Mobile SmartValve™ Unit

The Mobile SmartValve™ Unit leverages proven technology from the Mobile Guardian™ Unit and builds upon the success of its predecessors. By using revolutionary power electronics, the SmartValve devices within the SmartValve Mobile Unit effectively increase or decrease the reactance of a given circuit, enabling real-time control of power flow. Smart Wires offers a 15 MVAr Mobile SmartValve Unit, comprised of two 53.0 ft. (16.1 m) long trailers containing three 5 MVAr pods. Each 5 MVAr pod contains 5 SmartValve 1-1800 devices, 1 SmartBypass 2000 device and 1 Bypass Filter. A guest trailer is used to transport the pods and insulator frames to the deployment site, while the host trailer both transports the pods to the site and serves as the foundation/base for supporting the pods during the energized operation of the solution. Both trailers are designed to comply with DOT weight and dimension requirements for standard Class 8 trailers, thus obviating the need for special permitting or transportation procedures. The SmartValve and SmartBypass devices in the Mobile SmartValve Unit float at line potential but the host trailer foundation is grounded to ensure safe step and touch potentials during operation.

A five-person crew and a 10-ton crane are required to transfer the pods from the guest trailer to the host trailer. The total time required to set up a single, 15 MVAr Mobile SmartValve Unit is approximately 4 hours, once all the necessary equipment arrives on site. Any interconnection and site preparation activities, such as erecting posts to train conductor to the pods and building a temporary fence (if needed) can be completed prior to the arrival on site of the guest and host trailers and/or simultaneously as the trailers are being assembled.

The Mobile SmartValve Unit is a novel method for utilities to rapidly resolve temporary overloads in order to:

- Expand outage windows and accelerate construction and maintenance projects
- Address short-term needs such as a delay in the long-term solution
- Increase system resilience and response time for unusual or emergency system conditions
- Reduce congestion that appears during a limited period of time (e.g. seasonal, during maintenance, etc.)

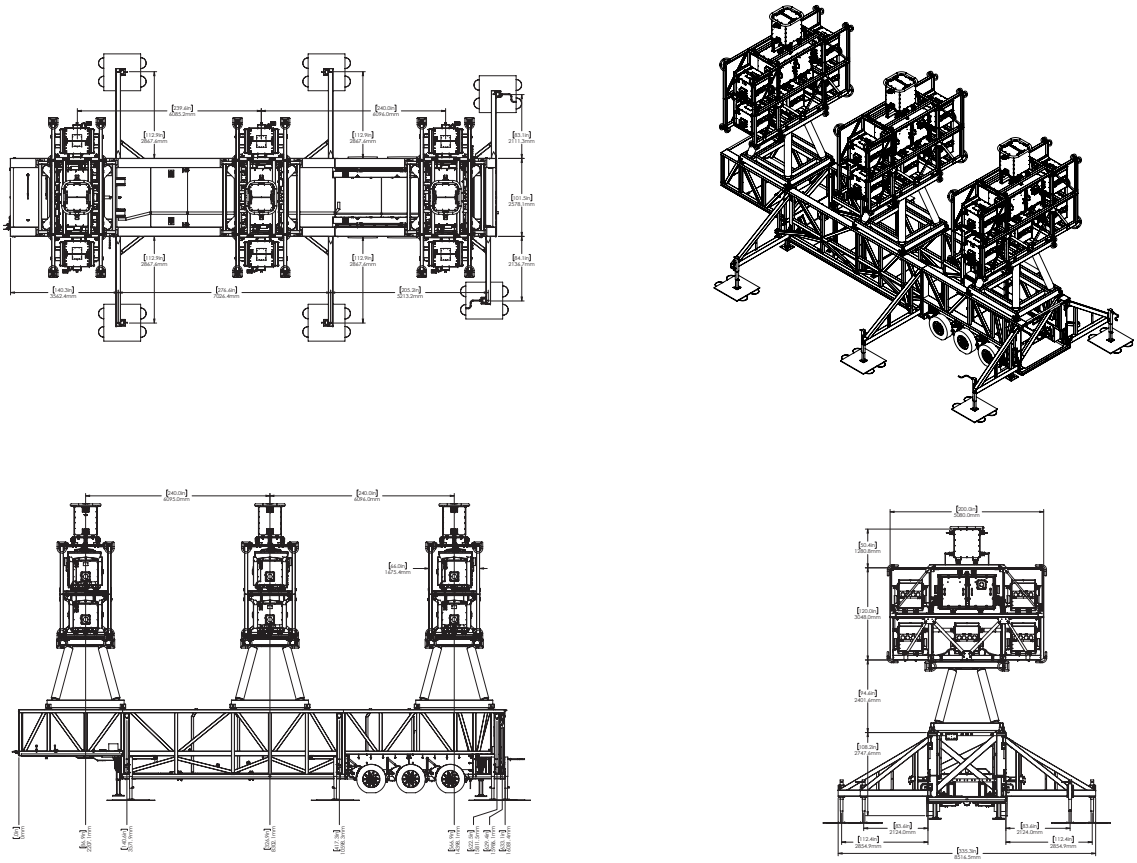

Figure 1: Mobile SmartValve Unit – Deployment Configuration Overview

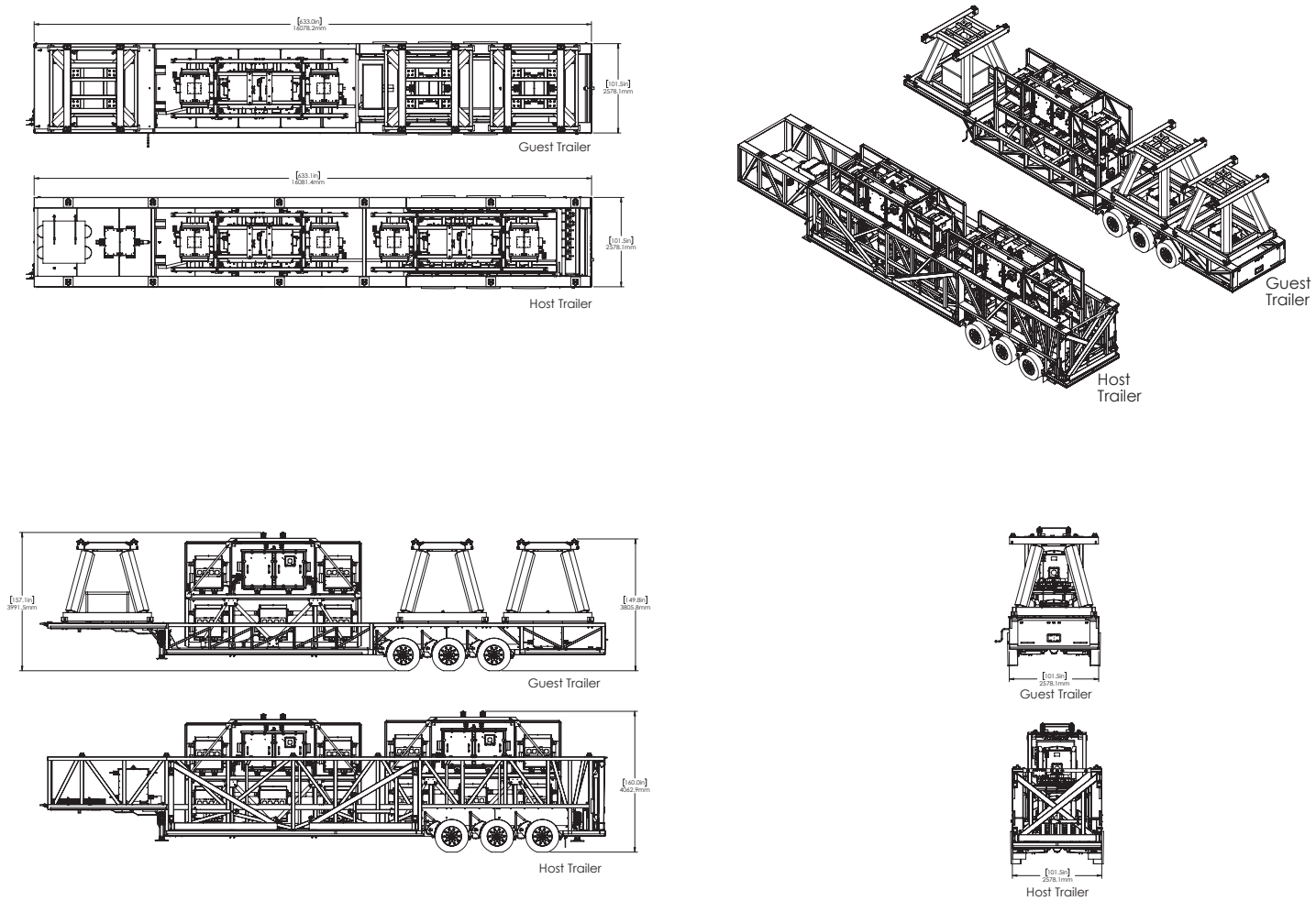

Figure 2: Mobile SmartValve Unit – Transportation Configuration Overview

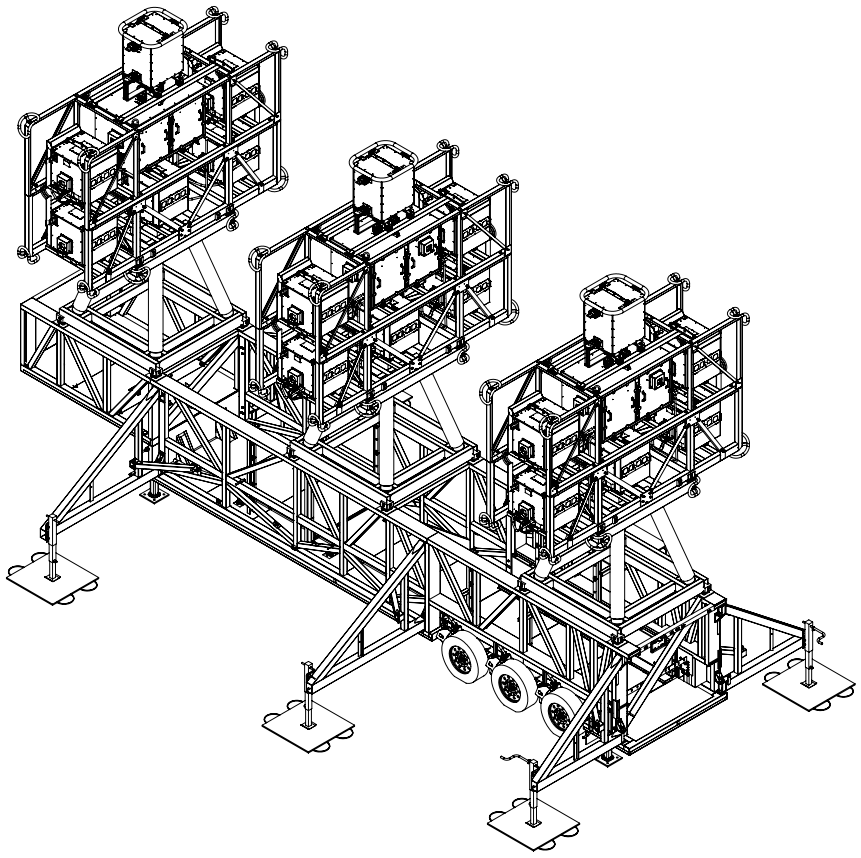

Figure 3: Mobile SmartValve Unit – Deployment Configuration Isometric View

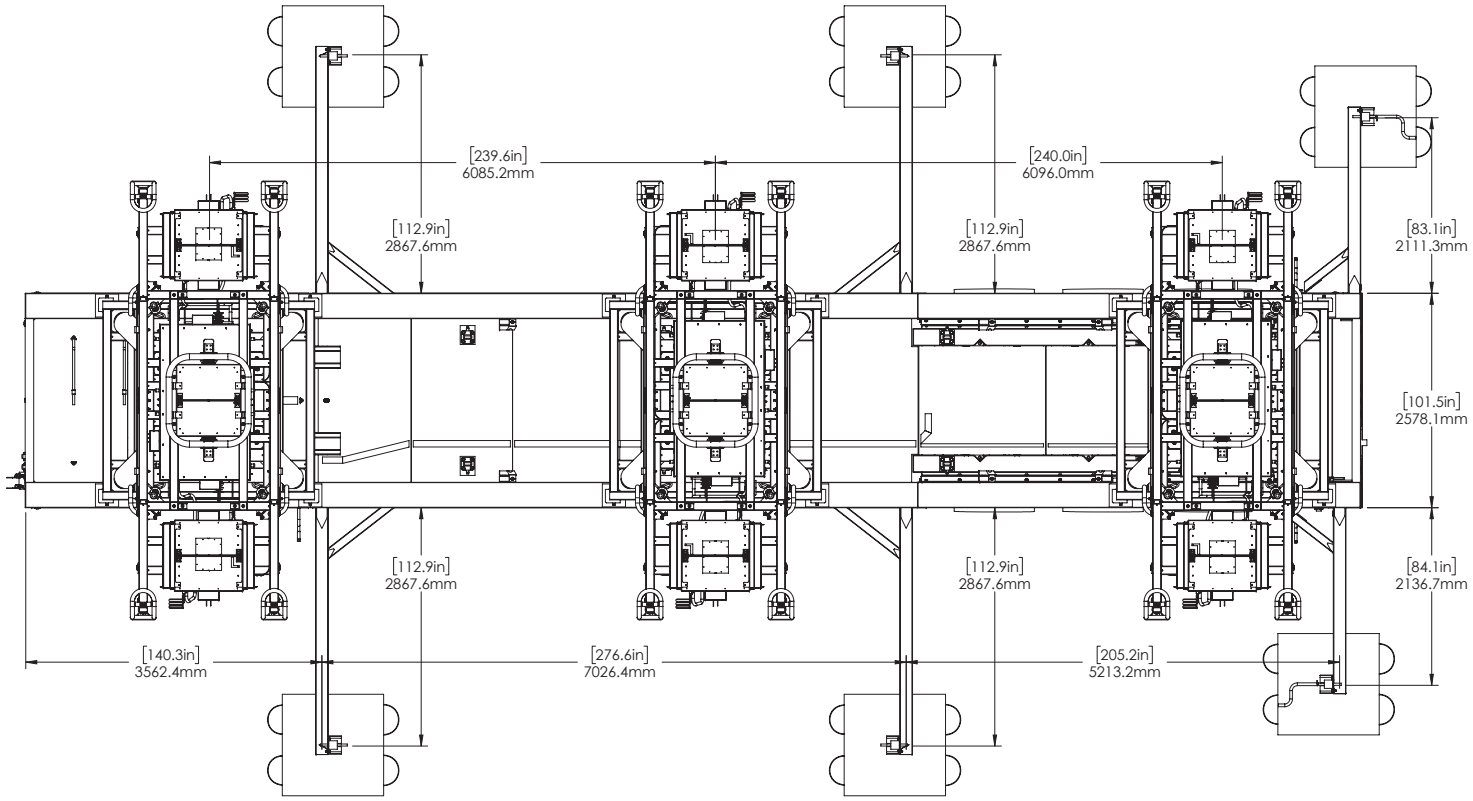

Figure 4: Mobile SmartValve Unit – Deployment Configuration Top View

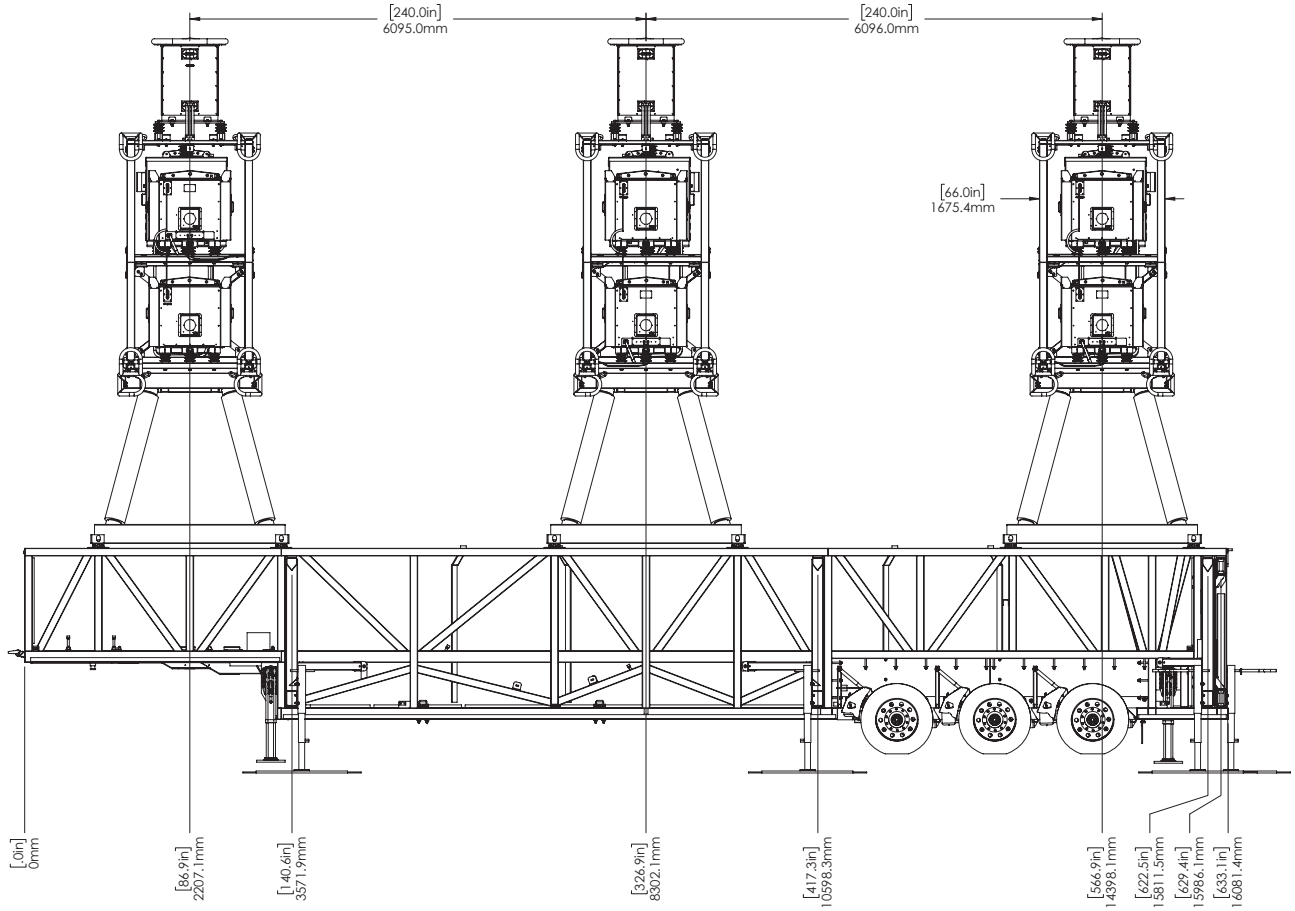

Figure 5: Mobile SmartValve Unit – Deployment Configuration Side View

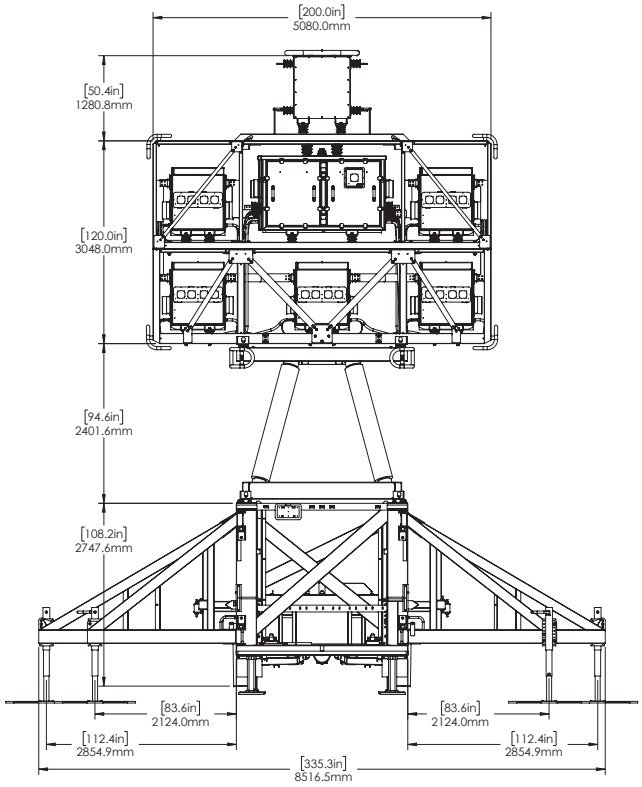

Figure 6: Mobile SmartValve Unit – Deployment Configuration Rear View

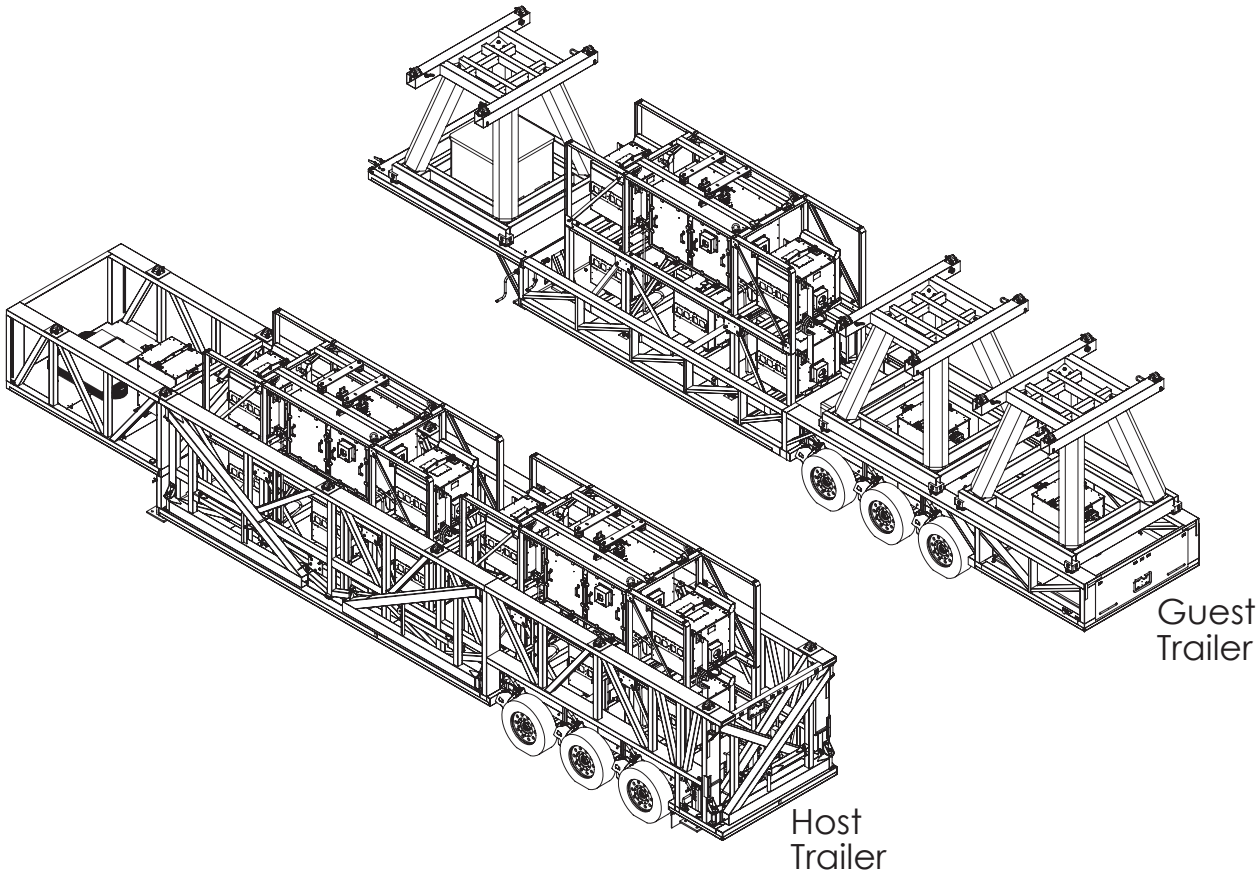

Figure 7: Mobile SmartValve Unit – Transportation Configuration Isometric View

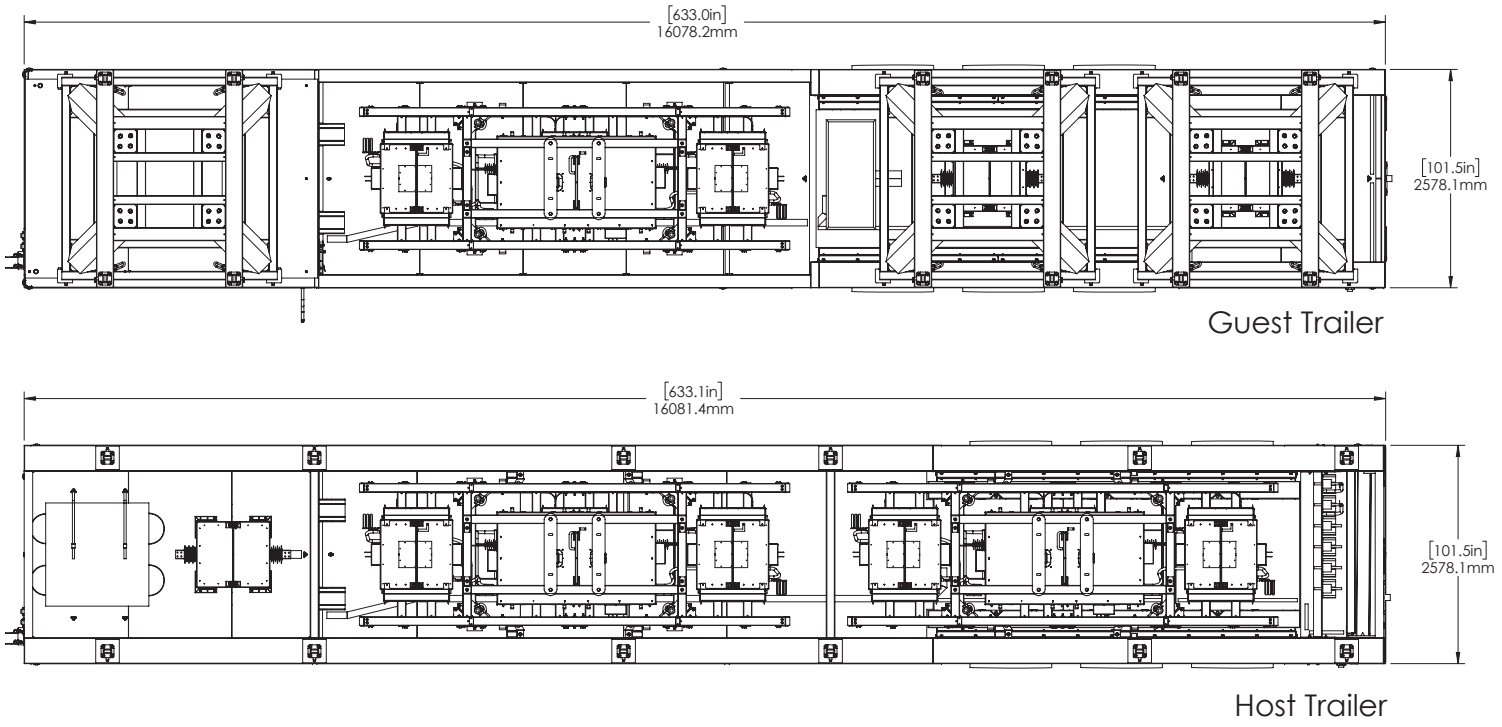

Figure 8: Mobile SmartValve Unit – Transportation Configuration Top View

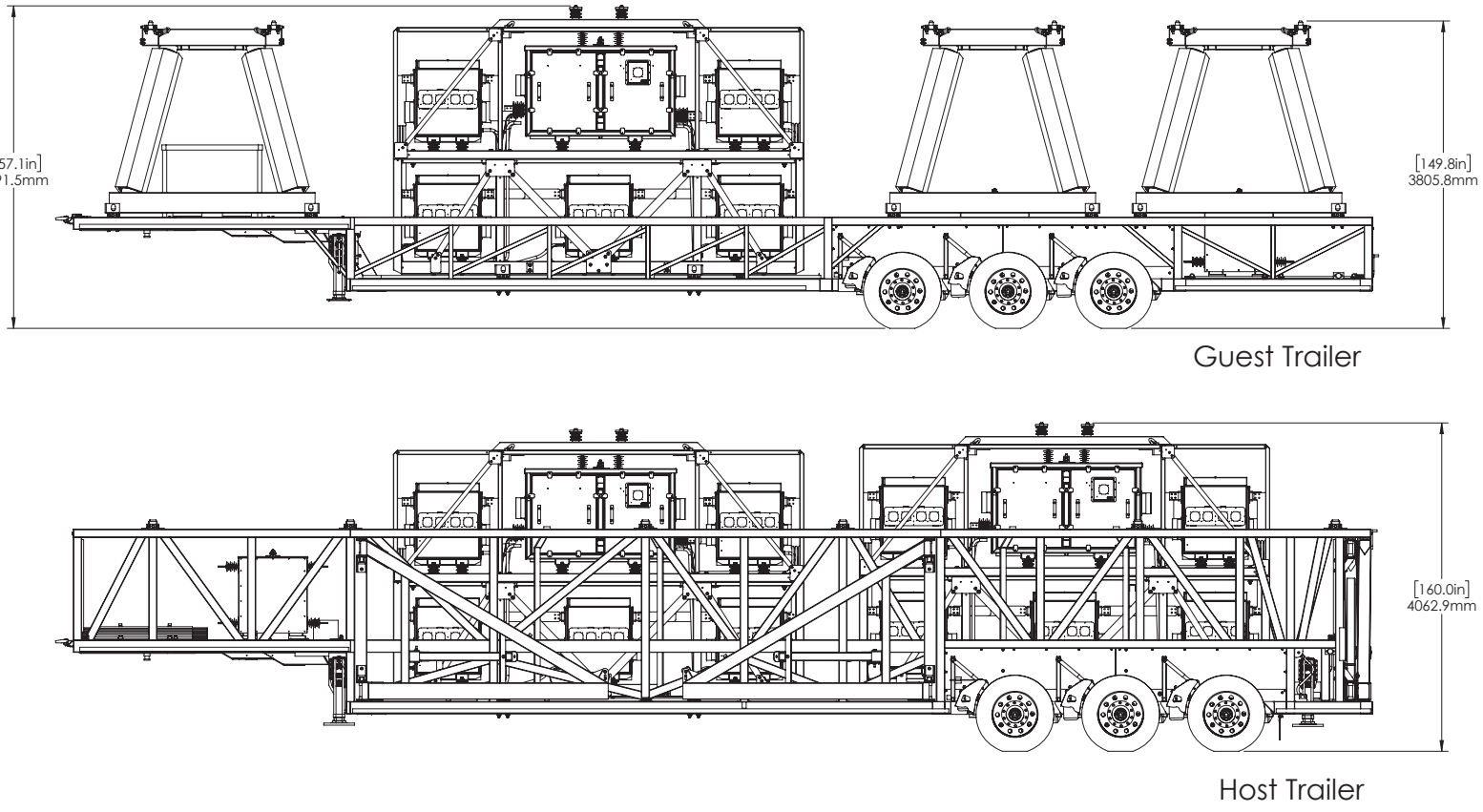

Figure 9: Mobile SmartValve Unit – Transportation Configuration Side View

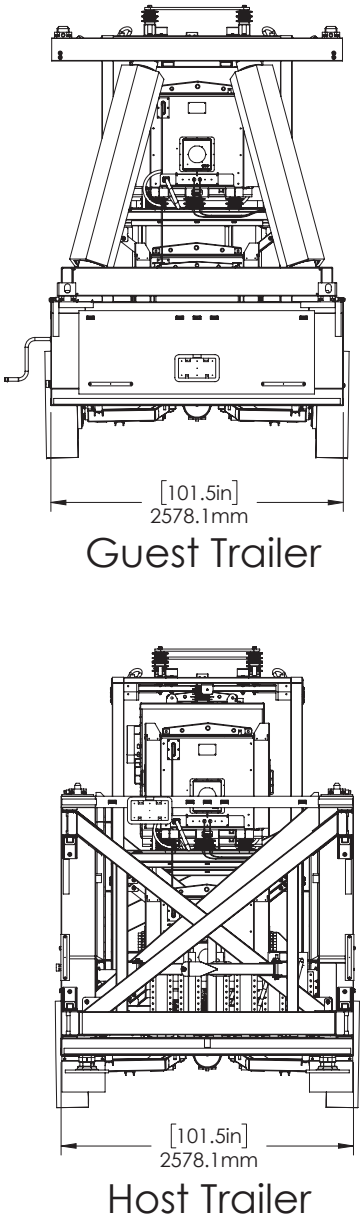

Figure 10: Mobile SmartValve Unit – Transportation Configuration Rear View

Technical Specifications [1]

Electrical

Maximum Continuous Current	1800 A RMS
Maximum Emergency Current	2160 A RMS for 2 Hours
Maximum Voltage Injection [4]	± 2830 V RMS Per Phase @ 60 Hz or @ 50 Hz
Minimum Current for Injection [5]	200 A RMS

Physical

Pod Frame Mass, Each	13000 lbs (5897 kg)
Insulator Frame Mass, Each	5000 lbs (2268 kg)
Empty Guest Trailer Mass	18000 lbs (8165 kg)
Loaded Guest Trailer Mass	46000 lbs (20865 kg)
Empty Host Trailer Mass	30000 lbs (13608 kg)
Loaded Host Trailer Mass	56000 lbs (25401 kg)
Deployed Host Trailer Mass	84000 lbs (38102 kg)
Dimensions	See Figures Above
Conductor Size Capacity	Agnostic
Seismic Withstand Capability	Up to 0.6 g or on request
Cooling	Integrated sealed forced air coolers with multiple fans on the heat sinks for redundancy

Transport and Assembly

Maximum Transport Speed	75 mph (120 km/h)
Maximum Slope of Ground for Deployment	5° [7]
Equipment required for installation	10-ton crane Standard power tools
Crew Required	5-person crew
Typical Assembly Time	Approx. 4 hours
Typical Line Connection Time	Approx. 4 hours [8]
Typical Commissioning Time	Approx. 1-2 days [8]

Communication

Communication Architecture	EMS integration via SmartBypass to PowerLine Gateway™ located at substation. All communication between the SmartValve and SmartBypass is transmitted via a wired connection [9]

Maximum Voltage (Corona-free)	275 kV RMS line-to-line[2]
Fault Current Rating	See Note [3]
Power	Powered by line current
Minimum Current for Monitoring [5]	100 A RMS

Environmental

Operating Ambient Temperature Range	-40°F to 122°F (-40°C to 50°C)
Storage Temperature Range	-40°F to 122°F (-40°C to 50°C)
Condensing Operating Humidity Range	5% to 100%
Maximum Sustained Rain	4.0 in/hr (102 mm/hr)

Standards

Software and Firmware	Conforms to IEC 61508 SIL-2
Electrical Connections	ANSI C119.4
Intrusion Protection of SmartValve and SmartBypass devices	IEC 60529, IP 54
Electrical Grounding	IEEE 80-2013 [5]

Sensor Accuracy

AC Line Current	± 3 %

Communication Security Features	Multilevel ISM band wireless protocol optimized for fast telemetry. Protocol uses SHA-256 to ensure cryptographic integrity of all messages while supporting full observability by utility firewalls

Notes:

1. Please refer to the SmartValve 1-1800 and SmartBypass Spec sheets for a full list of technical specification for those devices.
2. Mobile SmartValve Units capable of operating up to 550 kV RMS line-to-line can be made available upon request.
3. Operates in conjunction with a SmartBypass™ module to provide a fault current rating of up to 63 kA RMS for 1.0 sec and 164 kA peak for the first cycle. See the SmartBypass specification sheet for more details.
4. Maximum of the fundamental of the output voltage for an individual Mobile SmartValve Unit. Total voltage injection is determined by the number of Mobile SmartValve Units per phase.
5. In Monitoring Mode, the SmartValve is bypassed and does not inject voltage, while telemetry data is still transmitted via SmartBypass. In Injection Mode, the SmartValve injects voltage in series with the line and telemetry data is transmitted via SmartBypass.
6. Additional hardware is used to ensure proper grounding is achieved per IEEE or preferred utility standard, including ground rods, lugs, and other equipment to tie the host trailer to the substation ground grid.
7. Slope rating refers to the grades both perpendicular to and parallel with the longitudinal axis of the deployed trailer.
8. The time required to connect the Mobile SmartValve Unit to the line is a function of the complexity of the site and utility construction preferences. Similarly, the commissioning process duration can vary based on utility requirements for the extent of communication and control system integration into SCADA and EMS.
9. The structural frames enclosing the SmartValve and SmartBypass devices as well as all wired connections between the SmartBypass and SmartValve are at line potential.

About Smart Wires

Based in the San Francisco Bay Area, with offices in Ireland and Australia, Smart Wires is the leader in grid optimization solutions that leverage its patented modular power flow control technology. Driven by a world-class leadership team with extensive experience delivering innovative solutions, Smart Wires partners with utilities around the globe to address the unique challenges of the rapidly evolving electric system.

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