Measurement Time Method for Engine Assembly Line with Help of Maynard Operating Sequencing Technique (Most)

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Abstract: This paper presents TATA plant based Measurement time method for engine cylinder head assembly line with help of Maynard operating sequencing technique (MOST). Knowledge Based Design Methodology (KBDM) for automated and manual assembly lines, which can be applied equally well to single, multi- and mixed-product assembly lines with either deterministic operation times or stochastic operation times. The methodology starts from a suitable assembly system selection and thereafter decides suitable cycle times, parallel workstation requirements, and parallel line implementation for the type of assembly system being selected. An economical number of workstations are decided with the aid of workstation combining options depending upon the factual information provided. The end result is the detailed design of a manufacturing assembly line. A case study from a practical assembly line is presented to illustrate how the KBDM works.

Keywords: MOST, Established Standard Time, Most sheet, Line balancing of engine process, Measurement time method

Abbreviations:

MTM-	Measurement Time Method
EST-	Established Standard Time
MOST-	Maynard Operation Sequence Technique
RH-	Right Hand
LH-	Left Hand
RPT-	Rear Power Train
TMU-	Time Measurement Unit

I. INTRODUCTION

Work measurement is a systematic procedure for the analysis of work and determination of time required performing key tasks in processes, it is typically based on time standards for manual tasks. The release of the Methods Time Measurement (MTM) system in the 1940s was an important step forward in predictive work measurement. It is defined as `a procedure which analyses any manual operation or method into the basic motions required to perform it.MTM assigns to each motion predetermined time standard which is determined by the nature of the motion and the conditions under which it is made. One of the major problems in applying MTM to manufacturing operations is that it is extremely tedious and time consuming, since a work analyst must observe and document each movement in great detail. In addition, such an approach generates large amounts of data which must be managed. The development and release of the MOST in the 1960s alleviated many of these problems, since it is much simpler and more efficient. It classifies all human movements into three basic categories, and the description of each category is done by assigning values to only a few standard parameters. It is the latest work measurement technique that can be easily implemented and practically maintained to not only estimate the standard time but also improve methods and maximize the resource utilization.

II. MOST METHODOLOGY

MOST is the latest work measurement technique that can be easily implemented and practically maintained to estimate the standard time and also improve methods which maximize the resource utilization. It was originally developed by H. B. Maynard & Company Inc. and has three versions Basic MOST for the activities between 20 sec to 2 min, Mini MOST for the activities shorter than 20 sec, and Maxi MOST for the activities above 2 min. MOST focuses on three types of object movements Such as General Move, Control Move, and Tool Use which are briefly explained here under.

Establishing New Operation Time in Cylinder Hade assembly Preparation Area
Maynard Operating Sequencing Technique (MOST)

1. **Important Component of MOST**
2. **Types of Sequence**

1. Important Component of MOST

Takt Time: Takt is a German word meaning “Conductors Baton”. Takt time matches the pace of the manufacturing process to customer demand. Each manufacturing process works to the Takt.

$$\text{Takt} = \frac{Total\,Time\ Available}{Total\ Customer\ Demand}$$

Work Standards: Types for measuring Work Standards

1. Time Study
2. Synthetic Time data
3. MOST

Methods Time Measurement (MTM): -

1. Developed by H. B. Maynard, in 1948
2. Based on micro motions established by the Gilbreth
3. Identifies the variables which affect the time to perform each motion

2. **Types of Sequence Models:** Sequence models represent the sequence of events that occurs when an object is moved or a tool is used. Predefined sequence models represent different types of activities.

GENERAL MOVE PHASES: Sequence models are structured into phases used to describe the action performed. Each of the predefined sequence models has a different set of phases.

Parameters: Phases and sequence models are built using letters called parameters.

GET	PUT	RETURN
A B G	A B P	A

A = Action Distance   G = Gain Control

B = Body Motion   P = Placement

Time Calculation:
To arrive at the time for the step:

1. Sum the index values.
   6 + 6 + 1 + 6 + 0 + 1 + 0 = 20

2. Multiply by a factor of 10 to get time value
   20 x 10 = 200 TMU

CONTROLLED MOVE PHASE:-

Get	Move/Actuated	Return
ABG	MXI	A

Parameters

A = Action Distance

G = Gain Control

X = Process Time

B = Body Motion

M = Move Controlled

I = Alignment

TOOL USE PHASES:-

Get Tool	Put Tool	Aside Tool	Return
ABG	ABP	ABP	A

Tool Use Parameters

F = Fasten

S = Surface Treat

T = Think

L = Loosen

M = Measure

C = Cut

R = Record

Result:-Establishing New Operation Time in Cylinder Hade assembly Preparation Area
MOST SHEET OUTPUT=1
CYLINDER HEAD ASSEMBLY FLOW

Operation no.	Operation description	Most time	
		Sec	Min.
H10	Loading of head on Washing m/c	5.66	0.094333

H20	Washing of Head	54.72	0.912
H30	Cylinder Head Pulling & Pallet insertion	5.76	0.096
H40	Rotation of head by 180 deg	5.4	0.09
H50	Valve Insertion	4.68	0.078
H60	Rotation of head by 180 deg	5.4	0.09
H70	Camcap loosening	29.88	0.498
H80	Valve Guide Seal Pressing	21.24	0.354
H90	Valve Spring Assembly	18.36	0.306
H100	Lock half pressing	15.12	0.252
H110	Oscillation Checking	32.76	0.546
H120	Visual Inspection & History Filling	26.28	0.438
H130-Manual	Shim Selection-MANUALY	39.6	0.66
H130-Auto	Shim Selection	29.52	0.492
H140	Camcap Tightening	42.84	0.714
H150	Tappet Setting	52.2	0.87
H160	Front oil gallery plug fitment with anabond & teflon coating	11.88	0.198
H170	Oil Pressure Switch Fitment	13.32	0.222
H180	Exhaust stud fitment	27.36	0.456
H190	Oil Seal Fitment	11.52	0.192
H200	Thermostat Assembly Fitment	51.12	0.852
H210	Coolant Temperature sensor fitment	9.36	0.156
H220	Blow-by read valve fitment	16.56	0.276
H230	Rear Lifting hook fitment	16.56	0.276
H240	Rotation of head by 180 deg	5.4	0.09
H250	Spark Plug & HT Cable Fitment	16.92	0.282
H260	Front Lifting hook fitment	16.56	0.276
H270	Inlet stud fitment	27.36	0.456
H280	Visual Inspection, history card filling & placing head in trolley	27.36	0.456
	TOTAL TIME ALL HEAD LINE ASSEMBLY	**640.7**	**10.67833**

MOST SHEET OUTPUT=2
CYLINDER HEAD ASSEMBLY FLOW

Operation no.	**Operation description**	**Most time**	
		sec	min
Manual station no.2	1)Manual turn over device for manual fitment of water by pass nipple (new design)	37.8	0.63
HL_OP010	pallet lifter/ Lowerer		0
HL_OP020	1)Cam Cap Loosening, 2)Oil Gallery Plug Fitment	47.88	0.798
HL_OP030	1)Spring seat positioning, 2)Valve guide seal pressing	38.88	0.648
HL_OP050	1)Automatic TOD for Manual Valve Inseration		0
HL_OP070	1)Repair in Station: 2)Spring Inseration, Lock Half Retainer Placement	42.12	0.702
HL_OP080	Semi-automatic Lock half press	58	0.9667
HL_OP100	Valve oscillation	58	0.9667
HL_OP120	Camera Check for Lock half assembly verification (Common for Both Petrol and Diesel Head)		0
HL_OP130	Valve Seat Area Leak Test		0
HL_OP150	1)Repair Out Station- 2)Thermostat cover fitment		0
HL_OP160 & 170	Shim selection Machine (Length: 1.5 Meter)	50.04	0.834
HL_OP200	1)Cam cap Tightening, 2)Dummy Oil Pressure switch fitment	48.96	0.816
HL_OP210	Tappet clearance checking	0	0
HL_OP220	1)Oil Seal Fitment, 2)Rear Hook Fitment	37.08	0.618
HL_OP230	1)Coolant Temperature sensor Fitment, 2)Inlet stud Fitment	47.88	0.798
HL_OP250	1)Horizontal Turn table 2)Exhaust stud fitment 3)Front Hook fitment	44.64	0.744
HL_OP270	Pallet Lifter/ Lowerer		0
	TOTAL TIME OF ALL STATION	**511.28**	**8.5213**

MOST SHEET OUTPUT=3
CYLINDER HEAD ASSEMBLY FLOW

Operation no.	**Operation description**	**Most time**	
		sec	min
HAS OP 01	1)Positioning of Cylinder Head on Pallet, 2)Loosening of cam caps	49.68	0.828
HAS OP 02	1)Spring Seat Positioning, 2) Valve guide seal pressing	38.88	0.648
HAS OP 03	1)Valve Insertion, 2)oil gallery plug fitment, 3)spring insertion, 4)Retainer placement	45	0.75
HAS AUTO	1)Lock half pressing, 2)Camera Check for Lock half fitment, 3)Valve oscillation, 4)Leak testing of valve train	0	0
HAS OP 04	Shim Selection Station 1: Gauging of Components	45.72	0.762
HAS OP 05	Shim Selection Station 2: Positioning of Components	48.24	0.804
HAS OP 06	1)Camcap Tightening, 2)Dummy Oil Pressure Switch fitment	48.6	0.81
HAS OP 07	Tappet Clearance Checking	0	0
HAS OP 08	1)Oil Seal fitment, 2)Thermostat fitment, 3)Rear Hook fitment	47.88	0.798
HAS OP 09	1)Coolant Temperature Sensor Fitment, 2)Inlet Stud Fitment	47.16	0.786
HAS TTT AUTO	Camshaft TTT IPV	0	0
HAS OP 10	1)Rotation of Head by 180 deg, 2)Exhaust Stud fitment, 3)Front Lifting Hook fitment	54.36	0.906
	TOTAL TIME OF ALL HEAD LINE ASSEMBLY	**425.52**	**7.092**

III. CONCLUSION

We will obtain below out come after completed Cylinder head assembly flow with the help of Myrdal Operating Sequencing Techniques (MOST). Time of the whole cylinder head assembly flow is below the 425.52 sec and the some station time above the 425.52 sec and also reduces work station and area of work station with man power.

MOST OUTPUT COMPARISION SHEET					
MOST SHEET NUMBER	**NO.OF WORK STATION**	**DESCRIPTION**	**TOTAL STATION TIME**		**OUTPUT DESCRIPTION**
			SEC.	**MIN.**	
MOST 1	28	Cylinder head assembly flow	640.7	10.678	
MOST 2	18	Cylinder head assembly flow	511.28	8.521	Reduced work station and area of work station with man power and time
MOST 3	12	Cylinder head assembly flow	425.52	7.092	Reduced time

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