BMW i3 Cost Analysis
Zone 7: Driveline

Disclaimers

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Technical Disclaimer: The goal of this analysis is to establish a should cost value for manufacturing the vehicle and its sub-systems. These cost totals do not include tooling, Engineering Research and Development (ER&D), testing and calibration, logistics, or profit. Manufacturing process assumptions, such as manual assembly vs. automation or mold cavity numbers, were selected based on an annual volume of 20,000.

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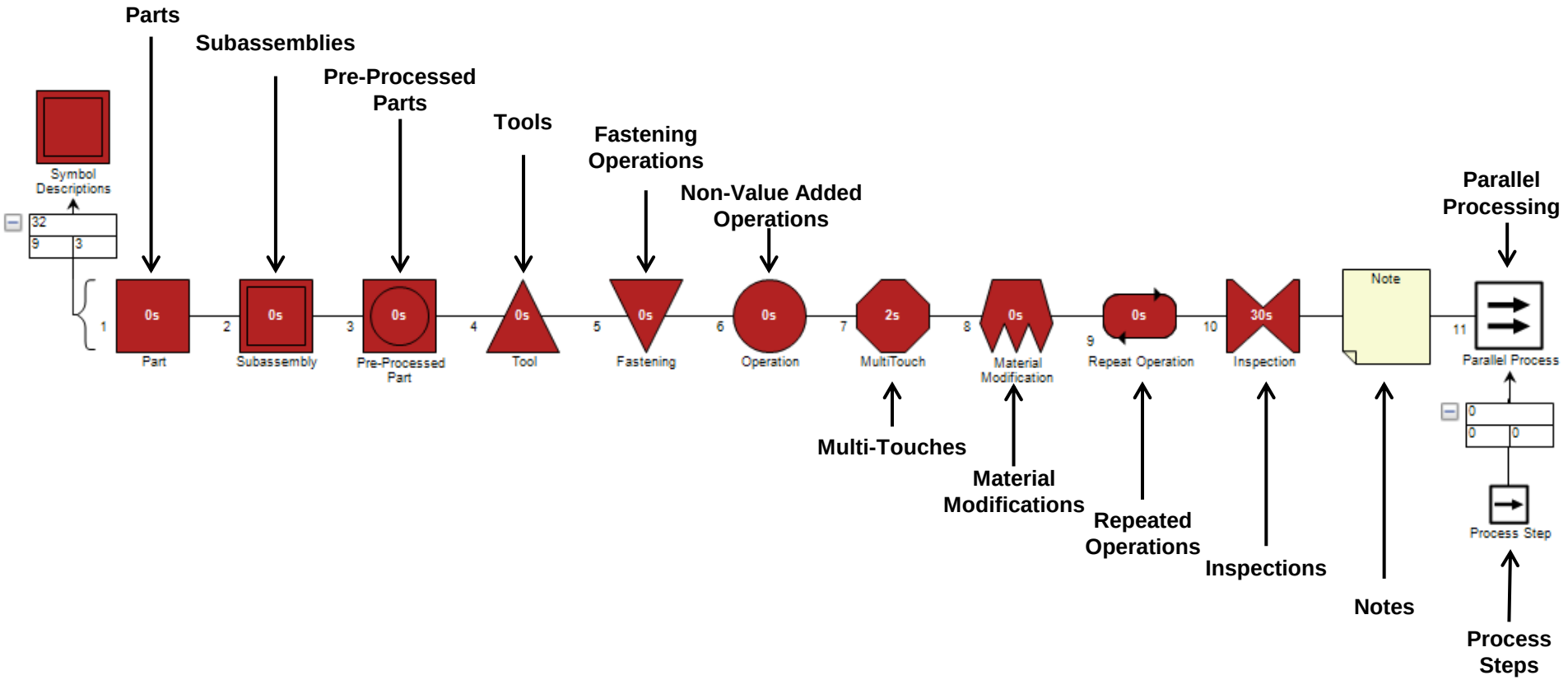
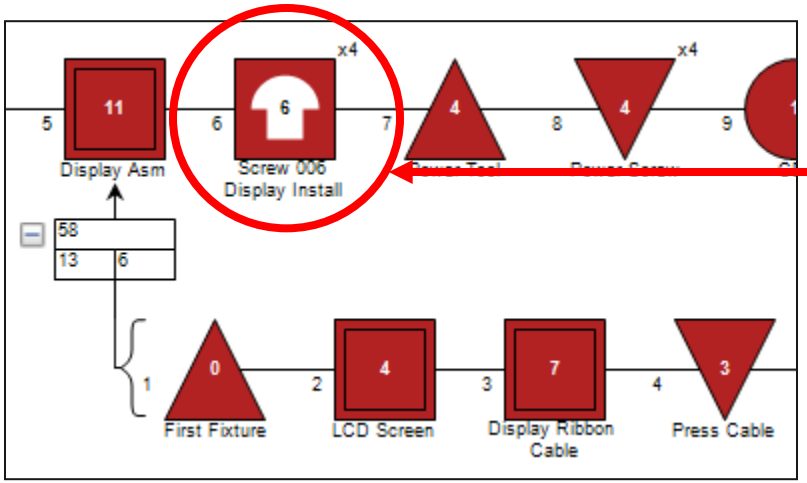
Design Profit® Process

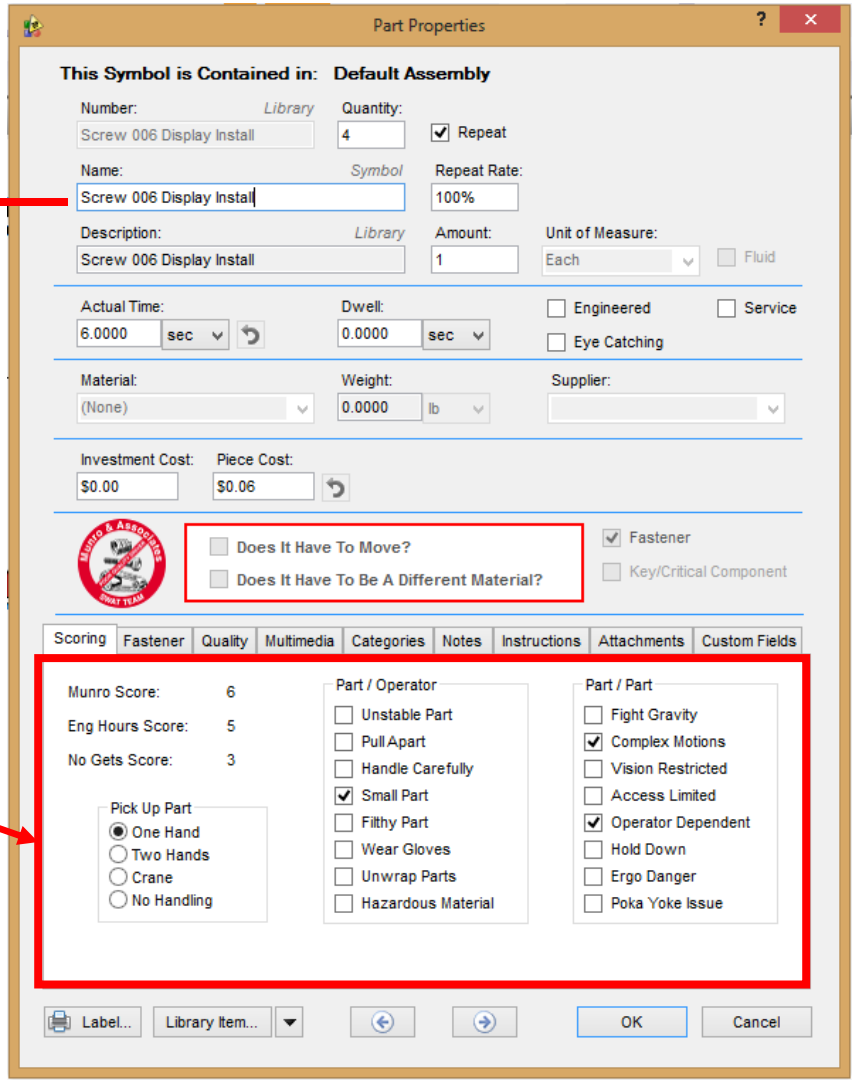
- The Design Profit® Software is used to provide a detailed cost map analyzing every subassembly, part, operation, & tool in the manufacturing process.
- The various symbols shown below are used in a hierarchical diagram to quantify & compare design and manufacturing efficiencies & costs.



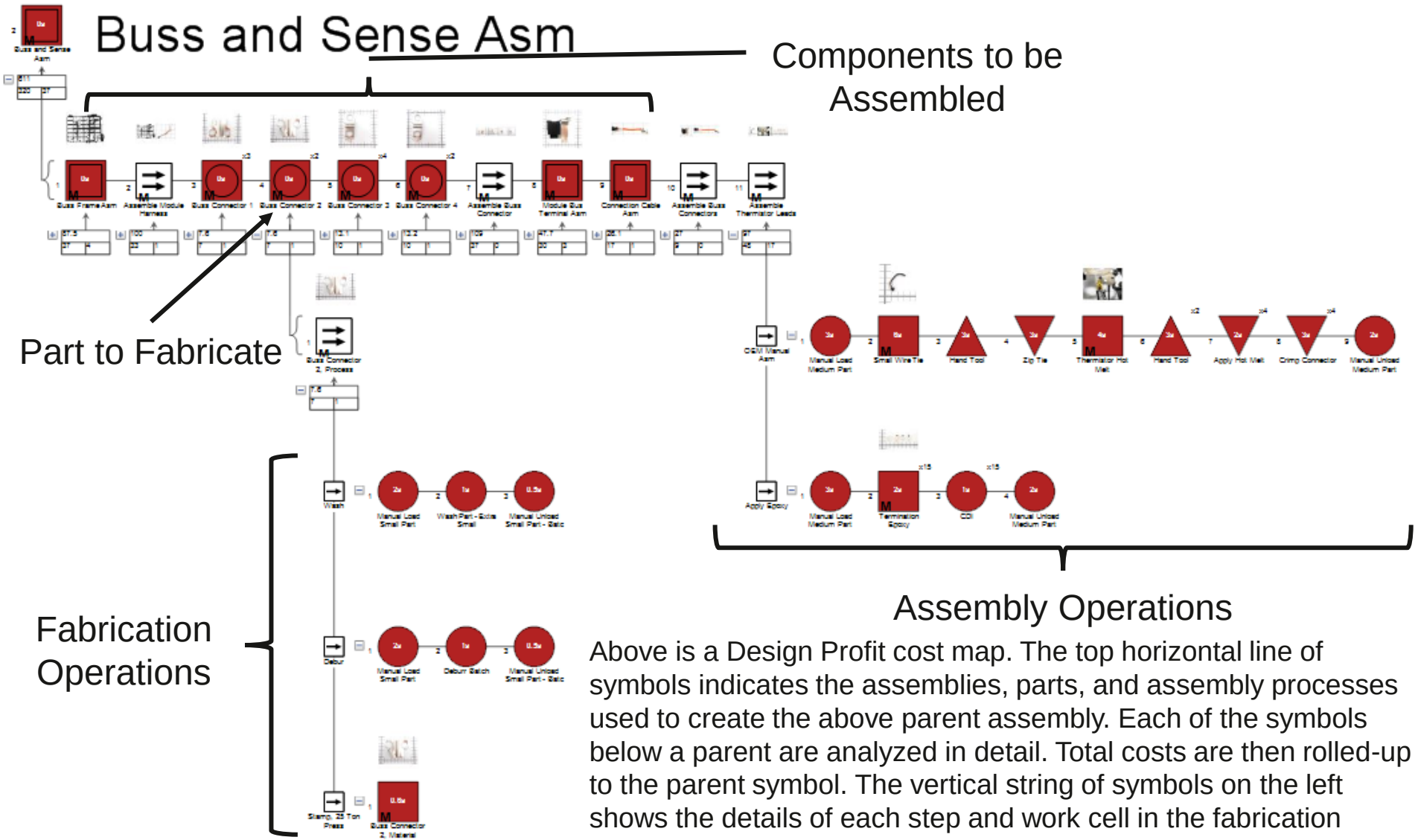
Design Profit® Process



Each symbol is created by filling out a properties window. Penalty conditions and other information related to the symbol are assigned, in order to calculate the effect of handling difficulties on assembly time.



Design Profit® Process



Above is a Design Profit cost map. The top horizontal line of symbols indicates the assemblies, parts, and assembly processes used to create the above parent assembly. Each of the symbols below a parent are analyzed in detail. Total costs are then rolled-up to the parent symbol. The vertical string of symbols on the left shows the details of each step and work cell in the fabrication process. The vertical string of symbols on the right shows the details of each step and work cell in the assembly process.

Assumptions

The following assumptions were made for the cost analysis:

- All processing was documented in the Design Profit software.
- All raw material prices are based on quotes and published information.
- All manufacturing processes include the man and machine to establish an hourly cost for the manufacturing work cell for each process and country utilized in creating the vehicle. These work cell rates are used along with calculation of cycle time to generate the process costs of components. Machine rates are developed through an internal model, accounting for all aspects of the primary and secondary equipment for the process. Operator rates are based on the specific country, and related industry labor rates. Adjustments are made for the number of operators in the workcell.
- Common/basic components were costed as commodity items. These included: bearings, seals, fasteners, and electronic components.
- Bearings/Seals/Fasteners are compared to numerous costed bills of materials to establish a purchased price.
- Electronic component costs are based on the costed bill of materials on hand, quote requests, and published information. Component pricing is run through trend lines to establish a cost for the appropriate targeted volumes.
- Machining cycle times are calculated using operations based on speeds and feeds from the standard machinist handbook.

SG&A Calculations

Sales, General, and Administration:

- The SG&A mark-up used for commodity parts is a flat 3.0% typically used as a standard industry value. This mark-up accounts for the purchasing and handling of commodity parts.
- The SG&A mark-up used for fabricated parts raw material and processing costs is a variable rate based on the technology level associated with the system. A table of the standard percentage mark-ups is shown to the right. Low technology is typical of a system mostly consisting of simple parts, such as basic stampings and injection molded parts. High technology is typically a system with complex automated assembly, high tolerance machined parts, and complex electronic systems, or more standard processes applied to new applications. Cutting edge is typically a system that uses first to market application of an advanced technology.

	Technology Level	SG&A Mark-Ups
Low	1	6.0%
	2	7.0%
	3	8.0%
	4	9.0%
	5	10.0%
Medium	6	11.0%
	7	12.0%
	8	13.0%
	9	14.0%
	10	15.0%
High	11	16.0%
	12	17.0%
	13	18.0%
	14	19.0%
	15	20.0%
Cutting Edge	16	21.0%
	17	22.0%
	18	23.0%
	19	24.0%
	20	25.0%

Defining Q Burden

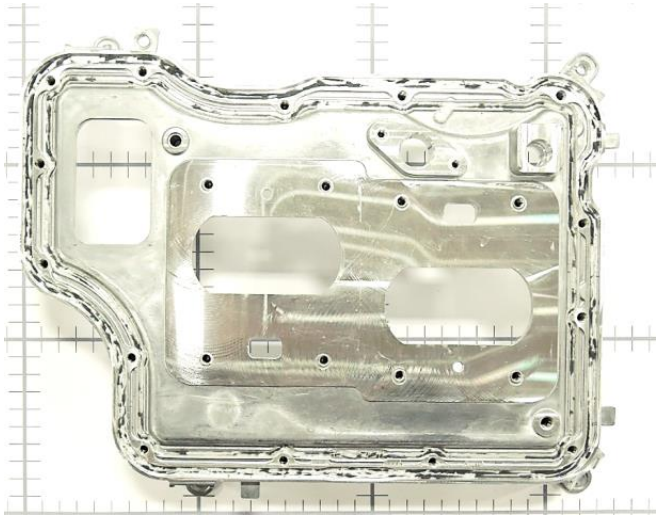
Quality Burden (Q Burden) is the additional cost carried by each good product unit, to account for the actions and materials used to correct defects in parts (as received or produced) or in production processes. Q Burden is a key component of the Cost of Quality and may be considered equivalent to failure costs. Q Burden reflects the variable cost of poor quality. The probability of a defect can be estimated from industry averages or can be based on company statistics.

Q Burden is calculated by adding the incident and disposition costs for each defect and multiplying the sum by the probability of a defect occurrence. The incident is the set of actions that are taken immediately upon the discovery of a real or suspected defect. The disposition is the actions to deal with the defective production after the incident.

Q Burden does not include:

- Base overhead associated with the quality organization (the amount required to assure compliance with industry and customer standards)
- Process documentation generally needed in order to communicate requirements and standards for production, inspection, and testing
- Inspection and test equipment depreciation and consumables (unless needed for troubleshooting defective product)
- Defect prevention activity (investment in new equipment, process improvement, mistake-proofing activities, redesign, lean/six sigma activities, etc.)

Die Casting Estimates



The die casting material costs and cycle times are calculated in an internal parametric based cost estimating sheet, and outputs are fed into Design Profit to develop final fabrication costs. Since die casting is a more material driven primary fabrication process, the cells to the right include general dimensional values and material selections.

Die Casting Material Costs & Cycle Times

Part Name: Top Plate, Top Plate w/Silicone Bead

Inputs:

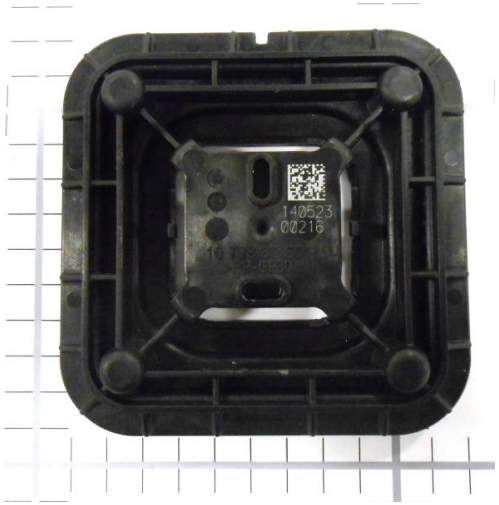
	Die Casting Inputs:		
1	Height - Tool Draw	82	mm
2	Length - Longest	314	mm
3	Width - Shortest	250	mm
4	Max. Wall Thickness	5.5	mm
5	Weight of Part - Finished	0.738	kg
6	Percent Loss from Machining	7.00	%
7	Number of Cavities in Tool	2	
8	Number of Die Lock Features	0	
9	Material Number	7	

Material Name	Abbreviation	Cost ($/kg)
Al-9Si-3Cu(Fe)	A380	$2.27

Outputs to DP:

	Die Casting Outputs:		
1	Min. Die Casting Machine	1927	tons
2	Die Casting Time	28.13	sec
3	Raw Material Weight	0.790	kg
4	Material Cost	$1.79	

Injection Molding Estimates



The injection molding material costs and cycle times are calculated in an internal parametric based cost estimating sheet, and outputs are fed into Design Profit to develop final fabrication costs. Since injection molding is a more complex material driven primary fabrication process, the cells to the right include detailed dimensional values and material selections.

Injection Molding Material Costs & Cycle Times

Part Name: Vent Body

Inputs:

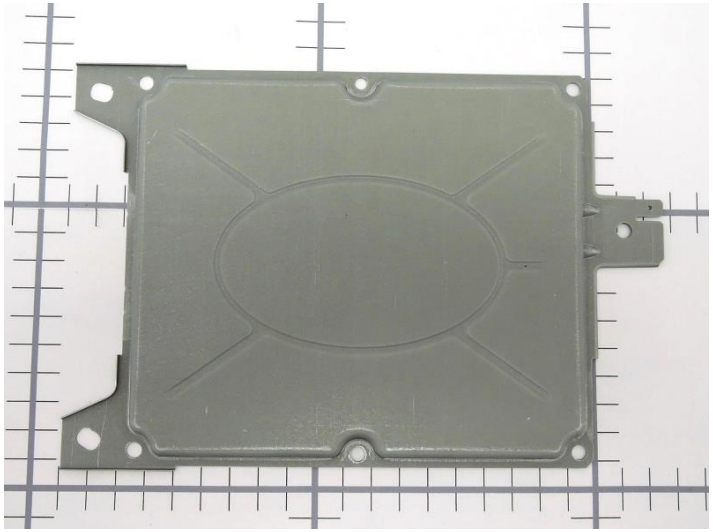
	Injection Molding Inputs:			
1	Number of Injection Shots: (1, 2, & 3)	1		
2	Weight of Part	0.050	kg	
3	Number of Cavities in Tool	2		
4	Number of Die Lock Features	0		
5	Recycle Offal (1=Yes , 0=No)	0		
6	Height - Tool Draw	19.52	mm	
	Inputs for Each Injection Shot:	-	-	-
7	Injection Process: (Standard=1 , MuCell=2, & Foaming Agent=3)	1		
8	Length - Longest (mm)	105.4		
9	Width - Shortest (mm)	105.3		
10	Percentage of Part Area Used Based on Square Area of Length x Width	90.00		
11	Nominal Wall Thickness (mm)	2		
12	Material Number	59		

	Material Name	Abbreviation	Cost ($/kg)	Offal Value ($/kg)
-	Polypropylene (30% glass)	PP + GF30	$2.71	$0.00
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

Outputs to DP:

	Injection Molding Outputs:			
1	Min. Injection Molding Press	103	tons	
	Outputs for Each Injection Shot:	PP + GF30	-	-
2	Injection Molding Time (sec)	7.29	-	-
3	Net Weight (kg)	0.050	-	-
4	Raw Material Weight (kg)	0.053	-	-
5	Raw Material Cost	$0.14	-	-

Stamping Estimates



The stamping material costs and cycle times are calculated in an internal parametric based cost estimating sheet, and outputs are fed into Design Profit to develop final fabrication costs. Since stamping is a more machine driven primary fabrication process, the cells to the right include dimensional values related to stations operating in the press, along with material selections.

Stamping Material Costs & Cycle Times

Part Name: Bottom Cover, Cell Control

Inputs:

	Stamping Inputs:		
	General Inputs:		
1	Stamping Quality: (Standard=1, Fine Blanking=2)	1	
2	Parts per Hit (Side by Side Across Press Width)	1	
3	Material Number	6	
	Blanking Inputs:		
4	Shape Type: (Formed Sheet=1, Drawn Box=2, Drawn Cylinder=3)	1	
5	Part Height - Tool Draw	6.73	mm
6	Wrap Length - Longest	225	mm
7	Wrap Width - Shortest	150	mm
8	Sheet Thickness	0.65	mm
9	Number of Blanking Hits (If Unknown = 0)	0	
	Piercing Inputs:		
10	Number of Circular Holes	8	
11	Average Diameter of Circular Holes	5	mm
12	Number of Non-Circular Holes	2	
13	Total Perimeter of Non-Circular Holes	64	mm
14	Number of Piercing Hits (If Unknown = 0)	0	
	Bending Inputs:		
15	Number of Bends	0	
16	Total Length of Bend Lines	0	mm
17	Number of Bending Hits (If Unknown = 0)	0	
	Flanging Holes Inputs:		
18	Number of Flanged Holes	0	
19	Total Perimeter of Flanged Holes	0	mm
20	Number of Flanging Holes Hits (If Unknown = 0)	0	
	Forming Depression Inputs:		
21	Number of Depressions	1	
22	Total Perimeter of Depressions	560	mm
23	Number of Forming Depression Hits (If Unknown = 0)	0	
	Deep Drawing Inputs:		
24	Drawn Area Depth	0	mm
25	Drawn Area Length - Longest	0	mm
26	Drawn Area Width - Shortest	0	mm
27	Number of Deep Drawing Hits (If Unknown = 0)	0	

Material Name	Abbreviation	Cost ($/kg)
Medium Carbon Steel 1040 - Galvanized	AISI 1040 - Galva	$1.50

Outputs to DP:

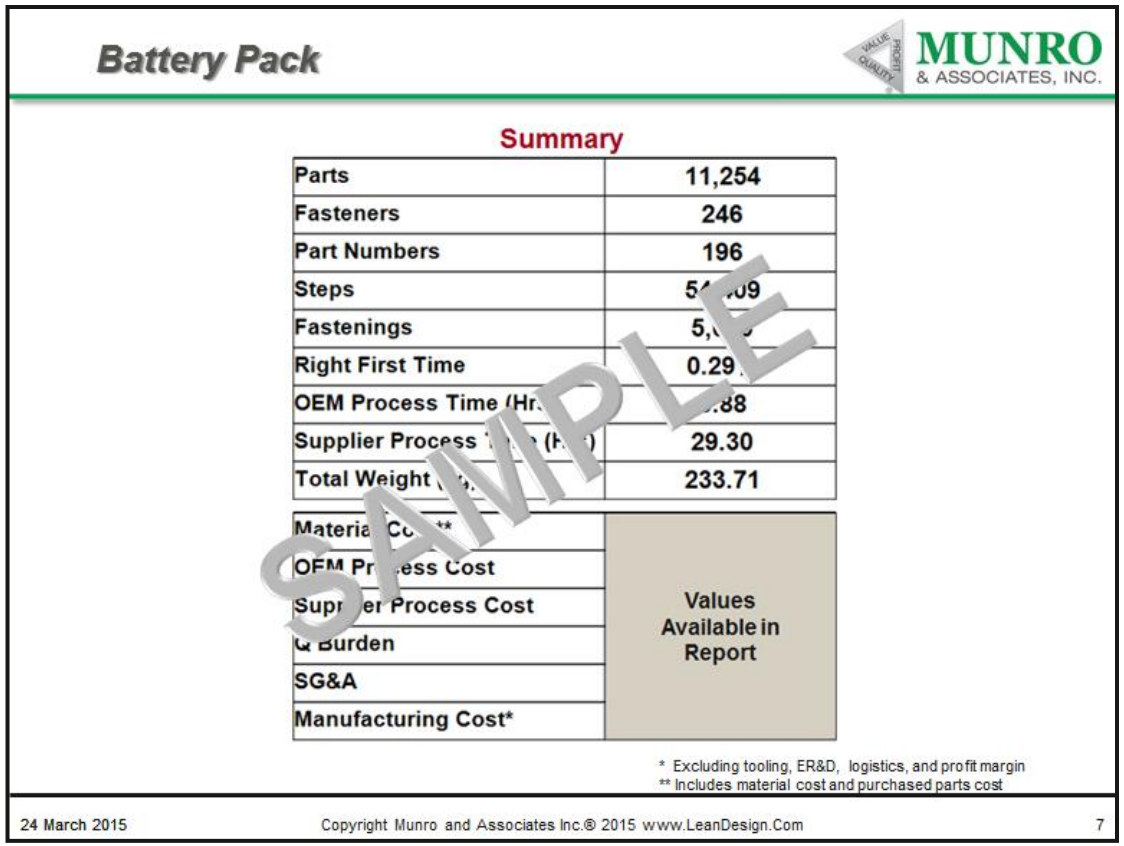
	Stamping Outputs: (Progressive Die)		
1	Stamping Press	60	tons
2	Stamping Cycle Time	0.67	sec
3	Blank Weight	0.197	kg
4	Material Cost	$0.30	

Zone Report Outline:

- Zone Information
  - Zone Overview
  - Zone Executive Summary
- Chapter Information
  - Chapter Overview
  - Eye Catching Features
  - Executive Summary
  - Repeating Series of Sets of Costing Detail Pages
    - Assembly Details (Set of 3 Pages)
    - Part Details (Set of 2 Pages)
    - Assembly Process (Set of 2 Pages)
- Appendix Information
  - TechInsights Reports
    - Electronic Component Costing Details
  - Munro & Associates Wire Harness Reports
    - Wire Harness Costing Details

- Zones and Chapters are meant to be similar in structure to a system and sub-system breakdown, however, they may or may not represent specific Original Equipment Manufacturer (OEM) organizations. For example, the Zone 7: Driveline contains the chapters for Motor, Gear Box and Half Shafts.

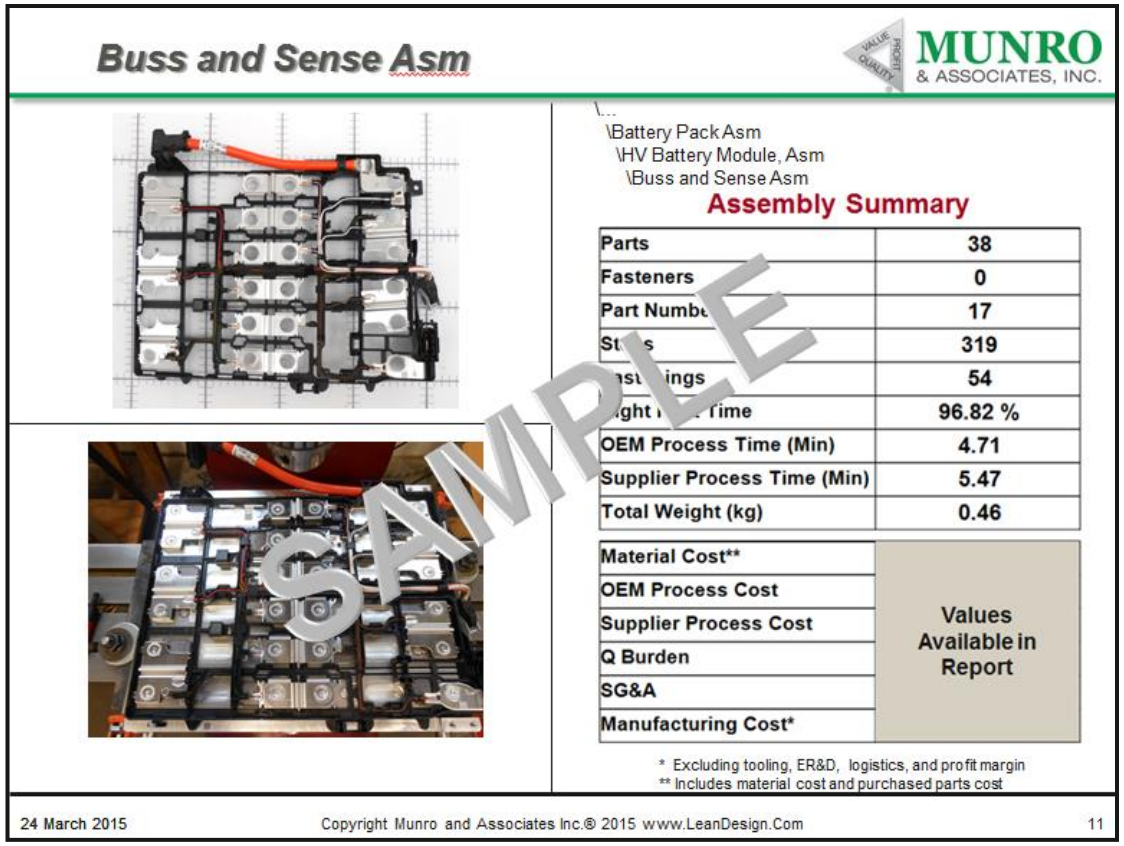
Data Overview – Executive Summaries



Executive Summary: Page 1 of 1

At the beginning of each Zone report and beginning of each Chapter, there will be a Executive Summary page. This page provides the high level totals of the Zone or Chapter, based on the following detailed data. The upper part of the summary table shows typical metrics totaled from the assembly and fabrication processes, including part counts, operation counts, timing, and weights. The lower part of the table shows the total costs incurred from these processes.

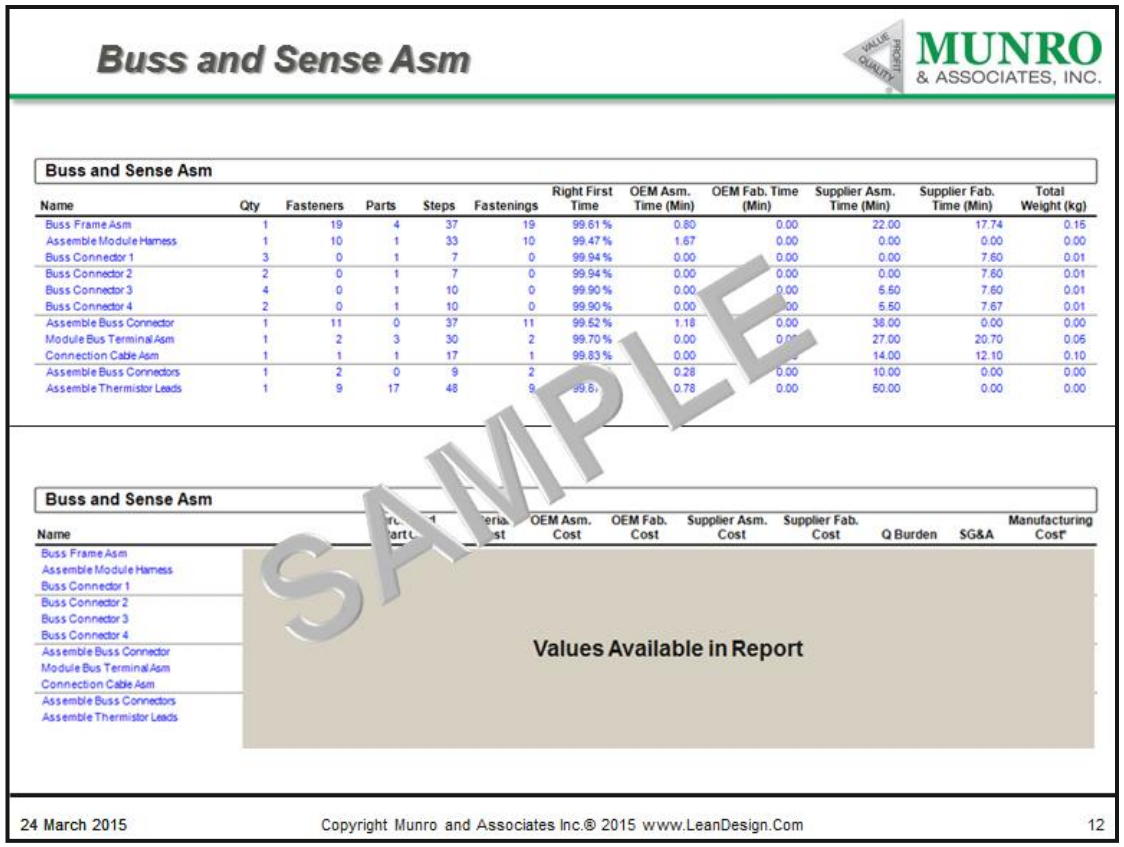
Data Overview – Assembly Details



Assembly Details: Page 1 of 3

As the report progresses through the breakdown hierarchy of the Chapter, when an assembly is analyzed, three detail pages will be provided. The first page, shown to the left, is a high level overview. The top left photo is the independent assembly, placed on a grid for a reference perspective. The bottom left photo is the assembly in location, once it is assembled to its parent assembly. The top right is a list of the parent assemblies of this assembly. The bottom right is a table summarizing total metrics and costs related to the completed assembly.

Data Overview – Assembly Details



Buss and Sense Asm

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Buss and Sense Asm

Name	Qty	Fasteners	Parts	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Buss Frame Asm	1	19	4	37	19	99.61 %	0.80	0.00	22.00	17.74	0.15
Assemble Module Harness	1	10	1	33	10	99.47 %	1.67	0.00	0.00	0.00	0.00
Buss Connector 1	3	0	1	7	0	99.94 %	0.00	0.00	0.00	7.60	0.01
Buss Connector 2	2	0	1	7	0	99.94 %	0.00	0.00	0.00	7.60	0.01
Buss Connector 3	4	0	1	10	0	99.90 %	0.00	0.00	5.50	7.60	0.01
Buss Connector 4	2	0	1	10	0	99.90 %	0.00	0.00	5.50	7.67	0.01
Assemble Buss Connector	1	11	0	37	11	99.52 %	1.18	0.00	38.00	0.00	0.00
Module Bus Terminal Asm	1	2	3	30	2	99.70 %	0.00	0.00	27.00	20.70	0.05
Connection Cable Asm	1	1	1	17	1	99.83 %	0.00	0.00	14.00	12.10	0.10
Assemble Buss Connectors	1	2	0	9	2		0.28	0.00	10.00	0.00	0.00
Assemble Thermistor Leads	1	9	17	48	9	99.6	0.78	0.00	50.00	0.00	0.00

Buss and Sense Asm

Name	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost
Buss Frame Asm							
Assemble Module Harness							
Buss Connector 1							
Buss Connector 2							
Buss Connector 3							
Buss Connector 4							
Assemble Buss Connector							
Module Bus Terminal Asm							
Connection Cable Asm							
Assemble Buss Connectors							
Assemble Thermistor Leads							

Values Available in Report

SAMPLE

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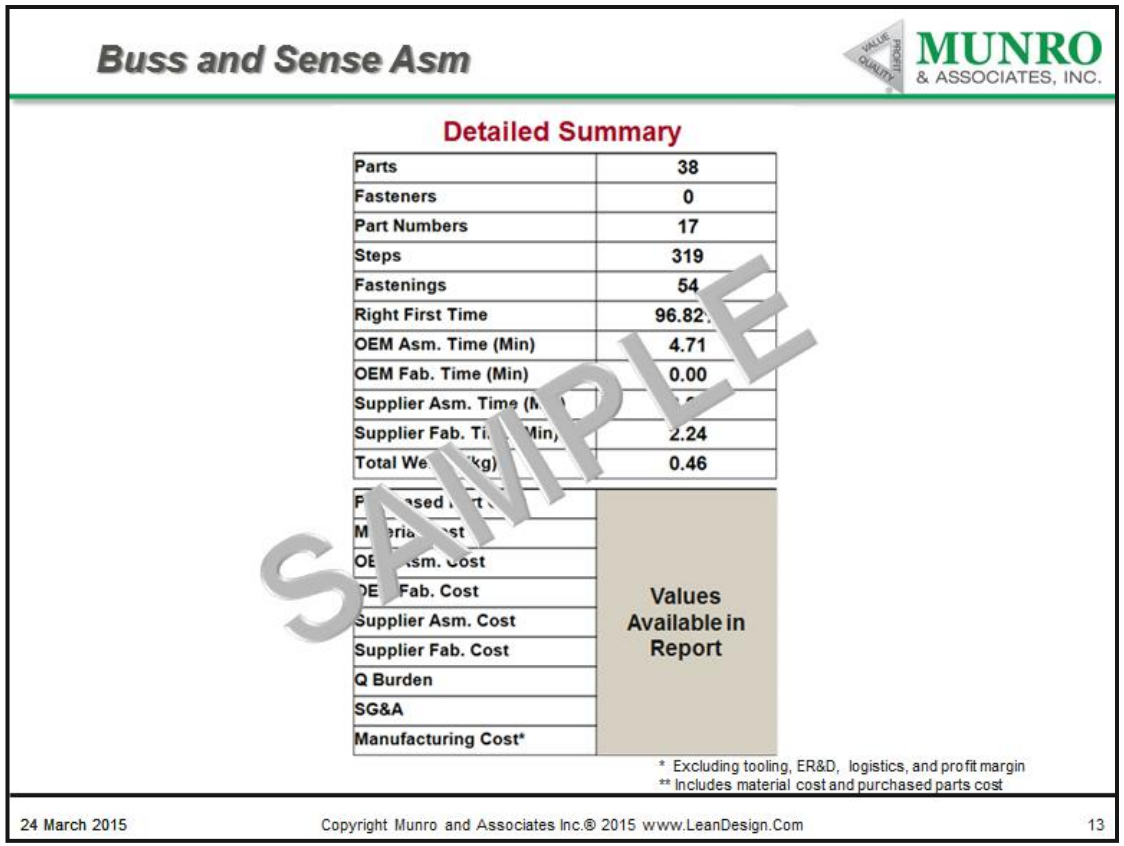
Assembly Details: Page 2 of 3

- Note for large assemblies with many line items this page could become multiple pages.

The second assembly detail page, shown to the left, is the detailed breakdown of the totals for each line item within the current assembly. The line items within the breakdown will include assemblies, parts, and assembly processes. This makes these tables effectively a combined Bill of Materials (BOM) and Bill of Process (BOP) for that assembly. The top table provides the typical metrics totaled from the assembly and fabrication process of each line item. The bottom table provides the total costs incurred from these processes.

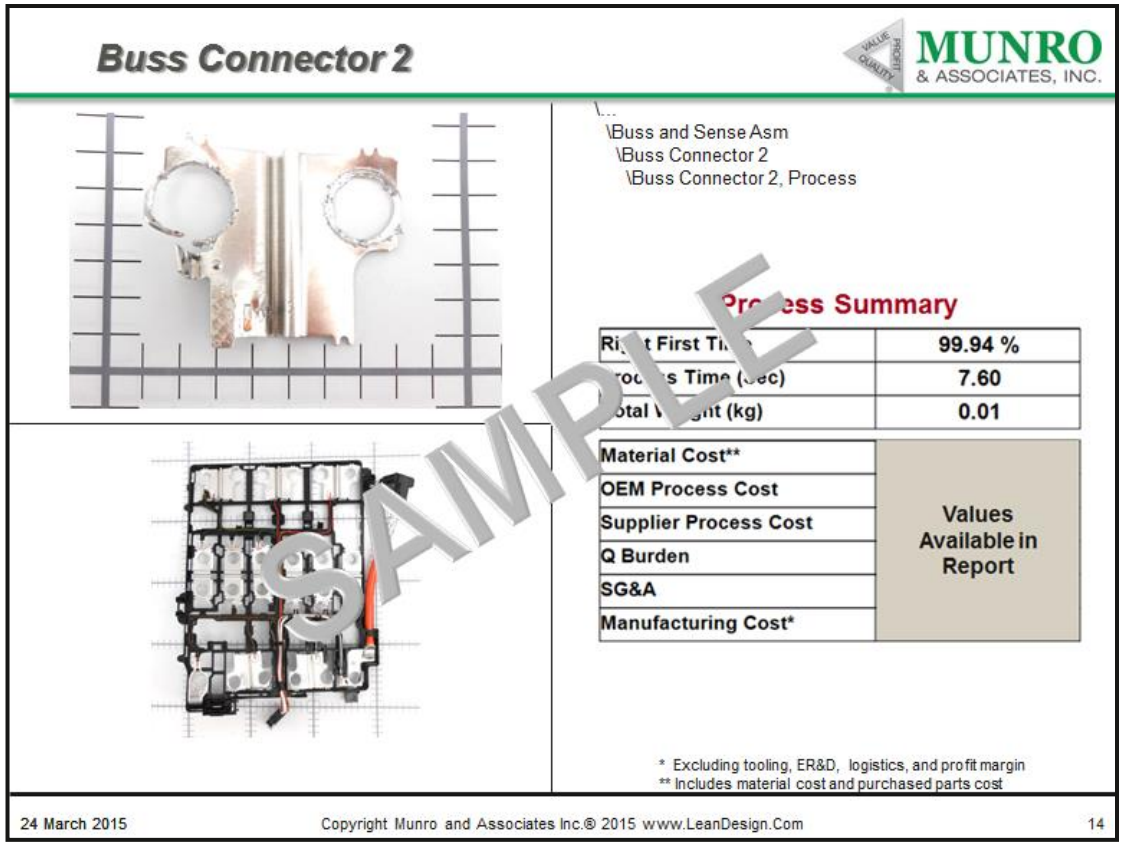
Data Overview – Assembly Details



Assembly Details: Page 3 of 3

The third assembly detail page, shown to the left, is a detailed summary of the totals shown on the previous page. The upper part of the summary table shows typical metrics totaled from the assembly and fabrication process, including part counts, operation counts, timing, and weights. The lower part of the table shows the total costs incurred from these processes.

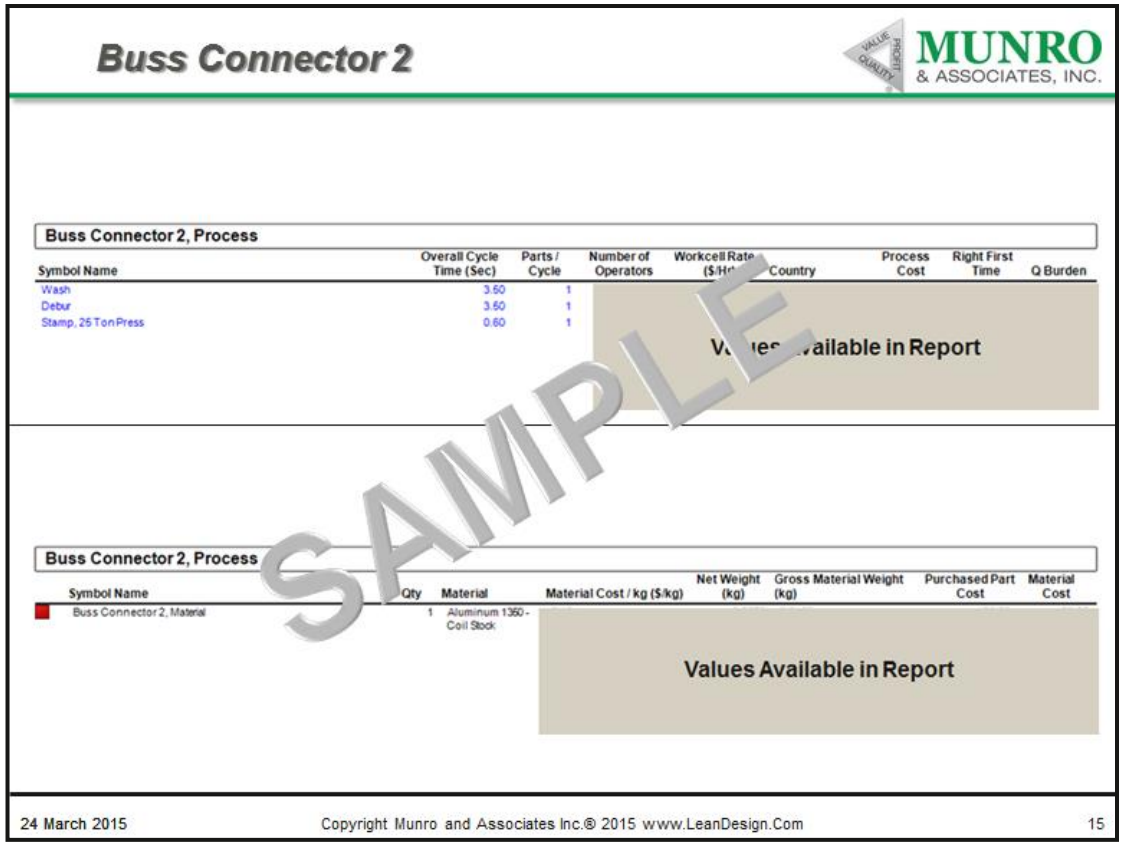
Data Overview – Part Details



Part Details: Page 1 of 2

As the report progresses through the breakdown hierarchy of the Chapter, when a part is analyzed, two detail pages will be provided. The first page, shown to the left, is a high level overview. The top left photo is the independent part, placed on a grid for a reference perspective. The bottom left photo is the part in location, once it is assembled to its parent assembly. The top right is a list of the parent assemblies of this part. The bottom right is a table summarizing total metrics and costs related to the completed part.

Data Overview – Part Details

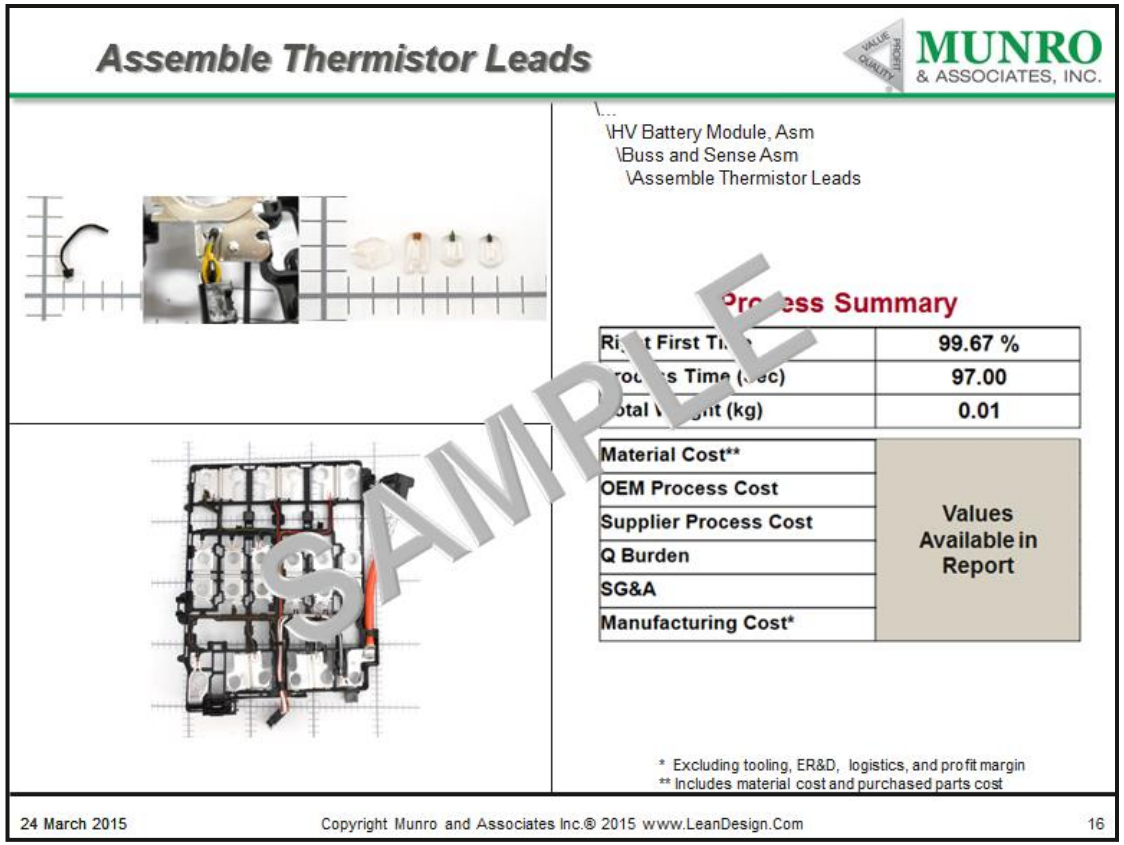


Part Details: Page 2 of 2

- Note for complex parts with many steps this page could become multiple pages.

The second part detail page, shown to the left, is the detailed breakdown of the totals for the raw materials and each process step to fabricate the part. The top table provides the typical fabrication process metrics and costs totaled for each step. The bottom table provides the total costs for raw material or purchased parts used in the fabrication process.

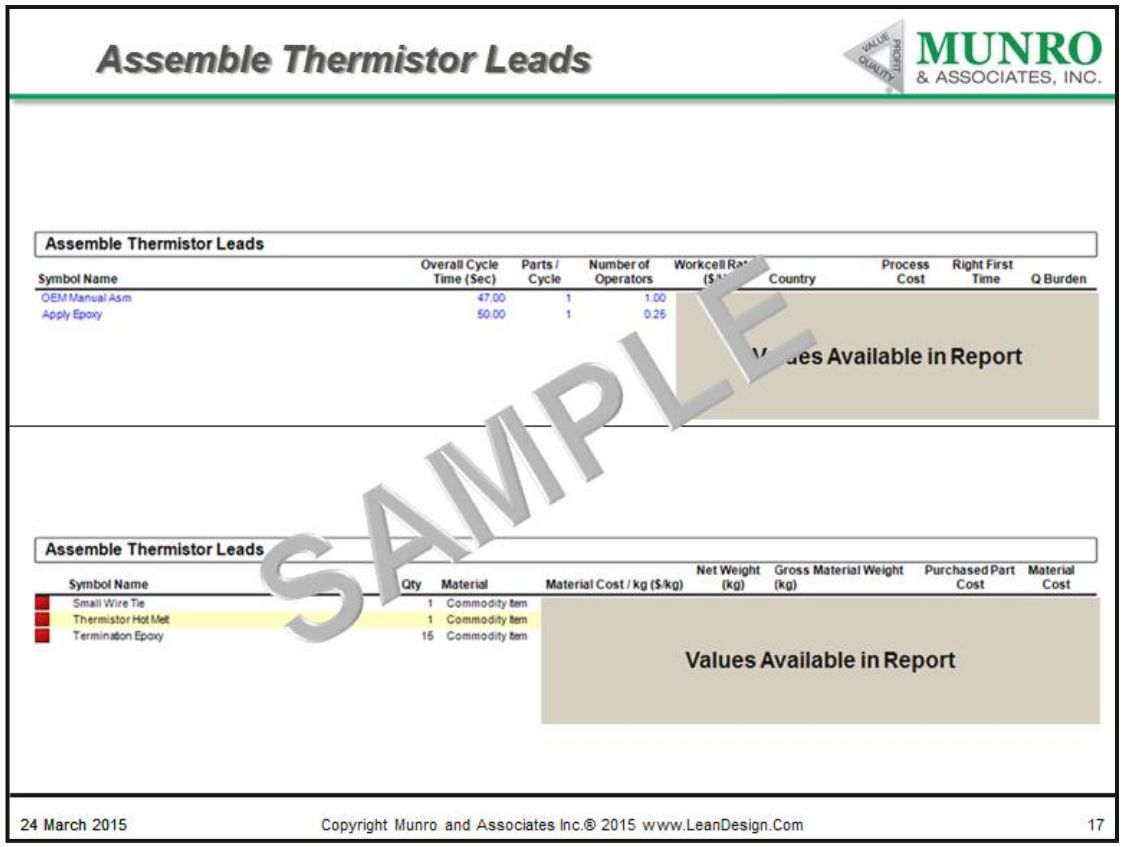
Data Overview – Assembly Process Details



Assembly Process Details: Page 1 of 2

As the report progresses through the breakdown hierarchy of the Chapter, when an assembly process is analyzed, two detail pages will be provided. The first page, shown to the left, is a high level overview. The top left are photos of the purchased parts utilized in the process, placed on a grid for a reference perspective. The bottom left photo is a view of the location, once the process is complete. The top right is a list of the parent assemblies of this process. The bottom right is a table summarizing total metrics and costs related to the process.

Data Overview – Assembly Process Details



Assembly Process Details: Page 2 of 2

- Note for complex processes with many steps this page could become multiple pages.

The second assembly process detail page, shown to the left, is the detailed breakdown of the totals for the purchased parts and each assembly process step. The top table provides the typical assembly process metrics and costs totaled for each step. The bottom table provides the total costs for purchased parts used in the assembly process. If a electronic component or wire harness are in the list of purchased parts, then this page will also have a link to the accompanying report in the Appendix.

Interpreting Data – Part Counts

Detailed Summary

Parts	38
Fasteners	0
Part Numbers	17
Steps	319
Fastenings	54
Right First Time	96.82%
OEM Asm. Time (Min)	4.71
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	3.23
Supplier Fab. Time (Min)	2.24
Total Weight (kg)	0.46

Purchased Part Cost	Values Available in Report
Material Cost	
OEM Asm. Cost	
OEM Fab. Cost	
Supplier Asm. Cost	
Supplier Fab. Cost	
Q Burden	
SG&A	
Manufacturing Cost*	

Summary tables, include three metrics related to part count. The first metric, “Parts” is the total quantity of parts. The second metric, “Fasteners” is the total quantity of fasteners, within that total part count, meaning that the fasteners count is a sub-total of the parts count. The third metric, “Part Numbers” is the total unique part instances in the total part count (this includes numbers for both main parts and fasteners).

Interpreting Data – Operation Counts

Detailed Summary

Parts	38
Fasteners	0
Part Numbers	17
Steps	319
Fastenings	54
Right First Time	96.82%
OEM Asm. Time (Min)	4.71
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	3.23
Supplier Fab. Time (Min)	2.24
Total Weight (kg)	0.46

Purchased Part Cost	Values Available in Report
Material Cost	
OEM Asm. Cost	
OEM Fab. Cost	
Supplier Asm. Cost	
Supplier Fab. Cost	
Q Burden	
SG&A	
Manufacturing Cost*	

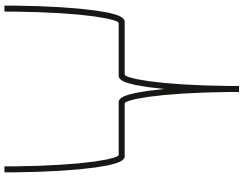
Summary tables, also include two metrics related to operation counts. The first “Steps”, is the total count of the operations required to complete an assembly, part, or assembly process. Operations counted in this total include handling of parts, movement of equipment or operators, handling of tools, fastenings of parts and assemblies, operations to add and remove material during the fabrication process, etc. The second “Fastenings” is the total count of the operations specifically related to fastenings components together, meaning that the fastening count is a sub-total of the steps count.

Interpreting Data – Fasteners vs. Fastenings

Detailed Summary

Parts	38
Fasteners	0
Part Numbers	17
Steps	319
Fastenings	54
Right First Time	96.82%
OEM Asm. Time (Min)	4.71
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	3.23
Supplier Fab. Time (Min)	2.24
Total Weight (kg)	0.46

Purchased Part Cost	Values Available in Report
Material Cost	
OEM Asm. Cost	
OEM Fab. Cost	
Supplier Asm. Cost	
Supplier Fab. Cost	
Q Burden	
SG&A	
Manufacturing Cost*	



Often it would be expected that the analysis would have the same number of fasteners to fastenings, however, that is not always the case. One scenario is shown to the right, where there are less fasteners, than fastenings. This is typical of welding operations or the application of sealant or adhesive, as there is not a standard bolt, nut, or clip to be counted as a fastener. A second scenario is where there are more fasteners, than fastenings. This is typical of a process that engages multiple fasteners at the same time, like a multi-head nut runner.

Interpreting Data – Right First Time

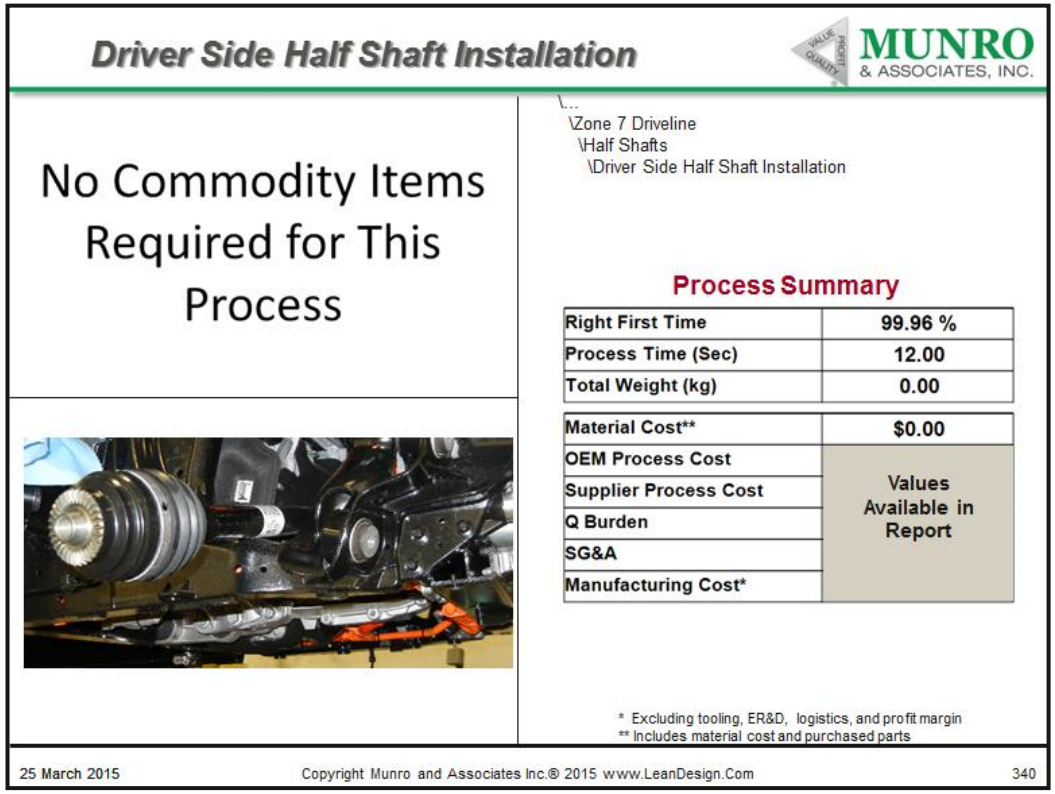
Detailed Summary

Parts	38
Fasteners	0
Part Numbers	17
Steps	319
Fastenings	54
Right First Time	96.82%
OEM Asm. Time (Min)	4.71
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	3.23
Supplier Fab. Time (Min)	2.24
Total Weight (kg)	0.46

Purchased Part Cost	Values Available in Report
Material Cost	
OEM Asm. Cost	
OEM Fab. Cost	
Supplier Asm. Cost	
Supplier Fab. Cost	
Q Burden	
SG&A	
Manufacturing Cost*	

Summary tables include “Right First Time” (RFT). This value states the probably that all the steps that total to this point in the process will be completed without an error. Naturally, as the number and complexity of steps required to complete the assembly, part, or assembly process increase, the RFT percentage will decrease. RFT is calculated using typical best-in-class PPM values for incident rates. However, even with high Sigma level processes, as the steps count increases greatly, the RFT percentage will decrease greatly.

Interpreting Data – No Commodity Items in Assembly Process



Some assembly processes will not require the use of commodity items in the process to fasten parts and assemblies. For example, the installation of the half shafts to the vehicle utilizes a press fit, and therefore does not require commodities, like bolts, nuts, or clips to fasten in place. When no commodities are required, the top left photos will be replaced with the standard statement shown on the left. Additionally there will be no weight or material cost / purchased parts cost present in the process summary.

Interpreting Data – Low Q Burden

Buss Connector 2, Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	3.50	1						$0.00
Debur	3.50	1						$0.00
Stamp, 25 Ton Press	0.60	1						$0.00

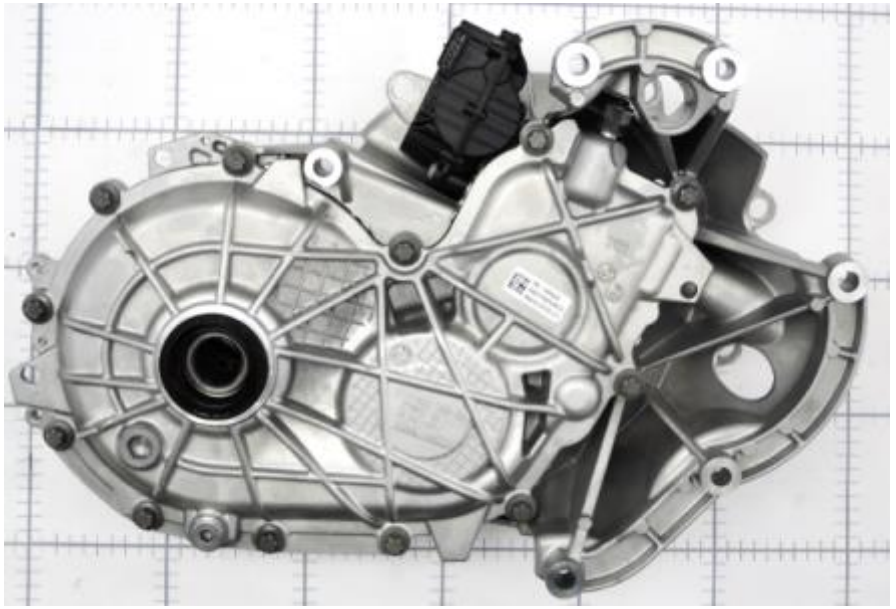
Values Available in Report

Some assembly and fabrication process steps that have few operations or operations with low PPMs of defects, will often display $0.00 in Q Burden. This is simply because the Q Burden value for that step in the process is less than one cent. However, this fraction of a cent of cost will be rolled-up to any parent part or assembly for these processes and added to its totals.

Cost Analysis

Zone 7 Overview

Zone 7 consists of the electric motor, gear box, and half shafts. The electric motor for the i3 is a liquid cooled three phase permanent magnet induction motor. The gear box for the i3 is a single speed fixed ratio design. Half shaft assemblies are Schaeffler LUK FAG Axial spline design with unique features to optimize weight. Assembly and manufacturing details for all three components will be covered throughout the report.



MUNRO & ASSOCIATES, INC.

Summary

Parts	4,958
Fasteners	84
Part Numbers	168
Steps	30,942
Fastenings	852
Right First Time	23.4%
OEM Process Time (Hrs)	1.72
Supplier Process Time (Hrs)	9.24
Total Weight (kg)	83.55

Material Cost**	$621.44
OEM Process Cost	$132.80
Supplier Process Cost	$346.26
Q Burden	$21.79
SG&A	$149.68
Manufacturing Cost*	$1,271.96

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Motor Overview

The electric motor for the i3 is a three phase permanent magnet induction motor. Assembly and manufacturing details for the motor will be covered throughout the report.

The electric motor consists of a three main components which are the housing, rotor and stator. The housing predominately consists of two aluminum die cast and machined components: the rotor housing and the stator housing. When the two halves of the housings are assembled, the stator housing (which fits inside and seals to the rotor housing) forms a helical path for the coolant to travel which cools the stator. The rotor consists of 6 laminate stacks, each being slightly skewed progressing from top to bottom. Each pole section in the rotor consists of two neodymium permanent magnets. The assembled stacks are pressed onto the motor output shaft and captured with bolts through aluminum end plates. Both ends of the shaft are supported by roller bearings. The stator consists of six sets of stacked laminates that are insulated and have several sets of wound copper coils pressed in place.

All major components are analyzed in detail, while prices are applied to commodity items (i.e. seals, rivets, snap rings).

Estimates are based on actual parts.

Photos: Background on 100mm grid paper.

Eye Catching Features

Description:

- The rotor (inner) housing features a helical pattern that seals against the stator (outer) housing to form a coolant channel. Housings are sealed at ends only

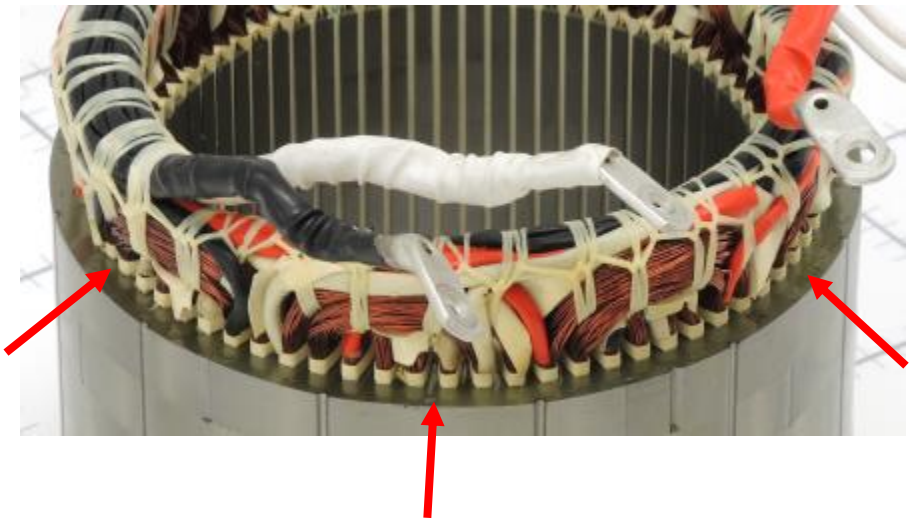
Advantages:

- Ensures that the coolant flows around the stator evenly
- Design allows for manufacturing utilizing a die casting process
- Simplified sealing strategy with O-rings on each end

Eye Catching Features

Description:

- Each laminate on the stator consists of six individual stampings that are held together using interlocking tabs that are reminiscent of a jigsaw puzzle piece



Advantages:

- The amount of offal produced is significantly reduced because the parts are easier to nest and no longer create a “land locked” center portion of the ring

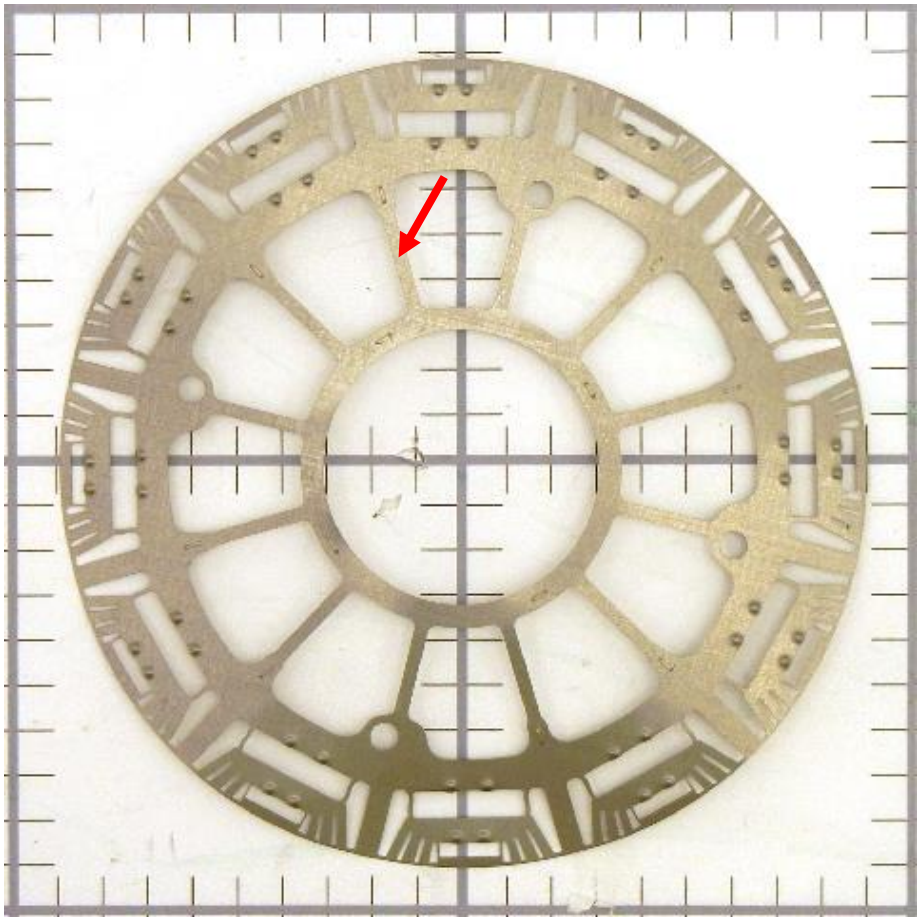
Eye Catching Features

Description:

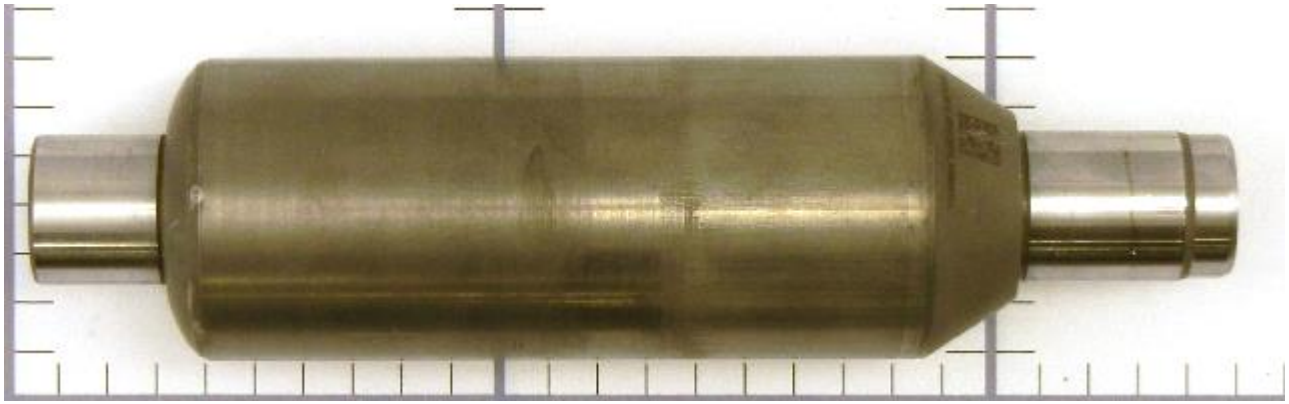
- The laminate plates on the rotor have been optimized to reduce weight. The inner diameter provides the press fit to the shaft with windows stamped out between the ID and the magnet mount slots.

Advantages:

- Reducing weight on a rotating member not only reduces overall weight of the product but also increases power output and efficiency.



Eye Catching Features



Description:

- The rotor spindle utilizes a hollow tube design
- The portion of the spindle that the laminates are pressed onto is a larger diameter than the bearing surfaces

Advantages:

- The larger diameter allows the spindle to handle more torque than a similar wall thickness pipe of a smaller diameter
- Provides more surface area for the (pressed in place) laminates to transfer torque to the shaft

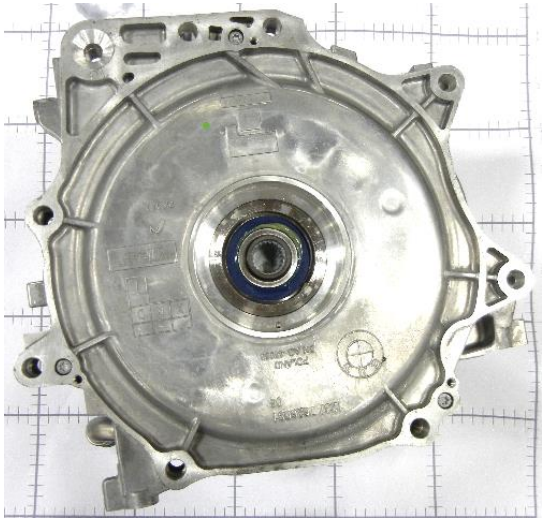
Summary

Parts	4,736
Fasteners	45
Part Numbers	54
Steps	27,768
Fastenings	681
Right First Time	31.16%
OEM Process Time (Hrs)	1.50
Supplier Process Time (Hrs)	5.34
Total Weight (kg)	48.37

Material Cost**	$486.75
OEM Process Cost	$112.99
Supplier Process Cost	$123.26
Q Burden	$17.49
SG&A	$101.06
Manufacturing Cost*	$841.54

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Drive Motor Asm



\...
\Zone 7 Driveline
\Motor
\Drive Motor Asm

Assembly Summary

Parts	4,699
Fasteners	21
Part Numbers	39
Steps	27,645
Fastenings	652
Right First Time	32.53 %
OEM Process Time (Min)	84.16
Supplier Process Time (Min)	312.62
Total Weight (kg)	47.73

Material Cost**	$481.61
OEM Process Cost	$103.90
Supplier Process Cost	$120.52
Q Burden	$16.84
SG&A	$97.47
Manufacturing Cost*	$820.33

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Drive Motor Asm

MUNRO & ASSOCIATES, INC.

Drive Motor Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Stator Housing Asm	1	4079	480	24042	480	39.68 %	45.89	6.18	0.00	244.64	25.6915
Rotor Housing Asm	1	609	164	3566	164	83.40 %	11.79	17.31	0.24	67.74	21.7995
Assemble Drive Motor Asm	1	11	8	35	8	98.30 %	3.00	0.00	0.00	0.00	0.1826

Drive Motor Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Stator Housing Asm	$79.28	$88.26	$65.86	$7.81	$0.00	$86.45	$13.86	$59.51	$401.03
Rotor Housing Asm	$218.10	$68.75	$9.72	$15.93	$0.10	$33.97	$2.72	$36.09	$385.39
Assemble Drive Motor Asm	$27.22	$0.00	$4.57	$0.00	$0.00	$0.00	$0.26	$1.87	$33.92

MUNRO & ASSOCIATES, INC.

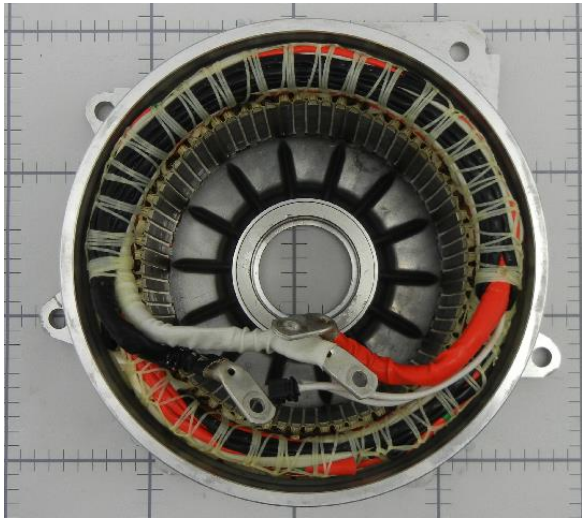
Detailed Summary

Parts	4,699
Fasteners	21
Part Numbers	39
Steps	27,645
Fastenings	652
Right First Time	32.53%
OEM Asm. Time (Min)	60.68
OEM Fab. Time (Min)	23.48
Supplier Asm. Time (Min)	0.24
Supplier Fab. Time (Min)	312.38
Total Weight (kg)	47.73

Purchased Part Cost	$324.60
Material Cost	$157.01
OEM Asm. Cost	$80.15
OEM Fab. Cost	$23.74
Supplier Asm. Cost	$0.10
Supplier Fab. Cost	$120.42
Q Burden	$16.84
SG&A	$97.47
Manufacturing Cost*	$820.33

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Stator Housing Asm



\...
\Motor
\Drive Motor Asm
\Stator Housing Asm

Assembly Summary

Parts	4,079
Fasteners	0
Part Numbers	16
Steps	24,042
Fastenings	480
Right First Time	39.68 %
OEM Process Time (Min)	52.07
Supplier Process Time (Min)	244.64
Total Weight (kg)	25.69

Material Cost**	$167.54
OEM Process Cost	$73.67
Supplier Process Cost	$86.45
Q Burden	$13.86
SG&A	$59.51
Manufacturing Cost*	$401.03

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Stator Housing Asm

Stator Housing Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Stator Housing, Stator Housing Asm	1	1	0	133	0	99.68 %	0.00	5.58	0.00	12.81	4.7500
Stator Asm, Stator Housing Asm	1	4077	477	23838	477	39.98 %	45.29	0.00	0.00	229.56	20.5741
Assemble Stator Asm to Housing	1	0	2	6	2	99.82 %	0.35	0.60	0.00	0.00	0.0000
Bushing, Stator Housing Asm	1	1	0	58	0	99.84 %	0.00	0.00	0.00	2.27	0.3170
Assemble Bushing	1	0	1	4	1	99.91 %	0.25	0.00	0.00	0.00	0.0000

Stator Housing Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Stator Housing, Stator Housing Asm	$0.00	$11.33	$0.00	$7.58	$0.00	$7.04	$0.05	$5.97	$31.97
Stator Asm, Stator Housing Asm	$79.28	$76.32	$65.45	$0.00	$0.00	$77.53	$13.75	$52.82	$365.15
Assemble Stator Asm to Housing	$0.00	$0.00	$0.24	$0.23	$0.00	$0.00	$0.03	$0.11	$0.61
Bushing, Stator Housing Asm	$0.00	$0.61	$0.00	$0.00	$0.00	$1.88	$0.02	$0.57	$3.08
Assemble Bushing	$0.00	$0.00	$0.17	$0.00	$0.00	$0.00	$0.01	$0.04	$0.22

MUNRO & ASSOCIATES, INC.

Detailed Summary

Parts	4,079
Fasteners	0
Part Numbers	16
Steps	24,042
Fastenings	480
Right First Time	39.68%
OEM Asm. Time (Min)	45.89
OEM Fab. Time (Min)	6.18
Supplier Asm. Time (Min)	0.00
Supplier Fab. Time (Min)	244.64
Total Weight (kg)	25.69

Purchased Part Cost	$79.28
Material Cost	$88.26
OEM Asm. Cost	$65.86
OEM Fab. Cost	$7.81
Supplier Asm. Cost	$0.00
Supplier Fab. Cost	$86.45
Q Burden	$13.86
SG&A	$59.51
Manufacturing Cost*	$401.03

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Stator Housing, Stator Housing Asm

\...
\Stator Housing Asm
\Stator Housing, Stator Housing Asm
\Stator Housing Process

Process Summary

Right First Time	99.68 %
Process Time (Sec)	1103.26
Total Weight (kg)	4.75

Material Cost**	$11.33
OEM Process Cost	$7.58
Supplier Process Cost	$7.04
Q Burden	$0.05
SG&A	$5.97
Manufacturing Cost*	$31.97

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Stator Housing, Stator Housing Asm

MUNRO & ASSOCIATES, INC.

Stator Housing Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Dot Peen Marking	15.75	1	0.25	25.21	GER	$0.11	99.97 %	$0.00
Wash	14.00	1	0.25	93.52	GER	$0.36	99.99 %	$0.00
Deburr	14.00	1	0.25	53.58	GER	$0.21	99.99 %	$0.00
CNC Machining	290.91	1	0.25	85.35	GER	$6.90	99.83 %	$0.03
Heat Treat Step 2	396.00	1	0.25	9.23	POL	$1.02	99.99 %	$0.00
Heat Treat Step 1	288.00	1	0.25	45.38	POL	$3.63	99.99 %	$0.00
Wash	14.00	1	0.25	73.35	POL	$0.29	99.99 %	$0.00
Deburr	14.00	1	0.25	34.92	POL	$0.14	99.99 %	$0.00
60 Ton Trim Press	6.67	1	0.25	15.19	POL	$0.03	99.98 %	$0.00
1050 Ton Die Casting Press	49.93	1	1.00	140.58	POL	$1.95	99.99 %	$0.00

Stator Housing Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Stator Housing Asm, Stator Housing	1	A380	$2.27	4.7500	4.9880	$0.00	$11.33

Stator Asm, Stator Housing Asm

\...
\Drive Motor Asm
\Stator Housing Asm
\Stator Asm, Stator Housing Asm

Assembly Summary

Parts	4,077
Fasteners	0
Part Numbers	14
Steps	23,838
Fastenings	477
Right First Time	39.98 %
OEM Process Time (Min)	45.29
Supplier Process Time (Min)	229.56
Total Weight (kg)	20.57

Material Cost**	$155.60
OEM Process Cost	$65.45
Supplier Process Cost	$77.53
Q Burden	$13.75
SG&A	$52.82
Manufacturing Cost*	$365.15

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Stator Asm, Stator Housing Asm

MUNRO & ASSOCIATES, INC.

Stator Asm, Stator Housing Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Stator Laminate Asm, Stator Asm	6	636	0	3817	0	86.66 %	2.68	0.00	0.00	38.16	2.0352
Assemble Stator Asm	1	261	477	930	477	94.37 %	29.19	0.00	0.00	0.60	8.3629

Stator Asm, Stator Housing Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Stator Laminate Asm, Stator Asm	$0.00	$12.72	$2.14	$0.00	$0.00	$12.89	$2.15	$6.38	$36.28
Assemble Stator Asm	$79.28	$0.00	$52.64	$0.00	$0.00	$0.17	$0.87	$14.52	$147.48

Stator Asm, Stator Housing Asm

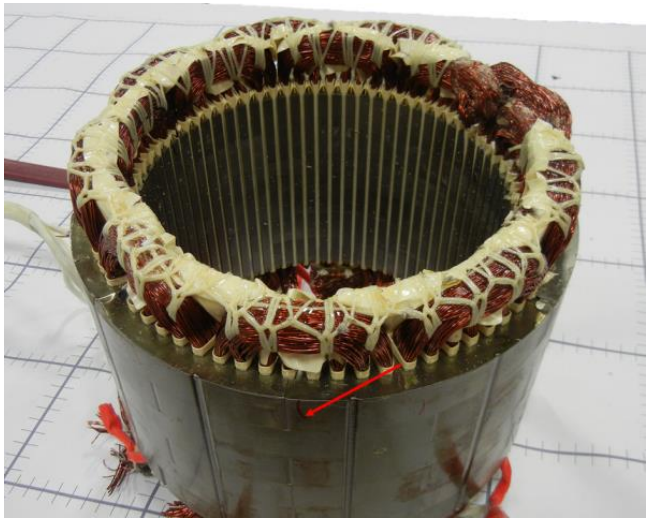
Detailed Summary

Parts	4,077
Fasteners	0
Part Numbers	14
Steps	23,838
Fastenings	477
Right First Time	39.98%
OEM Asm. Time (Min)	45.29
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	0.00
Supplier Fab. Time (Min)	229.56
Total Weight (kg)	20.57

Purchased Part Cost	$79.28
Material Cost	$76.32
OEM Asm. Cost	$65.45
OEM Fab. Cost	$0.00
Supplier Asm. Cost	$0.00
Supplier Fab. Cost	$77.53
Q Burden	$13.75
SG&A	$52.82
Manufacturing Cost*	$365.15

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Stator Laminate Asm, Stator Asm



\...
\Stator Housing Asm
\Stator Asm, Stator Housing Asm
\Stator Laminate Asm, Stator Asm

Assembly Summary

Parts	636
Fasteners	0
Part Numbers	1
Steps	3,817
Fastenings	0
Right First Time	86.66 %
OEM Process Time (Min)	2.68
Supplier Process Time (Min)	38.16
Total Weight (kg)	2.04

Material Cost**	$12.72
OEM Process Cost	$2.14
Supplier Process Cost	$12.89
Q Burden	$2.15
SG&A	$6.38
Manufacturing Cost*	$36.28

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Stator Laminate Asm, Stator Asm

MUNRO & ASSOCIATES, INC.

Stator Laminate Asm, Stator Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Stator Laminate, Stator Laminate Asm	636	1	0	4	0	99.98 %	0.00	0.00	0.00	0.06	0.0032
Assemble Stator Laminate Asm	1	0	0	637	0	98.42 %	2.68	0.00	0.00	0.00	0.0000

Stator Laminate Asm, Stator Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Stator Laminate, Stator Laminate Asm	$0.00	$0.02	$0.00	$0.00	$0.00	$0.02	$0.00	$0.01	$0.05
Assemble Stator Laminate Asm	$0.00	$0.00	$2.14	$0.00	$0.00	$0.00	$0.24	$0.49	$2.87

MUNRO & ASSOCIATES, INC.

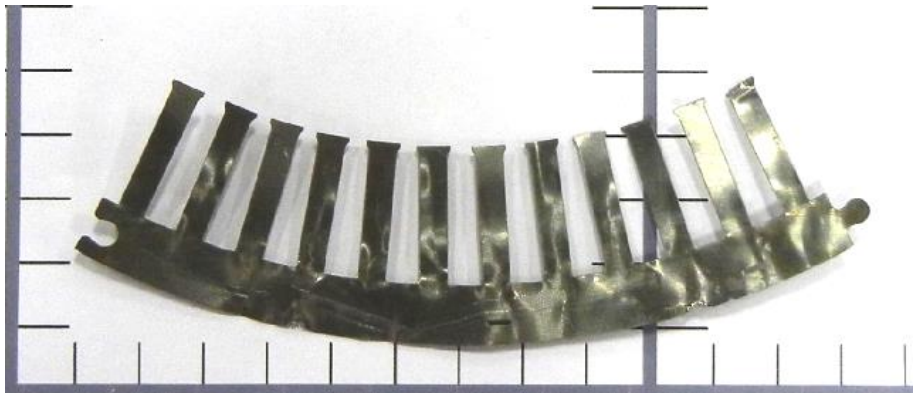
Detailed Summary

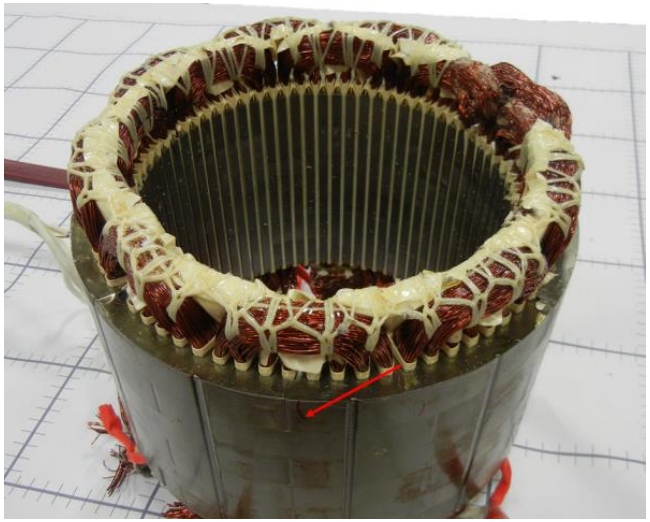
Parts	636
Fasteners	0
Part Numbers	1
Steps	3,817
Fastenings	0
Right First Time	86.66%
OEM Asm. Time (Min)	2.68
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	0.00
Supplier Fab. Time (Min)	38.16
Total Weight (kg)	2.04

Purchased Part Cost	$0.00
Material Cost	$12.72
OEM Asm. Cost	$2.14
OEM Fab. Cost	$0.00
Supplier Asm. Cost	$0.00
Supplier Fab. Cost	$12.89
Q Burden	$2.15
SG&A	$6.38
Manufacturing Cost*	$36.28

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Stator Laminate, Stator Laminate Asm





\...
\Stator Laminate Asm, Stator Asm
\Stator Laminate, Stator Laminate Asm
\Stator Laminate Process

Process Summary

Right First Time	99.98 %
Process Time (Sec)	3.60
Total Weight (kg)	0.00

Material Cost**	$0.02
OEM Process Cost	$0.00
Supplier Process Cost	$0.02
Q Burden	$0.00
SG&A	$0.01
Manufacturing Cost*	$0.05

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Stator Laminate, Stator Laminate Asm

MUNRO & ASSOCIATES, INC.

Stator Laminate Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	3.00	1	0.25	20.00	GER	$0.02	99.99 %	$0.00
25 Ton Stamping Press	0.60	1	0.25	21.63	GER	$0.00	99.99 %	$0.00

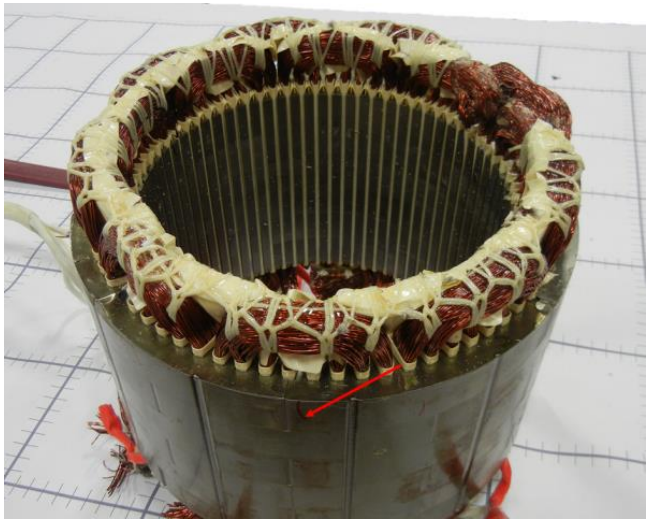
Stator Laminate Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Stator Laminate Asm, Stator Laminate	1	EM Steel	$1.65	0.0032	0.0133	$0.00	$0.02

Assemble Stator Laminate Asm

\...
\Stator Asm, Stator Housing Asm
\Stator Laminate Asm, Stator Asm
\Assemble Stator Laminate Asm

No Commodity Items Required for This Process



Process Summary

Right First Time	98.42 %
Process Time (Sec)	161.00
Total Weight (kg)	0.00

Material Cost**	$0.00
OEM Process Cost	$2.14
Supplier Process Cost	$0.00
Q Burden	$0.24
SG&A	$0.49
Manufacturing Cost*	$2.87

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Stator Laminate Asm

MUNRO & ASSOCIATES, INC.

Assemble Stator Laminate Asm

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Stack Laminate	161.00	1	0.25	47.75	GER	$2.14	98.42 %	$0.24

Assemble Stator Laminate Asm

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost

Assemble Stator Asm

\...
\Stator Housing Asm
\Stator Asm, Stator Housing Asm
\Assemble Stator Asm

Process Summary

Right First Time	94.37 %
Process Time (Sec)	1787.52
Total Weight (kg)	8.36

Material Cost**	$79.28
OEM Process Cost	$52.64
Supplier Process Cost	$0.17
Q Burden	$0.87
SG&A	$14.52
Manufacturing Cost*	$147.48

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Stator Asm

Assemble Stator Asm

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Test	16.00	1	0.25	35.77	GER	$0.16	99.99 %	$0.00
Resin Bath	36.00	1	0.25	213.55	GER	$2.14	99.98 %	$0.00
Lace Coils	153.00	1	0.25	40.13	GER	$1.71	98.54 %	$0.22
Form Coil Ends	18.00	1	0.25	38.76	GER	$0.19	99.68 %	$0.05
Fuse Leads to Coil	84.00	1	1.00	118.26	GER	$2.76	99.83 %	$0.03
Stator Insulation - Lead	985.00	1	1.00	94.66	GER	$25.90	98.26 %	$0.26
Stator Insulation - Slot	24.00	1	0.25	33.92	GER	$0.23	99.64 %	$0.05
Coil Winding	279.00	1	0.25	229.45	GER	$17.78	99.04 %	$0.14
Stator Insulation - Slot	78.00	1	0.25	33.92	GER	$0.73	99.64 %	$0.05
Heat Treat Laminate Stack	36.00	1	0.25	17.08	GER	$0.17	99.99 %	$0.00
Stack Laminate	78.52	1	0.25	47.75	GER	$1.04	99.68 %	$0.05

Assemble Stator Asm

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Stator Asm, Stitching	1	Commodity Item	Purchased	0.0180	-	$0.05	$0.00
Stator Asm, Stitching	1	Commodity Item	Purchased	0.0180	-	$0.05	$0.00
Stator Asm, Cable Crimp	6	Commodity Item	Purchased	0.0040	-	$0.25	$0.00
6 mm FabHeat Shrink Tubing x 112mm	18	Commodity Item	Purchased	0.0012	-	$0.04	$0.00
12 mm FabHeat Shrink Tubing x 57mm	6	Commodity Item	Purchased	0.0014	-	$0.03	$0.00
12 mm FabHeat Shrink Tubing x 28mm	6	Commodity Item	Purchased	0.0008	-	$0.01	$0.00
Stator Housing Asm, Coil Insulator	36	Commodity Item	Purchased	0.0014	-	$0.01	$0.00
Stator Housing Asm, Thermister Asm	1	Commodity Item	Purchased	0.0079	-	$1.45	$0.00
6 mm FabHeat Shrink Tubing x 442mm	18	Commodity Item	Purchased	0.0045	-	$0.14	$0.00
Stator Housing Asm, High Current Eyelet Connector	3	Commodity Item	Purchased	0.0281	-	$1.20	$0.00
12 mm FabHeat Shrink Tubing x 142	3	Commodity Item	Purchased	0.0037	-	$0.07	$0.00
Stator Outer Insulator	72	Commodity Item	Purchased	0.0017	-	$0.01	$0.00

Assemble Stator Asm to Housing

MUNRO & ASSOCIATES, INC.

No Commodity Items Required for This Process

\...
\Drive Motor Asm
\Stator Housing Asm
\Assemble Stator Asm to Housing

Process Summary

Right First Time	99.82 %
Process Time (Sec)	57.00
Total Weight (kg)	0.00

Material Cost**	$0.00
OEM Process Cost	$0.47
Supplier Process Cost	$0.00
Q Burden	$0.03
SG&A	$0.11
Manufacturing Cost*	$0.61

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Stator Asm to Housing

MUNRO & ASSOCIATES, INC.

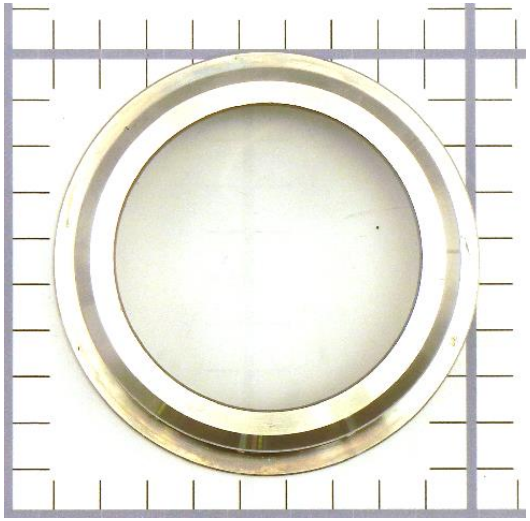
Assemble Stator Asm to Housing

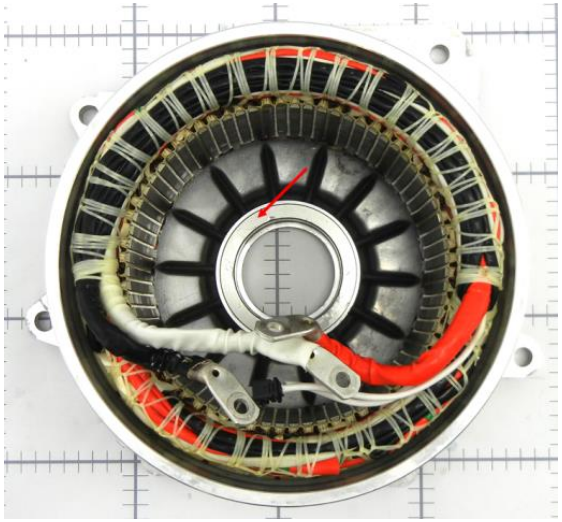
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Automated Asm	21.00	1	0.25	41.01	GER	$0.24	99.83 %	$0.03
Heat Expand Housing	36.00	1	0.25	23.29	GER	$0.23	99.99 %	$0.00

Assemble Stator Asm to Housing

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost

Bushing, Stator Housing Asm





\...
\Stator Housing Asm
\Bushing, Stator Housing Asm
\Bushing Process

Process Summary

Right First Time	99.84 %
Process Time (Sec)	136.08
Total Weight (kg)	0.32

Material Cost**	$0.61
OEM Process Cost	$0.00
Supplier Process Cost	$1.88
Q Burden	$0.02
SG&A	$0.57
Manufacturing Cost*	$3.08

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Bushing, Stator Housing Asm

MUNRO & ASSOCIATES, INC.

Bushing Process

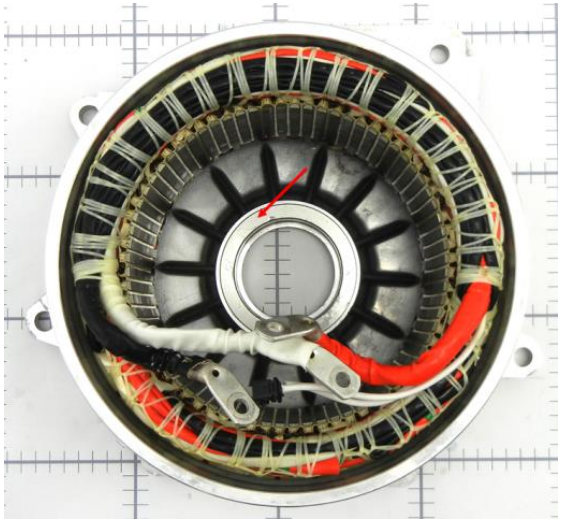
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Deburr	9.00	1	0.25	31.36	GER	$0.08	99.99 %	$0.00
CNC Machining	104.58	1	0.25	40.97	GER	$1.19	99.94 %	$0.01
25 Ton Trim Press	4.60	1	0.25	19.09	GER	$0.02	99.98 %	$0.00
500 Ton Forging Press	8.90	1	2.00	205.38	GER	$0.51	99.94 %	$0.01

Bushing Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Stator Housing Asm, Bushing	1	Steel 1045 - Bar Stock	$1.61	0.3170	0.3804	$0.00	$0.61

Assemble Bushing

No Commodity Items Required for This Process



\...
\Drive Motor Asm
\Stator Housing Asm
\Assemble Bushing

Process Summary

Right First Time	99.91 %
Process Time (Sec)	15.00
Total Weight (kg)	0.00

Material Cost**	$0.00
OEM Process Cost	$0.17
Supplier Process Cost	$0.00
Q Burden	$0.01
SG&A	$0.04
Manufacturing Cost*	$0.22

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Bushing

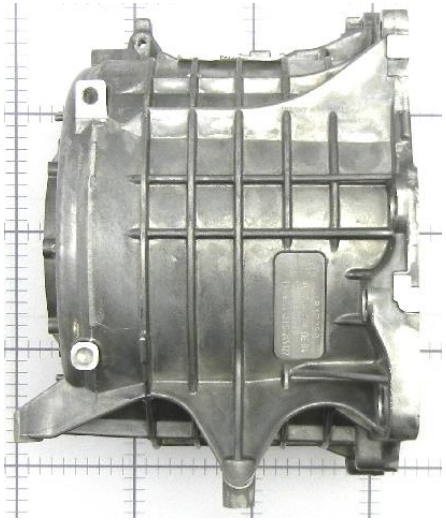
Assemble Bushing

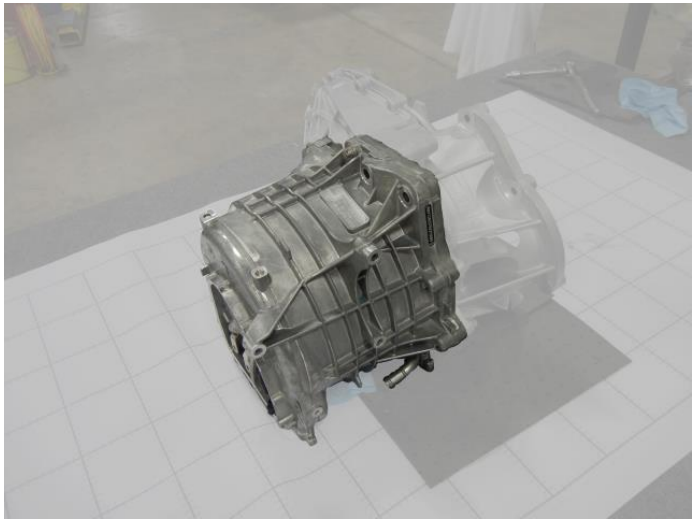
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Automated Asm	15.00	1	0.25	41.01	GER	$0.17	99.91 %	$0.01

Assemble Bushing

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost

Rotor Housing Asm





\...
\Motor
\Drive Motor Asm
\Rotor Housing Asm

Assembly Summary

Parts	609
Fasteners	14
Part Numbers	18
Steps	3,566
Fastenings	164
Right First Time	83.40 %
OEM Process Time (Min)	29.09
Supplier Process Time (Min)	67.98
Total Weight (kg)	21.80

Material Cost**	$286.85
OEM Process Cost	$25.65
Supplier Process Cost	$34.07
Q Burden	$2.72
SG&A	$36.09
Manufacturing Cost*	$385.39

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Rotor Housing Asm

MUNRO & ASSOCIATES, INC.

Rotor Housing Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Housing Asm, Rotor Housing Asm	1	9	8	329	8	98.26 %	1.08	13.91	0.00	16.56	6.9452
Rotor Asm, Rotor Housing Asm	1	582	151	3114	151	85.88 %	10.04	3.40	0.00	49.64	14.4286
Assemble Rotor Asm to Housing	1	1	2	6	2	99.78 %	0.30	0.00	0.00	0.00	0.3204
Speed Sensor Target Spacer, Rotor Housing Asm	1	1	0	24	0	99.92 %	0.00	0.00	0.00	0.77	0.0458
Assemble Speed Sensor Target Spacer	1	0	1	3	1	99.88 %	0.18	0.00	0.00	0.00	0.0000
Speed Sensor Target Asm, Rotor Housing Asm	1	16	1	83	1	99.38 %	0.00	0.00	0.24	0.78	0.0467
Assemble Speed Sensor Target	1	0	1	3	1	99.88 %	0.18	0.00	0.00	0.00	0.0000

Rotor Housing Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Housing Asm, Rotor Housing Asm	$4.55	$16.37	$0.73	$14.61	$0.00	$10.02	$0.26	$9.73	$56.28
Rotor Asm, Rotor Housing Asm	$201.84	$52.03	$7.97	$1.32	$0.00	$23.21	$2.28	$25.50	$314.16
Assemble Rotor Asm to Housing	$11.68	$0.00	$0.46	$0.00	$0.00	$0.00	$0.03	$0.46	$12.63
Speed Sensor Target Spacer, Rotor Housing Asm	$0.00	$0.09	$0.00	$0.00	$0.00	$0.48	$0.01	$0.13	$0.71
Assemble Speed Sensor Target Spacer	$0.00	$0.00	$0.28	$0.00	$0.00	$0.00	$0.02	$0.06	$0.36
Speed Sensor Target Asm, Rotor Housing Asm	$0.03	$0.26	$0.00	$0.00	$0.10	$0.26	$0.09	$0.14	$0.89
Assemble Speed Sensor Target	$0.00	$0.00	$0.28	$0.00	$0.00	$0.00	$0.02	$0.06	$0.36

MUNRO & ASSOCIATES, INC.

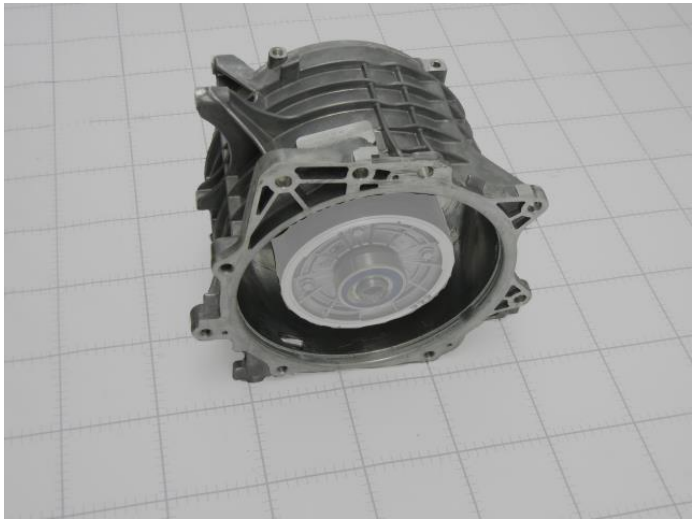
Detailed Summary

Parts	609
Fasteners	14
Part Numbers	18
Steps	3,566
Fastenings	164
Right First Time	83.4%
OEM Asm. Time (Min)	11.79
OEM Fab. Time (Min)	17.31
Supplier Asm. Time (Min)	0.24
Supplier Fab. Time (Min)	67.74
Total Weight (kg)	21.80

Purchased Part Cost	$218.10
Material Cost	$68.75
OEM Asm. Cost	$9.72
OEM Fab. Cost	$15.93
Supplier Asm. Cost	$0.10
Supplier Fab. Cost	$33.97
Q Burden	$2.72
SG&A	$36.09
Manufacturing Cost*	$385.39

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Housing Asm, Rotor Housing Asm



\...
\Drive Motor Asm
\Rotor Housing Asm
\Housing Asm, Rotor Housing Asm

Assembly Summary

Parts	9
Fasteners	3
Part Numbers	6
Steps	329
Fastenings	8
Right First Time	98.26 %
OEM Process Time (Min)	14.99
Supplier Process Time (Min)	16.56
Total Weight (kg)	6.95

Material Cost**	$20.92
OEM Process Cost	$15.35
Supplier Process Cost	$10.02
Q Burden	$0.26
SG&A	$9.73
Manufacturing Cost*	$56.28

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Housing Asm, Rotor Housing Asm

MUNRO & ASSOCIATES, INC.

Housing Asm, Rotor Housing Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Housing, Rotor Housing Asm	1	1	0	265	0	99.31 %	0.00	13.91	0.00	15.83	6.7240
90 Deg Tube, Rotor Housing Asm	2	1	0	17	0	99.90 %	0.00	0.00	0.00	0.36	0.0454
Assemble Rotor Housing Asm	1	6	8	27	8	99.14 %	1.08	0.00	0.00	0.00	0.1304

Housing Asm, Rotor Housing Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Housing, Rotor Housing Asm	$0.00	$16.03	$0.00	$14.61	$0.00	$9.66	$0.10	$9.27	$49.67
90 Deg Tube, Rotor Housing Asm	$0.00	$0.17	$0.00	$0.00	$0.00	$0.18	$0.02	$0.08	$0.45
Assemble Rotor Housing Asm	$4.55	$0.00	$0.73	$0.00	$0.00	$0.00	$0.13	$0.31	$5.72

MUNRO & ASSOCIATES, INC.

Detailed Summary

Parts	9
Fasteners	3
Part Numbers	6
Steps	329
Fastenings	8
Right First Time	98.26%
OEM Asm. Time (Min)	1.08
OEM Fab. Time (Min)	13.91
Supplier Asm. Time (Min)	0.00
Supplier Fab. Time (Min)	16.56
Total Weight (kg)	6.95

Purchased Part Cost	$4.55
Material Cost	$16.37
OEM Asm. Cost	$0.73
OEM Fab. Cost	$14.61
Supplier Asm. Cost	$0.00
Supplier Fab. Cost	$10.02
Q Burden	$0.26
SG&A	$9.73
Manufacturing Cost*	$56.28

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Housing, Rotor Housing Asm

\...
\Housing Asm, Rotor Housing Asm
\Housing, Rotor Housing Asm
\Housing Process

Process Summary

Right First Time	99.31 %
Process Time (Sec)	1784.40
Total Weight (kg)	6.72

Material Cost**	$16.03
OEM Process Cost	$14.61
Supplier Process Cost	$9.66
Q Burden	$0.10
SG&A	$9.27
Manufacturing Cost*	$49.67

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Housing, Rotor Housing Asm

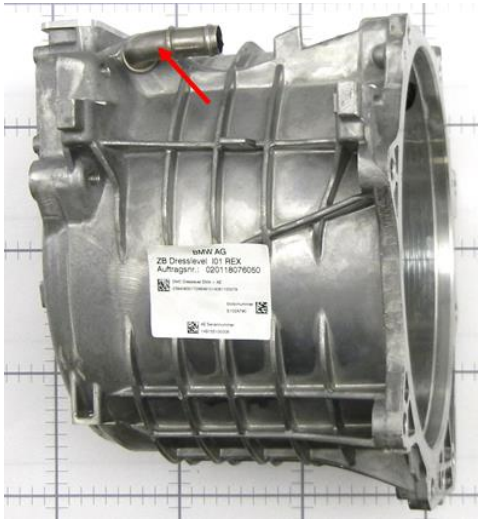
Housing Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Dot Peen Marking	11.75	1	0.25	25.21	GER	$0.08	99.97 %	$0.00
Wash	14.00	1	0.25	93.52	GER	$0.36	99.99 %	$0.00
Deburr	14.00	1	0.25	53.58	GER	$0.21	99.99 %	$0.00
CNC Machining	794.65	1	0.25	63.23	GER	$13.96	99.45 %	$0.08
Heat Treat Step 2	495.00	1	0.25	9.23	POL	$1.27	99.99 %	$0.00
Heat Treat Step 1	360.00	1	0.25	45.38	POL	$4.54	99.99 %	$0.00
Wash	14.00	1	0.25	73.35	POL	$0.29	99.99 %	$0.00
Deburr	14.00	1	0.25	34.92	POL	$0.14	99.99 %	$0.00
25 Ton Trim Press	6.67	1	0.25	11.86	POL	$0.02	99.98 %	$0.00
1800 Ton Die Casting Press	60.33	1	2.00	203.23	POL	$3.41	99.99 %	$0.00

Housing Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Rotor Housing Asm, Housing	1	A380	$2.27	6.7240	7.0600	$0.00	$16.03

90 Deg Tube, Rotor Housing Asm



\...
\Housing Asm, Rotor Housing Asm
\90 Deg Tube, Rotor Housing Asm
\90 Deg Tube Process

Process Summary

Right First Time	99.90 %
Process Time (Sec)	21.72
Total Weight (kg)	0.05

Material Cost**	$0.17
OEM Process Cost	$0.00
Supplier Process Cost	$0.18
Q Burden	$0.02
SG&A	$0.08
Manufacturing Cost*	$0.45

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

90 Deg Tube, Rotor Housing Asm

90 Deg Tube Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	3.00	1	0.25	20.00	GER	$0.02	99.99 %	$0.00
Deburr	3.00	1	0.25	12.36	GER	$0.01	99.99 %	$0.00
CNC Tube Bender	15.72	1	0.25	34.94	GER	$0.15	99.92 %	$0.01

90 Deg Tube Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Rotor Housing Asm, 90 Deg Tube	1	Aluminum 6061 - Seamless Tube	$3.64	0.0454	0.0467	$0.00	$0.17

Assemble Rotor Housing Asm

\...
\Rotor Housing Asm
\Housing Asm, Rotor Housing Asm
\Assemble Rotor Housing Asm

Process Summary

Right First Time	99.14 %
Process Time (Sec)	64.74
Total Weight (kg)	0.13

Material Cost**	$4.55
OEM Process Cost	$0.73
Supplier Process Cost	$0.00
Q Burden	$0.13
SG&A	$0.31
Manufacturing Cost*	$5.72

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Rotor Housing Asm

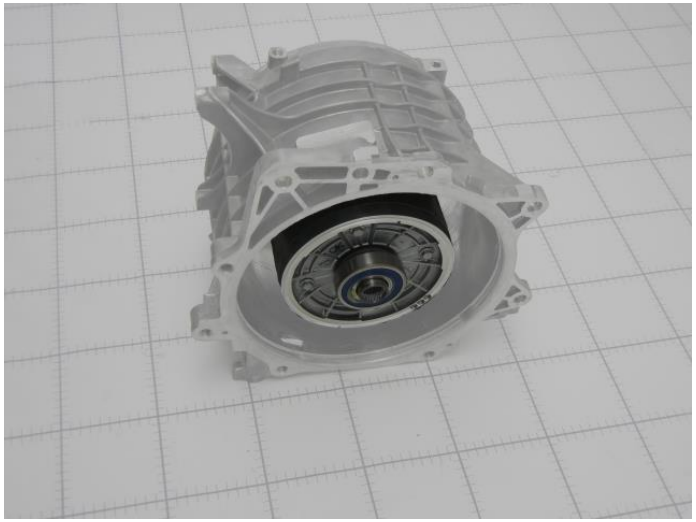
Assemble Rotor Housing Asm

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Automated Asm	33.74	1	0.25	41.01	GER	$0.38	99.36 %	$0.10
OEM Automated Asm	14.00	1	0.25	41.01	GER	$0.16	99.95 %	$0.01
OEM Automated Press	17.00	1	0.25	40.44	GER	$0.19	99.83 %	$0.03

Assemble Rotor Housing Asm

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Rotor Housing Asm, Threaded Insert	3	Commodity Item	Purchased	0.0036	-	$0.10	$0.00
Label, QR Code, Rotor Housing Asm	1	Commodity Item	Purchased	0.0001	-	$0.07	$0.00
Rotor housing Asm, Bearing	1	Commodity Item	Purchased	0.1105	-	$4.03	$0.00
Rotor Housing Asm, Snap Ring	1	Commodity Item	Purchased	0.0090	-	$0.15	$0.00

Rotor Asm, Rotor Housing Asm



\...
\Drive Motor Asm
\Rotor Housing Asm
\Rotor Asm, Rotor Housing Asm

Assembly Summary

Parts	582
Fasteners	8
Part Numbers	8
Steps	3,114
Fastenings	151
Right First Time	85.88 %
OEM Process Time (Min)	13.44
Supplier Process Time (Min)	49.64
Total Weight (kg)	14.43

Material Cost**	$253.87
OEM Process Cost	$9.29
Supplier Process Cost	$23.21
Q Burden	$2.28
SG&A	$25.50
Manufacturing Cost*	$314.16

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Rotor Asm, Rotor Housing Asm

Rotor Asm, Rotor Housing Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
End Cap, Rotor Asm	2	1	0	39	0	99.87 %	0.00	0.00	0.00	1.05	0.4650
Rotor Laminate Asm, Rotor Asm	6	95	24	483	24	97.80 %	1.26	0.57	0.00	6.63	1.9820
Assemble End Caps to Laminate Asm	1	8	5	30	5	98.93 %	2.18	0.00	0.00	0.00	0.1556
Spindle, Rotor Asm	1	1	0	90	0	99.59 %	0.00	0.00	0.00	7.71	1.4500
Assemble Spindle	1	0	1	4	1	99.91 %	0.18	0.00	0.00	0.00	0.0000
Output Shaft Cap, Rotor Asm	1	1	0	1	0	99.99 %	0.00	0.00	0.00	0.06	0.0010
Assemble Output Shaft Cap	1	0	1	3	1	99.98 %	0.10	0.00	0.00	0.00	0.0000

Rotor Asm, Rotor Housing Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
End Cap, Rotor Asm	$0.00	$1.09	$0.00	$0.00	$0.00	$0.99	$0.02	$0.48	$2.57
Rotor Laminate Asm, Rotor Asm	$33.48	$7.10	$0.99	$0.22	$0.00	$2.23	$0.33	$3.43	$47.78
Assemble End Caps to Laminate Asm	$0.96	$0.00	$1.79	$0.00	$0.00	$0.00	$0.16	$0.44	$3.35
Spindle, Rotor Asm	$0.00	$7.24	$0.00	$0.00	$0.00	$7.85	$0.06	$3.47	$18.62
Assemble Spindle	$0.00	$0.00	$0.18	$0.00	$0.00	$0.00	$0.01	$0.04	$0.24
Output Shaft Cap, Rotor Asm	$0.00	$0.01	$0.00	$0.00	$0.00	$0.02	$0.00	$0.01	$0.04
Assemble Output Shaft Cap	$0.00	$0.00	$0.07	$0.00	$0.00	$0.00	$0.00	$0.02	$0.09

Rotor Asm, Rotor Housing Asm

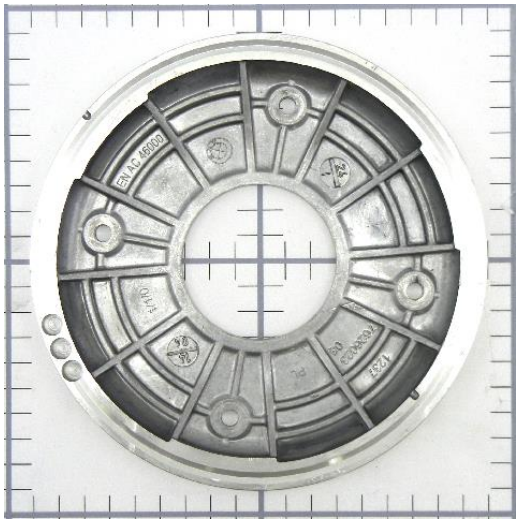
Detailed Summary

Parts	582
Fasteners	8
Part Numbers	8
Steps	3,114
Fastenings	151
Right First Time	85.88%
OEM Asm. Time (Min)	10.04
OEM Fab. Time (Min)	3.40
Supplier Asm. Time (Min)	0.00
Supplier Fab. Time (Min)	49.64
Total Weight (kg)	14.43

Purchased Part Cost	$201.84
Material Cost	$52.03
OEM Asm. Cost	$7.97
OEM Fab. Cost	$1.32
Supplier Asm. Cost	$0.00
Supplier Fab. Cost	$23.21
Q Burden	$2.28
SG&A	$25.50
Manufacturing Cost*	$314.16

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

End Cap, Rotor Asm



\...
\Rotor Asm, Rotor Housing Asm
\End Cap, Rotor Asm
\End Cap Process

Process Summary

Right First Time	99.87 %
Process Time (Sec)	63.15
Total Weight (kg)	0.47

Material Cost**	$1.09
OEM Process Cost	$0.00
Supplier Process Cost	$0.99
Q Burden	$0.02
SG&A	$0.48
Manufacturing Cost*	$2.57

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

End Cap, Rotor Asm

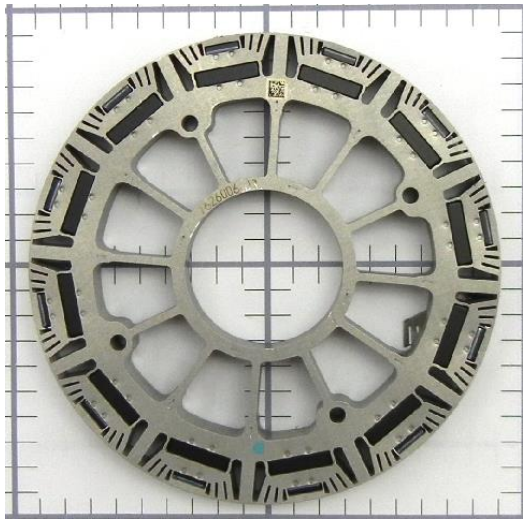
End Cap Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	5.00	1	0.25	30.69	GER	$0.04	99.99 %	$0.00
Deburr	4.00	1	0.25	21.70	GER	$0.02	99.99 %	$0.00
CNC Machining	26.18	1	0.25	40.97	GER	$0.30	99.94 %	$0.01
Wash	5.00	1	0.25	30.69	GER	$0.04	99.99 %	$0.00
Deburr	4.00	1	0.25	21.70	GER	$0.02	99.99 %	$0.00
60 Ton Trim Press	5.00	1	0.25	22.68	GER	$0.03	99.98 %	$0.00
530 Ton Die Casting Press	27.94	2	1.00	134.99	GER	$0.52	99.99 %	$0.00

End Cap Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Rotor Asm, End Cap	1	A380	$2.27	0.4650	0.4790	$0.00	$1.09

Rotor Laminate Asm, Rotor Asm



\...
\Rotor Housing Asm
\Rotor Asm, Rotor Housing Asm
\Rotor Laminate Asm, Rotor Asm

Assembly Summary

Parts	95
Fasteners	0
Part Numbers	3
Steps	483
Fastenings	24
Right First Time	97.80 %
OEM Process Time (Min)	1.83
Supplier Process Time (Min)	6.63
Total Weight (kg)	1.98

Material Cost**	$40.58
OEM Process Cost	$1.21
Supplier Process Cost	$2.23
Q Burden	$0.33
SG&A	$3.43
Manufacturing Cost*	$47.78

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Rotor Laminate Asm, Rotor Asm

MUNRO & ASSOCIATES, INC.

Rotor Laminate Asm, Rotor Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Rotor Laminate Stack, Rotor Laminate Asm	1	71	0	430	0	98.40 %	0.33	0.57	0.00	6.63	1.6472
Assemble Rotor Laminate Asm	1	24	24	52	24	99.39 %	0.93	0.00	0.00	0.00	0.3348

Rotor Laminate Asm, Rotor Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Rotor Laminate Stack, Rotor Laminate Asm	$0.00	$7.10	$0.29	$0.22	$0.00	$2.23	$0.24	$2.26	$12.35
Assemble Rotor Laminate Asm	$33.48	$0.00	$0.70	$0.00	$0.00	$0.00	$0.09	$1.16	$35.43

MUNRO & ASSOCIATES, INC.

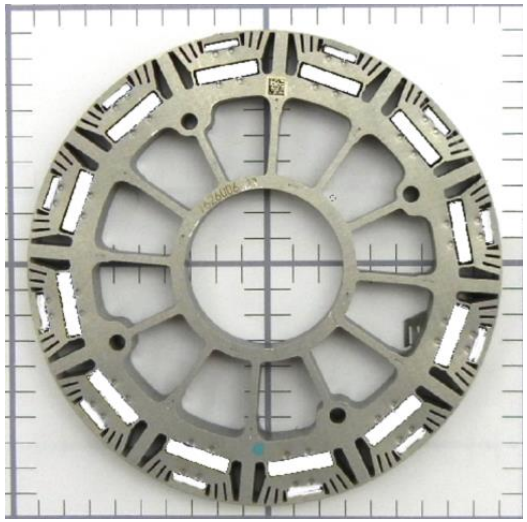
Detailed Summary

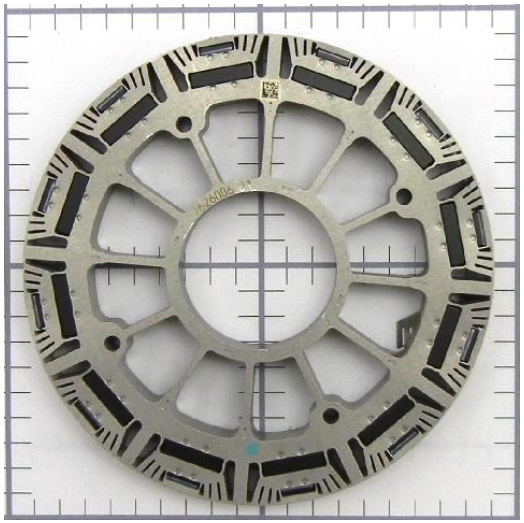
Parts	95
Fasteners	0
Part Numbers	3
Steps	483
Fastenings	24
Right First Time	97.8%
OEM Asm. Time (Min)	1.26
OEM Fab. Time (Min)	0.57
Supplier Asm. Time (Min)	0.00
Supplier Fab. Time (Min)	6.63
Total Weight (kg)	1.98

Purchased Part Cost	$33.48
Material Cost	$7.10
OEM Asm. Cost	$0.99
OEM Fab. Cost	$0.22
Supplier Asm. Cost	$0.00
Supplier Fab. Cost	$2.23
Q Burden	$0.33
SG&A	$3.43
Manufacturing Cost*	$47.78

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Rotor Laminate Stack, Rotor Laminate Asm





\...
\Rotor Asm, Rotor Housing Asm
\Rotor Laminate Asm, Rotor Asm
\Rotor Laminate Stack, Rotor Laminate Asm

Assembly Summary

Parts	71
Fasteners	0
Part Numbers	1
Steps	430
Fastenings	0
Right First Time	98.40 %
OEM Process Time (Min)	0.90
Supplier Process Time (Min)	6.63
Total Weight (kg)	1.65

Material Cost**	$7.10
OEM Process Cost	$0.51
Supplier Process Cost	$2.23
Q Burden	$0.24
SG&A	$2.26
Manufacturing Cost*	$12.35

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

MUNRO & ASSOCIATES, INC.

Rotor Laminate Stack, Rotor Laminate Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Rotor Laminate Plate, Rotor Laminate Stack	71	1	0	4	0	99.98 %	0.00	0.00	0.00	0.09	0.0232
Assemble Rotor Laminate Stack	1	0	0	75	0	99.81 %	0.33	0.57	0.00	0.00	0.0000

Rotor Laminate Stack, Rotor Laminate Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Rotor Laminate Plate, Rotor Laminate Stack	$0.00	$0.10	$0.00	$0.00	$0.00	$0.03	$0.00	$0.03	$0.16
Assemble Rotor Laminate Stack	$0.00	$0.00	$0.29	$0.22	$0.00	$0.00	$0.03	$0.12	$0.66

MUNRO & ASSOCIATES, INC.

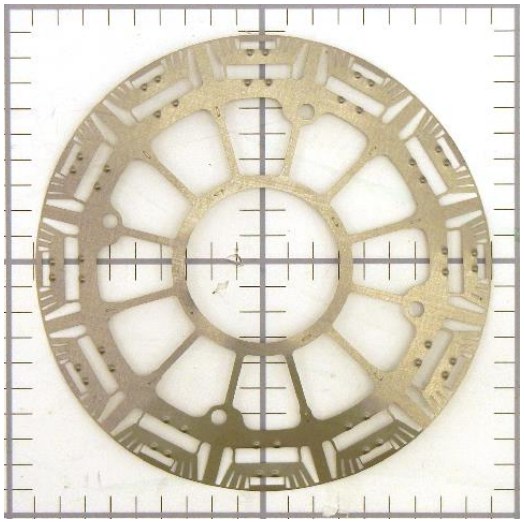
Detailed Summary

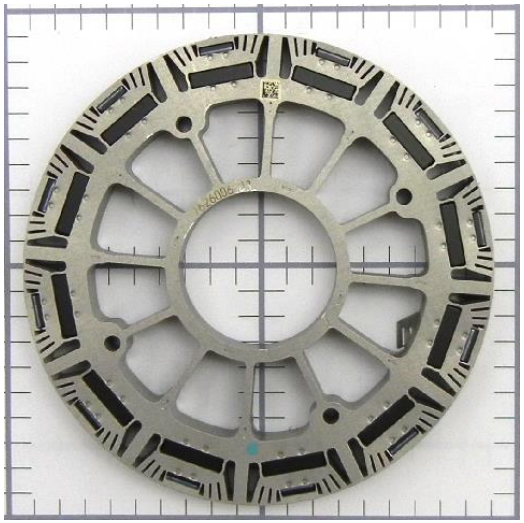
Parts	71
Fasteners	0
Part Numbers	1
Steps	430
Fastenings	0
Right First Time	98.4%
OEM Asm. Time (Min)	0.33
OEM Fab. Time (Min)	0.57
Supplier Asm. Time (Min)	0.00
Supplier Fab. Time (Min)	6.63
Total Weight (kg)	1.65

Purchased Part Cost	$0.00
Material Cost	$7.10
OEM Asm. Cost	$0.29
OEM Fab. Cost	$0.22
Supplier Asm. Cost	$0.00
Supplier Fab. Cost	$2.23
Q Burden	$0.24
SG&A	$2.26
Manufacturing Cost*	$12.35

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Rotor Laminate Plate, Rotor Laminate Stack





\...
\Rotor Laminate Stack, Rotor Laminate Asm
\Rotor Laminate Plate, Rotor Laminate Stack
\Rotor Laminate Plate Process

Process Summary

Right First Time	99.98 %
Process Time (Sec)	5.60
Total Weight (kg)	0.02

Material Cost**	$0.10
OEM Process Cost	$0.00
Supplier Process Cost	$0.03
Q Burden	$0.00
SG&A	$0.03
Manufacturing Cost*	$0.16

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Rotor Laminate Plate, Rotor Laminate Stack

MUNRO & ASSOCIATES, INC.

Rotor Laminate Plate Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	5.00	1	0.25	20.00	GER	$0.03	99.99 %	$0.00
25 Ton Stamping Press	0.60	1	0.25	21.63	GER	$0.00	99.99 %	$0.00

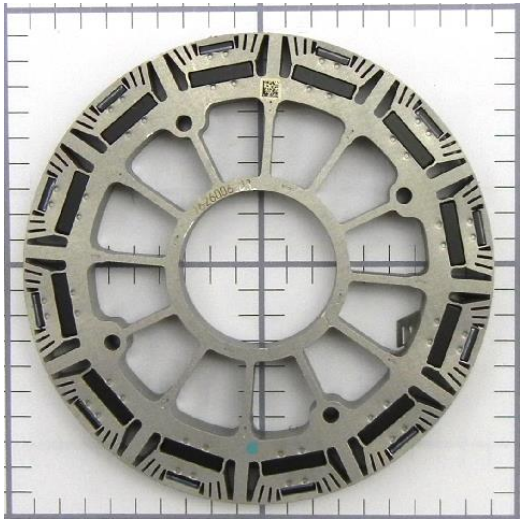
Rotor Laminate Plate Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Rotor Asm, Rotor Lamination Plate	1	EM Steel	$1.65	0.0232	0.0630	$0.00	$0.10

Assemble Rotor Laminate Stack

MUNRO & ASSOCIATES, INC.

No Commodity Items Required for This Process



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\Rotor Laminate Asm, Rotor Asm
\Rotor Laminate Stack, Rotor Laminate Asm
\Assemble Rotor Laminate Stack

Process Summary

Right First Time	99.81 %
Process Time (Sec)	53.75
Total Weight (kg)	0.00

Material Cost**	$0.00
OEM Process Cost	$0.51
Supplier Process Cost	$0.00
Q Burden	$0.03
SG&A	$0.12
Manufacturing Cost*	$0.66

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Rotor Laminate Stack

MUNRO & ASSOCIATES, INC.

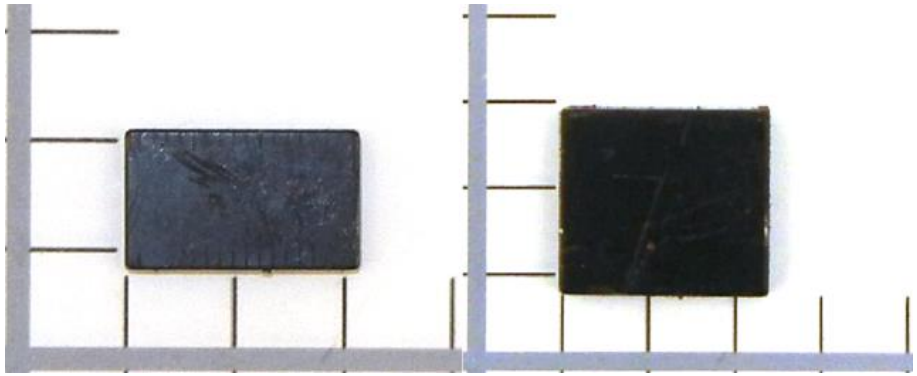
Assemble Rotor Laminate Stack

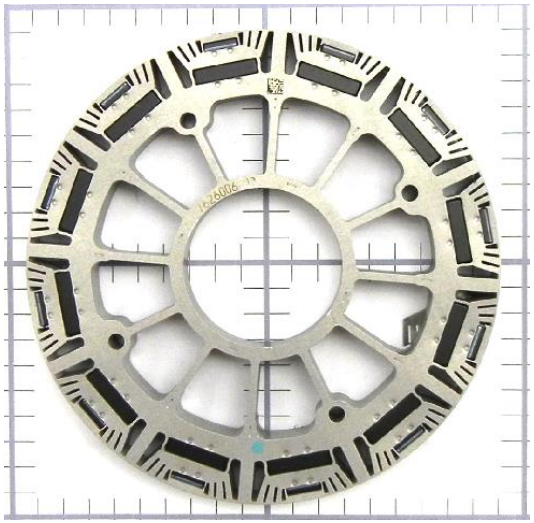
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Build Rotor Core	19.75	1	0.25	53.14	GER	$0.29	99.82 %	$0.03
Heat Treat Laminate Stack	34.00	1	0.25	23.29	GER	$0.22	99.99 %	$0.00

Assemble Rotor Laminate Stack

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost

Assemble Rotor Laminate Asm





\...
\Rotor Asm, Rotor Housing Asm
\Rotor Laminate Asm, Rotor Asm
\Assemble Rotor Laminate Asm

Process Summary

Right First Time	99.39 %
Process Time (Sec)	56.00
Total Weight (kg)	0.33

Material Cost**	$33.48
OEM Process Cost	$0.70
Supplier Process Cost	$0.00
Q Burden	$0.09
SG&A	$1.16
Manufacturing Cost*	$35.43

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Rotor Laminate Asm

MUNRO & ASSOCIATES, INC.

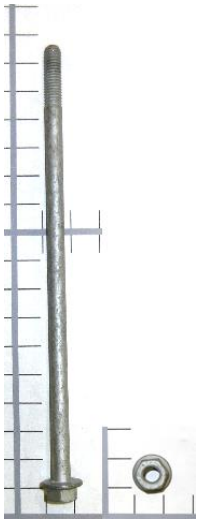
Assemble Rotor Laminate Asm

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Load Magnets	28.00	1	0.25	44.82	GER	$0.35	99.70 %	$0.05
Load Magnets	28.00	1	0.25	44.82	GER	$0.35	99.70 %	$0.05

Assemble Rotor Laminate Asm

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Rotor Asm, Small N30SH - N45SH Magnet	12	Commodity Item	Purchased	0.0061	-	$0.61	$0.00
Rotor Asm, Large N30SH - N45SH Magnet	12	Commodity Item	Purchased	0.0218	-	$2.18	$0.00

Assemble End Caps to Laminate Asm



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\Rotor Housing Asm
\Rotor Asm, Rotor Housing Asm
\Assemble End Caps to Laminate Asm

Process Summary

Right First Time	98.93 %
Process Time (Sec)	131.00
Total Weight (kg)	0.16

Material Cost**	$0.96
OEM Process Cost	$1.79
Supplier Process Cost	$0.00
Q Burden	$0.16
SG&A	$0.44
Manufacturing Cost*	$3.35

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble End Caps to Laminate Asm

MUNRO & ASSOCIATES, INC.

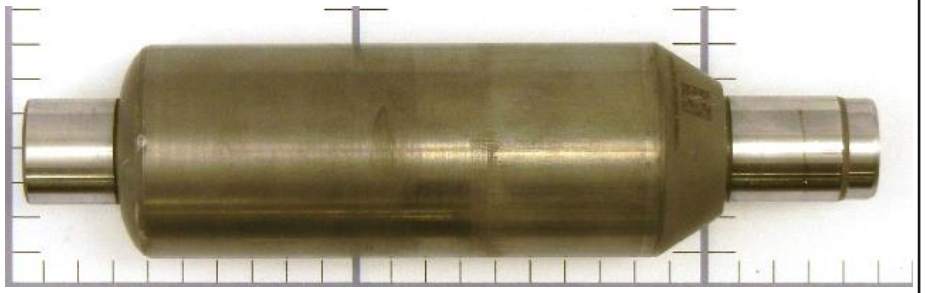
Assemble End Caps to Laminate Asm

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Balance Rotor	34.00	1	0.25	46.50	GER	$0.44	99.92 %	$0.01
Magnetize Rotor	14.00	1	0.25	44.82	GER	$0.17	99.96 %	$0.01
Rotor Asm	83.00	1	0.25	50.94	GER	$1.17	99.06 %	$0.14

Assemble End Caps to Laminate Asm

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
M6x150mm- Hex Flange Bolt	4	Commodity Item	Purchased	0.0357	-	$0.23	$0.00
M6x6- Hex Flange Nut	4	Commodity Item	Purchased	0.0032	-	$0.01	$0.00

Spindle, Rotor Asm



\...
\Rotor Asm, Rotor Housing Asm
\Spindle, Rotor Asm
\Spindle Process

Process Summary

Right First Time	99.59 %
Process Time (Sec)	462.80
Total Weight (kg)	1.45

Material Cost**	$7.24
OEM Process Cost	$0.00
Supplier Process Cost	$7.85
Q Burden	$0.06
SG&A	$3.47
Manufacturing Cost*	$18.62

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Spindle, Rotor Asm

Spindle Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Grind	47.37	1	0.25	50.01	GER	$0.66	99.93 %	$0.01
Temper	5.59	1	0.25	19.29	GER	$0.03	100.00 %	$0.00
Quench	1.42	1	0.25	25.28	GER	$0.01	100.00 %	$0.00
Carburize	50.42	1	0.25	167.44	GER	$2.35	100.00 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Grind	135.49	1	0.25	50.01	GER	$1.88	99.91 %	$0.01
Deburr	9.00	1	0.25	31.36	GER	$0.08	99.99 %	$0.00
14 Ton Broaching Press	11.96	1	1.00	46.85	GER	$0.16	99.99 %	$0.00
14 Ton Broaching Press	11.81	1	1.00	46.85	GER	$0.15	99.99 %	$0.00
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Deburr	9.00	1	0.25	31.36	GER	$0.08	99.99 %	$0.00

Spindle Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Rotor Asm, Spindle	1	Steel 4140 - Seamless Tube	$2.23	1.4500	3.2400	$0.00	$7.24

Spindle, Rotor Asm

Spindle Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
CNC Machining	117.17	1	0.25	40.97	GER	$1.33	99.92 %	$0.01
Cut Blank	12.00	1	0.25	30.34	GER	$0.10	99.95 %	$0.01
1000 Ton Hydroform Press	19.07	1	0.50	140.67	GER	$0.75	99.99 %	$0.00
Cut Blank	7.50	1	0.25	30.34	GER	$0.06	99.98 %	$0.00

Assemble Spindle

MUNRO & ASSOCIATES, INC.

No Commodity Items Required for This Process

\...
\Rotor Housing Asm
\Rotor Asm, Rotor Housing Asm
\Assemble Spindle

Process Summary

Right First Time	99.91 %
Process Time (Sec)	11.00
Total Weight (kg)	0.00

Material Cost**	$0.00
OEM Process Cost	$0.18
Supplier Process Cost	$0.00
Q Burden	$0.01
SG&A	$0.04
Manufacturing Cost*	$0.24

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Spindle

MUNRO & ASSOCIATES, INC.

Assemble Spindle

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Automated Press	11.00	1	0.25	59.49	GER	$0.18	99.91 %	$0.01

Assemble Spindle

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost

Output Shaft Cap, Rotor Asm

\...
\Rotor Asm, Rotor Housing Asm
\Output Shaft Cap, Rotor Asm
\Output Shaft Cap Process

Process Summary

Right First Time	99.99 %
Process Time (Sec)	3.59
Total Weight (kg)	0.00

Material Cost**	$0.01
OEM Process Cost	$0.00
Supplier Process Cost	$0.02
Q Burden	$0.00
SG&A	$0.01
Manufacturing Cost*	$0.04

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Output Shaft Cap, Rotor Asm

MUNRO & ASSOCIATES, INC.

Output Shaft Cap Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
55 Ton Injection Molding Press	14.36	4	0.25	23.71	GER	$0.02	99.99 %	$0.00

Output Shaft Cap Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Rotor Asm, Output Shaft Cap	1	PP TD20	$2.54	0.0010	0.0010	$0.00	$0.01

Assemble Output Shaft Cap

MUNRO & ASSOCIATES, INC.

No Commodity Items Required for This Process

\...
\Rotor Housing Asm
\Rotor Asm, Rotor Housing Asm
\Assemble Output Shaft Cap

Process Summary

Right First Time	99.98 %
Process Time (Sec)	6.00
Total Weight (kg)	0.00

Material Cost**	$0.00
OEM Process Cost	$0.07
Supplier Process Cost	$0.00
Q Burden	$0.00
SG&A	$0.02
Manufacturing Cost*	$0.09

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Output Shaft Cap

MUNRO & ASSOCIATES, INC.

Assemble Output Shaft Cap

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Automated Asm	6.00	1	0.25	41.01	GER	$0.07	99.98 %	$0.00

Assemble Output Shaft Cap

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost

Assemble Rotor Asm to Housing

\...
\Drive Motor Asm
\Rotor Housing Asm
\Assemble Rotor Asm to Housing

Process Summary

Right First Time	99.78 %
Process Time (Sec)	18.00
Total Weight (kg)	0.32

Material Cost**	$11.68
OEM Process Cost	$0.46
Supplier Process Cost	$0.00
Q Burden	$0.03
SG&A	$0.46
Manufacturing Cost*	$12.63

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Rotor Asm to Housing

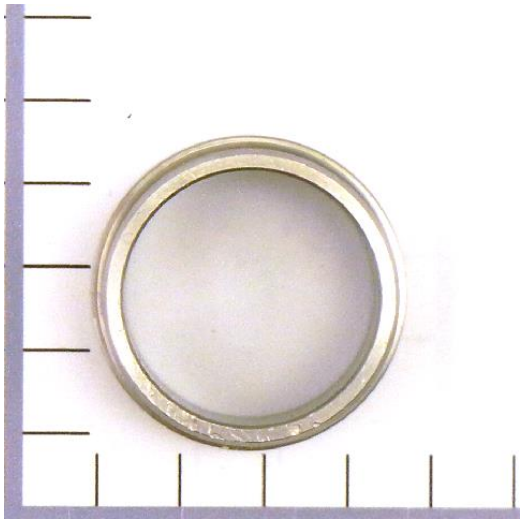
Assemble Rotor Asm to Housing

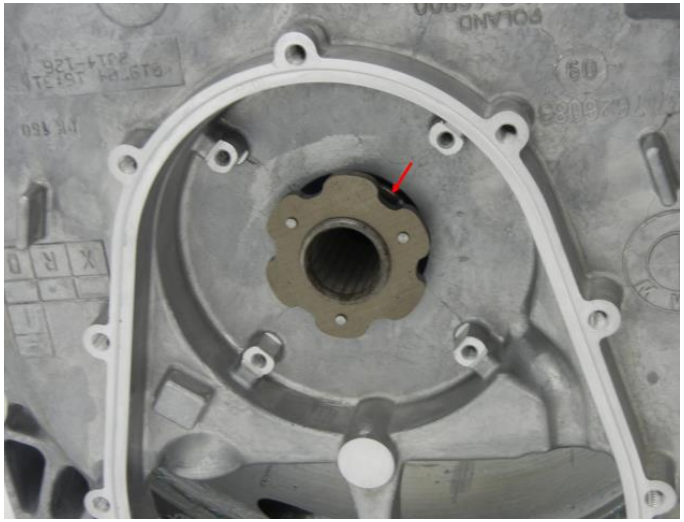
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	18.00	1	1.00	91.41	GER	$0.46	99.78 %	$0.03

Assemble Rotor Asm to Housing

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Rotor Bearing	1	Commodity Item	Purchased	0.3204	-	$11.68	$0.00

Speed Sensor Target Spacer, Rotor Housing Asm





\...
\Rotor Housing Asm
\Speed Sensor Target Spacer, Rotor Housing Asm
\Speed Sensor Target Spacer Process

Process Summary

Right First Time	99.92 %
Process Time (Sec)	46.16
Total Weight (kg)	0.05

Material Cost**	$0.09
OEM Process Cost	$0.00
Supplier Process Cost	$0.48
Q Burden	$0.01
SG&A	$0.13
Manufacturing Cost*	$0.71

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Speed Sensor Target Spacer, Rotor Housing Asm

Speed Sensor Target Spacer Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Deburr	9.00	1	0.25	31.36	GER	$0.08	99.99 %	$0.00
CNC Machining	28.16	1	0.25	40.97	GER	$0.32	99.94 %	$0.01

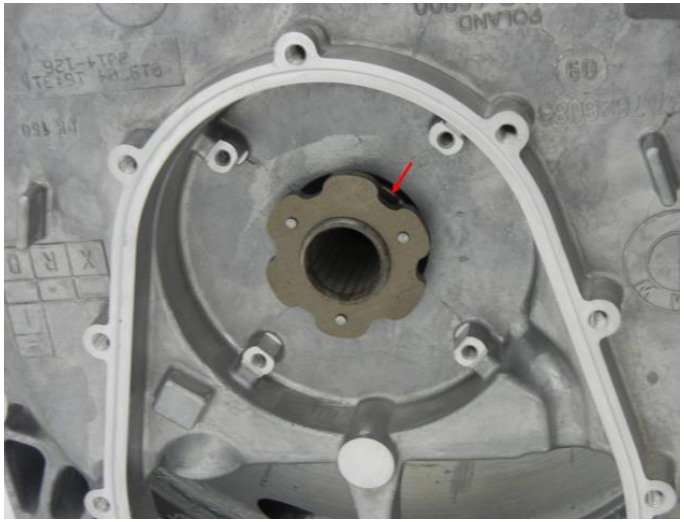
Speed Sensor Target Spacer Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Rotor Housing, Speed Sensor Target Space	1	Steel 1045 - Bar Stock	$1.61	0.0458	0.0550	$0.00	$0.09

Assemble Speed Sensor Target Spacer

\...
\Drive Motor Asm
\Rotor Housing Asm
\Assemble Speed Sensor Target Spacer

No Commodity Items Required for This Process



Process Summary

Right First Time	99.88 %
Process Time (Sec)	11.00
Total Weight (kg)	0.00

Material Cost**	$0.00
OEM Process Cost	$0.28
Supplier Process Cost	$0.00
Q Burden	$0.02
SG&A	$0.06
Manufacturing Cost*	$0.36

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Speed Sensor Target Spacer

MUNRO & ASSOCIATES, INC.

Assemble Speed Sensor Target Spacer

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	11.00	1	1.00	91.41	GER	$0.28	99.88 %	$0.02

Assemble Speed Sensor Target Spacer

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost

Speed Sensor Target Asm, Rotor Housing Asm

\...
\Drive Motor Asm
\Rotor Housing Asm
\Speed Sensor Target Asm, Rotor Housing Asm

Assembly Summary

Parts	16
Fasteners	3
Part Numbers	2
Steps	83
Fastenings	1
Right First Time	99.38 %
OEM Process Time (Min)	0.00
Supplier Process Time (Min)	1.02
Total Weight (kg)	0.05

Material Cost**	$0.29
OEM Process Cost	$0.00
Supplier Process Cost	$0.36
Q Burden	$0.09
SG&A	$0.14
Manufacturing Cost*	$0.89

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Speed Sensor Target Asm, Rotor Housing Asm

MUNRO & ASSOCIATES, INC.

Speed Sensor Target Asm, Rotor Housing Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Speed Sensor Target Laminate, Speed Sensor Target	13	1	0	4	0	99.98 %	0.00	0.00	0.00	0.06	0.0035
Assemble Speed Sensor Target Asm	1	3	1	18	1	99.64 %	0.00	0.00	0.24	0.00	0.0012

Speed Sensor Target Asm, Rotor Housing Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Speed Sensor Target Laminate, Speed Sensor Target	$0.00	$0.02	$0.00	$0.00	$0.00	$0.02	$0.00	$0.01	$0.05
Assemble Speed Sensor Target Asm	$0.03	$0.00	$0.00	$0.00	$0.10	$0.00	$0.05	$0.02	$0.21

Speed Sensor Target Asm, Rotor Housing Asm

MUNRO & ASSOCIATES, INC.

Detailed Summary

Parts	16
Fasteners	3
Part Numbers	2
Steps	83
Fastenings	1
Right First Time	99.38%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	0.24
Supplier Fab. Time (Min)	0.78
Total Weight (kg)	0.05

Purchased Part Cost	$0.03
Material Cost	$0.26
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.00
Supplier Asm. Cost	$0.10
Supplier Fab. Cost	$0.26
Q Burden	$0.09
SG&A	$0.14
Manufacturing Cost*	$0.89

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Speed Sensor Target Laminate, Speed Sensor Target

\...
\Speed Sensor Target Asm, Rotor Housing Asm
\Speed Sensor Target Laminate, Speed Sensor Target
\Speed Sensor Target Laminate Process

Process Summary

Right First Time	99.98 %
Process Time (Sec)	3.60
Total Weight (kg)	0.00

Material Cost**	$0.02
OEM Process Cost	$0.00
Supplier Process Cost	$0.02
Q Burden	$0.00
SG&A	$0.01
Manufacturing Cost*	$0.05

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Speed Sensor Target Laminate, Speed Sensor Target

MUNRO & ASSOCIATES, INC.

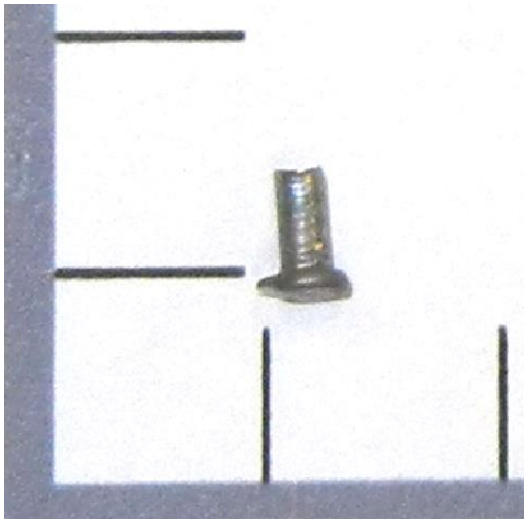
Speed Sensor Target Laminate Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	3.00	1	0.25	20.00	GER	$0.02	99.99 %	$0.00
25 Ton Stamping Press	0.60	1	0.25	21.63	GER	$0.00	99.99 %	$0.00

Speed Sensor Target Laminate Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Speed Sensor Target Laminate	1	EM Steel	$1.65	0.0035	0.0100	$0.00	$0.02

Assemble Speed Sensor Target Asm



\...
\Rotor Housing Asm
\Speed Sensor Target Asm, Rotor Housing Asm
\Assemble Speed Sensor Target Asm

Process Summary

Right First Time	99.64 %
Process Time (Sec)	14.25
Total Weight (kg)	0.00

Material Cost**	$0.03
OEM Process Cost	$0.00
Supplier Process Cost	$0.10
Q Burden	$0.05
SG&A	$0.02
Manufacturing Cost*	$0.21

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Speed Sensor Target Asm

MUNRO & ASSOCIATES, INC.

Assemble Speed Sensor Target Asm

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	14.25	1	0.25	25.62	GER	$0.10	99.64 %	$0.05

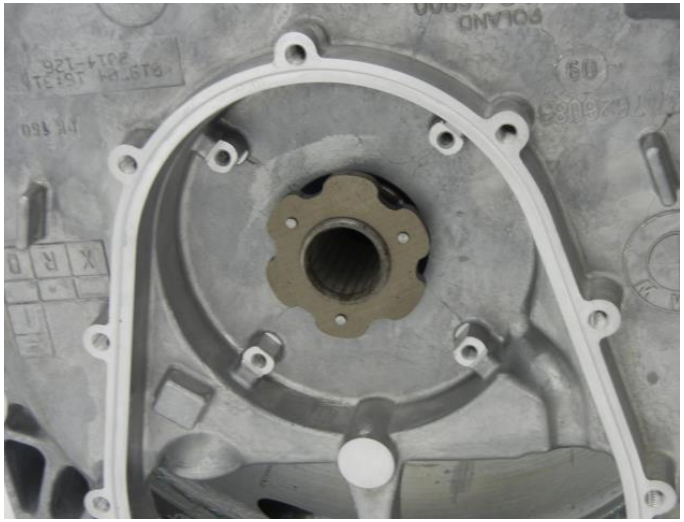
Assemble Speed Sensor Target Asm

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Rivet, Speed Sensor Target Asm	3	Commodity Item	Purchased	0.0004	-	$0.01	$0.00

Assemble Speed Sensor Target

\...
\Drive Motor Asm
\Rotor Housing Asm
\Assemble Speed Sensor Target

No Commodity Items Required for This Process



Process Summary

Right First Time	99.88 %
Process Time (Sec)	11.00
Total Weight (kg)	0.00

Material Cost**	$0.00
OEM Process Cost	$0.28
Supplier Process Cost	$0.00
Q Burden	$0.02
SG&A	$0.06
Manufacturing Cost*	$0.36

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Speed Sensor Target

MUNRO & ASSOCIATES, INC.

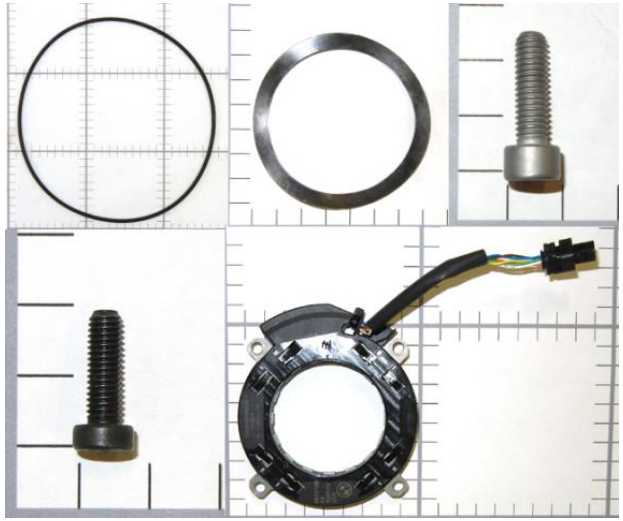
Assemble Speed Sensor Target

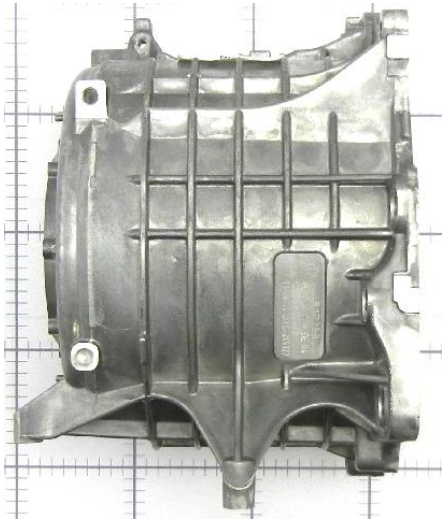
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	11.00	1	1.00	91.41	GER	$0.28	99.88 %	$0.02

Assemble Speed Sensor Target

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost

Assemble Drive Motor Asm





\...
\Motor
\Drive Motor Asm
\Assemble Drive Motor Asm

Process Summary

Right First Time	98.30 %
Process Time (Sec)	180.00
Total Weight (kg)	0.18

Material Cost**	$27.22
OEM Process Cost	$4.57
Supplier Process Cost	$0.00
Q Burden	$0.26
SG&A	$1.87
Manufacturing Cost*	$33.92

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Drive Motor Asm

MUNRO & ASSOCIATES, INC.

Assemble Drive Motor Asm

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	134.00	1	1.00	91.41	GER	$3.40	98.92 %	$0.16
OEM Manual Asm	46.00	1	1.00	91.41	GER	$1.17	99.38 %	$0.09

Assemble Drive Motor Asm

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Wave Washer	1	Commodity Item	Purchased	0.0084	-	$0.08	$0.00
O Ring, Stator Asm	2	Commodity Item	Purchased	0.0175	-	$2.27	$0.00
M6x20mm-Torx Bolt	3	Commodity Item	Purchased	0.0063	-	$0.02	$0.00
Motor Tone Ring Asm	1	Commodity Item	Purchased	0.1079	-	$22.50	$0.00
M5x16mm- Torx Socket Head Cap Screw	4	Commodity Item	Purchased	0.0031	-	$0.01	$0.00

Drive Motor Asm Installation

\...
\Zone 7 Driveline
\Motor
\Drive Motor Asm Installation

Process Summary

Right First Time	98.53 %
Process Time (Sec)	143.00
Total Weight (kg)	0.26

Material Cost**	$0.83
OEM Process Cost	$3.96
Supplier Process Cost	$0.00
Q Burden	$0.22
SG&A	$0.94
Manufacturing Cost*	$5.95

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Drive Motor Asm Installation

Drive Motor Asm Installation

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm w/ Ergo Assist	143.00	1	1.00	99.79	GER	$3.96	98.53 %	$0.22

Drive Motor Asm Installation

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
M10x53-Hex SEMS Bolt	5	Commodity Item	Purchased	0.0410	-	$0.13	$0.00
M8x9-Hex Flange Nut	1	Commodity Item	Purchased	0.0076	-	$0.02	$0.00
M10x73-Torx SEMS Bolt	1	Commodity Item	Purchased	0.0486	-	$0.16	$0.00

Motor Cover

\...
\Zone 7 Driveline
\Motor
\Motor Cover

Assembly Summary

Parts	3
Fasteners	0
Part Numbers	3
Steps	12
Fastenings	1
Right First Time	99.94 %
OEM Process Time (Min)	0.00
Supplier Process Time (Min)	0.37
Total Weight (kg)	0.14

Material Cost**	$0.73
OEM Process Cost	$0.00
Supplier Process Cost	$0.18
Q Burden	$0.01
SG&A	$0.18
Manufacturing Cost*	$1.10

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Motor Cover

Motor Cover

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Cover, Motor Cover	1	1	0	4	0	99.98 %	0.00	0.00	0.00	0.16	0.1368
Assemble Motor Cover	1	2	1	7	1	99.96 %	0.00	0.00	0.21	0.00	0.0036

Motor Cover

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Cover, Motor Cover	$0.00	$0.57	$0.00	$0.00	$0.00	$0.05	$0.00	$0.14	$0.77
Assemble Motor Cover	$0.16	$0.00	$0.00	$0.00	$0.13	$0.00	$0.01	$0.03	$0.33

MUNRO & ASSOCIATES, INC.

Detailed Summary

Parts	3
Fasteners	0
Part Numbers	3
Steps	12
Fastenings	1
Right First Time	99.94%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	0.21
Supplier Fab. Time (Min)	0.16
Total Weight (kg)	0.14

Purchased Part Cost	$0.16
Material Cost	$0.57
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.00
Supplier Asm. Cost	$0.13
Supplier Fab. Cost	$0.05
Q Burden	$0.01
SG&A	$0.18
Manufacturing Cost*	$1.10

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Cover, Motor Cover

\...
\Motor Cover
\Cover, Motor Cover
\Cover Process

Process Summary

Right First Time	99.98 %
Process Time (Sec)	9.60
Total Weight (kg)	0.14

Material Cost**	$0.57
OEM Process Cost	$0.00
Supplier Process Cost	$0.05
Q Burden	$0.00
SG&A	$0.14
Manufacturing Cost*	$0.77

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Cover, Motor Cover

Cover Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	9.00	1	0.25	20.00	GER	$0.05	99.99 %	$0.00
25 Ton Stamping Press	0.60	1	0.25	21.63	GER	$0.00	99.99 %	$0.00

Cover Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Cover	1	Aluminum 6061 - Coil Stock	$2.80	0.1368	0.2046	$0.00	$0.57

Assemble Motor Cover

\...
\Motor
\Motor Cover
\Assemble Motor Cover

Process Summary

Right First Time	99.96 %
Process Time (Sec)	12.64
Total Weight (kg)	0.00

Material Cost**	$0.16
OEM Process Cost	$0.00
Supplier Process Cost	$0.13
Q Burden	$0.01
SG&A	$0.03
Manufacturing Cost*	$0.33

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Motor Cover

MUNRO & ASSOCIATES, INC.

Assemble Motor Cover

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	6.64	1	0.25	45.16	GER	$0.08	99.97 %	$0.00
Supplier Automated Asm	6.00	1	0.25	25.62	GER	$0.04	99.99 %	$0.00

Assemble Motor Cover

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Gasket, Silicone Bead	1	Commodity Item	Purchased	0.0035	-	$0.11	$0.00
Label, Caution, Motor Cover Asm	1	Commodity Item	Purchased	0.0001	-	$0.05	$0.00

Motor Cover Installation

\...
\Zone 7 Driveline
\Motor
\Motor Cover Installation

Process Summary

Right First Time	97.95 %
Process Time (Sec)	122.00
Total Weight (kg)	0.06

Material Cost**	$0.20
OEM Process Cost	$3.10
Supplier Process Cost	$0.00
Q Burden	$0.31
SG&A	$0.72
Manufacturing Cost*	$4.33

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Motor Cover Installation

MUNRO & ASSOCIATES, INC.

Motor Cover Installation

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	122.00	1	1.00	91.41	GER	$3.10	97.95 %	$0.31

Motor Cover Installation

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
M6x16mm-Torx Bolt	10	Commodity Item	Purchased	0.0056	-	$0.02	$0.00

Thermal Cover, Motor Lower

\...
\Motor
\Thermal Cover, Motor Lower
\Thermal Cover, Motor Lower Process

Process Summary

Right First Time	99.82 %
Process Time (Sec)	184.79
Total Weight (kg)	0.09

Material Cost**	$1.03
OEM Process Cost	$0.00
Supplier Process Cost	$1.17
Q Burden	$0.03
SG&A	$0.51
Manufacturing Cost*	$2.73

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Thermal Cover, Motor Lower

MUNRO & ASSOCIATES, INC.

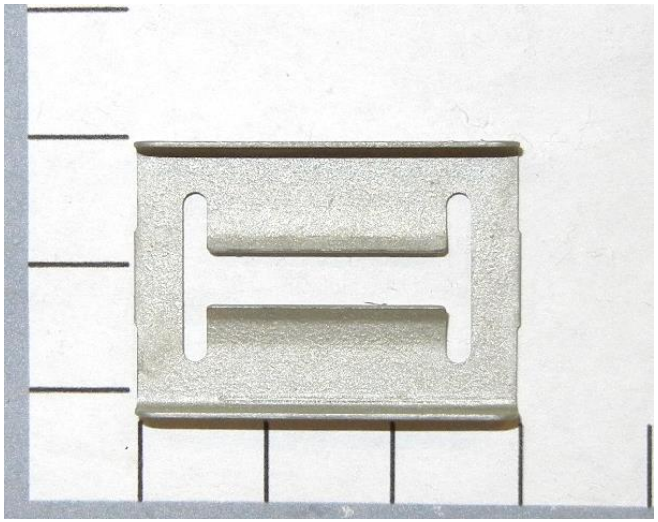
Thermal Cover, Motor Lower Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Die Cut	5.20	1	0.25	11.50	CZE	$0.02	99.98 %	$0.00
Thermoform	95.64	4	0.50	59.82	CZE	$0.40	99.97 %	$0.00
Cure Foam	78.14	1	0.00	3.97	CZE	$0.09	99.96 %	$0.01
Foam Molding	20.04	1	3.00	61.43	CZE	$0.34	99.98 %	$0.00
Cure Foam	41.00	1	0.00	3.97	CZE	$0.05	99.96 %	$0.01
Foam Molding	16.50	1	3.00	61.43	CZE	$0.28	99.98 %	$0.00

Thermal Cover, Motor Lower Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material 3, Thermal Cover, Motor Lower	1	PET Sheet Stock	By Area	0.0268	-	$0.00	$0.44
Material 3, Thermal Cover, Motor Lower	1	PET Sheet Stock	By Area	0.0268	-	$0.00	$0.44
Material 2, Thermal Cover, Motor Lower	1	PUR Foam	$4.08	0.0314	0.0323	$0.00	$0.13
Material 1, Thermal Cover, Motor Lower	1	PUR Foam	$4.08	0.0045	0.0046	$0.00	$0.02

Thermal Cover, Motor Lower Installation



\...
\Zone 7 Driveline
\Motor
\Thermal Cover, Motor Lower Installation

Process Summary

Right First Time	99.89 %
Process Time (Sec)	33.00
Total Weight (kg)	0.01

Material Cost**	$0.15
OEM Process Cost	$0.84
Supplier Process Cost	$0.00
Q Burden	$0.02
SG&A	$0.20
Manufacturing Cost*	$1.20

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Thermal Cover, Motor Lower Installation

MUNRO & ASSOCIATES, INC.

Thermal Cover, Motor Lower Installation

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	33.00	1	1.00	91.41	GER	$0.84	99.89 %	$0.02

Thermal Cover, Motor Lower Installation

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Push Clip	3	Commodity Item	Purchased	0.0021	-	$0.05	$0.00

Thermal Cover, Motor Outboard

\...
\Motor
\Thermal Cover, Motor Outboard
\Thermal Cover, Motor, Outboard Process

Process Summary

Right First Time	99.88 %
Process Time (Sec)	130.75
Total Weight (kg)	0.03

Material Cost**	$0.94
OEM Process Cost	$0.00
Supplier Process Cost	$0.62
Q Burden	$0.02
SG&A	$0.36
Manufacturing Cost*	$1.94

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Thermal Cover, Motor Outboard

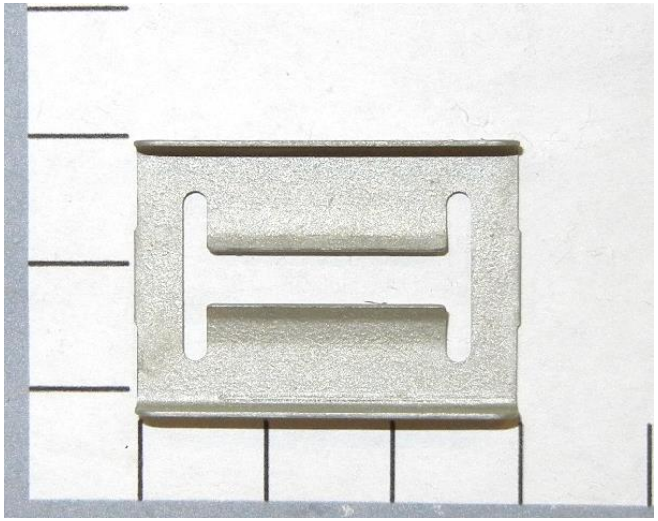
Thermal Cover, Motor, Outboard Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Die Cut	5.20	1	0.25	11.50	CZE	$0.02	99.98 %	$0.00
Thermoform	58.92	4	0.50	33.21	CZE	$0.14	99.97 %	$0.00
Cure Foam	89.16	1	0.00	3.97	CZE	$0.10	99.96 %	$0.01
Foam Molding	21.66	1	3.00	61.43	CZE	$0.37	99.98 %	$0.00

Thermal Cover, Motor, Outboard Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material 2, Thermal Cover, Motor, Outboard	1	PET Sheet Stock	By Area	0.0104	-	$0.00	$0.44
Material 2, Thermal Cover, Motor, Outboard	1	PET Sheet Stock	By Area	0.0104	-	$0.00	$0.44
Material 1, Thermal Cover, Motor, Outboard	1	PUR Foam	$4.08	0.0139	0.0143	$0.00	$0.06

Thermal Cover Motor Installation



\...
\Zone 7 Driveline
\Motor
\Thermal Cover Motor Installation

Process Summary

Right First Time	99.93 %
Process Time (Sec)	22.00
Total Weight (kg)	0.00

Material Cost**	$0.10
OEM Process Cost	$0.56
Supplier Process Cost	$0.00
Q Burden	$0.01
SG&A	$0.13
Manufacturing Cost*	$0.80

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Thermal Cover Motor Installation

MUNRO & ASSOCIATES, INC.

Thermal Cover Motor Installation

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	22.00	1	1.00	91.41	GER	$0.56	99.93 %	$0.01

Thermal Cover Motor Installation

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Push Clip	2	Commodity Item	Purchased	0.0021	-	$0.05	$0.00

Thermal Cover, Motor Upper

\...
\Motor
\Thermal Cover, Motor Upper
\Thermal Cover, Motor Upper Process

Process Summary

Right First Time	99.88 %
Process Time (Sec)	113.83
Total Weight (kg)	0.04

Material Cost**	$1.06
OEM Process Cost	$0.00
Supplier Process Cost	$0.77
Q Burden	$0.02
SG&A	$0.42
Manufacturing Cost*	$2.27

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Thermal Cover, Motor Upper

MUNRO & ASSOCIATES, INC.

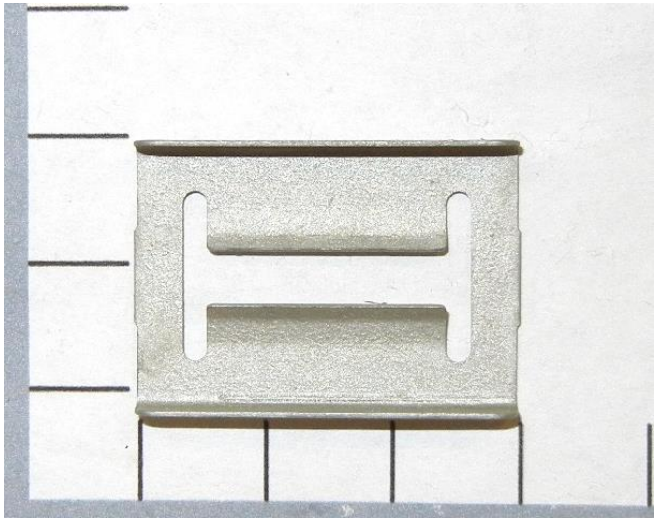
Thermal Cover, Motor Upper Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Die Cut	5.20	1	0.25	11.50	CZE	$0.02	99.98 %	$0.00
Thermoform	20.87	1	0.50	59.82	CZE	$0.35	99.97 %	$0.00
Cure Foam	68.50	1	0.00	3.97	CZE	$0.08	99.96 %	$0.01
Foam Molding	19.26	1	3.00	61.43	CZE	$0.33	99.98 %	$0.00

Thermal Cover, Motor Upper Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material 2, Thermal Cover, Motor Upper	1	PET Sheet Stock	By Area	0.0116	-	$0.00	$0.50
Material 2, Thermal Cover, Motor Upper	1	PET Sheet Stock	By Area	0.0116	-	$0.00	$0.50
Material 1, Thermal Cover, Motor Upper	1	PUR Foam	$4.08	0.0154	0.0159	$0.00	$0.06

Thermal Cover, Motor Upper Installation



\...
\Zone 7 Driveline
\Motor
\Thermal Cover, Motor Upper Installation

Process Summary

Right First Time	99.91 %
Process Time (Sec)	25.00
Total Weight (kg)	0.00

Material Cost**	$0.10
OEM Process Cost	$0.63
Supplier Process Cost	$0.00
Q Burden	$0.01
SG&A	$0.15
Manufacturing Cost*	$0.90

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Thermal Cover, Motor Upper Installation

MUNRO & ASSOCIATES, INC.

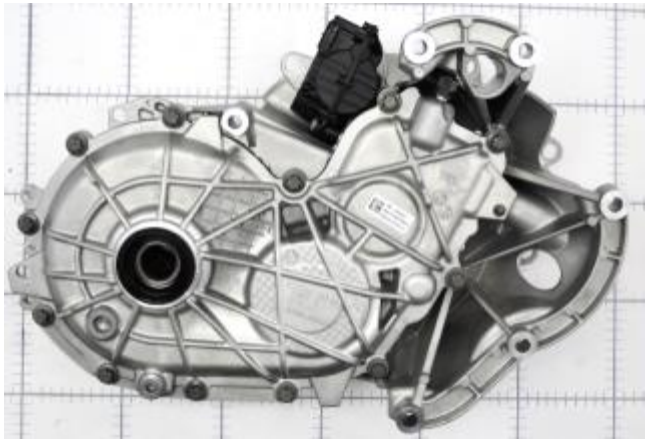
Thermal Cover, Motor Upper Installation

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	25.00	1	1.00	91.41	GER	$0.63	99.91 %	$0.01

Thermal Cover, Motor Upper Installation

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Push Clip	2	Commodity Item	Purchased	0.0021	-	$0.05	$0.00

Gear Box Overview



The gear box for the i3 is a single speed fixed ratio gear box. Assembly and manufacturing details for the gear box will be covered throughout the report.

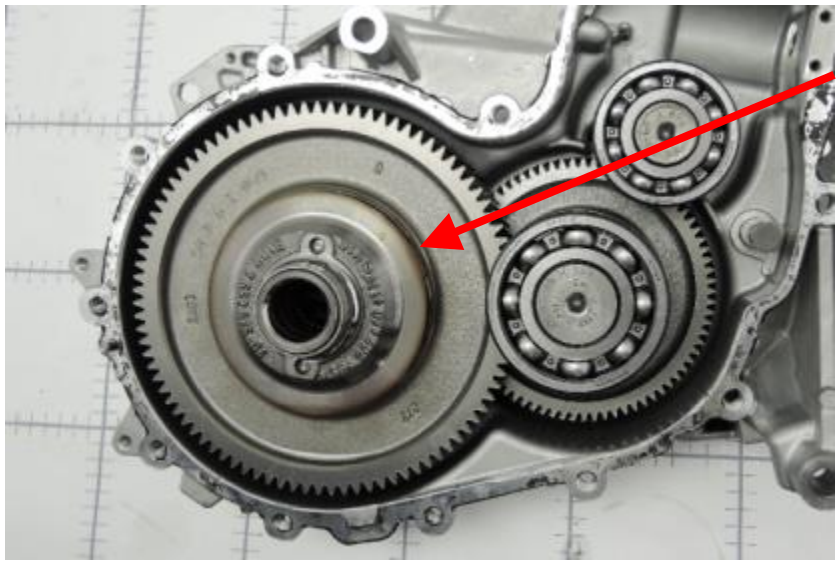
The gear box consists of an aluminum multi-piece machined housing containing an electronically engaged parking paw using an external mounted electric motor, a welded ring gear/carrier, coated side gears/pin, and the fixed ratio gears. The electronic parking pawl consists of an electric actuator utilizing plastic gears and mechanical locking mechanisms. The ring gear is forged whereas the carrier is a sand cast design.

All major components were costed in detail, while prices were applied to commodity items (i.e. seals, rivets, snap rings).

Estimates are based on actual parts.

Photos: Background on 100mm grid paper.

Eye Catching Features



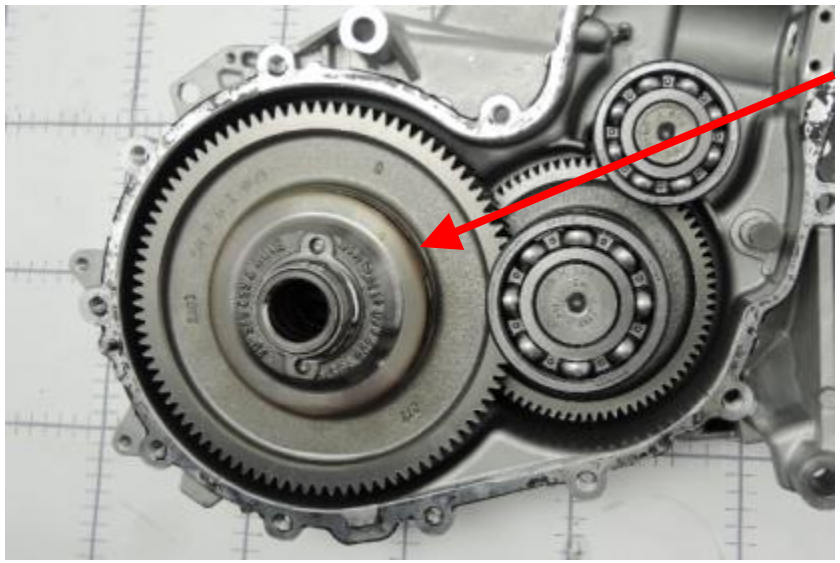
Description:

- Output differential assembly: The ring gear is laser welded to the differential carrier

Advantages:

- Reduced manufacturing complexity by reducing the number of fasteners and associated machining
- Reduced quality issues related with fasteners (i.e. cross threading, reduced torque over-time, etc.)

Eye Catching Features



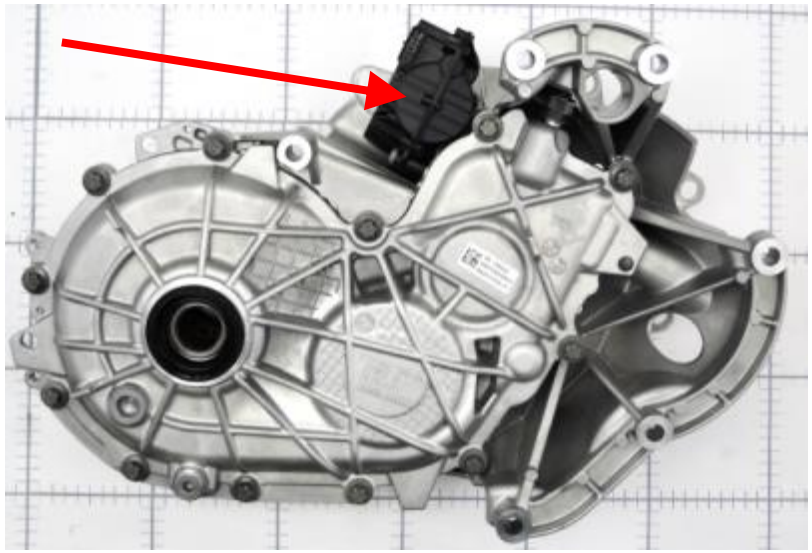
Description:

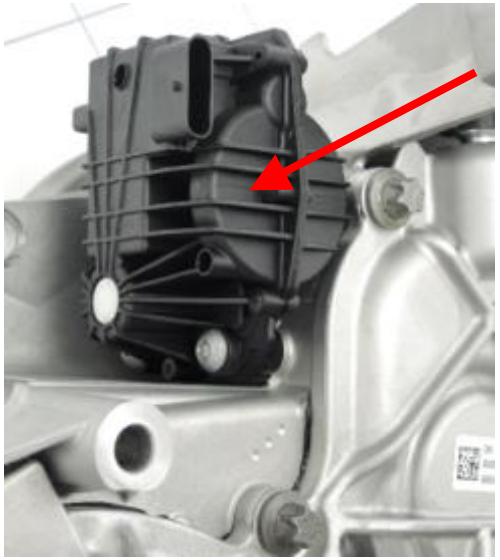
- Output differential assembly: The ring gear is laser welded to the differential carrier

Disadvantages:

- Increased manufacturing investment due to laser welding station

Eye Catching Features





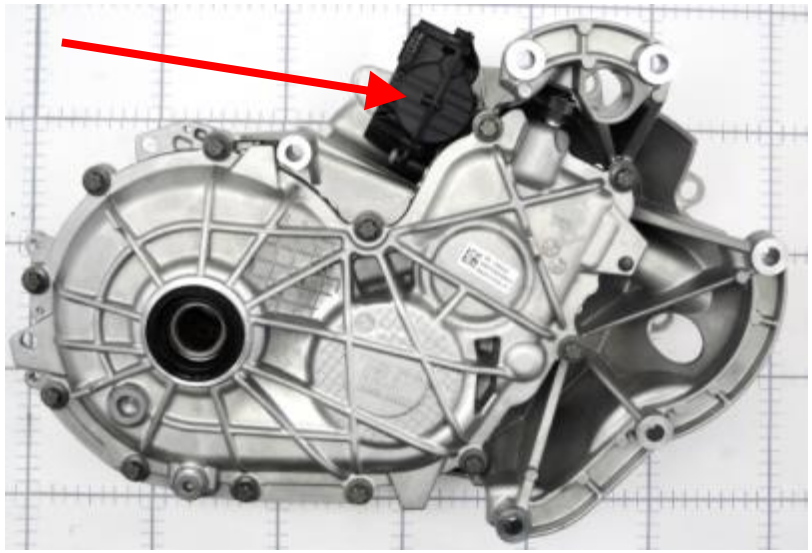
Description:

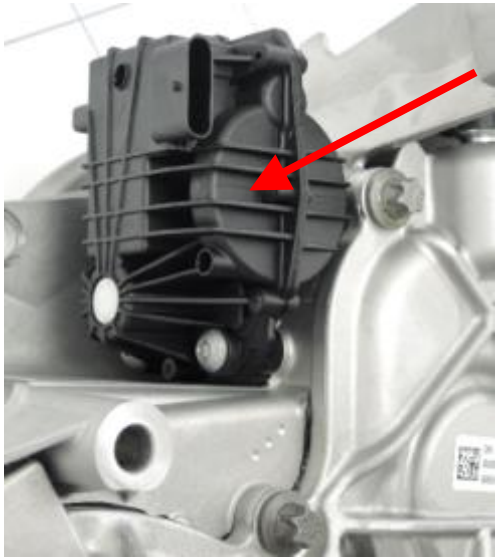
- Electronic parking brake pawl engagement: BMW i3 utilizes an electronic actuator to engage the parking brake pawl and lock the transmission in the park position

Advantages:

- Reduces manufacturing complexity by reducing the number of components installed when compared with cable operated systems

Eye Catching Features





Description:

- Electronic parking brake pawl engagement: BMW i3 utilizes an electronic actuator to engage the parking brake pawl and lock the transmission in the park position

Disadvantages:

- Increased cost compared to cable operated systems

Eye Catching Features

Description:

- Differential pin and side gears: The differential pin and side gears appear to be coated with a diamond like coating (DLC) to improve wear resistance and reduce friction

Advantages:

- Improved wear resistance
- Provides friction reduction

Eye Catching Features

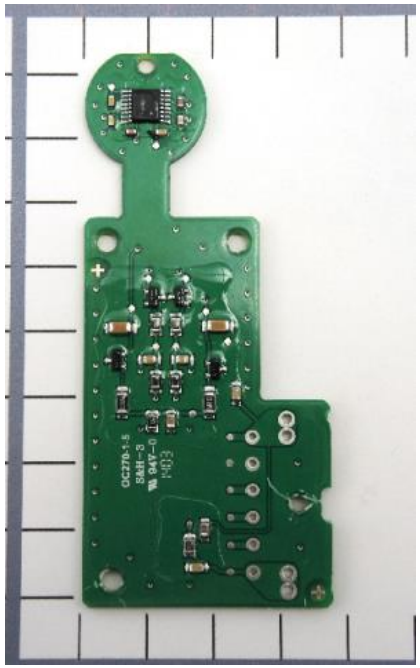
Description:

- Differential pin and side gears: The differential pin and side gears appear to be coated with a diamond like coating (DLC) to improve wear resistance and reduce friction

Disadvantages:

- Increased cost due to overall manufacturing processes and investment

Eye Catching Features



Observations:

- The gear box system includes 1 circuit board, containing 28 additional electrical components. This circuit board is used to control the actuation of the parking brake paw.

MUNRO & ASSOCIATES, INC.

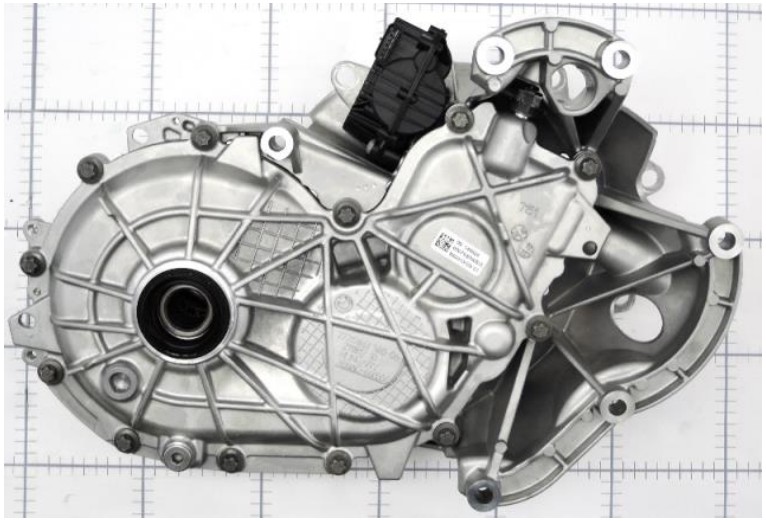
Summary

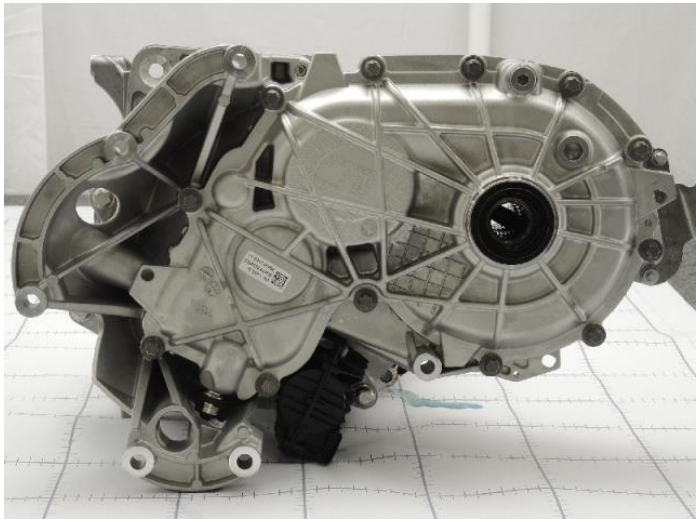
Parts	138
Fasteners	39
Part Numbers	89
Steps	1,542
Fastenings	111
Right First Time	82.79%
OEM Process Time (Hrs)	0.21
Supplier Process Time (Hrs)	2.13
Total Weight (kg)	23.01

Material Cost**	$108.36
OEM Process Cost	$19.20
Supplier Process Cost	$127.79
Q Burden	$2.83
SG&A	$30.97
Manufacturing Cost*	$289.15

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Gear Box Asm





\...
\Zone 7 Driveline
\Gear Box
\Gear Box Asm

Assembly Summary

Parts	121
Fasteners	28
Part Numbers	82
Steps	1,486
Fastenings	100
Right First Time	84.32 %
OEM Process Time (Min)	10.21
Supplier Process Time (Min)	124.23
Total Weight (kg)	22.80

Material Cost**	$106.68
OEM Process Cost	$15.46
Supplier Process Cost	$126.70
Q Burden	$2.56
SG&A	$30.07
Manufacturing Cost*	$281.47

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Gear Box Asm

Gear Box Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Gear Box Housing, Gear Box Asm	1	57	46	519	46	93.72 %	2.70	0.12	2.74	30.93	7.0950
Input Differential ShaftAsm, Gear Box Asm	1	1	0	102	0	99.47 %	0.00	0.00	0.00	5.45	0.8880
Parking Brake Gear, Gear Box Asm	1	1	0	31	0	99.74 %	0.00	0.00	0.00	1.10	0.2791
Intermediate Differential ShaftAsm, Gear Box Asm	1	1	0	69	0	99.57 %	0.00	0.00	0.00	6.88	2.1048
Intermediate Gear, Gear Box Asm	1	1	0	67	0	99.47 %	0.00	0.00	0.00	14.90	1.4032
Output Differential Asm, Gear Box Asm	1	18	14	390	14	97.00 %	0.00	0.00	3.70	44.23	6.0757
Assemble Gear Cluster	1	15	8	80	8	98.83 %	4.10	0.00	0.00	0.00	2.4082
Gear Box Cover, Gear Box Asm	1	9	8	150	8	98.71 %	0.00	0.00	1.13	13.17	2.3349
Assemble Gear Box Cover	1	18	24	71	24	96.77 %	3.29	0.00	0.00	0.00	0.1941

Gear Box Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Gear Box Housing, Gear Box Asm	$10.55	$18.51	$4.11	$0.09	$1.53	$24.01	$0.97	$7.55	$67.33
Input Differential ShaftAsm, Gear Box Asm	$0.00	$1.68	$0.00	$0.00	$0.00	$6.88	$0.08	$1.28	$9.92
Parking Brake Gear, Gear Box Asm	$0.00	$0.30	$0.00	$0.00	$0.00	$1.43	$0.04	$0.26	$2.03
Intermediate Differential ShaftAsm, Gear Box Asm	$0.00	$3.98	$0.00	$0.00	$0.00	$8.61	$0.06	$1.89	$14.54
Intermediate Gear, Gear Box Asm	$0.00	$2.66	$0.00	$0.00	$0.00	$18.37	$0.08	$3.15	$24.27
Output Differential Asm, Gear Box Asm	$0.84	$13.27	$0.00	$0.00	$4.00	$51.29	$0.46	$10.31	$80.17
Assemble Gear Cluster	$46.17	$0.00	$6.25	$0.00	$0.00	$0.00	$0.18	$2.32	$54.91
Gear Box Cover, Gear Box Asm	$0.55	$5.83	$0.00	$0.00	$0.36	$10.21	$0.20	$2.48	$19.62
Assemble Gear Box Cover	$2.34	$0.00	$5.01	$0.00	$0.00	$0.00	$0.49	$0.82	$8.67

MUNRO & ASSOCIATES, INC.

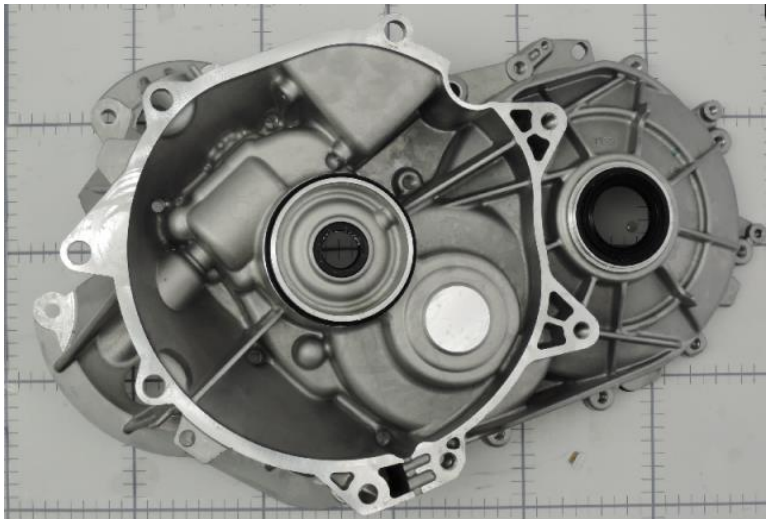
Detailed Summary

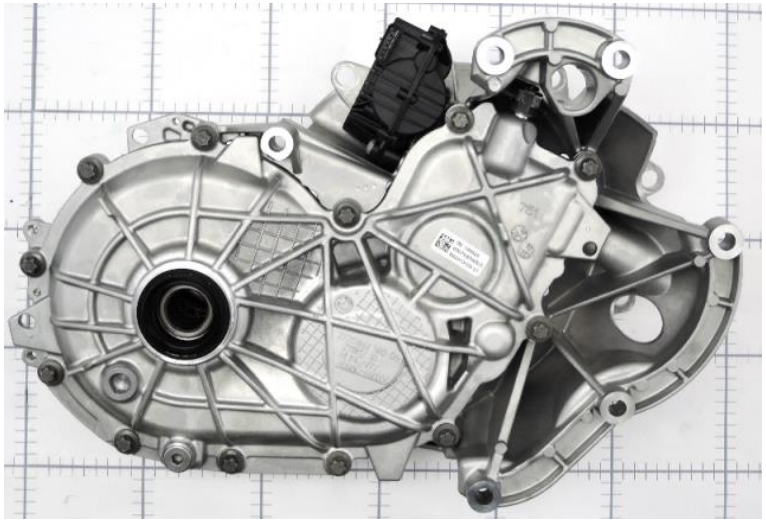
Parts	121
Fasteners	28
Part Numbers	82
Steps	1,486
Fastenings	100
Right First Time	84.32%
OEM Asm. Time (Min)	10.09
OEM Fab. Time (Min)	0.12
Supplier Asm. Time (Min)	7.57
Supplier Fab. Time (Min)	116.66
Total Weight (kg)	22.80

Purchased Part Cost	$60.45
Material Cost	$46.23
OEM Asm. Cost	$15.37
OEM Fab. Cost	$0.09
Supplier Asm. Cost	$5.90
Supplier Fab. Cost	$120.80
Q Burden	$2.56
SG&A	$30.07
Manufacturing Cost*	$281.47

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Gear Box Housing, Gear Box Asm





\...
\Gear Box
\Gear Box Asm
\Gear Box Housing, Gear Box Asm

Assembly Summary

Parts	57
Fasteners	14
Part Numbers	38
Steps	519
Fastenings	46
Right First Time	93.72 %
OEM Process Time (Min)	2.82
Supplier Process Time (Min)	33.67
Total Weight (kg)	7.10

Material Cost**	$29.06
OEM Process Cost	$4.20
Supplier Process Cost	$25.54
Q Burden	$0.97
SG&A	$7.55
Manufacturing Cost*	$67.33

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Gear Box Housing, Gear Box Asm

MUNRO & ASSOCIATES, INC.

Gear Box Housing, Gear Box Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Housing, Gear Box Housing Asm	1	1	0	239	0	99.20 %	0.00	0.00	0.00	27.14	6.0500
Assemble Housing	1	3	3	9	3	99.73 %	0.57	0.00	0.00	0.00	0.0838
Parking Brake Shaft Asm, Gear Box Asm	1	6	6	85	6	99.28 %	0.00	0.00	0.62	2.20	0.2544
Parking Brake Shaft Mounting Bracket, Gear Box	1	1	0	7	0	99.97 %	0.00	0.00	0.00	0.24	0.0451
Parking Brake Detent, Gear Box	1	4	2	25	2	99.81 %	0.00	0.00	0.19	0.30	0.0107
Assemble Parking Brake Shaft	1	4	8	16	8	99.04 %	1.05	0.00	0.00	0.00	0.0184
Parking Brake Pawl, Gear Box	1	1	0	21	0	99.81 %	0.00	0.00	0.00	0.87	0.1499
Assemble Parking Brake Pawl	1	3	4	8	4	99.89 %	0.38	0.00	0.00	0.00	0.0247
Actuator Asm, Gear Box Housing Asm	1	31	19	95	19	97.49 %	0.00	0.12	1.94	0.18	0.4109
Assemble Actuator	1	3	4	8	4	99.35 %	0.70	0.00	0.00	0.00	0.0462

Gear Box Housing, Gear Box Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Housing, Gear Box Housing Asm	$0.00	$14.43	$0.00	$0.00	$0.00	$20.84	$0.12	$5.29	$40.69
Assemble Housing	$0.67	$0.00	$0.86	$0.00	$0.00	$0.00	$0.04	$0.15	$1.72
Parking Brake Shaft Asm, Gear Box Asm	$0.34	$0.40	$0.00	$0.00	$0.50	$1.92	$0.11	$0.43	$3.71
Parking Brake Shaft Mounting Bracket, Gear Box	$0.00	$0.09	$0.00	$0.00	$0.00	$0.11	$0.00	$0.03	$0.23
Parking Brake Detent, Gear Box	$0.26	$0.02	$0.00	$0.00	$0.11	$0.09	$0.03	$0.04	$0.55
Assemble Parking Brake Shaft	$0.12	$0.00	$1.60	$0.00	$0.00	$0.00	$0.14	$0.24	$2.11
Parking Brake Pawl, Gear Box	$0.00	$0.25	$0.00	$0.00	$0.00	$0.95	$0.03	$0.18	$1.40
Assemble Parking Brake Pawl	$0.41	$0.00	$0.58	$0.00	$0.00	$0.00	$0.02	$0.10	$1.11
Actuator Asm, Gear Box Housing Asm	$8.57	$3.32	$0.00	$0.09	$0.92	$0.10	$0.38	$0.92	$14.31
Assemble Actuator	$0.18	$0.00	$1.07	$0.00	$0.00	$0.00	$0.10	$0.17	$1.51

MUNRO & ASSOCIATES, INC.

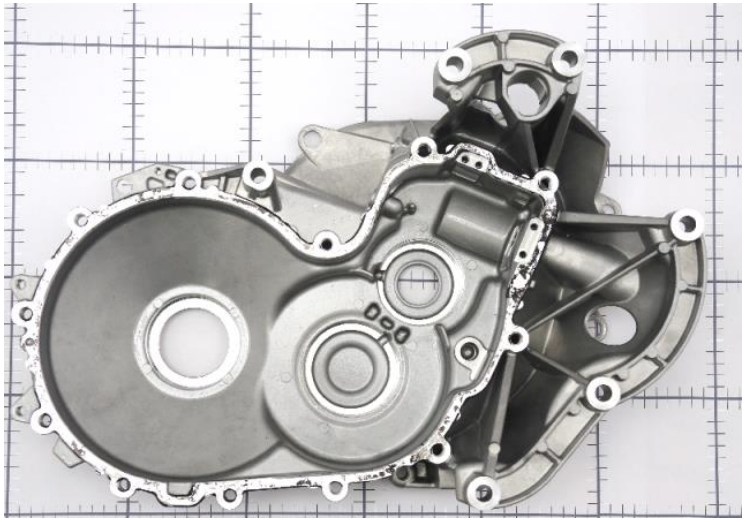
Detailed Summary

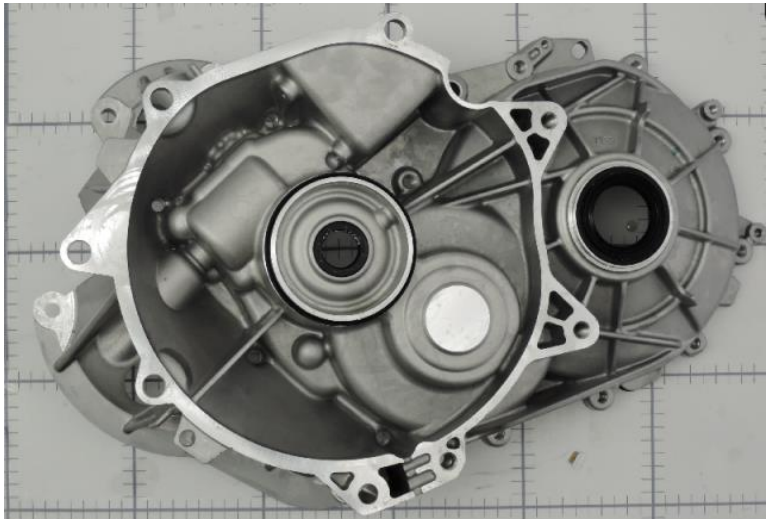
Parts	57
Fasteners	14
Part Numbers	38
Steps	519
Fastenings	46
Right First Time	93.72%
OEM Asm. Time (Min)	2.70
OEM Fab. Time (Min)	0.12
Supplier Asm. Time (Min)	2.74
Supplier Fab. Time (Min)	30.93
Total Weight (kg)	7.10

Purchased Part Cost	$10.55
Material Cost	$18.51
OEM Asm. Cost	$4.11
OEM Fab. Cost	$0.09
Supplier Asm. Cost	$1.53
Supplier Fab. Cost	$24.01
Q Burden	$0.97
SG&A	$7.55
Manufacturing Cost*	$67.33

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Housing, Gear Box Housing Asm





\...
\Gear Box Housing, Gear Box Asm
\Housing, Gear Box Housing Asm
\Housing Process

Process Summary

Right First Time	99.20 %
Process Time (Sec)	1628.33
Total Weight (kg)	6.05

Material Cost**	$14.43
OEM Process Cost	$0.00
Supplier Process Cost	$20.84
Q Burden	$0.12
SG&A	$5.29
Manufacturing Cost*	$40.69

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Housing, Gear Box Housing Asm

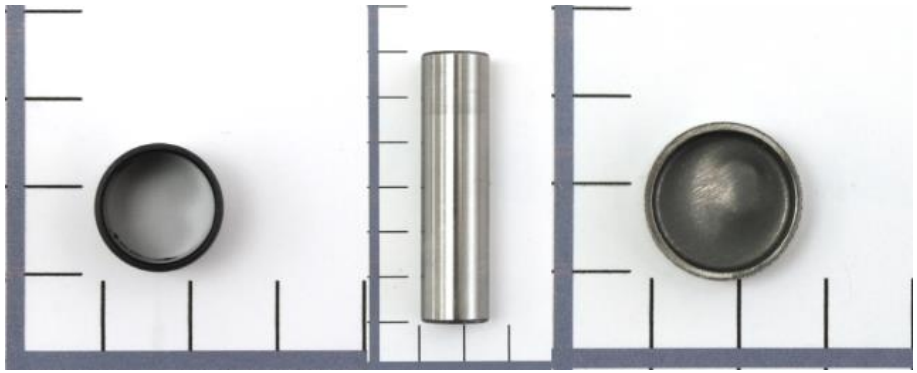
Housing Process

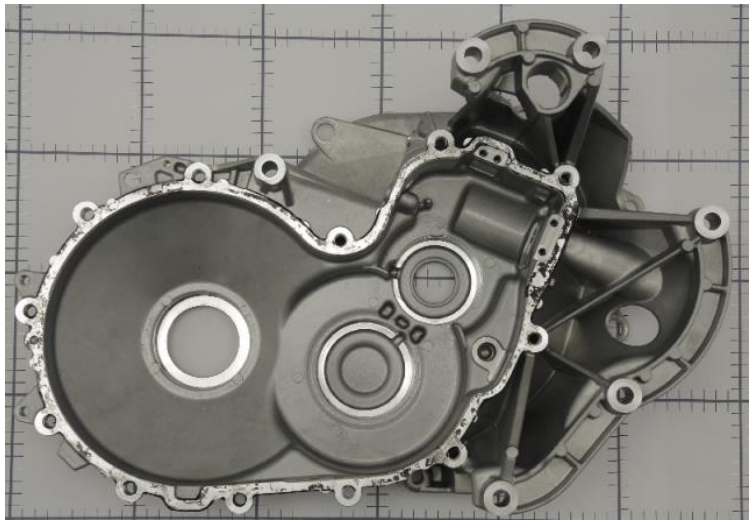
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	16.00	1	0.25	75.11	HUN	$0.33	99.98 %	$0.00
Deburr	14.00	1	0.25	36.15	HUN	$0.14	99.99 %	$0.00
CNC Machining	675.49	1	0.25	47.63	HUN	$8.94	99.33 %	$0.10
Heat Treat Step 2	471.43	1	0.25	9.58	HUN	$1.25	99.99 %	$0.00
Heat Treat Step 1	342.86	1	0.25	47.48	HUN	$4.52	99.99 %	$0.00
Wash	16.00	1	0.25	75.11	HUN	$0.33	99.98 %	$0.00
Deburr	14.00	1	0.25	36.15	HUN	$0.14	99.99 %	$0.00
60 Ton Trim Press	6.67	1	0.25	15.03	HUN	$0.03	99.98 %	$0.00
2200 Ton Casting Press	71.88	1	2.00	258.11	HUN	$5.15	99.99 %	$0.00

Housing Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Housing	1	A380	$2.27	6.0500	6.3530	$0.00	$14.43

Assemble Housing





\...
\Gear Box Asm
\Gear Box Housing, Gear Box Asm
\Assemble Housing

Process Summary

Right First Time	99.73 %
Process Time (Sec)	34.00
Total Weight (kg)	0.08

Material Cost**	$0.67
OEM Process Cost	$0.86
Supplier Process Cost	$0.00
Q Burden	$0.04
SG&A	$0.15
Manufacturing Cost*	$1.72

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Housing

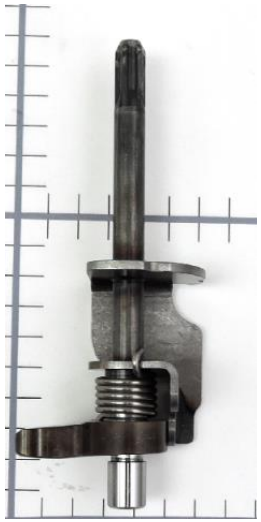
Assemble Housing

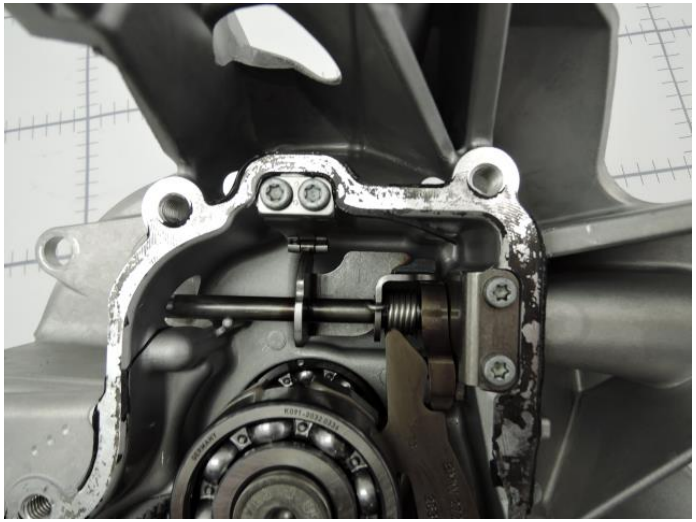
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	34.00	1	1.00	91.41	GER	$0.86	99.73 %	$0.04

Assemble Housing

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Parking Brake Dowel, Gear Box Housing	1	Commodity Item	Purchased	0.0798	-	$0.50	$0.00
Parking Brake Actuator Sleeve, Gear Box Housing As	1	Commodity Item	Purchased	0.0006	-	$0.10	$0.00
Plug Parking Brake Actuator, Gear Box Housing Asm	1	Commodity Item	Purchased	0.0034	-	$0.07	$0.00

Parking Brake Shaft Asm, Gear Box Asm





\...
\Gear Box Asm
\Gear Box Housing, Gear Box Asm
\Parking Brake Shaft Asm, Gear Box Asm

Assembly Summary

Parts	6
Fasteners	0
Part Numbers	6
Steps	85
Fastenings	6
Right First Time	99.28 %
OEM Process Time (Min)	0.00
Supplier Process Time (Min)	2.82
Total Weight (kg)	0.25

Material Cost**	$0.74
OEM Process Cost	$0.00
Supplier Process Cost	$2.42
Q Burden	$0.11
SG&A	$0.43
Manufacturing Cost*	$3.71

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

MUNRO & ASSOCIATES, INC.

Parking Brake Shaft Asm, Gear Box Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Shaft Asm, Parking Brake Shaft Asm	1	4	4	47	4	99.60 %	0.00	0.00	0.42	0.96	0.1720
Bumper, Parking Brake Asm	1	1	0	29	0	99.79 %	0.00	0.00	0.00	1.24	0.0737
Assemble Parking Brake Shaft	1	1	2	7	2	99.89 %	0.00	0.00	0.20	0.00	0.0087

Parking Brake Shaft Asm, Gear Box Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Shaft Asm, Parking Brake Shaft Asm	$0.20	$0.28	$0.00	$0.00	$0.40	$0.67	$0.06	$0.21	$1.82
Bumper, Parking Brake Asm	$0.00	$0.12	$0.00	$0.00	$0.00	$1.25	$0.03	$0.21	$1.60
Assemble Parking Brake Shaft	$0.14	$0.00	$0.00	$0.00	$0.10	$0.00	$0.02	$0.02	$0.28

MUNRO & ASSOCIATES, INC.

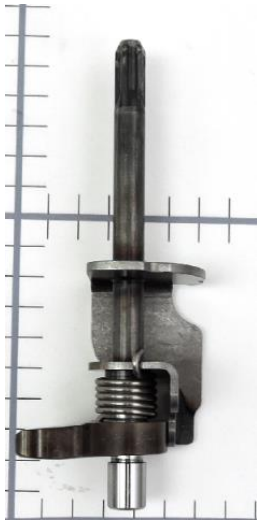
Detailed Summary

Parts	6
Fasteners	0
Part Numbers	6
Steps	85
Fastenings	6
Right First Time	99.28%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	0.62
Supplier Fab. Time (Min)	2.20
Total Weight (kg)	0.25

Purchased Part Cost	$0.34
Material Cost	$0.40
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.00
Supplier Asm. Cost	$0.50
Supplier Fab. Cost	$1.92
Q Burden	$0.11
SG&A	$0.43
Manufacturing Cost*	$3.71

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Shaft Asm, Parking Brake Shaft Asm



\...
\Gear Box Housing, Gear Box Asm
\Parking Brake Shaft Asm, Gear Box Asm
\Shaft Asm, Parking Brake Shaft Asm

Assembly Summary

Parts	4
Fasteners	0
Part Numbers	4
Steps	47
Fastenings	4
Right First Time	99.60 %
OEM Process Time (Min)	0.00
Supplier Process Time (Min)	1.38
Total Weight (kg)	0.17

Material Cost**	$0.48
OEM Process Cost	$0.00
Supplier Process Cost	$1.07
Q Burden	$0.06
SG&A	$0.21
Manufacturing Cost*	$1.82

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

MUNRO & ASSOCIATES, INC.

Shaft Asm, Parking Brake Shaft Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Shaft, Shaft Asm	1	1	0	19	0	99.85 %	0.00	0.00	0.00	0.64	0.0860
Large Bracket, Shaft Asm	1	1	0	7	0	99.97 %	0.00	0.00	0.00	0.16	0.0688
Small Bracket, Shaft Asm	1	1	0	7	0	99.97 %	0.00	0.00	0.00	0.16	0.0155
Assemble Shaft	1	1	4	11	4	99.81 %	0.00	0.00	0.42	0.00	0.0017

Shaft Asm, Parking Brake Shaft Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Shaft, Shaft Asm	$0.00	$0.11	$0.00	$0.00	$0.00	$0.58	$0.02	$0.10	$0.82
Large Bracket, Shaft Asm	$0.00	$0.11	$0.00	$0.00	$0.00	$0.05	$0.00	$0.02	$0.18
Small Bracket, Shaft Asm	$0.00	$0.06	$0.00	$0.00	$0.00	$0.05	$0.00	$0.02	$0.13
Assemble Shaft	$0.20	$0.00	$0.00	$0.00	$0.40	$0.00	$0.03	$0.07	$0.70

MUNRO & ASSOCIATES, INC.

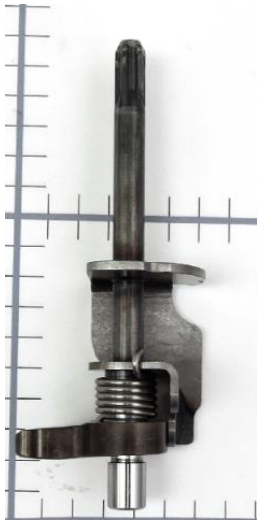
Detailed Summary

Parts	4
Fasteners	0
Part Numbers	4
Steps	47
Fastenings	4
Right First Time	99.6%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	0.42
Supplier Fab. Time (Min)	0.96
Total Weight (kg)	0.17

Purchased Part Cost	$0.20
Material Cost	$0.28
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.00
Supplier Asm. Cost	$0.40
Supplier Fab. Cost	$0.67
Q Burden	$0.06
SG&A	$0.21
Manufacturing Cost*	$1.82

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Shaft, Shaft Asm



\...
\Shaft Asm, Parking Brake Shaft Asm
\Shaft, Shaft Asm
\Shaft Process

Process Summary

Right First Time	99.85 %
Process Time (Sec)	38.33
Total Weight (kg)	0.09

Material Cost**	$0.11
OEM Process Cost	$0.00
Supplier Process Cost	$0.58
Q Burden	$0.02
SG&A	$0.10
Manufacturing Cost*	$0.82

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Shaft, Shaft Asm

MUNRO & ASSOCIATES, INC.

Shaft Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Deburr	9.00	1	0.25	35.68	GER	$0.09	99.99 %	$0.00
CNC Machining	9.68	1	0.25	39.15	GER	$0.11	99.97 %	$0.00
25 Ton Trim Press	4.60	1	0.25	19.09	GER	$0.02	99.98 %	$0.00
500 Ton Forging Press	4.85	1	2.00	205.38	GER	$0.28	99.96 %	$0.01
Cut Blank	1.20	1	0.25	25.18	GER	$0.01	99.97 %	$0.00

Shaft Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Shaft	1	Steel 1018 - Bar Stock	$1.21	0.0860	0.0940	$0.00	$0.11

Large Bracket, Shaft Asm

\...
\Shaft Asm, Parking Brake Shaft Asm
\Large Bracket, Shaft Asm
\Large Bracket Process

Process Summary

Right First Time	99.97 %
Process Time (Sec)	9.60
Total Weight (kg)	0.07

Material Cost**	$0.11
OEM Process Cost	$0.00
Supplier Process Cost	$0.05
Q Burden	$0.00
SG&A	$0.02
Manufacturing Cost*	$0.18

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Large Bracket, Shaft Asm

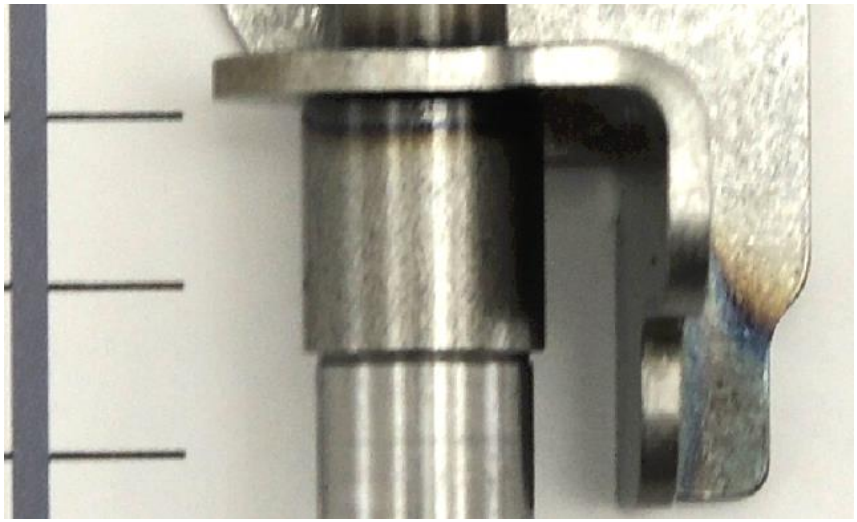
Large Bracket Process

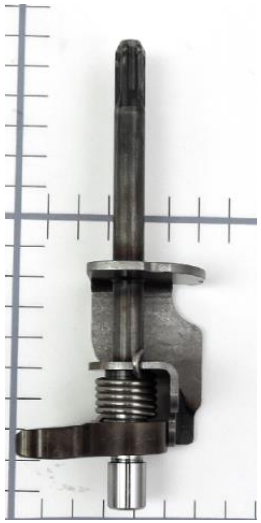
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	5.00	1	0.25	20.00	GER	$0.03	99.99 %	$0.00
Deburr	4.00	1	0.25	12.36	GER	$0.01	99.99 %	$0.00
25 Ton Stamping Press	0.60	1	0.25	21.63	GER	$0.00	99.99 %	$0.00

Large Bracket Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Large Bracket	1	Steel 1008 - Coil Stock	$0.99	0.0688	0.1130	$0.00	$0.11

Small Bracket, Shaft Asm





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\Shaft Asm, Parking Brake Shaft Asm
\Small Bracket, Shaft Asm
\Small Bracket Process

Process Summary

Right First Time	99.97 %
Process Time (Sec)	9.60
Total Weight (kg)	0.02

Material Cost**	$0.06
OEM Process Cost	$0.00
Supplier Process Cost	$0.05
Q Burden	$0.00
SG&A	$0.02
Manufacturing Cost*	$0.13

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Small Bracket, Shaft Asm

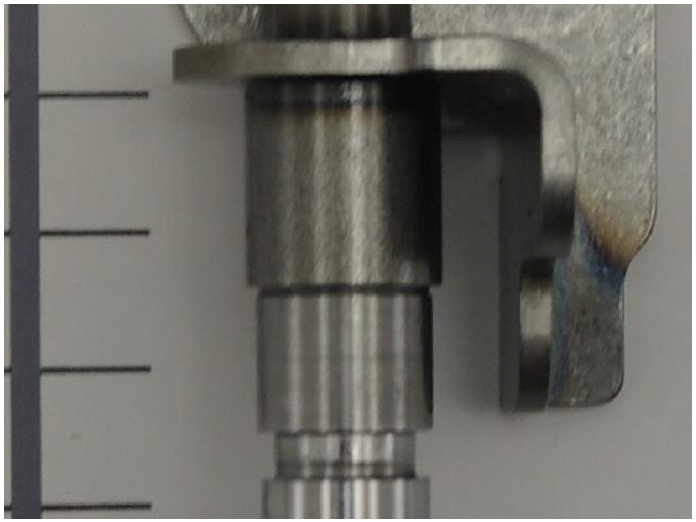
Small Bracket Process

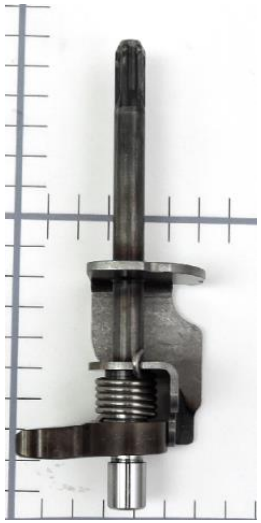
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	5.00	1	0.25	20.00	GER	$0.03	99.99 %	$0.00
Deburr	4.00	1	0.25	12.36	GER	$0.01	99.99 %	$0.00
25 Ton Stamping Press	0.60	1	0.25	21.63	GER	$0.00	99.99 %	$0.00

Small Bracket Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Small Bracket	1	Steel 1008 - Coil Stock	$0.99	0.0155	0.0600	$0.00	$0.06

Assemble Shaft





\...
\Parking Brake Shaft Asm, Gear Box Asm
\Shaft Asm, Parking Brake Shaft Asm
\Assemble Shaft

Process Summary

Right First Time	99.81 %
Process Time (Sec)	24.97
Total Weight (kg)	0.00

Material Cost**	$0.20
OEM Process Cost	$0.00
Supplier Process Cost	$0.40
Q Burden	$0.03
SG&A	$0.07
Manufacturing Cost*	$0.70

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Shaft

MUNRO & ASSOCIATES, INC.

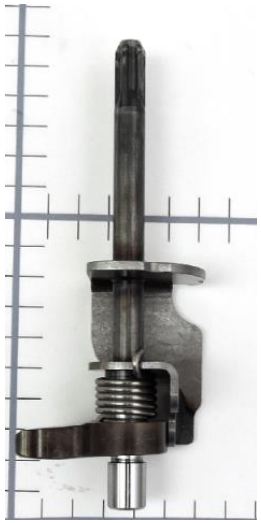
Assemble Shaft

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Laser Welding	24.97	1	0.25	58.22	GER	$0.40	99.81 %	$0.03

Assemble Shaft

	Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
	Sleeve, Shaft Asm	1	Commodity Item	Purchased	0.0017	-	$0.20	$0.00

Bumper, Parking Brake Asm



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\Parking Brake Shaft Asm, Gear Box Asm
\Bumper, Parking Brake Asm
\Bumper Process

Process Summary

Right First Time	99.79 %
Process Time (Sec)	74.54
Total Weight (kg)	0.07

Material Cost**	$0.12
OEM Process Cost	$0.00
Supplier Process Cost	$1.25
Q Burden	$0.03
SG&A	$0.21
Manufacturing Cost*	$1.60

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Bumper, Parking Brake Asm

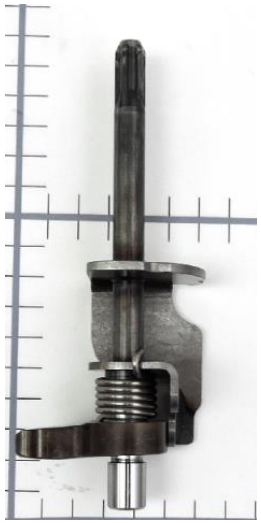
Bumper Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	9.00	1	0.25	20.00	GER	$0.05	99.99 %	$0.00
Deburr	9.00	1	0.25	35.68	GER	$0.09	99.99 %	$0.00
CNC Machining	35.20	1	0.25	49.86	GER	$0.49	99.97 %	$0.00
Carburize	4.94	1	0.25	167.44	GER	$0.23	100.00 %	$0.00
Quench	0.49	1	0.25	25.28	GER	$0.00	100.00 %	$0.00
Temper	0.61	1	0.25	19.29	GER	$0.00	100.00 %	$0.00
25 Ton Trim Press	4.60	1	0.25	19.09	GER	$0.02	99.98 %	$0.00
500 Ton Forging Press	5.70	1	2.00	205.38	GER	$0.33	99.92 %	$0.01
Cut Blank	5.00	1	0.25	25.18	GER	$0.03	99.97 %	$0.00

Bumper Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Bumper	1	Steel 1008 - Coil Stock	$0.99	0.0737	0.1220	$0.00	$0.12

Assemble Parking Brake Shaft



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\Gear Box Housing, Gear Box Asm
\Parking Brake Shaft Asm, Gear Box Asm
\Assemble Parking Brake Shaft

Process Summary

Right First Time	99.89 %
Process Time (Sec)	12.00
Total Weight (kg)	0.01

Material Cost**	$0.14
OEM Process Cost	$0.00
Supplier Process Cost	$0.10
Q Burden	$0.02
SG&A	$0.02
Manufacturing Cost*	$0.28

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Parking Brake Shaft

MUNRO & ASSOCIATES, INC.

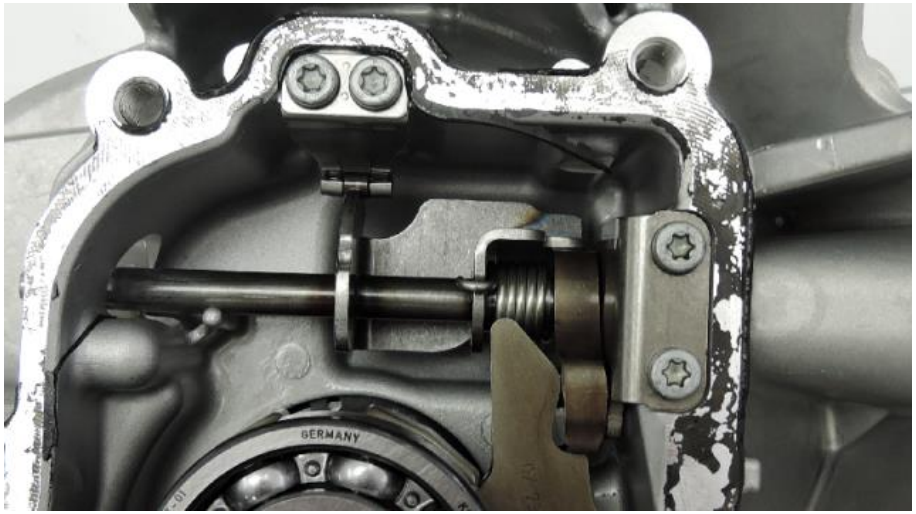
Assemble Parking Brake Shaft

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	12.00	1	0.25	30.27	GER	$0.10	99.89 %	$0.02

Assemble Parking Brake Shaft

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Return Spring, Parking Brake Asm	1	Commodity Item	Purchased	0.0087	-	$0.14	$0.00

Parking Brake Shaft Mounting Bracket, Gear Box



\...
\Gear Box Housing, Gear Box Asm
\Parking Brake Shaft Mounting Bracket, Gear Box
\Parking Brake Mounting Bracket Process

Process Summary

Right First Time	99.97 %
Process Time (Sec)	14.33
Total Weight (kg)	0.05

Material Cost**	$0.09
OEM Process Cost	$0.00
Supplier Process Cost	$0.11
Q Burden	$0.00
SG&A	$0.03
Manufacturing Cost*	$0.23

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Parking Brake Shaft Mounting Bracket, Gear Box

MUNRO & ASSOCIATES, INC.

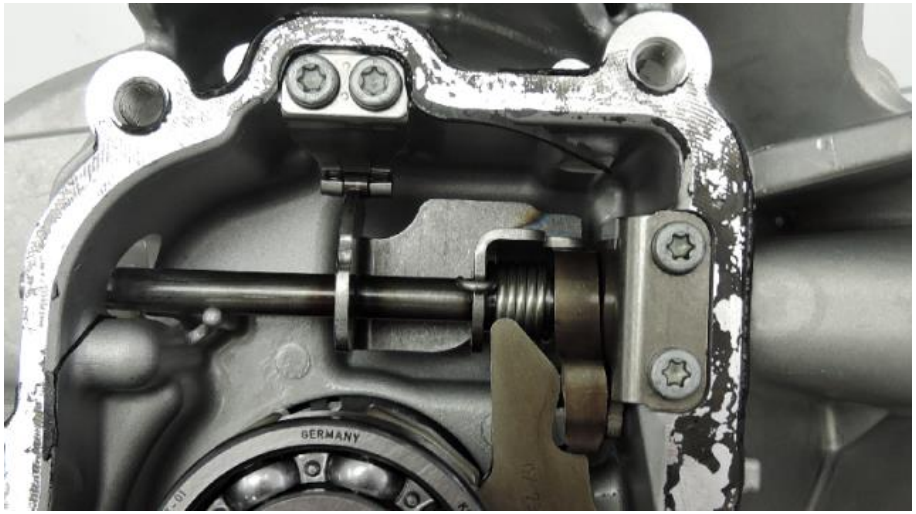
Parking Brake Mounting Bracket Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	7.00	1	0.25	20.00	GER	$0.04	99.99 %	$0.00
Deburr	6.00	1	0.25	35.68	GER	$0.06	99.99 %	$0.00
60 Ton Stamping Press	1.33	1	0.25	25.22	GER	$0.01	99.99 %	$0.00

Parking Brake Mounting Bracket Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Parking Brake Mounting Bracket	1	Steel 1008 - Coil Stock	$0.99	0.0451	0.0924	$0.00	$0.09

Parking Brake Detent, Gear Box



\...
\Gear Box Asm
\Gear Box Housing, Gear Box Asm
\Parking Brake Detent, Gear Box

Assembly Summary

Parts	4
Fasteners	0
Part Numbers	4
Steps	25
Fastenings	2
Right First Time	99.81 %
OEM Process Time (Min)	0.00
Supplier Process Time (Min)	0.49
Total Weight (kg)	0.01

Material Cost**	$0.28
OEM Process Cost	$0.00
Supplier Process Cost	$0.20
Q Burden	$0.03
SG&A	$0.04
Manufacturing Cost*	$0.55

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Parking Brake Detent, Gear Box

MUNRO & ASSOCIATES, INC.

Parking Brake Detent, Gear Box

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Detent, Parking Brake	1	1	0	7	0	99.97 %	0.00	0.00	0.00	0.16	0.0086
Detent Support, Parking Brake	1	1	0	7	0	99.97 %	0.00	0.00	0.00	0.14	0.0004
Assemble Detent	1	2	2	9	2	99.87 %	0.00	0.00	0.19	0.00	0.0017

Parking Brake Detent, Gear Box

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Detent, Parking Brake	$0.00	$0.01	$0.00	$0.00	$0.00	$0.05	$0.00	$0.01	$0.07
Detent Support, Parking Brake	$0.00	$0.01	$0.00	$0.00	$0.00	$0.04	$0.00	$0.01	$0.06
Assemble Detent	$0.26	$0.00	$0.00	$0.00	$0.11	$0.00	$0.02	$0.02	$0.42

MUNRO & ASSOCIATES, INC.

Detailed Summary

Parts	4
Fasteners	0
Part Numbers	4
Steps	25
Fastenings	2
Right First Time	99.81%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	0.19
Supplier Fab. Time (Min)	0.30
Total Weight (kg)	0.01

Purchased Part Cost	$0.26
Material Cost	$0.02
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.00
Supplier Asm. Cost	$0.11
Supplier Fab. Cost	$0.09
Q Burden	$0.03
SG&A	$0.04
Manufacturing Cost*	$0.55

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Detent, Parking Brake

\...
\Parking Brake Detent, Gear Box
\Detent, Parking Brake
\Detent Process

Process Summary

Right First Time	99.97 %
Process Time (Sec)	9.60
Total Weight (kg)	0.01

Material Cost**	$0.01
OEM Process Cost	$0.00
Supplier Process Cost	$0.05
Q Burden	$0.00
SG&A	$0.01
Manufacturing Cost*	$0.07

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Detent, Parking Brake

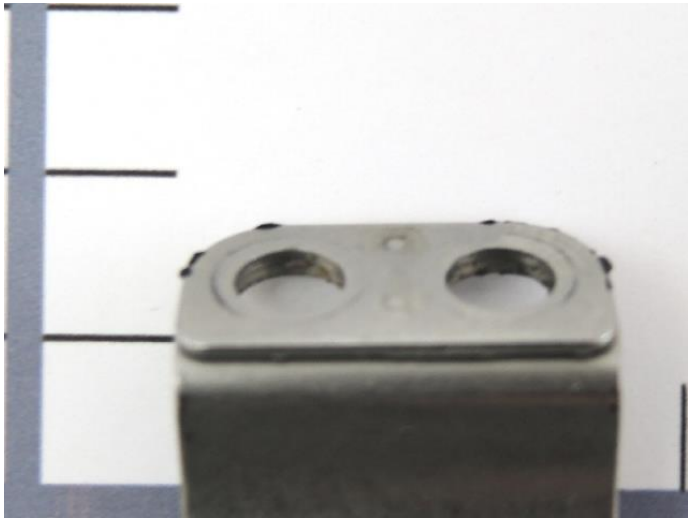
Detent Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	5.00	1	0.25	20.00	GER	$0.03	99.99 %	$0.00
Deburr	4.00	1	0.25	12.36	GER	$0.01	99.99 %	$0.00
25 Ton Stamping Press	0.60	1	0.25	21.63	GER	$0.00	99.99 %	$0.00

Detent Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Detent	1	Steel 1008 - Coil Stock	$0.99	0.0086	0.0120	$0.00	$0.01

Detent Support, Parking Brake



\...
\Parking Brake Detent, Gear Box
\Detent Support, Parking Brake
\Support Bracket, Process

Process Summary

Right First Time	99.97 %
Process Time (Sec)	8.60
Total Weight (kg)	0.00

Material Cost**	$0.01
OEM Process Cost	$0.00
Supplier Process Cost	$0.04
Q Burden	$0.00
SG&A	$0.01
Manufacturing Cost*	$0.06

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Detent Support, Parking Brake

MUNRO & ASSOCIATES, INC.

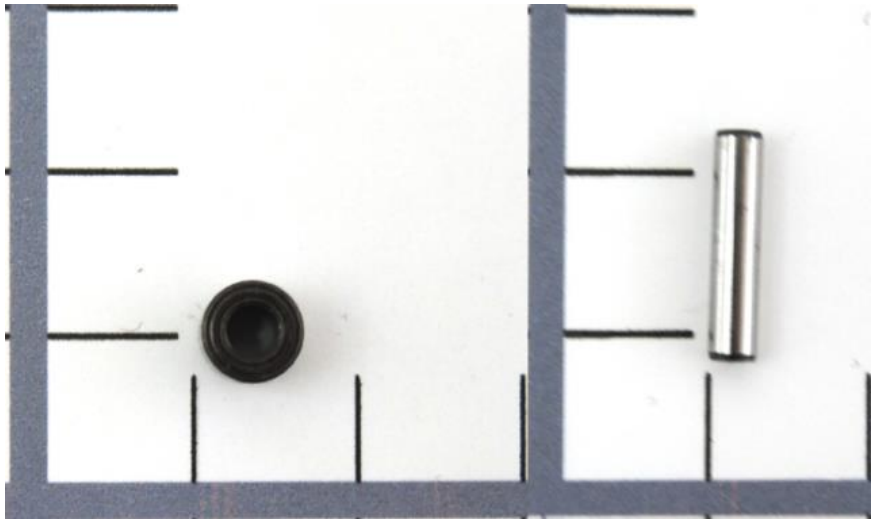
Support Bracket, Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	5.00	1	0.25	20.00	GER	$0.03	99.99 %	$0.00
Deburr	3.00	1	0.25	12.36	GER	$0.01	99.99 %	$0.00
25 Ton Stamping Press	0.60	1	0.25	21.63	GER	$0.00	99.99 %	$0.00

Support Bracket, Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Detent Support	1	Steel 1008 - Coil Stock	$0.99	0.0004	0.0080	$0.00	$0.01

Assemble Detent



\...
\Gear Box Housing, Gear Box Asm
\Parking Brake Detent, Gear Box
\Assemble Detent

Process Summary

Right First Time	99.87 %
Process Time (Sec)	11.20
Total Weight (kg)	0.00

Material Cost**	$0.26
OEM Process Cost	$0.00
Supplier Process Cost	$0.11
Q Burden	$0.02
SG&A	$0.02
Manufacturing Cost*	$0.42

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Detent

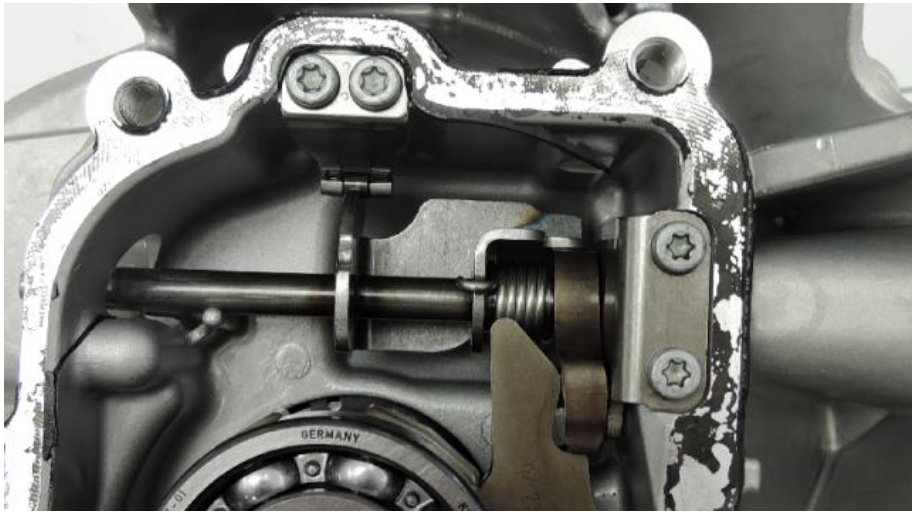
Assemble Detent

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Spot Welding, 1 Head	11.20	1	0.25	36.19	GER	$0.11	99.87 %	$0.02

Assemble Detent

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Detent Pin, Parking Brake	1	Commodity Item	Purchased	0.0008	-	$0.06	$0.00
Detent Roller, Park Brake	1	Commodity Item	Purchased	0.0009	-	$0.20	$0.00

Assemble Parking Brake Shaft



\...
\Gear Box Asm
\Gear Box Housing, Gear Box Asm
\Assemble Parking Brake Shaft

Process Summary

Right First Time	99.04 %
Process Time (Sec)	63.00
Total Weight (kg)	0.02

Material Cost**	$0.12
OEM Process Cost	$1.60
Supplier Process Cost	$0.00
Q Burden	$0.14
SG&A	$0.24
Manufacturing Cost*	$2.11

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Parking Brake Shaft

MUNRO & ASSOCIATES, INC.

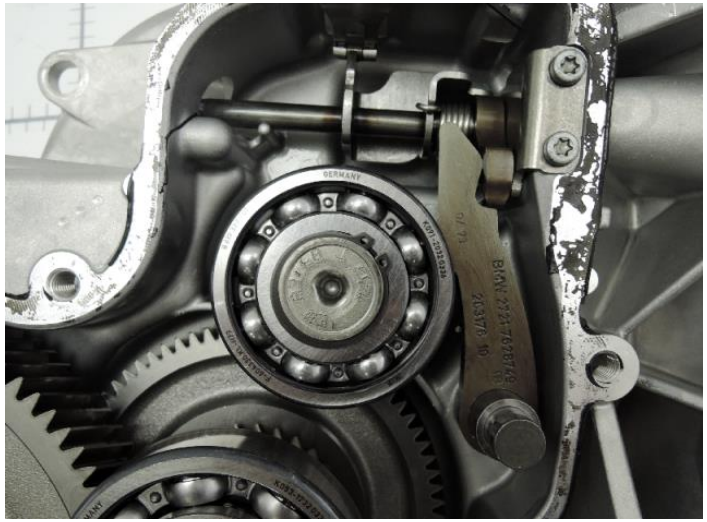
Assemble Parking Brake Shaft

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	63.00	1	1.00	91.41	GER	$1.60	99.04 %	$0.14

Assemble Parking Brake Shaft

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
M6x16mm-Pan Head Torx	4	Commodity Item	Purchased	0.0046	-	$0.03	$0.00

Parking Brake Pawl, Gear Box



\...
\Gear Box Housing, Gear Box Asm
\Parking Brake Pawl, Gear Box
\Parking Pawl Process

Process Summary

Right First Time	99.81 %
Process Time (Sec)	52.23
Total Weight (kg)	0.15

Material Cost**	$0.25
OEM Process Cost	$0.00
Supplier Process Cost	$0.95
Q Burden	$0.03
SG&A	$0.18
Manufacturing Cost*	$1.40

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Parking Brake Pawl, Gear Box

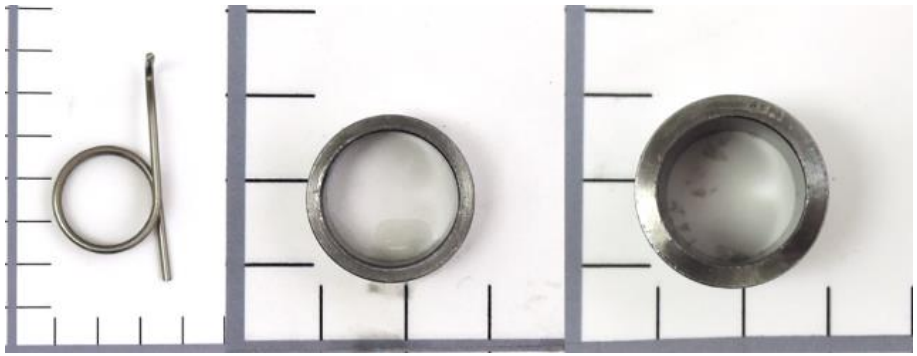
Parking Pawl Process

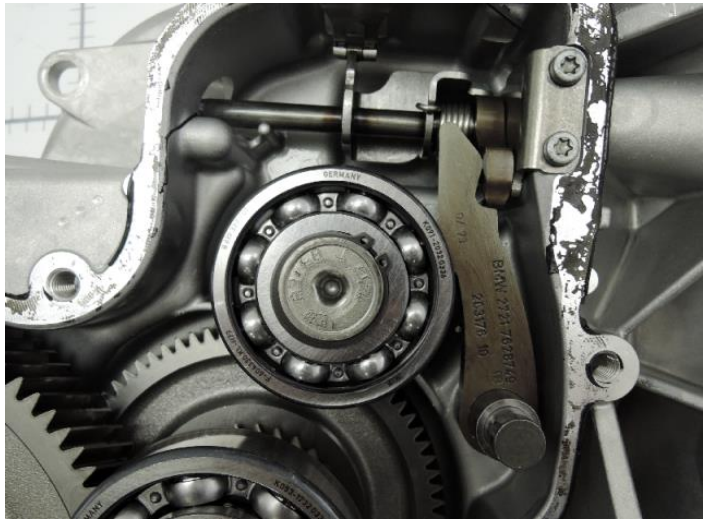
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Deburr	9.00	1	0.25	35.68	GER	$0.09	99.99 %	$0.00
CNC Machining	8.09	1	0.25	49.86	GER	$0.11	99.99 %	$0.00
Temper	0.75	1	0.25	19.29	GER	$0.00	100.00 %	$0.00
Quench	0.52	1	0.25	25.28	GER	$0.00	100.00 %	$0.00
Carburize	5.37	1	0.25	167.44	GER	$0.25	100.00 %	$0.00
25 Ton Trim Press	4.60	1	0.25	19.09	GER	$0.02	99.98 %	$0.00
500 Ton Forging Press	5.70	1	2.00	205.38	GER	$0.33	99.92 %	$0.01
Cut Blank	11.20	1	0.25	25.18	GER	$0.08	99.97 %	$0.00

Parking Pawl Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Parking Pawl	1	Steel 1008 - Coil Stock	$0.99	0.1499	0.2500	$0.00	$0.25

Assemble Parking Brake Pawl





\...
\Gear Box Asm
\Gear Box Housing, Gear Box Asm
\Assemble Parking Brake Pawl

Process Summary

Right First Time	99.89 %
Process Time (Sec)	23.00
Total Weight (kg)	0.02

Material Cost**	$0.41
OEM Process Cost	$0.58
Supplier Process Cost	$0.00
Q Burden	$0.02
SG&A	$0.10
Manufacturing Cost*	$1.11

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Parking Brake Pawl

MUNRO & ASSOCIATES, INC.

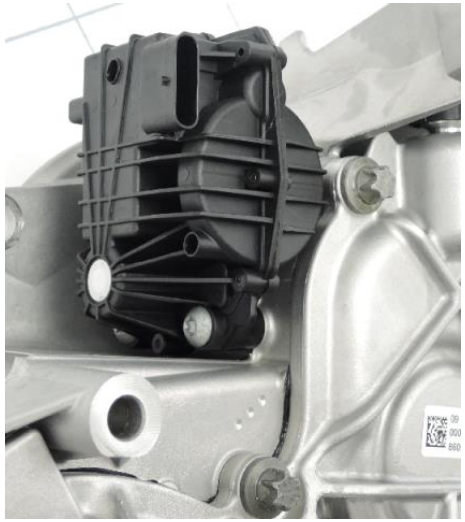
Assemble Parking Brake Pawl

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	92.00	4	1.00	91.41	GER	$0.58	99.89 %	$0.02

Assemble Parking Brake Pawl

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
M15x7mm-Sleeve	1	Commodity Item	Purchased	0.0056	-	$0.20	$0.00
Parking Brake Pawl Return Spring	1	Commodity Item	Purchased	0.0050	-	$0.06	$0.00
M15x14mm Sleeve	1	Commodity Item	Purchased	0.0141	-	$0.15	$0.00

Actuator Asm, Gear Box Housing Asm



\...
\Gear Box Asm
\Gear Box Housing, Gear Box Asm
\Actuator Asm, Gear Box Housing Asm

Assembly Summary

Parts	31
Fasteners	7
Part Numbers	17
Steps	95
Fastenings	19
Right First Time	97.49 %
OEM Process Time (Min)	0.12
Supplier Process Time (Min)	2.12
Total Weight (kg)	0.41

Material Cost**	$11.89
OEM Process Cost	$0.09
Supplier Process Cost	$1.02
Q Burden	$0.38
SG&A	$0.92
Manufacturing Cost*	$14.31

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Actuator Asm, Gear Box Housing Asm

MUNRO & ASSOCIATES, INC.

Actuator Asm, Gear Box Housing Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Actuator Cover Asm, Actuator Asm	1	6	5	25	5	99.66 %	0.00	0.12	0.49	0.00	0.0857
Actuator Base Asm, Actuator Asm	1	18	6	41	6	99.38 %	0.00	0.00	0.65	0.18	0.3160
Assemble Cover to Base	1	7	8	27	8	98.43 %	0.00	0.00	0.80	0.00	0.0091

Actuator Asm, Gear Box Housing Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Actuator Cover Asm, Actuator Asm	$0.52	$0.53	$0.00	$0.09	$0.22	$0.00	$0.05	$0.14	$1.56
Actuator Base Asm, Actuator Asm	$7.91	$2.79	$0.00	$0.00	$0.29	$0.10	$0.09	$0.71	$11.90
Assemble Cover to Base	$0.14	$0.00	$0.00	$0.00	$0.40	$0.00	$0.24	$0.06	$0.85

Actuator Asm, Gear Box Housing Asm

MUNRO & ASSOCIATES, INC.

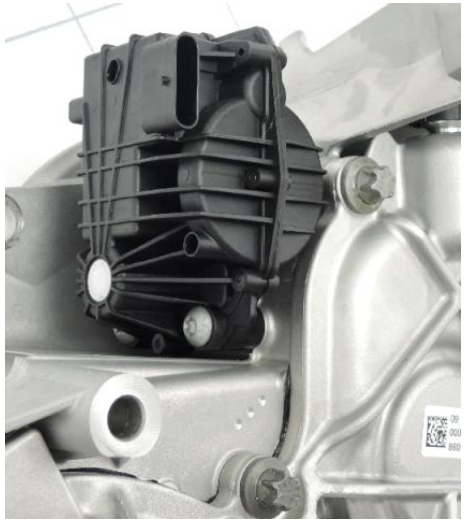
Detailed Summary

Parts	31
Fasteners	7
Part Numbers	17
Steps	95
Fastenings	19
Right First Time	97.49%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.12
Supplier Asm. Time (Min)	1.94
Supplier Fab. Time (Min)	0.18
Total Weight (kg)	0.41

Purchased Part Cost	$8.57
Material Cost	$3.32
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.09
Supplier Asm. Cost	$0.92
Supplier Fab. Cost	$0.10
Q Burden	$0.38
SG&A	$0.92
Manufacturing Cost*	$14.31

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Actuator Cover Asm, Actuator Asm



\...
\Gear Box Housing, Gear Box Asm
\Actuator Asm, Gear Box Housing Asm
\Actuator Cover Asm, Actuator Asm

Assembly Summary

Parts	6
Fasteners	0
Part Numbers	6
Steps	25
Fastenings	5
Right First Time	99.66 %
OEM Process Time (Min)	0.12
Supplier Process Time (Min)	0.49
Total Weight (kg)	0.09

Material Cost**	$1.05
OEM Process Cost	$0.09
Supplier Process Cost	$0.22
Q Burden	$0.05
SG&A	$0.14
Manufacturing Cost*	$1.56

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Actuator Cover Asm, Actuator Asm

MUNRO & ASSOCIATES, INC.

Actuator Cover Asm, Actuator Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Actuator Gear Asm, Actuator cover Asm	1	2	1	7	1	99.96 %	0.00	0.06	0.12	0.00	0.0242
Actuator Cover Housing, Actuator Cover Asm	1	4	3	12	3	99.79 %	0.00	0.06	0.22	0.00	0.0615
Assemble Cover	1	0	1	4	1	99.91 %	0.00	0.00	0.15	0.00	0.0000

Actuator Cover Asm, Actuator Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Actuator Gear Asm, Actuator cover Asm	$0.04	$0.33	$0.00	$0.04	$0.05	$0.00	$0.01	$0.06	$0.52
Actuator Cover Housing, Actuator Cover Asm	$0.48	$0.20	$0.00	$0.06	$0.11	$0.00	$0.03	$0.07	$0.95
Assemble Cover	$0.00	$0.00	$0.00	$0.00	$0.06	$0.00	$0.01	$0.01	$0.09

Detailed Summary

Parts	6
Fasteners	0
Part Numbers	6
Steps	25
Fastenings	5
Right First Time	99.66%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.12
Supplier Asm. Time (Min)	0.49
Supplier Fab. Time (Min)	0.00
Total Weight (kg)	0.09

Purchased Part Cost	$0.52
Material Cost	$0.53
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.09
Supplier Asm. Cost	$0.22
Supplier Fab. Cost	$0.00
Q Burden	$0.05
SG&A	$0.14
Manufacturing Cost*	$1.56

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Actuator Gear Asm, Actuator cover Asm

\...
\Actuator Asm, Gear Box Housing Asm
\Actuator Cover Asm, Actuator Asm
\Actuator Gear Asm, Actuator cover Asm

Assembly Summary

Parts	2
Fasteners	0
Part Numbers	2
Steps	7
Fastenings	1
Right First Time	99.96 %
OEM Process Time (Min)	0.06
Supplier Process Time (Min)	0.12
Total Weight (kg)	0.02

Material Cost**	$0.37
OEM Process Cost	$0.04
Supplier Process Cost	$0.05
Q Burden	$0.01
SG&A	$0.06
Manufacturing Cost*	$0.52

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Actuator Gear Asm, Actuator cover Asm

MUNRO & ASSOCIATES, INC.

Actuator Gear Asm, Actuator cover Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Gear, Actuator Gear Asm	1	1	0	1	0	99.99 %	0.00	0.06	0.00	0.00	0.0236
Assemble Gear	1	1	1	5	1	99.97 %	0.00	0.00	0.12	0.00	0.0006

Actuator Gear Asm, Actuator cover Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Gear, Actuator Gear Asm	$0.00	$0.33	$0.00	$0.04	$0.00	$0.00	$0.00	$0.05	$0.42
Assemble Gear	$0.04	$0.00	$0.00	$0.00	$0.05	$0.00	$0.00	$0.01	$0.10

MUNRO & ASSOCIATES, INC.

Detailed Summary

Parts	2
Fasteners	0
Part Numbers	2
Steps	7
Fastenings	1
Right First Time	99.96%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.06
Supplier Asm. Time (Min)	0.12
Supplier Fab. Time (Min)	0.00
Total Weight (kg)	0.02

Purchased Part Cost	$0.04
Material Cost	$0.33
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.04
Supplier Asm. Cost	$0.05
Supplier Fab. Cost	$0.00
Q Burden	$0.01
SG&A	$0.06
Manufacturing Cost*	$0.52

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Gear, Actuator Gear Asm

\...
\Actuator Gear Asm, Actuator cover Asm
\Gear, Actuator Gear Asm
\Gear Process

Process Summary

Right First Time	99.99 %
Process Time (Sec)	3.79
Total Weight (kg)	0.02

Material Cost**	$0.33
OEM Process Cost	$0.04
Supplier Process Cost	$0.00
Q Burden	$0.00
SG&A	$0.05
Manufacturing Cost*	$0.42

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Gear, Actuator Gear Asm

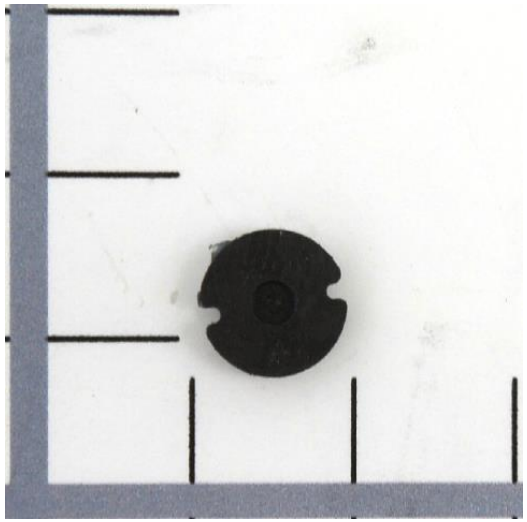
Gear Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
110 Ton Injection Molding Press	30.32	8	0.25	33.39	GER	$0.04	99.99 %	$0.00

Gear Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Gear	1	PPS GF40	$13.25	0.0236	0.0250	$0.00	$0.33

Assemble Gear



\...
\Actuator Cover Asm, Actuator Asm
\Actuator Gear Asm, Actuator cover Asm
\Assemble Gear

Process Summary

Right First Time	99.97 %
Process Time (Sec)	7.00
Total Weight (kg)	0.00

Material Cost**	$0.04
OEM Process Cost	$0.00
Supplier Process Cost	$0.05
Q Burden	$0.00
SG&A	$0.01
Manufacturing Cost*	$0.10

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Gear

Assemble Gear

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	7.00	1	0.25	25.62	GER	$0.05	99.97 %	$0.00

Assemble Gear

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Magnet, Actuator Gear	1	Commodity Item	Purchased	0.0006	-	$0.04	$0.00

Actuator Cover Housing, Actuator Cover Asm

\...
\Actuator Asm, Gear Box Housing Asm
\Actuator Cover Asm, Actuator Asm
\Actuator Cover Housing, Actuator Cover Asm

Assembly Summary

Parts	4
Fasteners	0
Part Numbers	4
Steps	12
Fastenings	3
Right First Time	99.79 %
OEM Process Time (Min)	0.06
Supplier Process Time (Min)	0.22
Total Weight (kg)	0.06

Material Cost**	$0.68
OEM Process Cost	$0.06
Supplier Process Cost	$0.11
Q Burden	$0.03
SG&A	$0.07
Manufacturing Cost*	$0.95

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

MUNRO & ASSOCIATES, INC.

Actuator Cover Housing, Actuator Cover Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Housing, Actuator Cover Housing	1	1	0	1	0	99.99 %	0.00	0.06	0.00	0.00	0.0590
Assemble Housing	1	3	3	10	3	99.80 %	0.00	0.00	0.22	0.00	0.0025

Actuator Cover Housing, Actuator Cover Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Housing, Actuator Cover Housing	$0.00	$0.20	$0.00	$0.06	$0.00	$0.00	$0.00	$0.04	$0.30
Assemble Housing	$0.48	$0.00	$0.00	$0.00	$0.11	$0.00	$0.03	$0.03	$0.65

MUNRO & ASSOCIATES, INC.

Detailed Summary

Parts	4
Fasteners	0
Part Numbers	4
Steps	12
Fastenings	3
Right First Time	99.79%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.06
Supplier Asm. Time (Min)	0.22
Supplier Fab. Time (Min)	0.00
Total Weight (kg)	0.06

Purchased Part Cost	$0.48
Material Cost	$0.20
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.06
Supplier Asm. Cost	$0.11
Supplier Fab. Cost	$0.00
Q Burden	$0.03
SG&A	$0.07
Manufacturing Cost*	$0.95

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Housing, Actuator Cover Housing

\...
\Actuator Cover Housing, Actuator Cover Asm
\Housing, Actuator Cover Housing
\Housing Process

Process Summary

Right First Time	99.99 %
Process Time (Sec)	3.36
Total Weight (kg)	0.06

Material Cost**	$0.20
OEM Process Cost	$0.06
Supplier Process Cost	$0.00
Q Burden	$0.00
SG&A	$0.04
Manufacturing Cost*	$0.30

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Housing, Actuator Cover Housing

Housing Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
390 Ton Injection Molding Press	13.44	4	0.25	59.39	GER	$0.06	99.99 %	$0.00

Housing Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Housing	1	PBT GF30	$3.18	0.0590	0.0634	$0.00	$0.20

Assemble Housing

\...
\Actuator Cover Asm, Actuator Asm
\Actuator Cover Housing, Actuator Cover Asm
\Assemble Housing

Process Summary

Right First Time	99.80 %
Process Time (Sec)	13.15
Total Weight (kg)	0.00

Material Cost**	$0.48
OEM Process Cost	$0.00
Supplier Process Cost	$0.11
Q Burden	$0.03
SG&A	$0.03
Manufacturing Cost*	$0.65

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Housing

Assemble Housing

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	13.15	1	0.25	30.27	GER	$0.11	99.80 %	$0.03

Assemble Housing

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
26MM Oring, Actuator Cover	1	Commodity Item	Purchased	0.0002	-	$0.03	$0.00
24MM Axis Seal, Actuator Cover	1	Commodity Item	Purchased	0.0022	-	$0.40	$0.00
Label, Dura QR Code	1	Commodity Item	Purchased	0.0001	-	$0.05	$0.00

Assemble Cover

MUNRO & ASSOCIATES, INC.

No Commodity Items Required for This Process

\...
\Actuator Asm, Gear Box Housing Asm
\Actuator Cover Asm, Actuator Asm
\Assemble Cover

Process Summary

Right First Time	99.91 %
Process Time (Sec)	9.00
Total Weight (kg)	0.00

Material Cost**	$0.00
OEM Process Cost	$0.00
Supplier Process Cost	$0.06
Q Burden	$0.01
SG&A	$0.01
Manufacturing Cost*	$0.09

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Cover

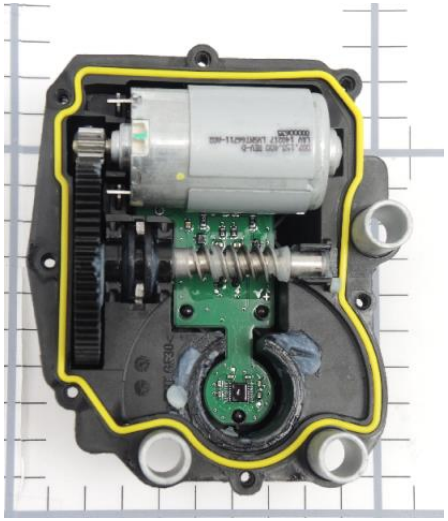
Assemble Cover

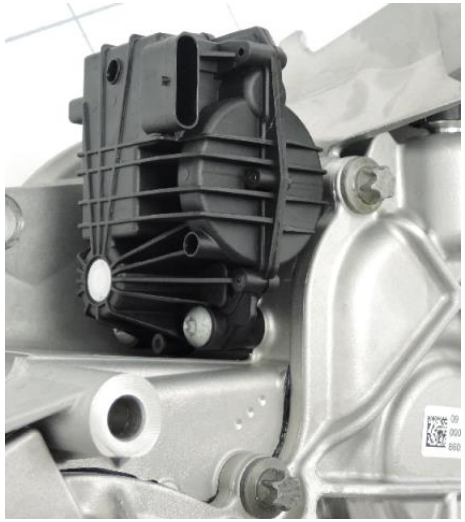
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	9.00	1	0.25	25.62	GER	$0.06	99.91 %	$0.01

Assemble Cover

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost

Actuator Base Asm, Actuator Asm





\...
\Gear Box Housing, Gear Box Asm
\Actuator Asm, Gear Box Housing Asm
\Actuator Base Asm, Actuator Asm

Assembly Summary

Parts	18
Fasteners	0
Part Numbers	10
Steps	41
Fastenings	6
Right First Time	99.38 %
OEM Process Time (Min)	0.00
Supplier Process Time (Min)	0.83
Total Weight (kg)	0.32

Material Cost**	$10.70
OEM Process Cost	$0.00
Supplier Process Cost	$0.39
Q Burden	$0.09
SG&A	$0.71
Manufacturing Cost*	$11.90

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Actuator Base Asm, Actuator Asm

MUNRO & ASSOCIATES, INC.

Actuator Base Asm, Actuator Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Base Actuator, Actuator Base Asm	1	10	0	13	0	99.94 %	0.00	0.00	0.00	0.11	0.0997
Assemble Actuator Printed Circuit Board	1	1	2	6	2	99.84 %	0.00	0.00	0.22	0.00	0.0088
Idler Gear, Actuator Asm	1	2	0	3	0	99.98 %	0.00	0.00	0.00	0.07	0.0299
Assemble Actuator Base	1	5	4	17	4	99.62 %	0.00	0.00	0.43	0.00	0.1776

Actuator Base Asm, Actuator Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Base Actuator, Actuator Base Asm	$0.31	$0.34	$0.00	$0.00	$0.00	$0.07	$0.01	$0.07	$0.80
Assemble Actuator Printed Circuit Board	$0.00	$2.40	$0.00	$0.00	$0.07	$0.00	$0.02	$0.37	$2.86
Idler Gear, Actuator Asm	$0.13	$0.05	$0.00	$0.00	$0.00	$0.04	$0.00	$0.02	$0.24
Assemble Actuator Base	$7.47	$0.00	$0.00	$0.00	$0.22	$0.00	$0.06	$0.26	$8.00

Actuator Base Asm, Actuator Asm

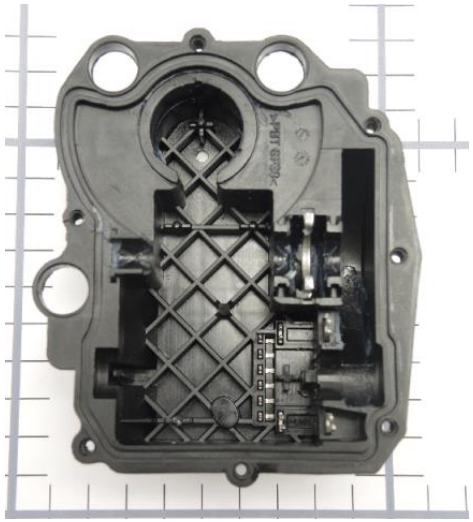
Detailed Summary

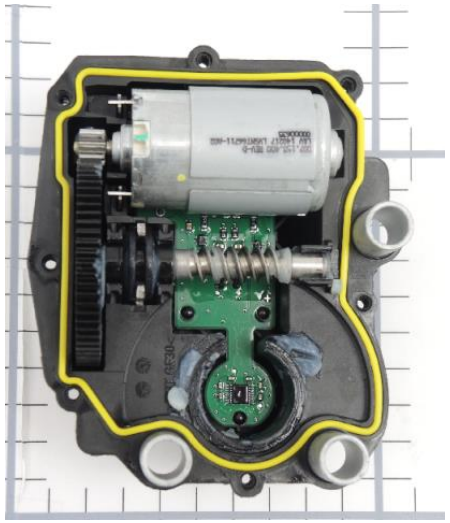
Parts	18
Fasteners	0
Part Numbers	10
Steps	41
Fastenings	6
Right First Time	99.38%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	0.65
Supplier Fab. Time (Min)	0.18
Total Weight (kg)	0.32

Purchased Part Cost	$7.91
Material Cost	$2.79
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.00
Supplier Asm. Cost	$0.29
Supplier Fab. Cost	$0.10
Q Burden	$0.09
SG&A	$0.71
Manufacturing Cost*	$11.90

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Base Actuator, Actuator Base Asm





\...
\Actuator Base Asm, Actuator Asm
\Base Actuator, Actuator Base Asm
\Base Process

Process Summary

Right First Time	99.94 %
Process Time (Sec)	6.58
Total Weight (kg)	0.10

Material Cost**	$0.65
OEM Process Cost	$0.00
Supplier Process Cost	$0.07
Q Burden	$0.01
SG&A	$0.07
Manufacturing Cost*	$0.80

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Base Actuator, Actuator Base Asm

MUNRO & ASSOCIATES, INC.

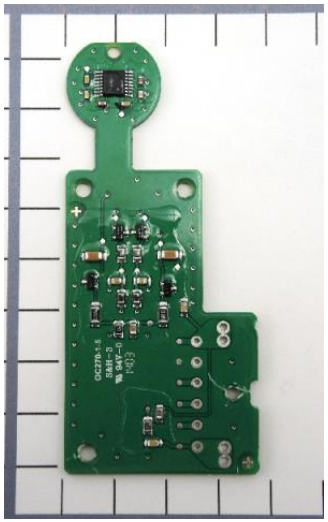
Base Process

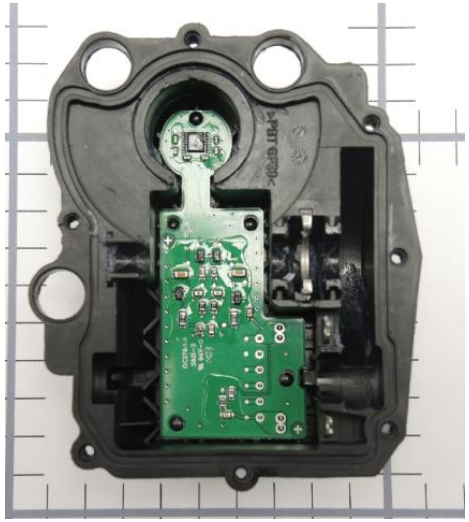
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
150 Ton Injection Molding Press	26.32	4	0.25	36.54	GER	$0.07	99.94 %	$0.01

Base Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Base	1	PBT GF30	$3.18	0.0984	0.1058	$0.00	$0.34
Connector Pin Small, Actuator Base	6	Commodity Item	Purchased	0.0001	-	$0.03	$0.00
Connector Large, Actuator Base	2	Commodity Item	Purchased	0.0002	-	$0.05	$0.00
Idler Gear Support, Actuator Bse	1	Commodity Item	Purchased	0.0003	-	$0.03	$0.00

Assemble Actuator Printed Circuit Board





\...
\Actuator Asm, Gear Box Housing Asm
\Actuator Base Asm, Actuator Asm
\Assemble Actuator Printed Circuit Board

Process Summary

Right First Time	99.84 %
Process Time (Sec)	13.00
Total Weight (kg)	0.01

Material Cost**	$2.40
OEM Process Cost	$0.00
Supplier Process Cost	$0.07
Q Burden	$0.02
SG&A	$0.37
Manufacturing Cost*	$2.86

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Actuator Printed Circuit Board

Assemble Actuator Printed Circuit Board

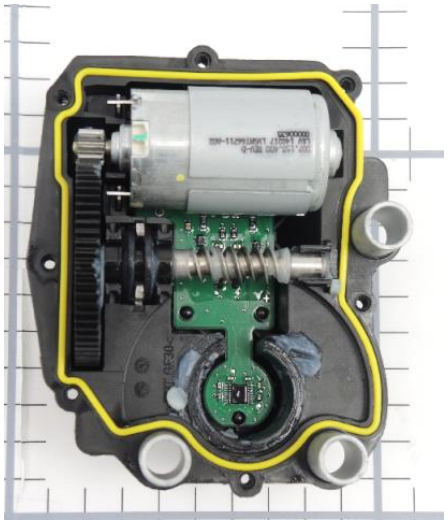
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Heat Staking, 4 Heads	13.00	1	0.25	19.48	GER	$0.07	99.84 %	$0.02

Assemble Actuator Printed Circuit Board

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Actuator Printed Circuit Board, Actuator Asm	1	See Appendix	-	0.0088	-	$0.00	$2.40

Click Here for TechInsights Electronics Report on Actuator Printed Circuit Board

Idler Gear, Actuator Asm



\...
\Actuator Base Asm, Actuator Asm
\Idler Gear, Actuator Asm
\Idler Gear Process

Process Summary

Right First Time	99.98 %
Process Time (Sec)	4.18
Total Weight (kg)	0.03

Material Cost**	$0.18
OEM Process Cost	$0.00
Supplier Process Cost	$0.04
Q Burden	$0.00
SG&A	$0.02
Manufacturing Cost*	$0.24

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Idler Gear, Actuator Asm

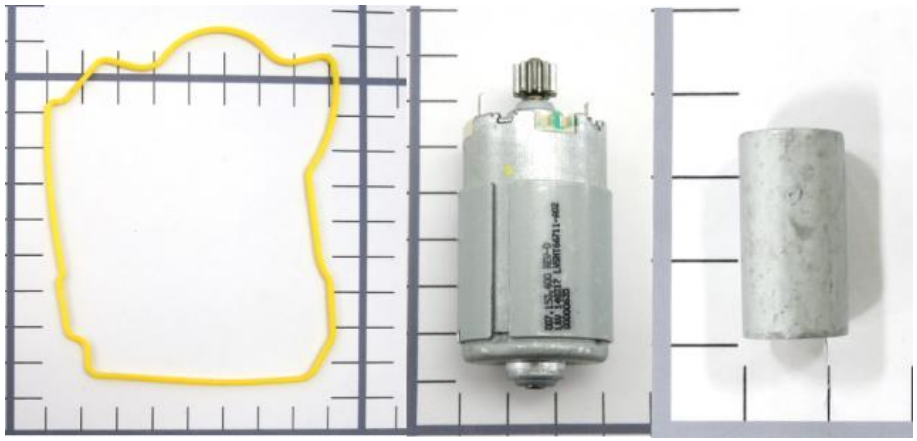
Idler Gear Process

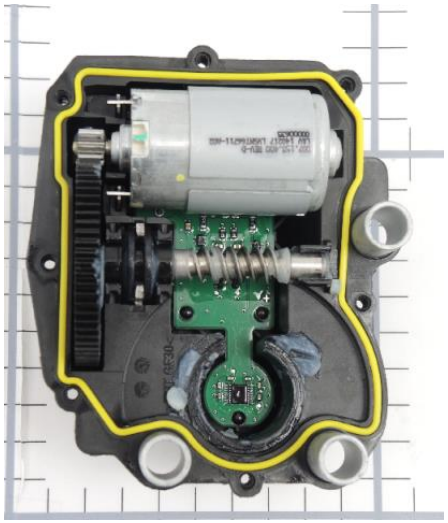
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
55 Ton Injection Molding Press	33.44	8	0.25	32.44	GER	$0.04	99.98 %	$0.00

Idler Gear Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Idler Gear	1	PA6 GF15	$4.52	0.0100	0.0108	$0.00	$0.05
Idler Shaft, Idler Gear	1	Commodity Item	Purchased	0.0199	-	$0.13	$0.00

Assemble Actuator Base





\...
\Actuator Asm, Gear Box Housing Asm
\Actuator Base Asm, Actuator Asm
\Assemble Actuator Base

Process Summary

Right First Time	99.62 %
Process Time (Sec)	26.00
Total Weight (kg)	0.18

Material Cost**	$7.47
OEM Process Cost	$0.00
Supplier Process Cost	$0.22
Q Burden	$0.06
SG&A	$0.26
Manufacturing Cost*	$8.00

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Actuator Base

MUNRO & ASSOCIATES, INC.

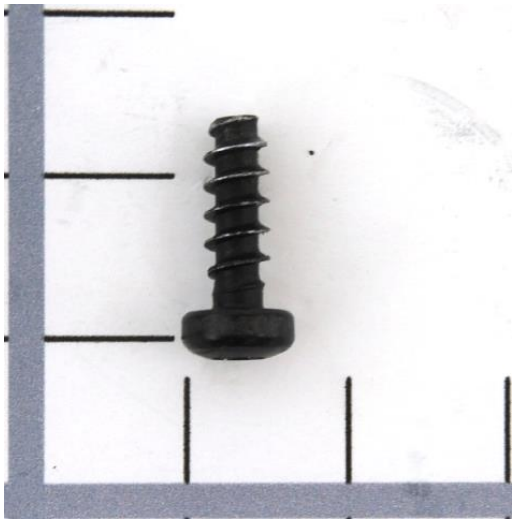
Assemble Actuator Base

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	26.00	1	0.25	30.27	GER	$0.22	99.62 %	$0.06

Assemble Actuator Base

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Alignment Dowel, Actuator Asm	3	Commodity Item	Purchased	0.0082	-	$0.08	$0.00
Actuator Motor Asm, Actuator Asm	1	Commodity Item	Purchased	0.1520	-	$7.00	$0.00
Case O-Ring, Actuator Asm	1	Commodity Item	Purchased	0.0010	-	$0.23	$0.00

Assemble Cover to Base



\...
\Gear Box Housing, Gear Box Asm
\Actuator Asm, Gear Box Housing Asm
\Assemble Cover to Base

Process Summary

Right First Time	98.43 %
Process Time (Sec)	48.00
Total Weight (kg)	0.01

Material Cost**	$0.14
OEM Process Cost	$0.00
Supplier Process Cost	$0.40
Q Burden	$0.24
SG&A	$0.06
Manufacturing Cost*	$0.85

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Cover to Base

MUNRO & ASSOCIATES, INC.

Assemble Cover to Base

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	48.00	1	0.25	30.27	GER	$0.40	98.43 %	$0.24

Assemble Cover to Base

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
M4x11mm-Pan Head Torx	7	Commodity Item	Purchased	0.0013	-	$0.02	$0.00

Assemble Actuator

\...
\Gear Box Asm
\Gear Box Housing, Gear Box Asm
\Assemble Actuator

Process Summary

Right First Time	99.35 %
Process Time (Sec)	42.00
Total Weight (kg)	0.05

Material Cost**	$0.18
OEM Process Cost	$1.07
Supplier Process Cost	$0.00
Q Burden	$0.10
SG&A	$0.17
Manufacturing Cost*	$1.51

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Actuator

MUNRO & ASSOCIATES, INC.

Assemble Actuator

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	42.00	1	1.00	91.41	GER	$1.07	99.35 %	$0.10

Assemble Actuator

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
M8x40mm-Pan Head Torx	3	Commodity Item	Purchased	0.0154	-	$0.06	$0.00

Input Differential Shaft Asm, Gear Box Asm

\...
\Gear Box Asm
\Input Differential Shaft Asm, Gear Box Asm
\Input Differential Shaft Process

Process Summary

Right First Time	99.47 %
Process Time (Sec)	326.89
Total Weight (kg)	0.89

Material Cost**	$1.68
OEM Process Cost	$0.00
Supplier Process Cost	$6.88
Q Burden	$0.08
SG&A	$1.28
Manufacturing Cost*	$9.92

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Input Differential Shaft Asm, Gear Box Asm

Input Differential Shaft Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Deburr	9.00	1	0.25	35.68	GER	$0.09	99.99 %	$0.00
Gear Grinding	113.65	1	0.25	83.40	GER	$2.63	99.96 %	$0.01
Temper	2.88	1	0.25	19.29	GER	$0.02	100.00 %	$0.00
Quench	0.39	1	0.25	25.28	GER	$0.00	100.00 %	$0.00
Carburize	27.14	1	0.25	167.44	GER	$1.26	100.00 %	$0.00
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Deburr	9.00	1	0.25	35.68	GER	$0.09	99.99 %	$0.00
Gear Hobbing	44.75	1	0.25	56.40	GER	$0.70	99.99 %	$0.00
CNC Machining	87.78	1	0.25	59.86	GER	$1.46	99.69 %	$0.05
Shot Blast	5.28	1	0.25	37.40	GER	$0.05	99.98 %	$0.00
1000 Ton Forging Press	5.00	1	2.00	279.11	GER	$0.39	99.96 %	$0.01

Input Differential Shaft Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Input Differential Shaft	1	Steel 4140 - Bar Stock	$1.72	0.8880	0.9760	$0.00	$1.68

Input Differential Shaft Asm, Gear Box Asm

MUNRO & ASSOCIATES, INC.

Input Differential Shaft Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Cut Blank	4.03	1	0.25	25.18	GER	$0.03	99.97 %	$0.00

Parking Brake Gear, Gear Box Asm

\...
\Gear Box Asm
\Parking Brake Gear, Gear Box Asm
\Parking Brake Gear Process

Process Summary

Right First Time	99.74 %
Process Time (Sec)	65.99
Total Weight (kg)	0.28

Material Cost**	$0.30
OEM Process Cost	$0.00
Supplier Process Cost	$1.43
Q Burden	$0.04
SG&A	$0.26
Manufacturing Cost*	$2.03

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Parking Brake Gear, Gear Box Asm

MUNRO & ASSOCIATES, INC.

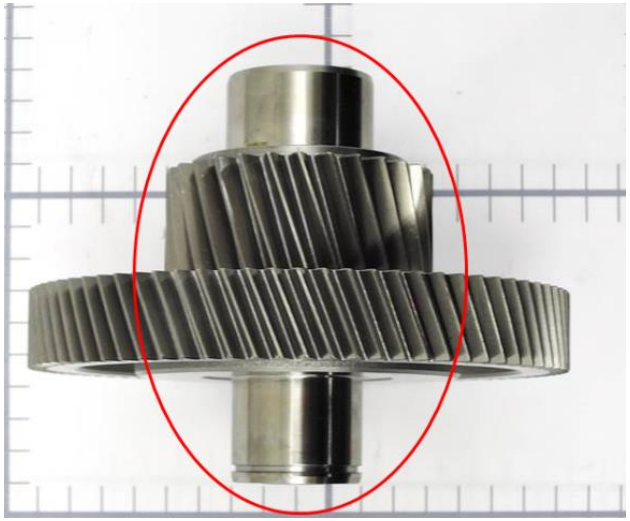
Parking Brake Gear Process

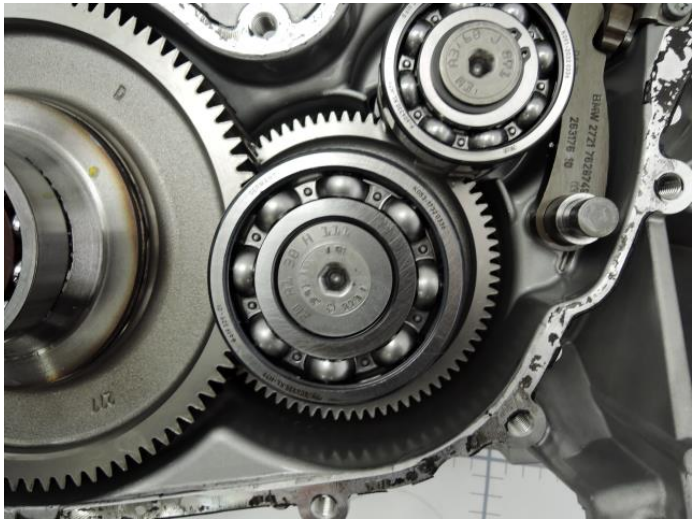
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Deburr	9.00	1	0.25	35.68	GER	$0.09	99.99 %	$0.00
Temper	1.35	1	0.25	19.29	GER	$0.01	100.00 %	$0.00
Quench	1.28	1	0.25	25.28	GER	$0.01	100.00 %	$0.00
Carburize	11.76	1	0.25	167.44	GER	$0.55	100.00 %	$0.00
CNC Machining	20.05	1	0.25	49.86	GER	$0.28	99.94 %	$0.01
500 Ton Forging Press	6.55	1	2.00	205.38	GER	$0.37	99.88 %	$0.02
Cut Blank	7.00	1	0.25	25.18	GER	$0.05	99.97 %	$0.00

Parking Brake Gear Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Parking Brake Gear	1	Steel 1008 - Coil Stock	$0.99	0.2791	0.3070	$0.00	$0.30

Intermediate Differential Shaft Asm, Gear Box Asm





\...
\Gear Box Asm
\Intermediate Differential Shaft Asm, Gear Box Asm
\Intermediate Shaft Process

Process Summary

Right First Time	99.57 %
Process Time (Sec)	413.02
Total Weight (kg)	2.10

Material Cost**	$3.98
OEM Process Cost	$0.00
Supplier Process Cost	$8.61
Q Burden	$0.06
SG&A	$1.89
Manufacturing Cost*	$14.54

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Intermediate Differential Shaft Asm, Gear Box Asm

MUNRO & ASSOCIATES, INC.

Intermediate Shaft Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Deburr	9.00	1	0.25	35.68	GER	$0.09	99.99 %	$0.00
Gear Grinding	163.00	1	0.25	83.40	GER	$3.78	99.96 %	$0.01
Grind	48.97	1	0.25	50.01	GER	$0.68	99.96 %	$0.01
Temper	3.99	1	0.25	19.29	GER	$0.02	100.00 %	$0.00
Quench	0.42	1	0.25	25.28	GER	$0.00	100.00 %	$0.00
Carburize	37.01	1	0.25	167.44	GER	$1.72	100.00 %	$0.00
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Deburr	9.00	1	0.25	35.68	GER	$0.09	99.99 %	$0.00
Gear Hobbing	61.87	1	0.25	56.40	GER	$0.97	99.99 %	$0.00
CNC Machining	46.90	1	0.25	48.45	GER	$0.63	99.83 %	$0.03
Shot Blast	5.84	1	0.25	37.40	GER	$0.06	99.98 %	$0.00

Intermediate Shaft Process

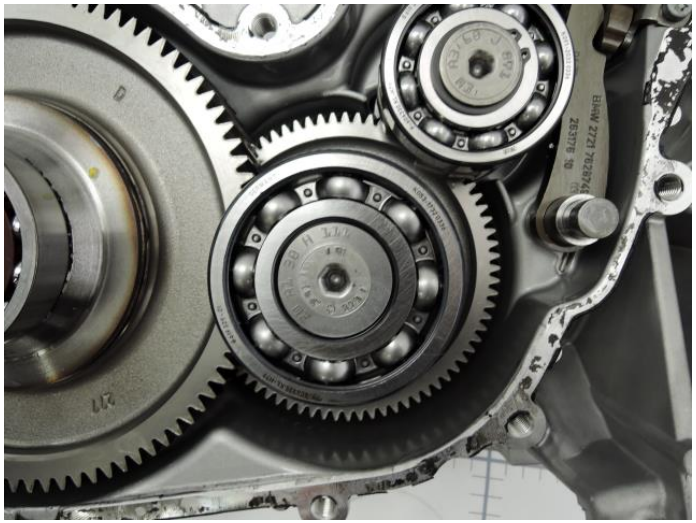
Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Intermediate Shaft	1	Steel 4140 - Bar Stock	$1.72	2.1048	2.3153	$0.00	$3.98

Intermediate Differential Shaft Asm, Gear Box Asm

Intermediate Shaft Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
1000 Ton Forging Press	5.00	1	2.00	279.11	GER	$0.39	99.96 %	$0.01
Cut Blank	4.03	1	0.25	25.18	GER	$0.03	99.97 %	$0.00

Intermediate Gear, Gear Box Asm



\...
\Gear Box Asm
\Intermediate Gear, Gear Box Asm
\Intermediate Gear Process

Process Summary

Right First Time	99.47 %
Process Time (Sec)	893.80
Total Weight (kg)	1.40

Material Cost**	$2.66
OEM Process Cost	$0.00
Supplier Process Cost	$18.37
Q Burden	$0.08
SG&A	$3.15
Manufacturing Cost*	$24.27

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Intermediate Gear, Gear Box Asm

Intermediate Gear Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Deburr	9.00	1	0.25	35.68	GER	$0.09	99.99 %	$0.00
Gear Grinding	313.93	1	0.25	83.40	GER	$7.27	99.96 %	$0.01
Grind	31.63	1	0.25	50.01	GER	$0.44	99.96 %	$0.01
Temper	4.47	1	0.25	19.29	GER	$0.02	100.00 %	$0.00
Quench	2.13	1	0.25	25.28	GER	$0.01	100.00 %	$0.00
Carburize	50.89	1	0.25	167.44	GER	$2.37	100.00 %	$0.00
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Deburr	9.00	1	0.25	35.68	GER	$0.09	99.99 %	$0.00
Gear Hobbing	123.74	1	0.25	66.73	GER	$2.29	99.99 %	$0.00
CNC Machining	283.53	1	0.25	49.86	GER	$3.93	99.94 %	$0.01
Shot Blast	19.48	1	0.25	37.40	GER	$0.20	99.95 %	$0.01

Intermediate Gear Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Intermediate Gear	1	Steel 4140 - Bar Stock	$1.72	1.4032	1.5440	$0.00	$2.66

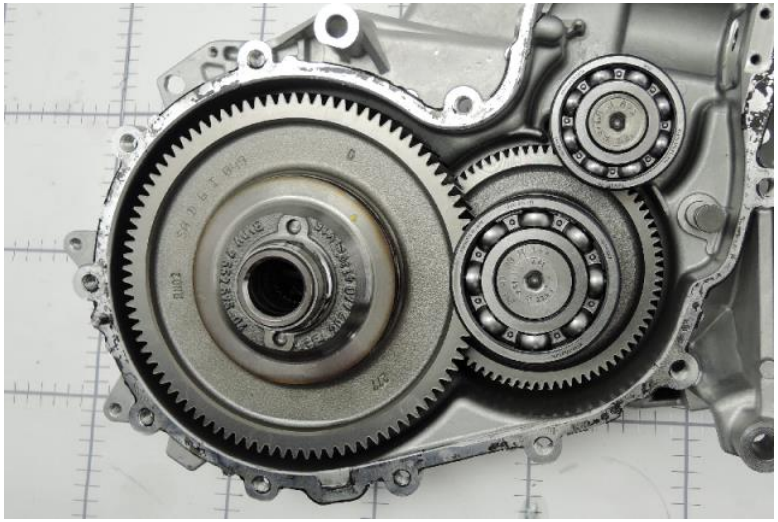
Intermediate Gear, Gear Box Asm

MUNRO & ASSOCIATES, INC.

Intermediate Gear Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
1000 Ton Forging Press	18.00	1	2.00	279.11	GER	$1.40	99.78 %	$0.03
Cut Blank	10.00	1	0.25	37.18	GER	$0.10	99.97 %	$0.00

Output Differential Asm, Gear Box Asm



\...
\Gear Box
\Gear Box Asm
\Output Differential Asm, Gear Box Asm

Assembly Summary

Parts	18
Fasteners	0
Part Numbers	13
Steps	390
Fastenings	14
Right First Time	97.00 %
OEM Process Time (Min)	0.00
Supplier Process Time (Min)	47.93
Total Weight (kg)	6.08

Material Cost**	$14.11
OEM Process Cost	$0.00
Supplier Process Cost	$55.30
Q Burden	$0.46
SG&A	$10.31
Manufacturing Cost*	$80.17

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Output Differential Asm, Gear Box Asm

MUNRO & ASSOCIATES, INC.

Output Differential Asm, Gear Box Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Carrier Asm, Output Differential Asm	1	17	13	324	13	97.63 %	0.00	0.00	2.28	17.74	2.3982
Gear, Output Differential Asm	1	1	0	60	0	99.40 %	0.00	0.00	0.00	26.49	3.6775
Assemble Output Differential	1	0	1	4	1	99.95 %	0.00	0.00	1.42	0.00	0.0000

Output Differential Asm, Gear Box Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Carrier Asm, Output Differential Asm	$0.84	$4.99	$0.00	$0.00	$2.07	$18.83	$0.36	$3.91	$30.99
Gear, Output Differential Asm	$0.00	$8.28	$0.00	$0.00	$0.00	$32.47	$0.09	$6.11	$46.95
Assemble Output Differential	$0.00	$0.00	$0.00	$0.00	$1.93	$0.00	$0.01	$0.29	$2.23

MUNRO & ASSOCIATES, INC.

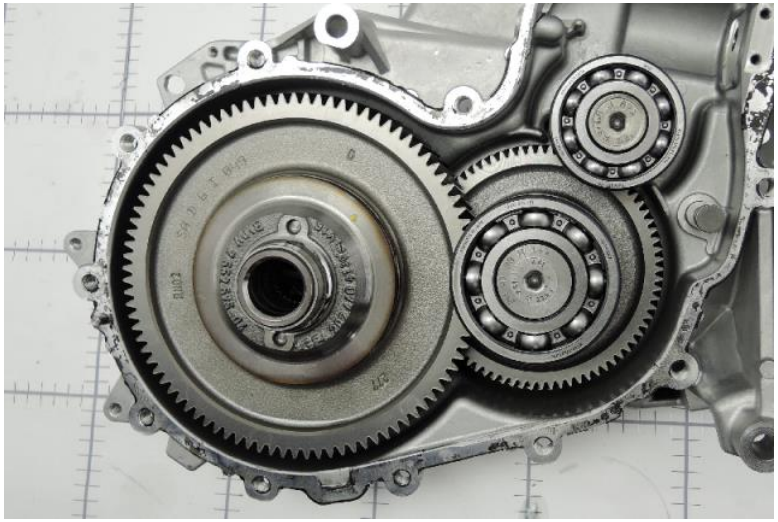
Detailed Summary

Parts	18
Fasteners	0
Part Numbers	13
Steps	390
Fastenings	14
Right First Time	97%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	3.70
Supplier Fab. Time (Min)	44.23
Total Weight (kg)	6.08

Purchased Part Cost	$0.84
Material Cost	$13.27
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.00
Supplier Asm. Cost	$4.00
Supplier Fab. Cost	$51.29
Q Burden	$0.46
SG&A	$10.31
Manufacturing Cost*	$80.17

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Carrier Asm, Output Differential Asm



\...
\Gear Box Asm
\Output Differential Asm, Gear Box Asm
\Carrier Asm, Output Differential Asm

Assembly Summary

Parts	17
Fasteners	0
Part Numbers	12
Steps	324
Fastenings	13
Right First Time	97.63 %
OEM Process Time (Min)	0.00
Supplier Process Time (Min)	20.02
Total Weight (kg)	2.40

Material Cost**	$5.83
OEM Process Cost	$0.00
Supplier Process Cost	$20.89
Q Burden	$0.36
SG&A	$3.91
Manufacturing Cost*	$30.99

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Carrier Asm, Output Differential Asm

MUNRO & ASSOCIATES, INC.

Carrier Asm, Output Differential Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Carrier, Carrier Asm	1	5	0	90	0	99.46 %	0.00	0.00	0.00	9.45	1.6296
Carrier Side Gear, Carrier Asm	2	1	0	47	0	99.69 %	0.00	0.00	0.00	2.32	0.1900
Carrier Pin Gear, Carrier Asm	2	1	0	35	0	99.72 %	0.00	0.00	0.00	1.31	0.0967
Carrier Pin, Carrier Asm	1	1	0	36	0	99.82 %	0.00	0.00	0.00	1.02	0.1258
Assemble Carrier	1	7	13	28	13	99.52 %	0.00	0.00	2.28	0.00	0.0694

Carrier Asm, Output Differential Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Carrier, Carrier Asm	$0.00	$3.74	$0.00	$0.00	$0.00	$9.69	$0.08	$2.01	$15.53
Carrier Side Gear, Carrier Asm	$0.00	$0.36	$0.00	$0.00	$0.00	$2.44	$0.05	$0.42	$3.27
Carrier Pin Gear, Carrier Asm	$0.00	$0.18	$0.00	$0.00	$0.00	$1.59	$0.04	$0.27	$2.08
Carrier Pin, Carrier Asm	$0.00	$0.17	$0.00	$0.00	$0.00	$1.07	$0.03	$0.19	$1.45
Assemble Carrier	$0.84	$0.00	$0.00	$0.00	$2.07	$0.00	$0.07	$0.34	$3.32

Carrier Asm, Output Differential Asm

MUNRO & ASSOCIATES, INC.

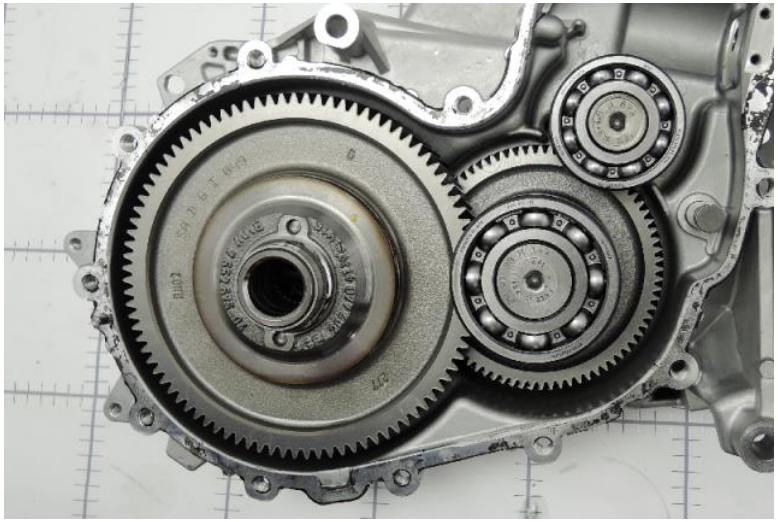
Detailed Summary

Parts	17
Fasteners	0
Part Numbers	12
Steps	324
Fastenings	13
Right First Time	97.63%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	2.28
Supplier Fab. Time (Min)	17.74
Total Weight (kg)	2.40

Purchased Part Cost	$0.84
Material Cost	$4.99
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.00
Supplier Asm. Cost	$2.07
Supplier Fab. Cost	$18.83
Q Burden	$0.36
SG&A	$3.91
Manufacturing Cost*	$30.99

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Carrier, Carrier Asm



\...
\Carrier Asm, Output Differential Asm
\Carrier, Carrier Asm
\Carrier Process

Process Summary

Right First Time	99.46 %
Process Time (Sec)	567.04
Total Weight (kg)	1.63

Material Cost**	$3.74
OEM Process Cost	$0.00
Supplier Process Cost	$9.69
Q Burden	$0.08
SG&A	$2.01
Manufacturing Cost*	$15.53

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Carrier, Carrier Asm

Carrier Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	16.00	1	0.25	30.69	GER	$0.14	99.98 %	$0.00
Deburr	14.00	1	0.25	46.42	GER	$0.18	99.99 %	$0.00
Grind	132.24	1	0.25	50.01	GER	$1.84	99.95 %	$0.01
Temper	8.97	1	0.25	19.29	GER	$0.05	100.00 %	$0.00
Quench	1.77	1	0.25	25.28	GER	$0.01	100.00 %	$0.00
Carburize	65.55	1	0.25	167.44	GER	$3.05	100.00 %	$0.00
Wash	16.00	1	0.25	30.69	GER	$0.14	99.98 %	$0.00
Deburr	14.00	1	0.25	46.42	GER	$0.18	99.99 %	$0.00
CNC Machining	270.11	1	0.25	40.97	GER	$3.07	99.67 %	$0.05
60 Ton Trim Press	6.67	1	0.25	22.68	GER	$0.04	99.98 %	$0.00
Remove Sand	16.00	1	1.00	89.53	GER	$0.40	99.99 %	$0.00
Sand Casting Press	3.62	1	2.00	522.20	GER	$0.53	99.98 %	$0.00

Carrier Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Carrier	1	Ductile Iron J2477	$1.61	1.6296	2.0610	$0.00	$3.32
Melt Energy, Carrier	1	Melt Energy	Utility	0.0000	-	$0.00	$0.23
Lost Sand, Carrier	1	Mold Sand	Expendable	0.0000	-	$0.00	$0.03
Core 1, Inner Upper Carrier	1	Core Sand	Expendable	0.0000	-	$0.00	$0.08
Core 2, Inner Lower Carrier	1	Core Sand	Expendable	0.0000	-	$0.00	$0.08

Carrier, Carrier Asm

Carrier Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Core Making Line	2.10	1	2.00	125.15	GER	$0.07	99.99 %	$0.00

Carrier Side Gear, Carrier Asm

\...
\Carrier Asm, Output Differential Asm
\Carrier Side Gear, Carrier Asm
\Side Gear Process

Process Summary

Right First Time	99.69 %
Process Time (Sec)	139.14
Total Weight (kg)	0.19

Material Cost**	$0.36
OEM Process Cost	$0.00
Supplier Process Cost	$2.44
Q Burden	$0.05
SG&A	$0.42
Manufacturing Cost*	$3.27

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Carrier Side Gear, Carrier Asm

Side Gear Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	5.00	1	0.25	30.69	GER	$0.04	99.99 %	$0.00
Deburr	4.00	1	0.25	31.36	GER	$0.03	99.99 %	$0.00
Temper	1.67	1	0.25	19.29	GER	$0.01	100.00 %	$0.00
Quench	1.97	1	0.25	25.28	GER	$0.01	100.00 %	$0.00
Carburize	12.77	1	0.25	167.44	GER	$0.59	100.00 %	$0.00
Wash	5.00	1	0.25	30.69	GER	$0.04	99.99 %	$0.00
Deburr	4.00	1	0.25	31.36	GER	$0.03	99.99 %	$0.00
CNC Machining	59.73	1	0.25	57.51	GER	$0.95	99.87 %	$0.02
14 Ton Broaching Press	34.30	1	1.00	46.85	GER	$0.45	99.99 %	$0.00
500 Ton Forging Press	3.70	1	2.00	205.38	GER	$0.21	99.92 %	$0.01
Cut Blank	7.00	1	0.25	30.34	GER	$0.06	99.97 %	$0.00

Side Gear Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Carrier Side Gear	1	Steel 4140 - Bar Stock	$1.72	0.1900	0.2090	$0.00	$0.36

Carrier Pin Gear, Carrier Asm

\...
\Carrier Asm, Output Differential Asm
\Carrier Pin Gear, Carrier Asm
\Pin Gear Process

Process Summary

Right First Time	99.72 %
Process Time (Sec)	78.85
Total Weight (kg)	0.10

Material Cost**	$0.18
OEM Process Cost	$0.00
Supplier Process Cost	$1.59
Q Burden	$0.04
SG&A	$0.27
Manufacturing Cost*	$2.08

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Carrier Pin Gear, Carrier Asm

MUNRO & ASSOCIATES, INC.

Pin Gear Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Apply DLC	14.00	1	0.25	146.20	GER	$0.57	99.96 %	$0.01
Temper	0.87	1	0.25	19.29	GER	$0.00	100.00 %	$0.00
Quench	1.02	1	0.25	25.28	GER	$0.01	100.00 %	$0.00
Carburize	6.38	1	0.25	167.44	GER	$0.30	100.00 %	$0.00
Wash	5.00	1	0.25	30.69	GER	$0.04	99.99 %	$0.00
Deburr	4.00	1	0.25	31.36	GER	$0.03	99.99 %	$0.00
CNC Machining	39.38	1	0.25	36.12	GER	$0.40	99.91 %	$0.01
500 Ton Forging Press	3.70	1	2.00	205.38	GER	$0.21	99.92 %	$0.01
Cut Blank	4.50	1	0.25	25.18	GER	$0.03	99.97 %	$0.00

Pin Gear Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Pin Gear	1	Steel 4140 - Coil Stock	$1.72	0.0967	0.1064	$0.00	$0.18

Carrier Pin, Carrier Asm

\...
\Carrier Asm, Output Differential Asm
\Carrier Pin, Carrier Asm
\Carrier Pin Process

Process Summary

Right First Time	99.82 %
Process Time (Sec)	61.30
Total Weight (kg)	0.13

Material Cost**	$0.17
OEM Process Cost	$0.00
Supplier Process Cost	$1.07
Q Burden	$0.03
SG&A	$0.19
Manufacturing Cost*	$1.45

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Carrier Pin, Carrier Asm

Carrier Pin Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Apply DLC	14.00	1	0.25	146.20	GER	$0.57	99.96 %	$0.01
Wash	5.00	1	0.25	30.69	GER	$0.04	99.99 %	$0.00
Deburr	4.00	1	0.25	31.36	GER	$0.03	99.99 %	$0.00
Grind	8.04	1	0.25	50.01	GER	$0.11	99.99 %	$0.00
Wash	5.00	1	0.25	30.69	GER	$0.04	99.99 %	$0.00
Deburr	4.00	1	0.25	31.36	GER	$0.03	99.99 %	$0.00
CNC Machining	21.27	1	0.25	39.15	GER	$0.23	99.92 %	$0.01

Carrier Pin Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Carrier Pin	1	Steel 1018 - Bar Stock	$1.21	0.1258	0.1383	$0.00	$0.17

Assemble Carrier

\...
\Output Differential Asm, Gear Box Asm
\Carrier Asm, Output Differential Asm
\Assemble Carrier

Process Summary

Right First Time	99.52 %
Process Time (Sec)	137.00
Total Weight (kg)	0.07

Material Cost**	$0.84
OEM Process Cost	$0.00
Supplier Process Cost	$2.07
Q Burden	$0.07
SG&A	$0.34
Manufacturing Cost*	$3.32

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Carrier

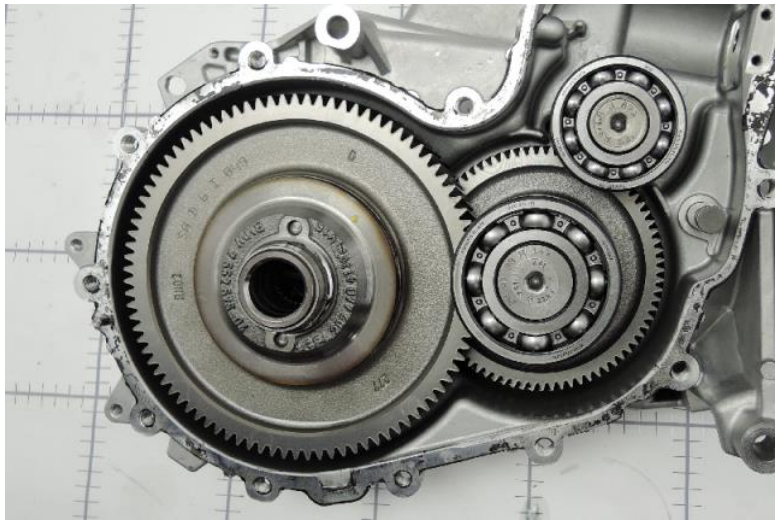
Assemble Carrier

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Manual Asm	137.00	1	1.00	54.32	GER	$2.07	99.52 %	$0.07

Assemble Carrier

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Carrrier Pin C-clip, Output Differential Asm	1	Commodity Item	Purchased	0.0006	-	$0.02	$0.00
Carrier Side Gear Washer Thick, Output Differntial	2	Commodity Item	Purchased	0.0182	-	$0.18	$0.00
Carrier Side Gear Washer Thin, Output Differential	2	Commodity Item	Purchased	0.0119	-	$0.10	$0.00
Carrier Pingear Washer, Output Differential Asm	2	Commodity Item	Purchased	0.0043	-	$0.13	$0.00

Gear, Output Differential Asm



\...
\Output Differential Asm, Gear Box Asm
\Gear, Output Differential Asm
\Gear Process

Process Summary

Right First Time	99.40 %
Process Time (Sec)	1589.39
Total Weight (kg)	3.68

Material Cost**	$8.28
OEM Process Cost	$0.00
Supplier Process Cost	$32.47
Q Burden	$0.09
SG&A	$6.11
Manufacturing Cost*	$46.95

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Gear, Output Differential Asm

Gear Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	16.00	1	0.25	30.69	GER	$0.14	99.98 %	$0.00
Deburr	14.00	1	0.25	46.42	GER	$0.18	99.99 %	$0.00
Gear Grinding	479.87	1	0.25	83.40	GER	$11.12	99.96 %	$0.01
Temper	12.82	1	0.25	19.29	GER	$0.07	100.00 %	$0.00
Quench	6.75	1	0.25	25.28	GER	$0.05	100.00 %	$0.00
Carburize	129.55	1	0.25	167.44	GER	$6.03	100.00 %	$0.00
Wash	16.00	1	0.25	30.69	GER	$0.14	99.98 %	$0.00
Deburr	14.00	1	0.25	46.42	GER	$0.18	99.99 %	$0.00
Gear Hobbing	177.62	1	0.25	66.73	GER	$3.29	99.99 %	$0.00
CNC Machining	673.28	1	0.25	49.86	GER	$9.32	99.89 %	$0.02
Shot Blast	12.00	1	0.25	37.40	GER	$0.12	99.99 %	$0.00
1000 Ton Forging Press	21.50	1	2.00	279.11	GER	$1.67	99.72 %	$0.04

Gear Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Gear	1	Steel 4140 - Bar Stock	$1.72	3.6775	4.8160	$0.00	$8.28

Gear, Output Differential Asm

Gear Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Cut Blank	16.00	1	0.25	37.18	GER	$0.17	99.97 %	$0.00

Assemble Output Differential

MUNRO & ASSOCIATES, INC.

No Commodity Items Required for This Process

\...
\Gear Box Asm
\Output Differential Asm, Gear Box Asm
\Assemble Output Differential

Process Summary

Right First Time	99.95 %
Process Time (Sec)	85.04
Total Weight (kg)	0.00

Material Cost**	$0.00
OEM Process Cost	$0.00
Supplier Process Cost	$1.93
Q Burden	$0.01
SG&A	$0.29
Manufacturing Cost*	$2.23

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Output Differential

MUNRO & ASSOCIATES, INC.

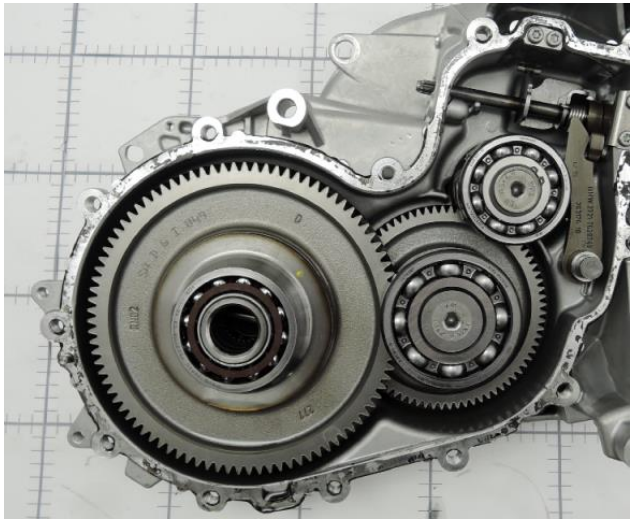
Assemble Output Differential

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Laser Welding	85.04	1	0.25	81.89	GER	$1.93	99.95 %	$0.01

Assemble Output Differential

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost

Assemble Gear Cluster



\...
\Gear Box
\Gear Box Asm
\Assemble Gear Cluster

Process Summary

Right First Time	98.83 %
Process Time (Sec)	246.00
Total Weight (kg)	2.41

Material Cost**	$46.17
OEM Process Cost	$6.25
Supplier Process Cost	$0.00
Q Burden	$0.18
SG&A	$2.32
Manufacturing Cost*	$54.91

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Gear Cluster

MUNRO & ASSOCIATES, INC.

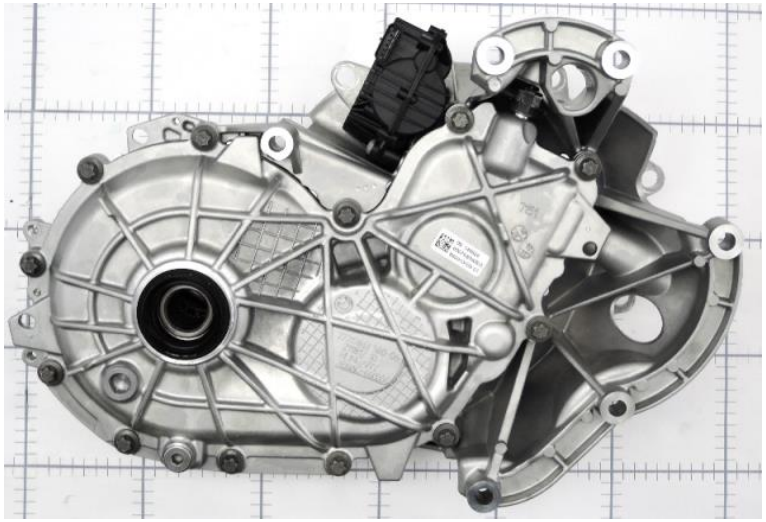
Assemble Gear Cluster

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	246.00	1	1.00	91.41	GER	$6.25	98.83 %	$0.18

Assemble Gear Cluster

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
30 mm Bearing, Input Differential Shaft	2	Commodity Item	Purchased	0.3367	-	$6.62	$0.00
77mm Snap Ring, Input Differential Shaft	1	Commodity Item	Purchased	0.0182	-	$0.18	$0.00
M30x2mm-Washer	1	Commodity Item	Purchased	0.0097	-	$0.11	$0.00
M40 Bearing, Intermediate Shaft	1	Commodity Item	Purchased	0.6100	-	$12.00	$0.00
M34 Bearing, Intermediate Shaft	1	Commodity Item	Purchased	0.4460	-	$8.77	$0.00
M47 Carrier Bearing Race, Differential Shaft	2	Commodity Item	Purchased	0.0624	-	$1.24	$0.00
32mm Snap Ring	1	Commodity Item	Purchased	0.0038	-	$0.09	$0.00
28mm Snap Ring, Input Shaft	1	Commodity Item	Purchased	0.0031	-	$0.06	$0.00
28mm Snap Ring, Input Shaft	1	Commodity Item	Purchased	0.0031	-	$0.06	$0.00
M36x3mm Washer, Intermediate Shaft	1	Commodity Item	Purchased	0.0339	-	$0.11	$0.00
M60X4mm-Bellive Washer	1	Commodity Item	Purchased	0.0258	-	$0.08	$0.00
M47 Carrier Bearing	1	Commodity Item	Purchased	0.2282	-	$4.49	$0.00

Gear Box Cover, Gear Box Asm



\...
\Gear Box
\Gear Box Asm
\Gear Box Cover, Gear Box Asm

Assembly Summary

Parts	9
Fasteners	2
Part Numbers	9
Steps	150
Fastenings	8
Right First Time	98.71 %
OEM Process Time (Min)	0.00
Supplier Process Time (Min)	14.31
Total Weight (kg)	2.33

Material Cost**	$6.38
OEM Process Cost	$0.00
Supplier Process Cost	$10.57
Q Burden	$0.20
SG&A	$2.48
Manufacturing Cost*	$19.62

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Gear Box Cover, Gear Box Asm

Gear Box Cover, Gear Box Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Gear Box Cover, Gear Box Cover Asm	1	1	0	65	0	99.67 %	0.00	0.00	0.00	12.43	2.2720
Assemble Alignment Dowel	1	1	1	5	1	99.91 %	0.00	0.00	0.17	0.00	0.0030
Small Plug Asm, Gear Box Cover	1	2	1	5	1	99.91 %	0.00	0.00	0.08	0.00	0.0223
Assemble Small Plug	1	1	2	7	2	99.77 %	0.00	0.00	0.27	0.00	0.0003
Large Plug Asm, Gear Box Cover Asm	1	2	1	6	1	99.96 %	0.00	0.00	0.08	0.00	0.0246
Assemble Large Plug	1	0	1	4	1	99.79 %	0.00	0.00	0.22	0.00	0.0000
Gear Box Breather Stem, Gear Box Breather Asm	1	1	0	44	0	99.83 %	0.00	0.00	0.00	0.70	0.0088
Assemble Breather Stem	1	0	1	4	1	99.91 %	0.00	0.00	0.17	0.00	0.0000
Gearbox Breather Cap, Gear Box	1	1	0	1	0	99.99 %	0.00	0.00	0.00	0.05	0.0038
Assemble Breather Cap	1	0	1	4	1	99.97 %	0.00	0.00	0.15	0.00	0.0000

Gear Box Cover, Gear Box Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Gear Box Cover, Gear Box Cover Asm	$0.00	$5.78	$0.00	$0.00	$0.00	$9.80	$0.05	$2.34	$17.97
Assemble Alignment Dowel	$0.04	$0.00	$0.00	$0.00	$0.05	$0.00	$0.01	$0.01	$0.11
Small Plug Asm, Gear Box Cover	$0.26	$0.00	$0.00	$0.00	$0.03	$0.00	$0.01	$0.01	$0.31
Assemble Small Plug	$0.03	$0.00	$0.00	$0.00	$0.10	$0.00	$0.04	$0.02	$0.18
Large Plug Asm, Gear Box Cover Asm	$0.22	$0.00	$0.00	$0.00	$0.03	$0.00	$0.01	$0.01	$0.26
Assemble Large Plug	$0.00	$0.00	$0.00	$0.00	$0.07	$0.00	$0.03	$0.01	$0.11
Gear Box Breather Stem, Gear Box Breather Asm	$0.00	$0.03	$0.00	$0.00	$0.00	$0.39	$0.03	$0.06	$0.51
Assemble Breather Stem	$0.00	$0.00	$0.00	$0.00	$0.05	$0.00	$0.01	$0.01	$0.07
Gearbox Breather Cap, Gear Box	$0.00	$0.02	$0.00	$0.00	$0.00	$0.01	$0.00	$0.00	$0.04
Assemble Breather Cap	$0.00	$0.00	$0.00	$0.00	$0.05	$0.00	$0.00	$0.01	$0.06

MUNRO & ASSOCIATES, INC.

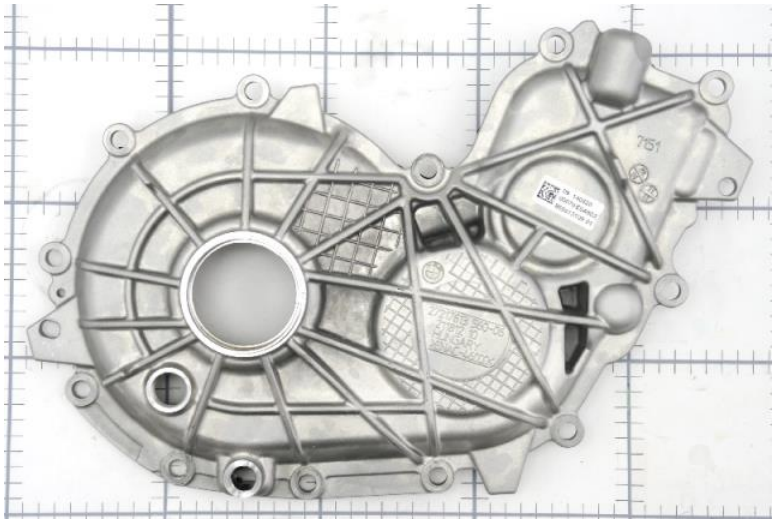
Detailed Summary

Parts	9
Fasteners	2
Part Numbers	9
Steps	150
Fastenings	8
Right First Time	98.71%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	1.13
Supplier Fab. Time (Min)	13.17
Total Weight (kg)	2.33

Purchased Part Cost	$0.55
Material Cost	$5.83
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.00
Supplier Asm. Cost	$0.36
Supplier Fab. Cost	$10.21
Q Burden	$0.20
SG&A	$2.48
Manufacturing Cost*	$19.62

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Gear Box Cover, Gear Box Cover Asm



\...
\Gear Box Cover, Gear Box Asm
\Gear Box Cover, Gear Box Cover Asm
\Gear Box Cover Process

Process Summary

Right First Time	99.67 %
Process Time (Sec)	745.62
Total Weight (kg)	2.27

Material Cost**	$5.78
OEM Process Cost	$0.00
Supplier Process Cost	$9.80
Q Burden	$0.05
SG&A	$2.34
Manufacturing Cost*	$17.97

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Gear Box Cover, Gear Box Cover Asm

MUNRO & ASSOCIATES, INC.

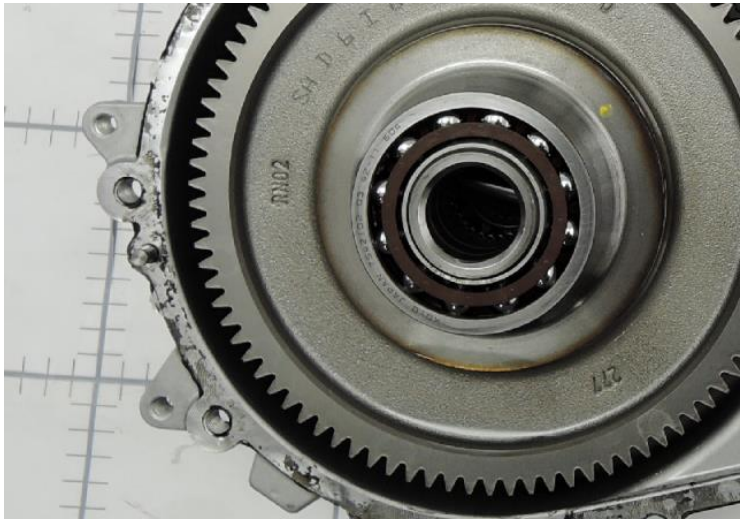
Gear Box Cover Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	16.00	1	0.25	21.64	HUN	$0.10	99.98 %	$0.00
Deburr	14.00	1	0.25	36.15	HUN	$0.14	99.99 %	$0.00
CNC Machining	413.66	1	0.25	47.63	HUN	$5.47	99.80 %	$0.03
Heat Treat Step 2	126.92	1	0.25	9.58	HUN	$0.34	99.99 %	$0.00
Heat Treat Step 1	92.31	1	0.25	47.48	HUN	$1.22	99.99 %	$0.00
Wash	16.00	1	0.25	21.64	HUN	$0.10	99.98 %	$0.00
Deburr	14.00	1	0.25	36.15	HUN	$0.14	99.99 %	$0.00
25 Ton Trim Press	6.60	1	0.25	11.61	HUN	$0.02	99.98 %	$0.00
1300 Ton Die Casting Press	46.13	1	2.00	178.03	HUN	$2.28	99.99 %	$0.00

Gear Box Cover Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Gear Box Cover	1	A380	$2.27	2.2720	2.5450	$0.00	$5.78

Assemble Alignment Dowel



\...
\Gear Box Asm
\Gear Box Cover, Gear Box Asm
\Assemble Alignment Dowel

Process Summary

Right First Time	99.91 %
Process Time (Sec)	10.00
Total Weight (kg)	0.00

Material Cost**	$0.04
OEM Process Cost	$0.00
Supplier Process Cost	$0.05
Q Burden	$0.01
SG&A	$0.01
Manufacturing Cost*	$0.11

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Alignment Dowel

MUNRO & ASSOCIATES, INC.

Assemble Alignment Dowel

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	10.00	1	0.25	18.11	HUN	$0.05	99.91 %	$0.01

Assemble Alignment Dowel

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Alignment Dowel, Gear Box Asm	1	Commodity Item	Purchased	0.0030	-	$0.04	$0.00

Small Plug Asm, Gear Box Cover

\...
\Gear Box Asm
\Gear Box Cover, Gear Box Asm
\Small Plug Asm, Gear Box Cover

Assembly Summary

Parts	2
Fasteners	1
Part Numbers	2
Steps	5
Fastenings	1
Right First Time	99.91 %
OEM Process Time (Min)	0.00
Supplier Process Time (Min)	0.08
Total Weight (kg)	0.02

Material Cost**	$0.26
OEM Process Cost	$0.00
Supplier Process Cost	$0.03
Q Burden	$0.01
SG&A	$0.01
Manufacturing Cost*	$0.31

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Small Plug Asm, Gear Box Cover

MUNRO & ASSOCIATES, INC.

Small Plug Asm, Gear Box Cover

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Assemble Small Plug	1	2	1	5	1	99.91 %	0.00	0.00	0.08	0.00	0.0223

Small Plug Asm, Gear Box Cover

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Assemble Small Plug	$0.26	$0.00	$0.00	$0.00	$0.03	$0.00	$0.01	$0.01	$0.31

Small Plug Asm, Gear Box Cover

MUNRO & ASSOCIATES, INC.

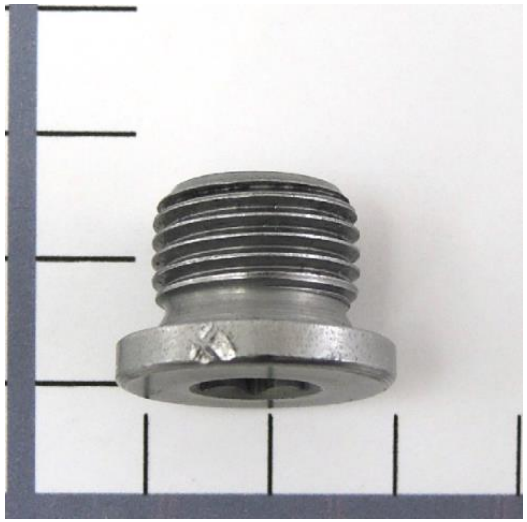
Detailed Summary

Parts	2
Fasteners	1
Part Numbers	2
Steps	5
Fastenings	1
Right First Time	99.91%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	0.08
Supplier Fab. Time (Min)	0.00
Total Weight (kg)	0.02

Purchased Part Cost	$0.26
Material Cost	$0.00
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.00
Supplier Asm. Cost	$0.03
Supplier Fab. Cost	$0.00
Q Burden	$0.01
SG&A	$0.01
Manufacturing Cost*	$0.31

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Small Plug



\...
\Gear Box Cover, Gear Box Asm
\Small Plug Asm, Gear Box Cover
\Assemble Small Plug

Process Summary

Right First Time	99.91 %
Process Time (Sec)	5.00
Total Weight (kg)	0.02

Material Cost**	$0.26
OEM Process Cost	$0.00
Supplier Process Cost	$0.03
Q Burden	$0.01
SG&A	$0.01
Manufacturing Cost*	$0.31

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Small Plug

MUNRO & ASSOCIATES, INC.

Assemble Small Plug

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	5.00	1	0.25	18.11	HUN	$0.03	99.91 %	$0.01

Assemble Small Plug

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Small Plug Magnet	1	Commodity Item	Purchased	0.0036	-	$0.06	$0.00
M16x12mm-Pan Head Allen	1	Commodity Item	Purchased	0.0187	-	$0.20	$0.00

Assemble Small Plug

\...
\Gear Box Asm
\Gear Box Cover, Gear Box Asm
\Assemble Small Plug

Process Summary

Right First Time	99.77 %
Process Time (Sec)	16.00
Total Weight (kg)	0.00

Material Cost**	$0.03
OEM Process Cost	$0.00
Supplier Process Cost	$0.10
Q Burden	$0.04
SG&A	$0.02
Manufacturing Cost*	$0.18

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Small Plug

MUNRO & ASSOCIATES, INC.

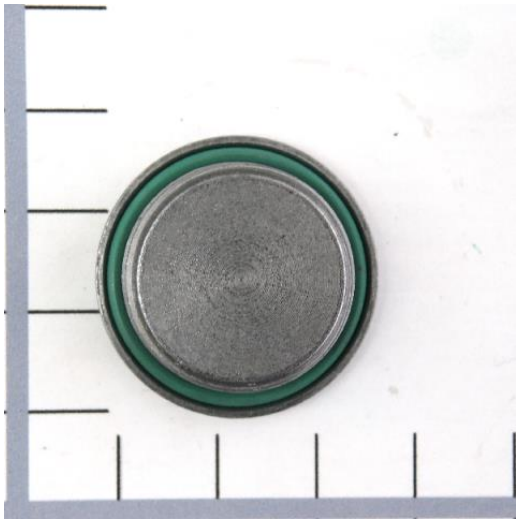
Assemble Small Plug

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	16.00	1	0.25	22.73	HUN	$0.10	99.77 %	$0.04

Assemble Small Plug

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
M16x2mm Washer	1	Commodity Item	Purchased	0.0003	-	$0.03	$0.00

Large Plug Asm, Gear Box Cover Asm



\...
\Gear Box Asm
\Gear Box Cover, Gear Box Asm
\Large Plug Asm, Gear Box Cover Asm

Assembly Summary

Parts	2
Fasteners	1
Part Numbers	2
Steps	6
Fastenings	1
Right First Time	99.96 %
OEM Process Time (Min)	0.00
Supplier Process Time (Min)	0.08
Total Weight (kg)	0.02

Material Cost**	$0.22
OEM Process Cost	$0.00
Supplier Process Cost	$0.03
Q Burden	$0.01
SG&A	$0.01
Manufacturing Cost*	$0.26

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Large Plug Asm, Gear Box Cover Asm

MUNRO & ASSOCIATES, INC.

Large Plug Asm, Gear Box Cover Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Assemble Large Plug	1	2	1	6	1	99.96 %	0.00	0.00	0.08	0.00	0.0246

Large Plug Asm, Gear Box Cover Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Assemble Large Plug	$0.22	$0.00	$0.00	$0.00	$0.03	$0.00	$0.01	$0.01	$0.26

MUNRO & ASSOCIATES, INC.

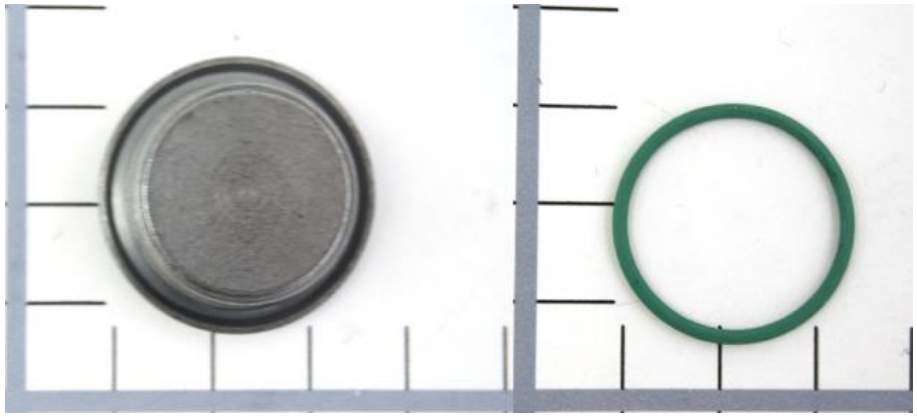
Detailed Summary

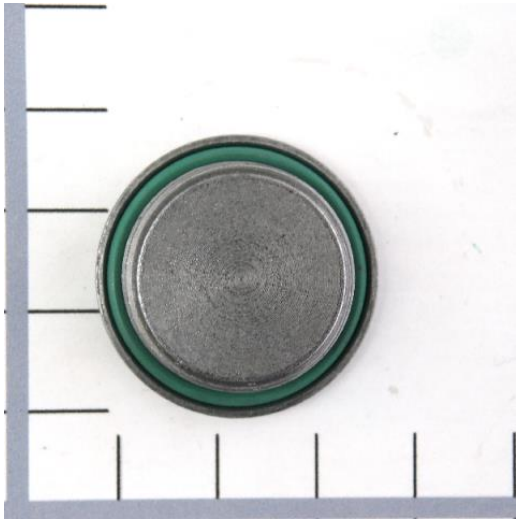
Parts	2
Fasteners	1
Part Numbers	2
Steps	6
Fastenings	1
Right First Time	99.96%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	0.08
Supplier Fab. Time (Min)	0.00
Total Weight (kg)	0.02

Purchased Part Cost	$0.22
Material Cost	$0.00
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.00
Supplier Asm. Cost	$0.03
Supplier Fab. Cost	$0.00
Q Burden	$0.01
SG&A	$0.01
Manufacturing Cost*	$0.26

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Large Plug





\...
\Gear Box Cover, Gear Box Asm
\Large Plug Asm, Gear Box Cover Asm
\Assemble Large Plug

Process Summary

Right First Time	99.96 %
Process Time (Sec)	5.00
Total Weight (kg)	0.02

Material Cost**	$0.22
OEM Process Cost	$0.00
Supplier Process Cost	$0.03
Q Burden	$0.01
SG&A	$0.01
Manufacturing Cost*	$0.26

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Large Plug

MUNRO & ASSOCIATES, INC.

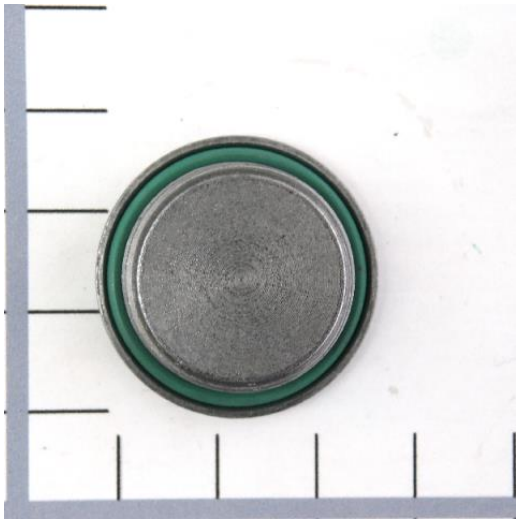
Assemble Large Plug

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	5.00	1	0.25	18.11	HUN	$0.03	99.96 %	$0.01

Assemble Large Plug

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
M22x9mm-Pan Head Allen	1	Commodity Item	Purchased	0.0243	-	$0.18	$0.00
O-Ring, Large Plug Asm	1	Commodity Item	Purchased	0.0003	-	$0.04	$0.00

Assemble Large Plug



\...
\Gear Box Asm
\Gear Box Cover, Gear Box Asm
\Assemble Large Plug

Process Summary

Right First Time	99.79 %
Process Time (Sec)	13.00
Total Weight (kg)	0.00

Material Cost**	$0.00
OEM Process Cost	$0.00
Supplier Process Cost	$0.07
Q Burden	$0.03
SG&A	$0.01
Manufacturing Cost*	$0.11

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Large Plug

MUNRO & ASSOCIATES, INC.

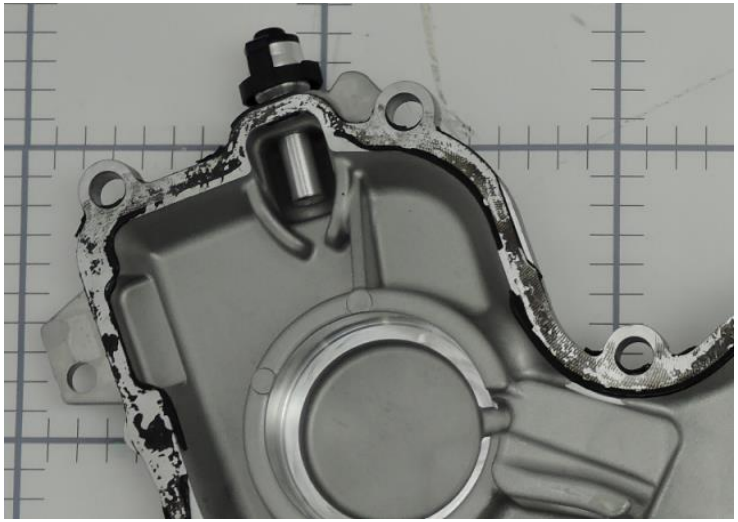
Assemble Large Plug

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	13.00	1	0.25	18.11	HUN	$0.07	99.79 %	$0.03

Assemble Large Plug

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost

Gear Box Breather Stem, Gear Box Breather Asm



\...
\Gear Box Cover, Gear Box Asm
\Gear Box Breather Stem, Gear Box Breather Asm
\Breather Stem, Process

Process Summary

Right First Time	99.83 %
Process Time (Sec)	42.03
Total Weight (kg)	0.01

Material Cost**	$0.03
OEM Process Cost	$0.00
Supplier Process Cost	$0.39
Q Burden	$0.03
SG&A	$0.06
Manufacturing Cost*	$0.51

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Gear Box Breather Stem, Gear Box Breather Asm

Breather Stem, Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	5.00	1	0.25	11.95	HUN	$0.02	99.99 %	$0.00
Deburr	4.00	1	0.25	22.62	HUN	$0.03	99.99 %	$0.00
CNC Machining	33.03	1	0.25	38.22	HUN	$0.35	99.85 %	$0.02

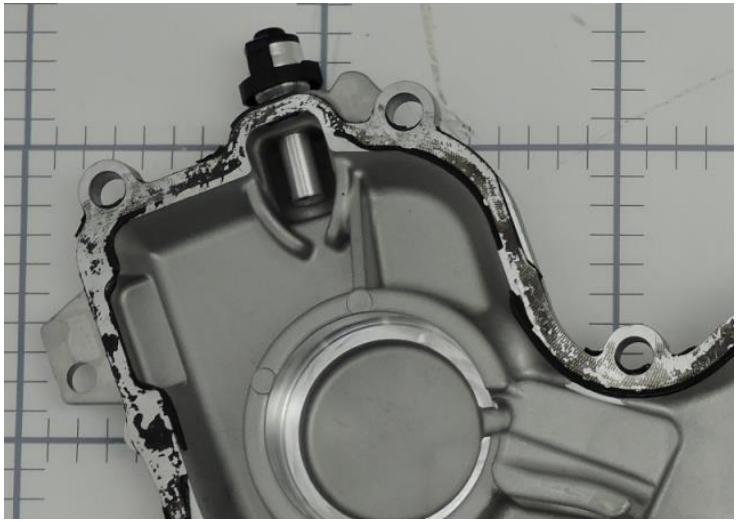
Breather Stem, Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Breather Stem	1	Aluminum 6061 - Bar Stock	$3.06	0.0088	0.0097	$0.00	$0.03

Assemble Breather Stem

MUNRO & ASSOCIATES, INC.

No Commodity Items Required for This Process



\...
\Gear Box Asm
\Gear Box Cover, Gear Box Asm
\Assemble Breather Stem

Process Summary

Right First Time	99.91 %
Process Time (Sec)	10.00
Total Weight (kg)	0.00

Material Cost**	$0.00
OEM Process Cost	$0.00
Supplier Process Cost	$0.05
Q Burden	$0.01
SG&A	$0.01
Manufacturing Cost*	$0.07

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Breather Stem

MUNRO & ASSOCIATES, INC.

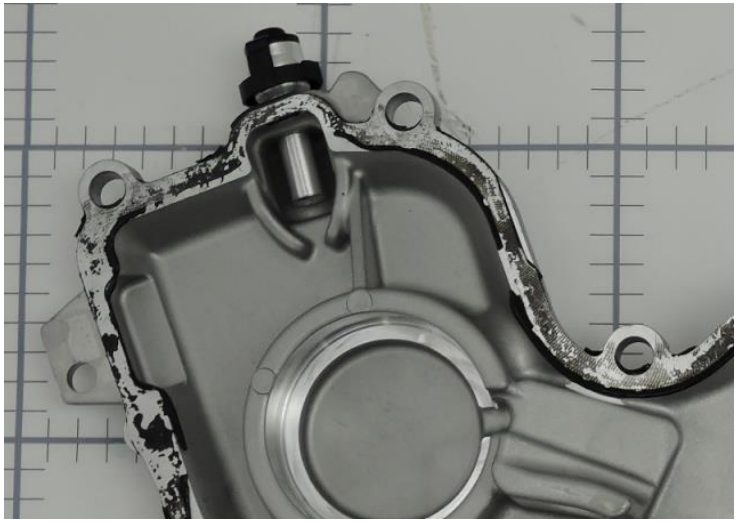
Assemble Breather Stem

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	10.00	1	0.25	18.11	HUN	$0.05	99.91 %	$0.01

Assemble Breather Stem

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost

Gearbox Breather Cap, Gear Box



\...
\Gear Box Cover, Gear Box Asm
\Gearbox Breather Cap, Gear Box
\Breather Cap, Process

Process Summary

Right First Time	99.99 %
Process Time (Sec)	2.71
Total Weight (kg)	0.00

Material Cost**	$0.02
OEM Process Cost	$0.00
Supplier Process Cost	$0.01
Q Burden	$0.00
SG&A	$0.00
Manufacturing Cost*	$0.04

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Gearbox Breather Cap, Gear Box

Breather Cap, Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
55 Ton Injection Molding Press	16.26	6	0.25	14.89	HUN	$0.01	99.99 %	$0.00

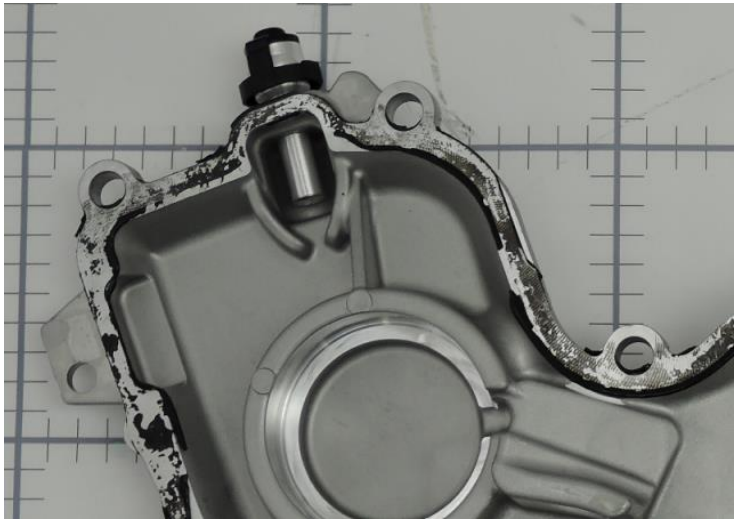
Breather Cap, Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material, Breather Cap	1	PA6 GF30	$4.10	0.0038	0.0041	$0.00	$0.02

Assemble Breather Cap

MUNRO & ASSOCIATES, INC.

No Commodity Items Required for This Process



\...
\Gear Box Asm
\Gear Box Cover, Gear Box Asm
\Assemble Breather Cap

Process Summary

Right First Time	99.97 %
Process Time (Sec)	9.00
Total Weight (kg)	0.00

Material Cost**	$0.00
OEM Process Cost	$0.00
Supplier Process Cost	$0.05
Q Burden	$0.00
SG&A	$0.01
Manufacturing Cost*	$0.06

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Breather Cap

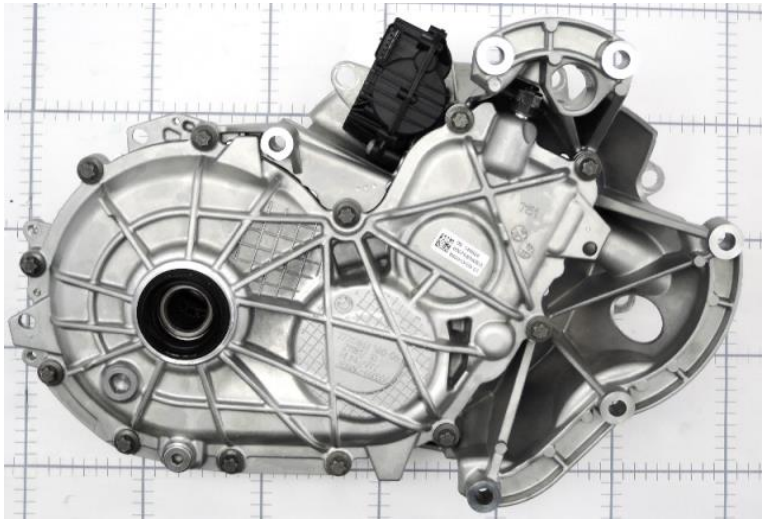
Assemble Breather Cap

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	9.00	1	0.25	18.11	HUN	$0.05	99.97 %	$0.00

Assemble Breather Cap

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost

Assemble Gear Box Cover



\...
\Gear Box
\Gear Box Asm
\Assemble Gear Box Cover

Process Summary

Right First Time	96.77 %
Process Time (Sec)	197.49
Total Weight (kg)	0.19

Material Cost**	$2.34
OEM Process Cost	$5.01
Supplier Process Cost	$0.00
Q Burden	$0.49
SG&A	$0.82
Manufacturing Cost*	$8.67

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Gear Box Cover

MUNRO & ASSOCIATES, INC.

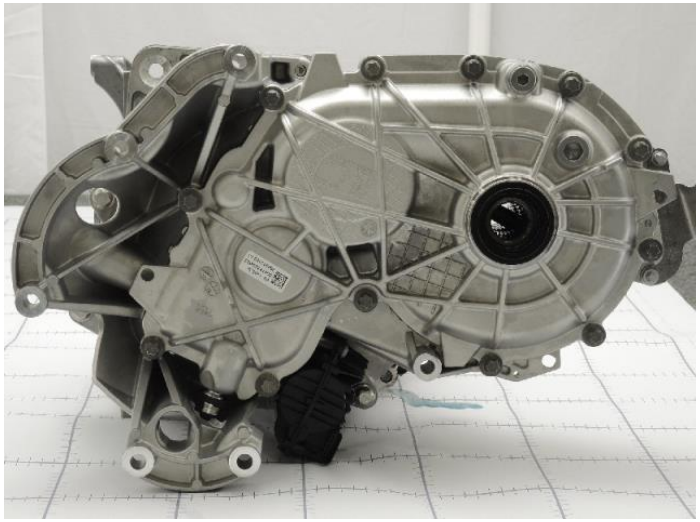
Assemble Gear Box Cover

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	197.49	1	1.00	91.41	GER	$5.01	96.77 %	$0.49

Assemble Gear Box Cover

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
M60 Bevile Washer	1	Commodity Item	Purchased	0.0315	-	$0.16	$0.00
M10x27mm-Torx Head Bolt	2	Commodity Item	Purchased	0.0097	-	$0.04	$0.00
M10x27mm-Torx Head Bolt	10	Commodity Item	Purchased	0.0097	-	$0.04	$0.00
Large Axle Seal	1	Commodity Item	Purchased	0.0331	-	$0.95	$0.00
Small Axle Seal	1	Commodity Item	Purchased	0.0066	-	$0.25	$0.00
Seal, Gear Box	1	Commodity Item	Purchased	0.0058	-	$0.41	$0.00
O-Ring, Input Differential Shaft	1	Commodity Item	Purchased	0.0006	-	$0.04	$0.00
Label, BMW QR Code	1	Commodity Item	Purchased	0.0001	-	$0.05	$0.00

Gearbox Installation



\...
\Zone 7 Driveline
\Gear Box
\Gearbox Installation

Process Summary

Right First Time	98.55 %
Process Time (Sec)	103.00
Total Weight (kg)	0.15

Material Cost**	$0.49
OEM Process Cost	$2.62
Supplier Process Cost	$0.00
Q Burden	$0.22
SG&A	$0.41
Manufacturing Cost*	$3.73

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Gearbox Installation

MUNRO & ASSOCIATES, INC.

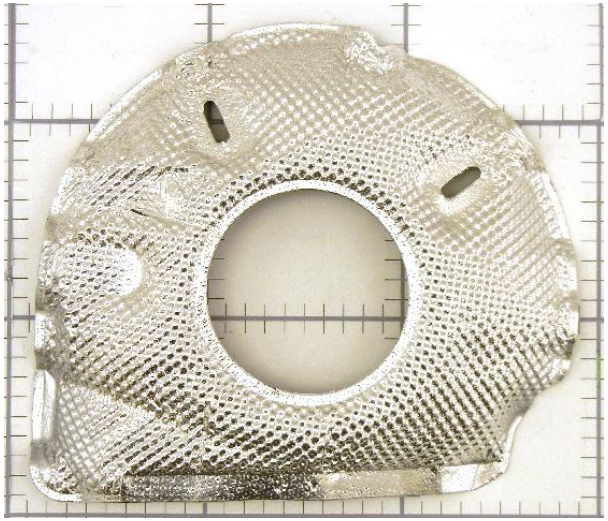
Gearbox Installation

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	103.00	1	1.00	91.41	GER	$2.62	98.55 %	$0.22

Gearbox Installation

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
M12x50mm-Torx Bolt Aluminum	7	Commodity Item	Purchased	0.0208	-	$0.07	$0.00

Heat Shield, Differential



\...
\Gear Box
\Heat Shield, Differential
\Heat Shield, Differential Processing

Process Summary

Right First Time	99.88 %
Process Time (Sec)	112.77
Total Weight (kg)	0.04

Material Cost**	$0.63
OEM Process Cost	$0.00
Supplier Process Cost	$0.57
Q Burden	$0.02
SG&A	$0.18
Manufacturing Cost*	$1.40

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Heat Shield, Differential

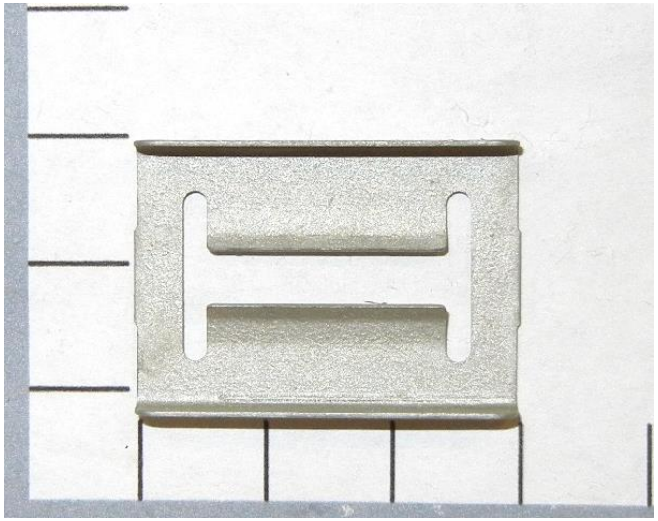
Heat Shield, Differential Processing

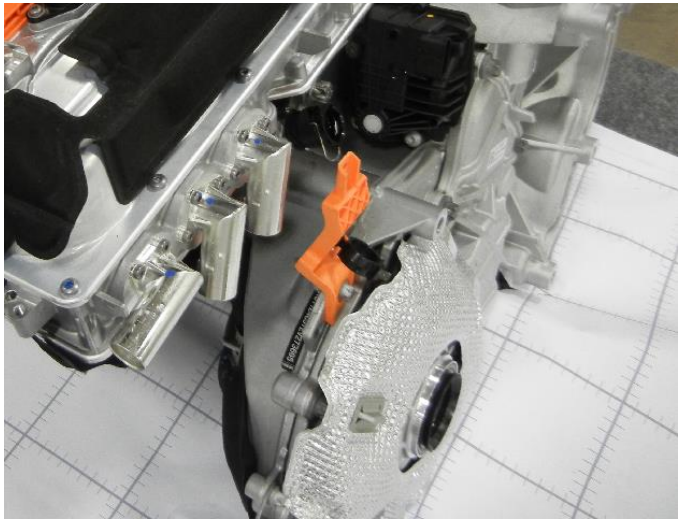
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Die Cut	5.20	1	0.25	11.50	CZE	$0.02	99.98 %	$0.00
Thermoform	58.92	4	0.50	33.21	CZE	$0.14	99.97 %	$0.00
Cure Foam	73.00	1	0.00	3.97	CZE	$0.08	99.96 %	$0.01
Foam Molding	19.84	1	3.00	61.43	CZE	$0.34	99.98 %	$0.00

Heat Shield, Differential Processing

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material 2, Heat Shield, Differential	1	PET Sheet Stock	By Area	0.0118	-	$0.00	$0.29
Material 3, Heat Shield, Differential	1	Dimpled Aluminum Sheet Stock & Scrim Cloth	By Area	0.0118	-	$0.00	$0.27
Material 1, Heat Shield, Differential	1	PUR Foam	$4.08	0.0158	0.0162	$0.00	$0.07

Heat Shield, Differential Installation





\...
\Zone 7 Driveline
\Gear Box
\Heat Shield, Differential Installation

Process Summary

Right First Time	99.93 %
Process Time (Sec)	22.00
Total Weight (kg)	0.00

Material Cost**	$0.10
OEM Process Cost	$0.56
Supplier Process Cost	$0.00
Q Burden	$0.01
SG&A	$0.09
Manufacturing Cost*	$0.76

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Heat Shield, Differential Installation

MUNRO & ASSOCIATES, INC.

Heat Shield, Differential Installation

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	22.00	1	1.00	91.41	GER	$0.56	99.93 %	$0.01

Heat Shield, Differential Installation

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Push Clip	2	Commodity Item	Purchased	0.0021	-	$0.05	$0.00

Thermal Cover, Differential

\...
\Gear Box
\Thermal Cover, Differential
\Thermal Cover, Differential Processing

Process Summary

Right First Time	99.88 %
Process Time (Sec)	98.91
Total Weight (kg)	0.01

Material Cost**	$0.36
OEM Process Cost	$0.00
Supplier Process Cost	$0.53
Q Burden	$0.02
SG&A	$0.13
Manufacturing Cost*	$1.04

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Thermal Cover, Differential

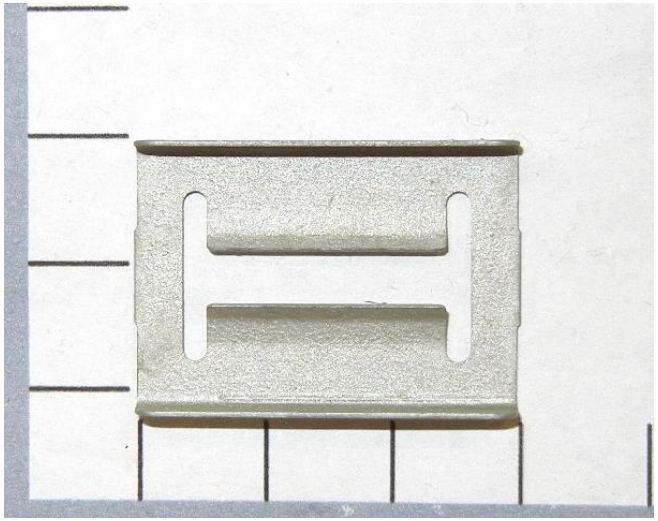
Thermal Cover, Differential Processing

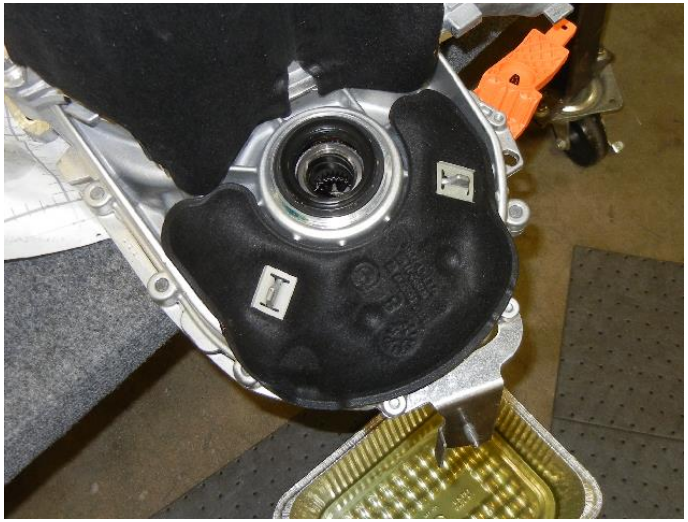
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Die Cut	5.20	1	0.25	11.50	CZE	$0.02	99.98 %	$0.00
Thermoform	58.28	4	0.50	32.84	CZE	$0.13	99.97 %	$0.00
Cure Foam	61.00	1	0.00	3.97	CZE	$0.07	99.96 %	$0.01
Foam Molding	18.14	1	3.00	61.43	CZE	$0.31	99.98 %	$0.00

Thermal Cover, Differential Processing

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material 2, Thermal Cover, Differential	1	PET Sheet Stock	By Area	0.0041	-	$0.00	$0.17
Material 2, Thermal Cover, Differential	1	PET Sheet Stock	By Area	0.0041	-	$0.00	$0.17
Material 1, Thermal Cover, Differential	1	PUR Foam	$4.08	0.0055	0.0057	$0.00	$0.02

Thermal Cover, Differential Installation





\...
\Zone 7 Driveline
\Gear Box
\Thermal Cover, Differential Installation

Process Summary

Right First Time	99.93 %
Process Time (Sec)	22.00
Total Weight (kg)	0.00

Material Cost**	$0.10
OEM Process Cost	$0.56
Supplier Process Cost	$0.00
Q Burden	$0.01
SG&A	$0.09
Manufacturing Cost*	$0.76

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Thermal Cover, Differential Installation

MUNRO & ASSOCIATES, INC.

Thermal Cover, Differential Installation

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	22.00	1	1.00	91.41	GER	$0.56	99.93 %	$0.01

Thermal Cover, Differential Installation

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Push Clip	2	Commodity Item	Purchased	0.0021	-	$0.05	$0.00

Half Shaft Overview

The BMW i3 half shaft assemblies are of the Schaeffler LUK FAG Axial spline design type with unique features which help unit balance and durability including large boot clamps without protrusions and inner race bearing channels with chamfered edges. Weight reduction strategies included tubular shafts, axial spline design and aluminum boot clamps

The half shaft consists of two steel CV (Constant Velocity) universal ball bearing joints with multi-piece machined housings containing ball bearings – bearing cages and inner and outer races.

All major components were costed in detail, while prices were applied to commodity items (i.e. seals, rivets, snap rings).

Estimates are based on actual parts.

Photos: Background on 100mm grid paper.

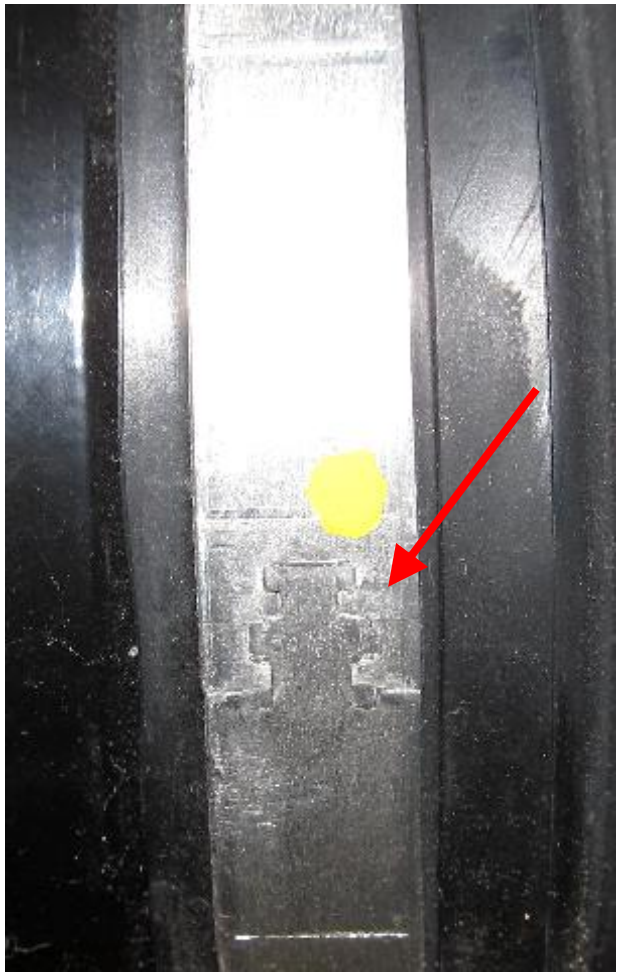
Eye Catching Features

Description:

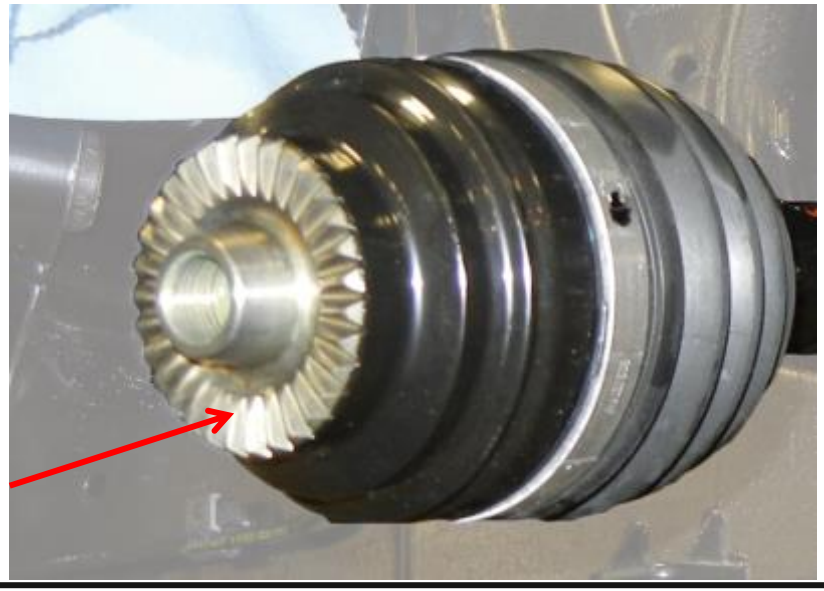
- Large clamp half shaft boot
- Oetiker clamp for half shafts
- MCR puzzle lock design -aluminum PG 150

Advantages:

- Better balance due to no crimp overhang
- Lighter weight
- Corrosion resistant 5754 aluminum (Euro Spec 3.3535)



Eye Catching Features



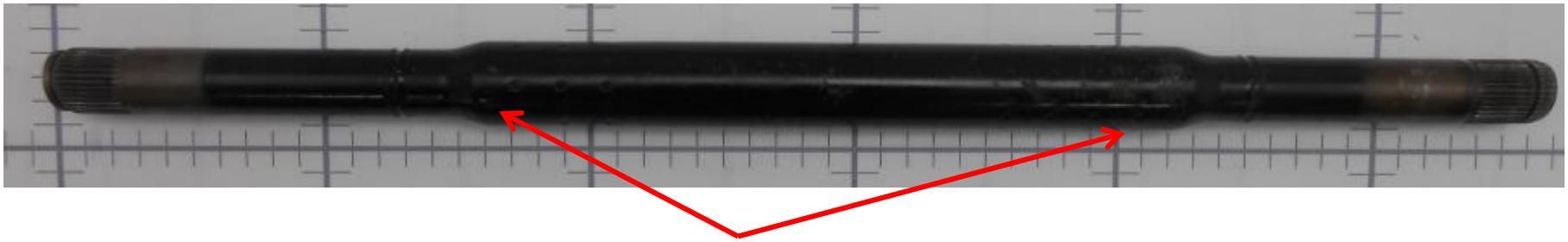
Description:

- Axial Spline – hub end connection Schaeffler LUK FAG type

Advantages:

- Reduces overall “un-sprung” weight
- Easier assembly
- Improved durability & improved vehicle chassis dynamics and handling
- Allows higher torque power transmission

Eye Catching Features



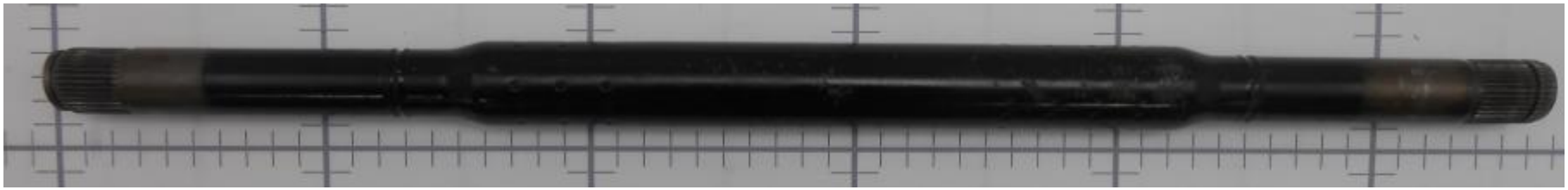
Description:

- Half shaft drivers side (long side) with no center carrier (unequal length)

Advantages:

- Reduced complexity
- Reduced weight
- Reduced cost

Eye Catching Features



Description:

- Half shaft are tubular design

Advantages:

- Reduced weight

MUNRO & ASSOCIATES, INC.

Summary

Parts	84
Fasteners	0
Part Numbers	26
Steps	1,632
Fastenings	60
Right First Time	90.69%
OEM Process Time (Hrs)	0.01
Supplier Process Time (Hrs)	1.77
Total Weight (kg)	12.18

Material Cost**	$26.33
OEM Process Cost	$0.61
Supplier Process Cost	$95.21
Q Burden	$1.47
SG&A	$17.65
Manufacturing Cost*	$141.27

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Driver Side Half Shaft Asm

\...
\Zone 7 Driveline
\Half Shafts
\Driver Side Half Shaft Asm

Assembly Summary

Parts	42
Fasteners	0
Part Numbers	24
Steps	813
Fastenings	29
Right First Time	95.27 %
OEM Process Time (Min)	0.00
Supplier Process Time (Min)	52.65
Total Weight (kg)	5.74

Material Cost**	$12.50
OEM Process Cost	$0.00
Supplier Process Cost	$46.28
Q Burden	$0.73
SG&A	$8.48
Manufacturing Cost*	$67.99

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Driver Side Half Shaft Asm

MUNRO & ASSOCIATES, INC.

Driver Side Half Shaft Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Half Shaft Drivers Side	1	2	0	54	0	99.76 %	0.00	0.00	0.00	3.75	1.8080
Bearing Boot Drivers side Inner	1	1	0	1	0	99.99 %	0.00	0.00	0.00	0.07	0.0621
Inner Race Drivers Side Inner	1	1	0	113	0	99.49 %	0.00	0.00	0.00	6.76	0.2248
Bearing Cage Drivers Side Inner	1	1	0	70	0	99.59 %	0.00	0.00	0.00	7.08	0.1189
Outer Race Drivers Side Driveshaft Joint	1	2	0	138	0	99.21 %	0.00	0.00	0.00	11.85	1.7380
Dust Shield Drivers Side Inner	1	1	0	7	0	99.97 %	0.00	0.00	0.00	0.16	0.0333
Assemble Drivers Side Inner Joint	1	17	21	62	21	99.14 %	0.00	0.00	1.45	0.00	0.2033
Bearing Boot Drivers Side Outer	1	1	0	1	0	99.99 %	0.00	0.00	0.00	0.09	0.0587
Inner Race Drivers Side Outer	1	1	0	113	0	99.49 %	0.00	0.00	0.00	6.76	0.2321
Cage Outer	1	1	0	70	0	99.60 %	0.00	0.00	0.00	6.68	0.0919
Outer Race Drivers Side Outer	1	2	0	136	0	99.32 %	0.00	0.00	0.00	7.21	0.9983
Assemble Drivers Side Outer Joint	1	12	8	38	8	99.62 %	0.00	0.00	0.78	0.00	0.1726

Driver Side Half Shaft Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Half Shaft Drivers Side	$0.00	$3.80	$0.00	$0.00	$0.00	$4.32	$0.04	$1.22	$9.37
Bearing Boot Drivers side Inner	$0.00	$0.17	$0.00	$0.00	$0.00	$0.04	$0.00	$0.03	$0.24
Inner Race Drivers Side Inner	$0.00	$0.35	$0.00	$0.00	$0.00	$5.83	$0.08	$0.93	$7.19
Bearing Cage Drivers Side Inner	$0.00	$0.19	$0.00	$0.00	$0.00	$5.67	$0.06	$0.88	$6.81
Outer Race Drivers Side Driveshaft Joint	$0.00	$2.86	$0.00	$0.00	$0.00	$11.20	$0.12	$2.11	$16.29
Dust Shield Drivers Side Inner	$0.00	$0.08	$0.00	$0.00	$0.00	$0.05	$0.00	$0.02	$0.15
Assemble Drivers Side Inner Joint	$1.60	$0.00	$0.00	$0.00	$0.73	$0.00	$0.13	$0.16	$2.62
Bearing Boot Drivers Side Outer	$0.00	$0.16	$0.00	$0.00	$0.00	$0.05	$0.00	$0.03	$0.24
Inner Race Drivers Side Outer	$0.00	$0.37	$0.00	$0.00	$0.00	$5.83	$0.08	$0.93	$7.21
Cage Outer	$0.00	$0.14	$0.00	$0.00	$0.00	$5.39	$0.06	$0.83	$6.42
Outer Race Drivers Side Outer	$0.00	$1.59	$0.00	$0.00	$0.00	$6.78	$0.10	$1.26	$9.72
Assemble Drivers Side Outer Joint	$1.19	$0.00	$0.00	$0.00	$0.40	$0.00	$0.06	$0.09	$1.74

MUNRO & ASSOCIATES, INC.

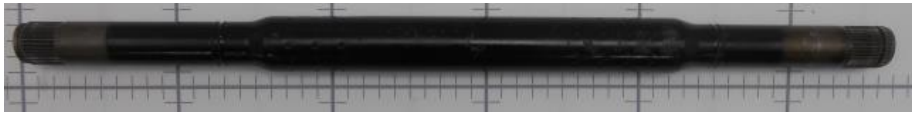
Detailed Summary

Parts	42
Fasteners	0
Part Numbers	24
Steps	813
Fastenings	29
Right First Time	95.27%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	2.23
Supplier Fab. Time (Min)	50.41
Total Weight (kg)	5.74

Purchased Part Cost	$2.79
Material Cost	$9.71
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.00
Supplier Asm. Cost	$1.13
Supplier Fab. Cost	$45.15
Q Burden	$0.73
SG&A	$8.48
Manufacturing Cost*	$67.99

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Half Shaft Drivers Side



\...
\Driver Side Half Shaft Asm
\Half Shaft Drivers Side
\Half Shaft Drivers Side

Process Summary

Right First Time	99.76 %
Process Time (Sec)	225.19
Total Weight (kg)	1.81

Material Cost**	$3.80
OEM Process Cost	$0.00
Supplier Process Cost	$4.32
Q Burden	$0.04
SG&A	$1.22
Manufacturing Cost*	$9.37

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Half Shaft Drivers Side

MUNRO & ASSOCIATES, INC.

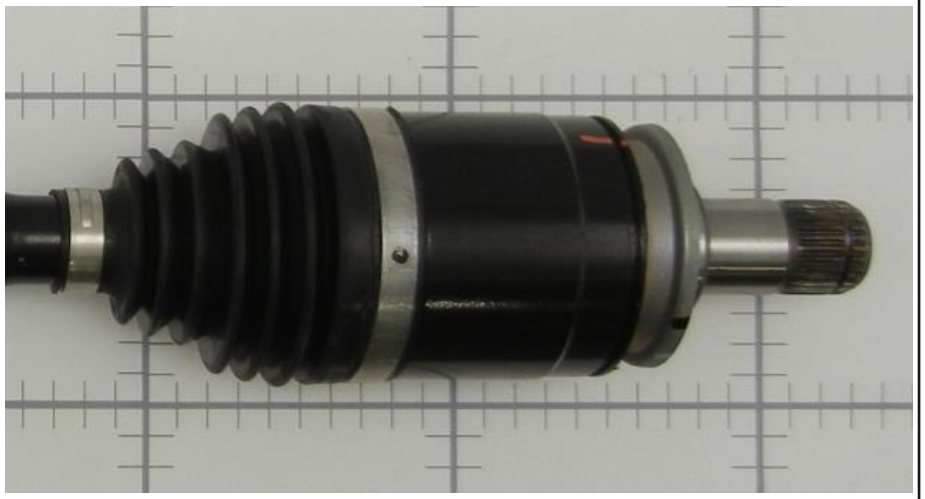
Half Shaft Drivers Side

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Paint Cure Oven	38.29	1	0.25	17.08	GER	$0.18	99.97 %	$0.01
Dip Coat Paint	4.90	1	0.25	143.33	GER	$0.20	99.99 %	$0.00
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Temper	7.80	1	0.25	19.29	GER	$0.04	100.00 %	$0.00
Quench	1.94	1	0.25	25.28	GER	$0.01	100.00 %	$0.00
Carburize	55.01	1	0.25	167.44	GER	$2.56	100.00 %	$0.00
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Deburr	9.00	1	0.25	35.68	GER	$0.09	99.99 %	$0.00
CNC Machining	28.19	1	0.25	39.15	GER	$0.31	99.95 %	$0.01
Roll Splines	21.00	1	0.25	31.61	GER	$0.18	99.96 %	$0.01
Roll Form Shaft	41.06	1	0.25	51.88	GER	$0.59	99.95 %	$0.01

Half Shaft Drivers Side

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Paint for dip coat	1	Paint - Basecoat	By Area	0.0000	-	$0.00	$0.06
Material Half Shaft	1	Steel 1040 - Seamless Tube	$1.87	1.8080	2.0000	$0.00	$3.74

Bearing Boot Drivers side Inner



\...
\Driver Side Half Shaft Asm
\Bearing Boot Drivers side Inner
\Boot Process

Process Summary

Right First Time	99.99 %
Process Time (Sec)	4.18
Total Weight (kg)	0.06

Material Cost**	$0.17
OEM Process Cost	$0.00
Supplier Process Cost	$0.04
Q Burden	$0.00
SG&A	$0.03
Manufacturing Cost*	$0.24

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Bearing Boot Drivers side Inner

MUNRO & ASSOCIATES, INC.

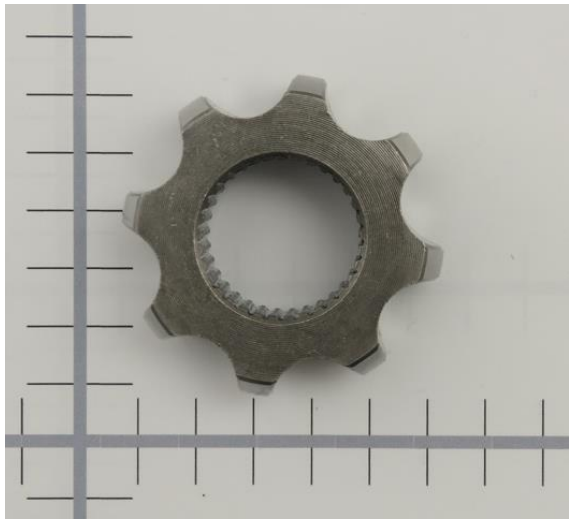
Boot Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
200 Ton Injection Molding Press	33.44	8	0.25	30.85	GER	$0.04	99.99 %	$0.00

Boot Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Boot Material	1	TPE	$2.54	0.0621	0.0670	$0.00	$0.17

Inner Race Drivers Side Inner



\...
\Driver Side Half Shaft Asm
\Inner Race Drivers Side Inner
\Inner Race Drivers Side Inner Process

Process Summary

Right First Time	99.49 %
Process Time (Sec)	405.76
Total Weight (kg)	0.22

Material Cost**	$0.35
OEM Process Cost	$0.00
Supplier Process Cost	$5.83
Q Burden	$0.08
SG&A	$0.93
Manufacturing Cost*	$7.19

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Inner Race Drivers Side Inner

MUNRO & ASSOCIATES, INC.

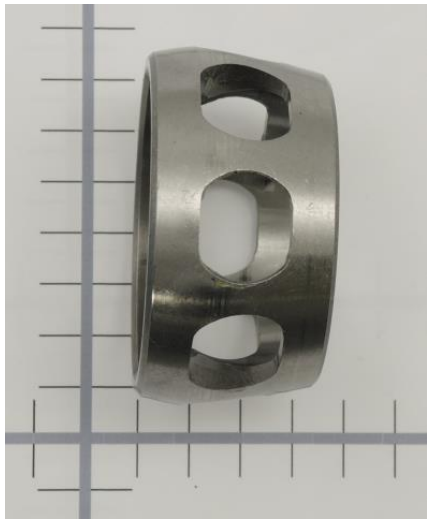
Inner Race Drivers Side Inner Process

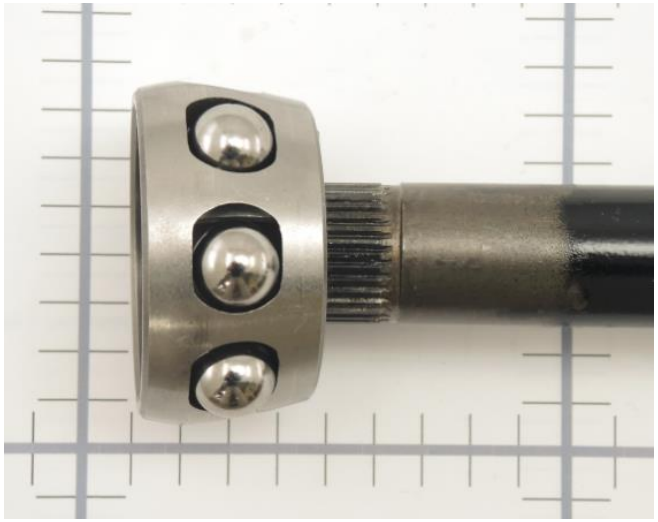
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Grind	95.24	1	0.25	50.01	GER	$1.32	99.87 %	$0.02
Temper	1.24	1	0.25	19.29	GER	$0.01	100.00 %	$0.00
Quench	1.00	1	0.25	25.28	GER	$0.01	100.00 %	$0.00
Pre Heat	8.64	1	0.25	167.44	GER	$0.40	100.00 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Deburr	7.00	1	0.25	31.36	GER	$0.06	99.99 %	$0.00
CNC Machining	209.40	1	0.25	49.86	GER	$2.90	99.93 %	$0.01
CNC Machining	52.69	1	0.25	39.15	GER	$0.57	99.94 %	$0.01
25 Ton Trim Press	2.60	1	0.25	19.09	GER	$0.01	99.98 %	$0.00
500 Ton Forging Press	6.55	1	2.00	205.38	GER	$0.37	99.86 %	$0.02
Cut Blank	7.40	1	0.25	25.18	GER	$0.05	99.97 %	$0.01

Inner Race Drivers Side Inner Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material Inner Race Drivers Side Inner	1	Steel 52100 Bearing Grade - Bar Stock	$1.43	0.2248	0.2473	$0.00	$0.35

Bearing Cage Drivers Side Inner





\...
\Driver Side Half Shaft Asm
\Bearing Cage Drivers Side Inner
\Bearing Cage Drivers side Inner

Process Summary

Right First Time	99.59 %
Process Time (Sec)	424.82
Total Weight (kg)	0.12

Material Cost**	$0.19
OEM Process Cost	$0.00
Supplier Process Cost	$5.67
Q Burden	$0.06
SG&A	$0.88
Manufacturing Cost*	$6.81

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Bearing Cage Drivers Side Inner

MUNRO & ASSOCIATES, INC.

Bearing Cage Drivers side Inner

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Grind	127.09	1	0.25	50.01	GER	$1.77	99.91 %	$0.01
Temper	1.62	1	0.25	19.29	GER	$0.01	100.00 %	$0.00
Quench	0.61	1	0.25	25.28	GER	$0.00	100.00 %	$0.00
Pre Heat	13.24	1	0.25	167.44	GER	$0.62	100.00 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Deburr	7.00	1	0.25	31.36	GER	$0.06	99.99 %	$0.00
CNC Machining	244.70	1	0.25	39.15	GER	$2.66	99.93 %	$0.01
25 Ton Trim Press	2.60	1	0.25	19.09	GER	$0.01	99.98 %	$0.00
500 Ton Forging Press	6.55	1	2.00	205.38	GER	$0.37	99.86 %	$0.02
Cut Blank	7.40	1	0.25	25.18	GER	$0.05	99.97 %	$0.01

Bearing Cage Drivers side Inner

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material Bearing cage Drivers side Inner	1	Steel 52100 Bearing Grade - Bar Stock	$1.43	0.1189	0.1308	$0.00	$0.19

Outer Race Drivers Side Driveshaft Joint

\...
\Driver Side Half Shaft Asm
\Outer Race Drivers Side Driveshaft Joint
\Bearing Race

Process Summary

Right First Time	99.21 %
Process Time (Sec)	710.82
Total Weight (kg)	1.74

Material Cost**	$2.86
OEM Process Cost	$0.00
Supplier Process Cost	$11.20
Q Burden	$0.12
SG&A	$2.11
Manufacturing Cost*	$16.29

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Outer Race Drivers Side Driveshaft Joint

Bearing Race

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Paint Cure Oven	6.90	1	0.25	17.08	GER	$0.03	99.97 %	$0.01
Dip Coat Paint	2.09	1	0.25	40.99	GER	$0.02	99.99 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Grind	356.82	1	0.25	50.01	GER	$4.96	99.69 %	$0.05
Temper	6.99	1	0.25	19.29	GER	$0.04	100.00 %	$0.00
Quench	1.87	1	0.25	25.28	GER	$0.01	100.00 %	$0.00
Pre Heat	56.20	1	0.25	167.44	GER	$2.61	100.00 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Deburr	7.00	1	0.25	35.68	GER	$0.07	99.99 %	$0.00
CNC Machining	240.55	1	0.25	39.15	GER	$2.62	99.87 %	$0.02
60 Ton Trim Press	2.60	1	0.25	22.68	GER	$0.02	99.98 %	$0.00
1000 Ton Forging Press	8.40	1	2.00	279.11	GER	$0.65	99.81 %	$0.03

Bearing Race

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Dip Coat Paint	1	Paint - Basecoat	By Area	0.0000	-	$0.00	$0.03
Material Bearing Outer Race	1	Steel 52100 Bearing Grade - Bar Stock	$1.43	1.7380	1.9800	$0.00	$2.83

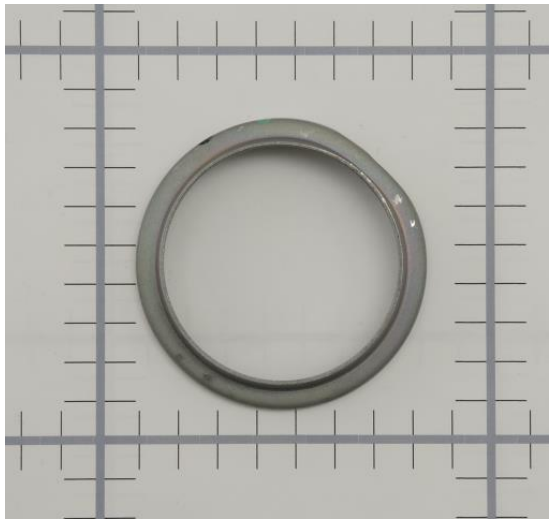
Outer Race Drivers Side Driveshaft Joint

MUNRO & ASSOCIATES, INC.

Bearing Race

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Cut Blank	7.40	1	0.25	25.18	GER	$0.05	99.97 %	$0.01

Dust Shield Drivers Side Inner



\...
\Driver Side Half Shaft Asm
\Dust Shield Drivers Side Inner
\Dust Shield Process

Process Summary

Right First Time	99.97 %
Process Time (Sec)	9.60
Total Weight (kg)	0.03

Material Cost**	$0.08
OEM Process Cost	$0.00
Supplier Process Cost	$0.05
Q Burden	$0.00
SG&A	$0.02
Manufacturing Cost*	$0.15

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Dust Shield Drivers Side Inner

Dust Shield Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	5.00	1	0.25	20.00	GER	$0.03	99.99 %	$0.00
Deburr	4.00	1	0.25	12.36	GER	$0.01	99.99 %	$0.00
25 Ton Stamping Press	0.60	1	0.25	21.63	GER	$0.00	99.99 %	$0.00

Dust Shield Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Dust Shield Material	1	Steel 1008 - Galvanized - Coil Stock	$1.06	0.0333	0.0720	$0.00	$0.08

Assemble Drivers Side Inner Joint

\...
\Half Shafts
\Driver Side Half Shaft Asm
\Assemble Drivers Side Inner Joint

Process Summary

Right First Time	99.14 %
Process Time (Sec)	87.00
Total Weight (kg)	0.20

Material Cost**	$1.60
OEM Process Cost	$0.00
Supplier Process Cost	$0.73
Q Burden	$0.13
SG&A	$0.16
Manufacturing Cost*	$2.62

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Drivers Side Inner Joint

MUNRO & ASSOCIATES, INC.

Assemble Drivers Side Inner Joint

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	87.00	1	0.25	30.27	GER	$0.73	99.14 %	$0.13

Assemble Drivers Side Inner Joint

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Sealing Caps Half Shaft	2	Commodity Item	Purchased	0.0031	-	$0.05	$0.00
Bar Code Identification Sticker Half Shaft Asm	1	Commodity Item	Purchased	0.0005	-	$0.10	$0.00
Snap Ring for Inner Race	1	Commodity Item	Purchased	0.0017	-	$0.05	$0.00
Ball Bearings	8	Commodity Item	Purchased	0.0163	-	$0.09	$0.00
Snap Ring Large	1	Commodity Item	Purchased	0.0038	-	$0.08	$0.00
"C" Spring Clip	1	Commodity Item	Purchased	0.0015	-	$0.02	$0.00
CV Joint Boot Clamp Small	1	Commodity Item	Purchased	0.0088	-	$0.05	$0.00
Grease	1	Commodity Item	Purchased	0.0390	-	$0.28	$0.00
CV Joint Boot Clamp Large	1	Commodity Item	Purchased	0.0114	-	$0.20	$0.00

Bearing Boot Drivers Side Outer

\...
\Driver Side Half Shaft Asm
\Bearing Boot Drivers Side Outer
\Boot Process

Process Summary

Right First Time	99.99 %
Process Time (Sec)	5.52
Total Weight (kg)	0.06

Material Cost**	$0.16
OEM Process Cost	$0.00
Supplier Process Cost	$0.05
Q Burden	$0.00
SG&A	$0.03
Manufacturing Cost*	$0.24

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Bearing Boot Drivers Side Outer

MUNRO & ASSOCIATES, INC.

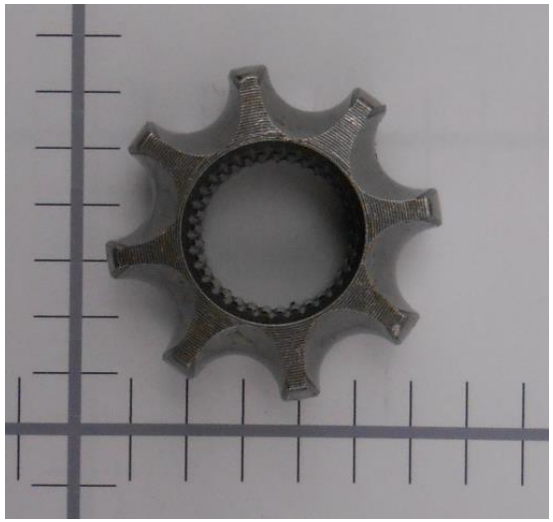
Boot Process

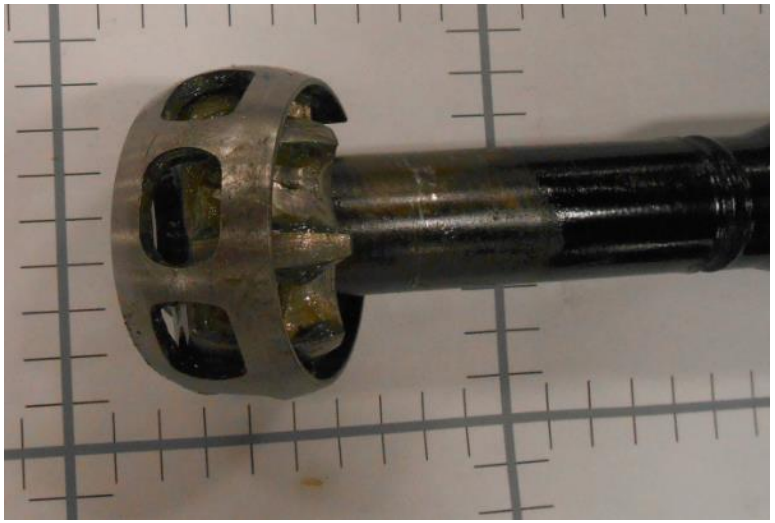
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
200 Ton Injection Molding Press	5.52	1	0.25	30.85	GER	$0.05	99.99 %	$0.00

Boot Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material Bearing Boot Drivers Side Uoter	1	TPE	$2.54	0.0587	0.0630	$0.00	$0.16

Inner Race Drivers Side Outer





\...
\Driver Side Half Shaft Asm
\Inner Race Drivers Side Outer
\Inner Race Drivers Side Outer Process

Process Summary

Right First Time	99.49 %
Process Time (Sec)	405.76
Total Weight (kg)	0.23

Material Cost**	$0.37
OEM Process Cost	$0.00
Supplier Process Cost	$5.83
Q Burden	$0.08
SG&A	$0.93
Manufacturing Cost*	$7.21

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Inner Race Drivers Side Outer

MUNRO & ASSOCIATES, INC.

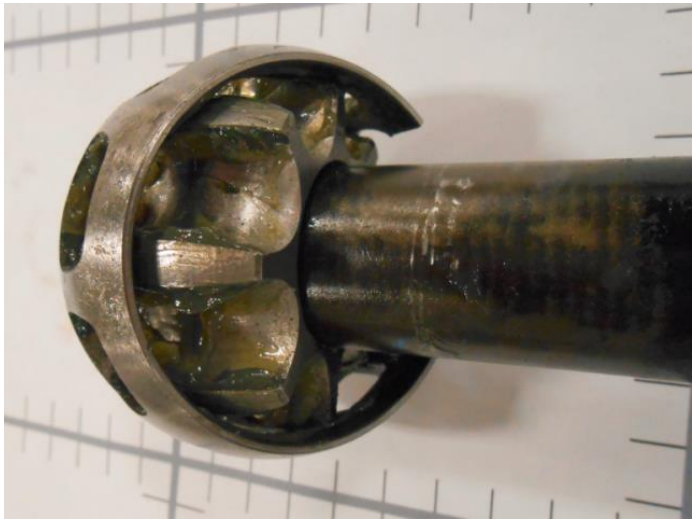
Inner Race Drivers Side Outer Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Grind	95.24	1	0.25	50.01	GER	$1.32	99.87 %	$0.02
Temper	1.24	1	0.25	19.29	GER	$0.01	100.00 %	$0.00
Quench	1.00	1	0.25	25.28	GER	$0.01	100.00 %	$0.00
Pre Heat	8.64	1	0.25	167.44	GER	$0.40	100.00 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Deburr	7.00	1	0.25	31.36	GER	$0.06	99.99 %	$0.00
CNC Machining	209.40	1	0.25	49.86	GER	$2.90	99.93 %	$0.01
CNC Machining	52.69	1	0.25	39.15	GER	$0.57	99.94 %	$0.01
25 Ton Trim Press	2.60	1	0.25	19.09	GER	$0.01	99.98 %	$0.00
500 Ton Forging Press	6.55	1	2.00	205.38	GER	$0.37	99.86 %	$0.02
Cut Blank	7.40	1	0.25	25.18	GER	$0.05	99.97 %	$0.01

Inner Race Drivers Side Outer Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material Inner Rce Outer	1	Steel 52100 Bearing Grade - Bar Stock	$1.43	0.2321	0.2553	$0.00	$0.37

Cage Outer



\...
\Driver Side Half Shaft Asm
\Cage Outer
\Bearing Cage Drivers side Outer

Process Summary

Right First Time	99.60 %
Process Time (Sec)	400.77
Total Weight (kg)	0.09

Material Cost**	$0.14
OEM Process Cost	$0.00
Supplier Process Cost	$5.39
Q Burden	$0.06
SG&A	$0.83
Manufacturing Cost*	$6.42

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Cage Outer

Bearing Cage Drivers side Outer

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Grind	119.35	1	0.25	50.01	GER	$1.66	99.91 %	$0.01
Temper	1.62	1	0.25	19.29	GER	$0.01	100.00 %	$0.00
Quench	0.61	1	0.25	25.28	GER	$0.00	100.00 %	$0.00
Carburize	13.24	1	0.25	167.44	GER	$0.62	100.00 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Deburr	7.00	1	0.25	31.36	GER	$0.06	99.99 %	$0.00
CNC Machining	228.40	1	0.25	39.15	GER	$2.48	99.94 %	$0.01
25 Ton Trim Press	2.60	1	0.25	19.09	GER	$0.01	99.98 %	$0.00
500 Ton Forging Press	6.55	1	2.00	205.38	GER	$0.37	99.86 %	$0.02
Cut Blank	7.40	1	0.25	25.18	GER	$0.05	99.97 %	$0.01

Bearing Cage Drivers side Outer

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material Bearing Cage Drivers Side Outer	1	Steel 52100 Bearing Grade - Bar Stock	$1.43	0.0919	0.1011	$0.00	$0.14

Outer Race Drivers Side Outer

\...
\Driver Side Half Shaft Asm
\Outer Race Drivers Side Outer
\Bearing Race

Process Summary

Right First Time	99.32 %
Process Time (Sec)	432.46
Total Weight (kg)	1.00

Material Cost**	$1.59
OEM Process Cost	$0.00
Supplier Process Cost	$6.78
Q Burden	$0.10
SG&A	$1.26
Manufacturing Cost*	$9.72

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Outer Race Drivers Side Outer

MUNRO & ASSOCIATES, INC.

Bearing Race

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Paint Cure Oven	5.06	1	0.25	17.08	GER	$0.02	99.97 %	$0.01
Dip Coat Paint	2.10	1	0.25	131.87	HUN	$0.08	99.99 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Grind	129.31	1	0.25	50.01	GER	$1.80	99.80 %	$0.03
Temper	3.86	1	0.25	19.29	GER	$0.02	100.00 %	$0.00
Quench	1.48	1	0.25	25.28	GER	$0.01	100.00 %	$0.00
Carburize	32.11	1	0.25	167.44	GER	$1.49	100.00 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Deburr	7.00	1	0.25	35.68	GER	$0.07	99.99 %	$0.00
CNC Machining	218.15	1	0.25	39.15	GER	$2.37	99.88 %	$0.02
25 Ton Trim Press	2.60	1	0.25	19.09	GER	$0.01	99.98 %	$0.00
1000 Ton Forging Press	9.40	1	2.00	279.11	GER	$0.73	99.80 %	$0.03

Bearing Race

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material-Paint Outer Race Drivers Side Outer	1	Paint - Basecoat	By Area	0.0000	-	$0.00	$0.02
Material, Outer Race Drivers Side Outer	1	Steel 52100 Bearing Grade - Bar Stock	$1.43	0.9983	1.0981	$0.00	$1.57

Outer Race Drivers Side Outer

Bearing Race

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Cut Blank	7.40	1	0.25	25.18	GER	$0.05	99.97 %	$0.01

Assemble Drivers Side Outer Joint

\...
\Half Shafts
\Driver Side Half Shaft Asm
\Assemble Drivers Side Outer Joint

Process Summary

Right First Time	99.62 %
Process Time (Sec)	47.00
Total Weight (kg)	0.17

Material Cost**	$1.19
OEM Process Cost	$0.00
Supplier Process Cost	$0.40
Q Burden	$0.06
SG&A	$0.09
Manufacturing Cost*	$1.74

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Drivers Side Outer Joint

MUNRO & ASSOCIATES, INC.

Assemble Drivers Side Outer Joint

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	47.00	1	0.25	30.27	GER	$0.40	99.62 %	$0.06

Assemble Drivers Side Outer Joint

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Pressure Ring Drivers Side Outer Race to Spline	1	Commodity Item	Purchased	0.0014	-	$0.02	$0.00
Ball Bearings Outer Joint 15.06mm dia	8	Commodity Item	Purchased	0.0140	-	$0.08	$0.00
CV Joint Boot Clamp Small	1	Commodity Item	Purchased	0.0088	-	$0.05	$0.00
Grease	1	Commodity Item	Purchased	0.0390	-	$0.28	$0.00
CV Joint Boot Clamp Large	1	Commodity Item	Purchased	0.0114	-	$0.20	$0.00

Driver Side Half Shaft Installation

MUNRO & ASSOCIATES, INC.

No Commodity Items Required for This Process

\...
\Zone 7 Driveline
\Half Shafts
\Driver Side Half Shaft Installation

Process Summary

Right First Time	99.96 %
Process Time (Sec)	12.00
Total Weight (kg)	0.00

Material Cost**	$0.00
OEM Process Cost	$0.30
Supplier Process Cost	$0.00
Q Burden	$0.01
SG&A	$0.05
Manufacturing Cost*	$0.36

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Driver Side Half Shaft Installation

MUNRO & ASSOCIATES, INC.

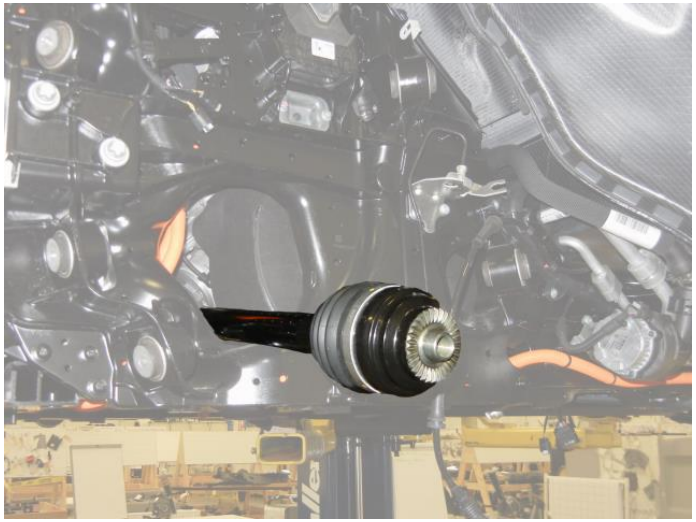
Driver Side Half Shaft Installation

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	12.00	1	1.00	91.41	GER	$0.30	99.96 %	$0.01

Driver Side Half Shaft Installation

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost

Passenger Side Half Shaft Asm



\...
\Zone 7 Driveline
\Half Shafts
\Passenger Side Half Shaft Asm

Assembly Summary

Parts	42
Fasteners	0
Part Numbers	24
Steps	813
Fastenings	29
Right First Time	95.27 %
OEM Process Time (Min)	0.00
Supplier Process Time (Min)	53.85
Total Weight (kg)	6.43

Material Cost**	$13.83
OEM Process Cost	$0.00
Supplier Process Cost	$48.93
Q Burden	$0.73
SG&A	$9.08
Manufacturing Cost*	$72.57

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Passenger Side Half Shaft Asm

MUNRO & ASSOCIATES, INC.

Passenger Side Half Shaft Asm

Name	Qty	Parts	Fasteners	Steps	Fastenings	Right First Time	OEM Asm. Time (Min)	OEM Fab. Time (Min)	Supplier Asm. Time (Min)	Supplier Fab. Time (Min)	Total Weight (kg)
Half Shaft Passenger Side	1	2	0	54	0	99.76 %	0.00	0.00	0.00	4.96	2.4940
Bearing Boot Drivers side Inner	1	1	0	1	0	99.99 %	0.00	0.00	0.00	0.07	0.0621
Inner Race Drivers Side Inner	1	1	0	113	0	99.49 %	0.00	0.00	0.00	6.76	0.2248
Bearing Cage Drivers Side Inner	1	1	0	70	0	99.59 %	0.00	0.00	0.00	7.08	0.1189
Outer Race Drivers Side Driveshaft Joint	1	2	0	138	0	99.21 %	0.00	0.00	0.00	11.85	1.7380
Dust Shield Drivers Side Inner	1	1	0	7	0	99.97 %	0.00	0.00	0.00	0.16	0.0333
Assemble Drivers Side Inner Joint	1	17	21	62	21	99.14 %	0.00	0.00	1.45	0.00	0.2033
Bearing Boot Drivers Side Outer	1	1	0	1	0	99.99 %	0.00	0.00	0.00	0.09	0.0587
Inner Race Drivers Side Outer	1	1	0	113	0	99.49 %	0.00	0.00	0.00	6.76	0.2321
Cage Outer	1	1	0	70	0	99.60 %	0.00	0.00	0.00	6.68	0.0919
Outer Race Drivers Side Outer	1	2	0	136	0	99.32 %	0.00	0.00	0.00	7.21	0.9983
Assemble Drivers Side Outer Joint	1	12	8	38	8	99.62 %	0.00	0.00	0.78	0.00	0.1726

Passenger Side Half Shaft Asm

Name	Purchased Part Cost	Material Cost	OEM Asm. Cost	OEM Fab. Cost	Supplier Asm. Cost	Supplier Fab. Cost	Q Burden	SG&A	Manufacturing Cost*
Half Shaft Passenger Side	$0.00	$5.13	$0.00	$0.00	$0.00	$6.97	$0.04	$1.82	$13.95
Bearing Boot Drivers side Inner	$0.00	$0.17	$0.00	$0.00	$0.00	$0.04	$0.00	$0.03	$0.24
Inner Race Drivers Side Inner	$0.00	$0.35	$0.00	$0.00	$0.00	$5.83	$0.08	$0.93	$7.19
Bearing Cage Drivers Side Inner	$0.00	$0.19	$0.00	$0.00	$0.00	$5.67	$0.06	$0.88	$6.81
Outer Race Drivers Side Driveshaft Joint	$0.00	$2.86	$0.00	$0.00	$0.00	$11.20	$0.12	$2.11	$16.29
Dust Shield Drivers Side Inner	$0.00	$0.08	$0.00	$0.00	$0.00	$0.05	$0.00	$0.02	$0.15
Assemble Drivers Side Inner Joint	$1.60	$0.00	$0.00	$0.00	$0.73	$0.00	$0.13	$0.16	$2.62
Bearing Boot Drivers Side Outer	$0.00	$0.16	$0.00	$0.00	$0.00	$0.05	$0.00	$0.03	$0.24
Inner Race Drivers Side Outer	$0.00	$0.37	$0.00	$0.00	$0.00	$5.83	$0.08	$0.93	$7.21
Cage Outer	$0.00	$0.14	$0.00	$0.00	$0.00	$5.39	$0.06	$0.83	$6.42
Outer Race Drivers Side Outer	$0.00	$1.59	$0.00	$0.00	$0.00	$6.78	$0.10	$1.26	$9.72
Assemble Drivers Side Outer Joint	$1.19	$0.00	$0.00	$0.00	$0.40	$0.00	$0.06	$0.09	$1.74

Passenger Side Half Shaft Asm

MUNRO & ASSOCIATES, INC.

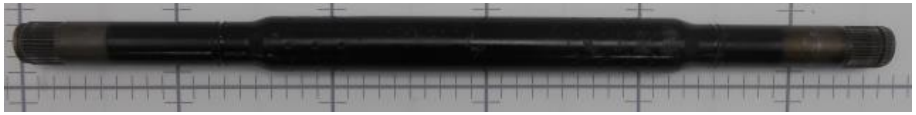
Detailed Summary

Parts	42
Fasteners	0
Part Numbers	24
Steps	813
Fastenings	29
Right First Time	95.27%
OEM Asm. Time (Min)	0.00
OEM Fab. Time (Min)	0.00
Supplier Asm. Time (Min)	2.23
Supplier Fab. Time (Min)	51.62
Total Weight (kg)	6.43

Purchased Part Cost	$2.79
Material Cost	$11.04
OEM Asm. Cost	$0.00
OEM Fab. Cost	$0.00
Supplier Asm. Cost	$1.13
Supplier Fab. Cost	$47.81
Q Burden	$0.73
SG&A	$9.08
Manufacturing Cost*	$72.57

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Half Shaft Passenger Side



\...
\Passenger Side Half Shaft Asm
\Half Shaft Passenger Side
\Half Shaft Passenger Side

Process Summary

Right First Time	99.76 %
Process Time (Sec)	297.31
Total Weight (kg)	2.49

Material Cost**	$5.13
OEM Process Cost	$0.00
Supplier Process Cost	$6.97
Q Burden	$0.04
SG&A	$1.82
Manufacturing Cost*	$13.95

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Half Shaft Passenger Side

MUNRO & ASSOCIATES, INC.

Half Shaft Passenger Side

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Paint Cure Oven	54.00	1	0.25	17.08	GER	$0.26	99.97 %	$0.01
Dip Coat Paint	5.34	1	0.25	143.33	GER	$0.21	99.99 %	$0.00
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Temper	7.80	1	0.25	19.29	GER	$0.04	100.00 %	$0.00
Quench	2.91	1	0.25	25.28	GER	$0.02	100.00 %	$0.00
Carburize	110.01	1	0.25	167.44	GER	$5.12	100.00 %	$0.00
Wash	9.00	1	0.25	30.69	GER	$0.08	99.99 %	$0.00
Deburr	9.00	1	0.25	35.68	GER	$0.09	99.99 %	$0.00
CNC Machining	28.19	1	0.25	39.15	GER	$0.31	99.95 %	$0.01
Roll Splines	21.00	1	0.25	31.61	GER	$0.18	99.96 %	$0.01
Roll Form Shaft	41.06	1	0.25	51.88	GER	$0.59	99.95 %	$0.01

Half Shaft Passenger Side

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Paint for dip coat	1	Paint - Basecoat	By Area	0.0000	-	$0.00	$0.08
Material Half Shaft	1	Steel 1040 - Seamless Tube	$1.87	2.4940	2.7000	$0.00	$5.05

Bearing Boot Drivers side Inner

\...
\Passenger Side Half Shaft Asm
\Bearing Boot Drivers side Inner
\Boot Process

Process Summary

Right First Time	99.99 %
Process Time (Sec)	4.18
Total Weight (kg)	0.06

Material Cost**	$0.17
OEM Process Cost	$0.00
Supplier Process Cost	$0.04
Q Burden	$0.00
SG&A	$0.03
Manufacturing Cost*	$0.24

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Bearing Boot Drivers side Inner

MUNRO & ASSOCIATES, INC.

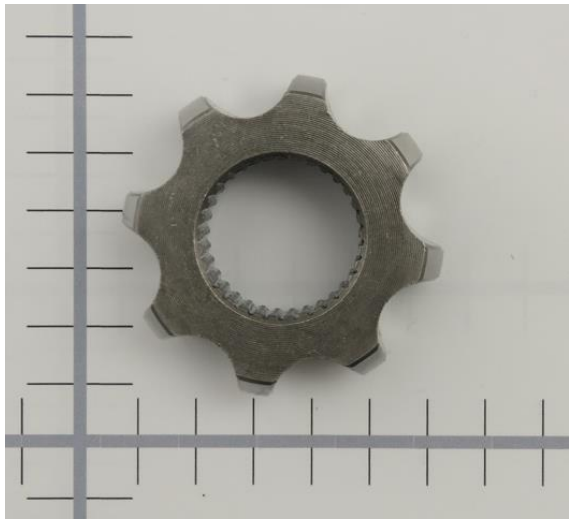
Boot Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
200 Ton Injection Molding Press	33.44	8	0.25	30.85	GER	$0.04	99.99 %	$0.00

Boot Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Boot Material	1	TPE	$2.54	0.0621	0.0670	$0.00	$0.17

Inner Race Drivers Side Inner



\...
\Passenger Side Half Shaft Asm
\Inner Race Drivers Side Inner
\Inner Race Drivers Side Inner Process

Process Summary

Right First Time	99.49 %
Process Time (Sec)	405.76
Total Weight (kg)	0.22

Material Cost**	$0.35
OEM Process Cost	$0.00
Supplier Process Cost	$5.83
Q Burden	$0.08
SG&A	$0.93
Manufacturing Cost*	$7.19

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Inner Race Drivers Side Inner

MUNRO & ASSOCIATES, INC.

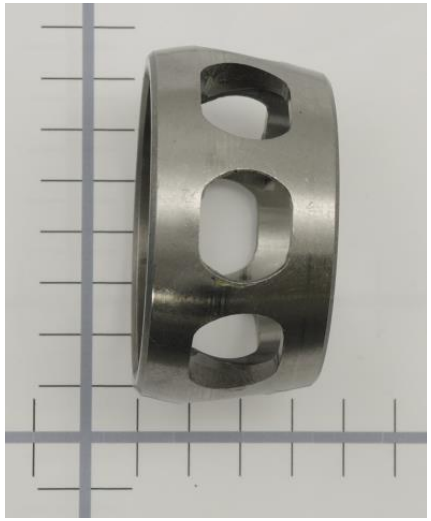
Inner Race Drivers Side Inner Process

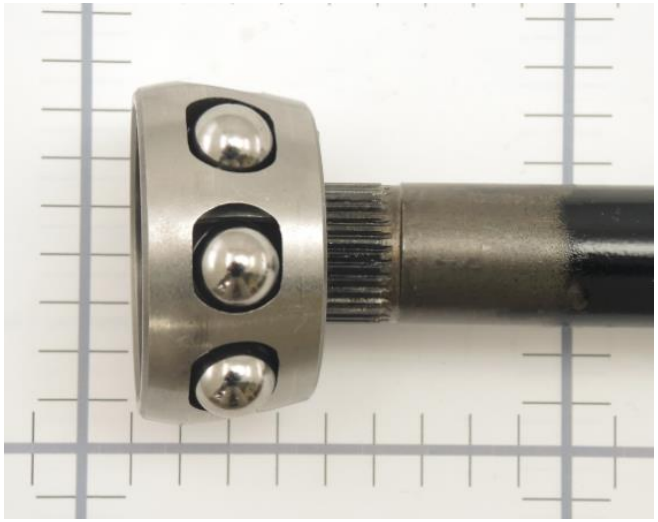
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Grind	95.24	1	0.25	50.01	GER	$1.32	99.87 %	$0.02
Temper	1.24	1	0.25	19.29	GER	$0.01	100.00 %	$0.00
Quench	1.00	1	0.25	25.28	GER	$0.01	100.00 %	$0.00
Pre Heat	8.64	1	0.25	167.44	GER	$0.40	100.00 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Deburr	7.00	1	0.25	31.36	GER	$0.06	99.99 %	$0.00
CNC Machining	209.40	1	0.25	49.86	GER	$2.90	99.93 %	$0.01
CNC Machining	52.69	1	0.25	39.15	GER	$0.57	99.94 %	$0.01
25 Ton Trim Press	2.60	1	0.25	19.09	GER	$0.01	99.98 %	$0.00
500 Ton Forging Press	6.55	1	2.00	205.38	GER	$0.37	99.86 %	$0.02
Cut Blank	7.40	1	0.25	25.18	GER	$0.05	99.97 %	$0.01

Inner Race Drivers Side Inner Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material Inner Race Drivers Side Inner	1	Steel 52100 Bearing Grade - Bar Stock	$1.43	0.2248	0.2473	$0.00	$0.35

Bearing Cage Drivers Side Inner





\...
\Passenger Side Half Shaft Asm
\Bearing Cage Drivers Side Inner
\Bearing Cage Drivers side Inner

Process Summary

Right First Time	99.59 %
Process Time (Sec)	424.82
Total Weight (kg)	0.12

Material Cost**	$0.19
OEM Process Cost	$0.00
Supplier Process Cost	$5.67
Q Burden	$0.06
SG&A	$0.88
Manufacturing Cost*	$6.81

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Bearing Cage Drivers Side Inner

MUNRO & ASSOCIATES, INC.

Bearing Cage Drivers side Inner

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Grind	127.09	1	0.25	50.01	GER	$1.77	99.91 %	$0.01
Temper	1.62	1	0.25	19.29	GER	$0.01	100.00 %	$0.00
Quench	0.61	1	0.25	25.28	GER	$0.00	100.00 %	$0.00
Pre Heat	13.24	1	0.25	167.44	GER	$0.62	100.00 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Deburr	7.00	1	0.25	31.36	GER	$0.06	99.99 %	$0.00
CNC Machining	244.70	1	0.25	39.15	GER	$2.66	99.93 %	$0.01
25 Ton Trim Press	2.60	1	0.25	19.09	GER	$0.01	99.98 %	$0.00
500 Ton Forging Press	6.55	1	2.00	205.38	GER	$0.37	99.86 %	$0.02
Cut Blank	7.40	1	0.25	25.18	GER	$0.05	99.97 %	$0.01

Bearing Cage Drivers side Inner

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material Bearing cage Drivers side Inner	1	Steel 52100 Bearing Grade - Bar Stock	$1.43	0.1189	0.1308	$0.00	$0.19

Outer Race Drivers Side Driveshaft Joint

\...
\Passenger Side Half Shaft Asm
\Outer Race Drivers Side Driveshaft Joint
\Bearing Race

Process Summary

Right First Time	99.21 %
Process Time (Sec)	710.82
Total Weight (kg)	1.74

Material Cost**	$2.86
OEM Process Cost	$0.00
Supplier Process Cost	$11.20
Q Burden	$0.12
SG&A	$2.11
Manufacturing Cost*	$16.29

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Outer Race Drivers Side Driveshaft Joint

Bearing Race

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Paint Cure Oven	6.90	1	0.25	17.08	GER	$0.03	99.97 %	$0.01
Dip Coat Paint	2.09	1	0.25	40.99	GER	$0.02	99.99 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Grind	356.82	1	0.25	50.01	GER	$4.96	99.69 %	$0.05
Temper	6.99	1	0.25	19.29	GER	$0.04	100.00 %	$0.00
Quench	1.87	1	0.25	25.28	GER	$0.01	100.00 %	$0.00
Pre Heat	56.20	1	0.25	167.44	GER	$2.61	100.00 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Deburr	7.00	1	0.25	35.68	GER	$0.07	99.99 %	$0.00
CNC Machining	240.55	1	0.25	39.15	GER	$2.62	99.87 %	$0.02
60 Ton Trim Press	2.60	1	0.25	22.68	GER	$0.02	99.98 %	$0.00
1000 Ton Forging Press	8.40	1	2.00	279.11	GER	$0.65	99.81 %	$0.03

Bearing Race

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Dip Coat Paint	1	Paint - Basecoat	By Area	0.0000	-	$0.00	$0.03
Material Bearing Outer Race	1	Steel 52100 Bearing Grade - Bar Stock	$1.43	1.7380	1.9800	$0.00	$2.83

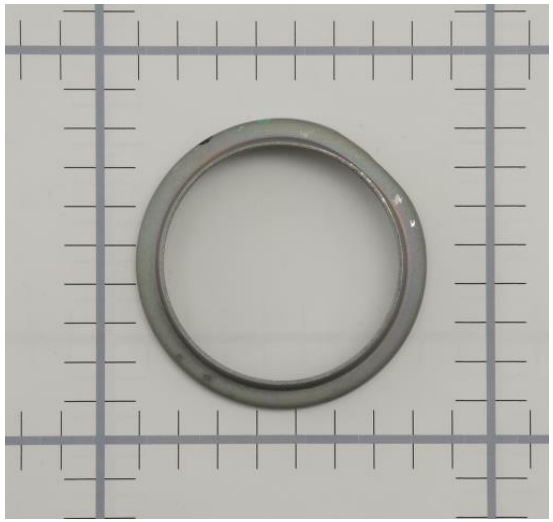
Outer Race Drivers Side Driveshaft Joint

MUNRO & ASSOCIATES, INC.

Bearing Race

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Cut Blank	7.40	1	0.25	25.18	GER	$0.05	99.97 %	$0.01

Dust Shield Drivers Side Inner



\...
\Passenger Side Half Shaft Asm
\Dust Shield Drivers Side Inner
\Dust Shield Process

Process Summary

Right First Time	99.97 %
Process Time (Sec)	9.60
Total Weight (kg)	0.03

Material Cost**	$0.08
OEM Process Cost	$0.00
Supplier Process Cost	$0.05
Q Burden	$0.00
SG&A	$0.02
Manufacturing Cost*	$0.15

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Dust Shield Drivers Side Inner

Dust Shield Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	5.00	1	0.25	20.00	GER	$0.03	99.99 %	$0.00
Deburr	4.00	1	0.25	12.36	GER	$0.01	99.99 %	$0.00
25 Ton Stamping Press	0.60	1	0.25	21.63	GER	$0.00	99.99 %	$0.00

Dust Shield Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Dust Shield Material	1	Steel 1008 - Galvanized - Coil Stock	$1.06	0.0333	0.0720	$0.00	$0.08

Assemble Drivers Side Inner Joint

\...
\Half Shafts
\Passenger Side Half Shaft Asm
\Assemble Drivers Side Inner Joint

Process Summary

Right First Time	99.14 %
Process Time (Sec)	87.00
Total Weight (kg)	0.20

Material Cost**	$1.60
OEM Process Cost	$0.00
Supplier Process Cost	$0.73
Q Burden	$0.13
SG&A	$0.16
Manufacturing Cost*	$2.62

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Drivers Side Inner Joint

MUNRO & ASSOCIATES, INC.

Assemble Drivers Side Inner Joint

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	87.00	1	0.25	30.27	GER	$0.73	99.14 %	$0.13

Assemble Drivers Side Inner Joint

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Sealing Caps Half Shaft	2	Commodity Item	Purchased	0.0031	-	$0.05	$0.00
Bar Code Identification Sticker Half Shaft Asm	1	Commodity Item	Purchased	0.0005	-	$0.10	$0.00
Snap Ring for Inner Race	1	Commodity Item	Purchased	0.0017	-	$0.05	$0.00
Ball Bearings	8	Commodity Item	Purchased	0.0163	-	$0.09	$0.00
Snap Ring Large	1	Commodity Item	Purchased	0.0038	-	$0.08	$0.00
"C" Spring Clip	1	Commodity Item	Purchased	0.0015	-	$0.02	$0.00
CV Joint Boot Clamp Small	1	Commodity Item	Purchased	0.0088	-	$0.05	$0.00
Grease	1	Commodity Item	Purchased	0.0390	-	$0.28	$0.00
CV Joint Boot Clamp Large	1	Commodity Item	Purchased	0.0114	-	$0.20	$0.00

Bearing Boot Drivers Side Outer

\...
\Passenger Side Half Shaft Asm
\Bearing Boot Drivers Side Outer
\Boot Process

Process Summary

Right First Time	99.99 %
Process Time (Sec)	5.52
Total Weight (kg)	0.06

Material Cost**	$0.16
OEM Process Cost	$0.00
Supplier Process Cost	$0.05
Q Burden	$0.00
SG&A	$0.03
Manufacturing Cost*	$0.24

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Bearing Boot Drivers Side Outer

MUNRO & ASSOCIATES, INC.

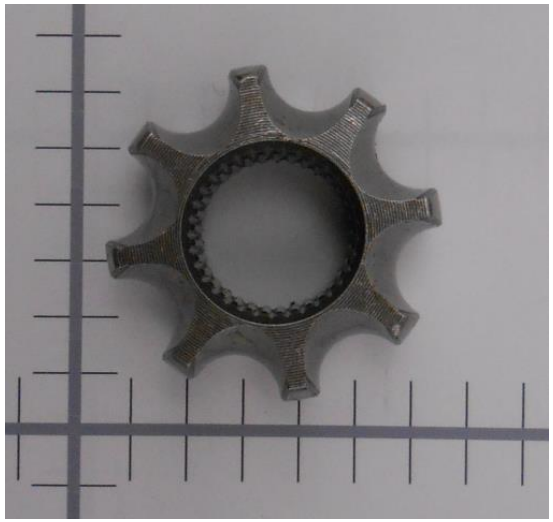
Boot Process

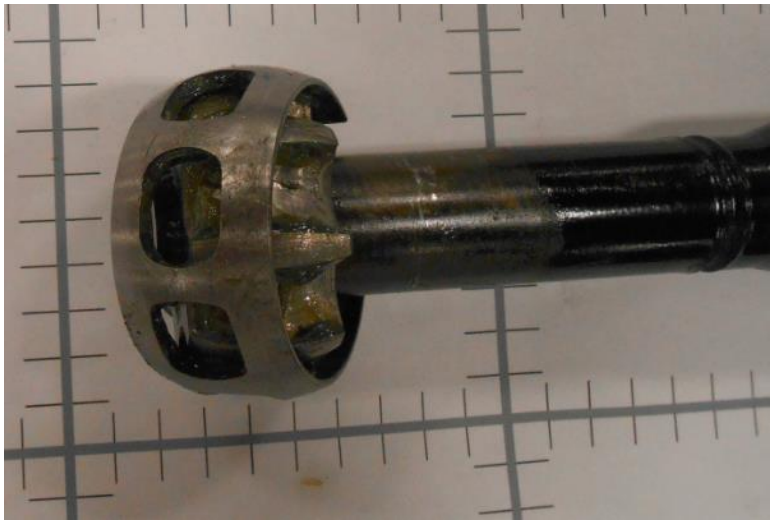
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
200 Ton Injection Molding Press	5.52	1	0.25	30.85	GER	$0.05	99.99 %	$0.00

Boot Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material Bearing Boot Drivers Side Uoter	1	TPE	$2.54	0.0587	0.0630	$0.00	$0.16

Inner Race Drivers Side Outer





\...
\Passenger Side Half Shaft Asm
\Inner Race Drivers Side Outer
\Inner Race Drivers Side Outer Process

Process Summary

Right First Time	99.49 %
Process Time (Sec)	405.76
Total Weight (kg)	0.23

Material Cost**	$0.37
OEM Process Cost	$0.00
Supplier Process Cost	$5.83
Q Burden	$0.08
SG&A	$0.93
Manufacturing Cost*	$7.21

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Inner Race Drivers Side Outer

MUNRO & ASSOCIATES, INC.

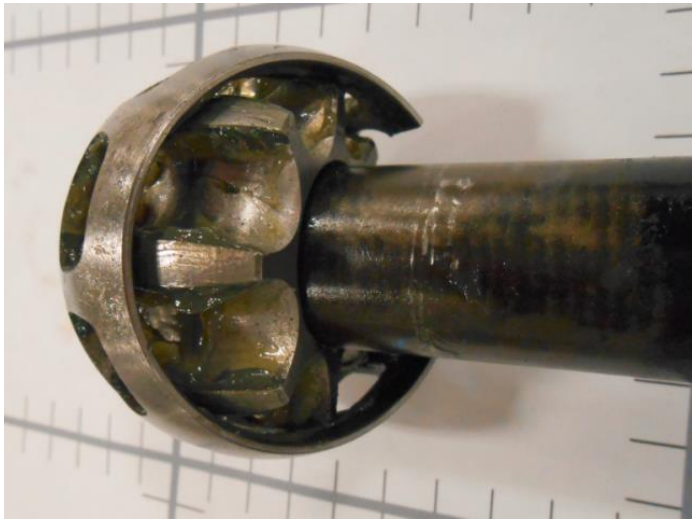
Inner Race Drivers Side Outer Process

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Grind	95.24	1	0.25	50.01	GER	$1.32	99.87 %	$0.02
Temper	1.24	1	0.25	19.29	GER	$0.01	100.00 %	$0.00
Quench	1.00	1	0.25	25.28	GER	$0.01	100.00 %	$0.00
Pre Heat	8.64	1	0.25	167.44	GER	$0.40	100.00 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Deburr	7.00	1	0.25	31.36	GER	$0.06	99.99 %	$0.00
CNC Machining	209.40	1	0.25	49.86	GER	$2.90	99.93 %	$0.01
CNC Machining	52.69	1	0.25	39.15	GER	$0.57	99.94 %	$0.01
25 Ton Trim Press	2.60	1	0.25	19.09	GER	$0.01	99.98 %	$0.00
500 Ton Forging Press	6.55	1	2.00	205.38	GER	$0.37	99.86 %	$0.02
Cut Blank	7.40	1	0.25	25.18	GER	$0.05	99.97 %	$0.01

Inner Race Drivers Side Outer Process

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material Inner Rce Outer	1	Steel 52100 Bearing Grade - Bar Stock	$1.43	0.2321	0.2553	$0.00	$0.37

Cage Outer



\...
\Passenger Side Half Shaft Asm
\Cage Outer
\Bearing Cage Drivers side Outer

Process Summary

Right First Time	99.60 %
Process Time (Sec)	400.77
Total Weight (kg)	0.09

Material Cost**	$0.14
OEM Process Cost	$0.00
Supplier Process Cost	$5.39
Q Burden	$0.06
SG&A	$0.83
Manufacturing Cost*	$6.42

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Cage Outer

Bearing Cage Drivers side Outer

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Grind	119.35	1	0.25	50.01	GER	$1.66	99.91 %	$0.01
Temper	1.62	1	0.25	19.29	GER	$0.01	100.00 %	$0.00
Quench	0.61	1	0.25	25.28	GER	$0.00	100.00 %	$0.00
Carburize	13.24	1	0.25	167.44	GER	$0.62	100.00 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Deburr	7.00	1	0.25	31.36	GER	$0.06	99.99 %	$0.00
CNC Machining	228.40	1	0.25	39.15	GER	$2.48	99.94 %	$0.01
25 Ton Trim Press	2.60	1	0.25	19.09	GER	$0.01	99.98 %	$0.00
500 Ton Forging Press	6.55	1	2.00	205.38	GER	$0.37	99.86 %	$0.02
Cut Blank	7.40	1	0.25	25.18	GER	$0.05	99.97 %	$0.01

Bearing Cage Drivers side Outer

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material Bearing Cage Drivers Side Outer	1	Steel 52100 Bearing Grade - Bar Stock	$1.43	0.0919	0.1011	$0.00	$0.14

Outer Race Drivers Side Outer

\...
\Passenger Side Half Shaft Asm
\Outer Race Drivers Side Outer
\Bearing Race

Process Summary

Right First Time	99.32 %
Process Time (Sec)	432.46
Total Weight (kg)	1.00

Material Cost**	$1.59
OEM Process Cost	$0.00
Supplier Process Cost	$6.78
Q Burden	$0.10
SG&A	$1.26
Manufacturing Cost*	$9.72

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Outer Race Drivers Side Outer

MUNRO & ASSOCIATES, INC.

Bearing Race

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Paint Cure Oven	5.06	1	0.25	17.08	GER	$0.02	99.97 %	$0.01
Dip Coat Paint	2.10	1	0.25	131.87	HUN	$0.08	99.99 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Grind	129.31	1	0.25	50.01	GER	$1.80	99.80 %	$0.03
Temper	3.86	1	0.25	19.29	GER	$0.02	100.00 %	$0.00
Quench	1.48	1	0.25	25.28	GER	$0.01	100.00 %	$0.00
Carburize	32.11	1	0.25	167.44	GER	$1.49	100.00 %	$0.00
Wash	7.00	1	0.25	30.69	GER	$0.06	99.99 %	$0.00
Deburr	7.00	1	0.25	35.68	GER	$0.07	99.99 %	$0.00
CNC Machining	218.15	1	0.25	39.15	GER	$2.37	99.88 %	$0.02
25 Ton Trim Press	2.60	1	0.25	19.09	GER	$0.01	99.98 %	$0.00
1000 Ton Forging Press	9.40	1	2.00	279.11	GER	$0.73	99.80 %	$0.03

Bearing Race

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Material-Paint Outer Race Drivers Side Outer	1	Paint - Basecoat	By Area	0.0000	-	$0.00	$0.02
Material, Outer Race Drivers Side Outer	1	Steel 52100 Bearing Grade - Bar Stock	$1.43	0.9983	1.0981	$0.00	$1.57

Outer Race Drivers Side Outer

Bearing Race

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Cut Blank	7.40	1	0.25	25.18	GER	$0.05	99.97 %	$0.01

Assemble Drivers Side Outer Joint

\...
\Half Shafts
\Passenger Side Half Shaft Asm
\Assemble Drivers Side Outer Joint

Process Summary

Right First Time	99.62 %
Process Time (Sec)	47.00
Total Weight (kg)	0.17

Material Cost**	$1.19
OEM Process Cost	$0.00
Supplier Process Cost	$0.40
Q Burden	$0.06
SG&A	$0.09
Manufacturing Cost*	$1.74

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Assemble Drivers Side Outer Joint

MUNRO & ASSOCIATES, INC.

Assemble Drivers Side Outer Joint

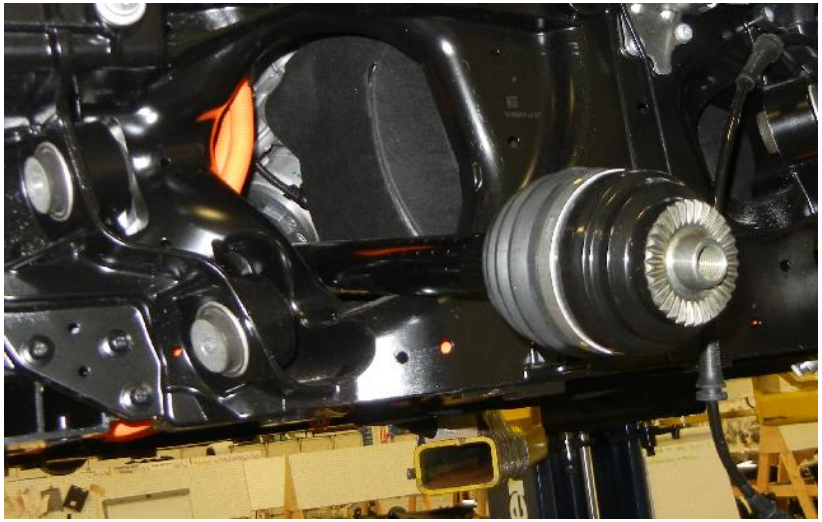
Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
Supplier Automated Asm	47.00	1	0.25	30.27	GER	$0.40	99.62 %	$0.06

Assemble Drivers Side Outer Joint

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost
Pressure Ring Drivers Side Outer Race to Spline	1	Commodity Item	Purchased	0.0014	-	$0.02	$0.00
Ball Bearings Outer Joint 15.06mm dia	8	Commodity Item	Purchased	0.0140	-	$0.08	$0.00
CV Joint Boot Clamp Small	1	Commodity Item	Purchased	0.0088	-	$0.05	$0.00
Grease	1	Commodity Item	Purchased	0.0390	-	$0.28	$0.00
CV Joint Boot Clamp Large	1	Commodity Item	Purchased	0.0114	-	$0.20	$0.00

Passenger Side Half Shaft Installation

No Commodity Items Required for This Process



\...
\Zone 7 Driveline
\Half Shafts
\Passenger Side Half Shaft Installation

Process Summary

Right First Time	99.96 %
Process Time (Sec)	12.00
Total Weight (kg)	0.00

Material Cost**	$0.00
OEM Process Cost	$0.30
Supplier Process Cost	$0.00
Q Burden	$0.01
SG&A	$0.05
Manufacturing Cost*	$0.36

* Excluding tooling, ER&D, logistics, and profit margin
** Includes material cost and purchased parts cost

Passenger Side Half Shaft Installation

MUNRO & ASSOCIATES, INC.

Passenger Side Half Shaft Installation

Symbol Name	Overall Cycle Time (Sec)	Parts / Cycle	Number of Operators	Workcell Rate ($/Hr)	Country	Process Cost	Right First Time	Q Burden
OEM Manual Asm	12.00	1	1.00	91.41	GER	$0.30	99.96 %	$0.01

Passenger Side Half Shaft Installation

Symbol Name	Qty	Material	Material Cost / kg ($/kg)	Net Weight (kg)	Gross Material Weight (kg)	Purchased Part Cost	Material Cost

Appendix Reports

TechInsights Electronics Report

TECHINSIGHTS

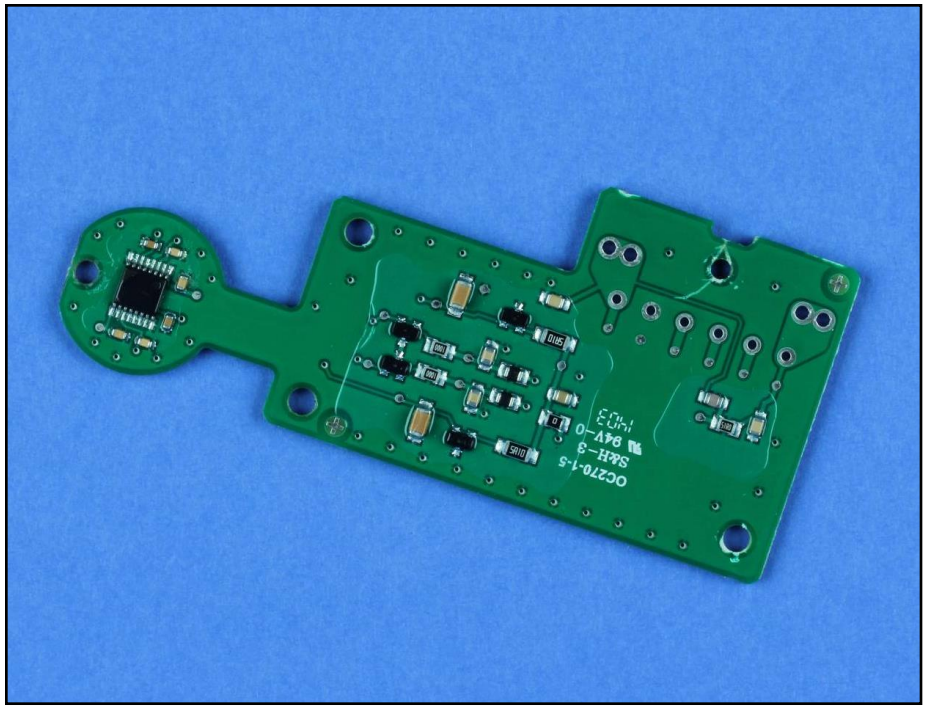
Deep Dive Report

teardown.com

BMW i3 Actuator PCB, Actuator Asm

A5075

Report #15900-150129-PKb



Product Description:

The Actuator PCB is used in the BMW i3 to read and communicate the position of the park pawl in the gearbox. By using the Melexis MLX90360 Triaxis Position Sensor IC, position sensing and control are possible.

Product Overview

Product Description	
Product Type	Automotive
Brand	BMW
Product Name & Model #	i3 Actuator Board A5075
Official Release Date	Unknown
Weight (grams)	8.8 (Measured)
Product Dimensions	84.5 x 37.3 x 3.47 (Measured at Longest/Widest/Thickest

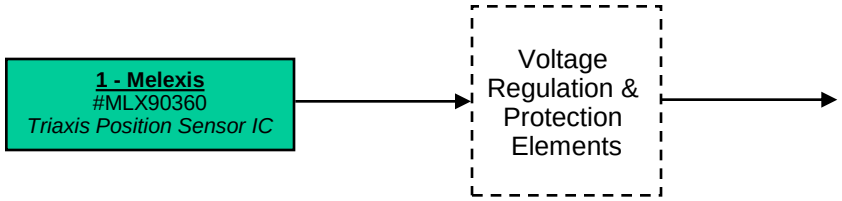
Product Features	
Sensor	Melexis MLX90360 Triaxis Position Sensor IC
Voltage Regulation	Zener Diodes

Integrated Circuit Metrics	
IC Die Count	2
IC Package Count	1

Cost Metrics	
Retail Price	
Total Manufacturing Cost	$2.40
Electronics Cost	$2.40

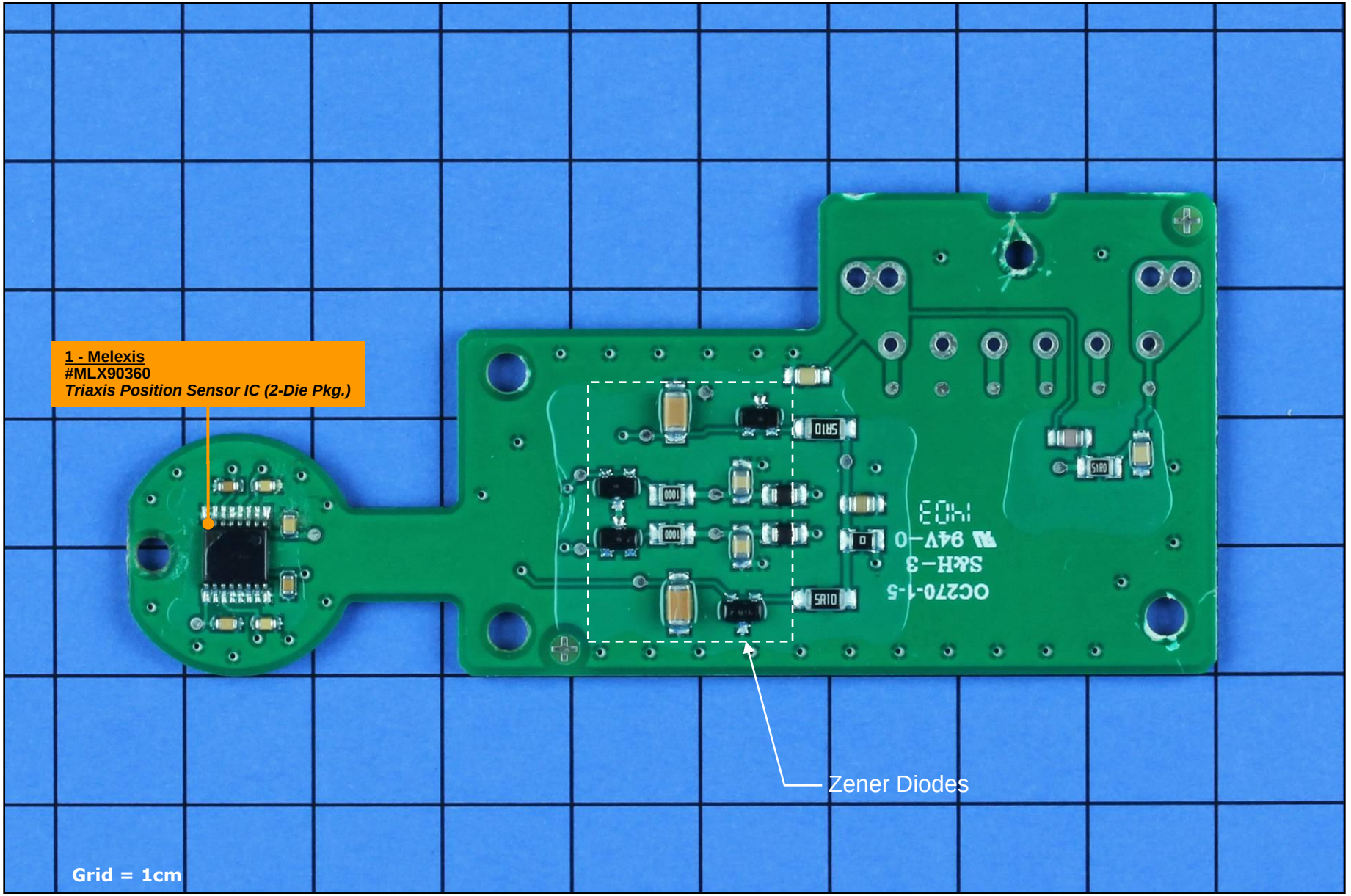
Manufacturing Cost Breakdown		
Integrated Circuits	$1.60	66.7%
Small Active Components	$0.08	3.3%
Passive Components	$0.09	3.8%
Substrate	$0.33	13.8%
Component Insertion	$0.14	5.8%
Card Test	$0.16	6.7%
Total	**$2.40**	**100.0%**

Block Diagram

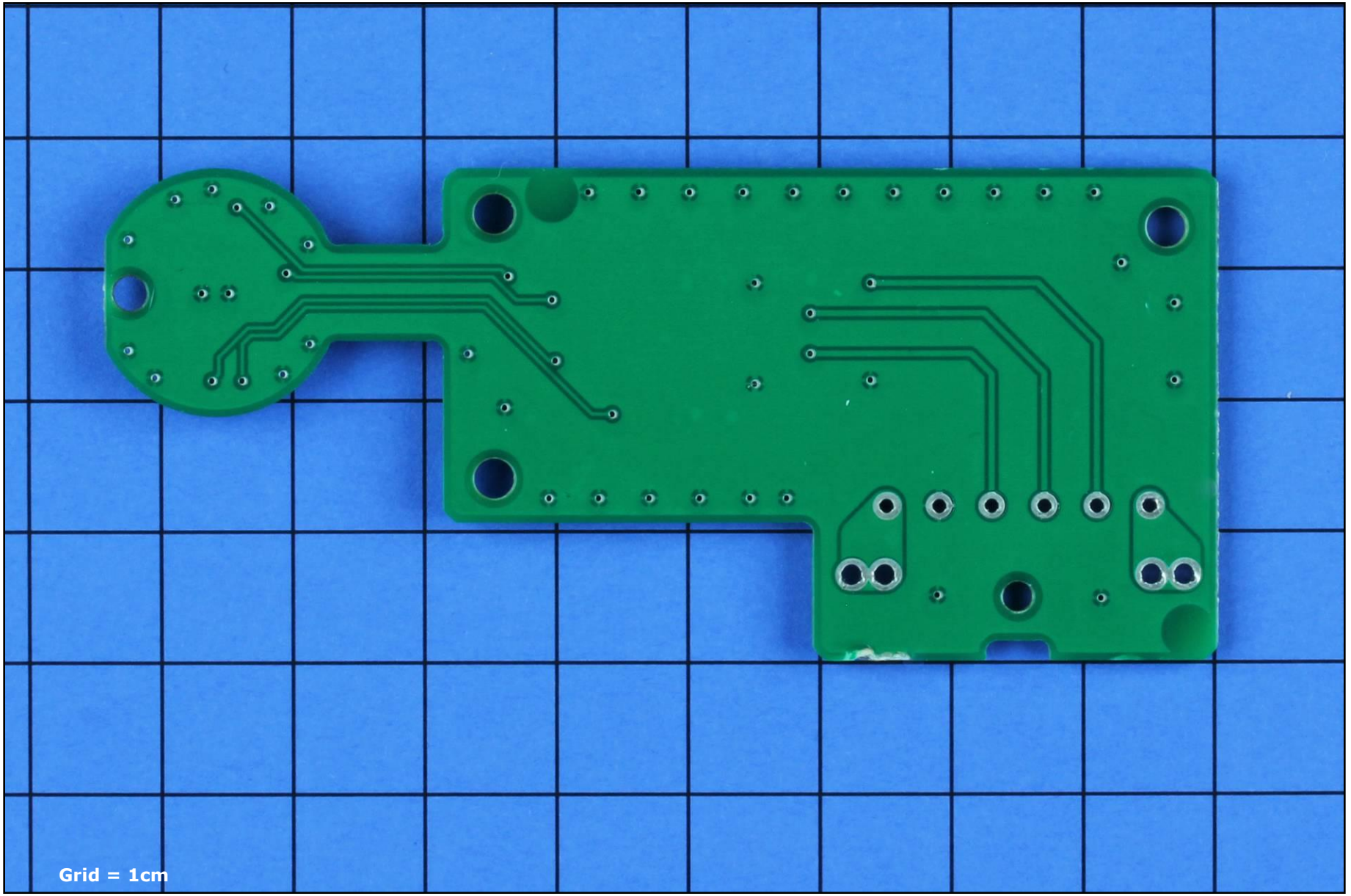


Estimated block diagram based on observation of this specific product implementation, manufacturer's data sheets where available, and best engineering judgment. Certain details of the interface circuitry are not reflected in this block diagram. Partitioning and connectivity are speculative.

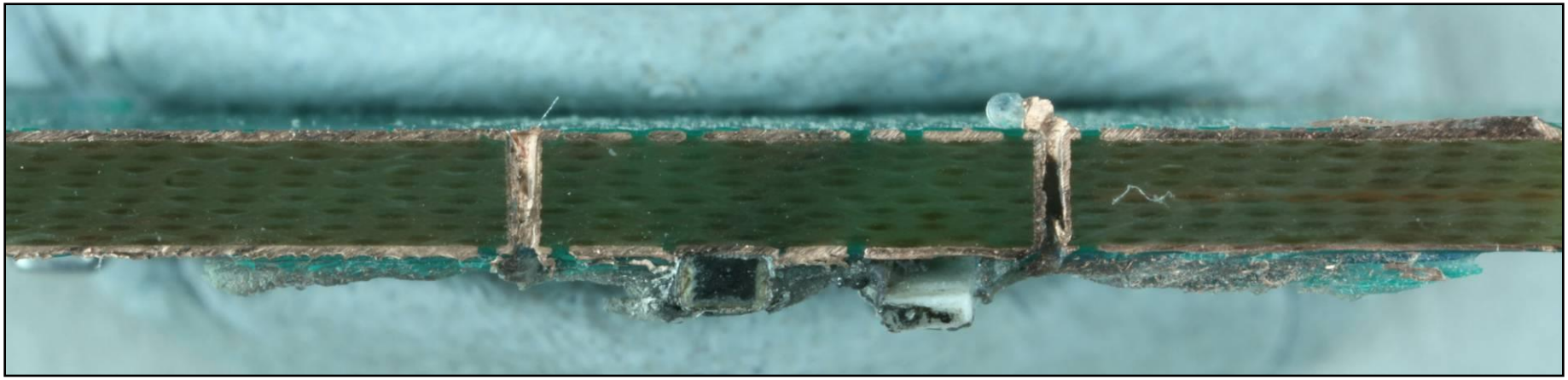
Main Board (Side 1 IC Identification)



Main Board (Side 2)



Main Board Cross-Section



Substrate Data

Substrates														
Assembly Name	Manufacturer	Core Material	Mfg. Technology	Layers	Area (cm^2)	Min. Trace Pitch (mm)	Min. Trace Width (mm)	ThruVia Land Dia (mm)	ThruVia Hole Dia (mm)	BlindVia Land Dia (mm)	BlindVia Hole Dia (mm)	Thickness (mm)	Routing Density	Estimated Costs
Actuator Board	Unkown	FR4	2 Layer conventional FR4 / HF	2	21.9	0.40	0.20	0.60	0.40			1.7	8.9	$ 0.33

Integrated Circuit Components

Location	Package Info										Die Info							Estimated Costs	
	Pkg Ref. #	Pkg Qty	Brand Name	Part Number	Pkg Description	Form	Pin Count	Length (mm)	Width (mm)	Height (mm)	Die Ref #	Die Qty	Brand Name	Part Number	Description	Length (mm)	Width (mm)	Each	Total
Actuator Board	1	1	Melexis	MLX90360	Triaxis Position Sensor IC	MCP - 2 Chips	16	6.50	5.00	0.96	1.0	2	Melexis	90360AC	Position Sensor IC	2.27	1.49	$ 0.800	$ 1.600
Totals		**1**					**16**					**2**							**$1.60**

Note: Supplemental information, such as IC package & die markings, is included in the Excel Bill of Materials (BOM) spreadsheet.

Active Discrete Components

Location	Qty	Functional Description	Package					Estimated Costs	
			Form	Top Marking	Pin Count	Length (mm)	Width (mm)	Each	Total
Actuator Board, Side 1	4	Small Active	Diode, SMT	PUW 3d	3	2.90	2.50	$0.020	$0.080
TOTALS	**4**				**12**				**$0.08**

Passive Discrete Components

Location	Qty	Functional Description	Package		Estimated Costs	
			Form	Pin Count	Each	Total
Actuator Board, Side 1	22	Small Passive	Cap, Res, Ferrite	2	$0.004	$0.088
TOTALS	**22**			**44**		**$0.09**

Electronic Assembly Metrics

Electronics Costs by Assembly										
General Area	Assembly Name	Total	Integrated Circuits	Modular & Odd Form Components	Small Active Components	Passive Components	Connector Components	Substrates	Insertion	Card Test
Main Board		$ 2.40	$ 1.60	$ -	$ 0.08	$ 0.09	$ -	$ 0.33	$ 0.14	$ 0.16
	System Totals	**$ 2.40**	**$ 1.60**	**$ -**	**$ 0.08**	**$ 0.09**	**$ -**	**$ 0.33**	**$ 0.14**	**$ 0.16**

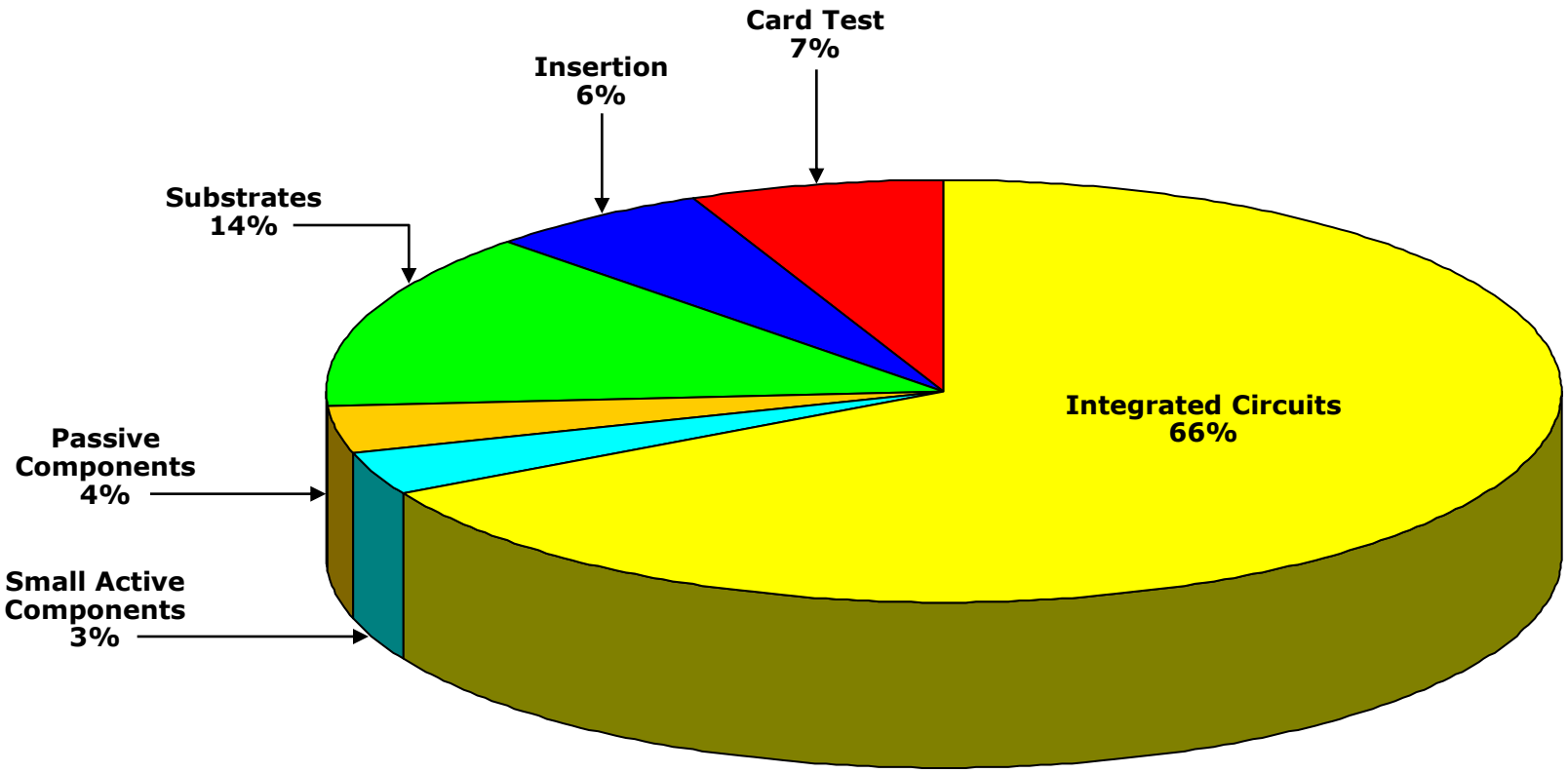
NOTE: Occasional inconsistencies in totals may be present due to rounding error.

Electronic Costs Breakdown

Estimated Cost of Electronics

(Includes Subsystem Electronics)

$2.40



NOTE: Occasional inconsistencies in totals may be present due to rounding error.

Cost Summary

Estimated Cost Totals		
Main Electronic Assemblies	$	2.40
Total	**$**	**2.40**

Cost Total Notes:
Estimated final assembly cost includes labor only.
Total cost does not include Non-recurring, R&D, G&A, IP licensing fees/royalties, software, sales & marketing, distribution.
Assumes fully scaled production.

Cost Estimation Process

(Overview & Discussion)

Cost modeling is tricky business. Multiple variables affect the actual production costs a manufacturer will experience, including development expenses, unit volumes, supply-and-demand in component markets, die yield-curve maturity, OEM purchasing power, and even variations in accounting practices. Different cost modeling methods employ different assumptions about how to handle these and other variables, but we can identify two basic approaches: that which seeks to track short-term variations in the inputs to the production process, and that which strives to maintain comparability of the output of the model across product families and over time.

TechInsights' philosophy in cost modeling is to emphasize consistency across products and comparability over time, rather than to track short-term fluctuations. During the past eight years, we have developed an estimation process that, while necessarily lacking an insider's knowledge of the cost factors that impact any one manufacturer, is reasonably accurate in its prediction of unit costs in high-volume production environments. We do not claim that the model will produce the "right" answer for your firm's environment. However, TechInsights does give customers a key analytical tool with a complete set of data in our Bill of Materials (BOM). The BOM allows readers to 1) scrutinize the assumptions behind our cost model and 2) modify the results based on substitution of their own component cost estimates where they have better information based on inside knowledge.

Our estimation process decomposes overall system cost into three major categories: Electronics, Mechanical, and Final Assembly. We begin by creating a complete electronics bill-of-materials (BOM). Each component from the largest ASIC to the smallest discrete resistor is entered into a BOM table with identifying attributes such as size, pitch, I/O count, package type, manufacturer, part number, estimated placement cost, and die size (if the component is an IC). Integrated circuit costs are calculated from measured die area. Using assumptions for wafer size, process type, number of die per wafer, defect density, and profit margin in combination with die area, an estimate of semiconductor cost is derived. Costs for discrete components and interconnect are derived from assumption tables which relate BOM line items to specific cost estimates by component type and estimates for part placement costs are included. For LCD display costs, we employ a model which tabulates expected cost from measurements of glass area, LCD type, and total pixel resolution. When market costs are available from alternative sources, LCD panel costs are taken from and referenced to these sources.

Costs of non-electronic components such as molded plastic enclosures and metallic components are measured in terms of weight, size, thickness, type of material, and complexity to arrive at their estimated cost. Other system items such as optics, antennae, batteries and displays are costed from a set of assumption tables derived from a combination of industry data, average high volume costs, and external sources. For final assembly, we re-build the torn-down product, tabulating stepwise assembly times as the reconstruction proceeds, to reach a total assembly time. Using a labor rate assumption for the country of origin, we then calculate final assembly cost.

The three major categories for system cost contributors can be broken down into the subcategories of ICs, other electronics parts, displays, batteries (as appropriate), camera modules, electronics assembly, non-electronic elements, and final assembly. By adding the cost estimates for each of these subcategories, an overall estimated cost is derived for the system under evaluation. Product packaging and accessories (CDs, cables, etc.) are also documented and estimated for their contribution to total cost as appropriate.

We believe our cost estimates generally fall within 15 percent of the "right answer," which itself can vary depending on the market and OEM-specific factors mentioned earlier. While the TechInsights cost model is imperfect, it yields important insights into technology and business dynamics along with good first-order contributions to system cost by component type. Additionally, the consistency of approach and gradual modification to assumptions (smoothing out frequently-shifting pricing factors) hopefully yields a credible, but user-modifiable, view of OEM high volume cost-to-produce.

Please feel free to contact us at support@techinsights.com with any comments, questions, or proposed corrections with respect to our cost estimates. We welcome your input.

Metrics (Overview & Discussion)

In our product teardowns, we gather a series of metrics for product profiling and comparison. Some metrics focus on system characteristics such as total silicon area, total system semiconductor storage capacity, and total connection count. Other metrics reflect more subtle aspects of electronics assembly such as connection density, average component I/O count, and silicon tiling density. Taken as a whole, the metrics allow deeper comparison and benchmarking across multiple disciplines and multiple products. Key metrics we gather on products are described below along with their definitions and what they tend to say about the system under study. Most metrics can be used both in comparing similar products for benchmarking purposes or for quantifying differences in levels of complexity between dissimilar product types. Data fall into two categories; either "raw" measured data or ratios of these measured data sets.

Total Silicon Area : This metric describes the total area of silicon as measured from X-ray or direct measurement of ICs. The area is an expression of the enclosed bare die area and excludes packaging area. The aggregate silicon area is a good benchmark to show how integrated a design might be when making comparisons to similar systems. Total silicon area also reflects the major cost driver for most systems we examine.

Silicon Tiling Density : Ratio of Total Silicon Area to total printed circuit board "projected" area (i.e. the simple board area and not the cumulative surface area of both sides of the board). This metric directly reflects the level of efficiency and aggressiveness in integrated circuit packing and placement. Single digit Silicon Tiling Density is typical but silicon coverage of 10% - 20% has been seen in some of the most advanced products we have examined. Higher Tiling Densities often correspond with the use of chip scale packaging (CSPs) or other small form-factor IC packaging technologies. High density circuit boards are also often a supporting technology.

Number of Parts : Total component count including ICs, passives, modules, connectors, etc., each separated out in our reporting.

Number of Connections : The total number of connections corresponds to the total number of interconnects introduced by the aggregate component set and reflects any electrical connection observed (solder joints, adhesive interconnect, or connector terminal interfaces).

Opportunity Count : Opportunity Count is the total number of parts plus the total number of connections; the name reflects that each of these constituent elements represents an opportunity for failure. A high opportunity count means more complex and riskier electronics assembly.

Average Pin Count (APC) : Ratio of total number of component terminals to total number of parts, at the system level. This metric reflects the 'average' terminal complexity of the components and often provide a signature of integration level and/or "digital-ness" of the overall product. Low APCs reflect a high number of discretes or other low-pincount devices often characteristic of analog circuitry. Conversely, high APCs are characteristic of highly integrated, high-pincount assemblies, often those composed largely of digital integrated circuits.

Connection Density : This metric is a ratio of the total Number of Connections to total printed circuit board assembly area, in units of connections per sq. inch. The metric provides data related to the Silicon Tiling Density above, but with an emphasis on complexity of I/O interconnect. For example, with a fixed Connection Density, high tiling density of low-pincount memory chips is more readily achieved than comparable silicon tiling of high pincount logic.

Part Density : This metric is a ratio of the total Number of Parts to total printed circuit board assembly area, in units of components per sq. inch. The metric provides data related to the Silicon Tiling Density and Connection Density as described above, but with an emphasis on density and complexity of component packing efficiency. For example, low Part Density of high-pincount devices can pose an equal challenge in Connection Density to high Part Density of low-pincount devices. High Part Density does reflect challenges in surface mount assembly in terms of (typically) precision of placement, number of placements, and engineering of part clearances.

Routing Density (heuristic estimate) = $3*(\text{Average Pin Count})*\sqrt{\text{Part Density}}$. The Routing Density metric is an empirically derived relationship that characterizes the wiring density of the interconnect used to support the interconnection of components in a planar electronic assembly (i.e. the circuit board). Architectural issues such as bussing or other factors affecting the regularity of wiring impact the actual Routing Density needed to support a given application, but the metric provides a ready measure of wiring complexity.

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