

Nanoautomate Program Certification Checklist

The primary purpose of this procedure is to verify that safety alarms produce the expected output.

Tables “Gas Alarms” and “Nanoautomate Inputs & Outputs” summarize the expected outputs. Any difference between these tables and the observed outcome must be corrected BEFORE the program may be downloaded into the gas system nanoautomates.

Name: _____

Name: _____

Date: _____

Version number to be tested: _____

Changes: _____

1. Load Program

- Download program into Ram memory of test nanoautomates.
Name of files downloaded (include path and date):

- Start program
- Disconnect PC

2. Verify Operating Modes and Correct Transitions

This section verifies that operating modes requests produce the desired outputs, that the system is in Rest Mode following a power outage, and that it is not possible to make a direct transition from an Alarm Mode to Running.

- Set inputs to default position: all OFF for nanoautomate 1; all ON for nanoautomate 2 and 3 except 3–4 off.
- Cycle power on nanoautomates (switch on back).
Verify Rest mode outputs.
Initial: _____
- Select Run Mode by briefly switching 1–13.
Verify Run mode outputs.
Initial: _____
- Select Rest Mode by briefly switching 1–12.
Verify Rest mode:
Initials _____

- Select VME Mode by briefly switching 1–11.
Verify VME mode outputs.
Initial: _____
- Place system in Alarm Mode 1 by activating 3–10, “Isobutane in front flush gas”.
Verify Alarm Mode 1.
Initial: _____
- Turn off 3–10;
activate Run Mode 1–13.
Verify system remains in Alarm Mode 1.
Initial: _____
- Select Rest Mode 1–12.
Verify Rest Mode.
Initials: _____

3. Verify Alarm Responses

Use the following sequence to test each input below in both Rest Mode and Running Mode:

- Select Rest Mode 1–12
- Set *Input* false (off)
- Verify correct input light on nanoautomate
- Verify delay is approximately correct (expected value is given)
- Verify correct outputs for expected Alarm Mode and initial “Rest Mode”
- Set *Input* true (on)
- Select Rest Mode 1–12
- Select Run Mode 1–13
- Set *Input* false (off)
- Verify correct outputs for expected Alarm Mode and initial “Run Mode”
- Set *Input* true (on)
- Select Rest Mode 1–12
- Select VME Mode 1–11
- Set *Input* false (off)
- Verify correct outputs for expected Alarm Mode and initial “Run Mode”
- Set *Input* true (on)

Any unexpected responses must be recorded and corrected before the program can be certified for use in the gas system.

The following inputs should produce “Alarm Mode 1”.

- 3–10 “Isobutane in front flush gas”:
5 sec Delay _____ Rest: _____ Running: _____ VME _____

- 3-11 "Isobutane in rear flush gas":
5 sec Delay _____ Rest: _____ Running: _____ VME _____
- 3-8 AND 3-7 "isobutane present" and "O2 present":
5 sec Delay _____ Rest: _____ Running: _____ VME _____
- 2-11 "Bulkhead flows":
30 sec Delay _____ Rest: _____ Running: _____ VME _____

The following inputs should produce "Alarm Mode 2".

- 2-0 "helium pressure":
5 sec Delay _____ Rest: _____ Running: _____ VME _____
- 2-3 "chamber pressure":
5 sec Delay _____ Rest: _____ Running: _____ VME _____
- 2-10 "inlet pressure":
5 sec Delay _____ Rest: _____ Running: _____ VME _____
- 2-9 "compressed air":
5 sec Delay _____ Rest: _____ Running: _____ VME _____
- 2-4 "iso temperature":
5 sec Delay _____ Rest: _____ Running: _____ VME _____
- 2-12 "110V power":
5 sec Delay _____ Rest: _____ Running: _____ VME _____

The following inputs should produce "Alarm Mode 2" in Running Mode ONLY. Initialing the Rest and VME Mode lines indicates NO Alarm.

- 2-8 "iso concentration" and 1-10 "Valid Sample Point":
90 sec Delay _____ Rest: _____ Running: _____ VME _____
- 2-7 "O2 concentration" and 1-10 "Valid Sample Point":
90 sec Delay _____ Rest: _____ Running: _____ VME _____
- 2-1 "isobutane pressure"
15 sec Delay _____ Rest: _____ Running: _____ VME _____
- 2-6 "fresh gas flow"
30 sec Delay _____ Rest: _____ Running: _____ VME _____
- 2-2 "recirc pressure"
50 sec Delay _____ Rest: _____ Running: _____ VME _____
- 2-5 "recirc flow"
30 sec Delay _____ Rest: _____ Running: _____ VME _____

The following inputs should produce "Alarm Mode 2" in VME mode if the pump is on.

- 2-2 "recirc pressure" and 3-4 (on) "pump on"
50 sec Delay _____ VME_____
- 2-5 "recirc flow" and 3-4 (on) "pump on"
30 sec Delay _____ VME_____

The following input should produce "Alarm Mode 3" (gas hut alarm).

- 3-6 "gas hut":
5 sec Delay _____ Rest: _____ Running: _____ VME_____

4. Verify Interlocks

- Select VME Mode 1-11.
Activate isobutane interlock by setting 3-7 off, "O₂ Not Present".
- Verify output 3-4 "HV enabled" is OFF. Initials _____
- Select 1-7 "Request Open VVPC_8".
Verify that Output 1-7 "Open VVPC-8" remains OFF.
Initials _____
- Set 3-7 ON "O₂ Not Present";
- Select 1-7 "Request Open VVPC_8".
Verify that Output 1-7 "Open VVPC-8" is ON.
Initials _____
- Select Rest Mode 1-12;
Select Running Mode 1-13;
- Turn 3-7 OFF "O₂ Not Present";
Verify that Output 1-7 "Open VVPC-8" goes OFF (5 sec delay)
Initials _____
- Set 3-7 ON "O₂ Not Present".
- Activate gain chamber interlock by setting 3-12 off, "Gain Chamber Flow OK".
- Verify Output 3-0 "Gain Chamber Enabled" is OFF. Initials: _____
- Select Run mode. Verify Output 3-0 is OFF. Initials: _____
- Select VME mode. Verify Output 3-0 is OFF. Initials: _____
- Select Rest Mode.
- Set 3-12 ON. Verify Output 3-0 is ON.