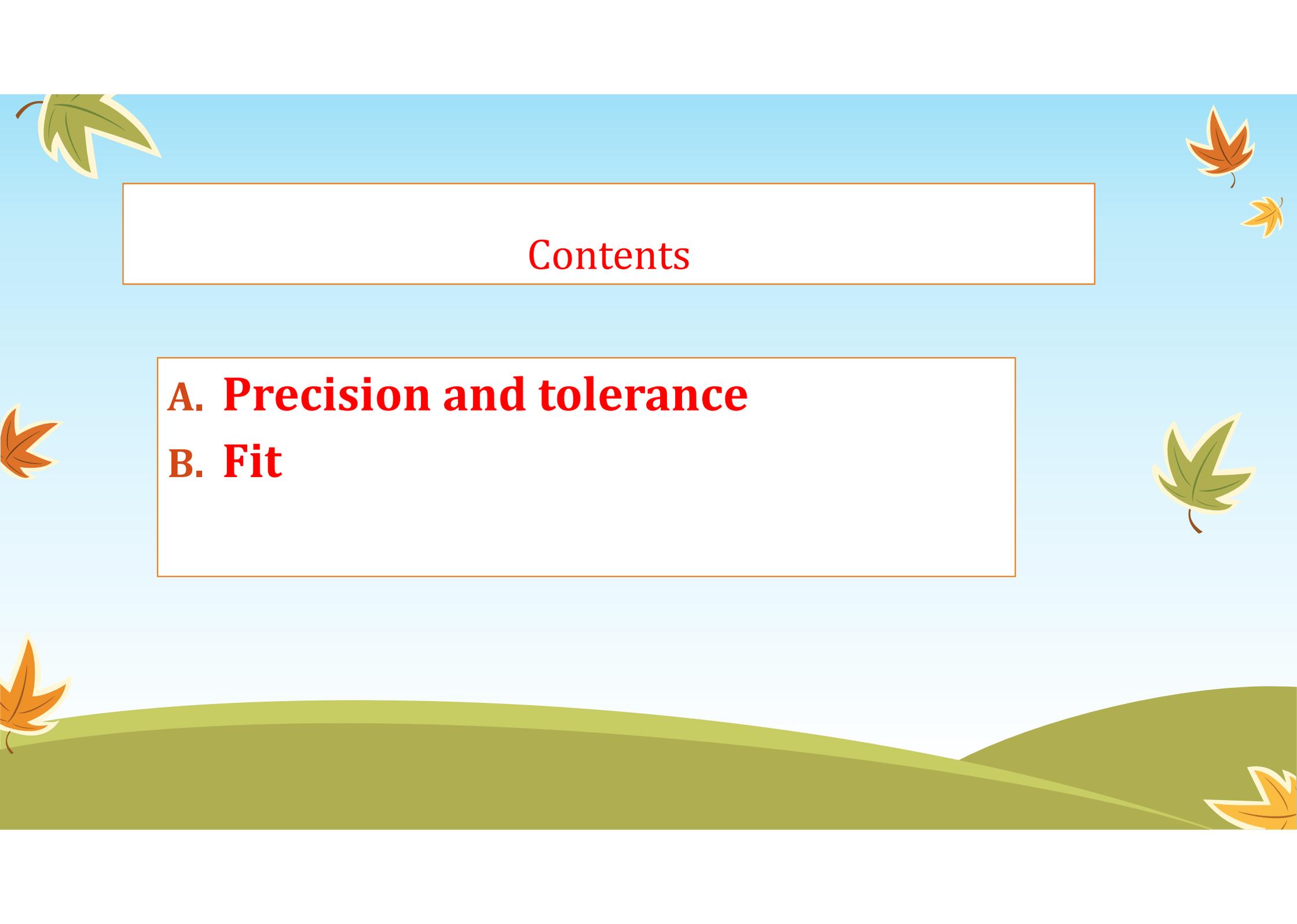


The background features a light blue sky with several falling leaves in shades of orange and yellow. On the left, a red brick barn with a yellow bell in a small tower sits on a green hill. A yellow school bus is driving on a winding road that curves across the landscape. The foreground is filled with stylized trees in various autumn colors (orange, yellow, brown) and several large pumpkins in shades of orange and yellow.

Technical English
Unit 7
professional English
Dimensional accuracy

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The slide features a light blue background with several stylized autumn leaves in shades of green and brown scattered around the edges. At the bottom, there are rolling green hills. The main content is presented in two white rectangular boxes with thin orange borders.

Contents

A. Precision and tolerance

B. Fit

Accuracy vs precision

- Accuracy refers to the closeness of a measured value to a standard or known value. For example, if in lab you obtain a weight measurement of 3.2 kg for a given substance, but the actual or known weight is 10 kg, then your measurement is not accurate. In this case, your measurement is not close to the known value.
- Precision refers to the closeness of two or more measurements to each other. Using the example above, if you weigh a given substance five times, and get 3.2 kg each time, then your measurement is very precise. Precision is independent of accuracy. You can be very precise but inaccurate, as described above. You can also be accurate but imprecise.

	Accurate	Inaccurate (systematic error)
Precise		
Imprecise (reproducibility error)		

A. Precision and tolerance

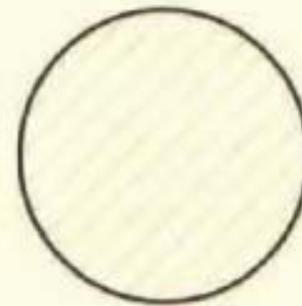


- ◆ It is impossible to produce components with dimensions that are absolutely **precise**, with sizes exactly the same as those specified in a design. This is because all production processes are **imprecise** to a certain extent. Therefore, the sizes of several components produced from the same design will **vary** (**differ**). Although the **variation** may only be a few hundredths of a millimetre, sizes will not be 100% **accurate** (**exact**) compared with the design.
- ◆ Because engineers know that **accuracy** cannot be perfect, in designs they often specify **tolerances** -that is, **acceptable variations in precision**. Instead of giving one precise size, **a tolerance specifies a range of acceptable sizes- an allowed amount of variation**. This is often given as a **deviation** (**difference**) from a precise size.



A. Precision and tolerance

◆ The drawing on the side shows a shaft with a specified diameter of 88 mm, **plus or minus** (\pm) 0.05 mm. This means the diameter may **deviate** 0.05 mm either side of this size. Therefore, diameters of 87.95 mm and 88.05 mm, which are slightly **inaccurate**, are still **permissible** (**allowed**), as they are **within tolerance**. However, diameters of 87.94mm or 88.06mm are not permissible- they are **outside tolerance**.



shaft \varnothing 88 mm \pm 0.05

A. Precision and tolerance

◆ When the permissible deviation in size is very small, we say it is a **tight tolerance** (or a **close tolerance**). A large permissible deviation is a **loose tolerance**. For example:

- Machining a metal component to a tolerance of ± 0.1 mm is relatively easy to do, so this tolerance is loose. But a tolerance of just ± 0.01 mm is a tight tolerance in metalworking.
- In a concrete structure, ± 10 mm is a loose tolerance. But ± 1 mm is tight, because it is difficult to place wet concrete accurately.

B. Fit



- ◆ When one component goes through another, such as a shaft or a bolt going through a hole, the two must **fit together**- their sizes and shapes must match. The key question is, how **tightly** (or **loosely**) should they fit together? There are two main types of **fit**:
- A **clearance fit** allows a component to slide or turn freely, by leaving **clearance** (a gap) between itself and the sides of the hole. This distance must be quite precise. If there is **insufficient clearance** - **if the gap is too small** - the component will fit too tightly. As a result, the component will **bind** - **it will not be able to slide or turn freely**. In other words, there will not be enough **play**. However, if there is too much clearance, there will be **too much play** and the component will be able to move too much.



B. Fit

- An **interference fit** is a very tight fit which does not allow a component to move freely inside a hole. This type of fit can be achieved by forcing the component into the hole. Alternatively, the metal around the hole can be heated so that it **expands** (increases in size due to heat). After **sufficient expansion**, the component is placed in the hole. The metal then cools and **contracts** (decreases in size due to cooling). The **contraction** results in a tight fit. An example of an interference fit is a train wheel fitted on an axle.

7.1 Find words and expressions with similar meanings to the words and expressions below. Sometimes there is more than one possible answer.

1. allowed **permissible**
2. Exact
3. Differ
4. Exactness
5. not exact

6. deviation between maximum and minimum
7. an acceptable deviation
8. an unacceptable deviation
9. little deviation allowed
10. large deviation allowed

- 1 permissible
- 2 accurate / precise
- 3 vary / deviate
- 4 precision / accuracy
- 5 imprecise / inaccurate

- 6 variation / range
- 7 within tolerance
- 8 outside tolerance
- 9 tight tolerance / close tolerance
- 10 loose tolerance

7.2 Match the related sentences.

1. It'll bind.
2. It'll contract.
3. It'll expand.
4. There'll be too much play.
5. It needs a clearance fit.
6. It needs an interference fit.

- A. The bolt will have to turn in the hole.
- B. The bolt won't be able to turn freely enough in the hole.
- C. The bolt won't fit tightly enough in the hole.
- D. The wheel will have to fit very tightly on the axle.
- E. The hole will widen with the high temperature.
- F. The shaft will shorten and narrow slightly as it cools.

1b, 2f, 3e, 4c, 5a, 6d

7.3 Complete the article about engine blueprinting using the words in the box.

Clearances, minus, plus, range, variation, fit, permissible
precise, tolerances, within



Blue Printing for performance

- The advantage of racing in a kart class with a standard engine spec seems obvious – everyone has the same power, so it's driving talent that makes the difference. But things aren't quite that simple. No two standard engines are identical. There will always be a slight (1) in the size of engine parts, since they are manufactured, not to perfectly (2) dimensions, but to specified (3)

Karts: small, open, four-wheeled vehicles

7.3 Complete the article about engine blueprinting using the words in the box.

Although these differences may only be (4) or (5) a few hundredths of a millimetre, they will nevertheless result in a slight performance gap between any two engines. One way round this problem (if you have the cash) is to have your engine blueprinted. The process is perfectly legal, as the sizes of all parts remain (6) the tolerances that are (7) for the standard engine specification. However, by carefully matching pairs or groups of parts that are all in either the lower or upper half of the tolerance (8) , a blueprinted engine is built to (9) together very precisely, thanks to almost perfect (10) between moving parts.

1 variation

3 tolerances

5 minus

7 permissible

9 fit

2 precise

4 plus

6 within

8 range

10 clearances

YANMAR

INDUSTRIAL / ENGINES / TNV DI SERIES



NET INTERMITTENT POWER
Potencia Neta Intermitente

47.5 hp
35.0 kW

RATED SPEED
Velocidad de Regimen

3000 RPM

4TNV88-BDSA

SPECIFICATION
Especificacion

BDSA

CYLINDERS
Cilindros

4

BORE X STROKE
Diametro x Carrera

3.4 X 3.5 (in)
88 X 90 (mm)

DISPLACEMENT
Cilindrada

133.6 (ci)
2190 (cc)

Dimensions & Performance Data & Quick Specs

Length / Longitud	28.58 in (726 mm)
Width / Ancho	20.43 in (519 mm)
Height / Altura	26.06 in (662 mm)
Dry Weight / Peso en seco	363 lbs / 165 kg



I see you
got right

Any Questions