Subject: Ergonomic Assessment Work-Sheet (EAWS)

02 August 2013

RISK SCREENING

The need for identifying the degree of exposition to biomechanical load has led to the development of specific ergonomic risk screening analysis related to given work tasks; aim of these tools is to analyze the risk factors that may lead to overload or even occupational diseases, in order to suggest retaliatory actions that minimize the present type of risk.

The basis of every ergonomic risk screening tool is to establish a link between the three factors that detemine a work task (force, frequency, grip) and the possibility to get into overload or even to contract an occupational disease because of the present working conditions and the type of task.

The main difficulty is to establish how the different factors interact and lead to work related troubles or diseases.

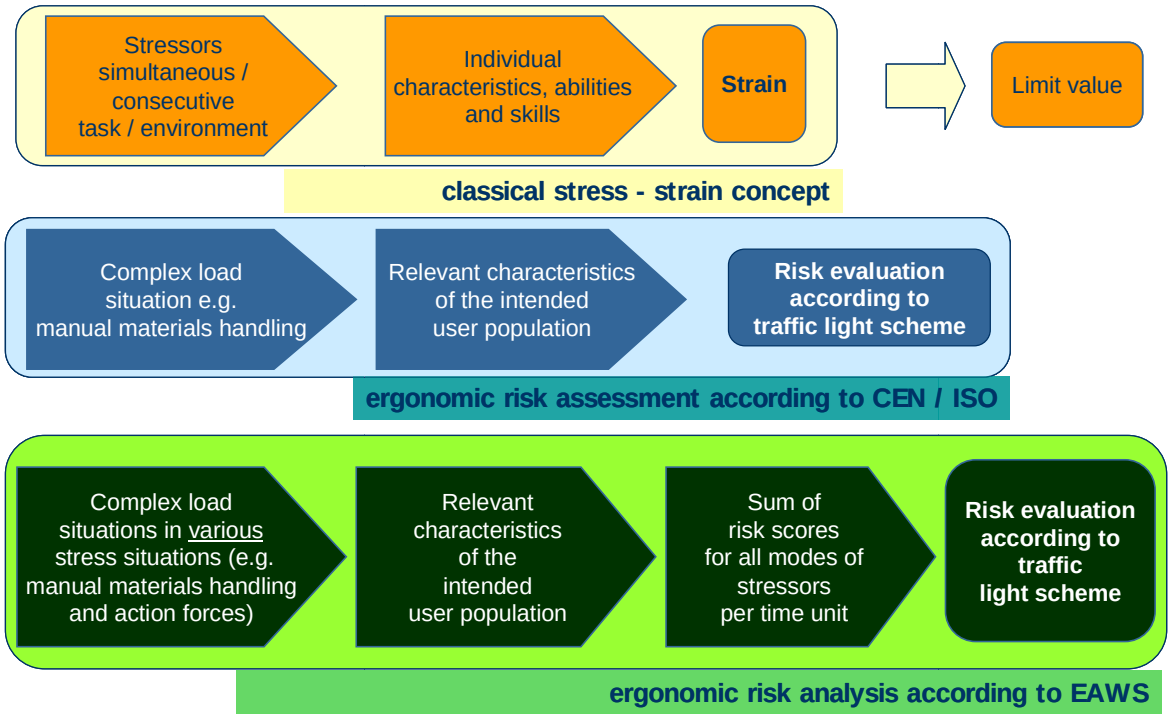


Figure 1 -Scheme of the new approach to risk evaluation of the EAWS

Certainly the perfect approach is to apply risk prevention in project / process design phase (preventive prospective ergonomics); if the product and/or process is already defined changes may cost more and be less efficient (corrective ergonomics) because process reorganizing is often limited due to high investments for modifications.

For a quantitative ergonomic risk evaluation of a specific working sequence, generally two evaluation levels are used:

- First level tools: risk evaluation tools which require a quick screening checklist.
- Second level tools: risk evaluation tools which require a detailed analysis with index calculations. They are applied where a possible risk has been already detected by a 1st level system.

The aim of First level tools is to get a very quick mapping of the different risk areas of all working tasks and to concentrate all the efforts for rapid redesigning. With Second level tools usually specific loads are analyzed in detail.

Trough the EAWS is described as First level tool, in some sections it exceeds the detail of Second level tools (e.g. OWAS, RULA, Stainindex, HAL-TV) or is at minimum equal to them.

In the following table are summarized the risk areas, the correlated rules and some First and Second level analysis tools that cover the risk analysis for each sections. A description of the Automotive Assembly Worksheet (AAWS) is given in Schaub/Landau 2004.

	Standards		Tools		
Risk Areas	**CEN**	**ISO**	**2nd Level**	**1st Level**	
Body Postures with low external effort	1005-4	11226	OWAS	AAWS	EAWS
Action Forces	1005-3	11228-2	SNOOK-CIRIELLO TABLES		
Manual Material Handling (Repositioning)	1005-2	11228-1	NIOSH		
Upper limbs – high frequencies / low loads	1005-5	11228-3	OCRA STAIN INDEX HAL-TV		

Figure 2 - EAWS compatibility to International Standards and select Second level Tools

THE EAWS PROJECT

The needs to comply with the rules push the companies to have at their disposal a 1° level ergonomic analysis system to evaluate biomechanical load for every component (static and dynamic load, force application, vibration and manual materials handling) for the whole body.

The EAWS meets these requirements. During its developments in particular the following design criteria were taken into account:

- The tool had to be accepted and considered exhaustive by:
  - Company
  - Workers
  - Unions
  - Authorities
- Applicator deviations – e.g. the gap between the analysis results of different applicators – had to be minimized, rendering the identification and measuring of technical actions, awkward postures and forces at maximum objective.
- The tool should have the capability to be used during the planning of the product/process as well as in the production process.

The main aims of the development of the EAWS system were:

- Compliance with labor legislation (national and international), e.g.:
  - EU Machinery Directive (2006/42/EC, former 98/37/EU, 89/392/EEC)
  - EU Framework Directive (89/391/EEC)
- Allow to document and evaluate the working conditions, taking into account the operator work load as it is described by the rules in force
- Ensuring ergonomic working conditions
- Developing an extension of the Automotive Assembly Worksheet (AAWS) for repetitive loads on the upper limbs in accordance with EN 1005-5 and the corresponding ISO standard 11228-3.
- Making this tool usable in any kind of company, from mass production to one of a kind production
- Developing a free tool without any kind of copyright
- Linking EAWS to MTM:
  - MTM-2 : mass production systems
  - UAS: batch production systems
  - MEK: one of a kind production systems

PROJECT DEVELOPMENT HISTORY

EAWS is originally an extension of the Automotive Assembly Worksheet (AAWS) developed by the IAD (Institut of Ergonomics at the Darmstadt University of Technology) on the basis of the “New Production Worksheet”, initiated 1997 by General Motors Europe (GME), and the “DesignCheck”, realized at the same time at Porsche. The development of the EAWS was carried out between 2006 and 2008, by occupational health, biomechanical and industrial engineering international experts from all over the world, coordinated by the IMD (International MTM Directorate).

The field test was run in multinational companies that allowed the team to analyze relevant processes that represented different production contests. In this way all the necessary tests were performed before the last release of the tool (Field Application Group).

In addition, software companies were involved during EAWS development in order to implement and develop specific software solutions based on EAWS structure (Engineering Application Group).

IMD and national MTM Associations, together with the experts that worked with the team, gave all the tests results to the reference teams that represent the EAWS users main process partners (Reference Groups). The general project organization during the development phase was the following:

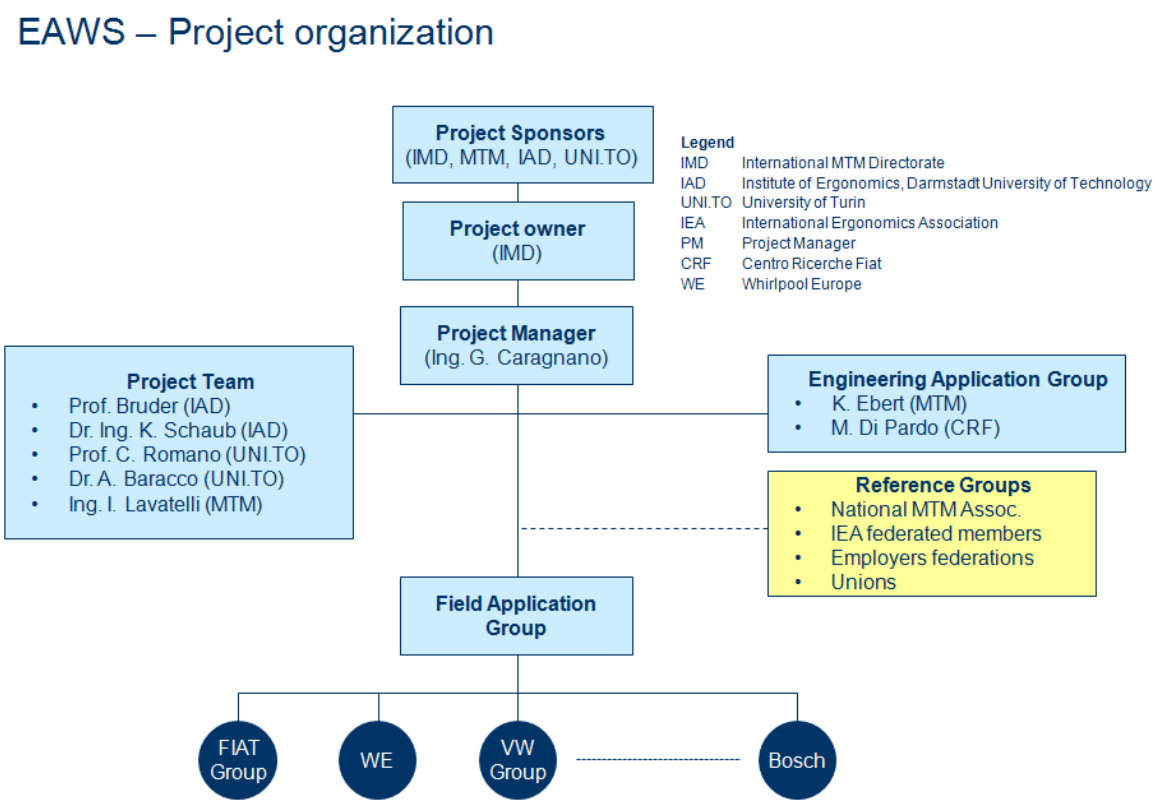


Figure 3: EAWS project development organization

Field Application Group:

ITALY AND FRANCE

- MTM Italia
  - I. Lavatelli, International MTM Instructor
  - A. Tassinari, International MTM Instructor
  - C. Rubano, MTM Instructor
- FIAT auto, Mirafiori Torino Plant
  - Ergonomy: S. Torrisi and S. Spada
  - Planning & Control: L. Galante, R. Bonetti, M. Capoccia, M. Vitello
- BOSCH Diesel Technologies and Breaking Systems (BA)
  - Industrial Engineering : M. Mancino and V. Nicassio
- WE: Whirlpool Europe (Home Appliances), Amiens plant, France
  - R. Delrue
- IVECO: commercial vehicles, Suzzara plant
  - H&S: S. Cencetti,

- Ergonomy: F. Leoni
- Work Analysis: G. Condò

GERMANY

- IAD
  - R. Bruder
  - K. Schaub
  - H. Rademacher
  - K. Ahmadi
- Volkswagen: automotive (IAD)
  - Industrial Engineering: J. Nanasi
  - Ergonomy: B. Toledo Munoz, R. Filus
- Bosch: (IAD)
  - Bosch components
  - Bosch- Siemens home appliances
  - Bosch Rexroth tools

EAWS MAINTENANCE PROCESS

The maintenance process of EAWS is managed by the EAWS Technical Board, which is composed of

- G. Caragnano, IMD – Distribution and coordination
- K. Schaub, IAD – EAWS form (figures and relations), scientific consulting and approval
- I. Lavatelli, AMI – Manual, slides and IVGA file

The Customer Care (CC) function is granted by AMI and IAD (EAWS@mtmitalia.com)

This function is a reference for the users in case they want to contact the EAWS Technical Board to submit proposals, articles or they have any question regarding the application.

The CC function is also in charge of editing the modifications to the training set and EAWS form and to keep a Log file of all the modifications (release notes).

Additionally, a User Board will be composed by organizations with EAWS instructors and practitioners, such as:

- National MTM Associations (translation, qualification procedure and certification)
- FGA and VW (reports from the field application)

The Engineering Application Group is composed of software developers who use EAWS in their software product and the software product is certified by the IMD.

The maintenance process regards the following items:

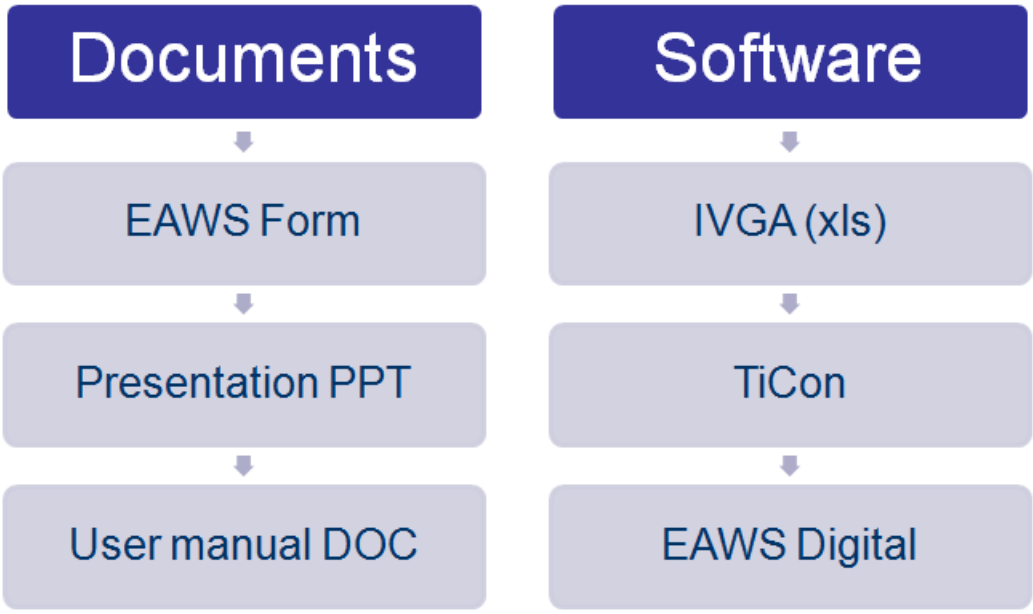


Figure 4 – EAWS set of items

The EAWS governance system is represented as follows:

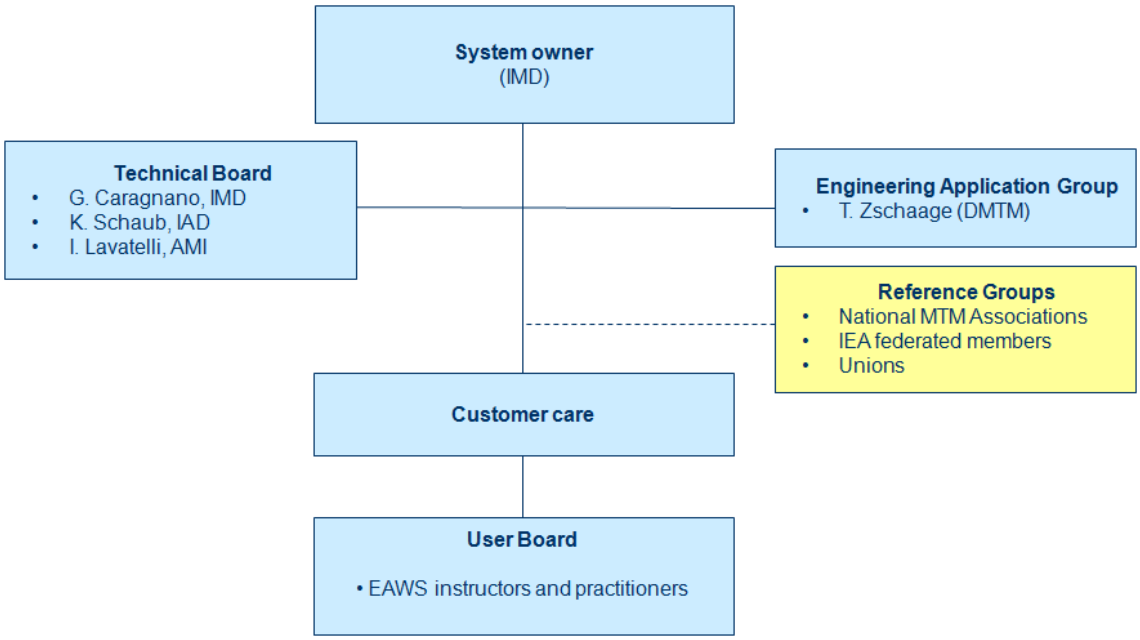


Figure 5 – EAWS governance

The maintenance process cycle is the following:

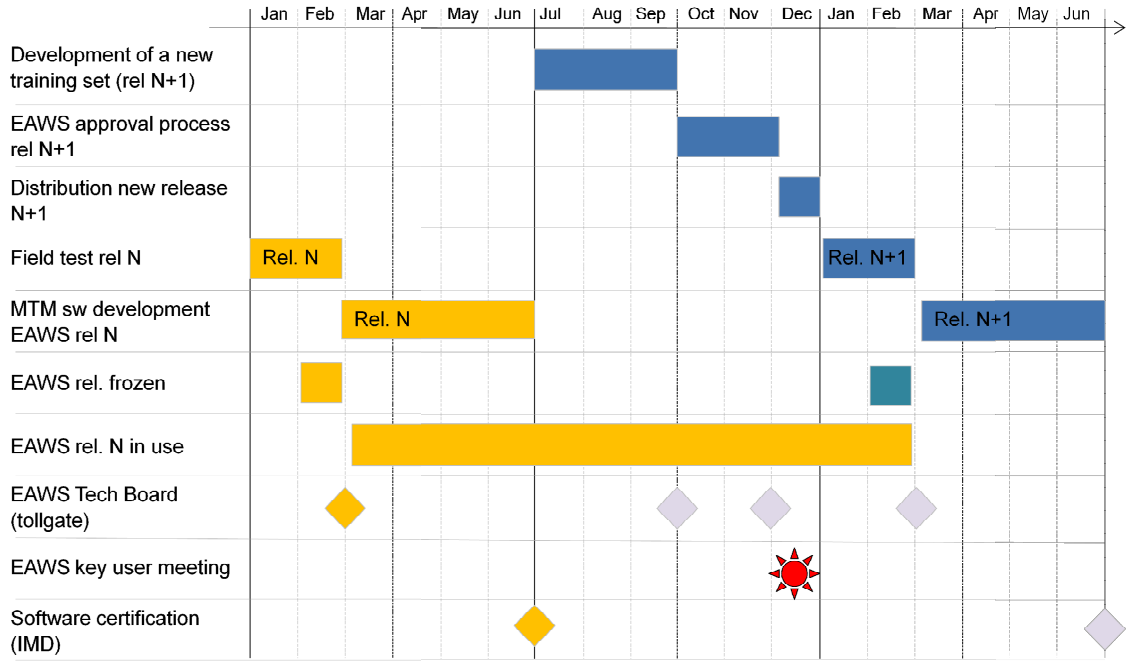


Figure 6 – EAWS maintenance process cycle

The key tollgates are the following:

- Concept Evaluation Tollgate (CET), at the end of September, to define the new concept
- Release Evaluation Tollgate (RET), at the end of November, to release the new EAWS documents
- Business Evaluation Tollgate (BET), at the end of February, to release the tested EAWS documents to the software developers
- Software Certification Tollgate (SCT) to certify software products using the officially released EAWS version

The EAWS key user meeting is intended to present to the main users the changes of the EAWS and to collect a feed-back from the field application.

EAWS: STRUCTURE AND BASIC PRINCIPLES

Note: The pictures of the EAWS form in the manual do not necessarily represent the latest release, which is instead annexed to the present manual in the Appendix.

EAWS is an ergonomic 1° level system for screening the risk due to biomechanical overload, developed to provide an overall risk evaluation that includes every biomechanical risk to which an operator may be exposed during a working task.

Up to a certain extent EAWS can also be used as 2nd level analysis tool, since it is quite analytical and detailed; EAWS gives the necessary information to redesign the work task, making the second level systems seldom necessary.

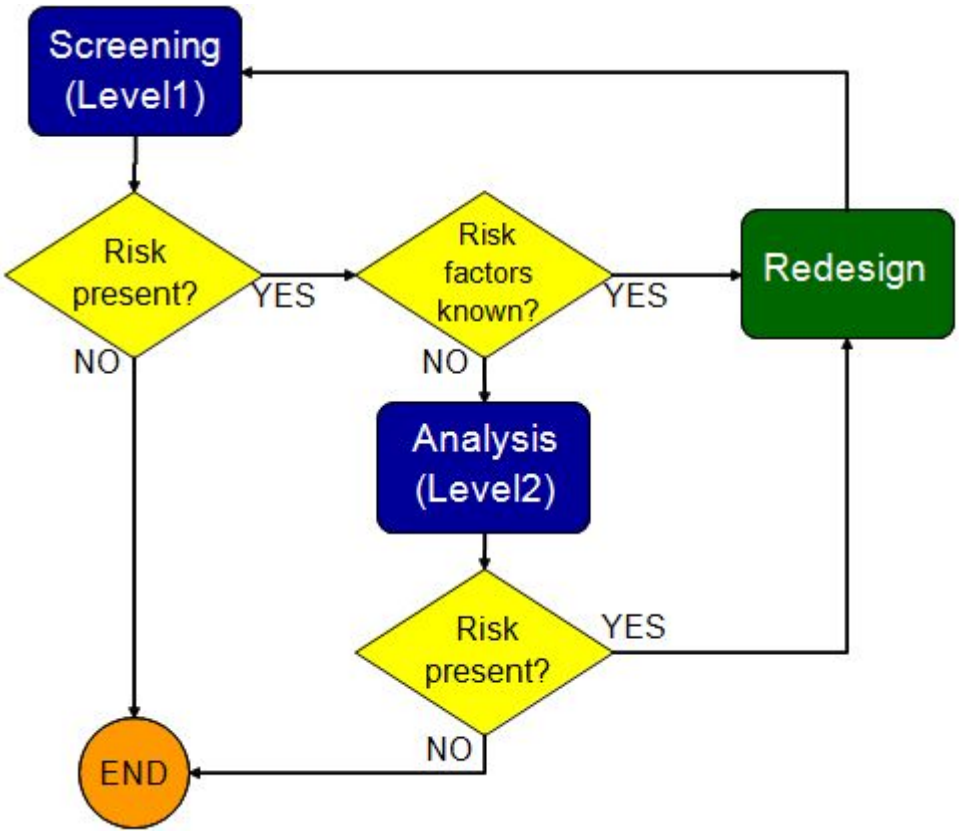


Figure 7 - EAWS Risk assessment model

The risk assessment model is defined more comprehensive in the International Standard ISO 11228 Part 2 (Pushing and Pulling) at page 3.

The structure of the analysis is as follows:

- Macro-Section “Whole body”:
  - Section 0: Extra Points
  - Section 1: Postures (static load)
  - Section 2: Action forces
  - Section 3: Manual materials handling
- Macro-Section “Upper limbs”
  - Section 4: Upper limb load in repetitive tasks

The EAWS sheet provides one score resulting for each Macro-Section which is exposed in a traffic light scheme (green, yellow, red) according to the Machinery Directive 2006/42/EC (EN 614).

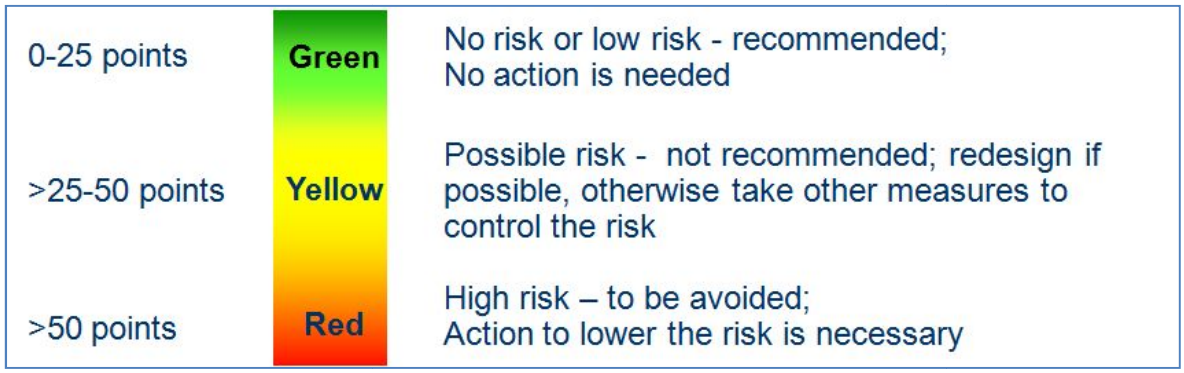


Figure 8 – Overall Evaluation

Whole body and upper limbs scores are evaluated on the same scale.

1.1. EAWS MODES OF USE AND BASIC STRUCTURE

The EAWS system can be used in two different modes which are different concerning scope and calculation:

"INSTANTANEOUS" RISK MAPPING\PRELIMINARY WORKSTATION RE-DESIGN FOR A SPECIFIC WORKER

- For a quick ergonomic risk assessment on an observed specific worker performing the work task on the shop-floor (observational method)
- Paper & pencil tool → two double-sided A4 sheets with interpolation possibilities.
- Analysis refers to observed work task (deviation risk from planned method)
- Risk factors estimated by users (forces, durations, frequencies, etc…)

QUICK WORKSTATION RE-DESIGN

- For a middle-range ergonomic risk assessment on a generic worker performing the standard work task (MTM method)
- Software tool: IVGA
- Task and work method are given by an MTM analysis. MTM analysis isn't the IVGA input.
- Useful in case of improvement proposals for what-if analysis

ERGO-MTM WORKSTATION DESIGN

- For a prior and analytic ergonomic risk assessment on an anthropometric group of operators performing a work task (MTM method)

- Software tool: TiCon - MTMergonomics
- Inputs needed:
    - MTM task analysis
    - Production plan for frequencies calculation
    - MTM codes ergonomic characterization (geometries, forces, weights, etc…)
    - Production flow macro-geometries (heights) and product positions (high, low, etc…)

EAWS BASIC STRUCTURE

The basic reference structure for analysis results is the paper form of the Worksheet, built up in the following way:

- FIRST PAGE:
    - Header
    - Result of overall evaluation (where results of each section are reported)
    - Section 0: Extra Points
    - Comments
    - Additional information for scoring repetitive tasks (cycle time, produced units, breaks, etc.)
- SECOND PAGE:
    - Section 1: Postures and movements
- THIRD PAGE:
    - Section 2: Action forces
    - Section 3: Manual materials handling
- FOURTH PAGE:
    - Section 4: Upper limb load in repetitive tasks

Below you find the EAWS paper form, with indications of related standards and level 2 systems:

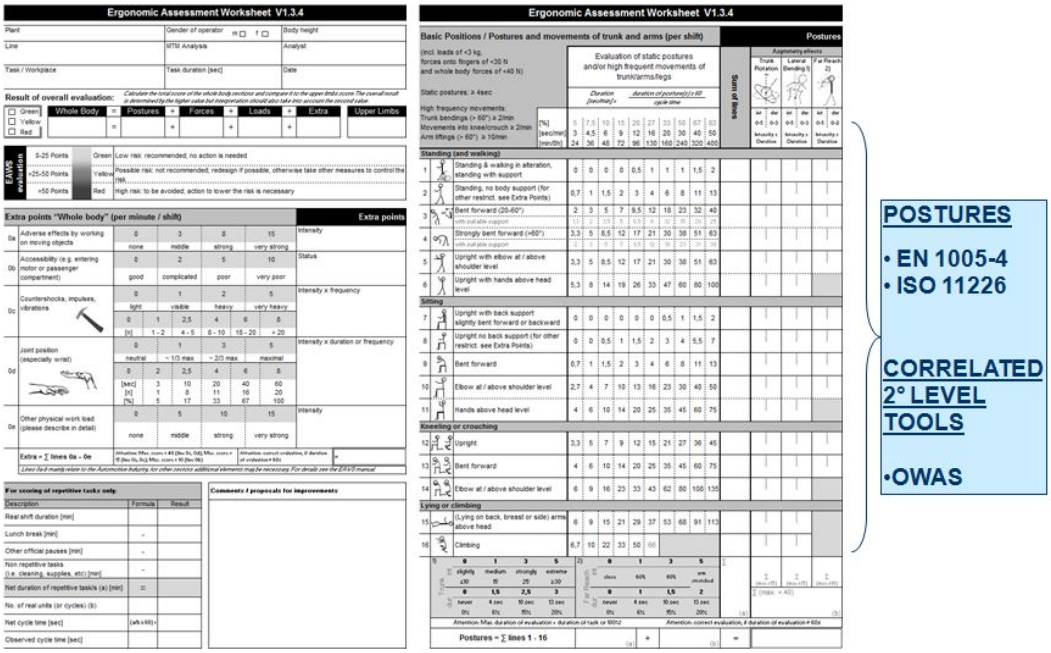


Figure 9 - EAWS pages 1 and 2

ACTION FORCES

EN 1005-3
ISO 11228-2

CORRELATED 2° LEVEL TOOLS

RULA; SCHULTETUS

MANUAL MATERIALS HANDLING

EN 1005-2
ISO 11228-1/2

CORRELATED 2° LEVEL TOOLS

NIOSH;
SNOOK & CIRIELLO

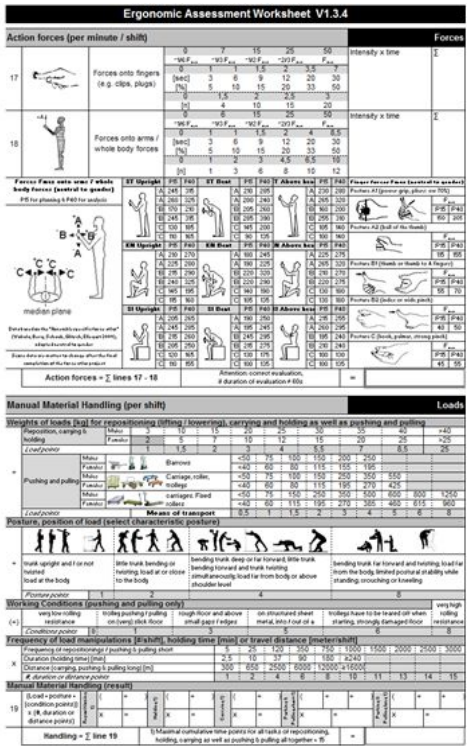
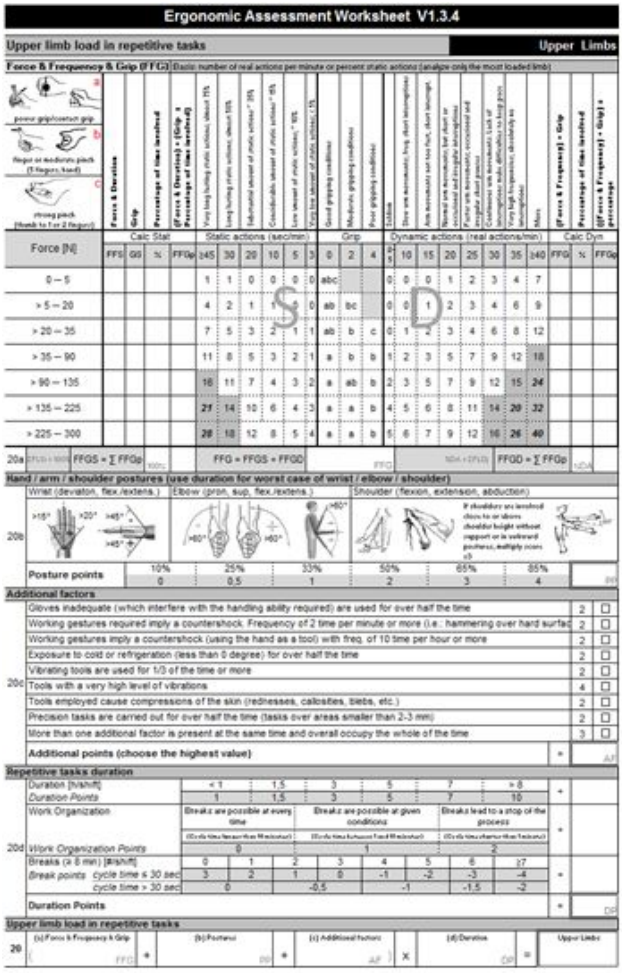


Figure 10 - EAWS page 3



HIGH FREQUANCY AND SMALL LOADS ON UPPER LIMBS

- EN 1005-5
- ISO 11228-3

CORRELATED 2° LEVEL TOOLS

- OCRA
- SI (Strain Index)
- HAL/TV (*)

(*) Hand Activity Level/ Threshold Value

Figure 11 - EAWS page 4

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