



Innovation through Teamwork

*SERVING THE AUTOMOTIVE INDUSTRY
SINCE 1964*

VARI-LITE[®]

Engineered Extruded Tubular Products

*COMPANY PROFILE
(2009)*

Mission Statement

U.S. Manufacturing Corporation is the recognized leader serving the transportation industry providing innovative engineering and lean, flexible manufacturing processes for extruded tubular products. These products are characterized by their superior value, weight, and strength.

This is accomplished through our extensive knowledge of cold extrusion processing, our excellence in welding and machining, and our ability to collaborate with our customers to meet their needs in a timely and cost effective manner.

USM Today

U.S. Manufacturing Corporation, a privately held company with over 45 years experience, is an ISO/TS 16949 & ISO 14001 certified. It occupies over 800,000 square feet of manufacturing floor space located in 2 locations with approximately 700 associates.



Silao, Guanajuato, Mexico
(175,000 ft²)
Engineering, Prototyping,
Manufacturing

Warren, Michigan
(630,000 ft²)
Worldwide Headquarters
Engineering, Prototyping,
Manufacturing, and Testing



Our Customers



Jeep



CHRYSLER



DODGE
GRAB LIFE BY THE HORNS



HUMMER



ArvinMeritor



Ford



NASCAR



CHEVROLET



GM



NISSAN



DELPHI

DANA

Ford

AAAM

MAGNA
MAGNA POWERTRAIN

G-FORCE
RACING GEAR

Our Technology

The company has pioneered a proprietary cold extrusion process to create variable wall tubing that offers outstanding strength and reduced weight.

VARI-LITE[®] ***TUBES***

We have extensive experience with advanced welding technologies and precision machining that allow us to support our customers with a wide range of value added products.

Our Technology

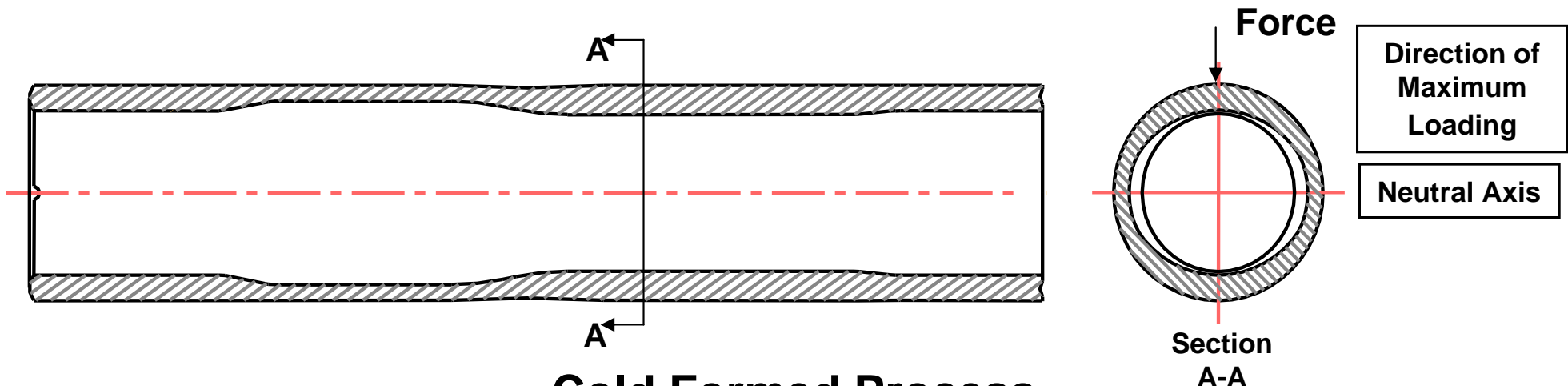
Optimized Cross Section Tubular Design

Thicker Walls for Highly Stressed and Welded Areas

Thinner Walls for Non Stressed Areas

Optimum Tuning for Stiffness & Strength

Optional Oval Internal Shape to Maximize Weight Savings



Cold Formed Process

Work Hardened Products

Formed to Near Net Shape

Achieve Yield Strength up to 825 MPa

from a Raw Material with Lower Yield Strength (350 MPa) !

Eliminates Costly Steel Grades & Heat Treatment

Our Technology

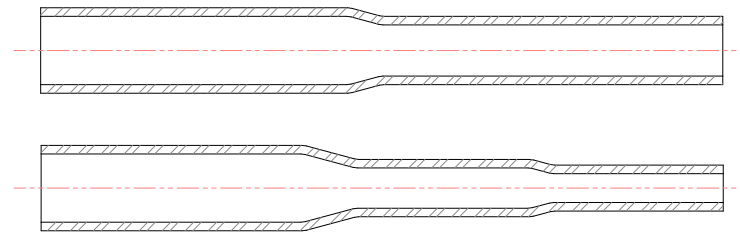
A Variety of Tubular Configurations

Multiple Outside Diameters
Variable Wall Thicknesses
Combination of Both

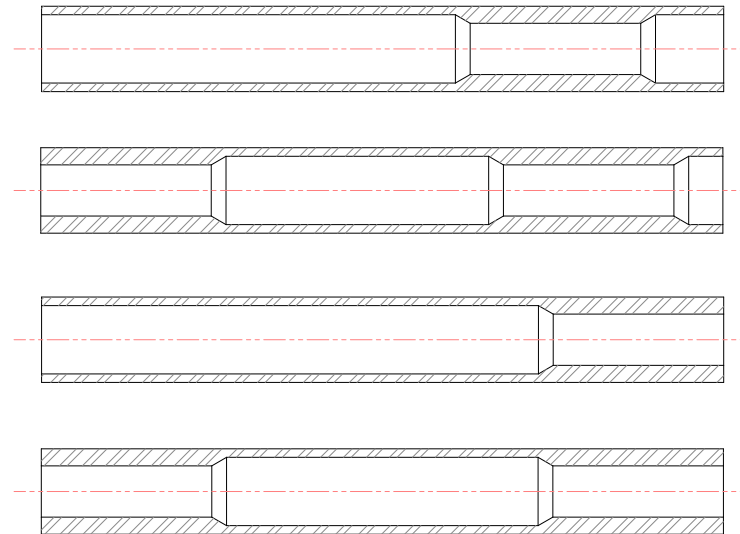
Size Capabilities

Outside Diameters 1" – 8"
OD & ID Tolerances as low as +/-0.002"
Lengths from 4" to 80"

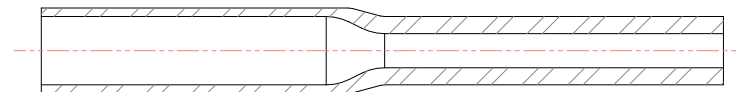
Multiple Outside Diameters



Variable Wall Thickness



Variable Wall Thickness and Multiple Outside Diameters



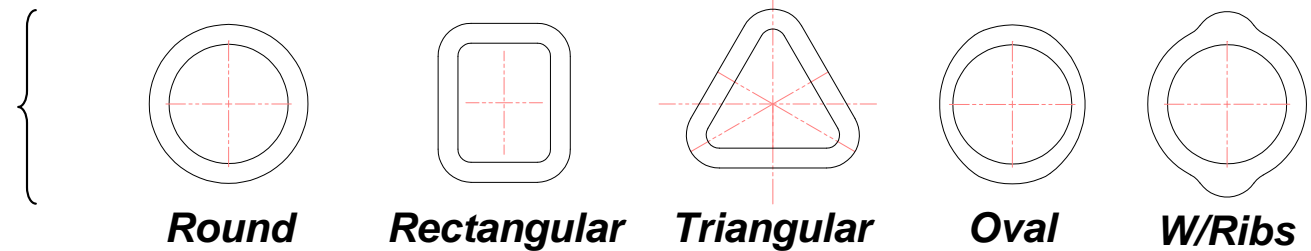
Our Technology

A Variety of Cross Sections

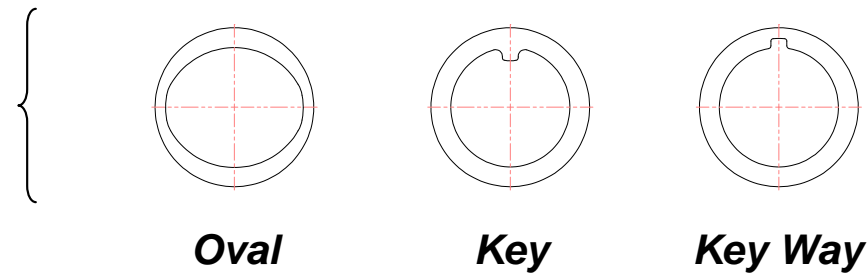
Round, Rectangular, Oval or Triangular Shapes

Internal or External Ribs, Key ways, ..., Internal or External Splines

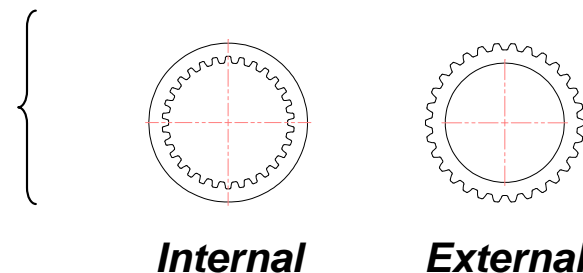
External Shapes

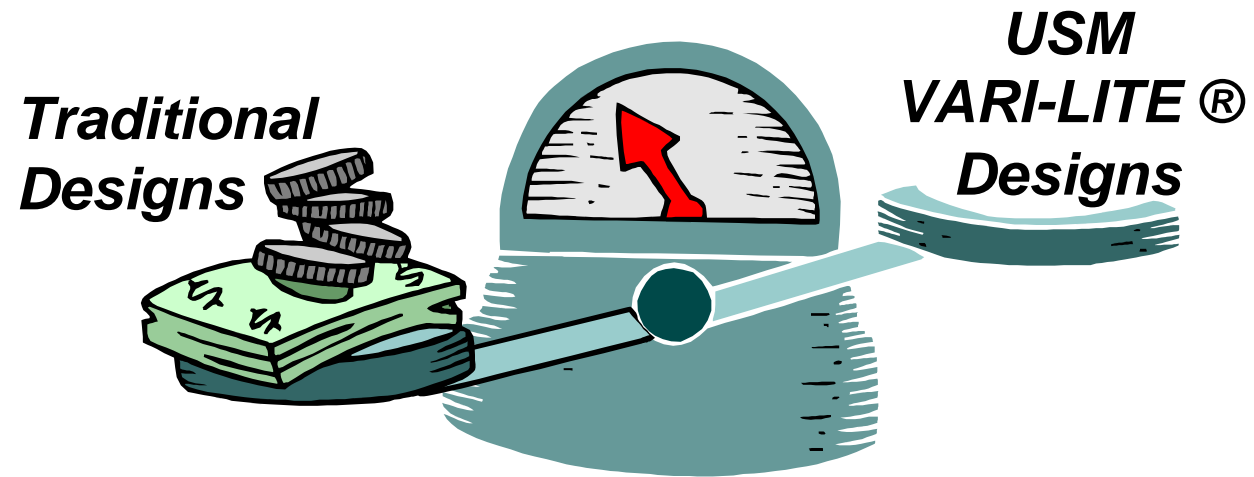


Internal Shapes



Internal or External Splines

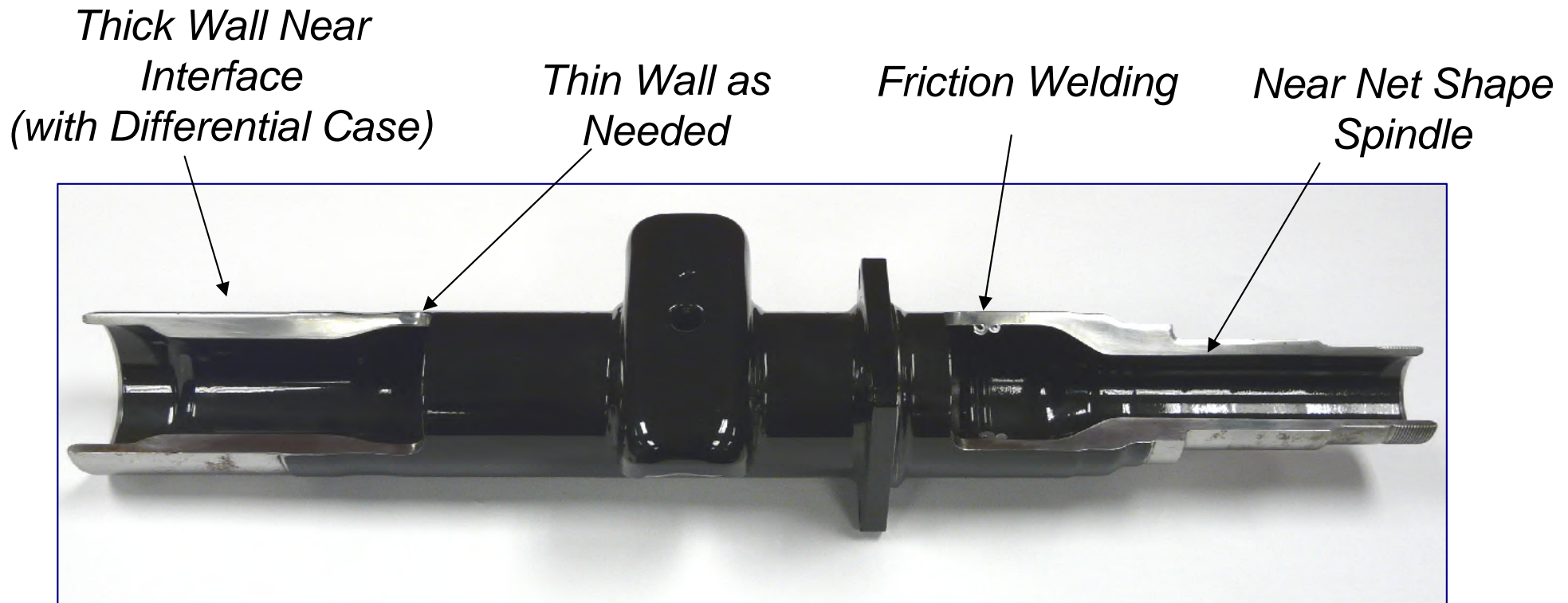




Example of a Weight Reduction

Using USM Variable Wall Technology
 (Axle Housing, 3/4 ton Truck)

Variable Wall Thickness Technology Allows an Optimum (Light & Cost Efficient) Design



Example:

Conventional Tube with Straight Wall Thickness: 64.5 lb

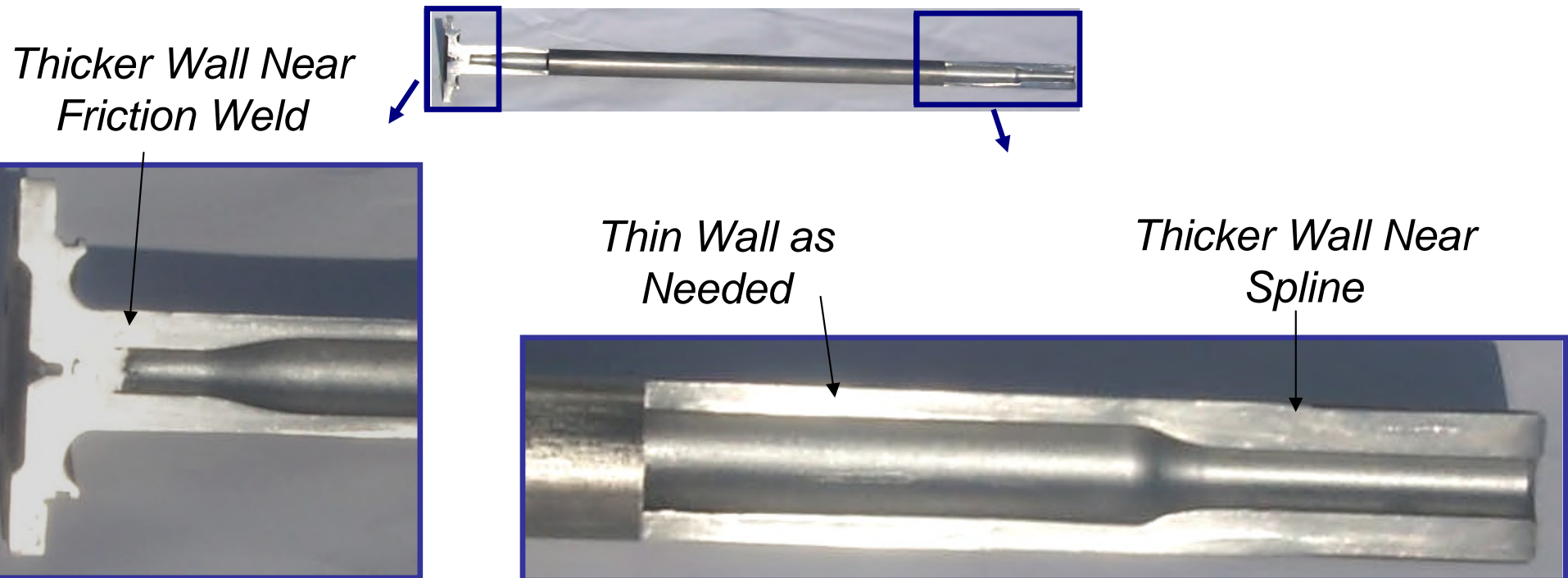
USM Lightweight Tube with Variable Wall Thickness: 51.8 lb

A weight reduction of 25.4 lb (or 20 %) per axle assembly

Example of a Weight Reduction

Using USM Variable Wall Technology
(Axle Shaft, 3/4 ton Truck)

Variable Wall Thickness Technology Allows an Optimum (Light & Cost Efficient) Design



Example:

Conventional Solid Axle Shaft: 17.9 lb

USM Lightweight Hollow Shaft: 13.4 lb

A weight reduction of 9.0 lb (or 25 %) per axle assembly

Example of a Weight Reduction Using USM Variable Wall Technology

(Summary, 3/4 ton Truck)

	Weight Reduction using USM <i>VARI-LITE</i> Axle Tube	Weight Reduction using USM <i>VARI-LITE</i> Axle Shafts	Total Weight Reduction using USM <i>VARI-LITE</i> Products
Rear Axle	25.4 lb	9.0 lb	34.4 lb
Front Axle	6.0 lb	8.6 lb	14.6 lb
Vehicle	31.4 lb	17.6 lb	49.0 lb

**Increased Payload
Increased Fuel Efficiency
Decreased CO₂ Emission**

Example of a Weight Reduction and Its Effect on Environment

- World Steel Makers emit about 1.7 tons of greenhouse emissions per ton of steel*
- At 1,000,000 vehicles per year**, and 49 lbs weight reduction per vehicle, USM can eliminate 41,650 tons per year greenhouse emission.
- Lighter vehicle with better fuel economy are on the road today using USM products***.



* Organization for Economic Corporation and development, The NAFTA Steel Industry and Greenhouse Gas Emissions
American Iron and Steel Institute, Recap of IISI & AISI Indicator Values (2007)

** Assumption

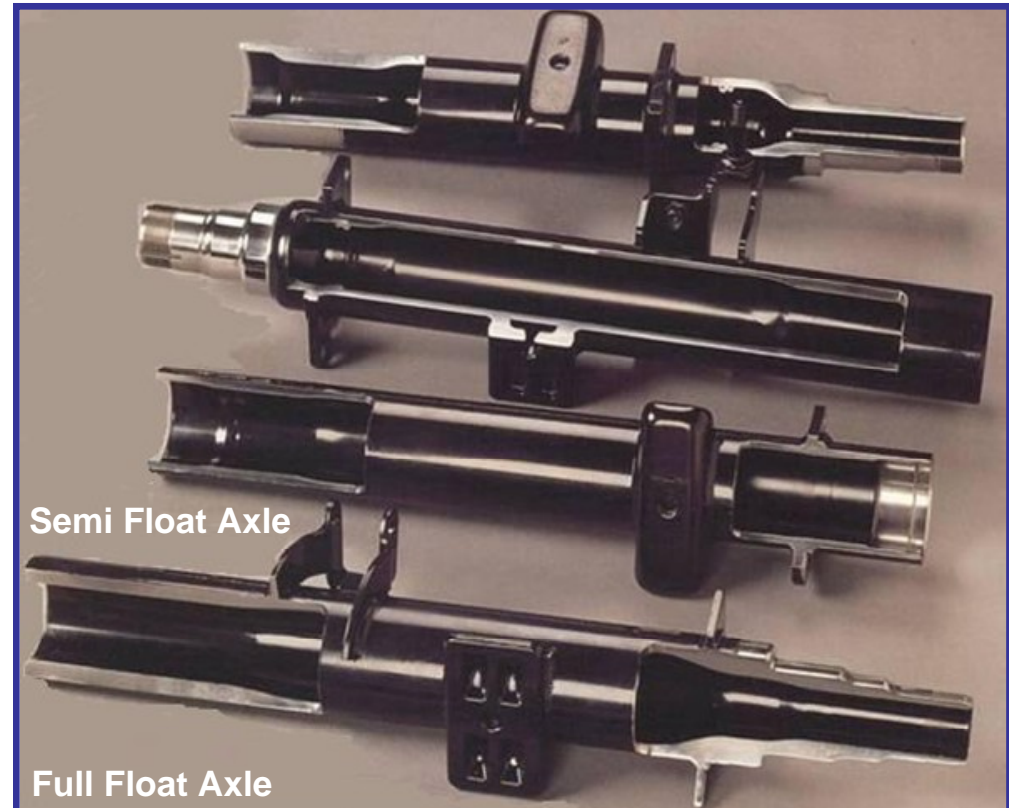
*** CO2 emissions from a gallon of gasoline are approximately 19.4 pound (U.S. Environmental Protection Agency Website);
For every 10% weight reduction, the vehicle's fuel consumption reduces by approximately 6 to 7%.

Our Product Portfolio

(Safety Critical Components)

VARI-LITE®, Tubular Products:

- **Axle Housings**
 - Semi & Full Float Rear Axles
 - Front (Steering) Assemblies
 - Heavy Truck (Class 8) Steering Axle
 - Trailer Axle
 - Dead Axle
 - Modular Banjo Axle Housing



Optimized Trailer Axle, with Oval ID



Oval ID Section



Our Product Portfolio

(Safety Critical Components)

VARI-LITE®, Tubular Products:

- **Hollow Axle Shafts**
 - Rear or Front
 - Half-Shaft



Hollow Rear Axle Shaft



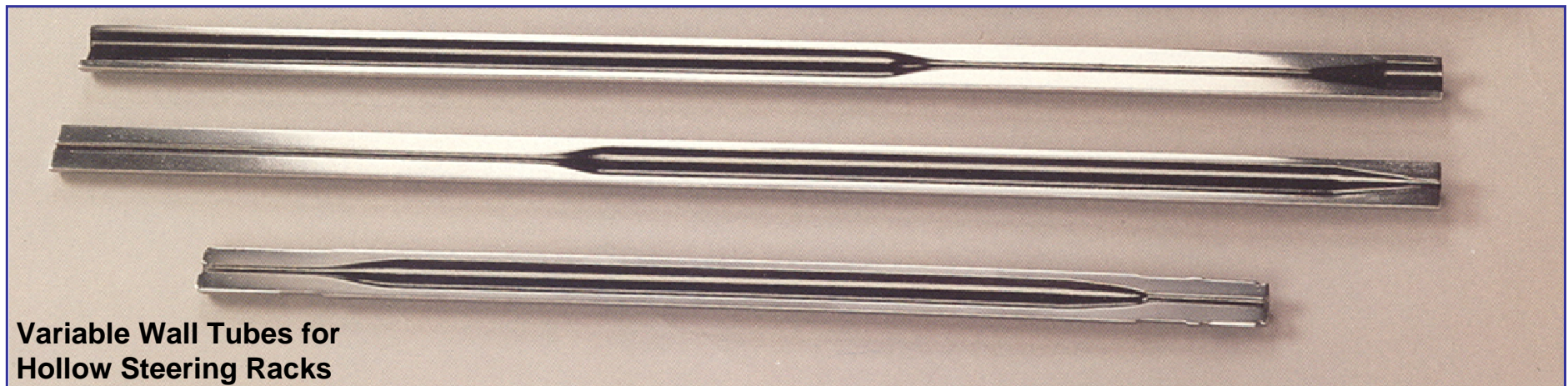
Hollow Half-Shaft

Our Product Portfolio

(Safety Critical Components)

VARI-LITE®, Tubular Products:

- **Hollow Steering Rack**

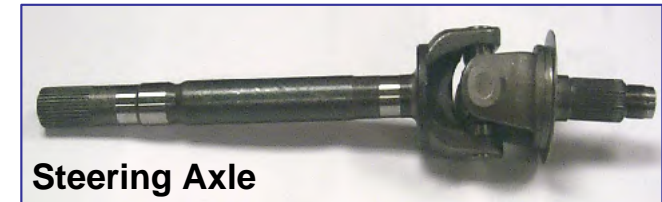


Low Inertia

Our Product Portfolio

(Safety Critical Components)

- Rigid and Steering Solid Axle Shafts
- One and Two Piece Differential Cases
- Steering Knuckles
- King Pin Yokes
- Spindles
- Specialty Products

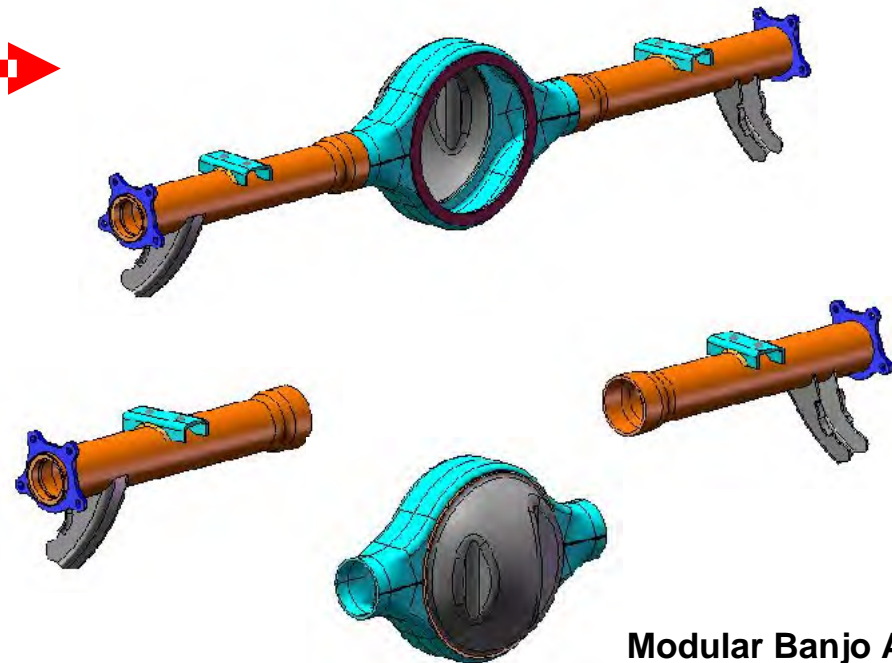


Other Applications

- Modular Banjo Axle Housing



Traditional Banjo Axle



Modular Banjo Axle

Other Potential Applications

- Tubular Torsion Bar
- Transmission Components
- Gearbox Shafts
- Stator Shafts
- Stabilizer Bars
- Steering Columns and Racks
- Railcar Axles
- Artillery Nose Cones



Transmission Stator Shaft



Tubular Steering Rack



Railcar Axle



Artillery



Value Added Technology

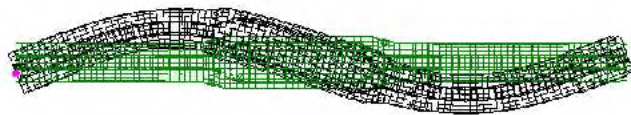
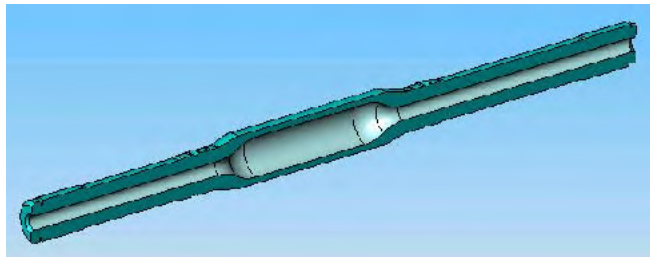
Cost Effective Processes

- **Cold Forming Process (Room Temperature)**
- **Fast Forming Process**
- **Flexible Process, Low Cost Tool Changes, Wide Range of Products**
- **Near Net Shape Forming, Less Machining**
- **Safeguard from Future Steel Price Hikes,
Minimizing Effects of Steel Pricing Increases:**
 - Less Steel Consumption
 - Our Technology Allows the Use of a Variety of Straight Carbon and Alloy Steels

Our Product & Process Design

Design

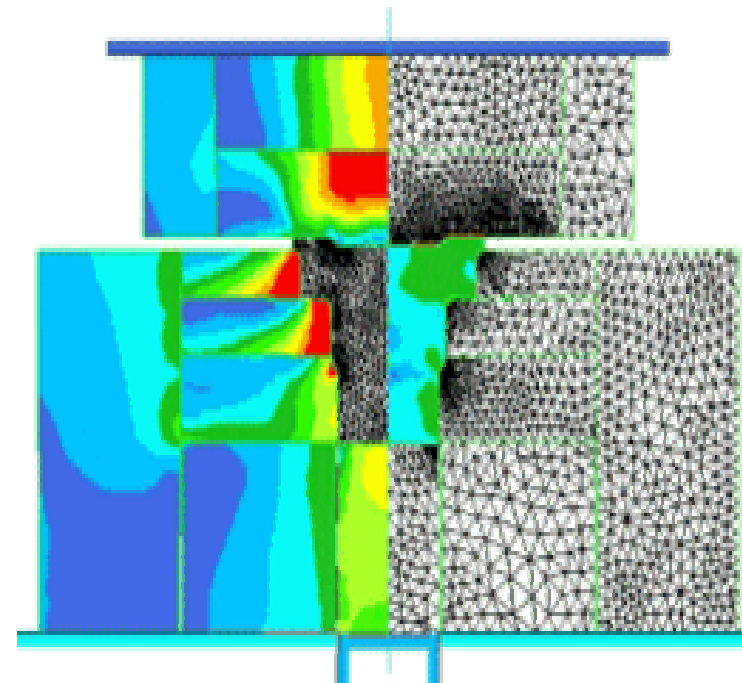
- 3D Modeling
- FEA
- Optimization



Value: 6.017
 Frequency: 1600.8/s
 Maximum Value: Not Available
 Minimum Value: Not Available

Cold & Warm Metal Forming

- Advanced 3D Metal Forming Simulation (Forge 3)
- Fully Automated Coating System
- Fully Automated Horizontal and Vertical Presses



Manufacturing Processes

Advanced Welding Processes

- Friction Welding
 - Inertia Friction Welding
 - Direct Drive Friction Welding
- Fully Automated / Robotic Welding Machines
 - Gas Metal Arc Welding (GMAW)
 - Flux Core Arc Welding (FCAW)
 - Resistance Spot Welding (RSW)
 - Resistance Projection Welding (RPW)
- Torches are Arc Data Monitored
- Simultaneous Engineering
 - Optimized Brackets and Weld Joints
 - Weld Cell Simulation



November 2008

Manufacturing Processes

Precision Machining

Fully Automated CNC

Turning, Boring, Milling, Drilling,

Broaching, and Grinding

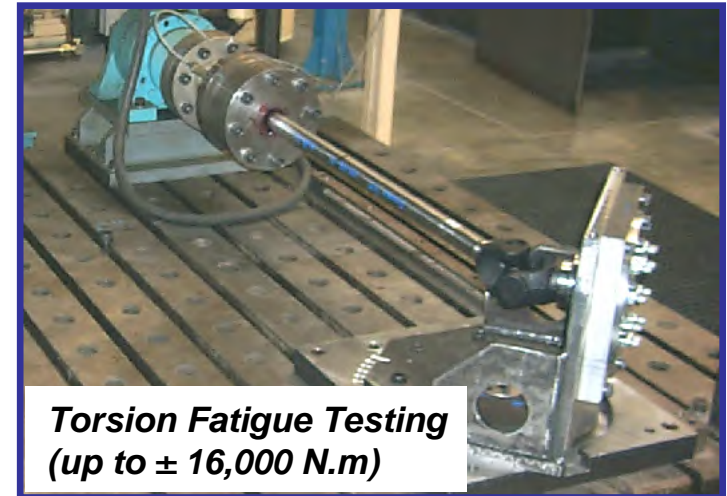
Gear & Spline Forming/Machining

Induction Hardening



Design Validation, Testing

Torsion Fatigue Testing
Ultimate Torsion Testing
Material Testing
Beam Fatigue Testing

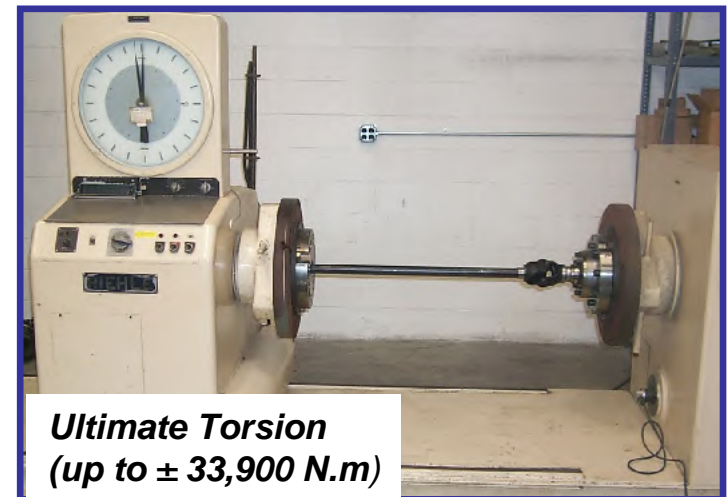
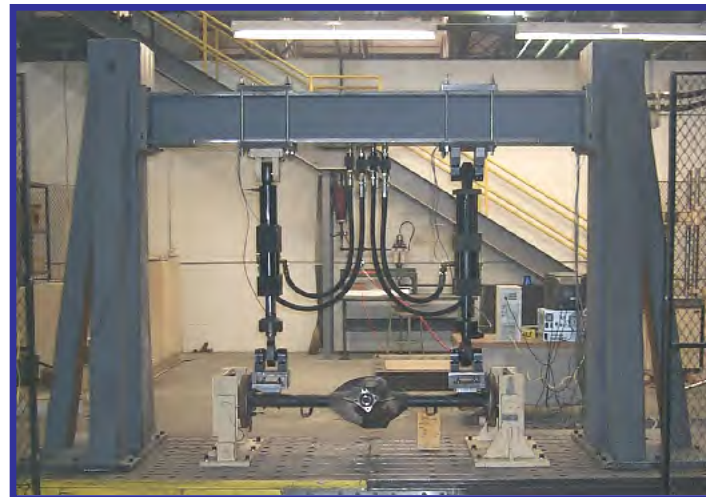


Torsion Fatigue Testing
(up to $\pm 16,000$ N.m)



Material Testing
(up to $\pm 89,000$ N)

Beam Fatigue Test
(up to $\pm 178,000$ N)



Ultimate Torsion
(up to $\pm 33,900$ N.m)

Inspection



MICROSCOPES



METALLOGRAPHS



MICROHARDNESS TESTERS



CMM'S



HARDNESS TESTERS



OPTICAL COMPARATOR

Metrology & Metallurgical Labs

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