

# VOLVO MATERIALS TECHNOLOGY COURSES

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JOIN OUR MATERIAL COURSES...  
...if you feel that you are missing a piece



**Practical Information & Registration:**

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**Course Content:**

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**For more information, please see:** [http://violin.volvogroup.net/sites/ec/Sweden-SE/training\\_development/Training\\_development\\_opportunities/engg\\_purchasing/Pages/material-tech.aspx](http://violin.volvogroup.net/sites/ec/Sweden-SE/training_development/Training_development_opportunities/engg_purchasing/Pages/material-tech.aspx)

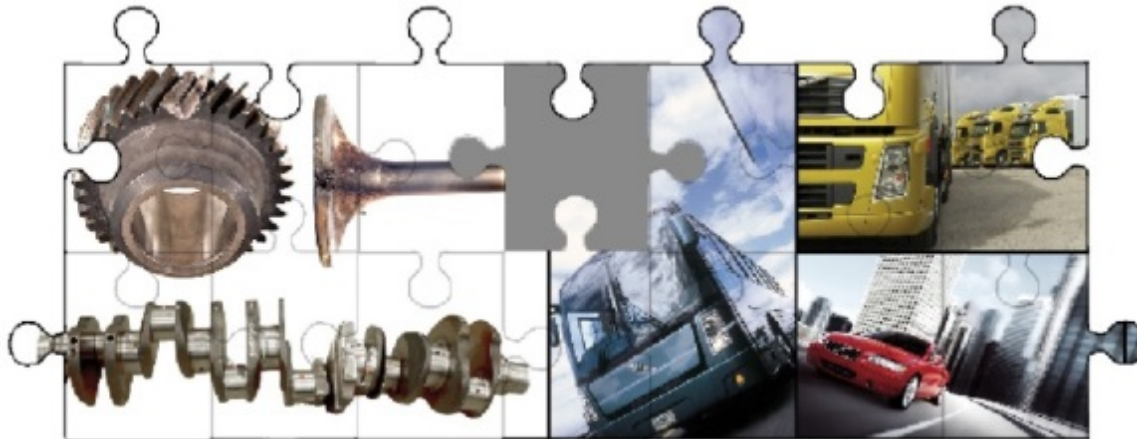
# Learn from the experts

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## JOIN THE COURSES AT VOLVO MATERIALS TECHNOLOGY

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Do you have difficulties in selecting materials for your components?  
Or do you simply want to improve your material knowledge?  
Then, the courses at Volvo Materials Technology are something for you.



*...if you feel that you are missing a piece*

**T**here are tons of different materials, surface treatments, and joining methods to choose from. As a design engineer, it can be difficult to know which choices that is best suited for the intended component. This is why Volvo Materials Technology has developed a variety of courses especially adjusted to help design engineers, but also purchasers and test engineers in contact with materials. The courses are held each year.

**THE EXPERTS OF** the department work with material related issues every year. All have many years of experience within applied materials technology for Volvo applications. They therefore know which problems to look out for and have adjusted the course contents in such manner. Thus, these events are excellent opportunities to learn how to avoid easily made mistakes and at the same time become a material expert of yourself.

### **The Basic Materials Technology and Failure Analysis**

Provides a fundamental understanding of terminology and mechanisms within the field of metallic materials. Naturally, its scope is the material used within the vehicle industry. Areas of focus will be on chemistry, phase transformations and hardening mechanisms and its effect on material properties. The course also treats failure analysis in detail with actual failure investigations performed at Volvo Materials Technology as a base for discussion. Moreover, a practical demonstration will show how materials and failed components are analysed through crack inspection, microscopy, metallography and tensile testing and how heat treatment can be used to modify the material properties

## **Cast Materials**

This course is best suited for people working with cast components such as cylinder blocks and heads, brackets, manifolds, casings etc. The course discusses processes, design, properties, and microstructure. A focus is the understanding of how the mechanical properties are affected by the casting method, heat treatment, defects and microstructure. Casting design, casting specifications, non-destructive testing methods and after-treatments are included. The course discusses our common cast materials such as grey iron, Compacted Graphite Iron (CGI), nodular iron, aluminium and magnesium. Different casting methods as sand casting, gravity die casting, high pressure die casting and rheo casting are explained.

### **TARGET GROUP**

Design Engineers, Purchasers, SQA's, Test engineers and Project Leaders working with Cast Materials.

### **LEARNING OBJECTIVES**

Upon Completion of the training you will:

- Understand which components that are suitable for casting
- Understand when different casting methods are to be used
- Understand how properties are affected by the casting method
- Understand how properties are affected by heat treatment
- Understand how properties are affected by the choice of alloy
- Understand how properties are affected by defects
- Knowledge about casting design, standards and requirements
- Basic understanding of how different parameters affect the cost of cast components

## **Corrosion**

By better understanding the underlying mechanism of corrosion we are more likely to avoid bad design choices for metallic parts. The course aims to give an introduction to common types of corrosion, such as general, galvanic and high temperature corrosion and to go through important material- and environmental parameters which affects the amount of corrosion.

## **Screw Joints**

In a truck there are over 2000 screw joints and the use of screws will be an important joining technology also in the foreseeable future. There are currently two courses that give an introduction to screw joint technology. Courses targeted at specific groups (Ex. Purchase, Assembly, Maintenance) can be held upon request. It is also possible that the course is held at your location alternatively through video link.

### **Screw Joints - Basic**

This course gives an introduction to screw joint technology. Basic features such as strength classes and static strength is covered. Influence of friction and settlements on clamping forces are shown. The importance of joint stiffness consideration for fatigue strength is discussed together with differently assembly methods. Some practical examples are presented together with rules of thumb for screw joint design.

**This course is available in English and Swedish.**

### **TARGET GROUP**

Design Engineers, SQA/SQE, Quality Engineers

### **LEARNING OBJECTIVES**

- Different types of screw joints
- Static strength of screws, nuts and internal threads
- Stiffness in a screw joint and the effect on fatigue properties
- Relation between assembly method, assembly friction and clamping force

- Loss of clamping force due to embedment
- Basic design considerations

### **Screw Joints – Calculations**

This course is best suited for designers who want to learn more about basic calculations and measurements of screw joints. It includes basic calculation methods for static and dynamic strength, clamping forces and some statistics.

**This course is available in English only.**

#### TARGET GROUP

Design Engineers, SQA, Quality Engineers

#### LEARNING OBJECTIVES

- Calculation of static strength of screws, internal threads and clamped parts
- Calculation of clamping force depending on assembly friction and torque including a brief statistical analysis
- Static strength of screws, nuts and internal threads
- Stiffness in a screw joint, load distribution and the effect on fatigue properties
- Yield point tightening



### **Sintered Steels / Powder metallurgy**

Sintered steels are produced to net shape without machining and the number of sintered products in the vehicle industry is constantly increasing. The course discusses manufacturing processes, properties, design issues and applications regarding sintered steels. Moreover, the course will also bring up other powder metallurgical manufacturing methods, such as metal injection moulding (MIM), hot isostatic pressing (HIP) and additive manufacturing (AM).

#### TARGET GROUP

Design Engineers, Purchasers, SQA, Cost engineers, Test engineers and Project Leaders working with, or having an interest in, sintered steels and powder metallurgy.

#### LEARNING OBJECTIVES

- Upon completion of the training you will get:
- Understanding of the manufacturing process route from powder to finished component
- Understanding of material properties for sintered steels
- Understanding of application of sintered steel components
- Basic understanding of the design rules for sintered steel components
- Basic understanding of factors influencing cost of sintered steel components
- Basic understanding of the sinter steel market

- Awareness of other powder metallurgical manufacturing methods (MIM, HIP, AM)

## Steel and heat treatment and forging

This course is best suited for people working with steel and steel components such as e.g. axles, beams and gears. The course discusses the key factors during the steel manufacturing process and the crucial importance of correct heat treatment of the steel components.

### STEEL

The first part of the course gives an introduction to the material steel, factors that decide its quality, developments and price sensitivity.

### HEAT TREATMENT

Steel is one of the most widely used materials thanks to good mechanical properties & interesting physical properties for a relatively low cost. Furthermore, steel is a versatile material where properties can be significantly affected by both chemical composition and heat treatments. Basics for heat treatments are discussed, and different heat treatments are explained and compared with focus on typical Volvo group components. Furthermore, the importance of correctly performed heat treatment is underlined with examples of failures related to poor heat treatment.

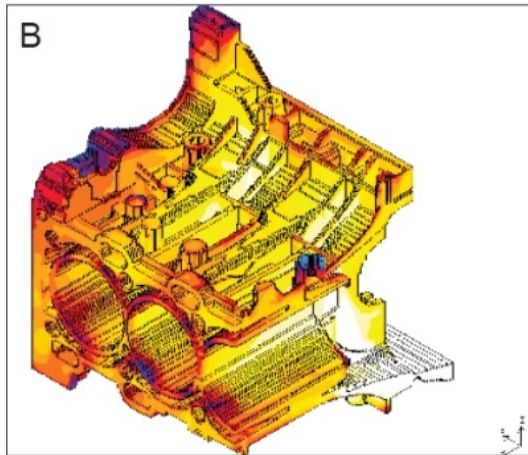
### TARGET GROUP

Design Engineers, Purchasing, SQA, Test engineers and Project Leaders working with steel & heat treatment of steel components.

### LEARNING OBJECTIVES

Upon completion of the training you will:

- Understand the properties of steels.
- Understand the importance of steel qualities and cleanliness.
- Have basic knowledge about different heat treatments and their usability.
- Understand the importance of correctly performed heat treatment



A. Labs are mixed with lectures. Here is Filip Bergman teaching about screw joints.

B. *Example of casting simulation.*

C. *Rivets and laser welds of a car body*

## **Residual stresses – Introduction**

This course serves as an introduction for the residual stresses in materials and the used methods of measurements. The course reviews the origin of residual stress and how it affects the component life. Also, the course presents the X-Ray diffraction method as a standard way and a widely used method of residual stress measurements.

### **TARGET GROUP**

Design Engineers, Purchasing, SQA, Test engineers and Project Leaders working with different metallic materials.

### **LEARNING OBJECTIVES**

Upon Completion of the training you will:

- Understand the different stresses acting on a part.
- Understand the residual stresses as a result of a manufacturing process and / or surface finish process.
- Understand the measurement results by X-Ray method.

## **Introduction to Additive manufacturing of metals**

The course is an introduction metal additive manufacturing. The training covers the basics of the techniques and processes (e.g. SLM, EBM, Binder jetting...). The advantages and limitation of the techniques, as well materials used, are discussed. Moreover, some applications and examples are given.

### **TARGET GROUP**

Design Engineers, Purchasing, Supplier quality engineers, component responsible etc... and anyone that would like to get a glimpse into metal additive manufacturing.

## **General knowledge of plastic materials**

### Introduction (1/2 day)

- Polymers Categories (Thermoplastics, Rubbers, Thermoplastic Elastomers, Thermosets)
- Polymers among the different types of materials
- Polymers Advantages and Disadvantages
- Polymers Synthesis and Structure
- Influence of the structure on polymers properties
- Polymers Additives (Plasticizers, Fillers, Fire retardants, Pigments etc.)

### Thermoplastics (1/2 day)

- Thermoplastics Categories (PE, PP, PA, PC, ABS, ASA, PMMA, PVC etc.), Characteristics and Applications
- Thermoplastics Formulation (Additives, Fillers etc.)
- Thermoplastics Compounding Processes
- Thermoplastics Molding Processes (Extrusion, Injection, Thermoforming, Rotational molding, 3D Printing etc.)

### Polymers Elastomers (1/2 day)

- Rubbers Categories (NR, SBR, EPDM, NBR, FKM, Silicone etc.), Characteristics and Applications
- Rubbers Formulation (Additives, Carbon black, Sulphur, Mineral fillers etc.)
- Rubbers Compounding Processes
- Rubbers Molding Processes (Extrusion, Injection, Compression, Calendaring etc.)
- Thermoplastic Elastomers Categories (TPE, TPO, TPS, TPC, TPV etc.), Characteristics and Applications

#### Thermosets (1/2 day)

- Thermosets Categories (Phenolic, Epoxy, Polyurethane, pDCPD, SMC etc.), Characteristics and Applications
- Thermosets Formulation (Additives, Fillers etc.)
- Thermosets Compounding Processes
- Thermosets Molding Processes (Compression, Transfer, Injection, RIM, 3D Printing etc.)
- Thermosets Composites Processes (RTM, Filament winding, VIP, Prepreg etc.)

### **Materials Technology – Electronic Assemblies and Failure Analysis**

The number of Electronic Assemblies are constantly increasing in the vehicle industry. This course will focus on basic understanding of Printed Circuit boards, the components mounted on them and typical failure modes. It will also give information on what to consider when purchasing or designing an electronic assembly. The courses will contain information about what type of failure analysis that can be performed at Volvo Materials Technology.

#### TARGET GROUP

Design Engineers, Quality Engineers, Purchasing

#### LEARNING OBJECTIVES

Upon completion of the training you will:

- Learn the basics about Electronic Assemblies – Printed Circuit boards, their surface finish and the components mounted on them.
- Have knowledge about how the Electronic Assemblies are produced.
- Basic understanding of what to consider when designing an Electronic assembly from a material and mechanical perspective.
- Awareness of what type of stresses they can be exposed to during their lifetime in a truck environment and what typical failure modes they have.
- Have knowledge of what type of non-destructive and destructive test that can be performed on the Electronic Assembly and what type of knowledge and equipment that the Volvo Materials Technology department can support with.

# MATERIAL COURSES 2022

<u>Navigator Code – Course Name</u>	<u>Date</u>	<u>Time</u>	<u>Price</u>
306120 – Basic Materials Technology and Failure Analysis	221207 <b>To be decided</b>	09:00-15:00 09:00-15:00	2500 SEK
306121 – Cast Materials	221018 221019	09:00-15:00 09:00-15:00	3500 SEK
306123 – Corrosion	221123	09:00-15:30	2000 SEK
306124 – Screw Joints - Basic	221006	08:00-15:00	1500 SEK
306125 – Screw Joints - Calculations	221012	08:00-12:00	1500 SEK
306126 – Sintered Steels and Powder metallurgy	221108	09:00-15:00	2000 SEK
306127 – Steel and heat treatment and forging	221116	09:00-15:00	2000 SEK
306130 – Residual stresses – Introduction – 2 hours	220901	09:00-11:00	2300 SEK
318505 – Introduction to Additive manufacturing of metals	221115	09:00-12:00	2000 SEK
307482 – General knowledge of plastic materials	221020 221021	09:00-16:00 09:00-16:00	2500 SEK
319581 – Electronic Assemblies and failure analysis	220923	09:00-11:00	2000 SEK

*The course documentation is in English*

**How to register?** All courses must be approved by manager. Registration should be made 3 weeks before the course starts. Last day to cancel is 7 days before the course. You will receive an email confirmation and practical information before the courses start. Please note that all courses are physical sessions. Online session can be arranged by request.

**All Courses:** Send a purchase order to Volvo Technology AB (PARMA Code: 0001090). Please also send an e-mail including name of participant and e-mail address, name of courses/s, date of the course and price to the e-mail address [materials.technology@volvo.com](mailto:materials.technology@volvo.com)

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**For course content contact:** Dazheng Jing, Tel: +46 31 323 75 87, [dazheng.jing@volvo.com](mailto:dazheng.jing@volvo.com)



## Visiting Address and Lecture room:

VLU2 Skolsalen.  
Visiting address and to sign in through **VGHQ Reception**,  
Groppegårdsgatan 2.

Please contact Janice Segerfelt telephone; +46 31-323 41 26 in advanced to agree on a time you have to be at the VLH Reception. Then she will take you to the Lecture room.