

ALD Heat Treat Services 2023

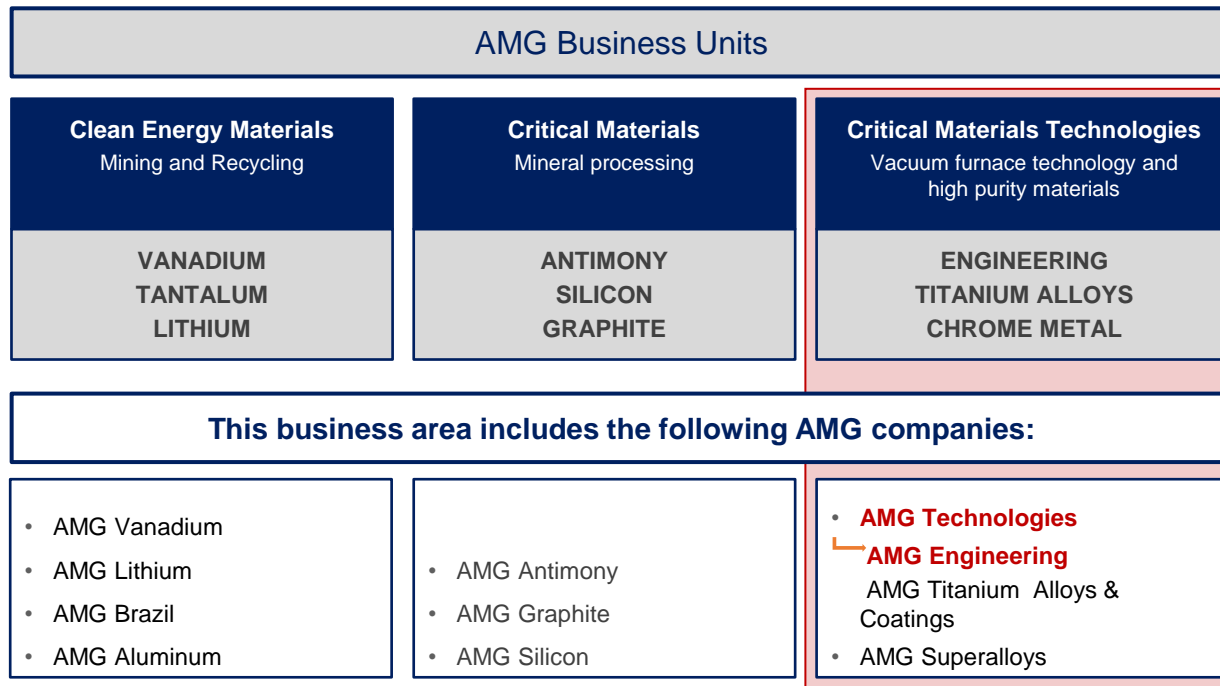
Agenda

Welcome / Introductions

- ALD Company Overview
- Why Chose ALD?
- ALD Expertise
- Total Cost Advantage
- Stellar Quality History
- Contacts
- Representative Parts



AMG Advanced Metallurgical Group N.V.



- Approx. 3,000 employees
- 937 m US\$ annual revenues in 2020
- Founded in the Netherlands in November 2006, IPO July 2007, Euronext listed
- Production facilities in Germany, UK, France, U.S., China, Mexico, Brazil, India, Sri Lanka, Mozambique

AMG Advanced Metallurgical Group N.V.

AMG Critical Materials Technologies

AMG Technologies

AMG Engineering



The world's leading manufacturer of vacuum equipment for vacuum metallurgy and heat treatment:

- Vacuum remelting
- Plasma melting
- EB-melting
- Induction melting
- Powder production
- Sintering
- Precision casting
- Turbine blade coating
- Solar silicon crystallization
- Vacuum heat treatment
- Vacuum case-hardening with gas-quenching

AMG Titanium Alloys



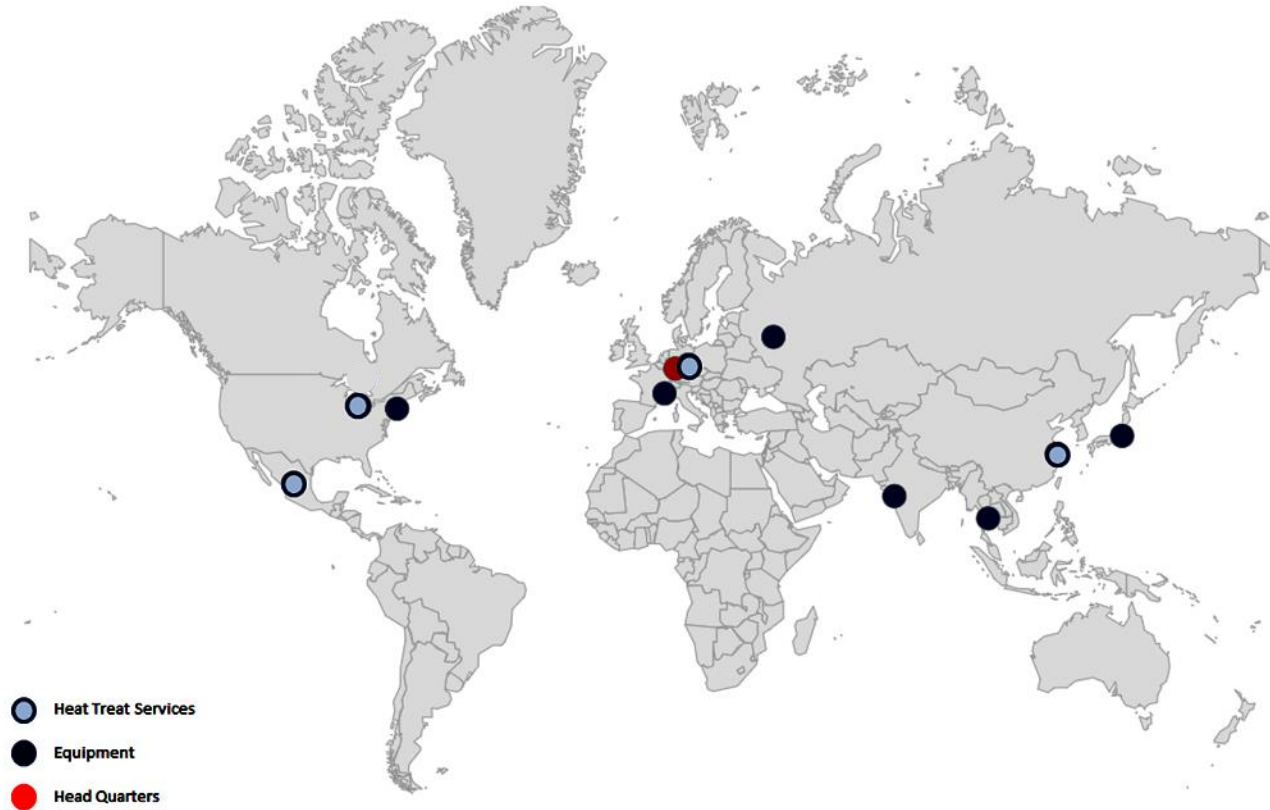
AMG Titanium Alloys & Coatings produces specialty titanium and super alloys, coatings, vanadium chemicals and powders at its facilities in Nuremberg, Germany.

AMG Superalloys



Based in Rotherham, UK, AMG Superalloys UK is a highly specialized manufacturer of specialty products to the aluminum, steel, superalloy, hard-facing, welding and glass industries.

AMG ENGINEERING – Locations



Europe

- Hanau, Germany
- Limbach-Oberfrohna, Germany
- Grenoble, France
- Moscow, Russia

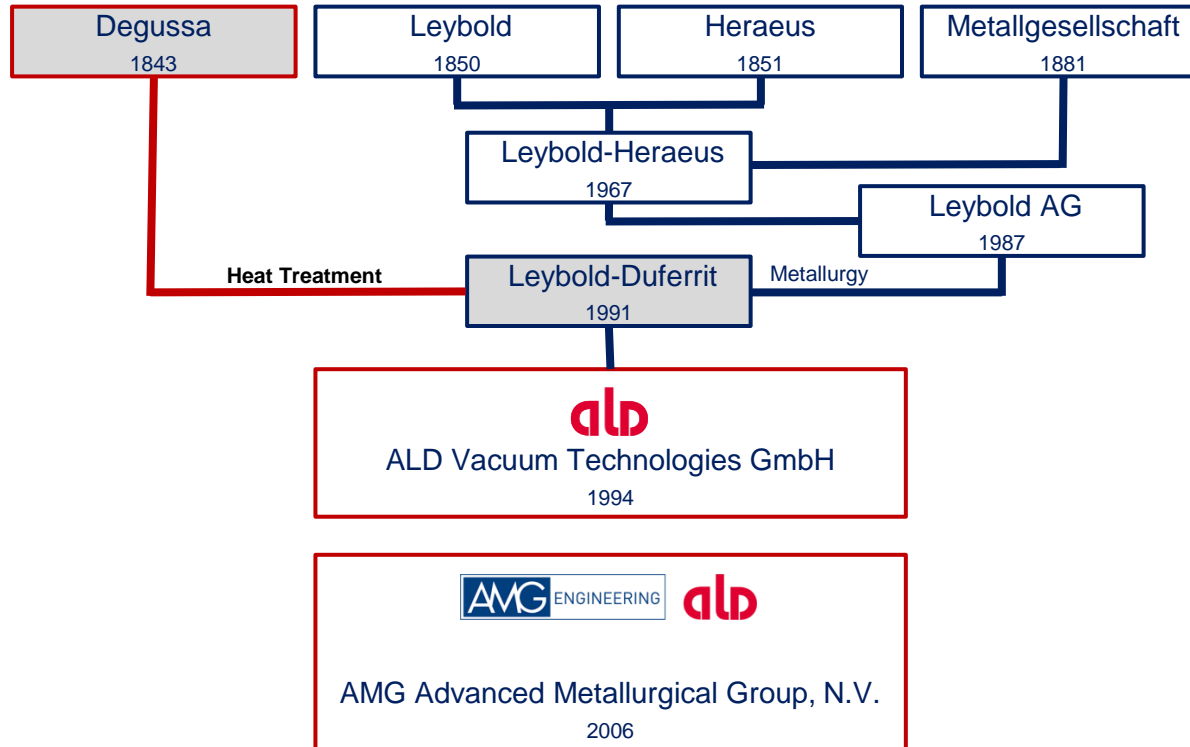
America

- Port Huron, MI, USA
- East Windsor, CT, USA
- Ramos Arizpe, Mexico

Asia

- Mumbai, India
- Suzhou, PR China
- Tokyo, Japan
- Bangkok, Thailand

AMG ENGINEERING



- Individual solutions for vacuum metallurgy and vacuum heat treatment sector
- Worldwide care and maintenance service of ALD high-quality equipment for their entire lifecycle.
- ~ 850 employees
- Engineering facilities in Germany, France, U.S., India and China
- Four heat treatment service centers (HTS) in Germany, the U.S., Mexico, and China
- Owns 63 patent families

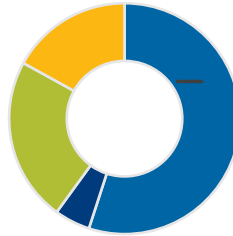
AMG Engineering – Key figures 2020

Revenue by Regions



Americas	39 %
Germany	12 %
Europe	15 %
Asia	34 %

Revenue by Markets



Energy	17 %
Transportation	55 %
Infrastructure	5 %
Special metals, Chemicals	23 %

Key figures: (31.12.2020)

Revenue: 224,4 EU€ m

Employees: 807

Installed systems (ALD):

- Asia: 40 %
- Europe: 40 %
- Americas: 20 %

AMG ENGINEERING – Business Segments

Engineering

Metallurgy



Heat Treatment

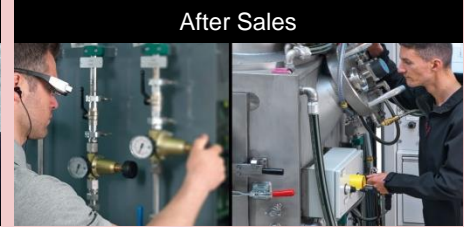


Services

Automation & Industrial IT



After Sales



EB Melting Services



Heat Treatment Services



AMG ENGINEERING – Products

INVESTMENT CASTING



VAR-SM
VIM-IC
LEICOMELT

POWDER ATOMIZATION



VIGA
EIGA

THERMAL BARRIER COATING



EB/PVD
Smart Coater

VACUUM INDUCTION MELTING



VIM
VID
VIDP

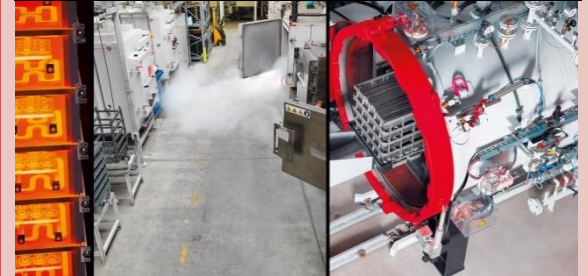
REMELTING & REFINING



EB-CHR
PAM

ESR
VAR

VACUUM HEAT TREATMENT



MonoTherm
DualTherm

SyncroTherm
ModulTherm

VKP (Sintering-HIP)
Special Furnaces

ALD HTS Global Footprint

Port Huron US



ALD HT HEADQUARTERS
Hanau, Germany



Limbach-Oberfrohna, Germany



Ramos Mexico



Central Mexico
Considered 2023



Suzhou, China
September, 2021



ALD VACUHEAT Limbach-Oberfrohna, Germany

Established 1999/2000

Technologies/Services:

- LPC & HPGQ (ModulTherm®, VZKQ)
- Tempering
- Brazing
- Annealing
- De-Oiling

Capacity:

- 3 ModulTherm® systems with 14 treatment chambers
- 3 Dual chamber furnaces
- Various other pre- & post processing facilities

Production Record:

>150 Million Injection Components

- (i.e. approx. 40 Million Cars)
- 0 Field ppm since 2000 SOP
- ~ 50 Employees

Limbach-Oberfrohna, DE - Equipment



ModulTherm-4 System with individual Vacuum pump sets



De-Oiling Furnace (for PM Parts)

ALD TT Port Huron, MI United States

Established 2006 “Sister Plant” of Ramos Arizpe

Technologies/Services:

- LPC & HPGQ (ModulTherm®)
- Washing / Pre-Oxidation
- Tempering / Gas Nitriding
- Ferritic Nitro Carburizing (FNC),
- Abrasive After Treatment (Shot Peen/Blast)
- Cryogenics

Capacity:

- 4 ModulTherm® Systems with **24** treatment chambers
- 2 Dual chamber furnaces & 3 nitriding furnace
- Various other pre- & post processing capability

Production Record:

>10 Million Automatic Transmissions

(up to ~5,500 Transmissions/Day... 60-70 Tons/Day)

- Field ppm since 2006 SOP
- ~55 Employees



Port Huron, US – Equipment



ModulTherm-4 Furnace System



Eddy Current Testing



Metallurgical Lab
(Hardness/Microstructure)

ALD TT Ramos Arizpe, Mexico

Established 2008 “Sister Plant” of Port Huron

Technologies/Services:

- LPC & HPGQ (ModulTherm®)
- Gas Nitriding & Ferritic Nitro Carburizing (FNC)
- Washing, Pre-Oxidation, Tempering
- Abrasive After Treatment (Shot Peen/Blast)
- Cryogenics

Capacity:

- **3** ModulTherm® Systems with **17** Treatment Chambers
- **1** VZKQ Dual Chamber & **1** Nitriding Furnace
- Various other Pre & Post Processing Facilities
- Extensive Equipment Service Capabilities

Production Record:

>7 Million Automatic Transmissions

- 0 Field ppm since 2008 SOP

Ramos Arizpe MX - Equipment



ModulTherm-7 Furnace System



Nitriding Furnace
(Payload 2.5 tons)



Abrasive Process



Cutting Lab

ALD HTS in China

Equipment available in phase 1 :

- 1 ModulTherm® system with 6 treatment chambers
- 7 Temper furnaces
- 2 Industrial washer
- 3 Pre-oxidation furnaces
- Cryogenic units (upon request)
- Metallography and related equipment

As expert in vacuum heat treatment we offer :

- Low Pressure Carburizing (LPC)
- High Pressure Gas Quenching (HPGQ) with N_2 / He
- Vacuum Processing
 - Neutral hardening, brazing, annealing
- Pre-cleaning
- Tempering
- Cryogenics (upon request)
- Rust protection after treatment
- Metallurgical analysis
- Heat treatment consultancy
- Certified quality management

Wujiang Economic and
Technological
Development Zone

Suzhou, CN - Equipment



ModulTherm-7 Furnace System



Why Choose ALD?

World Leader in LPC/HPGQ with 35 Years of Operational Experience
>1 Billion parts processed with 0 field ppm's

- Delivering Minimal and Predictable Distortion Control
- Quality Control: (GM Supplier Quality Excellence Award 8 consecutive years)
- Traceability; Individual part traceability is possible (2D matrix pre-heat treat)
- On time delivery with quick turn around times
- Root cause analysis expertise
- Fast response for development
- Unique R&D capabilities



Where is ALD's Expertise?

- Any Parts requiring low distortion & superior quality control
 - Gears for automotive and all other applications
 - Driveline systems (Joints, Cages, Tripods, Spiders)
 - Cam shafts and sliding cams
- Powder metal parts (e.g. Gears for automotive powertrain systems)
- Shafts and crank shafts
- Thin walled parts (synchronizer rings, actuator components, etc.)
- Parts with blind holes
- Fuel injection parts
- Anything hard to clean / parts with higher cleanliness requirements



Where is ALD's Expertise?

Process Development

The ALD Engineering team works hand in hand with our customer's Engineering team to develop processes yielding optimum results.

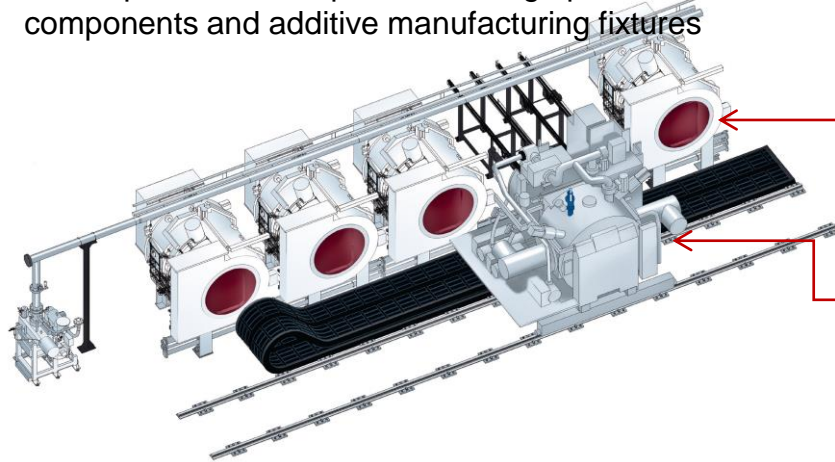
Trial loads for various transmission and driveline projects

	Port Huron	Ramos
2019:	374	319
2020:	339	307
2021:	379	372 (Steel), 218 (AL)
2022:	44 (as of mid-February)	

What we do and How we do it

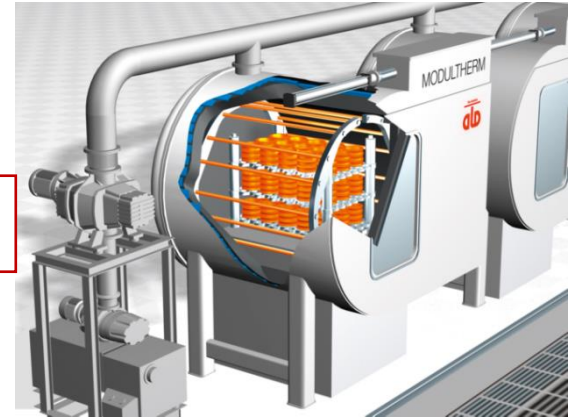
ModulTherm® (LPC & HPGQ)

- Best-in-class for superior distortion control
- Elimination/minimization of hard finishing of processed parts
- Capability for Helium or Nitrogen quench
- Cryogenic processing in place for specific metallurgical requirements (no retained austenite)
- Development trials in process for high performance eDrive components and additive manufacturing fixtures

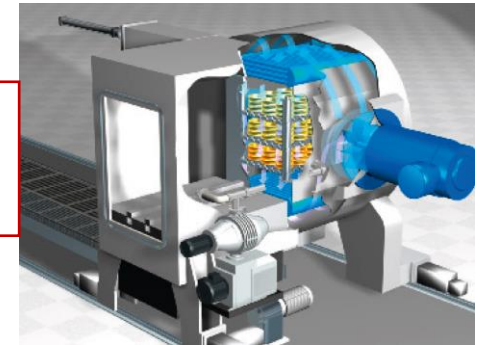


Treatment Chamber

Low Pressure Carburizing (LPC)



High Pressure Gas Quench (HPGQ)



Shuttle Module
Transport and
Quench Chamber

What we do and How we do it

Nitriding / Ferritic Nitro Carburizing (FNC)

- Low temperature process for minimal distortion
- Used where a hard wear resistance surface is required
- Cost effective, large loads, long cycle times



ALD's Total Cost Advantage

Conventional Process Chain



ALD Streamlined Process Chain

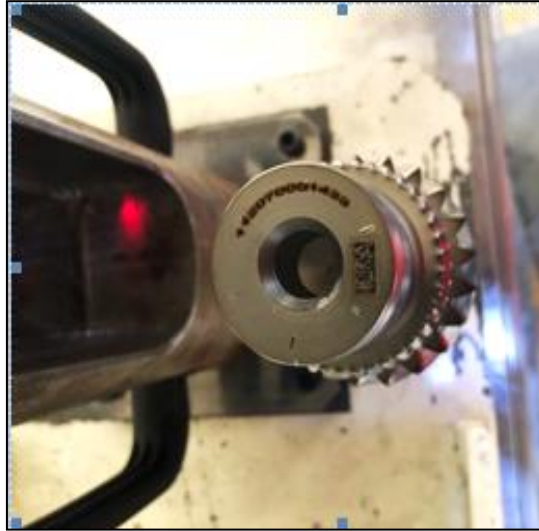


Benefits of HPGQ vs. Liquid Quench

- Reduced Distortion
- Clean Surfaces
- Better Fatigue Resistance
- Minimal Variation (load to load)
- Fewer Steps ➤ Less Cost
- Clean Shiny Parts
- Environmentally Friendly > 99%
- Flatness & Additional Distortion Control

Individual Part Traceability

- Individual parts must be marked so that traceability from the steel heat lot through the complete heat treat, shot peen, process.
- Laser etching process produces man and machine readable codes



Certificates, Awards & Highlights

Certified to:

- IATF 16949 : 2016
- AS9100D*
- ISO 9001 : 2015



Compliant to:

- CQI-9
- OHSA 18001
- ISO 27001
- ISO 14001



*Recommended for Continued Certification

GM Supplier Quality Excellence 8 consecutive years



- Safety: On Average <1 LTA/year
- Low employee turnover in all facilities
- International Engineering Network (GER, US, MX, CHN) including unique expertise in the world

Proven Production Quality

- **ALD Port Huron:**

Processed > 233M parts for GM in PH @ 0 field ppm since 2006

- Supported > 10M transmissions
- Processed > 176M parts for other customers in PH @ 0 field ppm since 2006

- **ALD Ramos:**

Processed > 120M parts in Ramos @ 0 field ppm since 2008

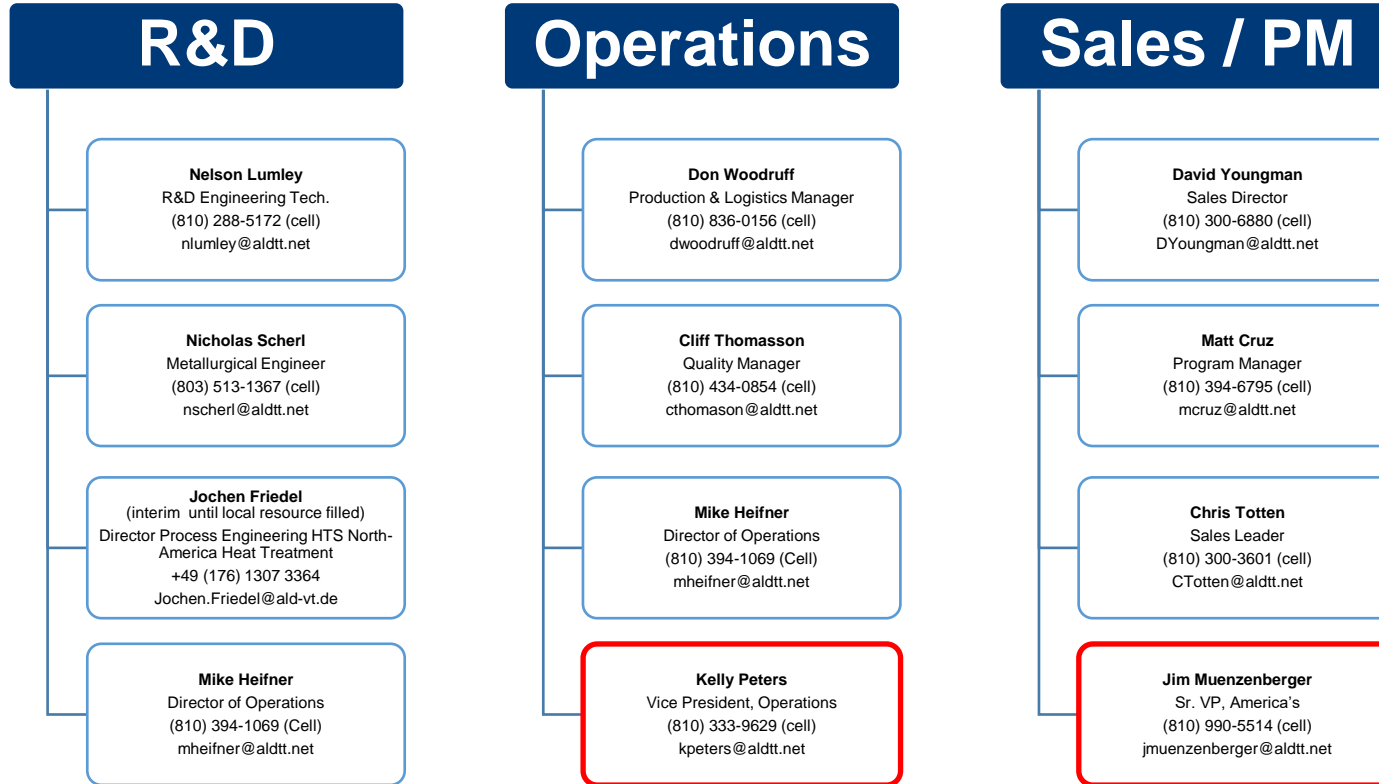
- Supported > 8M transmissions

- **ALD VACUHEAT Limbach-Oberfrohna:**

Processed > 200M high pressure fuel injection nozzles

- 0 field ppm since 2000

ALD Port Huron Support Team



ALD Ramos Support Team

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Samples of typical production parts

Back Up: Examples to consider

Sample of Heat Treatment Parts (I)



Gears



Shafts



Driveline Systems



Back Up: Examples to consider

Sample of Heat Treatment Parts (II)

Driveline Systems
Cages



Crankshafts



Spiders



Tripods



Sprockets



Pistons



Back Up: Examples to consider

Sample of Heat Treatment Parts (III)

Races



Couplings



Drill bits



Steering Nuts



Dies



Bearings



Back Up: Examples to consider

Sample of Heat Treatment Parts (IV)

Drive Transfer



Internal Gears



Arrow Heads



Injector bodies



Studs for Aircraft



Engine Lobes



Back Up: Examples to consider

Samples of Brazing Parts

Coolers/Heat Exchangers
(Automotive/Truck Appl.)



Axial Flow Compensators
(Non Automotive)



Thank You

