MSF9863 - MEP Fabrication Small to Mid-Size Companies

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Introduction

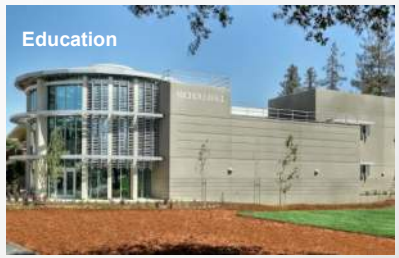
Who Am I?

- John Mack
- Best Practices Leader @ XL Construction
- 30 years in the construction industry
  - 8 month doing BIM Consulting and Preconstruction Services
  - 7 years as a CM/GC; BIM Department Manager, then CIO / CTO
  - 22.5 years in the mechanical and plumbing industry
  - Started with Prefab and BIM/VDC 1993
- Union trained plumber
- Ran detailing department for two large mechanical contractors
  - Plumbing – Piping – Sheet Metal
- Helped design software for third party AutoCAD and a Project Management programs
- Helped setup fabrication shop for piping, plumbing, electrical and sheet metal
- Been involved with Lean Construction for 10+ years.

- Established in 1992
- Offices in Silicon Valley, San Francisco, and Sacramento
- 425+ employees
- In-house BIM and MEP groups
- Provides preconstruction and construction services
- Capability to self-perform concrete, DFH, lab casework, rough carpentry, millwork, etc.
- EMR of 0.35 – lowest of any GC in CA
- CEA safety awards for the last 7 years

XL CONSTRUCTION

We build to improve lives.



Class summary

- In this class we will discuss the fundamental elements that make a successful fabrication shop by talking about material flow, people flow, automation, equipment placement, bulk buying, material movement, cultural / behavior changes, software, affects on job site safety, early turn over and packaging for delivery to job sites. There will be time for Q&A during after the presentation.

Key learning objectives

At the end of this class, you will be able to:

- Understand how to scale fabrication for your needs
- How fabrication affects job site safety
- Understand how placement of equipment / machinery effects productivity
- How culture and behavior of people effect productivity

Fabrication

- What is the definition of fabricate
  - to fake; forge (a document, signature, etc.).

Doh! Wrong definition!

Fabrication

- What is the definition of fabricate
  - To make by assembling parts or sections
  - To make by art or skill and labor; construct

Extreme Fabrication / Setting the Bar

When you think about MEP fabrication what comes to mind?

MEP Fabrication Thoughts

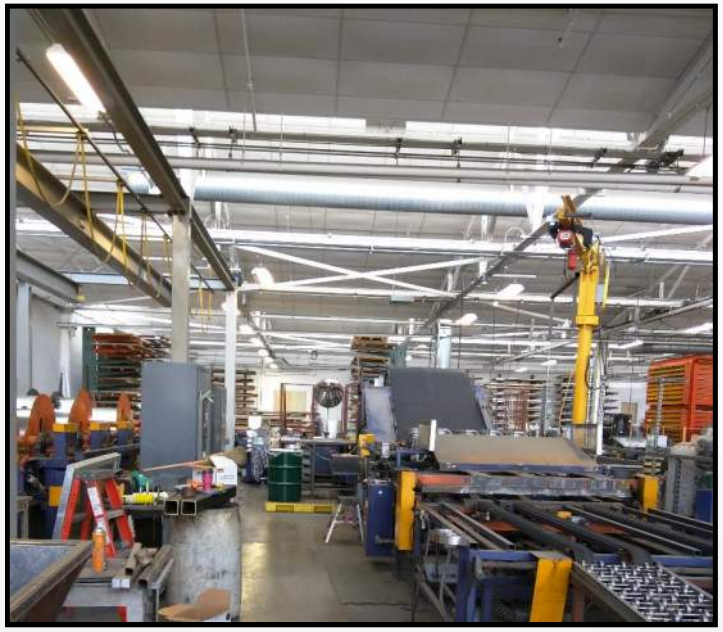
- Assembly of Parts

MEP Fabrication Thoughts

- Automation – ex. Part cutting

MEP Fabrication Thoughts

- Coil lines for building duct



MEP Fabrication Thoughts

- Automated Tube or Conduit Bending

MEP Fabrication Thoughts

- Lots of parts – Lots of Real Estate

MEP Fabrication Thoughts

- Other Equipment

MEP Fabrication Thoughts

- One last thought - Clean Room for Assembly

MEP Fabrication Thoughts

It does not have to be that way

Fabrication: Layout 101 (Scalability)

Layout 101

- Decide What You Want to Fabricate
- Understand the Space you have to Work With
  - Get plan of area
- Equipment or Station Placement
  - Get size, access requirements and utility needs
- Flow of Fabrication
  - Where are the doors for people and material
- Material Balance – Purchasing, Storage and Movement
  - Too much stock is money, but not enough stock is lost money in wait time

Layout 101

- Understand what you are going to fabricate
- Plan it
- Set the area up
- Do test runs to make sure it is efficient
- Create an Andon system
  - Do you know what an Andon is?
  - Have a supply line manager
  - Have a hierarchy for getting help when something breaks down

Layout 101

- Understand the flow of assembling the fabricated goods
- Align the material, machines and tools to favor the work flow
- Buy enough tools that someone does not have to leave their station to find something
- Have material ordered to minimize storage and minimize handling
- Have a material runner

Packaging for Just in Time Delivery

JIT Definition

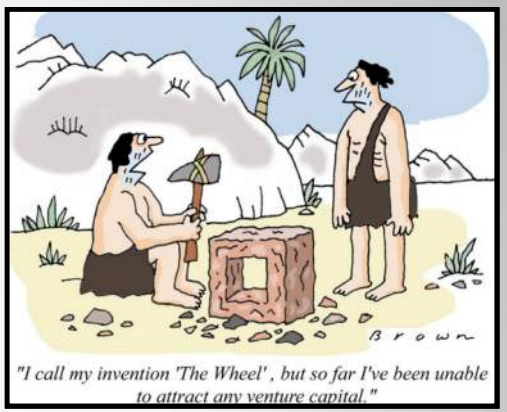
- A supply chain management system designed to reduce carrying costs to a minimum. A firm only orders what it expects for its immediate needs; therefore, it keeps a low inventory. For example, if a retailer believes it will sell 1,000 widgets in a week, it orders precisely 1,000 widgets from its manufacturer. JIT systems require that the retailer at the end of the supply chain can accurately predict demand for its products. They also require that each stage of the supply chain knows exactly how much time it takes to fill an order when it is made. The automotive industry and budget retailers commonly use JIT systems.

From Farlex Financial Dictionary. 2010

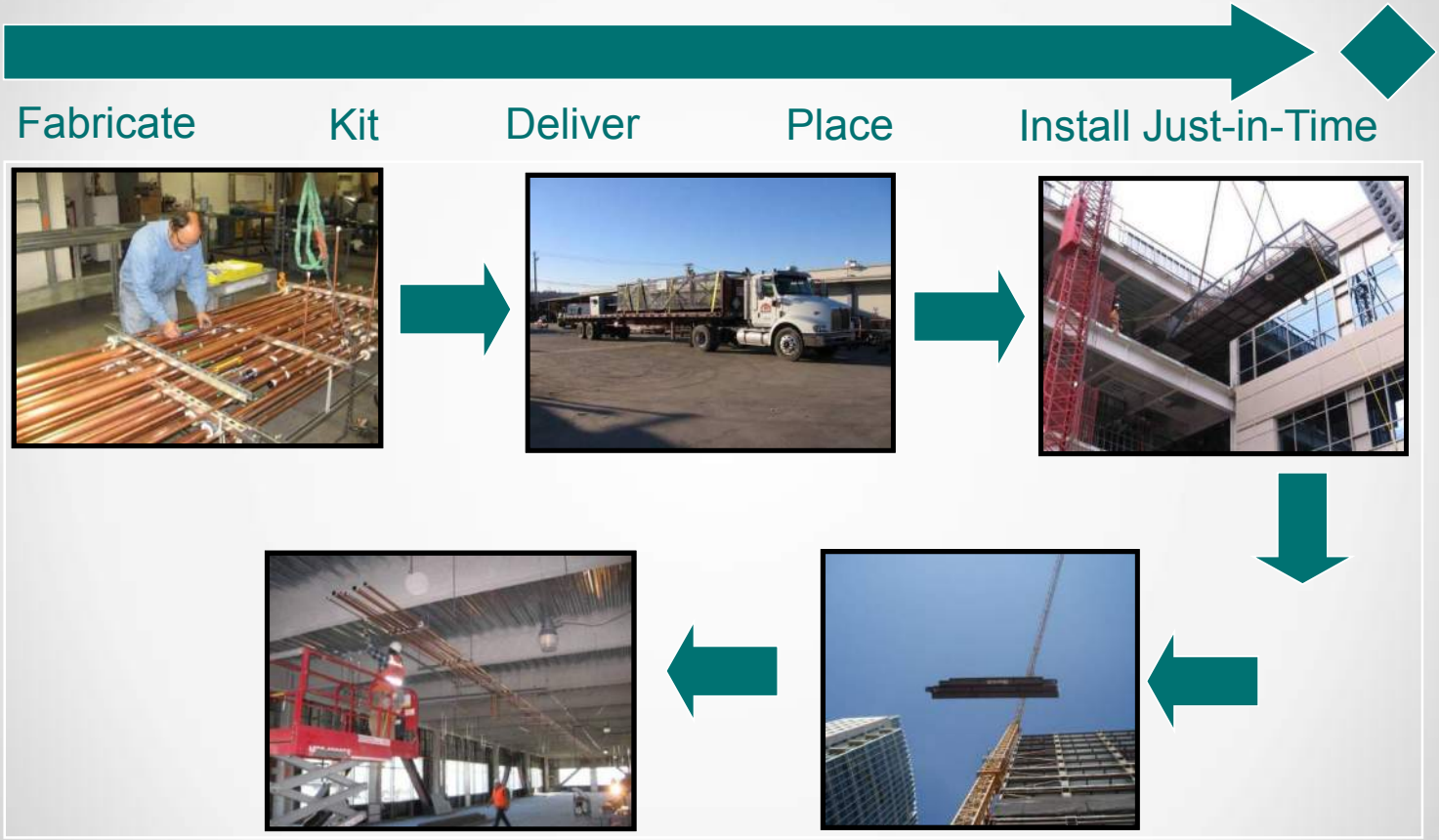
Assembly for Delivery

Packaging for Delivery

Use the Wheel – It's a Great Invention



The Outcome: Just in Time Delivery



Safety

How Fabrication Affects Job Site Safety

- Employees working in a controlled environment
- Employees working on bench tops, or at least on the ground, reducing time spent off the ground
- Reduces congestion of people at the job site
- Job site material handling minimized

How Fabrication Affects Job Site Safety

- Less mess in the field to clean up due to cutting and scrap material being done in the controlled environment of the fabrication area
  - Less mess = Less injuries
- Use of stationary equipment
- Equipment better maintained in fab area
- I have seen quotes of up to 50% better safety results

Cultural Change & Behavioral Change

Current Challenges

- So, with proof that this all works, saves time, labor and money, why is fabricated work not standard across the industry?
- What factors contribute to delay of implementation?
  - Social inhibitors
  - Fear of change
  - Traditional way of doing things

Social Inhibitors

- Corporate Culture, set from the top-down
  - The management has to drive this
- Are people encouraged to *try*, allowed to fail without punishment, and then encouraged to try again?
  - Figure out how to encourage them, maybe a reward system
- Is someone creating current work flows processes to be able to analyze them for improvement?
  - That is how we make changes – remember to batch test before applying to everything
- Lack of trust in team members
  - Get the correct people – If you cannot change the person, then change the person
- Prior experiences did not work
  - Get over it!!

Fear of Change

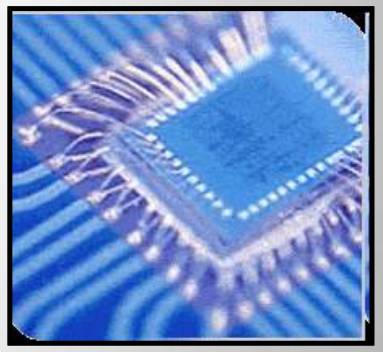
- Too risky!
  - Understand the risk and manage the risk
- Sticking to what you know
  - You are fabricating when installing - there is little difference
- Waiting for someone else to figure it out
  - Take the lead and get the competitive advantage
  - Learn from those ahead of you
- Lack of experience and training
  - Find the experience to train the people or bring in outside help

Remember Where there is risk, there is opportunity.

Traditional Way of Doing Things

- Don’t use existing hard-fast established procedures
  - Be willing to change. Setup a Kaizan system
- This is the way we’ve always done it!
  - Test new ideas to make your workers more efficient
- This is what we know, why change?
  - We can do better and if we don’t someone else will
- Why fix what ain’t broke?
  - Don’t fall into a comfort zone or you’ll be looking for a job

Vacuum Tube



Microprocessor

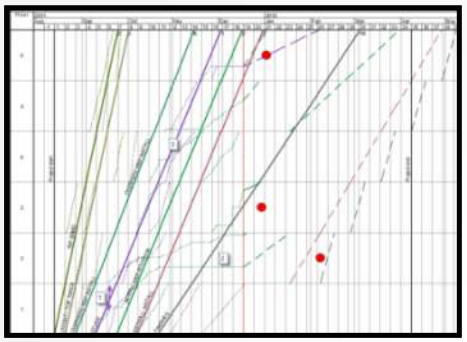
Story

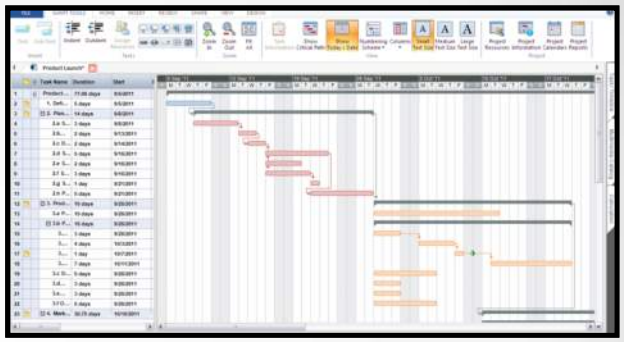
- Bringing in a laser cutter to cut sheet metal
- This replaced a lot of bench cutters
- Worker feared losing job
- The end result was:
  - More production
  - Ability to get more work
  - People needed to assemble and install
  - No one lost their job, in fact more people were hired
- Now the company does a lot of fabrication for competition

Schedule Impact

Schedule Impact

- Fabrication done correctly will reduce time of critical path work





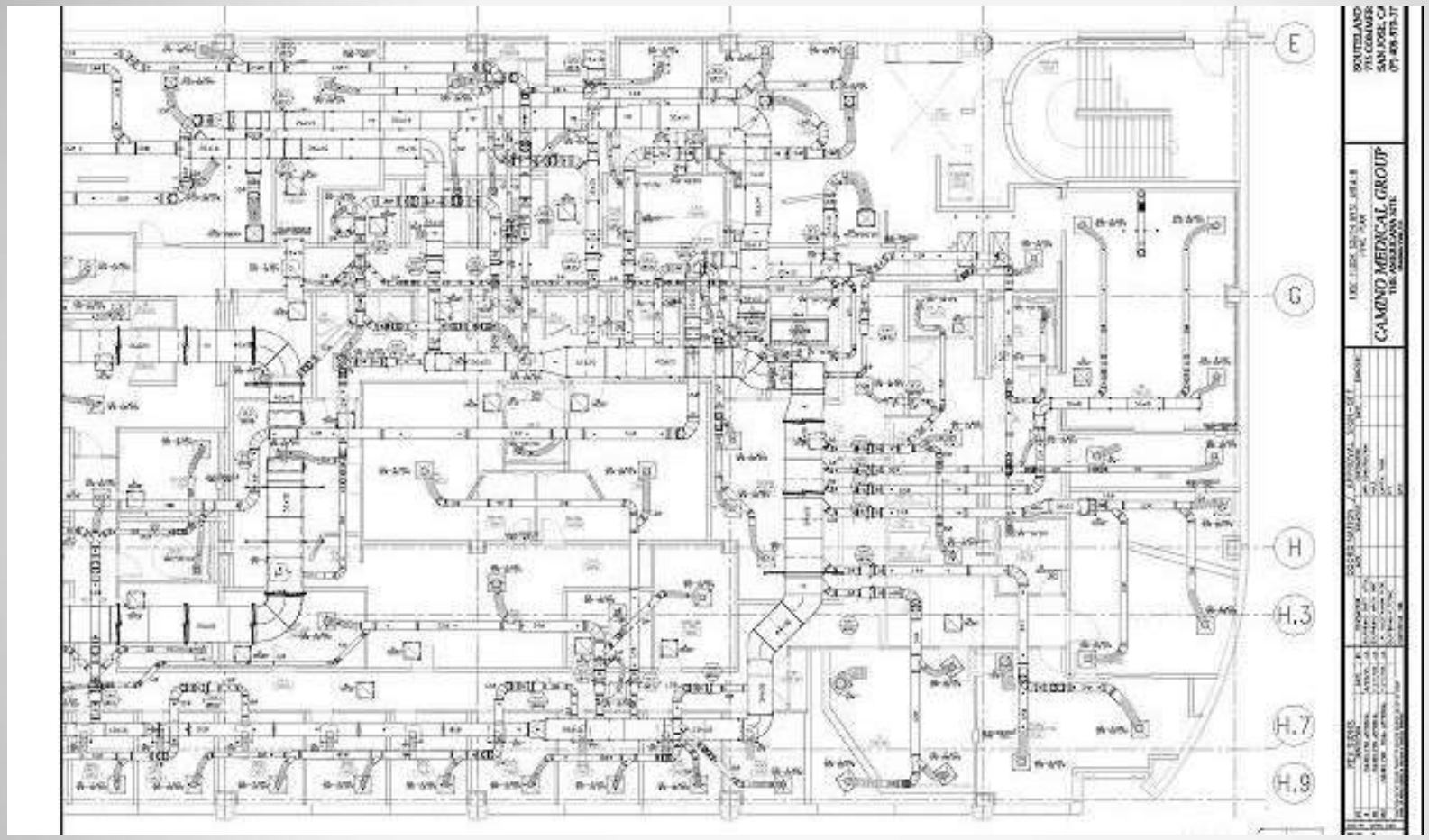
- Increase the certainty of outcome with MEP systems
- Allow float to be added to a congested schedule
- Better quality on a reduced schedule
- I have seen quotes of schedule savings in the field from 14% to 30% from use of fabrication

Software

Software

- My intention is to not get into specific software, but I cannot do a class at AU without mentioning it
- Navisworks Manage – Revit – AutoCAD – BIM 360 Platform - Third Party Add-ons and Apps – P6 – Autodesk Fabrication
- Use:
  - Automation
  - First run studies
  - Logistic planning
  - Delivery tracking
  - People tracking – man loading
  - Estimating
  - Material Ordering
  - Scheduling
  - Fabrication Sheets
  - Etc.

Multi-Trade Fabrication Example
Small and Simple



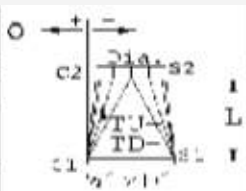
Extract all the Square to Round fittings for VAV assembly from the model / drawing

Job Number:	Detailer Name:	Field Foreman Name:
5615373	Jerry Shephard	Jim Burrows
Sheet Number:	Detailer Phone Number:	Foreman Phone Number:
OF	590-0202	406-210-1208

Shop Instructions:
Order loose DM/Ward from shop

Shipping Instructions:
Ship with factory frames.

Clean and Bag Level: None | Exposed: ___ | Weld: ___ | Seal: ___

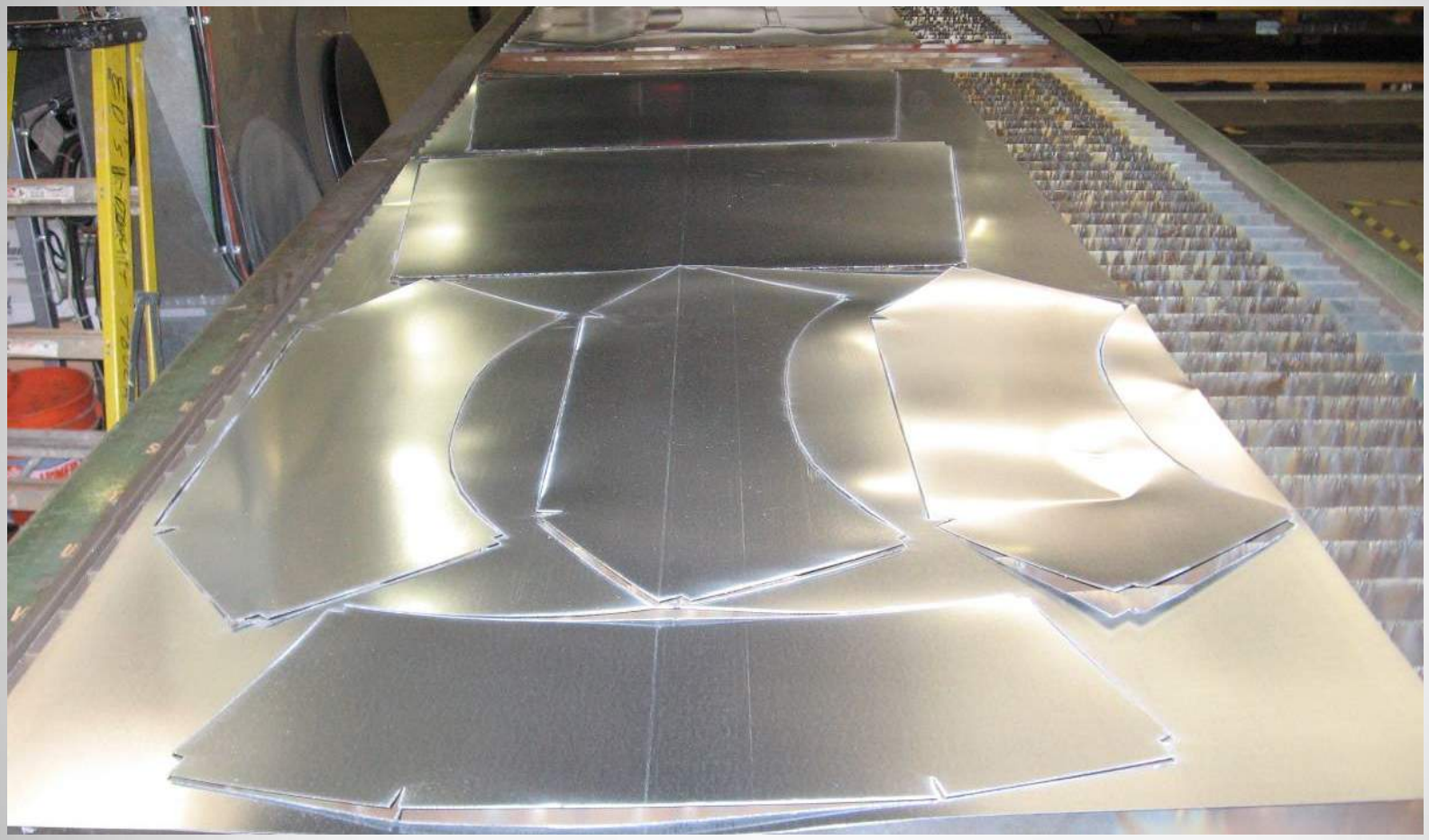


Square to Round

Pattern #6
Color:
Brown
Building Level:
1st FLOOR
Building Area:
SE

Qty	Mat.	Ga.	Spec.	W1xD1	Dia.	S1	S2	C1	C2	Length	O	TU	Seam	Insul	Stiffener	Notes	Tag #
1	GALV	26	+2" Round (M213si.dwg)	16x15	16	0.75	3	S&D	Col-SE	12	0	4	Stch-Wld	-			14
1	GALV	26	+/- 2" Rect. (M213si.dwg)	12x8	6	0.75	3	S&D	Col-SE	12	-3	-1	Stch-Wld	-			16
2	GALV	26	+/- 2" Rect. (M213si.dwg)	20x17.5	18	0.75	3	S&D	Col-SE	12	-1	0.3	Stch-Wld	-			19
1	GALV	24	+/- 4" Rect. (M213si.dwg)	12x8	8	0.75	3	S&D	Col-SE	22	-2	6	Stch-Wld	-			21
1	GALV	26	Not Set	14x12.5	14	0.75	3	S&D	None	12	0	0.7	Stch-Wld	-			23
1	GALV	26	+/- 2" Rect. (M213si.dwg)	20x12	18	1.5	3	Ward	Col-SE	36	2	11.5	Stch-Wld	-			26
1	GALV	26	+/- 2" Rect. (M213si.dwg)	12x10	12	0.75	3	S&D	Col-SE	12	0	1	Stch-Wld	-			27
1	GALV	26	+/- 2" Rect. (M213si.dwg)	20x17.5	18	0.75	3	S&D	Col-PS	12	-1	0.3	Stch-Wld	-			27
1	GALV	26	+/- 2" Rect. (M213si.dwg)	14x12.5	14	1.5	3	S&D	Col-SE	12	0	0.7	Stch-Wld	-			30
1	GALV	26	+/- 2" Rect. (M213si.dwg)	16x15	16	1	3	S&D	Col-SE	12	0	0.5	Stch-Wld	-			31

Create cut sheet(s) for Square to Round. To be used for quality control



Same parts on cut sheet are sent to CNC to be cut

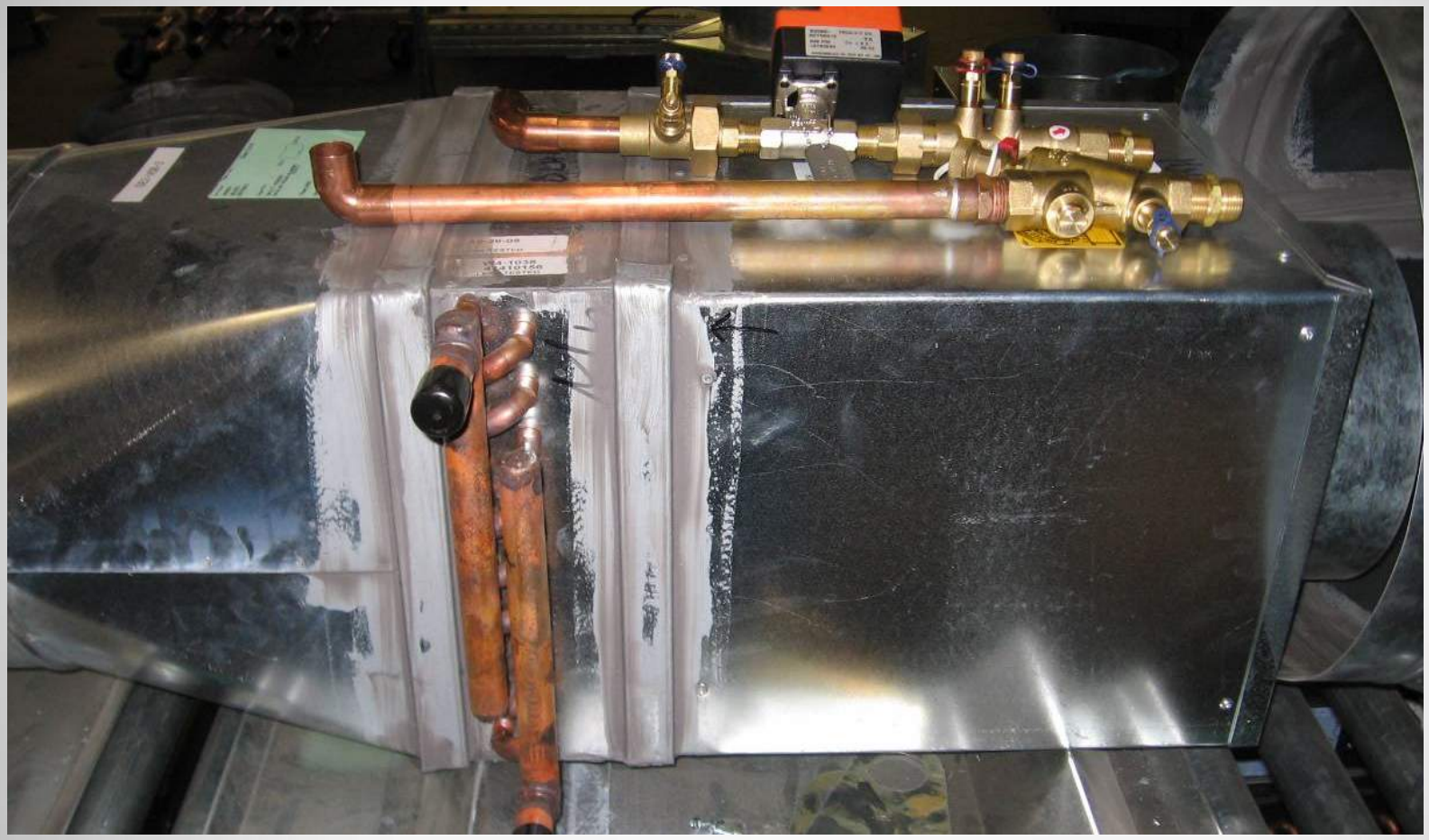
Assemble the cut fittings

Attached assembled fitting to coil on VAV box.

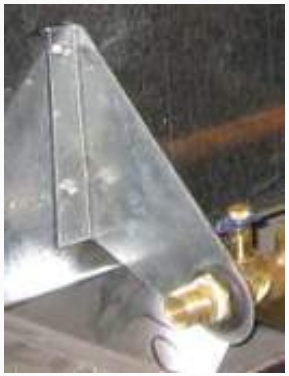
Note the checklist label to track quality of part

Start an assembly Line

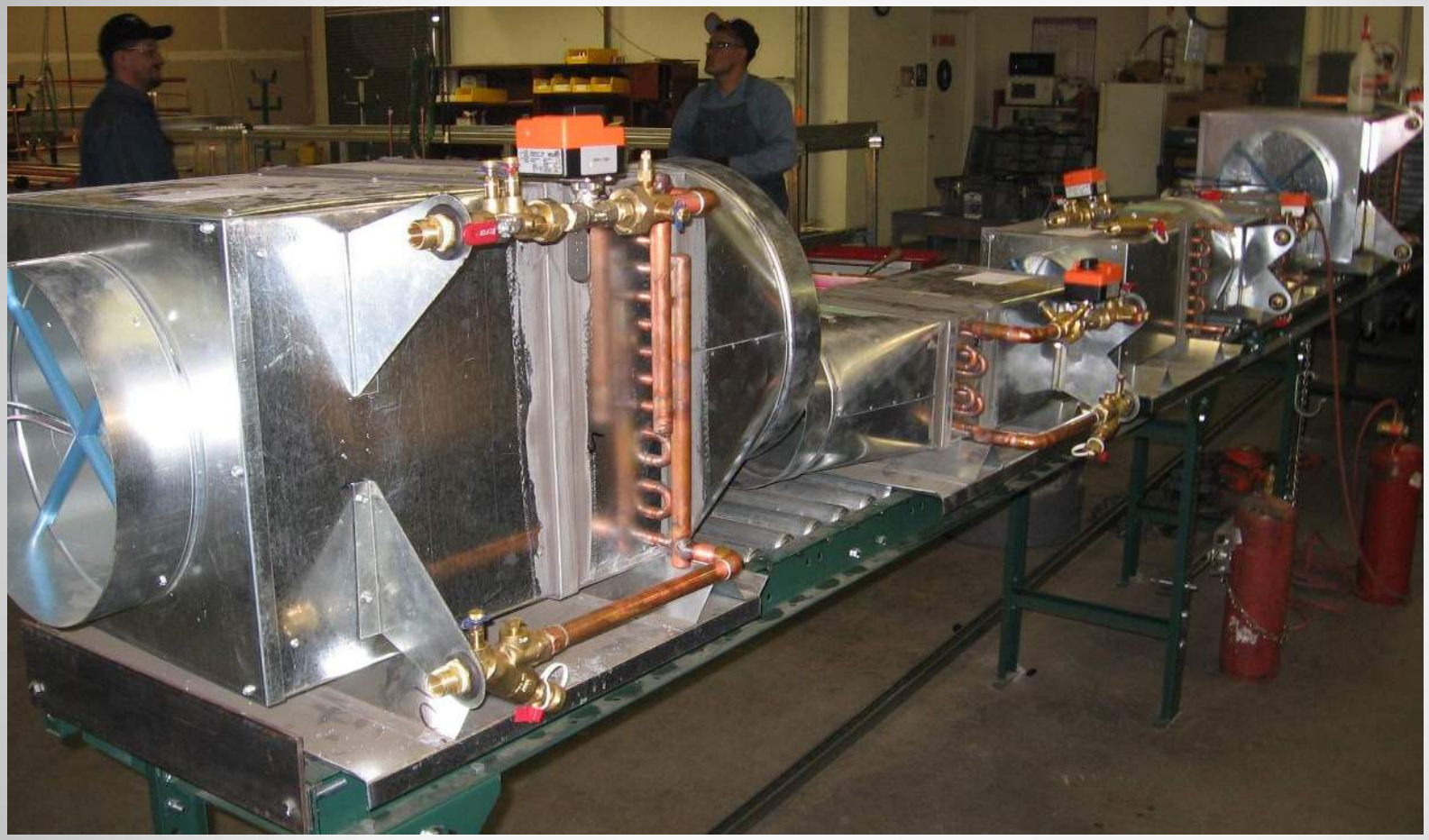
Cut copper pieces for VAV fabrication



Valve and Control Kits ready to be placed on VAV



Cut and bend the tabs to hold the piping in place on VAV. Place rubber grommet in place during pipe assembly.



Complete VAV assembly shown. Piping, Sheet Metal and Controls are all on the assembly, tested and ready to ship.

VAV cart ready to ship

VAV assembly installed in field

Summary

Summary

- Less time spent in field to turn over the project
- Added safety due to less time working overhead
- Controlled environment during assembly allows for greater quality of finish product. Less rejects.
- Building parts in bulk allows for faster assembly of product

Summary

- Less variation between assemblies
- Standardized parts makes for easy repairs and replacements in the event of a defect
- Repeatable assembly of product that can be built by less skilled workers
- Predictable labor for better estimating
- Labor that beats estimating's typical rates

What's the Next Step?

- Permanent Modular Construction (PMC) or Modular Building?
- Robotic Building?

It is up to us!!

Structural Fabrication Suite 2016

Everything Structure in one box!

Structural Fabrication Suite 2016

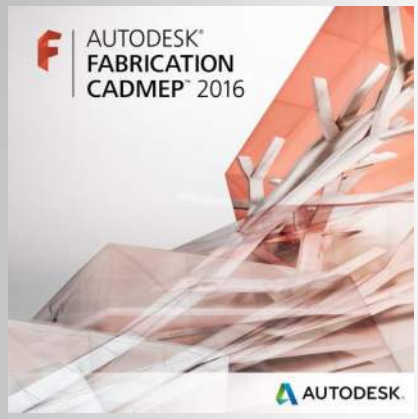
Everything Structure in one box!

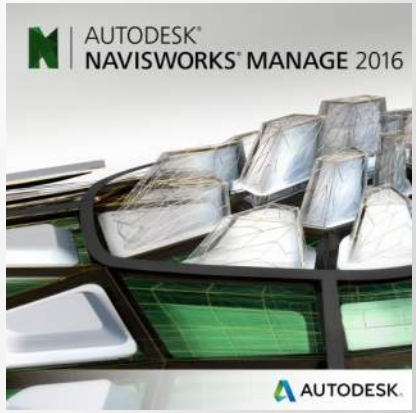
- Autodesk's Structural Fabrication Suite Desktop Subscription contains:
- Advance Steel
- AutoCAD
- Revit
- Navisworks Simulate

- AutoCAD customers have a path way to BIM
- More effective and integrated workflow
- Attractive pay-as-you-go offering

MEP Fabrication Suite 2016

Everything MEP in one box!





MEP Fabrication Suite 2016

Everything MEP in one box!

- MEP Fabrication Suite
- Desktop subscription only
- Fabrication CADmep, ESTmep and CAMduct still available as DTS

- An MEP Suite of commonly used adjacent products to support common industry workflows
- A path to BIM for contractors, sub-contractors and fabricators
- AutoCAD and Fabrication customers migrating to BIM, but in need of Fabrication tools


Take Aways

Discussion

DON'T FOGET THE CLASS SURVEY!

DOH!

Contact Information

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