

Invitation to IIW 's training programme for

## **International Welded Structures Designer, IWSD**

**Target audience: Design, Calculation, Research & Development, Testing, Welding Coordinator and IWS, IWT & IWE.**

**Meetings:** IWSD-S: 28/9-1/10, 26-29/10 & 23-26/11 - 2020

IWSD-C: 11-13/1, 8-10/2 & 8-10/3 - 2021

**Location:** Main location Weld on Sweden, Videum Science Park, Växjö – Sweden

Welding is the most common and most important joining methods for mechanical, industrial and engineering products of steel structures. Knowledge of designing and dimensioning of welded structures are essential for anyone involved in the design, development and production of such products.

You have now the opportunity to train yourself to the finest diploma in welding design and become an International Welded Structures Designer, IWSD.

IWSD skills will open up new career paths for a wide range of positions and generate growth and competitiveness in the industry.

This unique education program fulfills the requirements according to guidelines from the International Institute of Welding (IIW) and leads to international diploma issued by Swedish Welding Commission, IIW-ANB.

Syllabuses are available on two levels, International Welded Structures Designer at standard level, IWSD-S and International Welded Structures Designer at the comprehensive level, IWSD-C. IWSD-S consists of four modules and IWSD-C seven modules. Each module includes 25 hours and is performed at a three-day meeting.

### **Access Conditions**

Applicants entering for welded structures designer at comprehensive level shall fulfill at least the National Access Conditions at the IWT level (equivalent to Bachelor of Science in Sweden).

Applicants not fulfilling the entry access conditions at comprehensive level may follow the course but are not allowed entry to the IIW examination at comprehensive level.

Applicants entering for welded structures designer at the standard level shall fulfill at least the National Access Conditions at the IWS level and have knowledge in High School Mathematic D.

### **Examination**

Examination is performed by an Examination Committee appointed by the Swedish Welding Commission (IIW-ANB). To be admitted as examinee requires that the applicant has the entry access condition and undergone IWSD training.

Applicants not fulfilling the entry access conditions may follow the course but are not allowed entry to the IIW examination. In the case that a participant has an IWE, IWT or IWS diploma, the participant can get a release of attendance in modules 1 and 7 but she/he has to take part to examinations.

### **Course fee**

74 000 SEK for IWSD-S (4 modules) and 55 500 SEK for IWSD-C (3 modules) or 119 500 SEK for both IWSD-S and IWSD-C (7 modules) for the same person. The course fee includes course books, digital OH-materials (PDF), tinning and study certificates. Course fee is billed by Weld on Sweden in connection with start of the course. VAT will be added by 25% for Swedish companies. Payment terms 30 days.

**Examination fee** is currently 5 100 SEK for IWSD-S and 7 100 SEK for IWSD-C or 8 100 SEK for IWSD-S & -C for the same person. Examination fee is billed by the Swedish Welding Commission in connection with the examination. VAT will be added by 25%. Payment terms 30 days.

**Notification** is made by the registration form on the last page, via the website <https://weldonsweden.se> or to Ali Bahrami [ali@weldonsweden.se](mailto:ali@weldonsweden.se), +46 470 543370

## Syllabuses

### Block 1: Welding for Designers – Included in IWSD-S & IWSD-C

#### Module 1: Welding Technology

- 1.1 Welding terminology 3 h: Basic types of welded joints, Joint preparation; Fusion joints.
- 1.2 Welding symbols and design drawings 3 h: Welding symbols, Weld drawing characters, Weld process abbreviations.
- 1.3 Overview of welding processes 9 h: Manual metal arc, MIG/MAG, TIG, Submerged arc, Electron beam, Laser welding, Resistance welding, Friction stir welding.
- 1.4 Materials and weld metallurgy 10 h: Welding of constructional materials and their properties in the as-welded condition, Basics of welding metallurgy, Effect of heat input, Fe-C equilibrium- and TTT- diagrams, Microstructures and the effect on the mechanical properties of weld, Typical imperfections and errors.

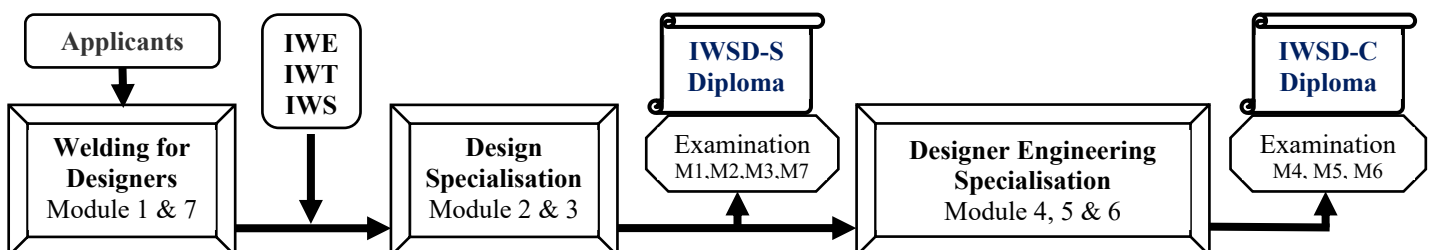
#### Module 7: Fabrication, Costs, Quality and Inspection

- 7.1 Fabrication costs and cost reduction 8 h: Joint preparation costs, Filler material cost, Welding speed and machine costs, Fixed and marginal costs, Semi finished components.
- 7.2 Fabrication friendly design 10 h: Production costs, Manufacture friendly design, Automated and robotized production, LCC, Production measures.
- 7.3 Quality assurance in welding fabrication 4 h: Quality standards involved, Weld imperfections, Acceptance of imperfections, Quality systems for production.
- 7.4 Inspection methods and criteria 3 h: Destructive testing: Charpy, Tensile, Bending Etc. Non-destructive testing: Magnetic particle, Ultrasonic Etc.

### Block 2: Design Specialisation – Included in IWSD-S & IWSD-C

#### Module 2: STRENGTH OF MATERIALS

- 2.1 Static equilibrium, 3 h: Equilibrium of forces, Equilibrium of moments, Action and reaction forces, Free body diagram, Shear and moment diagrams, Tension, compression, shear, bending and torsion force components.
- 2.2 Stress, strain and deformation, 3 h: Normal stresses and strains, Shear stresses and strains, Elastic deformation of solids, Static and dynamic forces, Plastic deformation of solids, Stress strain curves for materials, Yield strength, Mohr's circle.
- 2.3 Failure criteria for structures and structural materials, 4 h: Yielding, Multiaxial stresses, Plastic collapse, Ultimate strength, Fatigue and fracture, Global buckling, Local buckling, Lateral buckling, Slenderness
- 2.4 Introduction to fatigue, 6 h: Definition of a fatigue load cycle, Variable amplitude loading, Cumulative damage, Crack growth, Mean stress, Stress range, Stress concentrations, S-N curve, Fatigue limit.
- 2.5 Introduction to fracture mechanics, 5 h: Stress intensity factor, Brittle fracture, Ductile fracture, Fatigue crack growth, Paris equation, Plastic zone, Critical stress intensity factor.
- 2.6 Material properties, 4 h: Yield and ultimate strength, Elongation, Fracture toughness, Elastic modulus, Poisson ratio, Fatigue limit.



## Module 3: DESIGN OF WELDED STRUCTURES

- 3.1 Basic theory of structural systems, 4 h: Tension elements, Compression elements, Beam elements, Truss and frame structures, Plate elements, Joining and connections.
- 3.2 Loads on structures, 4 h: Dead loads, Live loads, Distributed and concentrated loads, Partial safety factors for loads, Design loads, Statistical load variation.
- 3.3 Introduction to the design of structures, 8 h: Design goals and constraints, Safety, economy, durability and serviceability, Proportioning of members, Analysis and evaluation, Partial safety factors, Sources of variation in design loads and strength of structural components, Ultimate and serviceability limit states.
- 3.4 Analysis methods for structures, 5 h: Spreadsheet tools, Finite Element Analysis, Design guideline formulas.
- 3.5 Design guidance documents, codes and standards, 4 h: Dimensioning, Partial safety factors, Design load, Design strength, Limit state design / allowable stress design.

## Block 3: DESIGNER ENGINEERING SPECIALISATION – Included in IWSD-C

### Module 4: DESIGN OF WELDED JOINTS

- 4.1 Categories of welded joints, 4 h: Weld categories: Primary load carrying joints, Connecting joints, Binding joints; Accessory joints.
- 4.2 Design of welded joints with predominantly static loading, 8 h: Throat thickness, Elastic and plastic design, Deformation capacity, Stress components in a fillet weld, Correlation factor for weld strength, Design strength.
- 4.3 Design of welded joints with predominantly fatigue loading, 10 h: Fatigue of welded joints: – stress concentrations, – residual stresses, – initial defects. Constant and variable amplitude loading, Cumulative damage, FAT class, Overview of fatigue calculation methods in a relevant design guidance document.
- 4.4 Design against brittle fracture, 3 h: Fracture toughness, Critical stress intensity, Critical crack size, Temperature and material toughness, Overview of calculation methods in a relevant design guidance document.

### Module 5: DESIGN OF WELDED PLATE STRUCTURES

- 5.1 Plates and shells, 8 h: Plate buckling, Modified slenderness, Effective width, Stiffeners, Buckling coefficient.
- 5.2 Beam and column structures, 8 h: Beam and column profiles, Cross section classes, Local and global stability, Plastic design, Longitudinal stiffeners, Design of slender webs, Shape factors for beam profiles.
- 5.3 Design considerations for welding residual stresses and distortion, 9 h: Welding induced residual stresses, Welding induced distortion, Classification of distortions, Weld sequence effects and residual stresses, Effect of residual stress on structural behaviour, Lamellar tearing.

### Module 6: DESIGN FOR PURPOSE OF WELDED STRUCTURES

- 6.1 Introduction to design for purpose concepts for welded structures, 3 h: Alternate structure solutions, Assessment of weld importance in terms of loading, Definition of weld quality for different purposes.
- 6.2 Improved design of statically loaded joints, 2 h: Flow of forces in welded joints, Weld start / stop positions, Slot and plug welds, Deformation capacity of a weld.
- 6.3 Improved design of fatigue loaded joints, 8 h: Nominal stress, Structural stress, Weld defects, Notch stress, Welds starts / stops, Root defects.
- 6.4 Post- weld treatment methods for welded structures, 4 h: TIG dressing, Grinding, Needle peening, Hammer peening, Quality control, Fatigue strength improvement.
- 6.5 Design considerations for manual and automated welding processes, 2.5 h: Weld angle and position, Interference, Seam tracking, Joint selection.
- 6.6 Numerical methods and fatigue design, 4 h: Finite element analysis, Nominal stress approach, Structural stress approach, Notch stress approach, Linear elastic fracture mechanics, Overview of fatigue numerical methods in a relevant design guidance document.
- 6.7 Laboratory testing, 1.5 h: Fatigue testing methods, Quasi-static testing methods, Evaluation of laboratory failures, Methods for data analysis.

**Application**

**International Welded Structures Designer, IWSD-2020**

**(Write clearly)**

Level sought (IWSD-S / IWSD-C):		
Last name:		
All first names: (Given name underlined)		
Personal identity number:		
Company:		
Address:		
Phone daytime:		
Mobile:		
E-mail:		
Billing Address:		
Relevant technical education. Enter in chronological order. Attach a copy of the final grade / degree certificate	From date	To date

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Signature: ..... Date: .....

Swedish Welding Commission's notes:  
Admission to IWSD-S / IWSD-C education

**Send application to Weld on Sweden, Videum Science Park, SE-351 96 Växjö, Sweden**