

# Evoluzioni nei connettori per applicazioni di segnale e potenza a bordo treno

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# Agenda

- ITT Company Overview
- Rolling Stock Market Trends and Impact on Connectors
- Innovative and Customized Connector Solutions



# Who We Are

Our Markets

Our Story

Transportation



## Who is ITT?

*At ITT, we have a clear purpose – to partner with our customers in the transportation, industrial, and oil and gas markets to solve their most critical problems.*

Industrial



## What Do We Do?

*We are a leading \$2.4 billion manufacturer of highly engineered, critical components and customized technologies that provide differentiated solutions for our customers across the globe.*

Oil and Gas



## What Makes Us Different?

*We are unique due to the talent and contributions of our 9,500 employees around the world, who are committed to leveraging their Impeccable character, Bold thinking and Collective know-how to solve it for our customers.*

## We solve it

Impeccable character

Bold thinking

Collective know-how



ITT

# History of ITT

## 1920

### The Original ITT

ITT begins life as International Telephone & Telegraph.

## 1960

### The Acquisition Years

ITT rapidly acquires companies, earning a reputation as one of the world's first true conglomerates.

## 1995

### The First Split

In 1995, ITT splits into three companies with ITT Industries retaining the industrial businesses. In 2006, the company reclaims the ITT Corporation name.

## 2011

### The Second Split

In 2011, history repeats itself as ITT splits once again into three publicly traded companies. ITT Corporation continues as a multi-industrial company serving the transportation, industrial and oil and gas end markets

## 2016

### Creating Value

Following the creation of a new parent company, ITT becomes ITT Inc. The company continues to drive a multi-industry strategy keenly focused on long-term growth and value creation by expanding market positions, optimizing execution and deploying capital effectively.

## 1840s-1960s Our Brands Come to Life



**Industrial Pumps and Valves:** In 1848, Seabury Gould starts manufacturing the world's first all-iron pumps. Goulds Pumps merges with ITT in 1997 to form the world's largest fluid technology equipment company, with a focus on pumps and valves for industrial applications.



**Shock Absorbers:** In 1857, KONI begins selling leather horse harnesses and upholstery in the Netherlands. It later switches focus to the automotive market and by 1932 is producing friction shock absorbers. KONI joins the ITT family in 1972.



**Electronic Connectors:** In 1915, Cannon is founded as a small electrical specialty shop, and its first plug sets the company direction and leads to hundreds of thousands of connector configurations over the years. Cannon is acquired by ITT in 1967.

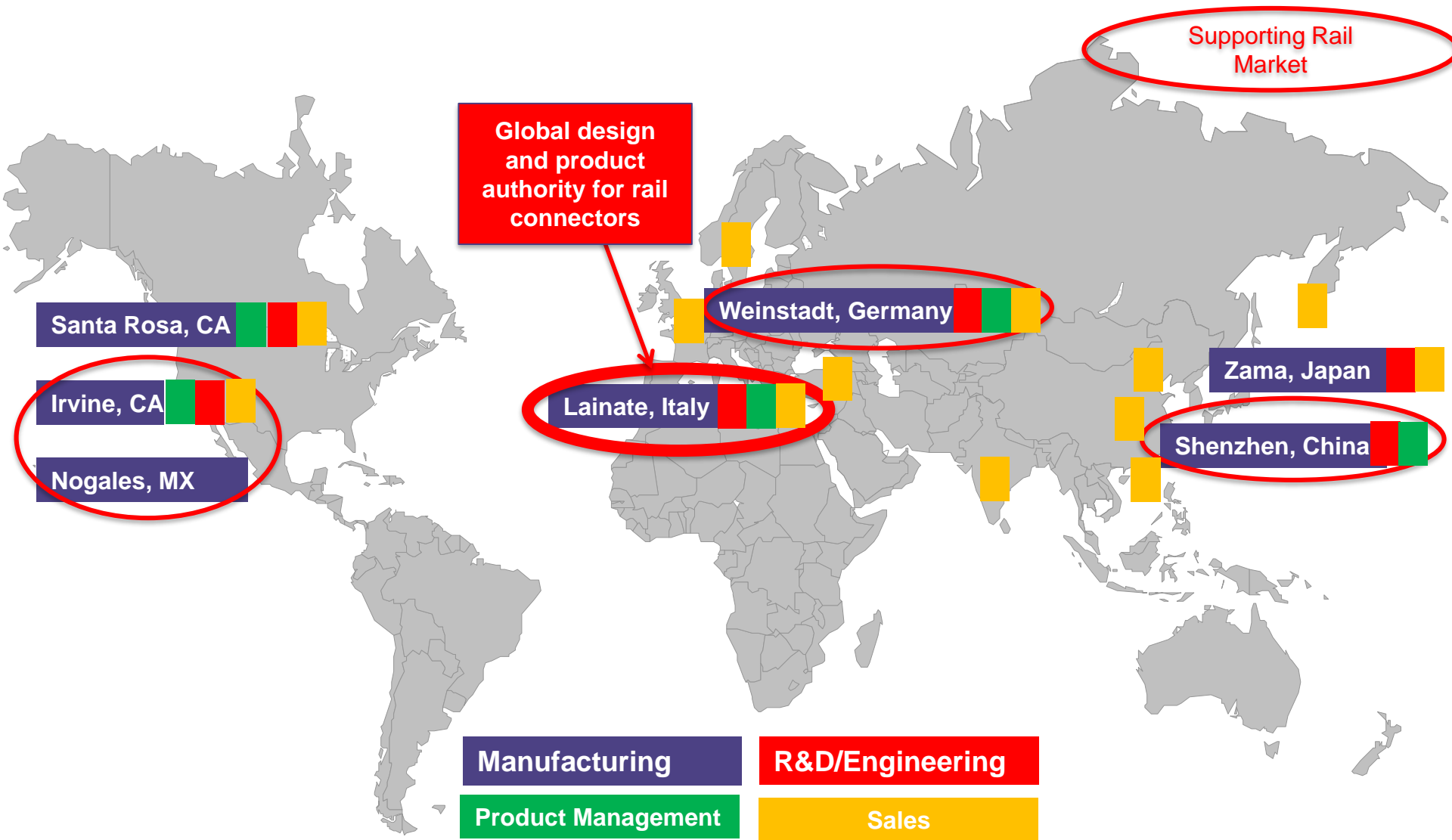
Veam is established in 1936 as a manufacturer of screw machined parts. Veam has begun producing connectors in 1953 and is acquired by ITT in 2003



**Motion Control Devices:** In 1936, Valve-maker General Controls, including its Aerospace Controls unit, is founded, and 1966 marks the founding of shock absorber maker Integrated Dynamics, which later changes its name to Enidine. These companies become part of ITT in 1963 and 2007, respectively.



# Global Footprint for the Connector Market

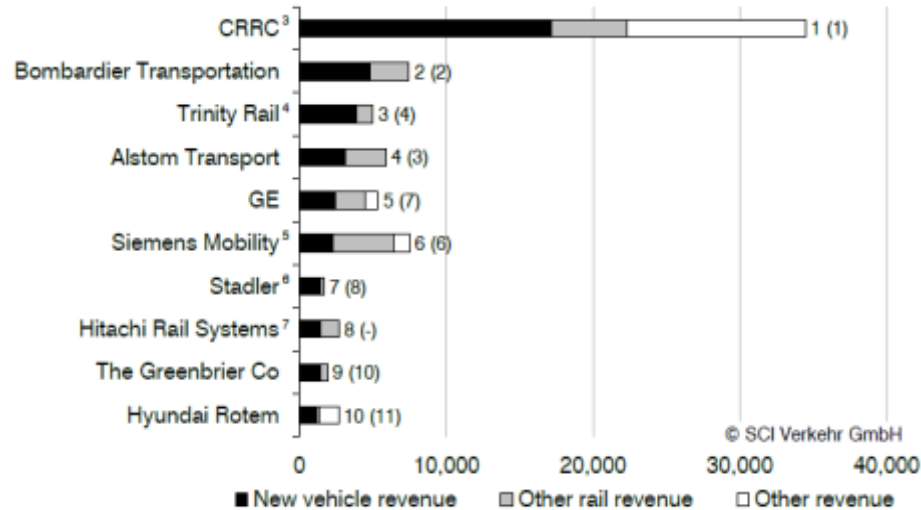


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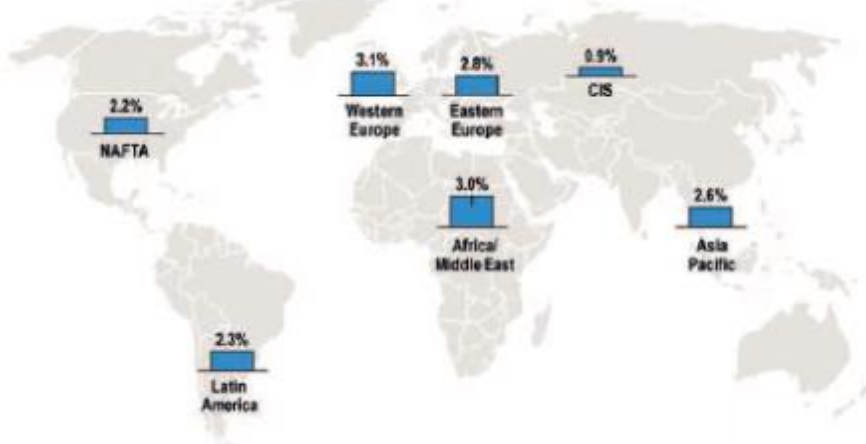
# Rolling Stock Market Evolution

Top 10 manufacturers of rolling stock ranked by new vehicles' revenue 2015<sup>1</sup> [EUR million<sup>2</sup>]



Overall rail supply market 2016-2021 CAGR (rolling stock, rail control, infrastructure, services)

Source: Unife 2016, World Rail Market Study



- CRRC transitioned from regional manufacturer to global leader within 3 years. Projected to gain more market position over next 5 years through strategy in USA & EU**
- Global Rail market to grow at 3% CAGR
  - Europe: 3% - Replacement of aging regional commuter trains
  - Americas: 2.2% - Mostly commuter & urban projects, high-speed programs still highly uncertain
  - Asia: 2.6% - China growing after-sales market, but declining in very high-speed (350km/h) applications. Regional growth in urban, suburban and intercity high-speed (250 km/h)
- Urbanization, Mega Cities, Mega Corridors – USA moving forward with High Speed plan
- Climate goals - Energy friendly trains - Innovating to ZERO (emissions, accidents, fatalities, defects)
- Upgrade and replacement of aging rolling stock in mature markets
- New rolling stock construction in developing economies
- High investments in rail control and infrastructure (ERTMS/PTC)
- OEM consolidation expected to continue, due to challenging market conditions for traditional manufacturers (Alstom/Siemens)
- CRRC's global expansion (Initially focused on NA, with further plans into European market)
- Price and lead time pressure on traditional products
- Rationalization/downsizing of Engineering at OEMs

# Impacts on Connector Technologies

## Market Trends

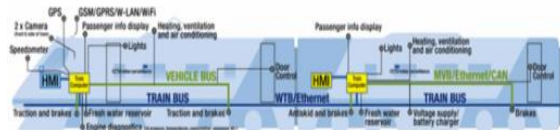
- **New industry standards**
  - for connectors (EN50467)
  - for fire & smoke performance (EN45545)
- **Increase in data communication (Ethernet, Video, etc)**
- **Increase in number of wires and power requirements**
- **Longer life of equipment**
- **Reduced maintenance**
- **Rationalization/downsizing of Engineering at train manufacturers**
- **Shorter project cycle times, market lead-time reductions**
- **Market consolidation**

## Impacts

- **Compliance to new specifications**
- **High-speed copper and fiber connectivity**
- **Space-saving solutions supporting high power density**
- **Longer corrosion resistance and reliability**
- **Easy-to-use solutions**
- **Easy-to-design solutions, engineering support for customized solutions**
- **Fast prototyping, part standardization**
- **Global products and support**



# Innovative Product – VEAM CIR M12



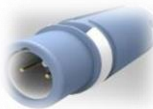
COAX



4-pole



2-pole



8-pole



1-way



4-way



7-way



## Market Drivers

- Increase of data communication inside the train and train-to-track
- Higher transmission speed and combination of multiple communication protocols

## Technical Requirements

- Compliance to rail standards
- Data communication over twisted pair (up to 1-10Gbps) or over coax

## Value Proposition

- Complete solution set (MVB, WTB, Ethernet, Coax)
- Multiple connector sizes (1-way, 4-way, 7-way)
- Reliable and rugged FRCIR bayonet system
- Harnessing and pre-testing capabilities





# Innovative Product – Blue Generation Plating



Plating type	RoHS	Salt spray	Conductive	Colour
T240 - Zn Nickel Blue	yes	500h	yes	grey-blue



## Market Drivers

- Longer equipment life
- Environmental regulations

## Technical Requirements

- Resistance to harshest environments
- Shell to shell conductivity
- Environmental compliance

- **Applicable on all machined or die cast Aluminium shells**
- **Compatible with other platings**
  - Test reports available



### 1. More environmentally friendly than Cadmium

- Same corrosion resistance, BUT ROHS COMPLIANT



### 2. Longer life than Zinc Cobalt

- Longer corrosion resistance (500H vs. 200H)

### 3. Allow standardization of conductive and non-conductive products

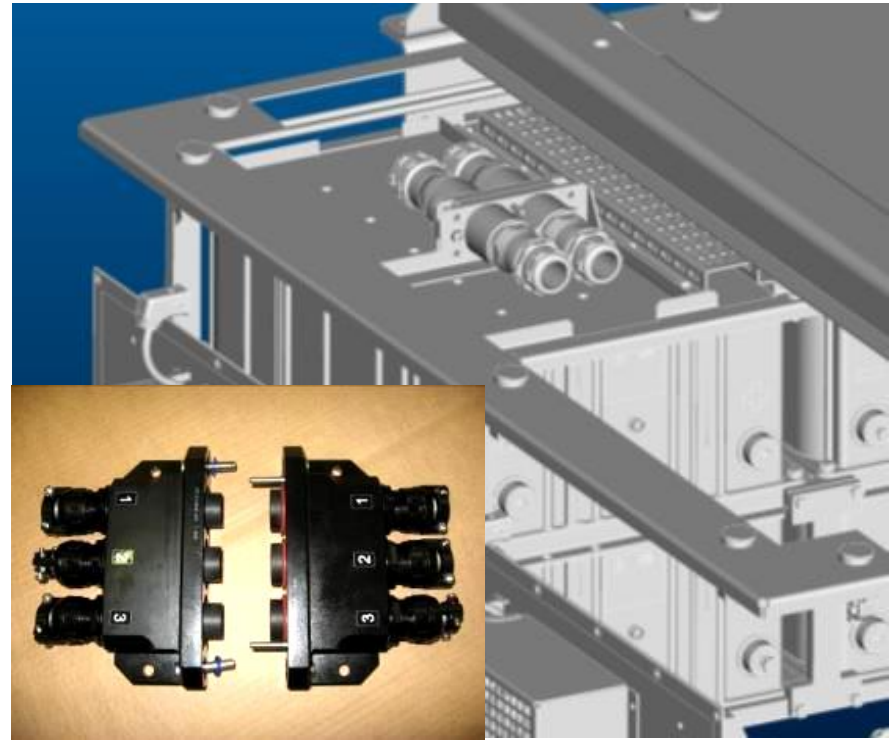
- Same corrosion resistance (500H) as non-conductive Epoxyurethanic varnish

## Value Proposition

- Available on multiple product lines (VEAM FRCIR, VEAM VBN, CA Bayonet, KPxx)
- Longer lifetime
- High corrosion resistance (superior to MIL-QPL stds)
- Environmentally friendly (RoHS and Reach compliant)



# Innovative Product – Veam Power Plates



## Market Drivers

- Higher power requirements
- Reduction of weight

## Technical Requirements

- Limited space
- Environmental protection
- Electrical performance

## Value Proposition

- Compact size and lighter weight compared to using multiple standard connectors
- Customized according cable, available space and mounting requirements
- Faster to install compared to modular products
- Easy to plug and unplug



# Innovative Product – Veam HTB (High Temperature)



## Market Drivers

- Safety into tunnels
- Fire protection of critical control signals

## Technical Requirements

- Resistance for 15 minutes at 738°C (ISO 834-1 heating curve)

## Applications



1- CONVERTERS

2- TRACTION MOTORS

3- INTER-VEHICLES

4- POWER DISTRIBUTION

## Value Proposition

- To exceed the standard set into the TSI of the European Union Agency for Railways
- Reliable CIR coupling mechanism
- REI 30 according to EN 13501-2 / EN 1363-1
- Able to withstand 800 degrees Celsius for 30 minutes (tested at external lab)



# Standards for Rail connectors - Overview

Traditional circular connectors used on train applications are based on military standards

- **MIL-DTL-5015 (US) - VG95234 (Germany)**
- **MIL-C-26482 (US) - VG95328 (Germany)**

Due to update of environmental, safety and fire resistance requirements, the above specifications are becoming obsolete.

A new EU standard has been introduced:

- **EN50467: Railway applications – Rolling stock – Electrical connectors, requirements and test methods**

The EN standard covers the main functional requirements, but not the interface requirements. That means: circular, rectangular, plastic, metal connectors can comply with EN50467.

There is no specific international standard (IEC) for connectors for railway applications.



# Standards for Rail connectors – EN50467

The EN50467 general standard refers to other specifications to define detailed requirements and test methods

## **ELECTRICAL SAFETY**

- **EN IEC 60664-1:** Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests
- **EN IEC 61984-1:** Connectors – Safety requirements and tests
- **EN 50124-1:** Railway applications - Insulation coordination -- Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment

## **MECHANICAL**

### **Shock and Vibration**

- **EN 61373-1:** Railway applications. Rolling stock equipment. Shock and vibration tests

## **PROTECTION**

### **Sealing**

- **EN IEC 60529:** Degrees of protection provided by enclosures (IP Code)

## **FIRE AND SMOKE**

- see next slides



# Fire and Smoke standards

Historically there has been a lot of different fire safety standards, with different classification schemes, test methods and requirements



- ❑ The new EN 45545 was published in March 2013
- ❑ The national versions were published too
  - NF EN 45545-04-20
  - BS EN 45545-07-31
  - DIN EN 45545-08-01
- ❑ National standards had to be withdrawn until March 2016

# Fire and Smoke standard - EN 45545-2

- **Relevant application categories for connectors**

- R22 (interior applications)
- R23 (exterior applications)

- **3 Hazard Levels**

- HL1 = Tramway, Light Rail
- HL2 = High Speed, Mainline, Regional, Subway... **90% of the market**
- HL3= Sleeping and couchette cars

	Design category			
OC	N standard	A automatic	D double decked	S sleeper
1	HL1	HL1	HL1	HL2
2	HL2	HL2	HL2	HL2
3	HL2	HL2	HL2	HL3
4	HL3	HL3	HL3	HL3

# Latest market requirements for Connectors

<b><i>Mechanical and Environmental</i></b>	
<b>Sealing</b>	IP67 – IP68
<b>Temperature range</b>	-40°C to 125°C <i>-50°C for Russia and Canada</i>
<b>Substances</b>	RoHS and REACH
<b>Corrosion resistance</b>	Min. 500h salt spray test
<b>Fire and Smoke</b>	EN45545 R22/R23 HL3 NPFA130 (USA) UL94V0 (USA)
<b>General requirements</b>	EN 50467 (for all not listed)
<b>Shock and Vibration</b>	EN 61373 Category 2 (up to bogie application)
<b>Mating cycles</b>	min. 500

## **CONTACTS / RATED CURRENT**

- Cable according to EN 50306-2 and EN 50264
- Stranded wires acc. To EN 60228 class 5
- Crimp dies acc. To EN 46235

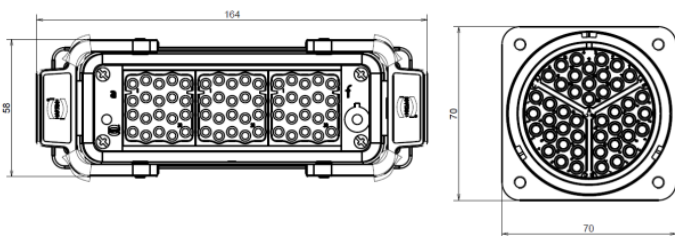
## **VOLTAGE RATING**

According to:

- EN 61984
- EN 60664
- **EN 50124 - rating OV3 / PD3**



# The future of connectors – VEAM ‘Modular Circular’



## Market Drivers

- Increased support and easy-to-use solutions required (rationalization of customer Engineering)
- New market-specific connector standard
- Responsiveness to shorter project cycle times
- Component standardization across regions and market lead-time reductions

## Technical Requirements

- Environmental protection IP67 or above
- Fire and smoke, electrical and mechanical performance according rail standards
- Corrosion resistance 500h



## Value Proposition

- Modularity
- Space saving
- Ease of assembly and configuration
- Easy to mate/unmate
- Standardization of core components / Shorter lead time
- Full compliance to new rail European standards



See you at InnoTrans



Thank you!