

# MechanicalXpert V1

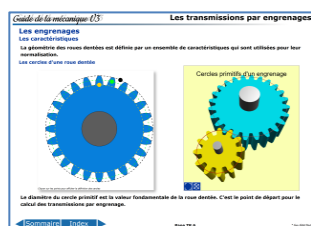
## Interactive Knowledge Base in Mechanics

**MechanicalXpert** is a versatile digital platform designed to support students in **general mechanics**, **mechanical design**, and **industrial maintenance**. It functions as a video-based course aid for instructors and an interactive knowledge hub available through the educational network that can be used in multiple departments at the same campus.

- ✓ Over 500 pages
- ✓ Over 780 photos and illustrations
- ✓ Over 428 3D and 2D animations
- ✓ 36 exercises

## INTERACTIVE ANIMATIONS & EXERCICES

**MechanicalXpert** offers a range of interactive 2D and 3D animations that complement the images and photos in the content. These animations help to clarify and deepen understanding of the topics. All media can be viewed in full-screen mode, making them ideal for video projection.



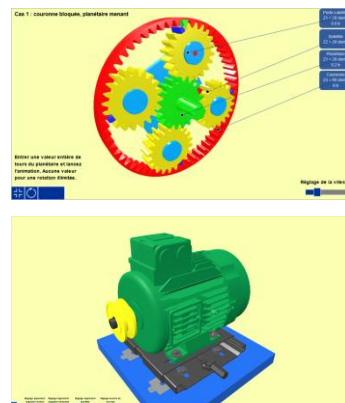
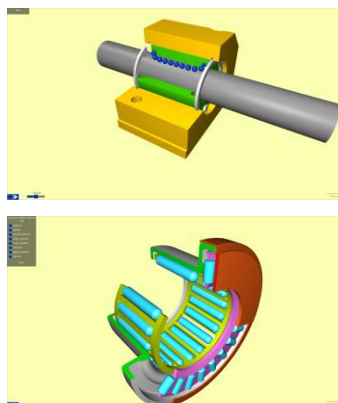
Les éléments de fixation			
La désignation des vis			
Les principales caractéristiques des vis pressées			
Exemple de la vis	Symbole	Image	Exemples d'utilisation
Bout plat	PL		Fixation de pièces
Bout à tête conique	TC		Fixation de pièces
Bout à tête large	TL		Fixation de pièces
Bout à tête hexagonale	TH		Fixation de pièces
Bout à tête buse	BB		Fixation de pièces
Bout en coque	CU		Fixation de pièces
Bout à bille			Fixation de pièces



Alongside the course material, a variety of exercises are available to help reinforce comprehension and knowledge.

## INTEGRATED 3D VIEWER

The **3D viewer** enables users to interact with objects, offering features such as spatial manipulation, zoom, full-screen display, customizable interactions, and adjustable speed.

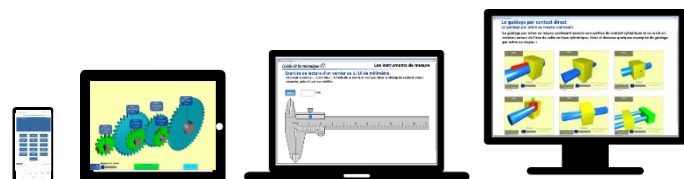


## NAVIGATION, ALPHABETICAL INDEX

Thanks to the menus, the navigation bar, and the **alphabetical index**, access to the content is facilitated.

## REMOTE ACCESS & INSTITUTION LICENCE

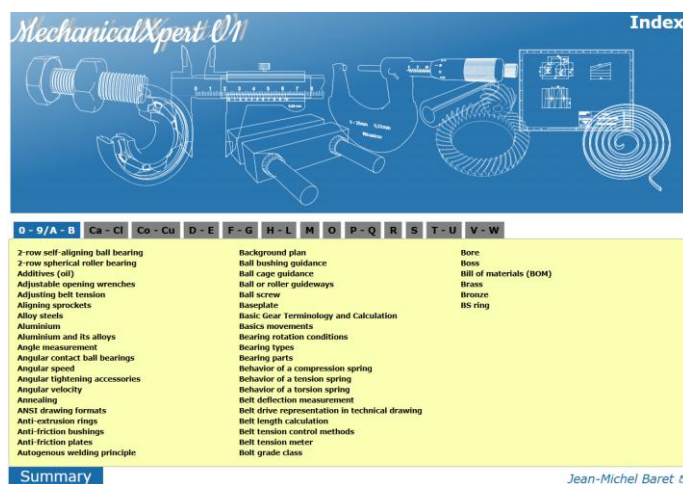
Developed in **HTML5** and with a **responsive design**, **MechanicalXpert** is accessible remotely via the Internet at any time and on all types of devices (PCs, tablets, and smartphones) through our **DidactXpert** platform via a subscription plan. It thus promotes individualized teaching and self-learning.



**MechanicalXpert** is also available as an installable version with an institution license (unlimited installations on the same site).

## REQUIRED CONFIGURATION

- ❖ Installable version : PC with MS Windows 10/11 - 500 MB HDD
- ❖ Online version on **DidactXpert** : Internet browser



## Kinematic diagram

- Introduction
  - General
  - Contacts types
  - The 2 basic movements
  - 3D reference frame
  - Degrees of freedom DOF
- Construction of a kinematic diagram
  - Construction of a kinematic diagram
  - Graphic symbols for kinematic diagrams
- How to draw kinematic diagram
  - Principle
  - Clamp kinematics diagram
  - Hole punch kinematics diagram
  - Vice kinematics diagram

## Technical drawing

- Drawing Sheet Layout
  - Formats
  - ANSI drawing formats
  - Background plan
  - Title block
  - Bill of materials
- Representing objects
  - System of representation
  - Perspective
  - Scale
  - Lines types
- Orthographic Projection
  - Orthographic projection ISO and US
  - Orthographic Projection
- Sectional view and dimensioning
  - Sectional view
  - Dimensioning

## Fasteners

- Pins
  - General
  - Spring pin
  - Dowel, taper and groove pins
- Springs
  - The function of a spring
  - Compression spring
  - Extension springs
  - Torsional springs
- Screw, nuts and bolts
  - Fasteners screws
  - Threads
  - Threads characteristics
  - ISO metric threads
  - Screw designation - ISO/DIN
  - Nut designation - ISO/DIN
- Washers
  - General
  - Support washers
  - Lock washers
  - Spring washer

## Sealing

- General
- The example of a hydraulic cylinder
- Overview of different types of sealing
- Direct static sealing
- Indirect static sealing

## Bearing

- General
  - Function of a bearing
  - Bearing parts
- Ball bearings
  - Radial contact ball bearings
  - Protecting and sealing ball bearings
  - Angular contact ball bearings
  - 2-row self-aligning ball bearing
  - Single-acting ball thrust bearing
- Roller bearings
  - Cylindrical roller bearing
  - Tapered roller bearing
  - 2-row spherical roller bearing
  - Spherical roller thrust bearing
- Other bearings
  - Needle bearing
  - Combined roller bearing
- Bearing load conditions

## Linear guiding

- Functions of a linear guiding
- Direct- contact linear guiding
- Guiding by interposing anti-friction elements
- Guiding by interposing rolling elements
- Ball screw guidance
- Non-contact guidance
- Overview of different guiding systems

## Welding

- Welding principle
  - General
  - Principle of autogenous welding
  - Oxy-acetylene welding unit

## Maintenance tools

- Hand tools
- Classification
- Cutting tools
- Screwdrivers
- Fixed opening wrenches
- Adjustable opening wrenches
- Hex and Torx wrenches
- Torques tools
- Pliers tools
- Nose pliers
- Inside and Outside-Circlip pliers
- Measurement tools
- Marking, Striking, Pullers tools

## Manual handling

- Manual handling
- Spinal column
- Lifting a load
- Moving a load
- Place a load

## Metals

- Main properties of metals
  - Main industrial metals
  - Physical properties of metals
  - Mechanical properties of metals
- Heat treatment of ferrous metals
  - Hardening
  - Tempering and annealing
- Ferrous metal designation
  - Obtaining cast iron and steel
  - Steel designation
  - Designation of cast iron
- Designation of non-ferrous metals
  - Copper and copper alloys
  - Aluminium and its alloys

## Metrology Metric system

- Vernier caliper
  - Function of a caliper
  - Vernier caliper parts
  - Main scale graduations
  - Vernier scale precision
  - Measuring with a 0.1 mm precision vernier caliper
  - Measuring exercise with a 0.1 mm precision vernier caliper
  - Measuring with a 0.05 mm precision vernier caliper
  - Measuring exercise with a 0.05 mm precision vernier caliper
  - Measuring with a 0.02 mm precision vernier caliper
  - Measuring exercise with a 0.02 mm precision vernier caliper
  - Inside measurement
  - Depth measurement
  - Depth measurement with a simple caliper
- Micrometer
  - External micrometer
  - Micrometer parts
  - Read with a micrometer
  - Micrometer verification
  - Micrometer reading exercise
  - Inside and depth micrometers
- Comparator
  - Comparator - general
  - Dial gauge parts
  - Reading and calibration
  - Comparison
  - Checking parallelism
  - Checking roundness
  - Reading example
  - Reading exercise

## Metrology impérial system

- General
  - Measuring length in inches
- Ruler graduated in inches
  - Ruler graduated in inches
  - Ruler graduated in decimal inches
  - Ruler graduated in fractional inches
- Inch caliper
  - Presentation
  - Caliper graduated in decimal inches
  - Caliper graduated in fractional inches
- Inch micrometer
  - Micrometer graduated in 1/1000 of an inch
  - Micrometer graduated in 1/10000 of an inch
- Reading exercise
  - Caliper reading in decimal inches
  - Caliper reading in fractional inches
  - Caliper reading in decimal and fractional inches
  - Micrometer reading to 1/1000 inch
  - Micrometer reading to 1/10000 inch

## Circles, angles and speed

- Circle
- Relationships within the circle
- Angle measurement
- Angular velocity
- Relationship between speeds
- Exercises

## Technical shape

- |               |                |                         |
|---------------|----------------|-------------------------|
| ○ Baseplate   | ○ Fillet       | ○ Recess                |
| ○ Bore        | ○ Fluting      | ○ Rib                   |
| ○ Boss        | ○ Groove       | ○ Rounding              |
| ○ Chamfer     | ○ Kerf         | ○ Shaft                 |
| ○ Collar      | ○ Knurling     | ○ Shoulder              |
| ○ Counterbore | ○ Lug          | ○ Tenon                 |
| ○ Countersink | ○ Metal profil | ○ Thread                |
| ○ Dog point   | ○ Mortise      | ○ Through or blind hole |
| ○ Dovetail    | ○ Notch        | ○ Undercut              |
| ○ Edge        | ○ Oblong       |                         |

## Transmissions

- Generals
  - Role of a transmission
  - Differences movements
  - Overview of different types of transmissions
- Gears
  - General
  - Basic gear Terminology and Calculation
  - Conditions for meshing gears
  - Gear ratio
  - Gear train with idler gear
  - Compound gear train
  - Gear representation in technical drawing
- Different types of gears
  - Spur gears with straight teeth
  - Helical external gears
  - Herringbone gears
  - Straight bevel gears
  - Spiral bevel gears
  - Hypoid gears
  - Worm gears
  - Rack and pinion gears
- Planetary gear
  - Planetary gear parts
  - How it works
  - Planetary gear ratio
  - Multistage planetary gear
- Belt drives
  - Belt drives
  - Flat belts
  - Theoretical belt pulley velocity ratio
  - Flat belt velocity ratio calculation exercise
  - Flat belt length calculation
  - V-belts
  - Variable speed drive belts
  - Poly-V belts
  - Standard V-belt dimensions
  - V-belt drive velocity ratio
  - Synchronous belts
  - Synchronous belt velocity ratio
  - Round belts
  - Belt drive representation in technical drawing
  - Comparative table of belt drives
  - Assembly, commissioning and maintenance of belt drives
  - Pulley alignment
  - Adjusting belt tension
- Chain drives
  - Chain drives
  - Chain drive velocity ratio
  - Velocity ratio calculation exercises
  - Roller chains
  - Roller chains sprockets
  - Chain drive assembly and commissioning
  - Lubricating roller chains
  - Silent chains
  - Chain drive representation in technical drawing

## Tolerances and fits

- Manufacturing tolerances
- Interchangeability
- Paired parts
- Toleranced size
- Entered toleranced size
- ISO tolerance system
- Tolerance grade
- Position of tolerance zones
- Entered ISO tolerance
- Fits
- Types of fits
- Choice of fits
- Hole and shaft basis system
- Hole basis system
- Shaft basis system
- Usuals fits according to the hole basis system

## Lubricants

- Function of a lubricant
- Oils
- Main oils characteristics
- Additives
- Main oils classifications

## Quiz

- Screw and thread characteristics
- Screw and nut designation