Manual
Hand Arm Risk-assessment Method (HARM)

HARM 2.0

Why the HARM method?

What is the purpose of HARM?
HARM is an instrument for determining the risk of arm, neck or shoulder complaints when performing tasks that predominately involve the use of the hands or arms[1].

The method helps you:

- gain an insight into what health risks the work may entail;
- identify the most important risk factors associated with the work;
- determine which intervention measures are likely to have the most benefit (that is to say, whether they reduce the risk of injury).

The assessment is carried out on each task, i.e. specific to the task not the employee and it is not performed on each workstation or every day. It is important to check whether a job involves several high risk tasks over the course of a work shift. If this is the case, it may be necessary to consult an expert in the area of physical workplace assessments.

What tasks can HARM be used for?
The method is intended for the assessment of those tasks involving the hands and arms, where lower leg and torso activity is minimal, e.g., tasks involving the assembly or disassembly of components, work undertaken by hairdressers or barbers, the sorting or packaging of products, or sanding/woodwork tasks.

The method should only be used for:

- **tasks that take longer than 1 hour per day in total and force exertions are applied.** If no force exertions are present and awkward working postures are, the Working posture risk assessment tool (WRAP) is the most appropriate to apply;
- tasks involving **one handed force exertions of less than 6 kg/60 N** (this is approximately equivalent to a bucket of water that is more than half full); and
- all hand and arm tasks other than **computer work**.

The HARM method is unsuitable for tasks that primarily involve activities of the back and/or legs, as is often the case with lifting, carrying, pushing, pulling and working while bent forward, kneeling or crouching.

Which type of employees can HARM be used with?
HARM is suitable for assessing tasks undertaken by adult workers aged between 18 and 67 years, across most industries and service sectors.

Who can use HARM?
Users are those who are responsible for a company's working conditions, such as injury prevention officers, health and safety coordinators, personnel officers, human resource

[1] HARM is a reliable and relatively simply instrument to use. The method is based on knowledge of risk factors reported in the literature supplemented by expert opinion. The method has been partly validated, i.e. the association between risks determined according to the HARM method on the one hand, and those determined from measurements and expert opinions on the other, has been investigated. The relationship to the occurrence of arm, neck or shoulder conditions is not known. Therefore, it is important to carefully examine all other indicators of ill-health, such as the occurrence of health complaints or absenteeism, alongside this risk assessment.

managers or, in small companies, the directors themselves. Health and safety consultants can also use the HARM method. HARM does not require any specialised, prior knowledge.

Working method

The assessment approach
The paper-based HARM assessment involves 8 steps, whereas the computer-based version involves 6 steps. This is because of the slight differences in the way information is calculated in the two approaches. The assessment is completed by selecting information from a table in each step of the assessment and placing a final score in the grey boxes below each table. These scores are then used to calculate the total risk score (Step 7), which determines whether a health risk is present or not (Step 8). This manual describes each of the steps taken and the methods used to calculate the final risk assessment score. We suggest to print this manual and use it as you apply the method step by step. In practice, it appears useful to apply HARM from video recordings of the task on which movements and postures can be observed well.

NB: The first assessment of a task often takes about hour to complete. However, following tasks usually often take much less time to complete, usually be about 30 minutes, depending on the number of actions and the information available. Steps 3 and 4 often take longer to complete than any of the other steps.

What do you need?
This manual describes in detail each step of the HARM assessment and what you need to do, as well as providing assessment forms used in steps 3 and 4, and two gauges for assessing body angles (required in Step 4, Annex 3 and 4). These forms and tools are included in the annex to this manual. You need to use a stopwatch to record action times. The use of video recordings has the advantage that observations do not have to take place immediately. Video recordings can also be helpful when searching for solutions. Besides, snapshots of the recordings can be used in the (management) report. A new assessment form should be completed for each task. In order to fill out the form you need to gather information about: postures and movements; the time duration of postures and force exertions; the frequency of actions within a task; and the vibration frequency of hand tools (if used). You collect this information by observing the task(s) and recording the duration of postures and force exertions using the stopwatch. You can perform observations directly at the workplace, or use video to record the task which you can then be analysed later.

Comments and tips before you start

- If the task being performed differs significantly between employees, use **average values for the different employees.** This particularly applies to steps 3 and 4 of the assessment. This means that you should observe and collect information from several employees performing the same task. You should also assess the same task performed on different days.
- When carrying out an assessment for the first time, conduct the assessment with a colleague, rather than on your own, as this generally results in a more accurate assessment.

What is a task?
A **task** is defined as a series of force exertions that have a common purpose, for example: the assembly or disassembly of a product, a hairdresser or barber cutting or dry-blowing hair, the sorting and packaging of a product, or sanding wood. You can define the task as broad or small as you wish, as long as you know what is included and what is not. **Forces exertions** are the components within a task which involve the application of a force, for example: picking up a part; using an electric screwdriver to put in a screw; or placing a product in a container.

You may now start the assessment!
Follow the instructions below step by step!

Step 1. Determining the task duration score

Step 1A: Indicate in the right-hand column **how long** the task takes in total (adding up the individual periods of time) and deduct 1 from the total time. Only determine the task duration for the days on which the task occurs. If, for example, the task takes place on 2 separate days, write down how long the task usually takes on those days (to 1 decimal place) and determine the average time duration. For example: let's say the task is performed on 4 separate days: 2 days for 2 hours and 2 days for 4 hours. The average time duration of the task will, therefore, be ((2x2) + (2x4))/4 = 3 hours. **Tasks that are similar to each other** in terms of the postures, movements and forces **should be assessed as a single task** (with their durations added together). Maximum score is 10 hours a day.

Step 1B: Determine **how often (number of days per week)** the tasks are performed. Maximum score is 7 days a week. Circle the appropriate score (-1 or -0).

Step 1C: Determine **whether a break of at least 7.5 minutes is taken at least every 1.5 hours**. That is to say, the employee leaves the workplace for at least 7.5 minutes to recover by performing a different task that places lower load on the neck, shoulders and arms for an equivalent period of time. Circle the appropriate score (-1 or -0). Taking a break of 15 minutes every 3 hours is not sufficient.

Step 1D: **Calculate the task duration score** and place this value in the grey box. If the task duration score is negative or less than 1 hour, then score the task duration as '1'.

Step 2. Identifying the most active hand or arm

Indentify the **most active hand(s) or arm(s)** when performing the task and circle either ‘right’, ‘left’ or ‘both’. The hand or arm that appears to perform the greater effort is the one that either exerts the higher forces or makes more movements per minute. If employees have complaints on either side, choose the side where complaints are present. Continue with the steps below for this hand.

NB: If both hands appear to be equally active, but in different ways (e.g. if one hand performs greater force exertions but the other makes more movements), conduct a separate risk assessment for each hand using the two separate assessment forms. In determining possible intervention measures, consideration should be given to the risk assessment that results in the highest risk score.

Step 3. Determining the force score

A force exertion is: the force that must be applied to materials or tools by the hand or fingers during the performance of the hand or arm task. For this step, use **the ‘form for force exertions’** at Annex 1. In steps 3A, 3B and 3C the force value, duration of force and frequency of the force are asked (see below). If there are no force exertions and awkward working postures are present, the Working posture risk assessment tool (WRAP) is the most appropriate to apply.

Step 3A: Tick the **force values** that best describe the forces that the most active hand exerts during the task. Only assess the side that you selected in step 2. If force is applied with both hands, only regard the force on the selected hand, which is the total force divided by 2. Look at the figures (weights in kg or forces in N) or the descriptions

of forces in the table under step 3A. Then identify the number of times the most active hand exerts the force. If a particular level of force occurs twice, tick it twice.

Step 3B: For **each** force exertion, record **how long (in seconds per minute)** it lasts and circle the corresponding value in the shaded area.

- Use a stopwatch and record how many seconds during a minute the hand exerts the force. Repeat the measurement until you can make a reasonable estimate of the average time duration of the force exertion. If a force for example lasts 4 seconds and occurs 3x per minute, the duration would be 12 seconds per minute. If the force exertion is difficult to measure, make a 'best' estimate of the time duration per minute. *For example, a hairdresser might be considered to cut hair for approximately 30-60 seconds of the task duration, as a hairdresser is cutting hair for more than half of the total task duration.*

- Repeat the measurements for every force exertion that has been identified (ticked) at Step 3A. If several force exertions occur within the task, *circle each corresponding number in the shaded area*. If the same force exertion occurs several times but for different durations, circle *each corresponding value* for that force exertion. If several force exertions with the same force value occur, these can be assessed as one and the same force.

Step 3C: For **each** force exertion, indicate **how often (frequency)** the force exertion occurs during a minute **(number of times per minute)** and circle the corresponding value in the columns under Step 3C.

- Determine the frequency of the force exertion (number of times per minute) by using a stopwatch and counting the number of times the force exertion occurs during a minute. Write this down on the measuring form. Repeat these measurements until you think you can make a reasonably estimate of the frequency. If the force exertion is difficult to measure, make a 'best' estimate of the frequency. *For example, the frequency with which the hairdresser cuts hair is more than 30 times per minute.*

- Determine the average frequency for each individual force exertion and circle the values in the columns of Step 3C that correspond to the combination of force and duration. If there are several force exertions, *circle each of the corresponding values in Step 3C.* If the same force exertion occurs several times but for different frequencies, circle *each corresponding value* for that force exertion. If several force exertions with the same force value occur, these can be assessed as one and the same force.

Step 3D: Determine the force score by noting the maximum score circled of either Step 3B or Step 3C and record this in the grey box below the tables (Step 3D).

Step 4. Determining the posture score

Step 4A. Firstly, determine the posture score for the head/neck and shoulder/upper arm together as follows:

- Look at the postures on the assessment form. Determine the percentage of the total task duration that these postures occur during the task. For **each** posture circle the score that corresponds to the appropriate duration, either <**10%, 10-50% or >50% of the total task duration** (refer to Step 1 for the total time duration). One number should be circled for each posture. Sometimes, it quickly becomes clear how long a certain posture occurs. If this is not the case, take a representative time period and keep a count of how often the posture occurs in that time period.

Record several measurements and note this down on the **measuring form for 'postures' (**Annex 2). Multiply the frequency and duration of time and convert this into a percentage of the observed time. It may also be helpful to make observations using video recordings as the video can be rewound and you do not have to wait for the next time the task occurs. Moreover, the video recording can be paused at a 'typical' posture in order to better assess the posture. When using a video camera, it is important that it is placed perpendicular (side-on) to the body part being assessed.

- Write down the highest score circled in the table of 4A and place this value in the grey box below the table. This is the **' neck/shoulder posture score'**.

Step 4B. Determine the posture score for the lower arm/wrist in the same way as for the neck/shoulder. When estimating the wrist angles, it may be helpful to perform the task yourself, or simulate the task. In this way you can properly observe the position of the wrist while performing the task. You might also ask the person performing the task to undertake the movement more slowly.

Step 5. Determining the vibration score

- If the task does not involve the use of vibrating tools then enter '0' as the vibration score in the grey box below Step 5A and proceed to Step 6.
- If vibrating tools are used, check whether the manual for the vibrating tool contains information about the vibration intensity of the tool. If not, proceed to Step 5A. If the vibration intensity is known, proceed to Step 5B.

Step 5A. Vibration intensity is unknown:

Determine the risk score by:

- identifying **which of the four situations** in Step 5A applies; and
- the duration of exposure per day.

Circle the corresponding score. **Only circle one score!** Place this score in the grey box below the table. **This is the vibration score**. Now proceed to Step 6.

Step 5B. Vibration intensity is known:

Determine the risk score by:

- identifying **which of the four situations** in Step 5B applies;
- the duration of exposure per day.

Circle the corresponding score. **Only circle one score!** If several vibrating tools are used, assess the one with the highest vibration intensity. Place this score in the grey box below the table. **This is the vibration score.**

Step 6. Determining the score for other factors

- Identify which of the situations described in the table of Step 6 applies to the task by **circle either 'yes' or 'no'**.
- **Determine the score for 'other factors'** as follows: if none of the situations apply, the score is '0'; each question that is answered with 'yes' gives 0,5 points. The total score of this step is the sum of all questions. (Maximum number of points is 2,5).

Step 7. Determining the risk score

- **Take each of the risk scores from steps 3 to 6 and add them up to get a total score (A).** If you assessed the task for both hands in Step 3 (exertion of force) and Step 4 (posture), take the scores corresponding to the hand or arm with the highest scores.
- **Take the task duration score (T) from Step 1 and multiply this value by the total score (A). The result is the risk score.** This score can be used to determine the level of risk posed by the task (Step 8).

Step 8. Determining the level of risk

Determine the risk level for the task using the 'traffic light table' provided.

- For a total risk score of **less than 30** the assessment is considered **green**. This means that the task is not considered to **pose a risk** of arm, neck or shoulder complaints for the majority of employees.
- For a total risk score of **between 30 and 50** the assessment is **amber**. This means that the task poses a **risk** of arm, neck or shoulder symptoms for some employees. In a particular company, whether the employees are at risk depends on the individual and their response to physical loads. However, to protect the majority of employees as far as possible, it is important to take **measures** to lower the risk.
- For a total risk score of **50 or more** the assessment is **red**. This means that the task poses a **significant risk** of arm, neck or shoulder complaints to the majority of the employees. Therefore, it is important that **immediate measures** are taken to lower the risk!

If there are health complaints - such as arm, neck or shoulder symptoms - that may be related to the task, it is always important to find the cause and take preventative measures!

You are now finished with the assessment for this task. Repeat the procedure for any other hand or arm tasks!

How to proceed?

When all the tasks have been assessed, it is important to examine whether measures are necessary to reduce the risks. The tasks that have received a 'red' assessment have priority over those assessed as 'amber'. The results of the assessment also indicate what action is likely to be most appropriate. For this, look at the risk factors that contribute most to the ‘red’ or ‘amber’ assessment. These are the risk factors with the highest scores in Step 7. For red and amber scores, always look at whether the task duration can be shortened.

The ‘Wegwijzer Fysieke Belasting’ can be helpful to guide you in the process from risk score to selecting and implementing measures to decrease the risks (only in Dutch). The ‘wegwijzer’ can be found at www.fysiekebelastingbeoordelen.tno.nl.

Annex 1: Form for recording force exertions (step 3)

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Task: ……

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Amount of force	**Measure (for the forces that are exerted during the task) the duration of the force exertions <u>over the course of one minute</u> (repeat the measurement a few times)**	**Make a new observation and keep a count of how often the force exertion occurs during each observation (also record how long you observed the task)**
(extremely) low to average: weight < 100 g to 1 kg force < 1 N to 10 N	….sec ….sec ….sec **Average duration per minute:** ..... seconds per minute *(add up all the durations for each force exertion and divide by the number of measurements)*	……. times in ……. minutes **Calculate the number of force exertions per minute (frequency)** *frequency = number of force exertions / the duration of the observation (in minutes)* **Frequency** =……. force exertion per minute
somewhat high to high: weight: 1 to 6 kg force: 10 to 60 N	….sec ….sec ….sec **Average duration per minute:** ..... seconds per minute *(add up all the durations for each force exertion and divide by the number of measurements)*	……. times in ……. minutes **Calculate the number of force exertions per minute (frequency)** *frequency = number of force exertions / the duration of the observation (in minutes)* **Frequency** =……. force exertion per minute

Annex 2: Form for recording postures (step 4)

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Taak: ……

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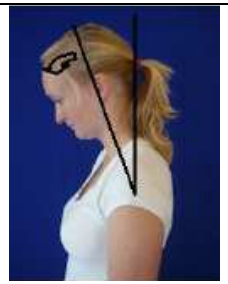
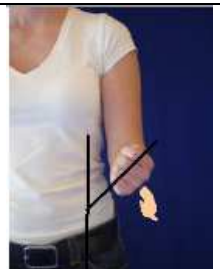
Postures			**Keep a count of how often the posture occurs per unit of time (also indicate how long you observed)**	**Duration of the postures (repeat the measurement a few times)**	**Duration of posture as a percentage of the task duration:** = number observed x average duration total duration of observation
The head is tilted further forward than in the first photograph OR tilted further back than in the second photograph			……. times in (K) ……. sec (O)	…. sec …. sec **Average duration per time:** ….. sec (G)	Percentage= …….(K) **x** ……sec (G) ……sec (O) =…….%
The head is tilted further to the side than in the first photograph OR the head is turned, as in the second photograph			……. times in (K) ……. sec (O)	…. sec …. sec **Average time duration:** ….. sec (G)	Percentage= …….(K) **x** ……sec (G) ……sec (O) =…….%
The head is tilted forward **and turned at the same time**			……. times in (K) ……. sec (O)	…. sec …. sec **Average time duration:** ….. sec (G)	Percentage= …….(K) **x** ……sec (G) ……sec (O) =…….%

Postures			**Keep a count of how often the posture occurs per unit of time (also indicate how long you observed)**	**Duration of the postures (repeat the measurement a few times)**	**Duration of posture as a percentage of the task duration:** = number observed x average duration total duration of observation
The head is tilted backward **and turned at the same time**			……. times in (K) ……. sec (O)	…. sec …. sec …. sec **Average time duration:** ..... sec (G)	Percentage= …….(K) **x** ……sec (G) ……sec (O) =……%
Head/chin are pushed (far) forward			……. times in (K) ……. sec (O)	…. sec …. sec …. sec **Average time duration:** ..... sec (G)	Percentage= …….(K) **x** ……sec (G) ……sec (O) =……%
The forearm arm is **unsupported** and the upper arm is further forward OR further sideways of the trunk than in the photographs, OR behind the trunk			……. times in (K) ……. sec (O)	…. sec …. sec …. sec **Average time duration:** ..... sec (G)	Percentage= …….(K) **x** ……sec (G) ……sec (O) =……%

Postures			**Keep a count of how often the posture occurs per unit of time (also indicate how long you observed)**	**Duration of the postures (repeat the measurement a few times)**	**Duration of posture as a percentage of the task duration:** = <u>number observed x average duration</u> total duration of observation
Shoulders raised (high)			……. times in (K) ……. sec (O)	…. sec …. sec …. sec **Average time duration:** ..... sec (G)	Percentage= <u>…….(K) **x** ……sec (G)</u> ……sec (O) =…….%
Elbow significantly bent or extended			……. times in (K) ……. sec (O)	…. sec …. sec …. sec **Average time duration:** ..... sec (G)	Percentage= <u>…….(K) **x** ……sec (G)</u> ……sec (O) =…….%
The forearm is rotated further (in the direction of the arrows) than in the photographs			……. times in (K) ……. sec (O)	…. sec …. sec …. sec **Average time duration:** ..... sec (G)	Percentage= <u>…….(K) **x** ……sec (G)</u> ……sec (O) =…….%

Postures			**Keep a count of how often the posture occurs per unit of time (also indicate how long you observed)**	**Duration of the postures (repeat the measurement a few times)**	**Duration of posture as a percentage of the task duration:** = number observed x average duration total duration of observation
The hand is bent sideways (in the direction of the little finger and/or thumb) at the wrist so that the position of the wrist is between the positions shown in the photographs.			……. times in (K) ……. sec (O)	…. sec …. sec …. sec **Average time duration:** ..... sec (G)	Percentage= …….(K) **x** ……sec (G) ……sec (O) =…… %
The hand is bent at the wrist so that the position of the wrist is between the positions shown in the photographs			……. times in (K) ……. sec (O)	…. sec …. sec …. sec **Average time duration:** ..... sec (G)	Percentage= …….(K) **x** ……sec (G) ……sec (O) =…… %

Annex 3: GAUGE 1 for determining postural angles (step 4)

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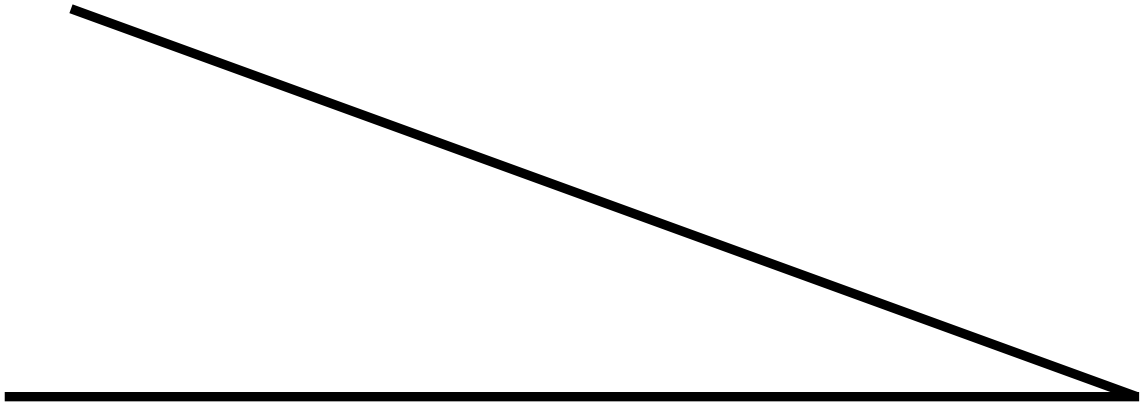
Angle to assess:

- Whether the head is tilted further forward than in the photographs.
- Whether the head is tilted further sideward than in the photographs.

For assessing “whether the upper arm is forward, sideways, or behind the trunk without the forearm supported” use **GAUGE 2*!***

Print out the diagram, preferably on transparent paper, and use it to assess the postural angles described above.



Annex 4: GAUGE 2 for determining postural angles (step 4)

Angle to assess:

- Whether the upper arm is forward, sideways, or behind the trunk without the forearm supported

For assessing “Whether the head is tilted further forward than in the photographs” and “Whether the head is tilted further sideward than in the photographs” use **GAUGE 1*!***

Print out the diagram, preferably on transparent paper, and use it to assess the postural angle described above.