

**PARTNERING FOR 21<sup>ST</sup> CENTURY**  
Value Creation | Automation | Innovation



**21<sup>ST</sup>** CENTURY  
TECHNOLOGIES



Microsoft



**HCL**





## Detailing

- 2D drawings Creation Process
  - Drawing, BOM release in PLM (ECO\ECN)
- 3D Tolerance analysis & GD&T

## 3D Modeling

- Top Down Design & Large assembly management
- **CAD Library Parts** management
- (MBD – Model Based Design Transformation)
- **SMART Verification tools to drive DFX**

## Data Integrity Check

- **Drawing checking** - missing or duplicate dimensions
- Fix BOM discrepancies – CAD model and PLM
- **Model Clean up** per standards, Eliminated circular references, run model checks

## Knowledge Based Engineering

- Develop flexible models to drive Variations
- Design optimization (thru' inbuilt rules)

# Drawings



## Input

- Assembly and Part CAD file



## Drawing Guidelines

- Drafting standards.
- Notes & symbols
- Error free drawings.
- Maintain consistency.

NO.	DESCRIPTION	UNIT	QTY
1	...	...	...
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50	...	...	...

## Part/Component Drawing

- Plastics.
- Castings.
- Sheet-metal.
- Foam pads & Gaskets.



## Assembly Drawing & BOM

- Top Level Assembly.
- Sub level Assembly.
- Cable Drawing Assembly.



## Assembly Instruction

- Product level assembly instruction.
- For ease of assembly.



**Release of part / Assembly drawing to manufacture or production through PLM-PDM Tool.**

## Defect Tracking

- Customized excel based Defect tracking work book.
- Engineer wise report.
- Error types report.
- Defect Trend Analysis.



## Drawing Review

- Customized Review Checklist.



# Monthly Drawing Metrics in an Engagement



## New

Drawing Category	Sum of No. of Tasks Clubbed	Sum of No. Of Modified A4 Sheets	Sum of Assembly (I)	Sum of Dimension (I)	Sum of Standard (I)	Sum of Textual (I)	Sum of Total Internal Defects	Sum of Rework Effort	Sum of Rework Review Effort^
ECO	79	346	2	0	17	17	36	4.95	4.6
Schematic	17	129	0	0	3	3	6	0.5	0.35
Sheetmetal	111	584	1	16	14	10	41	11.5	4.75
Pro/Cabling	37	661	0	0	0	0	0	0	0
11-Assembly	207	1472	16	0	19	15	50	17.7	7.45
CPS Catalogue Parts	35	142	0	0	10	3	13	1	0.75
Frames	3	39	0	0	0	0	0	0	0
Procedure-Bulletin	26	144	0	0	0	1	1	0.1	0.1
Large Assembly	14	247	3	0	1	1	5	2	0.35
Cabling (Acad)	25	118	2	9	19	12	42	3.5	3.25
OBS/General_Activity/FEA	18	49	0	0	2	1	3	1	0.5
Large Machine Part	5	92	0	10	7	0	17	4.5	2
Wire run list	5	22	0	0	0	2	2	0.5	0.5
Machine Parts	177	1022	1	49	33	30	113	30.75	13.1
<b>Grand Total</b>	<b>759</b>	<b>5067</b>	<b>25</b>	<b>84</b>	<b>125</b>	<b>95</b>	<b>329</b>	<b>78</b>	<b>37.7</b>

Drawing Category	No. of tasks clubbed
11-Assembly	44
Cabling (Acad)	3
CPS Catalogue Parts	30
Frames	0
Large Assembly	4
Machine Parts	104
OBS	0
Pro/Cabling	9
Procedure-Bulletin	18
Schematic	3
Sheetmetal	44
Wire run list	0
<b>Total Count</b>	<b>259</b>

<b>Defect Density No.Error/ No. of A4 sheet</b>	<b>0.06</b>	<b>Total Errors</b>	<b>329</b>	ECO Rejections/Drawing Error
<b>Total Rework effort (Hrs)</b>	<b>78</b>	<b>External errors</b>	<b>3</b>	

## Redlines

Drawing Category	No. of tasks clubbed
11-Assembly	163
Cabling (Acad)	17
CPS Catalogue Parts	5
Frames	3
Large Assembly	10
Machine Parts	78
OBS	16
Pro/Cabling	28
Procedure-Bulletin	8
Schematic	13
Sheetmetal	69
Wire run list	5
<b>Total Count</b>	<b>415</b>

# Drawing Quality Checking



Maintaining drawings standards uniformity and quality for Semiconductor OEMS & O&G Clients

## Customer Challenges

Manufacturing Drawings not conforming as per drawing practices.

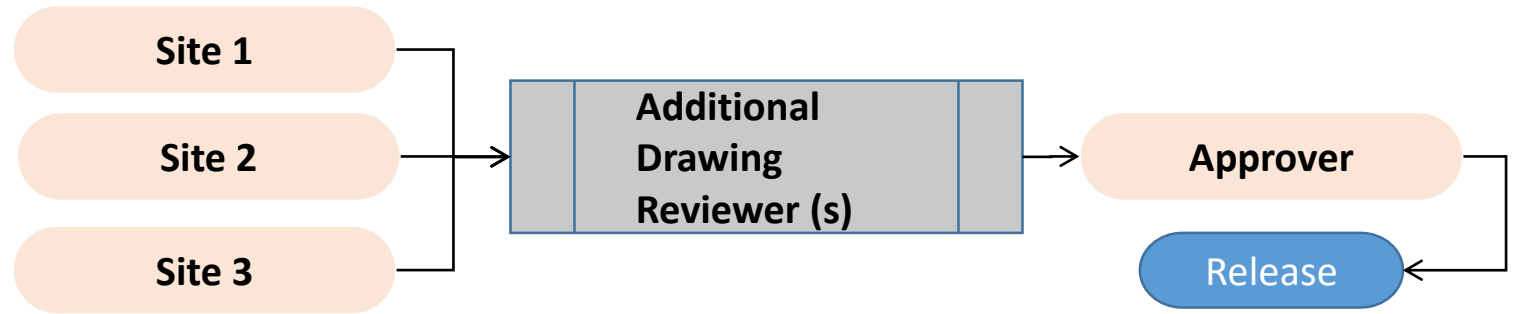
Multiple sites where engineers located at various geographies

Lack of focus on design & manufacturing guidelines leading to increased product cost

### Types of Parts & Drawings

Part Models, Assemblies, Forgings, Roughout & Cladding Drawings, Final Machining. Sheet metal, Plastic, Scope of Supply, Piping, GA

## Solution



### Activities:

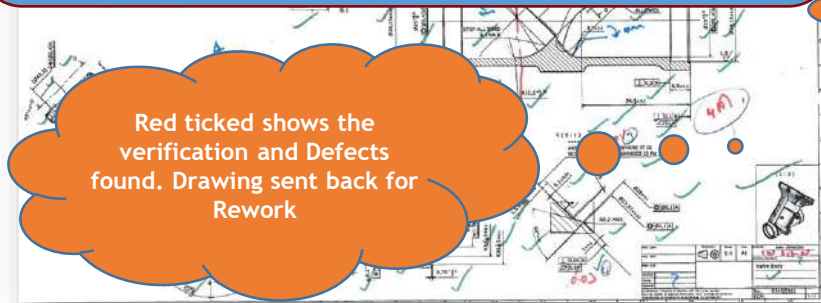
1. Review of correction of parts & drawings as per Client and ASME standards
2. Design reviews, Material, Manufacturing review
3. Design modification suggestions as per field issue
4. Applications of GD&T, Welding Symbols, Coatings and client specific standards
5. Collection and classification of errors, root causal analysis.
6. Feedback & Individual development plan

Project	Drawn By	Checked by	Drawing No.	Part/Assy	No. Of sheets	Complexity level	Major Error	Minor errors	Suggestions
SLS	Enginner 1	Siby	N126194-1	Assembly	5	High	1	2	2
THRT	Enginner 2	Shiva	A110914-29	Part	5	Medium	0	1	5
THRT	Enginner 2	Shiva	A110810-5	Part	1	Medium	0	2	1
THRT	Enginner 2	Shiva	A110811-5	Part	1	High	0	2	1
THRT	Enginner 2	Shiva	A110738-55	Part	1	Medium	0	2	0
THRT	Enginner 2	Shiva	A110738-53	Part	1	Medium	0	1	1
TEST FIXTURE	Enginner 3	Shiva	N149059-1	Part	3	High	1	1	2
TEST FIXTURE	Enginner 3	Shiva	N149059-2	Part	1	low	0	1	0
TEST FIXTURE	Enginner 3	Shiva	N149059-3	Part	2	High	0	1	1
TEST FIXTURE	Enginner 3	Shiva	N149063-1	Part	3	Medium	0	1	2
TEST FIXTURE	Enginner 3	Shiva	N149060-1	Part	2	High	1	1	2
TEST FIXTURE	Enginner 3	Shiva	N149060-2	Part	1	Low	1	1	2
TEST FIXTURE	Enginner 3	Shiva	N149060-3	Part	1	High	0	1	2
THRT	Enginner 4	Shiva	N126194-4	Part	1	Medium	0	1	2
THRT	Enginner 4	Shiva	N126194-16	Part	1	Medium	0	1	2
THRT	Enginner 4	Shiva	N126194-5	Part	1	Medium	0	1	1
THRT	Enginner 4	Shiva	a111131-7	Part	1	High	0	1	2

# Checking Process

## Fool -proof Quality Process

- Systematic matured process
- Dedicated quality check engineer
- Automated macros, utilities for modeling check
- Customized tools to compare old & new drawings which is a part of Organizational Innovation & Deployment Tool



Red ticked shows the verification and Defects found. Drawing sent back for Rework

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Checklist

Product Review Checklist

Defects found are logged

QC Signoff

PRODUCT CHECKLIST				ANGL	
Class	Software (Version)	Revision	Drawn	Checked	Drawn No.
Project Name	Project Code	Category (Part / Assy)	03462361		
Drawn No.					
GENERAL					
46	Is the title block placed in the bottom right corner of the drawing?				
47	Is the title block view of smaller scale than the orthographic view?				
48	Is the title block view of the first sheet for assembly drawings?				
49	Is the title block view of the first sheet for assembly drawings?				
50	Is the title block view of the first sheet for assembly drawings?				
51	Is the title block view of the first sheet for assembly drawings?				
52	Is the title block view of the first sheet for assembly drawings?				
53	Is the title block view of the first sheet for assembly drawings?				
54	Is the title block view of the first sheet for assembly drawings?				
55	Is the title block view of the first sheet for assembly drawings?				
56	Is the title block view of the first sheet for assembly drawings?				
57	Is the title block view of the first sheet for assembly drawings?				
58	Is the title block view of the first sheet for assembly drawings?				
ASSEMBLY					
59	Order of the parts in the Assembly is, as per BOM?				
60	Check whether the entire components connected is not used?				
61	Is proper method used to assemble the part with respect to functionality & to fully connected?				
62	Check whether the constraint is not given in assembly?				
63	Is analysis interference constraint used to check interference between part?				
64	Is Assembly represented/generation with our tool?				
65	Is Assembly created according to Datasheet standard?				
GENERAL					
66	Is DWG, DMFX & STSP created for web model?				
67	Is assembly drawing created with block template, correct size dimension (MM/IN)?				
68	PDF Creation: Is PDF created by selecting corresponding sheet size?				
DEFECT SUMMARY					
Types of Defects					
1	Detailing (Self) - Associativity, Modality, Dimensions, View dependent editing, Layers, Display, View Placement, Scaling, View/Section, Grid, etc., Angle of Projection, etc.				
2	Dimensioning - Missing Dimension, Repeated Dimension, Wrong Dimension, GD&T, Improper Unit Dimension, Dimension Power (ie. 10.0 or 10.0), Clutter Dimension				
3	Standards - Sheet Format, Dimension Pattern, Drawing Standards, Non Adherence to Standards				
4	Documentation - Text, Spelling, EDC, Checklist, Notes, Bill of Materials, Position Table, SAP properties Error				
5	Where necessary - Any Errors apart from the above mentioned category				
Total No. of Defects					
Engineer	Name	Signature	Review Date	Date	
Peer Project lead 1	RAVI KUMAR S	[Signature]	0.5	3/9/12	
QA 1	Abdulla P	[Signature]	0.5	3/9/12	
Engineer 2	RAVI KUMAR S	[Signature]	0.1	3/9/12	
Peer Project lead 2	Abdulla P	[Signature]	0.1	3/9/12	
QA 2	Abdulla P	[Signature]	0.1	3/9/12	
Status 1	ACCEPTED <input type="checkbox"/>	REJECTED <input type="checkbox"/>	ACCEPTED-CONDITIONALLY <input type="checkbox"/>		
Status 2	ACCEPTED <input type="checkbox"/>	REJECTED <input type="checkbox"/>	ACCEPTED-CONDITIONALLY <input type="checkbox"/>		

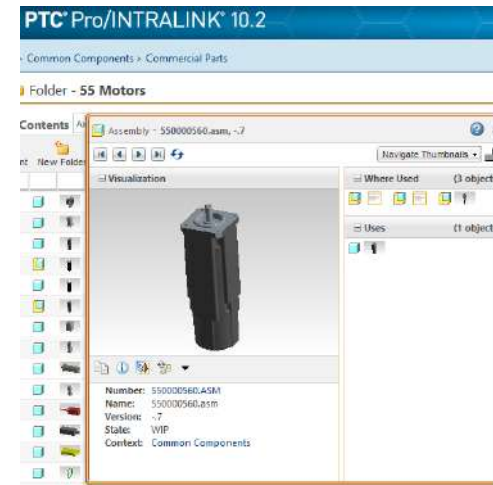


# CAD Library Data Management

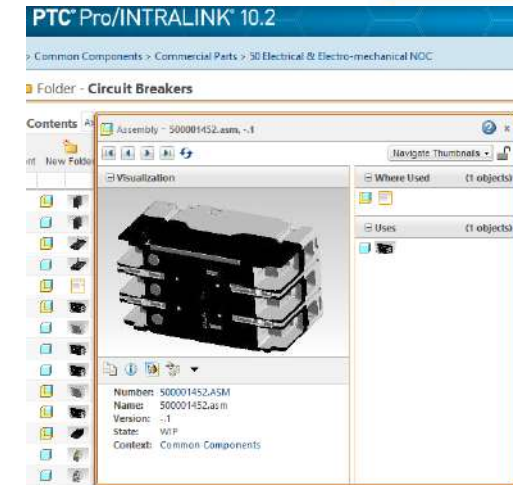


## CAD Library Objectives

- ✓ Build and Maintain a CAD Library consisting of Off the shelf components
- ✓ Mechanical Components ( Seals, Fasteners, Helicoils, PEMS, etc.)
- ✓ Standard Components (fan, Hard drive
- ✓ Electrical Components (Connectors, Cables, Switches, receptacles, Etc.)
- ✓ Electronic Components (Serial/Parallel Connectors, resistors, Computer Hardware)
- ✓ Any Third Party bought out items as a subassembly



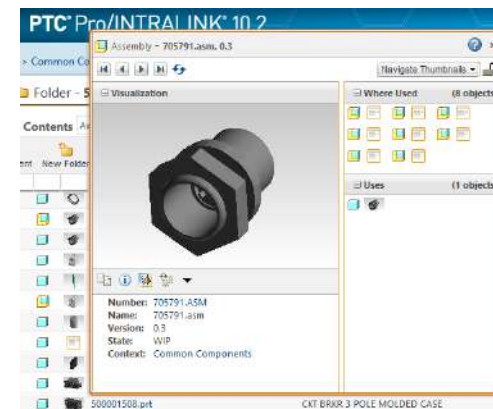
Motor



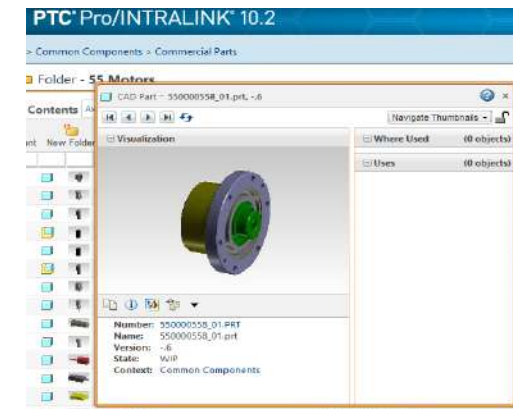
Circuit breaker

## Benefits of CAD Library Management

- ✓ Information on space constraints to avoid interference
- ✓ Saves time by avoiding repetitive parts creation & helps to minimize the CAD Database Size.
- ✓ Reduce assembly regeneration failures to ZERO
- ✓ 100% accurate BOM, accurate mass, CG information
- ✓ Reduce design cycle time by providing latest parts in library



Receptacle



Harmonic drive



# Part Modelling



## Input

- Industrial Design 3D CAD file

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## Master Model

- Top down Design approach.
- Maintains key relationships between parts
- Rapid modifications

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## Stout Modelling

- Novel modelling methodologies.
- Quick design optimization.
- Flexible and robust CAD models.



## Design Automation

- Reduce modelling time.
- UDF - Standardized library of commonly used features
- KBE - System level Design integration

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## DFM & DFA

- Part feasibility for tooling and machining.
- Simplifying the product assembly.

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## Defect Tracking

- Customized excel based Defect tracking work book.
- Engineer wise report.
- Error types report.
- Defect Trend Analysis.



## Part Review

- Customized Review Checklist.



## Best Practices

- Standardize the process and produce optimal results.

Below are list of Best Practice

- EMN/EMP Verification.
- Pro-Cabling modelling.
- Machining considerations.
- Master Modelling techniques.

Release of part / Assembly into Agile PLM-PDM Tool.



# Designing :Top Down Design Approach

## Input

### Input 1: ID - Sketched

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- In this phase the ideas are communicated through sketches

### Input 2: Product renderings

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- Product appearance is visualized by rendering tools.

### Input 3: Rhino -3D CD Model

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- CD design is Shared in the form of 3D cad model. To build the Parametric modeling for detail design.

### Developing parametric Master A-Surface Model

- Design best practice for complex Surface model: Boundary box method approach for Master Surface Model.

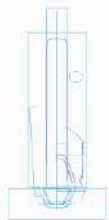


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- Boundaries box design approach for A-surface development gives maximum flexibility of redefining the model dimensions.
- In this phase Basic curves and form surfaces are built which eases further modification for design development

### Detail Design with sub-system development

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- Develop Skeleton model for Sub-system level with reference to the Master model
- Develop sub-system with part break-up and engineering details



# Flexible Modeling – Variant Management for Vacuum Cleaner



## Methodology:

- Design knowledge captured for existing units
- Possible correlation between the design parameters established
- Reusable automated data to improve the productivity
- Developed highly flexible models using Pro-E
- Develop Variants – parts/Sub assembly/top level assembly

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