

INTERNSHIP REPORT

**SONA BLW**

**PRECISION FORGING**



**UDAYA GOEL**

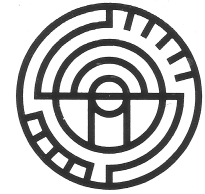
# SUMMARY

# SONA BLW PRECISION FORGING



In the summer of 2019, I spent 3 Weeks interning at the Sona BLW Precision Forging Ltd. in Gurugram, Haryana. Sona BLW is engaged in the manufacturing of Bevel Gears & Differentials for the Automobile Industry for companies such as Maruti Suzuki, Mahindra and even Tesla. During the internship I spent most of my time in the engineering department where I engaged with the teams of production and designing to learn the basics of computer-aided design. Over my 3-week internship training I had the chance to have a detailed plant tour, learn about the designing process and understand the importance of Quality check.

**Udaya Goel**



**SONA BLW**  
MORE TORQUE PER GRAM

NO: SBPL/HR/Training Certificate/2019

Date: - July 05, 2019

### TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Mr. Udaya Goel** (Roll No. 006) of The Doon School has under gone **Internship training** in our organization from 15.06.2019 to 05.07.2019.

During the tenure with us, we found him sincere and hard working. His main interests were seen in the fields of Mechanical Design. Throughout his internship he was observed to be a very keen learner and we hope he has benefited a lot by this industrial exposure.

We wish him all the best for his future endeavors.

For Sona *BLW Precision Forgings Ltd.*

**Amin Rao**  
DGM – Human Resource



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# INTERNSHIP OVERVIEW

## I. Plant Tour

### A. Dojo (Japanese name for Martial Art Training Centre) (Theoretical Overview of all Processes)

1. Safety (Helmet, Shoe, Glasses, Ear Plugs, Gangways, Gloves, etc.)
2. Forging (Billet Heated and Presses in a dye into the shape of a gear)
3. Machining (A gear is refined for better performance)
4. Heat Treatment (By heat durability and life of the product is increased)
5. Assembly (Differential is assembled for the customers)

### B. Manufacturing Plant Tour

#### 1. Forging

- a. Steel Rods Cut
  - i. Weight
  - ii. Blade (Better and smoother finish)
- b. The billet is put in an Induction Heater (800 – 1000.C)

- c. Using weight, the red-hot billet is forged
  - i. Automatic (Single Stroke)
  - ii. Manual (Single and Double Stroke)
- d. The forged gear is not cooled by external methods to avoid cracks

## **2. Machining**

- a. As the edges of the gears are not as smooth and have extra material that is removed and smoothed
- b. Grooves are cut in the center of the Gear
- c. And the back surface is smoothed

## **3. Heat Treatment**

- a. Pre-Heated so the furnace does not cool down
- b. Heated in a furnace
- c. Cool-down automatically to improve hardness and durability
- d. Machining happens again and doubles quality check

## **4. Assembly**

- a. Differential
  - i. Washer + Bevel Gear
  - ii. Washer + Pinion
  - iii. Shaft
  - iv. Play and Movement Check
  - v. Pin Lock
- b. Some Part sent as it is to the customer for their approval
- c. Note (Differential)
  - i. Produces more Torque
  - ii. Transfers Power during turning for a smoother drive
  - iii. Power consumption is less as it is transferred

## **5. Dye & Tool Shop**

- a. Dye
  - i. Cutting
    - (a) Milling (Better More Accurate) (Steel & Graphite)
    - (b) EMC (Steel)
  - ii. Laser Marking of Dye Number
  - iii. Double Quality Check and then sent to Forge Shop

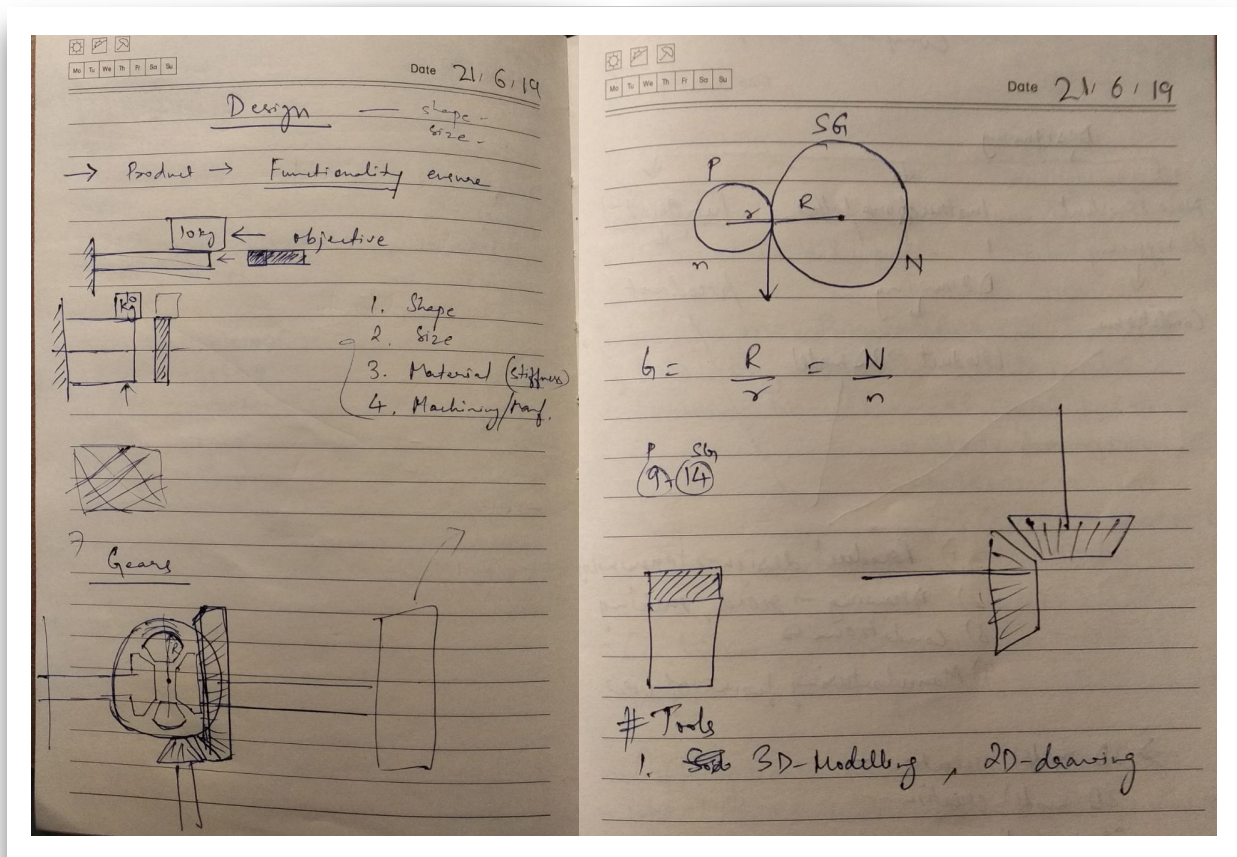
## **6. Tesla Line**

- a. Fully Automated
- b. The quality check involved testing for biological interference
- c. Dirt control was given very high importance

## II. Design

### A. Product – Ensure Functionality

1. Shape
2. Size
3. Material (Stiffness)
4. Manufacturing Feasibility
5. Gear Ratios are set, and new designs must be based on them
6. Tools
  - a. 2D Design
  - b. 3D Design



## **B. Types of Designing**

1. New-Product Design – Conditions
2. Instruction Following – Drawing – Product – 3D Modelling
3. Upgrading existing Product

## **C. What You Must Know While Designing**

1. Product Design Terminology
2. Drawing – Reading & Making
3. Conditions
4. Manufacturing Point of View

## **D. What You Do While Designing on Solid Edge ST10**

1. 3D Model Creation
2. 2D Model Creation
3. Cross – Sections

## **E. Comprehension of a Drawing**

1. Quality Check Requirements
2. Intersections and different views
3. Manufacturing Sheet and instruction sheet
4. Buckling Test – Most Designs made have a long shaft or pole or legs, Buckling is a test which uses weight on one end of the pole and test with how much weight will the start bending and when will it break.



## III. Quality Checks

### A. Straightness

1. Puppy Gauge
2. Table – Calibrated every year – Graphite – 0-micron error



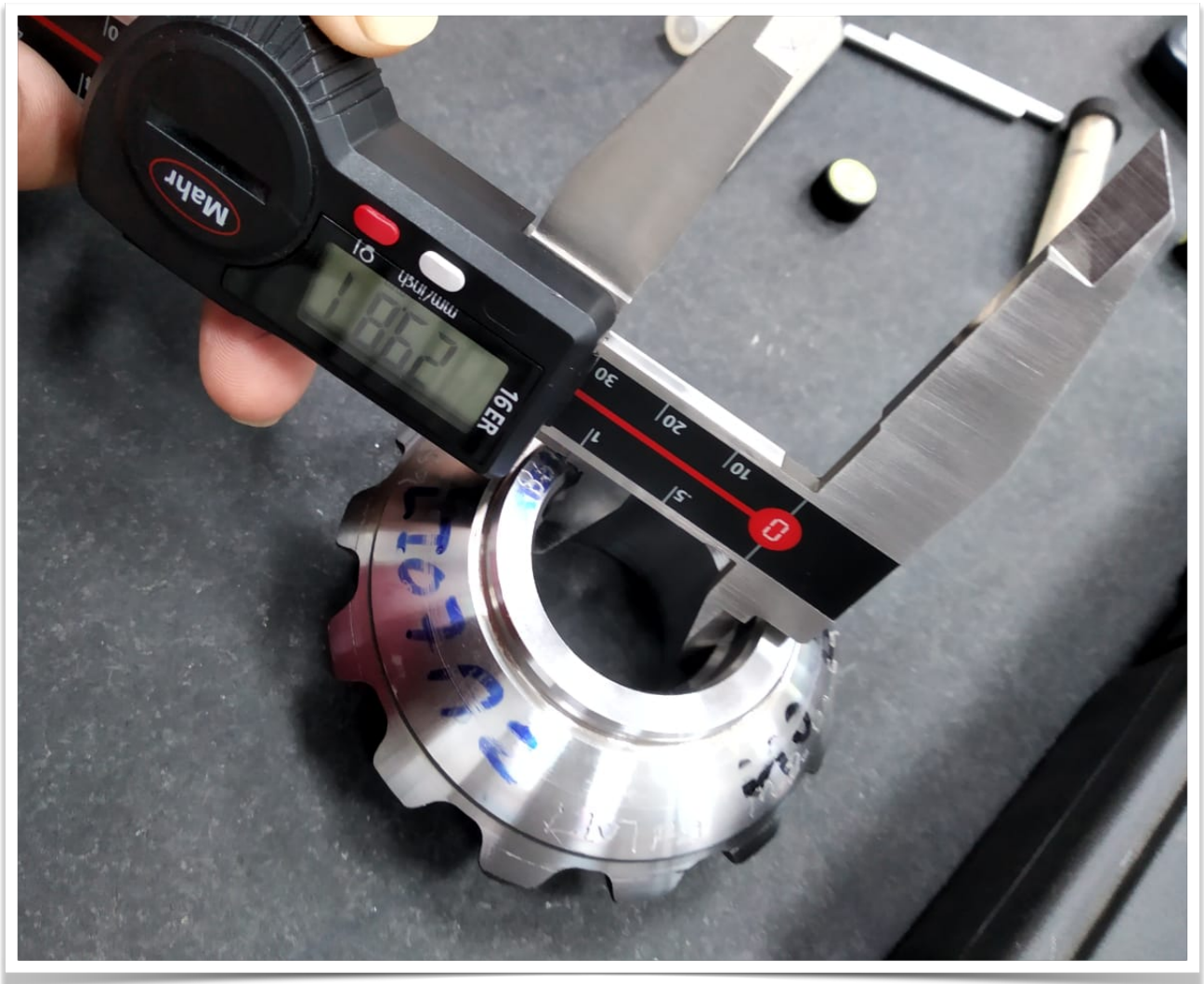
## B. Flatness

1. Puppy Gauge (1 – 10mm)/(0 – 1mm)



## C. Cylindricity

1. Digital Vernier Caliper is used at different points of the surface and the reading should be the same



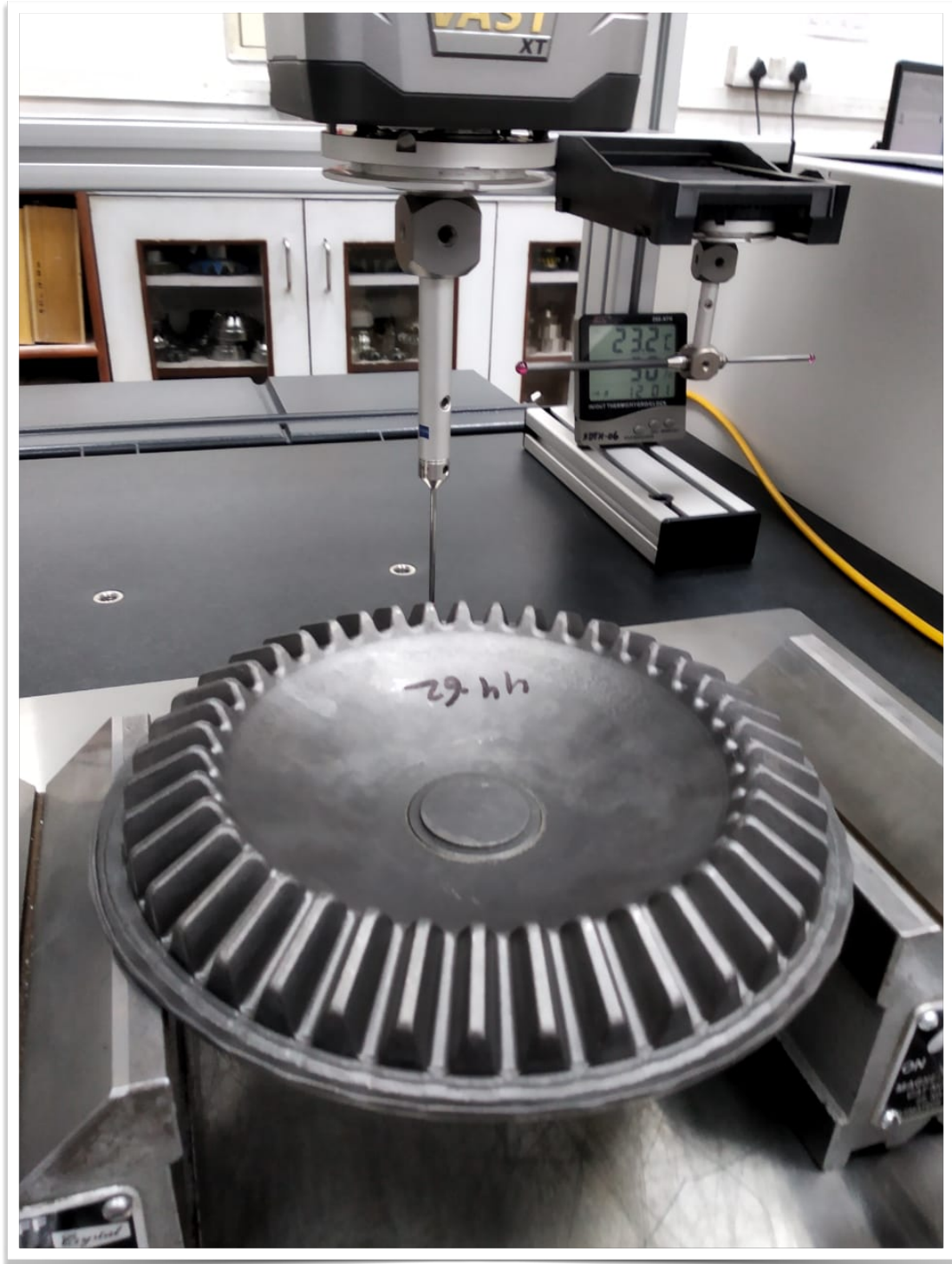
## D. Runout

1. Simple
2. Total
3. Checked using an expanding Mendel



## E. Line and Surface Profile

1. CMM-Coordinate Measuring Machine
2. Different Probes used for different parts

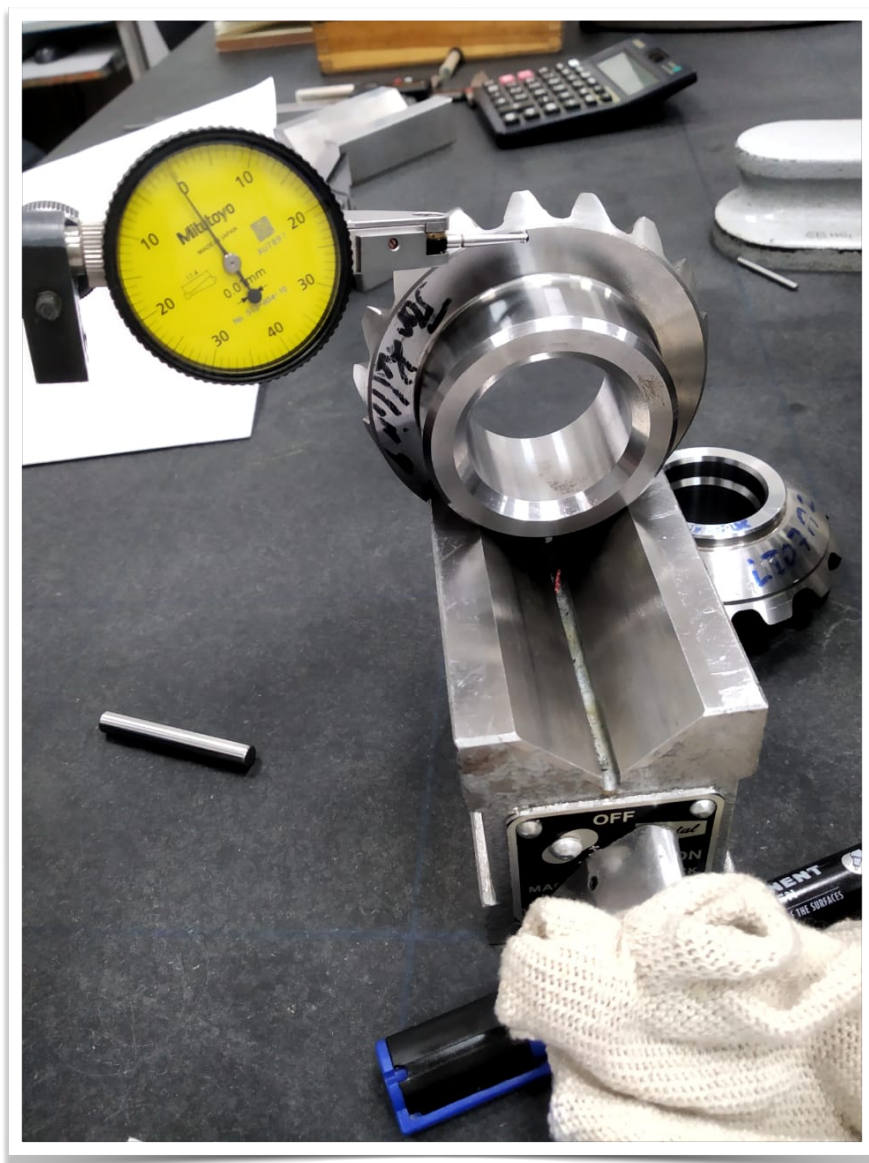


## F. Parallelism

1. Puppy Gauge
2. Checked with respect to the other surface

## G. Perpendicularity

1. Mounted on the V-Block
2. Puppy Gauge at 90°



## H. Angularity

1. Mounted at an Angle and rotated with a puppy gauge



# Hommel-Etamic measuring systems: Geometrical tolerancing in practice

## Form tolerances according to ISO 1101

### Straightness

The tolerance zone is limited by two parallel lines at a distance  $t$  apart. Every individual line of the tolerance cylinder must be between these two parallel lines.

### Roundness

The tolerance zone is limited by two concentric circles at a distance  $t$  apart. The circumference line of the tolerance cylinder must be within a width  $t$  of every radial section plane.

### Flatness

The tolerance zone is limited by two parallel planes at a distance  $t$  apart. The tolerance of form is compared to those of the tolerance zone. The tolerance zone must be between the two parallel planes at distance  $t$  apart.

### Cylindricity

The tolerance zone is limited by two parallel planes at a distance  $t$  apart. The tolerance of form is compared to those of the tolerance zone. The tolerance zone must be between the two parallel planes at distance  $t$  apart.

## General tolerances according to ISO 2768

Tolerance class	10	12	14	16	18	20	22	24	26	28	30
Normal	0.01	0.012	0.015	0.018	0.022	0.027	0.033	0.040	0.048	0.057	0.067
Finest	0.005	0.006	0.0075	0.009	0.011	0.013	0.016	0.019	0.023	0.027	0.032
Coarsest	0.02	0.025	0.03	0.036	0.043	0.052	0.062	0.074	0.088	0.104	0.123

## Standards of practical relevance

ISO 1101	Geometrical Product Specifications (GPS) - Geometrical tolerancing - Vocabulary and parameters of form, orientation, location and run-out
ISO 12780-1	Geometrical Product Specifications (GPS) - Cylindricity Part 1: Vocabulary and parameters of cylindricity
ISO 12780-2	Geometrical Product Specifications (GPS) - Roundness Part 1: Vocabulary and parameters of roundness
ISO 12780-3	Geometrical Product Specifications (GPS) - Straightness Part 1: Vocabulary and parameters of straightness
ISO 12781-1	Form measurement - Basic principles of the determination of form and positional parameters
ISO 12781-2	Form measurement - Basic principles of the determination of form and positional parameters
ISO 12781-3	Form measurement - Determination of the accuracy of the signal bandwidth chain
ISO 12781-4	Form measurement - Filter characteristics and selection

## Position tolerances according to ISO 1101

### Parallelism

The tolerance zone is limited by two parallel planes at a distance  $t$  apart which are parallel to the datum plane.

### Perpendicularity

The tolerance zone is limited by two parallel planes at a distance  $t$  apart which are perpendicular to the datum axis.

### Angularity

The tolerance zone is limited by two parallel planes at a distance  $t$  apart at the nominal angle to the datum axis.

### Coaxiality

The tolerance zone is limited by a cylinder of diameter  $t$  whose axis is coaxial with the datum axis.

## Evaluation method

Effect and function of different evaluation methods on the roundness evaluation

- MZC Minimum Zone Circle**: Consists of two and four profile points with a minimum radial distance, and which enclose the maximum profile. Individual profile peaks influence the center point considerably. Good for top profile form error.
- LSC Least Square Circle**: Circle through the roundness profile with minimum sum of profile deviation squares. Individual profile peaks influence the center point only a little. Very suitable for stable datum formation.
- MIC Maximum Inscribed Circle**: Maximum circle inscribed in the roundness profile for inside areas. The method is used for form measurement of the inside diameter.
- MCC Minimum Circumscribed Circle**: Minimum circle circumscribing the roundness profile for outside areas. The method is used for form measurement of the outside diameter.

## Filter stages

Filter effect of different cut-off numbers on the roundness results (cut-off filter 50 Hz)

- No filter**:  $R_{p1} (MCC) = 1.45 \mu m$
- Filter ISO WIR**:  $R_{p1} (MCC) = 1.04 \mu m$
- Filter 50 WIR**:  $R_{p1} (MCC) = 0.91 \mu m$
- Filter 15 WIR**:  $R_{p1} (MCC) = 0.71 \mu m$

## Run-out tolerances according to ISO 1101

### Radial run-out

In every radial section plane perpendicular to the datum axis, the tolerance zone is limited by two concentric circles at a distance  $t$  apart. The radial run-out tolerance zone is generally limited to a maximum of 180 degrees around the datum axis.

### Axial run-out

The tolerance zone is limited by two parallel planes at a distance  $t$  apart. The tolerance zone is limited by two parallel planes at a distance  $t$  apart. The tolerance zone is limited by two parallel planes at a distance  $t$  apart.

### Total radial run-out

The tolerance zone is limited by two concentric cylinders at a distance  $t$  apart. The tolerance zone is limited by two concentric cylinders at a distance  $t$  apart. The tolerance zone is limited by two concentric cylinders at a distance  $t$  apart.

### Total axial run-out

The tolerance zone is limited by two parallel planes at a distance  $t$  apart. The tolerance zone is limited by two parallel planes at a distance  $t$  apart. The tolerance zone is limited by two parallel planes at a distance  $t$  apart.

## Drawing entries

Tolerance frame	Toleranced elements	Datum

Precision is our business.



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**2020**

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