

## Welding - Engineering SLE Engineering in the welding technology

Sulzer Innotec

### Welding engineering for highest demands

Experienced welding engineers support our customers during the product development and design and with welding problems. In co-operation with our customers and with our specialist welding shop they develop new welding procedures. They plan procedure audits, assume welding supervisions and welding approvals. As a neutral expertise center they consult our customers on failure events.

#### Project management assignments

Our welding engineers are in the center of Sulzer Innotec's expertise. In close co-operation with internal and external specialists, knowledge management is cultivated.

#### Added value for our customers

The customer benefits from the project management of our welding engineers. Without additional effort the customer gets access to the know how of Sulzer Innotec and can focus on his core competences.

For decades we have carried out various demanding welding tasks for our customers all over the world. We weld and join components out of materials and combinations of materials that are difficult to weld. We use all kinds of welding techniques – dependent on material, geometry, and application. In addition, we offer welding repairs of cast materials and welding of inoxidable and wear resistant coating materials.

#### Service portfolio of our welding engineers

- Construction supervision
- Procedure audits according to most standards
- Surveys in case of failures
- Solving welding-related problems
- Consulting on materials

#### Internal knowledge clusters support our welding engineers

##### Service und Produktion

- Joining Technology and Heat Treatment
- Laser Welding
- Testing and Metrology
- Precision Machine Shop
- Materials and Failure Analysis

##### F&E

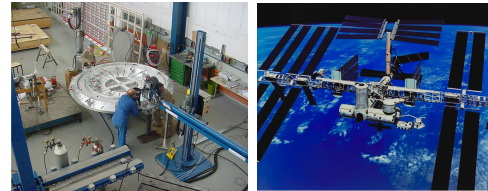
- Materials and Surfaces
- Fluid Dynamics
- Mechanical Systems
- Biomechanics and Implants
- Medical Systems

#### Example of engineering and supervision of the construction of space industry components

The welding engineers plan and supervise welding procedure audits and welding work for our customers worldwide.

The projects can be carried out by:

- Sulzer Innotec staff
- Customer staff
- Or third party



*mechanized TIG-welding of a super fluid helium vessel for the international space station ISS*

#### Example of a repair development for the recycling industry

The welding engineers plan and supervise welding repairs all over the world.

- Failure assessment on-site
- Repair proposals
- Quotation
- Planning of the repair project
- Supervision of the repair
- Quality assessment of the repair
- Repair approval the welding work can be carried out by:

- Sulzer Innotec staff
- Customer staff
- Or third party welders



*Damaged cutting slide of a shredder machine*

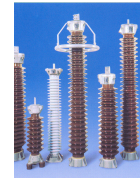
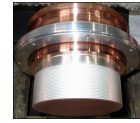
## Prototyping and production of limited lots

Our welding engineers offer project management services of complete part manufacture. Internal and external know how is applied within the part manufacturing.

## Example of a manufacturing project for high voltage applications

### Copper conductors for high voltage applications

- Material logistics
- Planning
- Manufacturing
  - Jet cutting
  - *Machining of components*
  - *Brazing*
  - *Ultrasonic testing in immersion (joint)*
  - *Finishing*
- **Refinement**
  - *Silvering of threads and flanges*
  - Packaging
  - Shipment



*Copper conductor for electricity supply*

## Consulting

Our welding engineers travel all seven seas. They support our customers during development and design or with averages. They prepare and supervise welding work throughout the world for:

### Example of consulting for the ship industry

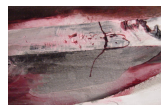
- New ships
- Repairs

The welding work can be carried out by:

- Sulzer Innotec staff
  - Customer staff
  - Or third party welders



*On customer order we consult on production processes  
And do constructions in licensee plants*



*On customer order we carry out diesel engine repairs*

## Consulting on the application of the following welding techniques: Melt welding techniques

The welding engineers support our customers on the evaluation of suitable welding procedures. They generate a functional specification and consult our customers on the procurement of welding equipment and facilities.

- **Arc welding with the following sub-groups:**
  - Metal Arc Welding Welding      Welding with electrodes
  - UP-Welding      Arc burns under a welding powder fill
- **Gas-shielded welding with the following sub-groups**
  - TIG-Welding      Arc is shielded by a gas flow and originates from a tungsten electrode
  - MIG / MAG welding      Arc is shielded by a gas flow and originates from a off-melting electrode
  - Plasma-welding      By using a water-cooled Cooper nozzle the arc will be constricted, which causes a high power density
- Electric slag welding      The currency conducting wire is melting off in the conducting slag bath without creating an arc
- Electron beam welding      Electrons accelerated in vacuum hit the workpiece inside the vacuum chamber
- Laser welding      The good focusing ability of the laser beam allows power densities.
- Gas melting welding      autogeneous welding
- Fire welding      Heating in the forge
- Gas pressure welding      Heating in the gas burner
- Electro-Resistance welding      Welding by electric energy and pressure. Point-welding, projection welding, resistance seam welding
- Inductive pressure welding      Heating by eddy currency
- Cold pressure welding      Joining under high pressure in cold or slightly heated state
- Arc pressure welding      Heating by an arc
- Friction welding      Heating by an arc Friction heat is generated by rotating or oscillating faces

## Pressure welding techniques