

IIoT in CNC Machining

Course Objectives	<ul style="list-style-type: none">• Concept and fundamentals of IIOT in CNC Machining.• Advanced knowledge of CNC machining process and hands on experience to configure machine tool monitoring.• Applying the concepts of data collection and monitoring the status of CNC Turning and Milling machines.• Comprehending the advantages and application of IIOT in CNC turning and milling machines in the manufacturing industry with department wise benefits.• Experiencing a hands-on application of IIOT to improve productivity and processes.
Course Outcomes	<ul style="list-style-type: none">• Display IIoT principles and machine tool monitoring role in CNC machining.• Analyse applications of IIOT in a real time scenario.• Apply, monitor & analyse machine tool monitoring operations in CNC machining.• Relate and analyse the way manufacturing processes are monitored, controlled, and optimized in smart factories.

Course Duration: 45 Hours

Course Curriculum:

UNIT I Introduction to IIOT and Machine Tool Monitoring

Definition & overview of IIOT - Evolution and Trends in Industrial Automation - Key Components and Architecture of IIoT Systems - Applications and Use Cases in Various Industries - Overview of Machine Tools and Their Importance in Manufacturing - Challenges in Machine Tool Monitoring - Role of IIoT in Enhancing Machine Tool Performance and Efficiency.

UNIT II Machine Tool Monitoring in CNC Machine

Importance of Real-Time Monitoring in CNC Machining - Sensors and Data Acquisition - Features and Functions of Machine Tool Monitoring Software – Testing & Validation of System Performance under Various Operating Conditions.

UNIT III Machine Tool Monitoring Functionalities - Part 1

Production monitoring: Live state monitoring and alarm recognition - Tool Life monitoring: Tool Life information including tool number, count, life limit - Performance overview: Reviewing operational results and machine utilization - Diagnostics: Viewing diagnostic data, alarm history, and program history.

UNIT IV Machine Tool Monitoring Functionalities - Part 2

Signal monitoring: Monitoring feed rates, spindle/servo load, temperature override, etc - Operational and production results: Graphs displaying machine states and comparing production plans - Alarm history and program history: Analyzing past alarms and program cycle times.

UNIT V Advanced Functionalities and Practical Implementation

Signal history: Identifying correlations between machine signals and checking component conditions - Macro value history: Storing and analyzing macro variable values - Report output: Scheduling and customizing reports for automatic generation - File transfer: Managing NC data and creating backups.

Test Projects:

Use Cases:

Industry Use-Cases

1. Real time monitoring dashboard

Assessment Rubrics:

Task 1: Data collection

Task 2: Data Transmission

Task 3: Data Processing & Storage

Task 4: Dashboard development

Task 5: Visualization & Analysis

2. Calculate Overall Equipment Effectiveness (OEE) of shop

Assessment Rubrics:

Task 1: Availability (A)

Task 2: Performance (P)

Task 3: Quality (Q)

Task 4: Calculation of OEE

Task 5: Resource Allocation

3. Predictive Maintenance Analytics Report.

Assessment Rubrics:

Task 1: Equipment Health Overview

Task 2: Predictive Maintenance Alert

Task 3: Failure Prediction Trends

Task 4: Maintenance Performance Analysis

Task 5: Recommendations & Action plan

4. Energy Consumption and Efficiency Report

Assessment Rubrics:

Task 1: Data Collection and Aggregation

Task 2: Energy Consumption Analysis

Task 3: Efficiency Assessment

Task 4: Identification of Opportunities

Task 5: Recommendations and Action Plan

5. Quality Assurance Report

Assessment Rubrics:

Task 1: Data Collection and Analysis

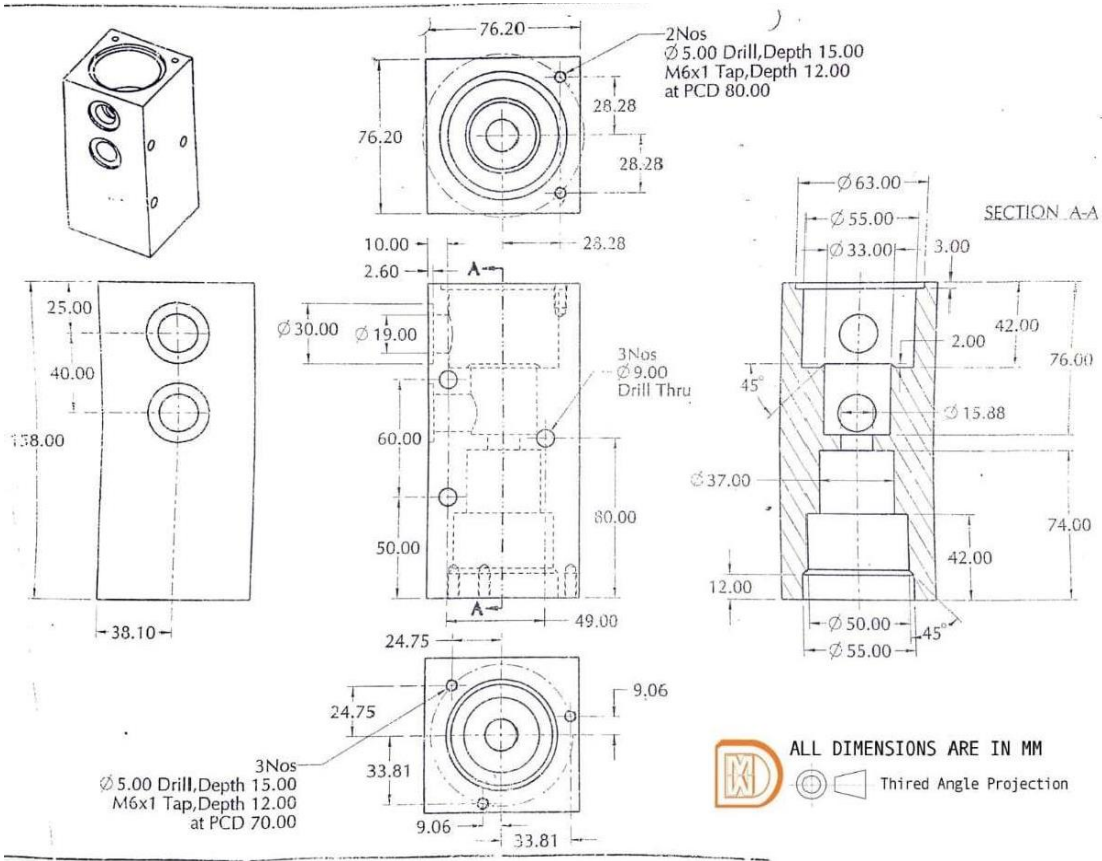
Task 2: Defect Analysis and Root Cause Identification

Task 3: Quality Performance Metrics

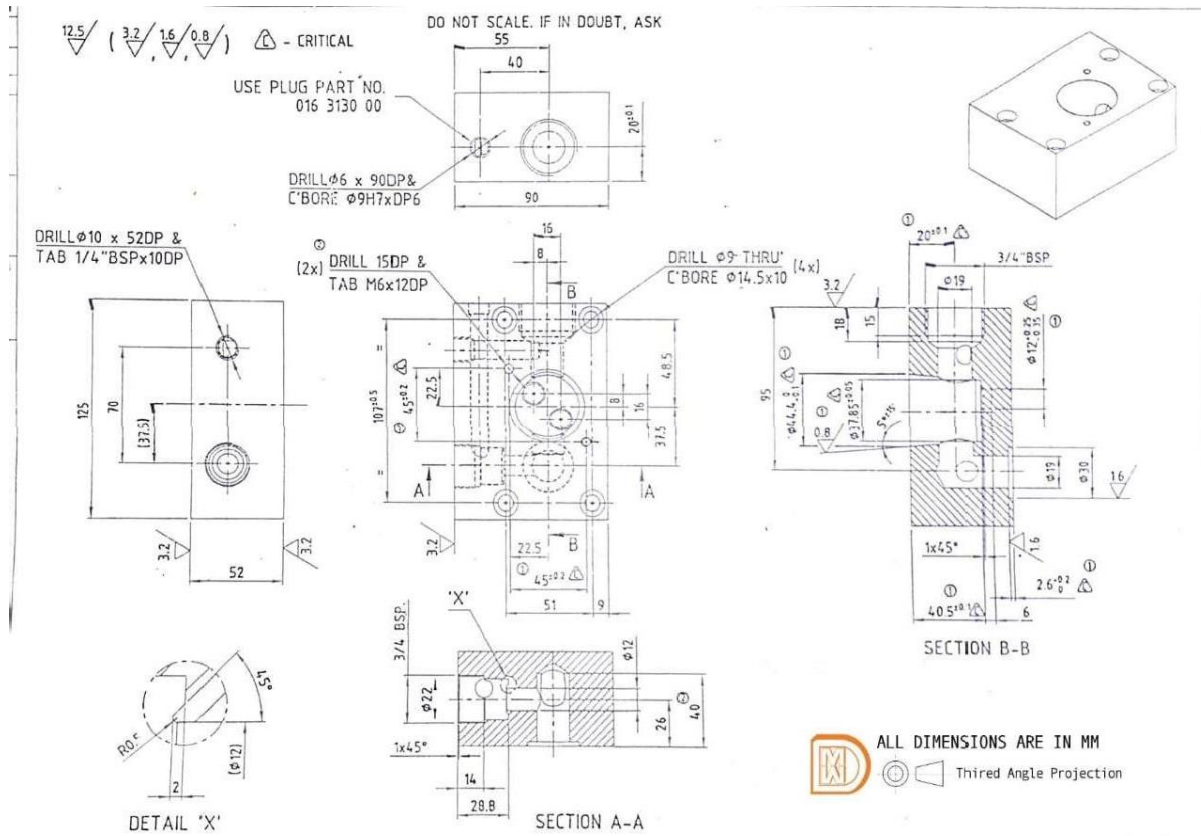
Task 4: Process Improvement Recommendations

Task 5: Continuous Improvement Plan

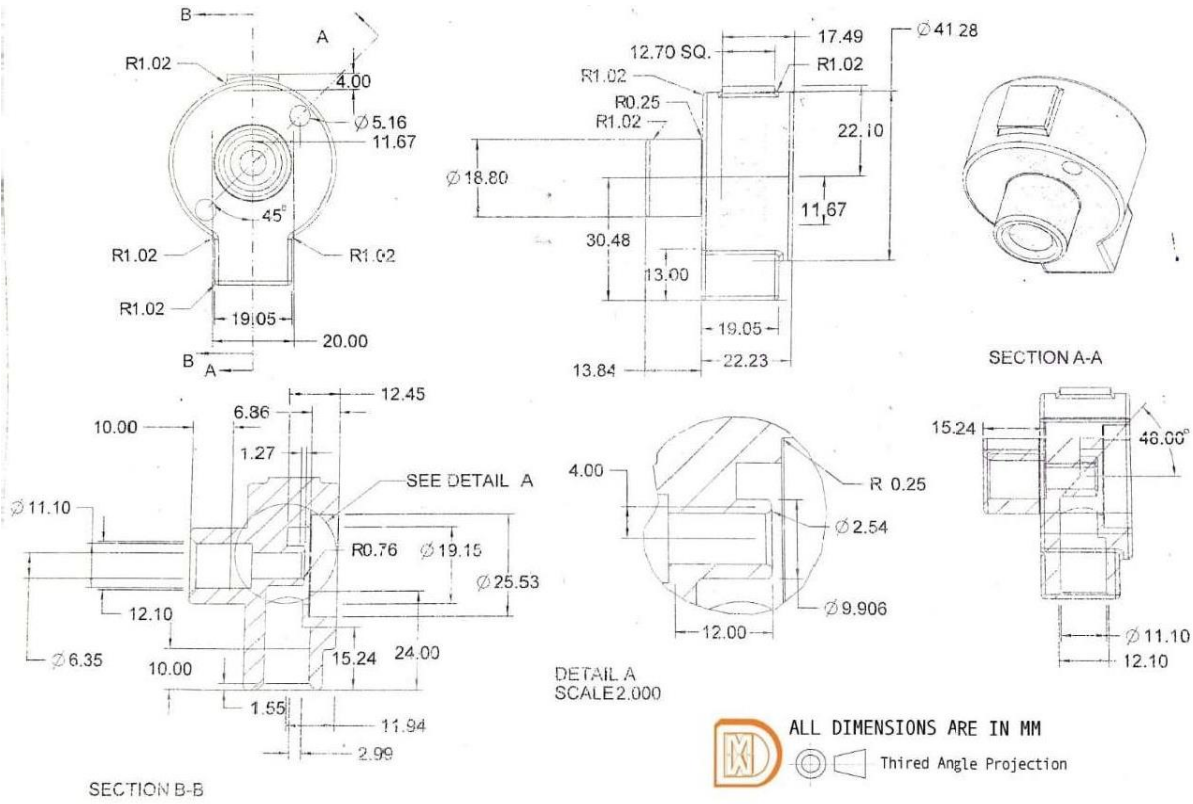
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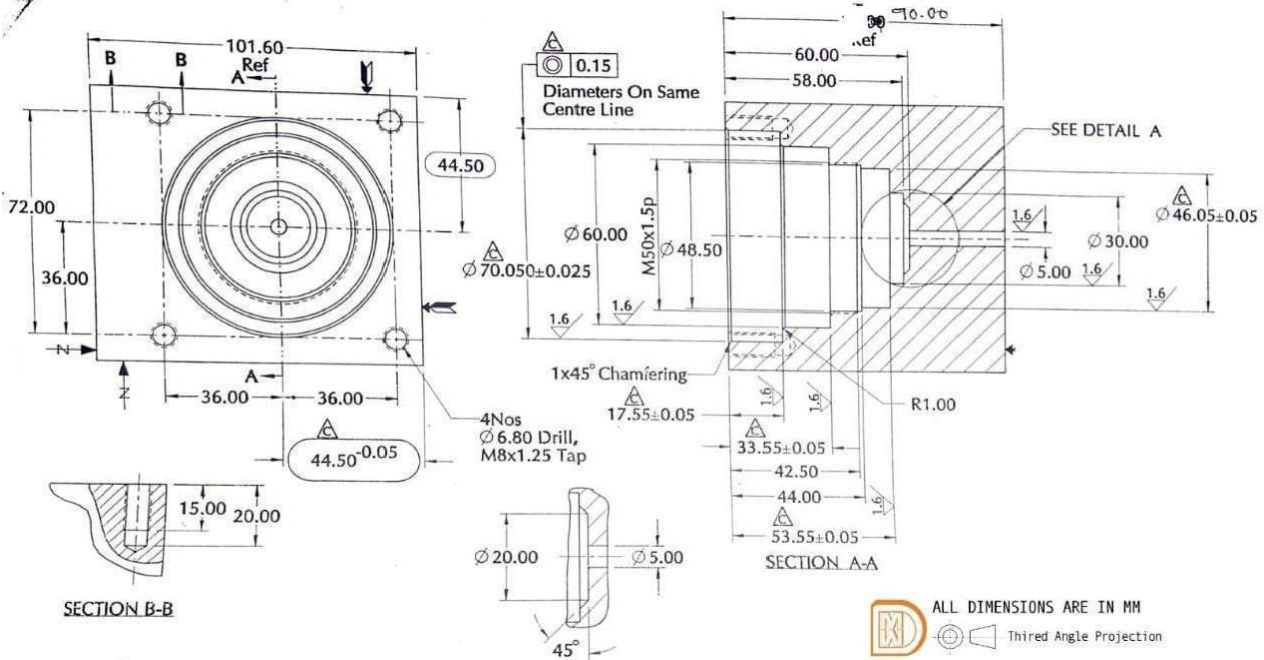
2) PART NAME - COCK BODY



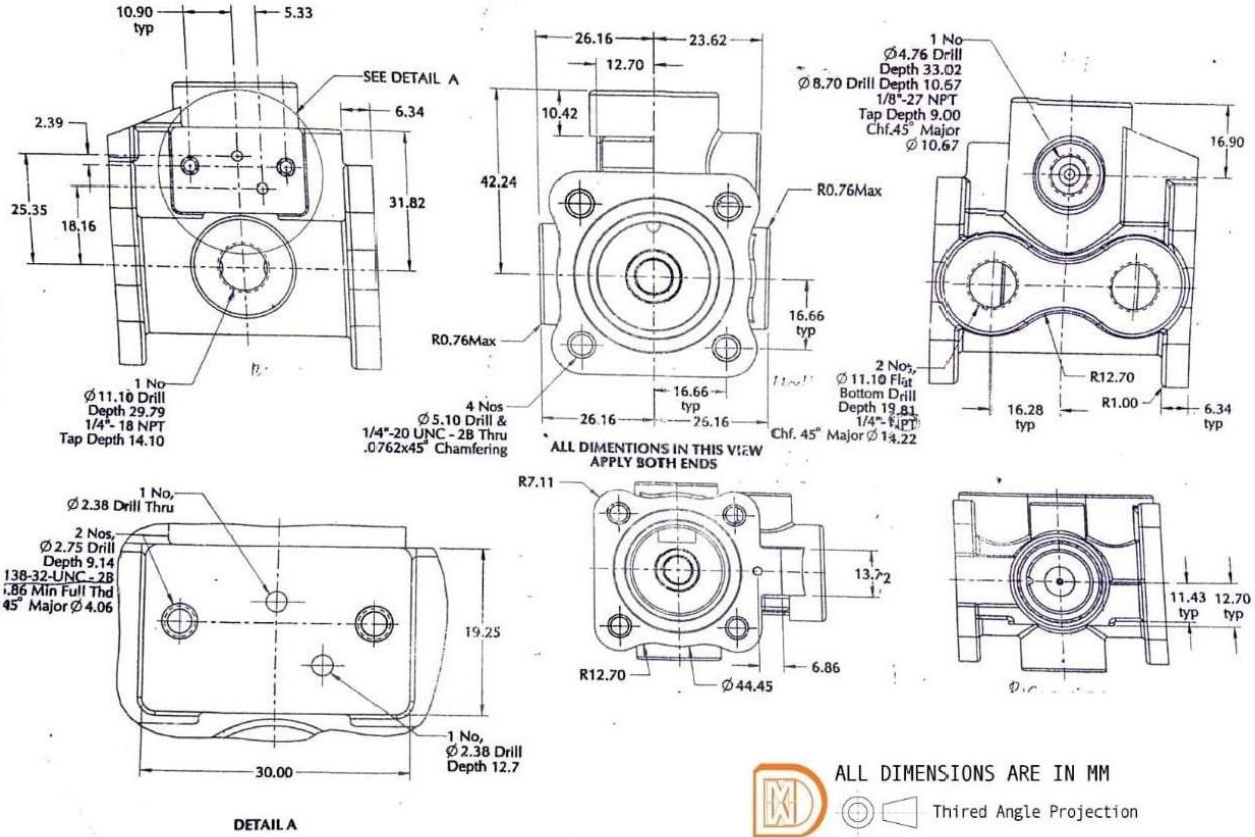
3) PART NAME –BODY ADAPTER QUICK EXHAUST

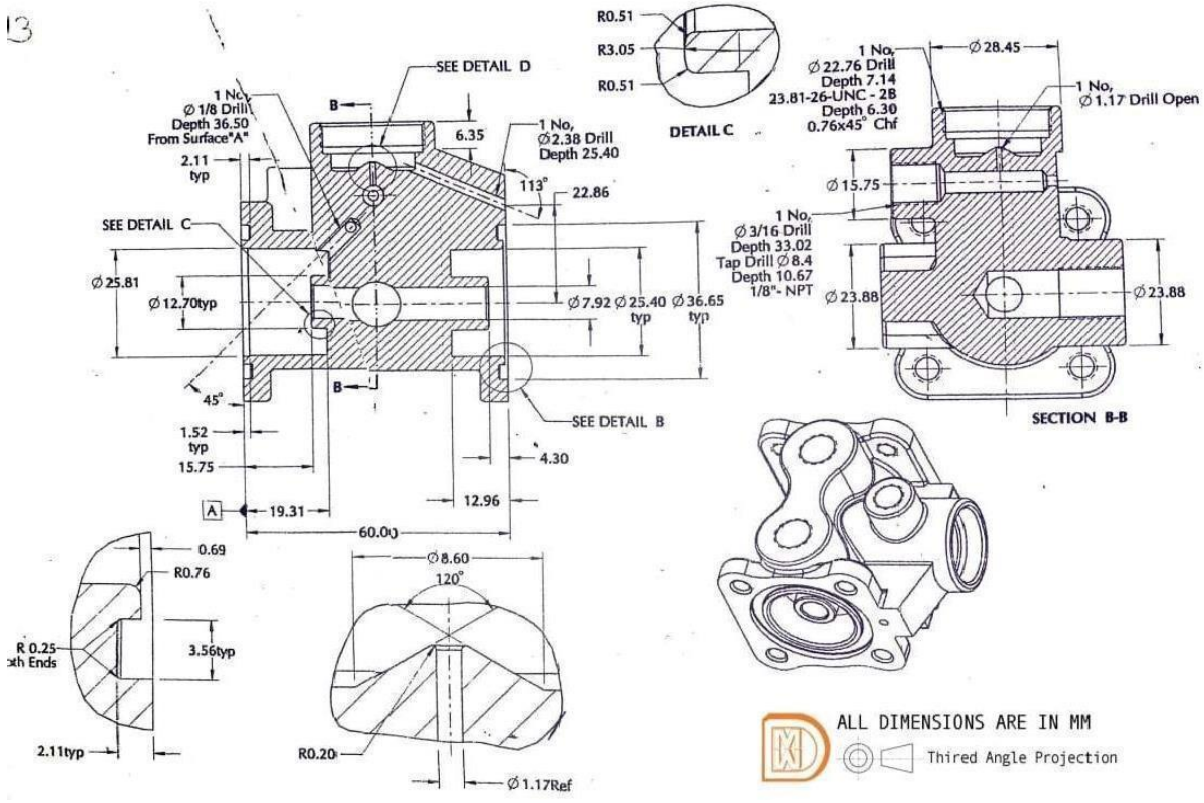


4) PART NAME - DISTRIBUTOR BODY

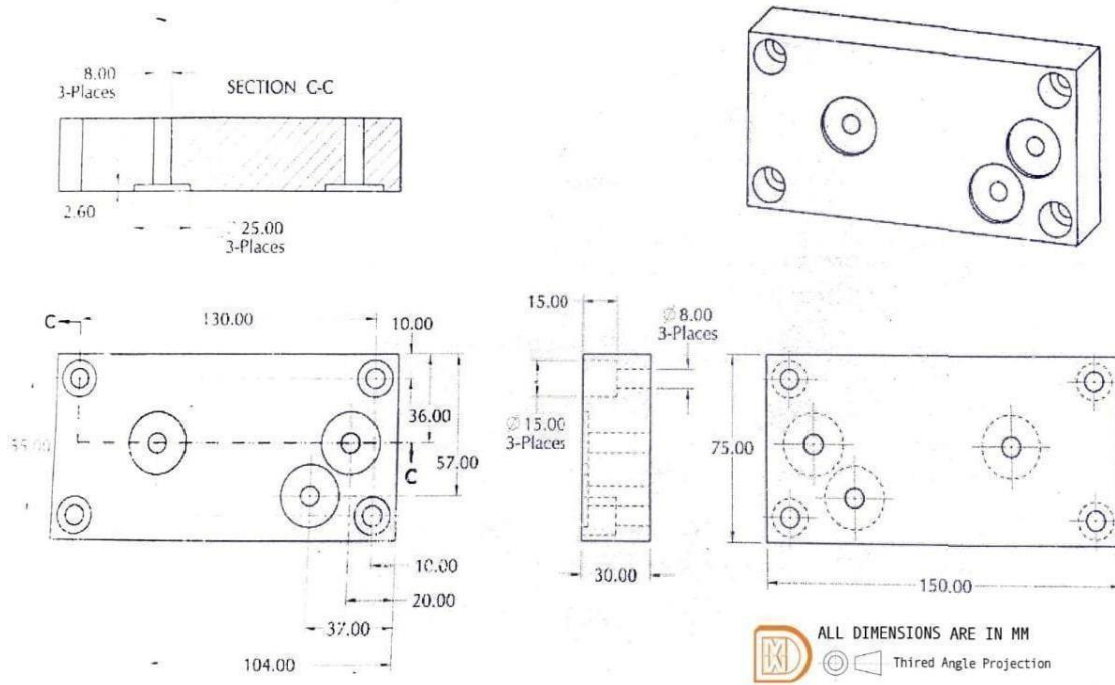


5)PART NAME - BODY PIPE THD SERIES

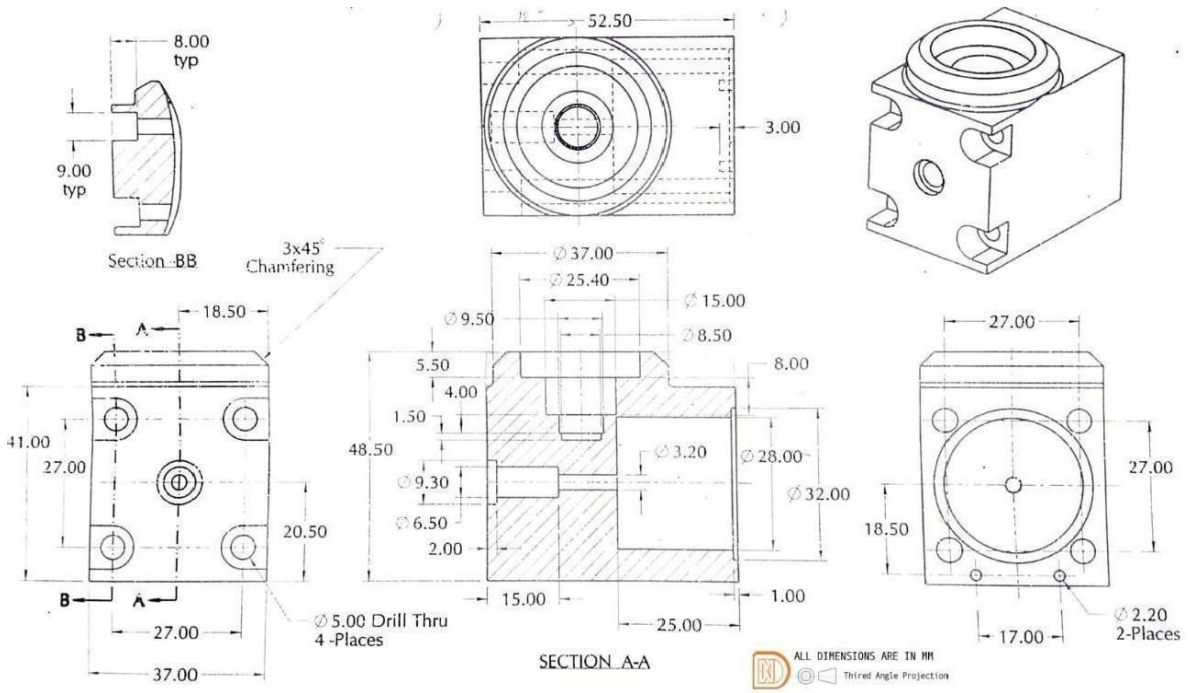




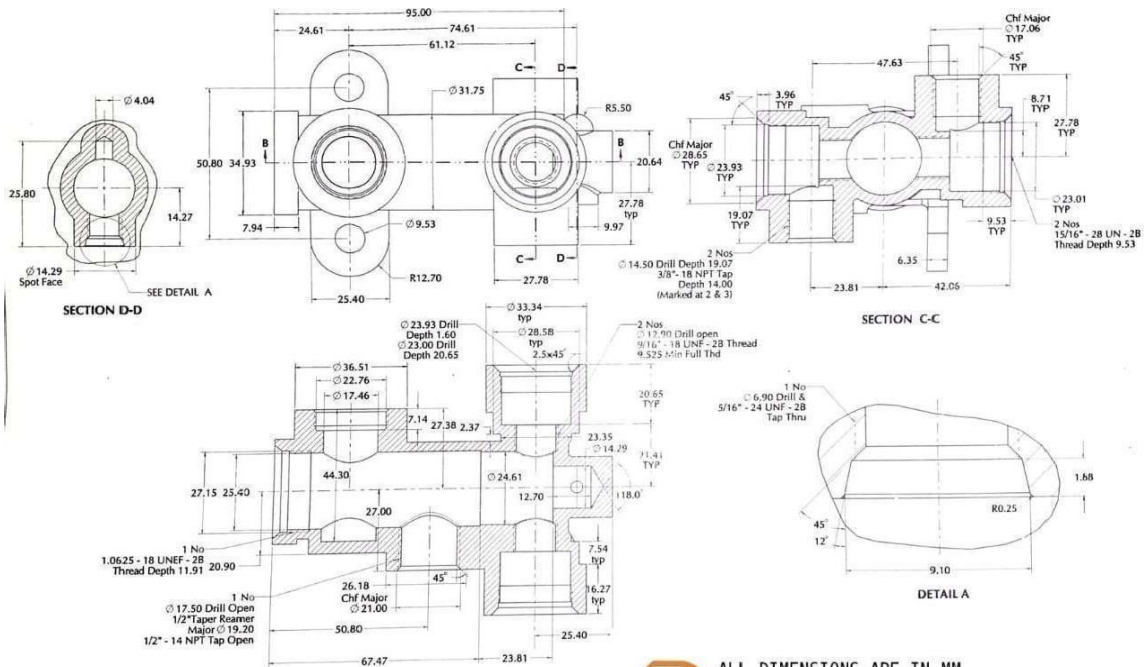
6)PART NAME – MANIFOLD



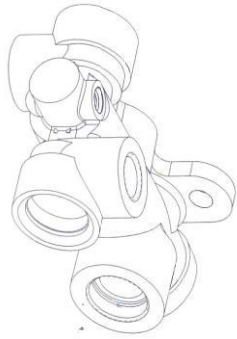
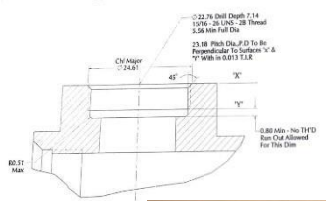
7)PART NAME - SOLENOID CAP



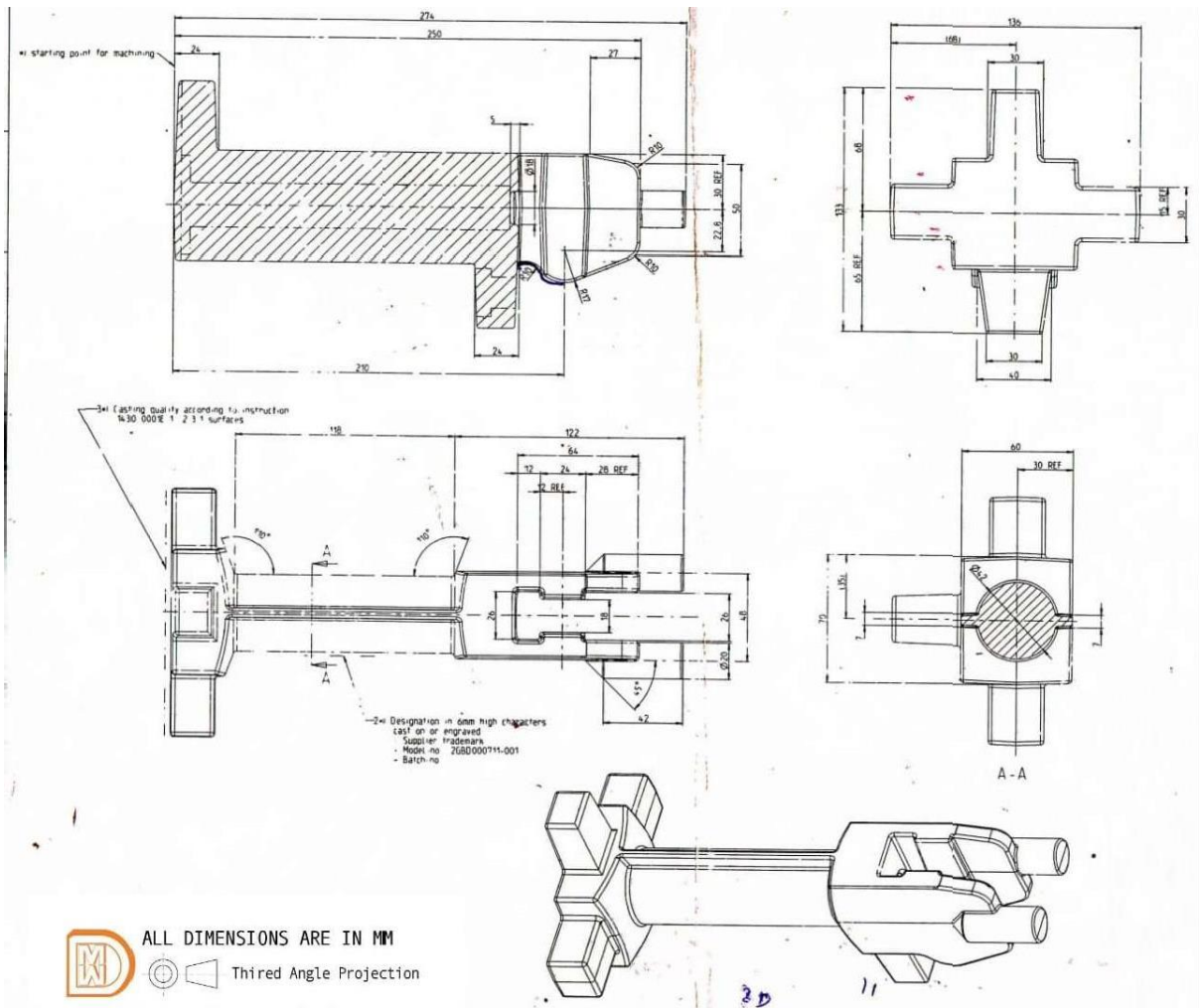
8) PART NAME - BODY BULL

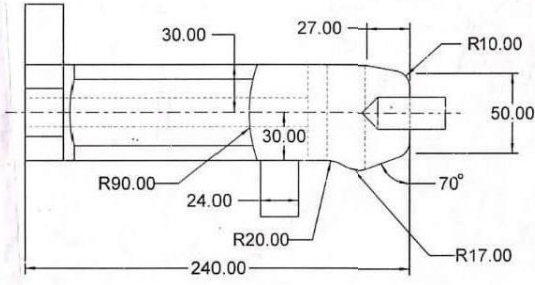
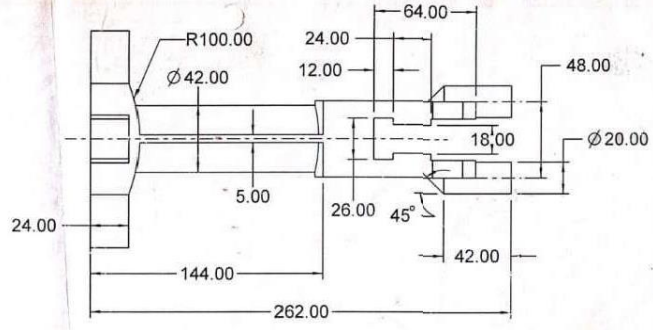
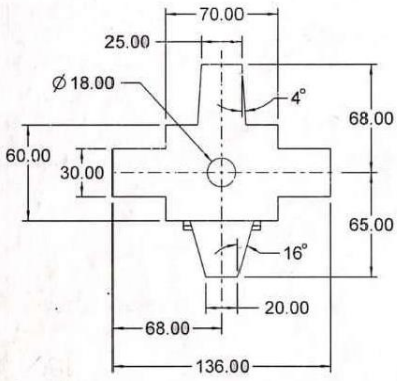
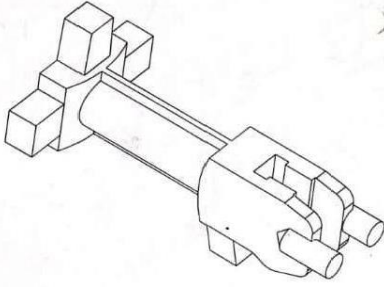


ALL DIMENSIONS ARE IN MM
 Third Angle Projection

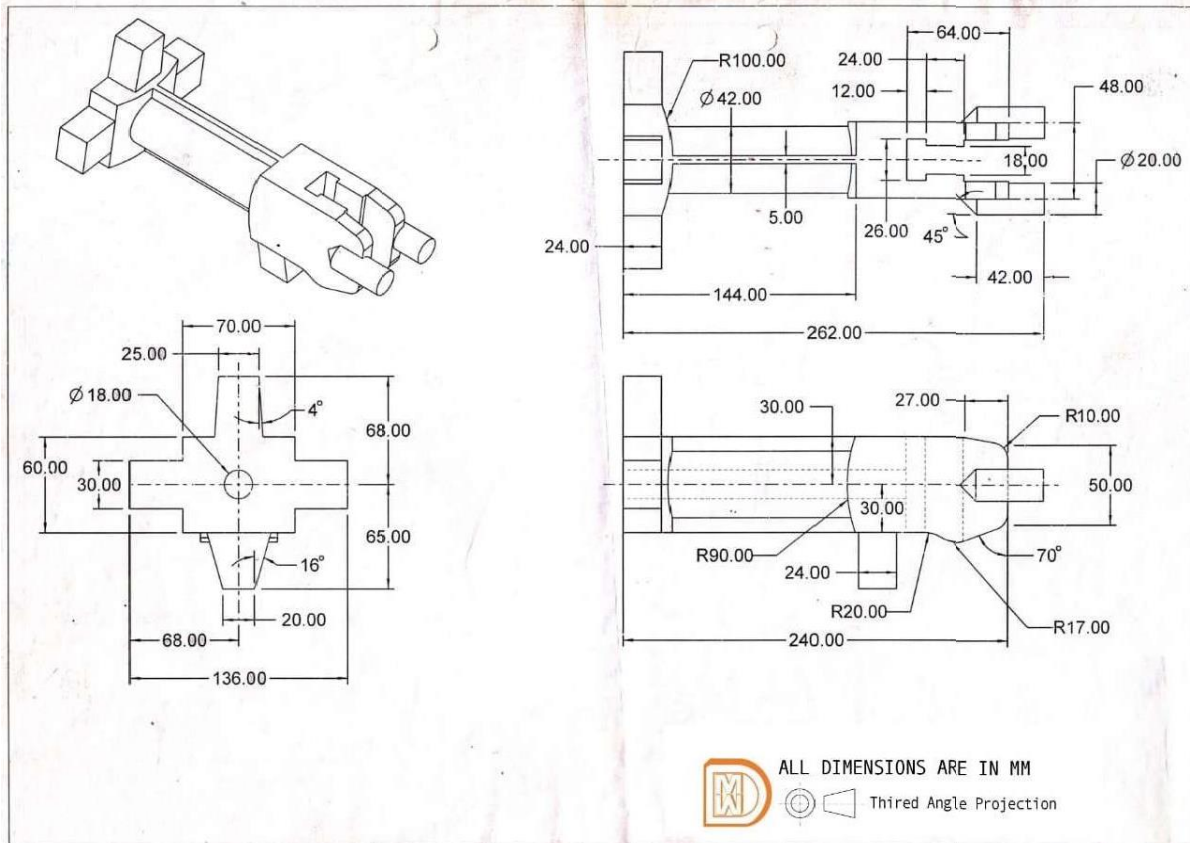


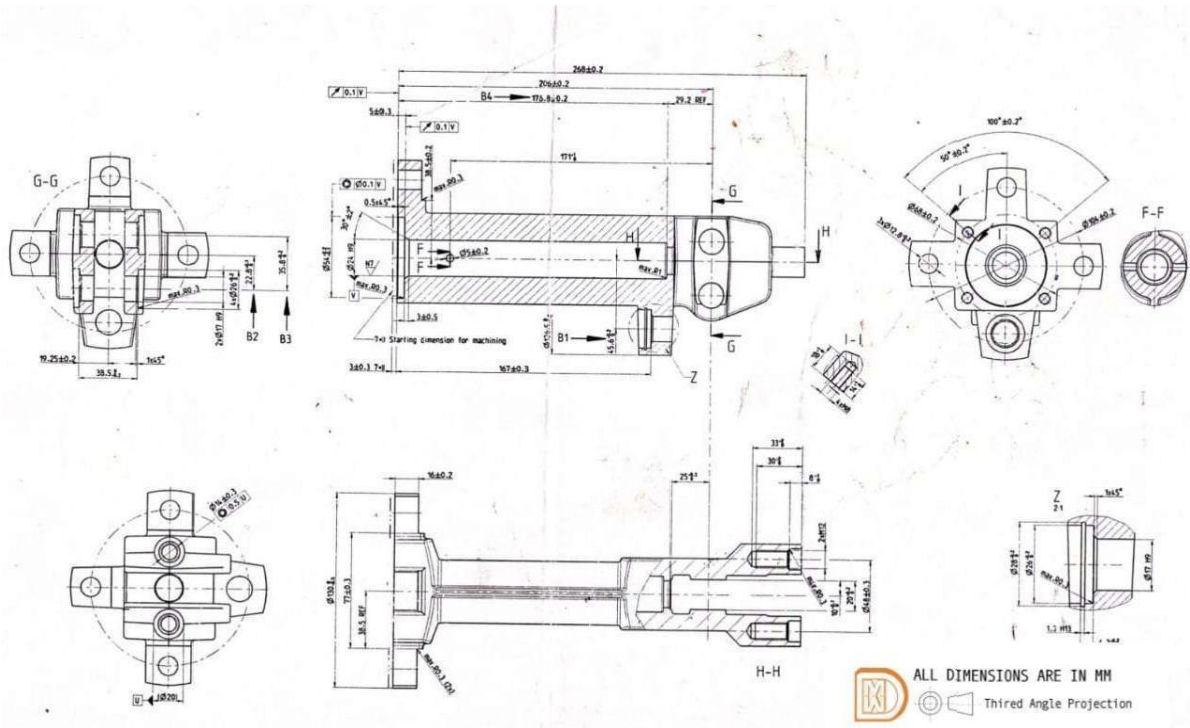
9) PART NAME - SUPPORT



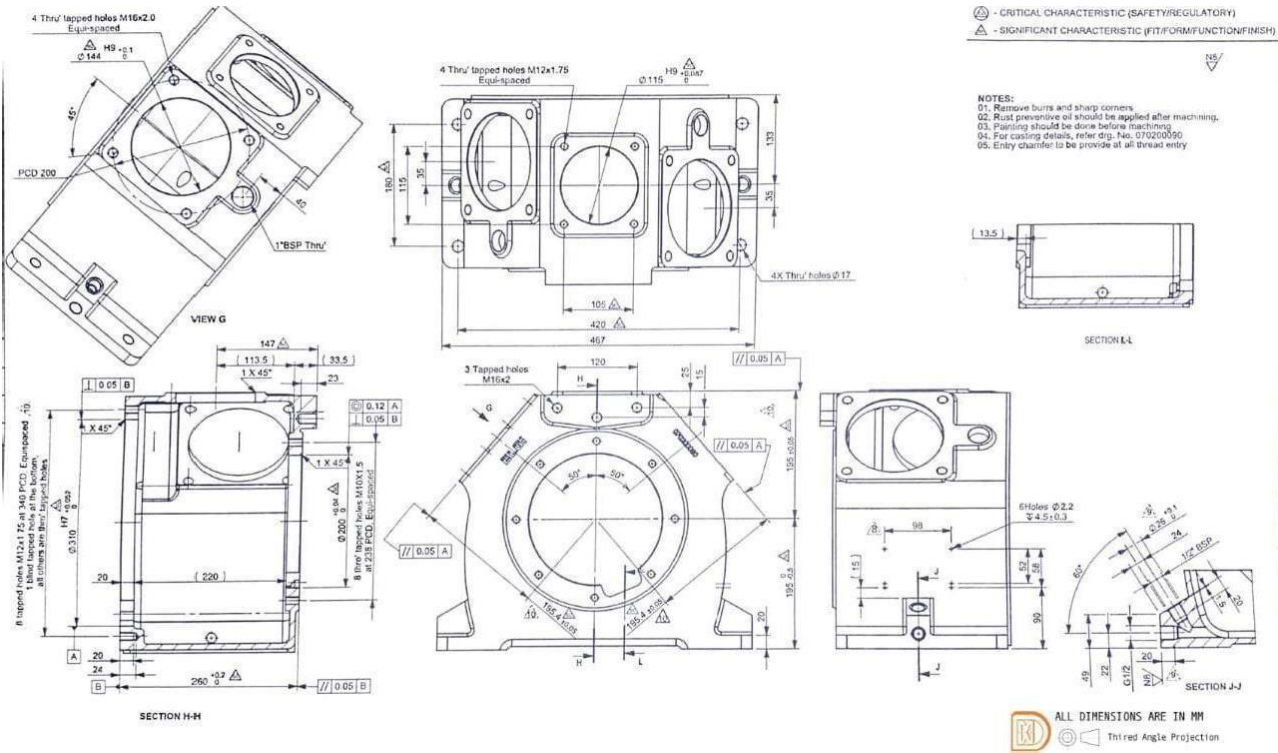


ALL DIMENSIONS ARE IN MM
Third Angle Projection





10) PART NAME - CRANK CASE



11)PART NAME - SQUARE GATE BONNET

A
B

DETAIL A - A

SURFACE FINISHING SYMBOL

- LAPPING FINISHING
- GRINDING FINISHING
- SMOOTH TURNED
- ROUGH MACHINED

Inspection Frequency = 2 H¹ 1 Pkg
Control Method = Stage Inspection
Responsibility = Setter

UNLESS OTHERWISE SPECIFIED

TOLERANCES
± 0.1 ANGLE 30°

1. DO NOT SCALE THE DRAWING.
2. ALL DIMENSIONS ARE IN MM.
3. MARKED DIMENTION VERY CRITICAL
4. IF ANY DOUBT PLEASE ASK
5. INSIDE CORNER RADIUS 0.5MAX.
6. BRAKE SHARP EDGES 0.5X45° MAX.
7. MACHINED SURFACE FINISH MAX 250RMS
8. NO DENT MARKS SCRATCHES ALLOWED IN MACHINED SURFACE

SPOT FACE = Ø22.0^{+0.1}
PCD = 56.0^{±0.05}

1/4 - 20 UNC - 2B
TAP DEPTH = 8.0^{±0.2}
DRILL DIA = Ø5.1 (2 HOLES)
DRILL DEPTH = 11.0^{±0.2}
PCD = 40.0^{±0.15}

8.0^{±0.5}

1. Visual inspection very must.
2. Tap Depth Very Must.

REFER PROGRAM TO SELECT TOOLS AND POSITION (STATION)
MACHINING PARAMETER TO BE CHECKED & INSTRUMENT TO USE

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
CUS GAU	TVC	TVC	TVC	TVC	TVC	TVC	TVC	TVC	TVC	TVC
[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]

REFERENCE CUSTOMER DRAWING No: CM3 1361 R9

CUST NAME	A	NAME	DATE
PART No.		DRAWN	M.S 01/09/14
MATERIAL	FORGED M.S	CHECKED	S.M.K 01/09/14
SCALE	1:2	APPROVED	A.M.S 01/09/14
SHEET No.	1 OF 1	DRG. No.	T4 CM3 1361

ALL DIMENSIONS ARE IN MM

3/4" SQUARE GATE BONNET

VMC DRILL & TAP

REV. No. 0

12)PART NAME - ROUND GLOBE BONNET

A
B

1.2X45° CHA

2 Nos EQUIL-SPACED
5/16-18UNC-2B
ON PCD 44 DEPTH 10

DRILL DIA 6.6 MM
DRILL DEPTH 14 MM

Inspection Frequency=1/2 Hr- 1 Pile
Control Method=Stage Inspection
Record=SIR
Responsibility=Setter

REFER PROGRAM TO SELECT TOOLS AND POSITION(STATION)
MACHINING PARAMETER TO BE CHECKED & INSTRUMENT TO USE

1	2	3	4	5	6	7	8	9	10	11
CUS GAU	TVC	TVC	TVC	TVC						
12	13	14	15	16	17	18	19	20	21	22

1. Visual inspection very must.

REFERENCE CUSTOMER DRAWING No: RM3 01160 P2

CUST NAME	A - S	NAME	DATE
PART No		DRAWN	M.S 17/01/13
MATERIAL	A105F22	CHECKED	S.M.K 17/01/13
SCALE	1:2	APPROVED	A.M.S 17/01/13
SHEET No	1 OF 1	DRG. No	

ALL DIMENSIONS ARE IN MM

1/2" ROUND GLOBE BONNET

DRILL & TAP

T4 RM3 1160

REV. No. 0

SURFACE FINISHING SYMBOL

WAPPING FINISHING

GRADING FINISHING

SMOOTH TURNED

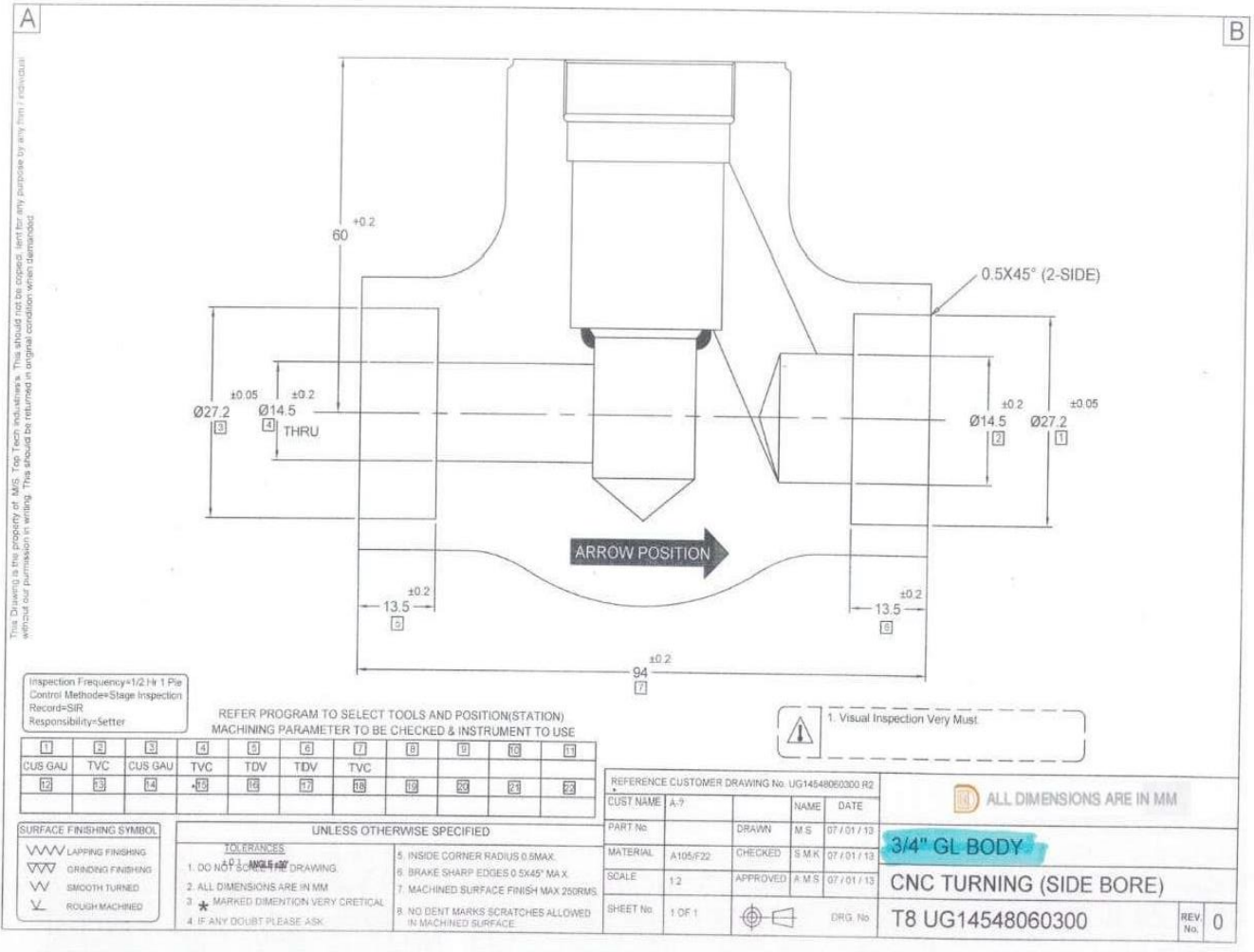
ROUGH MACHINED

TOLERANCES UNLESS OTHERWISE SPECIFIED

<p>1. DO NOT SCALE DRAWING</p> <p>2. ALL DIMENSIONS ARE IN MM</p> <p>3. * MARKED DIMENTION VERY CRITICAL.</p> <p>4. IF ANY DOUBT PLEASE ASK.</p>	<p>5. INSIDE CORNER RADIUS 0.6MAX</p> <p>6. BRAKE SHARP EDGES 0.5X45° MAX</p> <p>7. MACHINED SURFACE FINISH MAX 250RMS</p> <p>8. NO DENT MARKS SCRATCHES ALLOWED IN MACHINED SURFACE</p>
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13) PART NAME - GL BODY



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14)PART NAME - ROUND GATE BONNET

A
B

Inspection Frequency=1/2 Hr 1 Pile
Control Methode=Stage Inspection
Record=SIR
Responsibility=Setter

REFER PROGRAM TO SELECT TOOLS AND POSITION (STATION)
MACHINING PARAMETER TO BE CHECKED & INSTRUMENT TO USE

1	2	3	4	5	6	7	8	9	10	11
TPG 055	TPG 054	TPG 052	TGG 002	TDV	TDV					
12	13	14	15	16	17	18	19	20	21	22

SURFACE FINISHING SYMBOL

W LAPPING FINISHING

V GRINDING FINISHING

W SMOOTH TURNED

Y ROUGH MACHINED

UNLESS OTHERWISE SPECIFIED

TOLERANCES

<ol style="list-style-type: none"> 1. DO NOT SCALE DRAWING 2. ALL DIMENSIONS ARE IN MM 3. MARKED DIMENTION VERY CRITICAL 4. IF ANY DOUBT PLEASE ASK 	<ol style="list-style-type: none"> 5. INSIDE CORNER RADIUS 0.5MAX. 6. BRAKE SHARP EDGES 0.5X45° MAX. 7. MACHINED SURFACE FINISH MAX 250RMS 8. NO DENT MARKS SCRATCHES ALLOWED IN MACHINED SURFACE.
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1. Visual inspection very must

2. Bore finishing very must.

REFERENCE CUSTOMER DRAWING No. RM3 0175 R6			
CUST NAME	A - B	NAME	DATE
PART No.		DRAWN	M.S 17 / 01 / 13
MATERIAL	A105F22	CHECKED	S.M.K 17 / 01 / 13
SCALE	1:2	APPROVED	A.M.S 17 / 01 / 13
SHEET No.	1 OF 1	DRG No.	

ALL DIMENSIONS ARE IN MM

1/2" ROUND GATE BONNET

CNC TURNING (CUP SIDE)

T3 RM3 0175

REV. No.	0
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15) PART NAME –ROUND GLOBE BONNET

A
B

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Inspection Frequency=1/2 1/1 Pie
Control Methode=Stage Inspection
Record=SIR
Responsibility=Setter

REFER PROGRAM TO SELECT TOOLS AND POSITION(STATION)
MACHINING PARAMETER TO BE CHECKED & INSTRUMENT TO USE

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22

1. Visual inspection very must.
2. Bore finishing very must.

SURFACE FINISHING SYMBOL

- ▽▽▽ LAPPING FINISHING
- ▽▽ GRINDING FINISHING
- ▽ SMOOTH TURNED
- ▽ ROUGH MACHINED

UNLESS OTHERWISE SPECIFIED

TOLERANCES

1. DO NOT SCALE DRAWING 2. ALL DIMENSIONS ARE IN MM 3. * MARKED DIMENTION VERY CRITICAL 4. IF ANY DOUBT PLEASE ASK	5. INSIDE CORNER RADIUS 0.5MAX. 6. BRAKE SHARP EDGES 0.5X45° MAX 7. MACHINED SURFACE FINISH MAX 250RMS 8. NO DENT MARKS SCRATCHES ALLOWED IN MACHINED SURFACE
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REFERENCE CUSTOMER DRAWING No. RM3 01 160 R2

CUST NAME	A - 5	NAME	DATE
PART No.	DRAWN	M.S	17 / 01 / 13
MATERIAL	A105/F22	CHECKED	S.M.K
SCALE	1:2	APPROVED	A.M.S
SHEET No.	1 OF 1	DRG No.	

ALL DIMENSIONS ARE IN MM

1/2" ROUND GLOBE BONNET

CNC TURNING (CUP SIDE)

T3 RM3 1160

REV. No.	0
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16) PART NAME - SQUARE GATE BONNET

A
B

SURFACE FINISHING SYMBOL
 LAPPING FINISHING
 GRINDING FINISHING
 SMOOTH TURNED
 ROUGH MACHINED

Inspection Frequency = 2 Hr 1 Pie
 Control Method = Stage Inspection
 Record = SIR
 Responsibility = Setter

UNLESS OTHERWISE SPECIFIED
TOLERANCES
 ± 0.1 ANGLE ±30°

1. DO NOT SCALE THE DRAWING.
 2. ALL DIMENSIONS ARE IN MM.
 3. MARKED DIMENTION VERY CRITICAL
 4. IF ANY DOUBT PLEASE ASK.
 5. INSIDE CORNER RADIUS 0.5MAX.
 6. BRAKE SHARP EDGES 0.5X45° MAX.
 7. MACHINED SURFACE FINISH MAX 250RMS.
 8. NO DENT MARKS SCRATCHES ALLOWED IN MACHINED SURFACE.

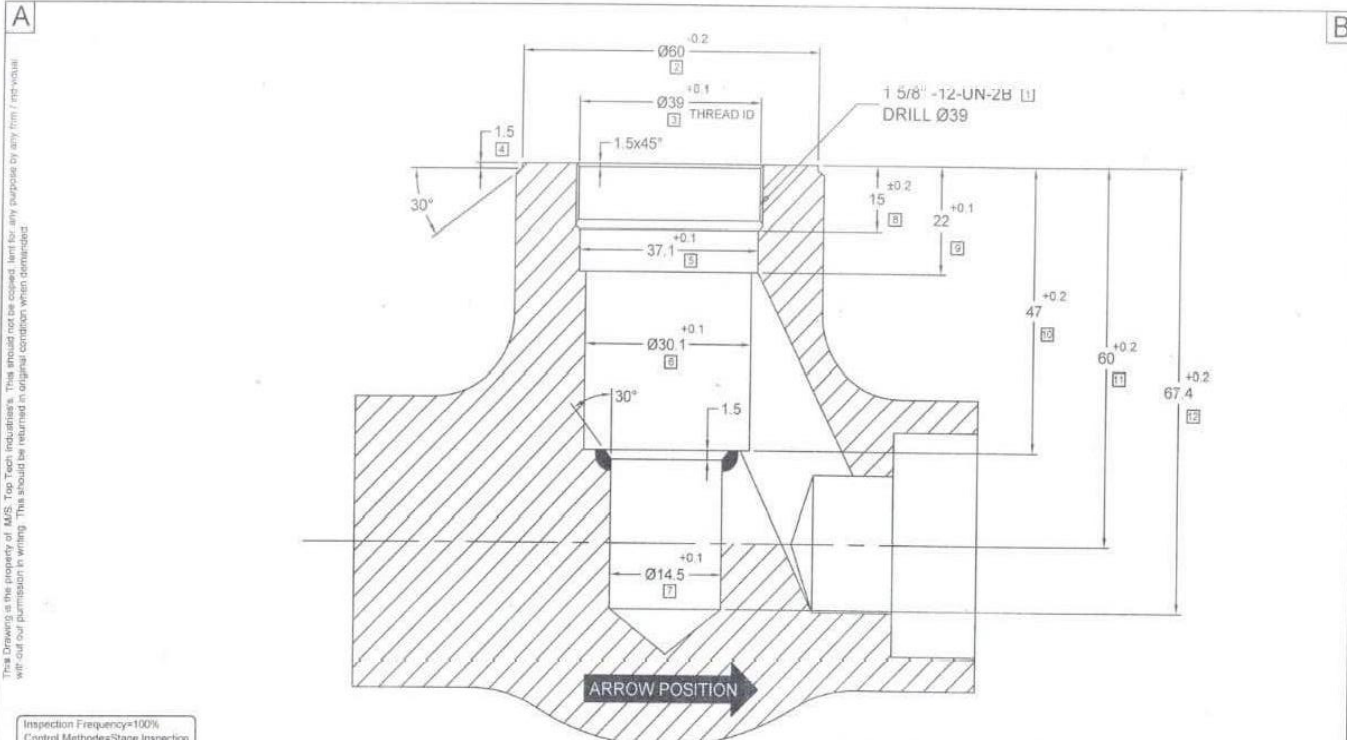
REFER PROGRAM TO SELECT TOOLS AND POSITION(STATION)
 MACHINING PARAMETER TO BE CHECKED & INSTRUMENT TO USE

1	2	3	4	5	6	7	8	9	10	11
TRG-041	TPG-093	TPG-103	TDV	TVC	TDV	TDV	TVC	TVC	TVC	TVC
12	13	14	15	16	17	18	19	20	21	22
TVC										

REFERENCE CUSTOMER DRAWING No. CM3 1361 R9

CUST NAME		A		ALL DIMENSIONS ARE IN MM	
PART No.	DRAWN	M.S	01 / 09 / 14	CM3 SQUARE GATE BONNET	
MATERIAL	CHECKED	S.M.K	01 / 09 / 14		
SCALE	APPROVED	A.M.S	01 / 09 / 14		
SHEET No.	1 OF 1	DRG No.	T2 CM3 1361	REV. No.	0

17)PART NAME - GL BODY



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Inspection Frequency=100%
Control Methode=Stage Inspection
Record=SIR
Responsibility=Setter

REFER PROGRAM TO SELECT TOOLS AND POSITION (STATION)
MACHINING PARAMETER TO BE CHECKED & INSTRUMENT TO USE

1. Visual Inspection Very Must.

1	2	3	4	5	6	7	8	9	10	11
CUS GAU	TRG 033	TPG 083	TDV	TPG 078	TPG 089	TPG 086	TDV	TDV	TDV	TDV
TDV										

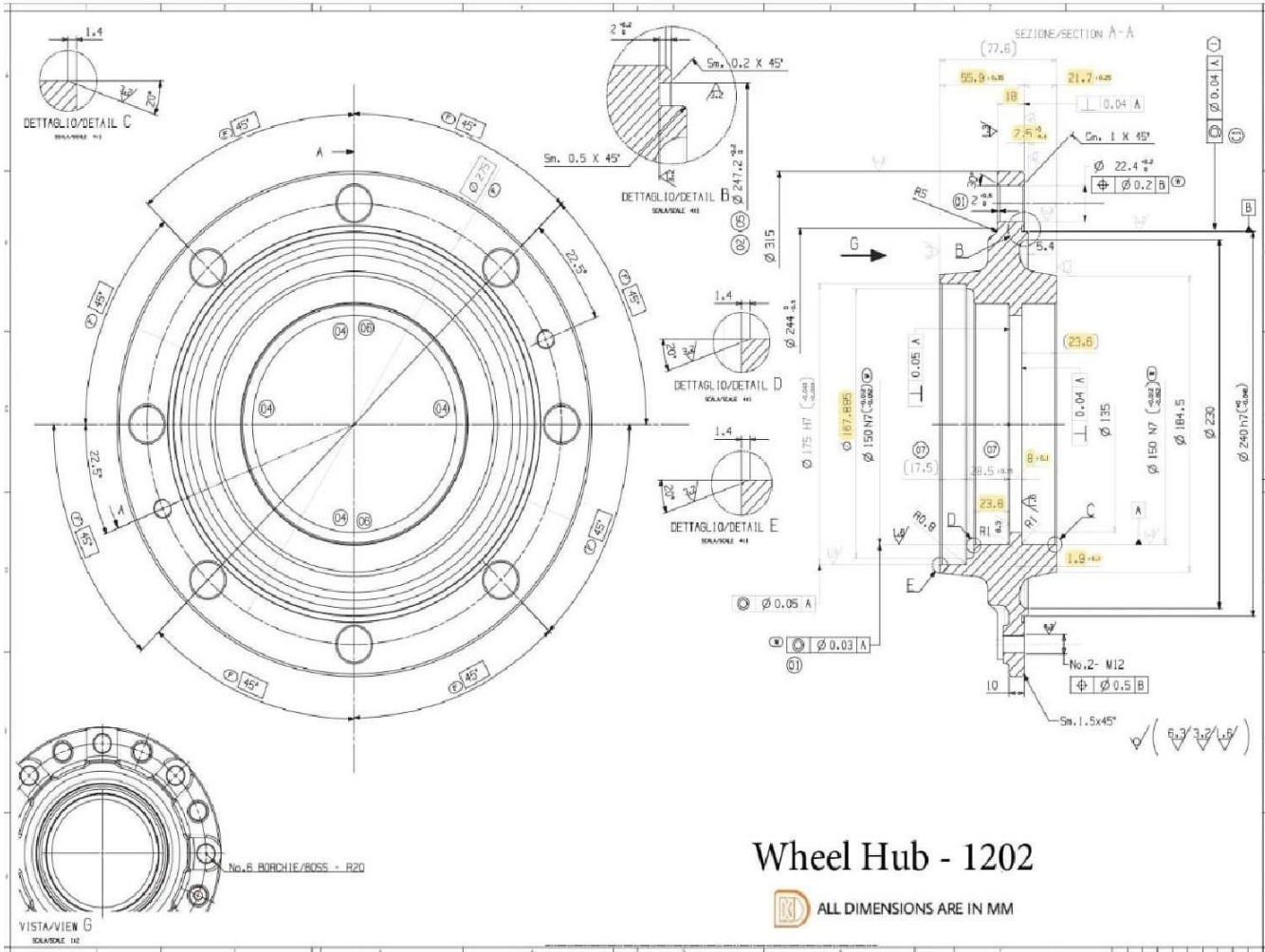
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CUST NAME	A.?	NAME DATE
PART No	DRAWN	M S 07 / 01 / 13
MATERIAL	CHECKED	S.M.K 07 / 01 / 13
SCALE	APPROVED	A.M.S 07 / 01 / 13
SHEET No	1 OF 1	DRG No

ALL DIMENSIONS ARE IN MM	
3/4" GL BODY	
CNC TURNING (TOP SIDE)	
T7 UG14548060300	REV. No. 0

SURFACE FINISHING SYMBOL	
▽▽▽	LAPPING FINISHING
▽▽	GRINDING FINISHING
▽	SMOOTH TURNED
∇	ROUGH MACHINED

TOLERANCES	
1. DO NOT SCALE DRAWING	5. INSIDE CORNER RADIUS 0.5MAX
2. ALL DIMENSIONS ARE IN MM	6. BRAKE SHARP EDGES 0.5X45° MAX.
3. MARKED DIMENTION VERY CRITICAL	7. MACHINED SURFACE FINISH MAX 250RMS
4. IF ANY DOUBT PLEASE ASK	8. NO DENT MARKS SCRATCHES ALLOWED IN MACHINED SURFACE

18) PART NAME - WHEEL HUB



20) PART NAME - BRAKE COUNTER DISC

