VAC-VVMC-01100\_VT-00004 | Verify that the parameters of the mass flow meter can be remotely modified. | Choose a parameter relative to the gauge. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| ISRC-010:VAC-VVMC-01100\_VT-00005 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

# Test Cases “LEBT-010:VAC" (First Vacuum Sector)

## Test case LEBT-010:VAC-VPDP-00031

### Primary Pump & Primary Pump Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Primary Pump & Primary Pump Controller Verification: Configuration

See 4.2 for generic configuration.

### Primary Pump & Primary Pump Controller Verification: Setup

See 4.3 for generic setup.

Primary pump shall be connected and shall not be running before starting the test.

Primary pump controller shall be energized, shall not display any error and control switch shall be on “PLC” position to start the verification procedure.

The GUI panel shall show that the controller to be check is free of errors before starting the verification procedure.

### Primary Pump & Primary Pump Controller Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the pump.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VPDP-00031: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VPDP-00031\_CR.01 | LEBT-010:VAC-VPDP-00031\_MR.01 | LEBT-010:VAC-VPDP-00031\_DAR.01 | LEBT-010:VAC-VPDP-00031\_CsR.01 | LEBT-010:VAC-VPDP-00031\_SR.01 | LEBT-010:VAC-VPDP-00031\_IR.01 |
| LEBT-010:VAC-VPDP-00031\_CR.02 | LEBT-010:VAC-VPDP-00031\_MR.02 |  |  |  |  |
| LEBT-010:VAC-VPDP-00031\_CR.03 | LEBT-010:VAC-VPDP-00031\_MR.03 |  |  |  |  |
| LEBT-010:VAC-VPDP-00031\_CR.04 | LEBT-010:VAC-VPDP-00031\_MR.04 |  |  |  |  |
|  | LEBT-010:VAC-VPDP-00031\_MR.05 |  |  |  |  |
|  | LEBT-010:VAC-VPDP-00031\_MR.06 |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VPDP-00031: Procedure of verification

LEBT-010:VAC-VPDP-00031\_VT-00001: Pump Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 14 LEBT-010:VAC-VPDP-00031: Local Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPDP-00031\_VT-00002 | Control the pump disconnection protection. | On the tunnel, after having verified that the pump is not running, disconnect the power supply connector. | Assess the corresponding error on the GUI panel: “Pump Not Connected”. | □ |
| Assess the corresponding error on the primary pump controller: the LED “Cable Connected” is off. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00003 | Reset the pump disconnected error. | After having assessed the disconnected error, reconnect the power supply connector.  Reset the error from the GUI. | Assess that the “Pump Not Connected” error has disappeared on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Cable Connected” is on. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00004 | Assess the “Local Control” status. | Actuate the “Control” switch to the “Local” position on the primary pump controller. | Assess the “Local” Status on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Local Control” is on. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00005 | Start the pump by the primary pump controller. | Make sure that the system is in a safe condition before starting the pump. | Assess that the system is in a safe condition to start the pump. | □ |
| Actuate the “Control” switch to the “ON” position on the primary pump controller. | Verify that the pump in running on the tunnel. | □ |
| Assess the “On” status on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Pump ON” is on. | □ |

Table 15 LEBT-010:VAC-VPDP-00031: Local Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPDP-00031\_VT-00006 | Stop the pump by the primary pump controller. | Actuate the “Control” switch to the “OFF” position on the primary pump controller. | Assess the “Off” status on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Pump ON” is off. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00007 | Verify the error status. | Open primary pump controller crate and trip the circuit breaker.  Close primary pump controller crate.  Actuate “Control” switch to the “ON” position on the primary pump controller.  Wait error timeout. | Assess the “CB Fail” status on the GUI panel. | □ |
| Assess the “Error” status on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Error” is on. | □ |
| Actuate the “Control” switch to the “OFF” position on the primary pump controller. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00008 | Eliminate the previous error. | Actuate “Control” switch to the “OFF” position on the primary pump controller.  Open primary pump controller crate, close the circuit breaker and close primary pump controller crate. | Circuit breaker is healthy and the “Error” LED is on. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00009 | Reset the pump error (remotely). | Reset the error from the GUI. | Assess that the “Error” and “CB Fail” status has disappeared on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Error” is off. | □ |

Table 16 LEBT-010:VAC-VPDP-00031: Local Control (Part 3).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPDP-00031\_VT-00010 | Verify the “Remote” status. | Actuate the “Control” switch to the “PLC” position on the primary pump controller. | Assess the “Remote” status on the GUI panel: “Local” status shall have disappeared. | □ |
| Assess the corresponding status on the primary pump controller: the LED “PLC Control” is on and the LED “Local Control” is off. | □ |

Table 17 LEBT-010:VAC-VPDP-00031: Remote Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPDP-00031\_VT-00011 | Verify the manual remote control of the pump. | Set “Manual” mode using the detailed GUI panel of the pump. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before starting the pump. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00012 | Start the primary pump remotely. | Start the primary pump through the GUI command | Assess the “On” status on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Pump ON” is on. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00013 | Stop the primary pump remotely. | Stop the primary pump through the GUI command | Assess the “Off” status on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Pump ON” is off. | □ |

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| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 18 LEBT-010:VAC-VPDP-00031: “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPDP-00031\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00009 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00010 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 19 LEBT-010:VAC-VPDP-00031: “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPDP-00031\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |  |
| LEBT-010:VAC-VPDP-00031\_VT-00016 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00017 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPDP-00031\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VVA-00031

### Angle Valves & Gates Valves Verification: Support Environment.

See 4.1 for generic support environment.

### Angle Valves & Gates Valves Verification: Configuration

See 4.2 for generic configuration.

### Angle Valves & Gates Valves Verification: Setup

See 4.3 for generic setup.

Angle valve or gate valve shall be connected and shall not be open before starting the test.

A simulator can be used instead of the valve to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the valve.

The GUI panel shall show that the valve to be check is free of errors before starting the verification procedure.

### Angle Valves & Gates Valves Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the valve.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VVA-00031: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to the requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VVA-00031\_CR.01 | LEBT-010:VAC-VVA-00031\_MR.01 | LEBT-010:VAC-VVA-00031\_DAR.01 | LEBT-010:VAC-VVA-00031\_CsR.01 | LEBT-010:VAC-VVA-00031\_SR.01 | LEBT-010:VAC-VVA-00031\_IR.01 |
| LEBT-010:VAC-VVA-00031\_CR.02 | LEBT-010:VAC-VVA-00031\_MR.02 | LEBT-010:VAC-VVA-00031\_DAR.02 |  |  |  |
|  | LEBT-010:VAC-VVA-00031\_MR.03 | LEBT-010:VAC-VVA-00031\_DAR.03 |  |  |  |
|  | LEBT-010:VAC-VVA-00031\_MR.04 |  |  |  |  |
|  | LEBT-010:VAC-VVA-00031\_MR.05 |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VVA-00031: Procedure of verification

LEBT-010:VAC-VVA-00031\_VT-00001: Valve Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 20 LEBT-010:VAC-VVA-00031: Remote & Manual Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00031\_VT-00002 | Assess the closed status of the valve. | No action required because the valve shall already be closed. | Assess the “Close” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00003 | Assess the “Undefined” status of the valve. | Disconnect the control cable from the connector on the valve.  Wait that “Undefined” time-out elapsed. | Assess the “Undefined” status on the GUI panel. | □ |

Table 21 LEBT-010:VAC-VVA-00031: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00031\_VT-00004 | Verify the manual remote control of the valve. | Set “Manual” mode using the detailed GUI panel of the valve. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before opening the valve. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00005 | Verify the opening function. | Verify that there are no active interlocks applied to the valve.  Open the valve through the GUI panel. | Assess the “Open” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00006 | Verify the closing function. | Close the valve through the GUI panel. | Assess the “Close” status on the GUI panel. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 22 LEBT-010:VAC-VVA-00031: First “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00031\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-00031\_VT-00009 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00010 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 23 LEBT-010:VAC-VVA-00031: Second “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00031\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VGP-00021** (Relay **1**) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-00031\_VT-00016 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00017 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 24 LEBT-010:VAC-VVA-00031: First “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00031\_VT-00021 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00022 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-VAC:VPDP-00031** (Nominal Speed) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-00031\_VT-00023 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00024 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00025 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00026 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00027 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 25 LEBT-010:VAC-VVA-00031: Second “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00031\_VT-00028 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00029 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-00031\_VT-00030 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00031 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00032 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00033 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00034 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 26 LEBT-010:VAC-VVA-00031: Third “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00031\_VT-00035 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00036 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-00031\_VT-00037 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00038 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00039 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00040 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00031\_VT-00041 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VGP-00021

### Gauge & Gauge Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Gauge & Gauge Controller Verification: Configuration

See 4.2 for generic configuration.

### Gauge & Gauge Controller Verification: Setup

See 4.3 for generic setup.

Gauge shall be under the nominal vacuum range before proceeding to the test.

Gauge shall be connected and shall not be measuring before starting the test.

Gauge controller shall be energized and shall not display any error to start the verification procedure.

A pre-calibrate simulator can be used instead of the gauge to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the gauge.

The GUI panel shall show that the gauge to be check is free of errors before starting the verification procedure.

### Gauge & Gauge Controller Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the gauge.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VGP-00021: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VGP-00021\_CR.01 | LEBT-010:VAC-VGP-00021\_MR.01 | LEBT-010:VAC-VGP-00021\_DAR.01 | LEBT-010:VAC-VGP-00021\_CsR.01 | LEBT-010:VAC-VEG-00011\_SR.01 | LEBT-010:VAC-VEG-00011\_IR.01 |
|  | LEBT-010:VAC-VGP-00021\_MR.02 |  |  |  | LEBT-010:VAC-VEG-10001\_IR.01 |
|  | LEBT-010:VAC-VGP-00021\_MR.03 |  |  |  | LEBT-010:VAC-VEG-10010\_IR.01 |
|  | LEBT-010:VAC-VGP-00021\_MR.04 |  |  |  | LEBT-010:VAC-VEG-20020\_IR.01 |
|  | LEBT-010:VAC-VGP-00021\_MR.05 |  |  |  |  |
|  | LEBT-010:VAC-VGP-00021\_MR.06 |  |  |  |  |
|  | LEBT-010:VAC-VGP-00021\_MR.07 |  |  |  |  |
|  | LEBT-010:VAC-VGP-00021\_MR.08 |  |  |  |  |
|  | LEBT-010:VAC-VGP-00021\_MR.09 |  |  |  |  |
|  | LEBT-010:VAC-VGP-00021\_MR.10 |  |  |  |  |
|  | LEBT-010:VAC-VGP-00021\_MR.11 |  |  |  |  |

#### LEBT-010:VAC-VGP-00021: Procedure of verification

LEBT-010:VAC-VGP-00021\_VT-00001: Gauge Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 27 LEBT-010:VAC-VGP-00021: Control & Monitoring (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGP-00021\_VT-00002 | Assess the gauge “Off” status. | No action required because the gauge shall already be off. Off, the gauge shall display a pressure of 1000 mbar. | Assess the gauge “Off” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-00021\_VT-00003 | Assess the gauge “On” status. | Stat the gauge. | Assess the “On” status of the gauge. | □ |
| Assess the “On” status of the gauge on the gauge controller. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-00021\_VT-00004 | Verify the pressure archiving. | Open archiving appliance. | Assess the value of the archived pressure. | □ |
| Assess the consistency between the row value and the scaled value. | □ |
| LEBT-010:VAC-VGP-00021\_VT-00005 | Verify the pressure archiving - Data Acquisition Alarm. | Disconnect or simulate a disconnection of the data acquisition analog measurement. | Assess the alarm on the control screen. | □ |

Table 28 LEBT-010:VAC-VGP-00021: Control & Monitoring (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGP-00021\_VT-00006 | Verify the over-range status. | Create or simulate an over-range pressure to be read by the gauge. | Assess the gauge “Over-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-00021\_VT-00007 | Verify the under-range status. | Create or simulate an under-range pressure to be read by the gauge. | Assess the gauge “Under-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-00021\_VT-00008 | Verify that the parameters of the gauges can be remotely modified. | Choose a parameter relative to the gauge. Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-00021\_VT-00009 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller.  Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

## Test case LEBT-010:VAC-VPT-02100

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Configuration

See 4.2 for generic configuration.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Setup

See 4.3 for generic setup.

Turbo-molecular pump shall be connected and shall not be running before starting the test.

Turbo-molecular pump controller shall be energized and shall not display any error to start the verification procedure.

The GUI panel shall show that the controller to be check is free of errors before starting the verification procedure.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the pump.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VPT-02100: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VPT-02100\_CR.01 | LEBT-010: VAC-VPT-02100\_MR.01 | LEBT-010:VAC-VPT-02100\_DAR.01 | LEBT-010:VAC-VPT-02100\_CsR.01 | LEBT-010:VAC-VPT-02100\_SR.01 | LEBT-010:VAC-VPT-02100\_IR.01 |
| LEBT-010:VAC-VPT-02100\_CR.02 | LEBT-010:VAC-VPT-02100\_MR.02 | LEBT-010:VAC-VPT-02100\_DAR.02 |  |  |  |
| LEBT-010:VAC-VPT-02100\_CR.03 | LEBT-010:VAC-VPT-02100\_MR.03 |  |  |  |  |
|  | LEBT-010:VAC-VPT-02100\_MR.04 |  |  |  |  |
|  | LEBT-010:VAC-VPT-02100\_MR.05 |  |  |  |  |
|  | LEBT-010:VAC-VPT-02100\_MR.06 |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VPT-02100: Procedure of verification

LEBT-010:VAC-VPT-02100\_VT-00001: Pump Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 29 LEBT-010:VAC-VPT-02100: Remote Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-02100\_VT-00002 | Verify the manual remote control of the pump. | Set “Manual” mode using the detailed GUI panel of the pump. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before starting the pump. | □ |
| LEBT-010:VAC-VPT-02100\_VT-00003 | Verify the error status. | Ensure that the turbomolecular pump controller is not running and disconnect the turbomolecular pump cable. Start the pump. | Assess the “Error” status on the GUI panel. | □ |
| Assess the “Error” status on the turbomolecular pump controller: the LED “ERROR” is on. | □ |
| LEBT-010:VAC-VPT-02100\_VT-00004 | Test the reset command. | After reconnecting the turbomolecular pump cable, reset the pump controller. | Assess that the “Error” status on the GUI panel disappears. | □ |
| Assess that the “Error” status on the turbomolecular pump controller disappear, the LED “ERROR” is off. | □ |
| LEBT-010:VAC-VPT-02100\_VT-00005 | Start the turbomolecular pump remotely. | Start the turbomolecular pump. | Assess the “On” status on the GUI panel.  Assess the “Accelerating” status on the GUI panel | □ |
| Assess the corresponding status on the primary pump controller: the LED “STATUS” is on. | □ |
| Assess the accelerating status show by the LEDs “LOAD” on the turbomolecular pump controller. | □ |

Table 30 LEBT-010:VAC-VPT-02100: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-02100\_VT-00006 | Assess turbomolecular pump controller parameters monitoring. | Assess evolution of dynamic parameters (converter frequency). | Control system monitors dynamic parameters. | □ |
| LEBT-010:VAC-VPT-02100\_VT-00007 | Stop the turbomolecular pump remotely. | Stop the turbomolecular pump. | Assess the “Off” status. | □ |
| Assess the corresponding status on the primary pump controller: “STATUS” LED is off. | □ |
| LEBT-010:VAC-VPT-02100\_VT-00008 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 31 LEBT-010:VAC-VPT-02100: “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-02100\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPT-02100\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VPT-02100\_VT-00009 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-02100\_VT-00010 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-02100\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-02100\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-02100\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 32 LEBT-010:VAC-VPT-02100: “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-02100\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPT-02100\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |  |
| LEBT-010:VAC-VPT-02100\_VT-00016 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-02100\_VT-00017 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-02100\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-02100\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-02100\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VVA-02100

### Angle Valves & Gates Valves Verification: Support Environment.

See 4.1 for generic support environment.

### Angle Valves & Gates Valves Verification: Configuration

See 4.2 for generic configuration.

### Angle Valves & Gates Valves Verification: Setup

See 4.3 for generic setup.

Angle valve or gate valve shall be connected and shall not be open before starting the test.

A simulator can be used instead of the valve to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the valve.

The GUI panel shall show that the valve to be check is free of errors before starting the verification procedure.

### Angle Valves & Gates Valves Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the valve.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VVA-02100: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to the requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VVA-02100\_CR.01 | LEBT-010:VAC-VVA-02100\_MR.01 | LEBT-010:VAC-VVA-02100\_DAR.01 | LEBT-010:VAC-VVA-02100\_CsR.01 | LEBT-010:VAC-VVA-02100\_SR.01 | LEBT-010:VAC-VVA-02100\_IR.01 |
| LEBT-010:VAC-VVA-02100\_CR.02 | LEBT-010:VAC-VVA-02100\_MR.02 | LEBT-010:VAC-VVA-02100\_DAR.02 |  |  |  |
|  | LEBT-010:VAC-VVA-02100\_MR.03 | LEBT-010:VAC-VVA-02100\_DAR.03 |  |  |  |
|  | LEBT-010:VAC-VVA-02100\_MR.04 |  |  |  |  |
|  | LEBT-010:VAC-VVA-02100\_MR.05 |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VVA-02100: Procedure of verification

LEBT-010:VAC-VVA-02100\_VT-00001: Valve Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 33 LEBT-010:VAC-VVA-02100: Remote & Manual Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-02100\_VT-00002 | Assess the closed status of the valve. | No action required because the valve shall already be closed. | Assess the “Close” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00003 | Assess the “Undefined” status of the valve. | Disconnect the control cable from the connector on the valve.  Wait that “Undefined” time-out elapsed. | Assess the “Undefined” status on the GUI panel. | □ |

Table 34 LEBT-010:VAC-VVA-02100: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-02100\_VT-00004 | Verify the manual remote control of the valve. | Set “Manual” mode using the detailed GUI panel of the valve. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before opening the valve. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00005 | Verify the opening function. | Verify that there are no active interlocks applied to the valve.  Open the valve through the GUI panel. | Assess the “Open” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00006 | Verify the closing function. | Close the valve through the GUI panel. | Assess the “Close” status on the GUI panel. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 35 LEBT-010:VAC-VVA-02100: First “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-02100\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VGP-00021** (Relay **1**) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-02100\_VT-00009 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00010 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 36 LEBT-010:VAC-VVA-02100: Second “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-02100\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-02100\_VT-00016 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00017 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 37 LEBT-010:VAC-VVA-02100: First “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-02100\_VT-00021 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00022 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-02100\_VT-00023 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00024 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00025 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00026 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00027 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 38 LEBT-010:VAC-VVA-02100: Second “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-02100\_VT-00028 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00029 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VPT-02100** (Nominal Speed) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-02100\_VT-00030 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00031 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00032 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00033 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00034 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 39 LEBT-010:VAC-VVA-02100: Third “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-02100\_VT-00035 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00036 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-02100\_VT-00037 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00038 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00039 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00040 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-02100\_VT-00041 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VPT-03100

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Configuration

See 4.2 for generic configuration.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Setup

See 4.3 for generic setup.

Turbo-molecular pump shall be connected and shall not be running before starting the test.

Turbo-molecular pump controller shall be energized and shall not display any error to start the verification procedure.

The GUI panel shall show that the controller to be check is free of errors before starting the verification procedure.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the pump.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VPT-03100: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VPT-03100\_CR.01 | LEBT-010: VAC-VPT-03100\_MR.01 | LEBT-010:VAC-VPT-03100\_DAR.01 | LEBT-010:VAC-VPT-03100\_CsR.01 | LEBT-010:VAC-VPT-03100\_SR.01 | LEBT-010:VAC-VPT-03100\_IR.01 |
| LEBT-010:VAC-VPT-03100\_CR.02 | LEBT-010:VAC-VPT-03100\_MR.02 | LEBT-010:VAC-VPT-03100\_DAR.02 |  |  |  |
| LEBT-010:VAC-VPT-03100\_CR.03 | LEBT-010:VAC-VPT-03100\_MR.03 |  |  |  |  |
|  | LEBT-010:VAC-VPT-03100\_MR.04 |  |  |  |  |
|  | LEBT-010:VAC-VPT-03100\_MR.05 |  |  |  |  |
|  | LEBT-010:VAC-VPT-03100\_MR.06 |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VPT-03100: Procedure of verification

LEBT-010:VAC-VPT-03100\_VT-00001: Pump Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 40 LEBT-010:VAC-VPT-03100: Remote Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-03100\_VT-00002 | Verify the manual remote control of the pump. | Set “Manual” mode using the detailed GUI panel of the pump. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before starting the pump. | □ |
| LEBT-010:VAC-VPT-03100\_VT-00003 | Verify the error status. | Ensure that the turbomolecular pump controller is not running and disconnect the turbomolecular pump cable. Start the pump. | Assess the “Error” status on the GUI panel. | □ |
| Assess the “Error” status on the turbomolecular pump controller: the LED “ERROR” is on. | □ |
| LEBT-010:VAC-VPT-03100\_VT-00004 | Test the reset command. | After reconnecting the turbomolecular pump cable, reset the pump controller. | Assess that the “Error” status on the GUI panel disappears. | □ |
| Assess that the “Error” status on the turbomolecular pump controller disappear, the LED “ERROR” is off. | □ |
| LEBT-010:VAC-VPT-03100\_VT-00005 | Start the turbomolecular pump remotely. | Start the turbomolecular pump. | Assess the “On” status on the GUI panel.  Assess the “Accelerating” status on the GUI panel | □ |
| Assess the corresponding status on the primary pump controller: the LED “STATUS” is on. | □ |
| Assess the accelerating status show by the LEDs “LOAD” on the turbomolecular pump controller. | □ |

Table 41 LEBT-010:VAC-VPT-03100: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-03100\_VT-00006 | Assess turbomolecular pump controller parameters monitoring. | Assess evolution of dynamic parameters (converter frequency). | Control system monitors dynamic parameters. | □ |
| LEBT-010:VAC-VPT-03100\_VT-00007 | Stop the turbomolecular pump remotely. | Stop the turbomolecular pump. | Assess the “Off” status. | □ |
| Assess the corresponding status on the primary pump controller: “STATUS” LED is off. | □ |
| LEBT-010:VAC-VPT-03100\_VT-00008 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 42 LEBT-010:VAC-VPT-03100: “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-03100\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPT-03100\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VPT-03100\_VT-00009 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-03100\_VT-00010 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-03100\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-03100\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-03100\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 43 LEBT-010:VAC-VPT-03100: “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-03100\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPT-03100\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |  |
| LEBT-010:VAC-VPT-03100\_VT-00016 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-03100\_VT-00017 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-03100\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-03100\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-03100\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VVA-03100

### Angle Valves & Gates Valves Verification: Support Environment.

See 4.1 for generic support environment.

### Angle Valves & Gates Valves Verification: Configuration

See 4.2 for generic configuration.

### Angle Valves & Gates Valves Verification: Setup

See 4.3 for generic setup.

Angle valve or gate valve shall be connected and shall not be open before starting the test.

A simulator can be used instead of the valve to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the valve.

The GUI panel shall show that the valve to be check is free of errors before starting the verification procedure.

### Angle Valves & Gates Valves Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the valve.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VVA-03100: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to the requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VVA-03100\_CR.01 | LEBT-010:VAC-VVA-03100\_MR.01 | LEBT-010:VAC-VVA-03100\_DAR.01 | LEBT-010:VAC-VVA-03100\_CsR.01 | LEBT-010:VAC-VVA-03100\_SR.01 | LEBT-010:VAC-VVA-03100\_IR.01 |
| LEBT-010:VAC-VVA-03100\_CR.02 | LEBT-010:VAC-VVA-03100\_MR.02 | LEBT-010:VAC-VVA-03100\_DAR.02 |  |  |  |
|  | LEBT-010:VAC-VVA-03100\_MR.03 | LEBT-010:VAC-VVA-03100\_DAR.03 |  |  |  |
|  | LEBT-010:VAC-VVA-03100\_MR.04 |  |  |  |  |
|  | LEBT-010:VAC-VVA-03100\_MR.05 |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VVA-03100: Procedure of verification

LEBT-010:VAC-VVA-03100\_VT-00001: Valve Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 44 LEBT-010:VAC-VVA-03100: Remote & Manual Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-03100\_VT-00002 | Assess the closed status of the valve. | No action required because the valve shall already be closed. | Assess the “Close” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00003 | Assess the “Undefined” status of the valve. | Disconnect the control cable from the connector on the valve.  Wait that “Undefined” time-out elapsed. | Assess the “Undefined” status on the GUI panel. | □ |

Table 45 LEBT-010:VAC-VVA-03100: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-03100\_VT-00004 | Verify the manual remote control of the valve. | Set “Manual” mode using the detailed GUI panel of the valve. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before opening the valve. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00005 | Verify the opening function. | Verify that there are no active interlocks applied to the valve.  Open the valve through the GUI panel. | Assess the “Open” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00006 | Verify the closing function. | Close the valve through the GUI panel. | Assess the “Close” status on the GUI panel. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 46 LEBT-010:VAC-VVA-03100: First “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-03100\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VGP-00021** (Relay **1**) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-03100\_VT-00009 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00010 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 47 LEBT-010:VAC-VVA-03100: Second “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-03100\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-03100\_VT-00016 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00017 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 48 LEBT-010:VAC-VVA-03100: First “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-03100\_VT-00021 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00022 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-03100\_VT-00023 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00024 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00025 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00026 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00027 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 49 LEBT-010:VAC-VVA-03100: Second “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-03100\_VT-00028 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00029 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VPT-03100** (Nominal Speed) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-03100\_VT-00030 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00031 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00032 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00033 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00034 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 50 LEBT-010:VAC-VVA-03100: Third “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-03100\_VT-00035 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00036 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-03100\_VT-00037 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00038 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00039 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00040 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-03100\_VT-00041 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VGP-10000

### Gauge & Gauge Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Gauge & Gauge Controller Verification: Configuration

See 4.2 for generic configuration.

### Gauge & Gauge Controller Verification: Setup

See 4.3 for generic setup.

Gauge shall be under the nominal vacuum range before proceeding to the test.

Gauge shall be connected and shall not be measuring before starting the test.

Gauge controller shall be energized and shall not display any error to start the verification procedure.

A pre-calibrate simulator can be used instead of the gauge to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the gauge.

The GUI panel shall show that the gauge to be check is free of errors before starting the verification procedure.

### Gauge & Gauge Controller Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the gauge.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VGP-10000: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VGP-10000\_CR.01 | LEBT-010:VAC-VGP-10000\_MR.01 | LEBT-010:VAC-VGP-10000\_DAR.01 | LEBT-010:VAC-VEG-10001\_CsR.01 | LEBT-010:VAC-VEG-10001\_SR.01 | LEBT-010:VAC-VEG-00011\_IR.01 |
|  | LEBT-010:VAC-VGP-10000\_MR.02 |  |  |  | LEBT-010:VAC-VEG-10001\_IR.01 |
|  | LEBT-010:VAC-VGP-10000\_MR.03 |  |  |  | LEBT-010:VAC-VEG-10010\_IR.01 |
|  | LEBT-010:VAC-VGP-10000\_MR.04 |  |  |  | LEBT-010:VAC-VEG-20020\_IR.01 |
|  | LEBT-010:VAC-VGP-10000\_MR.05 |  |  |  |  |
|  | LEBT-010:VAC-VGP-10000\_MR.06 |  |  |  |  |
|  | LEBT-010:VAC-VGP-10000\_MR.07 |  |  |  |  |
|  | LEBT-010:VAC-VGP-10000\_MR.08 |  |  |  |  |
|  | LEBT-010:VAC-VGP-10000\_MR.09 |  |  |  |  |
|  | LEBT-010:VAC-VGP-10000\_MR.10 |  |  |  |  |
|  | LEBT-010:VAC-VGP-10000\_MR.11 |  |  |  |  |

#### LEBT-010:VAC-VGP-10000: Procedure of verification

LEBT-010:VAC-VGP-10000\_VT-00001: Gauge Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 51 LEBT-010:VAC-VGP-10000: Control & Monitoring (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGP-10000\_VT-00002 | Assess the gauge “Off” status. | No action required because the gauge shall already be off. Off, the gauge shall display a pressure of 1000 mbar. | Assess the gauge “Off” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-10000\_VT-00003 | Assess the gauge “On” status. | Stat the gauge. | Assess the “On” status of the gauge. | □ |
| Assess the “On” status of the gauge on the gauge controller. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-10000\_VT-00004 | Verify the pressure archiving. | Open archiving appliance. | Assess the value of the archived pressure. | □ |
| Assess the consistency between the row value and the scaled value. | □ |
| LEBT-010:VAC-VGP-10000\_VT-00005 | Verify the pressure archiving - Data Acquisition Alarm. | Disconnect or simulate a disconnection of the data acquisition analog measurement. | Assess the alarm on the control screen. | □ |

Table 52 LEBT-010:VAC-VGP-10000: Control & Monitoring (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGP-10000\_VT-00006 | Verify the over-range status. | Create or simulate an over-range pressure to be read by the gauge. | Assess the gauge “Over-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-10000\_VT-00007 | Verify the under-range status. | Create or simulate an under-range pressure to be read by the gauge. | Assess the gauge “Under-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-10000\_VT-00008 | Verify that the parameters of the gauges can be remotely modified. | Choose a parameter relative to the gauge. Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-10000\_VT-00009 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller.  Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

## Test case LEBT-010:VAC-VGC-10000

### Gauge & Gauge Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Gauge & Gauge Controller Verification: Configuration

See 4.2 for generic configuration.

### Gauge & Gauge Controller Verification: Setup

See 4.3 for generic setup.

Gauge shall be under the nominal vacuum range before proceeding to the test.

Gauge shall be connected and shall not be measuring before starting the test.

Gauge controller shall be energized and shall not display any error to start the verification procedure.

A pre-calibrate simulator can be used instead of the gauge to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the gauge.

The GUI panel shall show that the gauge to be check is free of errors before starting the verification procedure.

### Gauge & Gauge Controller Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the gauge.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VGC-10000: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VGC-10000\_CR.01 | LEBT-010:VAC-VGC-10000\_MR.01 | LEBT-010:VAC-VGC-10000\_DAR.01 | LEBT-010:VAC-VEG-10001\_CsR.01 | LEBT-010:VAC-VEG-10001\_SR.01 | LEBT-010:VAC-VEG-00011\_IR.01 |
|  | LEBT-010:VAC-VGC-10000\_MR.02 |  |  |  | LEBT-010:VAC-VEG-10001\_IR.01 |
|  | LEBT-010:VAC-VGC-10000\_MR.03 |  |  |  | LEBT-010:VAC-VEG-10010\_IR.01 |
|  | LEBT-010:VAC-VGC-10000\_MR.04 |  |  |  | LEBT-010:VAC-VEG-20020\_IR.01 |
|  | LEBT-010:VAC-VGC-10000\_MR.05 |  |  |  |  |
|  | LEBT-010:VAC-VGC-10000\_MR.06 |  |  |  |  |
|  | LEBT-010:VAC-VGC-10000\_MR.07 |  |  |  |  |
|  | LEBT-010:VAC-VGC-10000\_MR.08 |  |  |  |  |
|  | LEBT-010:VAC-VGC-10000\_MR.09 |  |  |  |  |
|  | LEBT-010:VAC-VGC-10000\_MR.10 |  |  |  |  |
|  | LEBT-010:VAC-VGC-10000\_MR.11 |  |  |  |  |

#### LEBT-010:VAC-VGC-10000: Procedure of verification

LEBT-010:VAC-VGC-10000\_VT-00001: Gauge Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 53 LEBT-010:VAC-VGC-10000: Control & Monitoring (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGC-10000\_VT-00002 | Assess the gauge “Off” status. | No action required because the gauge shall already be off. Off, the gauge shall display a pressure of 1000 mbar. | Assess the gauge “Off” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGC-10000\_VT-00003 | Assess the gauge “On” status. | Stat the gauge. | Assess the “On” status of the gauge. | □ |
| Assess the “On” status of the gauge on the gauge controller. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGC-10000\_VT-00004 | Verify the pressure archiving. | Open archiving appliance. | Assess the value of the archived pressure. | □ |
| Assess the consistency between the row value and the scaled value. | □ |
| LEBT-010:VAC-VGC-10000\_VT-00005 | Verify the pressure archiving - Data Acquisition Alarm. | Disconnect or simulate a disconnection of the data acquisition analog measurement. | Assess the alarm on the control screen. | □ |

Table 54 LEBT-010:VAC-VGC-10000: Control & Monitoring (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGC-10000\_VT-00006 | Verify the over-range status. | Create or simulate an over-range pressure to be read by the gauge. | Assess the gauge “Over-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGC-10000\_VT-00007 | Verify the under-range status. | Create or simulate an under-range pressure to be read by the gauge. | Assess the gauge “Under-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGC-10000\_VT-00008 | Verify that the parameters of the gauges can be remotely modified. | Choose a parameter relative to the gauge. Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGC-10000\_VT-00009 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller.  Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

## Test case LEBT-010:VAC-VGD-10000

### Gauge & Gauge Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Gauge & Gauge Controller Verification: Configuration

See 4.2 for generic configuration.

### Gauge & Gauge Controller Verification: Setup

See 4.3 for generic setup.

Gauge shall be under the nominal vacuum range before proceeding to the test.

Gauge shall be connected and shall not be measuring before starting the test.

Gauge controller shall be energized and shall not display any error to start the verification procedure.

A pre-calibrate simulator can be used instead of the gauge to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the gauge.

The GUI panel shall show that the gauge to be check is free of errors before starting the verification procedure.

### Gauge & Gauge Controller Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the gauge.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VGD-10000: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VGD-10000\_CR.01 | LEBT-010:VAC-VGD-10000\_MR.01 | LEBT-010:VAC-VGD-10000\_DAR.01 | LEBT-010:VAC-VEVMC-10001\_CsR.01 | LEBT-010:VAC-VEVMC-10001\_SR.01 | LEBT-010:VAC- VEVMC -00011\_IR.01 |
|  | LEBT-010:VAC-VGD-10000\_MR.02 |  |  |  | LEBT-010:VAC- VEVMC -10001\_IR.01 |
|  | LEBT-010:VAC-VGD-10000\_MR.03 |  |  |  | LEBT-010:VAC- VEVMC -10010\_IR.01 |
|  | LEBT-010:VAC-VGD-10000\_MR.04 |  |  |  | LEBT-010:VAC- VEVMC -20020\_IR.01 |
|  | LEBT-010:VAC-VGD-10000\_MR.05 |  |  |  |  |
|  | LEBT-010:VAC-VGD-10000\_MR.06 |  |  |  |  |
|  | LEBT-010:VAC-VGD-10000\_MR.07 |  |  |  |  |
|  | LEBT-010:VAC-VGD-10000\_MR.08 |  |  |  |  |
|  | LEBT-010:VAC-VGD-10000\_MR.09 |  |  |  |  |
|  | LEBT-010:VAC-VGD-10000\_MR.10 |  |  |  |  |
|  | LEBT-010:VAC-VGD-10000\_MR.11 |  |  |  |  |

#### LEBT-010:VAC-VGD-10000: Procedure of verification

LEBT-010:VAC-VGD-10000\_VT-00001: Gauge Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 55 LEBT-010:VAC-VGD-10000: Control & Monitoring (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGD-10000\_VT-00002 | Assess the gauge “Off” status. | No action required because the gauge shall already be off. Off, the gauge shall display a pressure of 1000 mbar. | Assess the gauge “Off” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGD-10000\_VT-00003 | Assess the gauge “On” status. | Stat the gauge. | Assess the “On” status of the gauge. | □ |
| Assess the “On” status of the gauge on the gauge controller. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGD-10000\_VT-00004 | Verify the pressure archiving. | Open archiving appliance. | Assess the value of the archived pressure. | □ |
| Assess the consistency between the row value and the scaled value. | □ |
| LEBT-010:VAC-VGD-10000\_VT-00005 | Verify the pressure archiving - Data Acquisition Alarm. | Disconnect or simulate a disconnection of the data acquisition analog measurement. | Assess the alarm on the control screen. | □ |

Table 56 LEBT-010:VAC-VGD-10000: Control & Monitoring (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGD-10000\_VT-00006 | Verify the over-range status. | Create or simulate an over-range pressure to be read by the gauge. | Assess the gauge “Over-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGD-10000\_VT-00007 | Verify the under-range status. | Create or simulate an under-range pressure to be read by the gauge. | Assess the gauge “Under-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGD-10000\_VT-00008 | Verify that the parameters of the gauges can be remotely modified. | Choose a parameter relative to the gauge. Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGD-10000\_VT-00009 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller.  Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

## Test case LEBT-010:VAC-VPG-10001

### Vacuum Pumping Group Verification: Support Environment.

See 4.1 for generic support environment.

### Vacuum Pumping Group Verification: Configuration

See 4.2 for generic configuration.

### Vacuum Pumping Group Verification: Setup

See 4.3 for generic setup.

Devices that constitute the pumping group shall be tested and verified beforehand.

Adjacent pumping group, **LEBT-010:VAC-VPG-20001**, connected to the second sector shall be stopped to proceed to all of these test.

The GUI panel shall show that the devices to be check are free of errors before starting the verification procedure.

### Vacuum Pumping Group Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the device.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VPG-10001: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| No requirements | **No requirements** | **No requirements** | **No requirements** | LEBT-010:VAC-VEG-00011\_SR.01 | **No requirements** |
|  |  |  |  | LEBT-010:VAC-VEG-00011\_SR.02 |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VPG-10001: Procedure of verification

Table 57 LEBT-010:VAC-VPG-10001: Pump-Down Atmospheric Pressure (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-10001\_VT-00001 | Verify the pump down sequence (from atmospheric pressure). | Assess that the vacuum sector is at the atmospheric pressure. | Write down the actual pressure:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the “Normal” Mode. | Assess that it is not possible to start the pumping group. | □ |
| Assess the error. | □ |
| Disconnect the interlock from the gauge controller that conditions the starting of the turbomolecular pumps according to electrical diagram [6]. | Relay **1** of **LEBT-010:VAC-VEG-00011** has been disconnected. | □ |
| ~~Disconnect the open status of~~ **~~LEBT-010:VAC-VVA-00031~~** ~~according to electrical diagram [6].~~ | ~~Open status of~~ **~~LEBT-010:VAC-VVA-00031~~** ~~is disconnected.~~ | ~~□~~ |
| Set the “Pump-Down” Mode.  Reset the pumping group. | “Pump-Down” Mode is active. | □ |
| Assess that the error has disappeared. | □ |

Table 58 LEBT-010:VAC-VPG-10001: Pump-Down Atmospheric Pressure (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-10001\_VT-00002 | Verify the pump down sequence (from atmospheric pressure). | Start the pumping group | Assess the opening of  **LEBT-010:VAC-VVA-00031**. | □ |
| Assess the opening of  **LEBT-010:VAC-VVA-02100**. | □ |
| Assess the opening of  **LEBT-010:VAC-VVA-03100**. | □ |
| ~~Assess the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | □ |
| ~~Assess the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | □ |
| ~~Assess the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | □ |
| Assess the starting of the primary pump. | □ |
| Assess that turbomolecular pumps do not start. | □ |
| Wait that the delay has elapsed (more than 30s) | Assess that turbomolecular pumps do not start. | □ |
| Re-establish the interlock from the gauge controller that conditions the starting of the turbomolecular pumps according to electrical diagram [6]. | Assess that the turbomolecular pumps are starting. | □ |
| Pump down the vacuum sector. | Write down the pressure after having pumped down the sector: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

Table 59 LEBT-010:VAC-VPG-10001: Normal Starting Sequence [sector under vacuum] (Part 1)

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-10001\_VT-00003 | Verify the starting sequence (under vacuum). | Assess that the vacuum sector is under vacuum. | Write down the actual pressure:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Assess that the pumping group is stop. | All the pumps are off and the valves are close. | □ |
| LEBT-010:VAC-VPG-10001\_VT-00004 | Disconnect the “interlocks” required by the sequences to progress (accordingly to the electrical diagram [6]). | Disconnect the interlock from the pump that conditions the opening of **LEBT-010:VAC-VVA-00031**. | Interlock has been disabled. | □ |
| Disconnect the interlock from the gauge controller that conditions the starting of the turbomolecular pumps. | Interlock has been disabled. | □ |
| Disconnect the interlock from the turbomolecular pump controller that conditions the opening of  **LEBT-010:VAC-VVA-02100**. | Interlock has been disabled. | □ |
| Disconnect the interlock from the turbomolecular pump controller that conditions the opening of  **LEBT-010:VAC-VVA-03100**. | Interlock has been disabled. | □ |
| ~~Disconnect the interlock from the turbomolecular pump controller that conditions the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~Interlock has been disabled.~~ | ~~□~~ |
| ~~Disconnect the interlock from the turbomolecular pump controller that conditions the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~Interlock has been disabled.~~ | ~~□~~ |
| ~~Disconnect the interlock from the turbomolecular pump controller that conditions the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~Interlock has been disabled.~~ | ~~□~~ |

Table 60 LEBT-010:VAC-VPG-10001: Normal Starting Sequence [sector under vacuum] (Part 2)

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-10001\_VT-00005 | Verify the starting sequence (under vacuum). | Start the pumping group. | Assess that the primary pump starts. | □ |
| Re-establish the interlock from the pump that conditions the opening of **LEBT-010:VAC-VVA-00031**. | Assess the opening of  **LEBT-010:VAC-VVA-00031**. | □ |
| Re-establish disconnect the interlock from the gauge controller that conditions the starting of the turbomolecular pumps. | Assess the starting of the turbomolecular pumps. | □ |
| Once **LEBT-010:VAC-VPT-02100** is at nominal speed, re-establish interlock from the turbomolecular pump controller that conditions the opening of **LEBT-010:VAC-VVA-02100**. | Assess the opening of  **LEBT-010:VAC-VVA-02100**. | □ |
| Once **LEBT-010:VAC-VPT-03100** is at nominal speed, re-establish interlock from the turbomolecular pump controller that conditions the opening of **LEBT-010:VAC-VVA-03100**. | Assess the opening of  **LEBT-010:VAC-VVA-03100**. | □ |
| ~~Once~~ **~~\_\_\_\_-\_\_\_:VAC-VPT-0\_\_00~~** ~~is at nominal speed, re-establish interlock from the turbomolecular pump controller that conditions the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~Assess the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~□~~ |
| ~~Once~~ **~~\_\_\_\_-\_\_\_:VAC-VPT-0\_\_00~~** ~~is at nominal speed, re-establish interlock from the turbomolecular pump controller that conditions the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~Assess the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~□~~ |
| ~~Once~~ **~~\_\_\_\_-\_\_\_:VAC-VPT-0\_\_00~~** ~~is at nominal speed, re-establish interlock from the turbomolecular pump controller that conditions the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~Assess the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~□~~ |

Table 61 LEBT-010:VAC-VPG-10001: Normal Stopping Sequence [sector under vacuum] (Part 1)

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-10001\_VT-00006 | Verify the stopping sequence (under vacuum). | Assess that the vacuum sector is under vacuum. | Write down the actual pressure:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Assess that the pumping group is running. | All the pumps are running and all the valves are open. | □ |
| LEBT-010:VAC-VPG-10001\_VT-00007 | Disconnect valves close status. | ~~Disconnect the close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~** ~~according to electrical diagram [6].~~ | ~~Close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~** ~~is disconnected.~~ | ~~□~~ |
| ~~Disconnect the close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~** ~~according to electrical diagram [6].~~ | ~~Close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~** ~~is disconnected.~~ | ~~□~~ |
| ~~Disconnect the close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~** ~~according to electrical diagram [6].~~ | ~~Close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~** ~~is disconnected.~~ | ~~□~~ |
| Disconnect the close status of **LEBT-010:VAC-VVA-03100** according to electrical diagram [6]. | Close status of **LEBT-010:VAC-VVA-03100** is disconnected. | □ |
| Disconnect the close status of **LEBT-010:VAC-VVA-02100** according to electrical diagram [6]. | Close status of **LEBT-010:VAC-VVA-02100** is disconnected. | □ |
| Disconnect the close status of **LEBT-010:VAC-VVA-00031** according to electrical diagram [6]. | Close status of **LEBT-010:VAC-VVA-00031** is disconnected. | □ |

Table 62 LEBT-010:VAC-VPG-10001: Normal Stopping Sequence [sector under vacuum] (Part 2)

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-10001\_VT-00008 | Verify the stopping sequence (under vacuum). | Stop the pumping group. | Assess that the valves on the turbomolecular pumps are closed in the tunnel. | □ |
| Assess that the turbomolecular pumps are still running. | □ |

Table 63 LEBT-010:VAC-VPG-10001: Normal Stopping Sequence [sector under vacuum] (Part 3)

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-10001\_VT-00009 | Reconnect valves close status. | ~~Reconnect the close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~** ~~according to electrical diagram [6].~~ | ~~Assess the close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~□~~ |
| ~~Assess that~~ **~~\_\_\_\_-\_\_\_:VAC-VPT-0\_\_00~~** ~~is stopping.~~ | ~~□~~ |
| ~~Reconnect the close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~** ~~according to electrical diagram [6].~~ | ~~Assess the close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~□~~ |
| ~~Assess that~~ **~~\_\_\_\_-\_\_\_:VAC-VPT-0\_\_00~~** ~~is stopping.~~ | ~~□~~ |
| ~~Reconnect the close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~** ~~according to electrical diagram [6].~~ | ~~Assess the close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~□~~ |
| ~~Assess that~~ **~~\_\_\_\_-\_\_\_:VAC-VPT-0\_\_00~~** ~~is stopping.~~ | ~~□~~ |
| Reconnect the close status of **LEBT-010:VAC-VVA-03100** according to electrical diagram [6]. | Assess the close status of  **LEBT-010:VAC-VVA-03100**. | □ |
| Assess that **LEBT-010:VAC-VPT-03100** is stopping. | □ |
| Reconnect the close status of **LEBT-010:VAC-VVA-02100** according to electrical diagram [6]. | Assess the close status of  **LEBT-010:VAC-VVA-02100**. | □ |
| Assess that **LEBT-010:VAC-VPT-02100** is stopping. | □ |
| Reconnect the close status of **LEBT-010:VAC-VVA-00031** according to electrical diagram [6]. | Assess the close status of  **LEBT-010:VAC-VVA-00031**. | □ |
| Assess that  **LEBT-010:VAC-VPDP-00031** is stopping. | □ |

Table 64 LEBT-010:VAC-VPG-10001: Maintenance (Leak Detection) Sequence.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-10001\_VT-00010 | Verify the leak detection sequence (under vacuum). | Assess that the vacuum sector is under vacuum. | Write down the actual pressure:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Assess that a leak detector is connected to the sector and is running. | Write down the actual pressure of the leak detector:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Assess that the pumping group is running and the turbomolecular pump is/are running at the nominal speed. | Pumps are running and valves are open. | □ |
| Switch to the “Leak Detection” Mode. | “Leak Detection” Mode is active. | □ |
| Manually open or close the valve upon the primary pump. | The valve upon the primary pump is manually controlled. | □ |
| Switch back to the “Normal” Mode. | “Leak Detection” Mode is active. | □ |
| The valve upon the primary pump is no more manually controlled. | □ |

Table 65 LEBT-010:VAC-VPG-10001: Local Protections (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-10001\_VT-00011 | Assess the configuration of the hardware interlock. | Asses that the hardware interlock has been configured. | The interlock is not configured. | □ |
| The interlock is configured. | □ |
| Hardware interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| Verify that the tripped interlock stop the pumping group. | Start the pumping group and wait that it reaches its nominal state.  Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess that the group stop. | □ |
| LEBT-010:VAC-VPG-10001\_VT-00012 | Assess the configuration of the software interlock. | Asses that the hardware interlock has been configured. | The interlock is not configured. | □ |
| The interlock is configured. | □ |
| Software interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| Verify that the tripped interlock stop the pumping group. | Start the pumping group and wait that it reaches its nominal state.  Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess that the group stop. | □ |

Table 66 LEBT-010:VAC-VPG-10001: Local Protections (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-10001\_VT-00013 | Turbo-Pumps Controller Error | Start the pumping group and wait that it reaches its nominal state.  Simulate an error on the first turbomolecular pump controller according to the electrical diagram [6]:  **LEBT-010:VAC-VEPT-02100**. | ~~Assess that the pumping group stops~~. | □ |
| Assess that the pumping group keep pumping. | □ |
| Do not reset the pumping group.  Simulate an error on the second turbomolecular pump controller according to the electrical diagram [6] :  **LEBT-010:VAC-VEPT-03100**. | Assess that the pumping group stop. | □ |
| ~~Assess that the pumping group keep pumping.~~ | ~~□~~ |
| ~~Do not reset the pumping group.~~  ~~Simulate an error on the third turbomolecular pump controller according to the electrical diagram [6]~~ :  **\_\_\_\_-\_\_\_:VAC-VEPT-\_\_\_\_\_**. | ~~Assess that the pumping group stops.~~ | ~~□~~ |
| ~~Assess that the pumping group keep pumping.~~ | ~~□~~ |
| ~~Do not reset the pumping group.~~  ~~Simulate an error on the fourth turbomolecular pump controller according to the electrical diagram [6]~~ :  **\_\_\_\_-\_\_\_:VAC-VEPT-\_\_\_\_\_**. | ~~Assess that the pumping group stops.~~ | ~~□~~ |
| ~~Assess that the pumping group keep pumping.~~ | ~~□~~ |
| ~~Do not reset the pumping group.~~  ~~Simulate an error on the fifth turbomolecular pump controller according to the electrical diagram [6]~~ :  **\_\_\_\_-\_\_\_:VAC-VEPT-\_\_\_\_\_**. | ~~Assess that the pumping group stops.~~ | ~~□~~ |
| ~~Assess that the pumping group keep pumping.~~ | ~~□~~ |
| Re-establish each of the simulated errors.  Reset the pumping group. | Assess that there are no errors on the pumping group. | □ |
| Assess that there is no error on any of the turbomolecular pump controllers. |  |

Table 67 LEBT-010:VAC-VPG-10001: Local Protections (Part 3).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-10001\_VT-00014 | Power Supply Error | Start the pumping group and wait that it reaches its nominal state.  Trigger or simulate a power supply error according to the electrical diagram [6]. | Assess that the pumping group stops. | □ |
| Power Supply Error - Automatic restart. | If the automatic restart function is used and has been set, re-establish the power supply or remove the simulation of the error. | Assess that the error message disappear. | □ |
| Assess that the pumping group is restarting. | □ |
| LEBT-010:VAC-VPG-10001\_VT-00015 | Max Auto-Restart  (*If the automatic restart function is used and has been set*) | Start the pumping group and wait that it reaches its nominal state.  Trigger or simulate a power supply error according to the electrical diagram [6]. | Assess that the pumping group stops. | □ |
| Re-establish the power supply or remove the simulation of the error. | Assess that the error message disappear. | □ |
| Assess that the pumping group is restarting. | □ |
| Trigger or simulate a power supply error according to the electrical diagram [6]. | Assess that the pumping group stops. | □ |
| Wait that the maximal mount of restart tentative has been reached. Re-establish the power supply or remove the simulation of the error and do not reset the pumping group. | Assess that the pumping group doesn’t restart. | □ |

Table 68 LEBT-010:VAC-VPG-10001: Local Protections (Part 4 - Pressure Interlock).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-10001\_VT-00016 | ~~High Vacuum Manifold Vented Error- Pressure Interlock.~~ | ~~Identify the source of the interlock (Device & Relay) according to the settings document [7]: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_~~ | | ~~□~~ |
| ~~Write down the setting of the threshold before the test [7]:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_~~ | | ~~□~~ |
| ~~Start the pumping group and wait that it reaches its nominal state.~~  ~~Set a new (unreachable) set-point or switch off the gauge or simulate that the relay has tripped.~~ | ~~Write down the threshold set for the test:~~  ~~\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_~~ | ~~□~~ |
| ~~Assess that the pumping group stops.~~ | ~~□~~ |
| ~~High Vacuum Manifold Vented Error- Pressure Interlock. Automatic restart.~~ | ~~If the automatic restart function is used and has been set, re-establish the setting of the threshold or remove the simulation of the error.~~ | ~~Assess that the error message disappear.~~ | ~~□~~ |
| ~~Assess that the pumping group is restarting.~~ | ~~□~~ |
| LEBT-010:VAC-VPG-10001\_VT-00017 | Low Vacuum Manifold Vented Error - Pressure Interlock. | Identify the source of the interlock (Device & Relay) according to the settings document [7]: **LEBT-010:VAC-VGP-00021** (Relay **1**) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| Write down the setting of the threshold before the test [7]:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| Start the pumping group and wait that it reaches its nominal state.  Set a new (unreachable) set-point or switch off the gauge or simulate that the relay has tripped. | Write down the threshold set for the test:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Assess that the pumping group stops. | □ |
| Low Vacuum Manifold Vented Error - Pressure Interlock  Automatic restart. | If the automatic restart function is used and has been set, re-establish the setting of the threshold or remove the simulation of the error. | Assess that the error message disappear. | □ |
| Assess that the pumping group is restarting. | □ |

Table 69 LEBT-010:VAC-VPG-10001: Local Protections (Part 5 - Pressure Interlock).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-10001\_VT-00018 | Vacuum Sector Vented - Pressure Interlock. | Pumping group stopped in normal mode.  Vent the system at the atmospheric pressure. | Write down the threshold used to assess atmospheric pressure:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| When the atmospheric pressure is reached, assess that the error appears. | □ |
| Pumping group stopped in normal mode.  Sector vented at atmospheric pressure.  Switch the operation mode to “Pump-Down” and reset the pumping group. | Assess that the error has disappeared. | □ |

Table 70 LEBT-010:VAC-VPG-10001: Local Protections (Part 6).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-10001\_VT-00019 | Primary Pump Error **Case 1:  Pumping group without back-up primary pump.** | Start the pumping group and wait that it reaches its nominal state.  Trigger or simulate an error on the primary pump controller according to the electrical diagram [6]. | Assess that the pumping group stops. | □ |
| Primary Pump Error **Case 2:  Pumping group with back-up primary pump.** | Start the pumping group and wait that it reaches its nominal state.  Trigger or simulate an error on the primary pump controller according to the electrical diagram [6]. | Assess that the primary pump is stopped. | □ |
| Assess that the valve upon the primary pump is closes. | □ |
| Assess that the pumping group keeps running. | □ |
| LEBT-010:VAC-VPG-10001\_VT-00020 | Primary Pump / Valve Error  **Case 1:  Pumping group without back-up primary pump.** | Pumping group stopped; disconnect the digital output that controls the valve upon the primary pump according to the electrical diagram [6].  Start the pumping group, wait that the error delay’s has elapsed. | Assess that the primary pump starts. | □ |
| Assess that the valve remain close. | □ |
| Assess that the pumping group stops after the delay. | □ |
| Primary Pump / Valve Error  **Case 2:  Pumping group with back-up primary pump.** | Pumping group stopped; lock close the valve upon the primary pump.  Start the pumping group. | Assess that the primary pump starts. | □ |
| Assess that the valve remain close. | □ |
| Assess that the bypass valve open and that the pumping group keep starting. | □ |

Table 71 LEBT-010:VAC-VPG-10001: Local Protections (Part 7).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-10001\_VT-00021 | Turbo-Pumps Not Available | Pumping group stopped; lock off all the turbomolecular pumps controllers except one. | Only one turbomolecular pump controller has not been locked. | □ |
| Disconnect the digital input that read the nominal speed status of the non-locked turbomolecular pump controller according to the electrical diagram [6].  Start the pumping group. | Assess that the pumping group is starting. | □ |
| Once the turbomolecular pump controller has started, simulate an error. | Assess that the pumping group stops. | □ |

## Test case LEBT-010:VAC-VPM-00011

### Pressure Manometer Verification: Support Environment.

See 4.1 for generic support environment.

### Pressure Manometer Verification: Configuration

See 4.2 for generic configuration.

### Pressure Manometer Verification: Setup

See 4.3 for generic setup.

### Pressure Manometer Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the device.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VPM-00011: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VPM-00011\_CR.01 | LEBT-010:VAC-VPM-00011\_MR.01 | LEBT-010:VAC-VPM-00011\_DAR.01 | LEBT-010:VAC-VPM-00011\_CsR.01 | LEBT-010:VAC-VPM-00011\_SR.01 | LEBT-010:VAC-VPM-00011\_IR.01 |
|  | LEBT-010:VAC-VPM-00011\_MR.02 |  |  |  |  |
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#### LEBT-010:VAC-VPM-00011: Procedure of verification

LEBT-010:VAC-VPM-00011\_VT-00001: Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 72 LEBT-010:VAC-VPM-00011: Control & Monitoring.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPM-00011\_VT-00002 | Assess the pressure value. | Read pressure on the GUI panel. | Assess the pressure on the GUI panel. | □ |
| Corroborate the pressure on the GUI panel with the pressure display on the monometer. | □ |
| LEBT-010:VAC-VPM-00011\_VT-00003 | Verify the pressure archiving. | Open archiving appliance. | Assess the value of the archived pressure. | □ |
| LEBT-010:VAC-VPM-00011\_VT-00004 | Test the low pressure alarm. | Create or simulate a drop-down of the pressure read by the pressure manometer. | Assess that the alarm is active on the control room. | □ |
| It is also possible to modify the alarm threshold. | Write down the initial threshold before modification:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Write down the threshold set for the test:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Assess that the alarm is active on the control room. | □ |
| Write down value set after the test:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

## Test case LEBT-010:VAC-VVA-01100

### Angle Valves & Gates Valves Verification: Support Environment.

See 4.1 for generic support environment.

### Angle Valves & Gates Valves Verification: Configuration

See 4.2 for generic configuration.

### Angle Valves & Gates Valves Verification: Setup

See 4.3 for generic setup.

Angle valve or gate valve shall be connected and shall not be open before starting the test.

A simulator can be used instead of the valve to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the valve.

The GUI panel shall show that the valve to be check is free of errors before starting the verification procedure.

### Angle Valves & Gates Valves Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the valve.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VVA-01100: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to the requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VVA-01100\_CR.01 | LEBT-010:VAC-VVA-01100\_MR.01 | LEBT-010:VAC-VVA-01100\_DAR.01 | LEBT-010:VAC-VVA-01100\_CsR.01 | LEBT-010:VAC-VVA-01100\_SR.01 | LEBT-010:VAC-VVA-01100\_IR.01 |
| LEBT-010:VAC-VVA-01100\_CR.02 | LEBT-010:VAC-VVA-01100\_MR.02 | LEBT-010:VAC-VVA-01100\_DAR.02 |  | **LEBT-010:VAC-VEG-1001\_SR.01** |  |
| LEBT-010:VAC-VVA-01100\_CR.03 | LEBT-010:VAC-VVA-01100\_MR.03 | LEBT-010:VAC-VVA-01100\_DAR.03 |  |  |  |
|  | LEBT-010:VAC-VVA-01100\_MR.04 |  |  |  |  |
|  | LEBT-010:VAC-VVA-01100\_MR.05 |  |  |  |  |
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#### LEBT-010:VAC-VVA-01100: Procedure of verification

LEBT-010:VAC-VVA-01100\_VT-00001: Pump Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 73 LEBT-010:VAC-VVA-01100: Remote & Manual Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-01100\_VT-00002 | Assess the closed status of the valve. | No action required because the valve shall already be closed. | Assess the “Close” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00003 | Assess the “Undefined” status of the valve. | Disconnect the control cable from the connector on the valve.  Wait that “Undefined” time-out elapsed. | Assess the “Undefined” status on the GUI panel. | □ |

Table 74 LEBT-010:VAC-VVA-01100: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-01100\_VT-00004 | Verify the manual remote control of the valve. | Set “Manual” mode using the detailed GUI panel of the valve. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before opening the valve. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00005 | Verify the opening function. | Verify that there are no active interlocks applied to the valve.  Open the valve through the GUI panel. | Assess the “Open” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00006 | Verify the closing function. | Close the valve through the GUI panel. | Assess the “Close” status on the GUI panel. | □ |

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| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 75 LEBT-010:VAC-VVA-01100: First “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-01100\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VGC-10000** (Relay **11**) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-01100\_VT-00009 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00010 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 76 LEBT-010:VAC-VVA-01100: Second “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-01100\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-01100\_VT-00016 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00017 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 77 LEBT-010:VAC-VVA-01100: First “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-01100\_VT-00021 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00022 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-01100\_VT-00023 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00024 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00025 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00026 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00027 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 78 LEBT-010:VAC-VVA-01100: Second “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-01100\_VT-00028 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00029 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-01100\_VT-00030 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00031 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00032 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00033 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00034 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 79 LEBT-010:VAC-VVA-01100: Third “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-01100\_VT-00035 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00036 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-01100\_VT-00037 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00038 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00039 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00040 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-01100\_VT-00041 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

Table 80 LEBT-010:VAC-VVA-01100: Access Interlock (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-01100\_VT-00042 | Verify the closure of the valve in case of access of person in the tunnel. | Start the vacuum system and set the nominal conditions to produce beam. Open the valve. | Assess that the valve is open. | □ |
| Request an access to the MCR or simulate it according to the electrical diagram [6]. | Assess that the valve closes. | □ |

## Test case LEBT-010:VAC-VVMC-01100

### Mass Flow Meter & Mass Flow Meter Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Mass Flow Meter & Mass Flow Meter Controller Verification: Configuration

See 4.2 for generic configuration.

### Mass Flow Meter & Mass Flow Meter Controller Verification: Setup

See 4.3 for generic setup.

Mass flow meter shall be under the nominal vacuum range before proceeding to the test.

Mass flow meter shall be connected and shall be close before starting the test.

Mass flow meter controller shall be energized and shall not display any error to start the verification procedure.

### Mass Flow Meter & Mass Flow Meter Controller Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the mass flow meter.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VVMC-01100: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VVMC-01100\_CR.01 | LEBT-010:VAC-VVMC-01100\_MR.01 | LEBT-010:VAC-VVMC-01100\_DAR.01 | LEBT-010:VAC-VEVMC-01100\_CsR.01 | LEBT-010:VAC-VEVMC-01100\_SR.01 | LEBT-010:VAC-VEVMC-01100\_IR.01 |
|  | LEBT-010:VAC-VVMC-01100\_MR.02 |  | LEBT-010:VAC-VEVMC-02200\_CsR.01 | LEBT-010:VAC-VEVMC-02200\_SR.01 | LEBT-010:VAC-VEVMC-02200\_IR.01 |
|  | LEBT-010:VAC-VVMC-01100\_MR.03 |  | LEBT-010:VAC-VEVMC-10001\_CsR.01 | LEBT-010:VAC-VEVMC-10001\_SR.01 | LEBT-010:VAC-VEVMC-10001\_IR.01 |
|  | LEBT-010:VAC-VVMC-01100\_MR.04 |  |  |  |  |
|  | LEBT-010:VAC-VVMC-01100\_MR.05 |  |  |  |  |
|  | LEBT-010:VAC-VVMC-01100\_MR.06 |  |  |  |  |
|  | LEBT-010:VAC-VVMC-01100\_MR.07 |  |  |  |  |
|  | LEBT-010:VAC-VVMC-01100\_MR.08 |  |  |  |  |
|  | LEBT-010:VAC-VVMC-01100\_MR.09 |  |  |  |  |
|  | LEBT-010:VAC-VVMC-01100\_MR.10 |  |  |  |  |
|  | LEBT-010:VAC-VVMC-01100\_MR.11 |  |  |  |  |

#### LEBT-010:VAC-VVMC-01100: Procedure of verification

LEBT-010:VAC-VVMC-01100\_VT-00001: Pump Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 81 LEBT-010:VAC-VVMC-01100: Control & Monitoring (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVMC-01100\_VT-00002 | Assess the partial opening. | Partially open the mass flow meter through the GUI panel. | Assess the partial opening on the GUI panel. | □ |
| Assess the partial opening on the mass flow meter controller | □ |
| LEBT-010:VAC-VVMC-01100\_VT-00003 | Assess the partial closing. | Partially close the mass flow meter through the GUI panel. | Assess the partial closing on the GUI panel. | □ |
| Assess the partial closing on the mass flow meter controller | □ |

Table 82 LEBT-010:VAC-VVMC-01100: Control & Monitoring (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVMC-01100\_VT-00004 | Verify that the parameters of the mass flow meter can be remotely modified. | Choose a parameter relative to the gauge. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VVMC-01100\_VT-00005 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

## Test case LEBT-010:VAC-VGR-10000

### Residual Gas Analyzer & Residual Gas Analyzer Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Residual Gas Analyzer & Residual Gas Analyzer Controller Verification: Configuration

See 4.2 for generic configuration.

### Residual Gas Analyzer & Residual Gas Analyzer Controller Verification: Setup

See 4.3 for generic setup.

Residual gas analyzer shall be under the nominal vacuum range before proceeding to the test.

Residual gas analyzer shall be connected and shall not be measuring before starting the test.

Residual gas analyzer controller shall be energized and shall not display any error to start the verification procedure.

### Residual Gas Analyzer & Residual Gas Analyzer Controller Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the device.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VGR-10000: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VGR-10000\_CR.01 | LEBT-010:VAC-VGR-10000\_MR.01 | LEBT-010:VAC-VGR-10000\_DAR.01 | LEBT-010:VAC-VGR-10000\_CsR.01 | LEBT-010:VAC- VGR-10000\_SR.01 | LEBT-010:VAC- VGR-10000\_IR.01 |
|  | LEBT-010:VAC-VGR-10000\_MR.02 |  |  | LEBT-010:VAC- VGR-10000\_SR.02 |  |
|  | LEBT-010:VAC-VGR-10000\_MR.03 |  |  |  |  |
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#### LEBT-010:VAC-VGR-10000: Procedure of verification

LEBT-010:VAC-VGR-10000\_VT-00001: Pump Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 83 LEBT-010:VAC-VGR-10000: Control & Monitoring.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGR-10000\_VT-00002 | Assess the remote control of the residual gas analyser. | Start residual gas analyser through the GUI panel. | Read feedback gas analysis. | □ |
| LEBT-010:VAC-VGR-10000\_VT-00003 | ~~Verify the pressure interlock of the residual gas analyser.~~ | ~~Identify the source of the interlock (Device & Relay) according to the settings document [7]: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_~~ | | ~~□~~ |
| ~~Write down the setting of the threshold before the test [7]:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_~~ | | ~~□~~ |
| ~~Set a new (unreachable) set-point or switch off the gauge or simulate that the relay has tripped.~~ | ~~Write down the threshold set for the test:~~  ~~\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_~~ | ~~□~~ |
| ~~Assess that the residual gas analyser stops.~~ | ~~□~~ |
|  |  |  |  |  |

# Test Cases “LEBT-010:VAC" (Second Vacuum Sector)

## Test case LEBT-010:VAC-VPDP-00071

### Primary Pump & Primary Pump Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Primary Pump & Primary Pump Controller Verification: Configuration

See 4.2 for generic configuration.

### Primary Pump & Primary Pump Controller Verification: Setup

See 4.3 for generic setup.

Primary pump shall be connected and shall not be running before starting the test.

Primary pump controller shall be energized, shall not display any error and control switch shall be on “PLC” position to start the verification procedure.

The GUI panel shall show that the controller to be check is free of errors before starting the verification procedure.

### Primary Pump & Primary Pump Controller Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the pump.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VPDP-00071: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VPDP-00071\_CR.01 | LEBT-010:VAC-VPDP-00071\_MR.01 | LEBT-010:VAC-VPDP-00071\_DAR.01 | LEBT-010:VAC-VPDP-00071\_CsR.01 | LEBT-010:VAC-VPDP-00071\_SR.01 | LEBT-010:VAC-VPDP-00071\_IR.01 |
| LEBT-010:VAC-VPDP-00071\_CR.02 | LEBT-010:VAC-VPDP-00071\_MR.02 |  |  |  |  |
| LEBT-010:VAC-VPDP-00071\_CR.03 | LEBT-010:VAC-VPDP-00071\_MR.03 |  |  |  |  |
| LEBT-010:VAC-VPDP-00071\_CR.04 | LEBT-010:VAC-VPDP-00071\_MR.04 |  |  |  |  |
|  | LEBT-010:VAC-VPDP-00071\_MR.05 |  |  |  |  |
|  | LEBT-010:VAC-VPDP-00071\_MR.06 |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VPDP-00071: Procedure of verification

LEBT-010:VAC-VPDP-00071\_VT-00001: Pump Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 84 LEBT-010:VAC-VPDP-00071: Local Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPDP-00071\_VT-00002 | Control the pump disconnection protection. | On the tunnel, after having verified that the pump is not running, disconnect the power supply connector. | Assess the corresponding error on the GUI panel: “Pump Not Connected”. | □ |
| Assess the corresponding error on the primary pump controller: the LED “Cable Connected” is off. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00003 | Reset the pump disconnected error. | After having assessed the disconnected error, reconnect the power supply connector.  Reset the error from the GUI. | Assess that the “Pump Not Connected” error has disappeared on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Cable Connected” is on. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00004 | Assess the “Local Control” status. | Actuate the “Control” switch to the “Local” position on the primary pump controller. | Assess the “Local” Status on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Local Control” is on. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00005 | Start the pump by the primary pump controller. | Make sure that the system is in a safe condition before starting the pump. | Assess that the system is in a safe condition to start the pump. | □ |
| Actuate the “Control” switch to the “ON” position on the primary pump controller. | Verify that the pump in running on the tunnel. | □ |
| Assess the “On” status on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Pump ON” is on. | □ |

Table 85 LEBT-010:VAC-VPDP-00071: Local Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPDP-00071\_VT-00006 | Stop the pump by the primary pump controller. | Actuate the “Control” switch to the “OFF” position on the primary pump controller. | Assess the “Off” status on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Pump ON” is off. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00007 | Verify the error status. | Open primary pump controller crate and trip the circuit breaker.  Close primary pump controller crate.  Actuate “Control” switch to the “ON” position on the primary pump controller.  Wait error timeout. | Assess the “CB Fail” status on the GUI panel. | □ |
| Assess the “Error” status on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Error” is on. | □ |
| Actuate the “Control” switch to the “OFF” position on the primary pump controller. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00008 | Eliminate the previous error. | Actuate “Control” switch to the “OFF” position on the primary pump controller.  Open primary pump controller crate, close the circuit breaker and close primary pump controller crate. | Circuit breaker is healthy and the “Error” LED is on. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00009 | Reset the pump error (remotely). | Reset the error from the GUI. | Assess that the “Error” and “CB Fail” status has disappeared on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Error” is off. | □ |

Table 86 LEBT-010:VAC-VPDP-00071: Local Control (Part 3).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPDP-00071\_VT-00010 | Verify the “Remote” status. | Actuate the “Control” switch to the “PLC” position on the primary pump controller. | Assess the “Remote” status on the GUI panel: “Local” status shall have disappeared. | □ |
| Assess the corresponding status on the primary pump controller: the LED “PLC Control” is on and the LED “Local Control” is off. | □ |

Table 87 LEBT-010:VAC-VPDP-00071: Remote Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPDP-00071\_VT-00011 | Verify the manual remote control of the pump. | Set “Manual” mode using the detailed GUI panel of the pump. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before starting the pump. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00012 | Start the primary pump remotely. | Start the primary pump through the GUI command | Assess the “On” status on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Pump ON” is on. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00013 | Stop the primary pump remotely. | Stop the primary pump through the GUI command | Assess the “Off” status on the GUI panel. | □ |
| Assess the corresponding status on the primary pump controller: the LED “Pump ON” is off. | □ |

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| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 88 LEBT-010:VAC-VPDP-00071: “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPDP-00071\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00009 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00010 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

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| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 89 LEBT-010:VAC-VPDP-00071: “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPDP-00071\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |  |
| LEBT-010:VAC-VPDP-00071\_VT-00016 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00017 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPDP-00071\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VVA-00071

### Angle Valves & Gates Valves Verification: Support Environment.

See 4.1 for generic support environment.

### Angle Valves & Gates Valves Verification: Configuration

See 4.2 for generic configuration.

### Angle Valves & Gates Valves Verification: Setup

See 4.3 for generic setup.

Angle valve or gate valve shall be connected and shall not be open before starting the test.

A simulator can be used instead of the valve to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the valve.

The GUI panel shall show that the valve to be check is free of errors before starting the verification procedure.

### Angle Valves & Gates Valves Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the valve.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VVA-00071: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to the requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VVA-00071\_CR.01 | LEBT-010:VAC-VVA-00071\_MR.01 | LEBT-010:VAC-VVA-00071\_DAR.01 | LEBT-010:VAC-VVA-00071\_CsR.01 | LEBT-010:VAC-VVA-00071\_SR.01 | LEBT-010:VAC-VVA-00071\_IR.01 |
| LEBT-010:VAC-VVA-00071\_CR.02 | LEBT-010:VAC-VVA-00071\_MR.02 | LEBT-010:VAC-VVA-00071\_DAR.02 |  |  |  |
|  | LEBT-010:VAC-VVA-00071\_MR.03 | LEBT-010:VAC-VVA-00071\_DAR.03 |  |  |  |
|  | LEBT-010:VAC-VVA-00071\_MR.04 |  |  |  |  |
|  | LEBT-010:VAC-VVA-00071\_MR.05 |  |  |  |  |
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#### LEBT-010:VAC-VVA-00071: Procedure of verification

LEBT-010:VAC-VVA-00071\_VT-00001: Valve Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 90 LEBT-010:VAC-VVA-00071: Remote & Manual Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00071\_VT-00002 | Assess the closed status of the valve. | No action required because the valve shall already be closed. | Assess the “Close” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00003 | Assess the “Undefined” status of the valve. | Disconnect the control cable from the connector on the valve.  Wait that “Undefined” time-out elapsed. | Assess the “Undefined” status on the GUI panel. | □ |

Table 91 LEBT-010:VAC-VVA-00071: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00071\_VT-00004 | Verify the manual remote control of the valve. | Set “Manual” mode using the detailed GUI panel of the valve. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before opening the valve. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00005 | Verify the opening function. | Verify that there are no active interlocks applied to the valve.  Open the valve through the GUI panel. | Assess the “Open” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00006 | Verify the closing function. | Close the valve through the GUI panel. | Assess the “Close” status on the GUI panel. | □ |

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| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 92 LEBT-010:VAC-VVA-00071: First “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00071\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-00071\_VT-00009 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00010 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 93 LEBT-010:VAC-VVA-00071: Second “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00071\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VGP-00081** (Relay **3**) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-00071\_VT-00016 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00017 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 94 LEBT-010:VAC-VVA-00071: First “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00071\_VT-00021 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00022 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-VAC:VPDP-00071** (Nominal Speed) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-00071\_VT-00023 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00024 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00025 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00026 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00027 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 95 LEBT-010:VAC-VVA-00071: Second “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00071\_VT-00028 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00029 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-00071\_VT-00030 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00031 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00032 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00033 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00034 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 96 LEBT-010:VAC-VVA-00071: Third “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00071\_VT-00035 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00036 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-00071\_VT-00037 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00038 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00039 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00040 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00071\_VT-00041 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VGP-00081

### Gauge & Gauge Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Gauge & Gauge Controller Verification: Configuration

See 4.2 for generic configuration.

### Gauge & Gauge Controller Verification: Setup

See 4.3 for generic setup.

Gauge shall be under the nominal vacuum range before proceeding to the test.

Gauge shall be connected and shall not be measuring before starting the test.

Gauge controller shall be energized and shall not display any error to start the verification procedure.

A pre-calibrate simulator can be used instead of the gauge to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the gauge.

The GUI panel shall show that the gauge to be check is free of errors before starting the verification procedure.

### Gauge & Gauge Controller Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the gauge.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VGP-00081: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VGP-00081\_CR.01 | LEBT-010:VAC-VGP-00081\_MR.01 | LEBT-010:VAC-VGP-00081\_DAR.01 | LEBT-010:VAC-VGP-00081\_CsR.01 | LEBT-010:VAC-VEG-00011\_SR.01 | LEBT-010:VAC-VEG-00011\_IR.01 |
|  | LEBT-010:VAC-VGP-00081\_MR.02 |  |  |  | LEBT-010:VAC-VEG-10001\_IR.01 |
|  | LEBT-010:VAC-VGP-00081\_MR.03 |  |  |  | LEBT-010:VAC-VEG-10010\_IR.01 |
|  | LEBT-010:VAC-VGP-00081\_MR.04 |  |  |  | LEBT-010:VAC-VEG-20020\_IR.01 |
|  | LEBT-010:VAC-VGP-00081\_MR.05 |  |  |  |  |
|  | LEBT-010:VAC-VGP-00081\_MR.06 |  |  |  |  |
|  | LEBT-010:VAC-VGP-00081\_MR.07 |  |  |  |  |
|  | LEBT-010:VAC-VGP-00081\_MR.08 |  |  |  |  |
|  | LEBT-010:VAC-VGP-00081\_MR.09 |  |  |  |  |
|  | LEBT-010:VAC-VGP-00081\_MR.10 |  |  |  |  |
|  | LEBT-010:VAC-VGP-00081\_MR.11 |  |  |  |  |

#### LEBT-010:VAC-VGP-00081: Procedure of verification

LEBT-010:VAC-VGP-00081\_VT-00001: Gauge Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 97 LEBT-010:VAC-VGP-00081: Control & Monitoring (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGP-00081\_VT-00002 | Assess the gauge “Off” status. | No action required because the gauge shall already be off. Off, the gauge shall display a pressure of 1000 mbar. | Assess the gauge “Off” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-00081\_VT-00003 | Assess the gauge “On” status. | Stat the gauge. | Assess the “On” status of the gauge. | □ |
| Assess the “On” status of the gauge on the gauge controller. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-00081\_VT-00004 | Verify the pressure archiving. | Open archiving appliance. | Assess the value of the archived pressure. | □ |
| Assess the consistency between the row value and the scaled value. | □ |
| LEBT-010:VAC-VGP-00081\_VT-00005 | Verify the pressure archiving - Data Acquisition Alarm. | Disconnect or simulate a disconnection of the data acquisition analog measurement. | Assess the alarm on the control screen. | □ |

Table 98 LEBT-010:VAC-VGP-00081: Control & Monitoring (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGP-00081\_VT-00006 | Verify the over-range status. | Create or simulate an over-range pressure to be read by the gauge. | Assess the gauge “Over-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-00081\_VT-00007 | Verify the under-range status. | Create or simulate an under-range pressure to be read by the gauge. | Assess the gauge “Under-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-00081\_VT-00008 | Verify that the parameters of the gauges can be remotely modified. | Choose a parameter relative to the gauge. Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-00081\_VT-00009 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller.  Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

## Test case LEBT-010:VAC-VPT-06100

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Configuration

See 4.2 for generic configuration.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Setup

See 4.3 for generic setup.

Turbo-molecular pump shall be connected and shall not be running before starting the test.

Turbo-molecular pump controller shall be energized and shall not display any error to start the verification procedure.

The GUI panel shall show that the controller to be check is free of errors before starting the verification procedure.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the pump.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VPT-06100: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VPT-06100\_CR.01 | LEBT-010: VAC-VPT-06100\_MR.01 | LEBT-010:VAC-VPT-06100\_DAR.01 | LEBT-010:VAC-VPT-06100\_CsR.01 | LEBT-010:VAC-VPT-06100\_SR.01 | LEBT-010:VAC-VPT-06100\_IR.01 |
| LEBT-010:VAC-VPT-06100\_CR.02 | LEBT-010:VAC-VPT-06100\_MR.02 | LEBT-010:VAC-VPT-06100\_DAR.02 |  |  |  |
| LEBT-010:VAC-VPT-06100\_CR.03 | LEBT-010:VAC-VPT-06100\_MR.03 |  |  |  |  |
|  | LEBT-010:VAC-VPT-06100\_MR.04 |  |  |  |  |
|  | LEBT-010:VAC-VPT-06100\_MR.05 |  |  |  |  |
|  | LEBT-010:VAC-VPT-06100\_MR.06 |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VPT-06100: Procedure of verification

LEBT-010:VAC-VPT-06100\_VT-00001: Pump Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 99 LEBT-010:VAC-VPT-06100: Remote Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-06100\_VT-00002 | Verify the manual remote control of the pump. | Set “Manual” mode using the detailed GUI panel of the pump. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before starting the pump. | □ |
| LEBT-010:VAC-VPT-06100\_VT-00003 | Verify the error status. | Ensure that the turbomolecular pump controller is not running and disconnect the turbomolecular pump cable. Start the pump. | Assess the “Error” status on the GUI panel. | □ |
| Assess the “Error” status on the turbomolecular pump controller: the LED “ERROR” is on. | □ |
| LEBT-010:VAC-VPT-06100\_VT-00004 | Test the reset command. | After reconnecting the turbomolecular pump cable, reset the pump controller. | Assess that the “Error” status on the GUI panel disappears. | □ |
| Assess that the “Error” status on the turbomolecular pump controller disappear, the LED “ERROR” is off. | □ |
| LEBT-010:VAC-VPT-06100\_VT-00005 | Start the turbomolecular pump remotely. | Start the turbomolecular pump. | Assess the “On” status on the GUI panel.  Assess the “Accelerating” status on the GUI panel | □ |
| Assess the corresponding status on the primary pump controller: the LED “STATUS” is on. | □ |
| Assess the accelerating status show by the LEDs “LOAD” on the turbomolecular pump controller. | □ |

Table 100 LEBT-010:VAC-VPT-06100: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-06100\_VT-00006 | Assess turbomolecular pump controller parameters monitoring. | Assess evolution of dynamic parameters (converter frequency). | Control system monitors dynamic parameters. | □ |
| LEBT-010:VAC-VPT-06100\_VT-00007 | Stop the turbomolecular pump remotely. | Stop the turbomolecular pump. | Assess the “Off” status. | □ |
| Assess the corresponding status on the primary pump controller: “STATUS” LED is off. | □ |
| LEBT-010:VAC-VPT-06100\_VT-00008 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 101 LEBT-010:VAC-VPT-06100: “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-06100\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPT-06100\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VPT-06100\_VT-00009 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-06100\_VT-00010 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-06100\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-06100\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-06100\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 102 LEBT-010:VAC-VPT-06100: “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-06100\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPT-06100\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |  |
| LEBT-010:VAC-VPT-06100\_VT-00016 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-06100\_VT-00017 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-06100\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-06100\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-06100\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VVA-06100

### Angle Valves & Gates Valves Verification: Support Environment.

See 4.1 for generic support environment.

### Angle Valves & Gates Valves Verification: Configuration

See 4.2 for generic configuration.

### Angle Valves & Gates Valves Verification: Setup

See 4.3 for generic setup.

Angle valve or gate valve shall be connected and shall not be open before starting the test.

A simulator can be used instead of the valve to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the valve.

The GUI panel shall show that the valve to be check is free of errors before starting the verification procedure.

### Angle Valves & Gates Valves Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the valve.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VVA-06100: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to the requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VVA-06100\_CR.01 | LEBT-010:VAC-VVA-06100\_MR.01 | LEBT-010:VAC-VVA-06100\_DAR.01 | LEBT-010:VAC-VVA-06100\_CsR.01 | LEBT-010:VAC-VVA-06100\_SR.01 | LEBT-010:VAC-VVA-06100\_IR.01 |
| LEBT-010:VAC-VVA-06100\_CR.02 | LEBT-010:VAC-VVA-06100\_MR.02 | LEBT-010:VAC-VVA-06100\_DAR.02 |  |  |  |
|  | LEBT-010:VAC-VVA-06100\_MR.03 | LEBT-010:VAC-VVA-06100\_DAR.03 |  |  |  |
|  | LEBT-010:VAC-VVA-06100\_MR.04 |  |  |  |  |
|  | LEBT-010:VAC-VVA-06100\_MR.05 |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VVA-06100: Procedure of verification

LEBT-010:VAC-VVA-06100\_VT-00001: Valve Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 103 LEBT-010:VAC-VVA-06100: Remote & Manual Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-06100\_VT-00002 | Assess the closed status of the valve. | No action required because the valve shall already be closed. | Assess the “Close” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00003 | Assess the “Undefined” status of the valve. | Disconnect the control cable from the connector on the valve.  Wait that “Undefined” time-out elapsed. | Assess the “Undefined” status on the GUI panel. | □ |

Table 104 LEBT-010:VAC-VVA-06100: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-06100\_VT-00004 | Verify the manual remote control of the valve. | Set “Manual” mode using the detailed GUI panel of the valve. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before opening the valve. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00005 | Verify the opening function. | Verify that there are no active interlocks applied to the valve.  Open the valve through the GUI panel. | Assess the “Open” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00006 | Verify the closing function. | Close the valve through the GUI panel. | Assess the “Close” status on the GUI panel. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 105 LEBT-010:VAC-VVA-06100: First “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-06100\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VGP-00081** (Relay **3**) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-06100\_VT-00009 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00010 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 106 LEBT-010:VAC-VVA-06100: Second “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-06100\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-06100\_VT-00016 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00017 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 107 LEBT-010:VAC-VVA-06100: First “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-06100\_VT-00021 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00022 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-06100\_VT-00023 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00024 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00025 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00026 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00027 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 108 LEBT-010:VAC-VVA-06100: Second “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-06100\_VT-00028 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00029 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VPT-06100** (Nominal Speed) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-06100\_VT-00030 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00031 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00032 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00033 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00034 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 109 LEBT-010:VAC-VVA-06100: Third “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-06100\_VT-00035 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00036 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-06100\_VT-00037 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00038 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00039 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00040 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-06100\_VT-00041 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VPT-07100

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Configuration

See 4.2 for generic configuration.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Setup

See 4.3 for generic setup.

Turbo-molecular pump shall be connected and shall not be running before starting the test.

Turbo-molecular pump controller shall be energized and shall not display any error to start the verification procedure.

The GUI panel shall show that the controller to be check is free of errors before starting the verification procedure.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the pump.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VPT-07100: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VPT-07100\_CR.01 | LEBT-010: VAC-VPT-07100\_MR.01 | LEBT-010:VAC-VPT-07100\_DAR.01 | LEBT-010:VAC-VPT-07100\_CsR.01 | LEBT-010:VAC-VPT-07100\_SR.01 | LEBT-010:VAC-VPT-07100\_IR.01 |
| LEBT-010:VAC-VPT-07100\_CR.02 | LEBT-010:VAC-VPT-07100\_MR.02 | LEBT-010:VAC-VPT-07100\_DAR.02 |  |  |  |
| LEBT-010:VAC-VPT-07100\_CR.03 | LEBT-010:VAC-VPT-07100\_MR.03 |  |  |  |  |
|  | LEBT-010:VAC-VPT-07100\_MR.04 |  |  |  |  |
|  | LEBT-010:VAC-VPT-07100\_MR.05 |  |  |  |  |
|  | LEBT-010:VAC-VPT-07100\_MR.06 |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VPT-07100: Procedure of verification

LEBT-010:VAC-VPT-07100\_VT-00001: Pump Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 110 LEBT-010:VAC-VPT-07100: Remote Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-07100\_VT-00002 | Verify the manual remote control of the pump. | Set “Manual” mode using the detailed GUI panel of the pump. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before starting the pump. | □ |
| LEBT-010:VAC-VPT-07100\_VT-00003 | Verify the error status. | Ensure that the turbomolecular pump controller is not running and disconnect the turbomolecular pump cable. Start the pump. | Assess the “Error” status on the GUI panel. | □ |
| Assess the “Error” status on the turbomolecular pump controller: the LED “ERROR” is on. | □ |
| LEBT-010:VAC-VPT-07100\_VT-00004 | Test the reset command. | After reconnecting the turbomolecular pump cable, reset the pump controller. | Assess that the “Error” status on the GUI panel disappears. | □ |
| Assess that the “Error” status on the turbomolecular pump controller disappear, the LED “ERROR” is off. | □ |
| LEBT-010:VAC-VPT-07100\_VT-00005 | Start the turbomolecular pump remotely. | Start the turbomolecular pump. | Assess the “On” status on the GUI panel.  Assess the “Accelerating” status on the GUI panel | □ |
| Assess the corresponding status on the primary pump controller: the LED “STATUS” is on. | □ |
| Assess the accelerating status show by the LEDs “LOAD” on the turbomolecular pump controller. | □ |

Table 111 LEBT-010:VAC-VPT-07100: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-07100\_VT-00006 | Assess turbomolecular pump controller parameters monitoring. | Assess evolution of dynamic parameters (converter frequency). | Control system monitors dynamic parameters. | □ |
| LEBT-010:VAC-VPT-07100\_VT-00007 | Stop the turbomolecular pump remotely. | Stop the turbomolecular pump. | Assess the “Off” status. | □ |
| Assess the corresponding status on the primary pump controller: “STATUS” LED is off. | □ |
| LEBT-010:VAC-VPT-07100\_VT-00008 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

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| --- | --- |
| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 112 LEBT-010:VAC-VPT-07100: “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-07100\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPT-07100\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VPT-07100\_VT-00009 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-07100\_VT-00010 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-07100\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-07100\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-07100\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 113 LEBT-010:VAC-VPT-07100: “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-07100\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPT-07100\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |  |
| LEBT-010:VAC-VPT-07100\_VT-00016 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-07100\_VT-00017 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-07100\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-07100\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-07100\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VVA-07100

### Angle Valves & Gates Valves Verification: Support Environment.

See 4.1 for generic support environment.

### Angle Valves & Gates Valves Verification: Configuration

See 4.2 for generic configuration.

### Angle Valves & Gates Valves Verification: Setup

See 4.3 for generic setup.

Angle valve or gate valve shall be connected and shall not be open before starting the test.

A simulator can be used instead of the valve to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the valve.

The GUI panel shall show that the valve to be check is free of errors before starting the verification procedure.

### Angle Valves & Gates Valves Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the valve.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VVA-07100: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to the requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VVA-07100\_CR.01 | LEBT-010:VAC-VVA-07100\_MR.01 | LEBT-010:VAC-VVA-07100\_DAR.01 | LEBT-010:VAC-VVA-07100\_CsR.01 | LEBT-010:VAC-VVA-07100\_SR.01 | LEBT-010:VAC-VVA-07100\_IR.01 |
| LEBT-010:VAC-VVA-07100\_CR.02 | LEBT-010:VAC-VVA-07100\_MR.02 | LEBT-010:VAC-VVA-07100\_DAR.02 |  |  |  |
|  | LEBT-010:VAC-VVA-07100\_MR.03 | LEBT-010:VAC-VVA-07100\_DAR.03 |  |  |  |
|  | LEBT-010:VAC-VVA-07100\_MR.04 |  |  |  |  |
|  | LEBT-010:VAC-VVA-07100\_MR.05 |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VVA-07100: Procedure of verification

LEBT-010:VAC-VVA-07100\_VT-00001: Valve Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 114 LEBT-010:VAC-VVA-07100: Remote & Manual Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-07100\_VT-00002 | Assess the closed status of the valve. | No action required because the valve shall already be closed. | Assess the “Close” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00003 | Assess the “Undefined” status of the valve. | Disconnect the control cable from the connector on the valve.  Wait that “Undefined” time-out elapsed. | Assess the “Undefined” status on the GUI panel. | □ |

Table 115 LEBT-010:VAC-VVA-07100: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-07100\_VT-00004 | Verify the manual remote control of the valve. | Set “Manual” mode using the detailed GUI panel of the valve. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before opening the valve. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00005 | Verify the opening function. | Verify that there are no active interlocks applied to the valve.  Open the valve through the GUI panel. | Assess the “Open” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00006 | Verify the closing function. | Close the valve through the GUI panel. | Assess the “Close” status on the GUI panel. | □ |

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| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 116 LEBT-010:VAC-VVA-07100: First “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-07100\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VGP-00081** (Relay **3**) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-07100\_VT-00009 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00010 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 117 LEBT-010:VAC-VVA-07100: Second “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-07100\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-07100\_VT-00016 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00017 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 118 LEBT-010:VAC-VVA-07100: First “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-07100\_VT-00021 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00022 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-07100\_VT-00023 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00024 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00025 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00026 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00027 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 119 LEBT-010:VAC-VVA-07100: Second “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-07100\_VT-00028 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00029 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VPT-07100** (Nominal Speed) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-07100\_VT-00030 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00031 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00032 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00033 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00034 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 120 LEBT-010:VAC-VVA-07100: Third “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-07100\_VT-00035 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00036 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-07100\_VT-00037 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00038 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00039 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00040 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-07100\_VT-00041 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VGP-30000

### Gauge & Gauge Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Gauge & Gauge Controller Verification: Configuration

See 4.2 for generic configuration.

### Gauge & Gauge Controller Verification: Setup

See 4.3 for generic setup.

Gauge shall be under the nominal vacuum range before proceeding to the test.

Gauge shall be connected and shall not be measuring before starting the test.

Gauge controller shall be energized and shall not display any error to start the verification procedure.

A pre-calibrate simulator can be used instead of the gauge to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the gauge.

The GUI panel shall show that the gauge to be check is free of errors before starting the verification procedure.

### Gauge & Gauge Controller Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the gauge.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VGP-30000: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VGP-30000\_CR.01 | LEBT-010:VAC-VGP-30000\_MR.01 | LEBT-010:VAC-VGP-30000\_DAR.01 | LEBT-010:VAC-VEG-10001\_CsR.01 | LEBT-010:VAC-VEG-10001\_SR.01 | LEBT-010:VAC-VEG-00011\_IR.01 |
|  | LEBT-010:VAC-VGP-30000\_MR.02 |  |  |  | LEBT-010:VAC-VEG-10001\_IR.01 |
|  | LEBT-010:VAC-VGP-30000\_MR.03 |  |  |  | LEBT-010:VAC-VEG-10010\_IR.01 |
|  | LEBT-010:VAC-VGP-30000\_MR.04 |  |  |  | LEBT-010:VAC-VEG-20020\_IR.01 |
|  | LEBT-010:VAC-VGP-30000\_MR.05 |  |  |  |  |
|  | LEBT-010:VAC-VGP-30000\_MR.06 |  |  |  |  |
|  | LEBT-010:VAC-VGP-30000\_MR.07 |  |  |  |  |
|  | LEBT-010:VAC-VGP-30000\_MR.08 |  |  |  |  |
|  | LEBT-010:VAC-VGP-30000\_MR.09 |  |  |  |  |
|  | LEBT-010:VAC-VGP-30000\_MR.10 |  |  |  |  |
|  | LEBT-010:VAC-VGP-30000\_MR.11 |  |  |  |  |

#### LEBT-010:VAC-VGP-30000: Procedure of verification

LEBT-010:VAC-VGP-30000\_VT-00001: Gauge Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 121 LEBT-010:VAC-VGP-30000: Control & Monitoring (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGP-30000\_VT-00002 | Assess the gauge “Off” status. | No action required because the gauge shall already be off. Off, the gauge shall display a pressure of 1000 mbar. | Assess the gauge “Off” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-30000\_VT-00003 | Assess the gauge “On” status. | Stat the gauge. | Assess the “On” status of the gauge. | □ |
| Assess the “On” status of the gauge on the gauge controller. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-30000\_VT-00004 | Verify the pressure archiving. | Open archiving appliance. | Assess the value of the archived pressure. | □ |
| Assess the consistency between the row value and the scaled value. | □ |
| LEBT-010:VAC-VGP-30000\_VT-00005 | Verify the pressure archiving - Data Acquisition Alarm. | Disconnect or simulate a disconnection of the data acquisition analog measurement. | Assess the alarm on the control screen. | □ |

Table 122 LEBT-010:VAC-VGP-30000: Control & Monitoring (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGP-30000\_VT-00006 | Verify the over-range status. | Create or simulate an over-range pressure to be read by the gauge. | Assess the gauge “Over-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-30000\_VT-00007 | Verify the under-range status. | Create or simulate an under-range pressure to be read by the gauge. | Assess the gauge “Under-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-30000\_VT-00008 | Verify that the parameters of the gauges can be remotely modified. | Choose a parameter relative to the gauge. Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-30000\_VT-00009 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller.  Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

## Test case LEBT-010:VAC-VGC-30000

### Gauge & Gauge Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Gauge & Gauge Controller Verification: Configuration

See 4.2 for generic configuration.

### Gauge & Gauge Controller Verification: Setup

See 4.3 for generic setup.

Gauge shall be under the nominal vacuum range before proceeding to the test.

Gauge shall be connected and shall not be measuring before starting the test.

Gauge controller shall be energized and shall not display any error to start the verification procedure.

A pre-calibrate simulator can be used instead of the gauge to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the gauge.

The GUI panel shall show that the gauge to be check is free of errors before starting the verification procedure.

### Gauge & Gauge Controller Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the gauge.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VGC-30000: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VGC-30000\_CR.01 | LEBT-010:VAC-VGC-30000\_MR.01 | LEBT-010:VAC-VGC-30000\_DAR.01 | LEBT-010:VAC-VEG-10001\_CsR.01 | LEBT-010:VAC-VEG-10001\_SR.01 | LEBT-010:VAC-VEG-00011\_IR.01 |
|  | LEBT-010:VAC-VGC-30000\_MR.02 |  |  |  | LEBT-010:VAC-VEG-10001\_IR.01 |
|  | LEBT-010:VAC-VGC-30000\_MR.03 |  |  |  | LEBT-010:VAC-VEG-10010\_IR.01 |
|  | LEBT-010:VAC-VGC-30000\_MR.04 |  |  |  | LEBT-010:VAC-VEG-20020\_IR.01 |
|  | LEBT-010:VAC-VGC-30000\_MR.05 |  |  |  |  |
|  | LEBT-010:VAC-VGC-30000\_MR.06 |  |  |  |  |
|  | LEBT-010:VAC-VGC-30000\_MR.07 |  |  |  |  |
|  | LEBT-010:VAC-VGC-30000\_MR.08 |  |  |  |  |
|  | LEBT-010:VAC-VGC-30000\_MR.09 |  |  |  |  |
|  | LEBT-010:VAC-VGC-30000\_MR.10 |  |  |  |  |
|  | LEBT-010:VAC-VGC-30000\_MR.11 |  |  |  |  |

#### LEBT-010:VAC-VGC-30000: Procedure of verification

LEBT-010:VAC-VGC-30000\_VT-00001: Gauge Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 123 LEBT-010:VAC-VGC-30000: Control & Monitoring (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGC-30000\_VT-00002 | Assess the gauge “Off” status. | No action required because the gauge shall already be off. Off, the gauge shall display a pressure of 1000 mbar. | Assess the gauge “Off” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGC-30000\_VT-00003 | Assess the gauge “On” status. | Stat the gauge. | Assess the “On” status of the gauge. | □ |
| Assess the “On” status of the gauge on the gauge controller. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGC-30000\_VT-00004 | Verify the pressure archiving. | Open archiving appliance. | Assess the value of the archived pressure. | □ |
| Assess the consistency between the row value and the scaled value. | □ |
| LEBT-010:VAC-VGC-30000\_VT-00005 | Verify the pressure archiving - Data Acquisition Alarm. | Disconnect or simulate a disconnection of the data acquisition analog measurement. | Assess the alarm on the control screen. | □ |

Table 124 LEBT-010:VAC-VGC-30000: Control & Monitoring (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGC-30000\_VT-00006 | Verify the over-range status. | Create or simulate an over-range pressure to be read by the gauge. | Assess the gauge “Over-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGC-30000\_VT-00007 | Verify the under-range status. | Create or simulate an under-range pressure to be read by the gauge. | Assess the gauge “Under-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGC-30000\_VT-00008 | Verify that the parameters of the gauges can be remotely modified. | Choose a parameter relative to the gauge. Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGC-30000\_VT-00009 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller.  Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

## Test case LEBT-010:VAC-VPT-99998

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Configuration

See 4.2 for generic configuration.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Setup

See 4.3 for generic setup.

Turbo-molecular pump shall be connected and shall not be running before starting the test.

Turbo-molecular pump controller shall be energized and shall not display any error to start the verification procedure.

The GUI panel shall show that the controller to be check is free of errors before starting the verification procedure.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the pump.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VPT-99998: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| *LEBT-010:VAC-VPT-06100\_CR.01* | *LEBT-010: VAC-VPT-06100\_MR.01* | *LEBT-010:VAC-VPT-06100\_DAR.01* | *LEBT-010:VAC-VPT-06100\_CsR.01* | *LEBT-010:VAC-VPT-06100\_SR.01* | *LEBT-010:VAC-VPT-06100\_IR.01* |
| *LEBT-010:VAC-VPT-06100\_CR.02* | *LEBT-010:VAC-VPT-06100\_MR.02* | *LEBT-010:VAC-VPT-06100\_DAR.02* |  |  |  |
| *LEBT-010:VAC-VPT-06100\_CR.03* | *LEBT-010:VAC-VPT-06100\_MR.03* |  |  |  |  |
|  | *LEBT-010:VAC-VPT-06100\_MR.04* |  |  |  |  |
|  | *LEBT-010:VAC-VPT-06100\_MR.05* |  |  |  |  |
|  | *LEBT-010:VAC-VPT-06100\_MR.06* |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VPT-99998: Procedure of verification

LEBT-010:VAC-VPT-99998\_VT-00001: Pump Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 125 LEBT-010:VAC-VPT-99998: Remote Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-99998\_VT-00002 | Verify the manual remote control of the pump. | Set “Manual” mode using the detailed GUI panel of the pump. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before starting the pump. | □ |
| LEBT-010:VAC-VPT-99998\_VT-00003 | Verify the error status. | Ensure that the turbomolecular pump controller is not running and disconnect the turbomolecular pump cable. Start the pump. | Assess the “Error” status on the GUI panel. | □ |
| Assess the “Error” status on the turbomolecular pump controller: the LED “ERROR” is on. | □ |
| LEBT-010:VAC-VPT-99998\_VT-00004 | Test the reset command. | After reconnecting the turbomolecular pump cable, reset the pump controller. | Assess that the “Error” status on the GUI panel disappears. | □ |
| Assess that the “Error” status on the turbomolecular pump controller disappear, the LED “ERROR” is off. | □ |
| LEBT-010:VAC-VPT-99998\_VT-00005 | Start the turbomolecular pump remotely. | Start the turbomolecular pump. | Assess the “On” status on the GUI panel.  Assess the “Accelerating” status on the GUI panel | □ |
| Assess the corresponding status on the primary pump controller: the LED “STATUS” is on. | □ |
| Assess the accelerating status show by the LEDs “LOAD” on the turbomolecular pump controller. | □ |

Table 126 LEBT-010:VAC-VPT-99998: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-99998\_VT-00006 | Assess turbomolecular pump controller parameters monitoring. | Assess evolution of dynamic parameters (converter frequency). | Control system monitors dynamic parameters. | □ |
| LEBT-010:VAC-VPT-99998\_VT-00007 | Stop the turbomolecular pump remotely. | Stop the turbomolecular pump. | Assess the “Off” status. | □ |
| Assess the corresponding status on the primary pump controller: “STATUS” LED is off. | □ |
| LEBT-010:VAC-VPT-99998\_VT-00008 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

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| --- | --- |
| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 127 LEBT-010:VAC-VPT-99998: “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-99998\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPT-99998\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VPT-99998\_VT-00009 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-99998\_VT-00010 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-99998\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-99998\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-99998\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 128 LEBT-010:VAC-VPT-99998: “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-99998\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPT-99998\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |  |
| LEBT-010:VAC-VPT-99998\_VT-00016 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-99998\_VT-00017 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-99998\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-99998\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-99998\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VVA-99998

### Angle Valves & Gates Valves Verification: Support Environment.

See 4.1 for generic support environment.

### Angle Valves & Gates Valves Verification: Configuration

See 4.2 for generic configuration.

### Angle Valves & Gates Valves Verification: Setup

See 4.3 for generic setup.

Angle valve or gate valve shall be connected and shall not be open before starting the test.

A simulator can be used instead of the valve to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the valve.

The GUI panel shall show that the valve to be check is free of errors before starting the verification procedure.

### Angle Valves & Gates Valves Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the valve.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VVA-99998: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to the requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| *LEBT-010:VAC-VVA-06100\_CR.01* | *LEBT-010:VAC-VVA-06100\_MR.01* | *LEBT-010:VAC-VVA-06100\_DAR.01* | *LEBT-010:VAC-VVA-06100\_CsR.01* | *LEBT-010:VAC-VVA-06100\_SR.01* | *LEBT-010:VAC-VVA-06100\_IR.01* |
| *LEBT-010:VAC-VVA-06100\_CR.02* | *LEBT-010:VAC-VVA-06100\_MR.02* | *LEBT-010:VAC-VVA-06100\_DAR.02* |  |  |  |
|  | *LEBT-010:VAC-VVA-06100\_MR.03* | *LEBT-010:VAC-VVA-06100\_DAR.03* |  |  |  |
|  | *LEBT-010:VAC-VVA-06100\_MR.04* |  |  |  |  |
|  | *LEBT-010:VAC-VVA-06100\_MR.05* |  |  |  |  |
|  |  |  |  |  |  |
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#### LEBT-010:VAC-VVA-99998: Procedure of verification

LEBT-010:VAC-VVA-99998\_VT-00001: Valve Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 129 LEBT-010:VAC-VVA-99998: Remote & Manual Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-99998\_VT-00002 | Assess the closed status of the valve. | No action required because the valve shall already be closed. | Assess the “Close” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00003 | Assess the “Undefined” status of the valve. | Disconnect the control cable from the connector on the valve.  Wait that “Undefined” time-out elapsed. | Assess the “Undefined” status on the GUI panel. | □ |

Table 130 LEBT-010:VAC-VVA-99998: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-99998\_VT-00004 | Verify the manual remote control of the valve. | Set “Manual” mode using the detailed GUI panel of the valve. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before opening the valve. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00005 | Verify the opening function. | Verify that there are no active interlocks applied to the valve.  Open the valve through the GUI panel. | Assess the “Open” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00006 | Verify the closing function. | Close the valve through the GUI panel. | Assess the “Close” status on the GUI panel. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 131 LEBT-010:VAC-VVA-99998: First “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-99998\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VGP-00081** (Relay **3**) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-99998\_VT-00009 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00010 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 132 LEBT-010:VAC-VVA-99998: Second “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-99998\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-99998\_VT-00016 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00017 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 133 LEBT-010:VAC-VVA-99998: First “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-99998\_VT-00021 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00022 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-99998\_VT-00023 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00024 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00025 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00026 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00027 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 134 LEBT-010:VAC-VVA-99998: Second “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-99998\_VT-00028 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00029 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VPT-99998** (Nominal Speed) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-99998\_VT-00030 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00031 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00032 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00033 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00034 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 135 LEBT-010:VAC-VVA-99998: Third “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-99998\_VT-00035 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00036 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-99998\_VT-00037 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00038 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00039 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00040 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99998\_VT-00041 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VPT-99999

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Configuration

See 4.2 for generic configuration.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Setup

See 4.3 for generic setup.

Turbo-molecular pump shall be connected and shall not be running before starting the test.

Turbo-molecular pump controller shall be energized and shall not display any error to start the verification procedure.

The GUI panel shall show that the controller to be check is free of errors before starting the verification procedure.

### Turbo-Molecular Pump & Turbo-Molecular Pump Controller Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the pump.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VPT-99999: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| *LEBT-010:VAC-VPT-07100\_CR.01* | *LEBT-010: VAC-VPT-07100\_MR.01* | *LEBT-010:VAC-VPT-07100\_DAR.01* | *LEBT-010:VAC-VPT-07100\_CsR.01* | *LEBT-010:VAC-VPT-07100\_SR.01* | *LEBT-010:VAC-VPT-07100\_IR.01* |
| *LEBT-010:VAC-VPT-07100\_CR.02* | *LEBT-010:VAC-VPT-07100\_MR.02* | *LEBT-010:VAC-VPT-07100\_DAR.02* |  |  |  |
| *LEBT-010:VAC-VPT-07100\_CR.03* | *LEBT-010:VAC-VPT-07100\_MR.03* |  |  |  |  |
|  | *LEBT-010:VAC-VPT-07100\_MR.04* |  |  |  |  |
|  | *LEBT-010:VAC-VPT-07100\_MR.05* |  |  |  |  |
|  | *LEBT-010:VAC-VPT-07100\_MR.06* |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VPT-99999: Procedure of verification

LEBT-010:VAC-VPT-99999\_VT-00001: Pump Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 136 LEBT-010:VAC-VPT-99999: Remote Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-99999\_VT-00002 | Verify the manual remote control of the pump. | Set “Manual” mode using the detailed GUI panel of the pump. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before starting the pump. | □ |
| LEBT-010:VAC-VPT-99999\_VT-00003 | Verify the error status. | Ensure that the turbomolecular pump controller is not running and disconnect the turbomolecular pump cable. Start the pump. | Assess the “Error” status on the GUI panel. | □ |
| Assess the “Error” status on the turbomolecular pump controller: the LED “ERROR” is on. | □ |
| LEBT-010:VAC-VPT-99999\_VT-00004 | Test the reset command. | After reconnecting the turbomolecular pump cable, reset the pump controller. | Assess that the “Error” status on the GUI panel disappears. | □ |
| Assess that the “Error” status on the turbomolecular pump controller disappear, the LED “ERROR” is off. | □ |
| LEBT-010:VAC-VPT-99999\_VT-00005 | Start the turbomolecular pump remotely. | Start the turbomolecular pump. | Assess the “On” status on the GUI panel.  Assess the “Accelerating” status on the GUI panel | □ |
| Assess the corresponding status on the primary pump controller: the LED “STATUS” is on. | □ |
| Assess the accelerating status show by the LEDs “LOAD” on the turbomolecular pump controller. | □ |

Table 137 LEBT-010:VAC-VPT-99999: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-99999\_VT-00006 | Assess turbomolecular pump controller parameters monitoring. | Assess evolution of dynamic parameters (converter frequency). | Control system monitors dynamic parameters. | □ |
| LEBT-010:VAC-VPT-99999\_VT-00007 | Stop the turbomolecular pump remotely. | Stop the turbomolecular pump. | Assess the “Off” status. | □ |
| Assess the corresponding status on the primary pump controller: “STATUS” LED is off. | □ |
| LEBT-010:VAC-VPT-99999\_VT-00008 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

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| --- | --- |
| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 138 LEBT-010:VAC-VPT-99999: “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-99999\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPT-99999\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VPT-99999\_VT-00009 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-99999\_VT-00010 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-99999\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-99999\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-99999\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the pump shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 139 LEBT-010:VAC-VPT-99999: “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPT-99999\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VPT-99999\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |  |
| LEBT-010:VAC-VPT-99999\_VT-00016 | Assess the on status of the pump. | Start the pump or assess the on status of the pump. | Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-99999\_VT-00017 | Verify that the tripped interlock stop the pump. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-99999\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-start the pump. | Assess the override status of the interlock. | □ |
| Assess the “On” status of the pump. | □ |
| LEBT-010:VAC-VPT-99999\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Off” status of the pump. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VPT-99999\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-start the pump.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “On” status of the pump. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VVA-99999

### Angle Valves & Gates Valves Verification: Support Environment.

See 4.1 for generic support environment.

### Angle Valves & Gates Valves Verification: Configuration

See 4.2 for generic configuration.

### Angle Valves & Gates Valves Verification: Setup

See 4.3 for generic setup.

Angle valve or gate valve shall be connected and shall not be open before starting the test.

A simulator can be used instead of the valve to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the valve.

The GUI panel shall show that the valve to be check is free of errors before starting the verification procedure.

### Angle Valves & Gates Valves Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the valve.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VVA-99999: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to the requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| *LEBT-010:VAC-VVA-07100\_CR.01* | *LEBT-010:VAC-VVA-07100\_MR.01* | *LEBT-010:VAC-VVA-07100\_DAR.01* | *LEBT-010:VAC-VVA-07100\_CsR.01* | *LEBT-010:VAC-VVA-07100\_SR.01* | *LEBT-010:VAC-VVA-07100\_IR.01* |
| *LEBT-010:VAC-VVA-07100\_CR.02* | *LEBT-010:VAC-VVA-07100\_MR.02* | *LEBT-010:VAC-VVA-07100\_DAR.02* |  |  |  |
|  | *LEBT-010:VAC-VVA-07100\_MR.03* | *LEBT-010:VAC-VVA-07100\_DAR.03* |  |  |  |
|  | *LEBT-010:VAC-VVA-07100\_MR.04* |  |  |  |  |
|  | *LEBT-010:VAC-VVA-07100\_MR.05* |  |  |  |  |
|  |  |  |  |  |  |
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#### LEBT-010:VAC-VVA-99999: Procedure of verification

LEBT-010:VAC-VVA-99999\_VT-00001: Valve Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 140 LEBT-010:VAC-VVA-99999: Remote & Manual Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-99999\_VT-00002 | Assess the closed status of the valve. | No action required because the valve shall already be closed. | Assess the “Close” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00003 | Assess the “Undefined” status of the valve. | Disconnect the control cable from the connector on the valve.  Wait that “Undefined” time-out elapsed. | Assess the “Undefined” status on the GUI panel. | □ |

Table 141 LEBT-010:VAC-VVA-99999: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-99999\_VT-00004 | Verify the manual remote control of the valve. | Set “Manual” mode using the detailed GUI panel of the valve. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before opening the valve. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00005 | Verify the opening function. | Verify that there are no active interlocks applied to the valve.  Open the valve through the GUI panel. | Assess the “Open” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00006 | Verify the closing function. | Close the valve through the GUI panel. | Assess the “Close” status on the GUI panel. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 142 LEBT-010:VAC-VVA-99999: First “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-99999\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VGP-00081** (Relay **3**) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-99999\_VT-00009 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00010 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 143 LEBT-010:VAC-VVA-99999: Second “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-99999\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-99999\_VT-00016 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00017 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 144 LEBT-010:VAC-VVA-99999: First “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-99999\_VT-00021 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00022 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-99999\_VT-00023 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00024 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00025 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00026 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00027 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 145 LEBT-010:VAC-VVA-99999: Second “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-99999\_VT-00028 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00029 | Interlock identification | Identify the source of the interlock (Device & Status): **LEBT-010:VAC-VPT-99999** (Nominal Speed) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-99999\_VT-00030 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00031 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00032 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00033 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00034 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 146 LEBT-010:VAC-VVA-99999: Third “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-99999\_VT-00035 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00036 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-99999\_VT-00037 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00038 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00039 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00040 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-99999\_VT-00041 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

## Test case LEBT-010:VAC-VGP-99999

### Gauge & Gauge Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Gauge & Gauge Controller Verification: Configuration

See 4.2 for generic configuration.

### Gauge & Gauge Controller Verification: Setup

See 4.3 for generic setup.

Gauge shall be under the nominal vacuum range before proceeding to the test.

Gauge shall be connected and shall not be measuring before starting the test.

Gauge controller shall be energized and shall not display any error to start the verification procedure.

A pre-calibrate simulator can be used instead of the gauge to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the gauge.

The GUI panel shall show that the gauge to be check is free of errors before starting the verification procedure.

### Gauge & Gauge Controller Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the gauge.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VGP-99999: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| *LEBT-010:VAC-VGP-30000\_CR.01* | *LEBT-010:VAC-VGP-30000\_MR.01* | *LEBT-010:VAC-VGP-30000\_DAR.01* | *LEBT-010:VAC-VEG-10001\_CsR.01* | *LEBT-010:VAC-VEG-10001\_SR.01* | *LEBT-010:VAC-VEG-00011\_IR.01* |
|  | *LEBT-010:VAC-VGP-30000\_MR.02* |  |  |  | *LEBT-010:VAC-VEG-10001\_IR.01* |
|  | *LEBT-010:VAC-VGP-30000\_MR.03* |  |  |  | *LEBT-010:VAC-VEG-10010\_IR.01* |
|  | *LEBT-010:VAC-VGP-30000\_MR.04* |  |  |  | *LEBT-010:VAC-VEG-20020\_IR.01* |
|  | *LEBT-010:VAC-VGP-30000\_MR.05* |  |  |  |  |
|  | *LEBT-010:VAC-VGP-30000\_MR.06* |  |  |  |  |
|  | *LEBT-010:VAC-VGP-30000\_MR.07* |  |  |  |  |
|  | *LEBT-010:VAC-VGP-30000\_MR.08* |  |  |  |  |
|  | *LEBT-010:VAC-VGP-30000\_MR.09* |  |  |  |  |
|  | *LEBT-010:VAC-VGP-30000\_MR.10* |  |  |  |  |
|  | *LEBT-010:VAC-VGP-30000\_MR.11* |  |  |  |  |

#### LEBT-010:VAC-VGP-99999: Procedure of verification

LEBT-010:VAC-VGP-99999\_VT-00001: Gauge Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 147 LEBT-010:VAC-VGP-99999: Control & Monitoring (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGP-99999\_VT-00002 | Assess the gauge “Off” status. | No action required because the gauge shall already be off. Off, the gauge shall display a pressure of 1000 mbar. | Assess the gauge “Off” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-99999\_VT-00003 | Assess the gauge “On” status. | Stat the gauge. | Assess the “On” status of the gauge. | □ |
| Assess the “On” status of the gauge on the gauge controller. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-99999\_VT-00004 | Verify the pressure archiving. | Open archiving appliance. | Assess the value of the archived pressure. | □ |
| Assess the consistency between the row value and the scaled value. | □ |
| LEBT-010:VAC-VGP-99999\_VT-00005 | Verify the pressure archiving - Data Acquisition Alarm. | Disconnect or simulate a disconnection of the data acquisition analog measurement. | Assess the alarm on the control screen. | □ |

Table 148 LEBT-010:VAC-VGP-99999: Control & Monitoring (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGP-99999\_VT-00006 | Verify the over-range status. | Create or simulate an over-range pressure to be read by the gauge. | Assess the gauge “Over-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-99999\_VT-00007 | Verify the under-range status. | Create or simulate an under-range pressure to be read by the gauge. | Assess the gauge “Under-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-99999\_VT-00008 | Verify that the parameters of the gauges can be remotely modified. | Choose a parameter relative to the gauge. Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGP-99999\_VT-00009 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller.  Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

## Test case LEBT-010:VAC-VGC-99999

### Gauge & Gauge Controller Verification: Support Environment.

See 4.1 for generic support environment.

### Gauge & Gauge Controller Verification: Configuration

See 4.2 for generic configuration.

### Gauge & Gauge Controller Verification: Setup

See 4.3 for generic setup.

Gauge shall be under the nominal vacuum range before proceeding to the test.

Gauge shall be connected and shall not be measuring before starting the test.

Gauge controller shall be energized and shall not display any error to start the verification procedure.

A pre-calibrate simulator can be used instead of the gauge to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the gauge.

The GUI panel shall show that the gauge to be check is free of errors before starting the verification procedure.

### Gauge & Gauge Controller Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the gauge.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VGC-99999: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| *LEBT-010:VAC-VGC-30000\_CR.01* | *LEBT-010:VAC-VGC-30000\_MR.01* | *LEBT-010:VAC-VGC-30000\_DAR.01* | *LEBT-010:VAC-VEG-10001\_CsR.01* | *LEBT-010:VAC-VEG-10001\_SR.01* | *LEBT-010:VAC-VEG-00011\_IR.01* |
|  | *LEBT-010:VAC-VGC-30000\_MR.02* |  |  |  | *LEBT-010:VAC-VEG-10001\_IR.01* |
|  | *LEBT-010:VAC-VGC-30000\_MR.03* |  |  |  | *LEBT-010:VAC-VEG-10010\_IR.01* |
|  | *LEBT-010:VAC-VGC-30000\_MR.04* |  |  |  | *LEBT-010:VAC-VEG-20020\_IR.01* |
|  | *LEBT-010:VAC-VGC-30000\_MR.05* |  |  |  |  |
|  | *LEBT-010:VAC-VGC-30000\_MR.06* |  |  |  |  |
|  | *LEBT-010:VAC-VGC-30000\_MR.07* |  |  |  |  |
|  | *LEBT-010:VAC-VGC-30000\_MR.08* |  |  |  |  |
|  | *LEBT-010:VAC-VGC-30000\_MR.09* |  |  |  |  |
|  | *LEBT-010:VAC-VGC-30000\_MR.10* |  |  |  |  |
|  | *LEBT-010:VAC-VGC-30000\_MR.11* |  |  |  |  |

#### LEBT-010:VAC-VGC-99999: Procedure of verification

LEBT-010:VAC-VGC-99999\_VT-00001: Gauge Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 149 LEBT-010:VAC-VGC-99999: Control & Monitoring (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGC-99999\_VT-00002 | Assess the gauge “Off” status. | No action required because the gauge shall already be off. Off, the gauge shall display a pressure of 1000 mbar. | Assess the gauge “Off” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGC-99999\_VT-00003 | Assess the gauge “On” status. | Stat the gauge. | Assess the “On” status of the gauge. | □ |
| Assess the “On” status of the gauge on the gauge controller. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGC-99999\_VT-00004 | Verify the pressure archiving. | Open archiving appliance. | Assess the value of the archived pressure. | □ |
| Assess the consistency between the row value and the scaled value. | □ |
| LEBT-010:VAC-VGC-99999\_VT-00005 | Verify the pressure archiving - Data Acquisition Alarm. | Disconnect or simulate a disconnection of the data acquisition analog measurement. | Assess the alarm on the control screen. | □ |

Table 150 LEBT-010:VAC-VGC-99999: Control & Monitoring (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VGC-99999\_VT-00006 | Verify the over-range status. | Create or simulate an over-range pressure to be read by the gauge. | Assess the gauge “Over-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGC-99999\_VT-00007 | Verify the under-range status. | Create or simulate an under-range pressure to be read by the gauge. | Assess the gauge “Under-Range” status. | □ |
| Write down the pressure displayed by the gauge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGC-99999\_VT-00008 | Verify that the parameters of the gauges can be remotely modified. | Choose a parameter relative to the gauge. Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| LEBT-010:VAC-VGC-99999\_VT-00009 | Verify that the parameters of the controller can be remotely modified. | Choose a parameter relative to the controller.  Write down the Parameter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | Write down the value of the parameter before the modification: \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Modify the parameter. | Write down the value of the modified value of the parameter : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the parameter to the desired value. | Write down the value of the parameter after the modification: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

## Test case LEBT-010:VAC-VPG-20001

### Vacuum Pumping Group Verification: Support Environment.

See 4.1 for generic support environment.

### Vacuum Pumping Group Verification: Configuration

See 4.2 for generic configuration.

### Vacuum Pumping Group Verification: Setup

See 4.3 for generic setup.

Devices that constitute the pumping group shall be tested and verified beforehand.

Adjacent pumping group, **LEBT-010:VAC-VPG-10001**, connected to the first sector shall be stopped to proceed to all of these test.

The GUI panel shall show that the devices to be check are free of errors before starting the verification procedure.

### Vacuum Pumping Group Verification: Procedure

Remote commands shall be set and status shall be assessed using the detailed GUI panel of the device.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VPG-20001: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| No requirements | **No requirements** | **No requirements** | **No requirements** | LEBT-010:VAC-VEG-00011\_SR.01 | **No requirements** |
|  |  |  |  | LEBT-010:VAC-VEG-00011\_SR.02 |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VPG-20001: Procedure of verification

Table 151 LEBT-010:VAC-VPG-20001: Pump-Down Atmospheric Pressure (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-20001\_VT-00001 | Verify the pump down sequence (from atmospheric pressure). | Assess that the vacuum sector is at the atmospheric pressure. | Write down the actual pressure:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Set the “Normal” Mode. | Assess that it is not possible to start the pumping group. | □ |
| Assess the error. | □ |
| Disconnect the interlock from the gauge controller that conditions the starting of the turbomolecular pumps according to electrical diagram [6]. | Relay **5** of **LEBT-010:VAC-VEG-00011** has been disconnected. | □ |
| ~~Disconnect the open status of~~ **~~LEBT-010:VAC-VVA-00071~~** ~~according to electrical diagram [6].~~ | ~~Open status of~~ **~~LEBT-010:VAC-VVA-00071~~** ~~is disconnected.~~ | ~~□~~ |
| Set the “Pump-Down” Mode.  Reset the pumping group. | “Pump-Down” Mode is active. | □ |
| Assess that the error has disappeared. | □ |

Table 152 LEBT-010:VAC-VPG-20001: Pump-Down Atmospheric Pressure (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-20001\_VT-00002 | Verify the pump down sequence (from atmospheric pressure). | Start the pumping group | Assess the opening of  **LEBT-010:VAC-VVA-00071**. | □ |
| Assess the opening of  **LEBT-010:VAC-VVA-06100**. | □ |
| Assess the opening of  **LEBT-010:VAC-VVA-07100**. | □ |
| Assess the opening of  **LEBT-010:VAC-VVA-99998**. | □ |
| Assess the opening of  **LEBT-010:VAC-VVA-99999**. | □ |
| ~~Assess the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | □ |
| Assess the starting of the primary pump. | □ |
| Assess that turbomolecular pumps do not start. | □ |
| Wait that the delay has elapsed (more than 30s) | Assess that turbomolecular pumps do not start. | □ |
| Re-establish the interlock from the gauge controller that conditions the starting of the turbomolecular pumps according to electrical diagram [6]. | Assess that the turbomolecular pumps are starting. | □ |
| Pump down the vacuum sector. | Write down the pressure after having pumped down the sector: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |

Table 153 LEBT-010:VAC-VPG-20001: Normal Starting Sequence [sector under vacuum] (Part 1)

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-20001\_VT-00003 | Verify the starting sequence (under vacuum). | Assess that the vacuum sector is under vacuum. | Write down the actual pressure:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Assess that the pumping group is stop. | All the pumps are off and the valves are close. | □ |
| LEBT-010:VAC-VPG-20001\_VT-00004 | Disconnect the “interlocks” required by the sequences to progress (accordingly to the electrical diagram [6]). | Disconnect the interlock from the pump that conditions the opening of **LEBT-010:VAC-VVA-00071**. | Interlock has been disabled. | □ |
| Disconnect the interlock from the gauge controller that conditions the starting of the turbomolecular pumps. | Interlock has been disabled. | □ |
| Disconnect the interlock from the turbomolecular pump controller that conditions the opening of  **LEBT-010:VAC-VVA-06100**. | Interlock has been disabled. | □ |
| Disconnect the interlock from the turbomolecular pump controller that conditions the opening of  **LEBT-010:VAC-VVA-07100**. | Interlock has been disabled. | □ |
| Disconnect the interlock from the turbomolecular pump controller that conditions the opening of  **LEBT-010:VAC-VVA-99998**. | Interlock has been disabled. | □ |
| Disconnect the interlock from the turbomolecular pump controller that conditions the opening of  **LEBT-010:VAC-VVA-99999**. | Interlock has been disabled. | □ |
| ~~Disconnect the interlock from the turbomolecular pump controller that conditions the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~Interlock has been disabled.~~ | ~~□~~ |

Table 154 LEBT-010:VAC-VPG-20001: Normal Starting Sequence [sector under vacuum] (Part 2)

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-20001\_VT-00005 | Verify the starting sequence (under vacuum). | Start the pumping group. | Assess that the primary pump starts. | □ |
| Re-establish the interlock from the pump that conditions the opening of **LEBT-010:VAC-VVA-00071**. | Assess the opening of  **LEBT-010:VAC-VVA-00071**. | □ |
| Re-establish disconnect the interlock from the gauge controller that conditions the starting of the turbomolecular pumps. | Assess the starting of the turbomolecular pumps. | □ |
| Once **LEBT-010:VAC-VPT-06100** is at nominal speed, re-establish interlock from the turbomolecular pump controller that conditions the opening of **LEBT-010:VAC-VVA-06100**. | Assess the opening of  **LEBT-010:VAC-VVA-06100**. | □ |
| Once **LEBT-010:VAC-VPT-07100** is at nominal speed, re-establish interlock from the turbomolecular pump controller that conditions the opening of **LEBT-010:VAC-VVA-07100**. | Assess the opening of  **LEBT-010:VAC-VVA-07100**. | □ |
| Once **LEBT-010:VAC-VPT-99998** is at nominal speed, re-establish interlock from the turbomolecular pump controller that conditions the opening of **LEBT-010:VAC-VVA-99998**. | Assess the opening of  **LEBT-010:VAC-VVA-99998**. | □ |
| Once**LEBT-010:VAC-VPT-99999** is at nominal speed, re-establish interlock from the turbomolecular pump controller that conditions the opening of **LEBT-010:VAC-VVA-99999**. | Assess the opening of  **LEBT-010:VAC-VVA-99999**. | □ |
| ~~Once~~ **~~\_\_\_\_-\_\_\_:VAC-VPT-0\_\_00~~** ~~is at nominal speed, re-establish interlock from the turbomolecular pump controller that conditions the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~Assess the opening of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~□~~ |

Table 155 LEBT-010:VAC-VPG-20001: Normal Stopping Sequence [sector under vacuum] (Part 1)

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-20001\_VT-00006 | Verify the stopping sequence (under vacuum). | Assess that the vacuum sector is under vacuum. | Write down the actual pressure:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Assess that the pumping group is running. | All the pumps are running and all the valves are open. | □ |
| LEBT-010:VAC-VPG-20001\_VT-00007 | Disconnect valves close status. | ~~Disconnect the close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~** ~~according to electrical diagram [6].~~ | ~~Close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~** ~~is disconnected.~~ | ~~□~~ |
| Disconnect the close status of **LEBT-010:VAC-VVA-99999** according to electrical diagram [6]. | Close status of **LEBT-010:VAC-VVA-99999** is disconnected. | ~~□~~ |
| Disconnect the close status of **LEBT-010:VAC-VVA-99998** according to electrical diagram [6]. | Close status of **LEBT-010:VAC-VVA-99998** is disconnected. | ~~□~~ |
| Disconnect the close status of **LEBT-010:VAC-VVA-07100** according to electrical diagram [6]. | Close status of **LEBT-010:VAC-VVA-07100** is disconnected. | □ |
| Disconnect the close status of **LEBT-010:VAC-VVA-06100** according to electrical diagram [6]. | Close status of **LEBT-010:VAC-VVA-06100** is disconnected. | □ |
| Disconnect the close status of **LEBT-010:VAC-VVA-00071** according to electrical diagram [6]. | Close status of **LEBT-010:VAC-VVA-00071** is disconnected. | □ |

Table 156 LEBT-010:VAC-VPG-20001: Normal Stopping Sequence [sector under vacuum] (Part 2)

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-20001\_VT-00008 | Verify the stopping sequence (under vacuum). | Stop the pumping group. | Assess that the valves on the turbomolecular pumps are closed in the tunnel. | □ |
| Assess that the turbomolecular pumps are still running. | □ |

Table 157 LEBT-010:VAC-VPG-20001: Normal Stopping Sequence [sector under vacuum] (Part 3)

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-20001\_VT-00009 | Reconnect valves close status. | ~~Reconnect the close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~** ~~according to electrical diagram [6].~~ | ~~Assess the close status of~~ **~~\_\_\_\_-\_\_\_:VAC-VVA-0\_\_00~~**~~.~~ | ~~□~~ |
| ~~Assess that~~ **~~\_\_\_\_-\_\_\_:VAC-VPT-0\_\_00~~** ~~is stopping.~~ | ~~□~~ |
| Reconnect the close status of **LEBT-010:VAC-VVA-99999** according to electrical diagram [6]. | Assess the close status of  **LEBT-010:VAC-VVA-99999**. | ~~□~~ |
| Assess that **LEBT-010:VAC-VPT-99999** is stopping. | ~~□~~ |
| Reconnect the close status of **LEBT-010:VAC-VVA-99998** according to electrical diagram [6]. | Assess the close status of  **LEBT-010:VAC-VVA-99998**. | ~~□~~ |
| Assess that **LEBT-010:VAC-VPT-99998** is stopping. | ~~□~~ |
| Reconnect the close status of **LEBT-010:VAC-VVA-07100** according to electrical diagram [6]. | Assess the close status of  **LEBT-010:VAC-VVA-07100**. | □ |
| Assess that **LEBT-010:VAC-VPT-07100** is stopping. | □ |
| Reconnect the close status of **LEBT-010:VAC-VVA-06100** according to electrical diagram [6]. | Assess the close status of  **LEBT-010:VAC-VVA-06100**. | □ |
| Assess that **LEBT-010:VAC-VPT-06100** is stopping. | □ |
| Reconnect the close status of **LEBT-010:VAC-VVA-00071** according to electrical diagram [6]. | Assess the close status of  **LEBT-010:VAC-VVA-00071**. | □ |
| Assess that  **LEBT-010:VAC-VPDP-00071** is stopping. | □ |

Table 158 LEBT-010:VAC-VPG-20001: Maintenance (Leak Detection) Sequence.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-20001\_VT-00010 | Verify the leak detection sequence (under vacuum). | Assess that the vacuum sector is under vacuum. | Write down the actual pressure:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Assess that a leak detector is connected to the sector and is running. | Write down the actual pressure of the leak detector:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Assess that the pumping group is running and the turbomolecular pump is/are running at the nominal speed. | Pumps are running and valves are open. | □ |
| Switch to the “Leak Detection” Mode. | “Leak Detection” Mode is active. | □ |
| Manually open or close the valve upon the primary pump. | The valve upon the primary pump is manually controlled. | □ |
| Switch back to the “Normal” Mode. | “Leak Detection” Mode is active. | □ |
| The valve upon the primary pump is no more manually controlled. | □ |

Table 159 LEBT-010:VAC-VPG-20001: Local Protections (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-20001\_VT-00011 | Assess the configuration of the hardware interlock. | Asses that the hardware interlock has been configured. | The interlock is not configured. | □ |
| The interlock is configured. | □ |
| Hardware interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| Verify that the tripped interlock stop the pumping group. | Start the pumping group and wait that it reaches its nominal state.  Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess that the group stop. | □ |
| LEBT-010:VAC-VPG-20001\_VT-00012 | Assess the configuration of the software interlock. | Asses that the hardware interlock has been configured. | The interlock is not configured. | □ |
| The interlock is configured. | □ |
| Software interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| Verify that the tripped interlock stop the pumping group. | Start the pumping group and wait that it reaches its nominal state.  Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess that the group stop. | □ |

Table 160 LEBT-010:VAC-VPG-20001: Local Protections (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-20001\_VT-00013 | Turbo-Pumps Controller Error | Start the pumping group and wait that it reaches its nominal state.  Simulate an error on the first turbomolecular pump controller according to the electrical diagram [6]:  **LEBT-010:VAC-VEPT-06100**. | ~~Assess that the pumping group stops~~. | □ |
| Assess that the pumping group keep pumping. | □ |
| Do not reset the pumping group.  Simulate an error on the second turbomolecular pump controller according to the electrical diagram [6] :  **LEBT-010:VAC-VEPT-07100**. | ~~Assess that the pumping group stop~~. | □ |
| Assess that the pumping group keep pumping. | □ |
| Do not reset the pumping group.  Simulate an error on the third turbomolecular pump controller according to the electrical diagram [6] :  **LEBT-010:VAC-VEPT-99998**. | ~~Assess that the pumping group stops.~~ | □ |
| Assess that the pumping group keep pumping. | □ |
| Do not reset the pumping group.  Simulate an error on the fourth turbomolecular pump controller according to the electrical diagram [6] :  **LEBT-010:VAC-VEPT-99999**. | ~~Assess that the pumping group stops.~~ | □ |
| ~~Assess that the pumping group keep pumping.~~ | ~~□~~ |
| ~~Do not reset the pumping group.~~  ~~Simulate an error on the fifth turbomolecular pump controller according to the electrical diagram [6]~~ :  **\_\_\_\_-\_\_\_:VAC-VEPT-\_\_\_\_\_**. | Assess that the pumping group stops. | □ |
| ~~Assess that the pumping group keep pumping.~~ | ~~□~~ |
| Re-establish each of the simulated errors.  Reset the pumping group. | Assess that there are no errors on the pumping group. | □ |
| Assess that there is no error on any of the turbomolecular pump controllers. |  |

Table 161 LEBT-010:VAC-VPG-20001: Local Protections (Part 3).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-20001\_VT-00014 | Power Supply Error | Start the pumping group and wait that it reaches its nominal state.  Trigger or simulate a power supply error according to the electrical diagram [6]. | Assess that the pumping group stops. | □ |
| Power Supply Error - Automatic restart. | If the automatic restart function is used and has been set, re-establish the power supply or remove the simulation of the error. | Assess that the error message disappear. | □ |
| Assess that the pumping group is restarting. | □ |
| LEBT-010:VAC-VPG-20001\_VT-00015 | Max Auto-Restart  (*If the automatic restart function is used and has been set*) | Start the pumping group and wait that it reaches its nominal state.  Trigger or simulate a power supply error according to the electrical diagram [6]. | Assess that the pumping group stops. | □ |
| Re-establish the power supply or remove the simulation of the error. | Assess that the error message disappear. | □ |
| Assess that the pumping group is restarting. | □ |
| Trigger or simulate a power supply error according to the electrical diagram [6]. | Assess that the pumping group stops. | □ |
| Wait that the maximal mount of restart tentative has been reached. Re-establish the power supply or remove the simulation of the error and do not reset the pumping group. | Assess that the pumping group doesn’t restart. | □ |

Table 162 LEBT-010:VAC-VPG-20001: Local Protections (Part 4 - Pressure Interlock).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-20001\_VT-00016 | ~~High Vacuum Manifold Vented Error- Pressure Interlock.~~ | ~~Identify the source of the interlock (Device & Relay) according to the settings document [7]: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_~~ | | ~~□~~ |
| ~~Write down the setting of the threshold before the test [7]:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_~~ | | ~~□~~ |
| ~~Start the pumping group and wait that it reaches its nominal state.~~  ~~Set a new (unreachable) set-point or switch off the gauge or simulate that the relay has tripped.~~ | ~~Write down the threshold set for the test:~~  ~~\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_~~ | ~~□~~ |
| ~~Assess that the pumping group stops.~~ | ~~□~~ |
| ~~High Vacuum Manifold Vented Error- Pressure Interlock. Automatic restart.~~ | ~~If the automatic restart function is used and has been set, re-establish the setting of the threshold or remove the simulation of the error.~~ | ~~Assess that the error message disappear.~~ | ~~□~~ |
| ~~Assess that the pumping group is restarting.~~ | ~~□~~ |
| LEBT-010:VAC-VPG-20001\_VT-00017 | Low Vacuum Manifold Vented Error - Pressure Interlock. | Identify the source of the interlock (Device & Relay) according to the settings document [7]: **LEBT-010:VAC-VGP-00081** (Relay **3**) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| Write down the setting of the threshold before the test [7]:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| Start the pumping group and wait that it reaches its nominal state.  Set a new (unreachable) set-point or switch off the gauge or simulate that the relay has tripped. | Write down the threshold set for the test:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| Assess that the pumping group stops. | □ |
| Low Vacuum Manifold Vented Error - Pressure Interlock  Automatic restart. | If the automatic restart function is used and has been set, re-establish the setting of the threshold or remove the simulation of the error. | Assess that the error message disappear. | □ |
| Assess that the pumping group is restarting. | □ |

Table 163 LEBT-010:VAC-VPG-20001: Local Protections (Part 5 - Pressure Interlock).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-20001\_VT-00018 | Vacuum Sector Vented - Pressure Interlock. | Pumping group stopped in normal mode.  Vent the system at the atmospheric pressure. | Write down the threshold used to assess atmospheric pressure:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | □ |
| When the atmospheric pressure is reached, assess that the error appears. | □ |
| Pumping group stopped in normal mode.  Sector vented at atmospheric pressure.  Switch the operation mode to “Pump-Down” and reset the pumping group. | Assess that the error has disappeared. | □ |

Table 164 LEBT-010:VAC-VPG-20001: Local Protections (Part 6).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-20001\_VT-00019 | Primary Pump Error **Case 1:  Pumping group without back-up primary pump.** | Start the pumping group and wait that it reaches its nominal state.  Trigger or simulate an error on the primary pump controller according to the electrical diagram [6]. | Assess that the pumping group stops. | □ |
| Primary Pump Error **Case 2:  Pumping group with back-up primary pump.** | Start the pumping group and wait that it reaches its nominal state.  Trigger or simulate an error on the primary pump controller according to the electrical diagram [6]. | Assess that the primary pump is stopped. | □ |
| Assess that the valve upon the primary pump is closes. | □ |
| Assess that the pumping group keeps running. | □ |
| LEBT-010:VAC-VPG-20001\_VT-00020 | Primary Pump / Valve Error  **Case 1:  Pumping group without back-up primary pump.** | Pumping group stopped; disconnect the digital output that controls the valve upon the primary pump according to the electrical diagram [6].  Start the pumping group, wait that the error delay’s has elapsed. | Assess that the primary pump starts. | □ |
| Assess that the valve remain close. | □ |
| Assess that the pumping group stops after the delay. | □ |
| Primary Pump / Valve Error  **Case 2:  Pumping group with back-up primary pump.** | Pumping group stopped; lock close the valve upon the primary pump.  Start the pumping group. | Assess that the primary pump starts. | □ |
| Assess that the valve remain close. | □ |
| Assess that the bypass valve open and that the pumping group keep starting. | □ |

Table 165 LEBT-010:VAC-VPG-20001: Local Protections (Part 7).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VPG-20001\_VT-00021 | Turbo-Pumps Not Available | Pumping group stopped; lock off all the turbomolecular pumps controllers except one. | Only one turbomolecular pump controller has not been locked. | □ |
| Disconnect the digital input that read the nominal speed status of the non-locked turbomolecular pump controller according to the electrical diagram [6].  Start the pumping group. | Assess that the pumping group is starting. | □ |
| Once the turbomolecular pump controller has started, simulate an error. | Assess that the pumping group stops. | □ |

## Test case LEBT-010:VAC-VVA-00041

### Angle Valves & Gates Valves Verification: Support Environment.

See 4.1 for generic support environment.

### Angle Valves & Gates Valves Verification: Configuration

See 4.2 for generic configuration.

### Angle Valves & Gates Valves Verification: Setup

See 4.3 for generic setup.

Angle valve or gate valve shall be connected and shall not be open before starting the test.

A simulator can be used instead of the valve to proceed to these tests beforehand. In case of use of a simulator, tests cannot be validated with the simulator and must be performed using the valve.

The GUI panel shall show that the valve to be check is free of errors before starting the verification procedure.

### Angle Valves & Gates Valves Verification: Procedure

Commands shall be set and status shall be assessed using the detailed GUI panel of the valve.

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-VVA-00041: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to the requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| LEBT-010:VAC-VVA-00041\_CR.01 | LEBT-010:VAC-VVA-00041\_MR.01 | LEBT-010:VAC-VVA-00041\_DAR.01 | LEBT-010:VAC-VVA-00041\_CsR.01 | LEBT-010:VAC-VVA-00041\_SR.01 | LEBT-010:VAC-VVA-00041\_IR.01 |
| LEBT-010:VAC-VVA-00041\_CR.02 | LEBT-010:VAC-VVA-00041\_MR.02 | LEBT-010:VAC-VVA-00041\_DAR.02 |  |  |  |
|  | LEBT-010:VAC-VVA-00041\_MR.03 | LEBT-010:VAC-VVA-00041\_DAR.03 |  |  |  |
|  | LEBT-010:VAC-VVA-00041\_MR.04 |  |  |  |  |
|  | LEBT-010:VAC-VVA-00041\_MR.05 |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-VVA-00041: Procedure of verification

LEBT-010:VAC-VVA-00041\_VT-00001: Pump Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 166 LEBT-010:VAC-VVA-00041: Remote & Manual Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00041\_VT-00002 | Assess the closed status of the valve. | No action required because the valve shall already be closed. | Assess the “Close” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00003 | Assess the “Undefined” status of the valve. | Disconnect the control cable from the connector on the valve.  Wait that “Undefined” time-out elapsed. | Assess the “Undefined” status on the GUI panel. | □ |

Table 167 LEBT-010:VAC-VVA-00041: Remote Control (Part 2).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00041\_VT-00004 | Verify the manual remote control of the valve. | Set “Manual” mode using the detailed GUI panel of the valve. | Assess the “Manual” status on the GUI panel. | □ |
| Make sure that the system is in a safe condition before opening the valve. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00005 | Verify the opening function. | Verify that there are no active interlocks applied to the valve.  Open the valve through the GUI panel. | Assess the “Open” status on the GUI panel. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00006 | Verify the closing function. | Close the valve through the GUI panel. | Assess the “Close” status on the GUI panel. | □ |

Table 168 LEBT-010:VAC-VVA-00041: Automatic Control (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00041\_VT-00042 | Verify the automatic opening of the valve. | Start both pumping groups and wait that have reached their nominal state. | Assess that the valve remain closed. | □ |
| Trigger an error on the primary pump controller or simulate it according to the electrical diagram [6]. | Assess that the valve is open. | □ |
| Assess that both pumping groups are still running. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00043 | Verify the automatic closure of the valve. | Stop both pumping groups. | Assess that the two pumping groups stop. | □ |
| Assess that the valve closes. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00044 | Verify the automatic opening of the valve. | Lock off the faulty pump. Reset the pumping groups. | Assess that the two pumping groups are starting. | □ |
| Assess that the valve is open. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 169 LEBT-010:VAC-VVA-00041: First “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00041\_VT-00007 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00008 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-00041\_VT-00009 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00010 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00011 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00012 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00013 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 170 LEBT-010:VAC-VVA-00041: Second “Pressure” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00041\_VT-00014 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00015 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-00041\_VT-00016 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00017 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00018 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00019 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00020 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

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| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 171 LEBT-010:VAC-VVA-00041: First “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00041\_VT-00021 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00022 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-00041\_VT-00023 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00024 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00025 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00026 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00027 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 172 LEBT-010:VAC-VVA-00041: Second “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00041\_VT-00028 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00029 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-00041\_VT-00030 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00031 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00032 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00033 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00034 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

|  |  |
| --- | --- |
| **Specific setup:** | To perform these tests, the valve shall be safely operated regarding to the vacuum conditions, the source of the interlock shall be tested beforehand. |

Table 173 LEBT-010:VAC-VVA-00041: Third “Hardware” Interlock.

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-VVA-00041\_VT-00035 | Assess the configuration of the interlock. | Asses that the interlock has been configured. | The interlock is configured. | □ |
| The interlock is not configured. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00036 | Interlock identification | Identify the source of the interlock (Device & Status): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | □ |
| LEBT-010:VAC-VVA-00041\_VT-00037 | Assess the open status of the valve. | Open the valve or assess the open status of the valve. | Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00038 | Verify that the tripped interlock close the valve. | Trigger the interlock or simulate it according to the electrical diagram [6]. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00039 | Verify the bypass of a tripped interlock. | Override the interlock and reset the interlock fault.  Re-open the valve. | Assess the override status of the interlock. | □ |
| Assess the “Open” status of the valve. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00040 | Verify the clear bypass function  (the reactivation of the interlocks). | Clear the bypass command. | Assess the “Close” status of the valve. | □ |
| Assess the tripped status of the interlock. | □ |
| LEBT-010:VAC-VVA-00041\_VT-00041 | Verify the automatic activation of the interlock. | Override the interlock, reset the interlock fault and re-open the valve.  Re-establish the interlock according to the electrical diagram [6]. | Assess the “Open” status of the valve. | □ |
| Assess the healthy status of the interlock. | □ |

# Test Cases “:VAC-PLCIO-" (PLC tests)

## Test case LEBT-010:VAC-PLCIO-10001

### PLC Remote I/Os Verification: Support Environment.

See 4.1 for generic support environment.

### PLC Remote I/Os Verification: Configuration

See 4.2 for generic configuration.

### PLC Remote I/Os Verification: Setup

See 4.3 for generic setup.

All vacuum devices shall be stopped before starting the following tests.

### PLC Remote I/Os Verification: Procedure

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-PLCIO-10001: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to the requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| No requirements | No requirements | No requirements | No requirements | No requirements | No requirements |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-PLCIO-10001: Procedure of verification

LEBT-010:VAC-PLCIO-10001: Network Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 174 LEBT-010:VAC-PLCIO-10001: Hardware Fault Detection (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-PLCIO-10001\_VT-00002 | PLC hardware fault detection. | Trigger a PLC hardware error on the remote I/O station. | Assess the error on the GUI panel. | □ |
| Assess the invalid status. | □ |

## Test case LEBT-010:VAC-PLCIO-01001

### PLC Remote I/Os Verification: Support Environment.

See 4.1 for generic support environment.

### PLC Remote I/Os Verification: Configuration

See 4.2 for generic configuration.

### PLC Remote I/Os Verification: Setup

See 4.3 for generic setup.

All vacuum devices shall be stopped before starting the following tests.

### PLC Remote I/Os Verification: Procedure

The tables bellow list requirements to be fulfilled and tests to be achieved.

#### LEBT-010:VAC-PLCIO-01001: List of requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference to the requirements [4] | | | | | |
| Control Requirements | Monitoring and Graphical User Interface Requirements | Data Acquisition and Archiving Requirements | Constraint Requirements | Conventional Safety Requirements | Interface Requirements |
| No requirements | No requirements | No requirements | No requirements | No requirements | No requirements |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

#### LEBT-010:VAC-PLCIO-01001: Procedure of verification

LEBT-010:VAC-PLCIO-01001: Network Cable Number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Check cable labelling on both side of the cable).

Table 175 LEBT-010:VAC-PLCIO-01001: Hardware Fault Detection (Part 1).

| **Verification Plan ID** | **Verification Description** | **Action** | **Pass Criteria Statement** | **Verification is valid**  **(tick box)** |
| --- | --- | --- | --- | --- |
| LEBT-010:VAC-PLCIO-01001\_VT-00002 | PLC hardware fault detection. | Trigger a PLC hardware error on the remote I/O station. | Assess the error on the GUI panel. | □ |
| Assess the invalid status. | □ |

# Glossary

| Term | Definition |
| --- | --- |
| CPU | Central Processing Unit |
| EPICS | Experimental Physics and Industrial Control System |
| FB | Function Block - Siemens function type |
| FBS | Functional Breakdown Structure |
| ICS | Integrated Control System |
| LBS | Location Breakdown Structure |
| LINAC | Linear Accelerator |
| OPI | Operator Interface |
| PLC | Programmable Logical Controller |
|  |  |

# references

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20. Proton Beam Vacuum Control System - Control system Integration (ESS-0158136)

Changes summary

| Revision | Description of the changes |
| --- | --- |
| 1 | First issue |
| 2 | -LEBT-010:VAC-IOC-11010 replaced by VacS-ACCV:VAC-IOC11010. -Update of the name of the PLC Project. |
|  |  |
|  |  |

Document Revision history

| Revision | Reason for and description of change | Author | Date |
| --- | --- | --- | --- |
| 1 | First issue | François Bellorini | 2018-01-19 |
|  |  |  |  |
|  |  |  |  |