# ergosense **ergonomics and the workplace**

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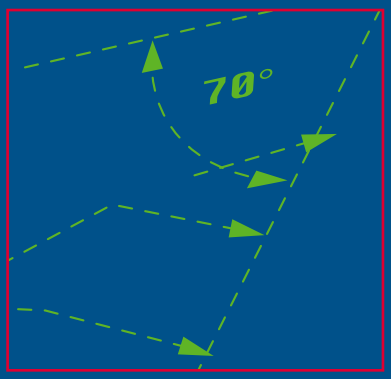
*Ergonomics at work deals with the interactions between operators and their work equipment, work environment and work process.*

*Ergonomically designed work systems enhance safety, effectiveness and efficiency, improve human working and living conditions, and counteract adverse effects on human health and performance.*




*The ergonomic partnership*

# Ergosense

## What is Ergonomics?

In today's workplaces, there is an increasing concern to ensure that people's health is not adversely affected by the work they do. *Desoutter* has been established as a prominent manufacturer of industrial hand held power tools for over 80 years. We have produced this booklet to help our customers to use our products in ways which will minimise the risks of problems occurring. The information given here is in addition to the specific safety instructions supplied with each tool, which must always be followed. *Desoutter* shall not be liable in any way for the failure to use products within the parameters laid down in this booklet, or for any consequential loss or damage resulting from reliance on the advice, guidelines and information contained in it. It is recommended that users contact *Desoutter* or their agents for advice as to the operation, nature and potential uses of our products.

Not all medical experts agree on the exact causes of Carpal Tunnel Syndrome or other Upper Limb Disorders. Nevertheless, we have done our best to provide an accurate layman's guide, by indicating what we understand to be the most common causes, and have not attempted to give a complete list. People requiring more detailed or specific information are encouraged to contact an Occupational Physician.

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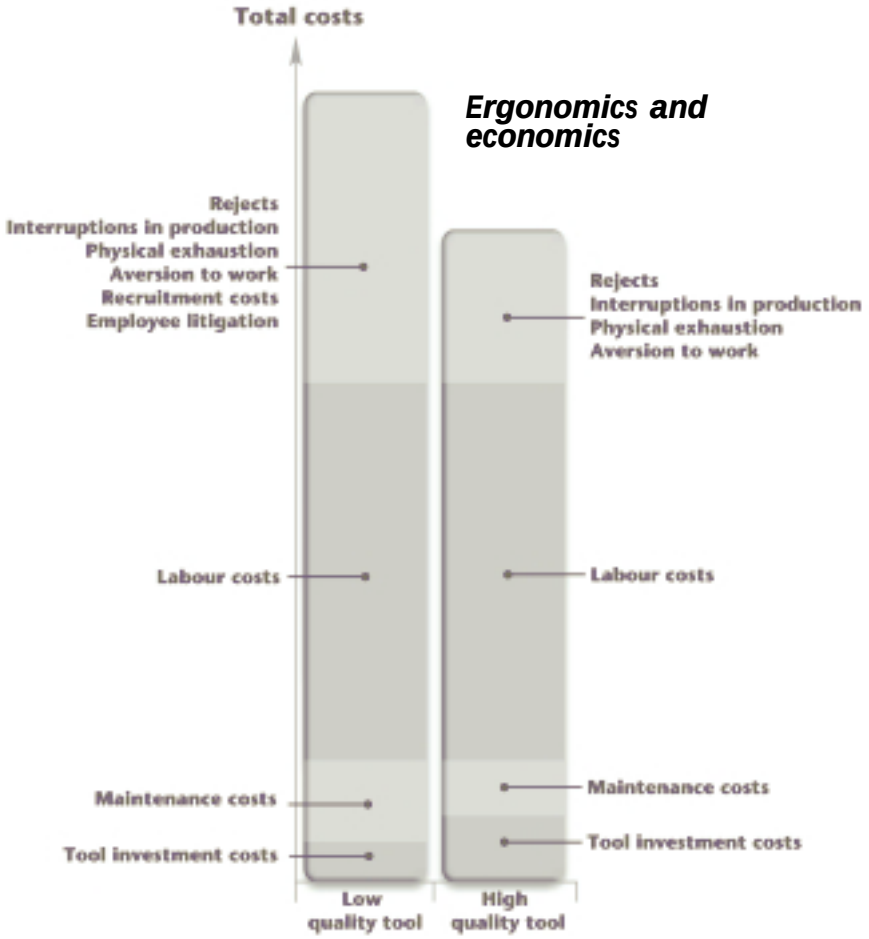
# Ergonomics in the workplace

## -a high priority!




### *The potential benefits are:*

- *reduced sickness*
- *reduced operator fatigue*
- *greater productivity*
- *improved quality*
- *less work-in-progress*
- *reduced handling times*
- *more flexible, multi-skilled workforce*
- *greater operator job satisfaction and increased loyalty*
- *lower recruitment costs*
- *less risk of legal disputes resulting from employee injuries*
- *lower employer's liability insurance costs*

### *The aims of this booket are:*

- *to examine the 4 Key Elements of Ergonomics – people, their work environment, the task they do and the tools they use – how they interrelate and how they best work together*
- *to look at what can go wrong*
- *to set out the legal position*
- *to show how Desoutter tools are designed to meet the ergonomic needs of their users.*

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# 4 key elements

## 1: People

### Health surveillance

In many countries, employers have a duty to provide health surveillance for employees whose jobs may involve risks to their health and safety. In Europe, this duty is enshrined in Directive 89/391/EEC.

The objective of health surveillance is to detect adverse health effects at an early stage, so enabling further harm to be prevented.

Ideally the first health check should take place prior to starting any work which might include repetitive movements (especially those involving lifting or twisting actions) or using vibrating equipment, or working in noisy or dusty environments. This health check should include:

- check for pre-disposition to Repetitive Strain Injuries (RSI), and to vibration and noise induced injuries
- check for general fitness and strength – will the work place undue strain on the person?
- check for existing conditions, such as RSI, Raynaud's disease or Raynaud's phenomenon, hearing loss and other injuries, eg. conditions possibly resulting from previous employment.

People exhibiting conditions such as obesity, pregnancy, menopause, arthritis, gout or diabetes, or who engage in certain hobbies, or play racquet sports or video games, as well as those already suffering from RSI, should discuss the risks involved in the work with a suitably qualified medical practitioner.

People with poor circulation are more likely to suffer from Vibration-Induced White Finger (VWF) and, for this reason, workers exposed to vibration should be discouraged from smoking.

The first health check should be followed by health surveillance at regular intervals, to monitor employee health and enable any preventive measures to be taken.

### Training

Employers should provide their workers with training to create awareness of:

- the effects of repetitive strain, noise, vibration and dust
- the need to minimise the risks by correct working practices
  eg. using correct hold/posture
  using minimum grip force (reduces likelihood of RSI & VWF)
  keeping cutting tools sharp
  not removing silencers
  wearing ear/eye protection
  and using dust collection/ suppression when necessary
- the need to inform supervision if abnormal vibration or torque reactions occur
- the need for employees to report the onset of any symptoms without delay.

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## 2: Environment

Attention should be paid to:

### Warmth

To reduce the risk of Vibration-Induced White Finger, it is important to maintain a good blood supply to the finger tips; therefore indoor workplaces should be comfortably warm.

### Comfort

Seated workers should have adjustable-height seating, so that the work is within the "ergonomic envelope" of the individual. **Fig 1.**

Standing workers should be provided with anti-fatigue mats.

### Noise

The background noise should be as low as possible. **Fig 2.**

Booths may reduce the noise levels for other workers, but usually amplify the noise for the operator inside.

### Dust

Where dust is produced by processes such as sanding or sawing, its concentration in the workplace atmosphere shall be kept as low as possible. The use of dust collection, extraction or suppression systems may be necessary.

### Rest areas

Rest areas should be warm, quiet and relaxing so that workers can use break periods to recover from the effects of repetitive strain, noise and vibration.

Wherever practically possible, the levels of noise, vibration and dust should be reduced by means other than the use of personal protective equipment.

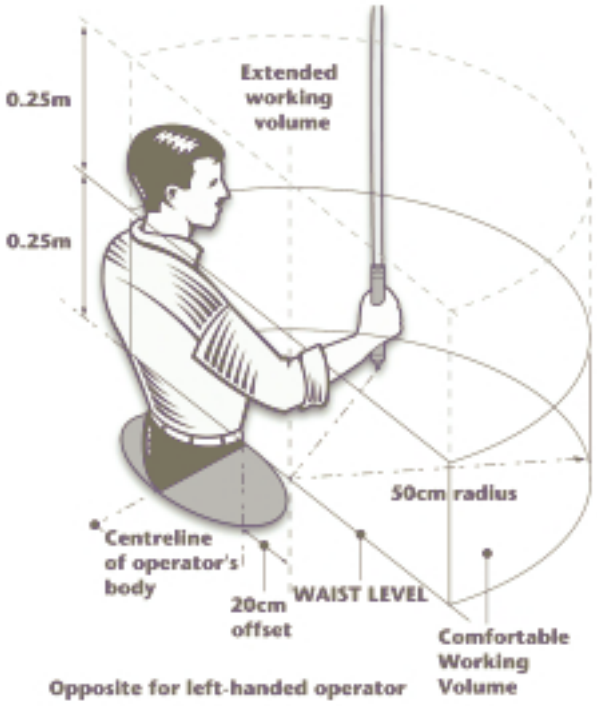


**Fig 1. The ergonomic envelope**

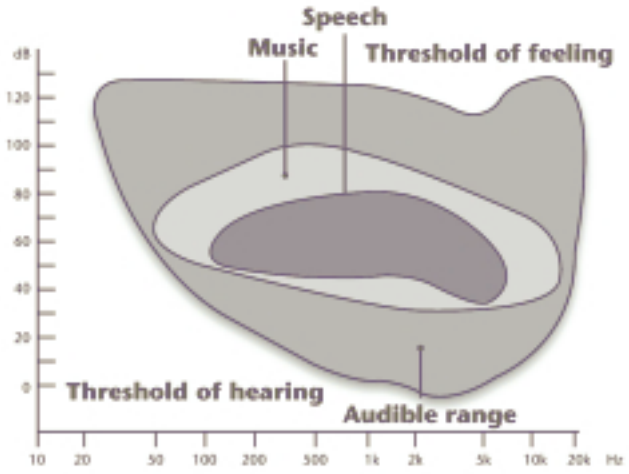


**Fig 2. The important areas of hearing**

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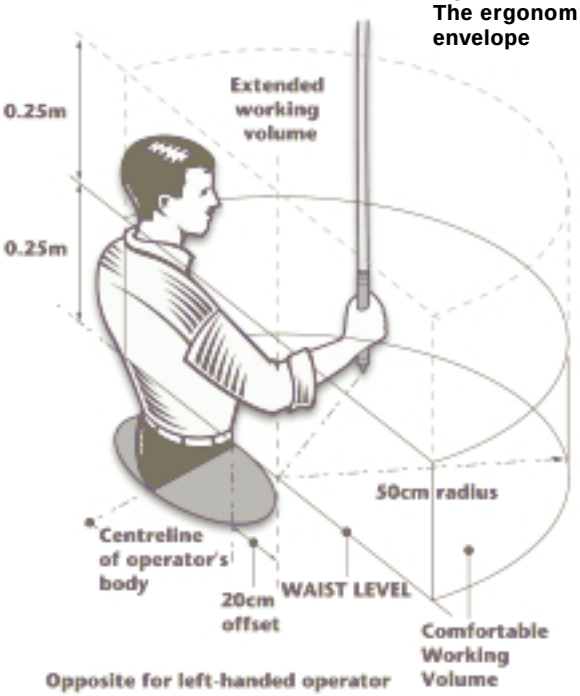


**Fig 1.**
**The ergonomic envelope**

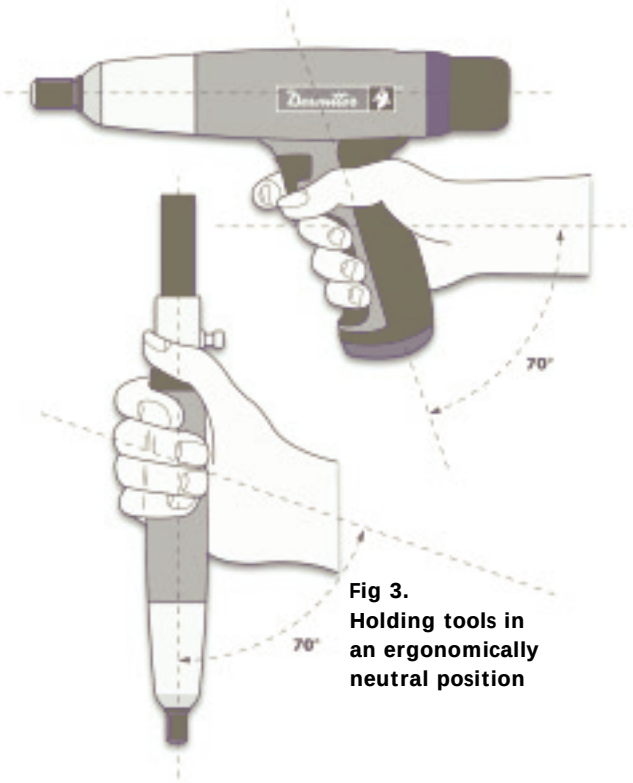


**Fig 3.**
**Holding tools in an ergonomically neutral position**

## 3: Task design

The design of the workstation and the way in which a task is performed are critical in avoiding long term problems. Here are the main pointers to success:

Work within the ergonomic envelope. **Fig 1.**

Ensure a neutral wrist position. **Fig 3.**

– by selection of correct tool (pistol or straight case) **Fig 4.**
– by orientation of workpiece e.g. angled towards workers. **Fig 5.**

Avoid excessive twisting or bending of the wrist.

Do not expect the worker to over-reach, or reach up.

Match the size of the task to the strength of the person.

Minimise lifting – provide balancers or, if not practicable, leave the tool at bench height between operations, not on the floor. Balancers can also reduce the effects of vibration by lowering the grip force exerted by the operator. **Fig 6.**

Replace screwdriver bits regularly, before they start to "ride out" (this causes the operator to use excessive axial force to keep the bit engaged with the screw head.

Where possible, provide side handles or bench stands to take torque reaction and reduce vibration transmitted to the operator. **Fig 7.**

Minimise repetitive movements – substituting power fastening tools for hand tools can reduce stressful repetition.

Provide task rotation, to ensure that different sets of muscles and joints are used during the day, and to limit exposure to noise, dust and vibration. Job enlargement may bring the **benefits** of a multi-skilled workforce and may result in reduced handling times and reduced work in progress.

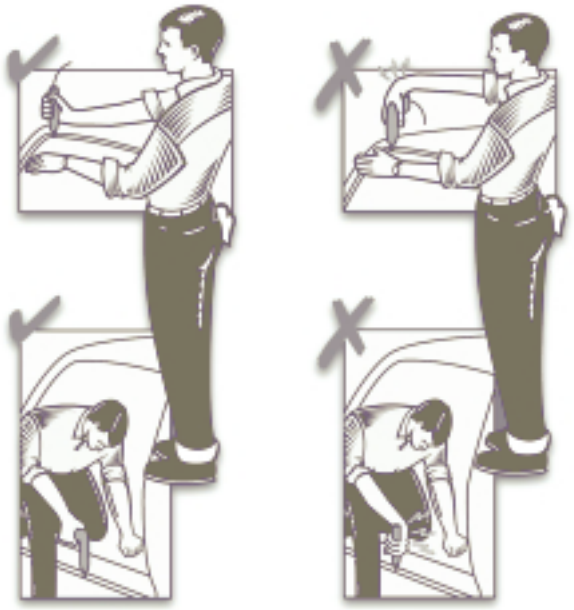

**Fig 4.**
**The right tool for the job**

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**Fig 5.**
**Correct orientation of the workpiece**

Ideally, avoid incentive schemes which can lead to operators neglecting scheduled breaks or exceeding safe rates of work. Nevertheless, self-paced systems are preferable to machine paced systems, insofar as loss of control is a major determinant of stress-related problems.

Avoid clustering noise sources, this adds to noise exposure and may cause mental stress and increase the likelihood of RSI.

Provide a firm fixture for the work-piece, so that it doesn't reverberate and amplify noise and vibration levels.

Assess and minimise daily noise, dust and vibration exposure.
**Fig 8.**

**Maximum exposure time (based upon*)**

| Sound pressure level (dBA) | Exposure in any 24 hours |
|---|---|
| 85 | 24 hours |
| 87 | 16 hours |
| 90 | 8 hours * |
| 93 | 4 hours |
| 96 | 2 hours |
| 99 | 1 hour |
| 102 | 30 mins |
| 105 | 15 mins |
| 108 | 7.5 mins |
| 111 | 3.75 mins |

**Fig 8** *N.B. These exposure times should not be regarded as safe*
** Second action level re. 86/188/EEC*

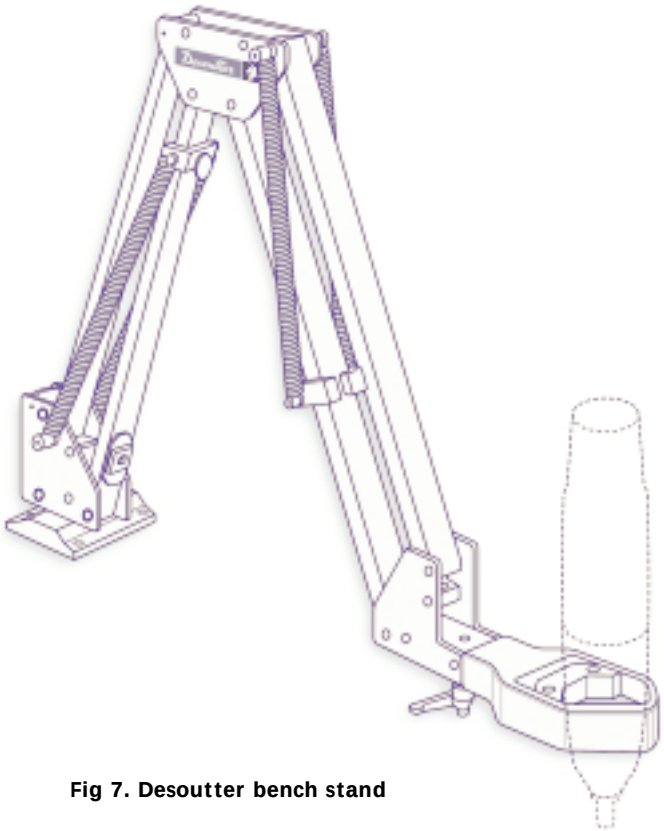

**Fig 7. Desoutter bench stand**

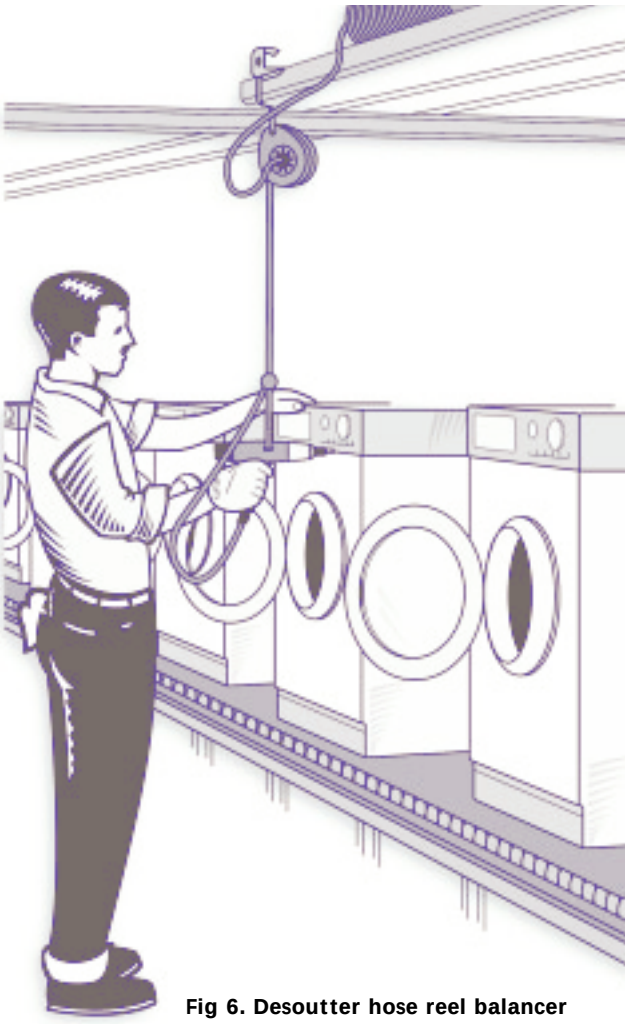

**Fig 6. Desoutter hose reel balancer**

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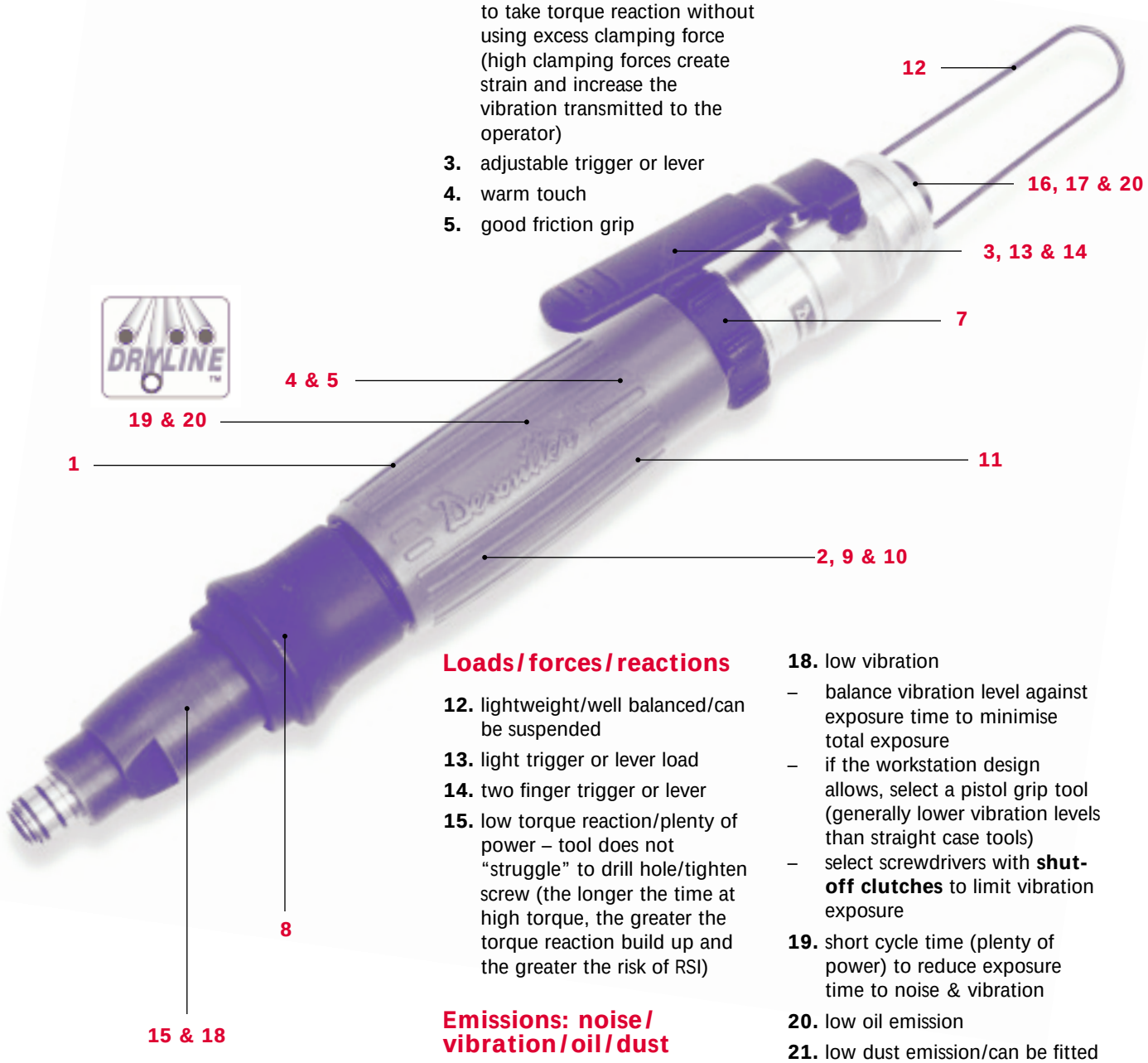
# 4: Power tool selection

These are the "ergonomic" features to look for when selecting hand-held power tools:

## Shape/size/handling

1. comfortable contoured grip shape
2. grip large enough for operator to take torque reaction without using excess clamping force (high clamping forces create strain and increase the vibration transmitted to the operator)
3. adjustable trigger or lever
4. warm touch
5. good friction grip
6. correct handle orientation/angle
7. suitable for left and right handed operators
8. thrust bump
9. shaped so that operator can take torque reaction easily
10. impervious to oil and grease (does not become slippery or harbour bacteria)
11. allows area between hand and power tool to be ventilated




## Loads/forces/reactions

12. lightweight/well balanced/can be suspended
13. light trigger or lever load
14. two finger trigger or lever
15. low torque reaction/plenty of power – tool does not "struggle" to drill hole/tighten screw (the longer the time at high torque, the greater the torque reaction build up and the greater the risk of RSI)

## Emissions: noise/vibration/oil/dust

16. low noise level
17. exhaust air can be piped/directed away from operator/workpiece, as desired
18. low vibration
    - balance vibration level against exposure time to minimise total exposure
    - if the workstation design allows, select a pistol grip tool (generally lower vibration levels than straight case tools)
    - select screwdrivers with **shut-off clutches** to limit vibration exposure
19. short cycle time (plenty of power) to reduce exposure time to noise & vibration
20. low oil emission
21. low dust emission/can be fitted with dust suppression/extraction

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# What can go wrong?

| Type of injury | What it is |
|---|---|
| Upper Limb Disorders (also known as Repetitive Strain Injuries - RSI or Cumulative Trauma Disorders - CTD) | A general term, the most common forms of which are: tendinitis, synovitis, tenosynovitis, trigger finger, De Quervain's disease, epicondylitis, carpal tunnel syndrome, thoracic outlet syndrome and vibration white finger. |
| Tendinitis | Inflammation and roughening of the tendon, a fibrous structure attaching muscle to bone.<br>Caused by repetitive use of the hands and/or arms for unaccustomed tasks. |
| Synovitis | Inflammation of the fluid lubricated membrane which surrounds a joint.<br>Caused by repetitive use or over use of a joint. |
| Tenosynovitis | Inflammation of the tendon and swelling of its surrounding sheath.<br>Caused by unaccustomed usage or over-use of the hand. |
| Trigger finger | A type of Tenosynovitis, involving the development of a nodule on the flexor tendon on the inside of the finger, so that the movement of the finger is sudden and jerky.<br>Caused by excessive use of the finger, e.g. for operating a power tool. |
| De Quervain's Disease | Tenosynovitis of the tendons of the thumb.<br>May be caused by repetitive forceful gripping and twisting movements of the hand, such as when using a screwdriver. |
| Epicondylitis<br>e.g. Tennis elbow | Pain in the attachments of the ligaments: strong fibrous bands joining bones which permit a limited range of movement.<br>Caused by rotation of the forearm against a force. |

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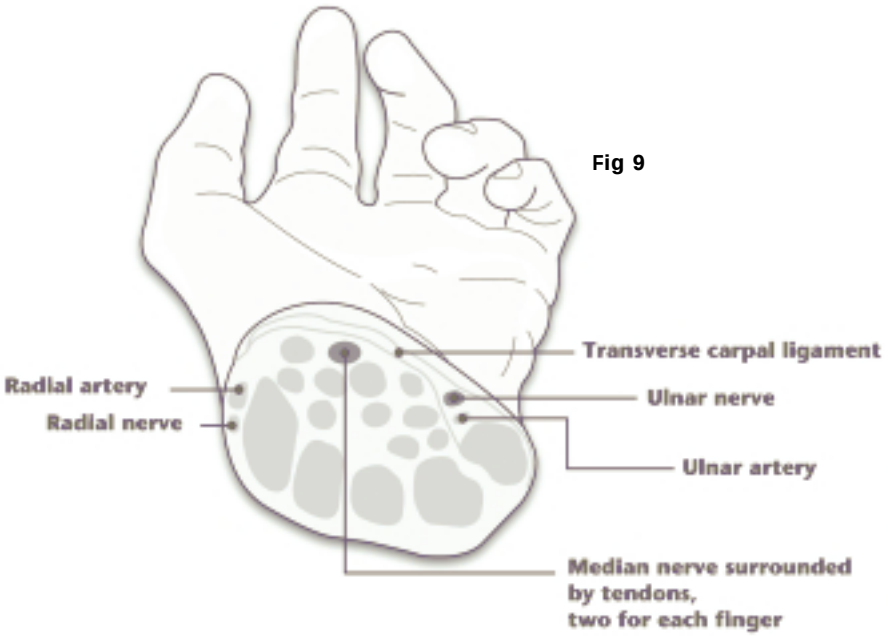


Fig 9

**Fig 10.**
**Hyperextension of the wrist**


| Type of injury | What it is |
|---|---|
| **Carpal Tunnel Syndrome** | Pain, numbness and tingling in the palmar surfaces of the thumb and in the index, middle and ring fingers.<br>Results from entrapment or irritation of the median nerve as it passes through a tunnel formed by the wrist (carpal) bones. **Fig 9.**<br>Caused by a combination of some or all of the following factors:<br>• the exertion of force by the tendons in the wrist, which pass through the carpal tunnel beside the median nerve (a pinch grip is worse than a closed fist)<br>• prolonged repetition of the task, leading to inflammation of the tendons and their sheaths<br>• bending the wrist, which can cause the space inside the carpal tunnel to be reduced and the tendons to compress the median nerve. **Fig 10.**<br>• insufficient time between work for the body to recover<br>• individual pre-disposition, e.g. fluid retention. |
| **Thoracic Outlet Syndrome** | Compression of the soft tissues in the neck and shoulder, affecting the nerves of the upper arm.<br>Caused by repeated overhead working. **Fig 11.** |
| **Vibration-Induced White Finger (VWF)** | Blanching of the fingers repeatedly exposed to vibration. **Fig 12.**<br>Attacks of white finger are usually precipitated by cold and during them there is often reduced sensitivity to temperature, pain and touch. Attacks typically end with a red flush and considerable pain. In some cases, after continued and prolonged vibration exposure, the fingers may possibly take on a permanent blue-black appearance. |

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| Type of injury | What it is |
|---|---|
| **Noise-Induced Hearing Loss** | Damage to hair cells of the inner ear following prolonged exposure to high noise levels.<br>Results in progressive loss of hearing, starting at the highest frequencies but eventually affecting speech frequencies. **Fig 13.**<br>Can also cause tinnitus (ringing in the ear). |
| **Respiratory Disease** | A general term covering a wide range of conditions, affecting the respiratory tract and lungs, some of which may be related to the inhalation of dusts, particularly with particle sizes of 5µ or less.<br>One of the most serious forms is asbestosis; however, wood dust can cause severe irritation of the respiratory system, as well as of the skin and eyes.<br>Long term exposure to hard wood dust is known to cause an increased risk of nasal cancer. |

**Fig 12**

**Equivalent exposure time***

| Vibration m/s² | Exposure time |
|---|---|
| 2 | 16 hours |
| 2.8 | 8 hours |
| 4 | 4 hours |
| 5.6 | 2 hours |
| 8 | 1 hour |
| 11.2 | 30 mins |
| 15.8 | 15 mins |
| 19.4 | 10 mins |
| 27.4 | 5 mins |
| 61.3 | 1 min |

*N.B. These exposure times should not be regarded as safe*

** Energy-equivalent exposure times calculated according to ISO 5349*

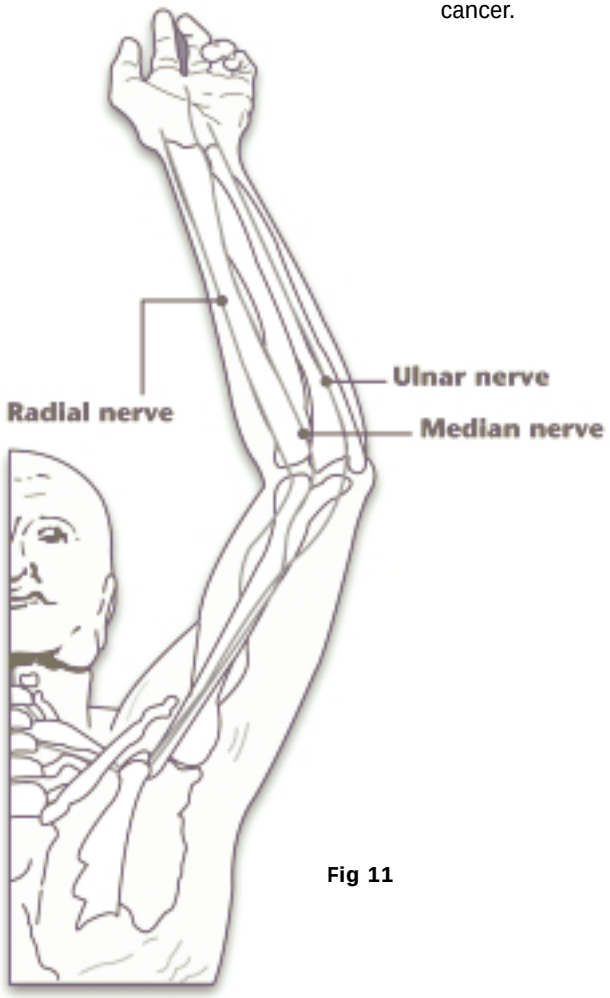


**Fig 11**

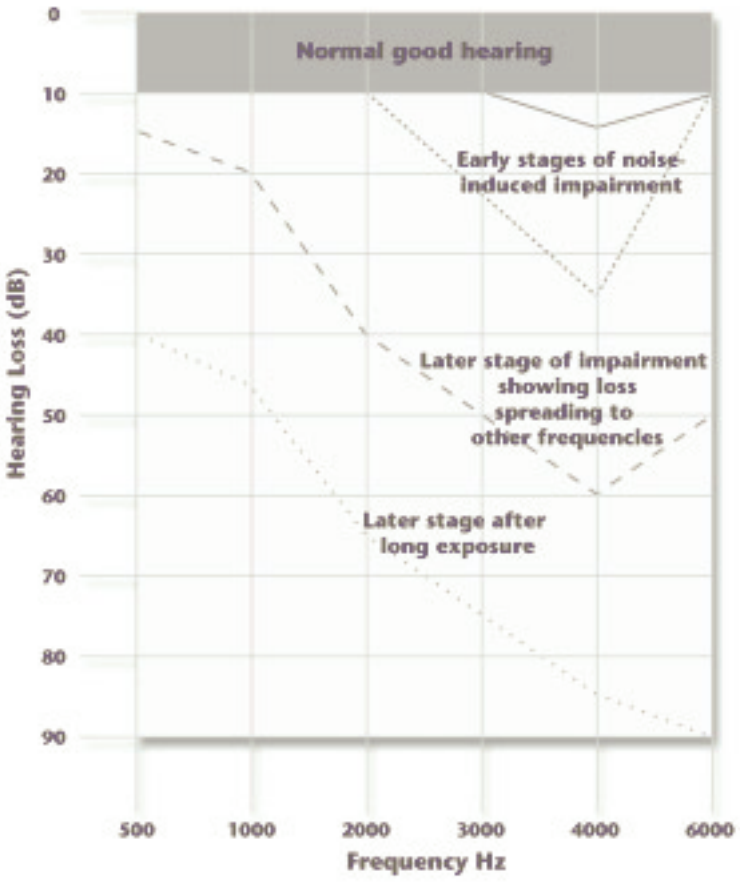


**Fig 13.**
**The different stages of hearing loss**

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# What the law says about Ergonomics at Work

Note: The reference numbers of the relevant European Directives are shown in brackets.

## The Employer's duties

- avoid risks to safety & health (89/391/EEC)
- purchase only "CE" marked machinery for use in workplaces (89/655/EEC)
- evaluate risks which cannot be avoided (89/391/EEC)
- combat risks at source (89/391/EEC)
- adapt the work to the individual, especially as regards the design of work places, the choice of work equipment and the choice of working and production methods, with a view, in particular, to alleviating monotonous work and work at a pre-determined work-rate and to reducing their effect on health (89/391/EEC)
- adapt to technical progress (89/391/EEC)
- replace the dangerous by the non-dangerous or the less dangerous (89/391/EEC)
- train workers adequately (89/655/EEC)
- give the written machinery operating instructions to the workers (89/655/EEC)
- provide personal protective equipment when appropriate (89/391/EEC & 86/188/EEC)

## The Worker/Operator's responsibilities

- use machinery and tools correctly, in accordance with the manufacturer's instructions (89/391/EEC)
- refrain from removing safety devices, including silencers (89/391/EEC & 86/188/EEC)
- use personal protective equipment correctly (89/391/EEC)
- co-operate with the employer in ensuring their health & safety (89/391/EEC)

## The Manufacturer's obligations

- *assess the risks* to health and safety associated with the product and then *design* to reduce the risks as far as possible or, if this is not possible, apply appropriate safety measures such as *guards* and, finally, *warn* against any residual risks (89/392/EEC)
- supply only "CE" marked machinery (89/392/EEC)
- supply operating and maintenance instructions (89/392/EEC)
- provide information on noise and vibration levels (89/392/EEC & 86/188/EEC)

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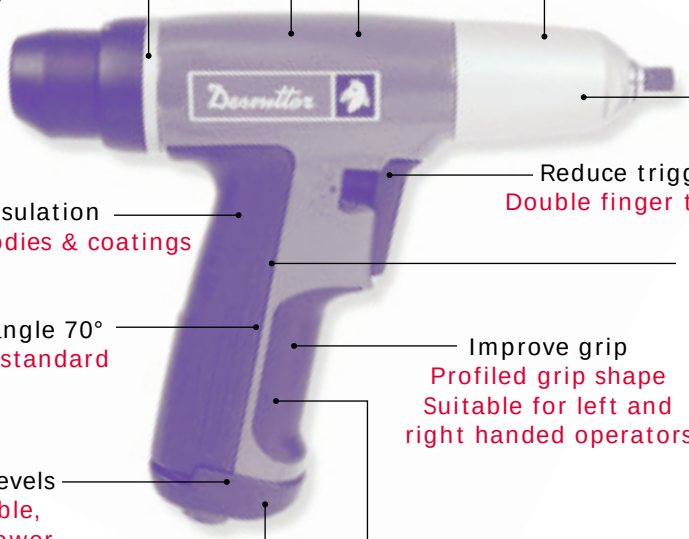
# Desoutter design principles*



Good balance
A Desoutter standard

Low weight
e.g. use thermoplastics
Provide bale hook attachments

Minimise torque reaction
Impulse clutches
Side handles

Minimise oil from exhaust
Desoutter "Dryline"™ motors

Minimise torque impulse
Quick acting clutches

Reduce trigger loading
Double finger trigger / lever

Thermal insulation
Thermoplastics bodies & coatings

Appropriate size
Soft grip,
Adjustable grip size
Adjustable trigger

Pistol grip angle 70°
A Desoutter standard

Improve grip
Profiled grip shape
Suitable for left and right handed operators

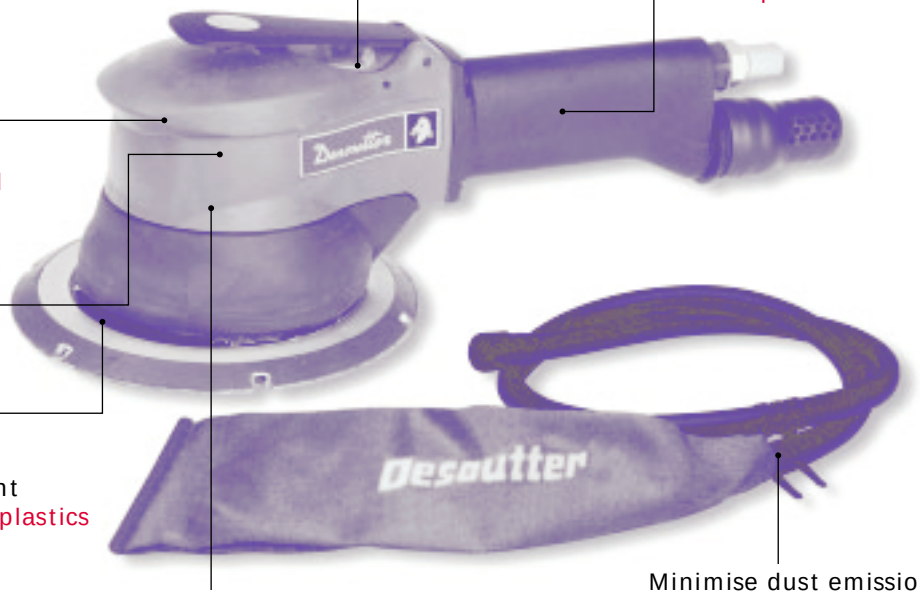
Minimise noise levels
As low as possible, depending on power
80 dBA maximum#

Minimise vibration
<2.5 m/s² on handles#

Reduce exhaust air jet
Angle away from operator
Provide collectors, exhaust hoses, adjustable silencers

* *These are examples of the principles which guide our designs. Please refer to the appropriate Desoutter catalogue for information on individual products.*

# *Does not include process noise and vibration which are significantly dependent on workpiece and work station design and which may, in many cases, exceed the noise and vibration directly caused by the tool.*




Good balance
A Desoutter standard

Thermal insulation
Thermoplastics bodies & coatings

Improve grip
Profiled grip shape
Suitable for left and right handed operators

Minimise vibration
<2.5 m/s² on handles#

Low weight
e.g. use thermoplastics

Minimise oil from exhaust
Desoutter "Dryline"™ motors

Minimise dust emission
Provide dust collector attachments / facilities
Sanders with integral vacuum