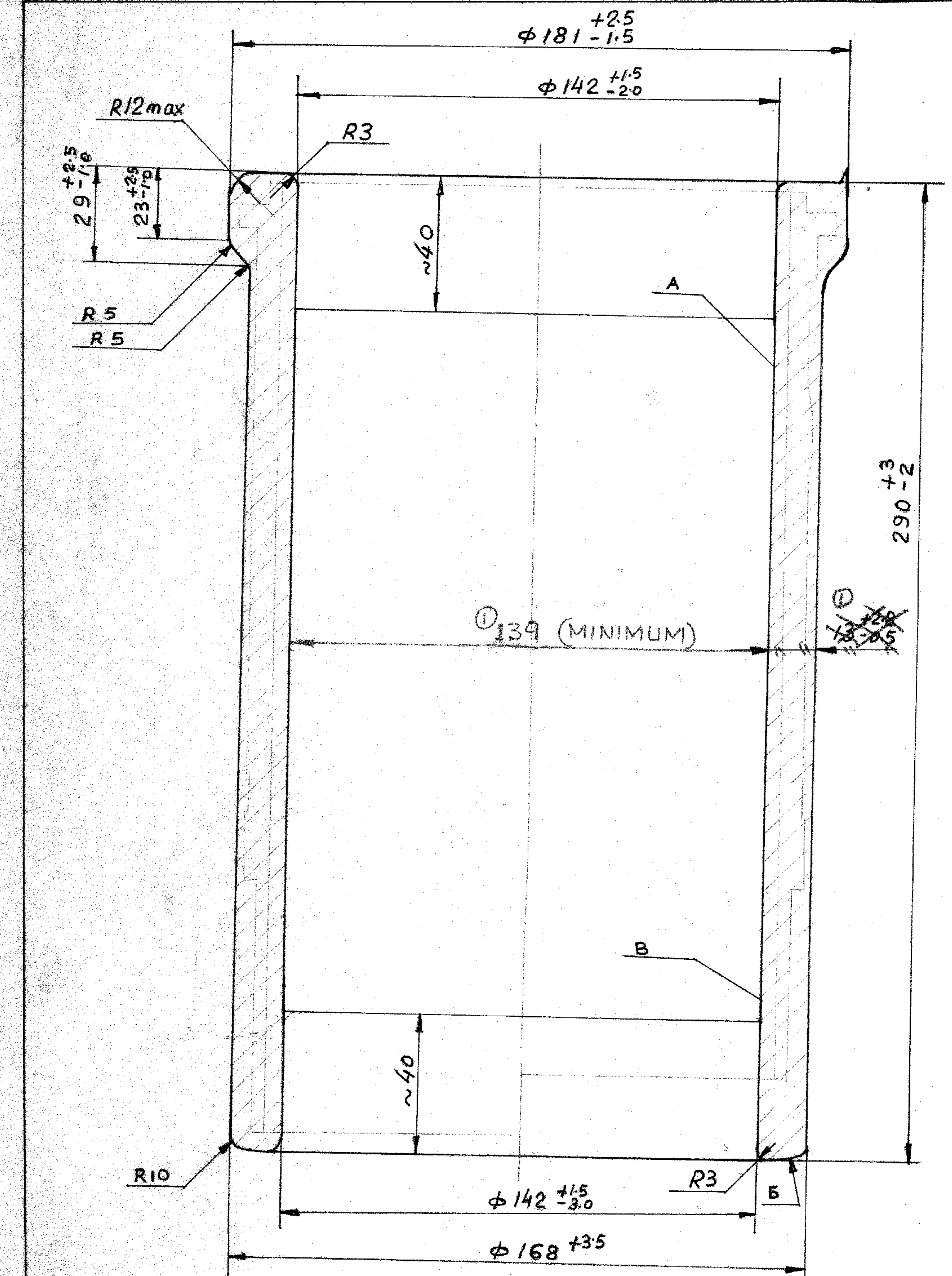


1. Поверхностные дефекты (вмятины, забоины, следы от окалины) в зонах высодки глубиной не более 0,5 фактического припуска.
2. Металлургические дефекты на поверхностях, не подвергаемых высадке, согласно ТУ на поставку труб.
3. Металлургические дефекты выточке не подлежат.
4. Смещение по плоскости разъема штампов не более 10мм.
5. Допускается заусенец по линии разъема штампа и торцевый по ϕ168 не более 2мм, торцовый по ϕ181 – не более 7мм.
6. На поверхности Б допускается заштампованный заусенец (контролировать 2% проточкой)
7. Внутри трубы, в местах А и Б, допускается кольцевой наплыв.
8. Поковки маркировать условным № плавки, а сдача производится не поплавочно.
9. Поковки сдавать вместе со свидетелями в количестве: 2 свидетеля на 300 штук. В качестве свидетеля должны направляться отрезки труб длиной не менее 200мм.
10. Допускается поставка свидетелей в размере месячной программы

11. Термообработать на твердость согласно чертежу детали.

1. SURFACE DEFECTS (DENTS, NICKS, SCALE MARKS) IN THE UPSETTING AREAS SHOULD BE TO A DEPTH OF NOT MORE THAN 0.5 OF ACTUAL ALLOWANCE.
2. METALLURGICAL DEFECTS ON THE SURFACES, NOT SUBJECTED TO UPSETTING, ARE IN ACCORDANCE WITH TY 14-3-579-76 FOR THE SUPPLY OF PIPES.
3. METALLURGICAL DEFECTS ARE NOT SUBJECTED FOR TURNING OPERATION.
4. SHIFT ALONG THE DIE FLASH PLANE SHOULD NOT EXCEED 10 mm.
5. FIN ALONG THE DIE FLASH LINE AND END FACE FIN ALONG ϕ168 NOT EXCEEDING 2 mm, END FACE FIN ALONG ϕ181 - 7 mm MAX. ARE ALLOWED.
6. FORGED FIN (2% WITH THE RECESS TO BE CHECKED) IS ALLOWED ON THE SURFACE Б.
7. RING FLASH ROLL IS ALLOWED INSIDE THE PIPE AND AT THE PLACES OF A AND B.
8. FORGINGS ARE TO BE MARKED WITH THE CONVENTIONAL HEAT NO. & TO BE ACCEPTED IRRESPECTIVE OF HEAT NO.
9. FORGINGS ARE TO BE SUPPLIED TOGETHER WITH TEST PIECES: 2 TEST PIECES FOR 300 PIECES. PIPE CUT TO A LENGTH OF 200 mm MIN SHOULD BE DESPATCHED AS TEST PIECE.
10. TEST PIECES CAN BE SUPPLIED AS PER MONTHLY SCHEDULE.
11. TO BE HEAT TREATED FOR HARDNESS - HB 255-302 IN ACCORDANCE WITH THE COMPONENT DRAWING 303-07-22.

303-07-22
~~20-01-50-1~~
Поковка
(Гильза)
38Х2МЮА
ТУ 14-3-579-76

ISSUE N	N OF A	AMENDMENT	SIGN/DATE
①	8	DIMN. 13 +2.8 -0.5 is deleted. DIMN. 139 MINIMUM IS ADDED	09/04/07

ISSUE	DATE	REFERENCE

APPROVED	B.K.SAHA	
CHECKED	GKM	
DRAWN	A.K.BURMAN	

303-07-22 ~~& 20-01-50-1~~

CYLINDER LINER (FORGING FROM PRESS OF CAPACITY 1250T)

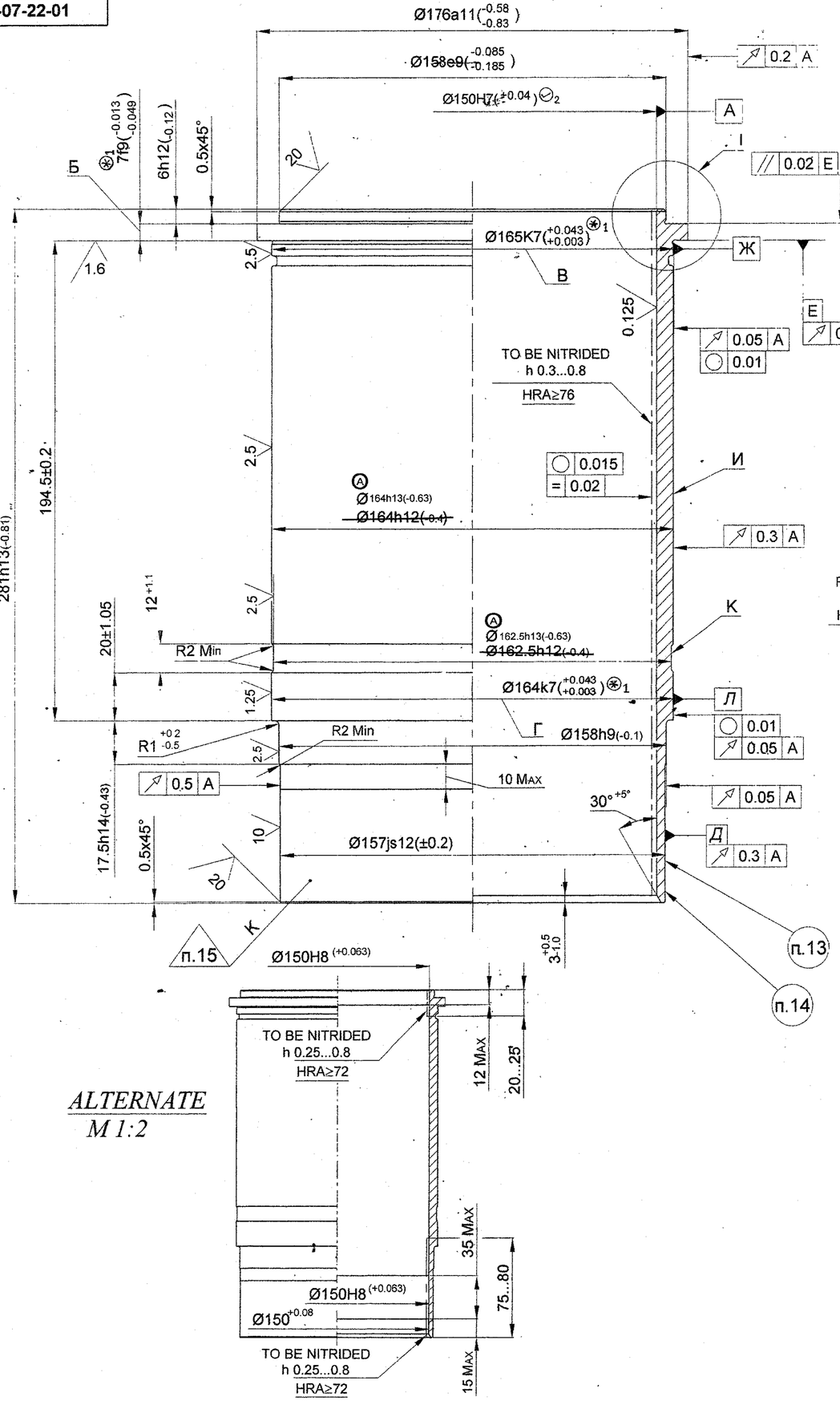
LETTERS	MASS	
	16.32 Kg	1:
SHEET		

STEEL 38X2MЮA
TY 14-3-579-76

ENGINE AVA

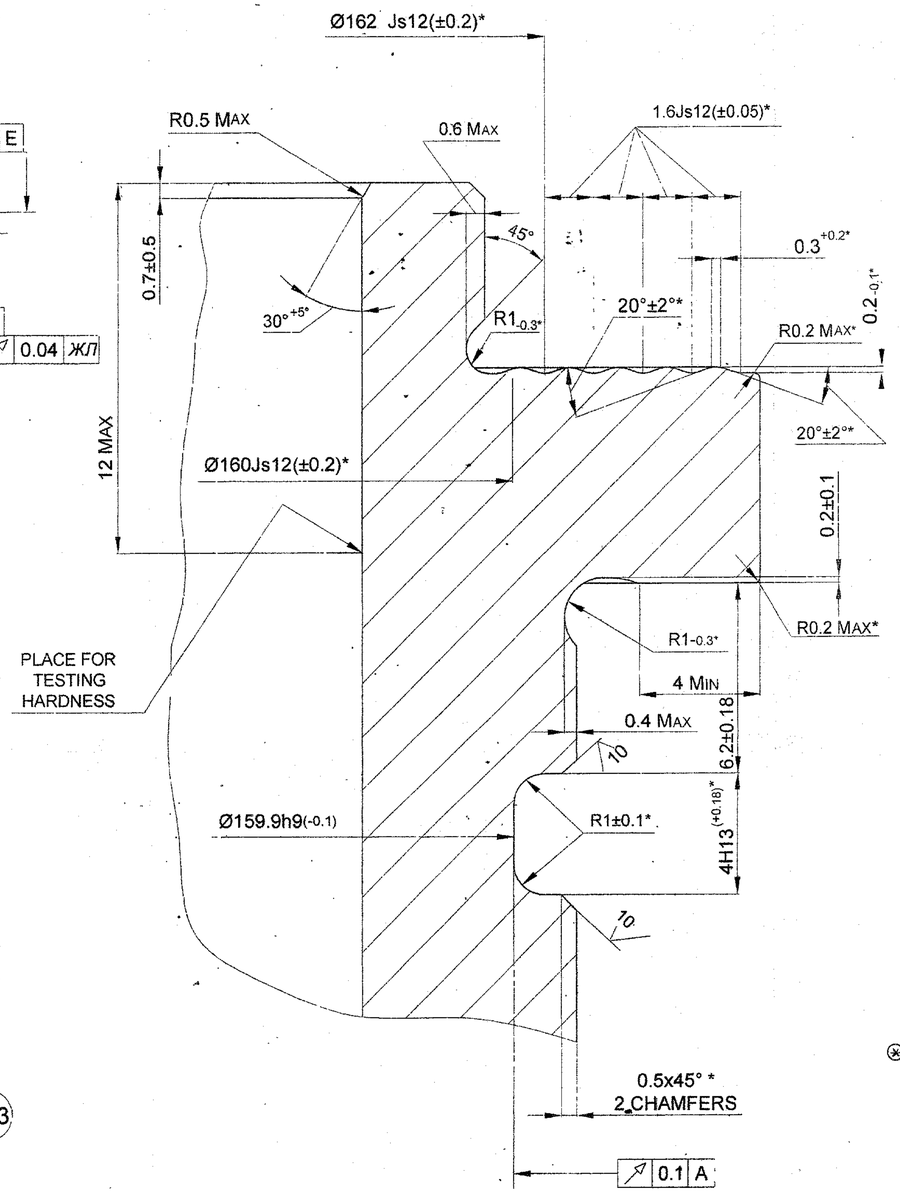
DRAWING NUMBER
303-07-22-01

5 (√)



ALTERNATE
M 1:2

I
M (10:1)



1. *Inspection group II as per TT-11.*
2. *255...302 HB; Minimum 10% of components to be checked at random from every heat-treated batch.*
3. *After final heat treatment, the components are accepted according to TTM-84-84.*
4. *Coating of surfaces ' И ' and 'K' with Milky chromium plating 15...30 and hydrogen embrittlement to be removed.*
5. *Nitriding layer on upper and lower chamfers of surface 'A' is allowed.*
6. *Following is allowed on the surface A :*
   a). Micro flaw(Non metallic inclusions) by flushing the nitrided layer with nitrogen around them,detected on surface as thin,dark lines,visible with naked eye.
   b). Hairlines,occured along the fibres,to a length up to 5mm to a maximum 5 nos on liner,hairlines to a width up to 10 mm.It is allowed to have Maximum 2 nos on band among themselves for minimum 100 mm and from upper end face minimum 75mm.
7. *Marks of maximum 2 numbers to a depth upto 0.3 mm are allowed on surface 'Д'.*
8. *Forging defects,breaking of nitriding layer and corrosion marks are not allowed.*
9. *Cracks are not allowed.*
10. *Deviation of surface plane 'E' to be checked by bluing, the imprint should be uniform along the circumference, having a width of minimum 1.8 mm around the circular surface.*
11. *In the bottom part of surface A for a width of 8mm for an arc length of 1/3 rd of circle direction of roughness area that does not coincide with the direction of area of the remaining surface is allowed.*
12. **Dimension to be ensured by tool.*
13. *To be marked with electrograph or with die as per ИЛ-581-85 solution No3 designation 303-07-22-01 and absolute value of dimensions 'B' and ' Г', rounded up to 0.01 mm,Letter type as per ПО-6 GOST 2930-62.*
14. *To be marked with electrograph or with die as per ИЛ-581-85 solution No.3 the minimum value of dimension 'Б' rounded to 0.01 mm. Letter type as per ПО-6 GOST 2930-62.*
15. *To be stamped with electrograph or die as per ИЛ-581-85 solution No.3,Letter type as per ПО-6 GOST 2930-62.*
16. *It is allowed to inspect the allowance for roundness and the profile of longitudinal section by measuring the ovality and conicity.*
17. *Variation of values of alignment of surfaces " Ж' and 'Л' relative to the surface 'A' while measuring from one plane should not exceed 0.03 mm.*
18. *Surface 'И' and 'K' to be nitrided h 0.3...0.88 mm. HRA ≥76,instead of Milky chromium plating 15...30 is allowed. Surfaces 'Ж' and 'Л' to be nitrided h 0.2...0.55 mm is allowed.*
19. *Repair size dimensions are added based on letter no. 82847/OH/QAD/ED dated 26 Dec 94 Appendix -'A'. Repair size dimensions to be stamped with electrograph or dye as per UJT-16-73 solution N3. From the bottom 25mm of outside diameter, mark repair sizes R_1, R_2, OS1, OS2 and OS3 respectively.*

MARK REPAIR SIZE DIMENSIONS WHERE INDICATED THUS ⊛ ✓

SL.No.	REPAIR SIZES (mm)			REMARKS
	R_1		R_2	
⊛1	$165.5_{K7}^{+0.043\ +0.003}$		$165.5_{K7}^{+0.043\ +0.003}$	1. ALL OTHER SIZES, SURFACE FINISH, MATERIAL AND TECHNICAL REQUIREMENTS ARE SAME.
⊛1	$164.5_{K7}^{+0.043\ +0.003}$		$164.5_{K7}^{+0.043\ +0.003}$	2. FROM THE BOTTOM 25mm OF OUTSIDE DIA MARK REPAIR SIZES R_1, R_2, OS1 OS2 AND OS3.
⊛1	$7f_9^{-0.013\ -0.042}$		$7.5f_9^{-0.013\ -0.042}$	
✓2	OS 1	OS 2	OS 3	
	$150.100_{H7}^{+0.04}$	$150.200_{H7}^{+0.04}$	$150.250_{H7}^{+0.04}$	

11.08

PILOT SAMPLE SHOULD BE APPROVED BY A H S P BEFORE BULK PRODUCTION.

EST. WT.(Kg)	TO BE STAMPED OR MARKED WHERE INDICATED THUS # (LETTERS)
6.528	

ALL SHARP EDGES AND CORNERS TO BE REMOVED UNLESS OTHERWISE STATED MACHINED CORNERS TO HAVE R OUT-SIDE R. INSIDE EQUIVALENT CHAMFERS ARE PERMISSIBLE

ISSUE	DATE	NATURE OF AMENDMENTS
A	303-06	Dt.23-09-08

DRN	
CHD	
APPD	
DATE	16/12/04
SCALE:-	1 : 1
DIMENSIONS IN mm	
TOLERANCE ON DIMNS UNLESS OTHERWISE STATED IS : 2102 - 69	
ALL THREADS TO CONFORM TO	

MATERIAL :- *STEEL 38X2MIOA TY 14-3-579-76*

USED ON :- СБ 303-00-16, СБ 303-01-16

CONTROLLERATE OF QUALITY ASSURANCE (HEAVY VEHICLES) AVADI

TITLE :- **CYLINDER LINER**

D S CAT NUMBER

DRAWING NUMBER **303-07-22-01**

FORM NO EFA/P-047

ENGINE FACTORY, AVADI

PROCESS SCHEDULE

DESCRIPTION :- CYLINDER LINER

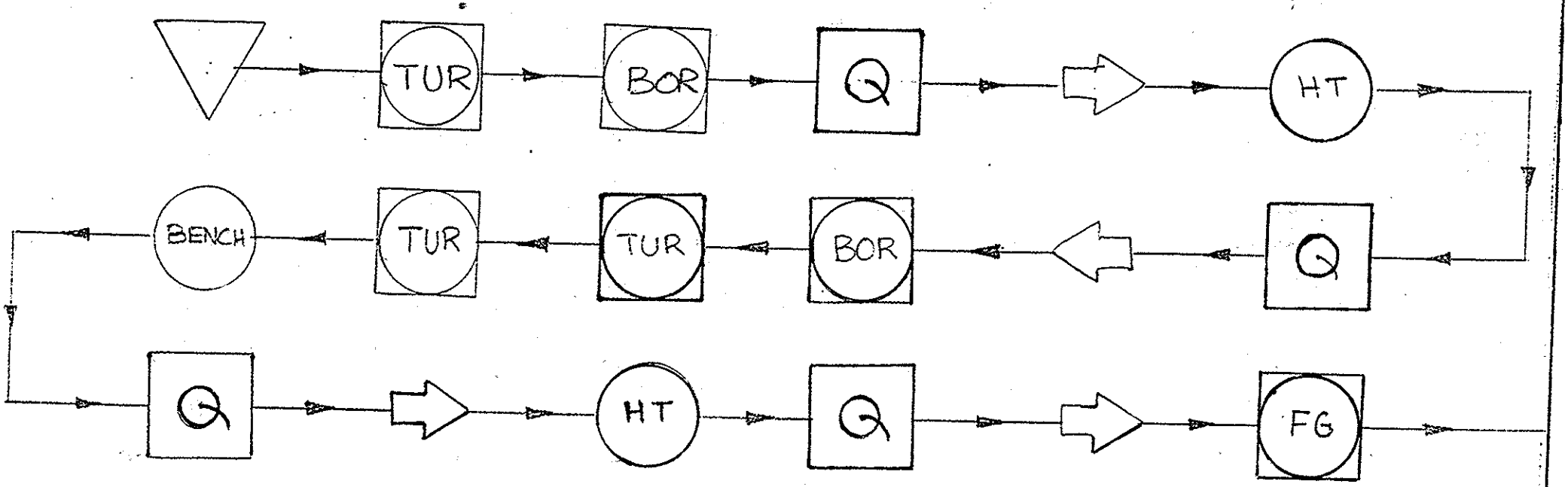
COMPT. No :- 303-07-22

MFG. SHOP :- MPS

REV. NO. 01
DATE :- 22.06.2K

FLOW PROCESS CHART

STORE : CYLINDER LINER | DRG. NO. : 303-07-22 | END STORE : V46-6-ASSEMBLY

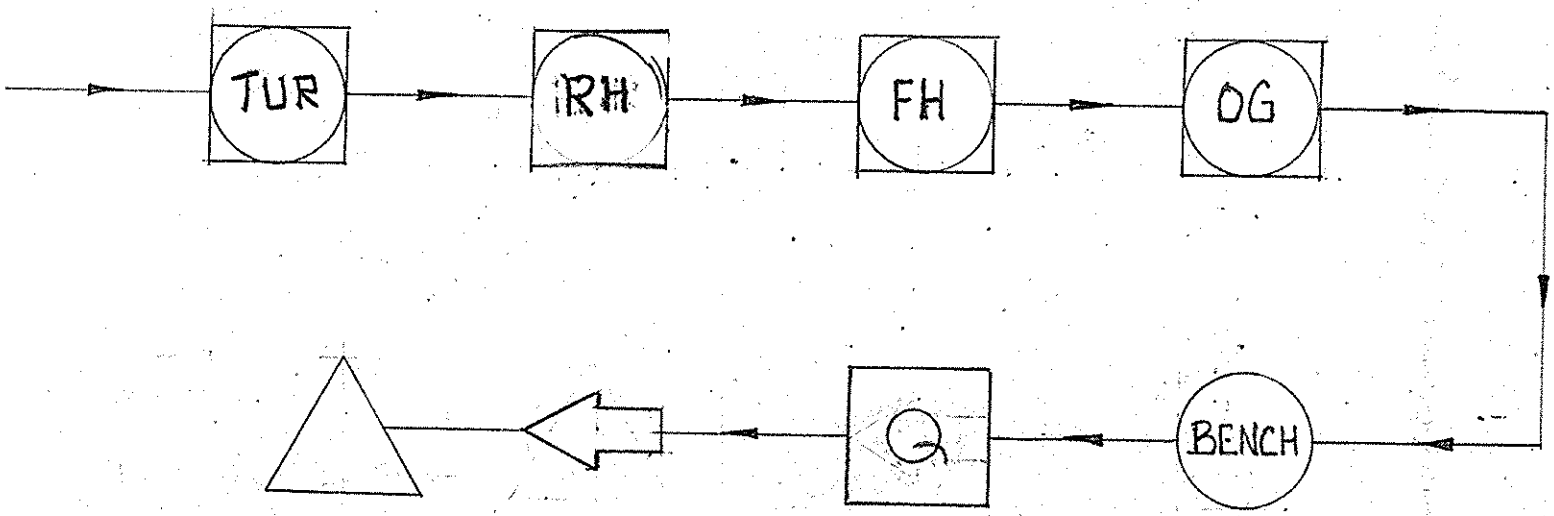


TUR = TURNING | BOR = BORING | HT = HEAT TREATMENT | FG = FACE GRINDING

LEGEND				APPROVAL			SECTION	MPS
TEMP. STORAGE	▽	TRANSPORTATION	⇨	SIGNATURE & DATE			NO. OF SHEETS	2
OPERATION	○	INSPECTION BY QC	Q	PREPARED BY	MGE	QC	SHEET NO.	1
OPERATION CUM INSPECTION	◘	INSPECTION BY SQAE/CQA ME) Etc	I	APPROVED BY	22/6/2K		ENGINE FACTORY AVADI, MADRAS-54.	
100 % INSPN. BY MFG SEC	□	STORAGE	△	AUTHORISED FOR ISSUE	22/6/2K			

FLOW PROCESS CHART

STORE : DRG. NO. : END STORE :



RH = ROUGH HONING	FH = FINISH HONING	OG = OD GRINDING

LEGEND				APPROVAL			SECTION	MPS
TEMP. STORAGE	▽	TRANSPORTATION	⇨	SIGNATURE & DATE			NO. OF SHEETS	2
OPERATION	○	INSPECTION BY QC	Q	PREPARED BY	MGR	QC	SHEET NO.	2
OPERATION CUM INSPECTION	◎	INSPECTION BY SQAE/CQA(ME) Etc	I	APPROVED BY	22/6/2K			
100% INSPN. BY MFG SEC	□	STORAGE	△	AUTHORISED FOR ISSUE	22/6/2K		ENGINE FACTORY AVADI, MADRAS-54	

ENGINE FACTORY AVADI

FORM No :EFA/P-038

PROCESS SCHEDULE

NOMENCLATURE : CYLINDER LINER
DRAWING No : 303-07-22
MATL. SPECIFICATION : STEEL 38X2MLOA FORGING

OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
000	FORGING	4				
010	TURNING	5	CNC LATHE STC-25			
020	BORING	6	CNC LATHE STC-25			
030	INSPECTION	7	BENCH			
035	STABILIZING	8	HTP			
040	INSPECTION	9	BENCH			
050	BORING	10	CNC LATHE STC-25			
055	TURNING	11	CNC LATHE STC-25			

PREPARED BY	CHECKED BY	APPROVED BY	AUTHORISED BY
SIGN	SIGN	SIGN	
DATE 16/6/2K	DATE 22/6/2K	DATE 22/6/2K	22/6/2K
CH/M-II CT/PDO	HOS/PDO	HOS/PDO	DO/PDO

PDO REF	ISSUE	DATE	SIGN

SHT. No 1 OF 25

ENGINE FACTORY AVADI

FORM No :EFA/P-038

PROCESS SCHEDULE

NOMENCLATURE : CYLINDER LINER
DRAWING No : 303-07-22
MATL SPECIFICATION : STEEL 38X2MHOA FORGING

OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
057	TURNING	12	CNC LATHE STC-25			
058	DEBURRING	—	BENCH			
060	INSPECTION	13 & 14	BENCH			
070	NITRIDING	15	HTP			
080	INSPECTION	16	BENCH			
090	FACE GRINDING & OD SKIMMING	17	CNC-CYL GRINDER GNC 18			
~~095~~ 100	ROUGH HONING	18	HONING M/C			OPN No 100 Rough honing was OPN 095 R. honing.
~~100~~ 95	TURNING	19	CNC LATHE STC-25			OPN 095 Turning was OPN 100 Turning NODA No 178 dt 17.06.11

PREPARED BY	CHECKED BY	APPROVED BY	AUTHORISED BY
SIGN [signature]	SIGN [signature]	SIGN [signature]	[signature] 22/6/22
DATE 16/6/2K	DATE 22/6/22	DATE 22/6/22	
CM/II /PDO	/PDO	HOS/PDG	DO/PDG

PDO REF	ISSUE	DATE	SIGN

SHT. No 2 OF 25

ENGINE FACTORY AVADI

FORM No :EFA/P-038

PROCESS SCHEDULE

NOMENCLATURE : CYLINDER LINER
DRAWING No : 303-07-22
MATL. SPECIFICATION : STEEL 38X2M.HOA FORGING

OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
110	FINISH HONING	20	HONING M/C			
120	OD GRINDING	21 & 22	CYL. GRINDER G-17			
130	DEBURRING	—	BENCH			
140	FINAL INSPECTION	23,24 & 25	BENCH			

PREPARED BY	CHECKED BY	APPROVED BY	AUTHORISED BY
SIGN Sawaha	SIGN	SIGN	
DATE 16/6/2K	DATE 22/6/2K	DATE 22/6/2K	22/6/2K
CM/II /PDO	/PDO	HOS/PDO	DO/PDO

PDO REF	ISSUE	DATE	SIGN

SHT. No 3 OF 25

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

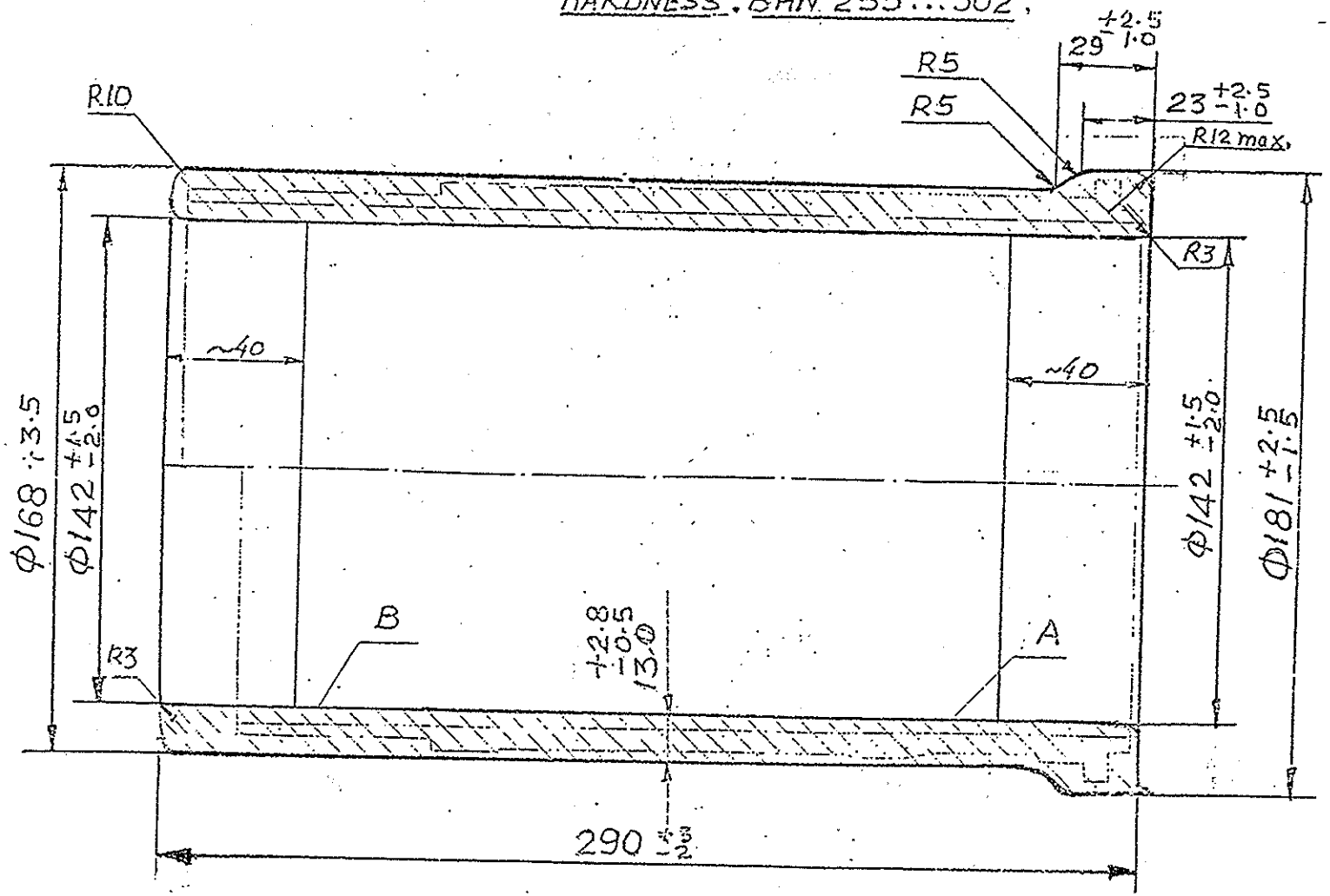
CYLINDER LINER

DRAWING No	ISSUE	C.R. No.	OPERATION
303.0 22		000	FORGING.

MACHINE:

MATERIAL: STEEL 38X2MHOA

HARDNESS: BHN 255...302.



TECHNICAL REQUIREMENTS

1. Surface defects (Dents, nicks, scales) upon upsetting areas should not exceed to a depth of 0.5 of actual allowance.

2. Shift along the die parting line should not exceed 10mm.

3. Fin along the die flashline and end face, along Φ168 should not exceed to 2mm, end face fin along Φ181 should not exceed 7mm.

4. Ring flash roll is allowed inside the pipe and at the places on 'A' and 'B'.

PRED.	CHD.	APPD

FORM No: EFA/F-85

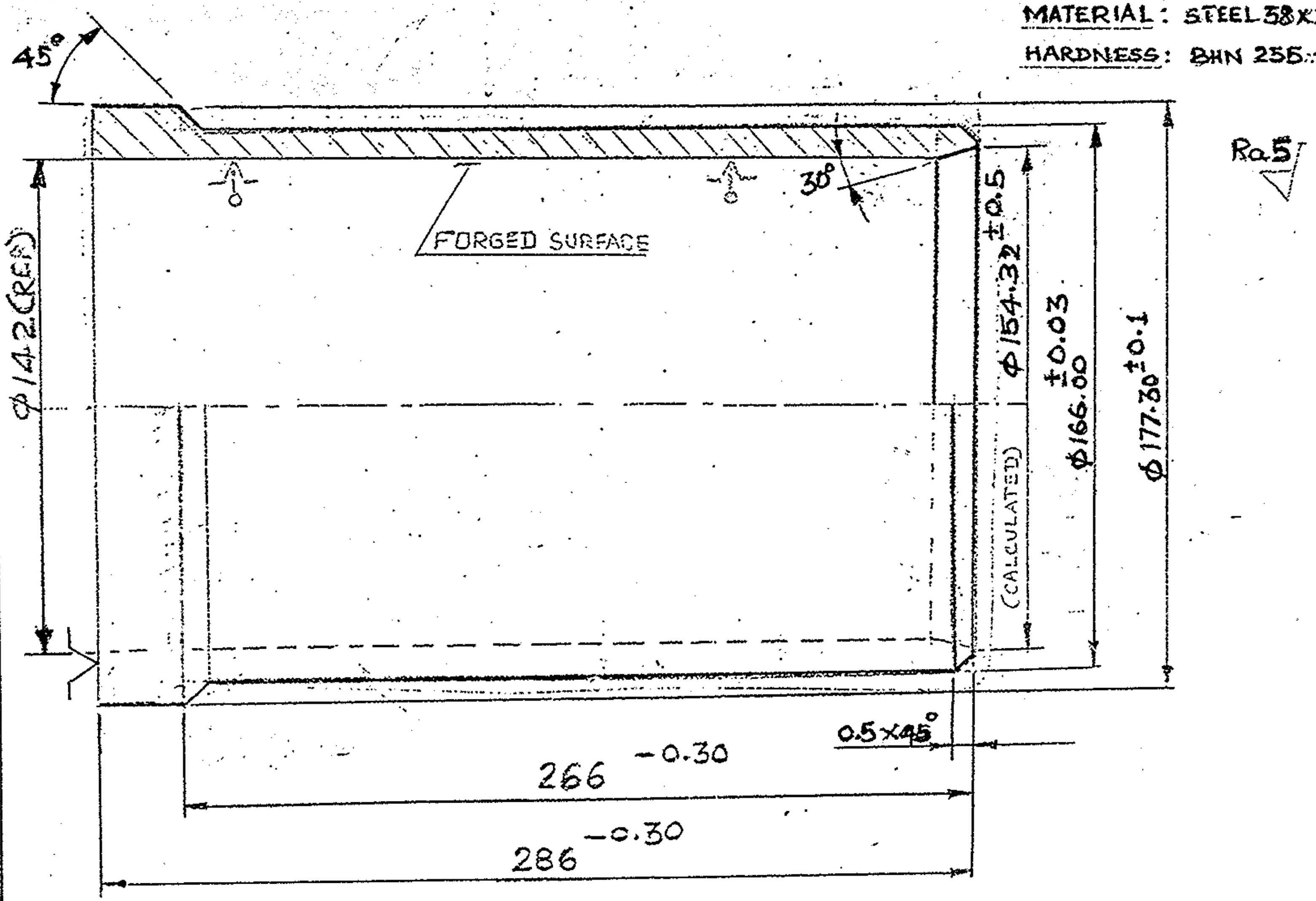
PLANNING SHEET PDO/EFA

NOMENCLATURE	DRAWING No.	ISSUE	OPN. NO	OPERATION
CYLINDER LINER	303-07-22		010	TURNING

MATERIAL: STEEL 38X2MIOA

HARDNESS: BHN 255-302

MACHINE: CNC LATHE HMT - STC 25



STD. TOOLS & GAUGES

TURNING TOOLHOLDER	PSSNL2525 12
INSERT-120404	
TURNING TOOLHOLDER	PDJNL2525 M15
INSERT. DNMG 150604	
BORING TOOL HOLDER	S32U-PCLNL 12
INSERT-CNMG120408	TK35

SPECIAL TOOLS & GAUGES

SPECIAL HYDRAULIC FIXTURE	401608
SNAP GAUGE φ177.3±.1	026/04/9
SNAP GAUGE φ166±.03	026/04/10

PRED	CHD	APPD	PDO REF	ISSUE	DATE

SHEET 5 OF 25

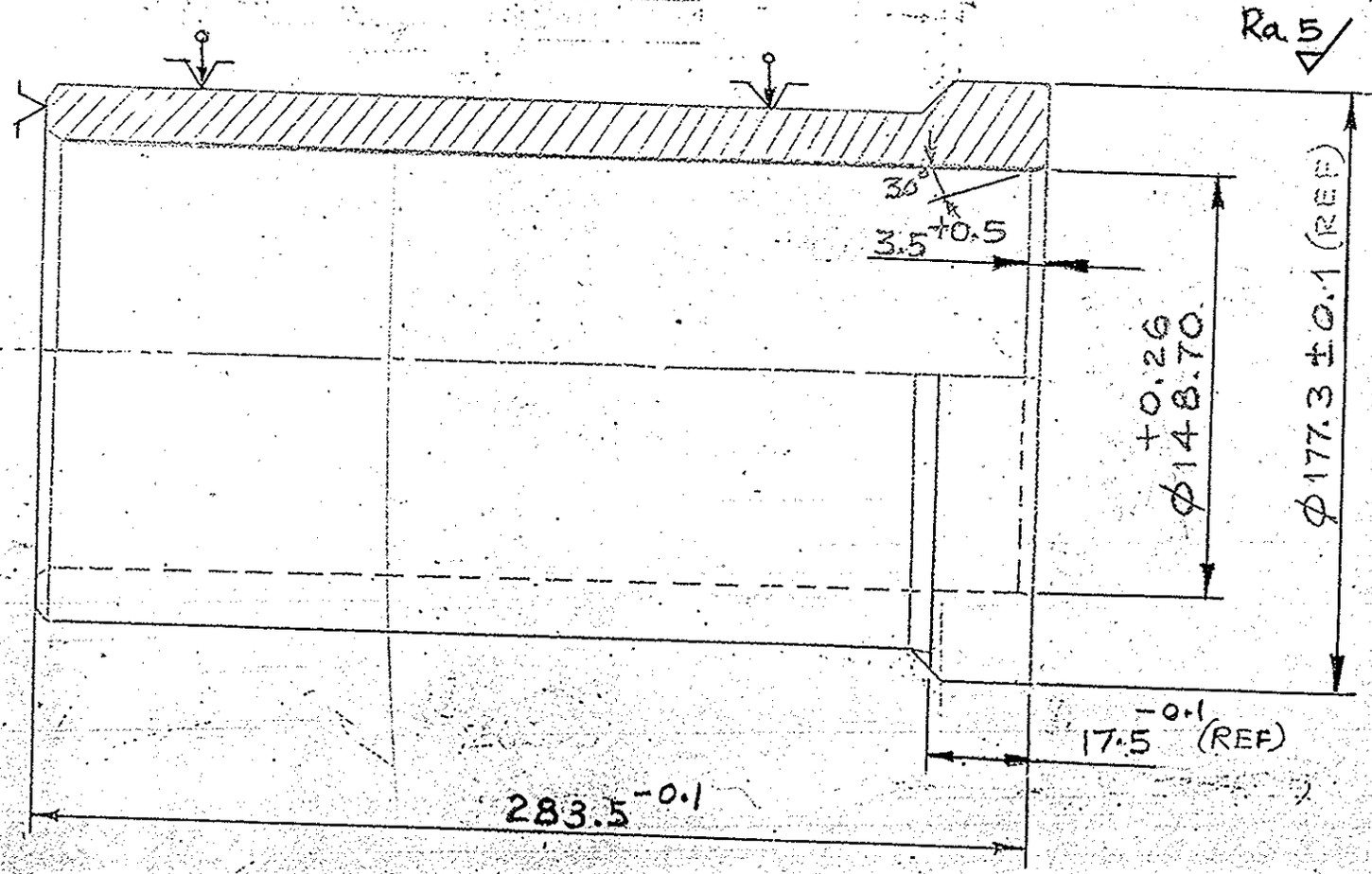
PLANNING SHEET-PD0 /E.F.R. FORM No: EF 23 /P 01

CYLINDER LINER

303-[illegible].22 | ISSUE

O/N. NO.	OPERATION
020	TURNING AND BORING

MACHINE: CNC LATHE STC-25.



STD. TOOLS&GAUGES

HMT SPECIAL BORING BAR (INTEGRAL SHANK) INSERT. CNMG120408	T-4150056228
SPECIAL TUNED BORING BAR (INTEGRAL SHANK) INSERT DNMG 150604	5691-010-03 (SANDVIK)
TURNING TOOL HOLDER INSERT-CNMG120408	PCLNL252512

SPECIAL TOOLS&GAUGES

HYDRAULIC COLLET FIXTURE	401292

TECHNICAL REQUIREMENTS

1. VARIATION IN WALL THICKNESS SHOULD NOT EXCEED 0.15 MM.
2. OVALITY AND CONICITY OF BORE SHOULD NOT EXCEED 0.15 MM.

PRPD	CHD	APPD

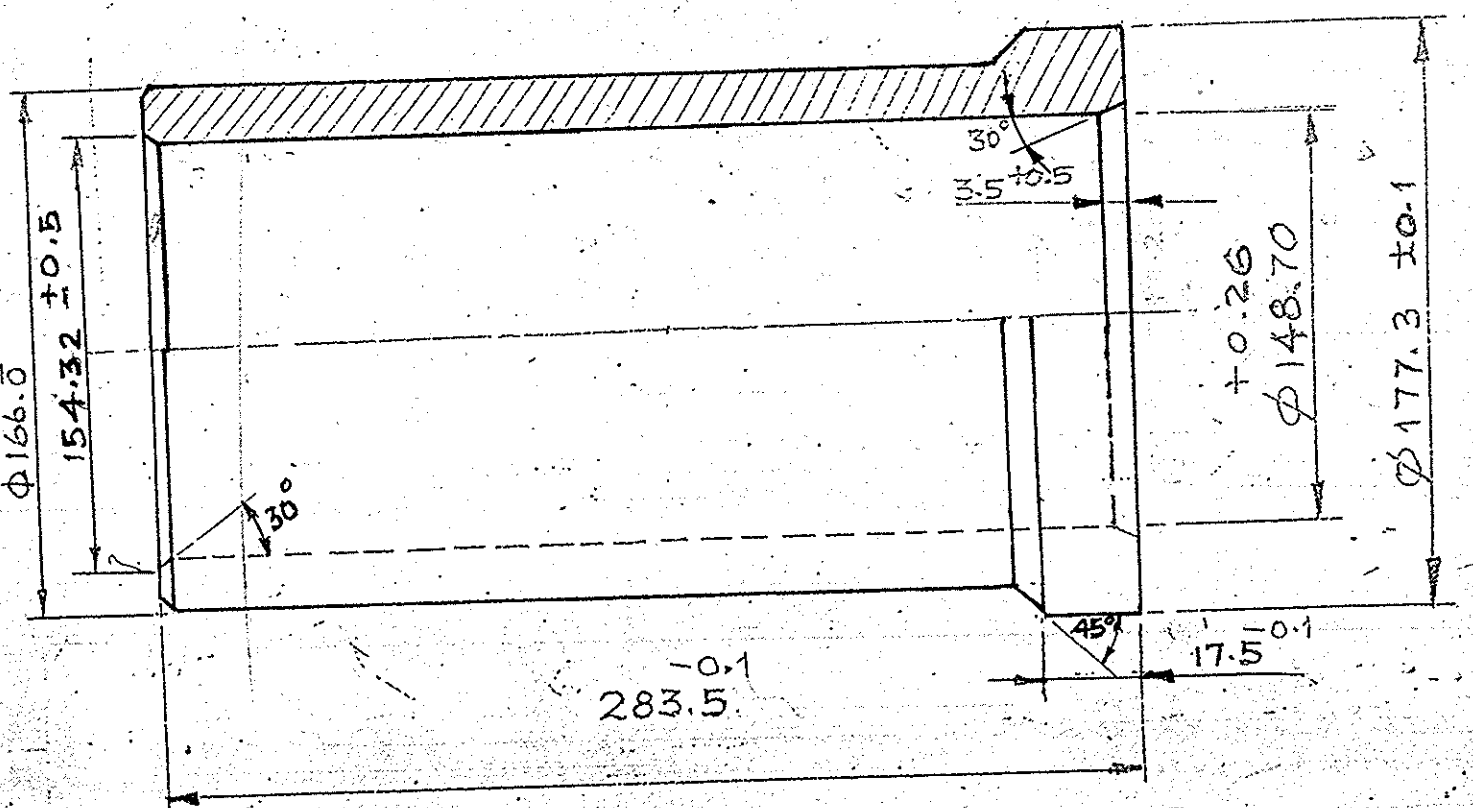
FORM No: EFA/P-C

PLANNING SHEET-PDO / EFA

NOMENCLATURE	DRAWING No.	ISSUE	OPN. No.	OPERATION
CYLINDER LINER	303-07-22		030	INSPECTION

MACHINE:

STD. TOOLS & GAUGES



SPECIAL TOOLS & GAUGES

TECHNICAL REQUIREMENTS

1. VARIATION IN WALL THICKNESS SHOULD NOT EXCEED 0.15 MM.
2. OVALITY AND CONICITY OF BORE SHOULD NOT EXCEED 0.15 MM

NOTE

MEASURE AND RECORD ALL DIMENSIONS & ACTUALS OF TECH. REQTS.

PRPD	CHD	APPD

PLANNING SHEET : PDO/ISFA : FORM No: EFA/P-030

NOMENCLATURE	DRAWING No.	ISSUE	OPN. No.	OPERATION
CYLINDER LINER	303-07-22		035	STABILIZING

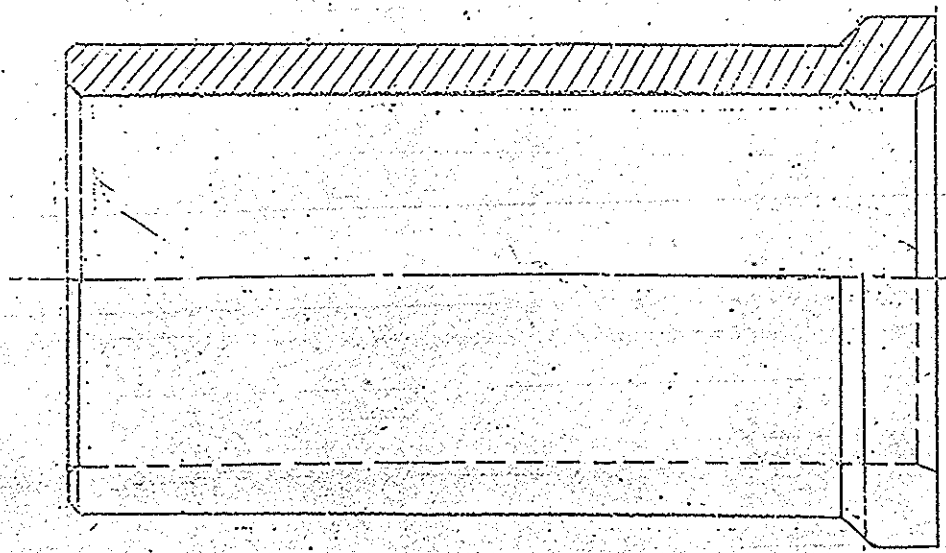
MACHINE: HEAT TREATMENT

STD. TOOLS & GAUGES

SPECIAL TOOLS & GAUGES

THE COMPONENTS ARE TO BE STABILIZED BY HOLDING IN FURNACE WITH 450°C ± 20°C FOR 2 HOURS AND COOLED IN FURNACE ONLY.

COMPT. FIGURE AT THIS STAGE



PRPD.	CHD	APPD

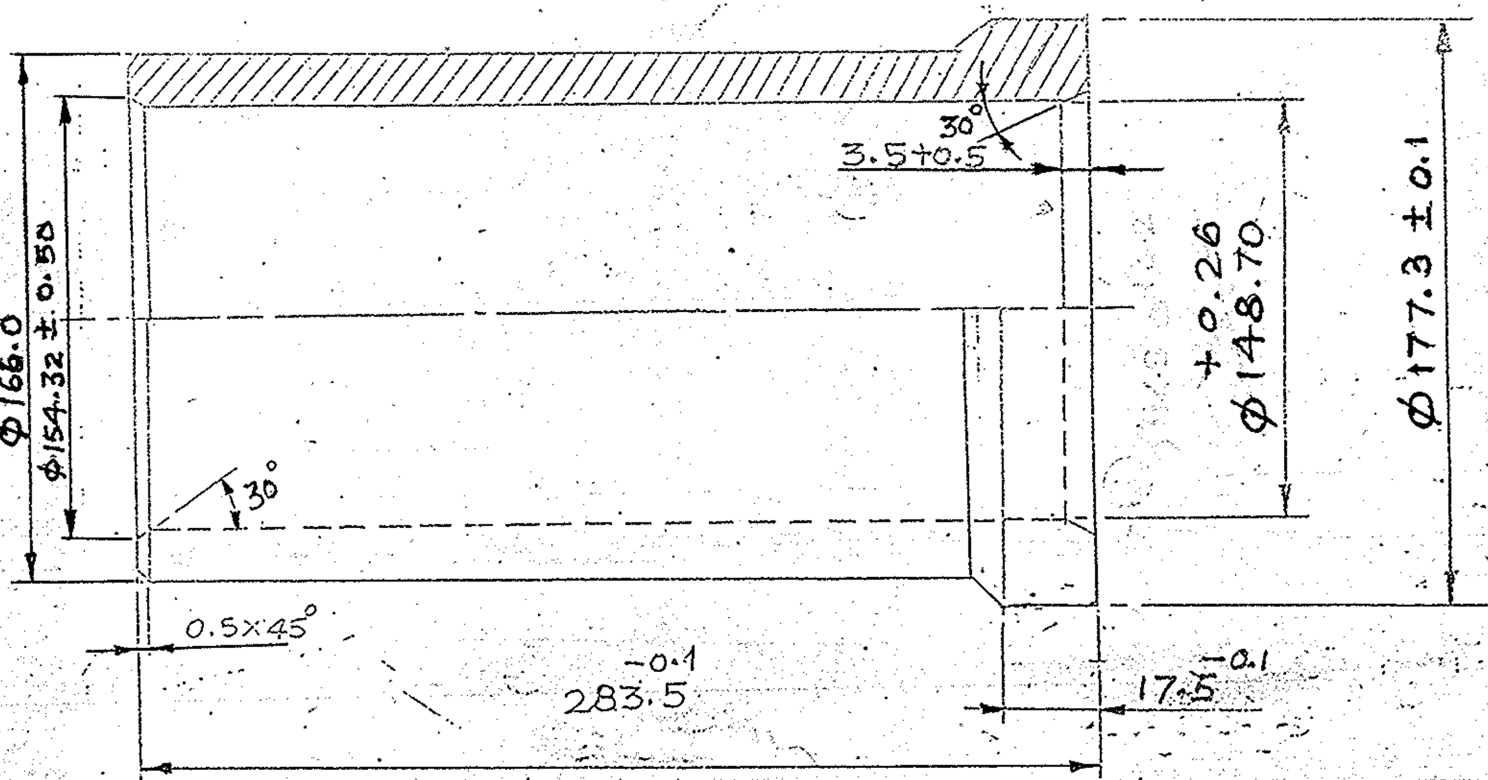
PLANNING SHEET-PDOF/EFA FORM No. EF&PP-039

NOMENCLATURE	DRAWING No.	ISSUE	OPN. No.	OPERATION
CYLINDER LINER	303-D-22		040	INSPECTION (AFTER STABILIZING)

MACHINE:

STD. TOOLS&GAUGES

SPECIAL TOOLS&GAUGES



TECHNICAL REQUIREMENTS

1. VARIATION IN WALL THICKNESS SHOULD NOT EXCEED 0.15 MM.
2. OVALITY AND CONICITY OF HOLE SHOULD NOT EXCEED 0.15 MM.

NOTE

MEASURE AND RECORD ALL THE DIMENSIONS AND ACTUALS OF TECH. REQTS.

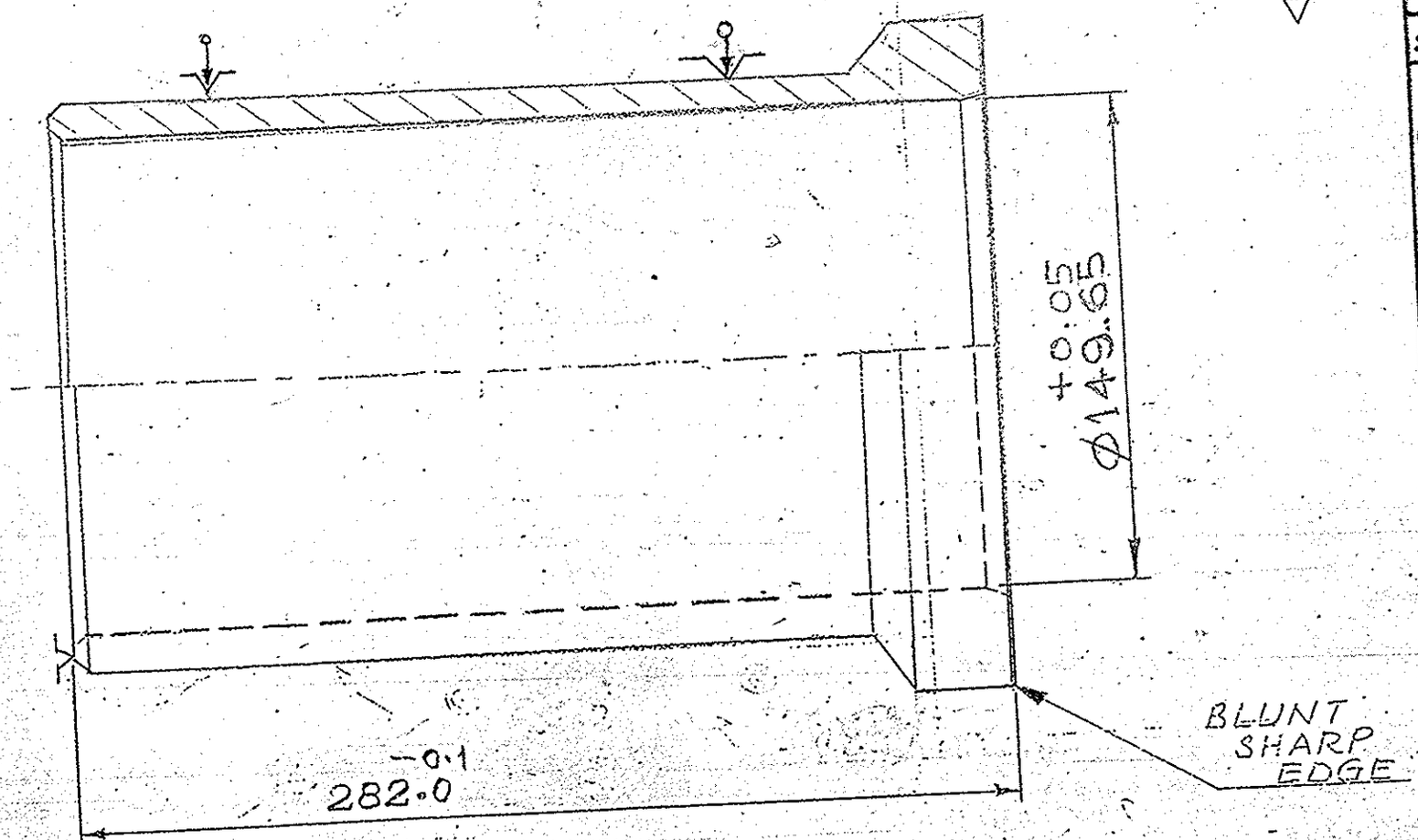
PRPD	CHD	APPD

PLANNING SHEET - PDO / EFA FORM No: EFA/AP-030

NOMENCLATURE	DRAWING NO	ISSUE	OPN. NO.	OPN. DESC
CYLINDER LINER	303-07-22		050	BORING

MACHINE: CNC - LATHE
STC-25

Ra5



STD. TOOLS&GAUGES

HMT SPECIAL BORING BAR (INTEGRAL SHANK) INSERT-CNMG120408 TK35	T-41500562
SPECIAL TUNED BORING BAR (INTEGRAL SHANK) INSERT-DNMG150604	5691-010-03 (SANDVIK)
TURNING TOOL HOLDER INSERT-CNMG120408 TK35	PELNL 252512

SPECIAL TOOLS&GAUGES

HYDRAULIC COLLET FIXTURE	401292

TECHNICAL REQUIREMENT

CONICITY AND OVALITY OF BORE SHOULD NOT EXCEED 0.06 MM.

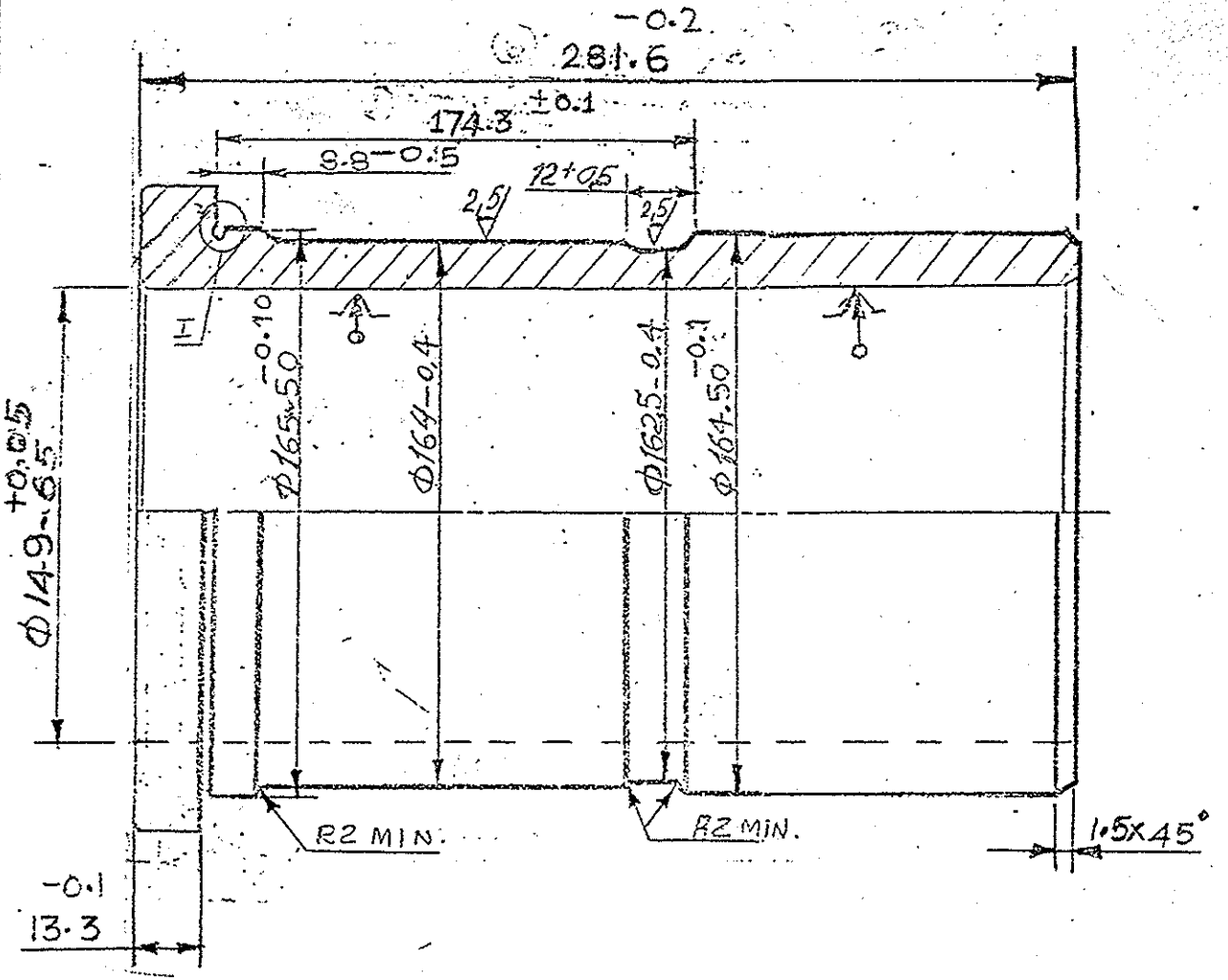
PRED	CHD	APPD	PDO REF	ISSUE	DATE

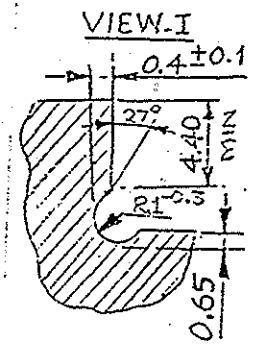
PLANNING SHEET-PDO/EFA FORM No: EF8/P-03

NOMENCLATURE	DRAWING NO.	ISSUE	OPN. NO.	OPERATION
CYLINDER LINER	303 07.22.		055	TURNING

MACHINE: CNC-LATHE
HMT STC 25/1500

Ra5 (4)





STD. TOOLS&GAUGES

	TURNING TOOL HOLDER	PDJNL-252515
	INSERT-DNMG150608	
①	~~TURNING TOOL HOLDER (CORNER RELIEF)~~	~~SP-66/1661/1 (SANDVIK)~~
	~~INSERT VCMM1604 08~~	
①	GROOVING TOOL HOLDER	202267
①	GROOVING INSERT	202268

SPECIAL TOOLS&GAUGES

	HYDRAULIC EXPANDING MANDREL	201569
②	~~SNAP GAUGE Φ165.5 +0.5 -0.5~~	~~026/04/17~~
	~~SNAP GAUGE Φ164.5 +1 -1~~	~~026/04/16~~
②	OUTSIDE MICROMETER 150-175 MM.	

			169	2	29/05/04
			150	1	12/01/2001
PRED	CHD	APPD	PDO REF	ISSUE	DATE

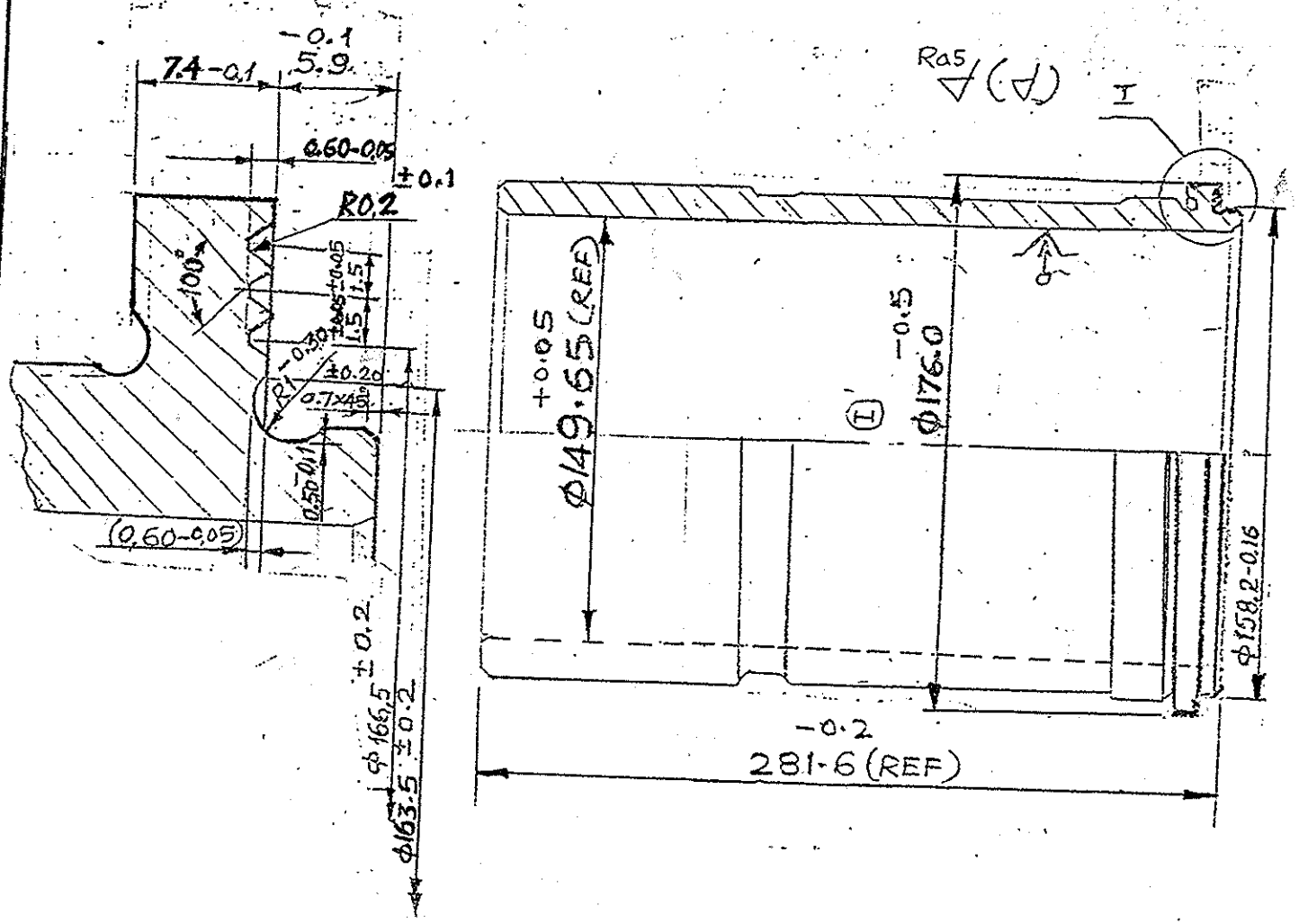
PLANNING SHEET - PDO / EFA FORM No: EF3/P-C

CYLINDER LINER

DRAWING No.	ISSUE	OPN. No.	OPERATION
303 07.22		057	TURNING.

MACHINE: CNC - LATHE
HMT - STC - 25

VIEW-I



STD. TOOLS&GAUGES

	TURNING TOOL HOLDER	PDJNR252515
	INSERT - DNMG 150608	
	TURNING TOOL HOLDER	PDJNL252515
	INSERT - DNMG 150608	
①	~~TURNING TOOL HOLDER (CORNER RELIEF)~~	~~SP64/1661/1 (SANDVIK)~~
	~~INSERT - VCMM160408~~	
	SPECIAL FACE GROOVING INSERT - 402295. (DNMG 150608)	
	TURNING TOOL HOLDER	PDJNR252512

SPECIAL TOOLS&GAUGES

	HYDRAULIC EXPANSION MANDREL	2.015696
②	~~SNAP GAUGE Ø158.2 -0.16~~	~~026/64/115~~
①	GROOVING TOOL HOLDER	202267
	GROOVING INSERT →	202268
②	OUTSIDE MICROMETER 150-175 MM.	

			169	2	29/05/02
			150	1	12/11/01
PRED	CHD	APPD	PDO REF	ISSUE	DATE

PLANNING SHEET-PDO/EFA FORM No: EFA/P-03

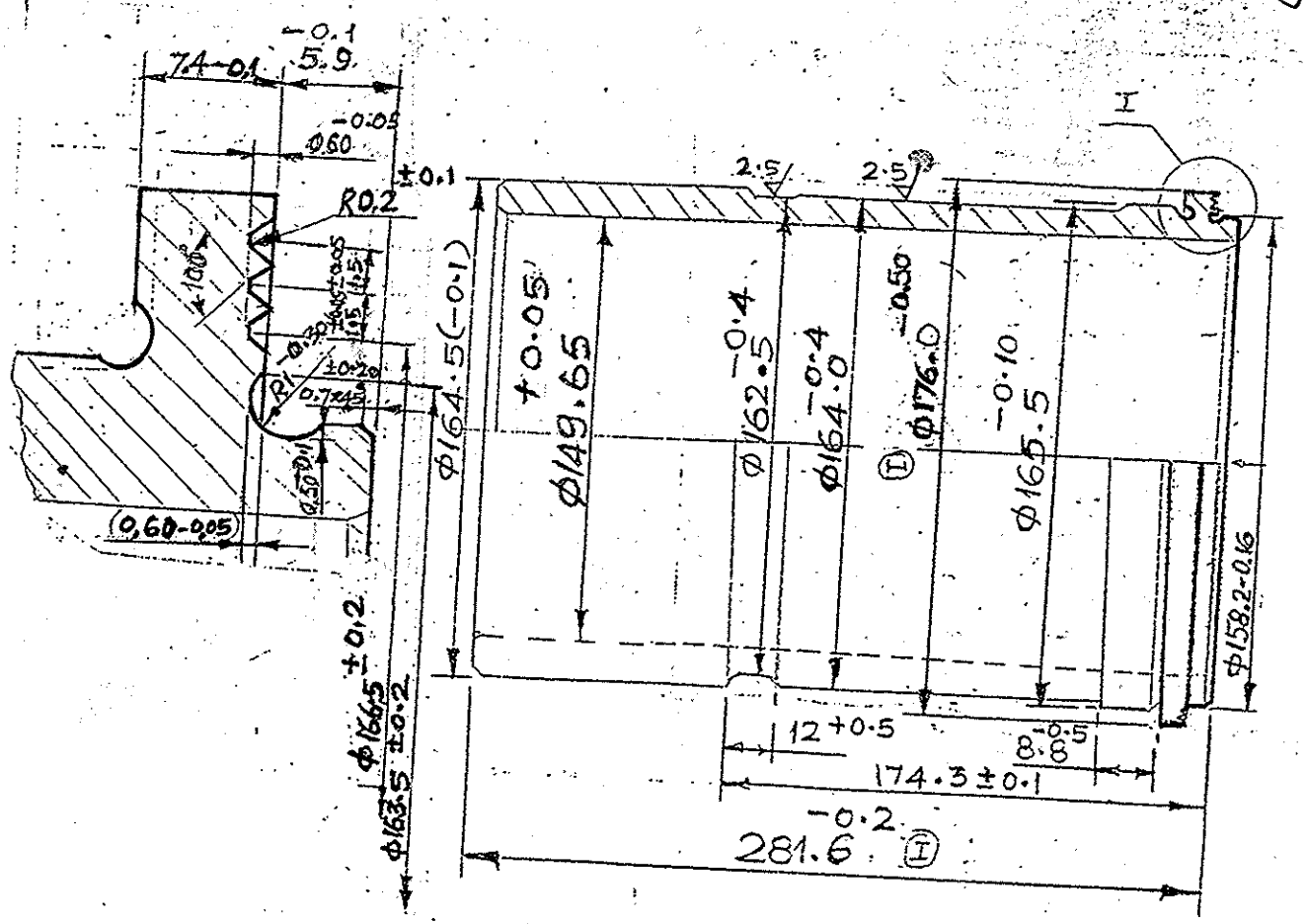
NOMENCLATURE: CYLINDER LINER

DRAWING No.	ISSUE	OPN. No.	OPERATION
303 7.22		060	INSPECTION

MACHINE: BEFORE NITRIDING

Ra 5 (4)

VIEW-I



TECH. REQT: CONICITY AND OVALITY OF BORE SHOULD NOT EXCEED 0.06 mm.

STD. TOOLS&GAUGES

SPECIAL TOOLS&GAUGES

SNAP GAUGE
~~Φ158-2 +0.16~~ 026/04/15
Φ165.5 -0.1 026/04/17
Φ164.5 -0.1 026/04/16

① OUTSIDE MICROMETER
150-175 MM

PRED	CHD	APPD	PDO.REF	ISSUE	DATE
			169	1	29/06/04

PLANNING SHEET-PDO /EFA FORM No: EFA/P-038

COMPONENT: CYLINDER LINER	DRAWING No. 303.d.22	ISSUE	OPN. No. 060	OPERATION INSPECTION

MACHINE: (BEFORE NITRIDING)

STD. TOOLS & GAUGES

SPECIAL TOOLS & GAUGES

BEFORE NITRIDING

(I) DELETED

~~1. LINERS HAVING BORE $\phi 149.65^{+0.10}$ (ELLIPTICITY AND CONICITY ON SHOULD NOT EXCEED 0.06 MM) ARE TO BE DELIVERED FOR NITRIDING. LINERS HAVING BORES WITH $\phi 149.82$ AND ELLIPTICITY AND CONICITY OF BORE UP TO 0.08 MM ARE TO BE DELIVERED FOR NITRIDING AS A SEPARATE BATCH ACCOMPANIED BY CORRESPONDING DOCUMENT. SPECIAL MARK SHOULD BE MADE ON SUCH COMPONENTS ON THE SIDE OF CENTERING COLLAR.~~

2. ONE NUMBER OF CUT-OUT RING HAVING WIDTH 10 ±1 MM FROM A REJECTED COMPONENT SHOULD BE SENT ALONG WITH A BATCH OF COMPONENTS FOR CHECKING HARDNESS.

PRED.	CHD.	APPD	ISSUE	DATE

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

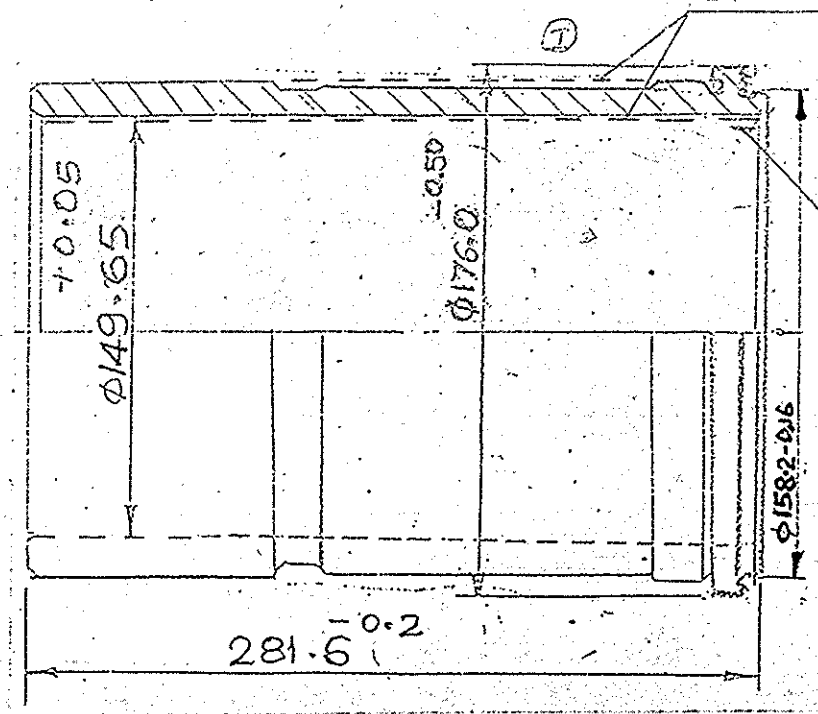
NOMENCLATURE	DRAWING	ISSUE	UPN. No.	OPERATION
CYLINDER LINER	303.07.22.		070	HEAT TREATMENT

MACHINE: NITRIDING

STD. TOOLS&GAUGES

SPECIAL TOOLS&GAUGES

DEPTH OF NITRIDED LAYER 0.5 TO 0.8mm



PLACE FOR CHECKING HARDNESS AT A DISTANCE OF 10 TO 20 mm FROM END FACE.

HARDNESS OF NITRIDED LAYER : HR A ≥ 76.

NOTE: 1) ONE No. OF CUT OUT RING HAVING WIDTH 10 ± 1mm FROM A REJECTED COMPONENT SHOULD BE SENT ALONG WITH A BATCH OF COMPONENTS FOR CHECKING HARDNESS.

Ⓘ 2. NITRIDED PLACES ARE INDICATED AS DOTTED LINE. OTHER PLACES ARE TOBE PROTECTED FROM NITRIDED.

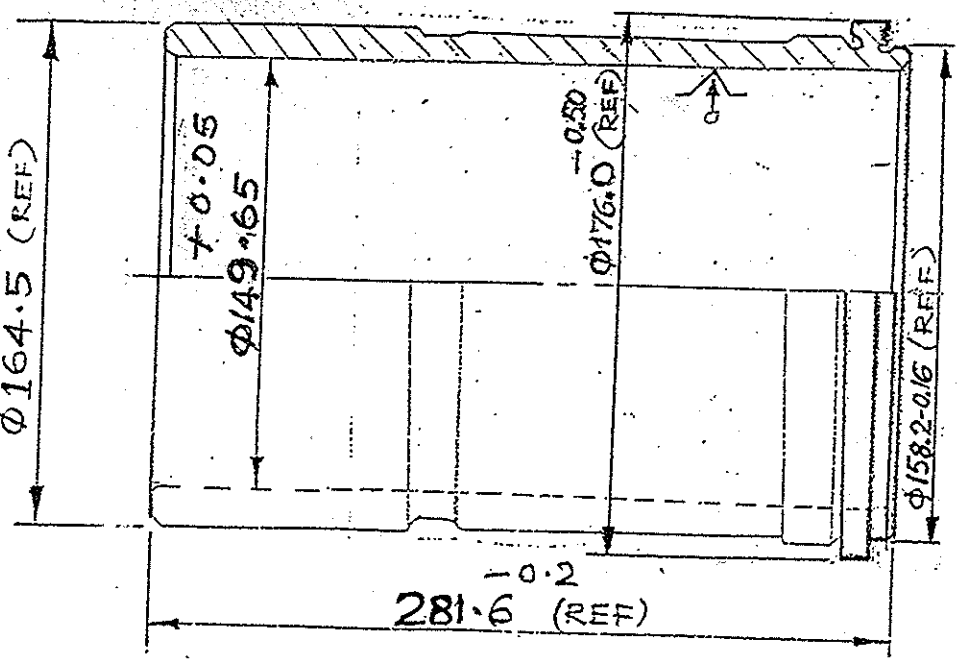
PRED	CHD	APPD

PLANNING SHEET-PDO/EFA FORM No: EFA/P-03

NOMENCLATURE	DRAWING NO.	ISSUE	OPN. No	OPERATION
CYLINDER LINER	305.07.22		080	INSPECTION

MACHINE: AFTER NITRIDING

STD. TOOLS&GAUGES



TECH. REQTS:- 1. CONICITY AND OVALITY OF BORE SHOULD NOT EXCEED 0.15 mm.
2. HARDNESS OF NITRIDED LAYER HRA ≥ 76.
3. DEPTH OF NITRIDED LAYER 0.5 TO 0.8 mm.

SPECIAL TOOLS&GAUGES

①	~~SNAP GAUGE φ158.2 -:16~~	~~026/04/15~~
	~~φ165.5 -:1~~	~~026/04/17~~
	~~φ164.5 -:1~~	~~026/04/16~~
①	OUTSIDE MICRO METER 150-175 MM.	

PREP	CHD	APPD	PDO REF	ISSUE	DATE
			169	1	29/5/14

PLANNING SHEET-PDO / EEA FORM No: EFA/P-038

NOMENCLATURE: CYLINDER LINER

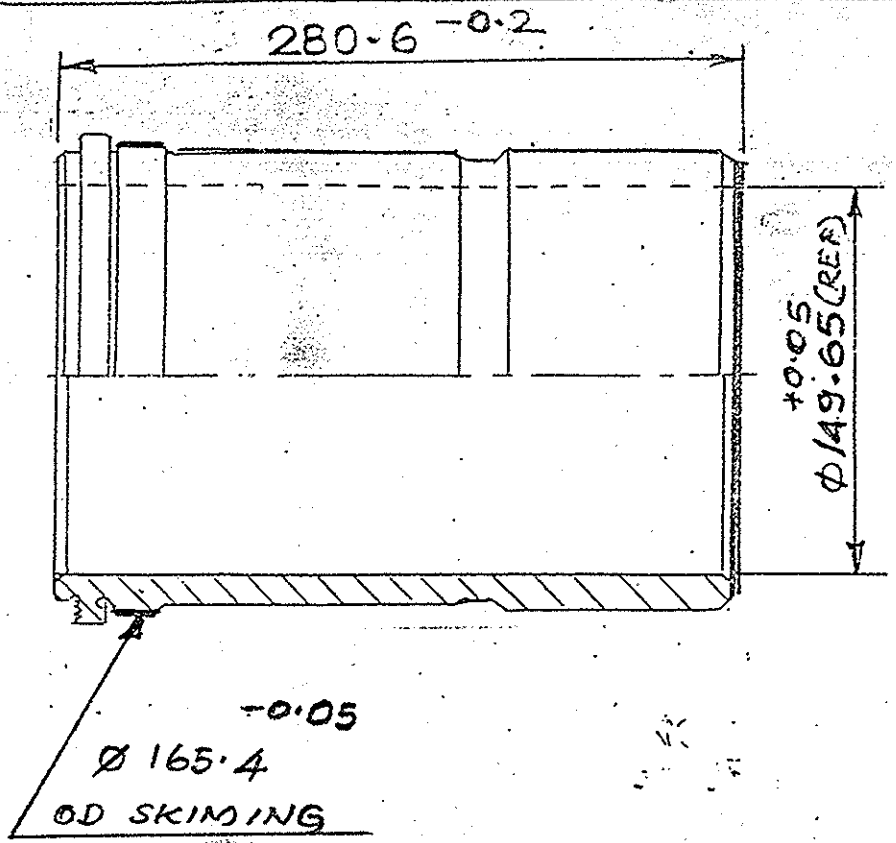
DRAWING No. 303[illegible]7.22

ISSUE

OPN. No. 090

OPERATION FACE GRINDING & OD SKIMMING

MACHINE: CNC-EXT. GRINDER HMT-GNC-18.



STD. TOOLS&GAUGES

GRINDIND WHEEL Φ450X60WXΦ254 (ROS1-Φ325-10W) A463K5V10	
DIAMOND DRESSER 070/000/079	
070/00/012	
070/00/013 [FOR G17 CYLINDRICAL GRINDING M/C]	

SPECIAL TOOLS&GAUGES

EXPANSION MANDREL	201522 201568
SPECIAL CENTER	400573

PREP'D	CHD	APPD		ISSUE DATE

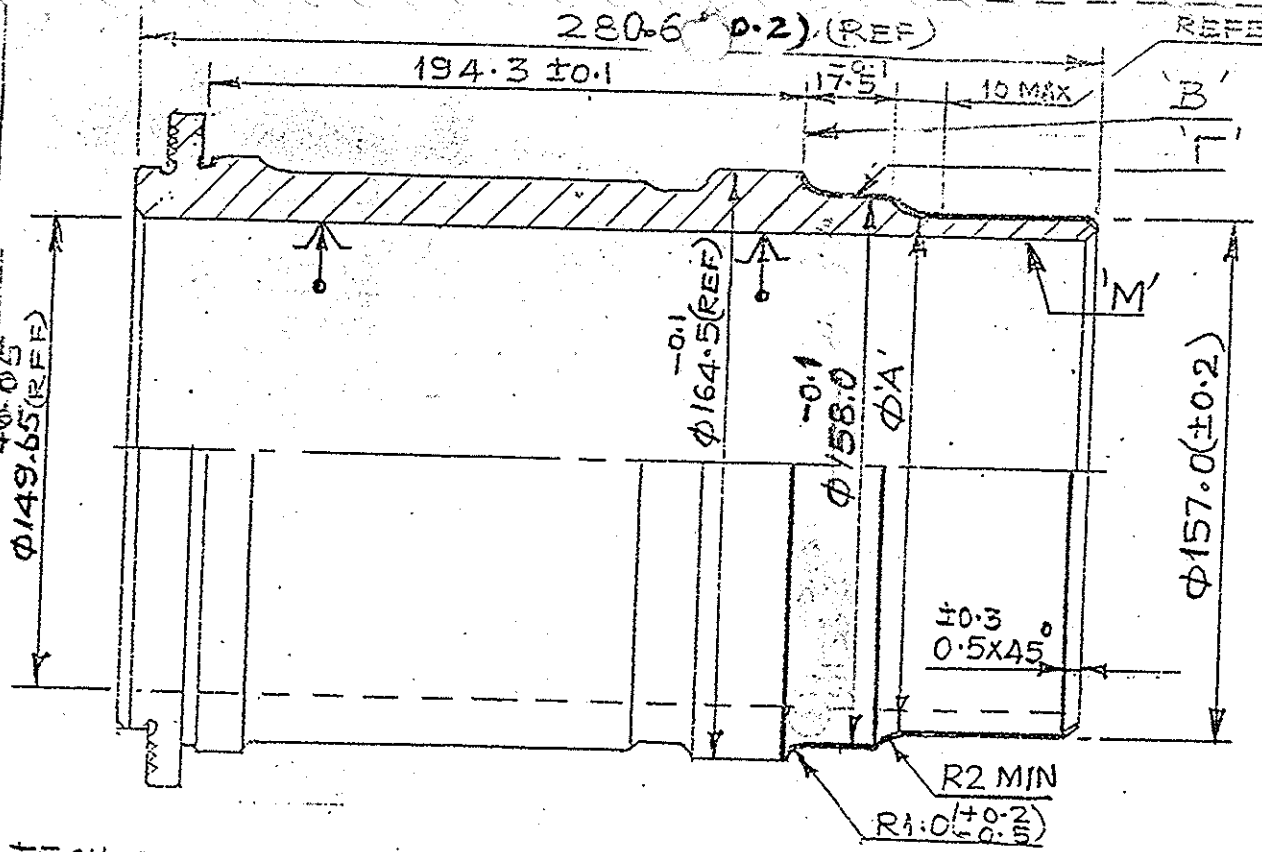
SHEET 17 OF 25

16

PLANNING SHEET - PDO / EFA FORM No: EFA/

303 07.22

ICD TURNING



OPN 095

Ra 5

MACHINE: CNC - LATHE
HMT STC 25/1500.

OPN ~~100~~ 10 TURNING ①

STD. TOOLS&GAUGES

TURNING TOOL HOLDER	PDJNL25251
INSERT - DNMG 150608	

SPECIAL TOOLS&GAUGES

HYDRAULIC EXPANSION MANDREL	201569
~~SNAP GAUGE~~	~~026/04/115~~
~~Φ156 ::1~~	

TECH. REQTS:-

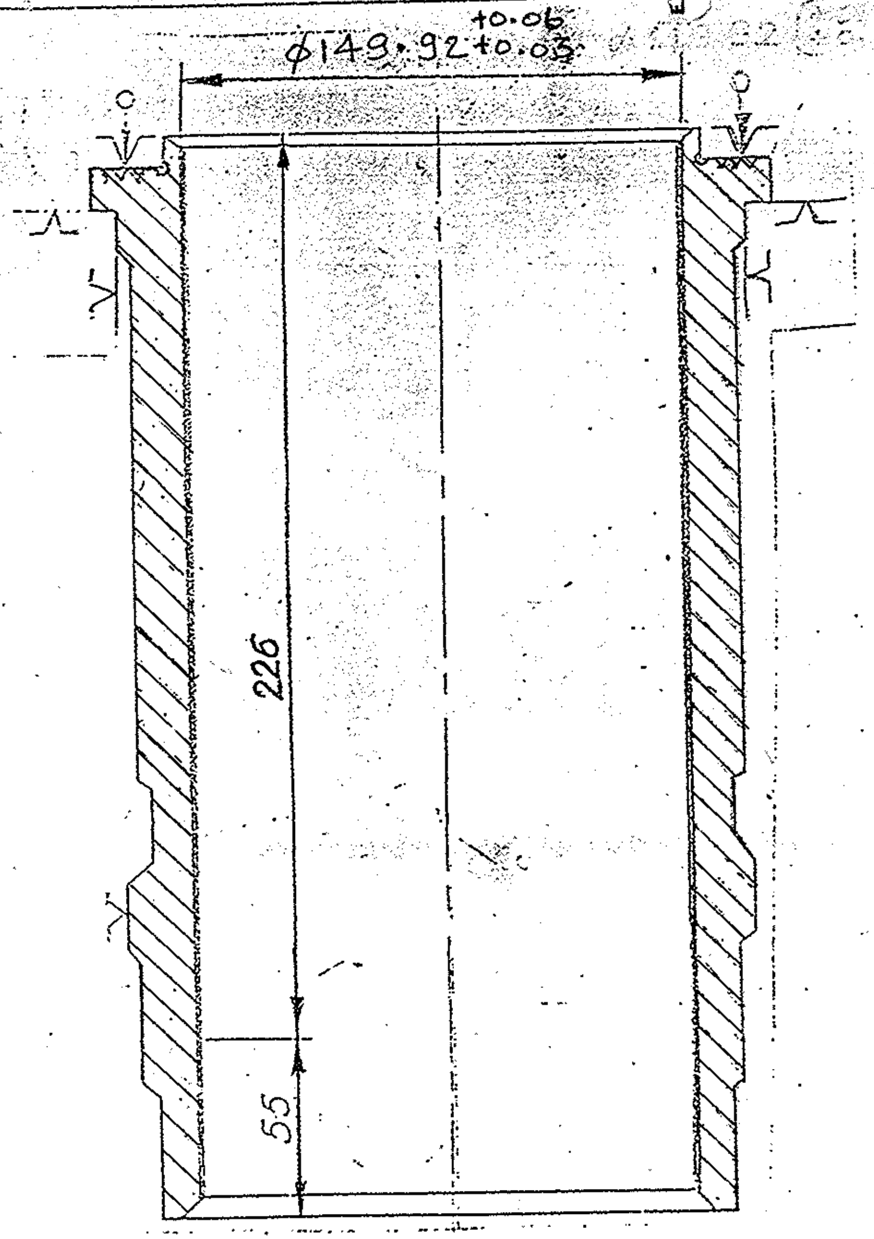
1. VARIATION IN MEASUREMENTS OF WALL THICKNESS OF SURFACE 'M' AND 'T' SHOULD NOT EXCEED 0.05mm.
2. ECCENTRICITY OF Φ 'A' UPTO A LENGTH OF 10mm RELATIVE TO Φ157 (±0.2) SHOULD NOT EXCEED 0.2mm.
3. BURRS ARE NOT ALLOWED ON FACE 'B'.

PRED	CHD	APPD	PDO REF	ISSUE	DATE

PLANNING SHEET-PDO/EPA FORM No: EPA/P.03

NOMENCLATURE	PART No.	ISSUE	OPN No.	OPERATION
CYLINDER LINER	303-07-22		OPN-100 (0951)	ROUGH HONING

MACHINE: HONING MACHINE "GEHRING"



ROUGH HONING

TECHNICAL REQUIREMENTS

1. ELLIPTICITY OF THE BORE ON A LENGTH OF 226 MM SHOULD NOT EXCEED 0.03 MM.
OVALITY OF THE BORE ON A LENGTH OF 55 MM FROM THE BOTTOM SHOULD NOT EXCEED 0.04 MM.

2. CONICITY OF BORE MEASURED ON A LENGTH OF THE LINER SHOULD NOT EXCEED 0.04 MM

3. CONCAVITY AND CONVEXITY OF THE BORE SHOULD NOT EXCEED 0.03 MM.

STD. TOOLS & GAUGES	
HONING STICK DIAMOND FINE (D251-55-M2-75) GRADE	402254/3 402254/4
HONING STICK DIAMOND COARSE (D301-50-M0-100) GRADE	402254/1 402254/2
BORE DIAL	

SPECIAL TOOLS & GAUGES	
FIXTURE	201412
HONING SHOE HOLDER	400545
LIFTING UNIT	200722
SETTING RING	094/00/072

PRED	CHD	APRD	PDO REF	ISSUE	DATE

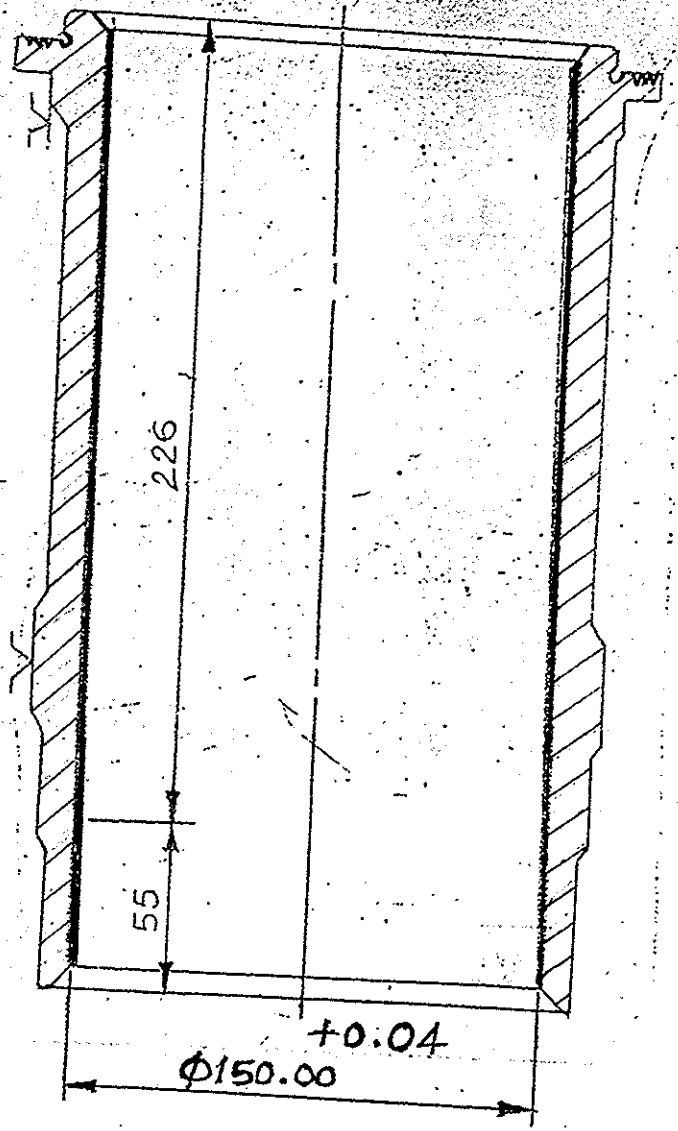
SHEET ~~18~~ 19 OF 25

PLANNING SHEET-PDO / EFA FORM No: EFA/P-03

OR NC AT RE

CYLINDER LINER

DRAWING No.	ISSUE	OPN. No.	OPERATION
303 7-22		110	FINISH HONING



Ra 0.125

FINISH HONING

TECHNICAL REQUIREMENTS

1. ELLIPTICITY OF THE BORE ON A LENGTH OF 226 MM SHOULD NOT EXCEED 0.03 MM. OVALITY OF THE BORE ON A LENGTH OF 55 MM SHOULD NOT EXCEED 0.04 MM.

2. CONICITY OF BORE MEASURED ON A LENGTH OF LINER SHOULD NOT EXCEED 0.04 MM.

3. CONCAVITY AND CONVEXITY OF THE BORE SHOULD NOT EXCEED 0.03 MM.

MACHINE: HONING MACHINE "GEHRING"

STD. TOOLS & GAUGES

HONING STICK ABRASIVE FINE
GC400-G-VG-1
13X13 SQUARE X 150 mm
13X13 SQUARE 100 mm.
BORE DIAL

SPECIAL TOOLS & GAUGES

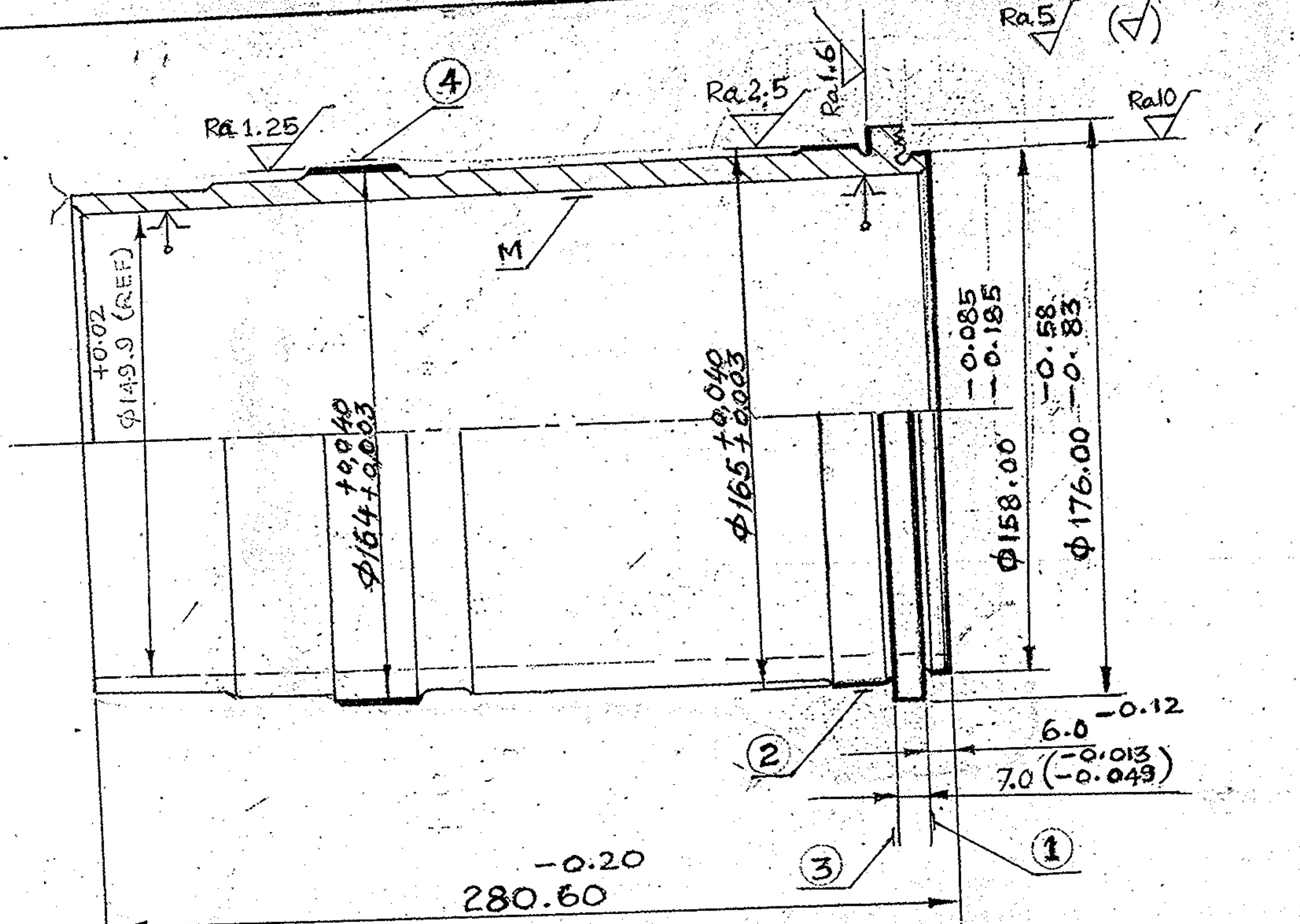
FIXTURE	201412
HONING SHOE HOLDER	400546
LIFTING UNIT	200722
SETTING RING	094/00/005

PRED	CHD	APPD	PDO REF	ISSUE	DATE

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

NOMENCLATURE	DR. WG. No.	ISSUE	OPN. No.	OPERATION
CYLINDER LINER	303.07 2		120	GRINDING

MACHINE: CNC CYLINDRICAL GRINDER, HMT GNC-18



NOTE: FOR TECHNICAL REQUIREMENTS REFER SHT: 22

STD. TOOLS & GAUGES	
GRINDING WHEEL Φ450 X 60W X Φ254 (R05-1-Φ254 X 60W) A463 K5 V10	
DIAMOND DRESSER	070/00/012 070/00/013

SPECIAL TOOLS & GAUGES	
EXPANDING MANDREL	201568
SPECIAL CENTER	400573
~~SNAP GAUGE~~	026/04/15
~~Φ158~~	
~~Φ164 +0.040 +0.003~~	~~026/04/20~~
Φ165 +0.043 +0.003	026/04/21
Φ158 -0.085 -0.185	026/04/22
DEPTH GAUGE 6 -0.12	030/58
GAP GAUGE 7 -0.013 -0.049	025/01/31

SHEET 21 OF 25

PRED	CHD	APPD	PDO REF	ISSUE	DATE
[signature]	[signature]	[signature]			

CYLINDER LINER 303-07-22

120 OD GRINDING

MACHINE: CNC CYLINDRICAL GRINDER - HMT GNC 18

PLANNING SHEET-PDO /EFA

FORM No: EF 8/P

TECHNICAL REQUIREMENTS

1. ~~OVALITY TOLERANCE OF SURFACE "6 & E" SHOULD NOT EXCEED 0.02 MM.~~

2. WHEN SURFACE ③ IS USED AS A BASE, RUN OUT OF SURFACE ② RELATIVE TO SURFACE ④ SHOULD NOT EXCEED 0.04 MM.

3. VARIATION IN WALL THICKNESS OF SURFACES Ⓜ & ② AND Ⓜ & ④ SHOULD NOT EXCEED 0.05 MM.

4. IMPRINT OF BLUEING ALONG THE CIRCUMFERENCE OF FACE ③ SHOULD BE CONTINUOUS AND NOT LESS THAN 1.8 MM IN WIDTH

5. VARIATION IN MEASUREMENTS OF THICKNESS OF FACES ① AND ③ OF LINER FLANGE SHOULD NOT EXCEED 0.02 MM.

STD. TOOLS & GAUGES

SPECIAL TOOLS & GAUGES

PRED.	CHD.	APPD

20

PLANNING SHEET - PDO / EFA FORMS No: EFA/P-033

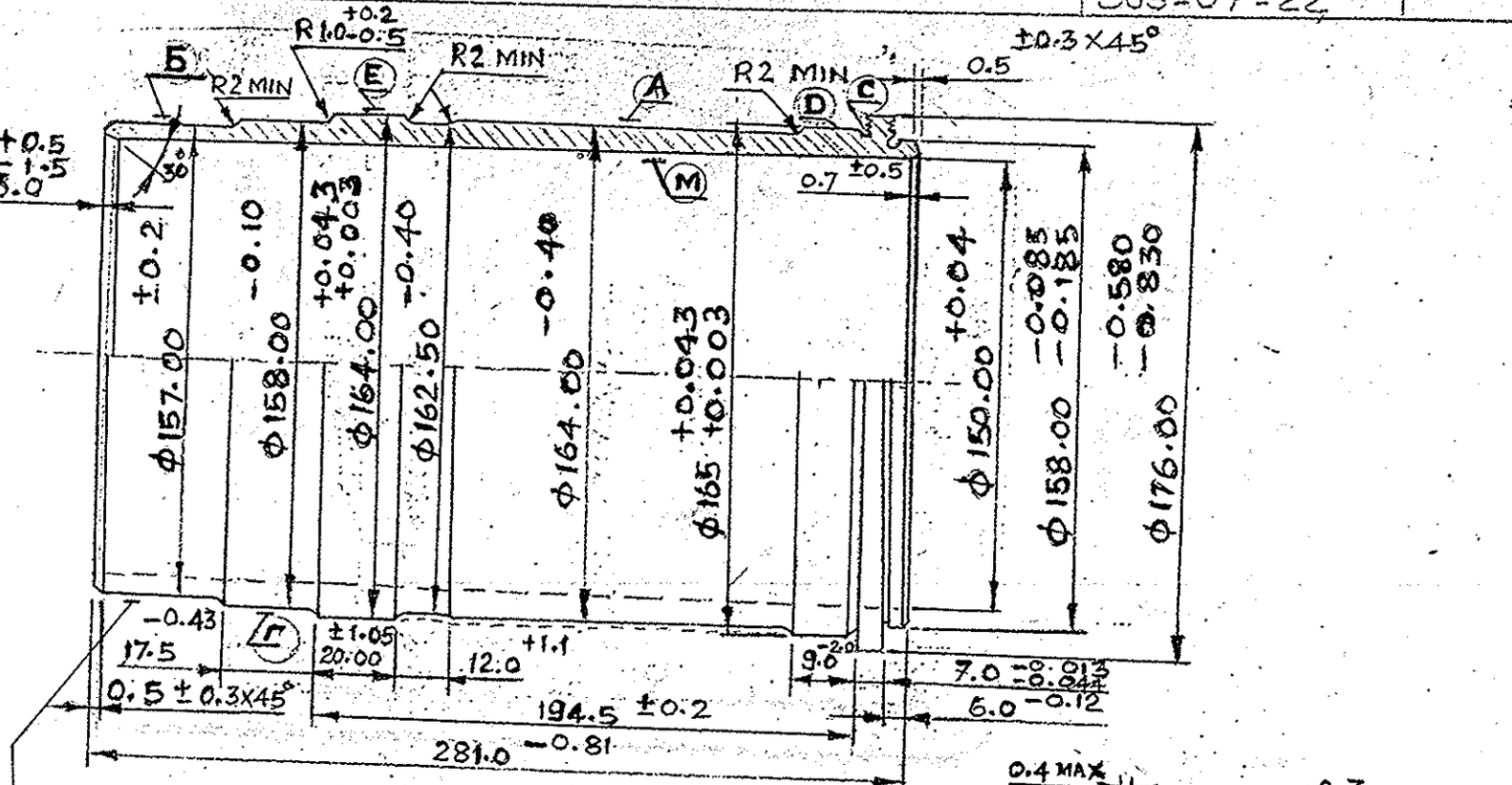
NOMENCLATURE: CYLINDER LINER

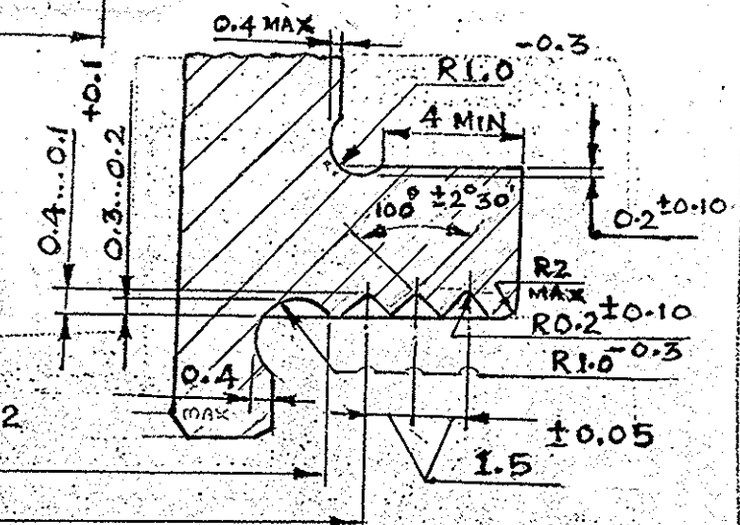
DRAWING No.	ISSUE	OPN. No.	OPERATION
303-07-22		140	FINAL INSPECTION

MACHINE

STD. TOOLS & GAUGES

SPECIAL TOOLS & GAUGES





PRED	CHD	APPD

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

CYLINDER LINER

JK W.O. No.	ISSUE	O.N. No.	DESCRIPTION
3037-22		140	INSPECTION

TECHNICAL REQUIREMENTS

(1) CHECK DIMENSION OF BORE. OVALITY OF SURFACE "M" ON A LENGTH OF 221 MM, SHOULD NOT EXCEED 0.03 MM AND ON A LENGTH OF 55 MM FROM THE END OF LINER LOWER PORTION SHOULD NOT EXCEED 0.04 MM. CONICITY OF SURFACE "M" SHOULD NOT EXCEED 0.04 MM. CONCACIVITY AND CONVEXITY OF SURFACE "M" SHOULD NOT EXCEED 0.03 MM.

(2) CHECK FACE "C" BY BLUEING

(3) THE OVALITY OF SURFACES "B" AND "E" SHOULD NOT EXCEED 0.02 MM

(4) THOROUGHLY CHECK INTERNAL AND EXTERNAL SURFACES OF THE COMPONENT. MARKS UP TO 0.3 MM DEEP LEFT BY CUTTING TOOLS ARE ALLOWED ON SURFACE "B"

PRED	CHD	APPD	PDO REF	ISSUE	DATE
			169	1	29/05/09

STD. TOOLS & GAUGES

SPECIAL TOOLS & GAUGES

~~SNAP GAUGE .158" -.1~~	~~026/04/15~~
~~Φ164 +.100 +.043~~	~~026/04/20~~
① Φ165 +.043 +.003	026/04/21
① Φ158 -0.065 -0.155	~~026/04/22~~
~~DEPTH GAUGE 6" -.12~~	~~030/58~~
~~GAP GAUGE -.043~~	~~025/04/51~~

① OUTSIDE MICROMETER
0-25 mm
0-150 mm
150-175 mm

PLANNING SHEET-PDO / EFA FORM No: EFA/R-009

CYLINDER LINER	DRAWING 303-07-22	ISSUE	OPN. No. 140	OPERATION INSPECTION

(5) MINIMUM DEVIATION FROM ϕ165 AND ϕ164 IN HUNDREDTH MM ON LOWER PORTION OF THE LINER USING ELECTROGRAPH METHOD

(6) CHECK VARIATION IN MEASUREMENTS OF WALL THICKNESS OF SURFACES "M" AND D, "M" AND "E", "M" AND "Γ". IT SHOULD NOT EXCEED 0.05 MM.

(7) BUBBLES AND BARE SPOTS ARE NOT ALLOWED ON SURFACE "A" COATED WITH ANTI-CORROSIVE LAYER.

(8) FINISHED COMPONENTS SHOULD NOT HAVE ANY FORGING DEFECTS, CHIPPINGS, OFF NITRIDED LAYER, DENTS ON GROUND SURFACES.

(9) EXTERNAL SURFACE, SHOWN WITH DOTTED LINE, SHOULD BE PROVIDED WITH CHROMIUM PLATING, MILKY.

STD. TOOLS & GAUGES

SPECIAL TOOLS & GAUGES

PRED	CHD	APPD

SHEET 25 OF 25

2522