PULSE

Diagnostic Study Report

A Productivity Appraisal, Waste Identification & Improvement Opportunity Diagnosis Report

Company : *ABC Company Pvt. Ltd.*

Submitted on: *28th XXXXX 2015*

Vrunda Consultancy Services

|||*Block A, 202, Titanium City Center, 100 Ft. Anand Nagar Road, Satellite, Ahmedabad – 380015*|||
|||*URL :www.vcs.co.in*||| *Mail : mktg@vcs.co.in*|||*Phone : +91 7567 881535* |||

Content

1. Executive Summary

Proposed plant performance

- Plant Capacity : 75 Machines / Month
- Mfg Lead Time : 7 Days
- OTIF : > 80%
- Customer Complaint : < 10 per year
- ITR : 8-10
- WIP : 4 Machines

Current plant performance

- Production : 44 Machines / Month
- Current Lead Time : 42 Days
- OTIF : 12%
- Customer Complaint : 75 per year (2013-14)
- ITR : 4
- WIP : 33 Machines

Synopsis of Data Analysis

- Productivity
  - Man : 54% (Utilization by Sampling)
  - Machine : 86% (Availability from Down-time ana.)
  - Quality : 94.8% (Rejection : 0.2%/ Rework : 3.7%)
  - Material Yields
    - MS : 93.8% (By Value)
    - SS : 92.7% (By Value)
- Customer Complaints (FTR)
  - Machines : 75 per year (22% of M/Cs sold)
  - Spares : ***Not Available***

- On Time In Full (Delivery)
  - Domestic : 12 %
  - Export : 9 %
  - Spares : ***N/A***

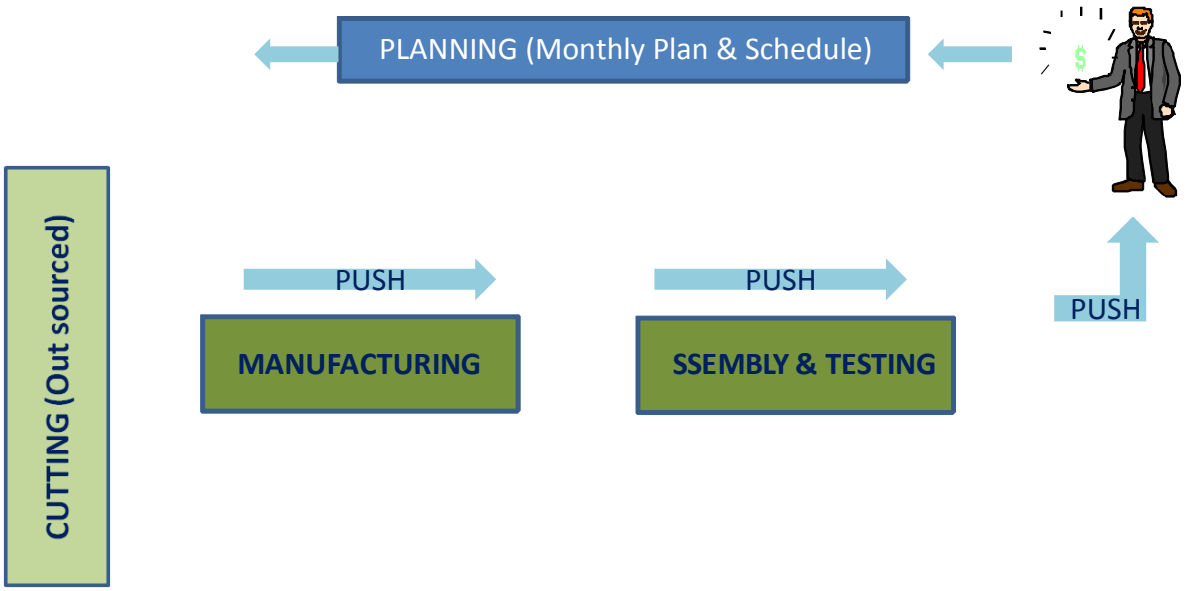
Opportunities :

- Exploiting available capacity & capability to produce "almost double" of current production, with no extra resource
- Basic frame-work ready for launching improvement initiatives
- Possibility to cater customer within 7 days of receiving IWO
- Tapping market potential with USP – "Speed Delivery"
- Exploit opportunity cost
- Improved ITR will lower Working capital requirement
- Removed mental barriers

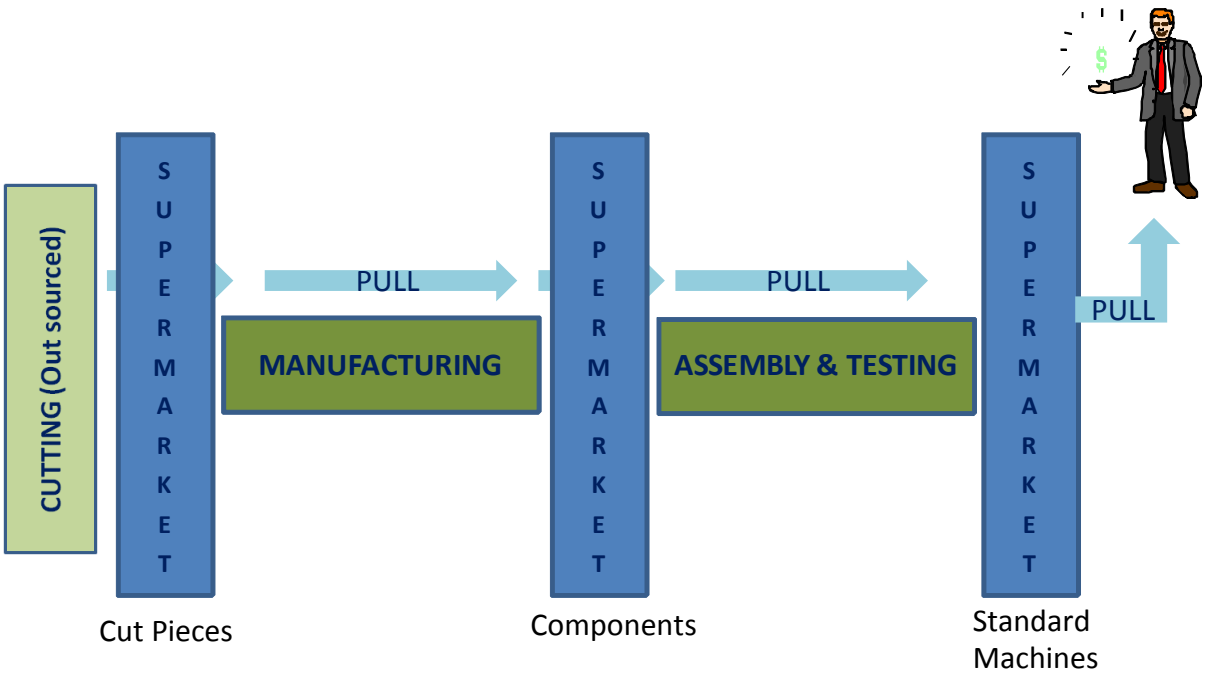
Recommendations:

- Determine Work Content & Standard Output Norms
- Implement Team-Building activities like Kaizen, 5S, TPM
- Create POUS, Balanced work-stations
- Re-layout to facilitate "Single Piece, Flow Manufacturing"
- Improve Planning & Scheduling to support Single Piece Flow
- Make weekly Plans & daily Schedules & Monitor every hour
- Use Supermarket for Standard Models & Accessories
- Create Multi-skilled Task Force
- Create cross-functional staff teams for shop-floor coordination

Current Planning to Execution Process



Proposed Pull System, Planning to Execution Process



2. Resource Productivity Appraisal

A. Man

There are 73 workmen on the shop floor who are engaged in the manufacturing activities. They are of following skill categories.

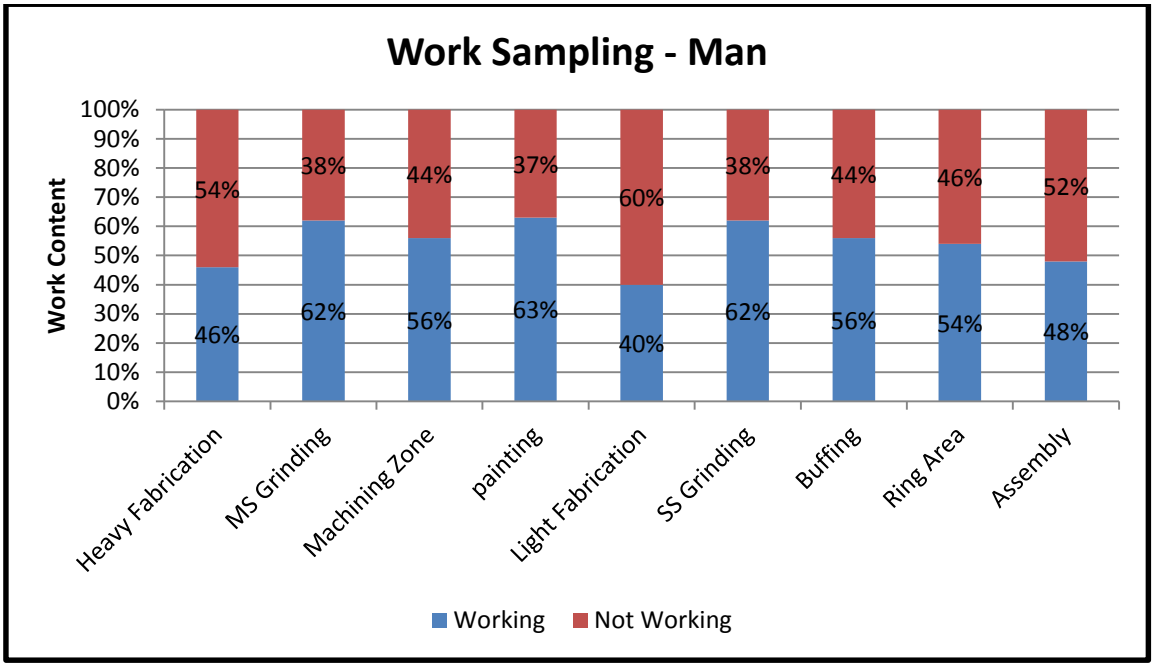
I. High skilled - Single skill
II. High skilled - Multi skill
III. Skilled - Single skill
IV. Skilled - Multi skill
V. Semi skilled - Single skill
VI. Semi skilled - Multi skill
VII. Unskilled

Current manufacturing practices required 68% Skilled workmen supported by 32% unskilled workmen.

Work sampling carried out for the workmen engaged in the manufacturing activities. Workmen were observed for 8.5 hours of their duty.

Following study data represents activity wise efficiency of the total 73 workman on shop floor.

Sr. No.	Activities	Work content
1	Heavy Fabrication	46%
2	MS Grinding	62%
3	Machining Zone	56%
4	painting	63%
5	Light Fabrication	40%
6	SS Grinding	62%
7	Buffing	56%
8	Ring Area	54%
9	Assembly	48%
	Average	54%



Following are the consideration for working and not working time calculation.

Working time:

- Worker doing actual process i.e. grinding, fitting, welding, buffing

Not working time:

- Idle time
- Material transportation and handling
- Waiting for machine
- Waiting for helper
- Waiting for material
- Waiting for information
- Discussion with supervisor
- Not present at work station
- Searching time

B. Machine:

Analysis of Past machine breakdown data reveal that plant has average 40 machine hours loss per month. The calculated overall uptime of the machines is 86%, (calculations consider general shift working with total 60 minutes work break) the detailed machine utilization will be studied in the further action plan.

During our data analysis, we considered over 20 types of major process machines as below.

- Angle Grinder
- Arc welding m/c
- Banding m/c
- Belt grinder
- Buffing motor
- Cutter m/c
- Drilling m/c
- Etching machine
- Gas cutting m/c
- Grinder
- Hand grinder
- Jib crane
- Light holder
- MIG welding m/c
- Plasma cutting
- Plate bending m/c
- Rolling m/c
- TIG welding m/c

Currently, machine uptime is not a prime focus area because we are manufacturing in batch system, however this will be very important when we go for low WIP and lead time reduction through single piece flow production.

C. Materials:

MS & SS are two major raw materials used in the product manufacturing.

The overall material loss (Scrap in terms of RM material value) during manufacturing process is as below.

- MS- 6.2%
- SS- 7.29 %

The manufacturing process has a system of self inspection at origin, however Quality Control person check the quality of finish parts before Assembly. The data of rework at origin is not available, however quality performance based on final inspection is as below.

	Avg. Numbers/month	%
Non confirming product identified	40	5.2%
Parts Rejected	1.4	0.2%
Parts Reworked	28.9	3.7%
Parts Accepted under deviation	9.75	1.3%

Source: In Process NCDR Register 2013-14

Further, Quality performance of the product at Customer end is measured in terms of customer complaints i.e. 75 customer complaints in 2013-14.

Nature wise Customer Complaints

TYPES (NATURE)	No. of Complaints	% Contri
Panwork related	15	20.0%
Wire mesh related	20	26.7%
Others	13	17.3%
M/c performance	8	10.7%
Motor problem	7	9.3%
Spring related	4	5.3%
Rusting problem	3	4.0%
Short supply	2	2.7%
Base & casing related	2	2.7%
Screen ring related	1	1.3%
Total	**75**	100.0%

Details of the Customer complaints data indicates 'Pan work' and 'Wire Mesh' processes as major area of improvement at shop floor.

3. Value Stream Map

A. Current State VSM

Based on Product Quantity Process Route (PQPR) GS40/GS48/GS60 model was selected for Value Stream mapping. Wherever process was not available for study, VSM data is taken from the concern person based on their experience. Outcome of the VSM is given below in tabular form.

Sub Assly	*Cycle Time*	*Deploy ment*	*Work Content*	*Work-in-process*	*Distance (Meters)*	*Qty reqd / Machine*	*Total work content*	*Man-Days reqd.*
Base	605	18	1005	33	300	1	1005	3
Motor Casing	571	22	1003	30	317	1	1003	3
Motor casing- top plate	40	9	60	1	90	1	60	1
Underpan	857	23	921	177	857	2	1842	6
Spout	162	14	177	58	352	1	177	1
Spout ring	87	7	87	31	192	1	87	1
Cone	128	13	166	26	170	2	332	1
Dummy Ring/Screen ring/RFL ring	95	6	105	359	322	2	210	1
Mesh Ring	120	2	240	18	5	1	240	1
Toggle base	111	14	123	168	155	8	984	3
Assembly	605	10	195	34	40	1	195	1
Total	3381	138	4082		2800		6135	22

Note:

Unit Of Measurement: Cycle Time (Minutes), Deployment (Nos), Work Content (Man-Minutes), Distance (Meters), Qty Reqd / Machine (Nos), Total Work Content (Man-Minutes), Man=Days Reqd (Nos)

B. VSM Analysis

Required Man-days : 22

Available Man-days : 78

Possible Production : 3.5 Machines / Day

Observations:

1. High Movement waste observed in searching of materials and parts i.e. marked SS sheet for required spout size cutting, WIP Cone etc
2. Observed high material transportation between work stations and WIP material storage locations. It was calculated from VSM that material of GS model machine travel around 2800 meters in a plant during a manufacturing cycle. This is highly contributing to the production cost in terms of transporting, Quality defects, Idle Inventory, Space requirement,
3. 50-60 mm SS material waste observed on each channel ring preparation. This is an example, however waste generation at other processes i.e. SS & MS cutting can also be minimized.
4. Instances observed where Information of the customer requirements or process requirements are missing at point of use.
5. Lack of defined process cycle time for each activities i.e. Design, Light fabrication
6. Many instances observed where workman is waiting for helper to carry out work i.e. Cutting on seizer, Channel rolling, SS grinding
7. Unsafe work practises found in heavy parts handling/lifting and cutting of light fabrication part
8. Updated drawings of the parts to be manufactured were not available with Workers, they have to ask for updated information.
9. In Ring making, fitter and welder both are working simultaneously. However high waiting time observed as fitting time is too high compare to welding time.

4. Suggestions for improvement

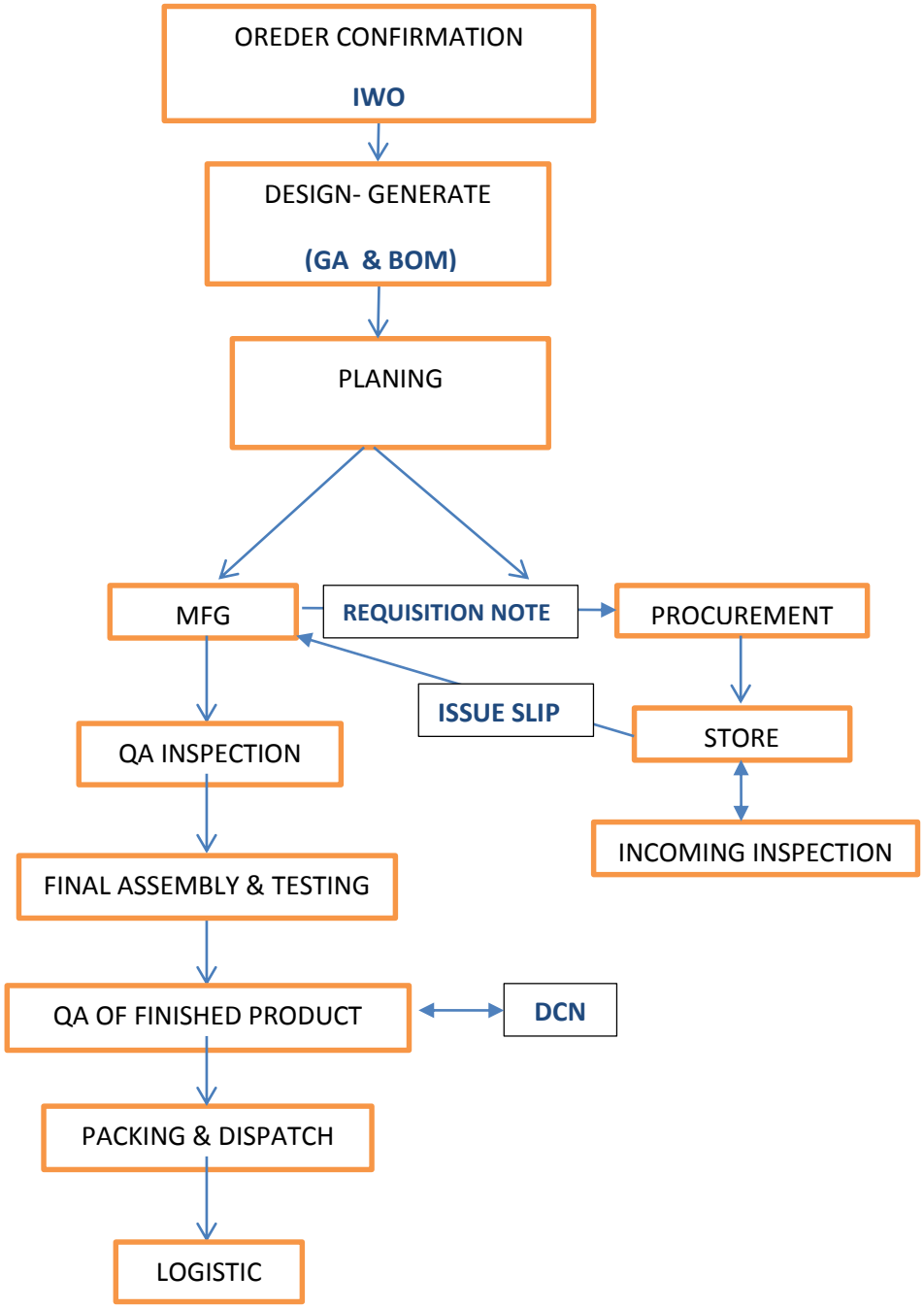
1. Re-layout of manufacturing area is required to create process / product flow. This is to minimize WIP and internal transportation and maximize productivity and space utilization.
2. Visual display to be used to enhance productivity through ensuring real-time and correct information required to workman
3. Availability and use of right tools to carry out required activities i.e. part holder for grinding or emery, Long length cutter for Spout cutting, Template for MS top plate marking and Deck angle ring marking,
4. Implementing work area organization (5'S) to reduce work fatigue, movement, transportation and enhance productivity i.e. cutting scissor, MS top plate drilling, grinder.
5. Building system for Product/part identification and traceability
6. Review of the standards and specifications to be carried out
7. Process re-engineering of existing processes e.g. Buffing / polishing, Spout raw cutting and then final cutting, Age bending the time of channel rolling
8. Implement Multi-activity manning
9. Inbuilt quality at work station to minimize rework and final quality checks to minimize customer complaints
10. Apply of MFCA (Material Flow & Cost Accounting) concept for identification and reduction of material and process cost at each stage of processing.
11. Supply of ready to use consumables by store i.e. Buffing roll cut in two strips
12. Creating pull system of production from assembly
13. Autonomation of critical machines i.e. buffing, rolling
14. Tack welding & full welding should be done at same place or by same welder so that we can reduce material handling time for base, casing and panwork.
15. In painting, bolt is covered by cello tape to avoid application of paint, instead of cello tape we can use pipe cover so that it time can be saved and material waste can be reduced.

5. Immediate Gains & ROI

- Reduction in order to delivery time from existing 42 days to 15 days
- Increasing plant throughput (from 44 M/C per Month to 60 M/C per month)
- Reduction in WIP (from 33 M/C to 4 M/C)
- Reduction in labor cost from existing around 13% to 7-8%
- Reduction in Over-head cost from existing approx 12% to 10%

Annexure-I

Process Flow Chart - ABC Company Pvt. Ltd



Annexure – II

Data Collection : Work Sampling

WORK SAMPLING OF HEAVY FABRICATION ZONE																														
DATE;19/08/2014	MANPOWER																													
WORK STATION	**MP**	**10:00**	**10:15**	**10:30**	**10:45**	**11:00**	**11:15**	**11:30**	**11:45**	**12:00**	**12:15**	**12:30**	**12:45**	**1:00**	**1:3**	**1:45**	**2**	**2:15**	**2:3**	**2:45**	**3:00**	**3:15**	**3:3**	**3:45**	**4**	**4:15**	**4:3**	**4:45**	**5**	
W.S -1	MP-1	NW	NW		NW	W	W	W	NW	NW	NW	NW	NW		NW	W	NW	W	W	W		NW	W	W	W	W	W	W	NW	
	MP-2	W	NW		W	NW	W	W	NW	NW	W	NW	NW	L	NW	NW	W	W	NW	W		NW	NW	NW	NW	NW	W	W	NW	
W.S -2	MP-3	W	NW	T	NW	W	NW	NW	NW	NW	NW	W	W	U	NW	NW	NW	W	NW	NW	T	NW	W	NW	W	W	W	W	W	
	MP-4	NW	NW	E	W	NW	W	NW	NW	NW	NW	NW	W	N	NW	NW	NW	NW	NW	NW	E	NW	NW	NW	NW	NW	NW	W	W	
W.S-3	MP-5	NW	NW	A	W	NW	W	W	W	W	NW	W	NW	C	NW	W	W	W	W	NW	A	NW	W	DW	NW	NW	W	NW	W	
W.S-4	MP-6	NW	W		NW	NW	W	W	NW	NW	W	NW	W	H	NW	W	NW	NW	NW	W		NW	W	W	W	NW	W	W	W	
	MP-7	NW	NW		NW	NW	W	NW	W	NW	NW	NW	W		NW	W	NW	NW	NW	W		NW	W	W	W	NW	W	W	W	
W.S-5	MP-8	NW	NW		W	W	W	W	W	W	W	NW	W		NW	NW	W	W	NW	NW		NW	W	W	NW	NW	W	NW	NW	
																								Value Added Work			=		**46%**	

PAINTING AREA																													
DATE:14/08/2014	TIME																												
WORK STATION	MP	**9:45**	**10:00**	**10:15**	**10:30**	**10:45**	**11:00**	**11:15**	**11:30**	**11:45**	**12:00**	**12:15**	**12:30**	**12:45**	**1:00**	**1:3**	**1:45**	**2**	**2:15**	**2:3**	**2:45**	**3:00**	**3:15**	**3:3**	**3:45**	**4**	**4:15**	**4:3**	
W.S-8	MP-1	W	W	NW		NW	W	W	W	NW	W	NW	NW	NW		NW	NW	NW	NW	W	W		NW	W	W	NW	W	W	
	MP-2	NW	W	W		NW	W	W	W	W	NW	NW	W	NW		W	W	W	NW	W	W		W	NW	W	W	W	W	
																							Value Added Work				=	**63%**	

RING AREA																													
DATE:14/08/2014	TIME																												
WORK STATION	MP	**9:45**	**10:00**	**10:15**	**10:30**	**10:45**	**11:00**	**11:15**	**11:30**	**11:45**	**12:00**	**12:15**	**12:30**	**12:45**	**1:00**	**1:3**	**1:45**	**2**	**2:15**	**2:3**	**2:45**	**3:00**	**3:15**	**3:3**	**3:45**	**4**	**4:15**	**4:3**	
W.S-9	MP-1	W	W	W		NW	NW	NW	NW	W	W	W	W	W		W	W	W	W	NW	W		W	W	W	W	W	W	
W.S-10	MP-2	W	W	W		NW	NW	NW	W	W	NW	NW	W	NW		NW	NW	W	NW	W	W		W	W	NW	NW	W	NW	
	MP-3	W	NW	NW		NW	NA	NW	NW	NW	W	NW	NW	NW		W	W	NW	W	NW	NW		NW	NW	NW	W	NW	NW	
																							Value Added Work				=	**54%**	

MACHINING ZONE																													
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W.S-11	MP-1	W	W	W		NW	W	W	W	NW	W	NW	W	NW		NW	NW	W	NW	W	NW		NW	W	W	W	NW	NW	
W.S-12	MP-2	W	W	NW		NW	NW	NW	NW	W	W	NW	W	NW		NW	W	W	NW	W	W		W	W	W	NW	W	W	
																							Value Added Work				=	**56%**	

WORK SAMPLING OF LIGHT FABRICATION ZONE																													
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W.S -1	MP-1	W	W	W		NW	W	NW	W	W	NW	NW	NW	NW		NW	NW	NW	NW	NW	NW		NW	W	W	W	W	W	
	MP-2	W	W	W		NW	W	NW	W	W	NW	NW	NW	NW		NW	NW	NW	NW	NW	NW		NW	NW	NW	NW	NW	NW	
W.S -2	MP-3	W	W	W		NW	NW	NW	NW	W	NW	W	W	W	L	W	W	NW	NW	W	NW		NW	NW	NW	NW	NW	W	
	MP-4	W	NW	W	T	NW	W	W	NW	NW	NW	NW	NW	NW	U	NW	NW	NW	NW	W	NW	T	NW	W	W	NW	NW	NW	
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W.S-3	MP-6	NW	W	W	A	NW	NW	W	NW	W	NW	W	W	NW	C	ME	ME	ME	NW	W	W	A	W	W	W	NW	W	W	
W.S-4	MP-7	NW	NW	NW		NW	W	NW	W	NW	NW	W	NW	W	H	ME	ME	ME	W	NW	W		W	W	NW	NW	W	NW	
W.S-5	MP-8	NW	NW	W		NW	W	W	W	NW	NW	W	W	NW		ME	ME	ME	NW	W	W		NW	W	NW	NW	NW	W	
W.S-6	MP-9	NW	W	W		NW	W	W	NW	NW	W	W	NW	W		ME	ME	ME	W	W	W		W	W	W	NW	NW	NW	
W.S-7	MP-10	W	W	NW		NW	NW	NW	NW	W	NW	W	NW	NW		NW	NW	NW	NW	NW	NW		W	W	W	W	NW	NW	
	MP-11	W	W	NW		NW	NW	NW	NW	NW	W	NW	NW	NW		NW	NW	NW	NW	NW	NW		NW	W	W	NW	W	W	
																							Value Added Work				=	40%	

WORK SAMPLING OF M.S GRINDING ZONE																															
DATE:21/08/2014	TIME																														
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																											Value Added Work			=	62%	
S.S GRINDING																															
DATE:21/08/2014	TIME																														
MANPOWER	9:15	9:30	9:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00	12:15	12:30	12:45	1:00	1:15	1:30	1:45	2:00	2:15	2:30	2:45	3:00	3:15	3:30	3:45	4:00	4:15	4:30	4:45	5:00
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MP-9	W	NW	W	W	W		W	W	W	NW	NW	W	W	NW	W			W	W	NW	W	W	W		W	NW	W	NW	NW	NW	W	NW
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																											Value Added Work			=	62%	
S.S BUFFING																															
DATE:21/08/2014	TIME																														
MANPOWER	9:15	9:30	9:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00	12:15	12:30	12:45	1:00	1:15	1:30	1:45	2:00	2:15	2:30	2:45	3:00	3:15	3:30	3:45	4:00	4:15	4:30	4:45	5:00
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MP-2	W	W	W	W	NW		W	W	NW	W	NW	W	NW	W	W			NW	NW	NW	W	W	W		NW	W	W	NW	NW	W	W	W
MP-3	NW	NW	NW	NW	W		W	W	W	W	W	W	NW	W	W			NW	NW	NW	W	W	W		NW	W	W	W	W	NW	W	W
MP-4	NW	NW	NW	NW	W		NW	W	NW	W	**NW**	**W**	**W**	**NW**	W			W	W	W	NW	NW	W		NW	NW	W	W	W	W	NW	W
MP-5	NW	NW	NW	W	NW		W	W	NW	W	NW	W	NW	W	W			W	W	W	NW	NW	NW		NW	W	W	NW	NW	NW	NW	NW
MP-6	NW	NW	NW	NW	NW		NW	W	W	NW	W	W	W	NW	NW			NW	W	NW	NW	NW	NW		NW	NW	W	W	NW	W	W	W
																											Value Added Work			=	56%	

ASSEMBLY ZONE																												
DATE:19/08/2014	TIME																											
MANPOWER	**10:00**	**10:15**	**10:30**	**10:45**	**11:00**	**11:15**	**11:30**	**11:45**	**12:00**	**12:15**	**12:30**	**12:45**	**1:00**	**1:3**	**1:45**	**2**	**2:15**	**2:3**	**2:45**	**3:00**	**3:15**	**3:3**	**3:45**	**4**	**4:15**	**4:3**	**4:45**	**5**
MP-1	W	NW		W	NW	W	W	NW	W	NW	W	NW		NW	W	DS	W	NW	W		NW	NW	NW	NW	NW	NW	NW	NW
MP-2	W	NW		NW	NW	NW	NW	W	NW	NW	NW	W		NW	NW	W	W	W	NW		NW	NW	NW	NW	NW	W	NW	NW
MP-3	W	W		NW	NW	WM	W	W	NW	NW	NW	W		NW	W	NW	W	W	W		NW	W	W	NW	W	NW	CL	CL
MP-4	W	NW		W	W	NW	NW	**W**	**NW**	**W**	**W**	NW		NW	NW	W	NW	W	NW		NW	W	W	NW	W	NW	W	NW
MP-5	W	NW		NW	W	W	NW	NW	W	NW	NW	NW		NW	NW	W	W	W	W		NW	NW	W	W	W	NW	NW	W
MP-6	W	NW		NW	W	W	W	W	W	NW	NW	W		NW	W	W	W	NW	W		NW	NW	W	W	W	W	NW	NW
MP-7	NW	NW		W	NW	W	W	W	W	NW	NW	NW		NW	W	NW	NW	NW	NW		A	A	A	A	A	NW	A	A
																							Value Added Work				=	**48%**