



ENGINE FACTORY, AVADI

PROCESS SCHEDULE

DESCRIPTION :- **CAM SHAFT**
INLET & EXHAUST

COMPT. No :- **307-06-4A & 307-21-1A**

MFG. SHOP :- **MPS**

REV. NO. 00

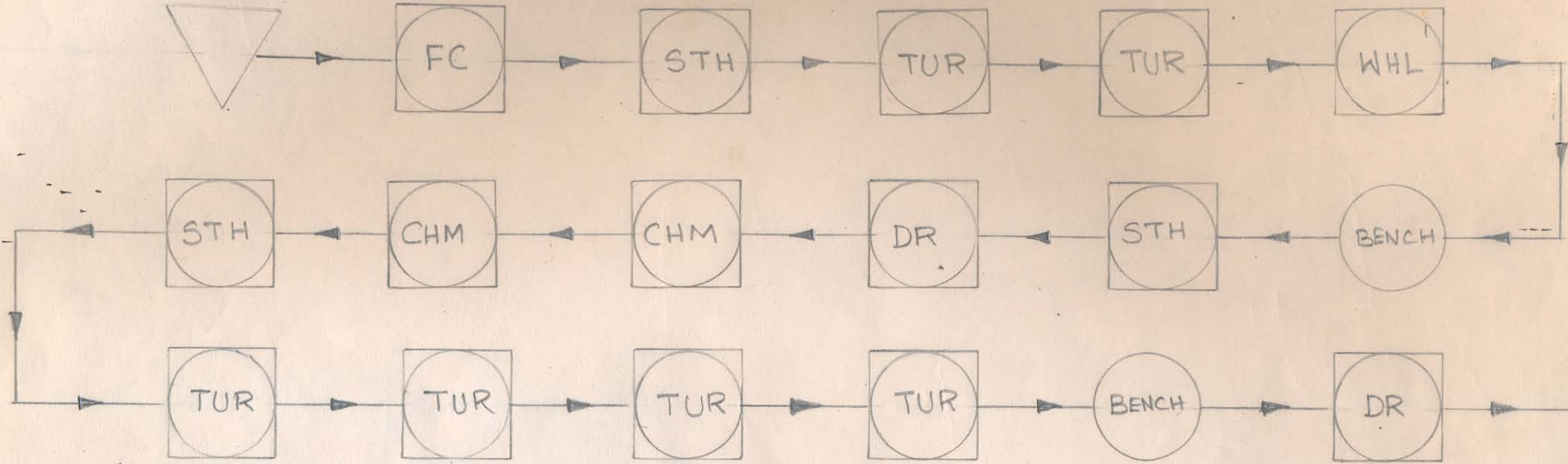
DATE: 12.15.81

FLOW PROCESS CHART

STORE : CAMSHAFT

DRG. NO.: 307-06-4A
307-21-1A

END STORE: V46-6-ASSEMBLY



FC = FACING & CENTERING STH = STRAIGHTENING TUR = TURNING WHL = WHIRLING CHM = CHAMFERING
DR = DRILLING

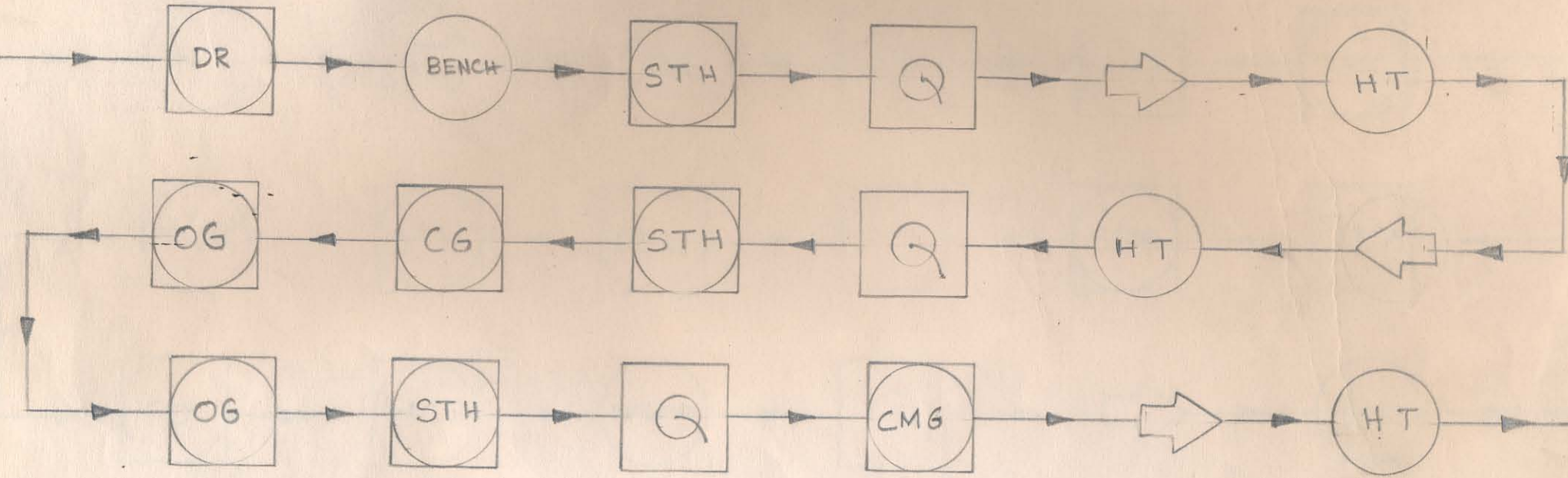
LEGEND		APPROVAL		SECTION	MPS
TEMP. STORAGE	▽	TRANSPORTATION	➔	SIGNATURE & DATE	NO. OF SHEETS
OPERATION	○	INSPECTION BY QC	Q	MGR <i>DBAR</i> QC 25 <i>Prake</i> 12/10/96	4
OPERATION CUM INSPECTION	◻	INSPECTION BY SQAE/CQA/ME) Etc.	I		SHEET NO.
100 % INSPN. BY MFG. SEC.	□	STORAGE	△	ENGINE FACTORY, AVADI, MADRAS-54	

FLOW PROCESS CHART

STORE : CAMSHAFT

DRG. NO.: 307-06-4A
307-21-1A

END STORE: V46-6-ASSEMBLY



DR= DRILLING STH=STRAIGHTENING HT= HEAT TREATMENT CG = CENTER GRINDING OG = OD GRINDING
 CMG = CAM GRINDING

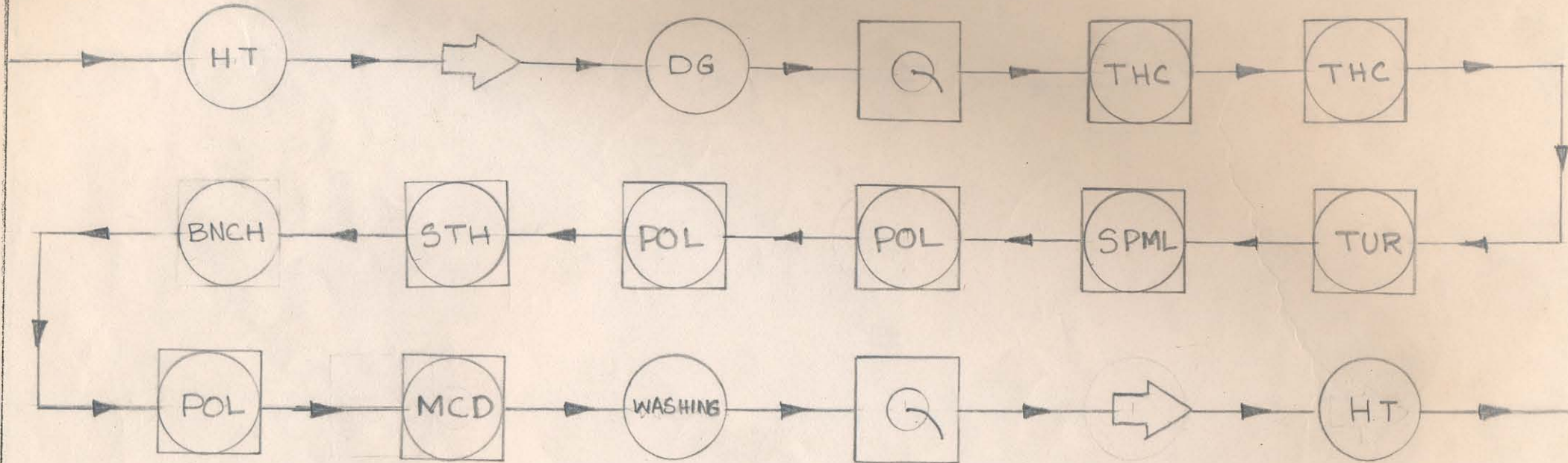
LEGEND		APPROVAL		SECTION	MPS
TEMP. STORAGE	▽	TRANSPORTATION	➡	SIGNATURE & DATE	NO. OF SHEETS
OPERATION	○	INSPECTION BY QC	Q	PREPARED BY MGF	4
OPERATION CUM INSPECTION	◻	INSPECTION BY SQA/CQA/ME) Etc.	I	QC	2
100% INSPN. BY MFG. SEC.	□	STORAGE	△	APPROVED BY	ENGINE FACTORY, AVADI, MADRAS-54
				AUTHORIZED FOR ISSUE <i>Anake</i> 12/10/96	

FLOW PROCESS CHART

STORE : CAM SHAFT

DRG. NO.: 307-06-4A
307-21-1A

END STORE: V46-6-ASSEMBLY



HT = HEAT TREATMENT	DG = DEGREASING	THC = THREAD CUTTING	TUR = TURNING
POL = POLISHING	STH = STRAIGHTENING	MCD = MAGNETIC CRACK DETECTION	HT = HEAT TREATMENT

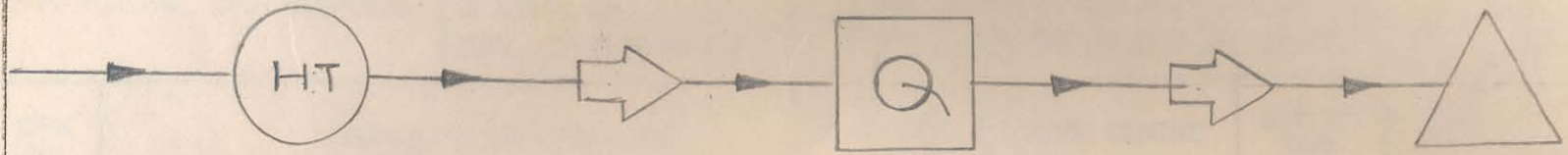
LEGEND		APPROVAL		SECTION	MPS
TEMP. STORAGE	▽	TRANSPORTATION	➔	SIGNATURE & DATE	NO. OF SHEETS
OPERATION	○	INSPECTION BY QC	□	MGE. <i>DWAR</i>	4
OPERATION CUM INSPECTION	□	INSPECTION BY SQAD/CQA/ME) Etc.	I	QC	SHEET NO.
100% INSPN. BY MFG. SEC.	△	STORAGE	△	-26	3
				<i>Make 12/10/96</i>	ENGINE FACTORY, AVADI, MADRAS-50

1 FLOW PROCESS CHART

STORE : CAM SHAFT

DRG. NO.: 307-06-4A
307-21-1A

END STORE: V46-6-ASSEMBLY



HT = HEAT TREATMENT

LEGEND		APPROVAL		SECTION	MPS
TEMP. STORAGE	—	TRANSPORTATION	➔	SIGNATURE & DATE	NO. OF SHEETS
OPERATION	○	INSPECTION BY QC	□ Q	PREPARED BY	SHEET NO.
OPERATION CUM INSPECTION	□	INSPECTION BY SQAE/CQA/ME) Etc	□ I	APPROVED BY	
100% INSPN. BY MFG. SEC.	—	STORAGE	△	AUTHORISED FOR ISSUE	

MGE: *DWRP* QC

M. S. K.
12/10/96

ENGINE FACTORY,
AVADI, MADRAS-56



ENGINE FACTORY AVADI

FORM No :EFA/P-038

PROCESS SCHEDULE

NOMENCLATURE : CAMSHAFT INLET & EXHAUST
 DRAWING No : 307.06.4A&307.21.1A
 MATL SPECIFICATION : STEEL STAMPING STEEL 45- GOST 1050-74

OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
000	FORGING	8 & 9	GUN DRILLING M/C HMT			
010	FACING & CENTERING	10	FACING & CENTERING M/C HMT			
020	STRAIGHTENING	11	HYDRAULIC PRESS 10 TON			
030	TURNING	12	CENTRE LATHE HMT NH26/1500			
040	TURNING	13	- DO -			
050	WHIRLING	14 & 15	WHIRLING M/C GFM			
060	DEBURRING	16	BENCH			
070	STRAIGHTENING	17	HYDRAULIC PRESS 10 TON			

PREPARED BY		CHECKED BY		APPROVED BY		AUTHORISED BY						SHT. No 1 OF 67
SIGN	QSV	SIGN	<i>[Signature]</i>	SIGN	<i>[Signature]</i>	<i>[Signature]</i>						
DATE	03/10/96	DATE	12.10.96	DATE	12/10/96	12/10/96						
C/MAN-II /PDO		C/man I /PDO		HOS/PDO		DO/PDO		PDO REF	ISSUE	DATE	SIGN	



ENGINE FACTORY AVADI

FORM No :EFA/P-038

PROCESS SCHEDULE

NOMENCLATURE : CAMSHAFT INLET & EXHAUST
 DRAWING No : 307.06-4A & 307.21.1A
 MATL. SPECIFICATION :

OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
080	DRILLING	18	GUN DRILLING M/C WIDMA			
090	FACING & CHAMFERING	19	CENTRE LATHE HMT NH26/1500			
100	FACING & CHAMFERING	20	- DO -			
110	STRAIGHTENING	21	HYDRAULIC PRESS 10 TON			
120	TURNING	22	CENTRE LATHE HMT NH26/1500			
130	TURNING	23	CNC-LATHE HMT SB-CNC			
140	TURNING	24	- DO -			
150	TURNING	25	- DO -			

PREPARED BY		CHECKED BY		APPROVED BY		AUTHORISED BY						SHT. No 2 OF 67
SIGN	QSV	SIGN	<i>[Signature]</i>	SIGN	<i>[Signature]</i>	<i>[Signature]</i>						
DATE	03/10/96	DATE	12.10.96	DATE	12/10/96	12/10/96						
C/MAN - II /PDO		Ch/man I /PDO		HOS/PDO		DG/PDO		PDO REF	ISSUE	DATE	SIGN	



ENGINE FACTORY AVADI

FORM No :EFA/P-038

PROCESS SCHEDULE	NOMENCLATURE : <u>CAMSHAFT INLET & EXHAUST</u> DRAWING No : <u>307.06.4A & 307.21.1A</u> MATL SPECIFICATION :
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OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
160	DRESSING		BENCH			
170	DRILLING	26	SWIFT DRILLING M/C			
180	DRILLING	27	- DO -			
190	DEBURRING	28	BENCH			
200	STRAIGHTENING	29	HYDRAULIC PRESS 10TON			
205	ROUGH GRINDING	29a 29b	CAMGRINDER LANDIS			
210	INSPECTION	30 to 33	BENCH			
220	PASSIVATION	34				
230	INDUCTION HARDENING	35 & 36	INDUCTION HARDENING MACHINE			

PREPARED BY		CHECKED BY		APPROVED BY		AUTHORISED BY				SHT. No 3 OF 67
SIGN	QSV	SIGN	[Signature]	SIGN	[Signature]	[Signature] 12/10/96				
DATE	03/10/96	DATE	12.10.96	DATE	12/10/96			PDO REF	1	
C/MAN-II /PDO		CH/man I /PDO		HOS/PDO		DO/PDO		SIGN	[Signature]	



ENGINE FACTORY AVADI

FORM No :EFA/P-038

PROCESS SCHEDULE

NOMENCLATURE : CAMSHAFT INLET & EXHAUST
 DRAWING No : 307.06.4A & 307.21.1A
 MATL. SPECIFICATION :

OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
315	PASSIVATION					
320	TEMPERING	47	HEATTREATMENT PLANT			
330	DEGREASING					
340	INSPECTION	48 TO 52	BENCH			
350	THREAD CUTTING	53	SB-CNC LATHE-HMT			
360	THREAD CUTTING	54	- DO -			
370	TURNING RACK DETECTION	55	CENTRE LATHE-HMT NH 26/1500			
380	SPLINE MILLING	56	SPLINE MILLING M/C WM/W			

PREPARED BY		CHECKED BY		APPROVED BY		AUTHORISED BY						SHT. No 5 OF 67
SIGN	QSV	SIGN	<i>[Signature]</i>	SIGN	<i>[Signature]</i>	<i>[Signature]</i>						
DATE	03/10/96	DATE	12.10.96	DATE	12/10/96	12/10/96						
C/MAN-II /PDO		CH/man-I /PDO		HOS/PDO		DO/PDO		PDO REF	ISSUE	DATE	SIGN	



ENGINE FACTORY AVADI

FORM No :EFA/P-038

PROCESS SCHEDULE

NOMENCLATURE : CAMSHAFT INLET & EXHAUST
 DRAWING No : 307.06.4A & 307.21.1A
 MATL SPECIFICATION :

OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
390	POLISHING	57	POLISHING M/L "HEY"			
400	POLISHING	58	-DO-			
410	STRAIGHTENING	59	HYDRAULIC PRESS 10 TON			
420	DRESSING	60	BENCH			
430	POLISHING	61	-DO-			
440	WASHING		WASHING PLANT			
450	MAGNETIC CRACK DETECTION		MAGNETIC FLAW DETECTOR			
460	WASHING		WASHING PLANT			

PREPARED BY		CHECKED BY		APPROVED BY		AUTHORISED BY						SHT. No 6 OF 67
SIGN	QSV	SIGN	<i>[Signature]</i>	SIGN	<i>[Signature]</i>	<i>[Signature]</i>						
DATE	03/10/96	DATE	12.10.96	DATE	12.10.96	12/10/96						
C/MAN-II /PDO		C/man I /PDO		HOS/PDO		DO/PDO		PDO REF	ISSUE	DATE	SIGN	



ENGINE FACTORY AVADI

FORM No :EFA/P-038

PROCESS SCHEDULE	NOMENCLATURE : CAMSHAFT INLET & EXHAUST
	DRAWING No : 307.06.4A & 307.21.1A
	MATL SPECIFICATION :

OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
470	FINAL INSPECTION	62 TO 67				
480	PASSIVATION					
490	OXIDIZING		HEAT TREATMENT PLANT			
500	INSPECTION					

PREPARED BY	CHECKED BY	APPROVED BY	AUTHORISED BY							SHT. No 7 OF 67
SIGN QSV	SIGN <i>[Signature]</i>	SIGN <i>[Signature]</i>	<i>[Signature]</i>							
DATE 03/10/96	DATE 12.10.96	DATE 12/10/96	12/10/96							
C/MAN-II /PDO	CHMAN I /PDO	HOS/PDO	DO/PDO							

NOMENCLATURE
CAMSHAFT INLET (307.06.4A) & EXHAUST (307.21.1A)

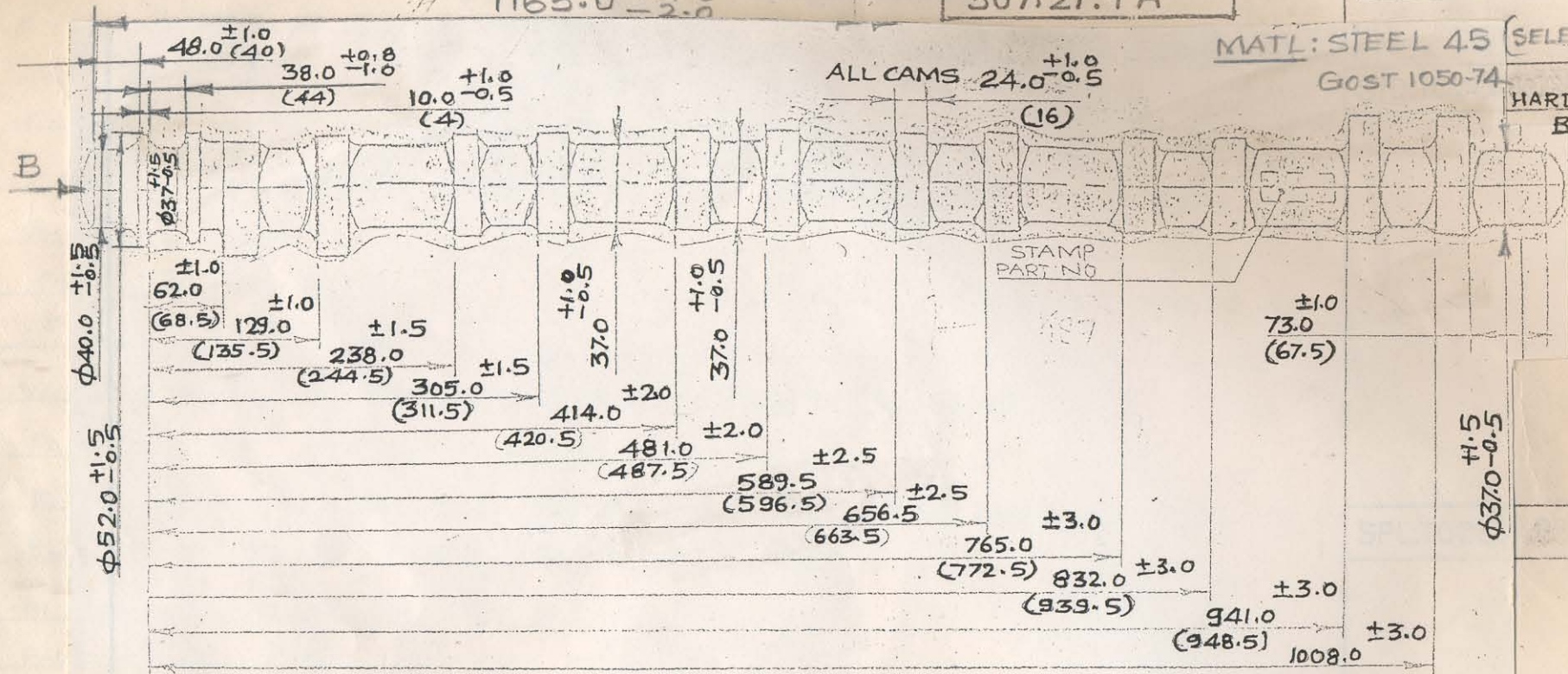
DRAWING.NO
307.06.4A
307.21.1A

ISSUE
OPN.NO
000
OPERATION
FORGING
MACHINE:

1163.0 ± 4.0
-3.0

MATL: STEEL 45 (SELECT C 0.42 TO 0.47)
GOST 1050-74

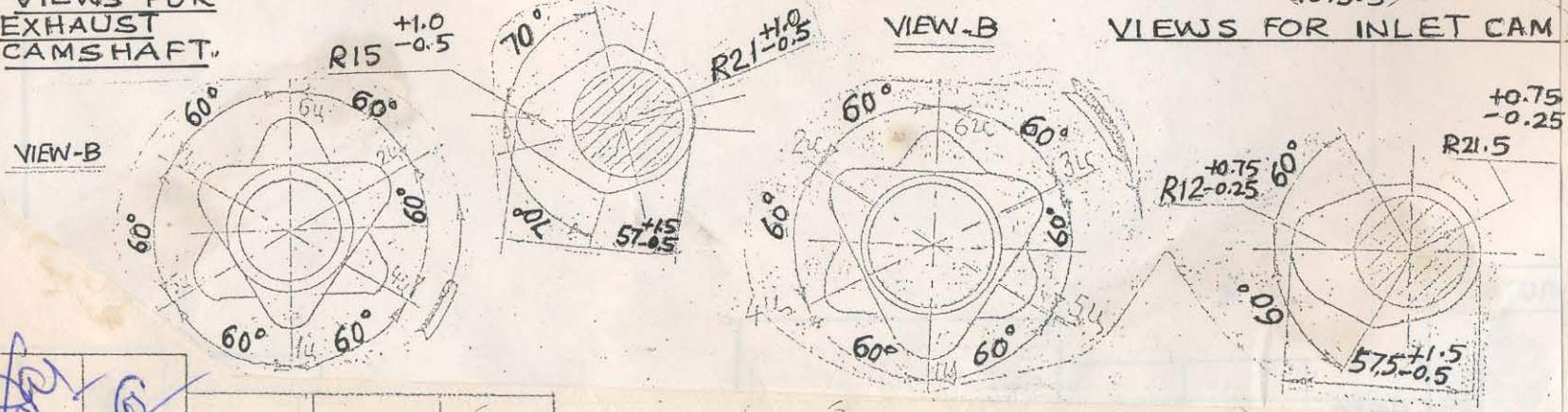
HARDNESS:
BHN: 163 TO 207



STAMP
PART NO

VIEWS FOR
EXHAUST
CAMSHAFT.

VIEWS FOR INLET CAM SHAFT



PRED.	CHD.	APPD.	DATE	ISSUE	DATE
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NOMENCLATURE

CAM SHAFT INLET (307.06.4A) & EXHAUST (307.21.1A)

DRAWING NO

307.06.4A

307.21.1A

ISSUE

OPN. NO

000

OPERATION

FORGING

MACHINE:

TECHNICAL REQUIREMENTS

STD. TOOLS & GAUGES

SPL. TOOLS & GAUGES

1. ALL DRAFTS TO BE $1^{\circ}/6$.
2. MIS-ALIGNMENT (SHIFT OF DIE AXES) UP TO 1 MM.
3. CURVATURE UP TO 1.5 MM.
4. CAVITIES AND DENTS ALONG THE CAM PROFILE ARE ALLOWED WITHIN TOLERANCE LIMIT.
5. LIMIT DEVIATION ON THE CAM CAMBER ANGLE RELATIVE TO POSITION OF 1ST CAM "C" TO BE $\pm 2^{\circ}$
6. UNDER FILLING OF CORNERS IS TO BE WITHIN 0.5 OF TOLERANCE.
7. PARTING LINE FIN UP TO 1 MM ON A SIDE IS ALLOWED.
8. TO BE MARKED WITH COMPONENT NUMBER AND MELT NO (TYPE NO: 7)
9. ELLIPTICITY TO BE WITHIN TOLERANCE LIMITS.
10. UN-SPECIFIED RADII TO BE R2.0
11. PARTS TO BE DE-SCALED BY ETCHING.
12. CUT OUT AND DRESSING OF DEFECTS ON JOURNALS TO THE DEPTH OF 1 MM FROM MINIMUM SIZE ARE ALLOWED.
13. TO BE HEAT TREATED TO HARDNESS BHN 163 TO 207 (DR 4.2 - 4.7)
14. MATERIAL - STEEL 45, SELECTED (0.42 - 0.47) GOST 1050-74

DSV					
PRED.	CHD.	APPD.	P&T REF	ISSUE	DATE

NOMENCLATURE
CAM SHAFT INLET (307.06.4A) & EXHAUST (307.21.1A)

DRAWING.NO
307.06.4A

307.21.1A

ISSUE

OPN.NO
010

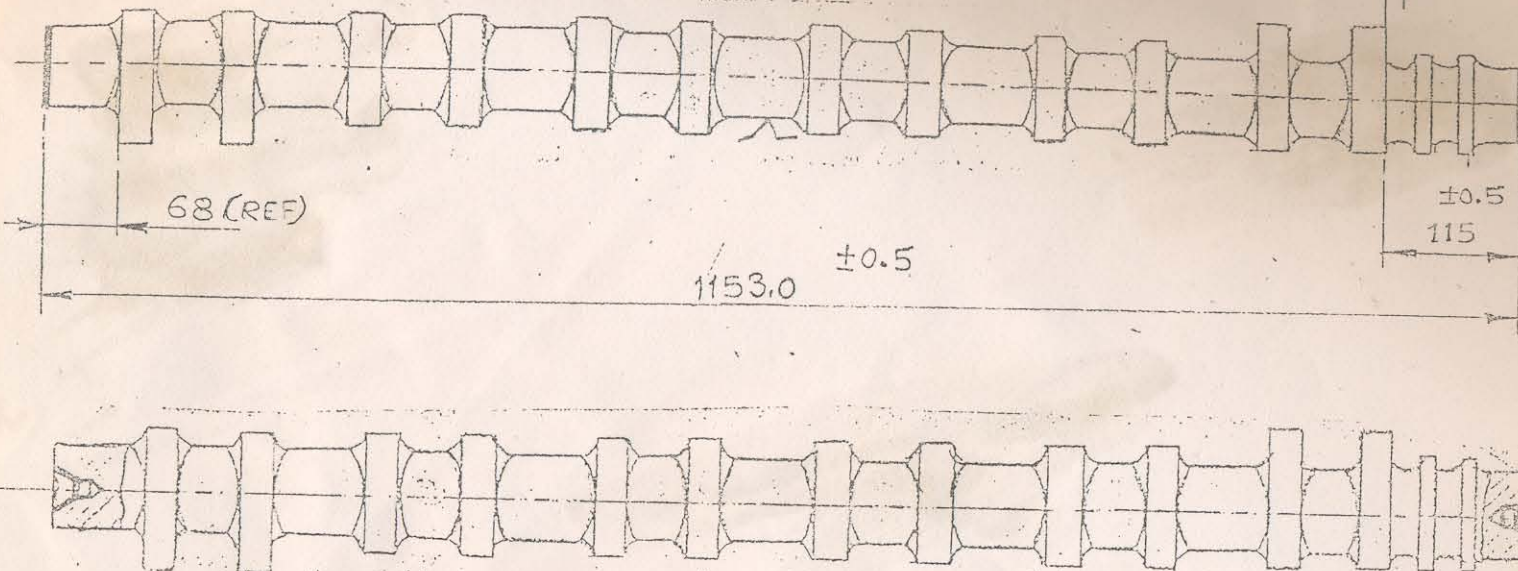
OPERATION
FACING AND CENTERING

MACHINE: FACING AND
CENTERING MACHINE
HMT

STD. TOOLS & GAUGES

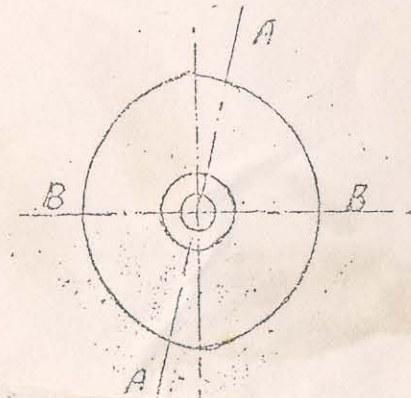
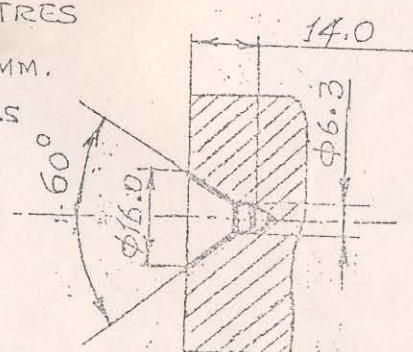
1. SQUARE SHOULDER
FACE MILL - $\phi 160$ R.H.
2. INSERT. TPKN-1603 PDR
(10 No's) P30
3. CENTRE DRILL A6.3 X 16
4. VERNIER HEIGHT
GAUGE 0-1500MM
5. VERNIER - 0-150MM

SPL. TOOLS & GAUGES



TECHNICAL REQUIREMENT

MIS-ALIGNMENT OF CENTRES
IS TO BE WITHIN ± 0.4 MM.
(VARIATION IN WALL THICKNESS
ALONG LINE A-A AND B-B
SHOULD NOT EXCEED 0.8 MM)



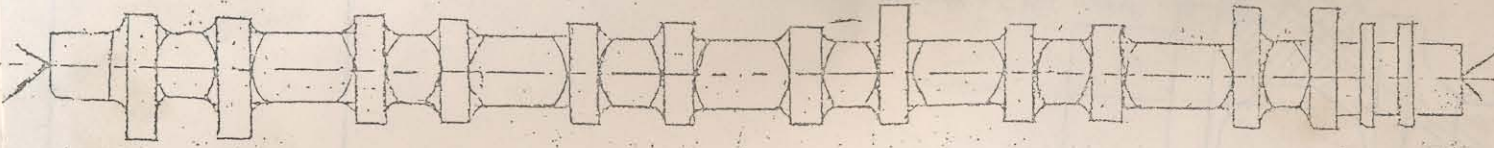
PRED.	CHD.	APPD.	DATE	ISSUE	DATE

NOMENCLATURE
CAM SHAFT INLET (307.06.4A) & EXHAUST (307.21.1A)

DRAWING NO
307.06.4A
307.21.1A

ISSUE
OPN.NO
O20
OPERATION
STRAIGHTENING
MACHINE: HYDRAULIC
PRESS - 10 TON.

STRAIGHTENING



TECH. REQT.

STRAIGHTEN CAM SHAFT RELATIVE TO
JOURNALS. ADMISSIBLE RUN-OUT TO BE
1.0MM MAX.

STD. TOOLS & GAUGES

- 1. 'V' BLOCK (2 No's) 400598
- 2. MARKING BLOCK

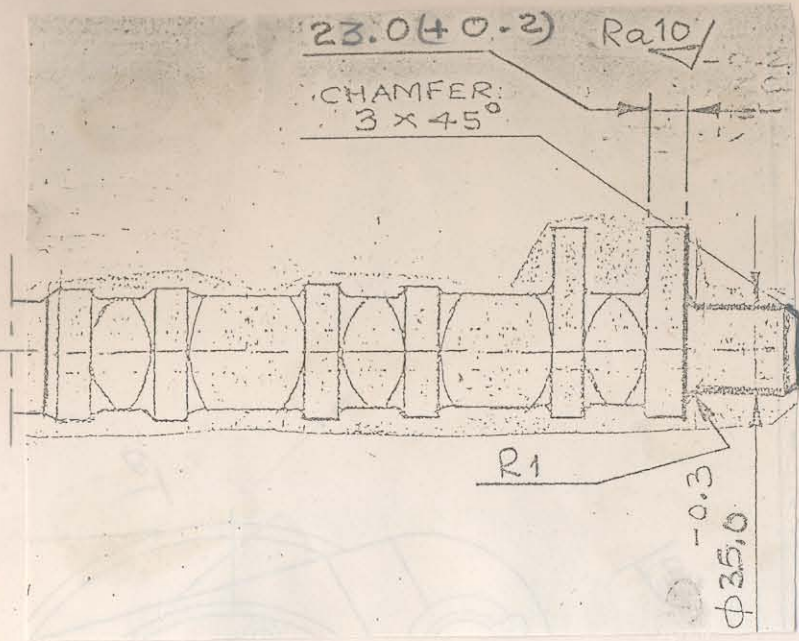
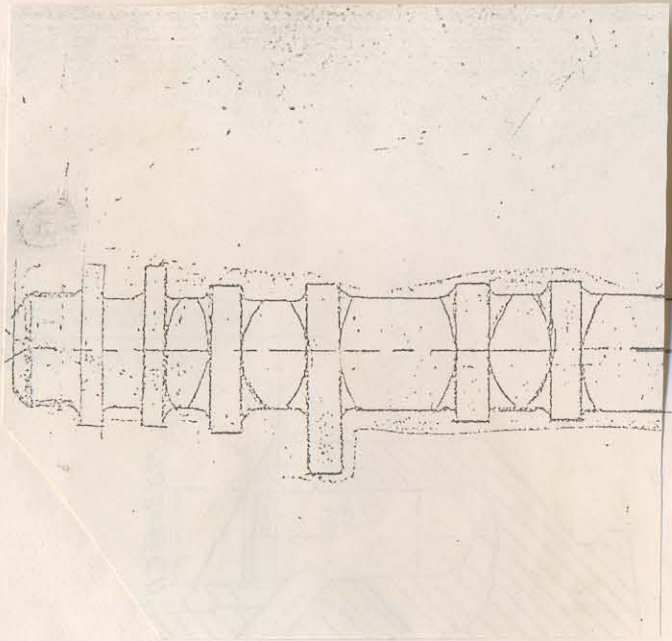
SPL. TOOLS & GAUGES

QSV	<i>[Signature]</i>	<i>[Signature]</i>			
PRED.	CHD.	APPD.	PETE REF	ISSUE	DATE

NOMENCLATURE
CAMSHAFT INLET (307.06.4A) & EXHAUST (307.21.1A)

DRAWING.NO
307.06.4A
307.21.1A

ISSUE
OPN.NO
030
OPERATION
TURNING
MACHINE: CENTRE LATHE
HMT-NH-26/1500.



- STD.TOOLS&GAUGES
- | | |
|-----------------------------|--------------------|
| 1. TURNING TOOL | PDS NR
2525 M15 |
| 2. INSERT - DNMG-150608 P30 | |
| 3. CHAMFERING TOOL | PSSNR
2525 M12 |
| 4. INSERT - SNMG-120408 P30 | |
| 5. VERNIER | 0-150MM |

SPL.TOOLS & GAUGES

RSV	for				
PRED.	CHD.	APPD.	PETE REF	ISSUE	DATE

NOMENCLATURE

CAM SHAFT INLET (307.06.4A) & EXHAUST (307.21.1A)

DRAWING.NO

307.06.4A

307.21.1A

ISSUE

OPN.NO

040

OPERATION

TURNING

MACHINE: CENTRE LATHE

HMT

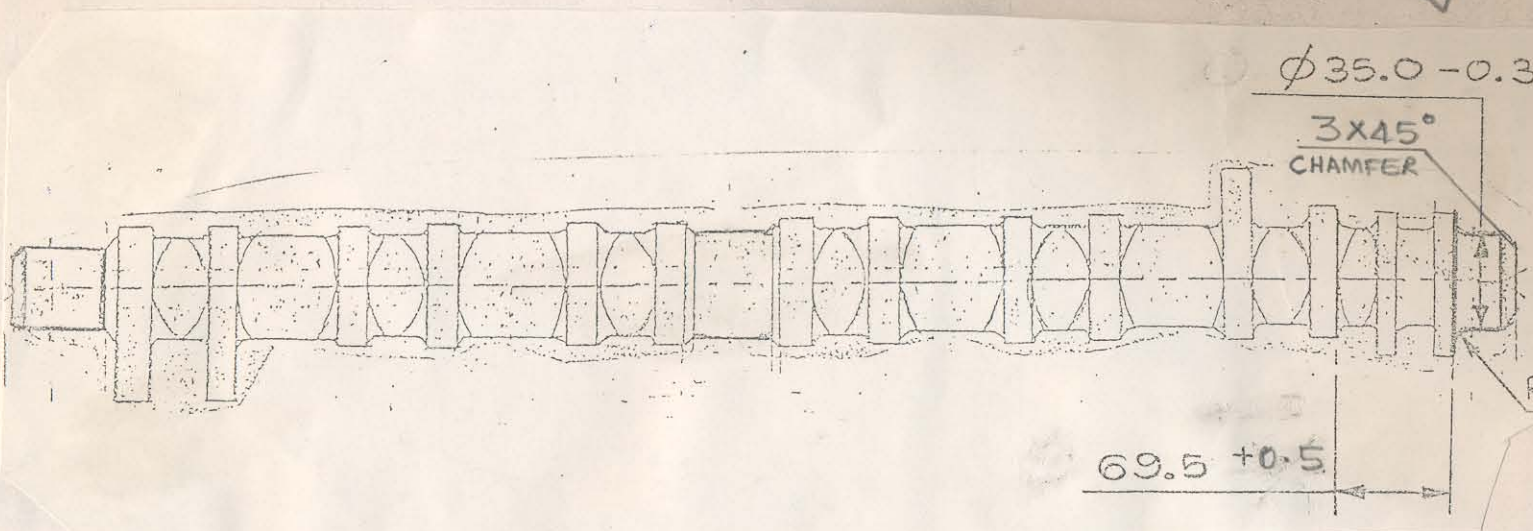
NH-26/1500

STD.TOOLS&GAUGES

- | | |
|--------------------|-------------------|
| 1. TURNING TOOL | PD3NR
2525 M12 |
| 2. INSERT. DNMG | 150608 P30 |
| 3. CHAMFERING TOOL | PSSNR
2525 M12 |
| 4. INSERT. SNMG | 120408 P30 |
| 5. VERNIER | 0-150 MM |

SPL.TOOLS & GAUGES

Ra10



PRED.	CHD.	APPD.	PETE RBF	ISSUE	DATE