



ENGINE FACTORY, AVADI

PROCESS SCHEDULEDESCRIPTION :- **ARTICULATED CONNECTING ROD**  
.....COMPT. No :- **20.04.19-4.**  
.....MFG. SHOP :- **SPS**  
.....

Rev. No.: 00

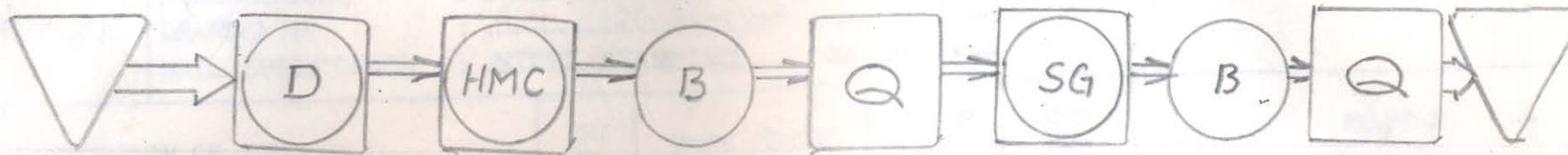
DATE - 22.10.96

# FLOW PROCESS CHART

STORE : ...

DRG. NO.: 20-04-19-4

END STORE: ...



B Bench	C Collection of items	HT Heat treatment	LP Lead plating
ASSEMBLY	CG CYLINDRICAL GRINDING	GD GUN DRILLING	MILL MILLING
BORING	D DRILLING	HMC HORIZONTAL MACHINING CENTRE OPERATION	POL POLISHING
CRACK DETECTION	DA DISASSEMBLY	HP HYDRAULIC PRESS	SG SURFACE GRINDING
CREEP FEED GRINDING	FB FINE BORING	LAP LAPPING	TUR TURNING

LEGEND		APPROVAL		SECTION
TEMP. STORAGE	▽	TRANSPORTATION	➡	IPS
OPERATION	○	INSPECTION BY QC	Q	NO. OF SHEETS
OPERATION CUM INSPECTION	◻	INSPECTION BY SQA/ECQA(QA/E) Etc.	I	SHEET NO.
100% INSPN. BY MFG. SEC.	◻	STORAGE	△	ENGINE FACTORY AVADI, MADRAS-54

APPROVAL  
 SIGNATURE & DATE  
 PREPARED BY: MGE *Qsh* | QC */*  
 APPROVED BY: *Q*  
 AUTHORIZED FOR ISSUE: *22/10/96*



# ENGINE FACTORY AVADI

FORM No :EFA/P-038

## PROCESS SCHEDULE

NOMENCLATURE : ARTICULATED CONNECTING ROD.....  
 DRAWING No : 20-04-19-4.....  
 MATL SPECIFICATION : STEEL..STAMPING.....18X..2H4MA....

OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
010	DRILLING	7	ACCUMAC Pillar drilling m/c			
020	MILLING I SET UP	8	PRAGA HMC 600			
030	-do- II SET UP	9	-do-			
040	-do- III SET UP	10	-do-			
050	-do- IV SET UP	11,12, 13&14	-do-			
060	-do- V SET UP	15	-do-			
070	DEBURRING	16	BENCH			
080	POLISHING CRACK DETECTION	17	BENCH			

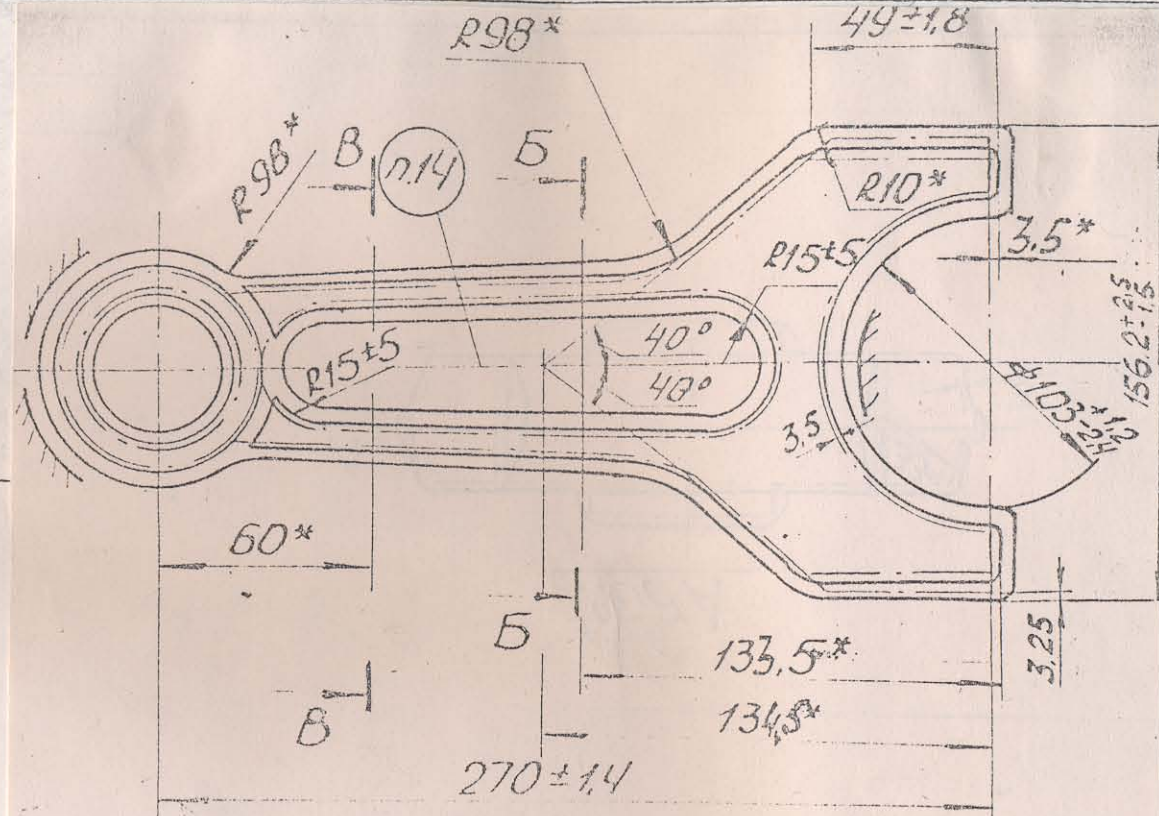
PREPARED BY	CHECKED BY	APPROVED BY	AUTHORISED BY							SHT. No
SIGN <i>R.S. V...</i>	SIGN <i>[Signature]</i>	SIGN <i>[Signature]</i>	<i>Beake</i>							1 of 26
DATE 14/10/96	DATE 22.10.96	DATE 22.10.96	22/10/96							
C/MAN -II /PDO	<i>[Signature]</i> /PDO	HOS/PDO	DO/PDO	PDO REF	ISSUE	DATE	SIGN			





PLANNING SHEET -- PDO / EFA Form No. EFA/P-039

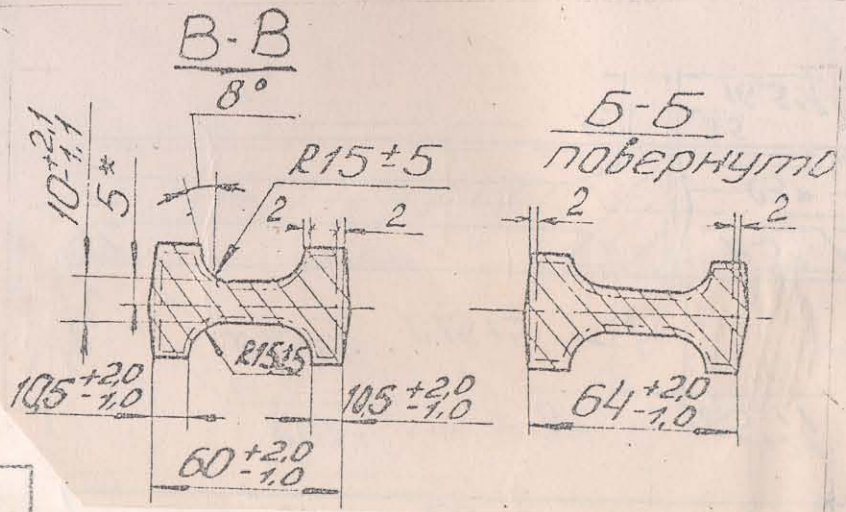
NOMENCLATURE **ARTICULATED CONNECTING ROD** DRAWING No. **20-04-19-4** ISSUE **000** DPN. No. **000** OPERATION **FORGING**



MACHINE:

STD. TOOLS & GAUGES

SPECIAL TOOLS & GAUGES



DES	APP	P&TE	ISSUE	DATE

NOMENCLATURE

ARTICULATED CONNECTING ROD CAP

DRAWING No.  
20-04-19

ISSUE

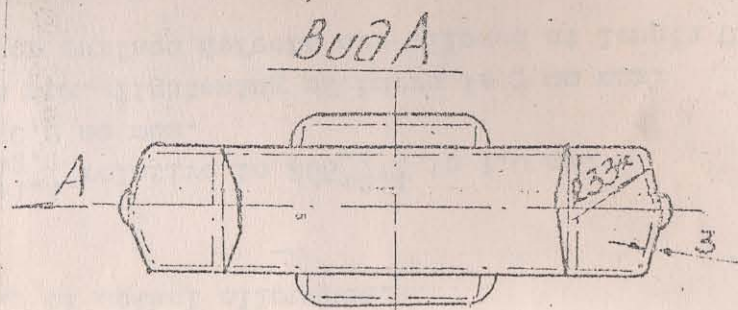
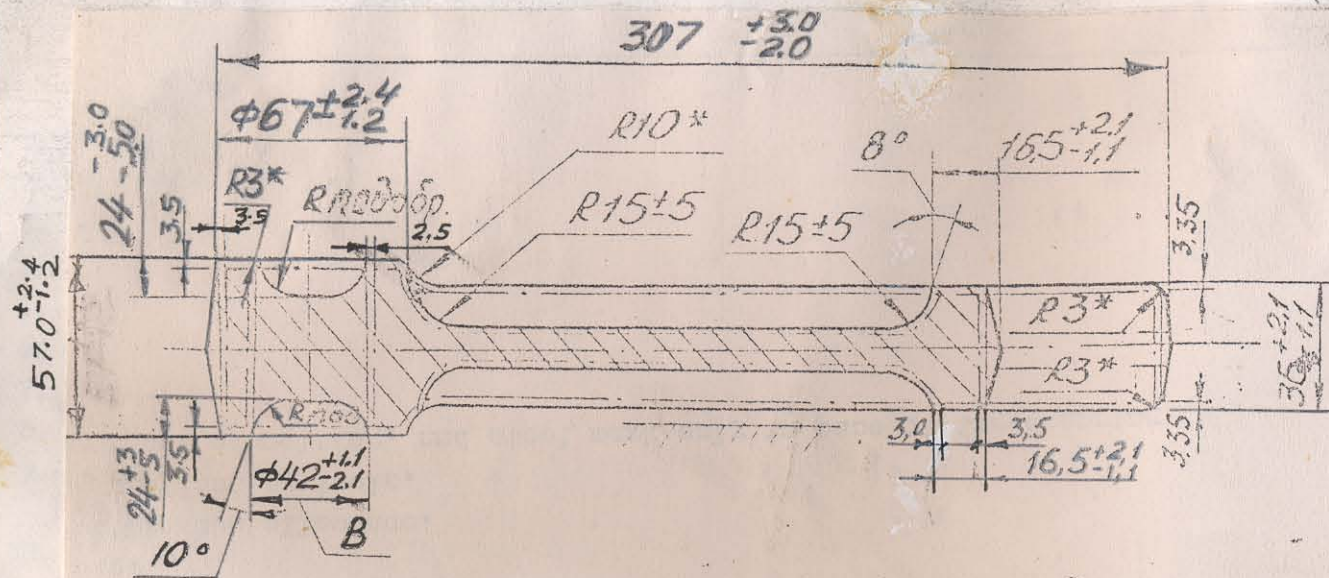
OPN. No.  
000

OPERATION  
.FORGING

MACHINE:

STD. TOOLS & GAUGES

SPECIAL TOOLS & GAUGES



Q8V	<i>[Signature]</i>	<i>[Signature]</i>			
PRFD	CHD	APPD	P&TE-REF	ISSUE	DATE

NOMENCLATURE

ARTICULATED CONNECTING ROD

DRAWING No.  
20-04-19-4

ISSUE

OPN. No.  
000

OPERATION  
FROGING

20-04-19-4

Operation No.  
005

MACHINE:

STD. TOOLS & GAUGES

1. HB 302...341 (d<sub>casting</sub> 3.5...3.3 mm).
2. Non-indicated drafts 5...7°. Non-indicated radiuses of roundings R2...4 mm.
3. Non-filling of angles within 0.5 of actual allowance.
4. Flatness allowance 1.2 mm.
5. Camber allowance 1.2 mm.
6. Concentricity allowance of  $\phi 42^{+1.1}_{-2.1}$  relative to  $\phi 66^{+2.4}_{-1.2}$  is 1.0 mm.
7. Displacement of dies planes is 0.9 mm max.
8. Burr by cut perimeter is 1.2 mm max. Tightening of burrs is 3 mm max.
9. Nicks from scale, dents and other surface defects are allowed at length 0.5 max of actual allowance.
10. Scabs, hair-cracks and other similar defects except cracks are allowed at depth 0.5 max of actual allowance with determination of defect laying depth across by local grooves, selectively 0.5% from the lot.
11. Clean from scale.
12. Turn of ribs within the allowance.
13. \* - dimensions provided by tools.
14. Mark number or index of melting, and steel mark only in case of its changing

SPECIAL TOOLS & GAUGES

Q&V	SA				
PREP	QID	APPD	P&TE	ISSUE	DATE

PLANNING SHEET - PDO / EFA Form No. EFA/P-039

NOMENCLATURE

ARTICULATED CONNECTING ROD

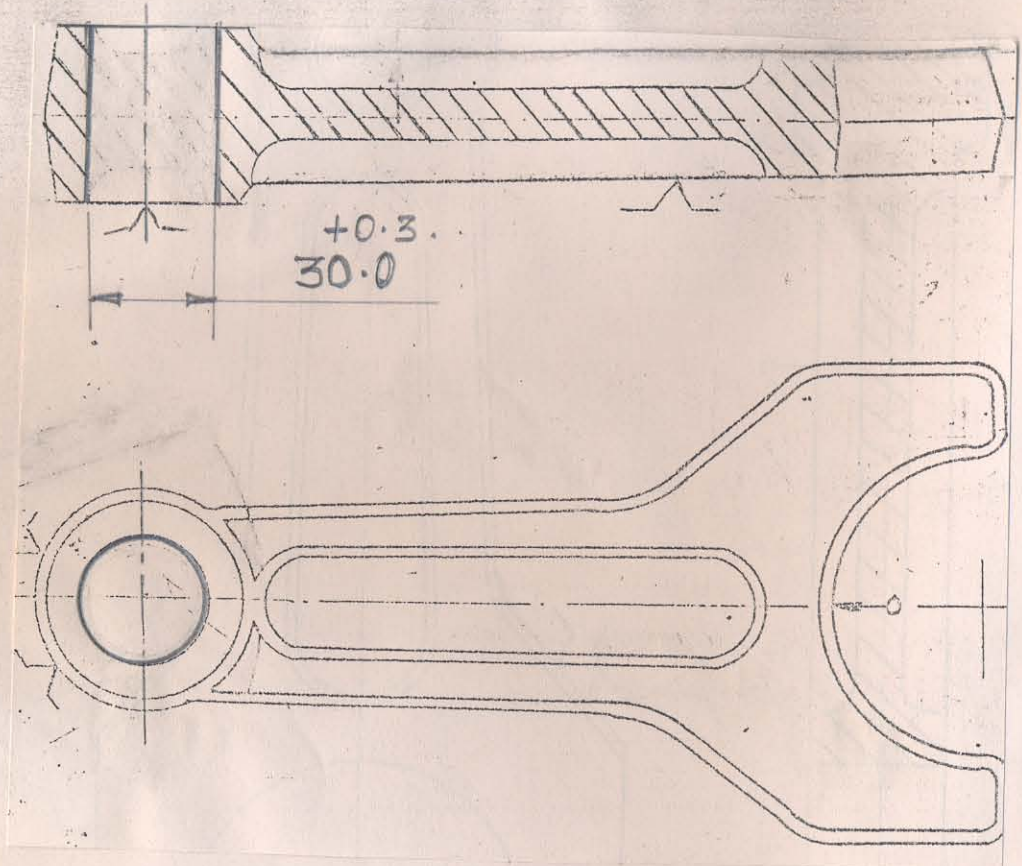
DRAWING NO. 20-97-19

ISSUE

010 DRILLING

MACHINE: ACCUMAC  
PILLAR DRILLING

*Ra 20/*



STD. TOOLS & GAUGES

1. Quick change collet MT3
2. -do- MT4
3. HSS Drill  $\phi 20$
4. HSS DRILL  $\phi 30$

SPECIAL TOOLS & GAUGES

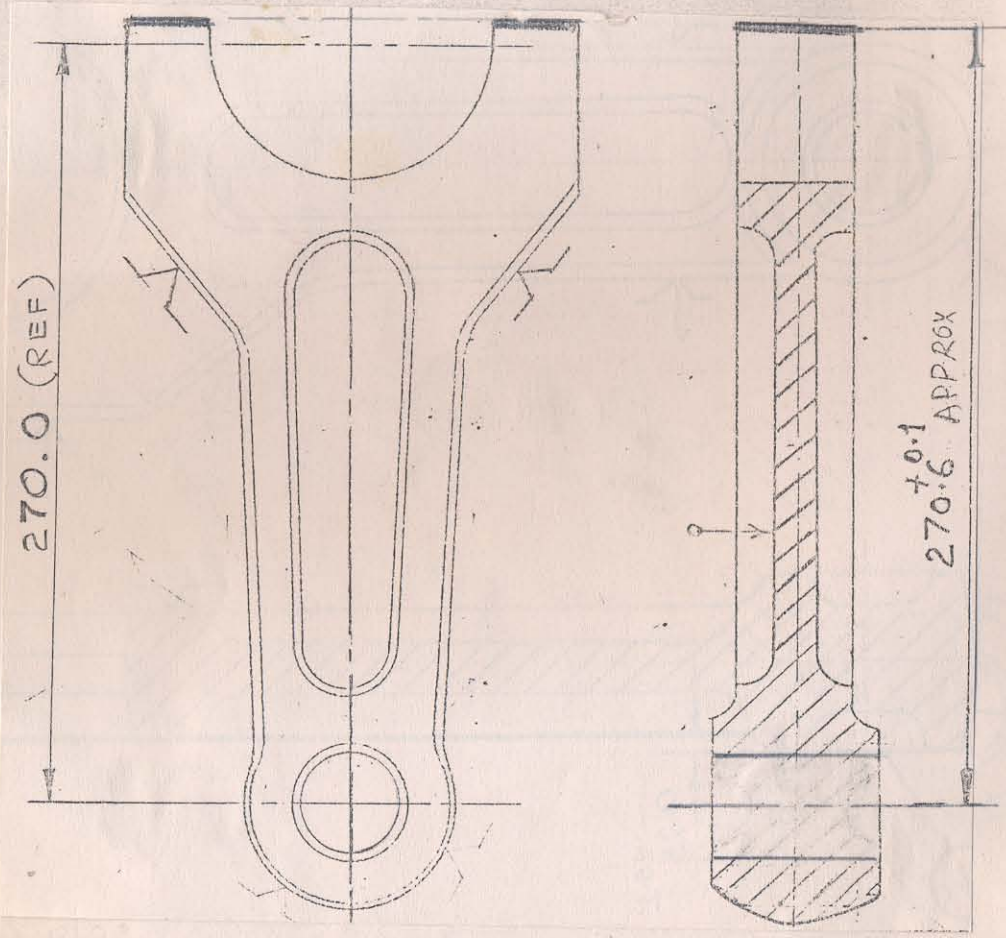
1. FIXTURE

<i>081</i>	<i>Sai</i>				
PRED	CHD	APPD	P&TE-REF	ISSUE	DATE

MACHINE: PRAGA  
HMZ - 600

RAS ✓

1ST SET UP



TECHNICAL REQUIREMENT

1. Deviation from the perpendicularity of joining face to the datum face end of the con.rod should not exceed 0.1 mm.

STD. TOOLS&GAUGES

1. Face mill  $\varnothing 80$   
M40 SP15
2. Insert:  
SPKN 1504 TTR EDR

SPECIAL TOOLS&GAUGES

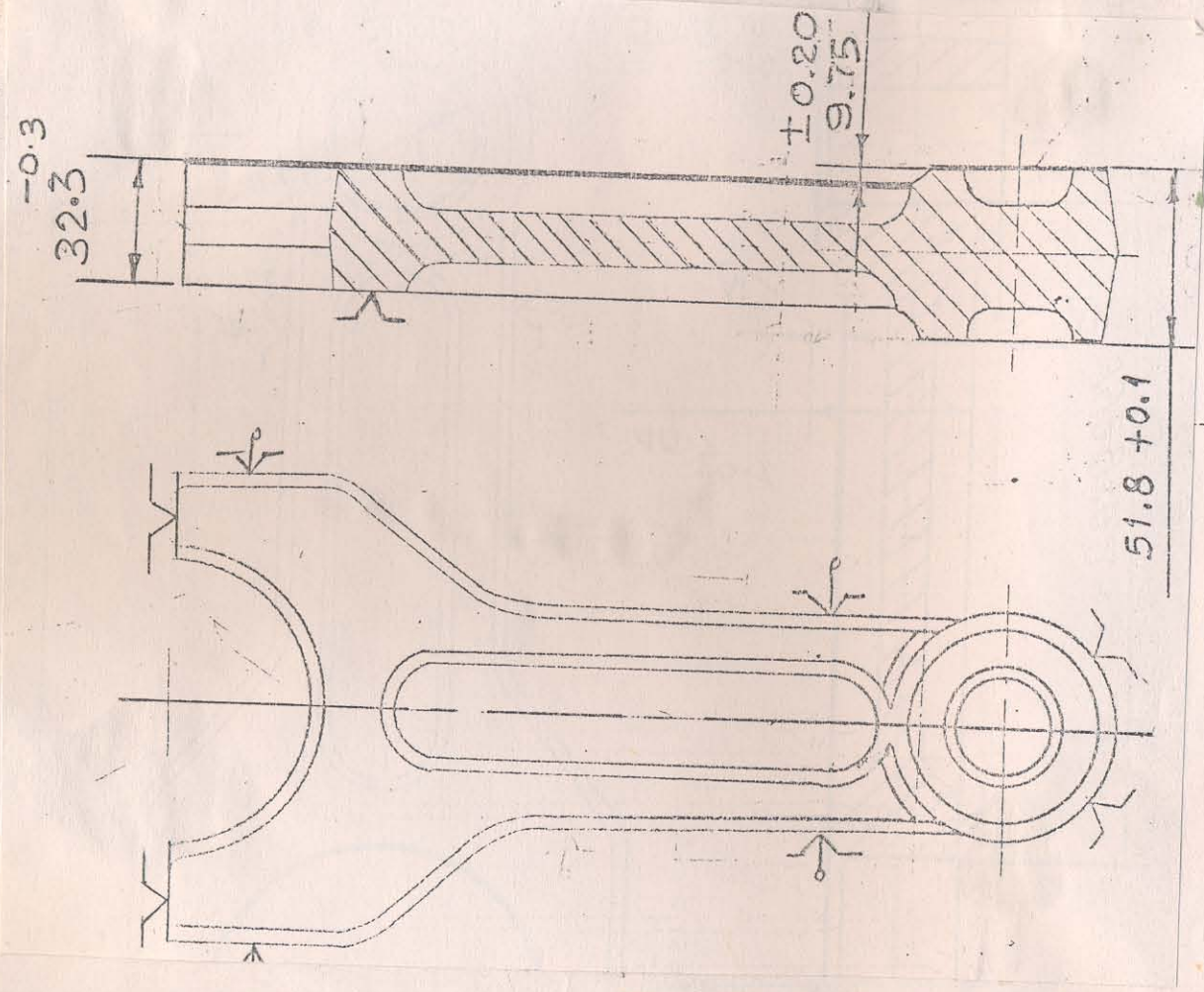
FIXTURE	201259
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CHD	APPD	P&TE-REF	ISSUE	DATE

Ras

MACHINE: PRAGA  
HMC 600

IIND SET UP



STD. TOOLS&GAUGES

1. Face milling cutter  $\varnothing 80$   
M40 SP15
2. Insert:  
SPKN 1504 TTR EDR

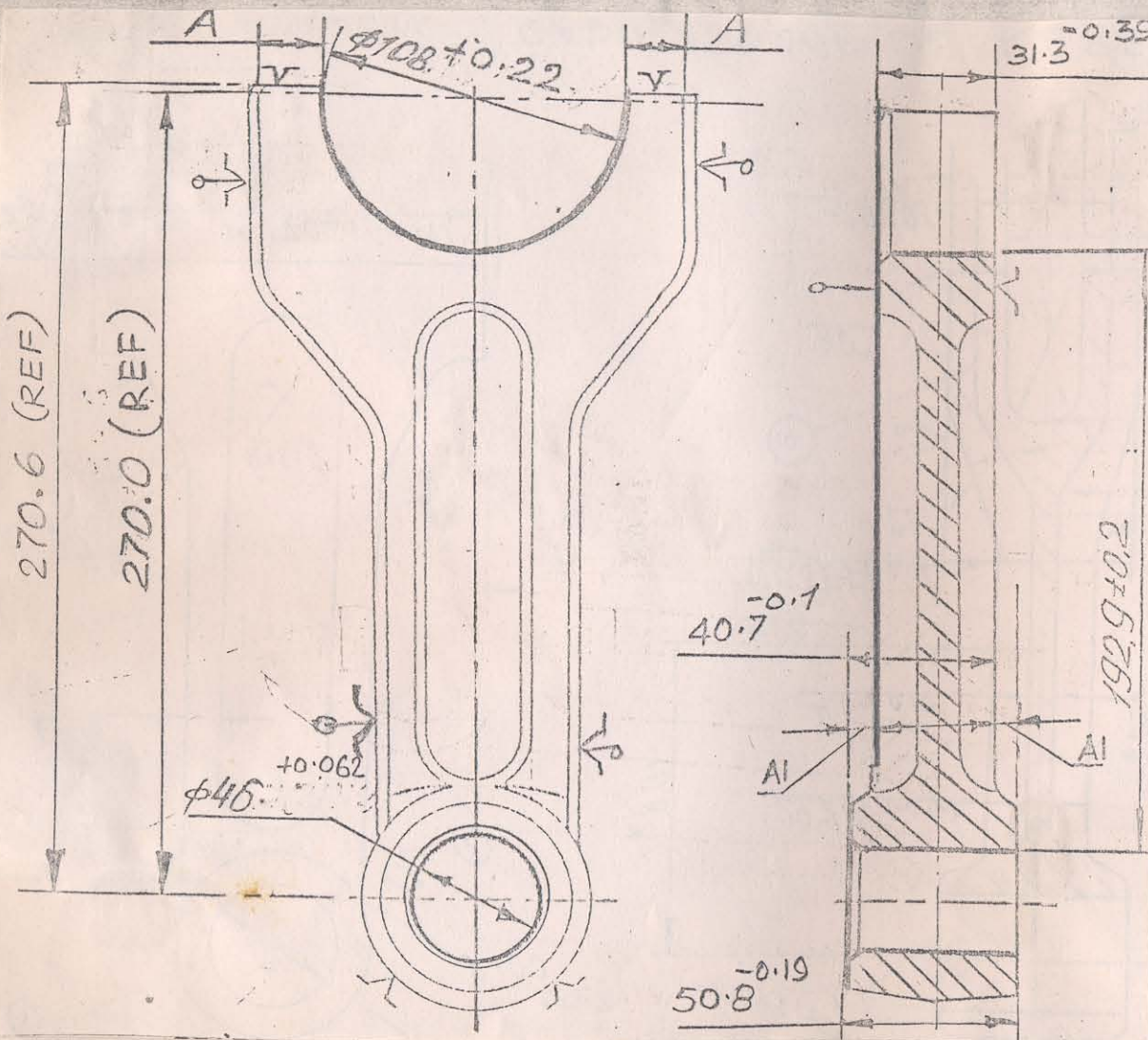
SPECIAL TOOLS&GAUGES

FIXTURE 201260

TECH NICAL REQUIPEMENT

1. Non-squareness of surfaces (1) & (2) should not exceed 0-20 mm.

QCV	<i>[Signature]</i>				
PRED	CHD	APPD	P&TE-REF	ISSUE	DATE



2004-19-4  
*Ra 5*  
IIIRD SET UP

040 MILLING  
 MACHINE: PRAGA  
 HMC - 600

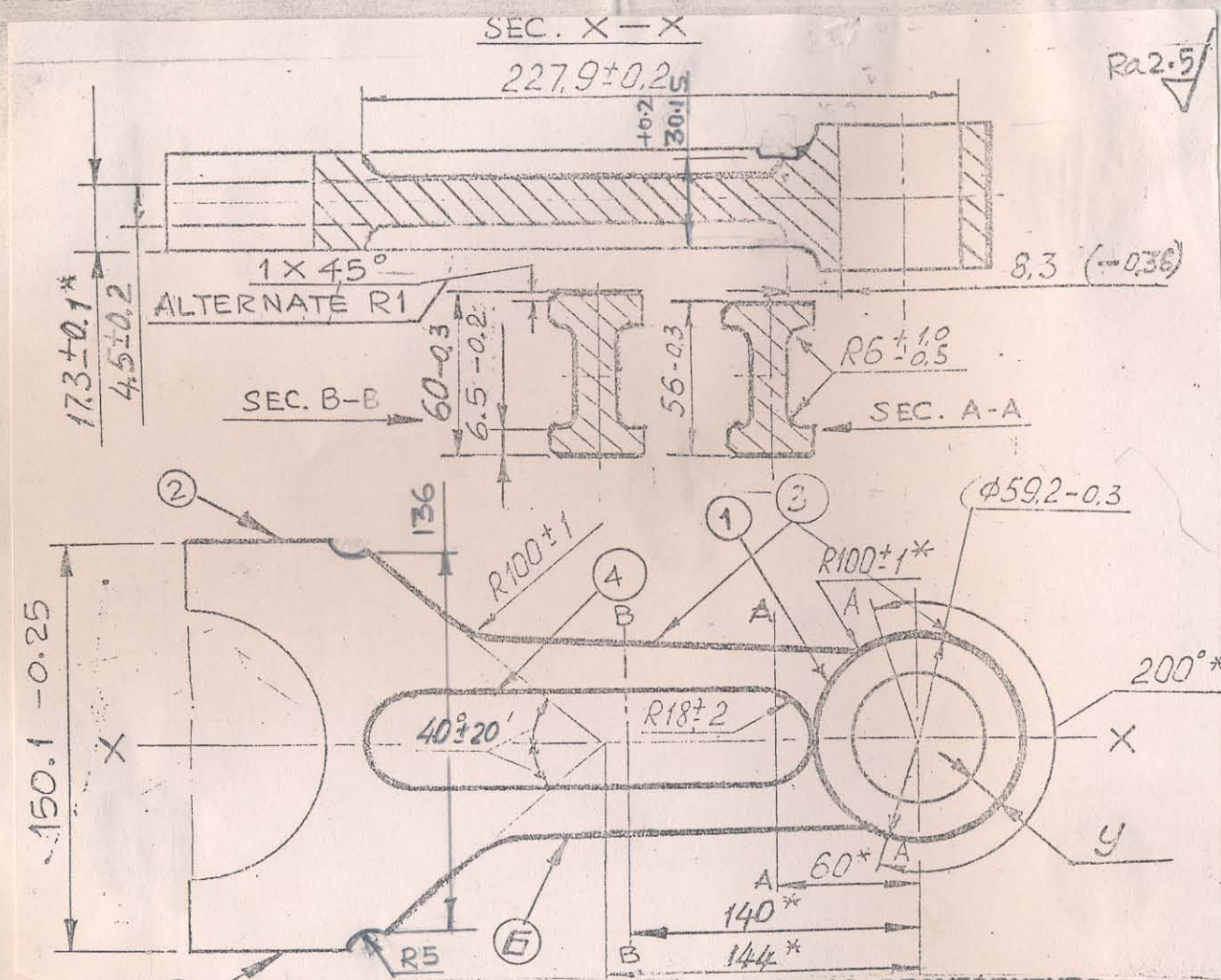
- STD. TOOLS & GAUGES
- Face milling cutter  $\phi 80$   
 M40 Sp 15  
 Insert: SPKN 1504  
 TTR EDR
  - Deep shoulder end mill  $\phi 63$  CEL 83  
 Insert: 120408
  - BW Core drill  $\phi 42$   
 Insert: SCMM 120408
  - Boring tool  
 Square shank 10x10  
 Widia No, 6938785220  
 Insert: CCMM 060204  
 Plug gauge  $\phi 46$  20/10/01

- SPECIAL TOOLS & GAUGES
- | FIXTURE  | 201261   |
|--|----------|
| 1. Deep shoulder end mill carbide tipped brazed $\phi 50$ CEL 75 | 46/00/01 |
| 2. Micro fine boring cartridge M5 A2 G40                         |          |
| 3. Insert: CCMM 060204   |          |

TECHNICAL REQUIREMENTS

- Variation in dimension A-A should not exceed 0.5 mm.
- Non-squareness of 1 & 2 relative to plane 'B' should not exceed 0.10 mm.

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**TECHNICAL REQUIREMENTS**

1. Tolerance of symmetry for contour w.r.t. common axis is 0.1 mm.
2. Difference in dimension 'y' should not exceed 0.25 mm at section A-A
3. Parallel shift of 'T' beam middle wall w.r.t. the faces should not exceed 0.2 mm.
4. \* Dimensions for reference.
5. Slop on middle portion of 'T' beam should not exceed 0.1 mm over entire length

**SET UP - IV**

STD. TOOLS & GAUGES

1. Dp. shoulder end mill  
 φ63 CEL 88  
 Insert: SPMW 120408
2. CC end mill φ25  
 Widia No. 69396417  
 Insert: TCMT 110204  
 SCMT 09T308
3. S&F Cutter  
 M90 TP 11 φ80  
 Insert: TPAN 1103 PPN
4. Gap gauge 6.5 -0.2

SPECIAL TOOLS & GAUGES

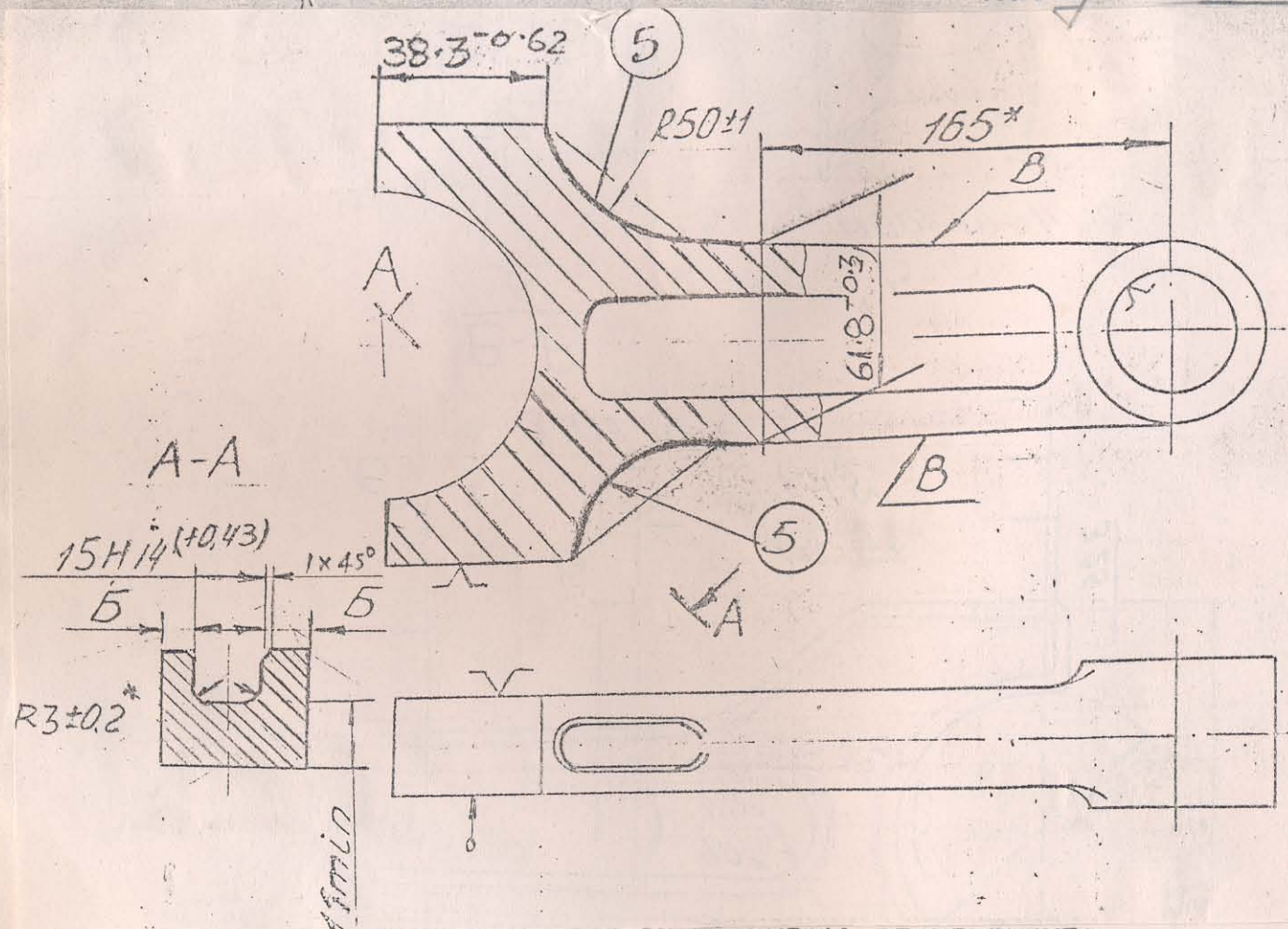
FIXTURE 201262

1. Deep shoulder end mill  
 φ50 CEL 75 46/00/01
2. Carbide tipped brazed  
 end mill φ30x5x45 46/00/003
3. -do- φ30 ER6 46/00/002
4. Solid carbide  
 end mill φ19 x CEL 40
5. S&F cutter Carbide  
 tipped brazed  
 φ100x15WxER6 42/00/10

DESIGN	APPROVED	DATE		
PREP	CHKD	APPD	P&T-REF	ISSUE DATE

Ra 2.5 / IV SET UP

MACHINE: PRAGA  
HMC 600



STD. TOOLS & GAUGES

1. Face milling cutter  
ø 80  
M 40 SP 15
2. Insert:  
SPKN 1504 EDR TTR
3. C.C. End mill ø25  
Widia No. 69396417
4. Insert:  
TCMT 110204  
SCMT 09T308
5. Vernier caliper  
0-150 mm TPAN
6. S&F cutter M90 TP11 090308

SPECIAL TOOLS & GAUGES

1. Fixture 201262
2. Profile gauge 203035
3. Carbide tipped braed end mill ø30x5x45 46/00/003
4. -do- ø30xER6 46/00/002
5. S&F cutter ø100 ER3
6. -do- ø100x5x45

TECHNICAL REQUIREMENTS

1. Non-uniformness by dimensions **B** is 0.5 mm.
2. Cuttings are not allowed on surface 'B'
3. \* Dimension for reference.

RSV	SA				
PRED	CHD	APPD	P&TE-REF	ISSUE	DATE

PLANNING SHEET - PDO/EFA FORM No: EFA/P-039

NOMENCLATURE

ARTICULATED CONNECTING ROD

DRAWING No.  
20-04-19 -4

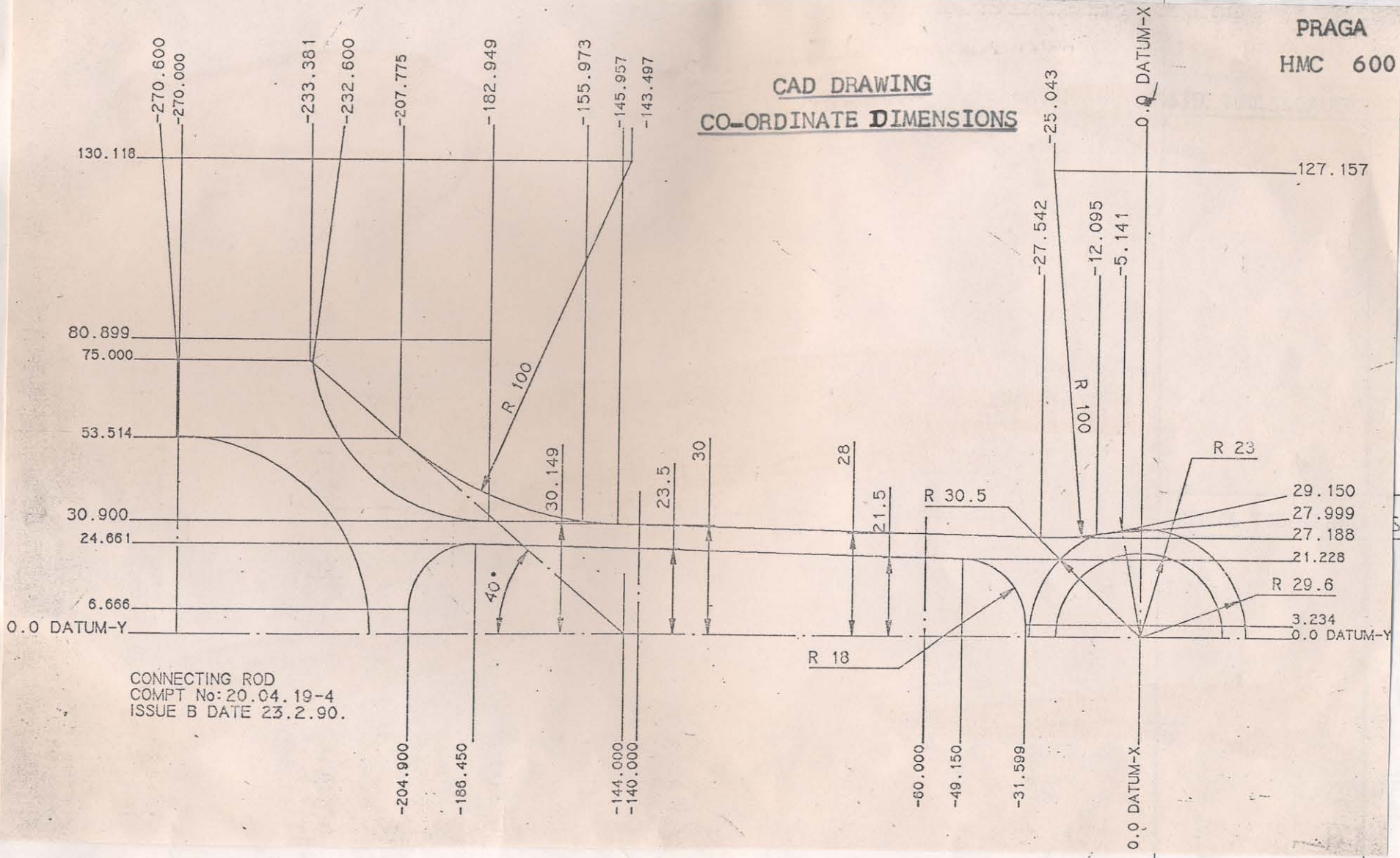
ISSUE

OPN. No.  
050

OPERATION  
MILLING

PRAGA  
HMC 600

CAD DRAWING  
CO-ORDINATE DIMENSIONS



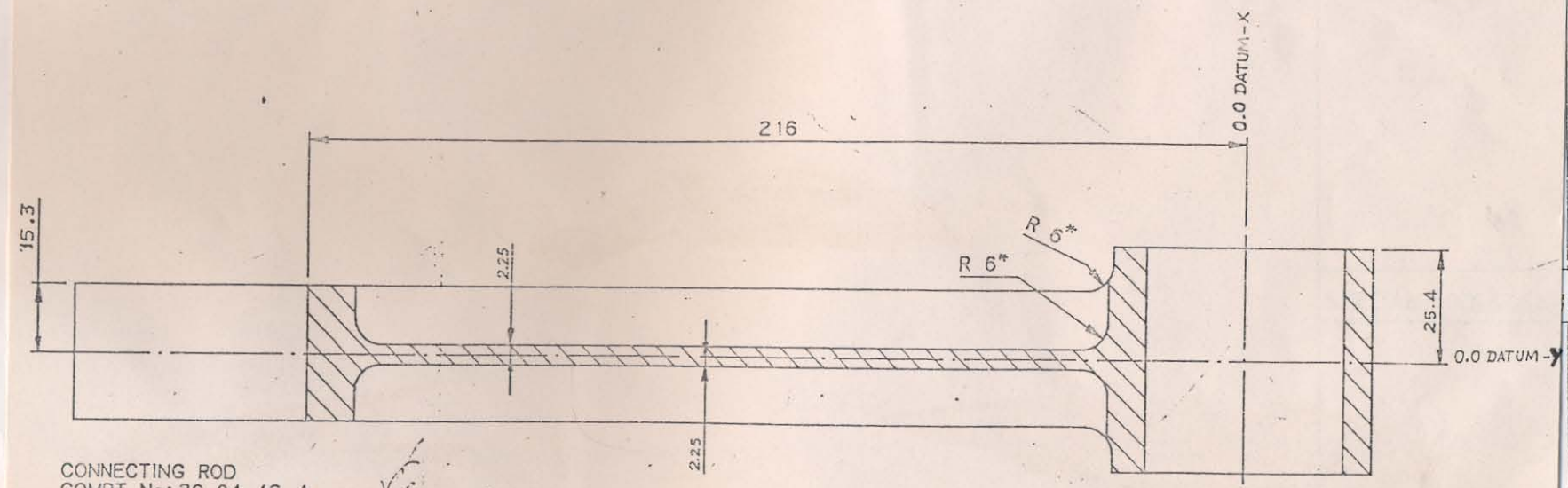
CONNECTING ROD  
COMPT No: 20.04.19-4  
ISSUE B DATE 23.2.90.

PRED	CHD.	APPD	P&TE-REF	ISSUE	DATE

ARTICULATED CONNECTING ROD. 20.04.19-4.

INTERNAL PROFILE. (CAD.DRG)

COORDINATE DIMENSIONS

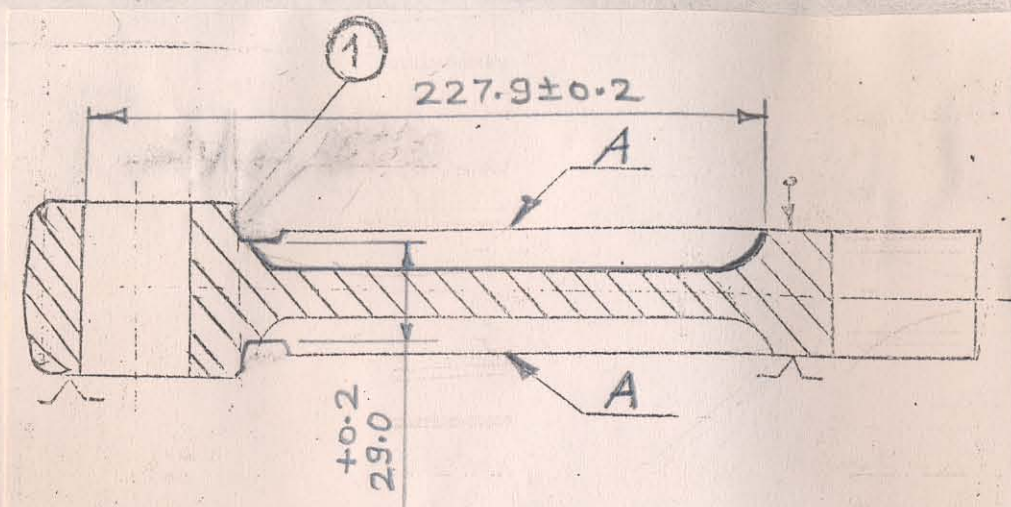


CONNECTING ROD  
COMPT No: 20.04.19-4  
ISSUE 'A' Date.22.7.89

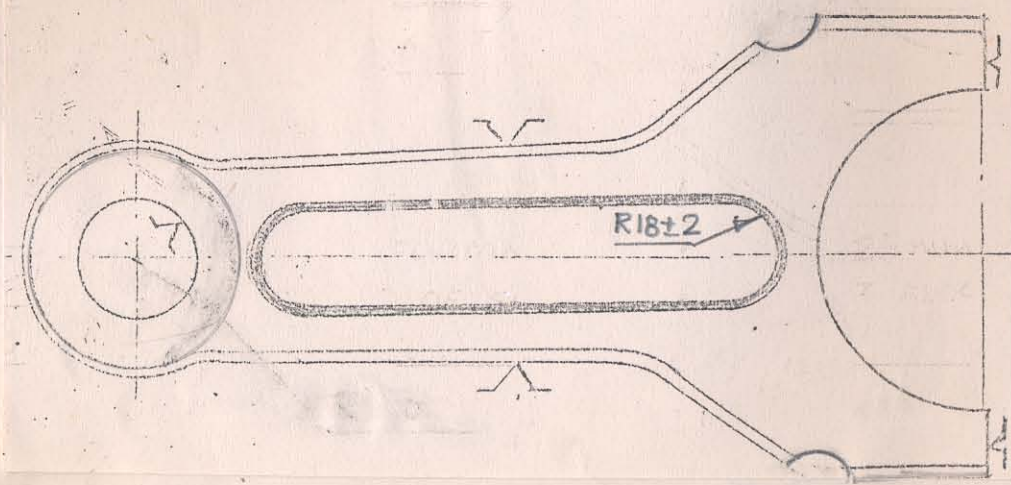
*Handwritten signature*  
26.01.89

\* ENSURED BY TOOL .

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SET UP V



TECHNICAL REQUIREMENTS

Surface finish of surface 'A' is  $0.25 \mu m$  Ra. Cutting of surface 'A' is not allowed.

PREP	CHD	APPD	P&TE-REF	ISSUE	DATE
RSV					

060 MILLING  
MACHINE: PRAGA  
HMC 600

- STD. TOOLS & GAUGES
- Face milling cutter  $\phi 80$   
M40 SP15
  - Insert:  
SPKN 1504  
TTR EDR
  - CC end mill  $\phi 25$   
Widia No. 69396417  
Insert:  
ICMT 110204  
SCMT 09T308

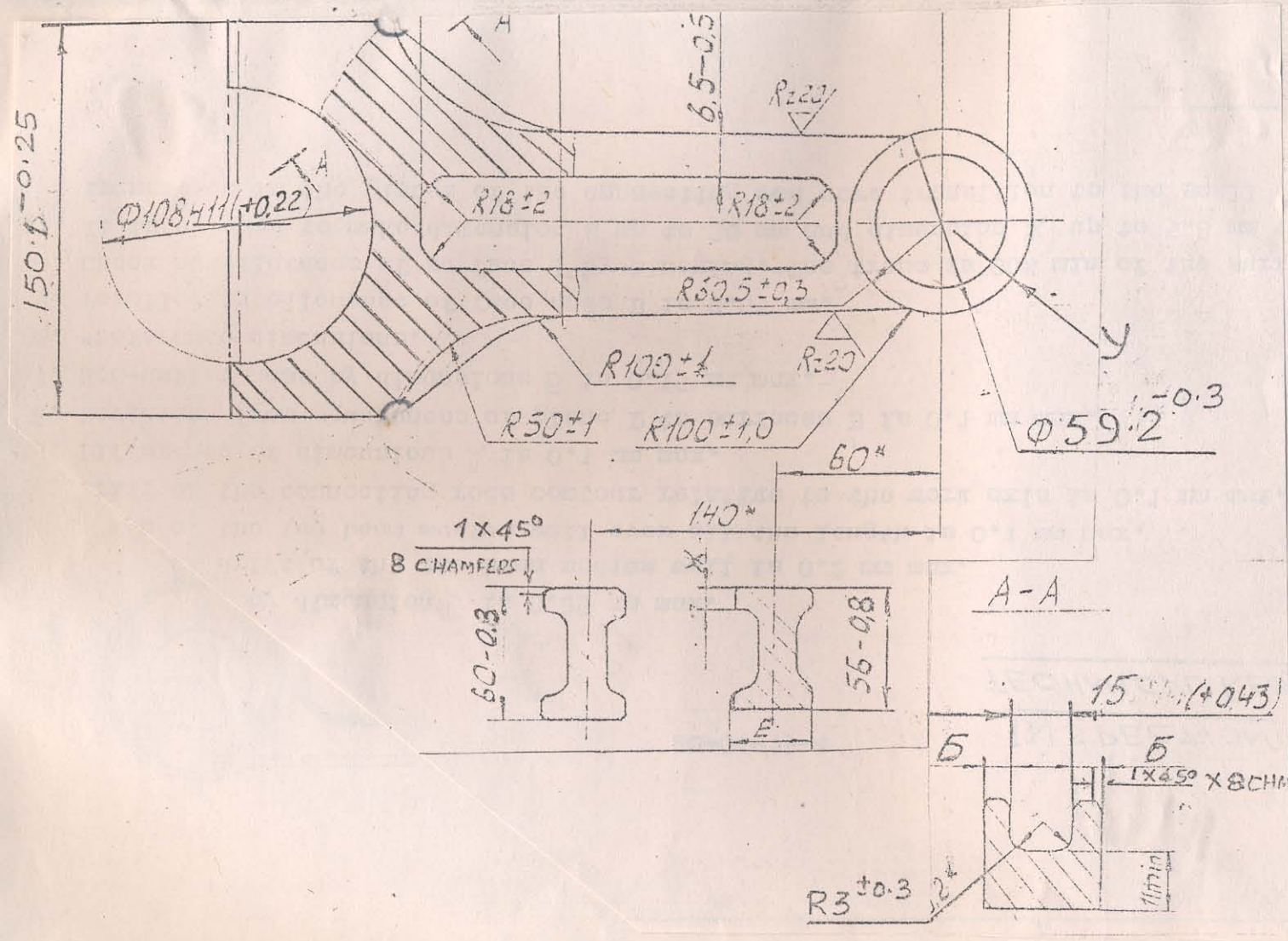
- SPECIAL TOOLS & GAUGES
- Carbide tipped brazed end mill  
 $\phi 30 \times 5 \times 45$  46/00/00
  - do-  
 $\phi 30$  ER6 46/00/002
  - Fixture 201262
  - Solid carbide end mill  $\phi 10 \times 40$

MACHINE: PRAGA  
HMC 600

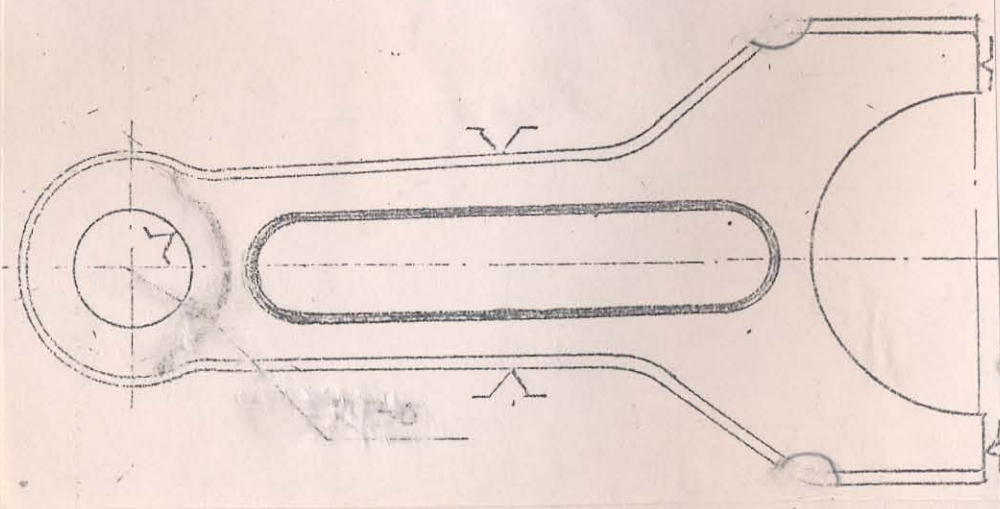
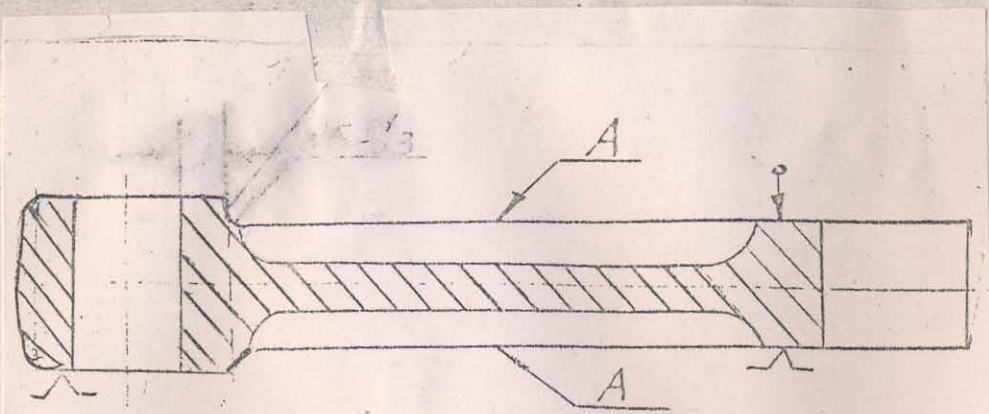
STD. TOOLS & GAUGES

- 1. Pneumatic Grinder
- 2. Mounted points
- 3. Half round file 150 mm
- 4. Emery sheets.

SPECIAL TOOLS & GAUGES



PRED	CHD	APPD	P&TE-REF	ISSUE	DATE



TECHNICAL REQUIREMENTS

- 1. Tool marks are not allowed

MACHINE:  
BENCH

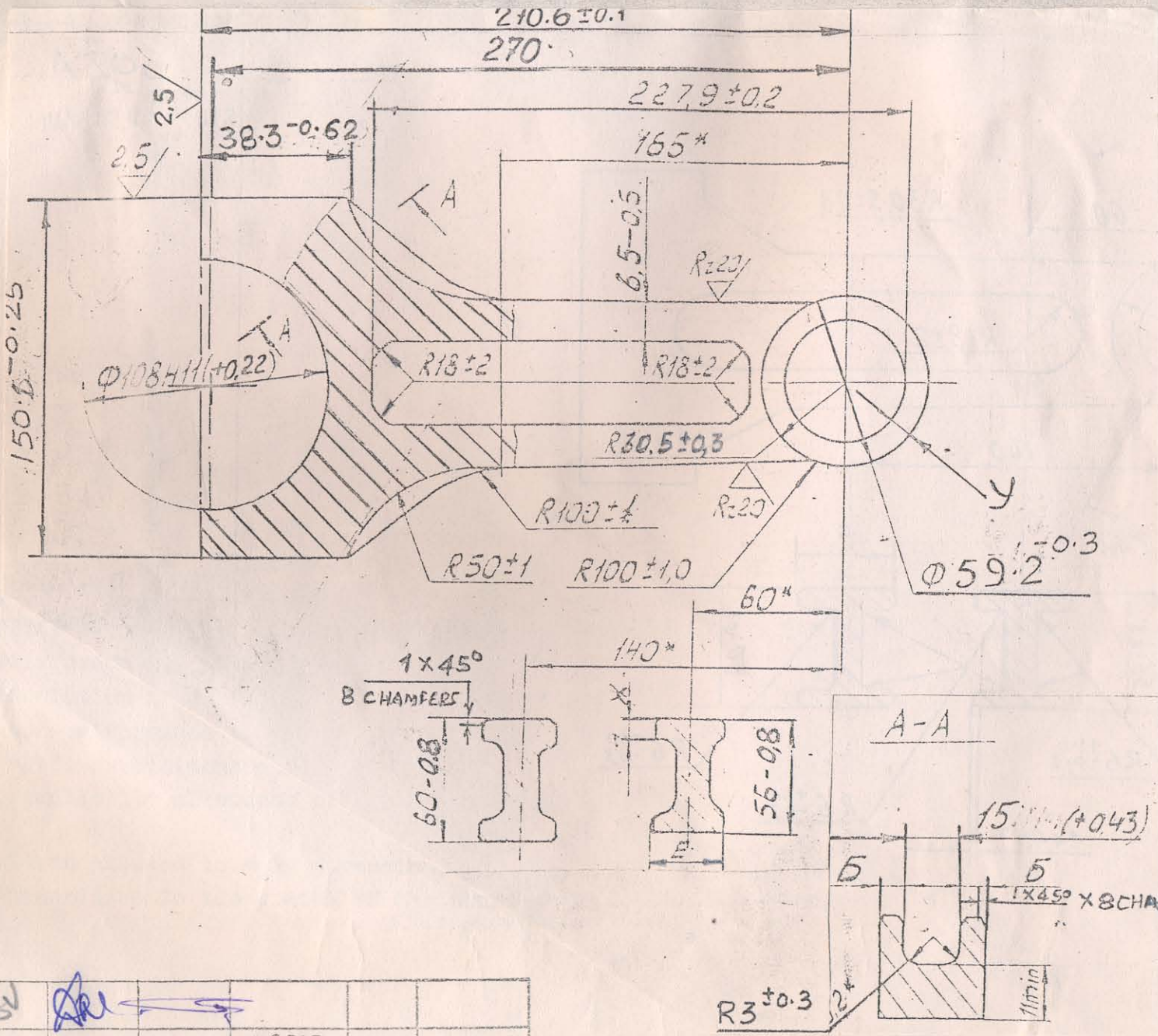
STD. TOOLS & GAUGES

- 1. Pneumatic Grinder
- 2. Polishing Wheel

69/00/01  
69/00/01

SPECIAL TOOLS & GAUGES

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RBN	[Signature]	[Signature]			



MACHINE:

STD. TOOLS & GAUGES

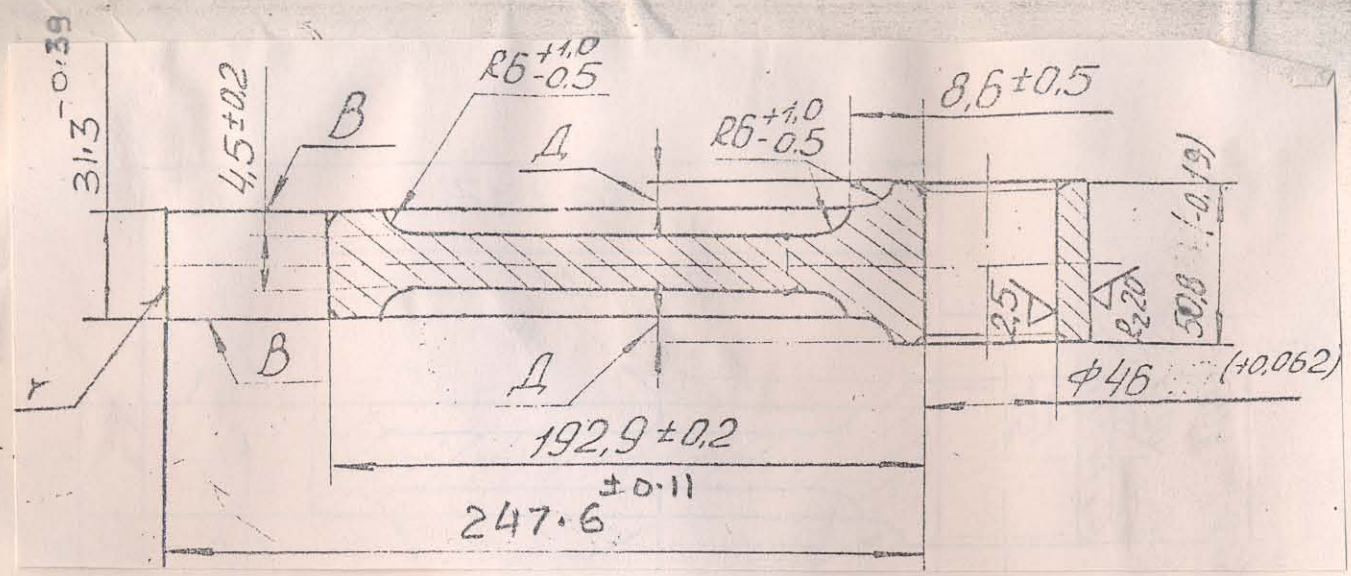
8. Gap gauge	25/04/20
50.8 -0.19	

SPECIAL TOOLS & GAUGES

1. Plate gauge	23/32
$\Phi 108$	
2. Profile gauge	203035
gauge R50	
3. Gap gauge	26/01/38
60 -0.8	
4. Gap gauge	26/01/39
56 -0.8	
5. Gap gauge	25/03/26
31.3 -0.39	
6. Length gauge	027/1
192.9 +0.2	
7. Plug gauge	20/10/1
$\Phi 46 +0.062$	

PRED	END	APPD	P&TE-REF	ISSUE	DATE

MACHINE:



TECH. REQTS:-

1. Difference by dimension  $\gamma$  is 0.25 mm max.
2. Parallel drift of the tee beam medium wall is 0.2 mm max.
3. Slope of the tee beam medium wall over all the length is 0.1 mm max.
4. Drift of the connecting rods contour relative to the work axis is 0.1 mm max.
5. Difference of dimensions  $\Delta$  is 0.15 mm max.
6. Deviation from squareness of plane  $\Gamma$  to surfaces B is 0.1 mm max.
7. Non-uniformness by dimensions  $\delta$  is 0.15 mm max.
8. \*Reference dimensions.
9. Parallelity allowance of face ends B is 0.1 mm.
10. It is allowed to make dimension E up to 30 mm and dimension X up to 5.8 mm with smooth transition in the places of the connecting rod core transition to the small end.

STD. TOOLS & GAUGES

SPECIAL TOOLS & GAUGES

PRED	CHD	APPD	P&TE-REF	ISSUE	DATE