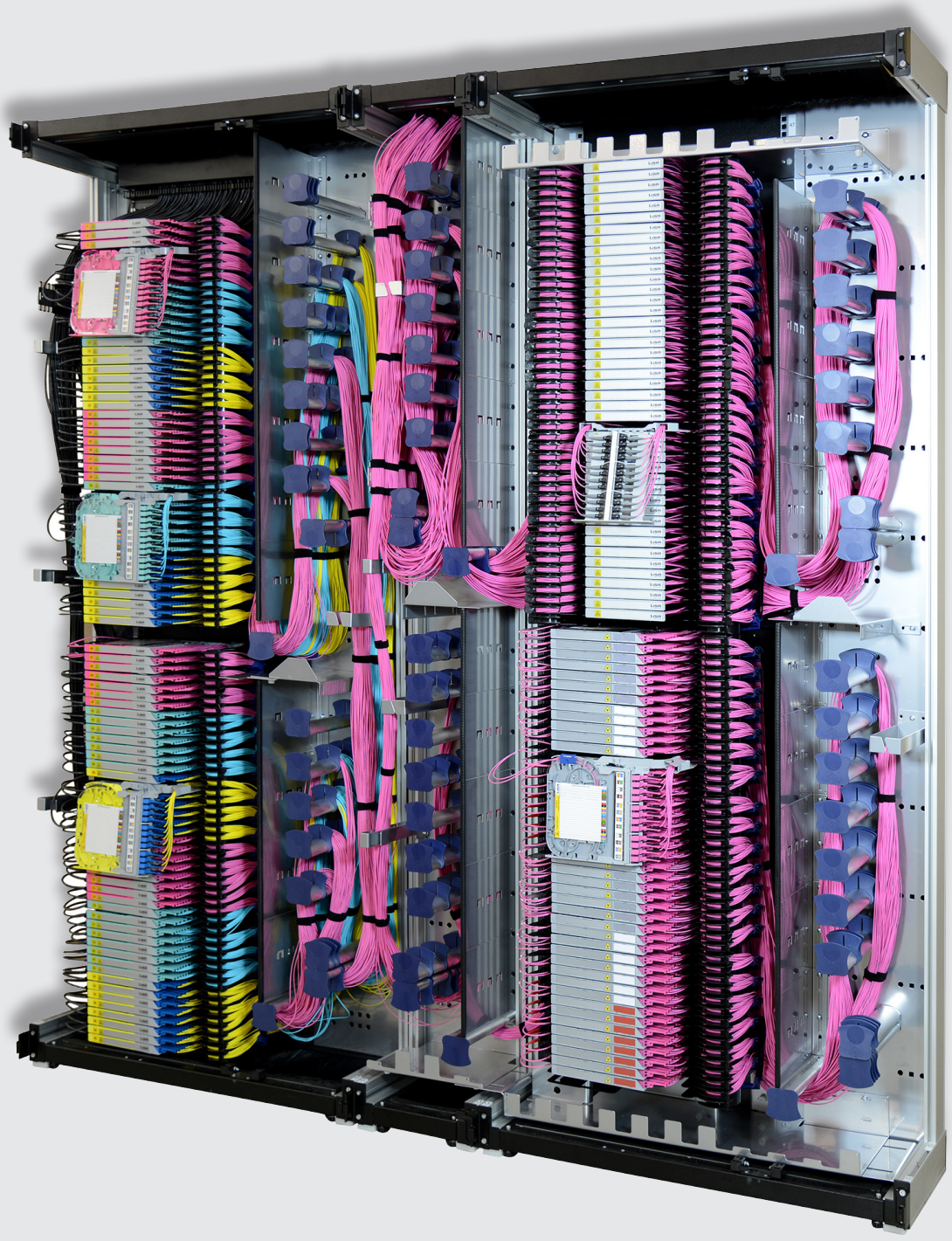
HUBER+SUHNER

Data Center Certified Training (DCCT)



HUBER+SUHNER
Excellence in Connectivity Solutions

Connecting a Wide Range of Market Segments

HUBER+SUHNER provides high performance and innovative products and services for the rapidly evolving structured cabling solutions (SCS) market. We leverage over 25 years of experience in creating tailored connectivity solutions which deliver business-critical services safely and reliably. Our solutions are relevant regardless of the environment or application, and whenever there is a demand for quality, you can rely on us.

Colocation Cloud Service Providers (CSP)

Colocation and cloud service providers (CSP) companies around the world rely on our high density fiber management systems to connect incoming carriers to their valued customers. Our excellent cost per port and structured cabling density makes us the number one choice for regional and global colocation companies.

Finance

Our high performance cable systems provide financial companies with the reliability they depend on to maintain their business-critical connections. Our exceptional cable management supporting high density SAN switches reduces cable clutter and virtually eliminates network latency .

Broadcast

Flexibility is key in the broadcast market and at HUBER+SUHNER, we pride ourselves in delivering customizable solutions that fit the specific needs of our customers. We are working with many of the world's largest broadcast companies who require the perfect combination of density, flexibility and speed.

Telecom

HUBER+SUHNER has been supplying the telecom market since our inception. Our technologies are used in all areas of the network and we are the ideal supplier for companies moving towards a converged all IP infrastructure. We support the requirements from the legacy network and we understand the challenging needs of the future.

Government

The government sector requires reliability and traceability in every aspect of its business. Our products are designed in such a way as to negate installation errors and avoid costly or embarrassing issues during the lifetime of the network.

Hospitality

Our combination of high-end copper and fiber optics solutions match perfectly to the demanding needs of hotels and casinos where signal availability is everything. Users can enjoy seamless signal quality from the moment they enter the property.

Global Presence, Local Support

Swiss precision delivered worldwide

HUBER+SUHNER is a Swiss company which prides itself in honesty, fairness and social responsibility. Furthermore, HUBER+SUHNER embodies the values traditionally associated with Swiss engineering excellence – those of quality, precision, reliability and high-performance. Even though the needs of a global market cannot be fulfilled from a single location, those values best associated with Switzerland are embedded globally.

Worldwide manufacturing and assembly

HUBER+SUHNER operates manufacturing plants around the world which guarantees that regionalized requirements are met. On top of that, HUBER+SUHNER cooperates extensively with numerous third-party fiber optic assembly shops to extend the capacity and coverage of the HUBER+SUHNER brand. All of our assembly shops follow the same stringent processes and quality controls as our own group companies.

Worldwide distribution and support

Customers can rely on HUBER+SUHNER's worldwide sales and support network. Market proximity is the advantage of our global presence with 14 subsidiaries and representatives in over 60 countries. Our customers benefit from our strength to deliver local solutions and services tailored to their requirements, and our global presence guarantees best in class support in all regions.

Data Center Certified Training (DCCT)

What is DCCT training?

Data center certified training is a fiber optic training course aimed at installers, system integrators and end customers who want to become official certified partners of HUBER+SUHNER (DCCT Certification).

The course combines theoretical content and practical hands-on training so that a balanced level of content is provided. Our objective is to ensure that anyone working with our products has the necessary skills to both consult, design and install. The course is compiled by HUBER+SUHNER and can be delivered in one day to three days depending on the type of individuals we are training and their availability. Training durations can be reduced based on the knowledge level of participants. Successful participants will be eligible to install and warranty installations made using our HUBER+SUHNER's data center portfolio

Who should attend the course?

Anyone wishing to become an approved DCCT partner of HUBER+SUHNER for the data center market or operators looking to update existing knowledge, and anyone wishing to receive comprehensive fiber optic training for non-partner related reasons.

Can the training be adjusted to your needs?

Yes it can. We will adapt the training to suit the particular needs of your organisation and also the competence level of your employees. We can also focus on more detail or particular aspects should you require it. We do insist that companies wishing to become certified partners complete the appropriate aspects of the DCCT course content.

Where does the training take place?

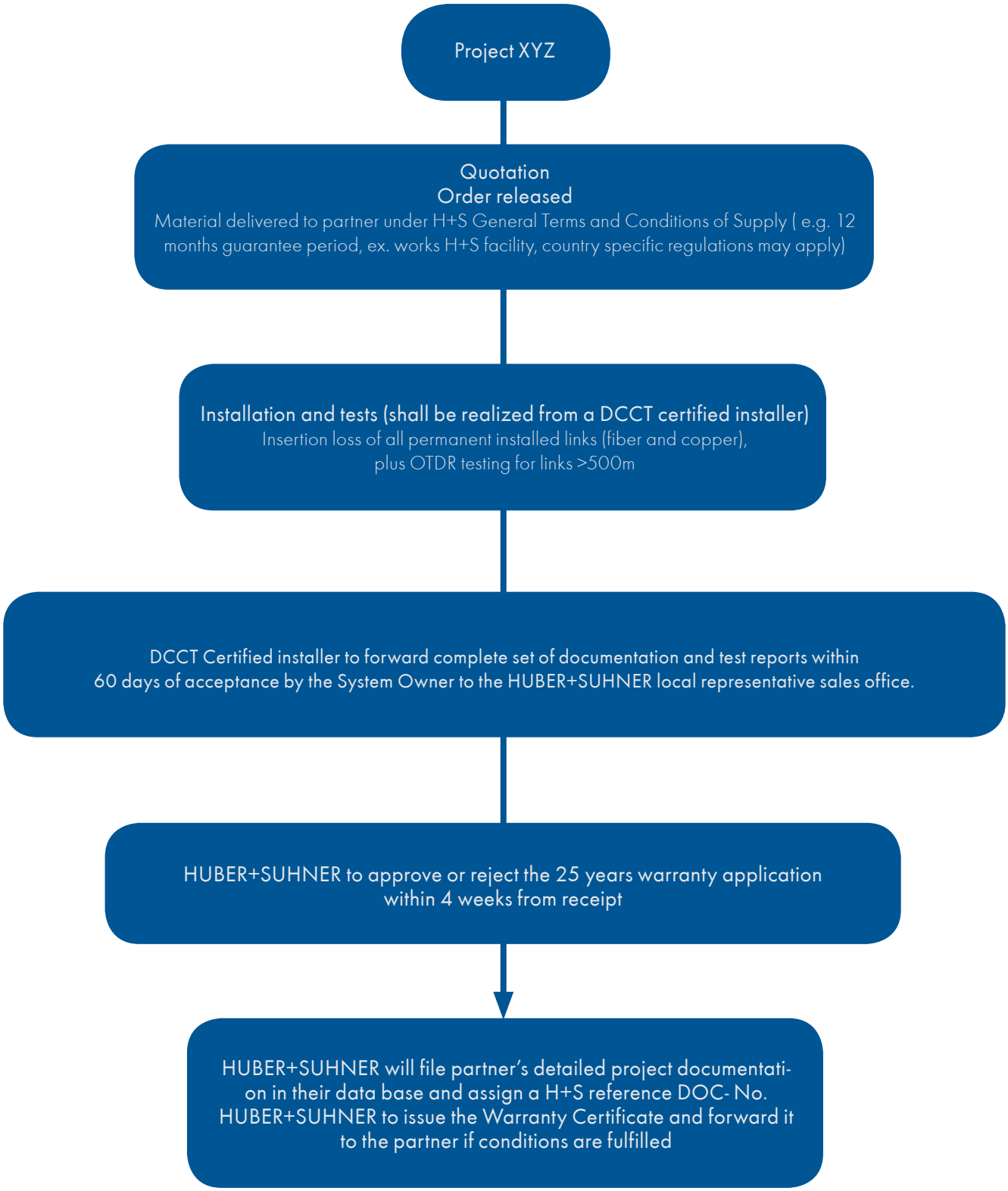
We strongly recommend that the training takes place in dedicated HUBER+SUHNER facilities. This will allow us to prepare the environment and ensure that the necessary hardware is available for the practical aspects of the course.

The following topics are covered in the standard DCCT training content:

- FO Fundamentals
- Structured Cabling Solutions
- MPO/MTP Connectivity
- Polarity and Connectors
- LISA centralized cross connect
- IANOS high density solution
- KYPROS balanced copper solution
- Optipack Cable Systems
- Network Design and Parallel Optics
- Transceiver Theory
- Test Requirement Serial and Parallel Optics
- Field Testing / Inspecting and Measurement

25 Year System Warranty Workflow

HUBER+SUHNER offers a 25 year system warranty for permanently installed fiber optic or copper links. To receive a 25 year warranty, the following workflow should be applied by DCCT certified installer.



Suggested DCCT Agenda

Use at the descretions of instructor.

Day 1	Time	Topic
08.00- 08.30	30'	HUBER+SUHNER DCCT Introduction and Warranty Certification Workflow
08.30 - 09.30	60'	Fiber Optic Fundamentals
09.30 - 10.30	60'	Structured Cabling Solutions
10.30 - 11.15	45'	MPO/MTP Connectivity
11.15 - 12.00	45'	Optipack Cable Systems
12.00 - 13.00	60'	Lunch
13.00 - 14.00	60'	Polarity and Connectors
14.00 - 15.30	90'	LISA centralized cross - connect / Portfolio and Hands-on
15.30 - 17.00	90'	IANOS high density solution / Portfolio and Hands-on

Day 2	Time	Topic
08.00 - 09.00	60'	Network Design / Parallel Optics 40G/100G/400G
09.00 - 10.30	90'	KYPROS balanced copper system / Portfolio and Hands-on
10.30 - 11.00	30'	Transceiver Theory and Order Guide
11.00 - 12.00	60'	Testing Requirements Serial and Parallel Optics / Standards
12.00 - 13.00	60'	Lunch
13.00 - 16.00	180'	Field Testing / Inspection and Measurement
16.00 - 17.00	60'	Questionnaire


LiSA
HUBER+SUHNER

DCCT Training

The following topics form the fundamentals of the DCCT training:

Fiber optic fundamentals

This is section of the training which covers the basics about fiber optic transmission and light propagation. Here we look at the conditions required for communication over glass and some of the influences that affect the quality of signal. This module can be adjusted based on the participants existing knowledge.

- Why fiber optics?
- How the glass is made
- Fiber cable construction
- Wavelengths
- Laser types
- Light reflection
- Modes
- Numerical aperture
- Optical loss
- Fiber attenuation
- Dispersion
- Choosing the right glass

IANOS high density panels

The 19" cabinet is here to stay... and this type of cabinet poses many more challenges than a dedicated fiber management system. In this session we will look at HUBER+SUHNER's high density solution IANOS and how it can be used effectively to offer the highest level of scalability. And how they can be used effectively to offer the highest level of scalability. This session includes a hands-on training.

- Inter-connect topology
- IANOS product portfolio
- Different connectivity methods (splice/patch/pre-term)
- Link examples
- MPO/MTP conversion modules
- Upgrade examples to higher data rates
- Patch-through products
- Cable management
- Patch cord management
- Accessories
- Server and switch connections

Network design and parallel optics

With rising data rates across the board, there is an increasing shift towards parallel optics using MPO/MTP connectivity over multimode fiber. In this session we will look at the possible backbone options and also consider the impact of these backbones on the final transceiver interface.

- Connectivity overview for emerging data rates
- 10 Gbs and 25 Gbs data rates (applying to 40, 100 and 400 GB/s applications)
- Common transceivers
- Fiber positions in the connector and transceiver
- Required connectivity gender
- Next generation transceivers
- MPO/MTP building blocks (8, 12 and 24 fiber)
- Pros and cons of each backbone design
- Common link designs for higher data rates

LISA centralised cross-connects

Centralised cross-connects provide the highest level of infrastructure flexibility. In this session we will look at the benefits of this type of topology and learn more about the LISA system HUBER+SUHNER's high density, cross-connect passive fiber management system. This session includes a hands-on training.

- Pros and cons of each topology (direct, inter-connect and cross-connect)
- Placement of the cross-connect and its primary functions
- CDR size variants and packing density
- LISA product portfolio
- Cold aisle/hot aisle containment systems
- Identification
- Construction and benefits
- Installing and accessing
- Patch cord management
- Typical applications
- Connecting to servers and switches
- Typical link designs

MPO and MTP connectivity

MPO/MTP connectivity has been used in many applications since the 1980's but only in the last years has this connector become the connector of choice for modern data centers running parallel optics. In this session we will look at the history of this connector and also consider the future applications that will depend on this interface in the years to come.

- History of MPO/MTP connectivity
- MPO/MTP benefits
- MPO/MTP performance
- MTP versus MPO
- Singlemode and multimode constraints
- MPO/MTP options and accessories
- Identification
- Cleaning

Polarity management and connectors

Making sure that light passes from a transmit port to a receive port can be a complex topic, especially with the rise in parallel optics over MPO/MTP cable systems and modules. In this session we will explain the main polarity methods and how they can be deployed in a logical way to ease deployment and scalability of the data center.

- Polarity basics and background
- The main types of polarity methods for 12 fiber and 24 fiber MPO/MTP array systems
- Pros and cons of each polarity method
- The impact of polarity methods when upgrading to higher data rates
- Which components can be inter-connected and which not?
- HUBER+SUHNER polarity system for simpler planning and ugrades
- Examples of link designs from 1G to 120G

Test requirements serial and parallel optics

With data rates increasing and link lengths shortening it is very important to guarantee that links are tested and documented in the correct manner. In this session we will look at the do's and don'ts of testing and give advice on how to correctly document the achieved results.

- Justification for testing
- Basics of serial and parallel optics
- Changes in the modern DC that influence testing
- The human factor
- Allowable losses
- Equipment required
- Return loss and insertion loss testing
- What needs to be tested?
- Documenting in accordance with warranty conditions

Fiber optic field cleaning, testing and measurement

Data centers are not always the cleanest environments and despite our best intentions, there is always an element of air-borne debris which can cause connector contamination. In this session we will look at the common contributors of contamination and also the best processes and tools to combat this problem. This session includes a hands-on training.

- Why clean connectors?
- What do the standards say?
- Sources of contamination
- Cleaning best practices
- Cleaning tools
- MPO/MTP cleaning

Optipack cable systems

Saving time and money is always at the forefront of every one's mind when choosing the right cable backbone. In this session we look at the HUBER+SUHNER Optipack portfolio which has significant benefits in terms of speed of installation and packing density.

- Simplex versus multi-strand
- MPO/MTP at the device
- Fiber selection
- Optipack options and fiber density
- Bend-optimised fiber
- Typical applications of each type
- Backbone trunks
- Equipment harnesses
- Labelling and naming schemes

KYPROS balanced copper cable systems

Structured cabling systems are also built from balanced twisted-pair copper components to serve the needs of lower-bandwidth applications, Remote Powering (PoE) and with increasing importance, the needs of building automation systems, CCTV, Access Control systems – the "Distributed Building".

- Copper cabling design rules and supported topologies
- Balanced copper cabling component choice – product overview
  - Component-based
  - Pre-terminated assemblies
  - Category required
  - Media type
- Pathway design
- Segregation
- Applicable Standards from ISO, CENELEC and TIA
- Installation and termination methods
- Test methodology and equipment
- Warranty applications

Structured cabling solutions – design and standards

This section will cover the common data center design approaches for the room space requirements and layout, ducting, optipack cabling systems and rack designs. Additionally there are many standards that are applicable to structured cabling, and may be different depending on where you are in the world. HUBER+SUHNER give an overview of those most applicable, which are preferred and to which component standards our products are constructed.

IEEE application standards
ISO/IEC international design and installation standards
CENELEC design and installation standards
TIA design and installation standards.

- Introduction in HUBER+SUHNER Visio Stencils
- ToR, EoR
- Applicable standards
- Design considerations

Transceiver Theory

This session is optional and explains the different transceivers available on the market. Participants will gain knowledge of the transceiver theory and will be able to use the HUBER+SUHNER transceiver selection guide.

- What are transceivers and how are they built
- Types and functions
- Transceiver selection guide
- Which transceiver for which scenario

Data transport WDM

Smaller and more robust fiber-optical transport systems will play a significant role in the future for different applications. HUBER+SUHNER Cube Optics offers a wide range of products for data center interconnect applications. This is an optional session.

- Company overview
- Active vs. passive transport system
- Technology and application
- Data center interconnect
- Access networks
- Products

Optical switching

Introduction in true transparent physical layer all-optical matrix switch technology. Applications in data centre environments and how to build an all secure optical communication system, mainly for defense and government applications. Solutions for fiber layer provisioning and protection for telecom and data center networks.

- Company overview
- Technology
- Products
- Application/examples

Standards

There are many standards that are applicable to structured cabling, and may be different depending on where you are in the world. HUBER+SUHNER give an overview of those most applicable, which are preferred and to which component standards our products are constructed.

- IEEE application standards
- ISO/IEC international design and installation standards
- CENELEC design and installation standards
- TIA design and installation standards.

HUBER+SUHNER AG
Fiber Optics
Degersheimerstrasse 14
9100 Herisau
Switzerland
Phone +41 71 353 4111
hubersuhner.com

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HUBER+SUHNER is certified according to EN(AS) 9100, ISO 9001, ISO 14001, ISO/TS 16949 and IRIS.