

ENGINE FACTORY, AVADI

PROCESS SCHEDULEDESCRIPTION :- **CAM SHAFT INLET & EXHAUST**COMPT. No :- **20-07-06A & 20-07-15A**MFG. SHOP :- **MPS**

REV. NO. - 00

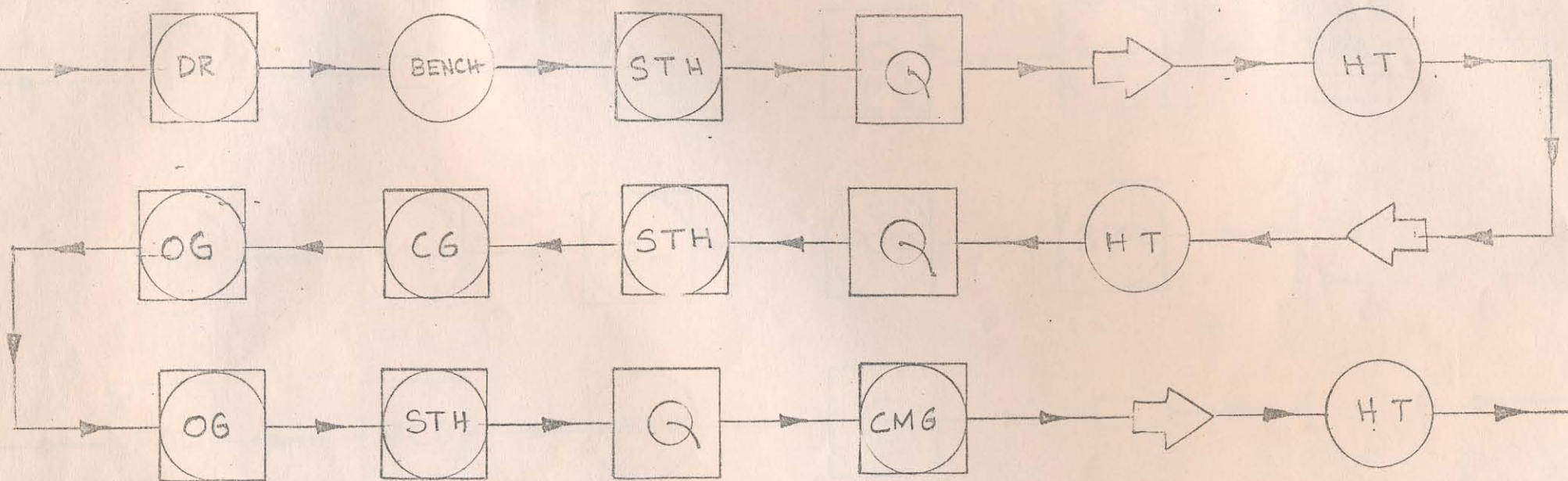
DATE - 12.10.96

FLOW PROCESS CHART

STORE : CAM SHAFT

DRG. NO. : 20-07-06A
20-07-15A

END STORE : UTD-20-ASSEMBLY



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

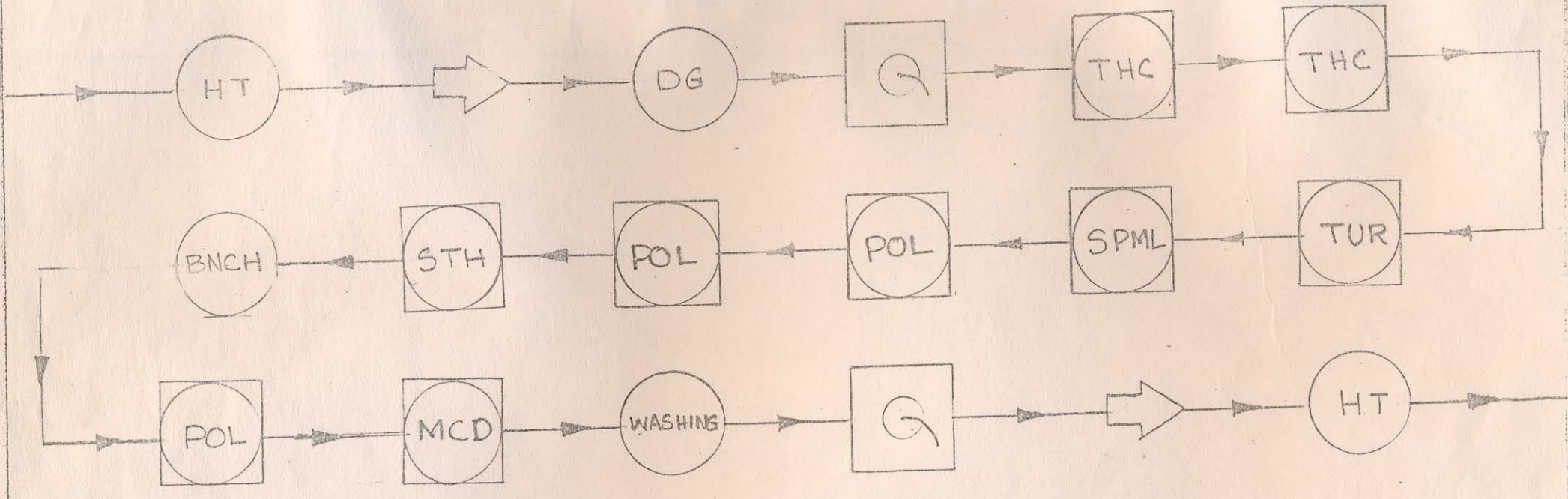
LEGEND		APPROVAL			SECTION	MPS	
TEMP. STORAGE	▽	TRANSPORTATION	⇒	SIGNATURE & DATE		NO. OF SHEETS	4
OPERATION	○	INSPECTION BY QC	⊠	PREPARED BY	MGR <i>DARR</i> QC	SHEET NO.	2
OPERATION CUM INSPECTION	◻	INSPECTION BY SQAE/CQA/ME) Etc.	⊡	APPROVED BY	<i>[Signature]</i>	ENGINE FACTORY, AVADI, MADRAS-54	
100% INSPN. BY MFG. SEC.	◻	STORAGE	△	AUTHORISED FOR ISSUE	<i>Prake</i> 12/10/96		

LOW PROCESS CHART

DRG. NO.: 20-07-06A
20-07-15A

END STORE: UTD-20-ASSEMBLY

STORE: CAM SHAFT



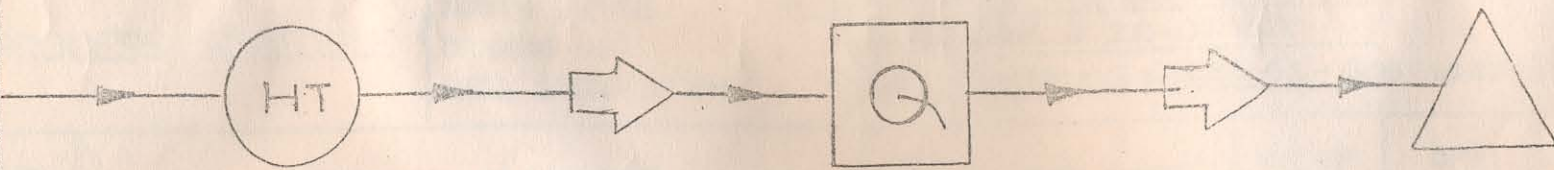
HT = HEAT TREATMENT	DG = DEGREASING	THC = THREAD CUTTING	TUR = TURNING	SPML = SPLINE MILLING
POL = POLISHING	STH = STRAIGHTENING	MCD = MAGNETIC CRACK DETECTION	HT = HEAT TREATMENT	

	LEGEND	APPROVAL	
TEMP. STORAGE	▽	TRANSPORTATION	➔
OPERATION	○	INSPECTION BY QC	Q
OPERATION CUM INSPECTION	□	INSPECTION BY SQAE/CQA/ME) Etc	1
100% INSPN. BY MFG. ENG.	—	STORAGE	△
		SIGNATURE & DATE	NO. OF SHEETS
		PREPARED BY	4
		MGR. <i>DWR</i> QC	SHEET NO.
		APPROVED BY	3
		AUTHORISED FOR ISSUE	ENGINE FACTORY, AVADI, MADRAS-60
		<i>Make 12/10/96</i>	

STORE : CAM SHAFT

DRG. NO.: 20-07-06A
20-07-15A

END STORE: UTD-20-ASSEMBLY



HT = HEAT TREATMENT

LEGEND		APPROVAL		SECTION	MPS
TEMP. STORAGE	—	TRANSPORTATION	→	SIGNATURE & DATE	NO. OF SHEETS 4
OPERATION	○	INSPECTION BY QC	□ Q	PREPARED BY MGE <i>DWR</i> QC	SHEET NO. 4
OPERATION CUM INSPECTION	□	INSPECTION BY SQAE/CQA/ME) Etc.	□ I	APPROVED BY <i>[Signature]</i>	ENGINE FACTORY, AWADI, MADRAS-54
ISSUE INSPN. BY MFG. SEC.	—	STORAGE	△	AUTHORISED FOR ISSUE <i>Make 12/10/96</i>	



ENGINE FACTORY AVADI

FORM No :EFA/P-038

PROCESS SCHEDULE

NOMENCLATURE : CAMSHAFT INLET & EXHAUST
 DRAWING No : 20.07.06A & 20.07.15A
 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				
010	FACING & CENTERING	10	FACING & CENTERING M/C HMT			
020	STRAIGHTENING	11	HYDRAULIC PRESS 10 TON			
030	TURNING	12	CENTRE LATHE HMTNH26/1500			
040	TURNING	13	-DO-			
050	WHIRLING	14 & 15	WHIRLING MACHINE GFM			
060	DEBURRING	16	BENCH			
070	STRAIGHTENING	17	HYDRAULIC PRESS 10 TON			

PREPARED BY		CHECKED BY		APPROVED BY		AUTHORISED BY						SHT. No 1 OF 58
SIGN	QSV	SIGN	<i>[Signature]</i>	SIGN	<i>[Signature]</i>	SIGN	<i>[Signature]</i>					
DATE	03/10/96	DATE	12.10.96	DATE	12/10/96	DATE	12/10/96					
C/MAN-II /PDO		CN/manI /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 : 20.07.06A & 20.07.15A
 MATL. SPECIFICATION :

OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
070	STRAIGHTENING	17	HYDRAULIC PRESS-10TON			
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-10TON			
120	TURNING	22	CENTRE LATHE HMTNH26/1500			
130	TURNING	23	CNC LATHE HMT SB-CNC			
140	TURNING	24	-DO-			

PREPARED BY		CHECKED BY		APPROVED BY		AUTHORISED BY						SHT. No 2 OF 58
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		Choran 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 : 20-DT-06A & 20-DT-15A
 MATL SPECIFICATION :

OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
150	TURNING HARDENING	25	CNC LATHE HMT SB-CNC			
160	DRESSING	26	BENCH			
170	DRILLING	26	SWIFT DRILLING M/C			
180	DRILLING GRINDING	27	- DD -			
190	DEBURRING	28	BENCH			
200	STRAIGHTENING	29	HYDRAULIC PRESS 10 TON			
205	ROUGH GRINDING	29a	CAMGRINDER LANDIS			
210	INSPECTION	30&31				
220	PASSIVATION	32				

PREPARED BY		CHECKED BY		APPROVED BY		AUTHORISED BY						SHT. No 3 OF 58
SIGN	RSV	SIGN	<i>[Signature]</i>	SIGN	<i>[Signature]</i>	<i>[Signature]</i>						
DATE	03/10/96	DATE	12.10.96	DATE	02/10/96	12/10/96		71	1	25/12/98		
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 : 20-07.06A & 20-07.15A
 MATL. SPECIFICATION :

OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
230	INDUCTION HARDENING	33	INDUCTION HARDENING M/C			
240	INSPECTION	-				
250	STRAIGHTENING	34	HYDRAULIC PRESS 10TON			
260	CENTRE HOLE GRINDING	35	CENTRE HOLE GRINDER "ACCUMAC"			
270	GRINDING	36	CYLINDRICAL GRINDER HMTG22/2000			
280	GRINDING	37	-DO-			
290	STRAIGHTENING	38	HYDRAULIC PRESS			
300	INSPECTION	39				

PREPARED BY		CHECKED BY		APPROVED BY		AUTHORISED BY						SHT. No 4 OF 58
SIGN	<i>RSN</i>	SIGN	<i>[Signature]</i>	SIGN	<i>[Signature]</i>	<i>[Signature]</i> 12/10/96						
DATE	03/10/96	DATE	12.10.96	DATE	12/10/96			PDO REF	ISSUE	DATE	SIGN	
C/MAN-II /PDO		Chyman.I /PDO		HOS/PDO		DO/PDO						



ENGINE FACTORY AVADI

FORM No :EFA/P-038

PROCESS SCHEDULE

NOMENCLATURE : CAMSHAFT INLET & EXHAUST
 DRAWING No : 20-07-06A & 20-07-15A
 MATL SPECIFICATION :

OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
310	CAM GRINDING	40	CAM GRINDER "LANDIS"			
315	PASSIVATION	—				
320	TEMPERING	41	HEAT TREATMENT PLANT			
330	DEGREASING	—				
340	INSPECTION	42				
350	THREAD CUTTING	43	SB-CNC LATHE HMT			
360	THREAD CUTTING	44	-DO-			
370	TURNING	45	CENTRE LATHE HMT NH 26/1500			

PREPARED BY		CHECKED BY		APPROVED BY		AUTHORISED BY						SHT. No 5 OF 58
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		PDO REF	ISSUE	DATE	SIGN	



ENGINE FACTORY AVADI

FORM No :EFA/P-038

<p>PROCESS SCHEDULE</p>	<p>NOMENCLATURE : <u>CAMSHAFT INLET & EXHAUST</u></p> <p>DRAWING No : <u>20.DT.D6A & 20.DT.15A</u></p> <p>MATL SPECIFICATION :</p>
--------------------------------	--

OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
380	SPLINE MILLING	46	SPLINE MILLING M/C WMW			
390	POLISHING	47	POLISHING M/C-HEY			
400	POLISHING	48	-DO-			
410	STRAIGHTENING	49	HYDRAULIC PRESS 10TON			
420	DRESSING	50	BENCH			
430	POLISHING	51	BENCH			
440	WASHING	—	WASHING PLANT			
450	MAGNETIC CRACK DETECTION	—	MAGNETIC FLAW DETECTOR			

PREPARED BY	CHECKED BY	APPROVED BY	AUTHORISED BY					SHT. No 6 OF 58
SIGN <i>QSY</i>	SIGN <i>[Signature]</i>	SIGN <i>[Signature]</i>	SIGN <i>[Signature]</i>					
DATE 03/10/96	DATE 12.10.96	DATE 12/10/96	DATE 12/10/96					
C/MAN-II /PDO	CH/ran I /PDO	HOS/PDO	DO/PDO					



ENGINE FACTORY AVADI

FORM No :EFA/P-038

PROCESS SCHEDULE

NOMENCLATURE : CAMSHAFT INLET & EXHAUST
 DRAWING No : 20.07.06A & 20.07.15A
 MATL SPECIFICATION :

OPN No	DESCRIPTION OF OPERATION	SHT No	WORK CENTRE	SET UP TIME	OPN TIME	REMARKS
460	WASHING	—	WASHING PLANT			
470	FINAL INSPECTION	52 To 57				
480	PASSIVATION	—				
490	OXIDIZING	—	HEAT TREATMENT PLANT			
500	INSPECTION	58				

PREPARED BY		CHECKED BY		APPROVED BY		AUTHORISED BY						SHT. No 7 OF 58
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	27/10/96						
C/MAN-II/PDO		CH/manI /PDO		HOS/PDO		DO/PDO		PDO REF	ISSUE	DATE	SIGN	

FORM No: EFA/P-001
PLANNING SHEET - PDO / EFA

NOMENCLATURE
CAMSHAFT INLET (20.07.06 A) & EXHAUST (20.07.15 A)

DRAWING.NO
20.07.06A
20.07.15 A

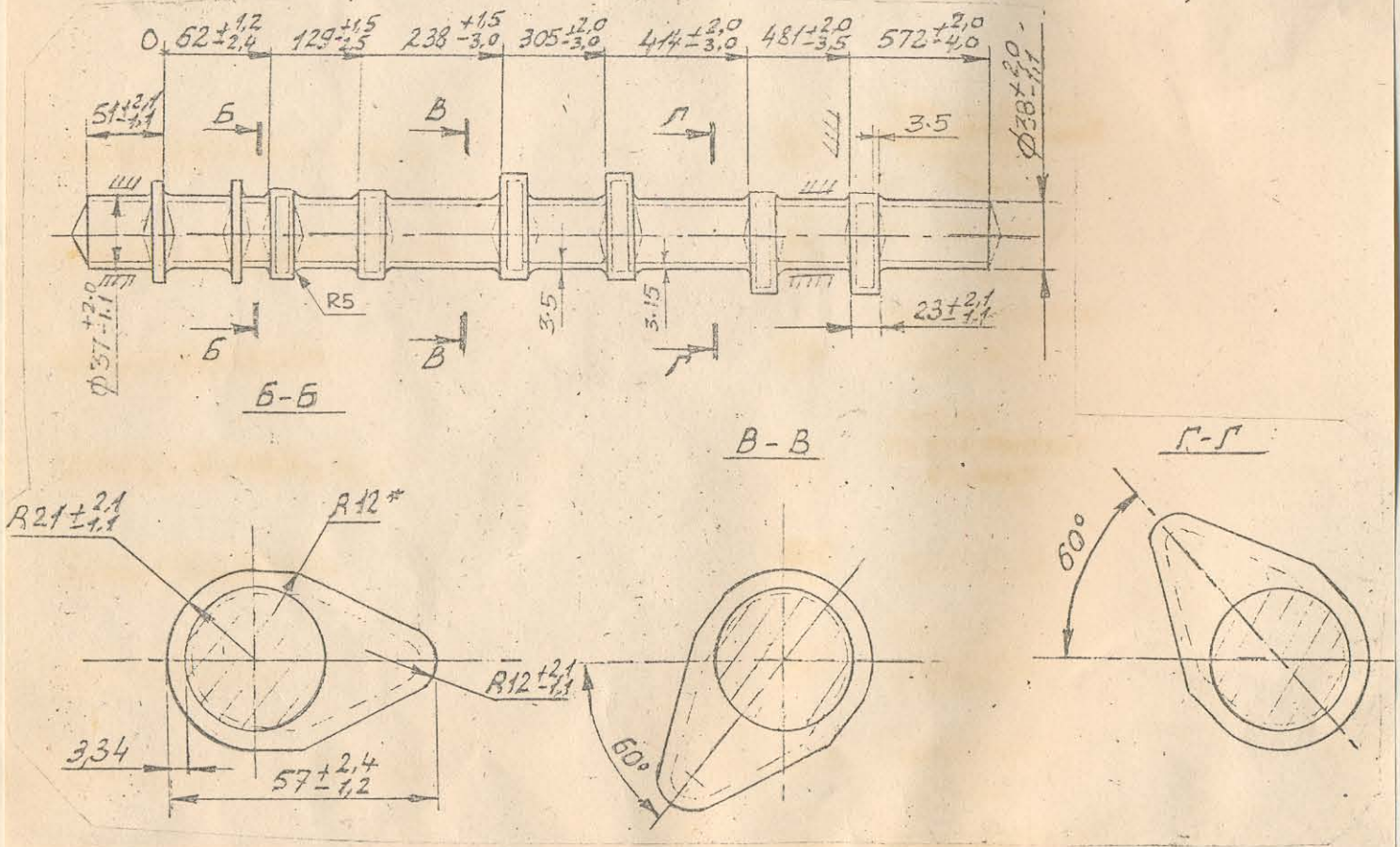
ISSUE
OPN.NO
000
OPERATION
FORGING

MACHINE:

MATERIAL: STEEL-45 (SELECT 0.42....0.47)
HARDNESS: BHN 163....207

STD.TOOLS & GAUGES

SPL.TOOLS & GAUGES



QSV	QSV	QSV			
PRED.	CHD.	APPD.	PETE REF	ISSUE	DATE

PLANNING SHEET - PDO / EFA FORM No: EFA/P-00

NOMENCLATURE
CAMSHAFT INLET (20.07.06A) & EXHAUST (20.07.15A)

DRAWING.NO	ISSUE
20.07.06A	
20.07.15A	

OPN.NO	OPERATION
	FORGING.
MACHINE:	

TECHNICAL REQUIREMENTS

1. UN SPECIFIED DRAFTS FROM 5° TO 7°
2. UN SPECIFIED RADIUS R3 MM
3. CURVATURE SHOULD NOT EXCEED 2 MM OVER LENGTH OF SHAFT.
4. ANGULAR DISPLACEMENT OF CAMS WITH RESPECT TO FIRST CAM SHOULD NOT EXCEED ±2°
5. DISPLACEMENT ALONG JOINT LINE OF DIE SHOULD NOT EXCEED 1 MM.
6. BURR ALONG SHEAR PERIMETER SHOULD NOT EXCEED 1.4 MM.
TIGHTENING OF BURR SHOULD NOT EXCEED 3 MM.
7. INCOMPLETE FILLING OF CORNERS SHOULD BE WITHIN 0.5 OF ACTUAL TOLERANCE
8. SCALE DENTS, NICKS AND OTHER SURFACE DEFECTS SHOULD NOT EXCEED THE DEPTH OF 0.5 OF ACTUAL ALLOWANCE.
9. CLAMPS, HAIR LINE CRACKS, AND OTHER DEFECTS IN DEPTH OF 0.5 MM SHOULD NOT EXCEED OF ACTUAL TOLERANCE. DETERMINE THE DEPTH OF DEFECT BY LOCAL RECESSES ACROSS AT RANDOM 0.5 OF THE BATCH.
10. REMOVE SCALE
11. NORMALISATION HARDNESS: BHN 207....163.

STD. TOOLS & GAUGES

SPL. TOOLS & GAUGES

RSV					
PRED.	CHD.	APPD.	PETE REF	ISSUE	DATE

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

NO. ENCLATURE
CAMSHAFT INLET (20.07.06A) & EXHAUST (20.07.15A)

DRAWING.NO
20.07.06A
20.07.15A

ISSUE

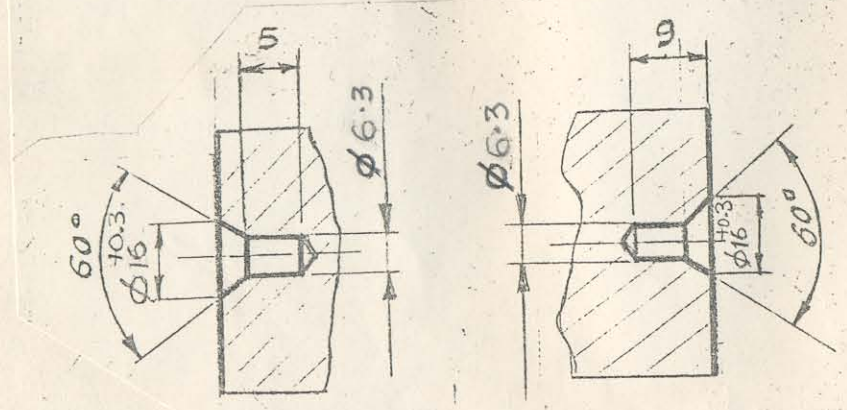
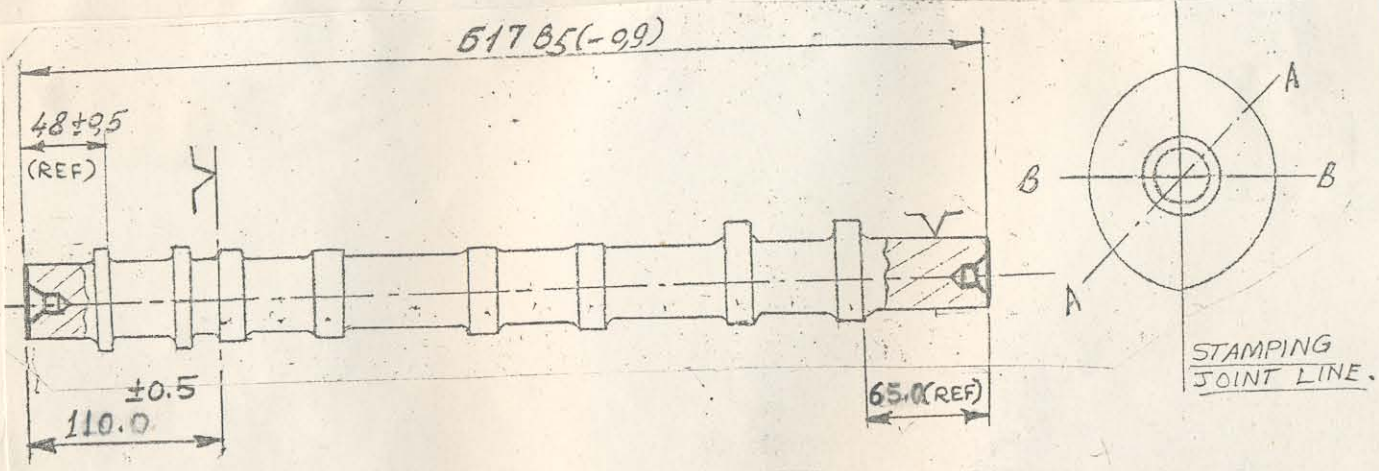
OPN.NO
010
OPERATION
FACING & CENTERING

MACHINE:
FACING & CENTERING M/C
HMT

STD. TOOLS & GAUGES

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

SPL. TOOLS & GAUGES



TECHNICAL REQUIREMENT:

1. DIFFERENCE IN WALL THICKNESS SHOULD NOT EXCEED 0.8MM. CARRY OUT MEASUREMENTS ALONG LINES A-A AND B-B
2. MOUNT PART IN 'V' BLOCKS SO THAT JOINT LINE OF DIE WAS LOCATED IN HORIZONTAL PLAN
3. DIMENSIONS OF CENTRE HOLES ARE ENSURED WITH DRILL

RSV	CHD	APPD.	PETE REF	ISSUE	DATE

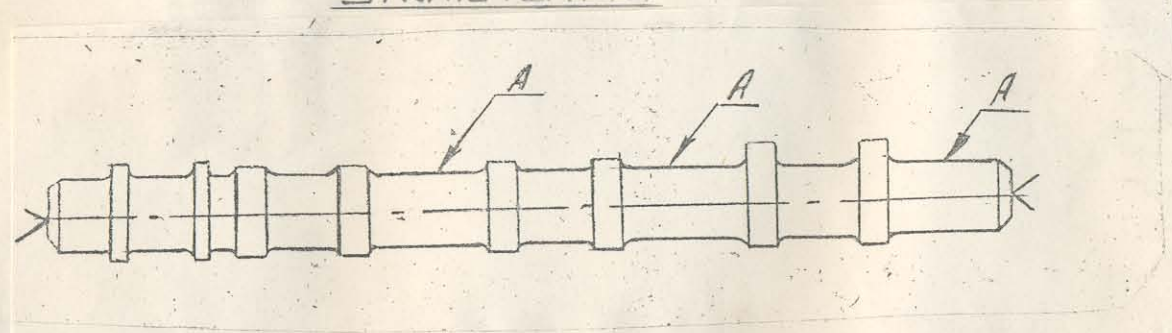
PLANNING SHEET - PDO / EFA FORM No: EFA/P-00

NOMENCLATURE
CAMSHAFT INLET (20.07.06A) & EXHAUST (20.07.15A)

DRAWING.NO
20.07.06A
20.07.15A

ISSUE
OPN.NO
020
OPERATION
STRAIGHTENING

STRAIGHTENING



TECHNICAL REQUIREMENT

RUN OUT OF SURFACE "A" WITH RESPECT TO CENTRES SHOULD NOT EXCEED 1.0 MM.

MACHINE:
HYDRAULIC PRESS
10 TON.

STD. TOOLS & GAUGES

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

SPL. TOOLS & GAUGES

RSV					
PRED.	CHD.	APPD.	PETE REF	ISSUE	DATE

PLANNING SHEET - PDO / EFA FORM No: EFA/P-0

NOMENCLATURE
CAMSHAFT INLET (20.07.06A) & EXHAUST (20.07.15A)

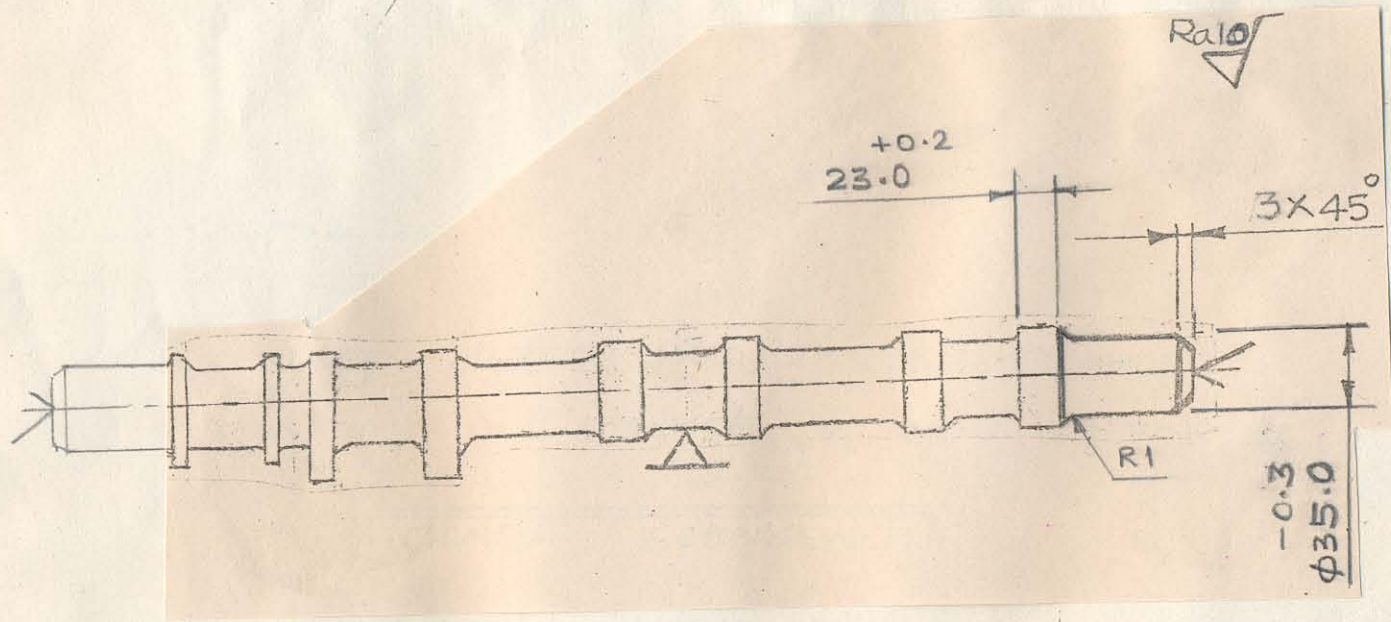
DRAWING.NO
20.07.06A
20.07.15A

ISSUE
OPN.NO: 030
OPERATION: TURNING

MACHINE: CENTRE LATHE
HMT - NH-26/1500.

STD. TOOLS & GAUGES

1. TURNING TOOL PDJNR
2525 M15
INSERT - DNMG-150608 P30
2. CHAMFERING TOOL PSSNR
2525 M12
INSERT - SNMG120408 P30
3. VERNIER 0-150MM



SPL. TOOLS & GAUGES

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

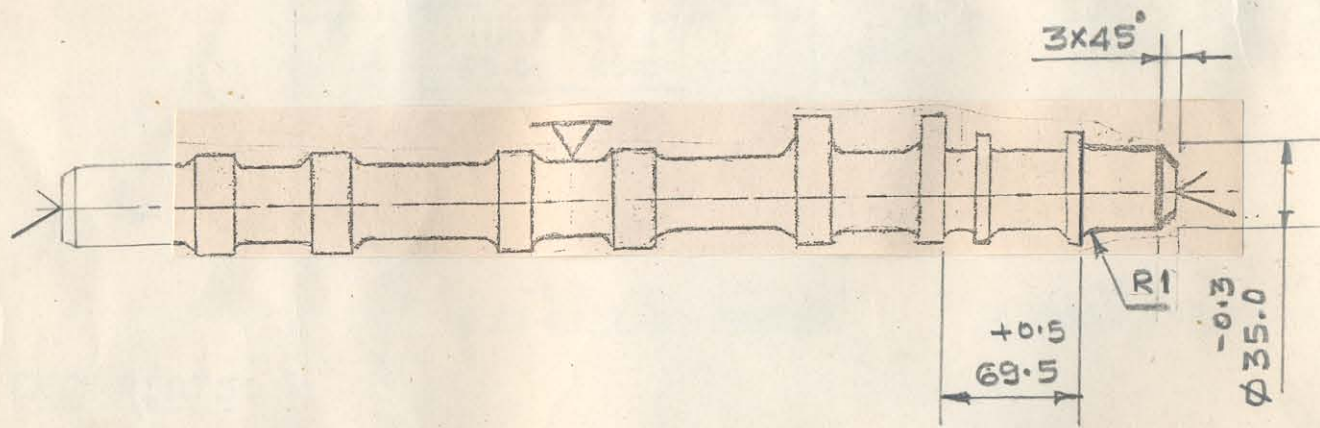
PLANNING SHEET - PDO / EFA FORM No: EFA/P-00

NOMENCLATURE
CAMSHAFT INLET (20.07.06A) & EXHAUST (20.07.15A)

DRAWING.NO
20.07.06A
20.07.15A

ISSUE
OPN.NO
040
OPERATION
TURNING
MACHINE: CENTRE LATHE
HMT-NH-26/1500

Ra10



- STD. TOOLS & GAUGES
- TURNING TOOL, PDSNR 2525 M15
INSERT - DNMG-150608 P30
 - CHAMFERING TOOL PSSNR 2525 M12
INSERT - SNMG-120408 P30
 - VERNIER - 0-150MM

SPL. TOOLS & GAUGES

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