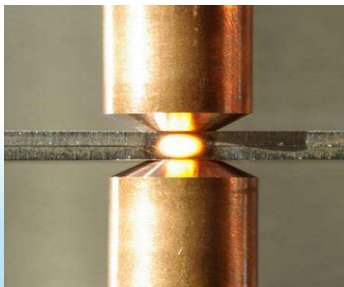




HARMS+WENDE HWH

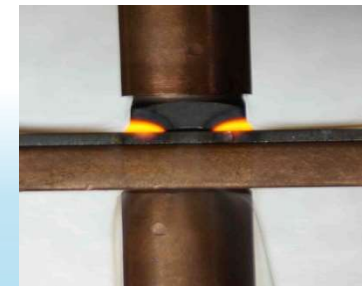


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**the best solution for every assignment in
resistance welding**

**young & innovative
since 70 years and fit for the future!**



competence in technical processes



Germany, Hamburg, Grossmoorkehre 9

Founded: 1946
Capital: 2,8 Mio. €
Headquarter: Hamburg-Harburg
Participation: 100% HWH-QST, Chemnitz
 100% Procon PAS, Willich
Management: Ralf Bothfeld - Managing director
Products: Control equipment for machinery, robots and welding application, friction welding, engineering
Services: Development, Manufacturing, Sales, Planning, Installation, Service, Project Management, Customized Solutions

**DEUTSCHLANDS
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2018**
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Installed User Base:
 ca. 180.000 Units
 ca. 6000 weld controllers/a

Turnover: ca. 26 Million € in 2019

Employees: 123, as follows
 34 Research and Development
 32 Production and Quality
 30 Sales and Support
 17 Administration and Trainees
 11 Purchasing and logistics

Companies target: The best possible solutions for customers' problems



Sales- and service locations of Harms & Wende Group:



Hamburg



Beijing



Willich-Anrath



Chemnitz



Karlsruhe

Harms & Wende sales- and service location west

Procon PAS

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- Solutions for automated applications.
- We care about your products.

Procon PAS

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D-47877 Willich-Anrath





Harms & Wende sales- and service location east

Company QS-Technologies GmbH | Chemnitz

We think in processes

Process containment as fundamental fact for constant quality and highest economical value.

Harms & Wende QST GmbH

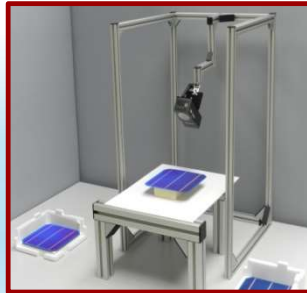
QualitätsSicherungsTechnologien

Nordstraße 25

D-09247 Chemnitz



PQS



PQS Vision



welding timers



welding heads



HWH-service

Branch Karlsruhe

Headquarter of development for user interface software and databases,
Industrie 4.0, software solutions

Coordination of research projects
Sales- and servicelocation south
Fairs and exhibitons



Harms & Wende GmbH & Co KG
Niederlassung Karlsruhe
Willy-Andreas-Allee 19
D-76131 Karlsruhe



Harms & Wende sales- and service location in China



Harms & Wende Welding (Beijing)



Harms & Wende Welding (Beijing) Ltd.
Guanghua Road No.16,
Zhangjiawanzhen, Tongzhou District
101113 Beijing
Republic of China



Business fields



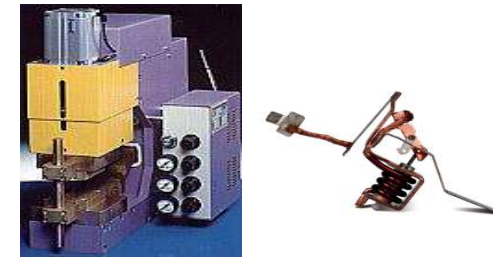
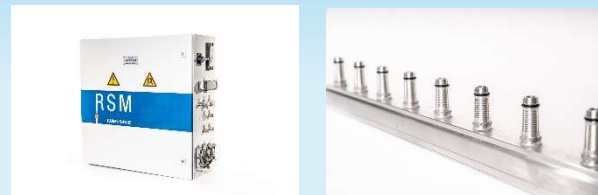
Automotive

Development and
production after your
specification



Industrial Solutions

Friction spot welding RPS
Friction welding

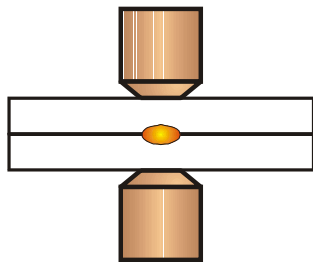


Microwelding

Engineering
Set up of parameters

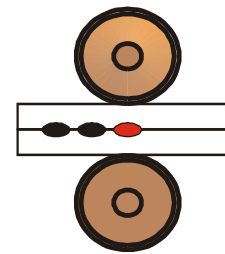
Harms & Wende product lines

spot welding



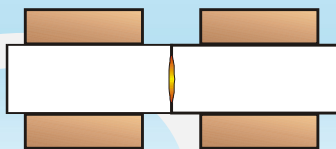
Serie WS, MPS 10
 Serie *Filius*
 Serie *Ratia43, Ratia73*
 Systems *iSpot* and *Primus*
 Inverterserie *GeniusMFI*
 Inverterserie *GeniusHWI*
 Systems *Sinius* and *Varius*

seam welding



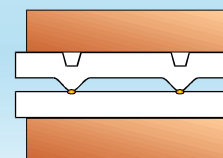
Serie WS, MPS10
 Serie *Filius*
 Serie *Ratia43, Ratia73*
 System *Sinius*
 System *Varius*

upset and butt welding



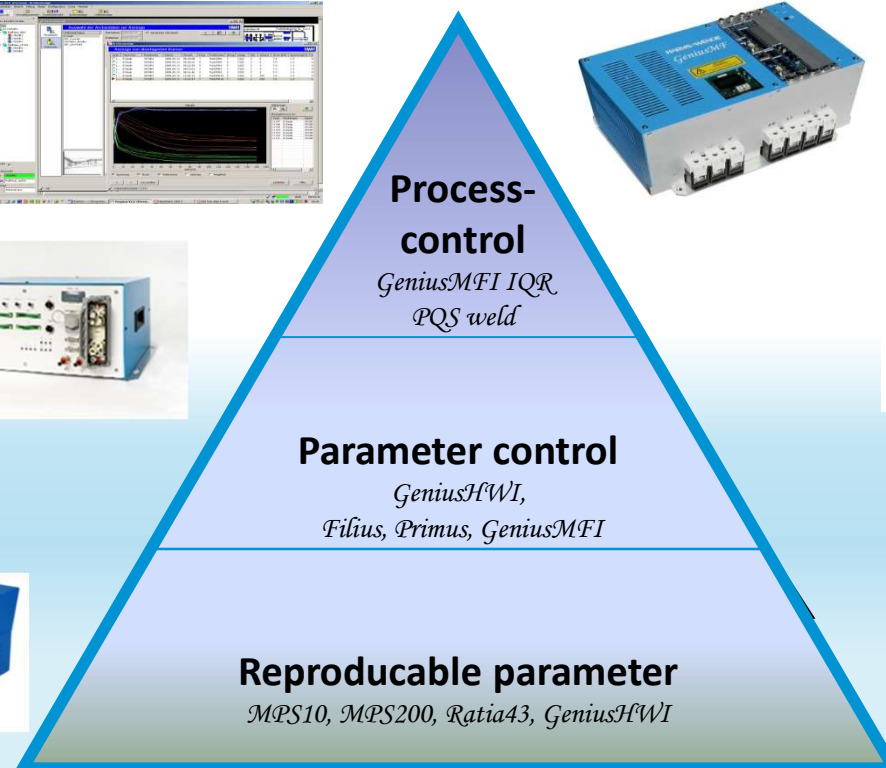
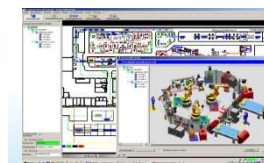
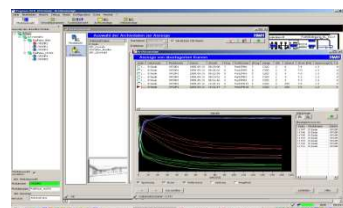
System *Sinius*
 System *Varius*
 LE 19 / LE 20

projection welding



Serie WS, MPS10
 Serie *Filius*
 Serie *Ratia43, Ratia73*
 Inverterserie *GeniusHWI*
 Systems *Sinius* and *Varius*

Harms & Wende product lines



Products for automotive

- Robot applications:
- Suspension welder (for hand guns):
- ZP systeme for pilot plants:
- Programming via **X**Pegasus

Genius mit IQR, AMF

Genius mit IQR

HWI2000 ZP, IQR



Products for industrial applications

- Systems with integrated programming and network solutions
- Timers and power sources in 50/60 Hz (AC) and 1000 Hz (MF)
- Different sizes and standards (Alpha, Beta und compact-size)
- Timers, processors, moduls and cabinets
- Power range appr. 100 Amps > 300 kA
- Series: *WS* and *PWS 3000*

MPS10 and *Filius*

Sinius & *Varius*

Genius with *Xcomand* / *XPegasus*



Products for micro welding

- Timer controls for 50/60 Hz (AC), 1000 Hz (MF) and 10.000 Hz (HF)
- Various feedback- and monitoring systems
- Free programmable sequences at system *Primus*

systems: *iSpot* *Sinius* *Filius* *Primus* *Genius*



References Harms & Wende

Examples (excerpt):

1. Automotive

Audi
BMW
Daimler
Ford
Opel/GM
Volkswagen
Volvo
Kia
.....



2. Machine builders

ARO
ASPA
AWL
CEA
Dalex
Düring
Nimak
Schlatter
.....



3. Line builders and suppliers

Benteler
Thyssen
Gedia
KUKA
Magna
Nothelfer
Linde & Wiemann
.....



4. micro welding

ABB
Electrolux
Technax
Siemens
SBT
EKS Keller
.....



Production at HWH

4-axis-CNC-machine for production of enclosures



Production at HWH

SMD production automat



Production of inverters

Production at HWH

**Production of welding
cabinets (enclosures)**



Examples welding cabinets automotive



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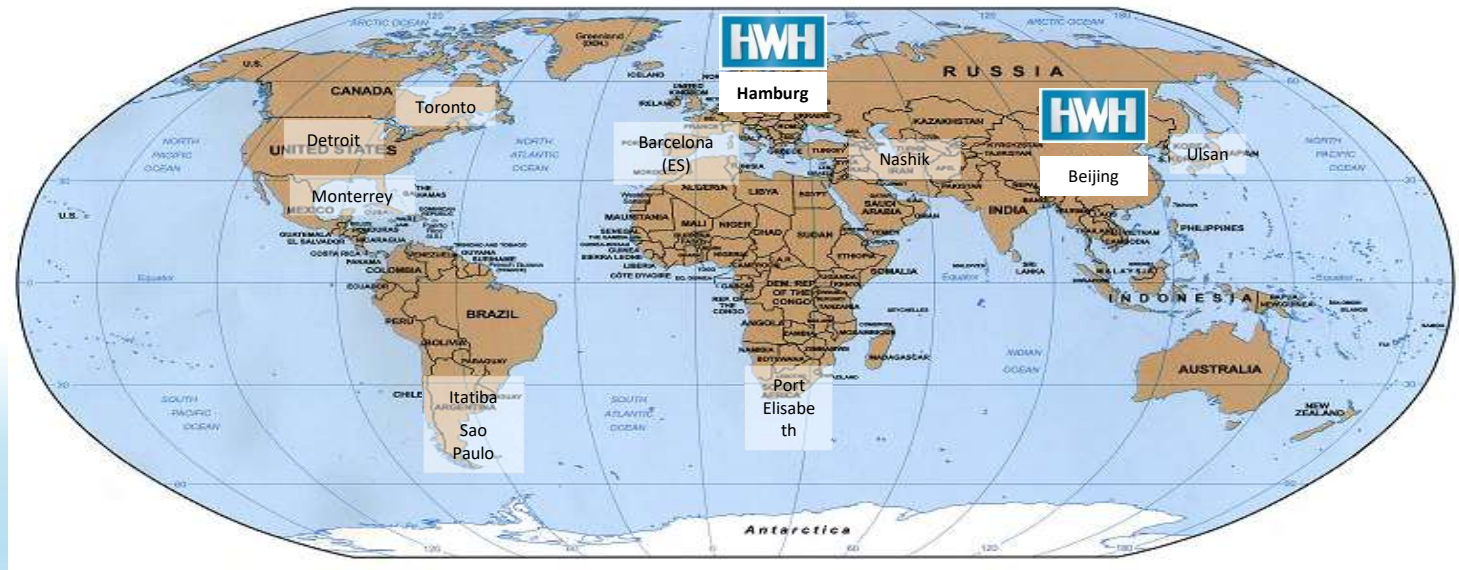
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- Spain
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- Turkey



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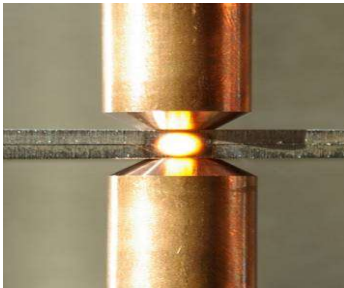
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- India
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- Taiwan

Afrika

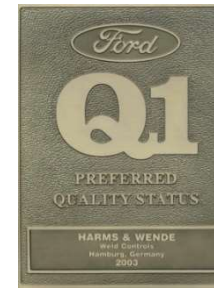
- South Africa



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**Wettbewerb
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in der Produkt-
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2. Preis



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System structure suggestion Kuka

In this section we describe a system for Kuka.



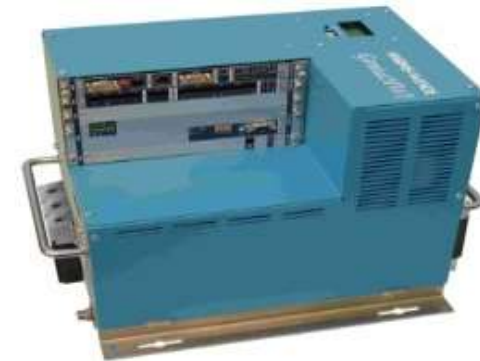
- Clean front panel design.
- Air cooled GeniusMFI408 or GeniusHWI408 600 A inverter.
- Air cooled GeniusMFI and GeniusHWI408 water cooled (outside panel).
- Multi Contact plugs for mains supply/power out.



- 600 A max output current
 - 400 to 480 V (50/60 Hz) mains supply.
 - Very compact power unit.
 - Forced air cooling.
 - Full Genius Professional function package.
- Status LCD display in front panel.
Messages, load, IP address, firmware version
 - Typical usage for spot weld applications.
 - Runs also in warmer environments up to ca. 120 F
 - Can be operated with GeniusHWI in one network.



- 600 to 3500 A max output current.
- 400 / 480 V (50/60 Hz) mains supply.
Two different models 400 and 480 V version
- Forced air and water cooling.
- Full Genius Professional function package.
- Status LCD display in front panel.
Messages, load, IP address, firmware version
- Typical usage for spot, projection and heavy duty weld applications.
- Master-Slave configuration available.
- Runs also in warmer environments up to ca. 120 F



- Available as Silver, Gold and Platinum version.
- Operates from Microsoft Windows XP and up.
- Standard PC/Laptop required or panel PC with full Windows running
- Silver version allows programming and monitoring.
- Gold version extends with database for weld data storage and extended monitoring.
- Platinum version extends the Gold version with server functionality to operate/view inverters from different line PCs.
- All versions provide a large language pack

Weld gun



Inverter

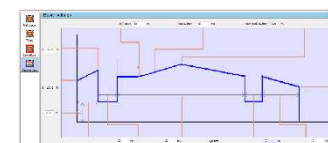


- Programming
- Message reset

Ethernet

- Inspector data
- Weld parameters
- Messages

XPegasus



Data storage

Recall data,
visualization

Current, Voltage

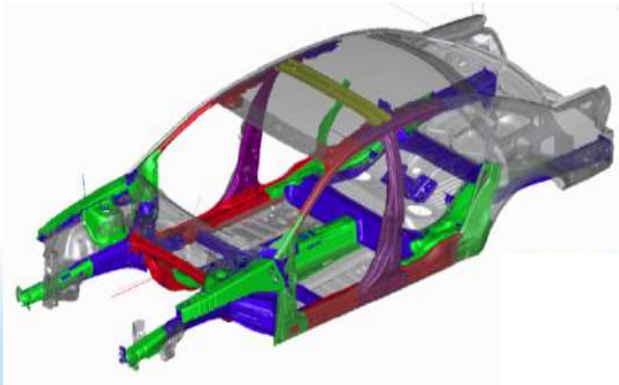
- **X**Pegasus is programming & visualization tool
- Database holds all weld data. Can be exported.
- If no database required inverter also runs without connection to **X**Pegasus.c

XPegasus SQL
database*

* Gold and Platinum version



The IQR weld cycle equals the standard cycle – keep it simple for the user.



Joining of steel materials with IQR – smart adaptive feedback joining

What are the challenges of joining steel?

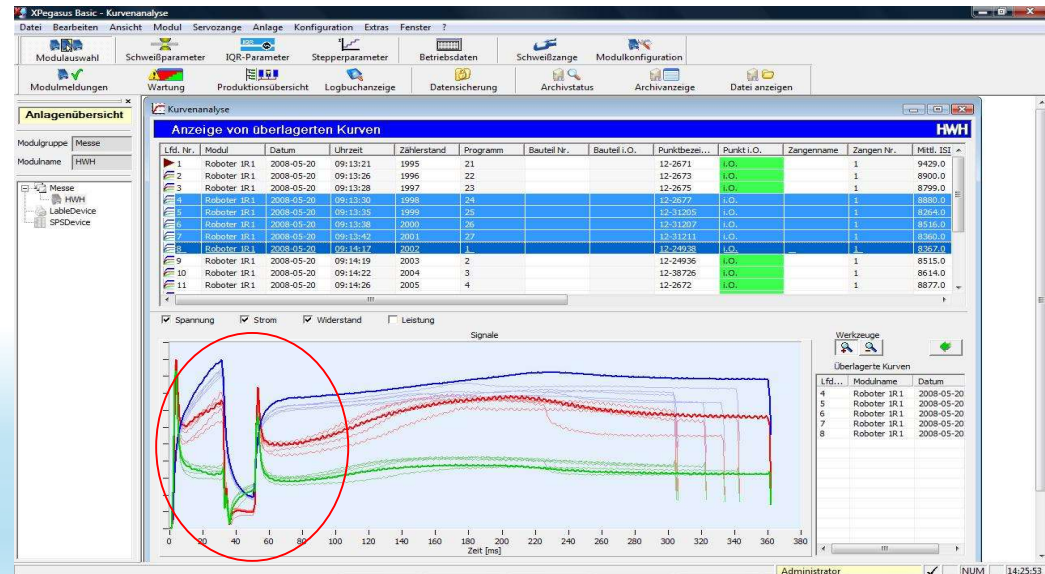
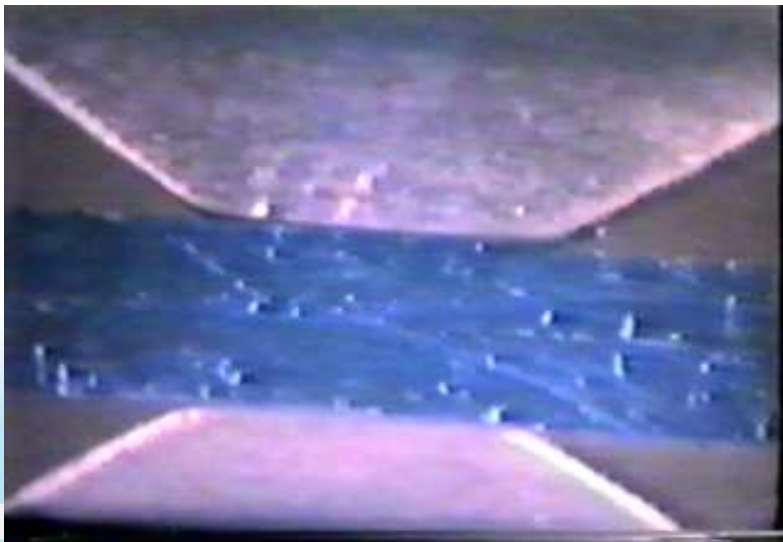
- Continuously new materials coming giving new demands.
- Any kind of material mixes.
- Process variations from the equipment side.
- Different electrical values lead to challenges.
- Process variations from different coatings.

How to address all this in typical 300-400 ms weld time?



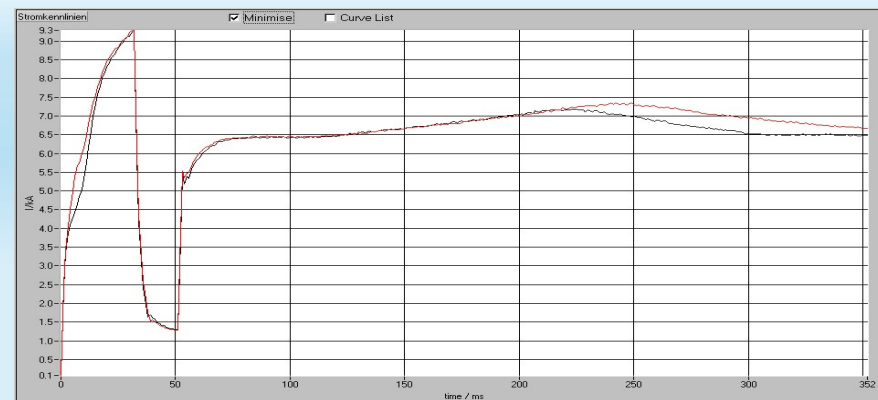
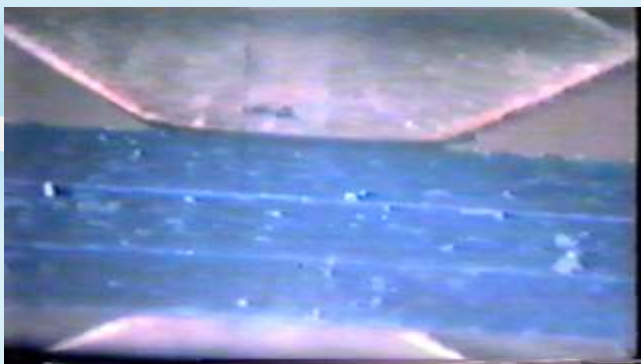
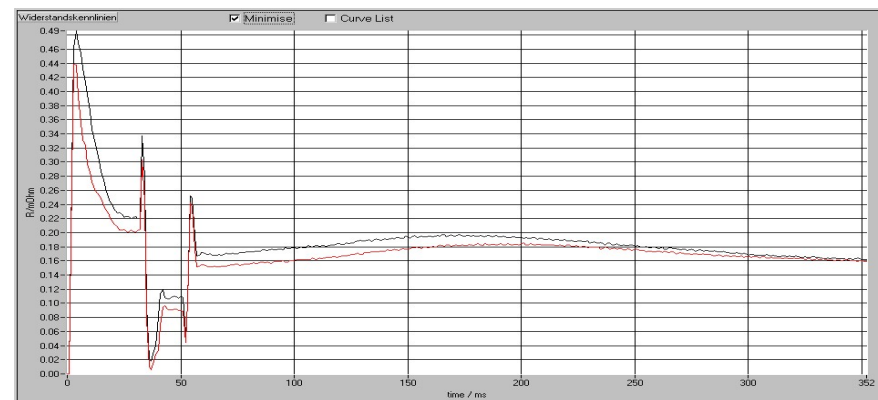
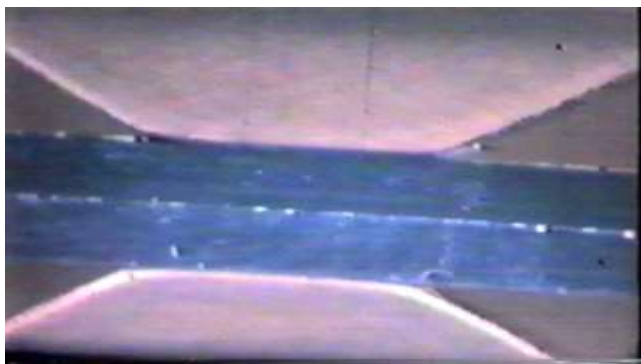
- IQR does logic reactions based on the resistance between the tips.
- IQR does not store any curve in memory rather that treats any spot as individual.

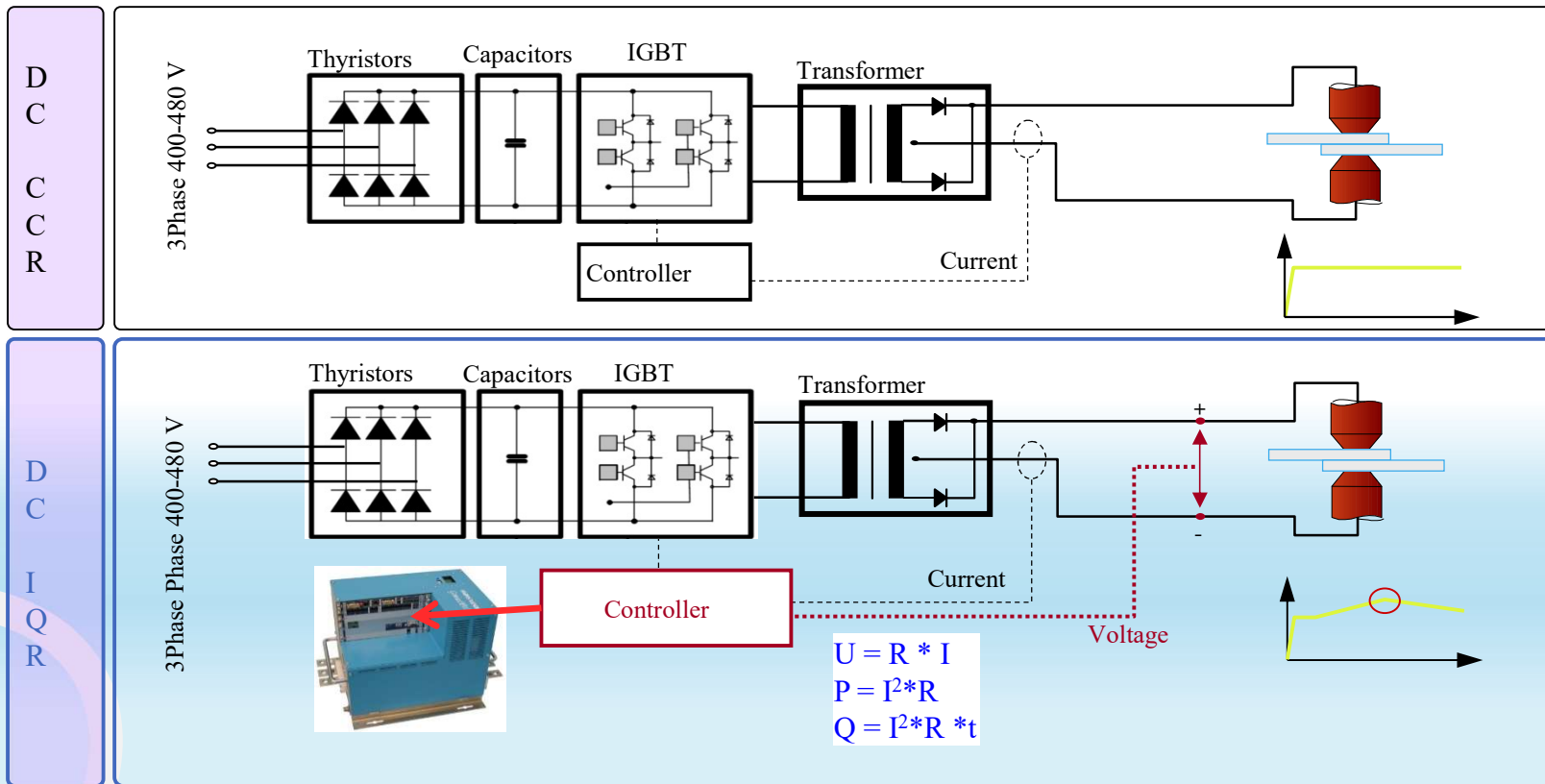
- IQR operates right from the beginning rather than making many trials before it operates.
- IQR operates on manual and robot guns equally.



Regulation through intelligent reaction on the physical variations of the material. During welding the natural parameter resistance is used.

Comparison of a 2 and 3 sheet combination

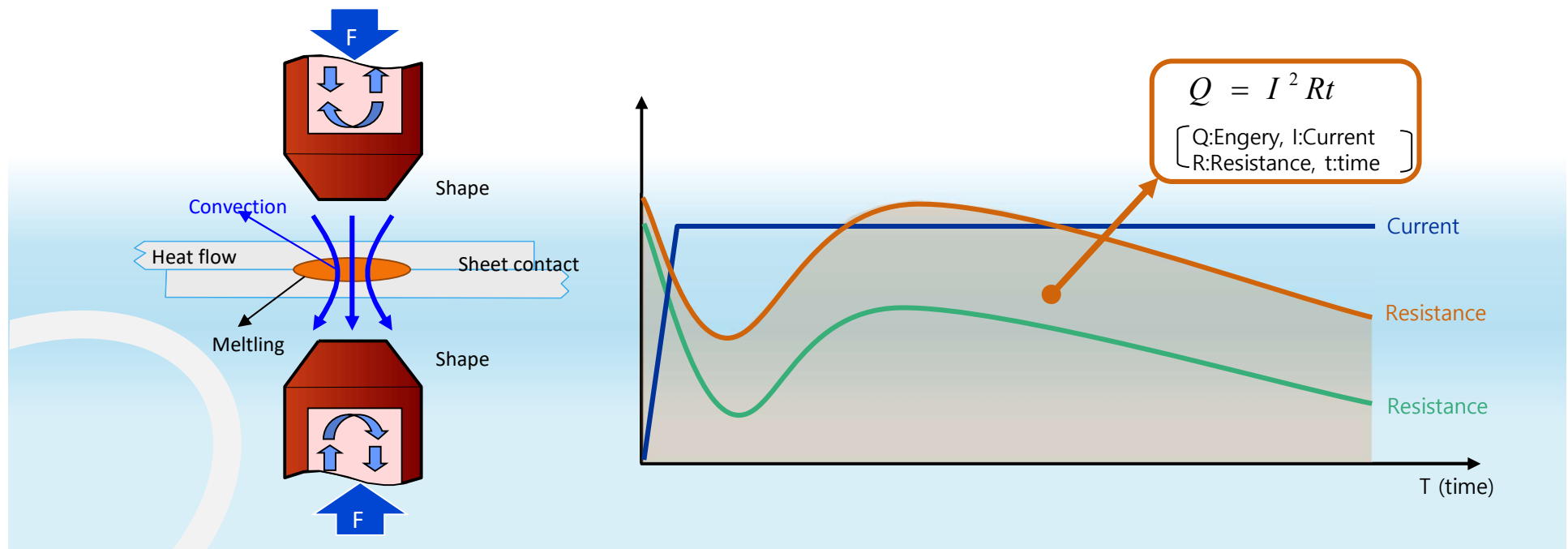


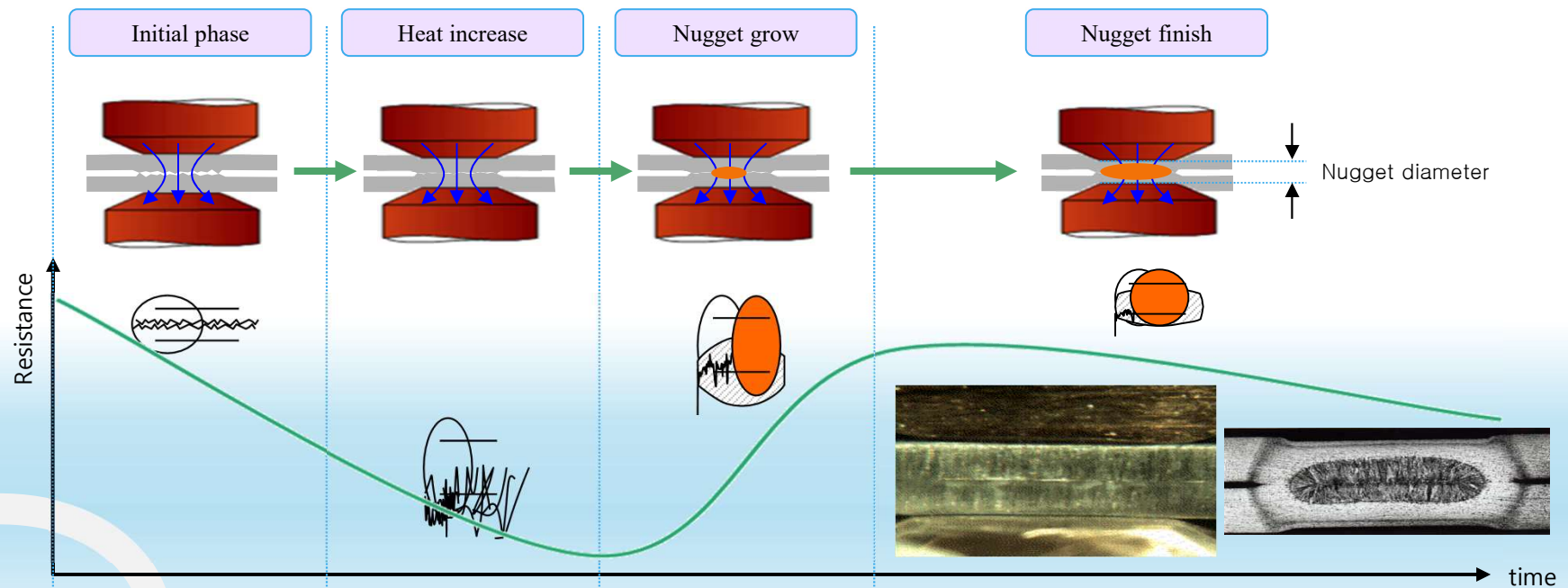


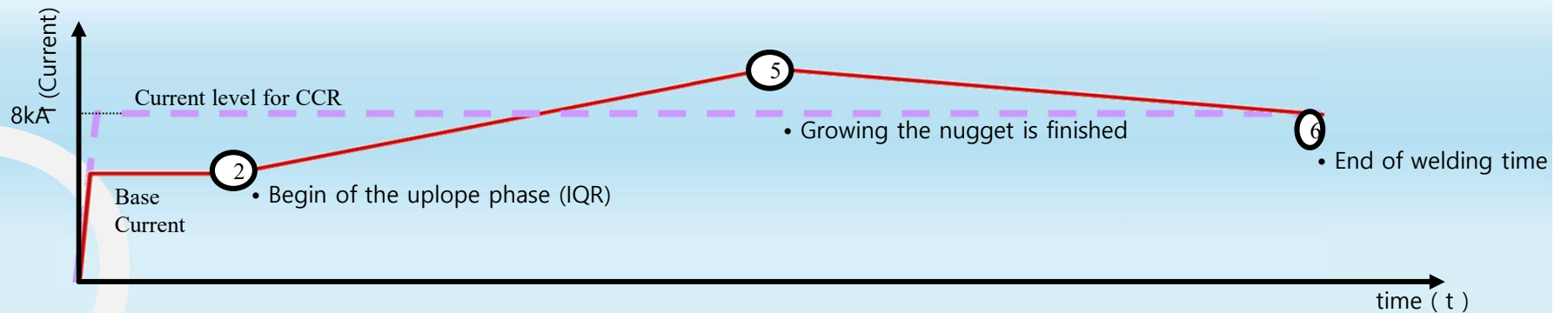
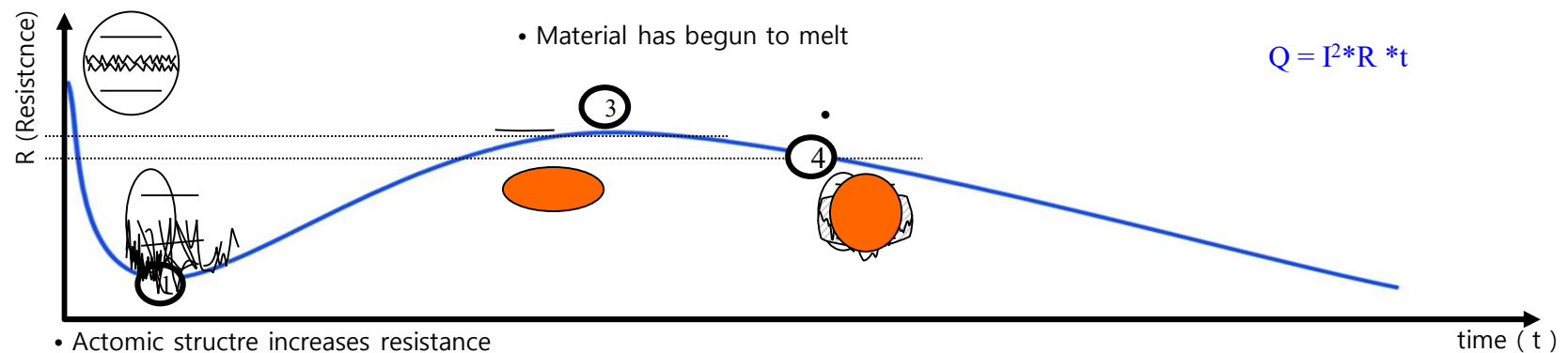
Energy equation

How does the heat flow?

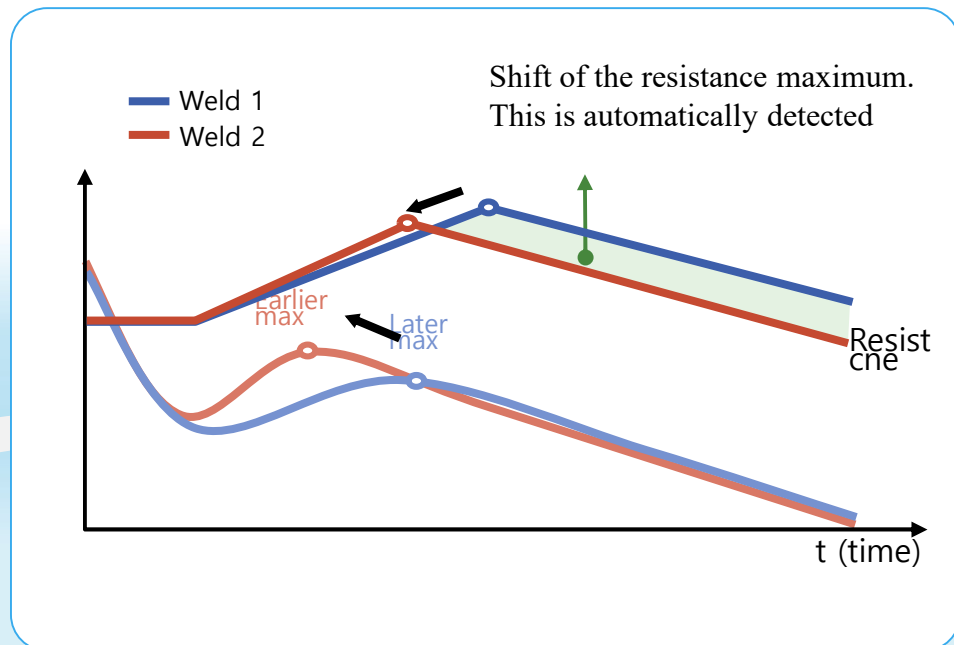
When current is sent through material it getting hot. Some portion of the heat is used to melt the material up, some is lost due to natural reasons. The energy in the spot is the surface below the curve.





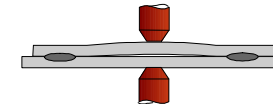
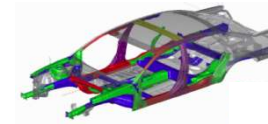


Early resistance maximum. When does this happen?

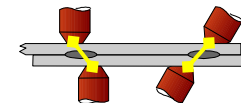


< Disturbances >

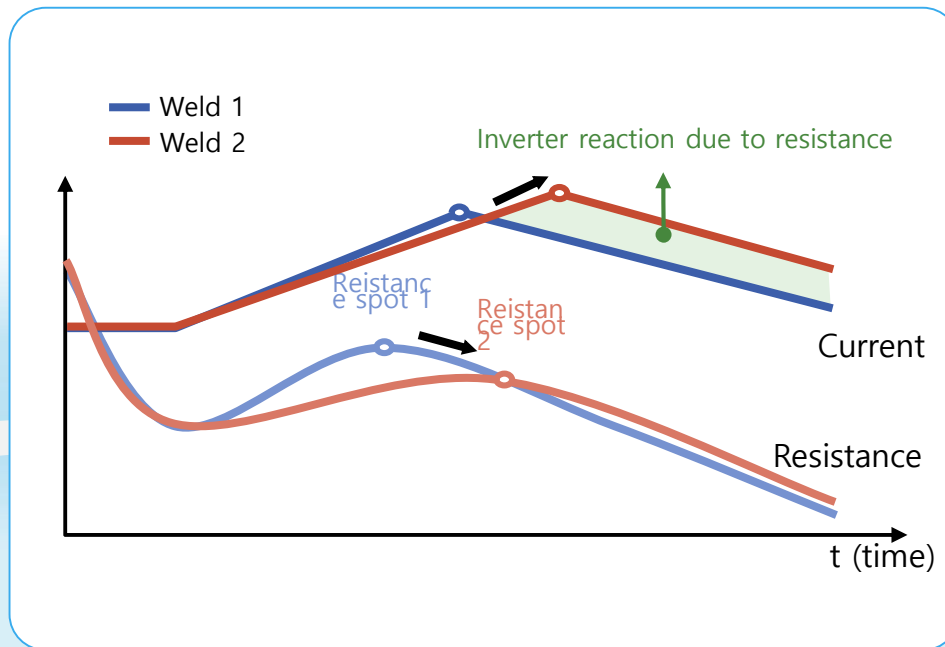
- ① Combinations(AHSS) ② Bending (GAP)



- ③ MIS-ALIGNMENT

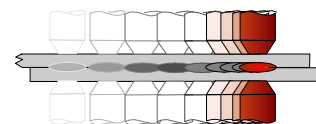


Early resistance maximum. When does this happen?

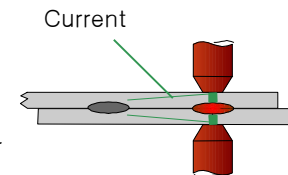


< Effects >

① Electrode wear



② Shunt



$$J = \frac{I}{A}$$

The current density describes this phenomenon of late maximum.



Aluminum Mode Classic AMC

What are the challenges of joining aluminum?

- Oxide layer non-predictible growth over time.
- Tendency to grain growth lead to rigid joints.
- Explosion like melting
- Sensitivity against particles from electrode material.
- Aggressivity against electrode material (Peltier effect).
- Low and continuously dropping electrical resistance.
- Soft material compared with i. e. steel.

How to address all this in typical 150 ms weld time?



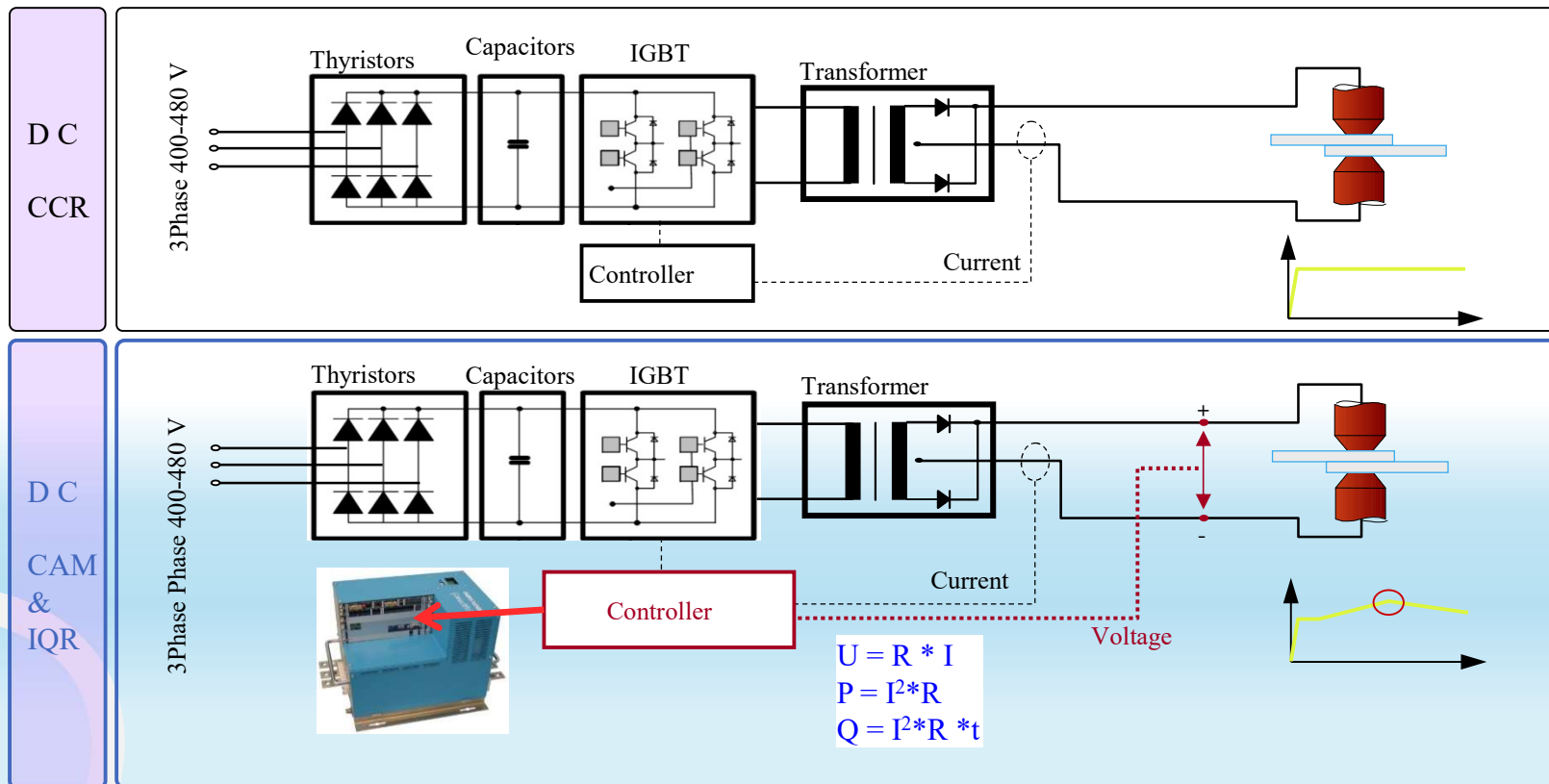
What aluminum types are we dealing with?

1xxx	> 99 % aluminum	70...190 ^N / _{mm²}
2xxx	Copper	190...570 ^N / _{mm²}
3xxx	Mangan	100...350 ^N / _{mm²}
4xxx	Silicium	170...380 ^N / _{mm²}
5xxx	Magnesium	100...450 ^N / _{mm²}
6xxx	Magnesium und Silicium	100...450 ^N / _{mm²}
7xxx	Zinc	220...700 ^N / _{mm²}

What is needed to solve the demand?

- Powerful inverter (typ 1600-2400A)
- Weld algorithms on the inverter
- Right gun and electrodes (1300 to 1800 lbf)
- Proper tip-dresser





The welding modes – by schedule

- **AMC – Aluminum Mode Classic (Aluminum)**
Software package to join aluminum material.

- **IQR (Steel materials)**

Adaptive welding package for steel materials running from mild steel to UHSS (Ultra High Strength Steel)

- **CCR – Secondary Constant Current Regulation**

Up to 7 seconds regulated current possible.

Inverter can change between all modes installed by schedule. -> flexible.

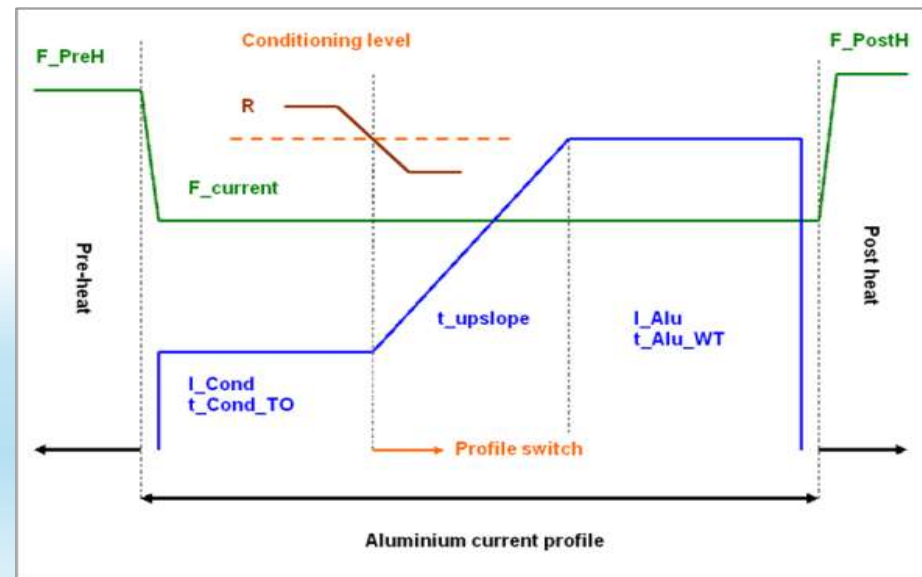


The Tool: MFDC inverter GeniusHWI

- Flexible configuration through software from factory.
- Later update possible at customers site.
- Suitable to run CAM and adaptive IQR welding for steel one unit.
- All major field bus systems available as EthernetIP or Devicenet.
- Available in wide power range from 80 to 600 KVA
(400 A to 3500 A max output current).



The AMC – welding mode



What does the CAM?

- Conditioning phase
 - Breaking up the oxide layer(s) = Process stabilization
- Upslope
 - Helping the gun to handle the expansion of the aluminum = avoidance of material loss = avoidance of expulsion
- High weld current
 - Fast heat input to melt up material = work against resistance drop
- Downslope
 - Relax the material = avoidance of cracks in the joint



What does the weld gun?

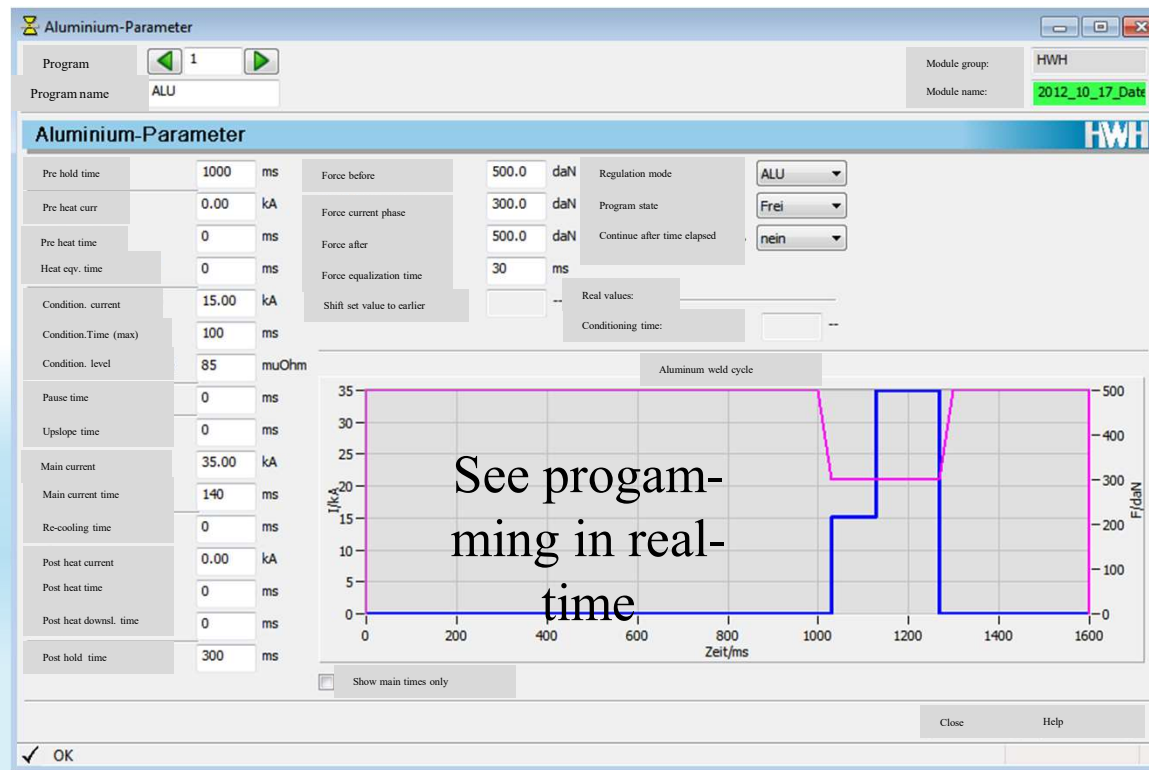
- Conditioning phase
 - Helps breaking through the oxide.
- Upslope
 - Use gun arm spring effect to work against expulsion.
- High weld current
 - Transfer energy to the new joint, keep the material between tips
- Downslope
 - Avoid grain growth of the material with constant high force

Typical force is as 1500 lbf and 1800 lbf (6000 – 8000 N)



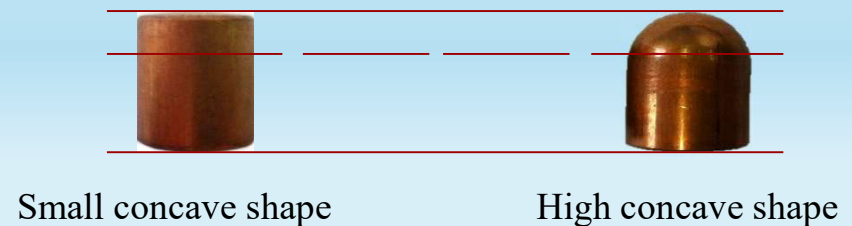
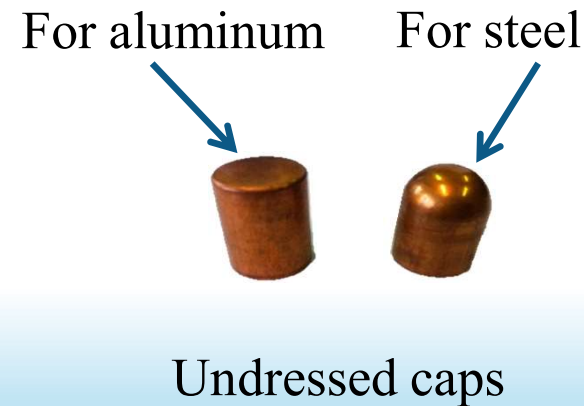
CAM implementation in XPegasus (HMI)

Top down programming
as standard schedule =
simple



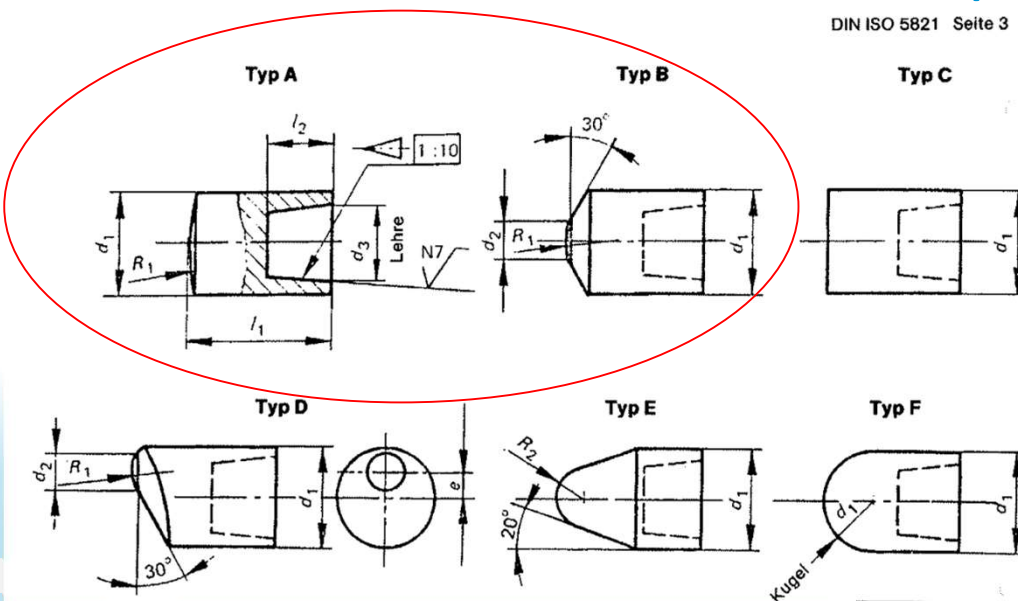
Electrode geometry

- Small concave shape prevents electrodes to penetrate sheets.
- Penetration is related to the soft material and high current.
- Electrode material: Cu – Cr- Zr and electrodes with aluminum alloy.
- Usage of a ball nose cap (steel) for aluminum will punch through.



Electrode forces related to its shape

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d_1 h11	d_2	$d_3^{1)}$	l_1	l_2 $+0,5$ 0	e	R_1	R_2	α	Elektroden- kraft $F_{\max}^{2)}$ kN
13	5	10	18	8	3	32	5	-	2,5
16	6	12	20	9,5	4	40	6	15°	4
20	8	15	22	11,5	5	50	8	22,5°	6,3

References (examples)

- **CAM:** Audi, Hyundai, Mercedes (Voestalpine in USA, China, South Africa and China), VW, ABB, Tesla, **IQR:** VW Global, Hyundai, Kia, Audi, Skoda, Gestamp, Magna Europe, Ford Motors Europe, Camaco NE

- **Industrial:** Stihl USA, Magneti Marelli USA, Miele, Continental, TRW, Autoliv, Takata, ZF (shock absorbers)
- **Tiers:** Tower USA, Magna Europe, Kirchhoff, Gestamp, Voestalpine White GA and Birmingham AL, Ajin USA, Sungwoo Hitech USA/Korea, PWO Canada, (Sungwoo Hitech USA), Gedia USA