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## **TRAINING ON ANTAM STANDARD CODE For TESTING OF KNAPSACK MISTERS CUM DUSTERS**

**Theory 2:** General Texts – Terminology-  
Guidelines Test Code Section III (1,2,3,4.5)

2nd Training of Trainers on ANTAM Codes  
16 - 28 October 2016, Nanjing China

# Defining a Power Tiller

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- Power tiller is a single axle, self-powered and self-propelled tractor, which can pull and power various farm implements such as rotary, cultivator, harrow, plough, seeder, harvester, and trailer.- ANTAM 001 2016
    - Single axle
    - Self powered
    - Self Propelled
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# Types of Power Tillers

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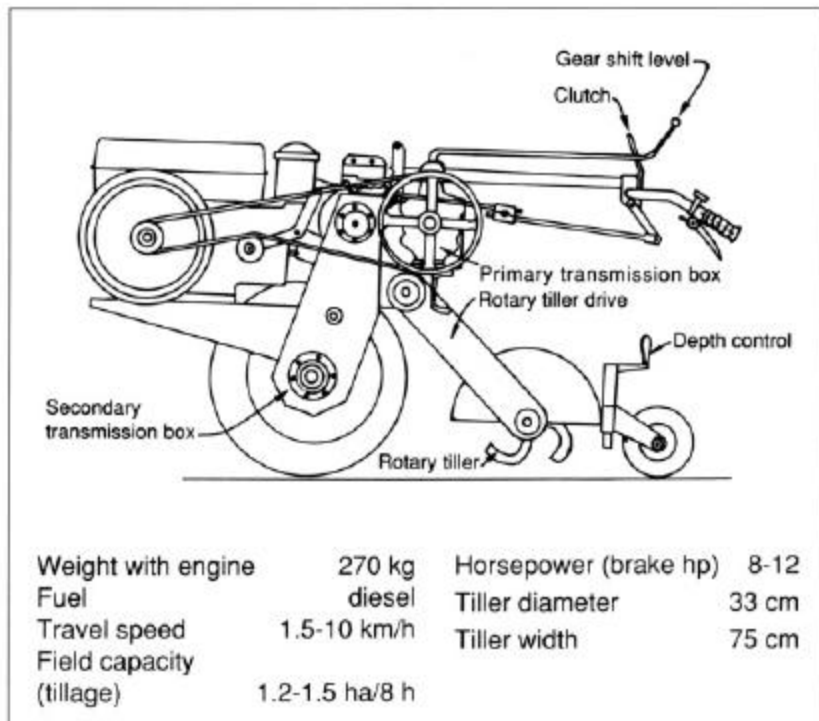
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# Tilling type power tiller

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# How does a Power tiller differ from a power weeder

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- Power weeders may be similar to power tillers but their functionality is only weeding- either by rotary weeding tool or hoe type passive weeding tool.
  - They are not general purpose
  - They cannot be used for haulage
  - They are for use only in the field.
  - Their Power is low in the range of 1.5 to 5.0kW
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# Classification of Power Tillers

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- ❑ Power tiller with rotary and fitted with cage wheel- for rice field preparation
  - ❑ Power tiller with tyres and fitted with rotary for tillage and weeding in unsaturated soils.
  - ❑ Power tillers with rubber tyres and used for haulage
  - ❑ Power tillers with rubber type or lugged wheel and used for drawbar work like ploughing , Sowing , digging potato, turmeric.
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# ANTAM Classification

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## **General Purpose Type**

The power tiller which can be used for a number of farm operations, including the types defined under pull type and tilling type.

## **Pull Type**

The power tiller which pulls various kind of implements.

## **Tilling Type**

The power tiller which uses an engine power driven tilling device, such as rotary and crank or screw blades.

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# Terminology

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## **Maximum Engine Power**

Maximum sustainable engine power available at the crankshaft.

## **Operational Mass**

The mass of the power tiller without operator in normal working condition with fuel tank and radiator (if fitted) full and lubricants filled to the specified levels.

Note: Any accessory fitted and its mass should be stated.

## **Rated Engine Power**

The power available at the crankshaft or its equivalent at the rated speed specified by the manufacturer.

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# Conditions for Checking of Dimensions

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1. The power tiller shall be without any wear on tyres
  2. Placed on a firm horizontal surface
  3. A minimum tyre tread bar height of 65 percent- Measured with a tripod gauge
  4. The power tiller shall be stationary with its wheels and components in the positions they would be, if the power tiller was travelling in a straight line
  5. The pressure in pneumatic tyres shall be adjusted to the value recommended by the power tiller manufacturer for field work. If a range of value is indicated the mean tyre pressure shall be used
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# Running-In

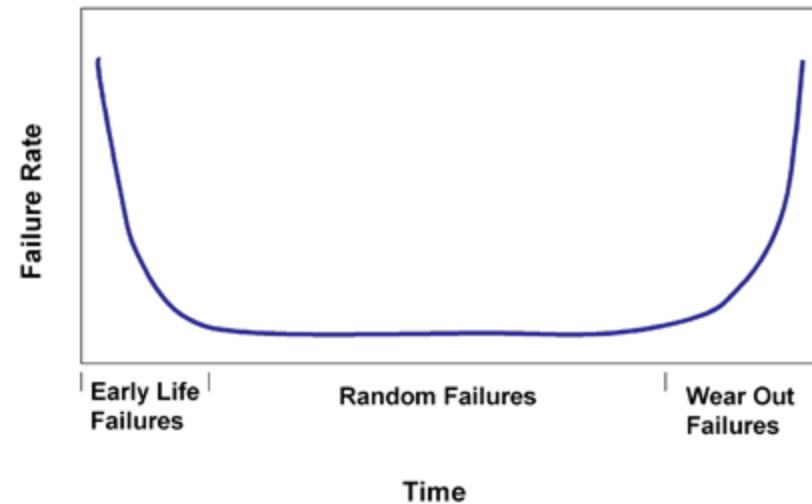
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The running in is done to allow the new engine to wear and seat itself (Piston- liner)

Running in will bring out any breakdown in the Early life failure.

Will allow the applicant to fine tune the power tiller by making adjustments provided in the system

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1. The manufacturer/applicant shall run-in the power tiller before the test
  2. Applicant's responsibility
  3. In accordance with his usual instructions.
  4. The running-in shall be carried out in collaboration with the testing authority.
  5. For imported model, the testing authority may itself run-in the power tiller in accordance with the procedure prescribed or agreed to with the manufacturer/applicant.
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# Servicing and Preliminary Setting after Running-In

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After completion of running-in, servicing and preliminary settings should be done according to the printed literature supplied by the manufacturer/applicant. The following may be carried out, wherever applicable:

1. Change of the engine oil;
  2. Change of air cleaner oil (if provided with an oil bath type air cleaner);
  3. Change of transmission oil;
  4. Change of oil and fuel filters (if required);
  5. Greasing/oiling of all the lubricating points;
  6. Adjustment of valve clearance and injection pressure (if required);
  7. Tightening the nuts and bolts;
  8. Checking and adjusting the tension of belts and chains;
  9. Checking and adjustment of safety devices, if any;
  10. Any other checking or adjustment recommended by the manufacturer after the running-in period, and included in the printed literature of the power tiller.
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# Post running in

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- ❑ The manufacturer/applicant may make adjustments in fuel injection pump, governor, fuel injector and any other adjustments during the period the power tiller is prepared for tests.
- ❑ These adjustments should conform to the values specified by the manufacturer/applicant for agricultural use in the printed literature/specification sheet.
- ❑ No adjustment shall be made, unless it is recommended in the literature. All the parts replaced shall be reported in the test report.

Note: Adjustment of fuel injection pumps except for low/high idling speed shall not be permitted under test.

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# Ballasting

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- ❑ The ballast mass, which are commercially available and approved by the manufacturer for use in agriculture, may be fitted.
  - ❑ For wheeled power tillers, liquid ballast on each tyre including liquid ballast in the tyres, and the inflation pressures shall be within the limits specified by the tyre manufacturer or load limit of axle, whichever is lower.
  - ❑ Measure inflation pressure with the tyre/tube valve in the possible lowest position.
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# Repair and adjustment during test

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- All repairs and adjustments made during the tests shall be reported, together with comments on any practical defects or shortcomings in **Annex C**.
  - This shall not include those maintenance jobs and adjustments which are performed in conformity with the manufacturer's recommendations.
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# Fuel-lubricant- auxiliary equip

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## Fuel and Lubricants

- Fuel and lubricants for the tests shall conform to the printed literature supplied by the manufacturer

## Auxiliary Equipments

- For all power tests, accessories/ auxiliary drives (if any) may be **disconnected** only if it is practicable to do so as a normal practice during work in accordance with the operator's manual without using any tool.
  - If not, they shall remain connected and operate at minimum load.
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# Measuring and converting fuel consumption

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## Measuring Fuel Consumption

- The fuel measurement apparatus shall be so arranged that the fuel pressure at the fuel transfer pump is equivalent to that which exists when the power tiller fuel tank is half full.
  - The fuel temperature shall be comparable to that in the normal operation of the power tiller when fuel is taken from the power tiller fuel tank.
  - Efforts shall be made to limit the temperature variations throughout the tests.
  - To obtain hourly fuel consumption by volume and the work performed per unit volume of fuel, **conversion of unit of mass to unit of volume** shall be made using the **density value at 15°C**
  
  - When the fuel consumption is measured by volume, the specific fuel consumption shall be calculated using the density corresponding to the appropriate fuel temperature.
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# Atmospheric Conditions

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## Atmospheric Pressure

- Minimum 96.6 kPa during laboratory tests
- The pressure shall be noted at the beginning of the test.

## Temperature

For power tests, the normal ambient temperature shall be  $27 \pm 7^{\circ}\text{C}$

Ambient air temperature at a representative point shall be measured as follows:

- Approximately 2 m in front or side depending upon the location of suction or blower device of power tiller
- Approximately 1 m above the ground.

Note: No correction shall be made to the test results for atmospheric conditions

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# Tolerance in measurement

a) Rotational speeds, rpm	$\pm 0.5$ percent
b) Time, s	$\pm 0.2$ s
c) Distance, m or mm	$\pm 0.5$ percent
d) Force, N and torque, N.m	$\pm 1.0$ percent
e) Acceleration, $m/s^2$	+ 1.0 percent
f) Mass, kg	$\pm 0.5$ percent
g) Atmospheric pressure, kPa	$\pm 0.2$ kPa
h) Tyre pressure, kPa	$\pm 5$ percent
i) Temperature of fuels etc, $^{\circ} C$	$\pm 2^{\circ} C$
j) Wet and dry bulb thermometers, $^{\circ} C$	+ $0.5^{\circ} C$
k) Fuel consumption (overall for the apparatus used): 1) Engine test, kg 2) Rotary shaft test, kg 3) Drawbar test, kg	+ 1.0 percent + 1.0 percent + 2.0 percent
l) Angle, degree	+ 0.5 degree

# How to ensure Tolerance limits

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- Obtain specification sheet of the measuring instrument
  - Determine span
  - Determine its accuracy and precision
  - Verify the accuracy from the calibration certificate
  - Verify validity of calibration certificate
  - From span and recommended tolerance, calculate the allowable variation.
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- ❑ When measurements are manually recorded, confirm if the variation is sufficiently low to permit manual recording.
  - ❑ Use automatic recording with sufficient sampling frequency for time varying signals
  - ❑ Ensure that the recording, reproduction and data processing stages will not introduce significant errors.
  - ❑ Ensure that the total tolerance is within specification as above
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# Tolerance Definition

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“The total amount by which a given dimension may vary, or the difference between the limits” ANSI Y14.5M - 1982(R1988) Standard (R 1.4)

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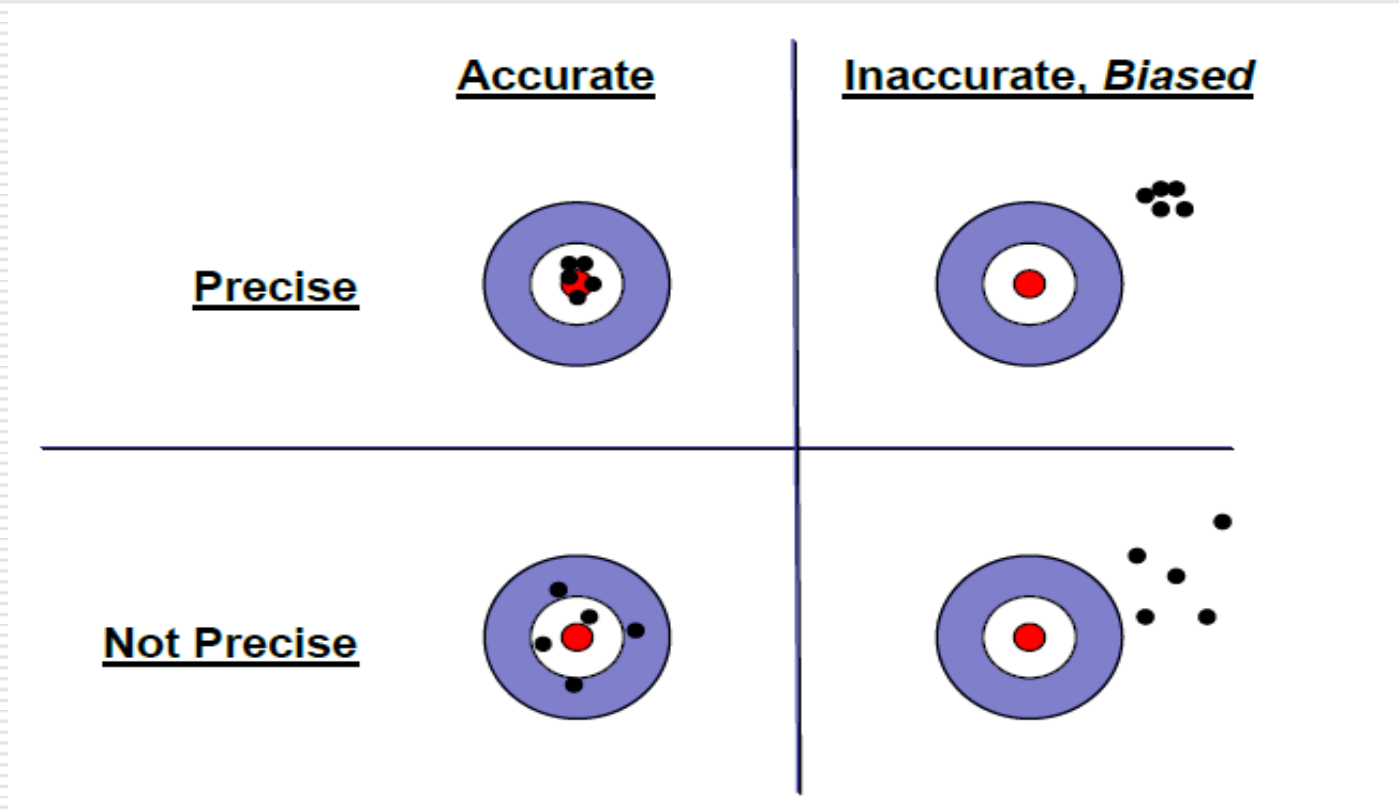
# Fundamental Properties of a GOOD measurement system

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- ❑ ADEQUATE SENSITIVITY – 10 TO 1 RULE – Instrument **ACCURACY** (and therefore Least Count) should divide the tolerance ( or process variation) into 10 parts or more – practical minimum point for gauge selection
  - ❑ Measurement system ought to be in statistical control – presence of only common causes of variation and not the special causes
  - ❑ Variation of measurement system must be small compared to specification limits or process variation (6-sigma) – more **PRECISION**
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# Accuracy and precision

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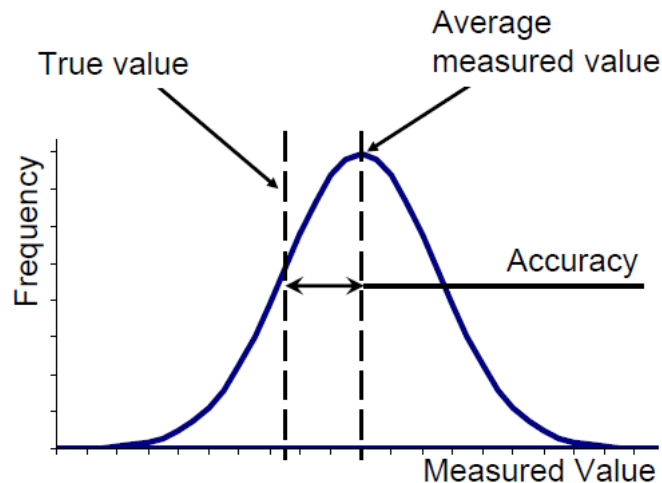
# Qualities of a measurement system

## Resolution

- ❑ Resolution is the incremental ability of a measurement system to discriminate between measurement values
- ❑ The measurement system should have a minimum of 20 measurement increments within the product tolerance

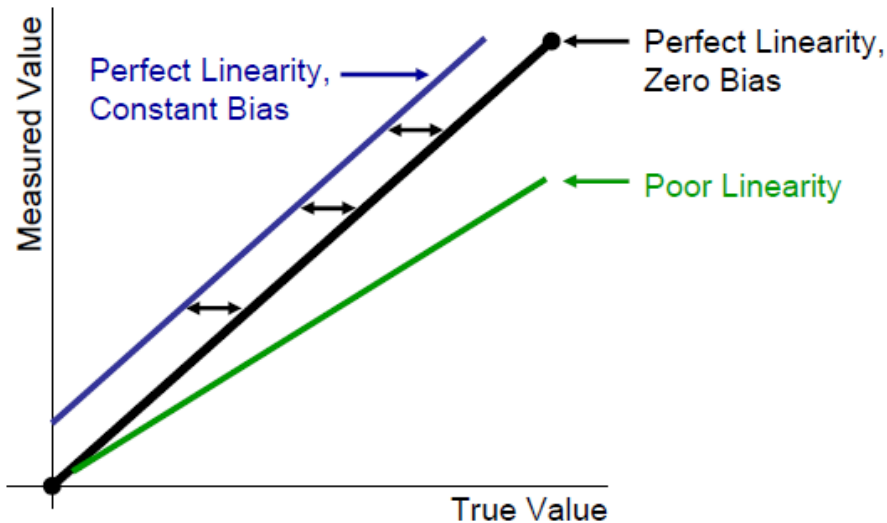
## Accuracy (Bias)

- ❑ Is a measure of the distance between the average value of the measurement of a part and the True, certified, or assigned value of a part



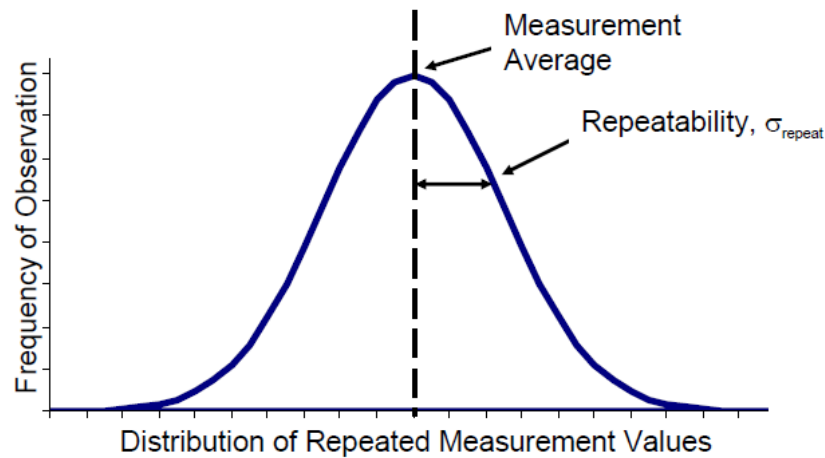
# Linearity:

- Is the consistency of accuracy (bias) over the range of measurement; a slope of one (unity) between measured and true value is perfect



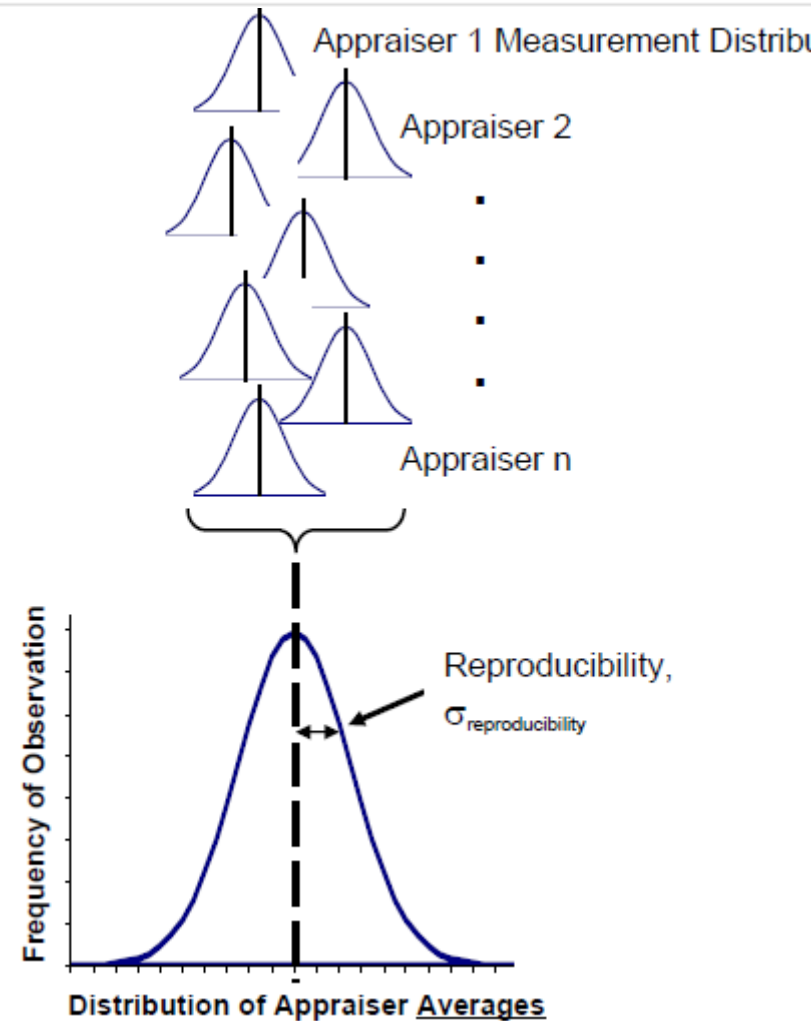
# Repeatability:

- Is the consistency of measurement system, by a single appraiser it is related to the standard deviation of the measured values



# Reproducibility

- is the consistency of different appraisers in measuring the same part with the same measurement system; it is related to standard deviation of the distribution of appraiser averages



# Stability

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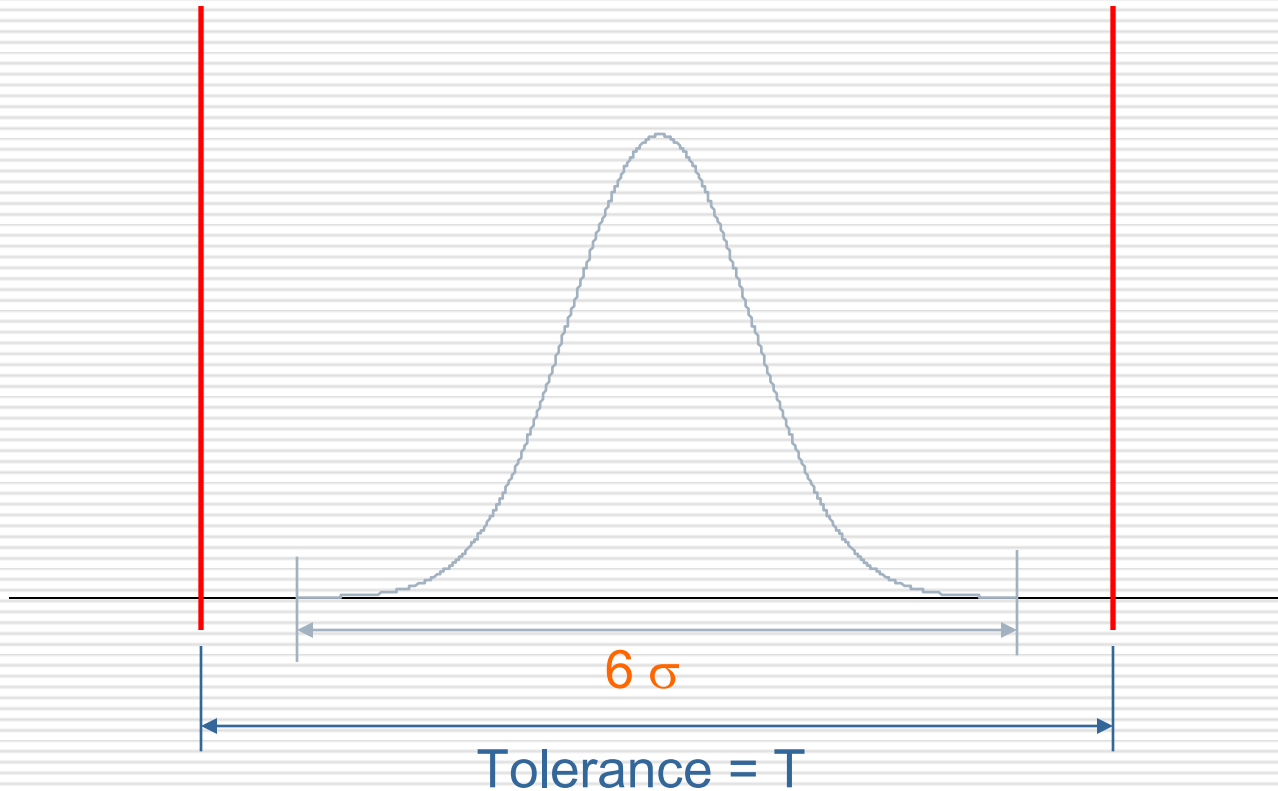
- **Stability is the ability of a measurement system to produce the same values over time when measuring the same sample**
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# Process Capability

Lower Spec. Limit

Upper Spec. Limit



$$\text{Process Capability} = T / 6\sigma > 1.33$$

$$\text{Means, } 6\sigma < (0.75 * T)$$

# Six sigma

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- For a perfect Gaussian distribution
  - 68% of the readings lie within  $\pm 1\sigma$  of  $\mu$
  - 95% of the readings lie within  $\pm 2\sigma$  of  $\mu$
  - 99.7% of the readings lie within  $\pm 3\sigma$  of  $\mu$
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