

California High-Speed Train Project



TECHNICAL MEMORANDUM

Traction Power 2x25kV Autotransformer Electrification System & System Voltages TM 3.1.1.1

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ABSTRACT

The California High-Speed Rail (CHSR) Line will be an Electrified Line with Traction Power for Electric Vehicles being supplied and distributed using a 2x25kV Autotransformer Power Supply System and an Overhead Contact System.

The purpose of this technical memorandum is to:

- Provide the basis for the choice of a 2x25kV Autotransformer System over other Electrification Systems.
- Describe the configuration of the 2x25kV Autotransformer System.
- Provide guidelines for the Utility Power Supplies to the Traction Power Supply Stations.
- Provide guidelines for the basic configuration and location of the Traction Power Supply, Switching and Paralleling Stations.
- Provide the Design Manual Criteria for the Supply Station Types for a 2 x 25kV Autotransformer System.
- Provide the Design Manual Criteria for the 2x25kV System Voltage levels.

Development of the Design Criteria for the 2x25kV traction power supply system and its operating voltages will include, but not be limited to, the following:

- The general configurations of the traction power supply feeding and return systems for the 2x25kV System (Single Line Diagrams).
- Criteria for the Utility Supply Circuits to Traction Power Supply Stations.
- The provisional layout of the major equipment in each type of supply station.
- The Nominal System Operating Voltage.
- The Maximum and Minimum Long Term System Operating Voltages.
- The Maximum and Minimum Short Term System Operating Voltages.

Note:

- (i) The Design Criteria for the Traction Power Supply Facilities and access for each type of facility will be provided in a separate technical memorandum.
- (ii) The Design Criteria for the equipment layout, metering and protection for each type of traction power facility will be provided in a separate technical memorandum.
- (iii) The Design Criteria for the Overhead Contact System, Negative Feeders, Rail Return and Grounding will be provided in a separate technical memorandum.
- (iv) The detailed requirements for the Utility Supply Circuits will be provided in a separate technical memorandum

6.0 DESIGN MANUAL CRITERIA

6.1 INFORMATION ON THE 2 x 25kV AUTOTRANSFORMER ELECTRIFICATION SYSTEM FOR INCLUSION IN DESIGN MANUAL

- The Traction Power Supply System (TPSS) for the CHSR Line will be a 2 x 25kV (Autotransformer) System.
- HV Utility Supply Voltage for the Traction Power Supply Stations will be 115kV or higher.
- Each Traction Power Supply Station will have redundant HV Utility Supply Circuits originating from different Utility Bus Systems.
- Each Traction Power Supply Station will have redundant Main Power Transformers each sized for the Ultimate full-load of the Supply Station.
- Each Traction Power Supply Station will have HV Switchgear configured to allow either Utility Circuit to supply either or both HV Transformers.
- Traction Power Supply, Switching and Paralleling Stations will be rated and located in accordance with the findings of the traction power computer load-flow simulations for the Ultimate load on the System.
- Supply Station ratings and configuration for each type of Supply Station will be standardized as much as is feasible.
- The Nominal System Voltage for the Traction Power Supply System is 25kV
- The Maximum permissible Long-Term (and No-Load) Voltage for the TPSS is 27.5kV.
- The Maximum permissible Short-Term Voltage of the TPSS is 29kV
- The Minimum permissible Long-Term Voltage for the TPSS is 19kV.
- The Minimum permissible Short-Term Voltage for the TPSS is 17.5kV
- There must be no degradation of Train Performance during First Contingency Power Supply conditions.
- There must be no stranding of Trains during Second Contingency Power Supply Conditions.

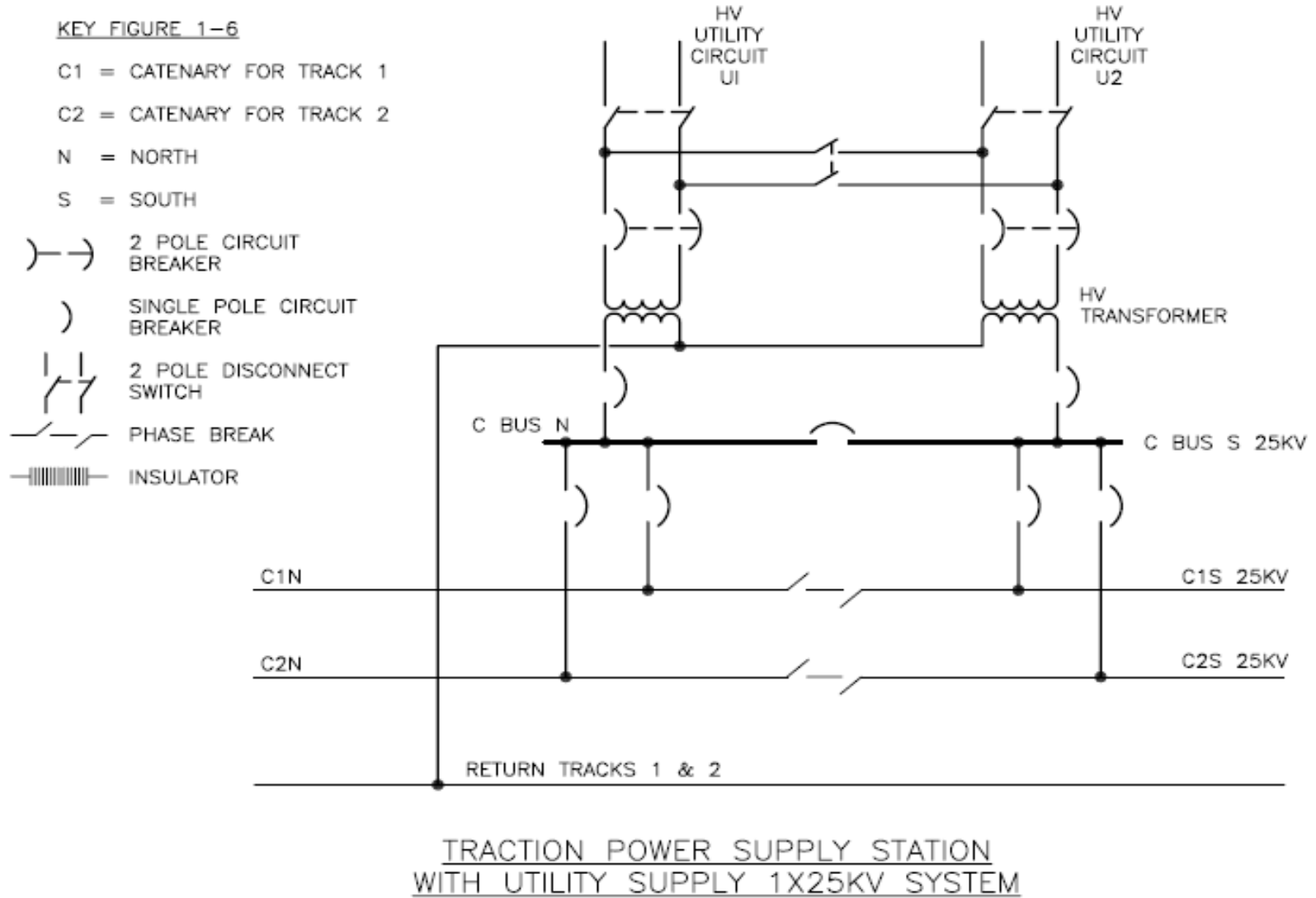
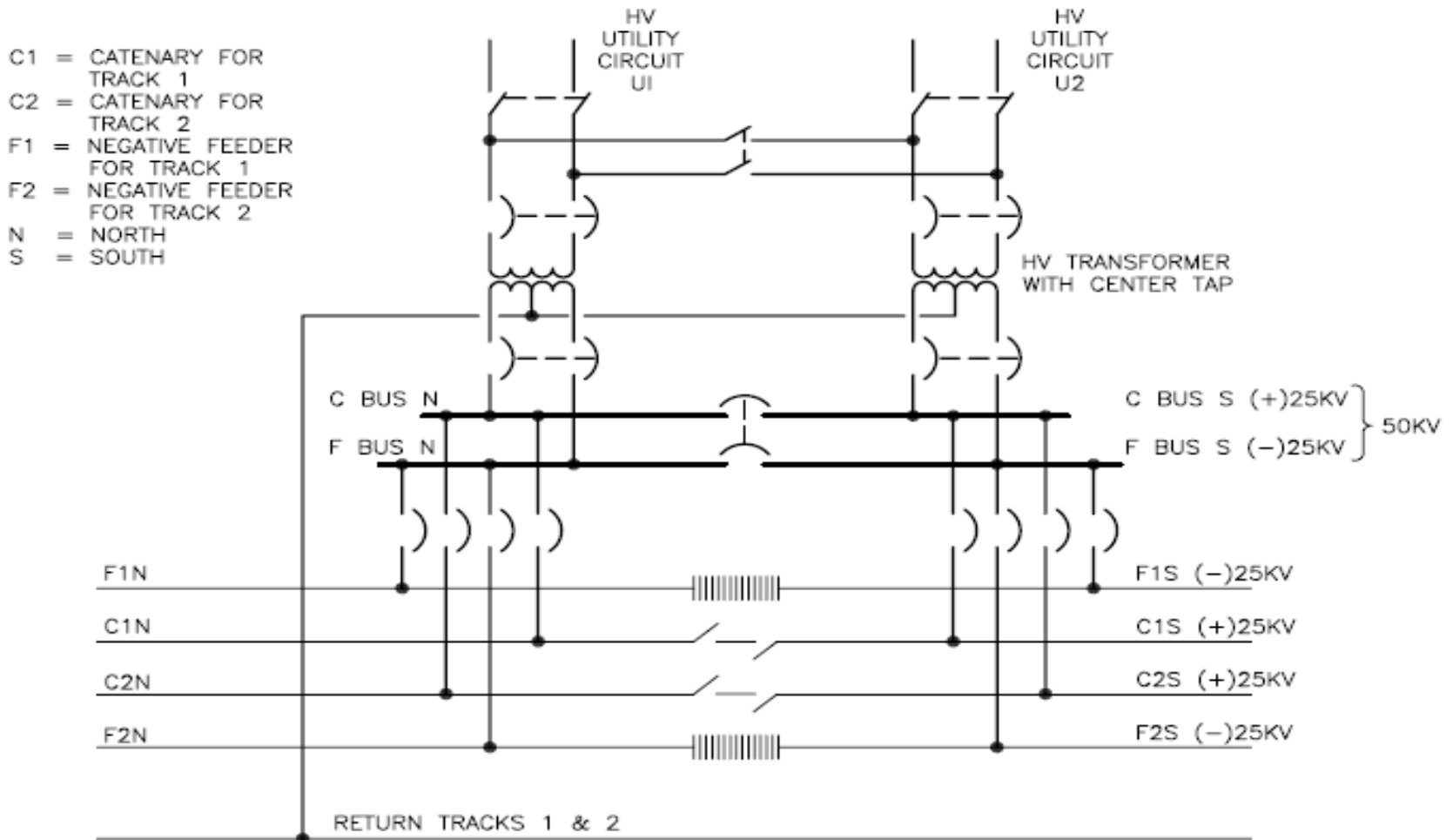
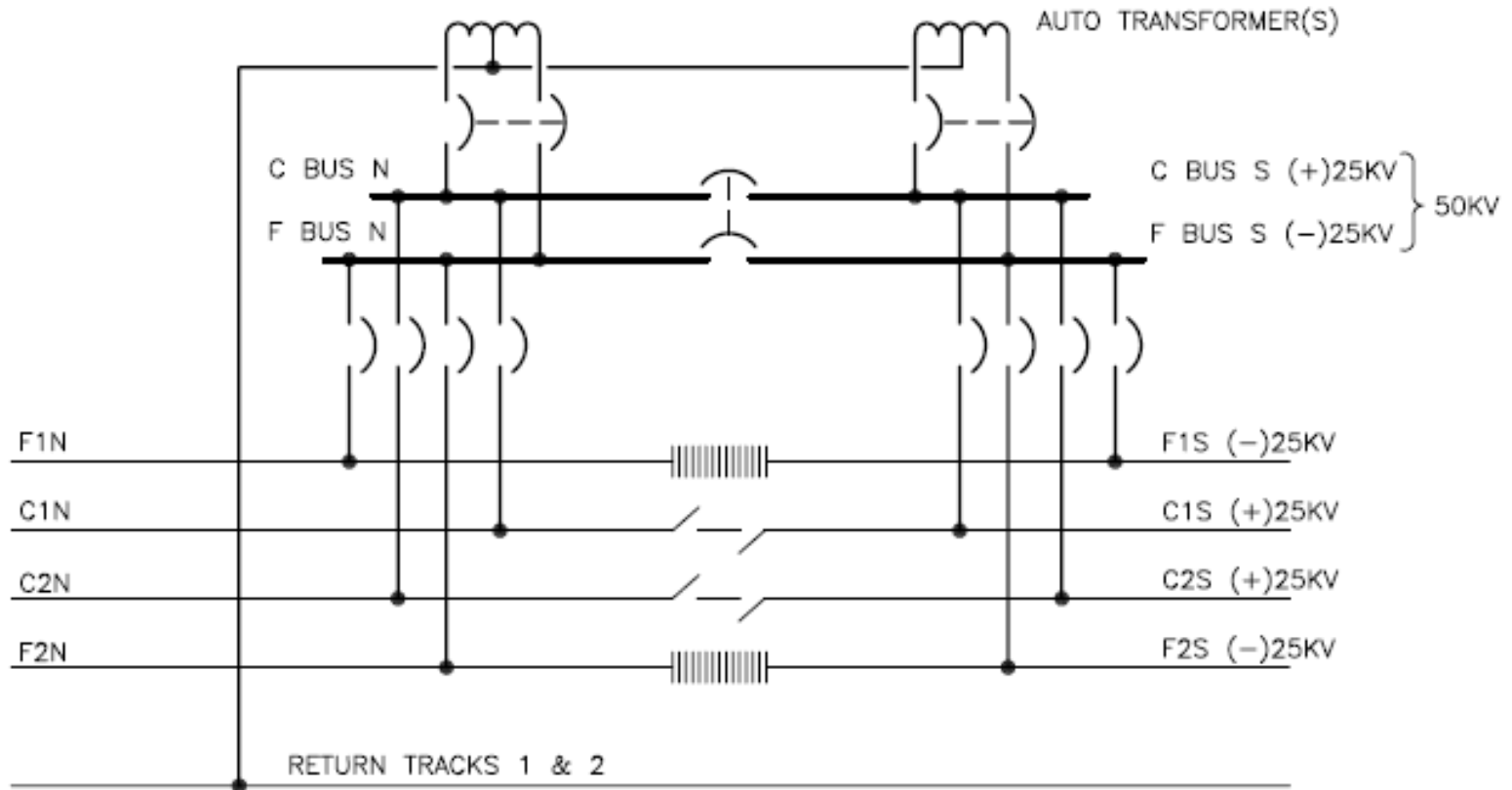


FIGURE 1



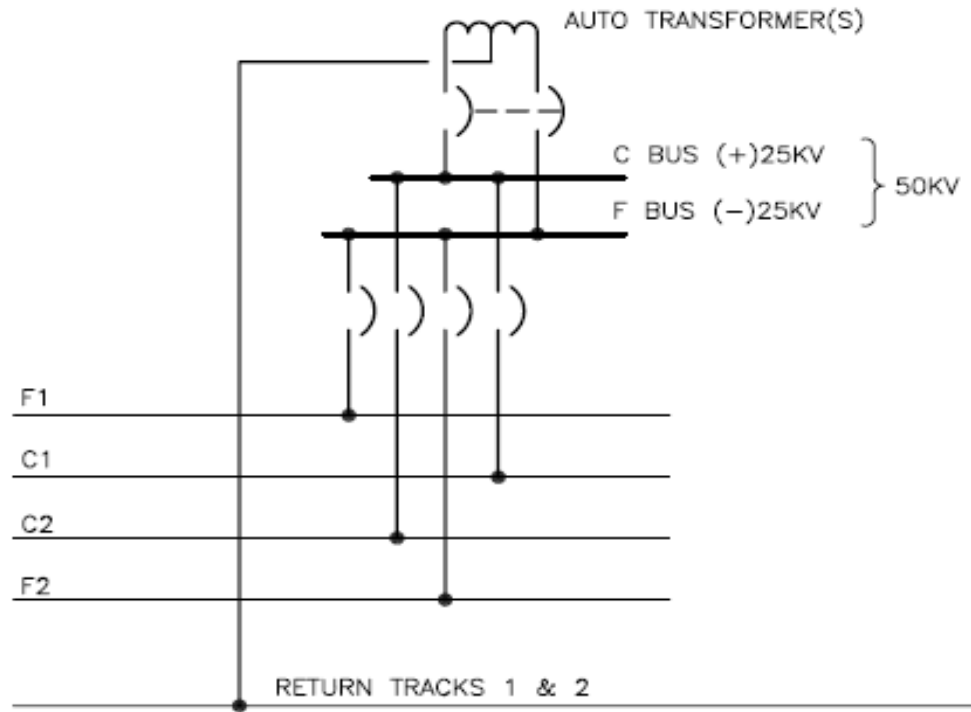
TRACTION POWER SUPPLY STATION
WITH UTILITY SUPPLY 2X25KV SYSTEM

FIGURE 2



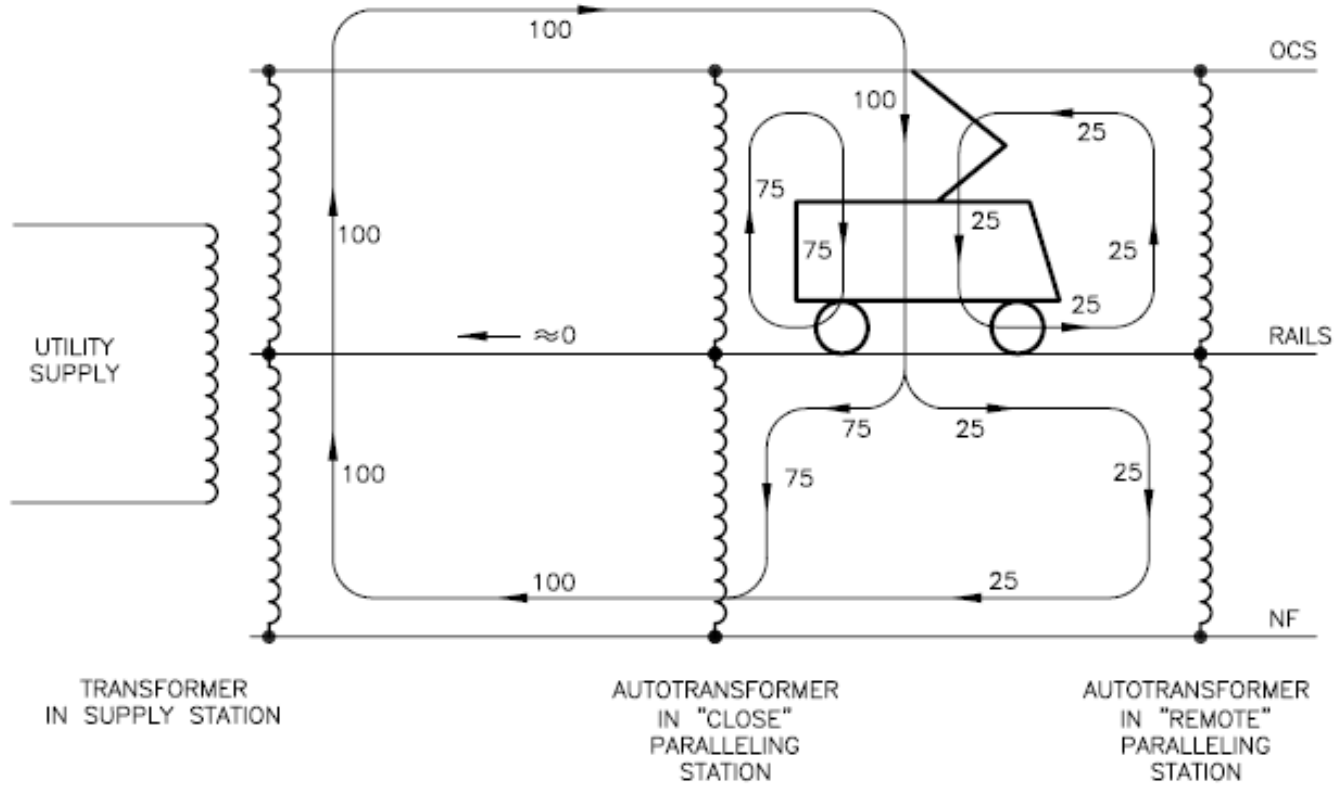
SWITCHING STATION FOR 2X25KV SYSTEM

FIGURE 3



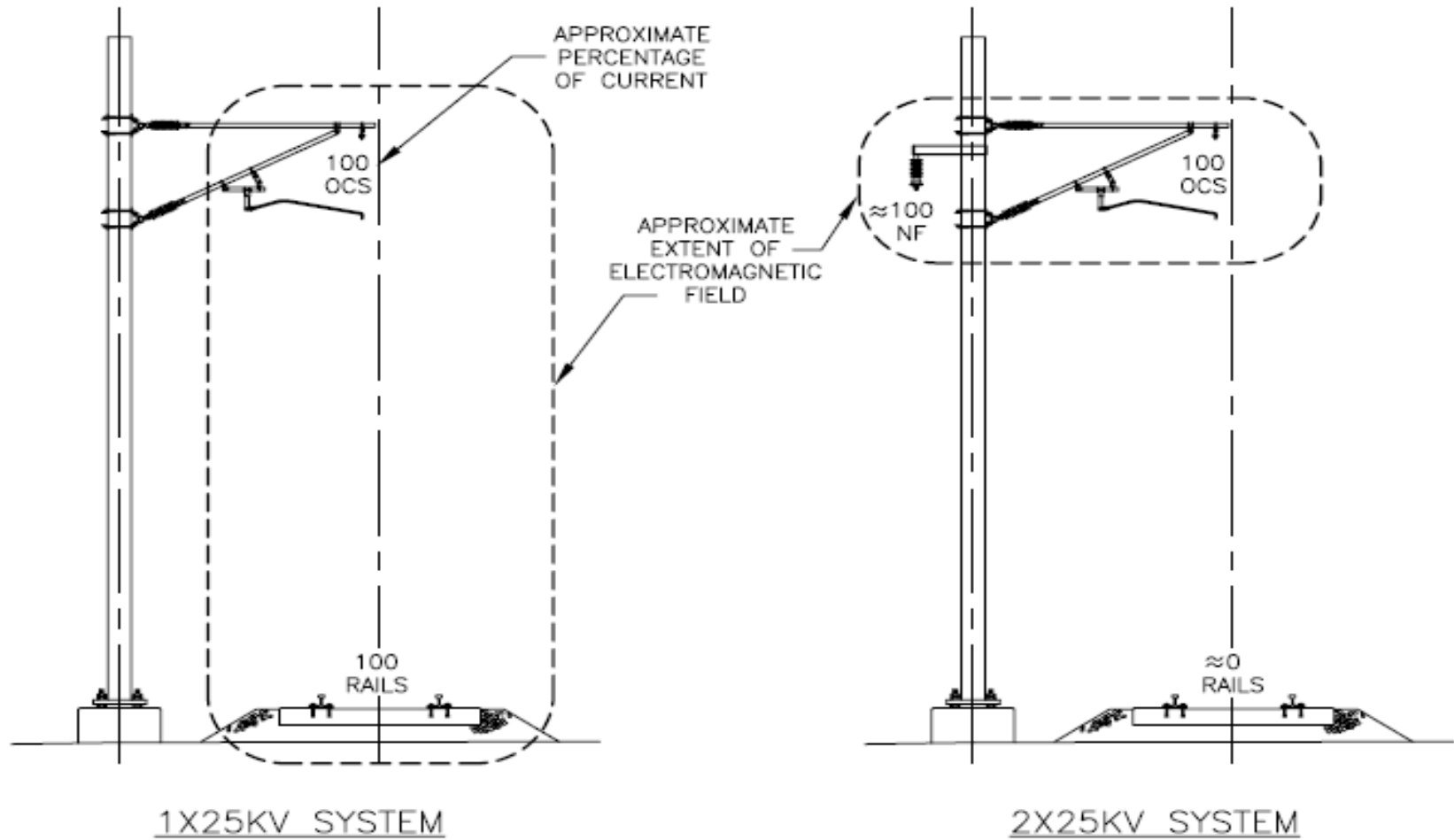
PARALLELING STATION FOR 2X25KV SYSTEM

FIGURE 4



2X25KV SYSTEM PROPORTIONAL CURRENT DISTRIBUTION
FOR TRAIN LOAD OF 200A

FIGURE 6



SIMPLIFIED COMPARISON OF EXTENT
OF ELECTROMAGNETIC FIELD FOR
1X25KV AND 2X25KV SYSTEMS

FIGURE 7