

Siemens Energy

EHV Capabilities



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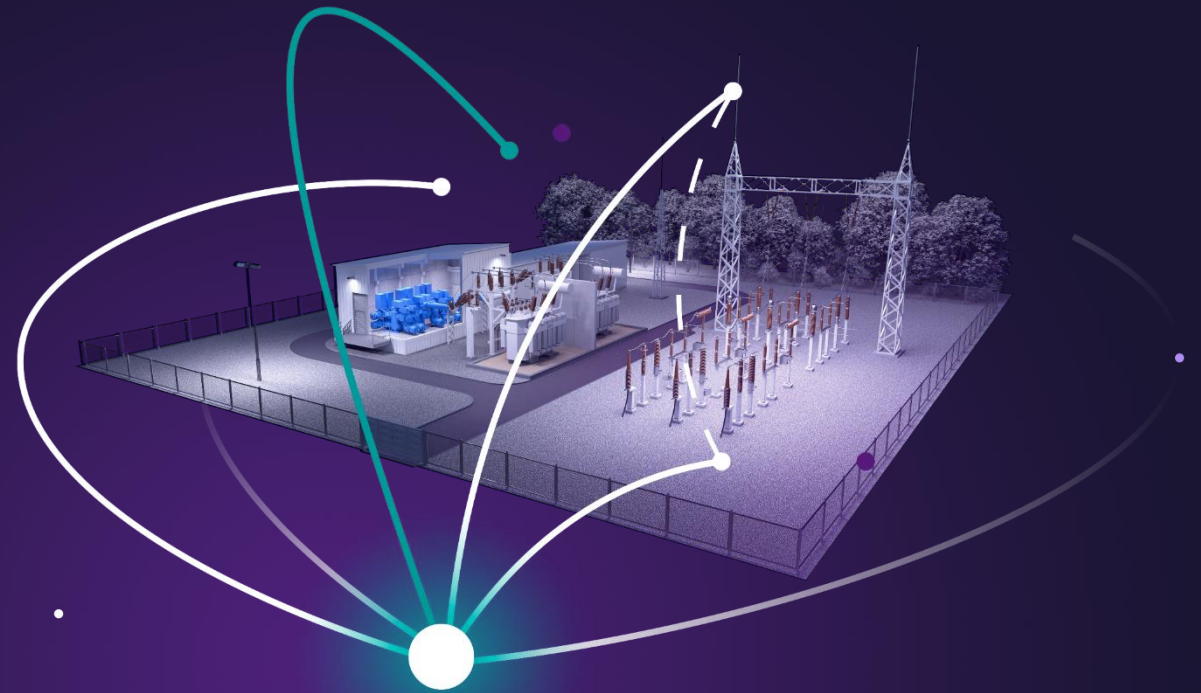
ERCOT
EHV 765 kV Vendor Workshop



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765/800 kV
EHV Circuit Breakers



Siemens Energy EHV Capabilities Global Network of Factories for Switchgear products

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More than 100 years of experience!

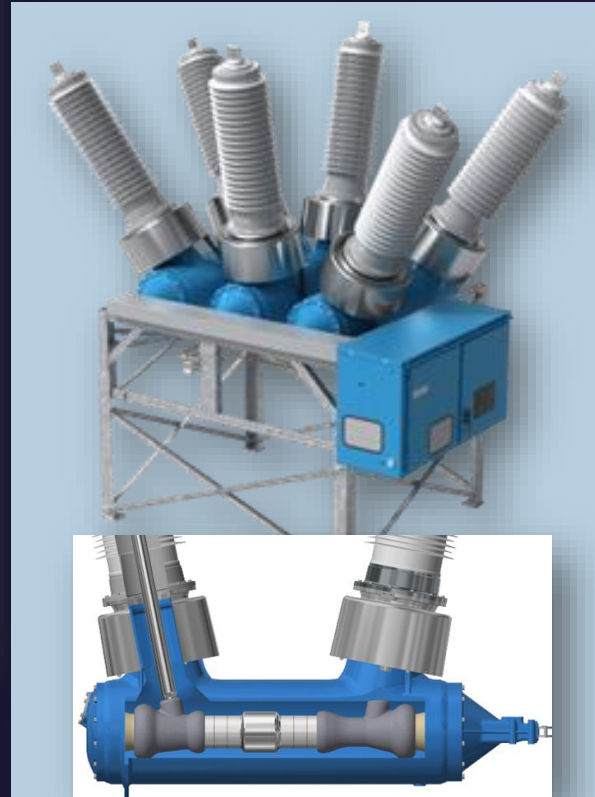
Siemens Energy EHV Capabilities Proud Long-Term Partner with US Utilities for Circuit Breakers

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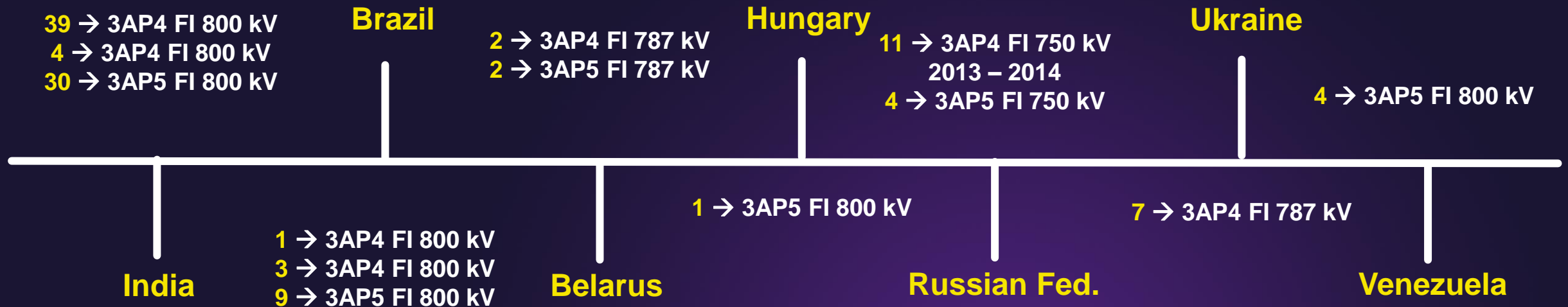


Siemens Energy EHV Capabilities High Voltage Circuit Breakers - Full Portfolio up to 800 kV

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Siemens Energy EHV Capabilities Breaker References 765 / 800 kV

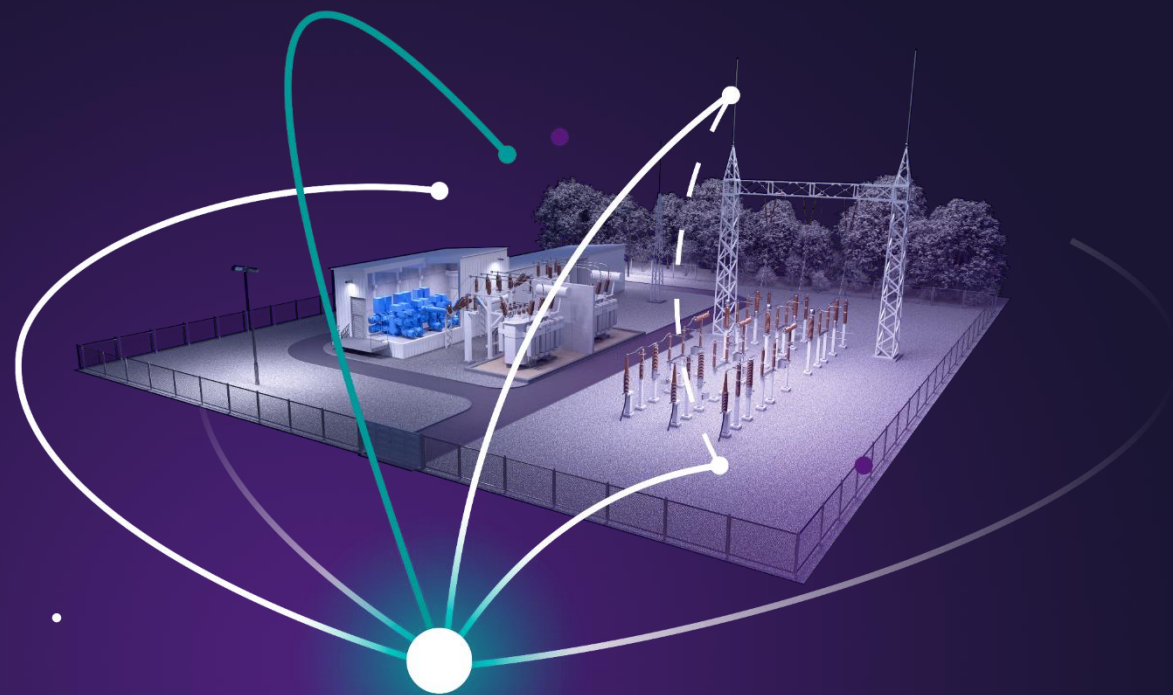


**765/800kV Breaker - Standard Delivery Lead time
20 – 24 months**

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765kV
Power Transformers



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EHV Power Transformer Manufacturing Locations

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Large Power Transformers
Nuremberg
Germany



Large Power Transformers
Weiz
Austria



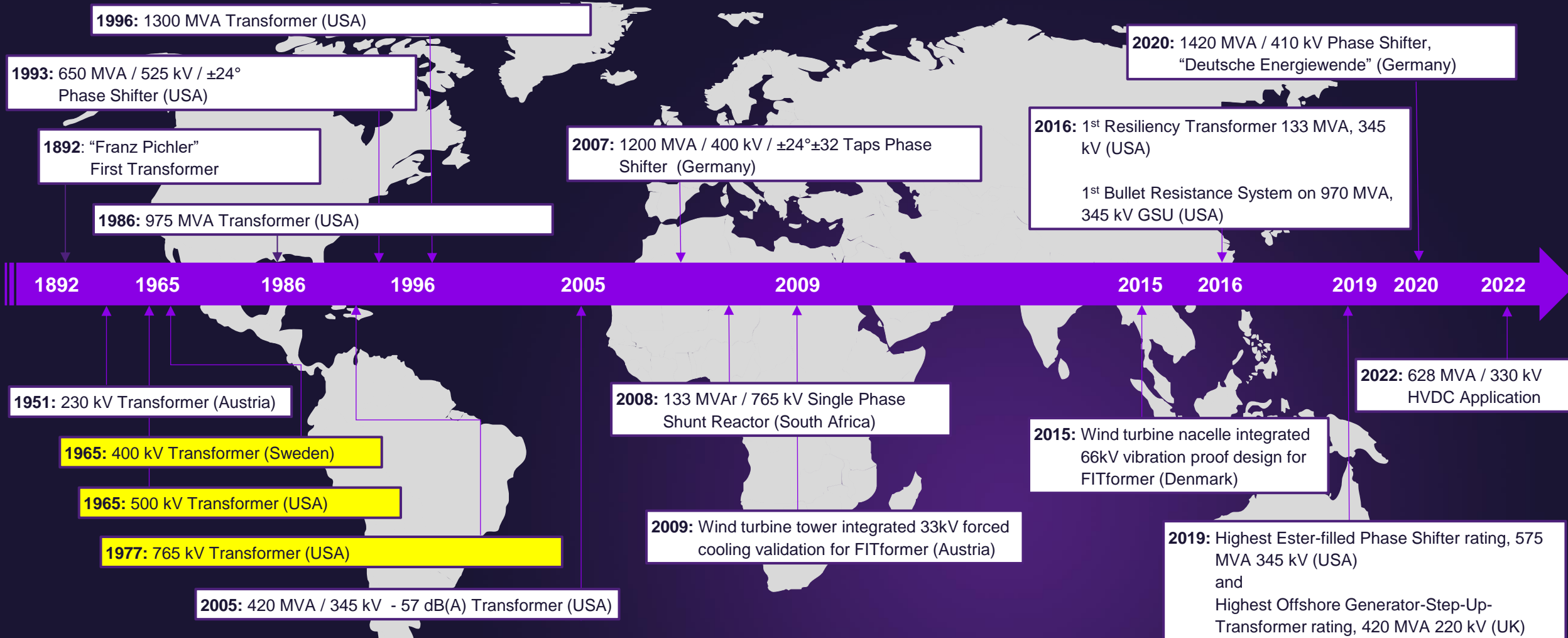
Large Power Transformers
Zagreb
Croatia



Large Power Transformers
Jundiai
Brazil

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Sample Milestones - History of the Weiz Plant



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765kV Reference in the USA

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Customer

- American Electric Power, USA

Destination

- Various substations

Rating

- 750 MVA, single-phase AUT
- 765/345/34.5 kV

Key Features

- Geomagnetically induced current (GIC) capability
- Supplied with a monitoring system which includes bushing health monitoring, on-line dissolved gas monitoring, UHF based partial discharge monitoring and fibre optic probes for direct temperature measurement

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765kV Transformers – Excerpt From Our Reference List

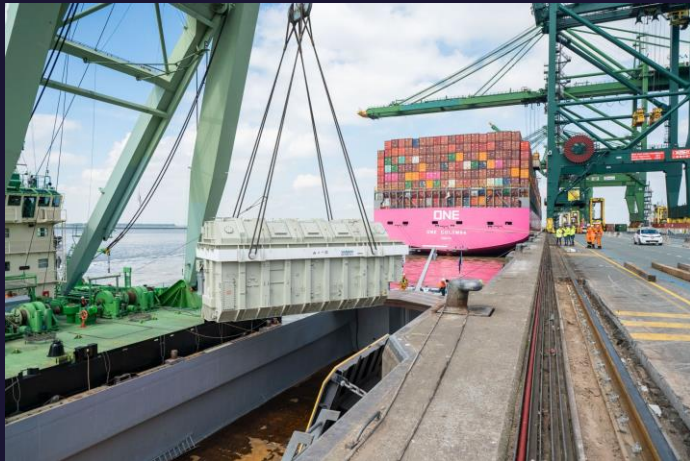


Siemens Energy Austria GmbH Transformers WEIZ			Excerpt of Reference-List/ only projects above or equal 700kV									
YEAR	CUSTOMER		PROJECT NAME	PCS	POWER	VOLTAGE	RATING	PHASE	FREQ	TYPE		
2024	First Energy Corporation	USA	Belmont	1	600.00	765.00	765/√3 // 528/√3	1	60.00	AUT		
2023	Hydro Quebec	Canada	Anjou	3	550.00	735.00	735/315/12,5	1	60.00	AUT		
2021	Hydro Quebec	Canada	Varenes storage	1	110.00	735.00	735/√3	1	60.00	SHR		
2020	Gemma Power Systems, LLC	USA	Guernsey	4	720.00	765.00	765/√3+2x2.5%//230/√3//13.8kV	1	60.00	AUT		
2019	Hydro Quebec	Canada	Varenes storage	3	110.00	735.00	735/√3	1	60.00	SHR		
2018	American Electric Power	USA	Amos	1	750.00	765.00	746/√3±1x2.5% // 345/√3 // 34,5	1	60.00	AUT		
2018	American Electric Power	USA	Kammer	1	100.00	765.00	765/√3	1	60.00	SHR		
2017	Hydro Quebec	Canada	Varenes storage	1	550.00	735.00	735/315/12,5	1	60.00	AUT		
2017	American Electric Power	USA	Jackson Ferry	4	150.00	765.00	765/√3	1	60.00	SHR		
2017	American Electric Power	USA	Axton	1	100.00	765.00	765/√3	1	60.00	SHR		
2017	American Electric Power	USA	Kammer	3	100.00	765.00	765/√3	1	60.00	SHR		
2017	American Electric Power	USA	Jefferson	3	100.00	765.00	765/√3	1	60.00	SHR		
2017	American Electric Power	USA	Wyoming	3	100.00	765.00	765/√3	1	60.00	SHR		
2017	American Electric Power	USA	Broadford	3	100.00	765.00	765/√3	1	60.00	SHR		
2017	American Electric Power	USA	Greentown	3	100.00	765.00	765/√3	1	60.00	SHR		
2017	American Electric Power	USA	Wyoming	4	100.00	765.00	765/√3	1	60.00	SHR		
2017	American Electric Power	USA	Rockport	4	50.00	765.00	765/√3	1	60.00	SHR		
2017	American Electric Power	USA	Sullivan	3	50.00	765.00	765/√3	1	60.00	SHR		
2017	American Electric Power	USA	Jefferson	3	50.00	765.00	765/√3	1	60.00	SHR		
2016	Hydro Quebec	Canada	Radisson Substation	3	550.00	735.00	735/315/12,5	1	60.00	AUT		
2016	American Electric Power	USA	Dumont	3	100.00	765.00	765/√3	1	60.00	SHR		
2016	American Electric Power	USA	Amos	4	100.00	765.00	765/√3	1	60.00	SHR		
2016	American Electric Power	USA	Jefferson	1	50.00	765.00	765/√3	1	60.00	SHR		
2015	American Electric Power	USA	Kammer	2	750.00	765.00	746/√3±1x2.5% // 345/√3 // 34,5	1	60.00	AUT		
2015	Hydro Quebec	Canada	Abitibi Substation	2	550.00	735.00	735/315/12,5	1	60.00	AUT		
2015	Exelon ComEd	USA	Wilton Center Substation	2	373.00	765.00	765/√3 +1/-3x2.5% // 345/√3 // 33	1	60.00	AUT		
2015	American Electric Power	USA	Cloverdale	2	100.00	765.00	765/√3	1	60.00	SHR		
2014	Exelon ComEd	USA	Plano Substation	2	373.00	765.00	765/√3 +1/-3x2.5% // 345/√3 // 33	1	60.00	AUT		
2013	American Electric Power	USA	Marysville	1	100.00	765.00	765/√3	1	60.00	SHR		
2013	American Electric Power	USA	Marysville	1	100.00	765.00	765/√3	1	60.00	SHR		
2013	American Electric Power	USA	Marysville	5	100.00	765.00	765/√3	1	60.00	SHR		
2013	American Electric Power	USA	Gavin	1	100.00	765.00	765/√3	1	60.00	SHR		
2013	American Electric Power	USA	Marysville(Gavin)	1	100.00	765.00	765/√3	1	60.00	SHR		
2012	Hydro Quebec	Canada	Deliveries 2011	2	110.00	735.00	735/√3	1	60.00	SHR		

Siemens Energy EHV Capabilities Transformer Logistics

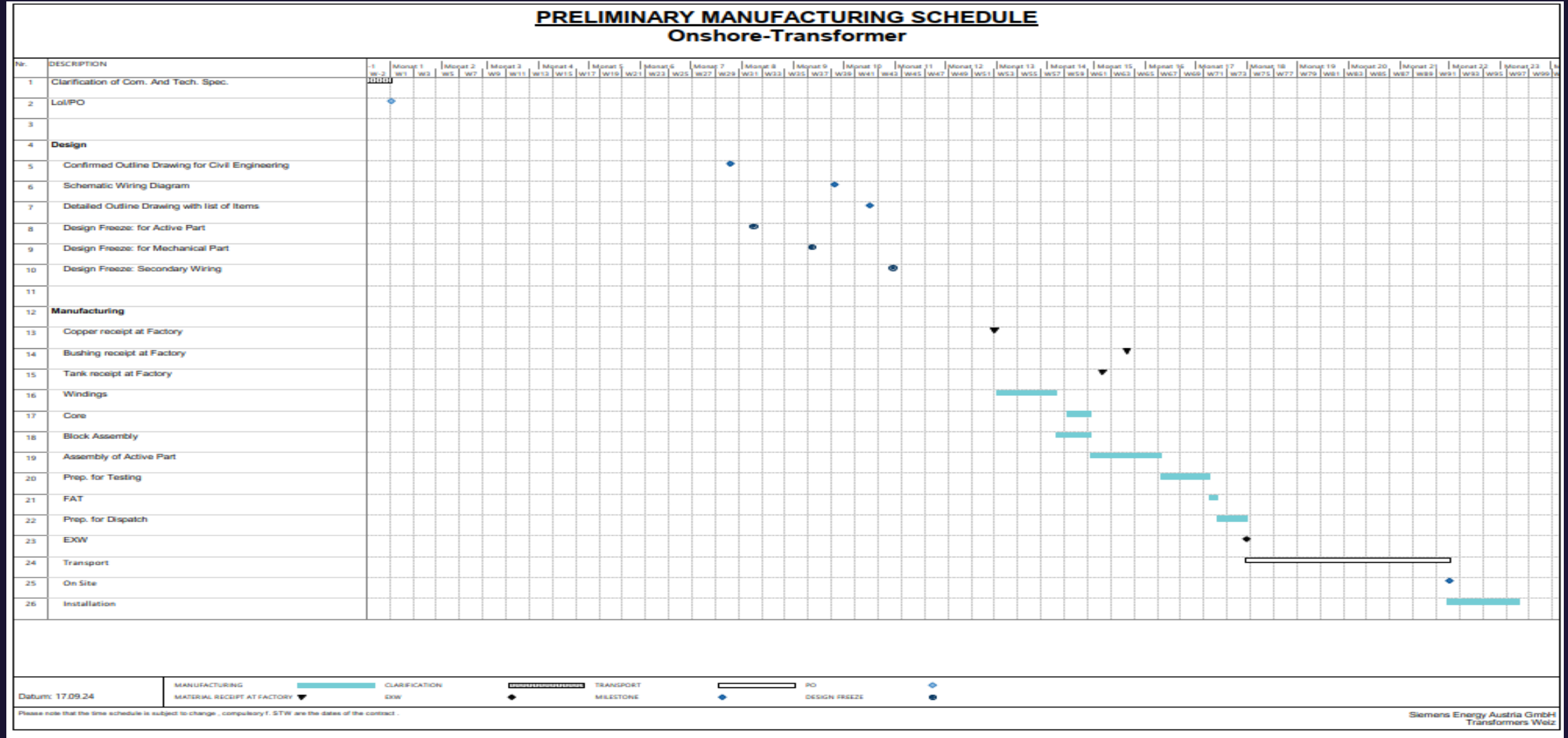


All 765kV transformers are inherently large units that require careful transport planning to ensure safe and successful transport from factory to the final pad location.



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Typical Project Schedule - 24 Months from Order to Site Install



Siemens Energy EHV Capabilities Transformer Design – Considerations for 765kV



Because of the extremely high voltage, special care must be taken on the design and manufacturing.

Some considerations:

1. Extremely low partial discharge design is critical.
2. GIC Concerns: Due to the high number of turns 765 kV transformers are more sensitive to DC and GIC than lower voltage transformers. (driver: DC Amps * number of turns)
3. Tank rupture concerns: High arc energy due to high system apparent power.
4. Moisture inside the insulation during manufacturing: Long term stability of insulation system requires extremely stringent moisture control.
5. Short circuit: Design/manufacturing must ensure minimal movement of windings and leads during a short circuit to reduce the risk of an internal flashover.
6. The leads design is of major importance due to the high dielectric stress.

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765kV Transformers – Supply Chain Considerations



The main materials such as core steel, conductors, insulation, tanks, are typically the same as used in all power transformers, and generally come from the same main suppliers.

But due to the extremely sensitive nature of 765kV units, extra care must be taken in the manufacturing, quality control, transportation, handling, and incorporation into the transformers to ensure the integrity and long life of the units,

In addition, some components are extremely specialized at 765kV, and these can only be sourced from one or two key suppliers that are uniquely qualified to produce such critical items.

These include components such as bushings, tap changers, and key insulation and shielding components.

Current material and components lead-times have stabilized, and most can be obtained to meet the ~24 month manufacturing schedule. A few specialized items (e.g. 765kV bushings), may need to be pre-reserved a few months earlier.

Thank you!

