



Continuing Professional Development  
in Vocational Education and Training

# General Tolerances

Inspiration for online teaching



In the COVET project, we have collected many great examples of teaching that have been transformed from the classic off-line version into a modern online learning method.

These sample lessons have been created by VET teachers from different EU countries. We present them to you as inspiration for your work.

The lessons are particularly suitable for vocational teachers, but can also serve as a training tool for teachers, trainers and lecturers in other educational settings.

All sample lessons, training materials as well as all information about the project are available at:

<https://www.covet-project.eu/>

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# General Tolerances

## Off-line version of the preparation

**Goal:** Students will learn and be able to locate dimensions in drawings used for part manufacturing for which tolerances are not defined in any way. They will realise that for many of the shaped elements of a part, there are actually no shape and position tolerances given in the drawing.

They will learn to find a **standard** on the accuracy of these dimensions and shaped elements **in the description field**. They will identify the number of a standard for these GENERAL TOLERANCES, which specifies the size of tolerances for each accuracy class. Students will be able to find the specific tolerances in the standard, which is part of the Engineering Tables. They will learn that the lowercase letter identifies the general tolerances for length and angle dimensions and the uppercase letter identifies the accuracy class for the shape and position of the individual non-toleranced elements of a manufacturing part.

## Teaching methods

problem-based interview, explanation, hands-on search for non-toleranced dimensions and for a standard on general tolerances in the drawing and subsequently search for specific tolerances in the tables; further steps to be taken according to the classroom situation

## Aids

**Presentation:** repetition of the concept of tolerances and the ways of defining them, details in the drawing such as the description field, different types of drawings presented to locate non-toleranced dimensions and shapes;

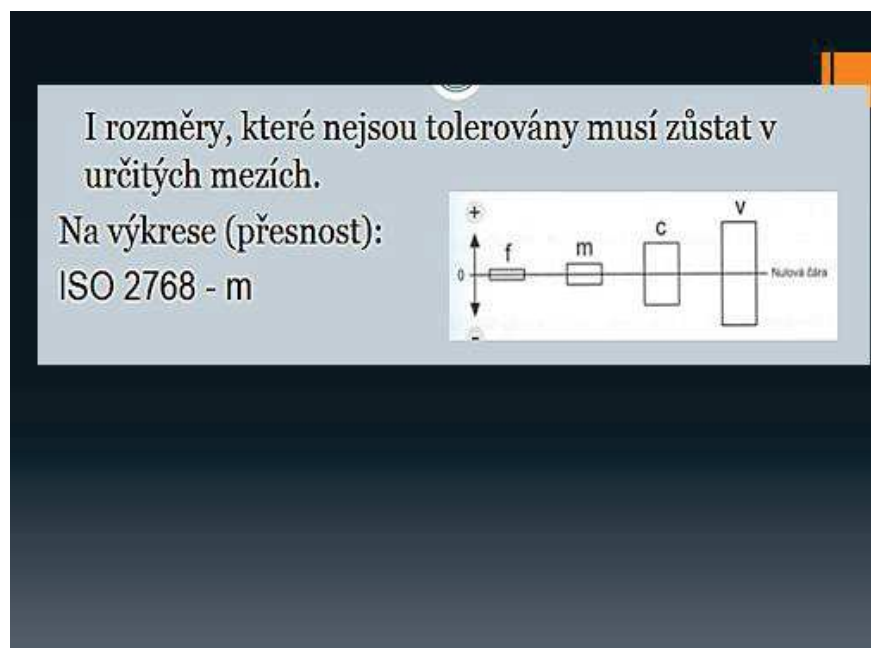
*Teaching (study) texts that summarize the content presented. To be handed out to the students once the lesson is over.*

## The course of activities in the lesson

- Repeat the concept of tolerances and terms used, repeat the ways of giving tolerances in the drawing, for length, shape and position
- Explain what the term **general tolerances** means and where it can be found in the drawing
- In the drawings shown on screen, first read the standard for general tolerances and search for non-toleranced dimensions together, then the students will try to find them on their own and the correct solution will be checked collectively
- Look for tolerance sizes in the standard provided in the Engineering Tables. Then everyone will try separately. Check the results collectively. For the specified dimensions and tolerances, calculate the upper and lower limit dimensions.
- Ask the students to write a general tolerances standard in a manufacturing drawing for a simple part assigned to them earlier

- Hand out learning sheets
- Discuss how the class went
- This task requires quite a complex thinking from VET students - apprentices. They have to be able to search, analyse and calculate. That is why I usually start with working as a whole class or in groups, after the students become more confident, they start working individually. Regarding their field of study, they have to be able to find solutions and solve technical tasks. And they should be able to do it independently. You always have to divide this kind of teaching into individual and achievable steps.

**An example of several slides from the PPT presentation showing how complex working with drawings can be**



**TOLEROVÁNÍ ISO 8015**

Tento předpis musí být doplněn o zápis nepředepsaných tolerancí rozměrů a nepředepsaných geometrických tolerancí:

**ISO 2768 – mK**

**m** – třída přesnosti tolerancí délkových a úhlových rozměrů  
**K** – třída přesnosti geometrických tolerancí

Zápis pravidla nezávislosti posuzování rozměrů a úhlů a geometrických tolerancí

Zápis nepředepsaných tolerancí rozměrů a geometrických tolerancí

MATERIÁL	11523.0	INDEX	ZMĚNA
POLOŽKA	UBD 60x30-178-ČSN425522		
TOLEROVÁNÍ ISO 8015	AND		
PŘESNOST ISO 2768	m K		
PROMĚTANÍ			
KONSTR.	HORKÝ & TOMEK	SCHWÄBLI	KI.
KONTR.	KI.	DATUM	5.3.1997
		NAZEV	

Popisové pole na výkrese

Z výkresu součásti vypište DÉLKOVÉ netolerované rozměry a v tabulkách k nim vyhledejte všeobecné tolerance. Spočítejte pro každý rozměr HMR (horní mezní rozměr) a DMR (dolní mezní rozměr).

Předpis v popisovém poli: ISO 2768 - m

## ŘEŠENÍ

rozměr [mm]	tolerance [mm]	HMR [mm]	DMR [mm]
průměr 6,5	$\pm 0,2$	6,7	6,3
průměr 95	$\pm 0,3$	95,3	94,7
průměr 37	$\pm 0,3$	37,3	36,7
průměr 62	$\pm 0,3$	62,3	61,7
10	$\pm 0,2$	10,2	9,8
5	$\pm 0,1$	5,1	4,9

## Online version of the preparation

In the first couple of days following the closure of schools, I set up Messenger groups with all of my classes. It was the only way to communicate with them in a reasonable manner via chat. Unlike email

and 'Bakalar' school programme communication, everyone participated in the discussion at the same time and could actively post their opinions and comments. They could also easily vote on a proposal in this way. At the time, Facebook did not yet allow to set up a group of more than six people that could share a phone call. So it was not possible to communicate with all of the class members. It was difficult to provide an oral explanation, especially without being able to show a PPT presentation.

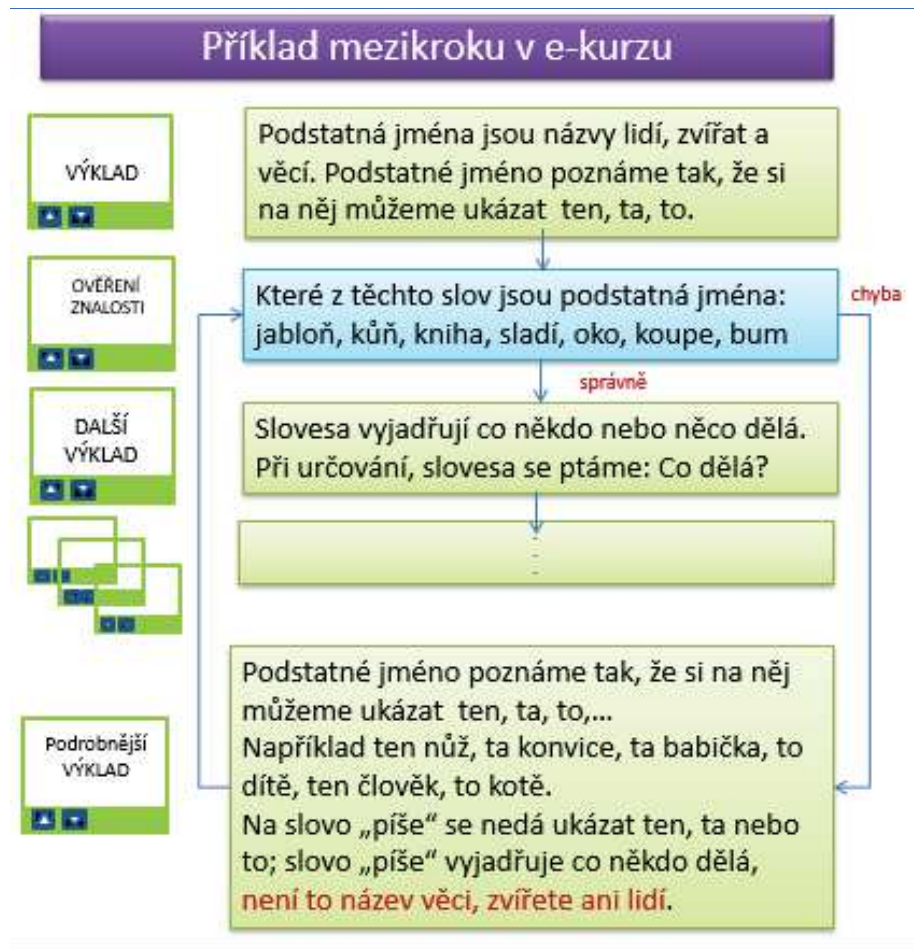
Within three days, I managed to secure a free two-month rental of the iTrivio e-learning application. It is an **LMS** that is above-average user friendly. Based on my long-term experience with teachers I have trained and students who have developed their own tests in iTrivio, I can say that they can learn the basics of operating iTrivio within twenty minutes. However, writing a proper distance-learning course in it requires strong teaching skills for distance learning.

These days, the term of "distance" learning incorporates online education, which emulates face-to-face teaching but without the benefits of direct contact with students. Such teaching has very limited effectiveness, especially if teaching units run in quick succession, each of them involving a different subject. **Teaching in blocks would perhaps increase effectiveness of the process.**

Another way to increase the effectiveness of distance learning is to apply the distant learning teaching techniques designed especially for distance learning.

### **A few important takeaways from developing e-courses for distance learning:**

- The content must be presented in such a way that **the students understand it without the need for further explanation.** Unless intended by the course designer, the students should not need to seek further explanatory information to study the content of the course.
- In distance learning, a **feedback system** must be properly designed for students. In e-courses, **immediate feedback** is available thanks to the LMS, which contains predefined types of questions. You can activate an option that after answering a question, the learner will immediately be informed whether they have answered correctly and the correct answer will be displayed.
- For strong and effective learning, it is necessary to **develop steps of an appropriate size for students to follow and understand the content being presented and explained.** The course designer must correctly **size the steps** for a student's progression through the content. The most difficult part of the job is to identify how big a **step is appropriate for the level achieved by the student(s).**
- If the **step is too big, the learner is forced to seek information from other sources** and will be dissatisfied with the level of the course. At our school, there is a risk that students **will simply not engage in the learning that they do not understand.**
- After each comprehensive step, the learners should be required to complete tasks to verify whether they have understood the step or not – in this way, they will get an **immediate feedback!** Feedback is very important for students and is a key element affecting popularity of this learning method.
- An example of how an educational step can be 'softened': **Provide a link on the assignment page that redirects the learner who has answered incorrectly to a page with a more detailed explanation.**



- A learning step in the LMS can also be reduced by providing an additional message when notifying the learner of a correct or wrong answer:

### Co je tolerovaný rozměr?

- Má předepsanu toleranci přímo u kóty.
- Má předepsanou toleranci hromadně pro všechny rozměry v popisovém poli
- Má předepsanou toleranci v technické zprávě.

Pokračovat

Změnit odpověď

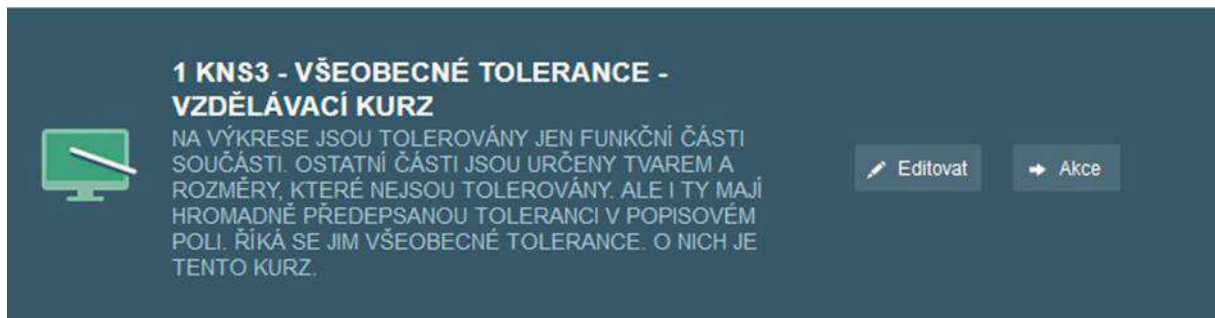
✓ Správná odpověď 1 bod Výborně, tolerance tolerovaného rozměru se předepisuje přímo ke kótě. Kóta je číselný údaj na kótovací čáře. Příklad tolerovaných rozměrů: průměr 40H7, 52±0,05

In the circumstances we suddenly faced, it **was impossible to maintain the high quality of the distance course as described above**. However, according to the learners, it was the best of the ways in which they were being educated.

The course was sent to them and made available for 24 or 48 hours. They were therefore free to choose the time at which they take it, which they saw as very important. *(One mother scolded me at my meeting with parents via Teams that I had assigned, due to time constraints, one of the courses for an afternoon study, saying that her son had to work at home in the afternoon and not have a lesson when there is work to be done in the garden 😊)*

Students could ask questions via Messenger and could also see others' questions and my answers to them. **This was intended to replace, to certain extent, the role of a tutor in distance learning.**

## Sample pages from the tutorial

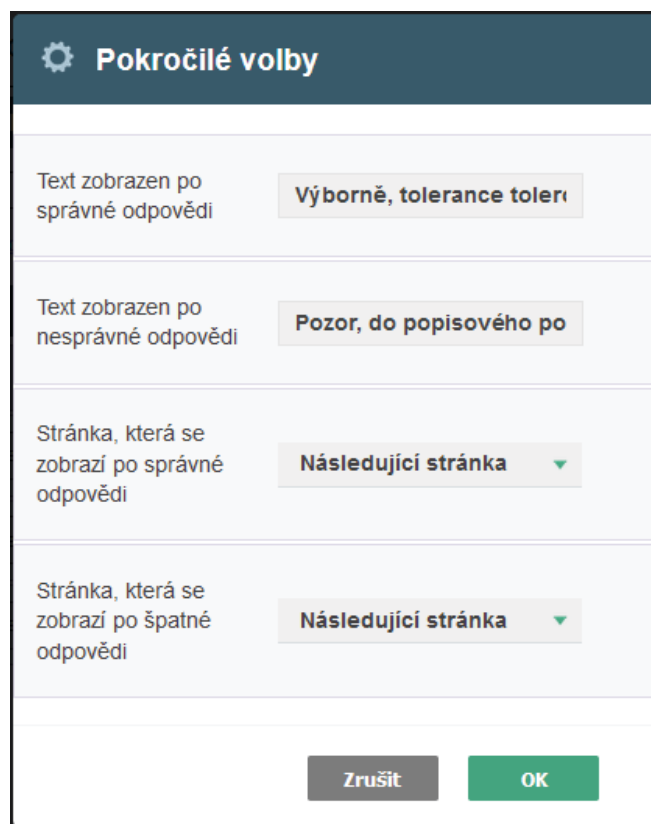


**1 KNS3 - VŠEOBECNÉ TOLERANCE - VZDĚLÁVACÍ KURZ**

NA VÝKRESE JSOU TOLEROVÁNY JEN FUNKČNÍ ČÁSTI SOUČÁSTI. OSTATNÍ ČÁSTI JSOU URČENY TVAREM A ROZMĚRY, KTERÉ NEJSOU TOLEROVÁNY. ALE I TY MAJÍ HROMADNĚ PŘEDEPSANOU TOLERANCI V POPISOVÉM POLI. ŘÍKÁ SE JIM VŠEOBECNÉ TOLERANCE. O NICH JE TENTO KURZ.

Editovat Akce

## The LMS option to insert an additional message when a correct or wrong answer is displayed



**Pokročilé volby**

Text zobrazen po správné odpovědi	Výborně, tolerance tolera
Text zobrazen po nesprávné odpovědi	Pozor, do popisového po
Stránka, která se zobrazí po správné odpovědi	Následující stránka ▼
Stránka, která se zobrazí po špatné odpovědi	Následující stránka ▼

Zrušit OK



## Co je tolerovaný rozměr?

- Má předepsanu toleranci přímo u kóty.
- Má předepsanou toleranci hromadně pro všechny rozměry v popisovém poli
- Má předepsanou toleranci v technické zprávě.

Pokračovat

Změnit odpověď



Špatná odpověď

0 bodů

Pozor, do popisového pole se píší jen všeobecné tolerance, hromadně pro všechny netolerované rozměr. Velikost tolerance pro rozmezí rozměrů a zvolenou třídu přesnosti je určena v normě. My tuto normu najdeme ve strojnických tabulkách.

## Kurz: 1 KNS3 - VŠEOBECNÉ TOLERANCE - VZDĚLÁVACÍ KURZ

Ukončit e

NORMA ČSN ISO 2768 - 1. DÍL - DÉLKOVÉ A ÚHLOVÉ ROZMĚRY

TŘÍDY PŘESNOSTI DÉLKOVÝCH ROZMĚRŮ - TABULKA **VÝKLAD**

Kde se předepisují všeobecné tolerance na výkrese? **ZPĚTNÁ VAŽBA**

Zaškrtněte všechny správné odpovědi. Na které rozměry na výkrese se všeobecné tolerance předepisují?

Které třídy přesnosti mají všeobecné tolerance délkových rozměrů?

### Otázka - Jedna správná odpověď

Kde se předepisují všeobecné tolerance na výkrese?

[Příklad vyplnění](#) [Vymazat pole](#) [Nastavení](#) [N](#)

### Odpovědi

Body

Odpověď

Odpověď

Odpověď

[+ Přidat odpověď](#)

This image is from the iTrivia editing mode in which the teacher - course designer works.

## **The course of teaching therefore changed as follows:**

- The course was made available to all students for a minimum of 24 hours
- PDF study/worksheets were sent to students
- Questions were answered via Messenger, within groups set up for individual classes
- Checks were performed in iTrivia reports to make sure that all students completed the course and to see which questions they found difficult
- A test was assigned to the students, containing questions previously used for feedback in the tutorial. They received a grade for the test.

Next year, teaching via Teams was mandated, with lessons quickly following one another and e-courses only used as supplementary source of study. I taught for five hours a day non-stop, therefore with limited time left for designing distance-learning courses. However, that form of e-learning had very limited effectiveness. When, as a minimum, I supplemented this with iTrivia tests for my students, the learning process became more effective.

## **Feedback on the lesson**

The students seemed to be highly satisfied with the LMS system. It offered them possibilities they had in no other class.



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