

# Polysius

Inspection instructions

for Grinding Parts

with cast iron insert (HE) or White cast iron insert

with cast ceramics (HEK) of roller mills

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## 1. Scope

Unless any other written agreements are made, these instructions apply to all cast roller mill wear parts with cast iron insert (HE) or white cast iron insert with cast ceramics (HEK) manufactured for Polysius AG and its subsidiaries.

These inspection instructions form an integral part of the relevant design drawings and parts lists.

If the supplier has any reservation on grounds of manufacturing methods, such reservations must be clarified with the purchaser in writing prior to the order acknowledgement.

Depending on the application, additional customer specifications may have to be met as detailed in the relevant purchase order.

In principle the latest issue of these instructions applies.

Any print-out of these instructions is an uncontrolled copy.

## 2. Standards

Provided it has been clarified with the purchaser in writing, national or international standards which are equivalent to those specified in these instructions may be used. This is to be considered in each individual case.

In principle the latest issue of the relevant standard applies.

### 3. Materials and material tests

The material quality to be used for the manufacture and the required mechanical properties of the wear parts are specified in the respective parts lists.

The material quality must be substantiated by the following test certifications:

- chemical composition of the base metal and inserts
- hardness testing (only for metal inserts)
- non-destructive material testing according to section 7 of these inspection instructions
- visual inspection according to section 6 of these inspection instructions

### 4. Dimensions and tolerances

#### Raw Casting

ISO 8062 CT12 applies with regard to the tolerances for all dimensions.

For surfaces to be machined, additional machining allowances must be observed to ensure that the work piece can be machined to the surface quality and dimensions specified in the drawings and these instructions.

The shape and position tolerance of outside diameter to the inner bore limit

#### Machining

The dimensions and surface qualities specified in the manufacturing drawings and piece lists are binding for the manufacture.

For untoleranced dimensions, ISO 2768-m applies unless otherwise specified.

Here, additional machining allowances must be observed to ensure that the workpiece can be machined to the surface quality and dimensions specified in the drawings and these instructions.

### 5. Inspection

The purchaser's inspectors as well as any additional third party inspectors must be given access to the manufacture at any time during normal working hours after prior notification.

**The purchaser reserves the right to witness the tests specified in these instructions. To enable this, the purchaser's quality control department must be notified in due time for the individual inspection stages.**

The supplier is obliged to provide all the equipment, tools and qualified personnel required for the inspection.

## 6. Visual inspection

The acceptance criteria for visual examination of grinding parts with cast iron insert (HE) and cast iron insert with cast ceramic (HEK) have been defined on the basis of location and type of defect observed.

### Working or Wear face of Roller Tyre and Table Segments :

#### Visual Cracks :

Working or wear face of components are made of a composite material. This composite material experiences differential contractions and expansions during processing and develops cracks. This face may show cracks at unpredictable location and in unpredictable numbers. As per experience cracks in composite material are not harmful to the functioning of these components and are considered acceptable. Such cracks are to be left unground. Examples of acceptable cracks are shown in Annexure I.

#### Cold shut and unfilled cavities :

Composite material may show discontinuities which look like cavities and cold shut at unpredictable location and in unpredictable numbers. Such discontinuities are acceptable if single indication is less than 50 mm dia or equivalent area and less than 10 mm deep. Total area of the defect should not exceed 10% of the area of wear face.

### Faces other than Fitting and Wear face of Table Segments :

#### Visual Cracks:

Visual cracks seen on these faces generate in the composite structure and some time may extend further in high chrome base during heat treatment. As per experience such cracks are not harmful to the functioning of the component and are to be accepted if maximum length of the crack is less than 0.7 times the thickness of the castings at the particular area under inspection.

These cracks are left unground. Total area of the defect should not exceed 10% of the area under inspection.

Examples of acceptable and unacceptable cracks are shown in annexure I.

#### Open shrinkage and ingate undercut:

Area of open shrinkage or ingate undercut should not exceed 100 mm dia or equivalent area and depth of the defect should not be more than 10 mm.

The results of the visual examination must be described and documented with sketches or photographs in the inspection report.

## 7. Non-destructive testing methods

### Qualification for testing

The personnel carrying out the test must have a certification according to EN 473 or an equivalent standard or a certification according to the specific regulations, e.g. those of the German society for non-destructive testing (Deutsche Gesellschaft für zerstörungsfreie Prüfung) or the American Society for Nondestructive Testing (SNT-TC-1A), or relevant company standards. On request of the purchaser, the supplier must present certifications of this qualification.

## 7.1 Surface testing by dye-penetration

### Test method

After the application of the penetrant, 10 to 20 minutes must be allowed for penetration. After the removal of the surplus penetration fluid, the developer can be applied. Since the color in the developer spreads rapidly, observation of the distribution must be made immediately after the application. The comparison with the inspection criteria must be made within 10 to 20 minutes. The dye-penetration tests must be performed in accordance with the instructions of the testing media Manufacturer.

### Surface preparation

The surfaces to be tested must be clean, free from oil or grease and ground.

### Scope of test

The following areas have to be tested:

- all machined areas
- all areas requiring additional tests as result of the visual examination
- all areas as demanded by the inspector

For assessment, quality standard EN 1371 applies.

On a reference area of 105 x 148 mm (DIN A6), the maximum acceptable number of non-linear indications is eight (8). The smallest recordable indication is 2 mm. The largest acceptable indication is 6 mm.

If the results of the dye-penetration test are not clear, the purchaser's inspectors are entitled to perform additional magnetic particle tests in any excavated areas.

### Assessment of indications

As per EN 1371, quality level 2 applies for section 1 and quality level 3 for section 2. For a reference area of DIN A6 format (105 x 148 mm), indications according to table 1 are still acceptable.

The reference area must be in the least favorable position.

**Table 1**

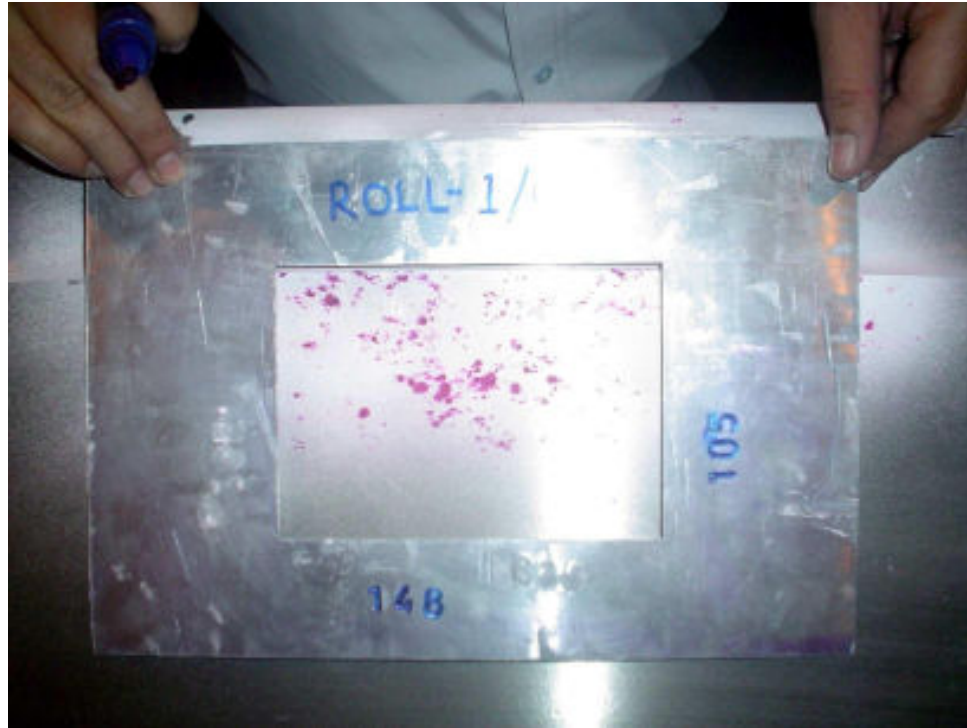
<u>Indications</u>	<u>Section 1</u>	
	<u>1</u>	<u>2</u>
Non-linear single indication	6 mm	9 mm
Linear single indication	10 mm	15 mm
Linear cumulative indication	20 mm	30 mm
No. of non-linear single indications	8	12

1) **Section 1** refers to machined surfaces and transition radii

**Section 2** refers to unmachined cast surfaces

All indications which exceed the values listed in this table are unacceptable and have to be eliminated in accordance with section 10.

Picture 1: Typical clustered indications



As example for the acceptance of nonlinear clustered indications picture 1 must be considered.

## 7.2 Magnetic Particle Inspection

Not applicable

## 7.3 Ultrasonic Examination

Not applicable.

## 8. Elimination of defects

If unacceptable indications are detected in the tests according to sections 7, these indications may be eliminated by grinding. The assessment of the remaining excavations must be based on the function of the part in question. The requirements of Fig. 2 must be met.

For the assessment of a single area and the t/r ratio, the most unfavorable case must be taken into account.

### Grinding table and roller tyre segments

The remaining excavations must not exceed the following dimensions:

- Single areas :  $\varnothing$  50 mm + transition radius
- Total area : 10 % of the respective surface
- Depth : 0.05 x the thickness of the respective work piece

**Roller tyres**

For the elimination of defects, the surface of Roller Tyres is divided into 4 (four) sections to ensure that the different load conditions are taken into account (Fig. 1). The remaining excavations must not exceed the following dimensions:

Section	I	II	III	IV
Single area	ø 50	ø 100	ø 50	ø 80
Total area	5 %	10 %	10 %	10 %
Depth	0.05 x s	0.1 x s	0.05 x s	0.05 x s

**Repair welding is not acceptable.**

If repair welding is detected, the purchaser is entitled to reject the work piece.

**9. Hardness Test****Roller Tyres**

Hardness shall be checked on the surface of any one insert of the roller tyre. Hardness shall be checked by Equotip hardness tester after surface preparation suitable for testing. Quantum of hardness check for final inspection shall be one insert per roller tyre.

**Table Wear Segments**

Hardness shall be checked at the centre of working face of the table segment. Hardness shall be checked by Equotip hardness tester after surface preparation suitable for testing. Quantum of hardness check for final inspection shall be each segment.

**Assessment**

The assessment of the determined hardness values is made in respect of the agreed hardness tolerance.



## 10. Dimensional checks

Finish machining must be performed after the final heat treatment.

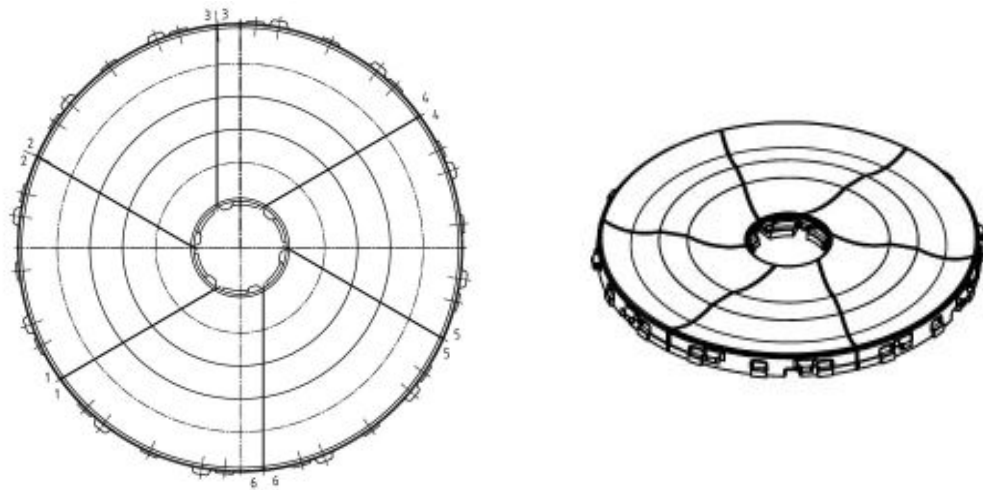
All drawing dimensions indicated to be recorded at inspection and all tolerance dimensions must be recorded and compared AS REQUIRED - ACTUAL in respective dimensioned sketches or dimensional records.

## 11. Marking

For identification, each casting must be marked with cast-on drawing -, material and serial numbers.

For assembling, all segments must be match-marked with clearly visible, weather resistant paint.

### Grinding Track Segment arrangement



## 12. Documentation

All results (actual and specified data) of the performed interim and final inspections must be entered by a representative of the manufacturer into the protocols provided. The entries must be confirmed by the stamp and signature of the representatives of both the manufacturer and the purchaser.

A works certificate 2.2 to EN 10204 documenting the results of the chemical analysis and an inspection certificate 3.1. to EN 10204 shall be submitted to the purchaser's representative at the latest during the final inspection of the castings.

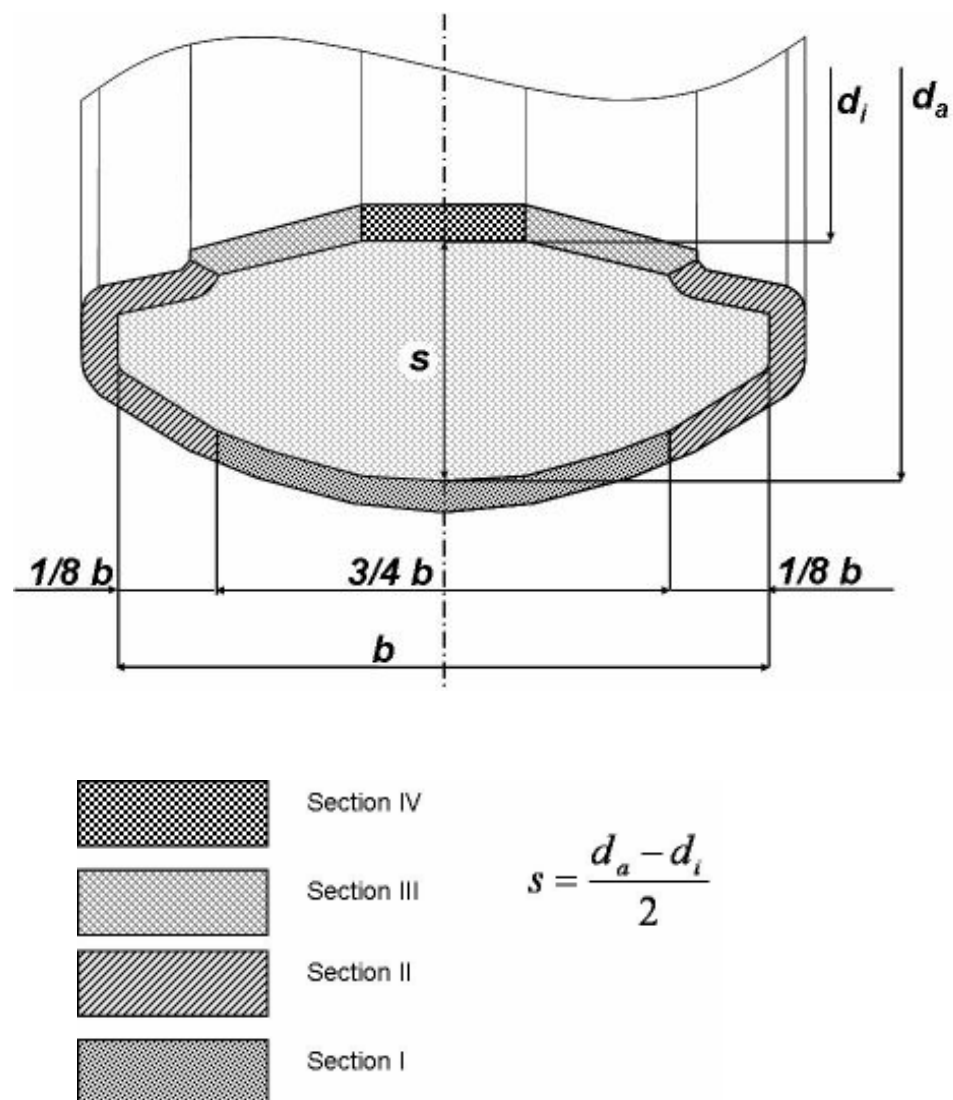
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## 13. Reference standards

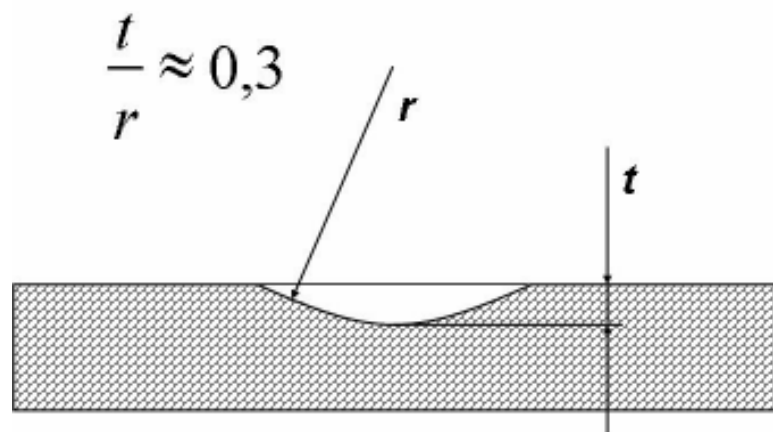
- DIN EN ISO 9934 Non-destructive testing - Magnetic particle testing
- DIN ISO 2768 General tolerances
- DIN ISO 8062 Casting system of dimensional tolerances and machining allowance
- DIN EN 1369 Founding - Magnetic particle testing
- DIN EN 1371 Founding, - liquid penetrant inspection - part 1
- DIN EN 10204 Metallic products; Types of inspection documents
- DIN 54130 Non-destructive testing; Magnetic leakage flux testing, general
- DIN EN 1559 Founding - Technical conditions of delivery



**Fig. 1**



**Fig. 2**



## ANNEXURE I



**Photo: 1** Example of acceptable cracks at different orientaion on the inserts.



**Photo: 2** Example of acceptable cracks at different orientaion on multiple inserts.



Photo: 3 Example of unacceptable crack at side face on table segment. Total thickness of table segment is 205 mm. Extension of crack is beyond 0.7 times of total thickness of table segment.

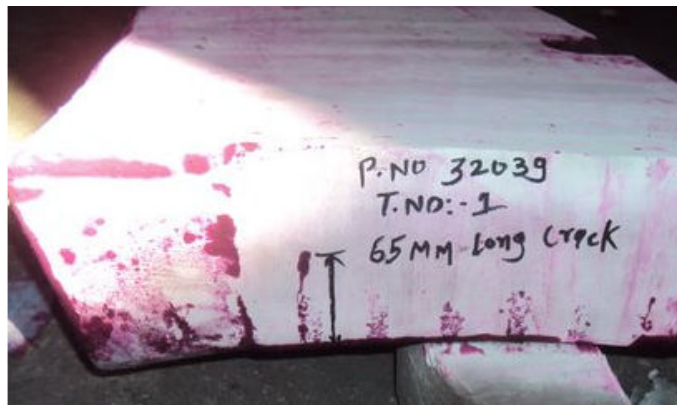


Photo: 4 Example of acceptable crack at side face on table segment. Total thickness of table segment is 145 mm. Extension of crack is less than 0.7 times of total thickness of table segment.