

Global On-board Traction Transformers Supply, Demand and Key Producers, 2026-2032

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Abstracts

The global On-board Traction Transformers market size is expected to reach \$ 1784 million by 2032, rising at a market growth of 5.6% CAGR during the forecast period (2026-2032).

On-board Traction Transformers are purpose-built power transformers installed between the high-voltage line circuit and traction converters of AC-fed railway rolling stock. They step down single-phase catenary voltages, commonly 15 kV or 25 kV, while providing electrical isolation and supporting traction, auxiliary, heating or integrated reactor functions according to vehicle design. The equipment is engineered for repetitive acceleration and regenerative-braking loads, restricted weight and installation envelopes, shock and vibration, temperature variation, fire safety and long operating life. Principal commercial forms comprise liquid-filled and dry-type transformers installed in machine rooms, beneath vehicle floors or on roofs, with natural, forced-air, forced-liquid or integrated cooling. Key specifications include rated power, input voltage and frequency, impedance, efficiency and losses, insulation level, short-circuit withstand capability, temperature rise, weight, dimensions, noise and maintainability. This study focuses on main traction-transformer equipment supplied for high-speed trains, electric locomotives, electric multiple units, intercity and commuter trains, tram-trains and AC metro rolling stock.

Key Findings

In 2025, global On-board Traction Transformers production reached approximately 7,377 Units. The average price is approximately \$160,000

New rolling-stock programs represented approximately 75%–82% of equipment revenue

Europe accounted for an estimated 48%–55% of supplier-origin revenue

The five leading groups represented approximately 66% of the narrow-scope market

Market Trends

The On-board Traction Transformers market is moving from conventional capacity expansion toward improvements in power density, energy efficiency, fire safety, environmental performance and lifecycle maintainability. Liquid-filled transformers remain the principal solution for high-power locomotives and established train platforms, while dry-type designs are gaining acceptance where oil-free operation, reduced leakage risk and simplified maintenance carry greater value. Integrated cooling, modular transformer-reactor assemblies, lower-loss magnetic materials, aluminum winding optimization and digital condition monitoring are becoming more important in new platform specifications. The 360-unit dry-type transformer program announced for Munich's new S-Bahn fleet illustrates that oil-free technology has progressed from demonstration to batch deployment. Power-electronic and solid-state traction transformers may eventually combine voltage conversion, high-frequency isolation and converter functions, but their near-term role remains concentrated in prototypes and limited pilot fleets because semiconductor cost, thermal management, electromagnetic compatibility and railway qualification remain significant barriers. The most probable industry direction is therefore parallel development: continuous optimization of line-frequency transformers alongside selective commercialization of PET/SST architectures. Hitachi Energy official announcement

Market Dynamics

Drivers

Demand is supported by railway electrification, new high-speed and intercity fleets, electric locomotive procurement and the replacement of aging rolling stock. Each new AC-powered platform creates requirements for project-specific voltage matching, thermal management, weight reduction and integration with traction converters, making

On-board Traction Transformers are an essential part of the propulsion chain rather than a discretionary component. Fleet modernization also generates replacement demand because transformers are exposed to long operating cycles, vibration and repeated thermal loading. Policy support for lower-emission transport, rail capacity expansion and localized manufacturing strengthens the investment case, particularly in China, India and selected European corridors. The continued expansion of electrified passenger and freight activity provides a stable underlying demand base, while stricter efficiency and lifecycle-cost requirements increase the value of upgraded transformers even where annual vehicle production grows moderately.

Restraints

The principal restraints are long qualification cycles, project-dependent demand and substantial engineering costs. On-board Traction Transformers must satisfy stringent insulation, short-circuit, thermal, vibration, noise and fire requirements, and a design qualified for one train platform cannot always be transferred directly to another. This limits production standardization and prevents manufacturers from obtaining the scale economics typical of general-purpose transformers. Copper, aluminum, electrical steel, insulation materials and cooling components create additional cost exposure, while project delays can shift revenue recognition materially between years. Customers also place strong pressure on weight, losses and procurement prices without relaxing reliability requirements. In markets with limited AC railway development, the addressable installed base remains too small to support independent local production, leaving demand dependent on imported components or global rolling-stock programs.

Opportunities

The most attractive opportunities lie in lightweight designs, dry-type and lower-environmental-impact insulation systems, integrated cooling, condition monitoring and localized production for emerging railway platforms. Underfloor products can capture demand from trainsets seeking to release passenger space, while modular transformer-reactor assemblies can reduce installation complexity for rolling-stock manufacturers. Replacement programs create opportunities for suppliers capable of redesigning discontinued or obsolete units without altering the vehicle's established electrical architecture. India offers a particularly visible localization opportunity as domestic manufacturers extend into semi-high-speed propulsion components; BHEL's commencement of underslung transformer deliveries for the Vande Bharat Sleeper platform confirms that regional supply chains are moving further into critical traction

equipment. PET/SST technology provides a longer-term opportunity for companies combining transformer engineering, high-voltage semiconductors, thermal management and vehicle-control expertise, although revenue potential will depend on successful platform qualification. BHEL official announcement

Challenges

The industry must manage low production volumes per design, concentrated customer procurement and responsibility for equipment expected to operate reliably over several decades. Manufacturers need early access to rolling-stock platform specifications, specialized testing capacity and the financial resources to support extended development and warranty periods. Supply-chain localization can create market access but may also fragment production, duplicate qualification work and increase quality-control complexity. The growing use of SiC traction converters, batteries, hydrogen powertrains and alternative vehicle architectures adds uncertainty to future transformer configurations. PET/SST commercialization presents an additional strategic challenge: suppliers must invest before clear volume visibility emerges, while conventional products still account for most near-term revenue. Companies that underinvest risk technological displacement, but aggressive investment could produce weak returns if railway operators retain proven line-frequency architectures for longer than anticipated.

Industry Chain Analysis

The upstream chain comprises electrical steel, copper or aluminum conductors, liquid or solid insulation systems, tanks and structural components, bushings, cooling equipment, sensors and specialized protection devices. Material selection directly affects transformer weight, losses, thermal performance, fire behavior and lifecycle reliability. Electrical steel and winding materials represent important cost elements, but engineering validation, project-specific tooling and quality assurance also account for a meaningful portion of delivered value. Suppliers must maintain traceability and process control across winding, core assembly, insulation treatment, tank fabrication, drying, testing and final system integration because deficiencies discovered after vehicle installation can create disproportionate warranty and operational costs.

Midstream participants design and manufacture complete On-board Traction Transformers, frequently co-engineering the unit with rolling-stock manufacturers and traction-converter suppliers. Value is created through electromagnetic, thermal,

mechanical and insulation-system optimization rather than through material conversion alone. Downstream customers include train manufacturers, propulsion-system integrators, railway operators and fleet-maintenance organizations. New-build contracts provide the majority of demand, while replacement and modernization projects contribute a smaller but strategically attractive stream with higher engineering and reverse-design content. Profitability depends on platform reuse, manufacturing utilization, localization requirements, warranty exposure and the ability to supply cooling, monitoring and lifecycle services around the core transformer.

Segment Insights

Conventional line-frequency electromagnetic transformers remain the principal revenue segment and are expected to retain their dominant position through the forecast period. Within this category, liquid-filled products account for the larger installed and revenue base because they offer established performance in high-capacity locomotives, high-speed trains and mainline electric multiple units. Dry-type products represent a smaller but strategically important segment, with adoption concentrated in applications where fire safety, oil-free operation and lower maintenance requirements can justify a higher initial engineering burden. Integrated transformer-reactor assemblies also have increasing relevance because they can simplify the traction package and reduce duplicated structural or cooling components.

By vehicle application, electric locomotives, high-speed trains and mainline or regional electric multiple units form the core demand base. The 25 kV, 50/60 Hz category offers the broadest platform opportunity because it is widely used in new high-speed and mainline electrification projects, while the 15 kV, 16.7 Hz segment remains important in established Central and Northern European networks. Underfloor mounting is likely to gain share in passenger trainsets as manufacturers prioritize usable interior space, although machine-room configurations retain advantages for high-power locomotives and maintenance access. PET/SST remains an emerging technology segment and should be assessed separately from commercially mature transformer shipments.

Downstream Market Opportunities

The strongest downstream opportunity is associated with new AC-powered train platforms and replacement cycles for fleets entering mid-life modernization. High-speed and intercity projects require low-loss, lightweight transformers capable of meeting strict noise and thermal limits, while freight locomotives prioritize high capacity, overload

performance and serviceability. Regional and commuter fleets create opportunities for compact underfloor or roof-mounted products that preserve passenger space. Operators replacing aging transformers increasingly require form-fit-function compatibility, improved efficiency and condition-monitoring capability without comprehensive redesign of the traction system. Localization policies can also create opportunities for technology transfer, joint manufacturing and regional service capacity. The most commercially attractive suppliers will be those able to participate early in train-platform design and remain involved through production, fleet commissioning, maintenance and eventual replacement.

Regional Insights

Europe is the largest supply-side center, representing an estimated 48%–55% of supplier-origin revenue and hosting the densest concentration of global engineering, qualification and manufacturing capabilities. Its market combines new rolling-stock programs with a substantial installed base requiring replacement and modernization. Asia is the principal volume and localization growth engine. China benefits from large high-speed, EMU and electric-locomotive platforms supported by domestic manufacturing entities, while Japan retains deep expertise linked to Shinkansen and established railway electrical systems. India is developing the most active group of regional specialists and new entrants as locomotive and semi-high-speed train programs increase local-content requirements.

South Korea supports a limited number of regional suppliers, whereas North America has relatively low demand because mainline railway electrification remains limited. Southeast Asia, the Middle East and other emerging regions generally depend on imported rolling stock, global propulsion packages or project-specific localization. Regional competition therefore differs materially: Europe emphasizes technology, lifecycle performance and cross-platform certification; China emphasizes scale, platform integration and domestic supply; India emphasizes localization and cost competitiveness; and smaller regions prioritize project access, financing, service support and compatibility with imported train fleets.

Competitive Landscape Analysis

The On-board Traction Transformers market has a moderately high level of concentration and a project-based competitive structure. Hitachi Energy, Siemens

Energy, Alstom, Mitsubishi Electric and CRRC form the leading group and together account for approximately two-thirds of the narrow-scope market. Their advantages arise from extensive installed bases, early participation in rolling-stock development, proprietary electromagnetic and thermal engineering, qualification capacity, manufacturing localization and global service coverage. Hitachi Energy combines broad liquid-filled and dry-type offerings with a large cross-platform installed base; Siemens Energy competes through its Tractronic portfolio; Alstom benefits from integration with traction and rolling-stock platforms; Mitsubishi Electric has strong high-speed rail expertise; and CRRC derives scale from Chinese train and locomotive programs. Fuji Electric, JST Transformatours and Hind Rectifiers occupy specialist positions, while BHEL, INTERNATIONAL ELECTRIC and River Engineering strengthen regional supply. Competitive differentiation is increasingly based on weight, losses, fire behavior, cooling integration, maintenance requirements and lifecycle cost rather than nominal transformer capacity alone. Historical consolidation also requires careful interpretation: former ABB traction-transformer activities are reflected under Hitachi Energy, and former Bombardier Transportation operations are incorporated into Alstom.

Report Scope

This report studies the global On-board Traction Transformers production, demand, key manufacturers, and key regions.

This report is a detailed and comprehensive analysis of the world market for On-board Traction Transformers and provides market size (US\$ million) and Year-over-Year (YoY) Growth, considering 2025 as the base year. This report explores demand trends and competition, as well as details the characteristics of On-board Traction Transformers that contribute to its increasing demand across many markets.

Highlights and key features of the study

Global On-board Traction Transformers total production and demand, 2021-2032, (Units)

Global On-board Traction Transformers total production value, 2021-2032, (USD Million)

Global On-board Traction Transformers production by region & country,

production, value, CAGR, 2021-2032, (USD Million) & (Units), (based on production site)

Global On-board Traction Transformers consumption by region & country, CAGR, 2021-2032 & (Units)

U.S. VS China: On-board Traction Transformers domestic production, consumption, key domestic manufacturers and share

Global On-board Traction Transformers production by manufacturer, production, price, value and market share 2021-2026, (USD Million) & (Units)

Global On-board Traction Transformers production by Type, production, value, CAGR, 2021-2032, (USD Million) & (Units)

Global On-board Traction Transformers production by Application, production, value, CAGR, 2021-2032, (USD Million) & (Units)

This report profiles key players in the global On-board Traction Transformers market based on the following parameters - company overview, production, value, price, gross margin, product portfolio, geographical presence, and key developments. Key companies covered as a part of this study include Hitachi Energy Ltd., Siemens Energy AG, Alstom SA, Mitsubishi Electric Corporation, CRRC Corporation Limited, Fuji Electric Co., Ltd., JST Transformatours, Hind Rectifiers Limited, Bharat Heavy Electricals Limited, INTERNATIONAL ELECTRIC Co., Ltd., etc.

This report also provides key insights about market drivers, restraints, opportunities, new product launches or approvals.

Stakeholders would have ease in decision-making through various strategy matrices used in analyzing the World On-board Traction Transformers market

Detailed Segmentation:

Each section contains quantitative market data including market by value (US\$ Millions), volume (production, consumption) & (Units) and average price (US\$/Unit) by manufacturer, by Type, and by Application. Data is given for the years 2021-2032 by

year with 2025 as the base year, 2026 as the estimate year, and 2027-2032 as the forecast year.

Global On-board Traction Transformers Market, By Region:

United States

China

Europe

Japan

South Korea

ASEAN

India

Rest of World

Market Segmentation

Global On-board Traction Transformers Market, Segmentation by Type:

Conventional Line-frequency Electromagnetic Transformers

Integrated Transformer-reactor Assemblies

Solid-state Traction Transformers

Others

Global On-board Traction Transformers Market, Segmentation by

Mounting Position:

Machine-room Mounted

Underfloor Mounted

Roof-mounted

Others

Global On-board Traction Transformers Market, Segmentation by Rated Capacity:

Small Capacity: ≤2,500 kVA

Medium Capacity: 2,500–6,000 kVA

Large Capacity: 6,000–12,000 kVA

Extra-Large Capacity: >12,000 kVA

Global On-board Traction Transformers Market, Segmentation by Application:

Electric Locomotives

High-speed Trains

Mainline and Regional EMUs

Others

Companies Profiled:

Hitachi Energy Ltd.

Siemens Energy AG

Alstom SA

Mitsubishi Electric Corporation

CRRC Corporation Limited

Fuji Electric Co., Ltd.

JST Transformatours

Hind Rectifiers Limited

Bharat Heavy Electricals Limited

INTERNATIONAL ELECTRIC Co., Ltd.

River Engineering Pvt. Ltd.

Key Questions Answered

1. How big is the global On-board Traction Transformers market?
2. What is the demand of the global On-board Traction Transformers market?
3. What is the year over year growth of the global On-board Traction Transformers market?
4. What is the total value of the global On-board Traction Transformers market?
5. Who are the Major Players in the global On-board Traction Transformers market?
6. What are the growth factors driving the market demand?

Contents

1 SUPPLY SUMMARY

- 1.1 On-board Traction Transformers Introduction
- 1.2 World On-board Traction Transformers Supply & Forecast
 - 1.2.1 World On-board Traction Transformers Production Value (2021 & 2025 & 2032)
 - 1.2.2 World On-board Traction Transformers Production (2021-2032)
 - 1.2.3 World On-board Traction Transformers Pricing Trends (2021-2032)
- 1.3 World On-board Traction Transformers Production by Region (Based on Production Site)
 - 1.3.1 World On-board Traction Transformers Production Value by Region (2021-2032)
 - 1.3.2 World On-board Traction Transformers Production by Region (2021-2032)
 - 1.3.3 World On-board Traction Transformers Average Price by Region (2021-2032)
 - 1.3.4 North America On-board Traction Transformers Production (2021-2032)
 - 1.3.5 Europe On-board Traction Transformers Production (2021-2032)
 - 1.3.6 China On-board Traction Transformers Production (2021-2032)
 - 1.3.7 Japan On-board Traction Transformers Production (2021-2032)
- 1.4 Market Drivers, Restraints and Trends
 - 1.4.1 On-board Traction Transformers Market Drivers
 - 1.4.2 Factors Affecting Demand
 - 1.4.3 On-board Traction Transformers Major Market Trends

2 DEMAND SUMMARY

- 2.1 World On-board Traction Transformers Demand (2021-2032)
- 2.2 World On-board Traction Transformers Consumption by Region
 - 2.2.1 World On-board Traction Transformers Consumption by Region (2021-2026)
 - 2.2.2 World On-board Traction Transformers Consumption Forecast by Region (2027-2032)
- 2.3 United States On-board Traction Transformers Consumption (2021-2032)
- 2.4 China On-board Traction Transformers Consumption (2021-2032)
- 2.5 Europe On-board Traction Transformers Consumption (2021-2032)
- 2.6 Japan On-board Traction Transformers Consumption (2021-2032)
- 2.7 South Korea On-board Traction Transformers Consumption (2021-2032)
- 2.8 ASEAN On-board Traction Transformers Consumption (2021-2032)
- 2.9 India On-board Traction Transformers Consumption (2021-2032)

3 WORLD MANUFACTURERS COMPETITIVE ANALYSIS

- 3.1 World On-board Traction Transformers Production Value by Manufacturer (2021-2026)
- 3.2 World On-board Traction Transformers Production by Manufacturer (2021-2026)
- 3.3 World On-board Traction Transformers Average Price by Manufacturer (2021-2026)
- 3.4 On-board Traction Transformers Company Evaluation Quadrant
- 3.5 Industry Rank and Concentration Rate (CR)
 - 3.5.1 Global On-board Traction Transformers Industry Rank of Major Manufacturers
 - 3.5.2 Global Concentration Ratios (CR4) for On-board Traction Transformers in 2025
 - 3.5.3 Global Concentration Ratios (CR8) for On-board Traction Transformers in 2025
- 3.6 On-board Traction Transformers Market: Overall Company Footprint Analysis
 - 3.6.1 On-board Traction Transformers Market: Region Footprint
 - 3.6.2 On-board Traction Transformers Market: Company Product Type Footprint
 - 3.6.3 On-board Traction Transformers Market: Company Product Application Footprint
- 3.7 Competitive Environment
 - 3.7.1 Historical Structure of the Industry
 - 3.7.2 Barriers of Market Entry
 - 3.7.3 Factors of Competition
- 3.8 New Entrant and Capacity Expansion Plans
- 3.9 Mergers, Acquisition, Agreements, and Collaborations

4 UNITED STATES VS CHINA VS REST OF THE WORLD

- 4.1 United States VS China: On-board Traction Transformers Production Value Comparison
 - 4.1.1 United States VS China: On-board Traction Transformers Production Value Comparison (2021 & 2025 & 2032)
 - 4.1.2 United States VS China: On-board Traction Transformers Production Value Market Share Comparison (2021 & 2025 & 2032)
- 4.2 United States VS China: On-board Traction Transformers Production Comparison
 - 4.2.1 United States VS China: On-board Traction Transformers Production Comparison (2021 & 2025 & 2032)
 - 4.2.2 United States VS China: On-board Traction Transformers Production Market Share Comparison (2021 & 2025 & 2032)
- 4.3 United States VS China: On-board Traction Transformers Consumption Comparison
 - 4.3.1 United States VS China: On-board Traction Transformers Consumption Comparison (2021 & 2025 & 2032)
 - 4.3.2 United States VS China: On-board Traction Transformers Consumption Market Share Comparison (2021 & 2025 & 2032)

4.4 United States Based On-board Traction Transformers Manufacturers and Market Share, 2021-2026

4.4.1 United States Based On-board Traction Transformers Manufacturers, Headquarters and Production Site (States, Country)

4.4.2 United States Based Manufacturers On-board Traction Transformers Production Value (2021-2026)

4.4.3 United States Based Manufacturers On-board Traction Transformers Production (2021-2026)

4.5 China Based On-board Traction Transformers Manufacturers and Market Share

4.5.1 China Based On-board Traction Transformers Manufacturers, Headquarters and Production Site (Province, Country)

4.5.2 China Based Manufacturers On-board Traction Transformers Production Value (2021-2026)

4.5.3 China Based Manufacturers On-board Traction Transformers Production (2021-2026)

4.6 Rest of World Based On-board Traction Transformers Manufacturers and Market Share, 2021-2026

4.6.1 Rest of World Based On-board Traction Transformers Manufacturers, Headquarters and Production Site (State, Country)

4.6.2 Rest of World Based Manufacturers On-board Traction Transformers Production Value (2021-2026)

4.6.3 Rest of World Based Manufacturers On-board Traction Transformers Production (2021-2026)

5 MARKET ANALYSIS BY TYPE

5.1 World On-board Traction Transformers Market Size Overview by Type: 2021 VS 2025 VS 2032

5.2 Segment Introduction by Type

5.2.1 Conventional Line-frequency Electromagnetic Transformers

5.2.2 Integrated Transformer-reactor Assemblies

5.2.3 Solid-state Traction Transformers

5.2.4 Others

5.3 Market Segment by Type

5.3.1 World On-board Traction Transformers Production by Type (2021-2032)

5.3.2 World On-board Traction Transformers Production Value by Type (2021-2032)

5.3.3 World On-board Traction Transformers Average Price by Type (2021-2032)

6 MARKET ANALYSIS BY MOUNTING POSITION

6.1 World On-board Traction Transformers Market Size Overview by Mounting Position:
2021 VS 2025 VS 2032

6.2 Segment Introduction by Mounting Position

6.2.1 Machine-room Mounted

6.2.2 Underfloor Mounted

6.2.3 Roof-mounted

6.2.4 Others

6.3 Market Segment by Mounting Position

6.3.1 World On-board Traction Transformers Production by Mounting Position
(2021-2032)

6.3.2 World On-board Traction Transformers Production Value by Mounting Position
(2021-2032)

6.3.3 World On-board Traction Transformers Average Price by Mounting Position
(2021-2032)

7 MARKET ANALYSIS BY RATED CAPACITY

7.1 World On-board Traction Transformers Market Size Overview by Rated Capacity:
2021 VS 2025 VS 2032

7.2 Segment Introduction by Rated Capacity

7.2.1 Small Capacity: ?2,500 kVA

7.2.2 Medium Capacity: 2,500–6,000 kVA

7.2.3 Large Capacity: 6,000–12,000 kVA

7.2.4 Extra-Large Capacity: >12,000 kVA

7.3 Market Segment by Rated Capacity

7.3.1 World On-board Traction Transformers Production by Rated Capacity
(2021-2032)

7.3.2 World On-board Traction Transformers Production Value by Rated Capacity
(2021-2032)

7.3.3 World On-board Traction Transformers Average Price by Rated Capacity
(2021-2032)

8 MARKET ANALYSIS BY APPLICATION

8.1 World On-board Traction Transformers Market Size Overview by Application: 2021
VS 2025 VS 2032

8.2 Segment Introduction by Application

8.2.1 Electric Locomotives

8.2.2 High-speed Trains

8.2.3 Mainline and Regional EMUs

8.2.4 Others

8.3 Market Segment by Application

8.3.1 World On-board Traction Transformers Production by Application (2021-2032)

8.3.2 World On-board Traction Transformers Production Value by Application
(2021-2032)

8.3.3 World On-board Traction Transformers Average Price by Application
(2021-2032)

9 COMPANY PROFILES

9.1 Hitachi Energy Ltd.

9.1.1 Hitachi Energy Ltd. Details

9.1.2 Hitachi Energy Ltd. Major Business

9.1.3 Hitachi Energy Ltd. On-board Traction Transformers Product and Services

9.1.4 Hitachi Energy Ltd. On-board Traction Transformers Production, Price, Value,
Gross Margin and Market Share (2021-2026)

9.1.5 Hitachi Energy Ltd. Recent Developments/Updates

9.1.6 Hitachi Energy Ltd. Competitive Strengths & Weaknesses

9.2 Siemens Energy AG

9.2.1 Siemens Energy AG Details

9.2.2 Siemens Energy AG Major Business

9.2.3 Siemens Energy AG On-board Traction Transformers Product and Services

9.2.4 Siemens Energy AG On-board Traction Transformers Production, Price, Value,
Gross Margin and Market Share (2021-2026)

9.2.5 Siemens Energy AG Recent Developments/Updates

9.2.6 Siemens Energy AG Competitive Strengths & Weaknesses

9.3 Alstom SA

9.3.1 Alstom SA Details

9.3.2 Alstom SA Major Business

9.3.3 Alstom SA On-board Traction Transformers Product and Services

9.3.4 Alstom SA On-board Traction Transformers Production, Price, Value, Gross
Margin and Market Share (2021-2026)

9.3.5 Alstom SA Recent Developments/Updates

9.3.6 Alstom SA Competitive Strengths & Weaknesses

9.4 Mitsubishi Electric Corporation

9.4.1 Mitsubishi Electric Corporation Details

9.4.2 Mitsubishi Electric Corporation Major Business

9.4.3 Mitsubishi Electric Corporation On-board Traction Transformers Product and Services

9.4.4 Mitsubishi Electric Corporation On-board Traction Transformers Production, Price, Value, Gross Margin and Market Share (2021-2026)

9.4.5 Mitsubishi Electric Corporation Recent Developments/Updates

9.4.6 Mitsubishi Electric Corporation Competitive Strengths & Weaknesses

9.5 CRRC Corporation Limited

9.5.1 CRRC Corporation Limited Details

9.5.2 CRRC Corporation Limited Major Business

9.5.3 CRRC Corporation Limited On-board Traction Transformers Product and Services

9.5.4 CRRC Corporation Limited On-board Traction Transformers Production, Price, Value, Gross Margin and Market Share (2021-2026)

9.5.5 CRRC Corporation Limited Recent Developments/Updates

9.5.6 CRRC Corporation Limited Competitive Strengths & Weaknesses

9.6 Fuji Electric Co., Ltd.

9.6.1 Fuji Electric Co., Ltd. Details

9.6.2 Fuji Electric Co., Ltd. Major Business

9.6.3 Fuji Electric Co., Ltd. On-board Traction Transformers Product and Services

9.6.4 Fuji Electric Co., Ltd. On-board Traction Transformers Production, Price, Value, Gross Margin and Market Share (2021-2026)

9.6.5 Fuji Electric Co., Ltd. Recent Developments/Updates

9.6.6 Fuji Electric Co., Ltd. Competitive Strengths & Weaknesses

9.7 JST Transformatours

9.7.1 JST Transformatours Details

9.7.2 JST Transformatours Major Business

9.7.3 JST Transformatours On-board Traction Transformers Product and Services

9.7.4 JST Transformatours On-board Traction Transformers Production, Price, Value, Gross Margin and Market Share (2021-2026)

9.7.5 JST Transformatours Recent Developments/Updates

9.7.6 JST Transformatours Competitive Strengths & Weaknesses

9.8 Hind Rectifiers Limited

9.8.1 Hind Rectifiers Limited Details

9.8.2 Hind Rectifiers Limited Major Business

9.8.3 Hind Rectifiers Limited On-board Traction Transformers Product and Services

9.8.4 Hind Rectifiers Limited On-board Traction Transformers Production, Price, Value, Gross Margin and Market Share (2021-2026)

9.8.5 Hind Rectifiers Limited Recent Developments/Updates

9.8.6 Hind Rectifiers Limited Competitive Strengths & Weaknesses

9.9 Bharat Heavy Electricals Limited

9.9.1 Bharat Heavy Electricals Limited Details

9.9.2 Bharat Heavy Electricals Limited Major Business

9.9.3 Bharat Heavy Electricals Limited On-board Traction Transformers Product and Services

9.9.4 Bharat Heavy Electricals Limited On-board Traction Transformers Production, Price, Value, Gross Margin and Market Share (2021-2026)

9.9.5 Bharat Heavy Electricals Limited Recent Developments/Updates

9.9.6 Bharat Heavy Electricals Limited Competitive Strengths & Weaknesses

9.10 INTERNATIONAL ELECTRIC Co., Ltd.

9.10.1 INTERNATIONAL ELECTRIC Co., Ltd. Details

9.10.2 INTERNATIONAL ELECTRIC Co., Ltd. Major Business

9.10.3 INTERNATIONAL ELECTRIC Co., Ltd. On-board Traction Transformers Product and Services

9.10.4 INTERNATIONAL ELECTRIC Co., Ltd. On-board Traction Transformers Production, Price, Value, Gross Margin and Market Share (2021-2026)

9.10.5 INTERNATIONAL ELECTRIC Co., Ltd. Recent Developments/Updates

9.10.6 INTERNATIONAL ELECTRIC Co., Ltd. Competitive Strengths & Weaknesses

9.11 River Engineering Pvt. Ltd.

9.11.1 River Engineering Pvt. Ltd. Details

9.11.2 River Engineering Pvt. Ltd. Major Business

9.11.3 River Engineering Pvt. Ltd. On-board Traction Transformers Product and Services

9.11.4 River Engineering Pvt. Ltd. On-board Traction Transformers Production, Price, Value, Gross Margin and Market Share (2021-2026)

9.11.5 River Engineering Pvt. Ltd. Recent Developments/Updates

9.11.6 River Engineering Pvt. Ltd. Competitive Strengths & Weaknesses

10 INDUSTRY CHAIN ANALYSIS

10.1 On-board Traction Transformers Industry Chain

10.2 On-board Traction Transformers Upstream Analysis

10.2.1 On-board Traction Transformers Core Raw Materials

10.2.2 Main Manufacturers of On-board Traction Transformers Core Raw Materials

10.3 Midstream Analysis

10.4 Downstream Analysis

10.5 On-board Traction Transformers Production Mode

10.6 On-board Traction Transformers Procurement Model

10.7 On-board Traction Transformers Industry Sales Model and Sales Channels

- 10.7.1 On-board Traction Transformers Sales Model
- 10.7.2 On-board Traction Transformers Typical Distributors

11 RESEARCH FINDINGS AND CONCLUSION

12 APPENDIX

- 12.1 Methodology
- 12.2 Research Process and Data Source
- 12.3 Disclaimer

List Of Tables

LIST OF TABLES

Table 1. World On-board Traction Transformers Production Value by Region (2021, 2025 and 2032) & (USD Million)

Table 2. World On-board Traction Transformers Production Value by Region (2021-2026) & (USD Million)

Table 3. World On-board Traction Transformers Production Value by Region (2027-2032) & (USD Million)

Table 4. World On-board Traction Transformers Production Value Market Share by Region (2021-2026)

Table 5. World On-board Traction Transformers Production Value Market Share by Region (2027-2032)

Table 6. World On-board Traction Transformers Production by Region (2021-2026) & (Units)

Table 7. World On-board Traction Transformers Production by Region (2027-2032) & (Units)

Table 8. World On-board Traction Transformers Production Market Share by Region (2021-2026)

Table 9. World On-board Traction Transformers Production Market Share by Region (2027-2032)

Table 10. World On-board Traction Transformers Average Price by Region (2021-2026) & (US\$/Unit)

Table 11. World On-board Traction Transformers Average Price by Region (2027-2032) & (US\$/Unit)

Table 12. On-board Traction Transformers Major Market Trends

Table 13. World On-board Traction Transformers Consumption Growth Rate Forecast by Region (2021 & 2025 & 2032) & (Units)

Table 14. World On-board Traction Transformers Consumption by Region (2021-2026) & (Units)

Table 15. World On-board Traction Transformers Consumption Forecast by Region (2027-2032) & (Units)

Table 16. World On-board Traction Transformers Production Value by Manufacturer (2021-2026) & (USD Million)

Table 17. Production Value Market Share of Key On-board Traction Transformers Producers in 2025

Table 18. World On-board Traction Transformers Production by Manufacturer (2021-2026) & (Units)

Table 19. Production Market Share of Key On-board Traction Transformers Producers in 2025

Table 20. World On-board Traction Transformers Average Price by Manufacturer (2021-2026) & (US\$/Unit)

Table 21. Global On-board Traction Transformers Company Evaluation Quadrant

Table 22. World On-board Traction Transformers Industry Rank of Major Manufacturers, Based on Production Value in 2025

Table 23. Head Office and On-board Traction Transformers Production Site of Key Manufacturer

Table 24. On-board Traction Transformers Market: Company Product Type Footprint

Table 25. On-board Traction Transformers Market: Company Product Application Footprint

Table 26. On-board Traction Transformers Competitive Factors

Table 27. On-board Traction Transformers New Entrant and Capacity Expansion Plans

Table 28. On-board Traction Transformers Mergers & Acquisitions Activity

Table 29. United States VS China On-board Traction Transformers Production Value Comparison, (2021 & 2025 & 2032) & (USD Million)

Table 30. United States VS China On-board Traction Transformers Production Comparison, (2021 & 2025 & 2032) & (Units)

Table 31. United States VS China On-board Traction Transformers Consumption Comparison, (2021 & 2025 & 2032) & (Units)

Table 32. United States Based On-board Traction Transformers Manufacturers, Headquarters and Production Site (States, Country)

Table 33. United States Based Manufacturers On-board Traction Transformers Production Value, (2021-2026) & (USD Million)

Table 34. United States Based Manufacturers On-board Traction Transformers Production Value Market Share (2021-2026)

Table 35. United States Based Manufacturers On-board Traction Transformers Production (2021-2026) & (Units)

Table 36. United States Based Manufacturers On-board Traction Transformers Production Market Share (2021-2026)

Table 37. China Based On-board Traction Transformers Manufacturers, Headquarters and Production Site (Province, Country)

Table 38. China Based Manufacturers On-board Traction Transformers Production Value, (2021-2026) & (USD Million)

Table 39. China Based Manufacturers On-board Traction Transformers Production Value Market Share (2021-2026)

Table 40. China Based Manufacturers On-board Traction Transformers Production, (2021-2026) & (Units)

Table 41. China Based Manufacturers On-board Traction Transformers Production Market Share (2021-2026)

Table 42. Rest of World Based On-board Traction Transformers Manufacturers, Headquarters and Production Site (State, Country)

Table 43. Rest of World Based Manufacturers On-board Traction Transformers Production Value, (2021-2026) & (USD Million)

Table 44. Rest of World Based Manufacturers On-board Traction Transformers Production Value Market Share (2021-2026)

Table 45. Rest of World Based Manufacturers On-board Traction Transformers Production, (2021-2026) & (Units)

Table 46. Rest of World Based Manufacturers On-board Traction Transformers Production Market Share (2021-2026)

Table 47. World On-board Traction Transformers Production Value by Type, (USD Million), 2021 & 2025 & 2032

Table 48. World On-board Traction Transformers Production by Type (2021-2026) & (Units)

Table 49. World On-board Traction Transformers Production by Type (2027-2032) & (Units)

Table 50. World On-board Traction Transformers Production Value by Type (2021-2026) & (USD Million)

Table 51. World On-board Traction Transformers Production Value by Type (2027-2032) & (USD Million)

Table 52. World On-board Traction Transformers Average Price by Type (2021-2026) & (US\$/Unit)

Table 53. World On-board Traction Transformers Average Price by Type (2027-2032) & (US\$/Unit)

Table 54. World On-board Traction Transformers Production Value by Mounting Position, (USD Million), 2021 & 2025 & 2032

Table 55. World On-board Traction Transformers Production by Mounting Position (2021-2026) & (Units)

Table 56. World On-board Traction Transformers Production by Mounting Position (2027-2032) & (Units)

Table 57. World On-board Traction Transformers Production Value by Mounting Position (2021-2026) & (USD Million)

Table 58. World On-board Traction Transformers Production Value by Mounting Position (2027-2032) & (USD Million)

Table 59. World On-board Traction Transformers Average Price by Mounting Position (2021-2026) & (US\$/Unit)

Table 60. World On-board Traction Transformers Average Price by Mounting Position

(2027-2032) & (US\$/Unit)

Table 61. World On-board Traction Transformers Production Value by Rated Capacity, (USD Million), 2021 & 2025 & 2032

Table 62. World On-board Traction Transformers Production by Rated Capacity (2021-2026) & (Units)

Table 63. World On-board Traction Transformers Production by Rated Capacity (2027-2032) & (Units)

Table 64. World On-board Traction Transformers Production Value by Rated Capacity (2021-2026) & (USD Million)

Table 65. World On-board Traction Transformers Production Value by Rated Capacity (2027-2032) & (USD Million)

Table 66. World On-board Traction Transformers Average Price by Rated Capacity (2021-2026) & (US\$/Unit)

Table 67. World On-board Traction Transformers Average Price by Rated Capacity (2027-2032) & (US\$/Unit)

Table 68. World On-board Traction Transformers Production Value by Application, (USD Million), 2021 & 2025 & 2032

Table 69. World On-board Traction Transformers Production by Application (2021-2026) & (Units)

Table 70. World On-board Traction Transformers Production by Application (2027-2032) & (Units)

Table 71. World On-board Traction Transformers Production Value by Application (2021-2026) & (USD Million)

Table 72. World On-board Traction Transformers Production Value by Application (2027-2032) & (USD Million)

Table 73. World On-board Traction Transformers Average Price by Application (2021-2026) & (US\$/Unit)

Table 74. World On-board Traction Transformers Average Price by Application (2027-2032) & (US\$/Unit)

Table 75. Hitachi Energy Ltd. Basic Information, Manufacturing Base and Competitors

Table 76. Hitachi Energy Ltd. Major Business

Table 77. Hitachi Energy Ltd. On-board Traction Transformers Product and Services

Table 78. Hitachi Energy Ltd. On-board Traction Transformers Production (Units), Price (US\$/Unit), Production Value (USD Million), Gross Margin and Market Share (2021-2026)

Table 79. Hitachi Energy Ltd. Recent Developments/Updates

Table 80. Hitachi Energy Ltd. Competitive Strengths & Weaknesses

Table 81. Siemens Energy AG Basic Information, Manufacturing Base and Competitors

Table 82. Siemens Energy AG Major Business

Table 83. Siemens Energy AG On-board Traction Transformers Product and Services

Table 84. Siemens Energy AG On-board Traction Transformers Production (Units), Price (US\$/Unit), Production Value (USD Million), Gross Margin and Market Share (2021-2026)

Table 85. Siemens Energy AG Recent Developments/Updates

Table 86. Siemens Energy AG Competitive Strengths & Weaknesses

Table 87. Alstom SA Basic Information, Manufacturing Base and Competitors

Table 88. Alstom SA Major Business

Table 89. Alstom SA On-board Traction Transformers Product and Services

Table 90. Alstom SA On-board Traction Transformers Production (Units), Price (US\$/Unit), Production Value (USD Million), Gross Margin and Market Share (2021-2026)

Table 91. Alstom SA Recent Developments/Updates

Table 92. Alstom SA Competitive Strengths & Weaknesses

Table 93. Mitsubishi Electric Corporation Basic Information, Manufacturing Base and Competitors

Table 94. Mitsubishi Electric Corporation Major Business

Table 95. Mitsubishi Electric Corporation On-board Traction Transformers Product and Services

Table 96. Mitsubishi Electric Corporation On-board Traction Transformers Production (Units), Price (US\$/Unit), Production Value (USD Million), Gross Margin and Market Share (2021-2026)

Table 97. Mitsubishi Electric Corporation Recent Developments/Updates

Table 98. Mitsubishi Electric Corporation Competitive Strengths & Weaknesses

Table 99. CRRC Corporation Limited Basic Information, Manufacturing Base and Competitors

Table 100. CRRC Corporation Limited Major Business

Table 101. CRRC Corporation Limited On-board Traction Transformers Product and Services

Table 102. CRRC Corporation Limited On-board Traction Transformers Production (Units), Price (US\$/Unit), Production Value (USD Million), Gross Margin and Market Share (2021-2026)

Table 103. CRRC Corporation Limited Recent Developments/Updates

Table 104. CRRC Corporation Limited Competitive Strengths & Weaknesses

Table 105. Fuji Electric Co., Ltd. Basic Information, Manufacturing Base and Competitors

Table 106. Fuji Electric Co., Ltd. Major Business

Table 107. Fuji Electric Co., Ltd. On-board Traction Transformers Product and Services

Table 108. Fuji Electric Co., Ltd. On-board Traction Transformers Production (Units),

Price (US\$/Unit), Production Value (USD Million), Gross Margin and Market Share (2021-2026)

Table 109. Fuji Electric Co., Ltd. Recent Developments/Updates

Table 110. Fuji Electric Co., Ltd. Competitive Strengths & Weaknesses

Table 111. JST Transformateurs Basic Information, Manufacturing Base and Competitors

Table 112. JST Transformateurs Major Business

Table 113. JST Transformateurs On-board Traction Transformers Product and Services

Table 114. JST Transformateurs On-board Traction Transformers Production (Units), Price (US\$/Unit), Production Value (USD Million), Gross Margin and Market Share (2021-2026)

Table 115. JST Transformateurs Recent Developments/Updates

Table 116. JST Transformateurs Competitive Strengths & Weaknesses

Table 117. Hind Rectifiers Limited Basic Information, Manufacturing Base and Competitors

Table 118. Hind Rectifiers Limited Major Business

Table 119. Hind Rectifiers Limited On-board Traction Transformers Product and Services

Table 120. Hind Rectifiers Limited On-board Traction Transformers Production (Units), Price (US\$/Unit), Production Value (USD Million), Gross Margin and Market Share (2021-2026)

Table 121. Hind Rectifiers Limited Recent Developments/Updates

Table 122. Hind Rectifiers Limited Competitive Strengths & Weaknesses

Table 123. Bharat Heavy Electricals Limited Basic Information, Manufacturing Base and Competitors

Table 124. Bharat Heavy Electricals Limited Major Business

Table 125. Bharat Heavy Electricals Limited On-board Traction Transformers Product and Services

Table 126. Bharat Heavy Electricals Limited On-board Traction Transformers Production (Units), Price (US\$/Unit), Production Value (USD Million), Gross Margin and Market Share (2021-2026)

Table 127. Bharat Heavy Electricals Limited Recent Developments/Updates

Table 128. Bharat Heavy Electricals Limited Competitive Strengths & Weaknesses

Table 129. INTERNATIONAL ELECTRIC Co., Ltd. Basic Information, Manufacturing Base and Competitors

Table 130. INTERNATIONAL ELECTRIC Co., Ltd. Major Business

Table 131. INTERNATIONAL ELECTRIC Co., Ltd. On-board Traction Transformers Product and Services

Table 132. INTERNATIONAL ELECTRIC Co., Ltd. On-board Traction Transformers

Production (Units), Price (US\$/Unit), Production Value (USD Million), Gross Margin and Market Share (2021-2026)

Table 133. INTERNATIONAL ELECTRIC Co., Ltd. Recent Developments/Updates

Table 134. INTERNATIONAL ELECTRIC Co., Ltd. Competitive Strengths & Weaknesses

Table 135. River Engineering Pvt. Ltd. Basic Information, Manufacturing Base and Competitors

Table 136. River Engineering Pvt. Ltd. Major Business

Table 137. River Engineering Pvt. Ltd. On-board Traction Transformers Product and Services

Table 138. River Engineering Pvt. Ltd. On-board Traction Transformers Production (Units), Price (US\$/Unit), Production Value (USD Million), Gross Margin and Market Share (2021-2026)

Table 139. River Engineering Pvt. Ltd. Recent Developments/Updates

Table 140. River Engineering Pvt. Ltd. Competitive Strengths & Weaknesses

Table 141. Global Key Players of On-board Traction Transformers Upstream (Raw Materials)

Table 142. Global On-board Traction Transformers Typical Customers

Table 143. On-board Traction Transformers Typical Distributors

List Of Figures

LIST OF FIGURES

Figure 1. On-board Traction Transformers Picture

Figure 2. World On-board Traction Transformers Production Value: 2021 & 2025 & 2032, (USD Million)

Figure 3. World On-board Traction Transformers Production Value and Forecast (2021-2032) & (USD Million)

Figure 4. World On-board Traction Transformers Production (2021-2032) & (Units)

Figure 5. World On-board Traction Transformers Average Price (2021-2032) & (US\$/Unit)

Figure 6. World On-board Traction Transformers Production Value Market Share by Region (2021-2032)

Figure 7. World On-board Traction Transformers Production Market Share by Region (2021-2032)

Figure 8. North America On-board Traction Transformers Production (2021-2032) & (Units)

Figure 9. Europe On-board Traction Transformers Production (2021-2032) & (Units)

Figure 10. China On-board Traction Transformers Production (2021-2032) & (Units)

Figure 11. Japan On-board Traction Transformers Production (2021-2032) & (Units)

Figure 12. On-board Traction Transformers Market Drivers

Figure 13. Factors Affecting Demand

Figure 14. World On-board Traction Transformers Consumption (2021-2032) & (Units)

Figure 15. World On-board Traction Transformers Consumption Market Share by Region (2021-2032)

Figure 16. United States On-board Traction Transformers Consumption (2021-2032) & (Units)

Figure 17. China On-board Traction Transformers Consumption (2021-2032) & (Units)

Figure 18. Europe On-board Traction Transformers Consumption (2021-2032) & (Units)

Figure 19. Japan On-board Traction Transformers Consumption (2021-2032) & (Units)

Figure 20. South Korea On-board Traction Transformers Consumption (2021-2032) & (Units)

Figure 21. ASEAN On-board Traction Transformers Consumption (2021-2032) & (Units)

Figure 22. India On-board Traction Transformers Consumption (2021-2032) & (Units)

Figure 23. Producer Shipments of On-board Traction Transformers by Manufacturer Revenue (\$MM) and Market Share (%): 2025

Figure 24. Global Four-firm Concentration Ratios (CR4) for On-board Traction Transformers Markets in 2025

Figure 25. Global Four-firm Concentration Ratios (CR8) for On-board Traction Transformers Markets in 2025

Figure 26. United States VS China: On-board Traction Transformers Production Value Market Share Comparison (2021 & 2025 & 2032)

Figure 27. United States VS China: On-board Traction Transformers Production Market Share Comparison (2021 & 2025 & 2032)

Figure 28. United States VS China: On-board Traction Transformers Consumption Market Share Comparison (2021 & 2025 & 2032)

Figure 29. United States Based Manufacturers On-board Traction Transformers Production Market Share 2025

Figure 30. China Based Manufacturers On-board Traction Transformers Production Market Share 2025

Figure 31. Rest of World Based Manufacturers On-board Traction Transformers Production Market Share 2025

Figure 32. World On-board Traction Transformers Production Value by Type, (USD Million), 2021 & 2025 & 2032

Figure 33. World On-board Traction Transformers Production Value Market Share by Type in 2025

Figure 34. Conventional Line-frequency Electromagnetic Transformers

Figure 35. Integrated Transformer-reactor Assemblies

Figure 36. Solid-state Traction Transformers

Figure 37. Others

Figure 38. World On-board Traction Transformers Production Market Share by Type (2021-2032)

Figure 39. World On-board Traction Transformers Production Value Market Share by Type (2021-2032)

Figure 40. World On-board Traction Transformers Average Price by Type (2021-2032) & (US\$/Unit)

Figure 41. World On-board Traction Transformers Production Value by Mounting Position, (USD Million), 2021 & 2025 & 2032

Figure 42. World On-board Traction Transformers Production Value Market Share by Mounting Position in 2025

Figure 43. Machine-room Mounted

Figure 44. Underfloor Mounted

Figure 45. Roof-mounted

Figure 46. Others

Figure 47. World On-board Traction Transformers Production Market Share by Mounting Position (2021-2032)

Figure 48. World On-board Traction Transformers Production Value Market Share by

Mounting Position (2021-2032)

Figure 49. World On-board Traction Transformers Average Price by Mounting Position (2021-2032) & (US\$/Unit)

Figure 50. World On-board Traction Transformers Production Value by Rated Capacity, (USD Million), 2021 & 2025 & 2032

Figure 51. World On-board Traction Transformers Production Value Market Share by Rated Capacity in 2025

Figure 52. Small Capacity: ≤2,500 kVA

Figure 53. Medium Capacity: 2,500–6,000 kVA

Figure 54. Large Capacity: 6,000–12,000 kVA

Figure 55. Extra-Large Capacity: >12,000 kVA

Figure 56. World On-board Traction Transformers Production Market Share by Rated Capacity (2021-2032)

Figure 57. World On-board Traction Transformers Production Value Market Share by Rated Capacity (2021-2032)

Figure 58. World On-board Traction Transformers Average Price by Rated Capacity (2021-2032) & (US\$/Unit)

Figure 59. World On-board Traction Transformers Production Value by Application, (USD Million), 2021 & 2025 & 2032

Figure 60. World On-board Traction Transformers Production Value Market Share by Application in 2025

Figure 61. Electric Locomotives

Figure 62. High-speed Trains

Figure 63. Mainline and Regional EMUs

Figure 64. Others

Figure 65. World On-board Traction Transformers Production Market Share by Application (2021-2032)

Figure 66. World On-board Traction Transformers Production Value Market Share by Application (2021-2032)

Figure 67. World On-board Traction Transformers Average Price by Application (2021-2032) & (US\$/Unit)

Figure 68. On-board Traction Transformers Industry Chain

Figure 69. On-board Traction Transformers Procurement Model

Figure 70. On-board Traction Transformers Sales Model

Figure 71. On-board Traction Transformers Sales Channels, Direct Sales, and Distribution

Figure 72. Methodology

Figure 73. Research Process and Data Source

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