

Standards and Assessment Guide

Industry 4.0

Introduction

Welcome to the Standards and Assessment Guide (SAG), a comprehensive resource designed to support excellence in assessment practices for all skills competitions hosted at the WorldSkills Competition. A key component of the SAG is the commitment to continuous improvement through ongoing review, ensuring that these guides consistently reflect the latest industry innovations and high standards of assessment in an open and transparent manner.

Purpose

The primary purpose of this guide is to provide a structured framework for the consistent and fair assessment of each skill competition. It aims to ensure that all assessments are conducted with a high degree of accuracy, reliability, validity, and reflect global industry standards. By adhering to these guidelines, assessors can maintain the integrity of the competition and uphold the high standards associated with WorldSkills.

Note: this guide is not a replacement for the Marking Scheme and should only be used as a reference when required during the assessment process. Competitors are not allowed to have a copy of this SAG in the workshop in either digital or paper form.

Scope

This document covers general assessment practices applicable to a diverse range of industry sectors including:

- Manufacturing and Engineering Technology
- Information and Communication Technology
- Construction and Building Technology
- Transportation and Logistics
- Social and Personal Services
- Creative Arts and Fashion

Each skill competition has its unique requirements and benchmarks, which are detailed within sections of this guide. The consistency of assessment across each skill is the overarching principle, ensuring a unified approach to evaluating Competitor performance to the highest standards.

Key Components

The guide is structured into several key components, each addressing critical aspects of the assessment process:

Assessment Principles and Objectives

- Emphasis on fairness, transparency, and objectivity in assessments.
- Alignment with global industry standards and best practices.

Assessment Methods and Tools

- Description of various assessment methods in Measurement and Judgement.
- Guidance on the application of appropriate assessment tools and equipment (if applicable).

Criteria and Benchmarks

- Examples of assessment criteria and aspects for each skill, outlining the expected competencies and performance standards.
- Benchmarks for different levels of proficiency i.e. Judgement award range 0, 1, 2, 3 or Yes/No criteria alongside clear measurable descriptors.

Expert assessment requirements

- Completion of the Access Programme.
- Approved Curriculum Vitae (CV).
- Reaching 100% Expert preparedness.
- Full participation of online and in-person Mandatory Assessment Training (MAT).
- Completion of practical assessment testing at the Competition.

Quality Assurance and Improvement

- Monitoring and evaluation: Ensuring assessments are carried out correctly and produce reliable results.
- Continuous improvement: Using feedback from Experts and Skill Competition Managers to enhance future assessments.
- Periodic review: Regularly updating processes to reflect current industry and WorldSkills standards.

Implementation

For effective implementation, this guide should be used for guidance purposes only and in parallel with the Technical Description for each skill. Experts are encouraged to familiarize themselves thoroughly with both the general guidelines and the particular requirements of their respective skill areas. Collaborative efforts between the Skill Management Team, Experts, and Competitors are vital for achieving the ultimate goal of global skills development.

Conclusion

The Standards and Assessment Guide embodies the commitment of the WorldSkills movement to nurturing talent and promoting the highest standards of vocational education and training worldwide. By providing clear and comprehensive guidance, we aim to empower Experts to conduct marking and assessment practices that are not only rigorous and equitable but also inspiring and transformative for all participants.

Thank you for your dedication to upholding these standards and contributing to the success of the WorldSkills Competition. Together, we can continue to champion skills excellence and celebrate the achievements of talented individuals from around the globe.

Skill 48 – Industry 4.0

The WorldSkills Assessment Strategy establishes the principles and techniques to which WorldSkills assessment must conform.

Assessment at the WorldSkills Competition involves two main methods – **Measurement and Judgement** – as defined below. Explicit benchmarks are essential for both methods. The benchmarks must relate to best practice in industry and business.

The main instruments used to support assessment are the relevant WorldSkills Occupational Standards, Marking Scheme, Test Project, and the Competition Information System (CIS).

WorldSkills Occupational Standard

In examples below, you will find references to WorldSkills Occupational Standards (or WSOS in short). They specify the knowledge, understanding, skills and capabilities that underpin international best practice in technical and vocational performance.

Marks of different WSOS relevance should be spread evenly as much as it is possible, across the Test Project. This way, the project allows testing Competitors involving all aspects of their skill.

The WorldSkills Occupational Standards are divided into sections, each assigned a percentage of the total marks indicating its relative importance. These sections are used to determine the allocation of marks within the Marking Scheme. A tolerance of 5% is permitted, provided that the balance of weightings within the WorldSkills Occupational Standards is maintained. The Lead Skill Advisor must approve any variations and check that the balance is maintained.

Measurement

Measurement is used to assess accuracy, precision, and other performance that can be measured objectively. It is used where ambiguity must be avoided. The total marks allocated to measurement marking may vary from competition to competition depending on the Test Project.

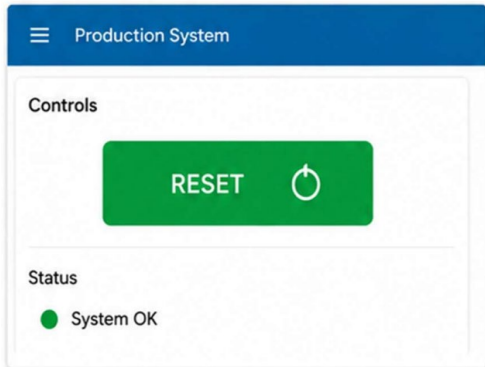
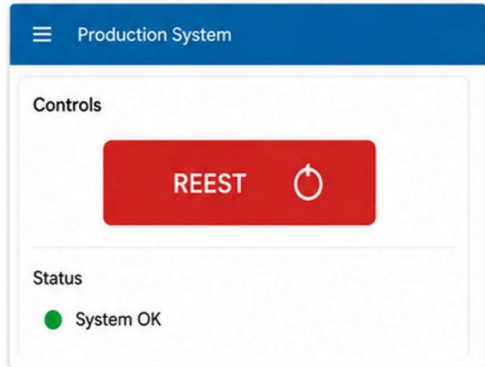
In Skill 48 Industry 4.0, most assessment points contained in Marking Scheme are measurement points. That is why it is crucial to understand their meaning and ways to correctly assess during the WorldSkills Competition. To guide and remove any doubts during marking, measurement points included in the Marking Scheme shall be worded in such way, to provide clear and concise description of the point that is about to be assessed.

Please find examples of measurement below (from WorldSkills Special Edition 2022 - Stuttgart):

Sub criterion	Aspect	WSOS section as per TD	Descriptor
A1	"All base modules are CP-L-LINEAR-C11-M0"	4	In Factory Views -> MES, Competitors must assemble a station according to requirement. If all modules included in the setup contain base module "CP-L-LINEAR-C11-M0" point is awarded (answer "YES"); in all other situations point cannot be given.
B2	"Standard product price is 39"	4	In Web shop configuration, Competitors were tasked with setting up a new product. If the price has been currently set to 39 euros – mark is granted. Any different variation will mean no point.
C2	"Siemens S7-1512 IP Address: 172.21.3.1/18"	5	Mark is only granted if a correct IP address has been set for Siemens controller <u>as well as subnet mask marked as wildcard mask</u> – "/18" means a subnet mask of "255.255.192.0"
D1	"VLANs initially transmitted by the router's trunk port (1, 4070, 4080) are also received on a trunk port of the switch (other than port 7 and 8)."	5	This measurement mark contains two parts – configuration of a router, and a switch. The mark shall be granted only when both devices are set up accordingly.
E1	Pepperl+Fuchs UC250-F77-EP-IO-V31 sensor is assembled	3	Even though this description may seem too broad, it is important to familiarize yourself fully with task description before the assessment process begins – a picture of correct assembly has been included in project description, which can be used by assessment team to clarify if the answer is "YES" or "NO".

When assessing dashboards, distinguish between functionality and labelling:

- If evaluating functionality, ignore minor label errors and award marks as long as the intended action or outcome is clear.
- If evaluating the label, assess only the displayed text per the CIS, regardless of functionality.

	Example A	Example B
Dashboard		
Measurement aspect 1: “A button “Reset” sets the system in the defined initial state.”	YES (if it works) NO (if it doesn't work)	YES (if it works) NO (if it doesn't work) Comment: Here, it is clear that the button is intended to reset the system.
Measurement aspect 2: “The button is labelled “Reset”.	YES Comment: Capitalization (reset/Reset/RESET) is usually ignored, unless specified explicitly.	NO Comment: Here, the label is not correct.

Judgement

Judgement is used to assess the quality of performance about which there may be small differences of view when applying the external benchmarks.

Usually, to assist assessment team during Judgement marking, additional resources as benchmark will be provided, such as images or descriptions.

Generic rules:

The assessment group comprises three Experts plus one Expert who acts as the supervisor. The supervising Expert will replace an Expert in the marking group to prevent compatriot marking.

A score is the award given by one Expert for a judgement Aspect of Sub Criterion. The score must be in the range from 0 to 3. The mark awarded is calculated from the scores awarded by three Experts in the marking team. Each of the three Experts assesses each Aspect of Sub Criterion, whether the Competitor has attempted the work or not. The scores from 0 to 3 relate to industry and business standards as follows:

- 0: Performance below industry standard, including a non-attempt
- 1: Performance meets industry standard
- 2: Performance surpasses industry standard
- 3: Excellent or outstanding performance relative to industry expectations

The benchmarks in the Marking Scheme (and recorded on the marking forms) provide a context for these standards and act as a reference point for the marking team.

The following procedure is used for scoring when using paper marking forms:

- Each Expert decides independently on a score (from 0 to 3) for an Aspect of Sub Criterion by comparing the Competitor's performance to the benchmark.
- Each Expert prepares the appropriate flash card for display.
- All three Experts display their flash cards at the same time when directed by the Expert coordinating the recording of scores.
- Where the range of scores awarded for an Aspect is greater than 1, Experts must re-score that Aspect.
- A brief discussion with reference to the benchmarks is permitted to reduce the range to 1 or 0 BUT
- Benchmarks must be agreed when finalizing the Marking Scheme and must not be changed during assessment and scoring.

The total marks allocated to judgement marking may vary from competition to competition depending on the Test Project.

Please find examples of judgement below:

Aspect “Documentation – Structure with elements”

(Such as title, author, page numbers, table of contents, headlines, sub headlines (where useful), figure and table captions)

WSOS section	Score	Descriptor	Resource
8	3	The documentation is well structured and all content specified in the Module to be documented is included, <i>here for example</i> : User instructions to close the runtime of the HMI (at least 2 steps on the HMI)	
	2	Most of the structuring elements are used properly.	
	1	Only a few structuring elements are used properly.	
	0	No structure, just text and/or pictures, or no documentation.	

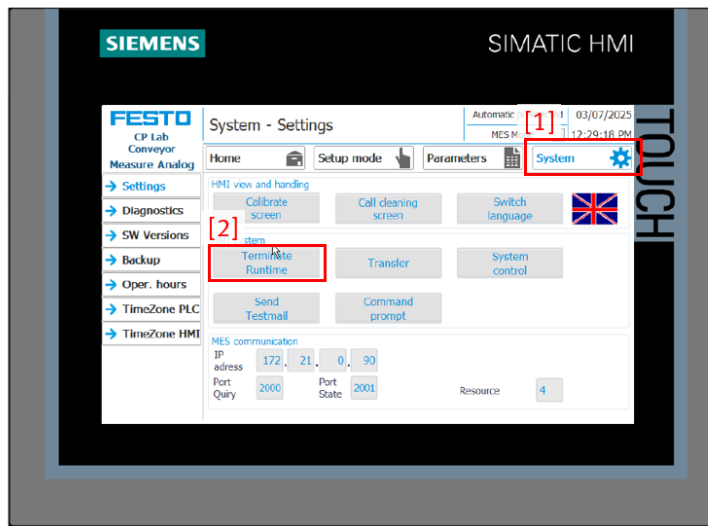
Aspect “Documentation – Consistency of design elements”

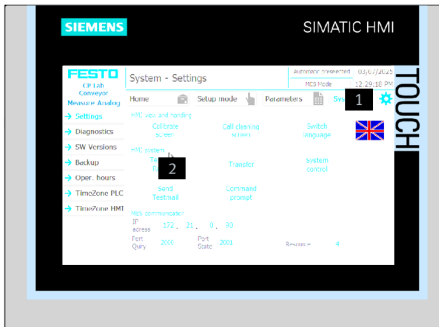
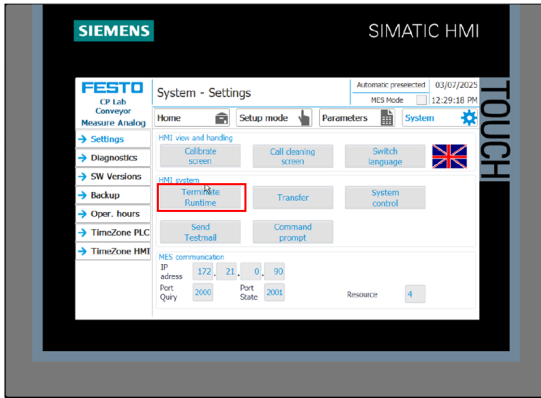
(Such as headlines, texts, figures, tables, descriptions, page numbers)

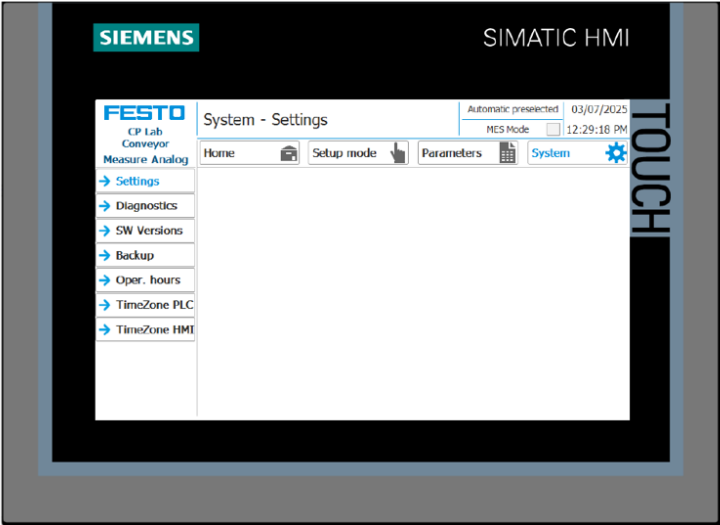
WSOS section	Score	Descriptor	Resource
8	3	All elements are consistent in design and all content specified in the Module to be documented is included, <i>here for example:</i> User instructions to close the runtime of the HMI (at least 2 steps on the HMI)	
	2	The majority of the elements are consistent in design.	
	1	Only the minority of the elements are consistent in design.	
	0	Complete inconsistency in design.	

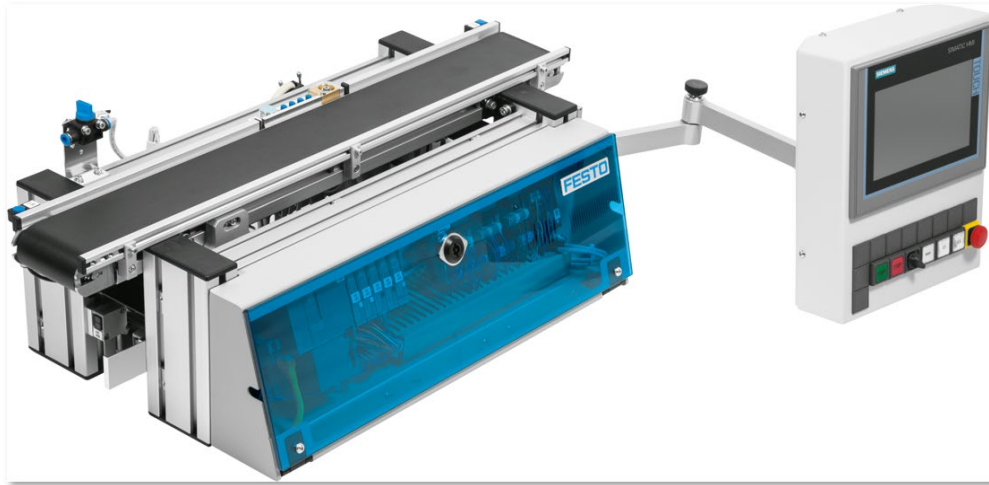
Aspect “Documentation – Illustrations”

(Such as charts, photos, drawings, sketches, screenshots)

WSOS section	Score	Descriptor	Resource
8	3	Well-designed illustrations with a high level of information that supports understanding and all content specified in the Module to be documented is included, <i>here for example</i>: User instructions to close the runtime of the HMI (at least 2 steps on the HMI)	 [1] Select “System” on the HMI screen. [2] Click on “Terminate Runtime” to close the runtime view.

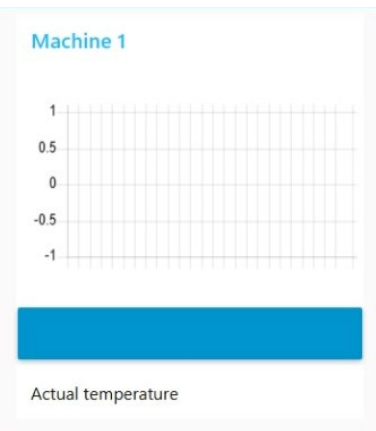
WSOS section	Score	Descriptor	Resource
	2	Illustrations with good information content that supports understanding.	 [1] Select "System" on the HMI screen. [2] Click on "Terminate Runtime" to close the runtime view.  Click on "Terminate Runtime" to close the runtime view. (Well designed, but not all content is documented.)

WSOS section	Score	Descriptor	Resource
	1	Only illustrations with low information content used and little support for understanding.	 1. Select “System” on the HMI screen. 2. Click on “Terminate Runtime” to close the runtime view.

WSOS section	Score	Descriptor	Resource
	0	No illustrations or only illustrations that do not improve understanding.	 1. Select "System" on the HMI screen. 2. Click on "Terminate Runtime" to close the runtime view.

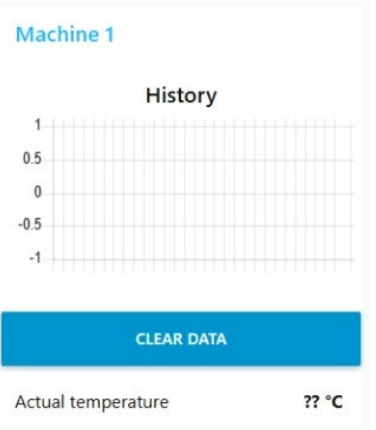
Aspect “Dashboard design – Readability”

WSOS section	Score	Descriptor	Resource
4	3	All information is well readable.	
	2	The majority of the information is well readable.	

WSOS section	Score	Descriptor	Resource
	1	Only a minority of the information is well readable.	
	0	None of the information is well readable.	 

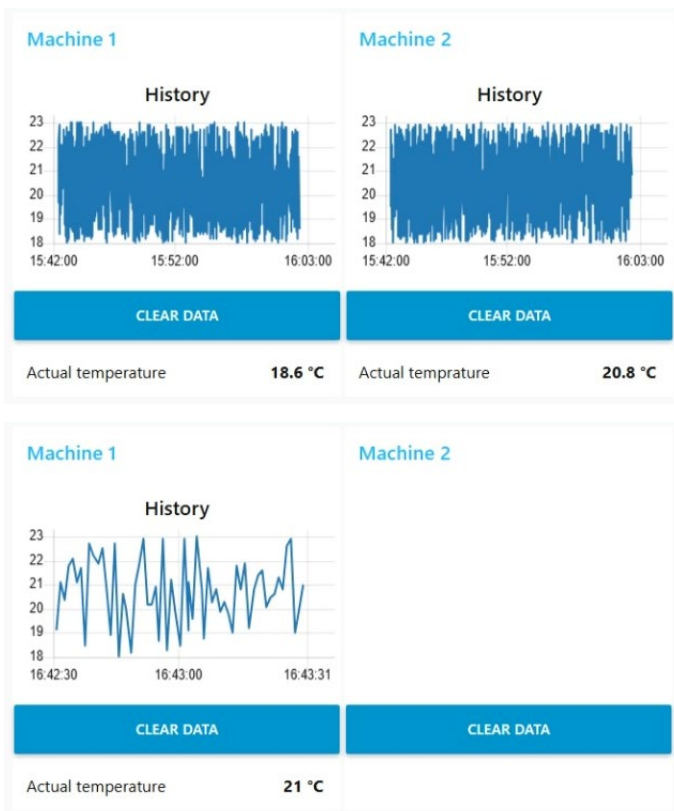
Aspect “Dashboard design – Data formatting”

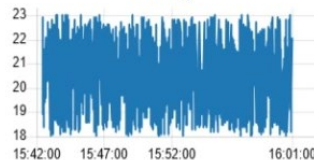
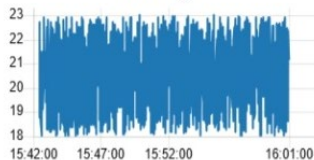
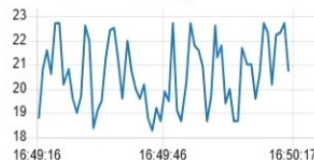
WSOS section	Score	Descriptor	Resource
4	3	All data is reasonably formatted.	
	2	The majority of the data is reasonably formatted.	

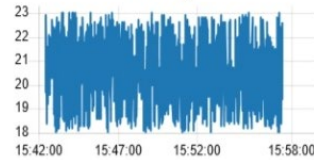
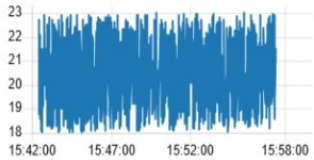
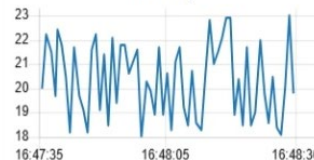
WSOS section	Score	Descriptor	Resource
	1	Only a minority of the data is reasonably formatted.	
	0	None of the data is reasonably formatted or no element with formattable data is available.	 

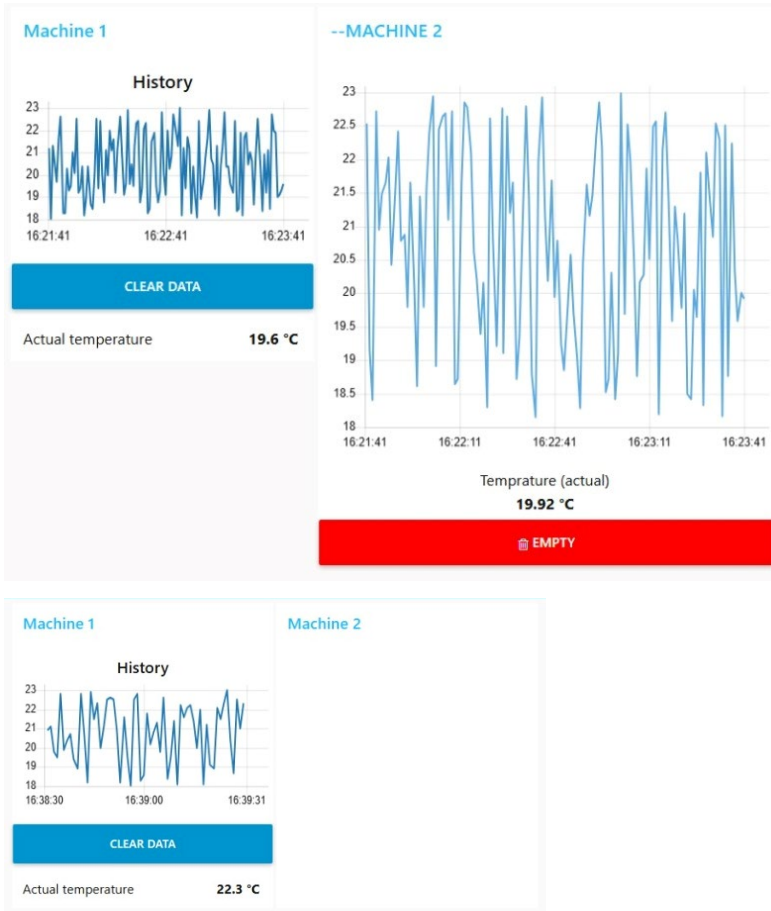
Aspect “Dashboard design – Consistency”

(Only if applicable, i.e. if elements of the same type are specified)

WSOS section	Score	Descriptor	Resource
4	3	All elements are consistent in design.	

WSOS section	Score	Descriptor	Resource
	2	The majority of the elements are consistent in design.	Machine 1 History  CLEAR DATA Actual temperature 22.1 °C Machine 2 History  CLEAR DATA Temperature (actual) 21.15 °C Machine 1 History  CLEAR DATA Actual temperature 20.7 °C Machine 2 History  CLEAR DATA Temperature (actual) 18.6 °C

WSOS section	Score	Descriptor	Resource
	1	Only a minority of the elements are consistent in design.	Machine 1 History  15:42:00 15:47:00 15:52:00 15:58:00 CLEAR DATA Actual temperature 22.6 °C --MACHINE 2 History  15:42:00 15:47:00 15:52:00 15:58:00 Temperature (actual) 21.54 °C EMPTY Machine 1 History  16:47:35 16:48:05 16:48:36 CLEAR DATA Actual temperature 19.8 °C Machine 2 History  CLEAR DATA Temperature (actual) 19.1 °C

WSOS section	Score	Descriptor	Resource
	0	Complete inconsistency in design or no elements of the same type available.	

Element means an item within the dashboard e.g. button with label, or value with label, or chart with title and labels. The title of a group, tab, page or menu is not an element.

Aspect “Mechanical and electrical installation”

(Of a sensor, device, module)

WSOS section	Score	Descriptor	Resource
3	3	Cables and tubes installed and fixed with accuracy.	
	2	Cables and tubes installed and fixed but missing accuracy.	

WSOS section	Score	Descriptor	Resource
	1	Rework necessary, e.g. cable or tube not installed properly or not fixed.	
	0	Installation not done for most of the components.	

Aspect – Cleanliness of the workplace and the station

WSOS section as per TD	Score	Descriptor	Resource
1	3	Excellent: Tools must not be left on the stations, chairs, or the floor of workspace Networking cables and tubes properly installed	
	2	Professional/Still acceptable (~80% Solution): If there are one or a few minor deviations Tools must not be left on the stations, chairs, or the floor of workspace Networking cables and tubes installation could be excellent with a bit more organization	
	1	Optimization/rework necessary: If there is a major deviation or more than a few minor deviations.	
	0	Not acceptable: If the workplace organization is far from the standard specified	