Hypertherm®

32nd International Forum on Design for Manufacture and Assembly

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Designing Great Products and Building High Performing Teams with DFMA

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Outline of Our Presentation

- Introduction to Hypertherm
- Business and learning objectives
- Workshop and outcomes
- Design project and outcomes
- Lessons learned

Hypertherm: About Us

- Founded in 1968
- Located in Hanover, New Hampshire
- Privately owned (ESOP)
- Strong continuous improvement culture
- 1400 Associates world-wide, 1200 in Upper Valley
- 11 Facilities, 500,000 square feet mixed mfg, R&D, office

71 Heater Road, opened 2012

21 Great Hollow Road, opened 1970

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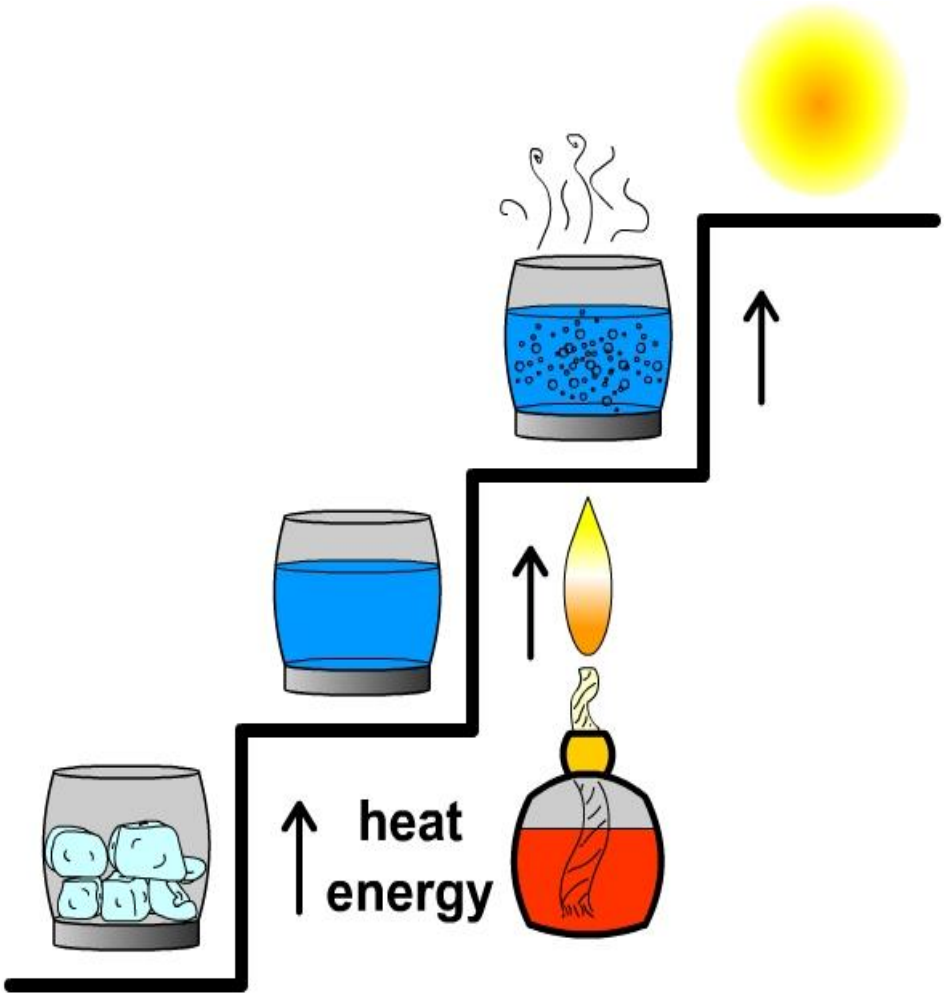
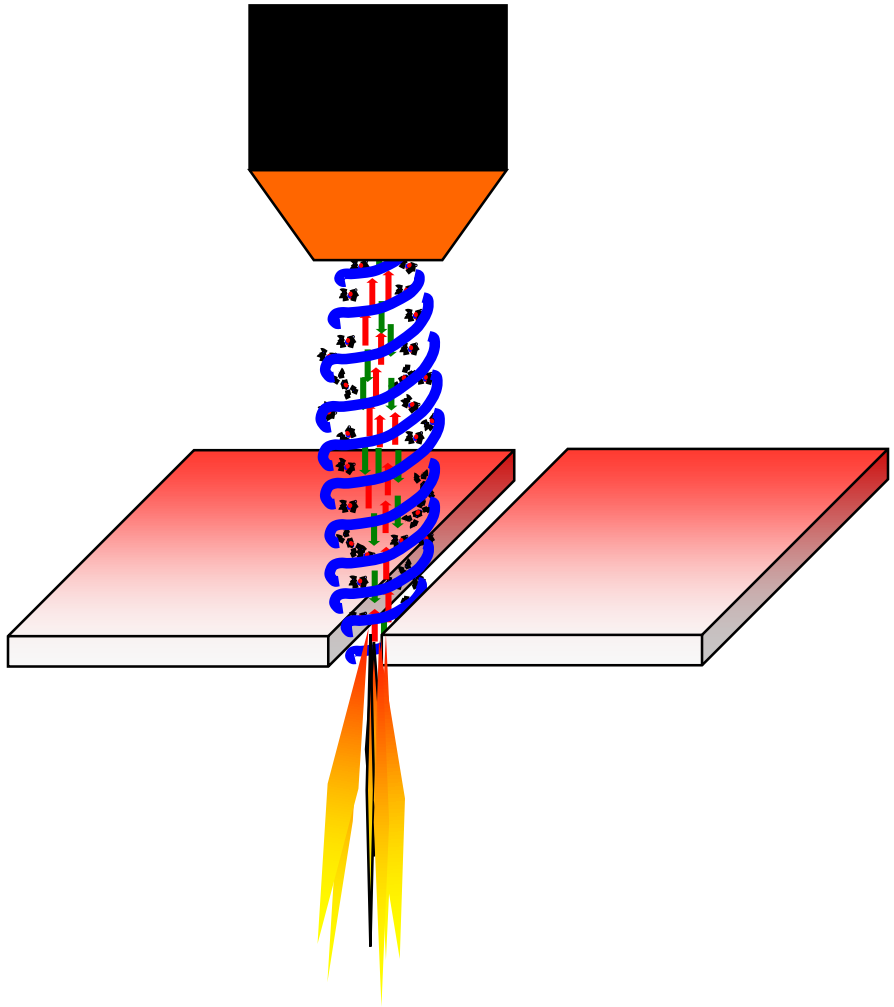
Physics Quiz: What is Plasma?





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About Hypertherm

Hypertherm designs and manufactures the world's most advanced metal cutting products

- Plasma - Light Industrial and Mechanized markets
- Laser
- Water Jet
- Automation, CNC controls, and CAM software

Hypertherm: End Markets

Energy

Pipelines

Transportation

Vehicle repair

Agriculture

Shipbuilding

Construction

Recreation

Auto restoration

Artwork

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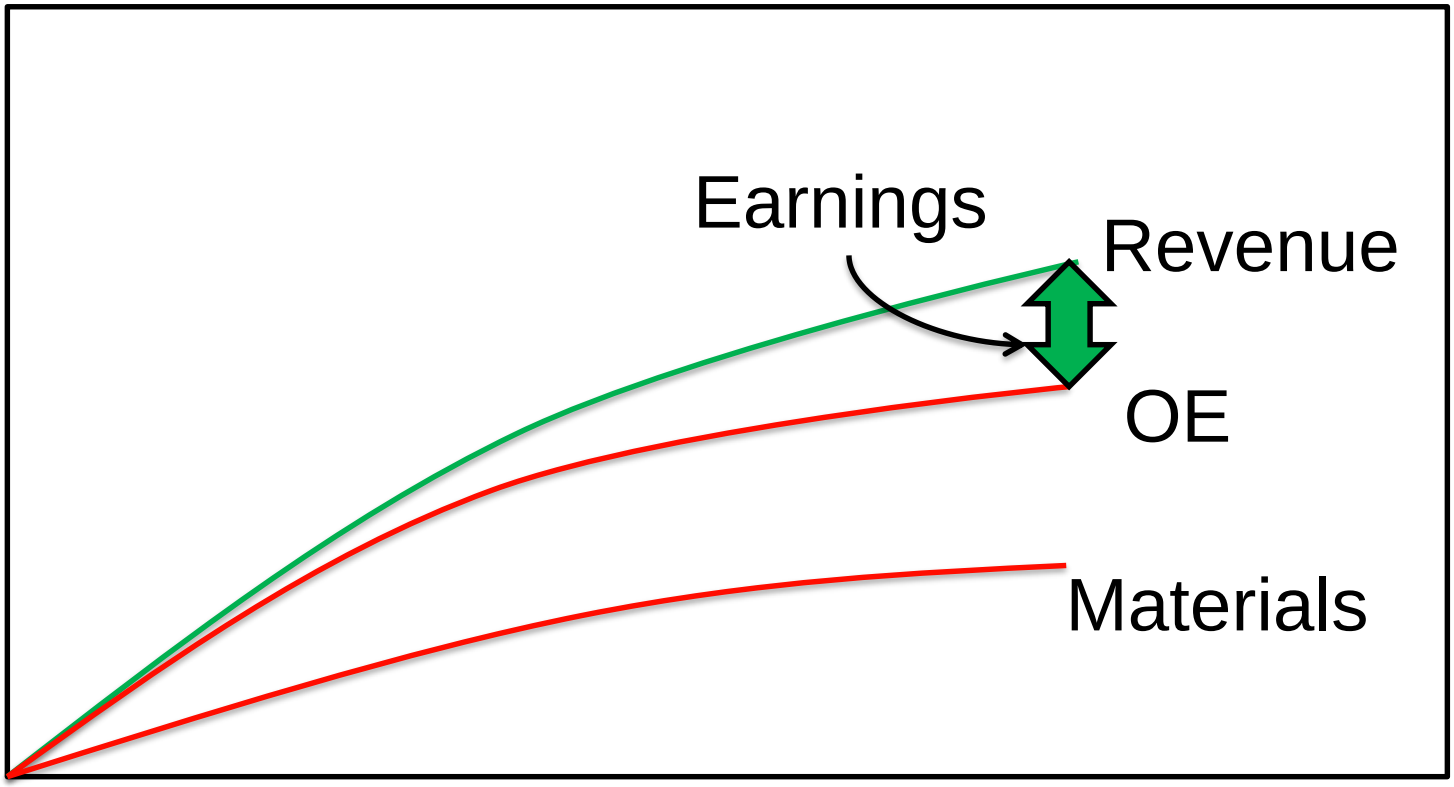
DFMA and Lean/Operational Excellence

DFMA and
Lean/Operational Excellence
are complementary

Design and Operations collaboration is essential

Continuous Improvement/OpEx Is a Growth Strategy



Earnings = Revenue – Operating Expense – Materials

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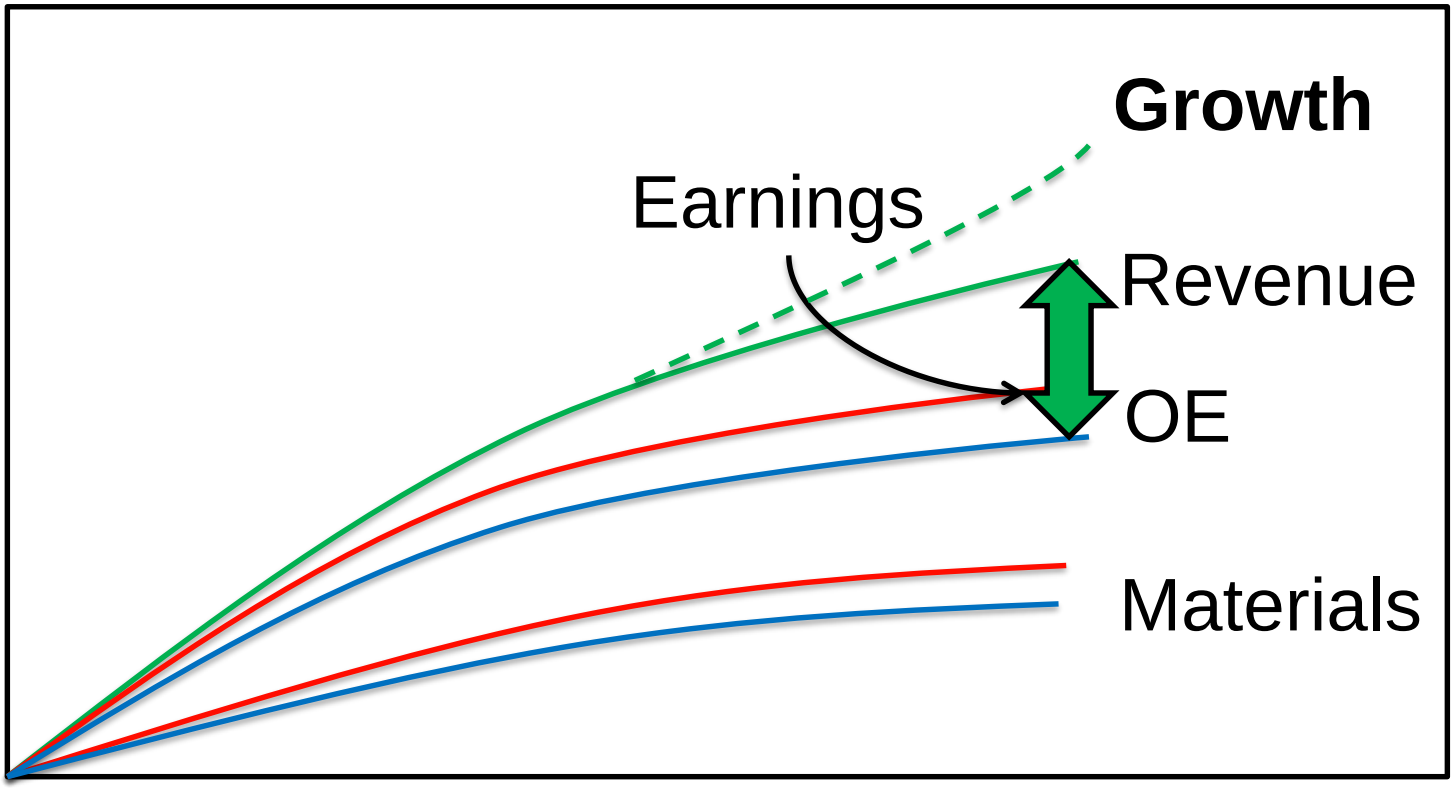
Earn the Right to Grow



Earnings
=
Revenue
-
Materials
-
OE

- DFMA reduces Material Costs
- DFMA reduces Operating Expense (direct and indirect)
- Increases Earnings
- Freed resources pursue business growth opportunities

Business Case: Prior outcomes with DFMA

DFMA, process, and reliability improvements over 6 years

- Material % of sales reduced by 13%
- Production % of sales reduced by 69%
- Warranty % of sales reduced by 81%
- Sales increased 6x
- Net contribution increased 31x

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Four Generations of Product

1993	1999	2010	2017
MAX43	Powermax600	Powermax45	Powermax45 XP

Four generations of products for the 3/8” – 5/8” steel market

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Lean Manufacturing – Assembly Value Stream

- Flow manufacturing
- Six station assembly
- Five minute cycle time
- 88 units/shift

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VISION: Powermax45 XP

- better cut performance,
- lighter weight
- low amp gouging
- enhanced look
- lower cost
- build team capability in DFMA

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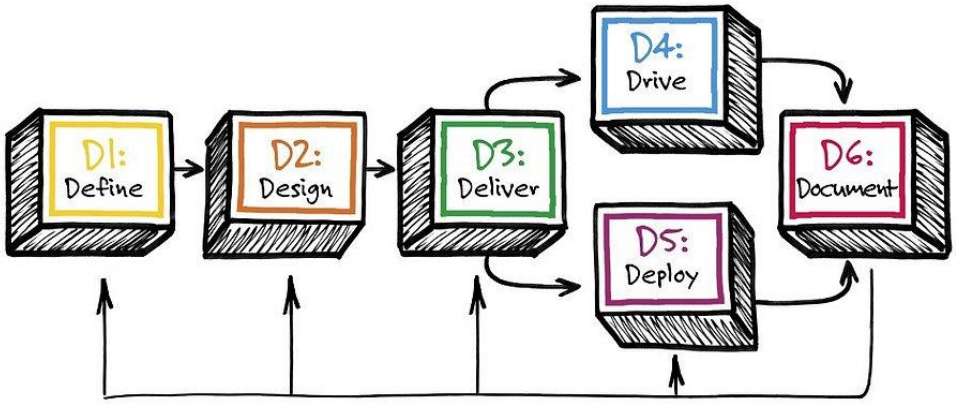
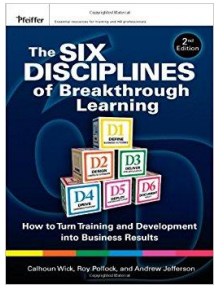
DFMA Project/Workshop Design

1. Define business outcomes and learning objectives
2. Design for learning transfer
3. Deliver training for easy and lasting impact
4. Drive learning transfer through leadership support
5. Deploy performance support
6. Measure, document, and share results





6 Disciplines of Breakthrough Learning
Wick, Pollock, & Jefferson

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DFMA Cross-functional Team

- Mechanical engineers
- Electrical engineers
- Software engineers
- Manufacturing process engineers
- Engineering technicians
- Engineering leaders

- Assemblers
- Marketing
- Procurement & supply chain
- Quality, reliability, and regulatory
- Engineers from outside of the team
- Supplier engineers

Workshop Timing and Outcomes

T1- T3	T4	T5	M1 – M3	M5	M12	M15
Project Origin	Concept Selection and Development	Design Validation	Marketing Brief, Specification Schedule	Design Validation/Review	Production Readiness	Market Launch
Technology Development			**Product Development**		**Product Commercialization**	

Value Analysis
DFMA

- 5 days
- 97 design concepts conceived
- 21 concepts implemented
- 10 concepts to technology hopper

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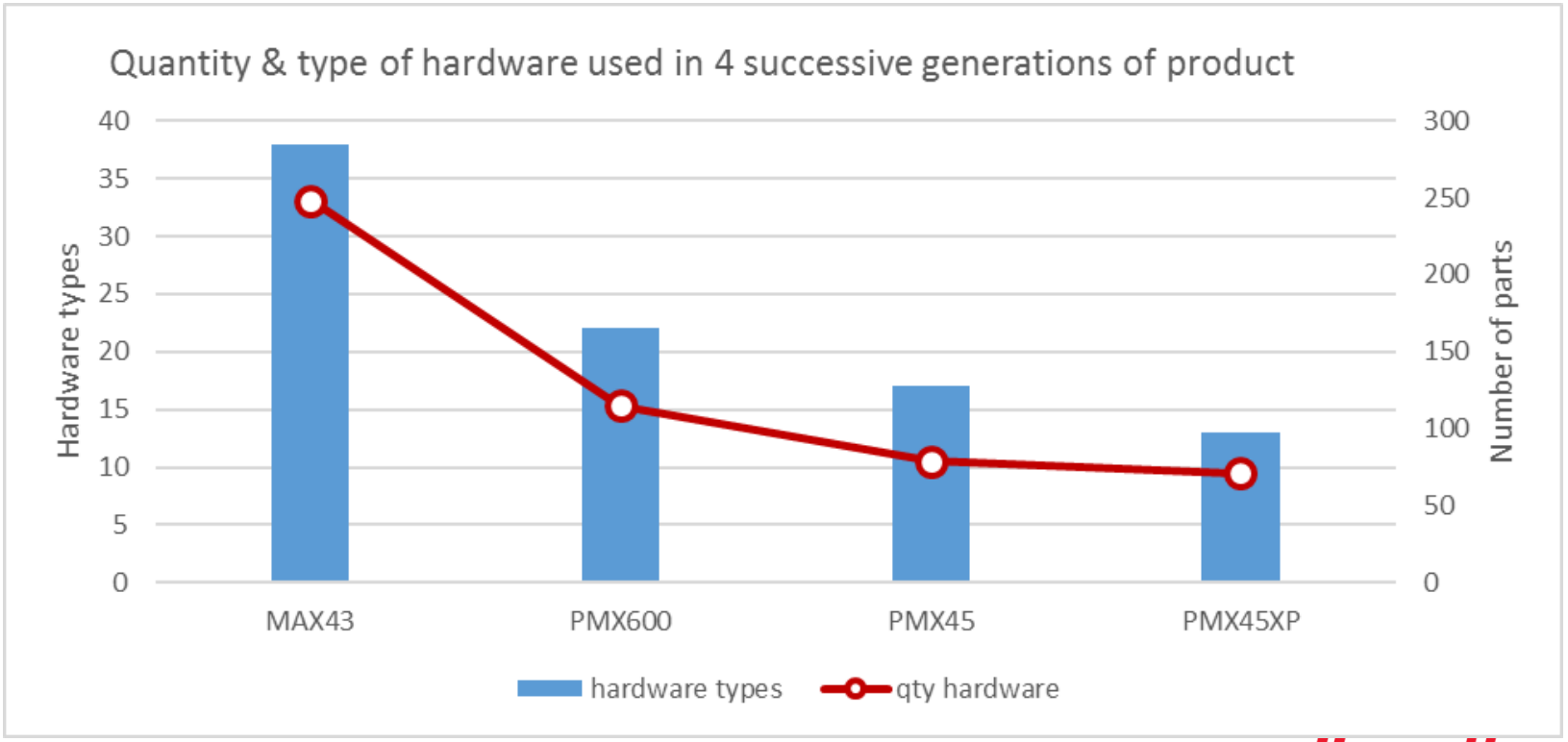
Design Outcomes

- Powermax45 XP total part reduction = 17 → **12% reduction**
- Powermax45 XP total fasteners eliminated = 16 → **22% reduction**
- With 12% weight decrease, 6% cost reduction, 10% throughput increase (cycle time and line rebalancing)



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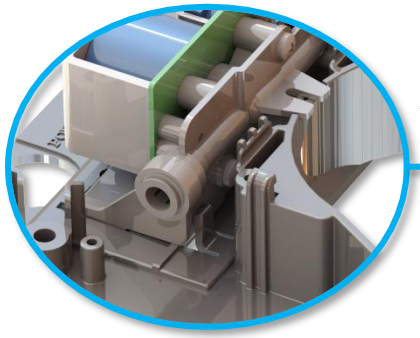
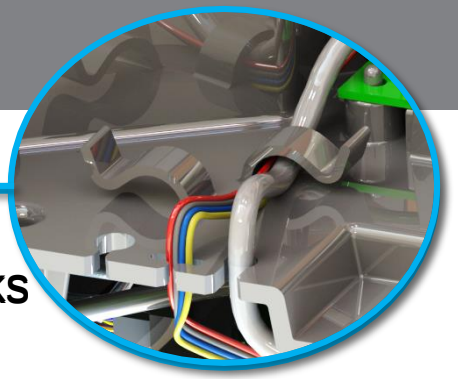
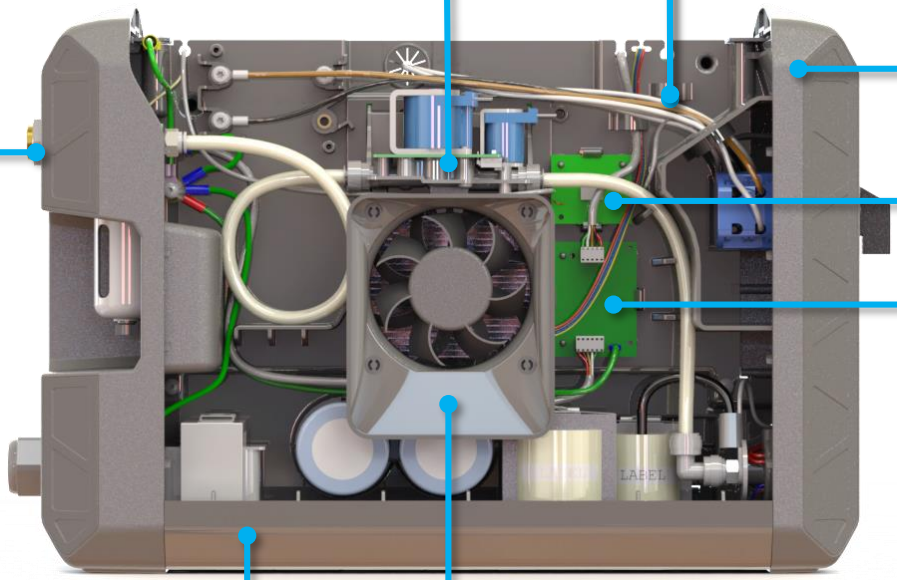
Powermax45 XP DFMA Examples

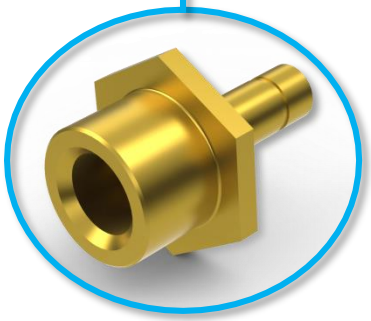


Snap-in Valve

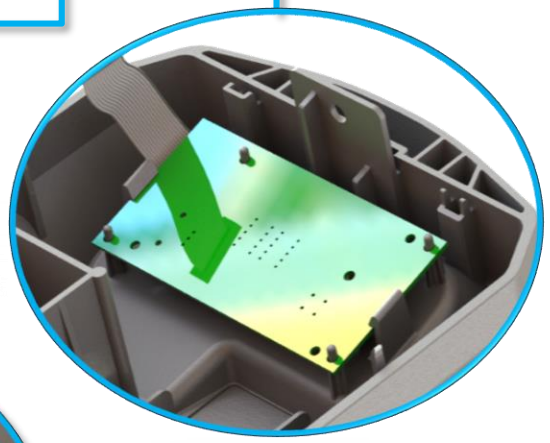


Wire Hooks

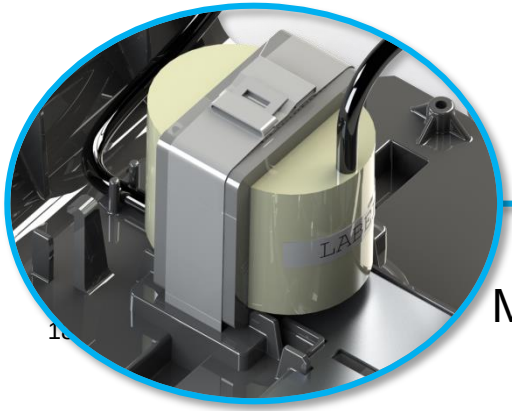




Bulkhead Air Fitting



Snap-in PCBs



Modular Magnetics

Snap-in Fan

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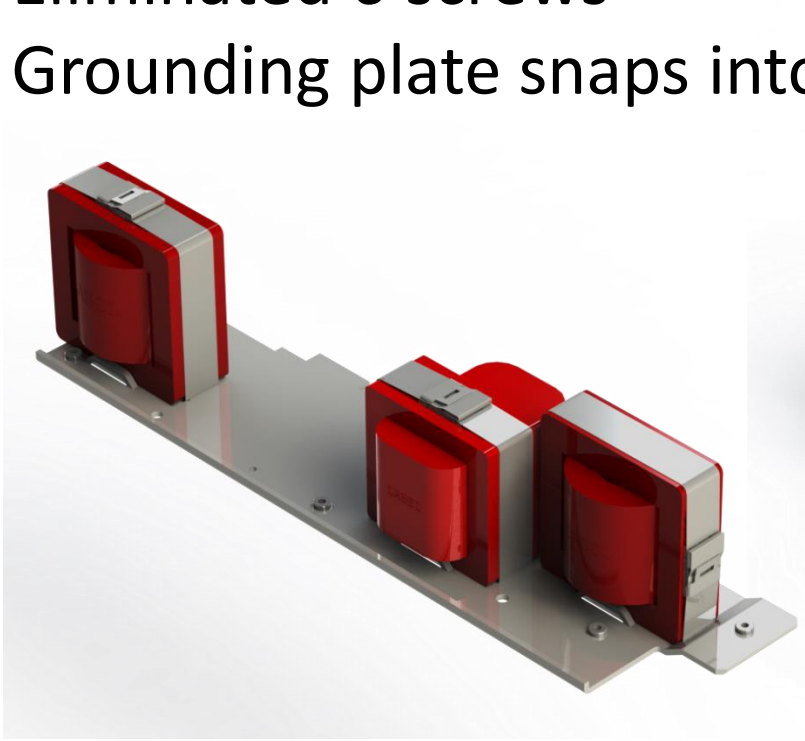
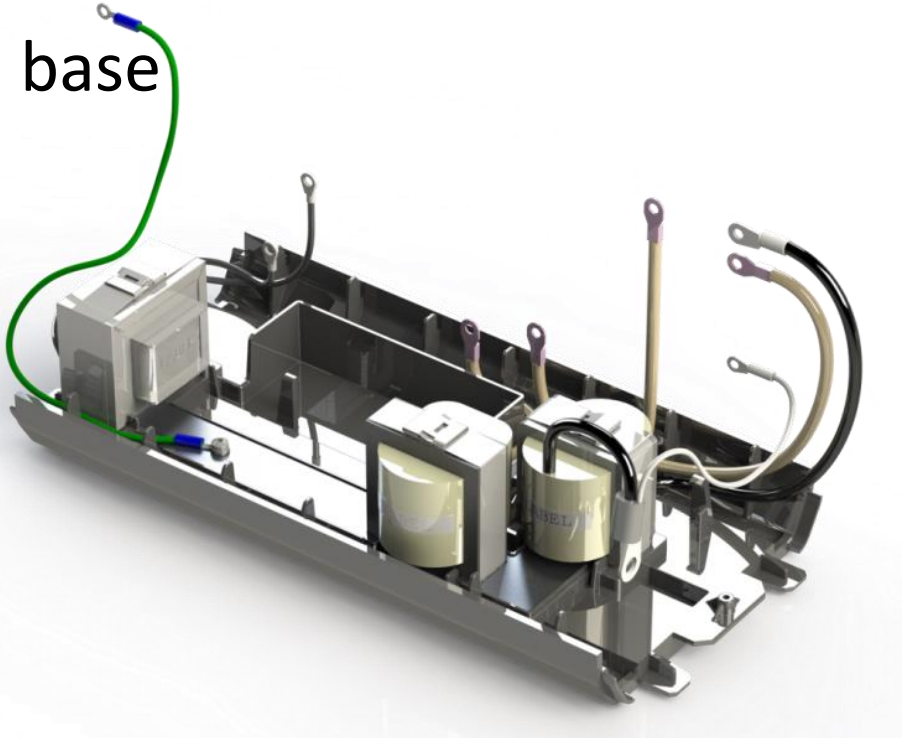
EXAMPLE: Magnetics Assembly

- Magnetics directly mounted to base
- Metal baseplate replaced with smaller grounding plate
- Eliminated 6 screws
- Grounding plate snaps into base



Powermax45 Magnetics (old design)



Powermax45 XP Magnetics

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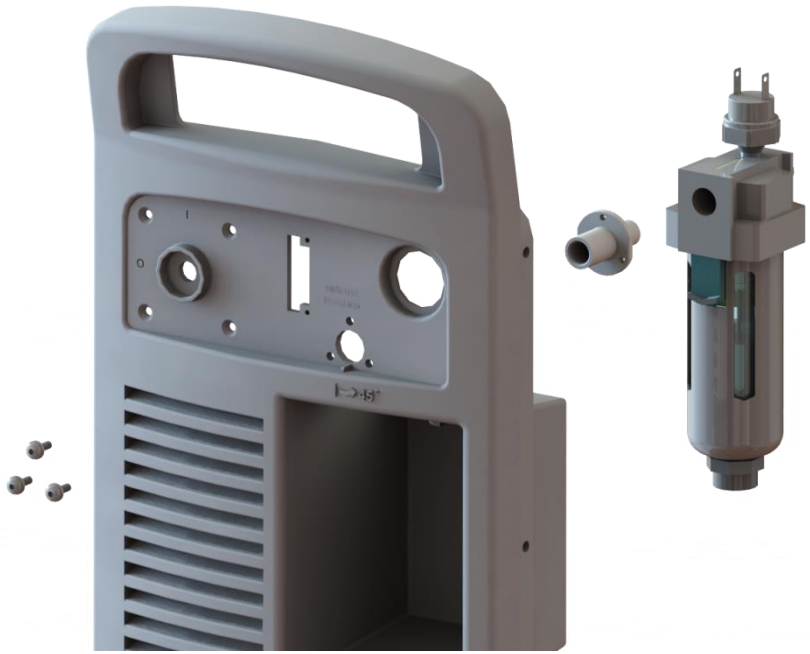
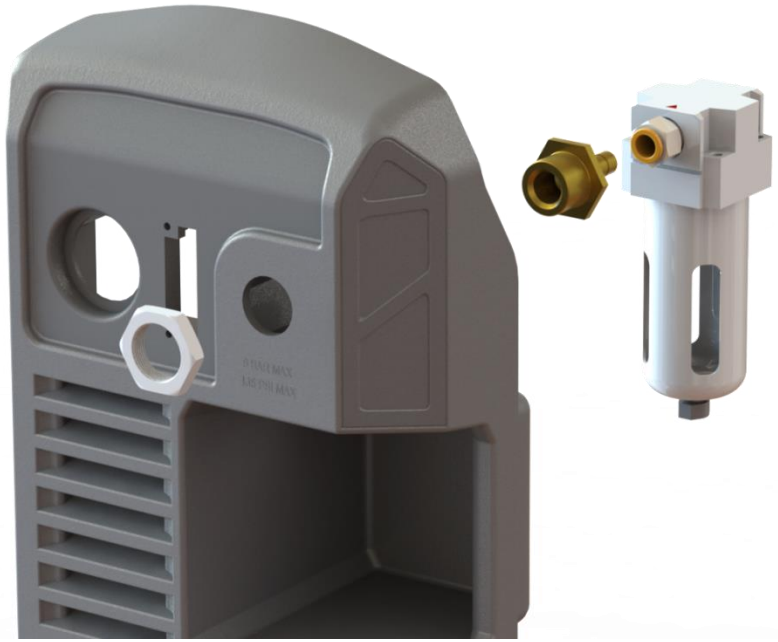
EXAMPLE: Bulkhead Air Fitting

- Eliminates 3 screws and reduces part cost
- Utilizes supplier-installed push-to-connect fitting
- Eliminates serviceability nightmare on existing Powermax45 via adequate wrench surface and by capturing the fitting in the endcap



Existing open-access filter design (Powermax65/85)



Powermax45 XP open-access filter design

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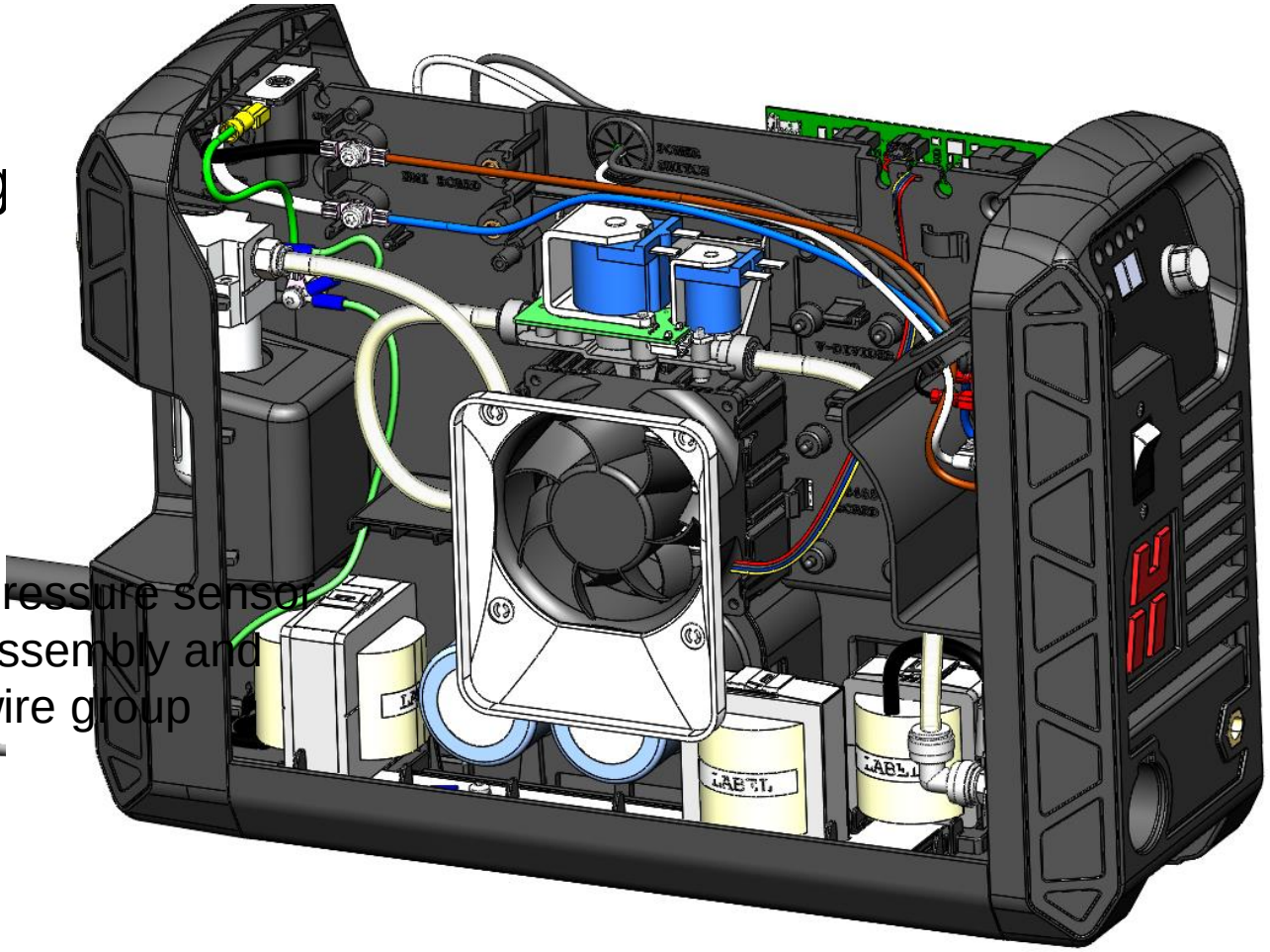
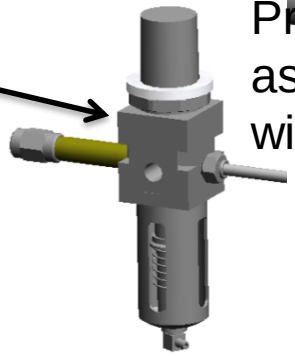
EXAMPLE: Gas System

- Auto-air
- Snap-in desig
- No pressure sensor



Air Filter / Manual Regulator Assembly



Pressure sensor assembly and wire group

3 way valve

Powermax45 Gas System

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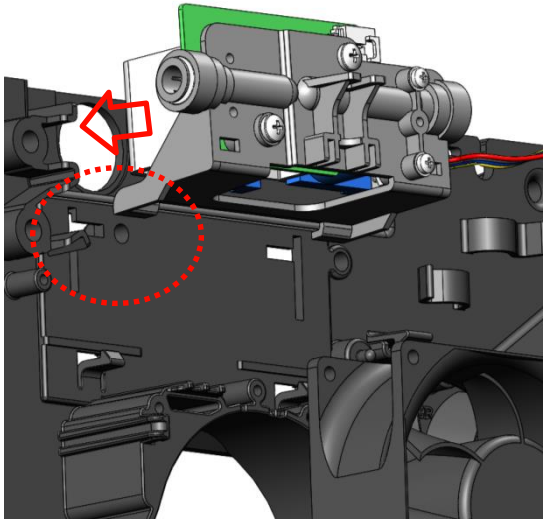
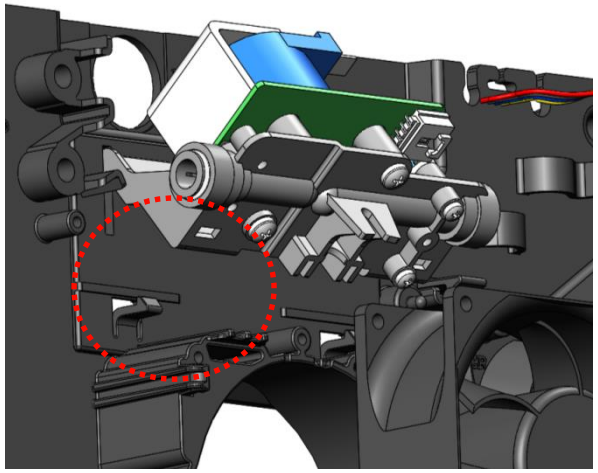
EXAMPLE: Valve

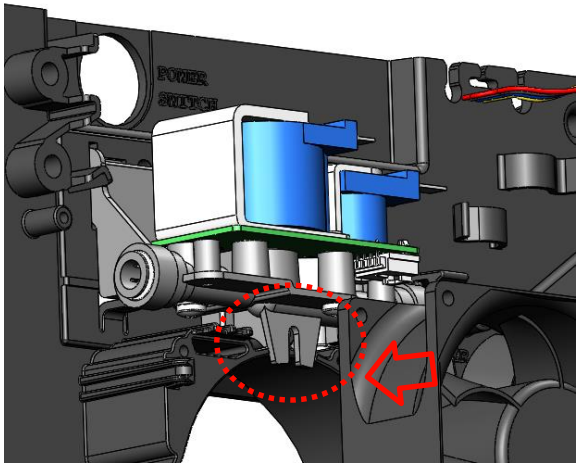
Top of valve body hooks into center panel



Swing valve into place; engage snap hooks

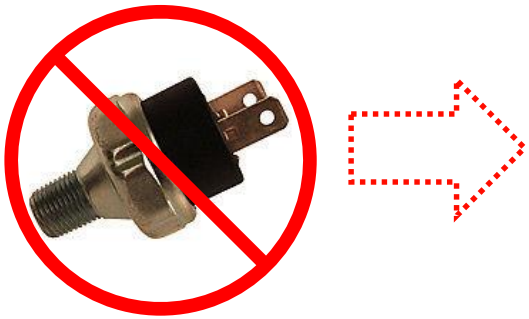


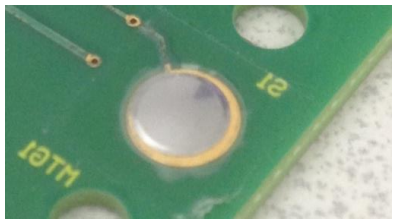
Tab held in place behind fan



EXAMPLE: Elimination of Pressure Switch

- Reduced cost: $4.65 + (wire group and fittings)
- Part reduction advantages…
  - Assembly
  - Reduced points of failure
  - More space
- Inlet gas detection through strategic pressure ‘checks’
- PC board has accommodations for an inlet pressure switch





Back-up plan

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Lessons Learned

- Early Value Engineering and DFMA is better
- Form a cross functional team
- Use a workshop as a team building opportunity
- Maximize creative design time
- DFMA and Lean manufacturing are complementary

Powermax45 XP

A Highly Portable 45 Ampere Plasma System

Rendering courtesy of Jeff Ortakales

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Cut with confidence®


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