VALIANT TMS®

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Customer:	**Volvo**
Program:	**2023 P6700**
Commodity:	**V11 Bodyside Sub Assemblies (17 JPH)**
Plant:	**NPV**
Job #	**16149**
Date:	**2/2/2023**
Cycle Time:	**212**

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
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Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

NPV

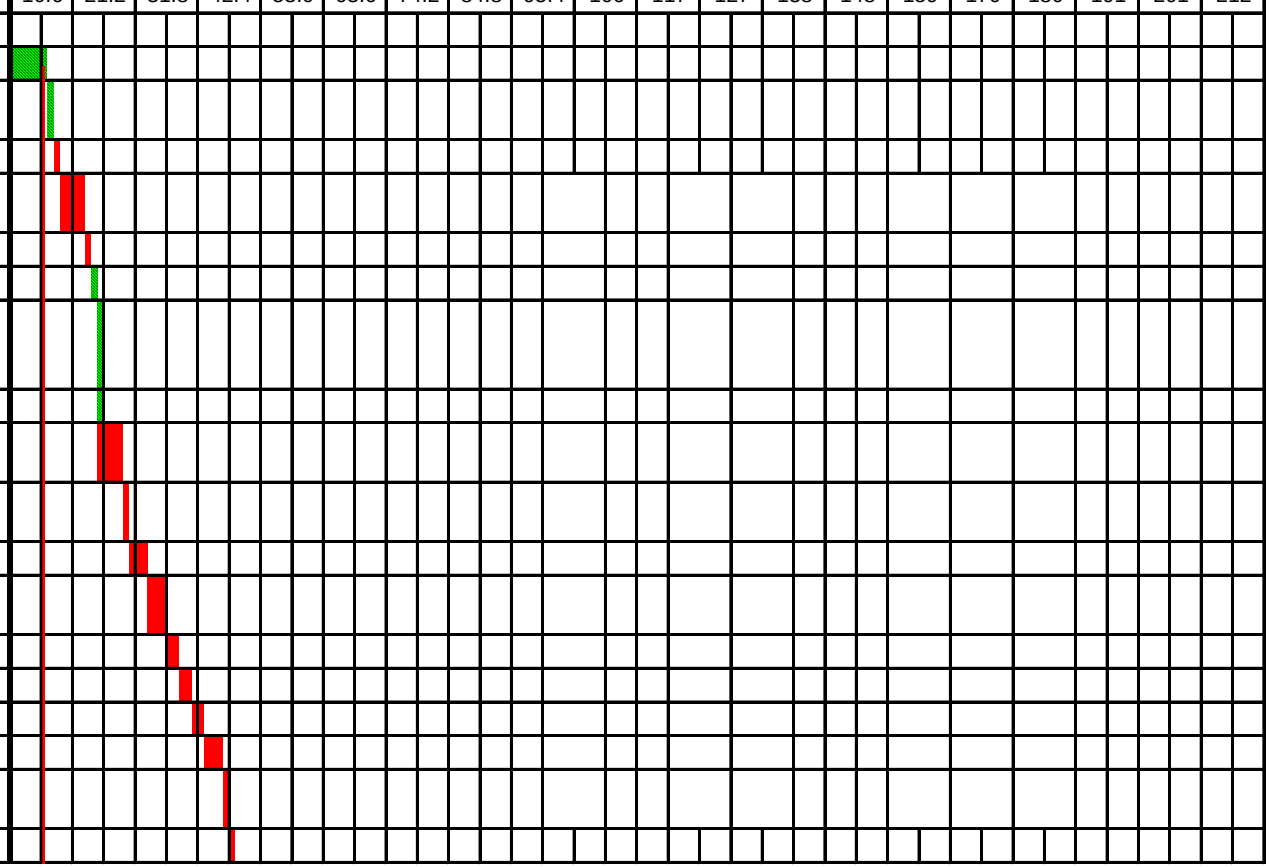
TOOL DESCRIPTION:

HDR SUB & C-PILL LTCH DayCab

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	88.83	2.00	74.83	59.60	152.40	28.11	26.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
1	**LH OPER LOAD - T1**				
2	Turntable rotates 180			6.00	6.00
3	Clamps open	UQ3.1, UQ3.2		1.00	7.00
4	Oper walks into station		4	1.20	8.20
5	Oper unloads one large assembly from GEO fixture			4.20	12.40
6	Oper sets aside assembly			1.20	13.60
7	Oper depress palm buttons			1.00	14.60
8	Shot pins Extend	UQ1.1, UQ1.2, UQ1.3		1.00	15.60
9	Clamps Close	UQ4.1		1.00	15.60
10	Oper walks to dunnage with completed assembly		14	4.20	18.80
11	Oper places finished sub assembly to dunnage racks			1.80	20.60
12	Oper walks part dunnage		10	3.00	23.60
13	Oper obtains 1 medium part from dunnage racks			2.40	26.00
14	Oper walks to GEO fixt with 1 part		10	3.00	29.00
15	Oper obtains 1 small part from tote			1.80	30.80
16	**Oper loads 1 part (4042)**			1.80	32.60
17	**Oper loads 1 part (2773)**			3.00	35.60
18	Oper walks to front of light screens		4	1.20	36.80
19	Oper depress palm buttons			1.00	37.80

CYCLE TIME (seconds)



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

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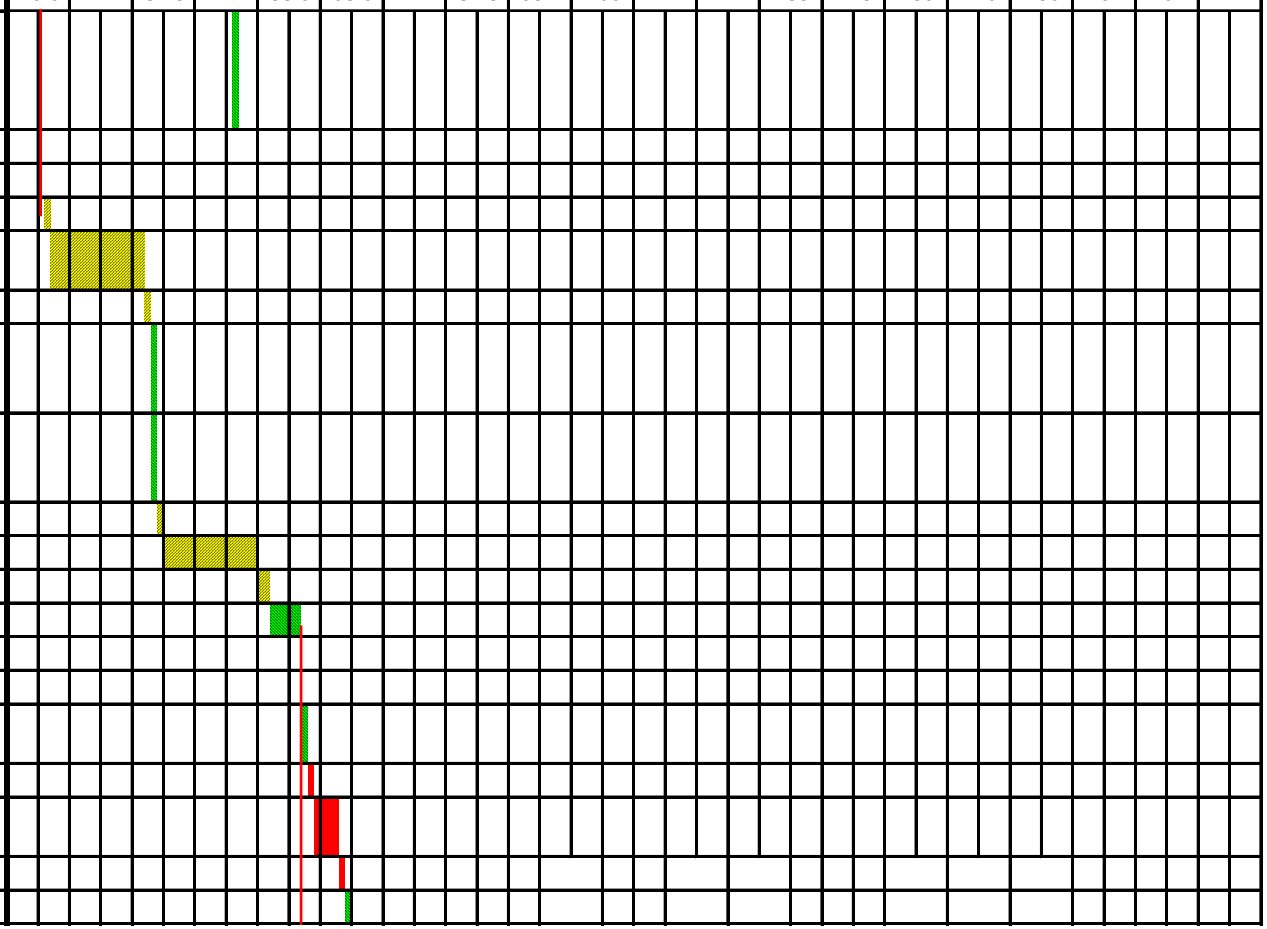
TOOL DESCRIPTION:

HDR SUB & C-PILL LTCH DayCab

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	88.83	2.00	74.83	59.60	152.40	28.11	26.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
20	Clamps Close	UQ2.1, UQ2.2, UQ3.1, UQ3.2		1.00	38.80
21					
22	**RH WELD - T3**				
23	Robot BS-010-V01AR21 moves in			1.50	7.50
24	Robot V01AR21 Geo welds (4) spots			16.00	23.50
25	Robot V01AR21 moves out			0.60	24.10
26	Shot Pin Retracts	UQ1.1, UQ1.2, UQ1.3		1.00	25.10
27	Clamps open	UQ4.1, UQ2.1, UQ2.2		1.00	25.10
28	Robot V01AR21 moves in			1.50	26.60
29	Robot V01AR21 welds (4) spots			15.95	42.55
30	Robot V01AR21 moves out			1.50	44.05
31	Turntable rotates 180			6.00	50.05
32					
33	**RH OPER LOAD - T3**				
34	Clamps open	UQ3.1, UQ3.2		1.00	51.05
35	Oper walks into station		4	1.20	52.25
36	Oper unloads one large assembly from GEO fixture			4.20	56.45
37	Oper sets aside assembly			1.20	57.65
38	Oper depress palm buttons			1.00	58.65

CYCLE TIME (seconds)



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

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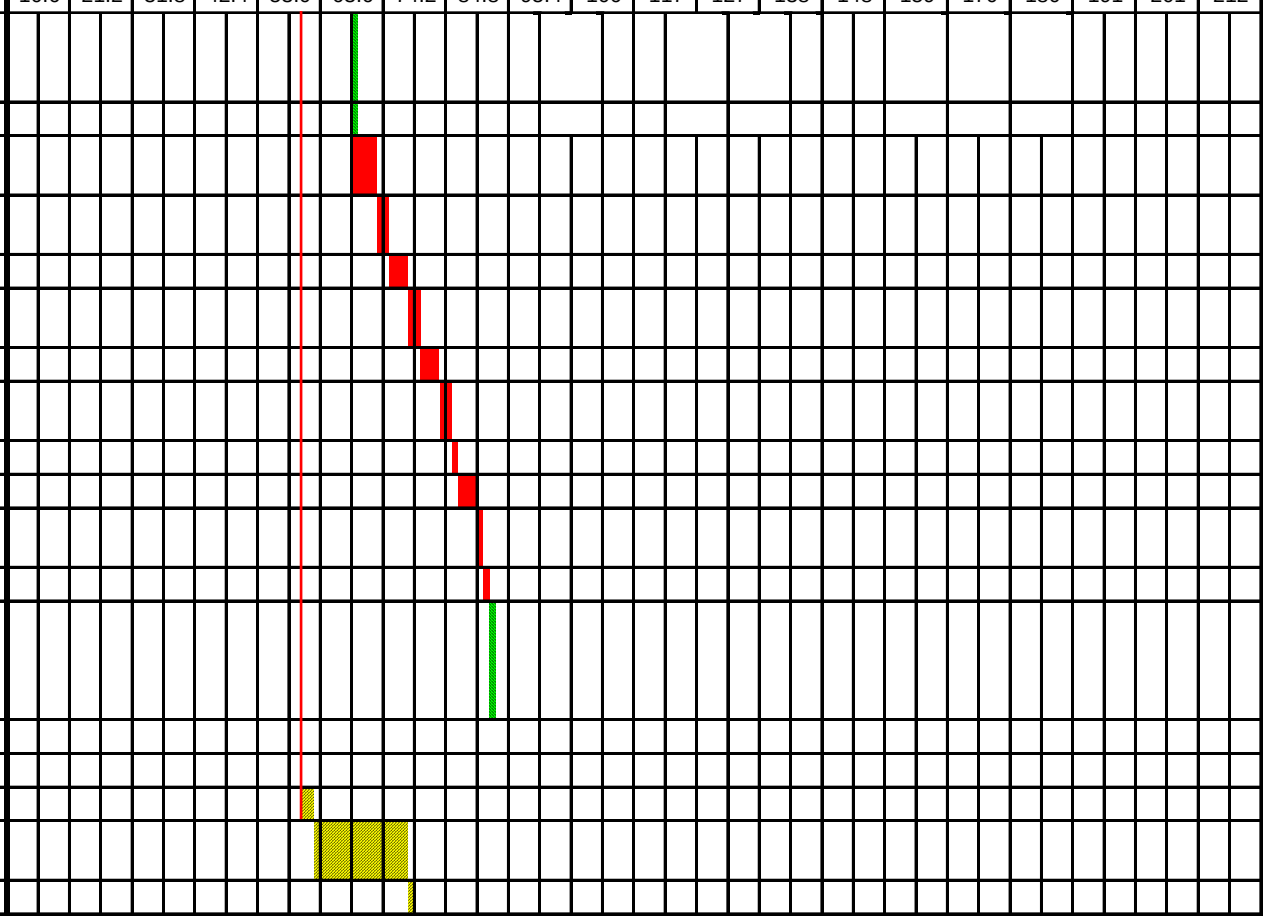
V11 Bodyside Sub Assemblies (17 JPH)

NPV

TOOL DESCRIPTION:	Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
HDR SUB & C-PILL LTCH DayCab	7.4	16.98	212.00	88.83	2.00	74.83	59.60	152.40	28.11	26.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
39	Shot pins Extend	UQ1.1, UQ1.2, UQ1.3		1.00	59.65
40	Clamps Close	UQ4.1		1.00	59.65
41	Oper walks to dunnage with completed assembly		14	4.20	62.85
42	Oper places finished sub assembly to dunnage racks			1.80	64.65
43	Oper walks part dunnage		10	3.00	67.65
44	Oper obtains 1 medium part from dunnage racks			2.40	70.05
45	Oper walks to GEO fixt with 1 part		10	3.00	73.05
46	Oper #1 obtains 1 small part from tote			1.80	74.85
47	**Oper loads 1 part (8103)**			1.80	76.65
48	**Oper loads 1 part (9534)**			3.00	79.65
49	Oper walks to front of light screens		4	1.20	80.85
50	Oper depress palm buttons			1.00	81.85
51	Clamps Close	UQ2.1, UQ2.2, UQ3.1, UQ3.2		1.00	82.85
52					
53	**LH WELD - T1**				
54	Robot BS-010 V01AR22 moves in			1.50	51.55
55	Robot V01AR22 Geo welds (4) spots			16.00	67.55
56	Robot V01AR22 moves out			1.50	69.05

CYCLE TIME (seconds)



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

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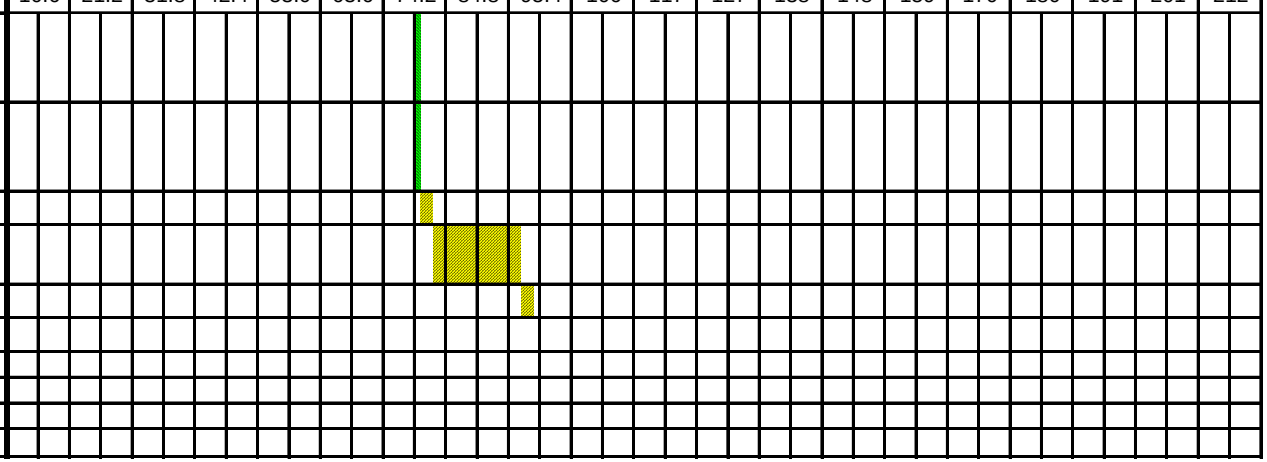
V11 Bodyside Sub Assemblies (17 JPH)

NPV

TOOL DESCRIPTION:	Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
HDR SUB & C-PILL LTCH DayCab	7.4	16.98	212.00	88.83	2.00	74.83	59.60	152.40	28.11	26.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
57	Shot Pin Retracts	UQ1.1, UQ1.2, UQ1.3		1.00	70.05
58	Clamps open	UQ4.1, UQ2.1, UQ2.2		1.00	70.05
58	Robot V01AR22 moves in			1.50	71.55
59	Robot V01AR22 welds (4) spots (SIM)			15.78	87.33
51	Robot V01AR22 moves out			1.50	88.83
52					
53					
54	Total Cycle Time				88.83
55	Estimated Walk Total		84		
56	Jobs Per Hour				40.53

CYCLE TIME (seconds)



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

NPV

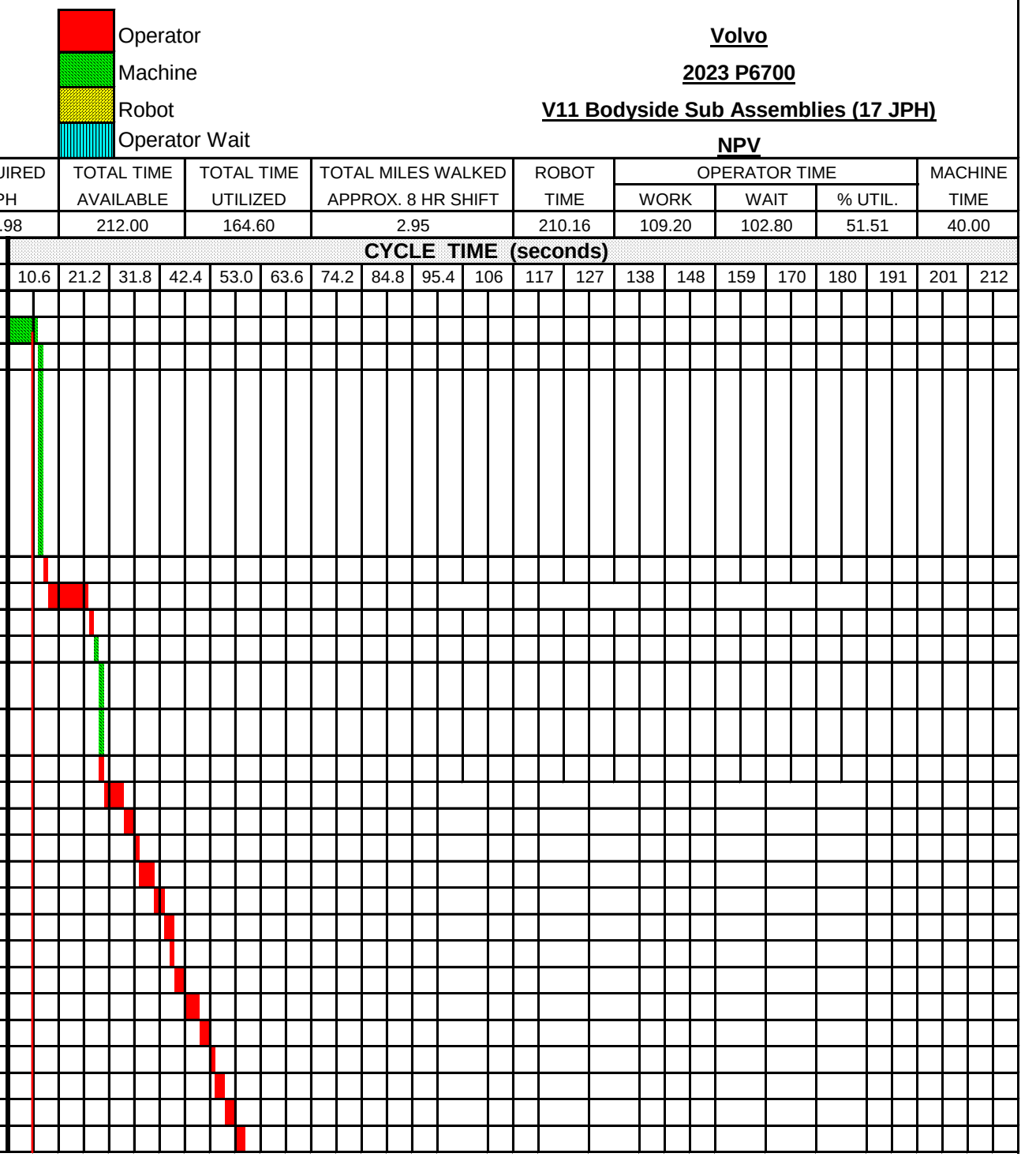
TOOL DESCRIPTION:

HDR &C-PILL LTCH L230 LH-RH

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	164.60	2.95	210.16	109.20	102.80	51.51	40.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
1	**LH/RH OPER LOAD - T1**				
2	Turntable rotates 180			6.00	6.00
3	Shot Pin Retracts	UQ6.1		1.00	7.00
4	Clamps Open	UQ5.1, UQ5.2, UQ7.1, UQ11.1, UQ11.2, UQ11.3, UQ11.4, UQ14.1		1.00	7.00
5	Oper walks into station		4	1.20	8.20
6	Oper unloads two large assemblies from GEO fixture			8.40	16.60
7	Oper sets aside large assemblies			1.20	17.80
8	Oper depress palm buttons			1.00	18.80
9	Shot Pin Extends	UQ6.1, UQ19.1		1.00	19.80
10	Clamps Close	UQ12.1, UQ20.1		1.00	19.80
11	Oper picks up completed assemblies			1.20	20.00
12	Oper walks to dunnage with completed assemblies		14	4.20	24.20
13	Oper places finished sub assemblies to dunnage racks			2.60	26.80
14	Oper walks to next dunnage		3	0.90	27.70
15	Oper places finished sub assemblies to dunnage racks			2.60	30.30
16	Oper walks to dunnage racks		10	3.00	33.30
17	Oper obtains 1 part (2599)			1.80	35.10
18	Oper walks to next dunnage		3	0.30	35.40
19	Oper obtains 1 part (4746)			1.80	37.20
20	Oper walks to GEO fixture		10	3.00	40.20
21	**Oper loads 1 part (2599)**			1.80	42.00
22	**Oper loads 1 part (4746)**			1.80	43.80
23	Oper obtains 1 small part from tote (3259)			1.80	45.60
24	**Oper loads 1 part (3259)**			1.80	47.40
25	Oper walks into dunnage		7	2.10	49.50

CYCLE TIME (seconds)



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

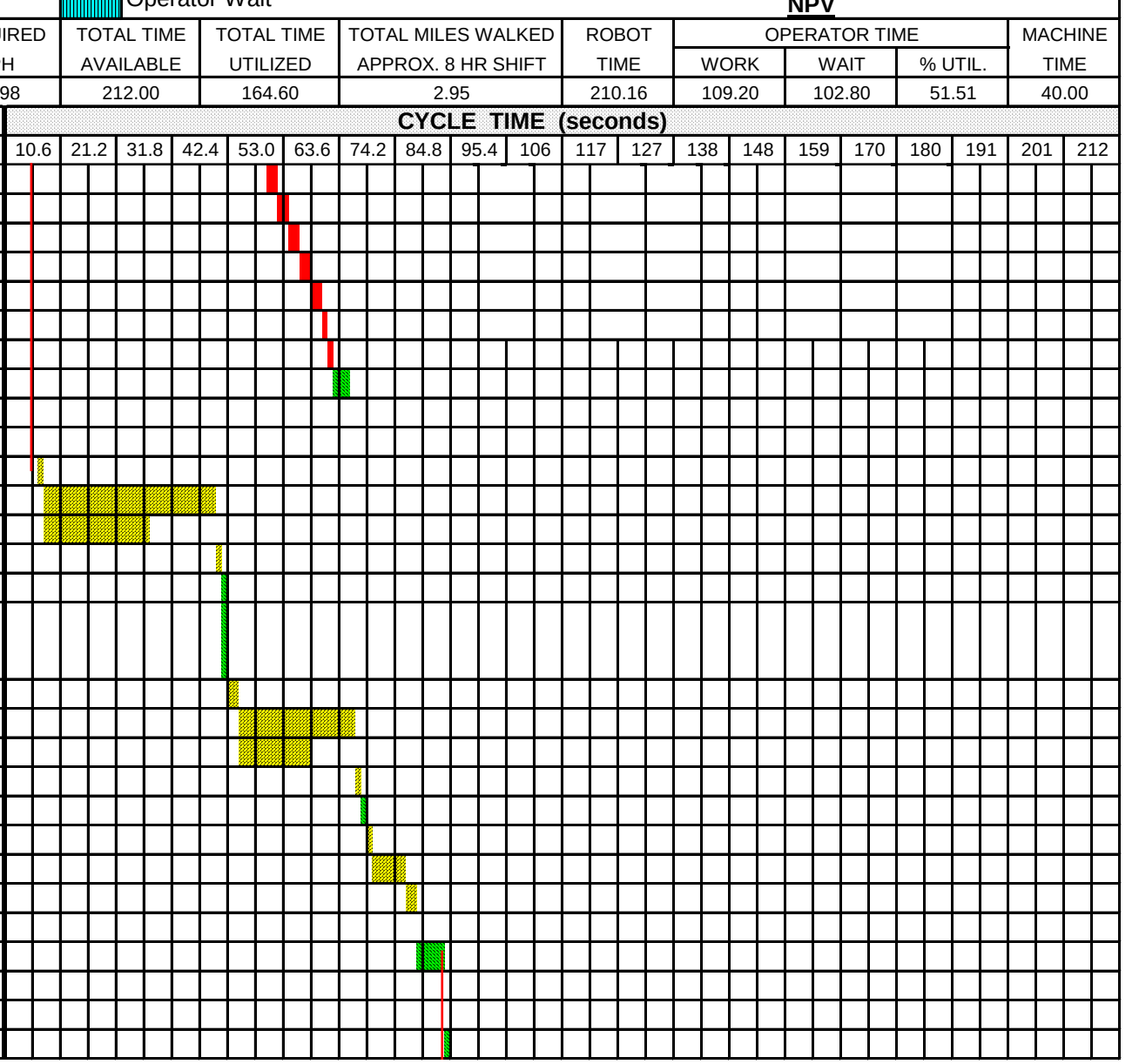
NPV

TOOL DESCRIPTION:

HDR &C-PILL LTCH L230 LH-RH

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	164.60	2.95	210.16	109.20	102.80	51.51	40.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
26	Oper obtains 1 part (4083)			2.60	52.10
27	Oper walks to fixture		7	2.10	54.20
28	Oper obtains 1 part (9143) from tote			1.80	56.00
29	**Oper loads 1 part (9143)**			2.60	58.60
30	Oper loads 1 part (9133)			1.80	60.40
31	Oper walks to palm button		4	1.20	61.60
32	Oper depress palm buttons			1.00	62.60
33	Fixture cycles closed			3.00	65.60
34					
35	**WELDING RH - T3**				
36	Robots BS-010-V01AR21 & V01AR22 move in			1.50	7.50
37	Robot V01AR21 Geo welds (7) spots @ 3.5 sec/spot			32.49	39.99
38	Robot V01AR22 Geo welds (4) spots @ 3.5 sec/spot			19.73	27.23
39	Robots V01AR21,V01AR22 move out			1.50	41.49
40	Shot Pin Retracts	UQ6.1		1.00	42.49
41	Clamps Open	UQ12.1, UQ13.1, UQ13.2		1.00	42.49
42	Robots V01AR21 & V01AR22 move in			1.50	43.99
43	Robot V01AR21 welds (4) spots			22.29	66.28
44	Robot V01AR22 welds (3) spots			14.33	58.32
45	Robots V01AR21 & V01AR22 move out			1.50	67.78
46	Clamps open	UQ20.1		1.00	68.78
47	Robot V01AR21 move in			1.50	70.28
48	Robot V01AR21 welds (1) spot			6.35	76.63
49	Robot V01AR21 move out			1.50	78.13
50					
51	Turntable rotates 180			6.00	84.13
52					
53	**RH OPER LOAD - T3**				
54	Shot Pins Retract	UQ19.1		1.00	85.13



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

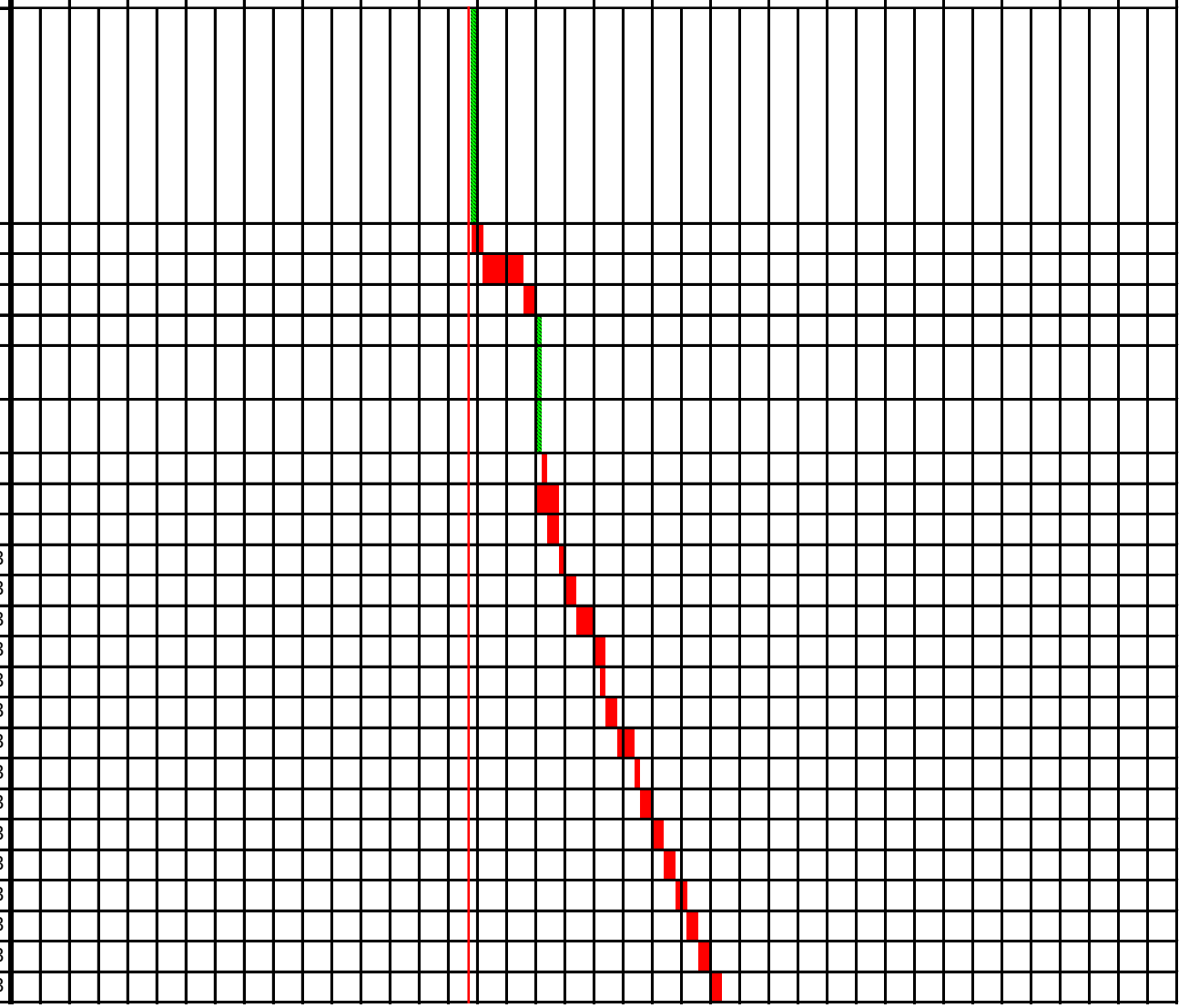
NPV

TOOL DESCRIPTION:

HDR &C-PILL LTCH L230 LH-RH

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	164.60	2.95	210.16	109.20	102.80	51.51	40.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
55	Clamps Open	UQ5.1, UQ5.2, UQ7.1, UQ11.1, UQ11.2, UQ11.3, UQ11.4, UQ14.1		1.00	85.13
56	Oper walks into station		4	1.20	85.33
57	Oper unloads two large assemblies from GEO fixture			8.40	93.73
58	Oper sets aside large assemblies			1.20	94.93
59	Oper depress palm buttons			1.00	95.93
60	Shot Pin Extends	UQ6.1, UQ19.1		1.00	96.93
61	Clamps Close	UQ12.1, UQ20.1		1.00	96.93
62	Oper picks up completed assemblies			1.20	97.13
63	Oper walks to dunnage with completed assemblies		14	4.20	99.13
64	Oper places finished sub assemblies to dunnage racks			2.60	99.73
65	Oper walks to next dunnage		3	0.90	100.63
66	Oper places finished sub assemblies to dunnage racks			2.60	103.23
67	Oper walks to dunnage racks		10	3.00	106.23
68	Oper obtains 1 part (5102)			1.80	108.03
69	Oper walks to next dunnage		3	0.30	108.33
70	Oper obtains 1 part (0875)			1.80	110.13
71	Oper walks to GEO fixture		10	3.00	113.13
72	**Oper loads 1 part (5102)**			1.80	114.93
73	**Oper loads 1 part (0875)**			1.80	116.73
74	Oper obtains 1 small part from tote (3259)			1.80	118.53
75	**Oper loads 1 part (3259)**			1.80	120.33
76	Oper walks into dunnage		7	2.10	122.43
77	Oper obtains 1 part (8595)			2.60	125.03
78	Oper walks to fixture		7	2.10	127.13
79	Oper obtains 1 part (9133) from tote			1.80	128.93



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

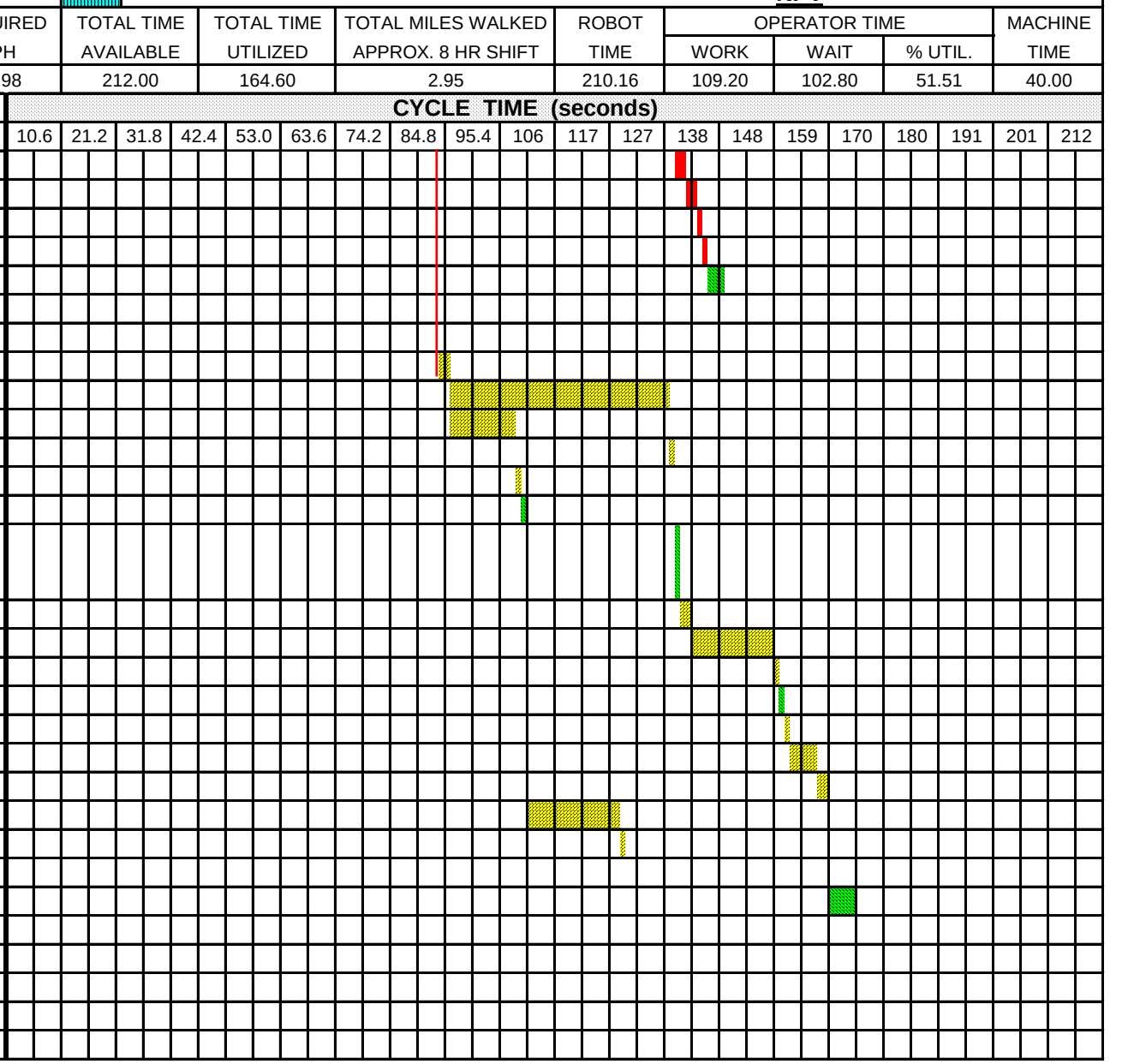
NPV

TOOL DESCRIPTION:

HDR &C-PILL LTCH L230 LH-RH

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	164.60	2.95	210.16	109.20	102.80	51.51	40.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
80	**Oper loads 1 part (9133)**			2.60	131.53
81	Oper loads 1 part (8595)			1.80	133.33
82	Oper walks to palm button		4	1.20	134.53
83	Oper depress palm buttons			1.00	135.53
84	Fixture cycles closed			3.00	138.53
85					
86	**WELDING LH - T1**				
87	Robots BS-010-V01AR21 & V01AR22 move in			1.50	85.63
88	Robot V01AR21 Geo welds (8) spots (SIM)			42.46	128.09
89	Robot V01AR22 Geo welds (3) spots (SIM)			12.65	98.28
90	Robots V01AR21 move out			1.50	129.59
91	Robots V01AR22 move out			1.50	99.78
92	Shot Pin Retracts	UQ6.1		1.00	100.78
93	Clamps Open	UQ12.1, UQ13.1, UQ13.2		1.00	130.59
94	Robot V01AR21 moves in			1.50	132.09
95	Robot V01AR21 welds (4) spots (SIM)			15.95	148.04
96	Robot V01AR21 moves out			1.50	149.54
97	Clamps Open	UQ20.1		1.00	150.54
98	Robots V01AR21 move in			1.50	152.04
99	Robot V01AR21 welds (1) spot (SIM)			5.06	157.10
100	Robots V01AR21 move out			1.50	158.60
101	Robot V01AR22 welds (3) spots (SIM)			17.85	118.63
102	Robots V01AR22 move out			1.50	120.13
103					
104	Turntable rotates 180			6.00	164.60
105					
106					
	Total Cycle Time				164.60
	Estimated Walk Total		124		
	Jobs Per Hour				21.87



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

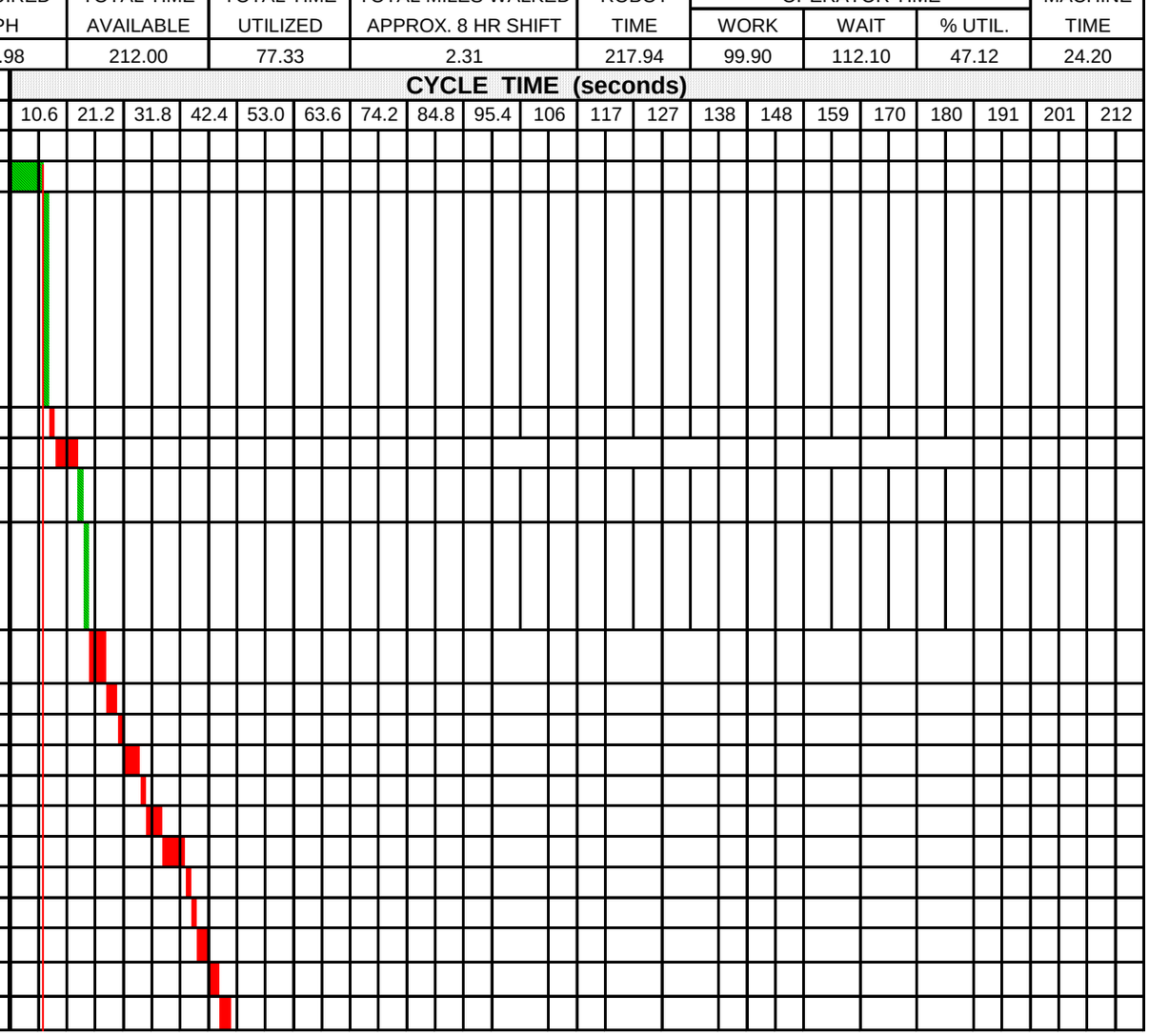
NPV

TOOL DESCRIPTION:

C-pill & Cab Mnt Ld L290 LH

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	77.33	2.31	217.94	99.90	112.10	47.12	24.20

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
1	**LH/RH OPER LOAD - T2**				
2	Turntable rotates 180° (RWD)			6.00	6.00
3	Clamps Open (RWD)	UQ3.1, UQ3.2, UQ3.3, UQ3.4, UQ4.1, UQ4.2, UQ4.3, UQ4.4		1.00	7.00
4	Oper #1 walks into station		4	1.20	8.20
5	Oper #1 unloads LH / RH sub ASM			4.80	13.00
6	L320 Shot Pins Retract (RWD)	UQ1.1, UQ1.2		1.00	14.00
7	L290 Shot Pins Extend (RWD)	UQ2.1, UQ2.3 UQ2.2, UQ2.4		1.00	15.00
8	Oper #1 walks to dunnage with completed assemblies		10	3.00	18.00
9	Oper #1 places LH ASM			2.60	20.60
10	Oper walks to next dunnage		3	0.90	21.50
11	Oper #1 places RH ASM			2.60	24.10
12	Oper #1 walks to totes		4	1.20	25.30
13	Oper #1 obtains 2 part (1033)			3.60	28.90
14	Oper #1 obtains 2 part (4646)			3.60	32.50
15	Oper #1 walks to fixture		4	1.20	33.70
16	**Oper #1 loads 1 (1033)**			1.80	35.50
17	**Oper #1 loads 1 (1033)**			1.80	37.30
18	**Oper #1 loads 1 (4646)**			1.80	39.10
19	**Oper #1 loads 1 (4646)**			1.80	40.90



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
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Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

NPV

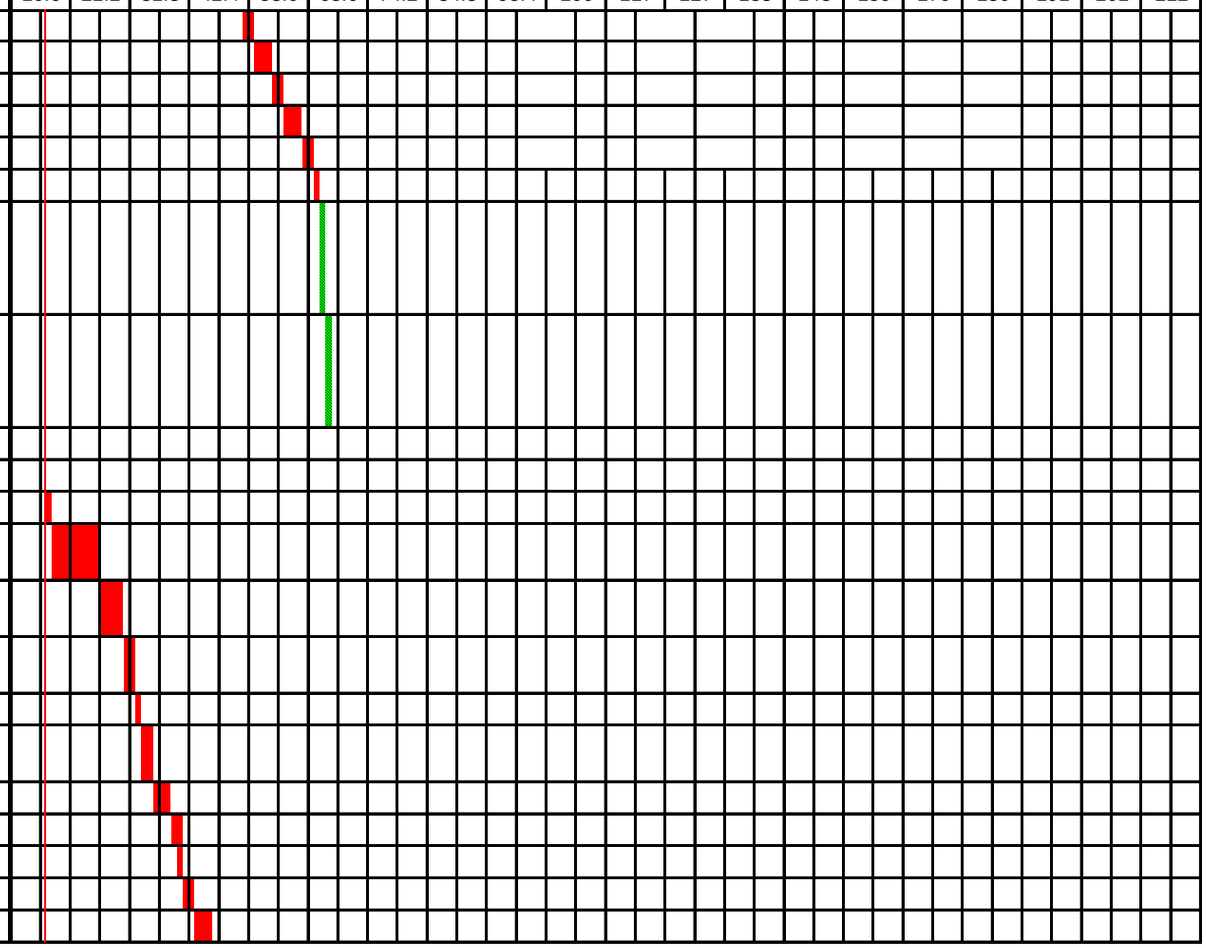
TOOL DESCRIPTION:

C-pill & Cab Mnt Ld L290 LH

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	77.33	2.31	217.94	99.90	112.10	47.12	24.20

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
20	Oper #1 walks to dunnage racks		7	2.10	43.00
21	Oper #1 obtains 2 (1038)			4.00	47.00
22	Oper #1 walks to fixture		7	2.10	49.10
23	**Oper #1 loads 2 (1038)**			2.40	51.50
24	**Oper #1 loads 2 (1038)**			2.40	53.90
25	Oper #1 depress palm buttons			1.00	54.90
26	X Clamps Close (RWD)	UQ3.1, UQ3.2, UQ3.3, UQ3.4		1.00	55.90
27	Y Clamps Close (RWD)	UQ4.1, UQ4.2, UQ6.1, UQ6.2		1.00	56.90
28					
29	**LH OPER LOAD**				
30	Oper walks into station		4	1.20	7.20
31	Oper #2 unloads two large assemblies from GEO fixture			8.40	15.60
32	Oper #2 walks to dunnage with completed assemblies		14	4.20	19.80
33	Oper #2 places finished sub assemblies to dunnage racks			2.60	22.40
34	Oper walks to next dunnage		3	0.90	23.30
35	Oper #2 places finished sub assemblies to dunnage racks			2.60	25.90
36	Oper #2 walks to dunnage racks		10	3.00	28.90
37	Oper #2 obtains 1 part (2599)			1.80	30.70
38	Oper #2 walks to next dunnage		3	0.30	31.00
39	Oper #2 obtains 1 part (4746)			1.80	32.80
40	Oper #2 walks to GEO fixture		10	3.00	35.80

CYCLE TIME (seconds)



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

NPV

TOOL DESCRIPTION:

C-pill & Cab Mnt Ld L290 LH

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	77.33	2.31	217.94	99.90	112.10	47.12	24.20

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
41	**Oper #2 loads 1 part (2599)**			1.80	37.60
42	**Oper #2 loads 1 part (4746)**			1.80	39.40
43	Oper #2 obtains 1 small part from tote (3259)			1.80	41.20
44	**Oper #2 loads 1 part (3259)**			1.80	43.00
45	Oper #2 walks into dunnage		7	2.10	45.10
46	Oper #2 obtains 1 part (4083)			2.60	47.70
47	Oper #2 walks to fixture		7	2.10	49.80
48	Oper #2 obtains 1 part (9143) from tote			1.80	51.60
49	**Oper #2 loads 1 part (9143)**			2.60	54.20
50	Oper #2 loads 1 part (9133)			1.80	56.00
51	Oper #2 walks to palm button		4	1.20	57.20
52	Oper #2 depress palm buttons			1.00	58.20
53	Fixture cycles closed			3.00	61.20
54					
55	**WELD RH C-pill/Header**				
56	Robots BS-010-V01AR21 & V01AR22 move in			1.50	7.50
57	Robot V01AR21 Geo welds (7) spots (SIM)			31.32	38.82
58	Robot V01AR22 Geo welds (4) spots (SIM)			19.62	27.12
59	Robots V01AR21 & V01AR22 move out			1.50	40.32
60	Shot Pins Retract			3.00	43.32
61	Clamps Open			3.00	46.32
62	Clamps Open			3.00	49.32
63	Robots V01AR21 & V01AR22 move in			1.50	50.82
64	Robot V01AR21 welds (4) spots (SIM)			22.19	73.01
65	Robot V01AR22 welds (3) spots (SIM)			14.30	65.12
66	Robots V01AR21 & V01AR22 move out			1.50	66.62
67	Clamps Open	UQ20.1		3.00	76.01
68	Robot V01AR21 moves in			1.50	77.51

CYCLE TIME (seconds)

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

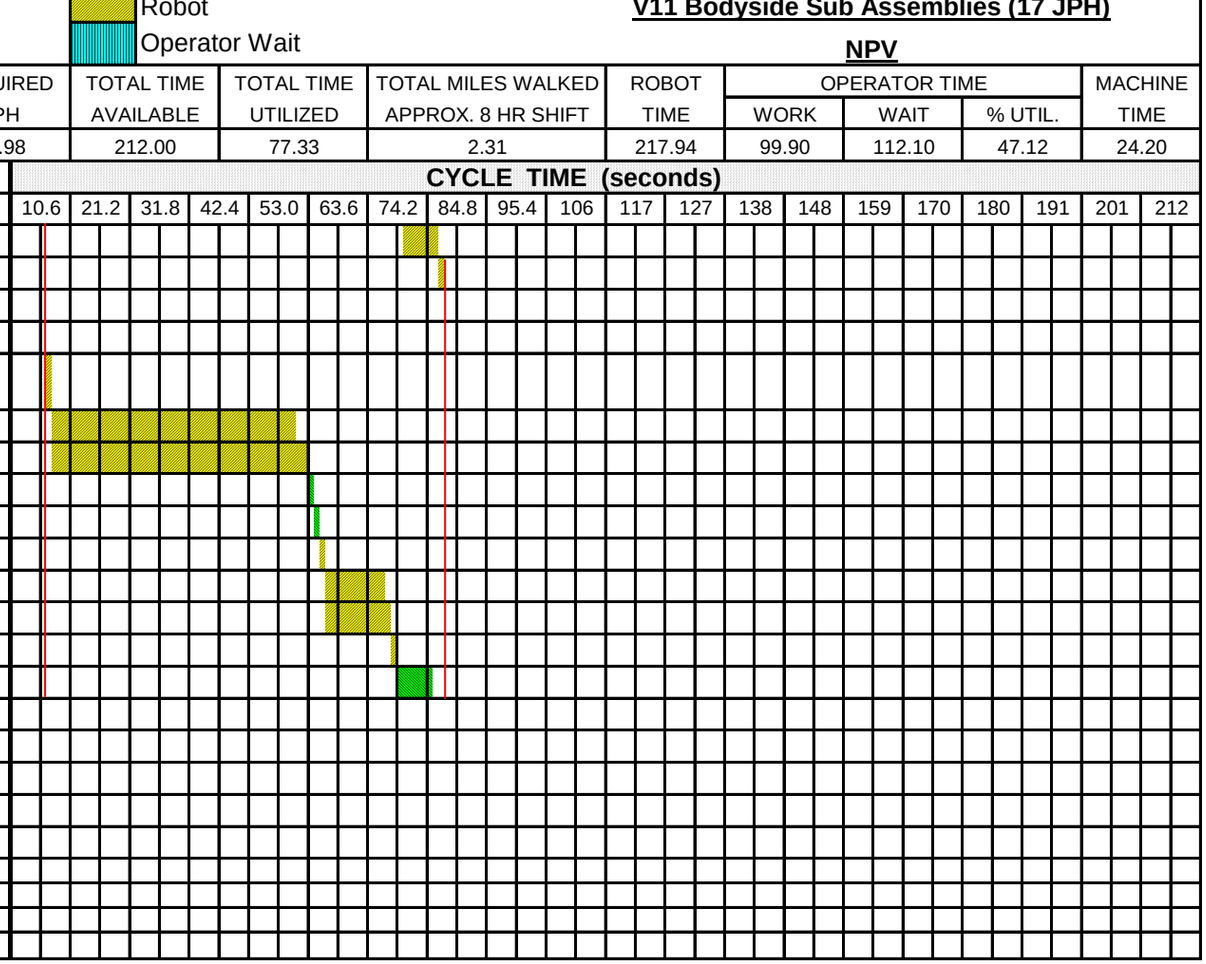
NPV

TOOL DESCRIPTION:

C-pill & Cab Mnt Ld L290 LH

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	77.33	2.31	217.94	99.90	112.10	47.12	24.20

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
69	Robot V01AR21 welds (1) spots (SIM)			6.32	83.83
70	Robot V01AR21 move out			1.50	85.33
71					
72	**WELD RH TV BRKT**				
73	Robots BS-010-V01AR23 & V01AR24 move in			1.50	7.50
74	Robot V01AR23 Geo welds (16) spots (SIM)			43.46	50.96
75	Robot V01AR24 Geo welds (16) spots (SIM)			45.37	52.87
76	Shot Pins Retract			3.00	55.87
77	Clamps Open			3.00	58.87
78	Robots V01AR23 & V01AR24 move in			1.50	60.37
79	Robot V01AR23 welds (2) spots (SIM)			10.37	70.74
80	Robot V01AR24 welds (2) spots (SIM)			11.49	71.86
81	Robots V01AR23 & V01AR24 move out			1.50	73.36
82	Turntable rotates 180°			6.00	79.36
83					
84					
85					
86					
87					
88					
89	Total Cycle Time				85.33
90	Estimated Walk Total		101		
91	Jobs Per Hour				42.19



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

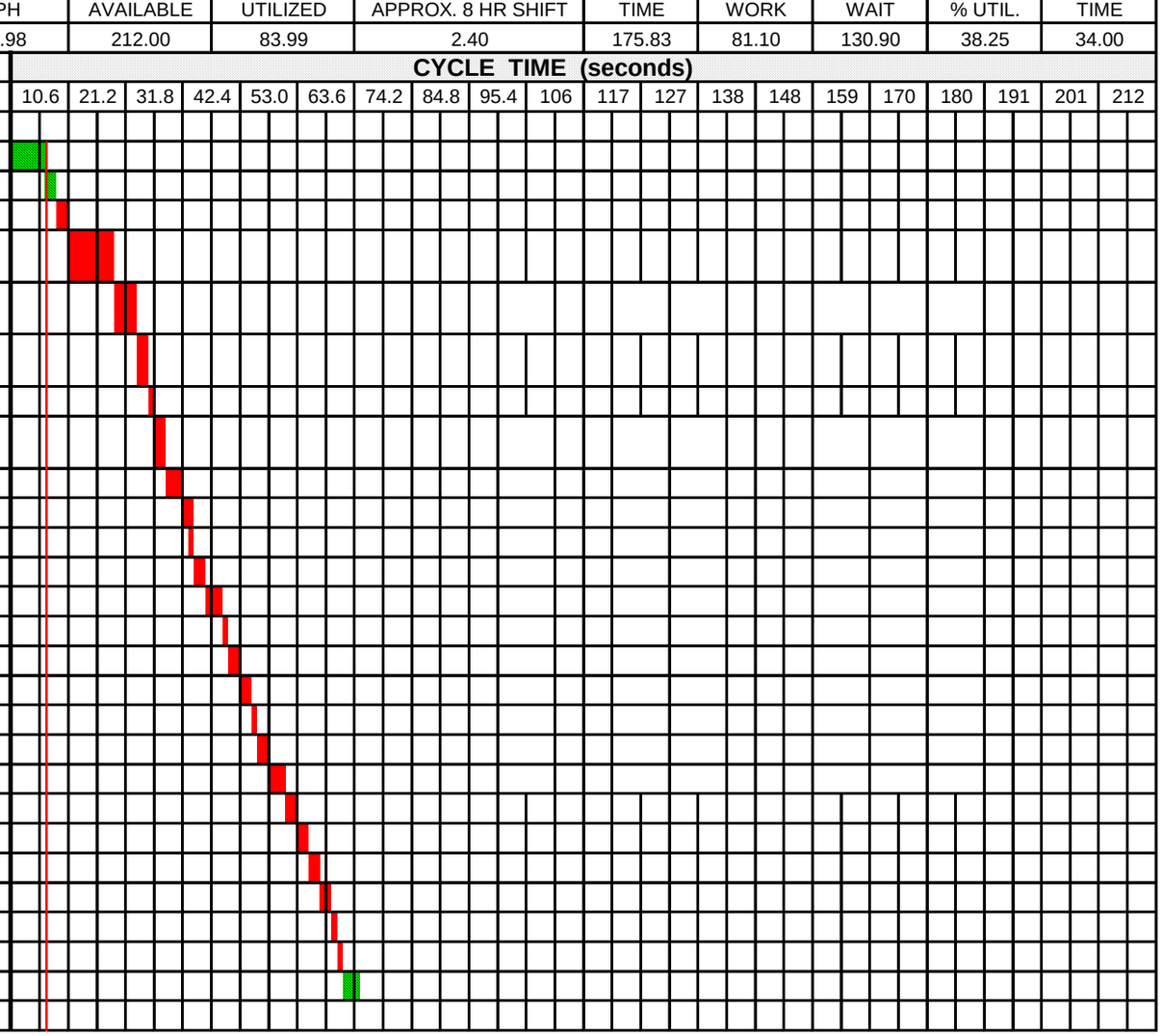
NPV

TOOL DESCRIPTION:

TV BRKT & Cab Mnt Ld L290 RH

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	83.99	2.40	175.83	81.10	130.90	38.25	34.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
1	**RH OPER LOAD**				
2	Turntable rotates			6.00	6.00
3	Fixture cycles open			3.00	9.00
4	Oper #1 walks into station		4	1.20	10.20
5	Oper #1 unloads two large assemblies from GEO fixture			8.40	18.60
6	Oper #1 walks to dunnage with completed assemblies		14	4.20	22.80
7	Oper #1 places finished sub assemblies to dunnage racks			2.60	25.40
8	Oper #1 walks to next dunnage		3	0.90	26.30
9	Oper #1 places finished sub assemblies to dunnage racks			2.60	28.90
10	Oper #1 walks to dunnage racks		10	3.00	31.90
11	Oper #1 obtains 1 part (5102)			1.80	33.70
12	Oper #1 walks to next dunnage		3	0.30	34.00
13	Oper #1 obtains 1 part (0875)			1.80	35.80
14	Oper #1 walks to GEO fixture		10	3.00	38.80
15	**Oper #1 loads 1 part (5102)**			1.80	40.60
16	**Oper #1 loads 1 part (0875)**			1.80	42.40
17	Oper #1 obtains 1 small part from tote (3259)			1.80	44.20
18	**Oper #1 loads 1 part (3259)**			1.80	46.00
19	Oper #1 walks into dunnage		7	2.10	48.10
20	Oper #1 obtains 1 part (8595)			2.60	50.70
21	Oper #1 walks to fixture		7	2.10	52.80
22	Oper #1 obtains 1 part (9133) from tote			1.80	54.60
23	**Oper #1 loads 1 part (9133)**			2.60	57.20
24	Oper #1 loads 1 part (8595)			1.80	59.00
25	Oper #1 walks to palm button		4	1.20	60.20
26	Oper #1 depress palm buttons			1.00	61.20
27	Fixture cycles closed			3.00	64.20
28					



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

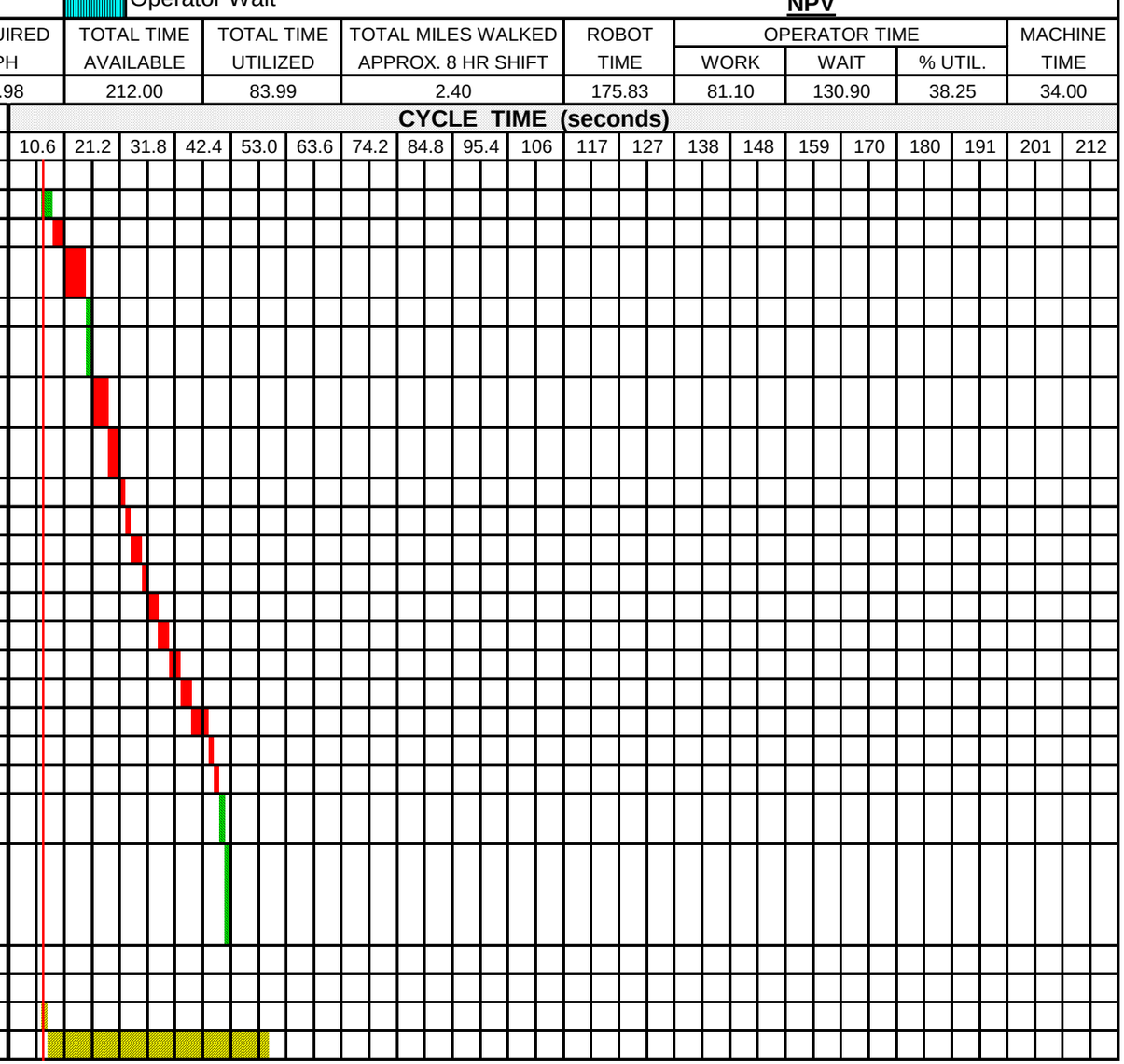
NPV

TOOL DESCRIPTION:

TV BRKT & Cab Mnt Ld L290 RH

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	83.99	2.40	175.83	81.10	130.90	38.25	34.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
29	**OPER LOAD**				
30	Fixture cycles open			3.00	9.00
31	Oper #2 walks into station		4	1.20	10.20
32	Oper #2 unloads one large assembly from GEO fixture			4.20	14.40
33	L320 Shot Pins Retract (RWD)	UQ1.1		1.00	15.40
34	L290 Shot Pins Extend (RWD)	UQ2.1, UQ2.2		1.00	16.40
35	Oper #2 walks to dunnage with completed assembly		10	3.00	19.40
36	Oper #2 loads finished sub assembly to dunnage racks			1.80	21.20
37	Oper #2 walks to palm button		3	0.90	22.10
38	Oper #2 walks into fixture with parts		4	1.20	23.30
39	**Oper #2 loads (8263)**			1.80	25.10
40	**Oper #2 loads (4649)**			1.80	26.90
41	**Oper #2 loads (1033)**			1.80	28.70
42	**Oper #2 walks to dunnage racks**		7	2.10	30.80
43	**Oper #2 obtains (1038)**			2.40	33.20
44	Oper #2walks to fixture		7	2.10	35.30
45	**Oper #2 loads (1038)**			2.40	37.70
46	Oper #2 walks out of sta		4	1.20	38.90
47	Oper #2 depress palm buttons			1.00	39.90
48	X Clamps Close (RWD)	UQ3.1, UQ3.2		1.00	40.90
49	Y Clamps Close (RWD)	UQ4.1, UQ4.2, UQ4.3, UQ6.1		1.00	41.90
51	**LH HANG BRKT**				
52	Robots BS-010-V01AR21 & V01AR22 move in			1.50	7.50
53	Robot V01AR21 Geo welds (8) spots (SIM)			42.34	49.84



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

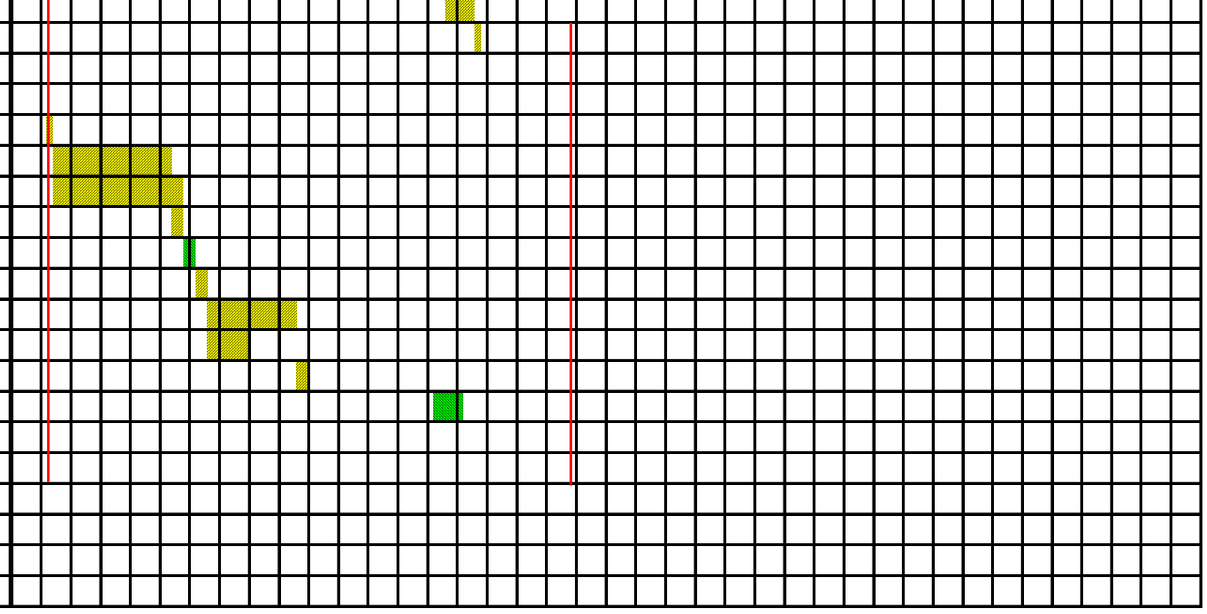
NPV

TOOL DESCRIPTION:

TV BRKT & Cab Mnt Ld L290 RH

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	83.99	2.40	175.83	81.10	130.90	38.25	34.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
54	Robot V01AR22 Geo welds (3) spots (SIM)			12.87	20.37
55	Robots V01AR21 & V01AR22 move out			1.50	51.34
56	Shot Pins Retract	UQ6.1		1.00	52.34
57	Clamps Open	UQ12.1		1.00	53.34
58	Clamps Open	UQ13.1, UQ13.2		1.00	54.34
59	Robot BS-010-V01AR21 move in			1.50	55.84
60	Robot V01AR21 welds (4) spots (SIM)			17.33	73.17
64	Robot V01AR22 welds (3) spots (SIM)			15.86	71.70
61	Clamps Open	UQ20.1		3.00	76.17
62	Robot BS-010-V01AR21 moves in			1.50	77.67
63	Robot V01AR21 welds (1) spot (SIM)			4.82	82.49
65	Robot V01AR21 moves out			1.50	83.99
66					
67	**WELD LH C-pill/Header**				
68	Robots BS-010-V01AR23 & V01AR24 move in			1.50	7.50
69	Robot V01AR23 Geo welds (6) spots (SIM)			21.31	28.81
70	Robot V01AR24 Geo welds (6) spots (SIM)			23.74	31.24
71	Robots V01AR23 & V01AR24 move out			1.50	30.31
72	Cylinder retracts			3.00	33.31
73	Robots V01AR23 & V01AR24 move in			1.50	34.81
74	Robot V01AR23 welds (5) spots (SIM)			16.52	51.33
75	Robot V01AR24 welds (2) spots (SIM)			7.54	42.35
76	Robots V01AR23 & V01AR24 move out			1.50	52.83
77	Turntable rotates 180°			6.00	81.00
78					
79					
80					
81					
82					
83					



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

	Operator
	Machine
	Robot
	Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

NPV

TOOL DESCRIPTION:	Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
TV BRKT & Cab Mnt Ld L290 RH	7.4	16.98	212.00	83.99	2.40	175.83	81.10	130.90	38.25	34.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC	CYCLE TIME (seconds) 10.6	21.2	31.8	42.4	53.0	63.6	74.2	84.8	95.4	106	117	127	138	148	159	170	180	191	201	212
84																									
85																									
86																									
87	Total Cycle Time				83.99																				
88	Estimated Walk Total		101																						
89	Jobs Per Hour				42.86																				

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

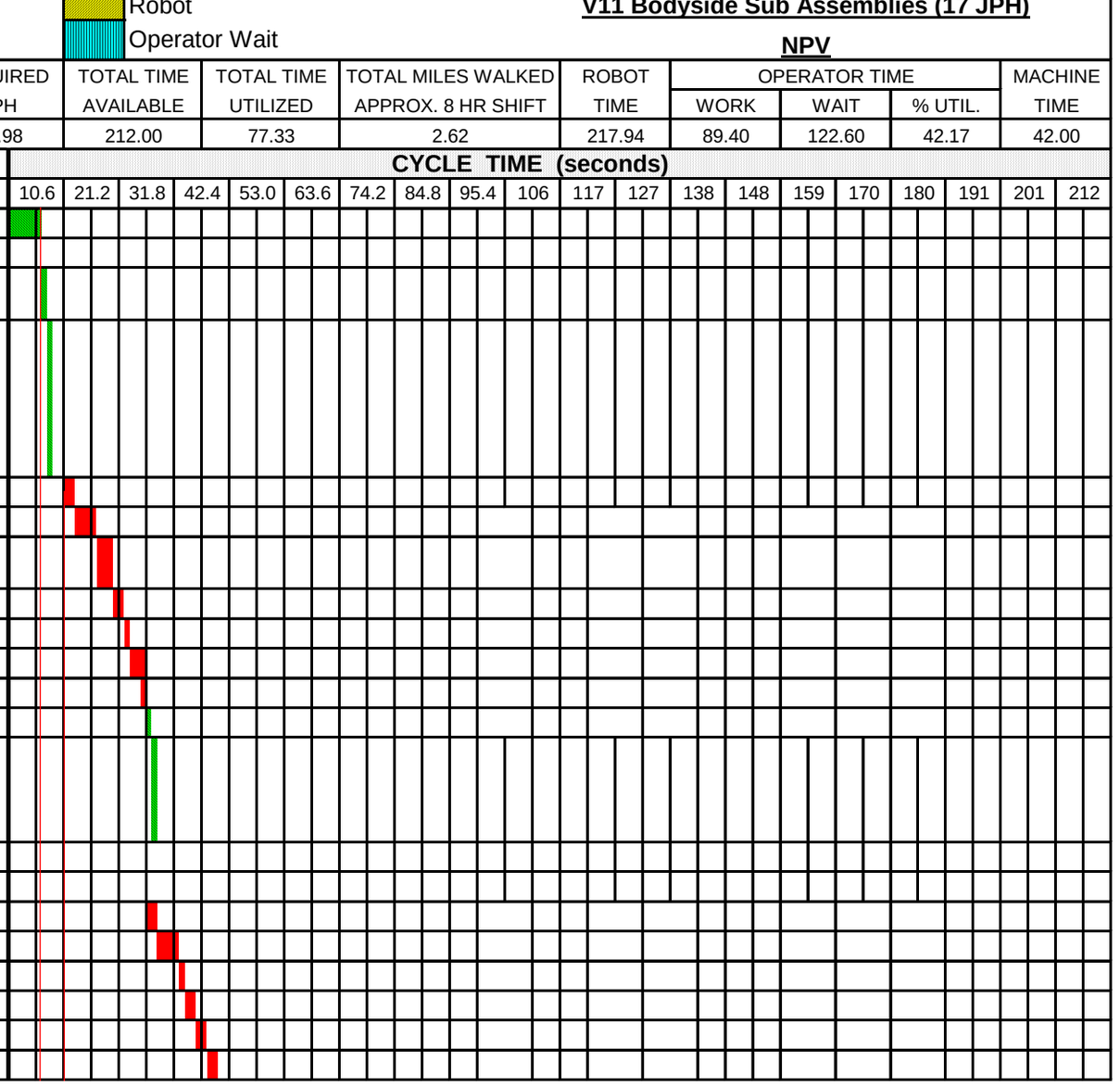
NPV

TOOL DESCRIPTION:

STATION 010 T1 & T2 (L320)

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	77.33	2.62	217.94	89.40	122.60	42.17	42.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
1	Turntable rotates 180°			6.00	6.00
2	**OPER UNLOAD T2**				
3	Shot Pin Retracts	UQ7.3, UQ7.4		1.00	7.00
4	Clamps Open	UQ3.1, UQ3.2, UQ3.3, UQ3.4, UQ5.1, UQ5.2		1.00	8.00
5	Oper #2 walks into station		4	1.20	12.20
6	Oper #2 unloads Bracket Asm x 2			4.80	17.00
7	Oper #2 walks to dunnage with completed assemblies		10	3.00	20.00
8	Oper #2 places LH ASM			2.60	22.60
9	Oper #2 walks to next dunnage		3	0.90	23.50
10	Oper #2 places RH ASM			2.60	26.10
11	Oper #2 walks to palm button		3	0.90	27.00
12	Oper #1&2 press palm buttons			1.00	28.00
13	Shot Pins Extend	UQ7.1, UQ7.2, UQ7.3, UQ7.4		1.00	29.00
14					
15	**OPER LOAD T2**				
16	Oper #2 walks to dunnage racks		7	2.10	29.10
17	Oper #2 obtains 2 (1033)			4.00	33.10
18	Oper #2 walks into GEO fixture with parts		4	1.20	34.30
19	**Oper #2 loads 1 (1033)**			1.80	36.10
20	**Oper #2 loads 1 (1033)**			1.80	37.90
21	Oper #2 walks to dunnage racks		7	2.10	40.00



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

NPV

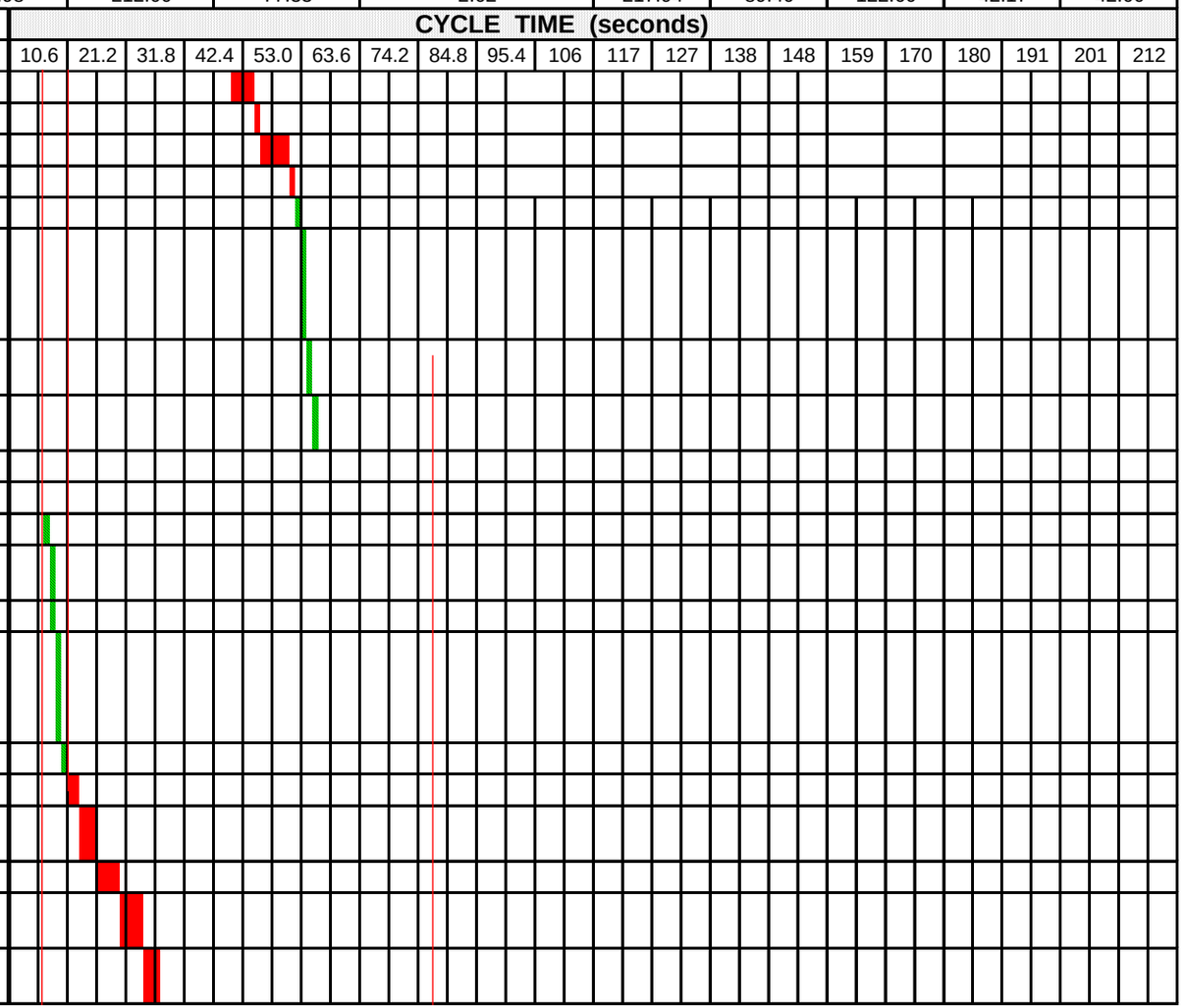
TOOL DESCRIPTION:

STATION 010 T1 & T2 (L320)

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	77.33	2.62	217.94	89.40	122.60	42.17	42.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
22	Oper #2 obtains 2 (1048)			4.00	44.00
23	Oper #2 walks to fixture		7	2.10	46.10
24	**Oper #2 loads 2 (1048)**			4.80	50.90
25	Oper #2 walks to palm button		3	0.90	51.80
26	Oper #2 press palm buttons			1.00	52.80
27	Clamps Close	UQ3.1, UQ3.2, UQ3.3, UQ3.4		1.00	53.80
28	Clamps Close	UQ4.1, UQ4.2		1.00	54.80
29	Clamps Close	UQ5.1, UQ5.2		1.00	55.80
30					
31	**OPER UNLOAD T1**				
32	Shot Pin Retracts	UQ19.1		1.00	7.00
33	Clamps Open	UQ5.1, UQ5.2		1.00	8.00
34	Clamps Open	UQ8.1		1.00	9.00
35	Clamps Open	UQ11.1, UQ11.2, UQ11.3, UQ11.4		1.00	10.00
36	Clamps Open	UQ18.1		1.00	11.00
37	Oper #1 walks into station		4	1.20	12.20
38	Oper #1 unloads Header asm from GEO fixture			4.20	16.40
39	Oper #1 unloads Pillar asm from GEO fixture			4.20	20.60
40	Oper #1 walks to dunnage with completed assemblies		14	4.20	24.80
41	Oper #1 places finished sub assemblies to dunnage racks			2.60	27.40

CYCLE TIME (seconds)



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

NPV

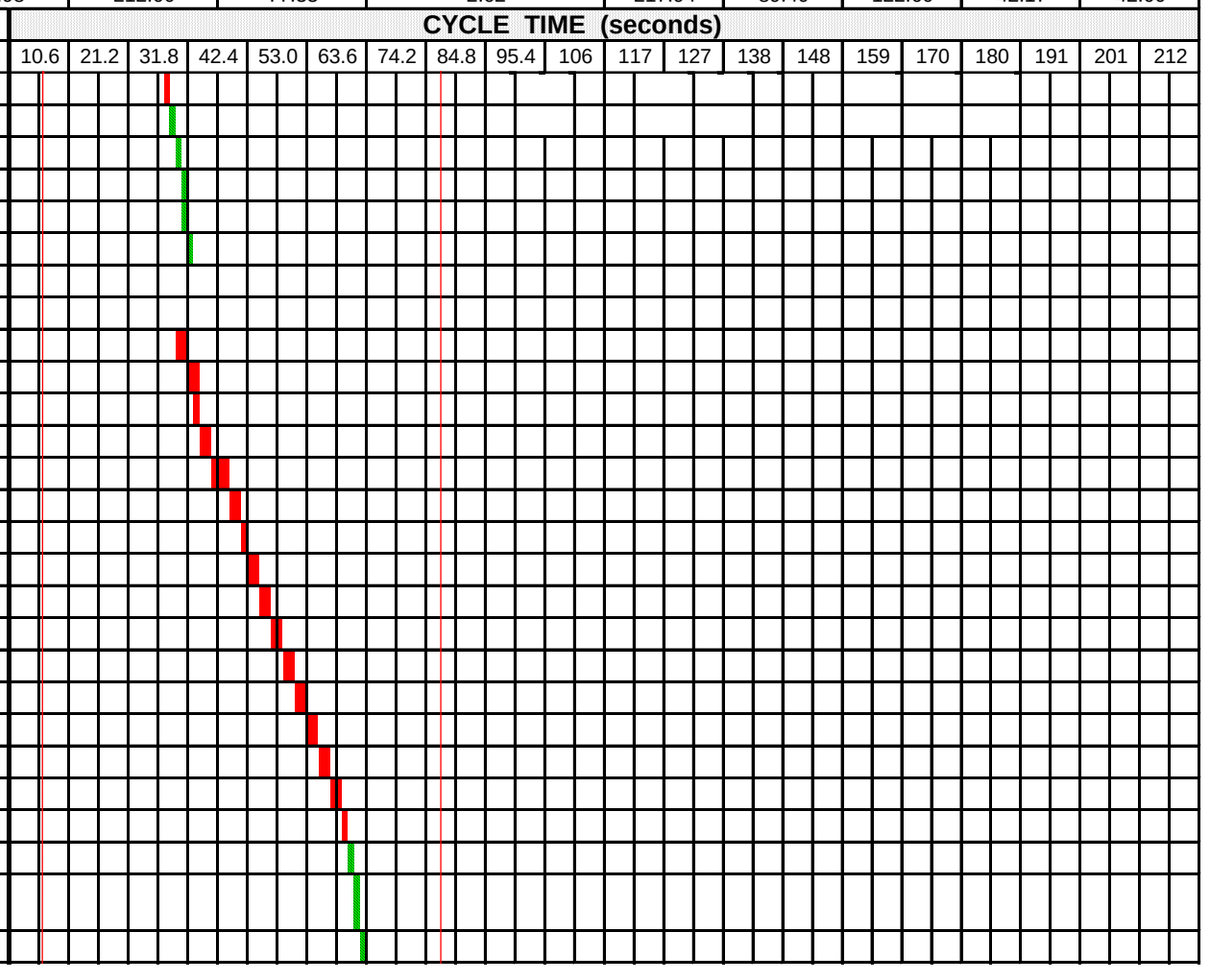
TOOL DESCRIPTION:

STATION 010 T1 & T2 (L320)

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	77.33	2.62	217.94	89.40	122.60	42.17	42.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
42	Oper #1 walks to palm button		3	0.90	28.30
43	Oper #1 press palm buttons			1.00	29.30
44	Shot Pin Extends	UQ6.1		1.00	30.30
45	Shot Pin Extends	UQ19.1		1.00	31.30
46	Clamps Close	UQ12.1		1.00	32.30
47	Clamps Close	UQ20.1		1.00	33.30
48					
49	**OPER LOAD T1**				
50	Oper #1 walks to dunnage racks		10	3.00	32.30
51	Oper #1 obtains 1 part (2599)			1.80	34.10
52	Oper #1 walks to next dunnage		3	0.30	34.40
53	Oper #1 obtains 1 part (0883)			1.80	36.20
54	Oper #1 walks to GEO fixture		10	3.00	39.20
55	Oper #1 loads 1 part (2599)			1.80	41.00
56	Oper #1 loads 1 part (0883)			1.80	42.80
57	Oper #1 obtains 1 part from tote (3259)			1.80	44.60
58	Oper #1 loads 1 part (3259)			1.80	46.40
59	Oper #1 walks into dunnage		7	2.10	48.50
60	Oper #1 obtains 1 part (8578)			2.60	51.10
61	Oper #1 walks to fixture		7	2.10	53.20
62	Oper #1 obtains 1 part (9133) from tote			1.80	55.00
63	Oper #1 loads 1 part (9133)			2.60	57.60
64	Oper #1 loads 1 part (8578)			1.80	59.40
65	Oper #1 exit cell to palm button		4	1.20	60.60
66	Oper #1 depress palm buttons			1.00	61.60
67	Clamps Close	UQ5.1, UQ5.2		1.00	62.60
68	Clamps Open	UQ8.1		1.00	63.60

CYCLE TIME (seconds)



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

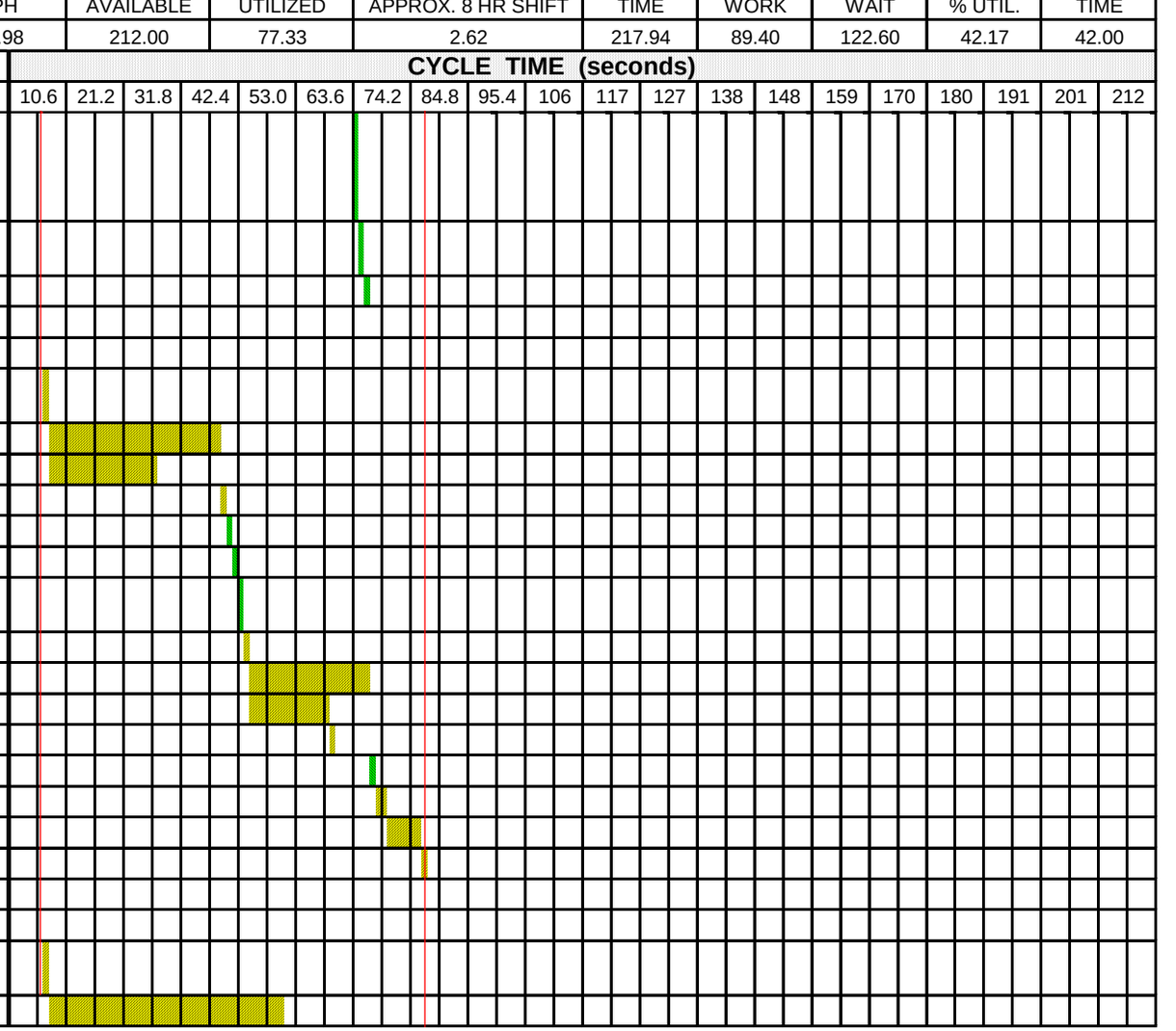
NPV

TOOL DESCRIPTION:

STATION 010 T1 & T2 (L320)

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	77.33	2.62	217.94	89.40	122.60	42.17	42.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
69	Clamps Open	UQ11.1, UQ11.2, UQ11.3, UQ11.4		1.00	64.60
70	Clamps Open	UQ13.1, UG13.2		1.00	65.60
71	Clamps Open	UQ18.1		1.00	66.60
72					
73	**WELD T1**				
74	Robots BS-010-V01AR21 & V01AR22 move in			1.50	7.50
75	Robot V01AR21 Geo welds (7) spots (SIM)			31.32	38.82
76	Robot V01AR22 Geo welds (4) spots (SIM)			19.62	27.12
77	Robot V01AR21 & V01AR22 move out			1.50	40.32
78	Shot Pins Retract	UQ6.1		1.00	41.32
79	Clamps Open	UQ12.1		1.00	42.32
80	Clamps Open	UQ13.1, UQ13.2		1.00	43.32
81	Robots V01AR21 & V01AR22 move in			1.50	44.82
82	Robot V01AR21 welds (4) spots (SIM)			22.19	67.01
83	Robot V01AR22 welds (3) spots (SIM)			14.30	59.12
84	Robots V01AR21 & V01AR22 move out			1.50	60.62
85	Clamps Open	UQ20.1		1.00	68.01
86	Robot V01AR21 moves in			1.50	69.51
87	Robot V01AR21 welds (1) spots (SIM)			6.32	75.83
88	Robot V01AR21 move out			1.50	77.33
89					
90	**WELD T2**				
91	Robots BS-010-V01AR23 & V01AR24 move in			1.50	7.50
92	Robot V01AR23 Geo welds (16) spots (SIM)			43.46	50.96



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

NPV

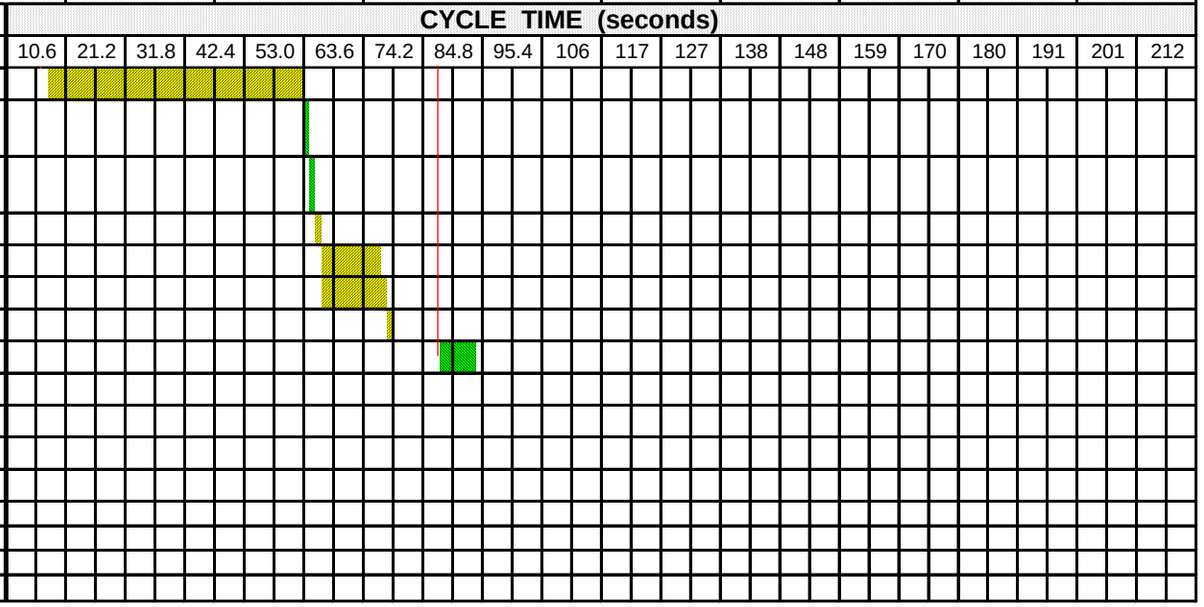
TOOL DESCRIPTION:

STATION 010 T1 & T2 (L320)

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	77.33	2.62	217.94	89.40	122.60	42.17	42.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
93	Robot V01AR24 Geo welds (16) spots (SIM)			45.37	52.87
94	Shot Pins Retract	UQ7.1, UQ7.2		1.00	53.87
95	Clamps Open	UQ4.1, UQ4.2		1.00	54.87
96	Robots V01AR23 & V01AR24 move in			1.50	56.37
97	Robot V01AR23 welds (2) spots (SIM)			10.37	66.74
98	Robot V01AR24 welds (2) spots (SIM)			11.49	67.86
99	Robots V01AR23 & V01AR24 move out			1.50	69.36
100	Turntable rotates 180°			6.00	83.33
101					
102					
103					
104					
105					
106	Total Cycle Time				83.33
107	Estimated Walk Total		110		
108	Jobs Per Hour				43.20

CYCLE TIME (seconds)



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

NPV

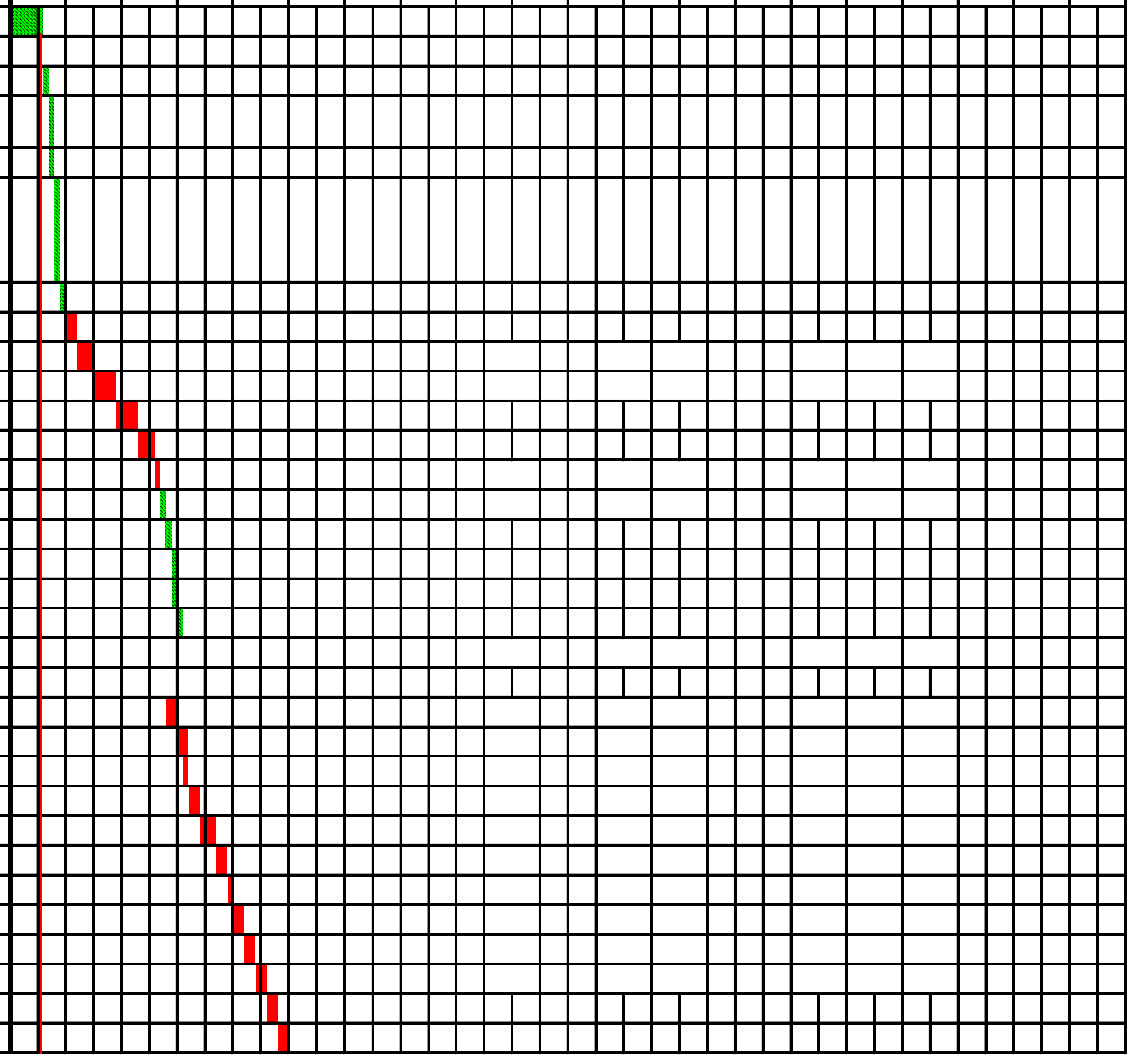
TOOL DESCRIPTION:

STATION 010 T3 & T4 (L320)

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	81.99	2.57	173.99	80.60	131.40	38.02	39.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
1	Turntable rotates 180			6.00	6.00
2	**OPER UNLOAD T3**				
3	Shot Pin Retracts	UQ19.1		1.00	7.00
4	Clamps Open	UQ5.1, UQ5.2		1.00	8.00
5	Clamps Open	UQ8.1		1.00	9.00
6	Clamps Open	UQ11.1, UQ11.2, UQ11.3, UQ11.4		1.00	10.00
7	Clamps Open	UQ18.1		1.00	11.00
8	Oper #1 walks into station		4	1.20	12.20
9	Oper #1 unloads Header asm from GEO fixture			4.20	16.40
10	Oper #1 unloads Pillar asm from GEO fixture			4.20	20.60
11	Oper #1 walks to dunnage with completed assemblies		14	4.20	24.80
12	Oper #1 places finished sub assemblies to dunnage racks			2.60	27.40
13	Oper #1 walks to palm button		3	0.90	28.30
14	Oper #1 press palm buttons			1.00	29.30
15	Shot Pin Extends	UQ6.1		1.00	30.30
16	Shot Pin Extends	UQ19.1		1.00	31.30
17	Clamps Close	UQ12.1		1.00	32.30
18	Clamps Close	UQ20.1		1.00	33.30
19					
20	**OPER LOAD T3**				
21	Oper #1 walks to dunnage racks		10	3.00	32.30
22	Oper #1 obtains 1 part (5102)			1.80	34.10
23	Oper #1 walks to next dunnage		3	0.30	34.40
24	Oper #1 obtains 1 part (0875)			1.80	36.20
25	Oper #1 walks to GEO fixture		10	3.00	39.20
26	**Oper #1 loads 1 part (5102)**			1.80	41.00
27	**Oper #1 loads 1 part (0875)**			1.80	42.80
28	Oper #1 obtains 1 small part from tote (3259)			1.80	44.60
29	**Oper #1 loads 1 part (3259)**			1.80	46.40
30	Oper #1 walks into dunnage		7	2.10	48.50
31	Oper #1 obtains 1 part (8595)			2.60	51.10
32	Oper #1 walks to fixture		7	2.10	53.20

CYCLE TIME (seconds)



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

NPV

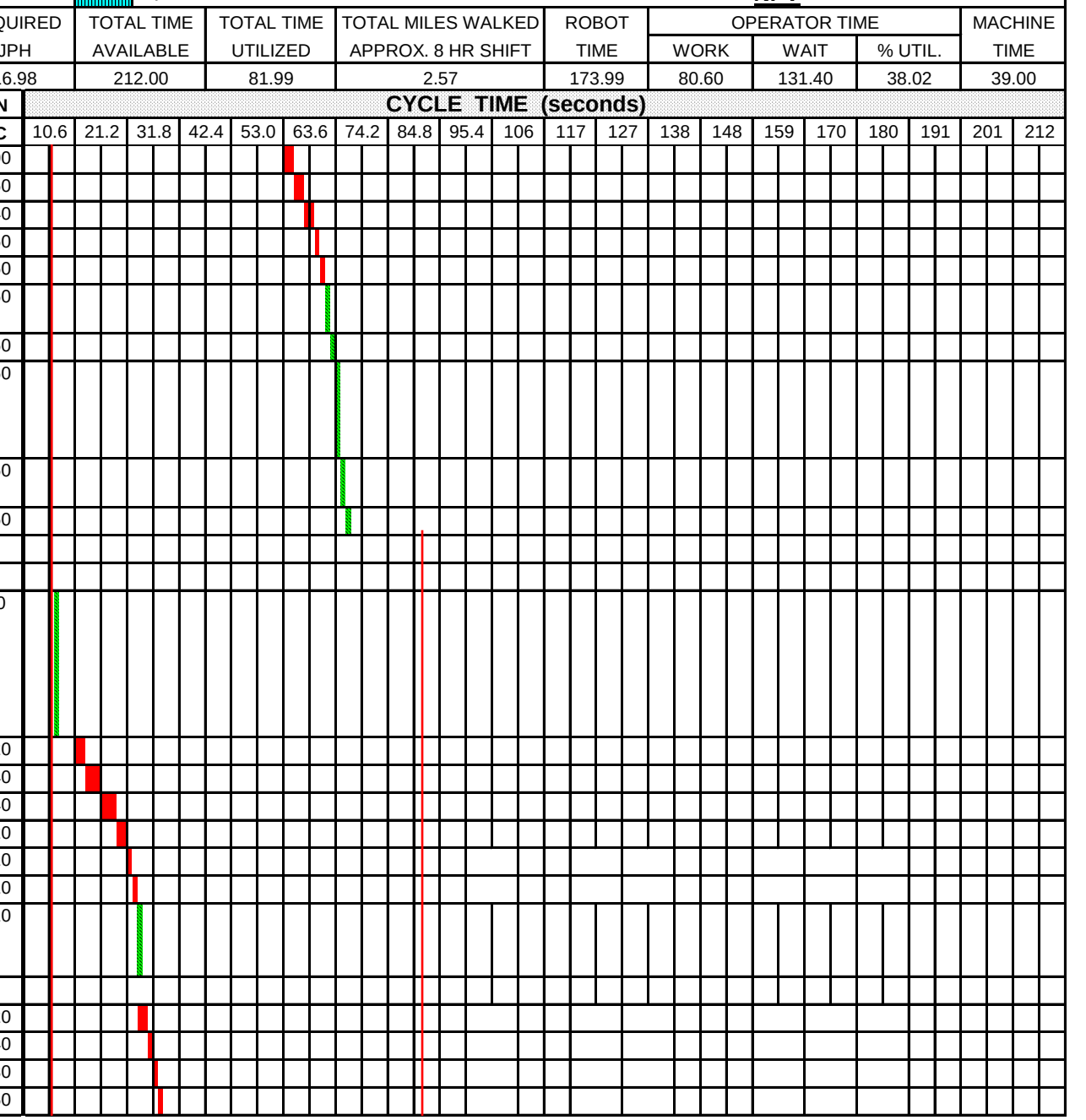
TOOL DESCRIPTION:

STATION 010 T3 & T4 (L320)

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	81.99	2.57	173.99	80.60	131.40	38.02	39.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
33	Oper #1 obtains 1 part (9133) from tote			1.80	55.00
34	**Oper #1 loads 1 part (9133)**			2.60	57.60
35	**Oper #1 loads 1 part (8595)**			1.80	59.40
36	Oper #1 walks to palm button		4	1.20	60.60
37	Oper #1 press palm buttons			1.00	61.60
38	Clamps Close	UQ5.1, UQ5.2		1.00	62.60
39	Clamps Open	UQ8.1		1.00	63.60
40	Clamps Open	UQ11.1, UQ11.2, UQ11.3, UQ11.4		1.00	64.60
41	Clamps Open	UQ13.1, UG13.2		1.00	65.60
42	Clamps Open	UQ18.1		1.00	66.60
43					
44	**OPER UNLOAD T4**				
45	Clamps Open	UQ3.1, UQ3.2, UQ4.1, UQ4.2, UQ4.3, UQ5.1		1.00	7.00
46	Oper #2 walks into station		4	1.20	12.20
47	Oper #2 unloads one large assembly from GEO fixture			4.20	16.40
48	Oper #2 walks to dunnage with completed assembly		10	3.00	19.40
49	Oper #2 loads finished sub assembly to dunnage racks			1.80	21.20
50	Oper #2 walks to palm button		3	0.90	22.10
51	Oper #2 press palm buttons			1.00	23.10
52	Shot Pins Extend	UQ7.1, UQ7.2, UQ7.3		1.00	24.10
53	**OPER LOAD T4**				
53	Oper #2 walks to dunnage racks		7	2.10	25.20
53	Oper #2 obtains (1038)			1.20	26.40
53	Oper #2 walks to dunnage racks		3	0.90	27.30
53	Oper #2 obtains (4649)			1.20	28.50

CYCLE TIME (seconds)



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

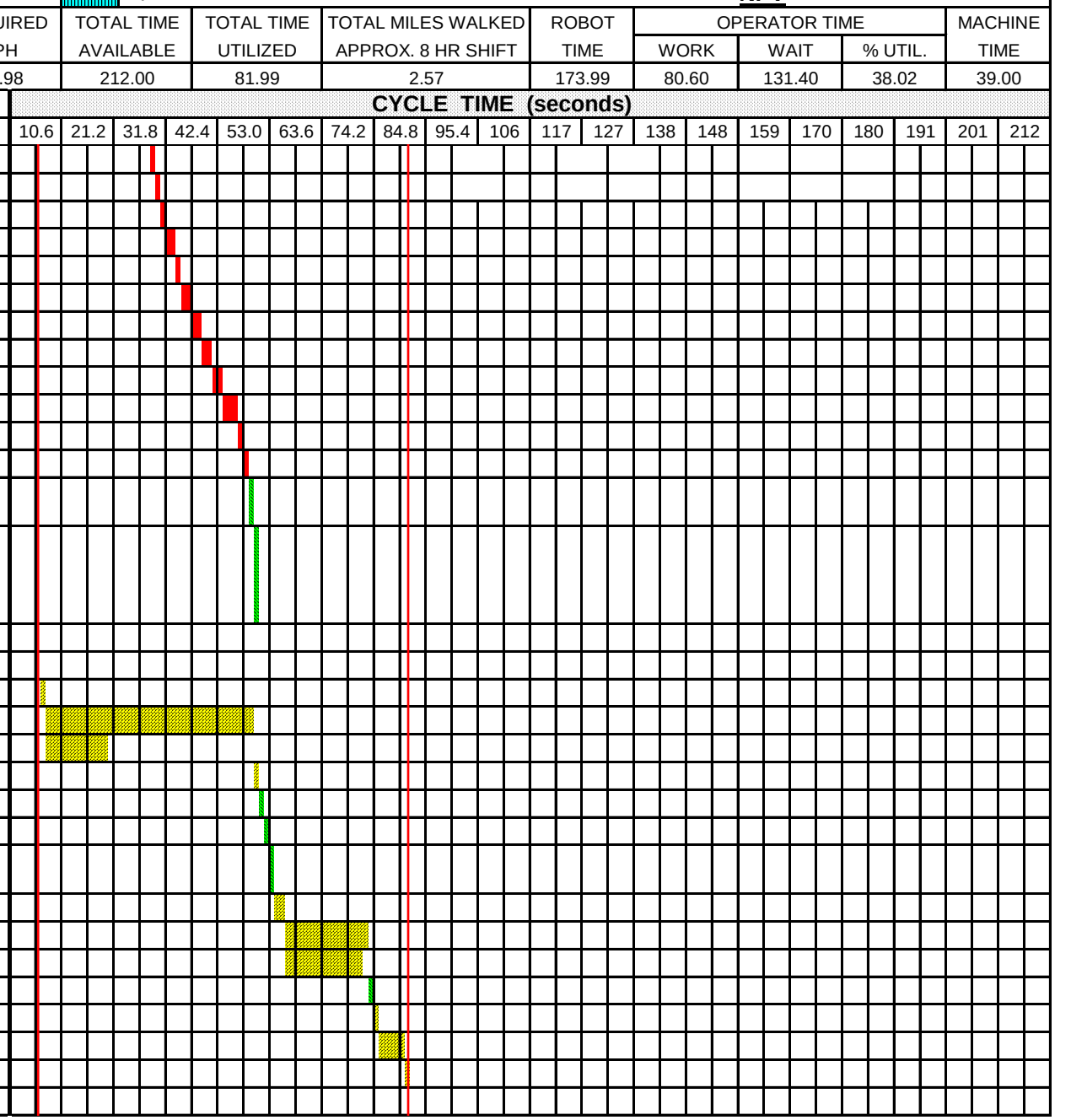
NPV

TOOL DESCRIPTION:

STATION 010 T3 & T4 (L320)

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	81.99	2.57	173.99	80.60	131.40	38.02	39.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
53	Oper #2 walks to dunnage racks		3	0.90	29.40
53	Oper #2 obtains (1033)			1.20	30.60
53	Oper #2 walks into fixture with parts		4	1.20	31.80
53	**Oper #2 loads (1038)**			1.80	33.60
53	**Oper #2 loads (4649)**			1.80	35.40
58	**Oper #2 loads (1033)**			1.80	37.20
59	Oper #2 walks to dunnage racks		7	2.10	39.30
60	Oper #2 obtains (8263)			2.40	41.70
61	Oper #2 walks to fixture		7	2.10	43.80
62	**Oper #2 loads (8263)**			2.40	46.20
63	Oper #2 walks out of sta		4	1.20	47.40
64	Oper #2 press palm buttons			1.00	48.40
65	Clamps Close	UQ3.1, UQ3.2		1.00	49.40
66	Clamps Close	UQ4.1, UQ4.2, UQ4.3, UQ5.1		1.00	50.40
67					
68	**WELD T3**				
69	Robots BS-010-V01AR21 & V01AR22 move in			1.50	7.50
70	Robot V01AR21 Geo welds (8) spots (SIM)			42.34	49.84
71	Robot V01AR22 Geo welds (3) spots (SIM)			12.87	20.37
72	Robots V01AR21& V01AR22 move out			1.50	51.34
73	Shot Pins Retract	UQ6.1		1.00	52.34
74	Clamps Open	UQ12.1		1.00	53.34
75	Clamps Open	UQ13.1, UQ13.2		1.00	54.34
76	Robots BS-010-V01AR21 move in			1.50	55.84
77	Robot V01AR21 welds (4) spots (SIM)			17.33	73.17
81	Robot V01AR22 welds (3) spots (SIM)			15.86	71.70
78	Clamps Open	UQ20.1		1.00	74.17
79	Robot BS-010-V01AR21 moves in			1.50	75.67
80	Robot V01AR21 welds (1) spots (SIM)			4.82	80.49
82	Robot V01AR21 clears			1.50	81.99
83					



Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo

2023 P6700

V11 Bodyside Sub Assemblies (17 JPH)

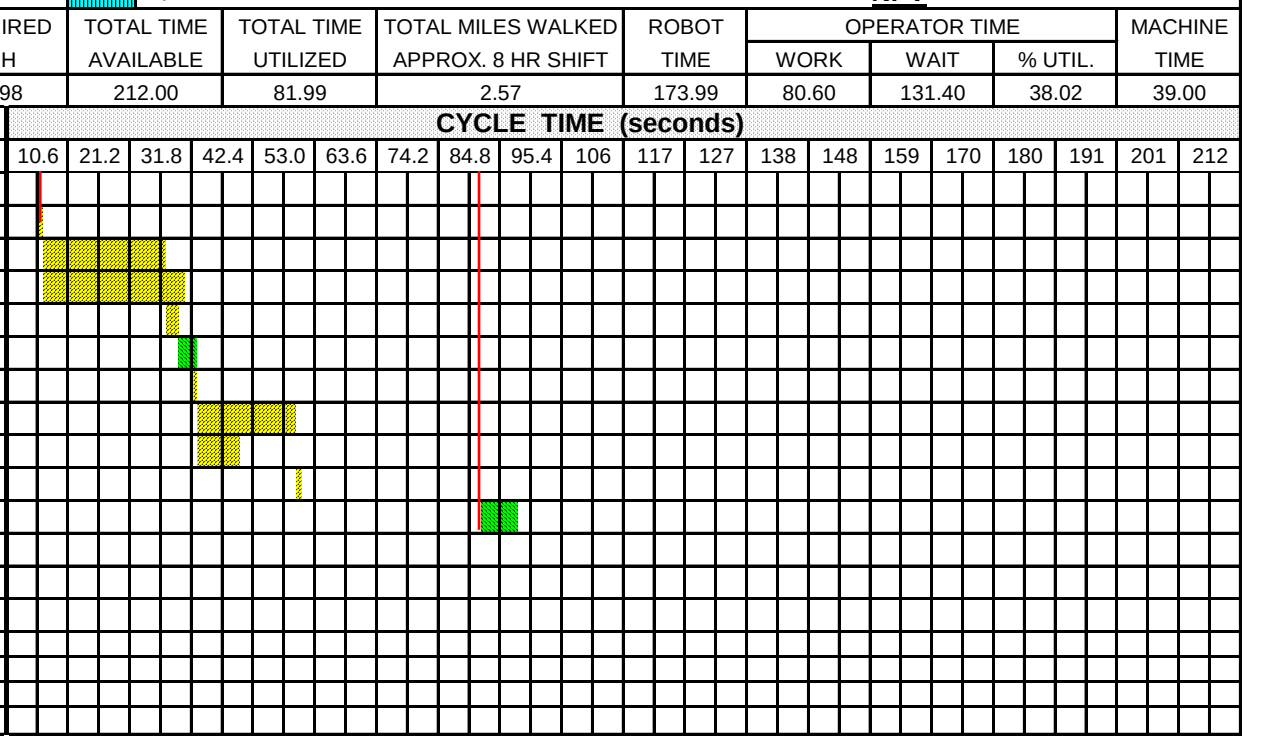
NPV

TOOL DESCRIPTION:

STATION 010 T3 & T4 (L320)

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	16.98	212.00	81.99	2.57	173.99	80.60	131.40	38.02	39.00

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
84	**WELD T4**				
85	Robots BS-010-V01AR23 &V01AR24 move in			0.60	6.60
86	Robot V01AR23 Geo welds (6) spots (SIM)			21.31	27.91
87	Robot V01AR24 Geo welds (6) spots (SIM)			23.74	30.34
88	Robots V01AR23 & V01AR24 move out			1.48	29.39
89	Cylinder retracts			3.00	32.39
90	Robots V01AR23 & V01AR24 move in			0.60	32.99
91	Robot V01AR23 welds (5) spots (SIM)			16.52	49.51
92	Robot V01AR24 welds (2) spots (SIM)			7.54	40.53
93	Robots V01AR23 & V01AR24 clear			1.48	50.99
94	Turntable rotates 180°			6.00	87.99
95					
96					
97					
98					
99	Total Cycle Time				87.99
100	Estimated Walk Total		114		
101	Jobs Per Hour				40.91



VALIANT TMS®

Powered by People

Robot / Operator Utilization Matrix

Customer: Volvo

Program: P6700

Commodity: Door Ring Sub 17JPH & 20JPH

Over Cycle

Station #	Robot / Operator #	System Cycle Time	Proposed Cycle Time	Utilization	
10	OP1	212.00	160.60	75.75%	Door Ring
10	R1	212.00	134.00	63.21%	Door Ring
10	R2	212.00	142.00	66.98%	Door Ring
10	R3	212.00	142.00	66.98%	Door Ring
10	OP1	180.00	160.60	89.22%	Door Ring
10	R1	180.00	134.00	74.44%	Door Ring
10	R2	180.00	142.00	78.89%	Door Ring
10	R3	180.00	142.00	78.89%	Door Ring

Operator obtain small parts	How many	1	1.8
Operator load small parts	How many	1	1.8
Operator place small part (no precision)	How many		0.0
Operator obtain medium parts	How many	2	4.8
Operator load medium parts	How many	1	3.0
Operator place medium part (no precision)	How many		0.0
Operator obtain large parts	How many	1	4.2
Operator load large parts	How many	1	4.2
Operator place large part (no precision)	How many	1	1.8
Operator total walk	Total in feet	7	2.1
Operator hit P.B.			0.0
Operator Load Assist- load/unload part to fixt or rack(includes lwr, open/close clp and raise)	# of loads /unloads		0.0
Operator walk with load assist	Total in feet		0.0
Fixture - Clamp/Gripper close	# of close		0.0
Fixture - Clamp /Gripper open	# of open		0.0
Fixture - Suction Cup vacuum on	# of vacuum on		0.0
Fixture - Suction Cup vacuum off	# of vacuum off		0.0
Fixture - Manual Clamp close	# of close		0.0
Fixture - Manual Clamp open	# of open		0.0
Fixture - Shot pin extend	# of extends		0.0
Fixture - Shot pin retract	# of retracts		0.0
Fixture - Slide extend	# of extends		0.0
Fixture - Slide retract	# of retracts		0.0
Fixture - Pivot close	# of close		0.0
Fixture - Pivot open	# of open		0.0
Fixture - Trunnion rotates 180	# of rotates		0.0
Fixture - Turn Table rotates 180	# of rotates		0.0
Robot pick part	# of picks	0	0.00
Robot rotate 45	# of rotates		0.0
Robot rotate 90	# of rotates		0.0
Robot rotate 180	# of rotates		0.0
Robot rotate 270	# of rotates		0.0
Robot place part	# of places	0	0.0
Robot moves on 7th axis	Distance (# foot)		0.0
Robot rotate to home	# of rotates		0.0
Robot delay	# of delays		0.0
Robot date scribe	# of date scribe		0.0
Robot check tree (nuts & studs)	# of check positions		0.0
Robot changes EOAT (drop 1 and pick 1)	# of changes		0.0
Weld robot in			0.0
Weld robot welds (GEO)	# of welds -GEO-	15	60.0
Weld robot welds (Respot)	# of welds -Respot-		0.0
Weld robot out			0.0
Mig robot in			0.0
Mig robot weld	# of welds	8	18.0
Mig robot weld	Weld Length (mm)	596	56.3
Mig robot out			0.0
Laser brazing robot in			0.0
Seam detection at start of process	Weld Length (mm)		0.0
Laser brazing robot welds	Weld Length (mm)		0.0
Laser brazing robot out			0.0
Adh/Seal robot in			0.0
Adh/Seal robot	# of Beads		0.0
Adh/Seal robot	Adh/Seal Length (mm)		0.0
Adh/Seal robot out			0.0
Proj/clinch nut/stud Weld robot in			0.0

Proj/clinch nut/stud Weld robot welds	# of welds		0.0
Proj/clinch nut/stud Weld robot out			0.0
DA studs Weld robot in			0.0
DA studs Weld robot welds	# of DA welds		0.0
DA studs Weld robot out			0.0
FDS robot in			0.0
FDS robot Screws	# of screws		0.0
FDS robot out			0.0
SPR robot in			0.0
SPR robot Rivets	# of Rivets		0.0
SPR robot out			0.0
Manual Weld - Operator obtains weld gun (medium)			0.0
Manual Weld - Operator obtains weld gun (large)			0.0
Manual Weld - Operator repositions weld gun (<6")			0.0
Manual Weld - Operator repositions weld gun (>6",<24")			0.0
Manual Weld - Operator repositions weld gun (>24")			0.0
Manual Weld - Operator repositions weld gun through access hole			0.0
Manual Weld - Operator rotates weld gun			0.0
Manual Weld - Operator returns weld gun to hook			0.0
Manual Weld - Operator releases weld gun			0.0
Manual Weld - Operator welds - 1st in a group or only (simple)			0.0
Manual Weld - Operator welds - each additional weld (simple)			0.0
Manual Weld - Operator welds - 1st in a group or only (complex)			0.0
Manual Weld - Operator welds - each additional weld (complex)			0.0
Manual Weld - Operator welds - 1st in a group or only (heavy gauge)			0.0
Manual Weld - Operator welds - each additional weld (heavy gauge)			0.0
		TOTAL ESTIMATED TIME	158.01
		TOTAL AVAILABLE TIME	#REF!
		DIFFERENCE	#REF!

Geo welds =	4.00	secs. Per weld
Respot welds =	3.50	secs. Per weld

MIG welds =	25	inches per min.

Laser brazing =	130	inches per min.

Note: Range of **95 inches/min** to max speed of **173 inches/min.** To achieve higher speeds 6 KW power unit needs to be used. **130 inches/min is an average.**

Adhesive/Seal =	300	mm per sec.

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator	#REF!
Machine	#REF!
Robot	#REF!
Operator Wait	#REF!

#REF!

TOOL DESCRIPTION:

Detail Time 1

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.	MACHINE TIME
7.4	#REF!	#REF!	0.00	N/A	N/A	N/A	N/A	N/A	N/A

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC	CYCLE TIME (seconds) 3.00	6.00	9.00	12.0	15.0	18.0	21.0	24.0	27.0	30.0	33.0	36.0	39.0	42.0	45.0	48.0	51.0	54.0	57.0	60.0
1					0.00																				
2					0.00																				
3					0.00																				
4					0.00																				
5					0.00																				
6					0.00																				
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13					0.00																				
14					0.00																				
15					0.00																				
16					0.00																				
17					0.00																				
18					0.00																				
	Total Cycle Time				0.00																				
	Estimated Walk Total		0																						
	Jobs Per Hour				#DIV/0!																				

	Robot Material Handling	Secs
1	Logic delay	1.0
2	Rotates approx. 45 degrees to	3.0
3	Rotates approx. 90 degrees to	4.0
4	Rotates approx. 180 degrees to	6.0
5	Clamps on end effector extend, securir	1.0
6	Clamps on end effector retract, releasir	1.0
7	Articulates part through welds at PED \	3.0
8	Rotates clear of fixture	3.0
9	Rotate to home	3.0
10	Rotates to Pounce	2.0
11	Articulate and pick second part	5.0
12	Articulate and set second part	5.0

	Welding Robots Only	Secs
1	Rotates approx. 45 degrees to	3.0
2	Rotates approx. 90 degrees to	4.0
3	Rotates pounce to first weld	2.0
4	Articulate weld gun through welds on part in fixtur	3.0
5	Repositions to weld in additional plane	3.0
6	Moves clear of fixture clamps	1.5
7	Rotates clear of fixture	2.5
8	Rotate home to pounce	2.0
9	Logic delay	1.0

Handling parts	Obtain		Select		Load		Place	
Very Small Part (No Walk)	0.7	0.2	0.7	0.2	1.1		0.5	
Small Part	3.5	0.9	3.5	0.9	1.1		0.5	
Medium Part	4.4		5.3		1.1		1.0	
Large Part	5.4		6.3		2.7		1.8	
Large Special	6.7		7.6		2.7		1.8	
Very Large Part * V0	17.5	V0	18.4	V0	1.7	V0	0.5	V0
Very Large Part * F0	12.0	F0	12.9	F0	1.7	F0	0.5	F0
Very Large Part * N0	15.5	N0	16.4	N0	2.0	N0	0.5	N0
Very Large Part * H0	11.6	H0	12.5	H0	2.0	H0	0.5	H0
Very Large Part * V1	18.8	V1	19.7	V1	1.7	V1	0.5	V1
Very Large Part * F1	13.3	F1	14.2	F1	1.7	F1	0.5	F1
Very Large Part * N1	14.7	N1	15.6	N1	2.0	N1	0.5	N1
Very Large Part * H1	10.9	H1	11.8	H1	2.0	H1	0.5	H1

	Other Robot Operations	Secs
1	Rotates pounce to start position	2.0
2	Apply mastic daubs at PED stand	3.0
3	Apply mastic bead at PED stand	275.0
4	Apply adhesive at PED stand	275.0
5	Apply sealer at PED stand	275.0
6	Repostions to another area on part	2.0
7	Apply mastic bead at fixture	275.0
8	Apply adhesive at fixture	275.0
9	Apply sealer at fixture	275.0
10	Apply CLINCH nuts	4.5
11	Apply WELD nuts	5.5
12	Applies date stamp	2.0

	Palm Buttons	Secs
	Step to pedestal, press and release 2 palm buttor	2.9
	Press palm button located on fixture requiring one	0.6
	Press and hold palm button (hold dependent on n	0.6
	Depress foot pedal	0.4
	Turn selector knob	1.2
	Press toggle switch	0.6
	Press keypad button (when extra force not require	0.5
	Firmly press keypad button (when button requires	1.2

Unload/Transfer/Position		Unload	Transfer	Position
Very Small Part		1.7	3.7	0.8
Small Part		1.7	4.0	0.8
Medium Part		1.7	5.2	1.1
Large Part		2.6	8.3	2.3
Very Large Part *	V	1.7	10.4	1.4
Very Large Part *	F	1.7	7.2	1.4
Very Large Part *	N	1.7	9.2	1.4
Very Large Part *	H	1.7	9.2	1.4

Part Handling

Note that lines between jobs contain "blanks" (not

Walk / Carry Parts

Obtain / Select/ Load / Place Parts

Unload / Transfer / Position Part

Palm Buttons

Handling with Hoists

Typical Part Sizes

Walk	Sec/ft
Standard walk with any other than large part	0.3
Any walk with very large object or 2 operators wal	0.4
Unrestricted walk over a long distance such in a v	0.2
Standard walk without part	0.3

Hoists	Type	0 Hooks	1 Hook	2 Hooks
Obtain and engage part	V	9.7	11	12.8
Obtain and engage part	F	7.4	8.6	10.4
Obtain and engage part	N	9.5	9.3	11.1
Obtain and engage part	H	7.7	9.1	10.9
Disengage from part and put aside	V	4.6	5.8	7.5
Disengage from part and put aside	F	5.2	6.3	8.0
Disengage from part and put aside	N	2.2	3.4	5.0
Disengage from part and put aside	H	6.1	7.2	8.9

Manual Tools

Note that lines between jobs contain "blanks" (not empty) to mak

Tool Handling (nut runners) / fastener securing

Open / Close doors, decklids, or hoods

Fit Closure Panels

Use portable fixtures

Manual clamping

Fasteners	Secs
Obtain power tool (and release after using)	4.5
Obtain power tool (and release after using) if grea	5.3
Insert margin or flushness gauge into gap	1.0
Hand start nut, screw, or bolt	3.0
Load nut, screw, or bolt to power tool	1.2
Secure nut, screw, or bolt using power tool	

Tool Motor Type / per fastener times	Torque	Secs
N01-N05	0.70-2.50	2.5
N1-N8	2.51-20.00	2.5
N9-N11	20.1-40.0	4.0
N12-N14	40.1-90.0	5.9
N15	90.1-115.0	6.6
N16	115.1-150.	7.9
N17-N22	150.1-700.	8.5

Very Small	Small	Medium	Large	Very Large
Bolt	Anchor	A-pillar	Bodyside	Cab Back
J-clip	Applicator	B-pillar	Dash Panel	Floor-pan
J-nut	Bar	Cowl side	Deck-lid	Rear Floor Pan
Locator	Brace	Cowl top	Door	Underbody
Nut	Bracket	C-pillar	Door-opening-Panel	
Nut and bolt assembly	Daub	D-pillar	Fender	
Nut and Washer Asser	Door-hinge	Front floor pan crossm	Floor	
Palm button	Fastener	Grille Opening Reinforc	Frame rail	
Pot-rivet	Header	Liftgate	Front Fender Body	
Push pin	Nut and Plate assembl	Package Tray	Hood	
Rivet	Reinforcement	Pillar	Lower back panel s/a	
Rivnut	Teleauto ticket	Plenum	Quarter panel	
Screw		Roof Bow	Roof	
Solder		Roof Rail	Tailgate	
Stud			Underbody Reinforcement	
Stud bolt			Wheelhouse inner	
Tab			Wheelhouse outer	
U-nut			Wheelhouse panel	
Weld				
Weld bolt				
Weld nut				

Portable Fixtures	
Obtain SMALL fixture and postion to body pane	4.4
Obtain MEDIUM fixture and postion to body par	5.5
Obtain LARGE fixture and postion to body pane	7.7
Pull detail locking in	1.9
Turn detail pin	1.2
Press control button on fixture	0.5
Rotate fixture on bench	3.4
Remove SMALL fixture after being unclamped f	1.4
Remove MEDIUM fixture after being unclampec	3.1
Remove LARGE fixture after being unclamped f	4.4

Fit Door / Hood / Decklids	
Fit Door	17.8
Fit Decklid	21.9
Fit Hood (assume same as decklid)	21.9

Open Close Doors, Decklids, Hoods	
Open Door	2.3
Open Hood	3.2
Open Decklid	2.1
Close Door	2.1
Close Hood	2.7
Close Decklid	2.1
Prop Open Hood	7.7
Remove prop rod (slave) from hood	1.4
Prop Open Decklid	7.7
Remove prop rod (slave) from decklid	1.4

Clamping	
Close manually operated fixure clamp	11.4
Open manually operated fixture clamp	2.3
Apply hand clamp	3.8
Remove hand clamp	3.1
Enter vehicle	6.1
Exit vehicle	2.2
Sit in chair or on stool	3.9

GEO Fixtures	
fixture clamps close	1.0
fixture clamps open	1.0
Shot Pins Extend	1.0
Shot Pins retract	1.0
Slides extend	2.0
Slides retract	2.0
Cylinders extend	1.0
Cylinders retract	1.0
Trunnion Rotate	4.0
Table Rotate	4.0