Sheet-Metal Design Using SolidWorks

By EGS India
Sheet Metal Capability

- Sheet Metal – Flexible Working Environment
- Blank Development
- Controlling Parameters
- Forming Tool
- Sheet Metal Design Tools
- Sheet Metal Assembly
- Drawing Creation
Flexible Working Environment

- Sheet metal models can be designed in following methods:
  - Design sheet metal from flatten state
  - Design sheet metal from solid
  - Design sheet metal from surface

- Copy and Paste feature between multiple documents
- Drag and Drop facility
- Snap to place, smart mate technology
- Integration with standard Microsoft software’s like MS-word, MS-Excel, Visual Basic, etc
Blank Development
Sheet metal Bend parameters can be controlled using following options:
- Bend Table
- Bend Allowance
- Bend Deduction
- K-factor

Bend allowance with a K-Factor is calculated as follows:

\[ BA = \frac{t(R + KT)}{A} \]

where:
- \( BA \) = bend allowance
- \( R \) = inside bend radius
- \( K \) = K-Factor, which is \( \frac{t}{T} \)
- \( T \) = material thickness
- \( t \) = distance from inside face to neutral sheet
- \( A \) = bend angle in degrees (the angle through which the material is bent)

### Table: Bend Table

<table>
<thead>
<tr>
<th>Radius</th>
<th>Thickness</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/26</td>
<td>.050</td>
</tr>
<tr>
<td></td>
<td>1/32</td>
<td>.066</td>
</tr>
<tr>
<td>1/32</td>
<td>.075</td>
<td>.083</td>
</tr>
<tr>
<td>1/16</td>
<td>.092</td>
<td>.101</td>
</tr>
<tr>
<td>1/8</td>
<td>.118</td>
<td>.135</td>
</tr>
</tbody>
</table>

### Table: Gauge Thickness

<table>
<thead>
<tr>
<th>Gauge No.</th>
<th>Gauge(Thickness)</th>
<th>Available Bend Radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Gauge</td>
<td>0.2391</td>
<td>.25; .50; .75</td>
</tr>
<tr>
<td>4 Gauge</td>
<td>0.2242</td>
<td>.25; .50; .75</td>
</tr>
<tr>
<td>5 Gauge</td>
<td>0.2092</td>
<td>.25; .50; .75</td>
</tr>
<tr>
<td>6 Gauge</td>
<td>0.1943</td>
<td>.20; .25; .50; .75</td>
</tr>
<tr>
<td>7 Gauge</td>
<td>0.1793</td>
<td>.20; .25; .50; .75</td>
</tr>
<tr>
<td>8 Gauge</td>
<td>0.1644</td>
<td>.20; .25; .50; .75</td>
</tr>
<tr>
<td>9 Gauge</td>
<td>0.1495</td>
<td>.15; .20; .25; .50</td>
</tr>
<tr>
<td>10 Gauge</td>
<td>0.1345</td>
<td>.15; .20; .25; .50</td>
</tr>
</tbody>
</table>
Forming Tools

- Forming tools can be created using regular Solid modeling and it can be saved in library. Whenever it needs, just drag and drop from library.
Sheet metal Design Tools

- Base Flange
- Tab
- Edge Flange
- Miter Flange
- Hem
- Sketched Bend
- Closed Corner
- Flatten
- Jog

- Break Corner / Corner Trim
- Lofted Bends
- Fold / Unfold
- Rip
- Insert Bends
- Vent
- Fill Pattern
- Feature Library
Sheet Metal Flange Design – Wide variety of Options

Base Flange Options

Tab Options

Edge Flange Options

Mitre Flange Edge Options

Before Mitre Flange

After Mitre Flange

Tangent Edges

Non-tangent Edges

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Sheet Metal Flange Design – Bend Options

**Mitre Flange Options**

**Trim side Bend Options**

**Hem Options**

This is the preview of an Edge Flange feature. Notice the bend region of the blue preview touches the bend of the L-shaped base flange.

This is the end result without the Trim side bends check box.

This is the end result with the Trim side bends check box.

Sketched Bend Options

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Sheet Metal Flange Design – Corner Treatment

Closed Corner Options

Gap Distance 0.1
Gap Distance 0.05

Examples of corner types

Front
Top
Dimetric
Butt
Overlap
Underlap

Corner Treatment

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Sheet Metal Flange Design – Trim & Jog Options

Closed Trim Options

Jog Offset Options

Jog Options
Sheet Metal Flange Design – Corner, Rip and Lofted Bends

Preview of Break Corner/Cornet-Trim

Begin with two open profile sketches.

Use Lofted Bends to create a solid feature.

Lofted bend is complete.

Lofted Bend

Preview of internal corners

Chamfered Filleted

Break Corner / Corner-Trim Options

Rip Feature

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Sheet Metal Flange Design – Forming Tools & Incorporating Library Features

Forming from Design Library

Positioning Forming Tools

Vent Formation
Sheet Metal Flange Design – Patterning & Surfacing

Fill Pattern Options
(Size, Shape of hole and distribution)

Sheet Metal examples with Surfaces
Sheet Metal Examples
Sample Components
Sheet metal Assembly

- Bottom up approach
- Top Down approach
- Smart mate technique
- Smart fasteners
- Smart Component
- Physical Simulation
- Interference Detection
- Part / Assembly Library
- Exploded View
- Mass and CG Calculations
Sample Assembly
Drawing Creation

- Bi-Directional Associativity
- Flatten view with bend lines and bend notes
- Automated BOM Generation, export it as text and excel formats
- Automated Ballooning
- Exploded View
- Alternate Position view
- Automated Drawing Templates
- Save as pdf, dwg, dxf, tiff, jpeg and
- Draw Compare
- Design Checker
- Annotation Library
Sample Drawing

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>QTY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Enclosure Base</td>
<td>Enclosure Base</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>PC Board Assembly</td>
<td>Satellite Receiver PC Board</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Enclosure Cover</td>
<td>Enclosure Cover</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Face Bazel</td>
<td>Front Bazel</td>
<td>1</td>
</tr>
</tbody>
</table>

SAT RECEIVER
Sheet Metal Customer References

SolidWorks used in Designing Sheet-metal Enclosures

www.egsindia.com
Installation manuals are developed using SolidWorks
SolidWorks is used for Sheet Metal Design

Configurations used for flexible design
Reference in Power Generator Equipment

SolidWorks is used for Generator Set design at Elliott

Generation of Layout drawings in SolidWorks

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SolidWorks Customer References

Leverages on SolidWorks 3D for Design and Downstream requirements

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References in Power Generator Equipment

SolidWorks Customers
Advanced Diesel Engineering uses SolidWorks to design canopies as shown.
SolidWorks in Use

SolidWorks Sheet Metal Design in Real-World Applications

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Reference in Power Generator Equipment

Users of SolidWorks for Enclosure and Control Panel designs

www.egsindia.com
Reference in Power Generator Equipment

Power-Plus DCGS3040

30 kW, Tactical Quiet Generator Set
400 Hz, Diesel Engine Driven, Skid Mounted

The Power Plus DCGS3040 Digital Controlled Generator is a portable, skid-mounted, self-contained unit ruggedly constructed with a proven reputation for long, trouble-free operation. The diesel engine is fully compliant with EPA emissions limits. All units are provided with digital controls, instruments and accessories necessary for operation as a single unit or in parallel with other units of the same type and rating. All components including the generator and controls have been engineered for minimum maintenance. The unit is skid-mounted and fully enclosed with an integral fuel tank and auxiliary fuel input hose and valve. This unit is the commercial equivalent of the DOD Model MEP-815B.

Standard Features
- Rugged Construction
- Digital Instrumentation
- Fully Instrumented
- Military Standard Design
- Digital Controls
- Fully Protected Circuitry
- High Reliability

SPECIFICATIONS
MODEL TYPE: Power Plus DCGS3040 Skid-Mounted, Self-Contained, Militarized, Portable, Brushless, Diesel Engine Driven Generator Set with Integral Digital Controls and 8 hr. Onboard Fuel Capacity

A SolidWorks customer in Generator Set application

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Reference in Power Generator Equipment

Shown with optional Crystal Quiet Enclosure

SolidWorks is #1 in Production

SolidWorks Customers

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Zero Zone, Inc. is a leading manufacturer of display coolers, freezers, and refrigerated merchandising cases. For years, company engineers used AutoCAD® to design its products. In 1997, according to project engineer Owen Warr, Zero Zone hired an engineer intern who had experience using the SolidWorks® 3D mechanical design system.

"The intern asked to use SolidWorks on the project he was assigned," Warr recalls. "Within months, the amount and quality of his work was a real eye-opener. In one week, he was able to design a complete product with four different-sized variations. We were impressed with the intern’s effort and realized that 3D modeling could provide significant advantages over 2D."

"SolidWorks provides the sheet metal functionality we need," says Mr. Owen Warr. "We make extensive use of this functionality in combination with configurations. SolidWorks has been very responsive in adding new features. We believe SolidWorks is one of the best design packages out there for handling sheet metal."

Results using SolidWorks:

- Shortened design cycle by 66 percent
- Increased sales by 335 percent
- Reduced ECO process by 85 percent
- Cut number of prototypes by 78 percent
Creactive Design's work for Syspal Ltd. is a great example of how using SolidWorks native data to communicate saved time and money. Syspal, the UK's number one supplier and manufacturer of stainless steel and aluminium products, won the contract to supply Chiller Cabinets to the company Bombardier for the refurbishment of the GNER Mark IV railcar rolling stock. Bombardier Transportation is the global leader in the rail equipment, manufacturing and servicing industry.

Lead times were very tight so Syspal commissioned Creactive Design, an award winning product design consultancy, to design the new cabinet. Creactive was commissioned in large part because they were experienced SolidWorks users, therefore able to provide files that would be native to Syspal's in-house SolidWorks system. This would make it much easier to meet the tight delivery time. **Creactive's use of SolidWorks reduced time to market by at least 20 percent.**

The assembly was based around stainless steel and aluminum fabrication and the development program **exploited the sheet metal functions of SolidWorks to the full.** Having agreed upon details such as bend allowances and notching parameters to suit Syspal's manufacturing equipment, the sheet metal parts were laser profiled directly from the flat patterns generated in SolidWorks.

Creactive, enabled by SolidWorks, was able to complete Syspal's commission with great success. The design program was completed in 4 weeks from being briefed and included the creation of 81 unique parts, 17 sub-assemblies and 65 associated production drawings.
Mann + Hummel Hydromation is the leading producer of automated coolant filtration and swarf (metal chips) handling systems for use with industrial processes involving high-speed metal cutting. The company designs, constructs, and installs its systems in large manufacturing plants for a range of customers, including major automobile manufacturers. Mann + Hummel Hydromation used Autodesk Inventor® 3D design software to develop its systems until 2003.

While attending a trade show, company representatives saw a quick demonstration of the SolidWorks® 3D mechanical design system in 2003 and began evaluating the software for implementation, according to Dirk Novak, CAD coordinator. “We were particularly interested in how SolidWorks handled large assemblies, which are used heavily in the development of our coolant filtration and swarf handling systems,” he says.

Novak asked his local SolidWorks reseller, Cadmes Belgium, for a complete demonstration. “When I saw SolidWorks configuration capabilities, I was impressed by the power and flexibility of the software, and realized we needed those capabilities to energize our product development effort,” notes Novak. “We also saw the potential for using SolidWorks sheet-metal capabilities and the SolidWorks Routing package for further automating systems development.”

“After we saw the capabilities of SolidWorks software, we believed we could realize a range of productivity improvements by implementing SolidWorks across the board for all new product development,” Novak adds.

Mann + Hummel Hydromation chose to migrate to SolidWorks software, installing 15 seats, because of its large assembly, configuration, and sheet-metal design capabilities.

The company wanted to tap the software’s performance power, robust application program interface (API), and versatility. The company also uses SolidWorks Routing software for routing cables, wiring, and piping throughout its custom-designed cooling and filtration systems.

Results using SolidWorks:

- Reduced design cycles by more than 30 percent
- Shortened time required to make design changes by 90 percent
- Improved quality and minimized design errors
- Enhanced design communications with existing & prospective customers
Sheet Metal Examples
Sheet Metal Examples
Sheet Metal in action
Sheet Metal assemblies in complex shapes
Fabricated Sheet metal design
SolidWorks Design in production
Sheet Metal Design Alternates in SolidWorks
Very Large Sheet Metal assembly in SolidWorks
Machine made of Sheet metal components
Designed and Developed using SolidWorks
Ergonomic sheet metal design in SolidWorks
Sheet metal design in progress
New Product developing using SolidWorks Sheet Metal
Sheet metal in Cooler Display
Sheet metal in Machine Tool Application
Sheet metal in batch processing
Sheet metal internal in medical application
Sheet metal in Switch gear application
SolidWorks Everywhere in Sheet Metal

- **PANS AND SINKS**
  - JK Mold design
  - USA

- **STOVE**
  - Comet Kato
  - Japan

- **VENTILATION**
  - Advance Metal Products
  - Australia

- **FURNITURE**
  - Teknion Furniture Systems
  - Canada

- **PLATE DISPENSER**
  - Tom Stoddart
  - Australia

- **COUNTERS**
  - Abk Innovent
  - Netherlands

- **RANGES**
  - Foster SPA
  - Italy

- **COOKING EQUIPMENT**
  - Werner & Pfleiderere
  - Germany

- **COOKING DRUMS**
  - Tecnozim
  - Portugal

- **PULL DOWN SHELF**
  - Knape & Vogt
  - USA

- **SCULLERY**
  - Elkay Manufacturing Co.
  - USA

- **STOVE**
  - Aliberinox
  - Spain

- **PIPES**
  - Dinex
  - Latvia

- **COUNTERS**
  - Arecov
  - Mexico

- **CABINETS**
  - Distform
  - Spain

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Key Customer References in Japan

- Hitachi
- Panasonic
- Sanyo
- Omakino
- Toshiba
- Sharp
- Amada
- Murata
- Carrier
- Toto
- Yazaki
- Fujifilm
- Citizen
- Yamaha
- Omron
- Denso
- YKK
- Inax
- Shinko Electric Co., Ltd.
- Mazak
- Alps
- Riso
- Mitsubishi Heavy Industries, Ltd.
Why Invest in SolidWorks?

- Proven Technology preferred by over 2 Million Users world-wide
- Protection and re-use of existing 2D CAD data
- Benefit by becoming a member of 3D Content Central and display your products for higher visibility in the world market
- Trusted technical support from EGS India, since 1993
- One-stop solution for changing needs
- Scope for new product development
- Communicate in 3D with Customers and Suppliers
- Standard 3D CAD Software used by manufacturing companies world-wide
- Safe investment with a Global Company with Extensive Presence in India
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Fax: 044-24844227
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